

# Personal Computer

US \$2.00/FF8:80/LIRE 1700/DM 3.80/FL 4.00/BF 55  
DKr 10.75/SKr 9.50/NKr 10.50/A Sch28/ S Fr 3.50/Pts 135 **World** SEPTEMBER 1979 50p



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Prices subject to change without notice.

Software Packages are available for most business applications. A few are:-  
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**Keen Computers**  
**5b The Poultry**  
**Nottingham**  
**Tel: 0602 583254**  
**Telex 37297**

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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.

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## EDITORIAL

One of the hallmarks of PCW has always been the lively participation of its readers. You are out there doing interesting things, developing new software and hardware devices, setting up clubs and societies — perhaps even getting concerned about the likely implications of the coming technological revolution. Where better to broadcast and share the wealth of your knowledge, ideas and experiences than in the pages of a respected and widely distributed journal?

If you are concerned about style of presentation — read our 'guidelines for contributors', if you are unsure about content — there are very few restrictions. Obviously, though, an unusual or radical contribution has more chance of being published than, say, yet another program for 'Mastermind'.

We'd be particularly interested to hear from people who have installed a personal computer in their own business, from people who have hooked-up something unusual — perhaps through an analogue interface (but, please, no more analogue to digital converters), from people who wish to 'soapbox' their views and from people still at school or college. Also, if you want to tell us something but prefer not to go into print — fine — just write in anyway because we'd love to hear your views, good or bad. Remember, this is very much *your* magazine and its future direction should, and will, reflect the views and desires of its readership. We look forward to hearing from you.  
*The Editors*

## DPS-1 MAINFRAME

Introducing the DPS-1 the full IEEE S100 bus computer system from Ithaca Intersystems — the S100 experts.

FOR EDUCATION, INDUSTRY, RESEARCH and all professional uses, including hardware and software development, low cost OEM systems, teaching applications etc.



A MINI COMPUTER using MICRO technology at a ridiculous MICRO Price!!! The front panel with a backplane and power supply accepts S100 bus boards from many manufacturers.

# InterSystems

### Just look at these professional features!

- ★ FRONT PANEL (we won't ask you to debug our hardware, but we will give you the tools to debug yours!) Has lights and switches to allow inspection and control of addresses and data. Other features include programmed input switches, and output lights, Examine, Examine next, deposit next, single or slow step (0.1 to 1000 IPS), hardware breakpoint on any data or address byte, repeat instruction and many other hardware diagnostic facilities.
- ★ 30 Amp, 8V power supply, 5 Amps on  $\pm 16v$  rails (all rails are separately fused)
- ★ 20 slot IEEE S100 Motherboard with active termination and shielding between bus lines
- ★ Guaranteed operation at 4MHz.

The DPS1 comes as a mainframe with front panel, Motherboard, power supply and 4MHz Z80A cpu board. The system is truly modular allowing the user to build up the system he requires in his own time.

S100 boards from a number of manufacturers will plug into the DPS1 IEEE S100 bus.

Just add S100 Memory Boards — S100 disk controller boards — S100 I/O boards — S100 video and/or graphics boards — S100 EPROM boards  
All Ithaca Intersystems OEM products including K2 disk operating system and PASCALZ on 8" floppy drives will run in the DPS-1.

Fully assembled and tested { DPS-1 with S100 4MHz Z80 cpu board £695  
DPS-1 less S100 4MHz Z80 cpu board £645

## SOFTWARE for your S100 system

### PASCAL/Z The new language for Micros £131.25

Runs under K2 operating system.

- ★ Compiler that produces Z80 macro assembler code
- ★ NO NEED for slow run time P-code interpreter.
- ★ Comes complete with Macro assembler.
- ★ Produces binary object modules — small and fast.
- ★ Modules are re-entrant and can be put into ROM.
- ★ IMBED, TRACE and ERROR debug facilities.
- ★ Recursion



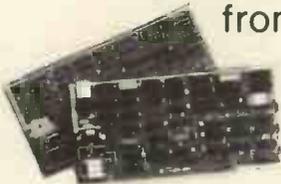
### K2 OPERATING SYSTEM £56.25

8" disk based operating system — distributed on Shugat compatible 8" floppy disk  
★ TED — 52 command character orientated text editor with macros. ★ PIP — File and directory handler. ★ ASMBLE — full Z80 2 pass assembler. ★ HDT — Hex debug tool. ★ QCI — Utility overlay/command decoder. ★ SYSGEN — System builder. ★ COPY — disk to disk file copier. ★ DUP — disk duplicator.

### ASMBLE/Z Z80 Macro assembler £37.50

★ Full 2 pass Macro Assembler. ★ IF and ELSE — 255 nesting levels. ★ Produces symbol table. ★ Relative jumps.

## OEM S100 boards from the experts!



	Assembled and tested
8K Static RAM board (450ns)	£123.75
8K Static RAM board (250ns)	£146.25
Z80 cpu board (2MHz)	£131.25
Z80 cpu board (4MHz)	£153.75
2708/2716 EPROM board	£63.75
Prototype board (bare board)	£18.75
Video display board (64x16, 128U/L Ascii)	£108.75

### New products from Ithaca audio!

	Assembled and tested
High density graphics (1024 x 512 points)	£660.00
Disk controller (up to 4 single or double sided drives)	£131.25
I/O board (serial and parallel outputs)	£210.00
S100 front panel (as used in DPS1)	£245.00
Analogue I/O board	£295.00

AVAILABLE SOON: ZBC-1 Single board computer for OEM market. Available in basic through to fully expanded. 4MHz Z80A, 64K RAM, memory mapped 4K screen buffer, composite video, up to 16K power on EPROM monitor, 4 parallel ports, 2 serial ports, 4 channel counter timer. 1 off £895 — please phone for a quote for your needs. (quantity discounts available).

Over 15,000 boards delivered worldwide

## PASCAL MICRO DEVELOPMENT SYSTEM

*Are you still waiting for one?*

ITHACA Intersystems HAVE JUST ANNOUNCED AN IEEE S100 SYSTEM WITH A TRUE PASCAL COMPILER

FOR RESEARCH and DEVELOPMENT LABORATORIES and TEACHING APPLICATIONS

### The PASCAL System



- DPS1 Mainframe with hardware front panel.
- Z80 4MHz Microprocessor.
- 64K Static RAM.
- 8" Shugat Floppy Disc Drive, Power Supply and Controller.
- K2 DOS Operating System.
- Pascal Compiler and Macro Assembler.
- I/O Board with RS232 port.

*While the others are talking about it, we are delivering!*

### CONTACT THESE UK DEALERS

All prices quoted are exclusive of VAT.

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DATAVIEW LTD. (Colchester) (0206) 78811

SIRTON PRODUCTS (Surrey) 01-660 5617  
CODIFIED COMPUTER SYSTEMS (North London) 01-226 1319

## UK & EUROPEAN DEALER ENQUIRIES INVITED — CONTACT

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(formerly ITHACA AUDIO of New York)

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North Star Horizon with 4MHz Zilog Z80A  
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floppy disks **from £1868.**

## Total System

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Systems Aquarius with 32K RAM, dual  
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software package for payroll, sales  
invoicing, and full accounting, plus  
Newbury video display terminal,  
DEC LA34 printer and one year's  
maintenance. **£5950.**



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West Horndon Essex CM13 3XJ

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AT  
**MICRODIGITAL**



## Apple II Plus

APPLE-II PLUS will change the way you think about computers. That's because it is specifically designed to handle the day to day activities of education, business, financial planning, scientific calculation, and entertainment. APPLE-II PLUS is appealing and comfortable (like other appliances that make your life easier), and it brings to personal computing a new level of power through hardware and software sophistication.

The APPLE-II PLUS is faster, smaller and more powerful than its predecessors, and it's easier to use too, because of advanced, built in features like:

### \*PALSOF

A fast, extended 10K BASIC with 9-digit precision and graphics extensions.

### \*HIGH RESOLUTION GRAPHICS

On a matrix of 280X192 individually addressable points.

### \*AUTO-START ROM

With power on boot of application programs, reset protection and improved screen editing.

### \*INTERNAL MEMORY EXPANSION TO 64K BYTES

For big system performance at a low cost.

### \*EIGHT EXPANSION SLOTS

To let the system grow with your needs.

## Apple Pascal

APPLE PASCAL™ is the new extension to microcomputer power.

PASCAL™ incorporating UCSD PASCAL™, offers extended features in a complete interactive package employing today's most sophisticated structured programming language. It provides advanced capabilities that boost performance and cut development time for large business, scientific, and educational programs.

This software package provides the most powerful set of tools yet available for the microcomputer programmer.

### \*EDITOR

A fast, screen-oriented editor for program development and word processing applications.

### \*COMPILER

Standard PASCAL plus full set of extensions for strings, disc files, graphics and system programming. Hi-res graphics "Turtlegraphics": as originated at MIT. INIT turtle, PENCOLOR, TURNO, TURN, MOVE, TEXT GRAF.

GOTOXY procedure for cursor addressing. FUNCTION Keypress tells whether character available. Library routines include: RANDOM, RANDOMIZE, PADDLE, BUTTON, TTOUT, KEYPRESS etc.

### \*RELOCATABLE ASSEMBLER

Permits relocatable assembly language routines to be generated and linked to Pascal programs.

### \*SYSTEM UTILITIES

Includes desk calculator-performs basic calculations and parameter — allows examination and modification of system environment.

## Floppy Disks

Gives your system immediate access to large quantities of data. The subsystem consists of an intelligent interface card, a powerful Disk Operating System and one or two mini-floppy drives.

### Features

- Storage capacity of 116 kilobytes/diskette.
- Data transfer rate 156K Bits/second.
- Individual file write protection.
- Powered directly from Apple II.
- Full disk capability with systems as little as 16K bytes of RAM.
- Fast access time — 600 m sec (max) across 35 tracks.
- Powerful disk operating software.
- Load and store files by name.
- BASIC program chaining.
- Random or sequential file access.

Floppy Disk Subsystem		
Nett	Vat	Total
425.00	63.75	488.75
Second disk drive and connecting cable		
375.00	56.25	431.25

## Parallel Printer Interface Card

Allows you to connect almost any popular printer to your Apple. A BASIC program can produce hard-copy output as easily as it prints to the TV monitor screen. Command interpretation and printer control details are handled by the firmware built into the card, to eliminate user programming requirements.

Nett	Vat	Total
110.00	16.50	126.50

## Communications Interface Card

Allows your Apple to "talk" (though a modem) with other computers and terminals over ordinary telephone an load programs over the phone, send messages to remote terminals or access your office computer from the comfort of your home.

Nett	Vat	Total
110.00	16.50	126.50

## High Speed Serial Interface Card

Allows Apple to exchange data with printers, plotters and computers in serial format at up to 19.2 K Baud.

Nett	Vat	Total
110.00	16.50	126.50

## Speechlab Voice Recognition Card

Allows the Apple to recognise a spoken vocabulary of up to 32 user-selected words. The computer can be programmed to perform any task desired upon recognition of a key word.

Nett	Vat	Total
165.00	24.75	189.75

## Prototyping Card

Provides the User with a means of building up experimental circuitry for the Apple computer. The 2 1/4" x 7" double-sided board includes a hole pattern that accepts all conventional integrated circuits and passive components. Documentation includes a complete system bus description to aid the interface designer.

Prototyping Card		
Nett	Vat	Total
18.00	2.70	20.70

## Carrying Case

The Apple is truly portable and this padded vinyl, leather look case protects your Apple in transit and makes it easier to carry.

Carrying Case		
Nett	Vat	Total
25.00	3.75	28.75

## Apple Pascal System

A recommended configuration for developing and using Pascal application programs.

APPLE-II PLUS, 48K RAM	£950
FLOPPY DISK system	£425
PASCAL extension card	Ring for price.

Apple Software Bank Vols. 1-5 (5 disks) FREE

## Other Prices

	Nett	VAT	Total
8 x 4 1/8 RAM 16k Bytes	100	15.00	115.00
Joylick	20	3.00	23.00
Diskettes	3	0.45	3.45
10 C13 Cassettes	4.44	0.66	5.10
Dolphin 8.0. 80	595	89.25	684.25
TRENDOM-100 incl. interface	295	44.25	339.25
AXIOM micro Printers	349	52.35	401.35
AXIOM graphics Printers	699	104.85	803.85

## Books

Apple operators manual	5.50	NO VAT ON THESE ITEMS
Applesoft extended		
Basic manual	4.00	
Basic tutor	4.00	
6502 programming manual	7.50	
6502 hardware manual	7.50	

## PART EXCHANGE

Pet owners', trade up to an Apple at MICRODIGITAL. We can allow up to £300 for your old PET against the cost of a new Apple II.

# MICRODIGITAL

25 BRUNSWICK STREET, LIVERPOOL L2 0BJ.

Mail Order: 051-236 0707

Other Departments: 051-227 2535



# OHIO Scientific Computers from MUTEK

## The c2-4p

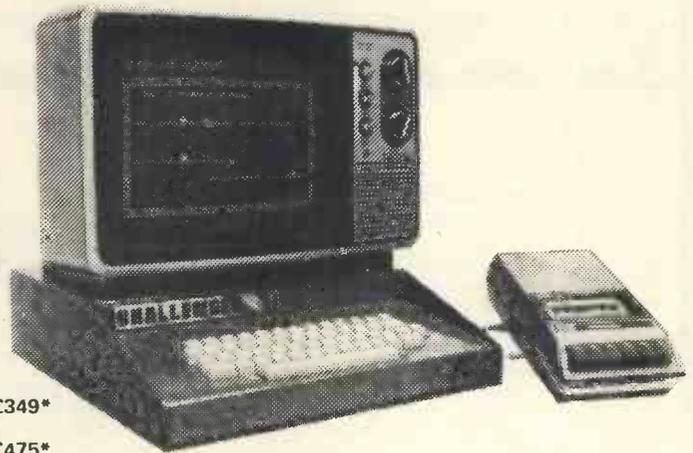
The Professional Portable  
by Ohio Scientific

### CHALLENGER 11P SERIES

Ultra high performance BUS oriented microcomputers for personal, educational, research and small business use.

- |  |               |
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| C2.4P – The professional portable  | 4K RAM £349*  |
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| C2.4P Disk – The ultimate portable   | 16K RAM £909  |
| C2.8P Dual Disk – Most cost effective small business system                                | 32K RAM £1533 |
| *Extra 4K RAM – £39. 8K RAM Board (expandable to 24K!) £125                                |               |

Prices exc of VAT

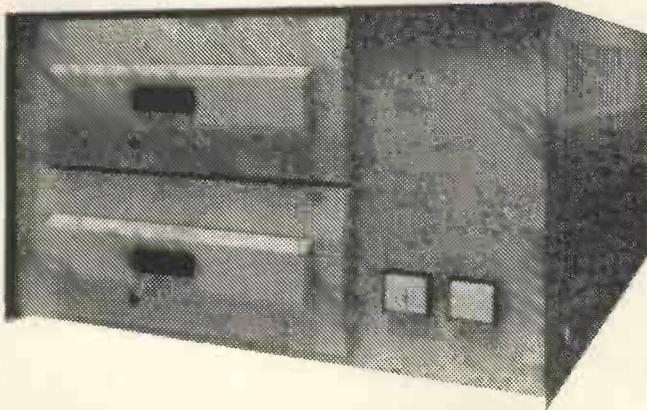


### CHALLENGER 111 The Ultimate in Small Computers

The unique three processor system for demanding business, education, research and industrial development applications.

- |  |                               |
|--|-------------------------------|
| C3-S1 – World's most popular 8" floppy based microcomputer | 32K RAM £2450<br>dual floppys |
| C3OEM – Single package high volume user version of C3-S1   | 32K RAM £2450<br>dual floppys |

ALL MACHINES are modified by us to suit British mains voltage and frequency, and, where TV output is used (C2 series) to be compatible with British TV standard (connection via aerial socket).



## The c3-Oem

The C3 OEM represents unbeatable value for system builders and end users. With the three most popular processors, the 6502, the Z80 and the 6800, all available on the CPU card and a large number of utilities and ready to use packages it is well worth considering for almost any application.

For BUSINESS USERS the C2 series offers very low cost systems capability. For instance a C28P with twin full size floppies, 32K of memory, a printer and full DMS inventory control software is well under £3,000 and is very easy to tailor to your exact requirements.

If your requirements for data storage are even larger why not look at the C3 SERIES offering Winchester technology Hard Disk capabilities in 74 or 23 MEGABYTE versions.

Using OSI's Data base Management System you could have a large on-line data base for less than £10,000. What other systems offer this capability at this price?

WHETHER YOUR INTEREST IS IN HARDWARE OR SOFTWARE, MACHINES OR SYSTEMS OSI CAN PROBABLY OFFER YOU A LOWER COST, MORE EFFECTIVE SOLUTION.

For further details on any of the above contact

## MUTEK

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Super software from the world's leading microsoftware supplier.

## DIGITAL RESEARCH

- CP/M\* FDOS** — Diskette Operating System complete with Text Editor, Assembler, Debugger, File Manager and system utilities. Available for wide variety of disk systems including North Star, Helios II, Micropolis, iCOM (all systems) and Altair. Supports computers such as Sorcerer, Horizon, Sol System III, Versatile, Altair 8800, COMPAL-80, DYNABYTE DB8/2, and iCOM Attache. Specially desired configuration ..... **£75/£15**
- MAC** — 8080 Macro Assembler. Full Intel macro definitions. Pseudo Ops include RPC, IRP, REPT, TITLE, PAGE, and MACLIB. Z-80 library included. Produces Intel absolute hex output plus symbols file for use by SID (see below) ..... **£55/£10**
- SID** — 8080 symbolic debugger. Full trace, pass count and break-point program testing system with back-trace and histogram utilities. When used with MAC, provides full symbolic display of memory labels and equated values ..... **£45/£10**
- TEX** — Text formatter to create paginated, page-numbered and justified copy from source text files, directable to disk or printer ..... **£45/£10**
- DESPOOL** — Program to permit simultaneous printing of data from disk while user executes another program from the console ..... **£30/£1**

## MICROSOFT

- Disk Extended BASIC** — Version 5, ANSI compatible with long variable names, WHILE/WEND, chaining, variable length file records ..... **£155/£15**
- BASIC Compiler** — Language compatible with Version 5 Microsoft interpreter and 3-10 times faster execution. Produces standard Microsoft relocatable binary output. Includes Macro-80. Also linkable to FORTRAN-80 or COBOL-80 code modules ..... **£195/£15**
- FORTRAN-80** — ANSI '66 (except for COMPLEX) plus many extensions. Includes relocatable object compiler, linking loader, library with manager. Also includes MACRO-80 (see below) ..... **£205/£15**
- COBOL-80** — ANSI '74 Relocatable object output. Format same as FORTRAN-80 and MACRO-80 modules. Complete ISAM, interactive ACCEPT/DISPLAY, COPY, EXTEND ..... **£325/£15**
- MACRO-80** — 8080/Z80 Macro Assembler. Intel and Zilog mnemonics supported. Relocatable linkable output. Loader, Library Manager and Cross Reference List utilities included ..... **£75/£10**
- EDIT-80** — Very fast random access text editor for text with or without line numbers. Global and intra-line commands supported. File compare utility included ..... **£45/£10**

## XITAN (software requires Z80\* CPU)

- Z-TEL** — Text editing language. Expression evaluation iteration and conditional branching ability. Registers available for text and commands. Macro command strings can be saved on disk for re-use ..... **£40/£12**
- ASM Macro Assembler** — Mnemonics per Intel with Z-80 extensions. Macro capabilities with absolute Intel hex or relocatable linkable output modules. New version 3 with added features ..... **£40/£12**
- LINKER** — Link-edits and loads ASM modules ..... **£40/£12**
- Z-BUG debugger** — Trace, break-point tester. Supports decimal, octal and hex modes. Disassembler to ASM mnemonic set. Emulation technique permits full tracing and break-point support through ROM ..... **£45/£12**
- TOP Text Output Processor** — Creates page-numbered, justified documents from source text files ..... **£40/£12**

- A4 package** includes Z-TEL, ASM, LINKER, Z-BUG, TOP ..... **£155/£30**

## EIDOS SYSTEMS

- KISS** — Keyed Index Sequential Search. Offers complete Multi-Keyed Index Sequential and Direct Access file management. Includes built-in utility functions for 16 or 32 bit arithmetic, string/integer conversion and string compare. Delivered as a relocatable linkable module in Microsoft format for use with FORTRAN-80 or COBOL-80, etc. .... **£275/£15**
- K BASIC** — Microsoft Disk Extended BASIC with all KISS facilities, integrated by implementation of nine additional commands in language. Package includes KISS.REL as described above, and a sample mail list program ..... **£495/£30**

## MICROPRO

- Super-Sort I** — Sort, merge, extract utility as absolute executable program or linkable module in Microsoft format. Sorts fixed or variable records with data in binary, BCD, Packed Decimal, EBCDIC, ASCII, floating, fixed point, exponential, field justified, etc. etc. Even variable number of fields per record! ..... **£125/£15**
- Super-Sort II** — Above available as absolute program only ..... **£105/£15**
- Super-Sort III** — As II without SELECT/EXCLUDE ..... **£75/£15**

- Word-Master Text Editor** — In one mode has super-set of CP/M's ED commands including global searching and replacing, forward and backwards in file. In video mode, provides full screen editor for users with serial addressable-cursor terminal ..... **£75/£15**

- Word-Star** — Menu driven visual word processing system for use with standard terminals. Text formatting performed on screen. Facilities for text paginate, page number, justify, center, underscore and PRINT. Edit facilities include global search and replace, read/write to other text files, block move, etc. Requires CRT terminal with addressable cursor positioning. .... **£255/£15**

## SOFTWARE SYSTEMS

- CBASIC-2 Disk Extended BASIC** — Non-interactive BASIC with pseudo-code compiler and runtime interpreter. Supports full file control, chaining, integer and extended precision variables etc. .... **£75/£10**

## GRAFFCOM SYSTEMS

- PAYROLL** — Designed in conjunction with the spec for PAYE routines by HMI Taxes. Processes up to 250 employees on weekly or monthly basis. Can handle cash, cheque or bank transfer payments plus total tracking of all year to date figures. Prints emp master, payroll log, payslips and bank giros. Requires CBASIC-2 ..... **£475/£15**
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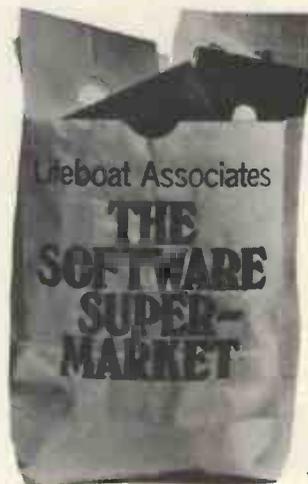
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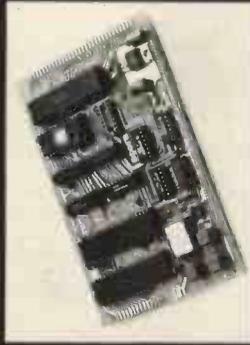
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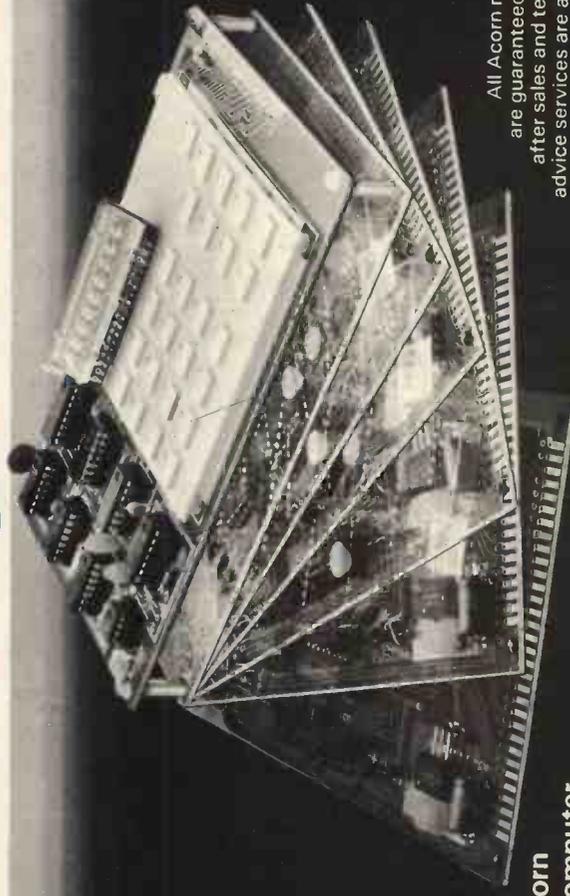
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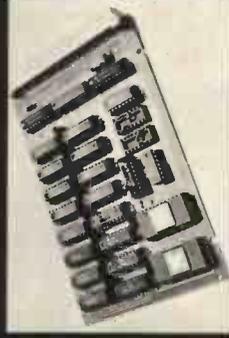
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- Set of sub-routines for use in programming
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Although a standard strip of

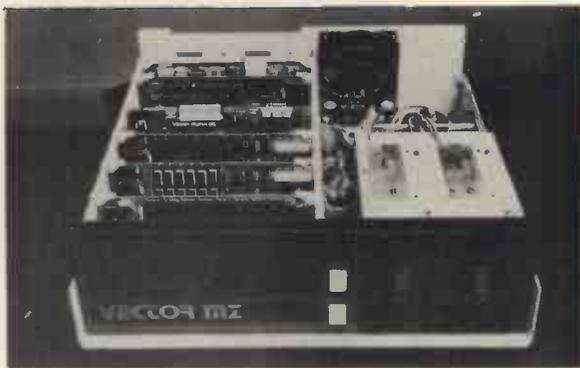


veroboard is all that is required for a full backplane, a racking system can be made available by Acorn Computers. The rack shown includes the VDU interface, two memory cards and dual floppy disc interface.

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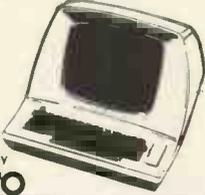
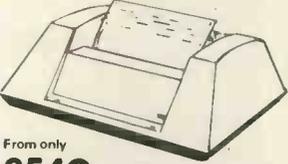
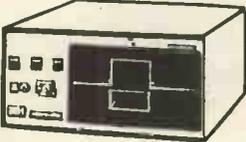
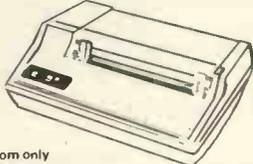
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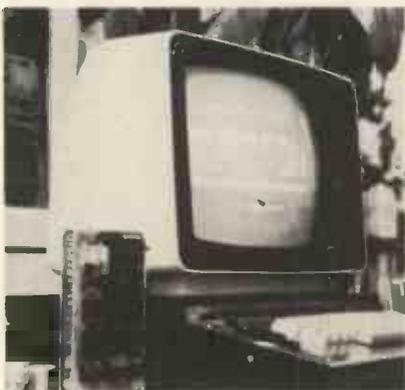
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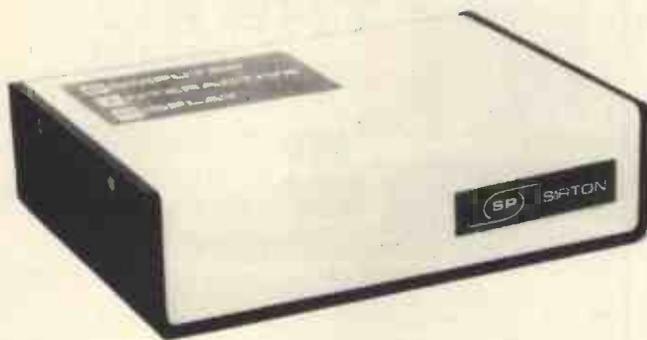
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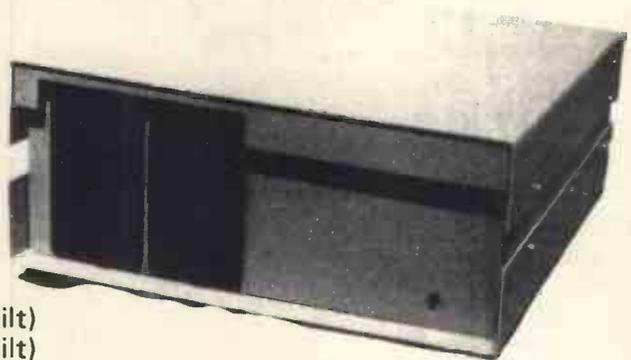
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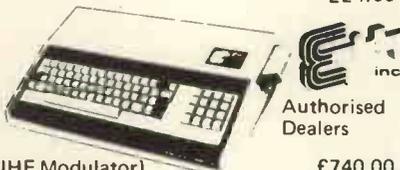
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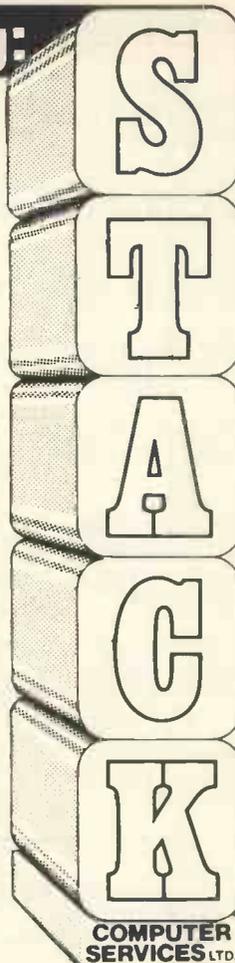
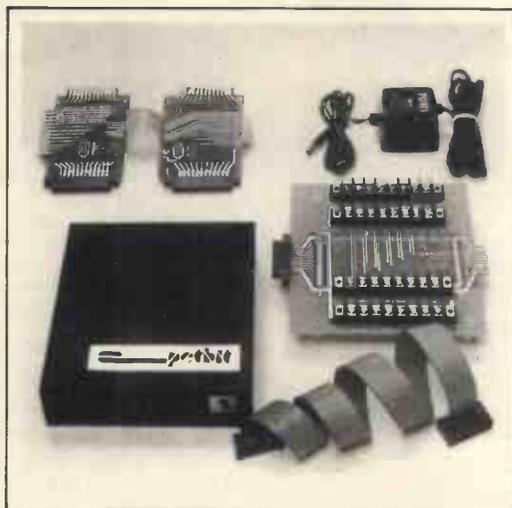
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The AIM 161 is also

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#### TECHNICAL SPECIFICATION

##### AIM 161

The AIM 161 is a 16 channel analogue to digital converter, designed to work with most microcomputers. It may be connected to the host computer directly, through the computer's 8-bit input and output, or via one of the various DAM system special interfaces.

##### Analogue Port Specification

The AIM 161 offers 16 channels allowing operation within the following basic parameters:

##### Normal Working

Input voltage, V<sub>ina</sub>, conversion range:

0 to 5.12 Volts

Reference voltage, V<sub>ref</sub>:

-0 or 5.12 Volts

##### Absolute Maximums

Input voltage, V<sub>ina</sub> (Max):

-3 to 5.4 Volts

Input current, I<sub>ina</sub> (max):

2 microamps

##### Conversion Data

Time per channel, T<sub>c</sub>:

100 microsecs

Counts per channel:

256

Output range (per channel):

00-FF(hex)

0-255(decimal)

000-377(octal)

0000-1111-1111-1111(binary)

##### Accuracy

While the conversion is normally accurate within ±5%, in extreme cases this may extend to an absolute maximum of 7%.

##### PETSET 1

This unit consists of 5 modules and is a complete ready-to-run system for analogue data capture on the COMMODORE PET (all models). Whilst the AIM 161 can be used on any 8-bit microcomputer with the requisite I/O ports the PETSET 1 as the name suggests is specifically for the PET.

##### Modules

##### 1) IEEE PORT CONNECTOR

This PCB is used to connect the IEEE-488 bus of the PET to the AIM 161 for the issuing of Analogue line selects from the Pet. The IEEE Port is reproduced on the rear and side of the board so that the user is provided with an additional IEEE-488 port. The PCB is of open construction to facilitate additional linking.

##### 2) USER PORT CONNECTOR

This PCB is used to input the digitised signals from the AIM 161 to the PET and as with (1) the port is reproduced on the rear, the construction is open, and board is linked to (1) by a short ribbon cable.

##### 3) AIM 161

This is a cased unit, as usually no linking is done here. The AIM 161 is connected to the other boards by a ribbon cable. The unit contains the address decoding and the ADC chip.

##### 4) MANMOD

This is an open PCB which plugs directly into the AIM 161 unit and provides screw terminal connections for V<sub>ref</sub>, Gnd and analogue lines, for each of 16 channels.

##### 5) PSU

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##### USAGE

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(59426 is GPIB on IEEE-488)  
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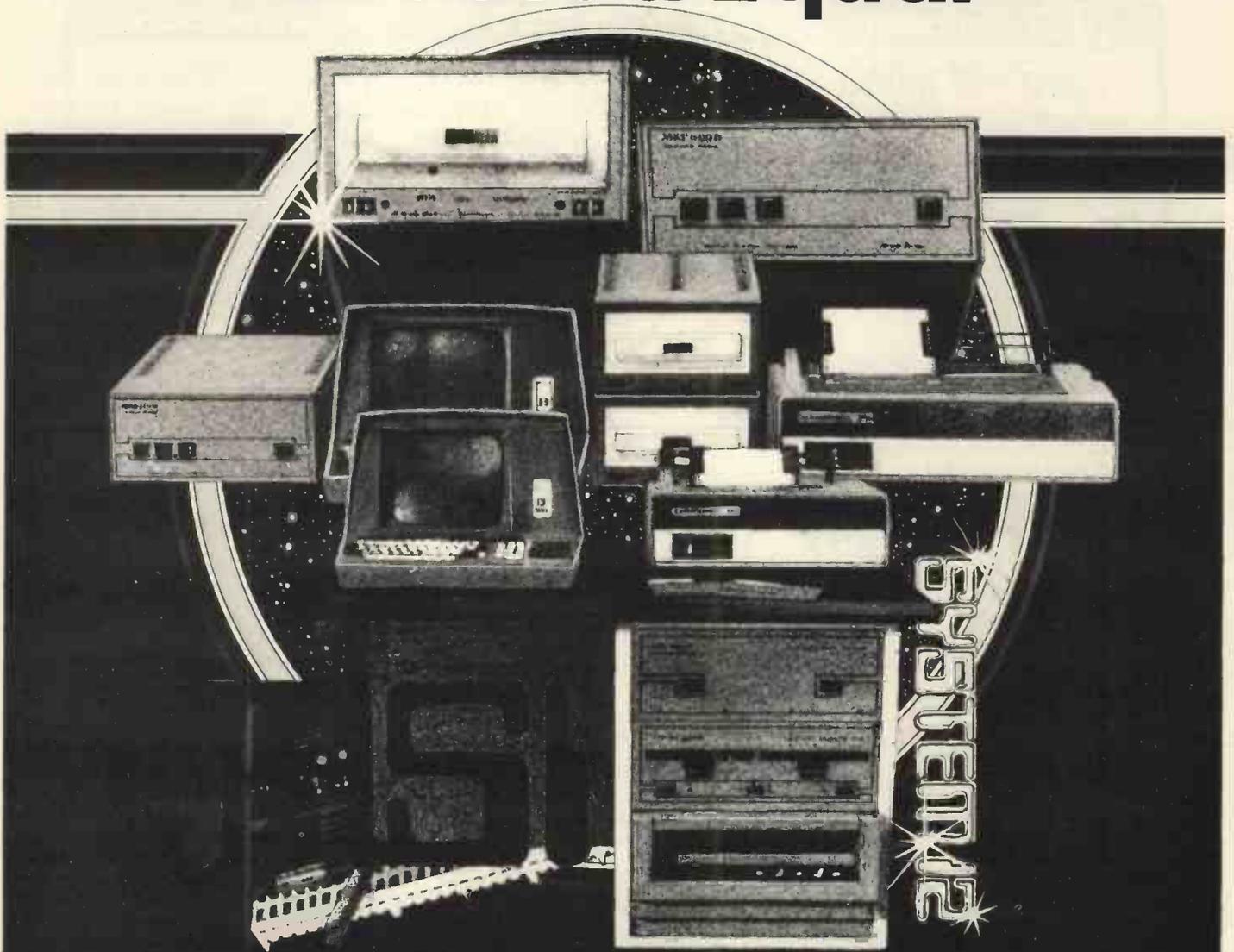
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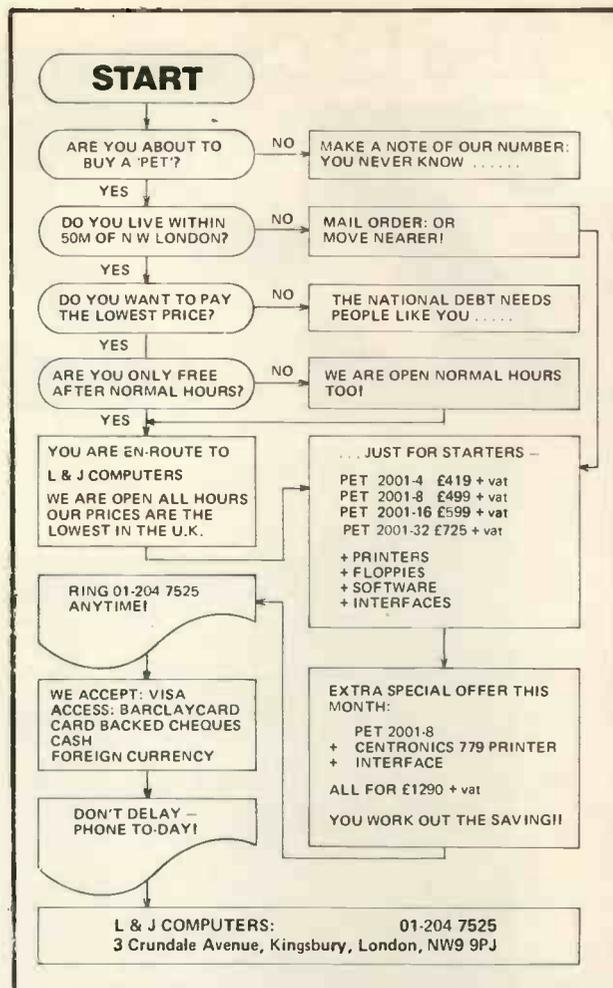
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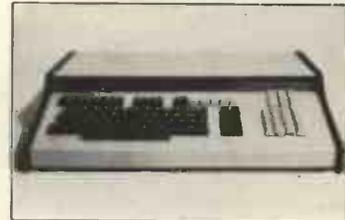
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## Retail news

Some 22 computer retailers have decided to clean up the business. In July, a trade association was started with Tim Keen of Keen Computers, Colin Stanley of HB Computers and Tim Moore of Newbear on the "steering committee". Its object is "to ensure that in spite of its dizzy growth, the industry develops in a stable and responsible way."

This means: retailers must agree not to advertise products in advance of having them in stock, especially when asking the public for money in advance.

The idea of the association was instantly attacked by some retailers who'd heard of it, but who had not been invited to the preliminary meeting. Their objections, however, seemed to be merely suspicions and anxieties rather than deeply considered opposition.

More serious opposition was voiced by Abacus. They maintained that the association was unlikely to insist on sufficiently high engineering support standards. Meanwhile, no customer so far approached has managed to raise a convincing sign of real interest. Tut, tut.

Gone are the times when the opening of a computer store made headlines. These days all you have to do is record the address and phone number.

There may be more to the new Birmingham store, CPS Data Systems in Acocks Green. What makes it different is not the simple fact that proprietor Tony Bolton calls it a Sales Centre rather than a shop, but rather that it is a shop, where the "jeans and T-shirt machines" share show-room space with CAP's MicroCobol. While few amateurs can afford CAP systems, the chance to evaluate this approach to micros is one that private buyers should not pass up. For what my opinion is worth, the Auto Clerk and Auto Index packages recently announced by CAP are signposts to the sort of software that part time "computerists" need. Sorcerer, Apple, Pet, Black Box and Transdata micros are on show. Telephone 021 707 3866 for directions to the store, and also for one-day course details



Martin Chatwin of GMS presents pupils with Pet prize (below)

## Bits and pieces

A prize Commodore Pet was presented to pupils of Carter Lodge School of Sheffield by GMS Computing Ltd. The school won a South Yorkshire area contest which is to become an annual event.

Liverpool store Microdigital is about to announce a £500 system that uses a Motorola 6808 micro, and is upgradeable to the 6809; neither chip will be familiar to domestic users — yet.

The newcomer, to be called ACFA (acronym for affordable computers for all) will be a kit with case, a Basic interpreter in permanent residence, high detail graphical display using a 3K-byte or 6K-byte memory array, a total of 48K-bytes of user memory, and a keyboard — says Bruce the boss. He's enthusiastic (he should be with the exclusive UK rights) and looking for dealers.

Newbear Computing Store, now an independent subsidiary of Data Recording Instruments rather than a division of Newbury Labs, has taken on two new microsystems. These are Apple II (not ITT 2020, after a lot of soul searching) and Ithica Inter-systems DPS-1, a newcomer to the scene. The latter uses S100, but they don't quote prices, so it can't be all that cheap (?). Price on the 16 K Apple is £830 plus VAT.

Philips has finally spotted the odd fact that it is cheaper to store 100,000 characters of data on a diskette than on digitally encoded cassette. Not before time, it is producing a cheap, digitally encoded

cassette drive which should cost £90 — with automatic stop, reverse, search, and direct phase encode circuitry. There should be lots around when the factory gets going — some time next year.

Micro courses for engineers to be run at the Polytechnic of Central London will be based on course material provided by American micro training specialist company, ICS. The courses have Department of Industry approval, National Computing Centre funds, but you won't be able to afford to go unless your company sends you.

A medical micro company has been formed, Medicom, in Ealing and it's interested to hear from anyone in the medical field who has recently written software; there's money in it for you. The company has "a particular interest" in the Mickie medical interviewing computer — the machine which replaces copies of the 1942 Readers Digest in doctor's waiting rooms by collecting basic facts. Details on 01-998 5377.

The Microcomputer Investor is the title of a journal for investors who use microcomputers. The publishers, in Virginia, write that Volume III is now available: "In this journal's 200 pages are 20 articles. . . practical computer programs accompany half the articles." Jack Williams of the Microcomputer Investors Association at 902 Anderson Drive, Fredericksburg, Virginia 22401, will send an information packet (contents not stated) on receipt of a dollar. The Association is

"nonprofit and professional"

Atari has reportedly been given approval for its model 400 and 800 computers by the American Federal Communications Commission — a decision that allows users to plug the machines into the TV set. It's a decision that Texas will consider deeply; at press time, its own fight with the FCC over "broadcasts" from its personal computer was still unresolved.

## IEEE NEWS

The microsystem of the future — only five years from now — will have around 16 million characters internal storage. It will use the big "supermicros" of today — probably having three or four in all, possibly as many as 16 — the Zilog/AMD Z8000, the MC68000, and the Intel whatever comes after 8086.

All this can be deduced from the definition of the S100 or Altair bus — the extraordinary skeleton around which some of the cheapest microsystems are built — by America's Institute of Electrical and Electronic Engineers (IEEE).

Those who drew up the standard don't expect it to be ratified for anything up to a year from now, as the document goes through various stages of approval, until it appears with an IEEE number on the front cover.

But it was designed so as not to become obsolescent until 1985 — and that meant looking at what would be cheap in the chip line in five years' time. The implication, for buyers is that a system bought now, using the S100 bus, can guarantee to be supplied with parts like memory boards, and special purpose add-ons (speech synthesis, music, modems). Suppliers will feel confident about committing designs to this standard.

The snag is: how do you know whether the system, bought now, uses the S100 bus? Answer: you don't. Even when the standard is ratified and published, it will be a while before the boards that nearly comply are separated from those that definitely don't.

At the moment, Ithaca Audio is the company to ask for details, because one of the top men there Kels Elmquist,

helped write the spec. At the top end of the market, David Broad of S100 bus specialist supplier, Comart, also has details and will help serious enquirers.

The most cunning bit of upgrade was the way the old S100 bus, with eight wires carrying data in and eight carrying data out of the central processor to memory, was specified in a way that would allow tomorrow's micros to send data along 16 wires (as they do) without splitting up each 16 bit parallel pulse into two "multiplexed" eight bit pulses.

This was done by specifying one of the "spare" lines on the current S100 bus systems (most of them, anyway) as a Sixteen Request. When this wire is pulled, so to speak, the system stops thinking of the data wires as eight in and eight out, and sees them as sixteen bidirectional wires. Neat.

Less straightforward were the methods of defining when and what signals would appear on which lines, and how long they would stay there, in order that the new S100 bus will be able to run with any micro chip controlling it, at optimum speed. Different designs of micro expect memory to return a request for data at different stages of the many clock pulses that make up the typical instruction cycle, and reconciling these differences was not trivial.

(PCW is preparing a detailed analysis of the new S100 bus).

## On line

The July Online Micro Show at Bloomsbury in London proved one thing... the big money in this business is being made by people who are well and truly part of the orthodox computer industry.

The home information system is still only for the rich and clever. And what we don't need are the thousand and one "bought ledger" and "double entry" and "stock control" systems which operate in a market already well served by LogAbax, and Olivetti, and Kienzle and Philips and the rest.

What is wanted is an indexing and storage system. The user must be able to say "Whose phone number is 123

4567?" and "When did I pay my last gas bill, and how much gas had I used then?" and "whose birthday will it be on my husband's side of the family next month, and how old will they be?" — and get immediate answers.

The hardware for such a system is getting very close. At the show, cheap hard discs from Pertec were shown by Tim Keen, and there are more and more printers around for under £500. Others like these are on the way, soon: but who, one asks, is writing the software?

Alan Wood of Digitus tells

me he is. He wasn't at the show. Word from California says that IBM is — but IBM does many things which never turn into products — and IBM wasn't at the show either. Hewlett Packard is rumoured to be working on a product with this sort of software included as a permanent resource — as "firmware" — but HP says it isn't! Texas Instruments could do it, but TI wasn't at the show. Anyway, TI didn't think of it first, so it can't be worth doing.

Also at the show, Euro Calc introduced an accounting

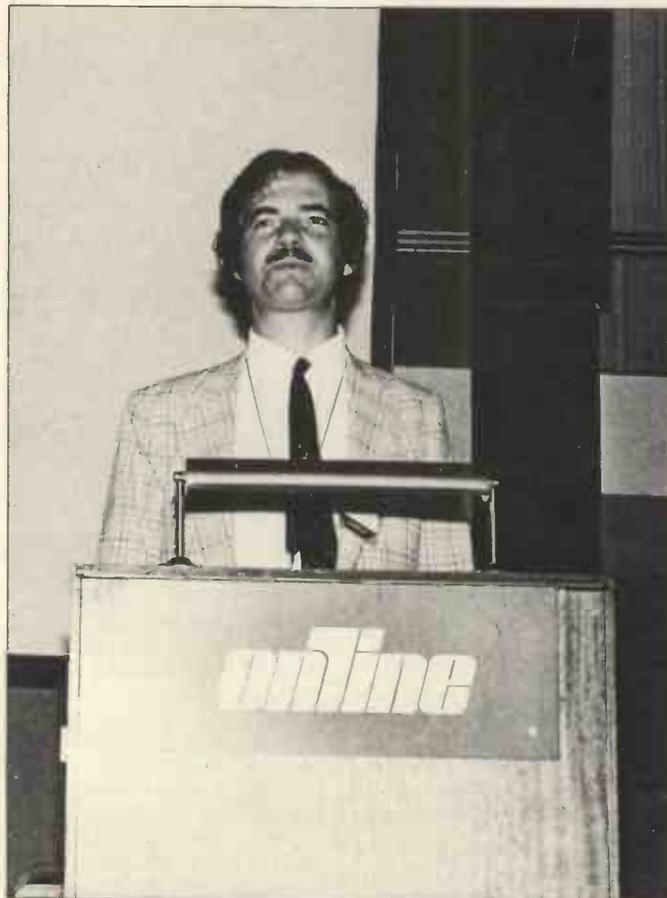
system and the Byte Shop introduced a Plessey-built system for accountants.

The most interesting thing at the Micro Show was kept secret until a week or so after it: Petsoft is to distribute the first UK version of a computer readable magazine. It is for Pet users, and comes on cassette. After an "animated front cover" displayed on the Pet screen, there are usually four or five programs (says Julian Allason at Petsoft) plus routines, utilities and so on. One of the programs is a game, the rest varied.

Probably the most interesting product for the domestic buyer was the TECS computer... built by two ex-Plessey designers who together go to make up Technalogs. It is a teletext computer. That is, it not only displays on your TV screen whatever you have programmed it to show, it also decodes the messages transmitted by the BBC's Cee-fax, and ITV's Oracle. There'll also be a version available to receive the Prestel viewdata service from the Post Office. Using the 6800, it looks to be potentially a very useful domestic computer.

Technalogs expressed considerable interest in the news that City and Government finance was going to Nascom. If that means the TECS price will be low, it must be good news.

For the rest, there was a lot on show for the enthusiastic businessman, but little for those with less than £500 to spend. That reflects the way the micro industry is today... still embryonic.



From the Online show. Top: Star speaker, Adam Osborne.

## NASCOM boost

Nascom, the UK's biggest supplier of computer kits, is planning a totally new "full colour" image by the New Year. Both the Nascom 1 and 2 will switch to colour output, for British standard PAL-type televisions and they'll be supplied assembled and tested.

Estimates of price at this stage indicate that marketing man, Kerr Borland, hopes to produce a complete system with most of the features that currently set Apple II apart — for about £550. A prototype colour board, developed by new recruit Nick Broome, was shown at the July

Online Micro Show, together with a special graphics board to drive it. Borland hopes the graphics board will be available by December for Christmas buyers and the colour board "within a month" of that.

The machine will come in two packages, one for the systems builder, and one for the consumer product showroom. Borland wouldn't say how the latter would look, apart from: "It's not going to be just another box — we are aware of the requirements of the market". All these confident plans stem from the biggest behind-the-scenes news of the UK micro business so far — the decision by Eagle Star finance subsidiary, Grovewood Securities, to put £500,000 behind the company.

This is big news for buyers. The difference between Apple, selling \$100 million worth of stuff this year, and other US companies, was its supply of finance.

Nascom's boss, John Marshall, has had a tough time getting the money to buy chips in the past, and the company has grown purely on the enthusiasm of customers. They were prepared to put money up in front of delivery, and wait — not patiently, admittedly — until the kit arrived.

With the example of Altair and Apple and other American successes, those of us who aren't bankers find it hard to understand why micro companies can't get finance. However, the fact is most bank managers are form fillers. If they want to persuade Head Office to provide £100,000 or so, there is a space on the form which asks what a company's turnover was last year, this year, and estimated next year. They aren't mentally or administratively equipped to write down "Nothing" and "£100,000" and "Maybe £10 million or more" in these spaces.

With Grovewood behind him, John Marshall will be able to get that overdraft, and suddenly, chip suppliers will be asking, not: "When can you pay" but "how much do you want?" He will also be able to get money from the National Research Development Corporation. That Government backed body is, embarrassingly, rolling in plentiful cash —

royalties from medical projects it backed in past years.

Projects like a packaged, consumer aimed, micro-processor that needs development, plus companies that can match the money put up by the Corporation, are just what NRDC is aching for.

## Apple upset

There has been an astonishing fight between the many suppliers of Apple II (the American microsystem) as to who should import it into the UK. At the end of the fight — assuming that it actually has ended — the scene from the customer's point of view has changed in only one important way. Whereas before they were few and expensive, now there'll be lots more available, at moderate prices.

Those who followed the story as it was disclosed in the press, will have been given the impression that it was a fight between the original importer, Mike Sterland (and his company Personal Computers) versus Mike Brewer of Microsense, the new "master distributor".

In fact, the only man who is in a position to know exactly what happened is Andre Sousan, head of Eurapple, the "European marketing arm" of Apple, is based in California. This distance may explain Sousan's detachment from the realities of the UK market.

For example, at one stage when dealers were complaining of low margins of around 20%, Sousan was under the impression that they all insisted on 50%. That, at least, was his explanation last year, of Apple II's high price in the UK, relative to the US.

Apple itself, only four years old, had its hands full in the US market. There, Apple II, Pet and TRS-80 all sell for very similar prices. . . product differences are more relevant to success than here. Even more relevant is the fact that Tandy's huge Radio Shack chain of hi-fi stores and Commodore's established calculator outlets in the retail market, gave these companies a good edge over Apple. To compete, Apple had to flood every willing dealer in the US with supplies. It did so successfully, pushing Pet into the number three slot. . . with

some help from a complacent and over confident Commodore.

That left few machines for Europe — and even they were a nuisance, with non standard power supplies, a different colour card, and the administrative hassle of exporting. The UK, at least, was not flooded with them and Sterland had to assuage a hostile press (who correctly considered the end user price outrageous) with explanations that boiled down to: "I can't get any more machines, so what's in it for me or my dealers if we cut the price?" And without breaking any confidence, I can reveal that his margins were nothing like 50%.

How did Sterland get into bad odour with Apple? According to sources in Cupertino, it was the effect on the market of a dispute between Sterland and Tim Keen, who wanted more Apples. Keen eventually took his complaints to the top, and requested that he, too, be appointed direct distributor.

The dispute itself was petty, small, and irrelevant; it concerned whether or not a disc drive should have been sent registered post, and whether it had been received if it hadn't been sent registered. It so happened, though, that the dispute reached the top of Apple itself just at the point where head office was congratulating itself on taking over Pet's number two position, and was starting to ask: "Why aren't we number two in Europe?"

There is no doubt about the answer. Demand was lower than it should have been because of the high price and, worse still, supply was only spasmodic.

The Apple II is its own best salesman, generating satisfied customers even when they have had to wait weeks for delivery of a machine, when software produces a crazy mixture of colours, when disc drives are as rare as hen's teeth, and when spares and upgrades have to be cannibalised. At the time of writing, some 40 Apples are sitting in Sterland's warehouse, gutless, as the only source of repair parts.

But the best salesman wasn't getting into the field. If Cupertino seriously believed that the Sterland/Keen dispute was "tearing the heart out of the market"

then it was getting its information from an uninformed source. The problem was availability.

Sousan was therefore authorised to appoint Microsense as "master distributor", a step he accordingly took. Rather strangely, he preceded this step with a letter to Sterland assuring him that Apple had "no intention" of appointing any other distributor. He then went on holiday.

A discreet veil is the best treatment of the unseemly wrangle that ensued, with dealers assuring both old and new distributors of their support while solicitors' letters threatened all manner of implausible repercussions. None of it was surprising, in the circumstances. Not so much out of support for Sterland as out of sheer bewilderment, Apple dealers banded together, and decided to send Alan Wood of Digitus as representative for their cause. . . the need for a regular supply.

Apple told him not to bother coming and Microsense declared that nothing would come of it; but Wood made peace between Sterland and Brewer despite, as he put it, "the emotion that had been spent previously". The strange thing is that the cause of all the fuss was Apple's decision to cut prices and increase shipment volume — plans are for 1,500 Apples a month. These improvements seem to be what everybody is now claiming will be the results of all the changes.

In the end, the price of an Apple II with 16 Kbytes of memory — a quarter of its maximum — is now around £830 for black and white TV output models, and UK customers will be seeing advertisements which are paid for by UK dealers, but created by Apple. Considering that the price is still \$400 adrift from the US price, was it worth all the fuss?

It is *Personal Computer World's* sad task to report that Wim Hoeksma, publisher of *Practical Computing*, died recently from injuries received in a road accident near London. He was 39 years old and left behind a wife and sons aged 11 and 13. We offer our sincere condolences to his family and many friends. He will be greatly missed.

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## A to D

The typical electronics experimenter will be able to devise methods of using a micro to measure voltages. The typical Pet user, TRS-80 user, or Kim user, will not. Kimset is a \$285 US built analogue to digital converter made by Connecticut Micro-computer Inc, and versions are built for other machines.

The point of measuring voltage is that most sensors one would want to use for making a computer monitor things — temperature sensors, light meters, pressure meters, flow meters — tend to output varying voltages.

Connecticut Micro's converter wouldn't do, perhaps, for professional process control, because it converts voltage levels into 8-bit digital values — only 256 different gradations, and for serious process control that's not accurate enough. Most use 12-bit codes, but for the private user with an 8-bit micro, nothing could be nicer.

It also has an RS232 interface, and a HP bus interface. It allows 16 analogue inputs.

Connecticut Micro-computer is at 150 Pocono Road, Brookfield, Con 06804. Tel: (203) 775 9659.

## Intel 8088

Intel's most powerful 8-bit micro, the new 8088, is now available from UK distributors.

The machine is really a 16-bit 8086 with a truncated databus; it will address a million bytes of memory, and runs the 8086 instruction set. Jermyn, the distributor, is confusing the issue somewhat, however, by claiming "The bus structure provides full hardware and software compatibility with the popular 8080 and 8085 based systems." This should not be read, they say, as implying that it runs the same software; just that they have an assembler to produce 8088 machine code from 8080/8085 source menmonics. On these grounds, Zilog has only to produce an assembler to claim "full software compatibility" with the IBM 370, for its Z8000.

The importance of this chip is still widely unappreciated, however irritating you may find the marketing policy. It will not be left behind when big bubble memory systems start being used instead of discs — because the bubble will slot into the memory map in five years time. Full list of dealers from Intel, Between Town Road, Oxford.

## Pascal validation

Pascal is the language in which programs of the future will be written, and the language which microsystem builders are rushing to offer on their products. Before being dazzled, remember that BASIC programs are different from one machine to another; ask whether the Pascal on offer is really Pascal.

About to announce a new Pascal compiler or interpreter? Don't release it until it has been checked against the validation package — some 300 programs written in Pascal, which

your version must run correctly. Don't just assume that anyone writing Pascal will know about this package; if you are thinking of buying a Pascal machine, ask how it rated on the validation test. If the supplier doesn't know, it's worth suspecting that programs written for your machine's Pascal will need heavy re-writing before they can be sold to users of different Pascal compilers or interpreters: worse still, programs which others have written, won't run on your machine at all. If that frightens you, contact Southampton University's Computer Studies Group for news of the package.

## Lab basic

The attraction of using a computer to control things has always been somewhat reduced by the fact that instructions to turn the X-ray on, monitor the mass spectrometer or reduce the power supply to the heating element by 10 degrees, don't occur in high level languages like Basic. The user normally has to interrupt the easy flow of human-readable instructions with a string of machine code numbers.

Research Resources of Welwyn Garden City has started solving this problem for users of machines in the South West Tech Products family. . . which includes Smoke Signal, Midwest, and so on, all with the SS50 bus structure. Its Labbasic language has statements such as SENSE, FLIP and DELAY. Research Resources say that timing down to a millisecond is made possible with the addition of an interrupt clock; with this and Labbasic, experiments and other happenings may be controlled and

timed.

A special version of Labbasic for use with SWTPC's CT-82 graphics display is available. A version for Pet is coming and a compiler, to convert Labbasic statements to Motorola 6800 machine code (loadable into read only memory) is also under development. Cost of Labbasic is £25 plus £3 for the manual. Research Resources is at 40 Stonehills, Welwyn Garden City, Herts AL8 6PD.

## Teksim~save 'kilobucks'

Apple dealer Mike Sterland has found a software product — Teksim — which allows users of big, expensive graphics systems to display their pictures on an Apple, rather than on a Tektronix screen. Even to these people, the difference in cost is considerable. In the words of Teksim makers, ABW Corporation, "a hunk of hardware like a Tek can set you back quite a few kilobucks." Teksim comes on a read only memory chip which disguises the Apple as a Tek terminal from the point of view of the computer holding the software, and very nearly does the same job for the user. The shortfall may well be worth the saving; in essence, where Tek shows 35 lines of 73 characters, Teksim on Apple would become illegible with more than 32 lines of 68 characters. Further details from the applications engineer at Personal Computers: he is Nilu Pattnaik, tel: 01-623 7970.

## Intel floppy control

Intel has produced its own "universal" floppy

disc controller board. It won't control dual density drives, nor hard sector drives, and it uses the SBC bus found inside the Intel MDS development system, so it is not bargain basement price; however, it will be better engineered than most S100 bus boards. Details from Intel's Belgian office in Brussels; Parc Seny, Rue du Moulin a Papier 51, Boite 1, B1160.

## Explorer 85

From the makers of the Cosmac Elf micro kit, comes a £300 DIY package based on the Intel 8085. It is called the Explorer 85, and for the price, the importer Newtronics will supply a 4K-byte system with a 2K-byte monitor program. There are two slots for S100 cards so you can add cheap Godbout memory or diskette controllers. Output is to a standard television or video; it may be necessary to adjust the synch a bit to get good output, however. The maker is Netronics, the importer Newtronics; address is 138 Kingsland Road, London E2 8BY.

## Intel 2118

When the big 64K-bit read and write memory (ram) chips are available, those who designed their boards around Intel's latest 16K ram will be able to plug them and get four times the memory capacity. The new 16K, the 2118, is also fast; access under 100 nanoseconds.

## Price wars

Look out for cheaper S100 products from the big Comart chain of concessionaires. . . due mainly to lower cost memory. Prices were cut to below the prices



Cosmac Explorer; a new £300 micro package.

asked by the Micro Centre in Edinburgh, but before these could be announced, the Centre cut its own prices, aggressively and by similar amounts.

## Like Superboard, like Compukit

Computer Components in Barnet has launched its Compukit. It appears to be a splendid little system, described by Robin Bradbeer in his North London Hobby Club circular as "their version of the Ohio Superboard 2." From this, potential customers can safely deduce that if they like the Superboard, they will like Compukit. More in later issues. . .

## Century 40-Mbyte disc

Plans for large-scale external data storage should be considered in the light of an announcement by Century Data Systems to the trade. For \$1,800 (nowadays well under £900) Century is offering a 40M-byte disc to bulk buyers. Obviously it will be more expensive with interfaces and controllers, and since it uses

sealed "winchester" discs, not £5 floppies, it will be costlier still. But remember that this machine, the Marksman, is delivered this year, and it has forty times the capacity of a floppy and many times the speed. It comes around three times the price.

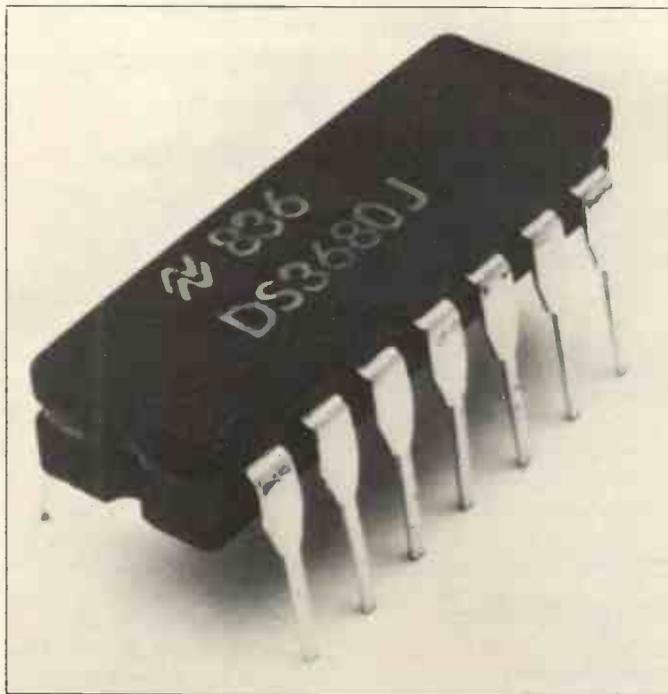
Century is a Xerox subsidiary in Anaheim, California 92806, at 1270 N. Kraemer Blvd.

## Chip on the tap

A computer can dial telephone numbers. Unless you are post

office approved, you cannot do it the easy way, by putting a relay across the two phone wires and turning it on and off at the right speed; you need instead a gadget that will lift and drop the receiver at the right speed.

Assuming you can do this, there is a chip to control the relay in the little machine. National Semiconductor has produced it for the telephone design engineer. It is a relay driver or, more accurately, four relay drivers on one chip. Details from National in Bedford on 0234 47147.



National's relay driver chip.



Price cut for Plessey memory expansion units

plugging into a spare ROM socket. For the 8K machine they will cost £75, plugging into the memory expansion interface.

## PET food

Enough users of the Pet have wanted to run long programs for Plessey to sell large numbers of its memory expansion unit. Good for Plessey: and good for us too, because the prices of its Petite and Inpet expansions are now down 20%.

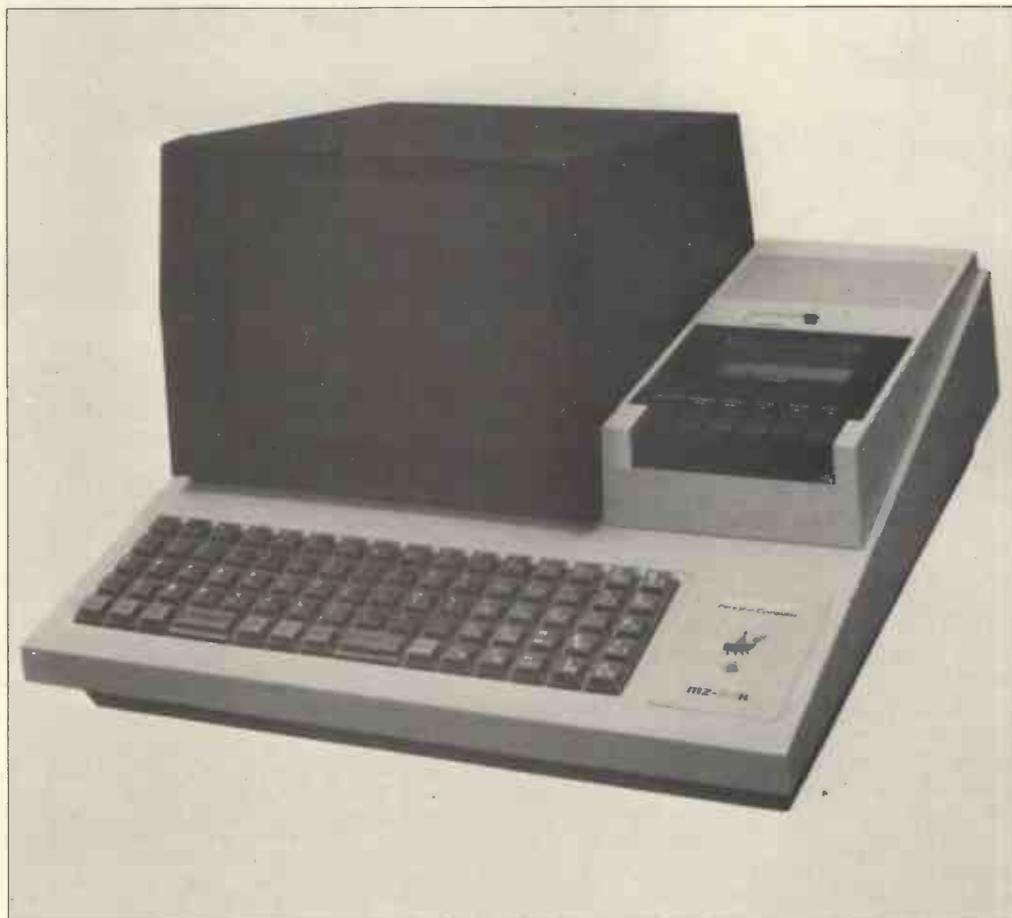
Cost of the Petite becomes £289 plus VAT . . . Inpet is £249. The difference between the two is that the Petite is a box connected to the Pet, while Inpet is a card which goes inside. Details on Towcester 0327 50312.

## Pet kit cuts corners

Petsoft have produced a software package on a ROM chip especially for the programmer. Called *The Programmers' Tool Kit*, it helps in the coding and debugging of programs. Facilities available are: AUTO — Automatic line numbering; DELETE — Deletes specified blocks of code; RE-NUMBER — Renumbers the entire program to user specified increment; HELP — Highlights error by reversing the field in question; TRACE — Provides a display in the top right hand corner of the screen showing the line currently being processed plus the previous 5 lines; STEP — Allows single stepping through the program; APPEND — Allows concatenation of successive programs or subroutines read from tape; DUMP — Displays names and values of all variables used in a program; FIND — Search facility — lines containing specified code are listed; and OFF — Switches the facility out of TRACE or STEP modes.

These devices will be available from October

1st. They will cost £55 for the 16K or 32K PET,



*Shhh. . . whisper who dare! Quietly gearing-up for a big market push in October comes Sharp with its PET-aimed, MZ-80K. With Sony and Hitachi (to name but two) also currently consumer-testing products in Japan, it looks as though the long-predicted Nippon micro invasion is but a few months away.*

# COMPUCOLOR II

*This month's review of the Compucolor II marks the inauguration of the PCW Benchtest.*

*Though check-outs of microcomputers are nothing new, so far none of Britain's monthly magazines have made any consistent attempt at standardisation of testing routines and procedures.*

*Results, even those excellently conceived, have rarely been tabulated for sensible comparison.*

*Over the next few months, we hope that the name "Benchtest" will become synonymous with the structured, reliable and meaningful investigation of hardware equipment. Benchmarks provide handy measuring tools for reading one machine's performance against another. In the past, PCW has made use of the 8 conceived by America's Kilobaud magazine; we shall soon be adding more of our own derivation.*



The Compucolor II is a fairly recent addition to the currently available range of personal computers. Being a late arrival has allowed it to benefit from careful research into the desires of the American hobby market, where it is already the fourth most popular microcomputer (after Tandy, Pet and Apple). A useful starting place for a review of this machine would be to speculate what might have been the results of this research.

"At the cheap end, volume production of well-packaged units ensures Commodore and Tandy an unassailable market lead, while the top end — where the hobby market merges into the small business and science-lab field — is too fragmented to offer substantial sales on a single product. The middle of the range (e.g. Apple) offers the sophistication of graphics and/or color. Hobbyists generally upgrade their BASIC

and exchange their cassettes for disc drives as soon as they can, so that anything pitched at Apple prices which includes a powerful BASIC, disc drive and color video is in with a chance".

It seems that the Compucolor II was produced around this philosophy of design.

## Hardware

The Compucolor II looks very much like a colour television set with a separate keyboard. The minifloppy disc drive is located to the right of the screen and the microcomputer itself is located underneath the CRT. The system tested was built for American mains but came with a 230 volt transformer rated for a line frequency of 60 Hz. Apparently this caused the consistent high-pitched whistle and the wobbly picture with pincushion distortion, faults which should not exist in the systems that are now being produced for the British market.

A great deal of attention has obviously gone into the design of the CRT display (all reference material describes

this as 13" — my tape measure made it just 12"). There are eight bright colours which can be selected by program or from the keyboard. They are fully utilized by the operating system (prompts for filing are yellow, BASIC is green, errors are red). In character mode there are sixty four characters per line and either thirty two or sixteen (double size) lines per page. It has 128 x 128 point graphics and as the display is memory mapped, there are the usual cursor control facilities as well as the ability to store the full screen on disc.

There are three choices of keyboard. The standard has seventy one keys including AUTO (that brings up a disc directory), repeat, CPU reset, escape, break and control. It requires two keystrokes for "plotting" (a term that covers character height, flashing and colour as well as its obvious meaning). The extended keyboard with 101 keys has a special pad for colour and commonly used commands, as well as a numeric keypad. The deluxe keyboard with 117 keys can access all the plotting facilities with one keystroke. Since all possible plotting options can be called on the standard keyboard there are two (and sometimes three) ways of accessing most commands on the extended and deluxe keyboards.



PCW's regular Benchtester, Sue Eisenbach, with the CompuColor II.

## Graphics

The Compucolor II has colour graphics capabilities accessible through the keyboard and under program control. Rather than having just the elementary graphic functions (move from point to point and draw from point to point), Compucolor provides a wider range of facilities. For instance:

1 colour: The eight colours — red, blue, green, yellow, white, black, magenta and cyan (light blue) — can be used in any combination for both background and foreground. Any colour can be intensified.

2 cursor: the cursor, which is an "equals" sign, can be moved around the screen and homed. It can be made invisible, that is, the same colour as the background (normally it is a different colour to both the foreground and the background). When editing a line under cursor control the back arrow causes characters to disappear, while the forward arrow causes them to reappear.

3 characters: All special characters are constructed from a 2 by 4 matrix of small blocks. There are sixty four special characters of which thirty two can be user defined while the rest are predefined. All characters can be displayed in single or double height (width remaining the same).

4 flashing: Any display or part of display can be made to flash.

5 graphics: Individual points can be plotted on a 128 by 128 point grid. An optimal path can be drawn between two points.

6 bar graphs: A bar can be drawn either vertically or horizontally in one instruction.

Playing with the graphics on the keyboard is quite straightforward but incorporating graphics into a program is a different matter (on any system). Compucolor avoids the sheer drudgery of point to point work by providing the powerful routines detailed above. I suspect though that their usefulness is somewhat diminished by a rather unimaginative calling mechanism.

## Disc drives

The 5¼" minifloppy disc drive is made by Wangco. Each side of the disc may be used but as there is only one read/write head per drive then, equally, only one side of each disc may be on line at any one time.

Each disc has a formatted capacity of 51.2K Bytes per side and it is possible to attach an extra drive making a maximum of two.

Compucolor claim an average access time of 400ms and a transfer rate of 76.8K Bits per second. Our benchmark tests, however, made things appear a lot slower than this would indicate.

It is interesting to note that there is no disc controller on Compucolor II. All data transfers take place through an eight bit parallel port, one byte at a time, tying up the MPU in the process.

## Basic

The 16K BASIC interpreter is stored in ROM. Compucolor Corporation named it DISK BASIC 8001 to emphasise its disc filing facilities. It bears a strong resemblance to Micro-soft Extended BASIC and is quite powerful.



The Compucolor II — disc drive, colour video and pitched at Apple prices.

Numbers are in the range  $10^{-38}$  to  $10^{38}$ . Variable names can be of any length but, unfortunately, only the first two characters are recognized. The system has a comprehensive set of error messages, also only two letters long. The interpreter is quite particular when it comes to what spacing it will accept. However after imposing this spacing convention on the programmer, the interpreter itself does not follow it, listing programs in a different and slightly peculiar format! The screen editing facilities cannot be easily used to re-edit a BASIC program.

The main BASIC reserved words are listed in chart 1. Note the following:

- DIM Defines multi-dimensional arrays. Subscripting starts at 0.
- GET Used for file processing.
- OUT Outputs a byte to another port.
- PLOT Multifunctional graphics facility.
- PUT Used for file processing
- FRE Number of free bytes left.
- LIST Only does a full listing. Pressing "BREAK" followed by return will enable stepping through a program screen by screen).
- CALL Used to interface with 8080 routines.
- RUN Used to run programs in machine code only.

Note also that there is no re-initiating command, requiring the programmer to boot the BASIC to clear the memory,

thereby losing any colour and character size settings.

## File handling

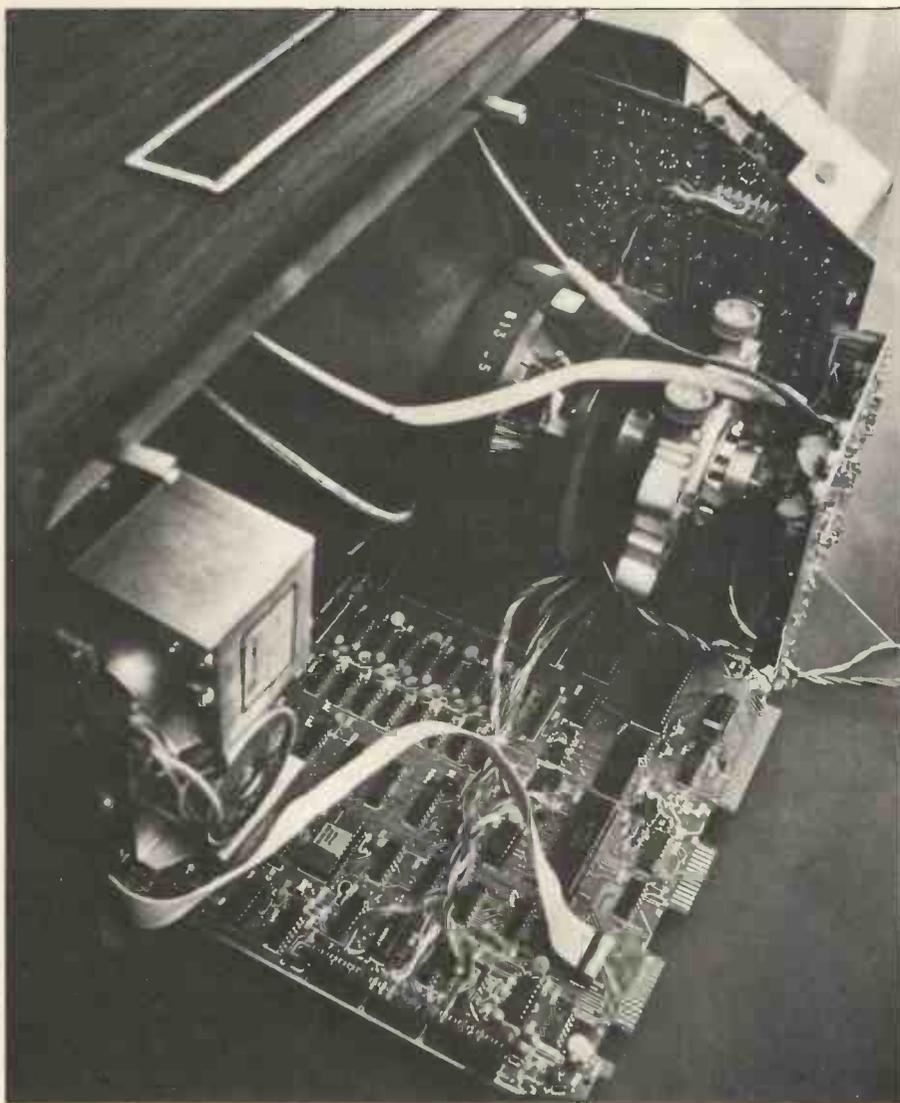
Incorporated in the systems software supplied with the Compucolor II is a set of routines known generally as FCS (for File Control System); it has much in common with PDP 11 software. The prompts (in yellow) are FCS> while the file naming format is Name.Ext; Version.

The main FCS commands are listed in chart 2. They may be used under FCS or within the BASIC system.

In addition there is an extensive set of mnemonic error messages. One annoying feature of the sharing of commands between BASIC and FCS is that BASIC requires quotes around the filename while FCS does not.

The DISK BASIC 8001 also offers extensive random access file-handling through FCS with instructions including creating, opening and closing files, inserting and amending records and error trapping. Unfortunately these commands are all concentrated into a single routine and are called via single character parameters (much like the PLOT instruction).

There is also a very convenient disc accessing facility that allows easy execution of stored programs. When the



The processor board plays neighbours with the CRT. . . we detected no overheating.

AUTO key is pressed, if there is a program called MENU. BAS on the disc it will be loaded and executed. The manual explains how this program can be written to display a numbered list of the other programs on the disc, any one of which can be run by selecting the appropriate number. After the requested program has been executed, control returns to MENU. BAS.

On the whole the file-handling software constitutes an impressive and powerful tool which compensates in many applications for the inefficient disc transfer mechanism.

In order to test the file handling characteristics I created two small files; one I called the product file, comprising five 200ch. records; the other, the customer file, comprising three 300ch. records. My plan was to read a customer record; read, update and write each product record; then update the customer record. I was intending to repeat this cycle twice more in order to establish some average timings. Unfortunately the test couldn't be completed. I spent several hours on two machines, one at Abacus, the other at Eurocalc, and somewhere in the middle of each test run the system reported a hardware failure. Whether this was really a hardware failure, or a system software bug or a formatting error on the disc I wouldn't like to

say. Both Eurocalc and Abacus spent a lot of time trying to get to the bottom of the problem but in neither case were they able to find a solution in the time available. I would certainly require some sort of demonstration to show that compucolor discs can be used to the full before considering this machine for business use.

In view of the above I can only approximate the timings for this part of the benchtest. If the records were placed somewhere near the centre of the disc, it would take approximately one minute to open the files, perform one test cycle (customer read, 5 x product read/update/write, customer update and write) and to close the files again.

## Business potential

The price range of the Compucolor II places it in the small business class and although the bright colours might prove to distract, it could be argued that they may usefully be used to convey information (red debts, green credits etc.).

The disc system provides the greatest limitations for using the Compucolor as a business machine. Only two discs can be on line at the same time, and these may only have 51Kch each. For example, a disc would hold just 200 records if each was 256ch long, or 500

if each was 100 characters in length — not an unreasonable demand for a product record, for example. The lack of DMA (direct memory access) probably rules out Compucolor for any serious business application. Also in practise it takes several seconds to access and process a single record. Although this is much faster than accessing a filing cabinet it is far slower than one might expect from a disc based personal computer.

Compucolor Corporation did not design this system to interface easily with add-on products currently available. It would be extremely difficult to upgrade the disc system because of its non standard design. Even if the access times are acceptable, a maximum capacity of 102K bytes on line would be easy to outgrow.

## Education

The Compucolor II keyboard is a bit flimsy for normal school use and the availability of all the controls on the keyboard is probably unwise in an educational environment. A key which disabled CPU reset and Auto (disc load) would make it a more viable school system.

However, the Compucolor II offers many features considered highly desirable, if not essential, in a good teaching aid. The distinct colours, the large letters and (rudimentary) graphics are invaluable for demonstrations, and the packaging makes it more portable than an overhead projector. It could be argued that a graphics capability with better resolution should be traded for the colour but this would depend both on the level of pupil and the amount of time available for development.

When considering the microcomputer as a system for teaching programming and computer science, it must be noted that 16K BASIC is as extensive as could be desired and the filing system is excellent for teaching data processing as well as storing pupils' programs. CESIL listings in BASIC are readily available. An 8080 assembler can be purchased for A-level computer science which, although not the best assembler on the market, is adequate for teaching low level programming. There are no other language translators available at this time.

Graphical exercises (a major non-mathematical application) are useful for teaching problem solving to pupils. The PLOT instruction, the heart of the graphics system, is so obscurely parameterized that the mastery of it is a difficult skill. More importantly, it constitutes a hindrance to the clear-out programming style towards which the pupil should be steered.

## Home and games

Whilst it is not the purpose of this review to study packages in detail, I could not resist having a go at some of the offerings from Compucolor.

I found that the home accounting and housekeeping packages were very American in both spelling and content. It is unlikely that these will be greatly used in the UK. This, of course, means that there is plenty of scope for developing your own, or for someone to develop and market some UK versions.

Some of the games are really spectacular with, as you might expect, lovely graphics. Unfortunately my joy

# BENCH TEST

at finding these games was marred by the fact that bugs creep into some of them. In fact on one called Concentration (in which you have to remember pairs of numbers) I am sure that Compucolor was deliberately cheating! From time to time it sneakily changed the numbers.

## Expandability

There is limited scope for plug-in expansion. At present it consists of a

## Technical data

CPU:	8080A. 2MHz
Memory:	8 - 32K dynamic RAM
Keyboard:	70, 101, or 117 key versions
Screen:	13" (?), 8 colours. 16 or 32 lines of 64 characters. 128x128 point graphics
Cassette	N/A
Disc Drives:	Up to 2 drives. 1 head per drive. 5 1/4" discs. 51.2ch per side.
Printer:	N/A
Bus:	50 pin. (Enough signals to attach an S100 motherboard)
Ports:	RS232. Compucolor II may be used as a terminal via this port. Selectable baud rate.
System Software:	File Control System (FCS)
Languages:	16K Disc BASIC 8001 in ROM. 8080 Assembler.

## At a glance

### FIRST IMPRESSIONS

Looks	***
Setting up	*****
Ease of use	****

### HIGH LEVEL LANGUAGES

Basic	****
Cobol	N/A
Fortran	N/A
Pascal	N/A
Other	N/A
System Software	****

### PACKAGES

Business	N/A
Education	*
Home	***
Games	****

### PERFORMANCE

Processor	**
Cassette	N/A
Disc	*
Peripherals	N/A

### EXPANDABILITY

Memory	**
Cassettes	N/A
Discs	*
Bus	**

### COMPATABILITY

Hardware	**
Software	***

### DOCUMENTATION

VALUE FOR MONEY	***
-----------------	-----

****	excellent
****	v. good
***	good
**	fair
*	poor

second disc drive (which is needed if the discs are to be copied), an RS232 printer or terminal, and memory up to 32K. The Compucolor II can, itself, be used as a terminal via the RS232 port. With some technical knowledge an S100 motherboard could be connected to the 50 pin bus, thus allowing all the S100 options.

## Documentation

The Compucolor II Programming and Reference Manual is a comprehensive and clearly written document. It contains a thorough description of the BASIC system (including the graphics), a guide to the file control system together with the associated lists of commands and error messages, and the

## Memory map

0000	Restarts & tables
0100	ROM BASIC
2100	FCS & CRT ROM
4000	Future space
6000	High speed refresh RAM
7000	Slow speed refresh RAM
8000	Scratch pad RAM
8200	Scratch BASIC RAM
8300	
FFFF	Work space RAM

## Benchmark comparisons

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8
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

## BASIC

Statements:	CLEAR	DATA	DIM	END	FILE
	FOR	GET	GOSUB	GOTO	IF
	INPUT	NEXT	ON	OUT	PLOT
	PEEK	POKE	PUT	PRINT	READ
	REM	RESTORE	STEP	THEN	TO
	WAIT				

Commands:	CONT	LIST	LOAD	RUN	SAVE
Mathematics:	ABS	ATN	CALL	EXP	INT
	INP	LOG	POS	RND	SGN
	SPC	SQR	TAB	TAN	

String handling:	ASC	CHRS	LEFT	LEN	MID
	RIGHT	STR	VAL		

Disc handling: See FCS

## FCS

Logical blocks:	READ	WRITE		
File:	COPY	DELETE	LOAD	RENAME
	SAVE			RUN
Diskette:	DEVICE	DIRECTORY	DUPLICATE	INITIALISE

specifications of the major hardware components. Although there are chapters entitled "Essentials for Simple Programming" and "Beginning to Program", this book is not a suitable text for the novice wishing to learn how to program.

The chapter on graphics is not so clearly presented. . . this may be due to the clumsy graphics system.

## Prices

At the time of writing, the basic Compucolor II with 8K Ram cost £1390 (exclusive of VAT) from Abacus (the major UK dealers). The 16K and 32K versions cost £1485 and £1750 respectively. The extended keyboard was £120 extra while the deluxe keyboard cost £175 more than the standard version. The second disc drive was £350. Therefore, the most expensive system (32K deluxe keyboard, 2 disc drives) cost £2275.

The programming manual, which should have been included in the price as it contains all the instructions needed to use the system, was £19. The maintenance manual cost £37.50. There are some games, an 8080 assembler and home finance programs available on discs costing £16 apiece.

A maintenance contract can be arranged for approximately 10% of the purchase price per annum.

## Conclusion

At £1400, the Compucolor II offers an extensive keyboard, a 13" (?) eight colour CRT (128x128), 16K Basic in ROM, 8K RAM (expandable to 32K) and one (or two) slow minifloppy drives. If your needs fall within those criteria, you will find the system good value for money.

# 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".

Lawrence Mynott

I am in a dilemma. It appears that tailor-made programs for my business are very expensive, I have been quoted over £500. Can such costs be justified? Should I learn how to program so that I can do the job myself?

If you have never programmed before, then it is something that I can thoroughly recommend you try (WARNING. . . programming can become addictive and your business will suffer). The best way to learn is to buy a micro and jump in at the deep end. If you find that it's not for you, then you can always sell your computer on the secondhand market. They fetch good prices and, after a year's use, you could find that it's only cost you £100-£200.

Another short cut to learning is to arrange for someone to teach you, or at least show you how to start; this will save you many hours. If you have a little money then there are companies that run introductory courses to programming. I run one myself in London and know how valuable such courses can be. A few days being taught is far quicker than weeks of sitting reading a book. Beware, though, of assuming that you'll be able to write a business system after only three months programming practise. Some people learn very fast, others take longer.

The charge of £500 seems fairly reasonable for a tailor-made business program. Remember it may have taken in excess of 60 man hours to write and it could be a one-off. If you can get a guarantee with the program that's backed by a substantial company, then you may find it cheaper in the long run to buy a tailor-made package. If the money is very important, then there are ways to obtain cheaper programs, but they're less likely to have the backing of a guarantee and good after-sales service.

My own, very personal, recommendation is to have a go yourself. At least then you can correct, modify and update your program whenever needed; and you'll be gaining a skill that will be very useful

in the future and also learning a fascinating and absorbing art. Unfortunately, you may also lose your wife, and bore your friends to death in the process!  
Sheridan Williams

## HIGH OR LOW LEVEL CHESS?

When is it better to write programs in a high rather than a low-level language? I'm asking because I'd like to create my own chess program and I'm not sure whether to use BASIC or not.

First I'll start by giving you a definition. A high-level language is one where each source code statement is translated into many (sometimes hundreds) of machine code instructions.

Programming in a high-level language takes far less time than writing the same thing in a low level (assembly) language. Nowadays, cost of labour is one of the predominant factors in the production of a working computer system and, in general, the shorter the programming time the cheaper the program will be. However, a program written in a high level language will translate less efficiently, sometimes taking 50% more space and half as much time again to run than the machine code equivalent. So for programs where speed is important, or where the amount of available memory is low, it's better to write in machine code.

An example of an inefficient translation would be the machine code produced when the single BASIC statement `LET A=X↑2` is translated; the machine code produced could be immensely long, and up to 50 instructions may be needed to enable the computer to find the log of X, multiply it by 2, and then antilog it. With very little thought this could have been coded in only a few instructions.

If ever you have used PEEK and POKE in a BASIC program, then you have effectively programmed in machine code.

Finally, to answer your question on whether to write chess in BASIC or machine code. If you have a BASIC compiler rather than an interpreter then go ahead in BASIC; the program won't be as efficient, but it will be far quicker to write, and easier to debug. If, however, you have a BASIC interpreter (which most people have), then I'm afraid that you will have to write it in a low level language or it will be so slow as to be almost useless. Chess playing algorithms, are very complicated and require huge amounts of searching; speed is of paramount importance. A BASIC interpreter will work 100-200 times slower than the equivalent machine code! The reason is that instead of translating the whole program into machine code right at the start of the run (as a compiler will do) an interpreter will re-translate every line into machine code as, and when it comes to it.  
Sheridan Williams

## LOW COST, MULTI-FUNCTION

I am beginning to make a survey of microcomputers with the intention of buying one in the near future. I have two technical questions:-

1. Am I right in assuming that a CPU can only execute programs and manipulate data if instructions and data are addressed (i.e. the CPU cannot work directly from a peripheral such as cassette or floppy disc)?

2. In a micro system with some kind of motherboard and bus structure (eg Nascom 1) would it be possible to have two different kinds of memory boards (a ROM and a spare RAM) of the same memory size and with the same address, replacing one with the other as circumstances require?

My applications are statistical analysis; handling of large data arrays; plotting and drawing graphs; simulation of ecological, meteorological, and population models. I envisage a cost initially under £400 ultimately under £800, I don't wish to consider floppy disc systems.

Given the above information, eight further questions need to be considered:

3. Can I program satisfactorily in assembly language?
4. Is BASIC a suitable alternative?
5. Can I get FORTRAN or a more suitable language in Prom?
6. How much RAM will I ultimately need?
7. Would I be better off considering a 16 rather than an 8-bit micro?
8. I've been told that the Nascom 1 and Newbear 77/68 are unsuitable for my use. . . is this true?
9. Can I get started for under £400?
10. What possible candidates among micros should I consider?

1. In common with most computers, microcomputers do require program instructions to be in addressable memory. The same does not apply to data however, where frequently the input is from some peripheral such as tape or floppy disc. Perhaps the most fundamental example of this is loading a program from tape or disc. The program is transferred byte by byte from the storage device to main memory by a loader program (probably part of the monitor or operating system) designed for the task. To the loader program it is simply a matter of moving data from one place to another in spite of the fact that the data consists of code for another program.

The main reason that data is usually stored in addressed memory is speed of access. A byte in addressed memory is available to the processor in a matter of microseconds. . . from tape it might take minutes.

2. Your proposal for 'parallel' RAM and ROM memory is entirely possible though rarely used since most people want to have all their system resources available at the same time; what you describe is an "either-or" situation. The switching from one type of memory to the other could be by manual switching — involving least modification of circuitry — or by complex switching done under

program control.

3. Since most of the applications involve complex numerical manipulation I would definitely not recommend assembly language. I am not saying that it cannot be done, simply that it would take a lot of time and experience to develop software of this nature on a system without floppy discs.

4. Since what you need is in effect a 'super programmable calculator' BASIC is certainly a good language to choose. Look for a system offering at least an 8K BASIC, anything less (eg Tiny BASIC) will not have the features that you require.

5. BASIC is available in PROM inside many systems; PET, TRS80, NASCOM 2, and the Ohio Scientific Superboard are just a few examples. FORTRAN is not available in ROM form it requires disc support for practical operation.

6. It is impossible to guess how much RAM you will require without further details of your applications. It depends for instance on how large your 'large data arrays' are. Consider as a loose rule-of-thumb that each element of the array will use up 4 bytes of RAM.

7. Since there are so few 16-bit systems on the market, and none within your price range, I would stick to 8-bits. Things will be different in 12 months, however; there must be many companies working on 16-bit micros, although I would expect most to be up-market.

8. Nascom 1 and 77/68 are essentially designed for the electronic kit builders market rather than the serious programmer. It is my opinion that it would be cheaper in the long run to buy a ready constructed application oriented computer like the PET or Tandy TRS80.

9. I think your budget of £400 is a bit tight. The main problem is memory requirements. Large data arrays imply large amounts of memory and that is expensive.

10. I have already mentioned the PET and TRS80 which are both super-calculator type machines; they have many advantages in terms of manufacturer support, expansion, repairability, and availability. The major problem is cost. Both these machines are outside your budget, even in their most basic forms. You would probably have to consider memory expansion almost immediately. If you can afford it, consider the following machines:

PET £500-£800 plus extra for printers, disc etc.  
TRS80 £400-£600 plus extra for expansion. Graphics easy to use, can be obtained without TV display, or cassette. Get at least level 2 BASIC.

APPLE Also known as ITT2020 in its UK version. Prices start at £850; this includes excellent graphics capability; it's fully expandable.

Exidy Sorcerer around £800 (including 32K RAM). Graphics are high resolution but not easy to use for curve plotting. Research machines 380Z BASIC on cassette rather than in ROM but this has advantages. Graphics are reasonable, high resolution also being available.

Neil Harrison

## SCHOOL CHOICE

I have been asked to investigate a suitable microcomputer for use in school. What points should I consider when looking for such a system?

The first thing I suggest you do is join MUSE (Minicomputer Users in Secondary Education)... they will be able to answer your questions in far more detail than I can here.

School use has certain distinct requirements that help determine the ideal microcomputer. Firstly, is the computer to be used for the reaching of computing, or is it to be an aid for other fields? Will the physics and engineering departments wish to use it? Once these decisions have been made, the choice is narrowed down considerably.

One always has the option of not buying a micro and instead using a link to some nearby organisation... or even using the batch processing facilities of a local college. Most people will, however, agree that having one's own micro has many

advantages.

Having decided that a micro is the best way to proceed, the next point to look at is the kind of courses that the micro must be able to support. Is the micro needed just to stimulate an interest in computers, or is it required to support a CSE, O, or A level course in computer science; are you offering any data processing courses? Will it be required by the geography department, or by the school administrators? Do you have the necessary staff with the required knowledge to teach to the level required?

You can begin to choose a system from the following questions:

1. Will it need to be expandable later on?
2. Does it have to have multi-use capability?
3. Do you require a range of software — such as BASIC, FORTRAN, COBOL, an assembler, a text editor, and so on?
4. What are the cost limits?
5. Do you require compatibility with existing equipment?
6. Is reliability of paramount importance?
7. Do you require good file storage facilities?
8. Will you need readily available programs?

My own personal preferences are towards systems such as the PET, TANDY and APPLE for stimulating interest in computers under conditions of limited budget — say £500/£1,000. For a larger outlay — £1,000/£5,000 — and the ability to support advanced courses, and if the answer to most of the above questions was 'yes', then Research Machines, Horizon, SWTP and Vector

Graphics MZ are worthwhile considering. Finally, for those who are exceedingly rich, the Equinox is well worth a look. Unfortunately, I really am only able to scratch the surface and for that reason you should seek any further help from MUSE.

Sheridan Williams

## TEACHING PROGRAM

I wish to make available a micro based teaching program that will lead people (such as qualified architects) through many aspects of building design. It would be useful for those who already have a sound knowledge in their field and who may only require specific routines very rarely. The computer could perform individual calculations, and ask relevant questions at all stages, leading the user through to the answer to his problem. I feel that this might be available on a micro at between £5,000 and £10,000. I think that a hard-copy printout of around 300x420 characters would be desirable, and suggest that a massive ROM would be needed to store the variety of programs necessary. I have heard that the Commodore PET could fill my requirements... is this so? Thankyou for a most stimulating journal.

Your proposals for a micro based system are perfectly feasible, and they should fall well within your price range. A floppy disc based system should satisfy all your needs. A 'massive ROM' will not be required as disc based software and data is instantly retrievable and, often, disc drives may be added giving you extra capacity as your requirements grow. It is worth mentioning that the type of system you describe would be totally impractical on a cassette based micro.

The PET would not seem to be your best buy — I would look up market a little. BASIC is not the best language to choose as your programs will be very text based. I would go for a system that gives you a choice of language — Pascal and Pilot are worthy contenders. It would also benefit you if the system could support more than one user at a time. This narrows down the field considerably. I would suggest that you contact a consultant who specialises in your application area, and who would be able to advise you in more detail.

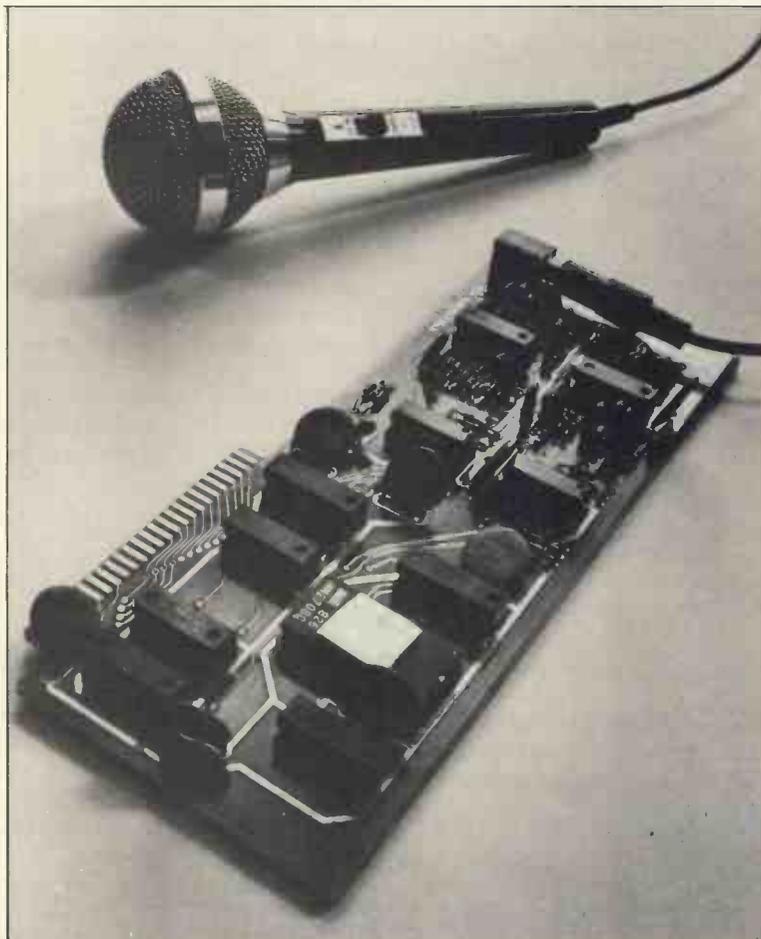
You say that you would like a hard copy printout of 300x400 characters. The only micros that can approach that for screen output are the Apple, Research Machine's 380Z and the Vector Graphics MZ, but as far as I know none of these support this resolution of printout.



"I dare you to say something in computerese"

CHECKOUT

# HEURISTICS SPEECHLAB



*Once upon a time you talked to the trees. . . now you can chat to the Apple on its own! Seriously, this could be the peripheral of the future. Forget fiddly keyboards. . . just speak normally (well, almost) and the micro will react to your every word. Some way towards this dream goes the Heuristics SpeechLab with its repertoire of up to 64 words. Stephen Withers takes up the story. . .*

The Heuristics Speechlab Model 20A is a plug-in voice input peripheral designed for use with the Apple II micro computer. It comes supplied in the form of a small, ready-assembled circuit board. . . all the purchaser has to do is plug the microphone cable into its socket and insert the board into a spare slot on the Apple's bus (normally that'll be slot 3). Since two demonstration programs are supplied on a cassette, it only takes a few minutes to test the operation of SpeechLab.

## Application and control

Possible applications, I suspect there are many, but I have been using my Apple/SpeechLab com-

bination as an intelligent terminal to control an interactive simulation program that's running on a mainframe computer. It's useful for this purpose as the program is used almost exclusively by managers and supervisors — i.e. people who aren't noted for their typing expertise. It's handy, too, that there are relatively few valid commands that may be given to the program. For example, saying "RUN" starts the model running from its current state, and "KILL" terminates the program.

There are two main classes of command; the first simply controls the model (as in the example above), the second allows the user to alter some of the parameters, thus enabling him to explore the various consequences of different decisions. It's easy to

use SpeechLab for the former class since it generally contains just one section, the command itself. The second type of command, however, is usually followed by several data items, often numeric. It's been found that for numeric input, people prefer use of a keyboard to voice entry<sup>1</sup>, so I have programmed the Apple to accept only command words through SpeechLab. Any additional input must be keyed in.

## How it works

SpeechLab is capable of recognising up to 32 words. It distinguishes between each vocal command by splitting the signal into high — and low — frequency bands, and storing amplitudes at regular intervals over the duration of the word.



# CHECKOUT

The training mode associates this information with a specified string or number. . . whichever the programmer may require. No fancy software is required, the Apple will accept input from SpeechLab in the same way as from any other peripheral, through the use of the IN # command and INPUT statements.

All the speech data is stored in an area of RAM so that release is effected by moving LOMEM (the bottom end of BASIC workspace) up to memory location 5500 (decimal).

This leads me to SpeechLab's greatest limitation. . . it can only be used with integer BASIC. The reason appears to be that this section of memory overlaps the Applesoft text display buffer. The result is the appearance of speech data on the screen in character form, so any subsequent changes to the display will corrupt the SpeechLab tables. In some cases the system may 'hang' and the program will be lost. Perhaps we'll see a replacement ROM being made available in the near future to overcome this unfortunate problem.

Once the system has been trained, the speech patterns may be saved on cassette or disc — thus avoiding the irksome business of having to retrain the system each time a particular user wishes to run the program. If a disc store is employed, then it becomes feasible to use several different 'pages' of speech data (each of 32 words) within a program. A specific page may then be loaded under program control according to which contains the valid responses to that section of the program — or by the user requesting a particular page. The latter can be done via SpeechLab, of course!

## Documentation

The user's Manual is a reasonable job, making it easy to get started and giving an excellent description of how the software and hardware function. It also offers a full circuit diagram and parts list, though these are probably more interesting than useful.

Although six demonstration program listings come as part of the package (including the two on cassette), I'm afraid some debugging is required. I suspect the mistakes crept in because the programs were typed out rather than reproduced from printer listings. Also, some modifications to the 'Mastermind' program are required since it was written with American colour televisions in mind. The colour entered does not match the one that appears on the screen, making the game even more difficult than usual.

The Manual offers no advice about saving the speech patterns on cassette or disc — the user is left to glean the probable location of their starting address from the memory map given in the Apple Manual. Similarly no warning is given that the use of:

```
PR # 3: REM SPEECHLAB IS IN  
SLOT 3
```

```
and  
IN# 3  
will deactivate the Disc Operating  
System. The alternative form of  
these commands must be used, i.e.  
PRINT D$;"PR #3": REM  
WHERE D$=CONTROL D  
and  
PRINT D$;"IN #3"
```

Again this information can be found in the Apple publication, but surely for the sake of a few extra lines of text it would be worth also entering in the SpeechLab Manual?

## Conclusions

Of course, the 64 thousand dollar question must be: 'Does SpeechLab work?' The answer is 'yes', but for maximum reliability, bear in mind these following points:

The first is perhaps obvious. . . read and follow the instructions given in the Manual! A more subtle factor is that SpeechLab looks for the pattern that most closely resembles the new spoken word and accepts the match only if it comes within a certain tolerance. This tolerance seems to be

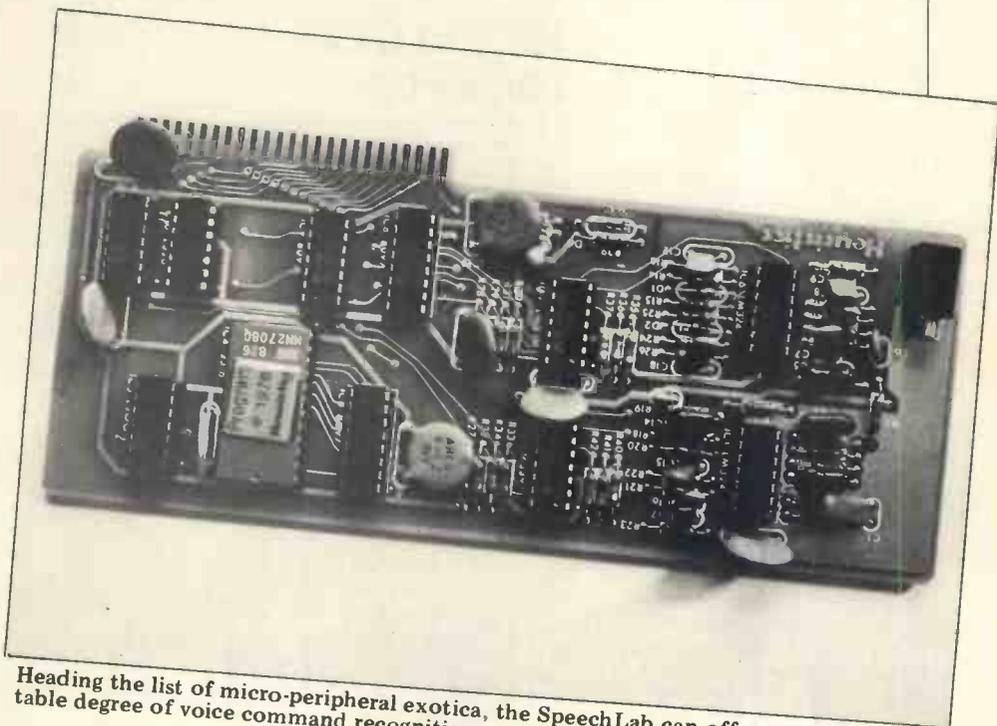
inversely related to the number of words the system has been trained to recognise. In other words, were there to be only one entry in the pattern table, then virtually any sound could find itself accepted as a match. So if, for example, one wishes the system to recognise the ten digits, it's worth storing three copies of each spoken number. If this is done, the reliability of recognition can exceed 90%. I believe this is acceptable. . . how often do you use the backspace key on your terminal?

SpeechLab represents a very powerful man/computer interface and is available in three versions: the 20A (reviewed here), the 20S (as 20A but S-100 bus), and the 50 (64-word vocabulary, S-100 bus). The prices come out around £160 for the model 20 and £250 for the model 50 and that's reasonable for what the device can do. However, it may put them beyond the reach of many hobbyists.

On balance, a printer and a disc system are probably more desirable peripherals, but I'd rate SpeechLab as coming a close third.

1, Braunstein, M. and Anderson, N.S. A comparison of reading digits aloud and keypunching. IBM Technical Memorandum RC-185, 1959. Reported in Umbers, I.G. A review of the human factors data on input devices used for process computer communication. TRC Report T78-1010, 1978.

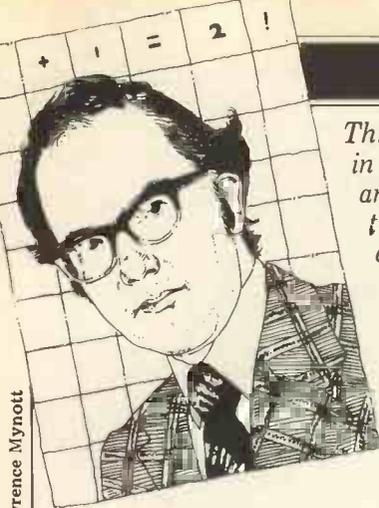
*Stephen Withers is currently working towards a Ph. D. on the visual, interactive simulation of industrial systems — using both micro and mainframe computers. He is keen to hear from any other readers who have experience with voice recognition. Letters to him may be sent via the offices of PCW.*



Heading the list of micro-peripheral exotica, the SpeechLab can offer an acceptable degree of voice command recognition.

This month, John Coll takes charge of what PCW hopes will become a regular spot in the magazine. . . Young Computer World. Though interest in computing is rife among people of all ages and inclinations, younger readers have perhaps been getting something of a raw deal — certainly so far as weekly and monthly publications are concerned. Yet, one glance through our magazine's incoming mail reveals there is a very real need for such an addition as this, and PCW is happy to be the first to take up the initiative.

Lawrence Mynott



## The possibilities

I'm very much aware that it's difficult to get anything like enough time at a keyboard. Many schools have nil, or only minimal facilities, so perhaps, in addition to this page, we might also consider the idea of a YCW club. One of its prime functions would be to put people in touch with others in their area who have a computer. And getting hold of information can also be difficult, especially when dealing with big organisations. Such a club ought to be able to help there as well . . . perhaps even opening a few doors on the way.

The space that's been set aside in PCW is to be used in whatever way YOU want. However, as ultimately I shall be doing the choosing, some initial guidelines might be useful. For example, I would like to publish some really "smart" programs, not necessarily long, but useful (and NOT HANGMAN again please!). Why not try making them really "idiot proof" so that you never get the message "Type mismatch — re-enter" on the screen? And how about sending in some neat calculator programs, or maybe some examples of computer art?

By the way, I think it's also worth mentioning, anything I receive that's really good — but too long for this section — may well be considered by the Editor for inclusion in the main magazine.

If you are submitting programs then, if possible, include a machine readable version as well; I can cope with most formats. Don't go too crazy with impractical suggestions but it's surprising how much can happen if you're really determined. I'm offering £5.00 for the best contribution each month — well, it all helps! Write to me direct at: Laxton House, Oundle, Peterborough, PE8 4AQ (but please don't phone, 'cause I'm meant to teach for my living, not talk on the phone all day). I will try and answer all letters, though life gets a bit hectic during term

time, and I WILL act on suggestions. . . well, polite ones anyway!

## Contributions

Ian O'Neill (18) has just left Drayton Manor High School, Ealing and he has sent in a program for plotting graphs on the TRS-80. . . which I hope to print next issue. He has also included a neat program for saving a screenful of graphics onto a cassette tape. If there's enough interest from 'out there', you may even be seeing that in print in some future YCW column.

John Young (16) of Bedford School has sent in a useful booklet which could well be entitled: "Everything you wanted to know about the SWTPC 6800, but were afraid to ask". It's a pity that Computer Workshop haven't printed a booklet like it and in fact John's offering may soon be published in PCW's upcoming "Summary Card" section.

## HEX to DEC converter

Here are a couple of short but useful programs; the first, by Mark Taylor (14), of Methley near Leeds, converts a 4 digit HEX number into decimal.

```

● 10 DIM AS (4)
  20 FOR A = 1 TO 4
  30 INPUT AS (A)
  40 NEXT A
  50 LET F=1
  60 FOR N=4 TO 1 STEP -1
  70 READ RS,R
  80 IF AS (N)=RS THEN 100
  90 GOTO 70
 100 LET T=T+F*R
 110 LET F=F*16
 120 RESTORE
 130 NEXT N
 140 PRINT T
 150 DATA "0",0,"1",1,"2",2,"3",3,"4",4
 160 DATA "5",5,"6",6,"7",7,"8",8,"9",9
 170 DATA "A",10,"B",11,"C",12,"D",13
 180 DATA "E",14,"F",15
 190 END
    
```

The hex number is entered one digit at a time. To get the decimal equivalent of 1A27 the run would look like:

```

● ? 1↓
  ? A↓
● ? 2↓
  ? 7↓
● 6695
    
```

## TI57 Mathstester

The second program is written for a TI57 programmable calculator. Mark Eley (16) of Kent College, Canterbury wrote it to test the user's addition, subtraction, multiplication, division and powers. First the program:

Key	Location	Code
LBI 1	00	86 1
SBR 2	01	61 2
STO 1	02	32 1
LLR	03	15
SBR 2	04	61 2
STO 2	05	32 2
R/S	06	81
RCL 1	07	33 1
=	08	85
STO 7	09	32 7
RCL 1	10	33 1
=	11	85
R/S	12	81
x=t	13	66

GTO 1	14	51 1
RCL 7	15	33 7
SBR 9	16	61 9
LBL 2	17	86 2
π	18	30
+	19	75
RCL 0	20	33 0
=	21	85
y <sup>x</sup>	22	35
5	23	05
=	24	85
INV INT	25	-49
STO 0	26	32 0
X	27	55
RCL 6	28	33 6
=	29	85
INT	30	49
INV SBR 31	31	-61

Before running the program a number, less than 1, is entered into STORE 0 as a "seed" for the random number generator. The largest random number is then entered into STORE 6. Try 60 for addition and subtraction and 16 for multiplication, division and powers. When the program is run the machine displays a number and waits for the user to first key the function (+, -, x, ÷, y<sup>x</sup>) and then to press R/S. The calculator displays the second number, then waits for the user to enter his answer and press R/S. If the user's answer is wrong, the correct answer flashes up.

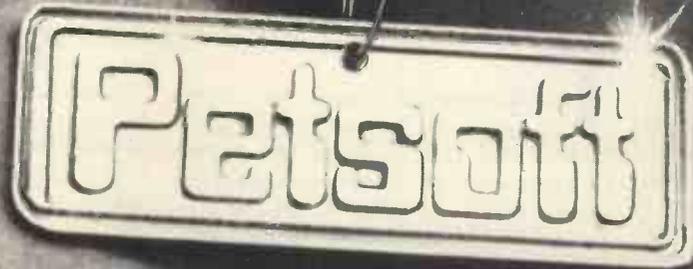
## Idiot-proof subroutines

Time now for something else you might like to try. There is often a need to ask the user for a number. For example, you might want to write:

```

100 INPUT "What is the length of the rod", L
The trouble is if the user replies "I don't know", the system isn't usually very helpful! What we need is a short subroutine which returns the value Z even if it is embedded in a reply like "I think it is 60mm long". The other useful feature would be the variable Z1 returning to zero (Z1=0) if a number is
    
```

Continued on page 67



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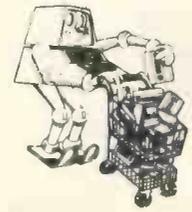
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# ESP: PSYCHIC PERCEPTION ~OR DECEPTION?

TYRONE CRUDIS PEERS  
INTO THE UNKNOWN

Extra-Sensory Perception, abbreviated ESP, is the presumed ability to become aware of events external to one-self without the use of the known senses. Included in this definition are *precognition* or the knowledge of events before they happen; *mental telepathy* or the knowledge of the thoughts of another; and *clairvoyance* or the ability to perceive events or objects at a distance. Whether such abilities exist in actuality is still a subject for heated discussion among scientific investigators today, as it has been for many decades.

Some scientists discount any phenomena that do not occur regularly under conditions which are known and can be reproduced ("laboratory conditions"), but there is a whole alternate side of reality encompassing phenomena which are evidenced only by uncontrolled incidents appearing spontaneously. Examples are mutation in plants and animals, the effects of impact of subatomic particles and automobiles, fireballs, love at first sight, and, perhaps, ESP. This article gives the background for, and examines a BASIC program which will test an individual's ability to predict a coming event by ESP, and will evaluate performance in terms of

the deviation from what could have been expected by chance.

## Testing problems

In tests of precognition, telepathy, and clairvoyance involving two persons, an *experimenter* and a *subject*, it is difficult to isolate one such ability from the others. For example, if an experimenter is shuffling and dealing cards while a subject in another room successfully calls out what he believes each card to be, how can we tell whether the subject is using precognition to predict the order of the cards, telepathy to read from the experimenter's mind the name of the card dealt, or clairvoyance to perceive the card through the intervening wall? Clearly the existence of the human experimenter causes the problem, and if he could be replaced by a machine capable of truly random shuffling and unimpeachable recording of the order of a deck of cards and of the guesses, telepathy at least could be ruled out. If the actual deck could then be replaced by an invisible symbolic deck, not shuffled or cut until the subject's choice was recorded, a good argument could be made that clairvoyance was also prevented, leaving pure precognition as the only possible mechanism to explain successful tests.

Prior to the advent of computers many complex electro-mechanical devices were developed to solve this problem and, incidentally, to prevent unconscious errors or conscious cheating on the part of the experimenter or subject from affecting the results. Your micro-computer offers you an ideal way to run such tests, isolating precognition from all other potential results. The accompanying short program, due to F. Chambers of Co. Mayo, Ireland, is designed to test precognition in this way. While it uses PET graphics to good effect, these can be easily modified to suit other machines' requirements.

## Scoring ability

In order to evaluate performance it is necessary to know not only how many right guesses were

made but also how much this number deviates from the number which might have been achieved by chance.

Common sense tells us that it is equally probable that a fairly-tossed coin will fall heads or tails. The statisticians say that the probability of heads is one in two or 0.5, the probability of tails is also 0.5, and the probability of either one or the other occurring is 1, or a certainty. On the other hand, experience tells us that when we flip a coin a number of times we do not always get heads half the time. The mathematician, Jacob Bernoulli, (1654-1705) is said to have cogitated about this for twenty years before he came up with Bernoulli's Theorem: "If the probability of an event's occurrence on a single trial is P and if a number of trials are made independently and under the same conditions, the most probable proportion, X/N, of the event's occurrences, X, to the total number of trials, N, is also P; furthermore, the probability that X/N will differ from P by less than a given amount, however small, increases as N increases."<sup>(1)</sup>

Although this statement appears simple, it is a nest of subtleties and traps and can easily lead us into fallacious inferences such as the so-called "Law of Averages" which many gamblers insist guarantees that a run of bad luck must be followed by a run of good luck "to even things up". Not so! In infinite time the heads will equal the tails, but the pattern of events by which this is achieved cannot be predicted.

## Binomial distribution

In the deck of cards used for ESP tests the familiar suits and values are replaced by five symbols for a total of twenty-five cards. If the deck is shuffled and cut and a random guess made as to the value of the card thus exposed, the odds are five in twenty-five or 0.2 that the guess will be correct due to chance alone. Such a situation where there is one "right" category and one "wrong" category, is called by statisticians a *binomical distribution*. In a binomial distribution the probability that X out of N

selections will be right by chance is:

$$\frac{N!}{X!(N-X)!} p^X Q^{(N-X)}$$

where N! (read "N factorial") is  $1 \times 2 \times 3 \dots \times (N-2) \times (N-1) \times N$ . One can observe that the fractional term on the left is the number of combinations of N objects taken X at a time. This is also known as the *binomial coefficient* for N and X, and tables of its values can be found in many handbooks. On the other hand our computers can be put to work generating them. P is the probability of being right by chance, which is 0.2 in the ESP card guessing case, and Q is 1-P, the probability of being wrong, or 0.8. If this formula is worked out for each value of X from 1 to N, the result is a binomial distribution, a stepped, bell-shaped curve, shown in Fig. 1 for N=100. The plateaux of the curve represent the probability of guessing exactly X



cards correctly by chance. The value of X corresponding to the peak of the curve is  $P \times N$ , the probability of a single trial times the number of trials; it is called the *mean*. A parameter called the *standard deviation*, symbolized by the Greek letter sigma, which represents the extent of scatter of points within the curve, has the value  $(N \times P \times Q)^{1/2}$  or  $0.4 \times N^{1/2}$  for this particular case. As the peak of the curve is made lower, and the skirts more extended, the standard deviation becomes greater. *Variance*, an alternate term, is simply the square of the standard deviation. It is interesting to note from Fig. 1 that the probability of getting less than 7 or more than 35 cards right out of 100 is so small as to be invisible on the graph; no less than  $2 \times 10^{-4}$ . The probability of getting half the cards right is  $1.6 \times 10^{-11}$ .

## Appraising results

The standard deviation of the binomial distribution has been used since about 1885 as a basis for measuring the amount of deviation from chance of actual results in card-guessing experiments.(2) The quotient of the actual number of correct guesses less the expected chance number divided by the standard deviation is called the *critical ratio*. It is a measure of the unlikelihood of getting the results by chance:

$$CR = \frac{X - PN}{(NPQ)^{1/2}}$$

A ratio of zero indicates that chance alone is at work. A ratio greater or less than zero signifies that some factor other than chance is affecting the results. Whether this factor is ESP depends on how well the experiment is designed to exclude all other possible explanations. The larger the ratio, the greater the significance. A critical ratio of 2.7 sigma, which has a probability of only about 0.0035 occurring by chance, and corresponds to 31 guesses right in 100, is often used as the minimum acceptable criterion for non-chance phenomena. Critical ratios in the twenties and thirties and above for individuals are reported in the literature of professionally-supervised tests for ESP. If you can achieve 3 sigma results on 100-trial runs you are definitely material for the Society for Psychical Research.(3)

## Random number generation

We now understand what parameters the computer should record and compute to appraise the results of an ESP test. We have not, however, discussed how the computer is to "shuffle" and "cut" the ESP deck to ensure that the input to the subject is determined purely by chance. Here, too, there are unexpected subtleties which must be dealt with. You may be in for a rude awakening if you thought your computer could "generate" random numbers.

In BASIC the command RND(X) produces a decimal fraction between 0 and 1. Generally in micro-computers X is a dummy argument; that is, the value of X does not affect the numbers generated. In some dialects of BASIC the argument is omitted and the function is simply written as RND. One or another algorithm is used which is known to generate a non-repeating series of decimal fractions, and each time RND(X) is called for, the next term in the series will be produced. Such a system is known as a *pseudo-*



*random number generator*. If you are not sure about how your computer responds to RND or RND(X), make a series of tests. I will wager that, *starting from power on each time*, the following program will give the same set of numbers for any positive value of X:

```
10 FOR J=1 TO 10
20 PRINT RND(X)
30 NEXT J
```

If it doesn't, write to the editor and your inputs may make a useful collation for a survey article. In this connection, the Commodore UK PET User's Handbook implies that a different set of numbers is generated for each different X. This is not the case on PETs I have tested. However, it is true for PET that if X is given zero or negative values, fixed numbers are generated; that is: RND(0) always gives .564705882, RND(-1) always gives 2.99196472E-08, etc.

How truly non-repetitive is your RND algorithm? My answer for PET is that it is non-repetitive enough for all practical purposes, which is to say that inanity set in after running 25,000 terms and finding that none of them was the same as the first term. You can try this with:

```
10 X=RND(1):PRINT "X="X
20 Y=RND(1):N=N+1:
PRINT N;Y
30 IF Y=X THEN STOP
40 GOTO 20
```

... or something similar in your own dialect.

How random is your RND algorithm? Here's a well-known little demonstration, sometimes done with darts and a board, which should give you confidence in your computer's randomness (if it merits it): Fig. 2 shows a square enclosing the quadrant of a circle of unit radius. The ratio of the area of the square to the area of the quadrant is  $4/\pi$  as can be determined by observation.

The following program generates random points in X, Y within the square. It tests to see if they are within the quadrant, and sums

# PSYCHIC RESEARCH



them in K if they are. The step number and the result to date are continuously updated until the final step. Punch this in and let it run for a few days. You may be surprised by the results.

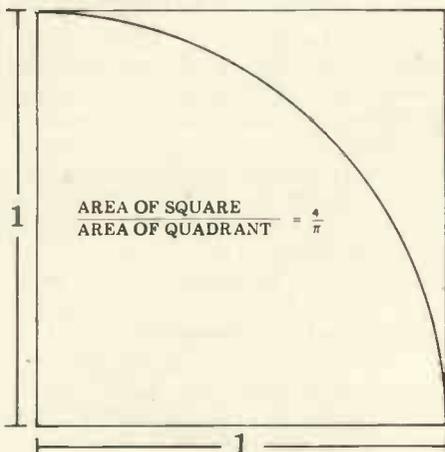
```
80 REM: 'π GENERATOR'
90 PRINT "[CS]":K=0:FOR J=1
TO 500000:PI=4*K/J
100 X=RND(1):Y=RND(1):
IF X↑2+Y↑2>1 THEN 120
110 K=K+1
120 PRINT "[HO] J=" JTAB
(22)"π="PI
130 NEXT J:PRINT "[CS] π="PI
```

I note with humility that the legislature in the sovereign state of Kentucky in the United States of America once planned to pass a law making  $\pi$  equal to 22/7. An even better approximation, incidentally, is 355/113.

## Randomizing the start

Clearly we can't afford to have our ESP Test program always generate the same sequence of symbols from power on! Like Caesar's wife, the test must be above suspicion in this department. One good way to ensure this is to randomize the point of entry into the table of random numbers. If your computer has a real-time clock, a simple technique

The  $\pi$  maker



applicable also to games is to use the clock time to determine how many successive generations of numbers are to be ignored before the first number is used. This need only be done once in a series of tests. For example, the PET has among other clocks a dedicated variable named TI which counts the number of jiffies (1/60 secs.) since power on up to 5184000, or 24 hours. At the point in the program where the first random number is required one can instruct the computer:

```
10 FOR J=1 TO TI
20 X=RND(1)
30 NEXT J
```

... or the running time can be held to a certain maximum by substituting VAL(RIGHTS(STRS(TI),3)) or TI-1000\*INT(TI/1000) or a similar expression for TI. Another good way is to let the random number generator run continuously until the subject is through reading the instructions. For example the program might read:

```
10 PRINT "PRESS ANY KEY
WHEN READY."
20 X=RND(1)
30 GET AS:IF AS=""GO TO 20
```

This is the technique incorporated in the accompanying program.

## Single digit random numbers

Having achieved the eminence of Caesar's wife, random-wise, you may now ask what we are to do with these random nine-digit numbers between zero and one, since what is required is random one-digit numbers from one to five inclusive. Those who know the answer may skip to the next paragraph. The answer is: one can generate integers from 1 to A with the expression:

```
INT(A*RND(X)+1)
A*RND(X) will change the range from between zero and one to between zero and five. In most micros, INT(Y) will generate the greatest integer not greater than
```

Y, changing the range of our expression to the integers from zero to four. The addition of one, either within or without the parentheses, will shift the range to the integers from one to five. (There is one intentional error in this article. Readers who spot it and who approach the editor on or about the birthday of the dog Laika, (and who can correctly identify the dog Laika) will be treated to a drink - in all Laikelihood).

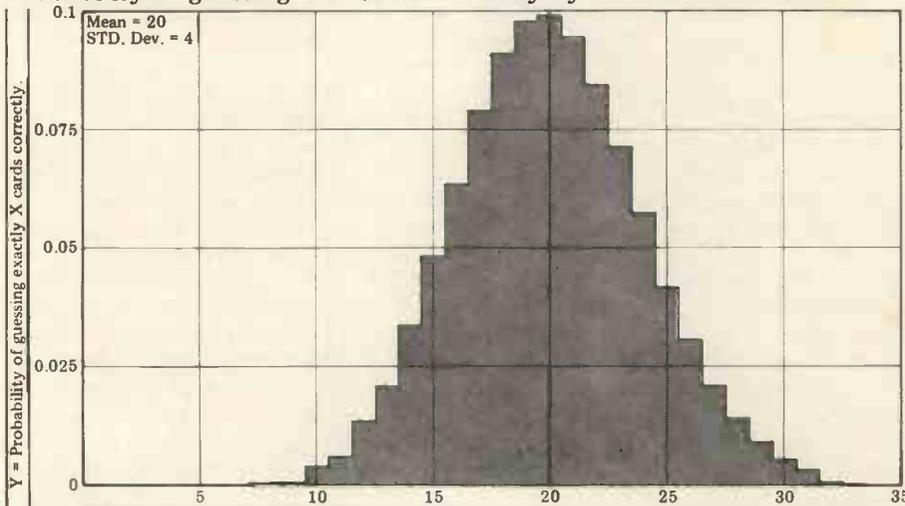
## Program comments

With all these concepts firmly in mind we can now confidently analyse the appended program, "ESP TEST", submitted by F. Chambers. An earlier version is available on cassette from Commodore's library.

### LINE COMMENT

- 100 Good practice to give clear statement of title, author, and date, with room for addition of notes on future modifications by others without renumbering. 400 lines is a bit more than enough, however! Good practice not to use line numbers below 10, as single digits can sometimes be entered in error in the "ready" state by novice operators, thus wiping out lines having those numbers.
- 500 Instructions: I am glad to see the title printed as part of the instructions; I also approve the use of double-spaced text throughout.
- 590 Randomizes the start of the random numbers table (see text).
- 600 X= incremental count of successful trials; N1= incremental count of total trials.
- 630 F=1 flags the sample run of symbols.
- 645 Good practice.
- 670 N= number of trials.
- 690 SS= symbol selected by sub-

Probability of guessing ESP cards correctly by chance in 100 trials



ject; S= numerical equivalent.

- 800 Generates random numbers from 1 to 5; R= symbol selected by computer.
- 910 See Table 1 for PET program listing conventions. These graphics can be re-designed for computers that do not have PET's facilities in this department. The author has not copied the original ESP graphics faithfully for technical reasons. They included a circle and parallel, wavy lines.
- 1500 Routine to display sample graphics. Delay using the TI clock.
- 1570 Routine completed, flag reset.
- 1600 Increment trials count.
- 1610 If guess was correct, increment success count. Print response.
- 1640 End of run.
- 1710 Rounds off percentage to three figures (five places because of decimal point and the blank which precedes all numerals. Same affect could have been achieved with  $INT(X/N*1000)/1000$ .
- 1740 Equivalent to  $(X-Mean)/Std. Dev.$
- 1800 Some may not care for this kind of touch or for line 675, but I find them refreshing.

#### PET Program Listing Conventions (4)

[ ]: any text in brackets is to be interpreted as instructions to print cursor, clear, home, space, or reverse symbols.

CU: cursor up.  
 CD: cursor down.  
 CL: cursor left.  
 CR: cursor right.  
 CS: clear screen.  
 HO: home.  
 RE: reverse.  
 RO: reverse off.  
 SH: shift (hold shift down for next symbol outside of brackets).  
 SL: shift lock (hold shift down for all symbols outside of brackets until advised otherwise or end of line).  
 SR: shift release (cancels SL).  
 SP: space.

Example: "[5CU 3CR]" : print 5 cursor up symbols followed by 3 cursor rights. Note that it is not necessary to specify that these require the use of the shift key.

## References

- 1: This simplified statement of Bernoulli's Theorem is due to James R. Newman and is taken from "The World of Mathematics" vol.3 p. 1448: Simon & Schuster: New York 1956.
- 2: "Extra-Sensory Perception After Sixty Years": Rhine et al: Henry Holt: New York 1940. Devotes one chapter and an appendix to the mathematics of proper statistical analysis of ESP tests.
- 3: The Society for Psychical Research: 1 Adam and Eve Mews, London W8
- 4: Derived from suggestions by J. Collins and other sources: readers' reactions will be appreciated.

## Program listing

```

● 100 REM /ESP TEST/ BY F. CHAMBERS REV. 5/78.
500 PRINT "IN"SPC(15)"ESP TEST
505 PRINTSPC(14)"
● 510 PRINT "THIS PROGRAM TESTS ONE VARIETY OF
520 PRINT "EXTRA-SENSORY PERCEPTION: THE ABILITY TO PREDICT FUTURE EVENTS.
530 PRINT "I WILL SELECT ONE OF FIVE SYMBOLS
540 PRINT "RANDOMLY BUT WILL NOT DISCLOSE IT UNTIL
550 PRINT "YOU HAVE RECORDED YOUR PREDICTION.
560 PRINT "THE FIVE SYMBOLS ARE DIAMOND, PARALLELS,"
570 PRINT "CROSS, TRIANGLE, AND SQUARE.
575 PRINTSPC(14)"
● 580 PRINT "PRESS ANY KEY TO TURN PAGE.
590 R=RND(1) GET K$:IF K$="" GOTO590
600 X=0:NI=0
● 610 PRINT "DO YOU WISH TO SEE THE SYMBOLS BEFORE
620 PRINT "STARTING? PRESS 'Y' FOR YES, 'N' FOR NO.
630 INPUT Y$:IF Y$="Y" THEN F=1 GOTO1500
● 640 IF Y$="N" THEN 650
645 PRINT "WRONG KEY TRY AGAIN." GOTO 630
650 PRINT "HOW MANY TRIALS DO YOU WISH TO MAKE? I
660 PRINT "SUGGEST A MINIMUM OF 25 FOR STATISTICAL SIGNIFICANCE. ";
670 INPUT N:IF N<0 THEN 650
675 IF N<100 THEN PRINT "I HAVE THE TIME IF YOU DO!
680 INPUT "OK. ENTER YOUR FIRST SYMBOL SELECTION (D,P,T,C,OR S)";S$:GOTO700
690 INPUT "ENTER YOUR NEXT SELECTION (D,P,T,C,OR S)";S$
700 IF S$="D" THEN S=1 GOTO 800
710 IF S$="P" THEN S=2 GOTO 800
720 IF S$="C" THEN S=3 GOTO 800
730 IF S$="T" THEN S=4 GOTO 800
740 IF S$="S" THEN S=5 GOTO 800
750 PRINT "WRONG KEY TRY AGAIN." GOTO 690
900 R=INT(RND(5)*5)+1
920 IF R=1 GOTO 900
930 IF R=2 GOTO 1000
940 IF R=3 GOTO 1100
950 IF R=4 GOTO 1200
960 IF R=5 GOTO 1300
● 900 REM DIAMOND GRAPHICS.
910 PRINT "J"SPC(19)"
920 PRINTSPC(18)"
930 PRINTSPC(17)"
940 PRINTSPC(16)"
950 PRINTSPC(15)"
960 PRINTSPC(15)"
965 PRINTSPC(16)"
970 PRINTSPC(17)"
975 PRINTSPC(18)"
980 PRINTSPC(19)"
985 IF F=1 THEN 1540
990 GOTO 1600
● 1000 REM PARALLEL GRAPHICS.
1010 PRINT "J"SPC(15)"
1020 PRINTSPC(15)"
1030 IF F=1 THEN 1540
1040 GOTO 1600
● 1100 REM CROSS GRAPHICS.
1110 PRINT "J"SPC(19)"
1120 PRINTSPC(19)"
1130 PRINTSPC(19)"
1140 PRINTSPC(15)"
1150 PRINTSPC(15)"
1160 PRINTSPC(19)"
1170 PRINTSPC(19)"
1180 PRINTSPC(19)"
1190 IF F=1 THEN 1540
1195 GOTO 1600
● 1200 REM TRIANGLE GRAPHICS.
1210 PRINT "J"SPC(19)"
1220 PRINTSPC(18)"
1230 PRINTSPC(17)"
1240 PRINTSPC(16)"
1250 PRINTSPC(15)"
1260 PRINTSPC(14)"
1270 PRINTSPC(14)"
1280 IF F=1 THEN 1540
1290 GOTO1600
● 1300 REM SQUARE GRAPHICS.
1310 PRINT "J"SPC(16)"
1320 FOR W=1TO6:PRINTSPC(16)"
1330 NEXT W
1340 PRINTSPC(16)"
1350 IF F=1 THEN 1540
1360 GOTO 1600
● 1500 REM PRINT SAMPLE GRAPHICS.
1510 FOR K=1 TO 5
1520 R=K
1530 T=TI GOTO 920
1540 IF TIC>T+120 THEN 1540
1550 T=TI
● 1560 NEXT K
1570 F=0: GOTO 650
1600 NI=NI+1
● 1610 IF S=R THEN X=X+1: PRINT "CORRECT!"; GOTO 1630
1620 PRINT "WRONG. ";
1630 PRINT X"CORRECT OUT OF"NI"TRIALS."
1640 IF NI=N GOTO1700
1650 GOTO690
● 1700 REM END-OF-GAME ROUTINES
1704 PRINTSPC(14)"
1705 PRINT "PRESS ANY KEY TO SEE RESULTS.
1706 GET K$:IF K$="" GOTO1706
1710 PRINT "YOUR PREDICTIONS WERE"LEFT$(STR$(X/N*100),5)"% CORRECT.
1720 PRINT "CHANCE RESULTS WOULD GIVE 20% CORRECT.
1730 PRINT "YOUR PREDICTIONS HAD A CRITICAL RATIO OF"
1740 PRINTLEFT$(STR$(5*X-N)/(2*SQR(N)),3)" STANDARD DEVIATIONS."
1750 PRINT "A FIGURE GREATER THAN 2.7 S.D. WOULD BE"
1760 PRINT "SIGNIFICANTLY HIGH FOR A RUN OF 25 OR MORE."
1770 INPUT "ANOTHER RUN? ('Y' OR 'N')";Y$:IF Y$="Y" GOTO600
1780 IF Y$="N" GOTO 1300
● 1790 PRINT "WRONG KEY TRY AGAIN": GOTO 1770
1800 PRINT "OK. IT'S BEEN A PLEASURE TO COMPUTE FOR"
1810 PRINT "YOU. TRY ME AGAIN SOON!"END

```

# THE MEMORY LINGERS ON

## SC/MP UVEPROM BURNER

*John A. Stephenson shows the construction and software required for 'permanently' programming the 2708 and 2716 Proms.*

As the owner of an early Mk14 SC/MP system, the author became aware of its severe limitations and decided to proceed to something more ambitious, using a Z80 and a home-designed system and monitor. To this end the Mk14 has been put to good use as a RAM tester (since one can get at about 1K of Mk14 memory addressing space very easily), and, lately, as a programmer for 2708 and 2758 or 2716 UVE PROMs.

The Mk14 could itself be improved by a better monitor. And the ability to easily and cheaply program such devices is very useful, since the fusible-link Proms used by the Mk14 are not exactly convenient or easy to obtain cheaply.

The circuit described here, together with software, will allow the owner of a Mk14 (or any SC/MP system) to use the existing monitor to load and check the data to be programmed. A short program then loads this data, in manageable 'chunks' into the Prom. The total memory requirement is 48 bytes for the program and 128 for the data store, although owners with more memory to spare can up this to 256 bytes and load twice as much at once.

There is no reason why the system should not run from any processor arrangement which has a 'Hold' or 'Wait' input, but the circuit shown is for a Mk14, and the necessary modifications are included to allow the required further address decoding.

### Circuit operation

To avoid complicated switching arrangements two sockets are provided for the two types of Prom. The key part of the circuit is based around the 74121 monostable. This provides a 50 millisecond O/P pulse when triggered and serves two purposes. When programming 2716's it provides the TTL programming pulse required. When using 2708's it serves to slow down the programming cycle to avoid overheating the Prom.

Programming 2716's or 2758's is easy; set up an address plus data, apply +25v to pin 21, and a 50ms pulse to pin 18 and you have programmed that address. This circuit avoids using latches by having the processor supply

address and data, and then, at the leading edge of the next write data strobe, it starts a 50ms monostable. The Q output of this is fed back to the processor NHOLD pin, and the 'write' cycle is thus extended by 50ms. The Q O/P is used to provide the programming pulse. The 74121 has an input, pin 5, which inhibits triggering when low. This is fed from the 'Flag 1' O/P of the Mk14, and the software sets flag 1 high only when a programming run is in progress, so preventing spurious data from entering the Prom during normal monitor operations.

IC 1 and 2 provide further address decoding which, with the modification shown to IC17 on the Mk14 P.C.B., restricts the monitor to the lowest 1/2K of memory, leaving 0400-07FF for the Prom.

The 2708 programmer is a little more involved. The two transistors form a 1ms monostable which is triggered by the leading edge of the 74121 O/P pulse, to provide a high-current drive +24v pulse to pin 18 of the 2708 socket. The manufacturers of 2708's do not approve of programming the chip any way other than by cycling through all 1024 locations at least 100 times. Anything else will cook the chip, I was told. This is not true if one allows the circuit to space out the programming pulses. The 50ms monostable does this admirably, and only slows the process down a little when one considers that the longest job is typing in the 1K of data!

The 2708 requires +25 and +12 volts as well as -5 volts, and the +12 volts is derived here from the +25v line to simplify matters. Do NOT leave out the diodes on the power lines, or you may blow up the Prom.

2708's require the CS pin, pin 20, to be at +12v during programming, but TTL levels are required for read cycles and normal Rom use. S1 is used as the simplest and cheapest way of providing this function and is set to the appropriate position prior to programming or checking the Prom.

### Construction

The author's prototype was constructed on 3"x4" of Veroboard, wired up with single-core insulated wire on the copper side, tracks being cut where appropriate. The switches were small slide-switches,

soldered to P.C. pins inserted through the board, and the interconnections were made direct on to the I.C. P.C. pads, using ribbon cable. The NHOLD connection was made to pin 6, which is linked to the "continue" I/P of the SC/MP but this does not affect operation. Only one track on the Mk14 needs to be cut; that to the monitor ROM's CE I/P's.

### Software

The program shown is written for the SC/MP, and will run on the basic Mk14 (with only 256 bytes RAM). Modifications will be required should the reader wish to use the system with other processors.

To start, the program is loaded, by hand or cassette, beginning at OF20 (the whole program is relocatable). The START address of the RAM data block to be copied is placed in OF22, OF23, and the START address of the Prom position that's to be copied to is stored at OF24, OF25. The number of bytes to be copied (MINIMUM 128) is loaded (in HEX) at OF27. For 128 bytes this is 80. Finally, the number of 'loops' to be executed is placed at OF2B; if a 2716 or 2758 is to be programmed this should be 1, for a 2708 it should be at least 100, and the author recommends 128 loops (80 HEX).

### Operation

To load and program a 2708, set the RAM START ADDRESS to OF50. The lowest PROM START ADDRESS is 0400, and extends for 1K to 07FF, in 128 BYTE BLOCKS (keep a careful written record of which blocks you have programmed!). The Prom occupies 0400-07FF. Select the block of data that you wish to program and, using the monitor, load the data to RAM starting at OF50. Check carefully the contents of the RAM that you have just loaded, as mistakes cannot be rectified afterwards! Switch the READ/PROGRAM switch, S1 to "PROGRAM".

Load the start address (OF26) and run the program. You now have time for a quick cup of coffee before the display returns. Change S1 to "READ", and, using the monitor, the Prom contents may be examined. You can then

load the next 128 bytes into the RAM positions, and change the start address for the Prom, e.g. to 0480. Set S1 to "PROGRAM" and run again from OF26, continuing the sequence to fill the Prom, in steps of 128 bytes at a time. To program 2716's (or 2758's) set the "Loop Count", CF27, to "01", and load data as described for 2708's. Run the program, and it will perform one complete load of 128 Bytes, and return to the monitor. Prom contents may be examined by 'reading' 0400-07FF, (S1 is not used).

For programming a 2716 (which is a 2K device) S2 must be set to choose the 'Upper' or 'Lower' half of the chip since pin 19 is the M.S.B. of the Address. For 2758's it is set to '0' (Ground, 0.v dc).

Now, here is something interesting; would you believe that many 2758's are really 2716's in disguise? It seems that there are two 1K chips in a 2716 from some manufacturers and that the best of the two chips is selected, internally, at time of manufacture. The other 1K is still accessible though, as if the chip was a genuine 2716. I cannot guarantee this to be true of all the 2758's around but it certainly is for some — check yours and see!

John A Stephenson is a development engineer working in the field of background music systems. John's next project will be to develop a selective PROM copier. Why selective? — Well, it will enable you to copy parts of existing PROMs — ideal for bypassing burnt-in bugs — while keying in the correct code. Details coming soon.

## Program listing SC/MP~MK14 PROM programmer

USES P1 TO POINT TO RAM STORE AND P2 TO PROM.  
RELOCATABLE.  
DATA TO TRANSFER STORED OF50-OFCE

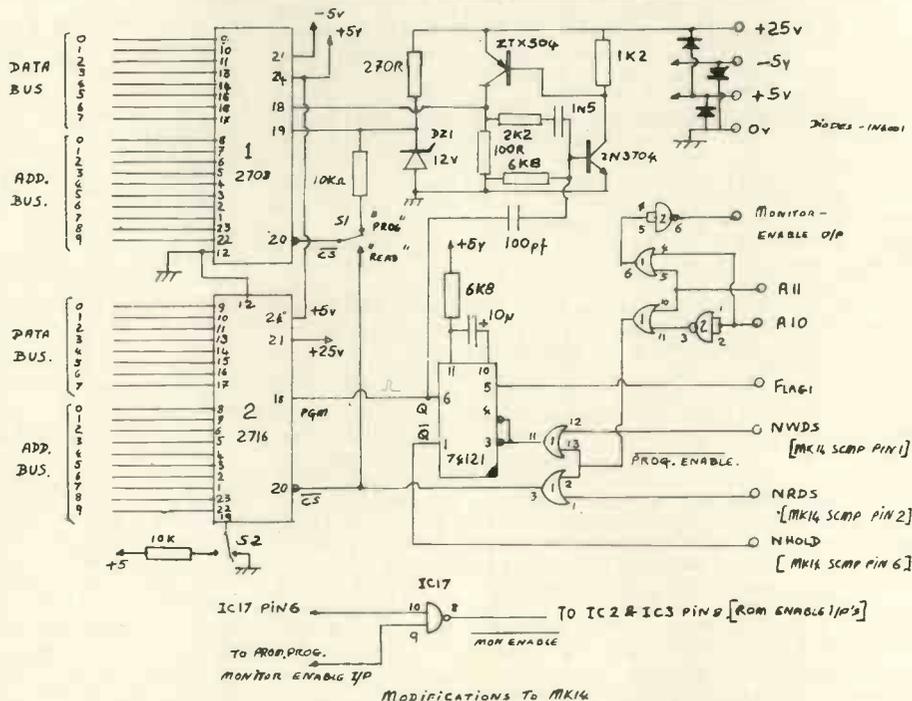
```

OF20 00  A COUNT
OF21 00  B COUNT
OF22 OF50 RAM START ADD.(STORAGE)
OF24 0400 PROM START ADD.
  
```

PROGRAM RUNS FROM OF26

```

"LOOP"
OF26 C4  LDI          LOAD NO.OF
OF27 80  LOOP TOTAL  LOOPS
OF28 C8 F8 ST(B COUNT) STORE AT B.
OF2A C4  LDI          LOAD NO. OF
OF2B 80  BYTE TOTAL  BYTES
OF2C C8 F3 ST (A COUNT) STORE AT A
OF2E C4 02 LDI 02     LOAD 2
OF30 07  CAS          SET FLAG 1
OF31 C0 F0 LD RAM Hi  LOAD
OF33 35  XPAH 1      POINTER
OF34 C0 EE LD RAM Lo  1 WITH
OF36 31  XPAL 1      RAM POSITION
OF37 C0 EC LD PROM Hi LOAD
OF39 36  XPAH2      POINTER
OF3A C0 EA LD PROM Lo 2 WITH
OF3C 32  XPAL2      PROM POSITION
"WRITE"
OF3D C5 01 LD @ (RAM)  LOAD DATA
OF3F CE 01 ST @ (PROM) WRITE TO PROM
OF41 B8 DE DLD (A COUNT) DECREMENT & GO TO
OF43 9C F8 JNZ "WRITE" "WRITE" ON ZERO
                          BYTE COUNT
OF45 B8 DB DLD (B COUNT) DECREMENT & GO TO
OF47 9C E1 JNZ "LOOP"  "LOOP" ON ZERO LOOP
                          COUNT
OF49 C4 00 LDI 0       LOAD 0 &
OF4B 07  CAS          CLEAR FLAG 1
OF4C 3F  XPPC3       RETURN TO MONITOR
OF50                START OF DATA STORE
OFCE                END OF DATA STORE (128 BYTES)
  
```



# NEW 10 PART PASCAL SERIES

## THE COMPLETE PASCAL

BY SUE EISENBACH AND CHRIS SADLER

### CHAPTER 1 WHY PASCAL?

How many people who program picked "their language" by consulting unbiased experts, reading books, and then making a rational choice before they began? Most of us learned our first language because it was the one available at the time. Tied up with learning a first language is learning to mechanize problem-solving, and hence to control a powerful, and captivating, machine — the computer. There's little wonder that some programmers form an emotional loyalty to their language which makes the learning of a new one almost an infidelity.

Because there are a great variety of them available, and because a second language is much easier to learn than the first one, it seems short-sighted to stick passionately to one that was so accidentally selected. As designers have gained from past mistakes, so the structure of programming languages has evolved and, while one doesn't want to devote a great deal of time to digesting some fantastic syntactic edifice too big and complicated to run on a real machine, there are several modern languages which may amply repay the trouble taken to learn them. We hope that the potted history that follows will convince you that Pascal, in particular, is worth looking into.

The early machines had no formal languages; they were programmed in machine code. It soon became clear that this procedure was unnecessarily tedious and that the speed and accuracy of the computer itself could be employed to overcome the problem of slow, error-prone transcription. Assembly languages were designed therefore, to allow programmers to use mnemonic codes rather than numbers, and an *assembler* translated these programs into machine code for execution. Using an assembly language, the programmer still had the same control over the computer as with machine code but avoided having to remember and key in long and indistinguishable number codes. Unfortunately an assembly language must be designed for a particular processor so that a program written on one model will not, in general, execute on another.

The second generation of machines proved so much faster than the first that it became no longer at all necessary for the programmer to have complete control over every processor cycle. General-purpose, high-level languages came into being as a consequence. If all processes within a program could be reduced or adapted to a limited number of fixed sequences of

machine code instructions, then each such fixed sequence could be represented by a single statement in the high-level language. The problem of the high-level language designer was, therefore, to specify the set of sequences which would effectively cater for the range of problems he wished to solve. The variety of languages developed at this time (as typified by FORTRAN, COBOL and ALGOL 60) aptly demonstrates the differing approaches adopted by their designers. Learning to program came to involve learning the vocabulary of a (human-oriented) language, of which, each word corresponded to a particular operation, or set of operations performed by the computer. Programming became faster to learn and easier to do (although not necessarily easier to do well!) In addition, a program written in a high-level language should, in theory, execute on any machine possessing the appropriate *compiler* (a program that generates machine code sequences from high-level language statements).

Of these early high-level languages, FORTRAN, still the most popular "scientific" language, was closest in style to the actual machine processes. This had two results — firstly, it was relatively straightforward to produce an efficient, fast FORTRAN compiler for a wide range of machines, and secondly, FORTRAN programmers were compelled to structure their algorithms in machine-oriented terms, so that the actual programs were also efficient, and fast. It is these features, its machine-efficiency and wide availability, that account for FORTRAN's continued popularity.

The other two major languages of this period made greater concessions to the human programmer at the expense of a degree of machine efficiency. COBOL, the "business" language, is written in English-like code, has a wide range of data storage and handling facilities, but, compared to FORTRAN is relatively limited in its (mathematical) processing power. ALGOL 60, the "academic" language, was designed, on the other hand, so that the mathematical specification of the problem (the algorithm) could be coded as naturally as possible by the programmer (mathematician) — this criterion has led to the class of "structured" languages, about which more later. ALGOL 60, however, had very limited data-manipulation facilities and neglected to incorporate general Input/Output routines, thus making ALGOL programs almost

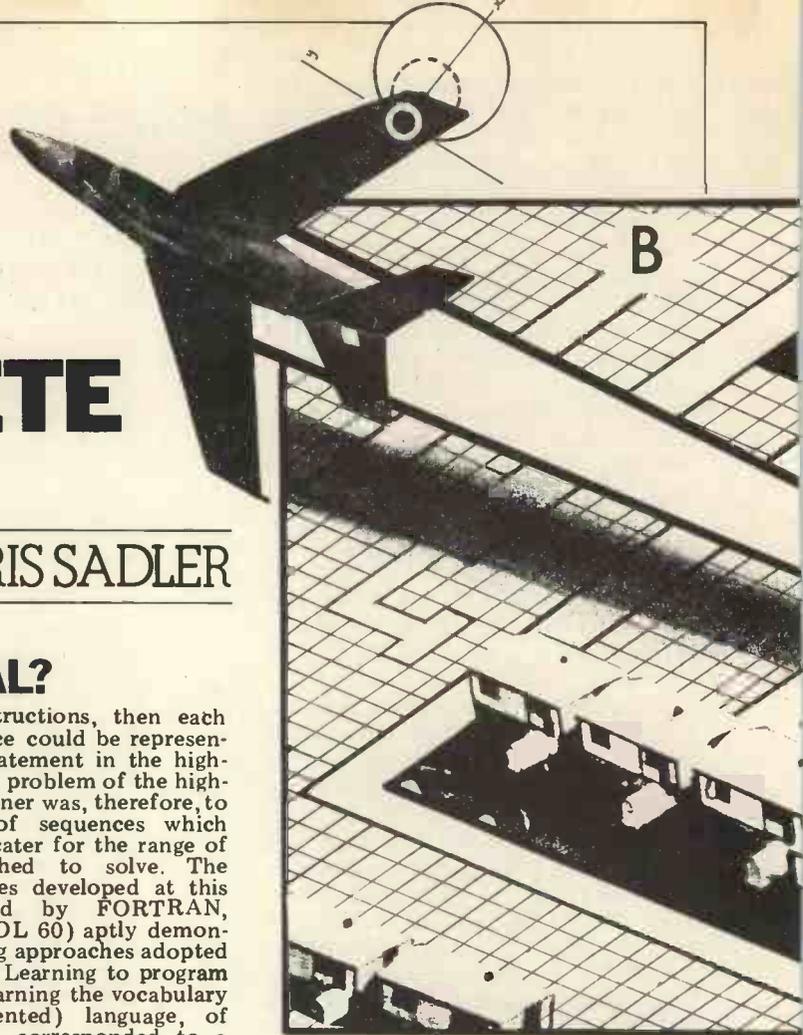
completely machine-dependent.

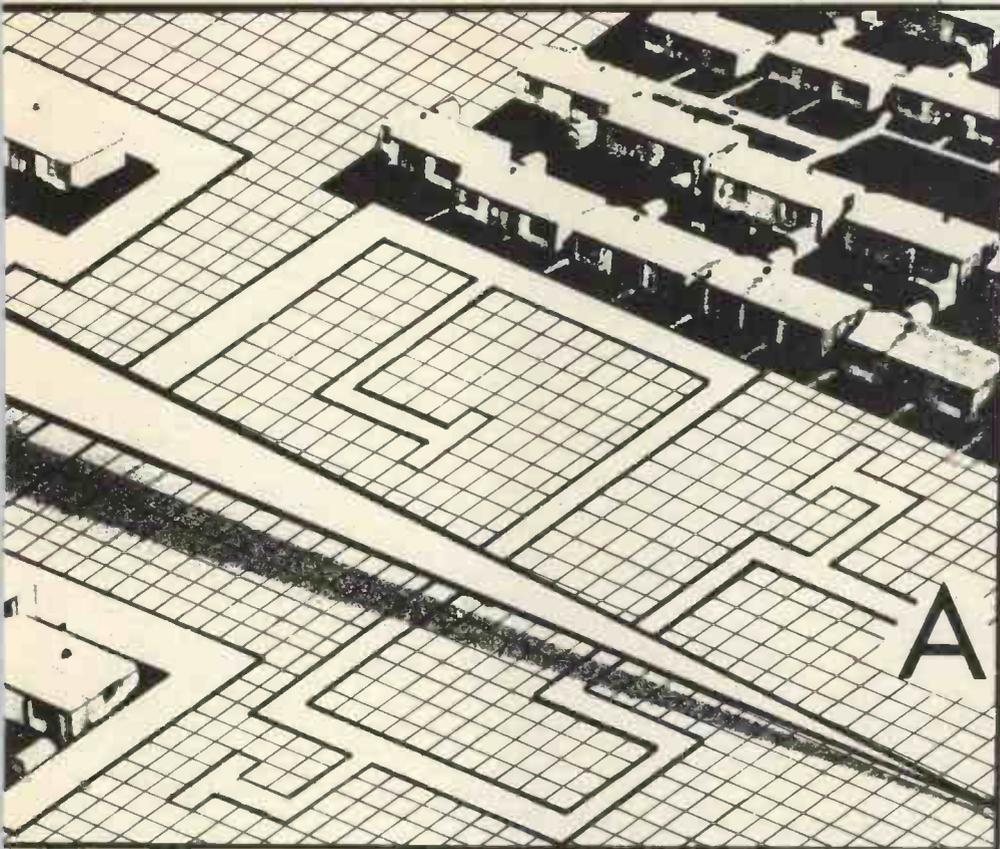
Taken together these languages contain features which can be said to epitomize a well-designed, general purpose high-level language. These are:

1. Algorithms should be expressible in a natural way.
2. A variety of means of storing and handling different types of data should be available.
3. The language should compile and execute efficiently on a variety of machines.
4. I/O instructions should be general and easy to use.
5. The language should be self-consistent and coherent so that it is easy to learn and open to standardization and hence program-probability.

The mid-sixties brought the second generation of high-level languages. Although in some ways these languages represented an improvement over the originals, none of them adequately took account of all of the five points detailed above. PL/1, the "IBM language", attempted to incorporate all known facilities of all the languages into one monolithic creation. However the entire might of IBM could not persuade programmers to drop their FORTRAN or COBOL in favour of such a large, ungainly language which required an immense effort to learn, and which produced large, ungainly programs.

BASIC, the "peoples' language", represents a different tack. It was designed as a teaching language for students who would normally have been taught FORTRAN. It took advantage of the interactive facilities which by then had become available, eliminating the need to learn about compilers, loaders, linkers and editors and allowing the students to concentrate purely on the programming. Although the BASIC syntax is closer to English than





FORTRAN, and the Input/Output is much simpler, BASIC betrays its parentage in its data handling facilities and in the algorithmic style it imposes on its adherents. While no *standardized* BASIC exists (unlike almost all other languages) variations on the BASIC theme (from 2K Tiny BASIC to monstrous 32K Commercial BASIC compilers) abound throughout the micro-world. It is worth noting that very few programs will convert from one system to another without a degree of fiddling about between the different (and often idiosyncratic) dialects.

The mid-sixties also saw the convening of the working party of the International Federation for Information Processing (IFIP) who had previously produced ALGOL 60. This group felt that the algorithmic approach of ALGOL 60 was correct and that its limited impact had been due to its restricted data-handling facilities and non-existent general I/O statements. Their final report on ALGOL 68 appeared in early 1969. ALGOL 68 was designed to be as comprehensive as PL/1 in that the failings of ALGOL 60 had been more than made up, but the compactness of the ALGOL 60 design formalism gave it a greater degree of coherence over PL/1. It is still a vast and complex language which is difficult to learn and even more difficult to implement on the huge machines it requires. Also, as a European language, it was slow to be implemented on hardware designed, manufactured and primarily marketed in the USA.

Niklaus Wirth, a member of the IFIP working party, watched his colleagues painstakingly constructing their heavy-weight language with a certain measure of disquiet. He looked for one which would not only incorporate the strength of previous languages but which could also be implemented on any reasonably-

sized computer (like FORTRAN). He (rightly) predicted that ALGOL 68 would not fall into this category and so designed his own language, Pascal, as an ALGOL-like language in machine-realizable form (i.e. easy to compile and not too big).

Actually, Pascal didn't catch on straight away either, even though it is implementable on a wide variety of machines and contains the major features of ALGOL 68. However, today, with the onslaught of micro-computers (requiring smallish, efficient compilers) and with the demand amongst professional programmers for "structured" programming languages, Pascal, the "five-star" language is coming into its own. (See Table 1)

①	ALGORITHMIC STYLE	RICH DATA STRUCTURES	MACHINE EFFICIENT	I/O SIMPLE	PORTABLE AND COHERENT
ASSEMBLY LANGUAGE			●		
FORTRAN			●		●
COBOL		●		●	
ALGOL 60	●		●		
PL/2	●	●		●	
BASIC				●	
ALGOL 68	●	●		●	
PASCAL	●	●	●	●	●

It may seem as though the unblinking row of "stars" against Pascal betrays a fair amount of bias; the real point, however, is that Pascal was *designed* with just these principles in mind. Of course there have been other languages designed on completely different lines (take, for instance, APL), but if the construction philosophy is to be based on the five points that have been established above, then Pascal must certainly be worth a closer look. While this survey could in no way be described as being fully comprehensive, we have included the major *micro* languages for comparison.

## Pascal nuts and bolts

Any algorithm or computer program consists of two complementary elements — a description of the "actions" which are to be performed, and a description of the *data* with which the actions are to be performed.

Clearly, any programming language must supply one with the means of expressing these two descriptions and the better the language, the more elegant, efficient, understandable (readable) and error-free the programs of a given programmer are likely to be. The aim of Pascal is to provide a set of statements (action) and data types which are at the same time comprehensive (to cover all eventualities) and succinct (to convey the meaning without getting too complicated). Anyone familiar with another language will recognise that the actions and data types described can usually be accomplished in that language too, so that the comparison is not so much about *what* they can do but more *how* elegantly and efficiently they do it.

## Data types

In machine code, the big patterns in a location may be interpreted in any way the programmer chooses. In high-level languages, the designer must decide what interpretations the programmer will be permitted to employ. In BASIC, for instance, information is held as REAL numbers (with or without a decimal point) or STRINGS of characters. These are known as data types. Pascal has four data types:

BOOLEAN — has values: TRUE or FALSE

INTEGER — has values: an implementable subset of the whole numbers.

REAL — has values: an implementable subset of floating point real numbers (REALS usually occupy two stage locations in contrast to INTEGERS which are only allocated one)

CHAR — has values: a single alphabetic, numeric or special character.

Pascal also offers the facility of defining a new data type if the above 4 seem restrictive. For instance:

TYPE SUIT = (HEART, DIAMOND, CLUB, SPADE) defines SUIT as a data type which can have any "value" as specified in parenthesis.

likewise:

TYPE DAY = 1..31 allows only one of the define values, and no other, to be assigned of a variable of the DAY type.

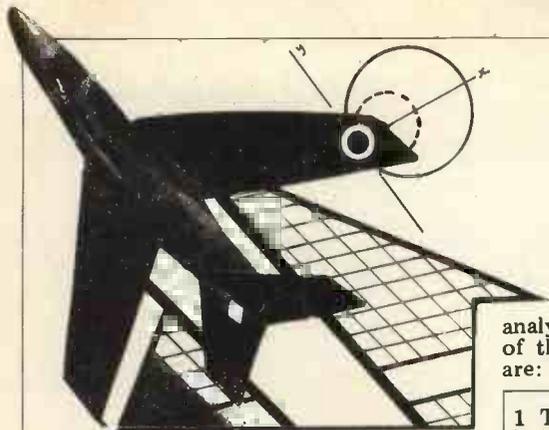
Similarly:

TYPE STRING = ARRAY (1..15) OF CHAR defines a 15-element BASIC-like character string.

while:

TYPE LONGSTRING = ARRAY (1..80) OF CHAR would be suitable to describe a punched-card format record.

Incidentally, the Pascal rule for the naming of objects (e.g. types, variables, constants, procedures and functions) is that the name should begin with a letter of the alphabet and may be arbitrarily long. Compilers for small machines may only recognise the first eight characters (which should therefore be unique) but



this is no reason to restrict the name-size to eight characters. The more self-explanatory a name can be chosen to be, the less actual explanation is required elsewhere in the program.

In addition to its data types, Pascal allows for the creation of certain data structures, namely ARRAYS, RECORDS, SETs and FILEs. An ARRAY is a data structure containing two or more elements of the same type. These are particularly useful in certain mathematical algorithms. The commercial counterpart is a RECORD consisting of two or more "fields" which may be of any type. SETs are a special case of ARRAYS while FILEs provide the means whereby data in any form can be extracted from or introduced to the program from (external) mass storage. Pascal enables the programmer to pack data to maximum density by enabling the specification of variable ranges and limited range data-types.

Most programmers agree that any computable problem can eventually be divided and subdivided and thence

analysed (and so programmed) in terms of three fundamental operations. These are:

1 The Sequence  
in BASIC  
LET A=B+C  
or just A=B+C  
and GOSUB 4900

in PASCAL  
SUM:= NEXTONE  
+ SUM;  
and  
DEALCARDS or  
DEALCARDS  
(FIRSTPLAYER)

2 The Loop  
in BASIC  
FOR I = 1 to 10  
NEXT I

in PASCAL  
a) WHILE Condition  
DO action,  
b) REPEAT action  
UNTIL condition  
c) FOR I:=M TO N  
DO action  
FOR I:=M DOWN  
TO N DO action

3 The Conditional  
in BASIC  
a) IF condition  
THEN Action  
b) ON K GO TO  
100, 200, 300

in PASCAL  
a) IF condition  
THEN Action  
ELSE alternative  
b) CASE N OF  
A : ACTION 1;  
B : ACTION 2;  
etc.  
end

## Control structures

There are obviously other constructs which could be employed, and, on the other hand, any loop construct could be replaced by an equivalent conditional. So why does Pascal seem to have 3 different forms of loop? The answer appears to lie in the delicate balance between supplying the programmer with enough techniques to do his work elegantly and adequately while keeping the language simple enough to operate it efficiently and effectively. Pascal is, at the same time, comprehensive as a problem solver, and succinct as a language.

Of course, this brief description doesn't illustrate Pascal any more than a dictionary describes the English language. What is needed are some examples used in actual programs, and also some practice in formulating the problems in the "Pascal way". That is just what will be offered in the next 9 issues of PCW — a systematic exposition of Pascal with a host of illustrative examples and some exercises every month. As few readers are likely to have Pascal up and running on their machines, we are willing to look at exercises you would like to submit. The most interesting programs may even find their way into PCW.

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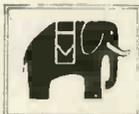
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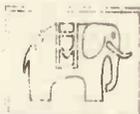
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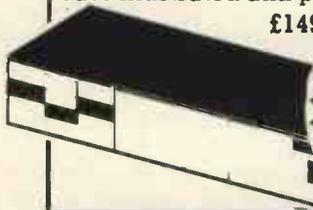
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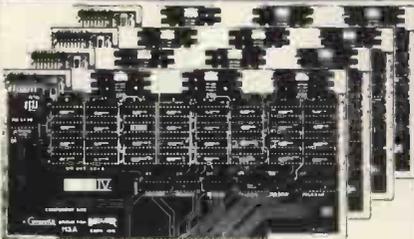
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# INTERRUPT

*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.*

## Micro mania

There is a sequence in the film of 'Hair' when a couple of mounted police, complete with clubs and helmets, come upon a group of hippies dancing in a park. For a moment, it looks as if the police are going to attack — then the horses begin to dance, forwards, backwards and sideways to the music.

I want to draw an analogy between those dancing horses and computers. The film sequence is meaningless. At most, it raises an ironic laugh, because we know the horses wouldn't *really* have danced. We know the police would have dispersed the dancers. But the film, in its facile way, seems to be saying "Hey — you know — if it could only be like that — with a little love — *wow* man!" But it *won't* be like that, it *isn't* like that; and love can't make police horses dance.

We think of personal computers as liberating us in some sense. People talk about the information technology revolution, of computing-power to the people, of the new scope the individual will have to... well, to *compute*, at least.

But it isn't like that, it won't be like that; computers can't make police horses dance either. Nor will they make nasty people nice, poor people rich or starving people well-fed.

Yet we say "Hey — you know — if it could only be like that — with everyone programming — *wow* man!"

Computers, whether they act as straightforward tools or as advanced, 'artificially intelligent' decision makers, cannot of themselves change political, social or economic relations in this country. You think they can? With *Star Trek*, *Mastermind* and noughts-and-crosses? With balance sheets, mortgage packages and, for God's sake, *chicken* recipes? Oh, I see — we haven't really begun yet. Please — when will it start? When Woolworths sell pocket computers with sound, graphics etc.? Can you imagine what these machines will do? How they will be presented and sold? Or will it be when even 'poor' people can afford a computer — so they can see how their shares are doing?

If you point to individual cases where computers have helped, for example, handicapped people, I must still enquire how this is going to be revolutionary in any way.

Further, I might ask whether spin-off from, say, Russian defence research, even if perhaps it helps crippled people, necessarily and sufficiently justifies that research.

I believe that in many ways the shape of personal computing has already been defined. It is to do with leisure, with exercising the mind, with money and with retreating from most of the world to a small space in between the screen and our eyes, and then pretending that space is ever so important and significant.

The trouble is, as well, that we inevitably incorporate the tools we use into our model or 'internal representation' of the world. Thus we run the risk of beginning to see the world in terms which are increasingly 'to do with' computers. We may even alter our lives to fit the demands of the computer, becoming, for instance, the 'compulsive programmers' that others have already warned about.

Worse, we may start to model the world using the computer, kidding ourselves we actually simulate parts of it, including people; these models will then affect our perception, which affects the next model, which affects... and so on.

How else, even in these 'early' days, can we explain the unutterably boring 'computer art', that might as well be done with a Spirograph or pen and ruler, but which is exhibited for all the world as if it were at the frontiers of creativity? Or the fact that virtually all available software is either business programs or games: the former just glorified pen and paper, the latter rapidly becoming as superficial and irritating, though perhaps as addictive, as a slot machine.

The games are even advertised for these attributes! "Absolutely addictive" says the catalogue; "Yes, boring old hangman", admits the advert.

Addicted, bored, dehumanised, unable to think of much to justify the hundreds or even thousands we spent on the machine, we fly like moths to every new software candle to bask in the light... for a time, anyway. And will *that* be revolutionary? How about when your computer is obsolete? Just buy the latest wonder? will *that* make us free and powerful and able to... you know... control things?

Oh yes, I have a computer. I play games and make 'art'. I hope to be contributing a regular

column about anything that I can justify as being a 'valid' use of computers in the arts.

But I keep having a sneaking suspicion, as the winking cursor beckons me across the room, that the best thing one can do with one's 32K, all-singing, all-dancing, micro-processor-based delight, is to drop it from a great height onto the head of someone who's on their way out to get one — and that could be quite a few people, if I do my job right.

Brian R. Smith

## Say that again?

Do you ever feel unintelligent? If not, you are either very intelligent anyway or you have not tried to learn all about micro-processors very quickly.

Having scraped up the necessary I purchased a Videotime 'Softy' SC/MP development system. This is, on paper, a very sophisticated board aimed at the engineer who wants to write programs in machine code and then store his efforts in a memory — a UV erasable EPROM, in fact. It is based on the National microprocessor INS8060 — SC/MP as it is usually called in the literature. (Here was the first confusion — most references to the device call it SC/MP meaning simple, Cost-effective Chip MicroProcessor, but the I.C. itself and the data sheet are both labelled INS8060 — its correct part number).

Softy will do lots of clever things like control external systems to prove the program plus editing features etc., all for £79.50 plus VAT. It reads out on to an ordinary television set in the form of a 'memory map' showing you exactly what is in the program memory. Now, I know that the literature which came with it was only in provisional form, but at the same time I understand it was only likely to be slightly modified when it was published as the manual. I would guess Softy is one of the better systems around, but here are some of the things which tripped me up. (Remember, I didn't know a microprocessor from a Ford Escort — just a general electronics background).

It presumed an acquaintance with microprocessors far above my level, in spite of claiming to be — among other things — a training aid. There was a tendency to use words in the English

language in rather off-beat ways, for example, the word 'reference' as a verb; the word 'scan' to imply imposing action on something rather than merely to 'look at'.

A friend of mine who went through all this two years ago advised jumping in at the deep end. I bought a system which appeared to offer (and actually DID offer, eventually, after much head scratching) a useful system design function. However, the lack of linear progression in the layout of the instructions left one with the feeling that the writer believed in that system of educational text book design in which, by tearing out each alternate page, the student is encouraged to think for himself. It does, but the thoughts are not very constructive. Program examples are given, but how they work is not explained. Deciphering instruction codes from National's own data sheets was not helpful either. They seem reluctant to explain exactly how to do something for fear they insult your intelligence. At least, I can think of no other explanation.

National SC/MP Operation Codes (Instruction Codes) are formed by starting with a base code and adding various digits to modify its meaning. For example C8xx means 'Store at address xx relative to Program Counter, ("What is a Program Counter"? I hear you cry). In one of the Softy examples the code CD is used. No mention of a CD code is to be found in the National data. It is explained to you by someone already in the know that it is the base code C8 modified by adding 04 for a feature known as 'Auto-Indexing' and a further 01 for the use of pointer register 1. C8 plus 04 plus 01, in Hexadecimal, makes CD — geddit? All obvious when you re-read the National data sheet, but not first time round. All this confusion for the sake of two or three lines of explanation! (Incidentally, for a crystal clear introduction to the whole business of microprocessors taken to the stage just short of actual programming and system design, the first chapter of the Intel MCS48 Users Manual takes a bit of beating).

Although Softy can run programs on its own resident microprocessor INS 8060 (SC/MP — remember?), it can't just perform any old program because certain features of the microprocessor are already used by Softy's own system to display the memory map on the screen. In particular, the pointer registers, which theoretically are available to the programmer, are used respectively for: 1) Cursor, 2)

Alternate Cursor, 3) Subroutine programmes. Vague references are made to this state of affairs without actually saying as much. Again, no doubt, an experienced user would appreciate this immediately — but 'one' was not such a person. I finally purchased 'A guide to SC/MP programming' by J. S. Drury — a publication not without its own faults, I may say. (At one point, it asserts that two 1's into a dual input EXOR gate gives a 1 out - 0 is correct). So I now had three sets of information — Softy notes, National data and Drury and understanding gradually began to leak into my head. So, what to do? I offer a modest solution. It is, get all data proof-read by total ignorami, then you will get the shortcomings pointed out to you. I appeal to all you in-folk out there, remember, you need us; we buy your stuff, but only if we can understand it!

*Tony Roberts*

## Frogs on the hop

In line with the United Nations and Australia, for the nations of Western Europe, a problem exists — high unemployment and the consequent search for a remedy. There's also a common aim... to raise the status of the individual in society.

The theory has been that machines can help to improve levels of unemployment and raise living standards. Now a report coming from France refutes this idea completely. In effect it says (and it is difficult to fault its conclusions) that the spread of computerisation allied to teleprocessing, data banks and so on, will not solve unemployment. In fact, it will increase it and at the same time devalue human skills and tighten the grip of an all-powerful state machine over most sections of society. A danger also exists that computerisation could undermine the traditional sovereignty of nations.

This sensational report — L'Information de la Societe — should not be seen as the work of a group of cranks... but of a commission set up by the French Government. Headed by M. Simon Nora, Inspector of Finance, the commission, being charged with the task of examining the effects in French Society of computerisation and teleprocessing, points out that in the 1960's computers were expensive, had limited capability and that 80% of France's computer installations were in the hands of 250 firms.

But, says the report, micro-

processors have effected an enormous drop in computer prices with a multitude of small, efficient and reasonably priced machines now available on the market. We live, it goes on, in the era of mass data processing. Tending to merge into one multi-purpose communications network, the fields of tele-communications and TV channels are now capable of linking computers to data banks and transmitting speech, pictures, sound and data.

Quoting from a summary of the report: "Types of services that until recently were in the realm of science fiction, are coming within our grasp. For instance, newspapers being transmitted directly to our homes, telecopying access to databanks simply by telephoning electronic postal and TV services.

"Used in conjunction with satellites, the marriage of computer and telecommunication technology has produced remote data processing. It has become a dominant means of communication — powerful, universal, soon accessible by low-cost aeriels and capable of flooding vast areas. What's more, the computer revolution will upset a number of traditional balances."

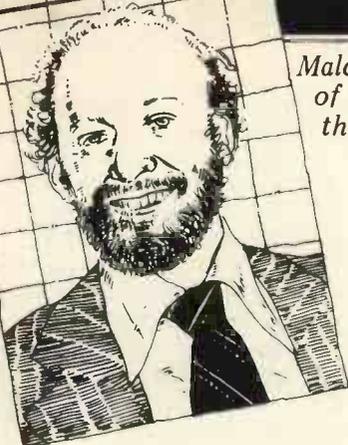
This means that the massive productivity that will come with data processing, particularly in services, should lead to a major cut-back in the number of employees. And, according to research estimates this could affect up to 30% of staff in banks and insurance companies in 10 years time. Over a longer period of time, a similar trend will probably cut back employment in social security, post office and secretarial work.

Computerisation of administration in manufacturing, particularly in the car industry, will mean that firms will be able to expand production without increasing — possibly even decreasing — their labour force. And the commission concludes that the French Government's seventh plan's ambition to create 1,300,000 jobs may well be put at risk by the effects of increasing computerisation. What may happen in France can equally take place in other highly industrialised countries.

Then again, what is going to be the effect on the individual of computerisation? Will it create a robotised sub-proletariat, as human skills are devalued by all-powerful "know-alls" or will teleprocessing, like electricity, flood into all aspects of social life,

*Continued on page 71.*

Malcolm Peltu has made his name writing and lecturing about the nature and impact of computer-related technologies. This month, the magazine is happy to announce that he is taking on the role of Personal Computer World Book Review Editor.



Lawrence Mynott

## THINK TANKS IN FERMENT

"And in Thames at Six tonight, how this micro chip is putting up taxi fares in London."

It is on waves of misinformed trivia such as this that society is being washed towards what some pundits see as a precipice that drops away into a chasm of unemployment and human strife; others predict it will be a technicolour paradise of entrepreneurial wealth, human leisure and computerised work-slaves.

Ever since the BBC TV Horizon programme "Now the chips are down" in March last year belatedly created a public awareness of the impact of microelectronics and computers, there has been a proliferation of punditry trying to determine the shape of a future in which these new technologies predominate.

One computer consultant claims to have a file of predictions which he uses as a party game: give him any number up to around 5 million or more and he will find a quote predicting that micro technology will create or destroy that number of jobs.

With the "experts" showing such wide disagreement, where does a seeker of the truth about the "micro revolution" begin?

A quick glance around even large bookshops like Foyles or Dillons in London will reveal a total lack of coherence in identifying "the impact of computers/micros/telecommunications" as a subject in its own right.

In the computer section one might find a book like *The Future with Microelectronics* by Ian Barron and Ray Curnow (Frances Pinter Ltd, £7.95) but not *The Collapse of Work* by Clive Jenkins and Barrie Sherman (Eyre Methuen, £3.50 paperback), although both are about the same subject.

Looking under other subject headings such as economics, industrial relations, or sociology might bring to light *The Collapse of Work* but not *The Future with Microelectronics* while other relevant books, such as *The Sane Alternative* by James Robertson (published by the author, £1.95), will not be self-evidently about the same subject.

And who would think that a book by President Carter's main East-West political advisor, Zbigniew Brzezinski called *Between Two Ages* (Penguin, £1.60) would echo some of the warnings about technological change given by a polemical trade unionist like Clive Jenkins.

Under Computer Sciences, if you are lucky, you might find *Computer Power and Human Reason* by Joseph Weizenbaum (W. H. Freeman, £3.80), although it is essentially a book about philosophy, psychology, sociology and metaphysics, as well as computers.

Under science fiction there will be, of course, many books on robots and future technologies. But a book like *Profiles of the Future* by Arthur C Clarke (Pan, 80p) although it may be placed next to his fiction works, is really about "science fiction" and how the science fiction writer can have clear sighted perceptions of the future. (In an article in *Wireless World* in 1945, Clarke predicted the coming of telecommunications satellites).

In the poetry section, unexpected insights might also be found, such as *A.R.T.H.U.R., the Life and Opinions of a Digital Computer* by Laurence Lerner (Harvester Press, 95p). Although a professor of English literature who knows little about computers, Lerner shows a remarkable awareness of the subtleties of man/machine relations and there can be no more succinct summaries of human fears about automation than these words by computer-poet Arthur:

They thought I'd be their

slave.

They thought they'd sit

And watch me work.

They'd watch the profits rise,

the wastage drop,

While they play golf.

They thought they wanted

slaves.

The workers go on strike,

or answer back,

So they hired me.

In the exploration of the impact of computer-related technologies there are few "experts" because there have been few systematic studies which bring together the disciplines of the "human sciences", like sociology and economics, with any real technological understanding.

The global significance of the technology is clearly spelt out by Brzezinski, whose book is subtitled "America's role in the Technocentric Era". Technocentric is his term for what others have called the "post-industrial society". He identifies factors such as changes in employment levels, changing skill needs, new educational objectives, industrial participation and democracy as the challenges one faces from the new technocentric age, although most of his book is a more generalised political analysis.

These general factors and their technological interfaces are pursued in more detail in the Barron/Curnow and Jenkins/Sherman books, which are best read together.

In some areas, it is necessary to read *The Collapse of Work* to bring to life and to make comprehensible some of the dry, jargon-ridden writing of *The Future with Microelectronics*, which is essentially a report prepared for the Computer,

Systems and Electronics Requirements Board (CSERB) of the Department of Industry.

Despite the fact that some lay readers might find the Barron/Curnow book heavy going, it is an important book to read because it focuses attention on the real nature of the technological revolution, in which the microprocessor is but one ingredient, albeit a crucial one.

Although there has been some fuss surrounding the supposed "government suppression" of the Barron/Curnow report, most of its recommendations have been openly discussed in the computer press ever since a meeting organised in 1977 by a group of the British Computer Society and Computer Weekly. There Barron, amongst others, highlighted the catalytic effect of microelectronics in creating a new, powerful force which he calls "information technology".

Information technology is the convergence of computing, communications and microelectronics into a total, digital-based technology capable of handling all information.

"Neither the present reality of communications nor that of computing is likely to play a major part in the future of the technologies. Instead it is the underlying concepts like the switching of information and the use of programmability that will be the significant features," Barron and Curnow stress in their book.

They continue, "The term 'information technology' has been chosen to describe this subject, because it emphasises that the basic area of concern is information and that for the first time we have a coherent technology to handle information. At present, the various aspects of information technology are regarded as separate subjects, like electronics engineering, communications and computing science. Associated with these subjects are a plethora of structures — university departments, research organisations and professional institutions.

"As the convergence of these subjects continues, so the degree of overlap and

**"...and in Thames at Six tonight, how this micro chip is putting up taxi fares all over London..."**

interaction between the subjects will increase, causing *increased confusion* (my emphasis) until it is resolved by the revision of the associated structures".

Much public comment on the book focused around its conclusion that "we may be contemplating levels of unemployment around 10 to 15% of the workforce and more" if information technology leads to job displacements on the lines postulated in the book. But the real embarrassment of government caused by the Barron/Curnow report was its criticism of the failure of government and educational institutions to provide a policy framework based on a perception of a future with information technology rather than a cobbled together version of traditional developments.

As the authors say in the beginning of the book. "It is apparent that the pattern of development (in the future) will be determined by non-technological factors; these have been considered, but not to the depth desirable."

For a more considered, in-depth view of the human consequences of the technology, *The Collapse of Work* provides an invaluable companion book. But just as Barron and Curnow are relatively strong on technology and weak on social impact, so Jenkins and Sherman are good on the human aspects but poor on technology.

It is surprising for example to find in *Collapse of Work* an incomprehensibly incorrect statement like "4K simply means that the chip is capable of 'memorizing' 4,000 bytes. A byte is either an eight or sixteen form of computer word." Even the most elementary dictionary of computing terms would reveal that a byte consists of eight bits and that the units of measurements on chips is usually K-bits.

As general secretary of the ASTMS white collar union, Clive Jenkins is well known but, although less in the public eye, it has been ASTMS research director Barrie Sherman who has been playing an important role in recent years in working within the trade union movement to look beyond immediate concerns, towards the medium and long term impact of technology.

From its title, *The Collapse of Work* clearly foresees a future in which information technology creates an environment where there is a substantially smaller demand for both physical and "white collar" clerical labour, leading to the possible creation of a "leisure society" in which it will be normal for most people to be "unemployed" most of the time.

Jenkins and Sherman estimate that the British labour force could drop from over

22.3 million in 1978 to about 21.3 million in 1983 and a mere 18.5 million in 1993.

In the same way that Barron and Curnow argue for a more integrated approach to the converging information technologies, Jenkins and Sherman say that "The jobs holocaust can be moderated but only if we have a multi-dimensional approach now." These dimensions encompass education and training strategies including preparation for "life long education", industrial and economic policy, government attitudes to social services and the revision of the belief in the "work ethic."

For anyone brought up on the mass media presentation of modern trade unionism, it will come as a surprise to read Jenkins and Sherman's strong advocacy that Britain must "first ensure that we do get our technological revolution and we get it early enough." In fact, this remark is typical of most unions who have examined the problem. Despite the appreciation of some potentially negative impacts on employment prospects, most unions believe that we should exploit the technology as well as ensuring that we are not exploited by it.

This approach is evident in a booklet published by Apex (the Association of Professional, Executive, Clerical and Computer Staff) *Office Technology - The Trade Union Response* (£2.00, 50p to union members). At a more specific and practical level than the global scope of *Collapse of Work*, the Apex booklet provides a basic introduction to concepts like word processing with practical guidelines on how unions should negotiate agreements relating to the introduction of technology.

While aware of the possibility that word processors could mean unemployment amongst office workers, Apex still applauds moves to have a British commitment to developing and manufacturing the technology, such as the National Enterprise Board company, Nexos.

In the same way, although in his book he points out the dangers of an uncontrolled spread of information technology, Iann Barron has entered the microelectronics marketplace as director of the NEB Inmos Microelectronic manufacturing company in the belief that the technology must be lived with and exploited rather than shut out, even if that was possible to do.

The humane use of technology versus the potential Frankenstein distortions has been a theme running through social and literary thought for many years. Over the past decade there has been a particular move towards concepts like "alternative", "appropriate" or

"community" technology, which found its eloquent propagandist in E. F. Schumacher's "Small is beautiful" philosophy.

Most of the writings on appropriate technology have concentrated on the vital questions of energy and food technology. Until the advent of low cost micro power, computing was really too expensive a technology to offer much attraction for an area where low cost mass applicability and adaptability to small-scale application was of prime importance.

There is, however, a coherent and well developed general approach towards the factors which move technology towards more human, ecologically sound uses as can be found by a visit to Intermediate Technology Publications in King Street, London.

A book like *James Robertson's Sane Alternative or Technology For a Changing World* by John Davis (Intermediate Technology Publications, £1.75) are essentially about the same areas of concern as the Barron/Curnow and Jenkins/Sherman books.

Robertson examines a number of options for the future of which the Hyper-Expansionist (HE) and Sane, Humane, Ecological (SHE) approaches encapsulate the opposing views that the way out of our foreseeable problems is either through a butch HE approach which accelerates the super-industrialist and high-technology drives in Western society or the alternative SHE approach which tries to sensitively balance human and environmental needs.

Davis' book is a compilation of his papers which generally examine mechanisms by which technology can be directed to meet social objectives other than the pure economic drive to increase productivity and sell more goods.

I found *Community Technology* by Godfrey Boyle (*Open University*, £3.50) a useful introduction to the whole field of alternative technology (this volume is units 10 and 11 of the OU Control of Technology course). Computers, however, are only briefly mentioned and there is only one quote which captures the exciting potential of personal computers.

The quote comes from an alternative technology pioneer Murray Bookchin who pointed out not only that "cybernetics technology" can eliminate boring routine human work but that microelectronics offers the capability of cheap, multi purpose machine tools which could be used in a small personal community workshop rather than requiring larger resources.

Bringing together these strands of alternative techno-

logical thought with the hard facts of microelectronic progress and industrial relations might provide some creative answers to the world's most pressing problems.

And beyond the question of man's external relationships with machines is the whole internalised philosophical quest after man's unique "qualifications" as a superior thinking being.

Weizenbaum's *Computer Power and Human Reason* is one of the few "factual" books to explore the territory that has been most frequently colonised by science fiction.

Weizenbaum is a computer scientist at the Massachusetts Institute of Technology who once wrote simple conversational programs, *Eliza* and *Doctor*. He was astounded when *Doctor*, acting as a kind of online psychiatrist, was enthusiastically received by psychiatrists who believed it could be used as a computer-based psychiatric analysis aid.

What horrified him was that intelligent people believed a computer could act "like a human". Machines, he insists are intrinsically alien to the human organism and its way of thinking. He believes attempts to try to define humans merely as "information processing systems" and to suggest that computers could "know" enough to act as a judge or psychiatrist is a "monstrous obscenity" and a sign of the madness of our times.

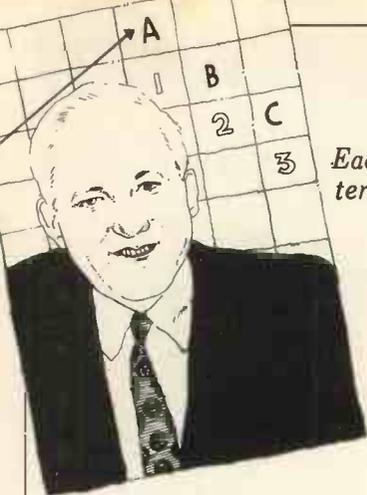
Although Weizenbaum argues cogently and humanely, there are still many "experts" who, having studied machine intelligence, believe that computers will continue to grow and overlap many functions currently regarded as essential features of humanity. Arthur C. Clarke, author of 2001, is one who considers that homo sapiens will give way to machine sapiens and that the new machine intelligencia will be both different and superior to its biological progenitor.

He admits he cannot describe how his advanced machine intelligence will be implemented. But when he predicted telecommunications satellites in 1945 he thought they would have to be manned because he did not know about transistor technology.

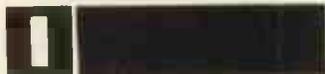
It may seem a long leap from a microprocessor in a taxi to the creation of a new species, yet they are part of the same spectrum. Appropriately, therefore, let the last word rest with A.R.T.H.U.R. who recently appeared on BBC Radio 3. His prayer begins:  
Our maker at IBM  
And all speakers of Fortran,  
May your reign endure  
For ever and ever;  
May the kingdom of number  
Absorb all verbiage. . .

# BUZZWORDS

Each month, Pete Reynolds takes us through the minefield of microcomputer terminology and jargon.



Lawrence Mynott



**i** (sometimes **I**)  
Standard symbol for electric current.

## **I - Register**

**Instruction address Register.** A register which holds the location of the next instruction to be followed by a program. The provision of more than one such register allows different sequences of instructions to be followed, for instance for branching to a subroutine.

**IC**  
Integrated Circuit

**ID**  
Identification (number or initials). Typically called for in a multi-user timesharing system to identify (for charging purposes) each user for the time he is using the system.

**I/O**  
Input/Output. Descriptive of a port or of a peripheral device that may be used either to channel data or instructions to a computer or to pass data from it.

**IEEE-48**  
Institute of Electronic and Electrical Engineers' standard interface for electronic instruments; same as HPIB, the Hewlett Packard Interface Bus.

**Image**  
An exact duplicate array of information stored in a different medium. For example, images of several punched cards which have passed through a reader may be held in an input area of storage awaiting transfer as required by the central processor.

**Impact Printer**  
One which forms characters on paper by striking it (normally through an ink ribbon). Generally noisier than the non-impact type, impact printers have the capability of making carbon copies.

**Impedance**  
The opposition an electrical circuit offers to a current passing through it. Total impedance, normally measured in ohms, may vary with the frequency of the applied voltage and include

elements of resistance, inductance and capacitance.

**Implementation**  
The set of processes that transform a set of program (or hardware) ideas into reality.

**Inch.**  
To move a tape (paper or magnetic) or the stationery in a printer very slowly forward until some desired point is reached.

**Inclusive OR**  
The logical Boolean operator (or a gate to provide this function) that gives an output of 1 if either or both of two inputs are 1. Output is 0 only when both inputs are 0.

**Increment**  
(noun) The (normally small) quantity by which some other value is altered.  
(verb) to alter a value by the amount of the increment. For example, after the instruction FOR I = 1 TO 25 STEP 2 the value of I will be incremented by 2 each time the program goes through that loop.

**Incremental Plotter**  
A device that gives a graphical display comprising a number of small steps rather than a smoothly continuous line.

**Index Register**  
A register or device used to hold a number which, when added to whatever is in the base address register, gives the address of the next program instruction to be followed.

**Indirect Address**  
The storage location in computer memory which holds, not the looked-for instruction but another address to be accessed in pursuit of that aim.

**Inductance**  
The electrical impedance, typically measured in millihenries, which opposes any change in the current flowing through a circuit. In doing this it may generate a reverse voltage if, for instance, the current flowing through an inductive load is switched off.

**Information**  
Strictly, knowledge new to the recipient. In computing 'information' generally relates to the processed output while the input, before processing,

is usually known as data.

**Information Retrieval**  
The location and display, normally very speedily and at will, of specified items or categories of information from computer files or a 'data bank'.

**Infra-Red**  
Radiation frequencies slightly below the low-frequency end of the visible spectrum which, like radio frequencies, may be modulated to carry information without a physical connection.

**Inhibit**  
To prevent an operation from occurring.

**Initialize**  
To establish required starting conditions, eg to set variables and counters to zero.

**Ink-jet (printer).**  
A form of serial printer in which the characters are formed by a jet of ink droplets. In one version these are drawn and guided from a stationary nozzle by electrostatic charges and are directed much in the same way that the spot of light in a television tube is directed so that there are no moving parts except the paper.

**Input**  
Transfer of data or instructions to a processor from an external device, particularly from keyboard.

**Input Buffer**  
An area of memory, typically RAM, in which input data (eg from keyboard, tape or disc) is temporarily stored as it is received for speedy transfer as a block to the processor when the buffer is full or some appropriate command (like 'Return') is given.

**Instruction**  
A signal which directs a computer to do some specific thing. It will state the operation (for example, add) and indicate where the data to be operated upon is to be found, (that is, the address). Sometimes further addresses will state where the result of the computation is to be stored and where the next instruction is located.

**Instruction Address**  
The memory location holding the next instruction that a

program requires a computer to follow.

**Instruction Counter**  
A register which keeps count of the address of the instructions next to be obeyed during the course of an object program and makes each successive instruction available in turn (except when a transfer of control is introduced by the program).

**Instruction Cycle**  
The steps involved in processing each different instruction and the time, usually measured in microseconds, taken to perform them. From this knowledge the duration of a routine may be calculated and improved.

**Instruction Format**  
The required shape and composition of processor instruction, typically including an address part and an operation part.

**Instruction Register**  
An area of store which holds the instruction currently being obeyed.

**Instruction Set**  
A system of signs, symbols, names and definitions of all the instructions which are acceptable to a given computer or micro processor chip.

**Integer**  
A whole number, without any decimal or fractional part.

**Integrated Circuits**  
Elements of computer hardware in which a number of formerly discrete components are formed and interconnected on the face of a small chip of silicon or similar substance. Integrated circuits are generally held to mark the third generation of computer development. The first generation used thermionic valves and the second transistors — the size of a circuit in each generation being only a fraction of that of its predecessor.

Advantages claimed for each stage of miniaturisation include a significant reduction in power consumption and, therefore, in heat dissipation and consequent demands on ventilation plant; greater reliability; greater compactness; shorter wiring, permitting faster internal working. The outstanding im-

provement has been in cost reduction.

### Integrated Data Processing

A methodical system of interrelating business records so that there is no duplication of input. When several files need to be updated for one event, this will be achieved automatically from a single input. For example, an advice that goods have been despatched in satisfaction of a customer's order would cause the printing of the customary invoice set and the updating of the relevant sales ledger account and stock account. In addition it might test the residual stock level and, if appropriate, set in motion re-ordering procedure. A wholly integrated system would require this reaction to every event affecting the business served. This idea is widely discussed and sought after, but has not yet been achieved, though several firms claim to be moving in this direction.

### Intelligent Terminal

One equipped with a micro-processor or comparable logical devices as well as buffer storage so that data may be validated, edited or otherwise varied locally, without using the computing power of the main machine to which the terminal is connected.

### Interactive

A mode of operating a computer whereby each action of the operator generates a response from the computer which indicates the next action required of the operator, and so on. Synonymous with Conversational mode.

### Interblock Gap

Blank area in magnetic tape between record areas. No data is permitted to be recorded in this gap, which is necessary to allow the tape transport device to accelerate or decelerate between stop and full speed winding.

### Interface

The boundary between a central processor and each of the various peripherals which it serves. A common interface system allows additions and alterations to be made to a configuration with little disruption of normal working. There are however many possible variables, including code, format, physical dimensions and wiring of connectors, voltage levels, phase and speed.

### Interpreter

A software routine that decodes instructions (written,

for example, in BASIC) and immediately executes them. A compiler, by contrast, will create a machine-level version of the program which may be stored for use on some later occasion.

### Interrogate

To seek more complex information from a data processing system than a simple answer to a routine enquiry. An interrogation might ask for a full record of all the transactions on a customer's account over a given period. It implies speedy access to detailed files or 'data base'.

### Interrupt

Temporary suspension of a routine in a computer following automatic detection of some condition which makes the interrupt desirable. The cause may be a physical "fault," such as disconnection of a peripheral or lack of paper in a printer and resumption of working will only follow operator intervention. An interrupt may also arise out of the data processed, for example, if improper division is attempted, and resumption might be automatic. In a time-sharing computer interrupts will allow another program to be run. Storage is provided in working store of the next instruction to be obeyed in the interrupted program and of any associated data, so that processing can continue immediately control is returned to the interrupted routine.

### Inverter

An electronic circuit which delivers an output which is opposite to its input, that is, an 0 for every 1 and vice versa. Synonymous with NOT-gate.

### IRQ

Interrupt Request

### ISAM

Indexed Sequential Access Method.

### Isolator

A device to separate something electrically while still allowing data signals to pass.

### Iterative Process

One which is repeated again and again, typically with the minimum amount of data varied on each computer run. An optimisation program may be run in this way, using the result of each iteration to guide the next selection of value for the variable parameter under trial. Iterative processing can take a great deal of computing time unless there are good rules to cut short the heuristic exercise as soon as sufficient trials have been made.

# PUZZLES

## LEISURE LINES

With J. J. Clessa

As part of the 'new look' PCW, we hope to bring you every month a page of diversions, puzzles and competitions. There'll be chances to win prizes and although "Leisure Lines" will primarily be concerned with puzzles, we expect from time to time to digress a little and maybe even tell the occasional joke.

### Quickie

This month's quickie — no prizes, no answers given. . . a 2-digit number, read from left to right, is  $4\frac{1}{2}$  times as large as the same number read from right to left. What is the number?

### Prize Puzzle 1a

This, the first of this month's prize puzzles, is designed to test your logic and reasoning ability. A prize goes to the sender of the first correct postcard out of the bag.

On the London-Glasgow air shuttle service are three passengers named Brown, Jones and Smith. By coincidence the pilot, co-pilot and cabin steward on the aircraft are also named Brown, Jones and Smith — but not necessarily respectively.

1. Passenger Jones earns £5,200 per annum.
2. The cabin steward lives midway between London and Glasgow.
3. Smith, the crew member, is married to the co-pilot's sister.
4. The passenger with the same last name as the cabin steward lives in Glasgow.
5. The passenger who lives nearest the cabin steward, earns exactly three times as much per week as the cabin steward.
6. Passenger Brown lives in London.

What is the pilot's name?

### Prize Puzzle 1b

You are permitted to solve this by any means at your disposal — inclu-

ding the offer of bribes to J. J. Clessa (who's address will NOT be given. Ed).

A Pythagorean triangle is a right angled triangle whose sides are an exact number of units in length — and of course, it conforms to the famous rule: "The square of the hypotenuse is equal to the sum of the squares on the other two sides. . ."

Probably the best known Pythagorean triangle has sides 3, 4 and 5 units, and, of course,  $5^2 = 3^2 + 4^2$ .

The area of the triangle is obtained by the product of the two smaller sides:  $3 \times 4 = 12$  units. The perimeter of the triangle is the sum of all three sides:  $3 + 4 + 5 = 12$  units.

(Sorry to go through all that, for those who already knew it, but I want to be sure that everyone starts equal).

I'd like you to find the smallest area Pythagorean triangle whose perimeter is a perfect square and whose area is a perfect cube.

Please send answers in on a separate postcard for each puzzle, addressed to: Puzzle (1a or 1b), Personal Computer World, 14 Rathbone Place, London W1P 1DE. Winners will be notified by post and results, plus solutions, will be published in the next-but-one edition of PCW. The Editor reserves the right to make final decisions on all matters.

### Prizes

Alright, you asked for it, this month the "Silly Prize" for each competition will be 2.5 Kg of Cadbury's Dairy Milk Chocolate (that's 50 bars, each weighing 50g).

Before leaving, I'd like to stress that "Leisure Lines" is designed to be a two-way thing. I'd welcome any offerings of puzzles, jokes, ideas, etc. All contributions will be gratefully received and acknowledged if used.

# DIARY DATA

Wembley, England	Trade & Technology in Orbit - The British Contribution. Orb Foundation Ltd., 15 Chapel St., Belgrave Sq., London SW1. Tel: 01-235 0376	Aug 27 - Sept 2
Gothenburg, Sweden	KOMPONENT - Electrical & Electronics Components Exhibition, Svenska Massan, Box 5222 S-402 24, Gothenburg, Sweden.	Aug 28 - Aug 31
Tokyo, Japan	INFO ASIA - Information Management Exhibition, ECL, 11 Manchester Sq., London W1M 5AB. Tel: 01-486 1951.	Sept 5 - Sept 8
Dallas, U.S.A.	International Minicomputer Exposition. IME, 413 Carlton Tower, 13601, Preston Rd., Dallas, Tx 75240, U.S.A.	Sept 6 - Sept 9
Melbourne, Australia	International Business Equipment Fair. Riddell Exhibition Promotions Pty. Ltd., 166 Albert Rd. South, Melbourne 3205, Australia.	Sept 10 - Sept 13
Bristol, England	Electronics Show. Exhibitions for Industry Ltd., 157 Station Rd. East, Oxted, Surrey, RH8 0QF. Tel: 0883 34371.	Sept 11 - Sept 13
New York, U.S.A.	Personal & Small Business Computer Show. Ralph Ianuzzi, H A Bruno & Associates Inc., 78 E 56th St., New York, NY 10022, U.S.A.	Sept 13 - Sept 16
Paris, France	Data Processing: Choosing Your Own. Secretariat, 6 Place de Valois, 75001, Paris, France. Tel 261 52 42.	Sept 17 - Sept 21
Munich, W. Germany	SYSTEMS - International Exhibition of Computers & Peripheral Equipment, ECL, 11 Manchester Sq., London W1M 5AB. Tel: 01-486 1951	Sept 17 - Sept 21
Boston, U.S.A.	Semicon East. Golden Gate Enterprises Inc., De Anza Office Center, 1307 So. Mary Ave., Suite 210, Sunnyvale, CA 94087, U.S.A.	Sept 18 - Sept 20
Oslo, Norway	OFFICE - Office Machinery & Equipment Exhibition, Norges Varesmesse, PO Box 130, Skoyen, Oslo 2, Norway	Sept 18 - Sept 26
Paris, France	SICOB - International Office Equipment Exhibition. French Trade Exhibitions, 54 Conduit St., London W1R 9SD. Tel: 01-439 3964	Sept 19 - Sept 28
Manchester, England	Microprocessors & Microcomputers. Dept. of Electrical Engineering, University of Salford, M5 4WT. Tel: 061-736 5843 Ext. 453.	Sept 24 - Sept 25
London, England	IFIP - International Conference & Exhibition on Information Processing. On Line Conferences, PO Box 46, Cleveland Rd., Uxbridge UB2 2DD. Tel: Uxbridge 39262.	Sept 25 - Sept 28
Bristol, England	Business Equipment & Efficiency Exhibition. Gwen Shillaber Design, 81 Whiteladies Rd., Clifton, Bristol, BS8 2NT. Tel: 0272 312850.	Sept 25 - Sept 28
Stockholm, Sweden	International Computer & Business Efficiency Exhibition. Marketing Exhibitions Ltd., 25 Oakhills Rd., London SW15 2QJ. Tel: 01-874 6034	Sept 27 - Oct 3
Seoul, Korea.	Electronics Show, Electronics Industries Association of Korea Ltd., 10 - 1, 2 ga Hoehyeon-dong, Jung-gu, Seoul, Korea.	Sept 27 - Oct 4
Toronto, Canada	International Electronics Conference & Exhibition. Westbourne Marketing Services Ltd., Crown House, Morden, Surrey, SM4 5EB. Tel: 01-540 1101	Oct 1 - Oct 3
Manchester, England	Electronics Engineering & Components Exhibition. Groundrule Exhibition Company, 7 Market St., Altrincham, Cheshire, WA14 2QW. Tel: 061-928 2227	Oct 2 - Oct 3
Tokyo, Japan	Data Show. Japan Convention Bureau, 167 Regent St., London W1. Tel: 01-734 9638.	Oct 2 - Oct 5
Stuttgart, Sweden	Eltro-Hobby '79 Stuttgart. G.E.S. (Overseas) Ltd., 181 Queen Victoria St., London EC4.	Oct 3 - Oct 7
Kowloon, Hong-Kong	Electronics Show, HK Productivity Centre, Sincere Buildings 2 20/F, 173 Des Voeux Rd., Central, Hong Kong.	Oct 3 - Oct 8
Philadelphia, U.S.A.	Personal Computing '79. John Dilks, Rte 1, Box 242, Mays Landing, NJ 08330, U.S.A.	Oct 5 - Oct 7
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
Birmingham, 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 Sq., 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

# DIARY DATA

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
Wembley, England	Microsystems '80 Exhibition & Conference. Iliffe Promotions Ltd., Dorset House, Stamford St., London SE1 9LU. Tel: 01-261 8000.	Jan 30 - Feb 1
Milan, Italy	INTEL — International Electrical and Electronic Technology Exhibition, Intel, Via Luciano Manara 1, 20122 Milan, Italy.	Feb 9 - Feb 13
London, England	Business Computing, Word Processing & Information Mgt., Exhibition & Conference. BED Exhibitions Ltd., Bridge House, Restmor Way, Wallington, Surrey SM6 7BZ. Tel: 01-647 1001.	Feb 12 - Feb 15
Wembley, England	INFO EUROPE — European Information Management Exhibition & Conference Clapp & Poliak Europe Ltd., 232 Acton Lane, London W4 5DL. Tel: 01-995 4806.	Feb 18 - Feb 21
Bournemouth, England	BEX — Business Equipment Exhibition, Douglas Temple Studio Ltd., 104b Old Christchurch Rd., Bournemouth, Dorset, Tel: 0202 20533	Feb 20 - Feb 21
Dortmund, W. Germany	HOBBYTRONIC — Electronic Hobby Exhibition, Westfalenhalle GmbH, Postfach 1130, Reinlanddamm 200, 4600, Dortmund, W. Germany	Feb 20 - Feb 24
Birmingham, England	IEA — International Instruments, Electronics & Automation Exhibition, Industrial & Trade Fairs Ltd., Radcliffe House, Blenheim Court, Solihull, West Midlands, B91 2BD. Tel: 021 705 6707.	Feb 25 - Feb 29



## NewBear Books



**NEWBEAR MAIL ORDER:** 40 Bartholomew Street, Newbury, Berks. Tel: 0635 30505

**NORTHERN SHOWROOM:** Mersey House, 220-222 Stockport Road, Cheadle Heath, Stockport

Tel: 061 491 2290

### GAMES

Chess & Computer	D. Levy	£ 7.16
Chess Skill in Man and Machine	P. Frey	£11.84
32 Basic Programs for the Pet		£ 9.95
Game Playing with Computers	D. Spencer	£10.20
Basic Computer Games	D. Ahl	£ 5.50
Star Ship Simulation		£ 5.10
Game Playing with Basic	D. Spencer	£ 4.10

### BASIC

Learning Basic Fast	De Rossi	£ 6.30
Basic Basic	J. S. Coan	£ 5.00
Advanced Basic	J. S. Coan	£ 5.50
Illustrated Basic	D. Alcock	£ 2.25
The Basic Workshop	Hayden	£ 6.60
Basic with Business Applications	Hayden	£ 5.56
Introduction to Basic	J. Morton	£ 6.50
Beginning Basic	P. Gosling	£ 2.95
Introduction to Basic	P. Hartley	£ 1.95

### NEW BOOKS

Fundamentals of Computer Algorithms		£15.00
Computer Mathematics		£ 8.58
Top-Down Structured Programming Techniques		£12.76
Microcomputer Design		£ 8.99
A Directory of Microcomputing		£10.00

### Z80 BOOKS

Z80 Programming for Logic Design	A. Osbourne	£ 5.95
Z80 Technical Manual	Zilog	£ 4.00
Z80 P10 Technical Manual	Zilog	£ 2.75
Z80 Programming Manual	Zilog	£ 4.50
Z80 Microcomputer Handbook	W. Barden	£ 6.99
Practical Microcomputer Programming (Z80)	Weller	£23.96

### 6800 BOOKS

6800 Programming for Logic Design	A. Osbourne	£ 5.95
6800 Assembly Language Programming	A. Osbourne	£ 6.95
Using the 6800 Microprocessor		£ 5.65
77-68 6800 Microprocessor		£ 7.50
6800 Software Gourmet Guide		
Cook Book	Seelbi	£ 7.95
Practical Microcomputer Programming (6800)	Weller	£17.56
The 6800 Microprocessor		£ 3.60
D.N. 4 Definite description of the 6800 Instruction Set		£ 1.50

### PASCAL

Pascal: User Manual & Report	Springer-Verlag	£ 5.52
Problem Solving Using Pascal	Springer-Verlag	£ 7.84
Programming in Pascal	P. Grogono	£ 7.50
A Practical Introduction to Pascal	A. Addyman	£ 3.50

### 6502

The Best of Micro 6502 Journal		£ 5.99
Sym Reference Manual		£ 7.50
Sym Programming Manual		£ 7.50
First Book of Kim		£ 7.00
6500 Hardware Manual		£ 7.50
6500 Programming Manual		£ 7.50
Programming the 6502 SYBEX	Zaks	£ 7.95

### COOKBOOKS

Active Filter Cookbook	Lancaster	£10.45
CMOS Cookbook	Lancaster	£ 6.95
IC OP-AMP Cookbook	Jung	£ 9.50
IC Timer Cookbook	Jung	£ 7.50
TTL Cookbook	Lancaster	£ 6.95
T.V. Typewriter Cookbook	Lancaster	£ 7.50
Cheap Video Cookbook	Lancaster	£ 4.30

“BY RETURN ORDER SERVICE”

# The 2nd PERSONAL COMPUTER WORLD SHOW

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

## LAST YEAR

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

Exhibitors informed us of record orders at the show. Visitors ranged from businessmen to educationalists, from industry managers to administrative civil servants, from the home enthusiast to foreign buyers. And they came in their thousands! Conference delegates, too, had some extremely complimentary things to say about the speakers and the range and organisation of the conference programmes. Media interest was extensive, including both British and foreign press, radio and television coverage.

In summary, a tremendous success.

## THIS YEAR

For the 2nd Personal Computer World Show it's going to be even bigger and better. We've organised more space for exhibitors and much of it 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 below.

## THE CONFERENCE

As with last year, a full conference programme is attached to the show and once again 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

The use of Microprocessors in Industrial Production. Product Innovation Incorporating Microprocessors. The Introduction of Micro-controlled Industrial Robots. The Impact of Microprocessors on Industrial Relations.

### Seminar 3

Saturday 3 November MICRO-COMPUTERS FOR THE INDIVIDUAL ENTHUSIAST

An Overview of the Personal Computer Marketplace. The Information Potential of Personal Computing (Hooking into data bases). Socket to your Personal Computer! (Hooking up Exotic Peripherals). The Mechanics of Micro-controlled Robots.

*Full list of Conference Speakers to be announced shortly*

## TO BOOK CONFERENCE RESERVATIONS, EXHIBITION SPACE OR EXHIBITION TICKETS

Use the form opposite this advertisement. Visitors, Exhibitors and Conference Delegates are strongly advised to book early. Last year a substantial number of people had to be turned away.

**Visitors:** Please note that pre-booked tickets are £1.00 whilst entrance at the door will be £1.50. A pre-booked ticket guarantees you entrance. Owing to the large number of people expected to this year's show, we cannot guarantee entrance to visitors who have not pre-booked. Use the coupon opposite to obtain pre-booked tickets.

**Exhibitors:** Use the coupon opposite to obtain further information of exhibition space still available. Or telephone Timothy Collins on 01-486 1951 (Telex 24591).

**Conference Delegates:** You can use the coupon opposite either to book now or request further information regarding the Conference Programme. The charges for Seminars 1 and 2 include coffee, lunch and tea. The charges for Seminar 3 include coffee, sandwich lunch and tea and includes VAT. All Conference Delegates will receive abstracts, an Exhibition Catalogue and free entrance to the Exhibition on any day.

# 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.

## For Sale

Card Reader. . . Motorola table top model N.1141C-11 with Teletype adaptor, self-contained 117V power supply. Untested, so £70 o.n.o. Buyer collects from: Richard Barns, 97 Ringmer Road, Worthing, Sussex BN13 1DU.

Mite Printer. . . standard ASC11 characters, cased, working order. Includes 240V PSU, logic (needs repair) - £15 or what have you?

Teletype 28ASR. . . includes 2 printed tape perfs, reader, cable and wireless line unit; 240V. Good working order - £35 or what have you? Phone R. Wilmot on Horsham (0403) 69835.

To clear: 2111-A4 RAMS @ £1.75 each/2112-2 RAMS @ £1.75 each/GR1-756 keyboard and connector @ £47 each/Superboard II PSU, 5V 3A + 7V 400MA - £25/5204 UV ERPOMS @ £6 each.

Few only: Sinclair Enterprise Programmable Calculator + PSU program library - £20. Phone B. Mistry on 0274 77636 (evenings).

Teletype RO-35. . . standard serial teletype interface (ASCII), complete with stand and cover (vgc) and 110V transformer - £65. Phone Chris North on Harrogate 67328 (after 6pm).

Nascom 1. . . professionally built and tested, including high quality power unit, plus games tape. Mounted in stylish metal cabinet, all manuals and paperwork supplied - £200. Mr D. A. Shinn of 18 Hitch Common Road, Newport, Essex. Phone Bishops Stortford 850317 (day), Saffron Walden 41191 (evenings).

Extended Nascom Computer. . . with Nasbus, buffer board and 8K memory. Also has floating point BASIC on EPROMS, professionally built, fully

working with power supply and tapes (inc. Startrek, Minefield, Zombie game, Maths). All manuals supplied - £300. G. R. Lindforth, 3 Gaza Close, Coventry, CV4 9EF.

Nascom 1 Super Tiny-BASIC. . . in 3 x 2708 EPROMS, with documentation - £30. Phone D. Jay on (0702) 218662.

Synthesiser - Mini Korg. . . as new, cost over £700. Will swap for your Apple, PET, TRS or w.h.y. Phone J. Aldhous-Evans on Crawley (0293) 24504.

TRS-80 Compatible. . . Centronics Microprinter Type P1 (5,10,20 cpi pitch selection). Data input 7-bit ASC11, parallel input TTL levels with strobe. Uses aluminised paper 4.3/4 inches wide. Current price inc. Vat, £454. Will sell at £350 o.n.o. with three rolls of paper - quick sale, owner upgrading system. Phone W. Davies on Cheltenham 29135.

PET. . . for sale, 2001-8. Includes set of games and utility programs - £500 o.n.o. Phone R. D. Geere on Farnborough - Hants - (0252) 42921; evenings.

SWTP 6800 Computer. . . with 24K RAM, SWATBUG Monitor, SWTP AC30 tape interface, SWTP CT64 Terminal with UHF converter. All up and running on 8K BASIC. Make me an offer - Phone 0253 733369.

Cossor VDU. . . 80 by 15, RS232, cursor pad, buffered screen editing facilities. Must sell, need the cash - £250 o.n.o. Phone Sue on 01-794 8419.

MK14. . . sockets throughout, revised monitor and extra RAM, tape interface and single step facility. All built into case with new keyboard - £50 or offers. Willing to deliver within 30

mile radius. Mr. R. Young, 14 New Street, Bakestone Moor, Worksop, S80 4QN.

Z80 Data Book Pack. . . purchased from Greenbank Electronics. For sale as new, £9.50 inc. p&p.

Set of 61 high reliability push-button reed switches. . . suitable for making keyboard - unused. Cost 40p each when new, will sell as set for £14.50, inc. p&p (no keytops). Phone P. Blair on 0969 23462 (after 6.30pm).

Westrex paper-tape punch - £100 o.n.o. ICL 250 ch-sec reader - £100 o.n.o. DataProducts 250 lpm drum printer - £500

Mowhawk 400 card per minute reader - £100. Phone Richard Gould on 0234 57135

4116 (16K-250ns) Dynamic RAM I/Cs . . . set of 8 for £52. Also some singly @ £6.50 (prices include p&p). Postal applications only please. Ray Freeman, 19 Newman Place, Bilston, West Midlands.

Triton Computer. . . 8K, including new Humbug monitor, BASIC software and tape recorder. Plugs into domestic TV - £325 o.n.o. Phone between 7 and 8pm any day and ask for Richard - 01-859 0323

PET 8K Computer . . . plus software - £500. Phone Stockton-on-Tees 617911 (evenings).

## Wanted

TRS-80. . . 4K Level II (Keyboard only). Will pay up to £250. Phone Burton-on-Trent 61040.

Second hand PET 2001. . . state your price to Mr. R. Harvey, 30 Wimborne Close, Coombe Glen, Cheltenham, Glos. Phone 0242 27588.

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Please send me further information about  
The Conference Programme   
Taking Exhibition Space

#### Exhibition Tickets

Please send me  
tickets @ £1.00

#### Conference Bookings

Please reserve me the following Conference Tickets

Seminar No.	Cost (+ VAT)	No. of Tickets	Total
1 Thursday 1 November (Small Business)	£45(+6.75VAT)		£
2 Friday 2 November (Industry)	£45(+6.75VAT)		£
3 Saturday 3 November (Enthusiast)	£14(inc.VAT)		£
	TOTAL		£

I enclose a cheque for £ made payable to Montbuild Ltd.  
(VAT Registration No. 232 764 760)

Cancellations: If a notice of withdrawal is received in writing by 15th October a refund less 15% administration charges will be made on Conference Bookings. After that date, no refund will be made.

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Tel No: \_\_\_\_\_

Please complete and return to Timothy Collins (for Exhibition Space), Peter Tuke (for Conference Bookings/Enquiries) or Exhibition Ticket Applications: The 2nd Personal Computer World Show, Montbuild Ltd, Manchester Sq, London W1M 5AB

## YOUNG COMPUTER WORLD

Continued from page 46

found, non-zero if no number is found. The person writing is found and negative if the the program would call the word (substring) "HELP" subroutine like this:

```

● 100 PRINT "What is the length of the rod?" ●
● 110 GOSUB 9000 ●
● 120 IF Z1=0 THEN 160:REM GOT ●
  A VALUE ●
● 130 IF Z1>0 THEN 50:REM TAKES ●
  THE USER BACK ●
● 140 PRINT "The rod is usually about ●
  60mm long" ●
● 150 GOTO 100 ●
● 160 L=Z ●
  
```

PCW welcomes correspondence from its readers. Be as brief and concise as possible and please add "not for publication" if your comments/questions are to be kept private.

Address letters to: "Communications", Personal Computer World, 14 Rathbone Place, London W1P 1DE.

## Sunburnt PROMS

For about a year I have erased 2708 and 2758 EPROMs using a health lamp which has both UV and a 150W IR element! At first I was worried because the EPROMs got too hot to hold, then the local Intel engineer told me that it is an old trick to salvage EPROMS with bits stuck down to cook them at 250°C for half an hour or so — so I don't worry any more. A second authority, NEC, says that 1702s have to be cooked at 400°C for 45 minutes after 52 program-erase cycles. (Best of Byte. Vol 1, page 205), so the best of luck to Mr Coates. Thanks for the suggestion of where to get the tubes. . . I did wonder. Peter Bendall, Kaltenkirchen, Germany

## Good book guide

I recently purchased my first copy of PCW (June 1979) and I must say I shall be a regular reader from now on. I am hooked and would very much like to know more about processors and their programming. I have a grounding in BASIC (picked up whilst using a Hewlett Packard desk top computer,) which I used for solving engineering problems.

I therefore ask if you could recommend a reading list of books or reprints which will give me a working knowledge of programming and hardware. I hope to build my own system.

Mr M D Juniper. Gravesend. Kent

*This letter echoes the sentiments of many readers so here, by no means comprehensive or exhaustive, are some suggestions:-*

*For the total newcomer to computing*

*"An introduction to personal and business computing" by Rodney Zaks. Publisher, Sybex. Cost £4.95.*

*"An introduction to microcomputers" Volume 0 — the beginners' book. Written and published by Adam Osborne. Cost £5.95*

*"Your own computer" Mitchell Waite and Michael Pardee. Published by Howard H Sams & Co. Inc. Cost £1.40*

*For the relative newcomer with access to a machine*

*"My computer likes me" \*when I speak in BASIC" by Bob Albrecht. Published by Dilithium Press. Cost £2.75.*

*For someone with a little experience*

*"An introduction to microcomputers" Volume 1 — basic concepts. Written and published by Adam Osborne. Cost £6.30.*

*For someone who can program already and who wishes to learn BASIC*

*"Basic basic" By James S Coan. Published by Hayden Book Company Inc. Cost £6.00*

*For the experienced electronics hobbyist or engineer.*

*"Microprocessors — from chips to systems" By Rodney Zaks. Published by Sybex. Cost £7.95.*

*For the electronics wizard wishing to interface other equipment to a micro or vice versa*

*"Microprocessor interfacing techniques" Austin Lesea and Rodney Zaks. Published by Sybex. Cost £7.95.*

*Finally, a plug for a Byte Shop booklet because they were so helpful chewing over the alternatives with us.*

*"A personal guide to microprocessors" The Byte Shop and Computerland. Cost 40p (This is only sold over the counter — please don't ask them to post you a copy). Ed.*

## Burrowing into Burroughs

We have a Burroughs L4000 accounting machine, and at present pay around £100 a time for programs on paper tape. I have extensive experience of programming in BASIC, on a time sharing telephone terminal system, but practically zero experience of programming in machine code (which is what I think L4000

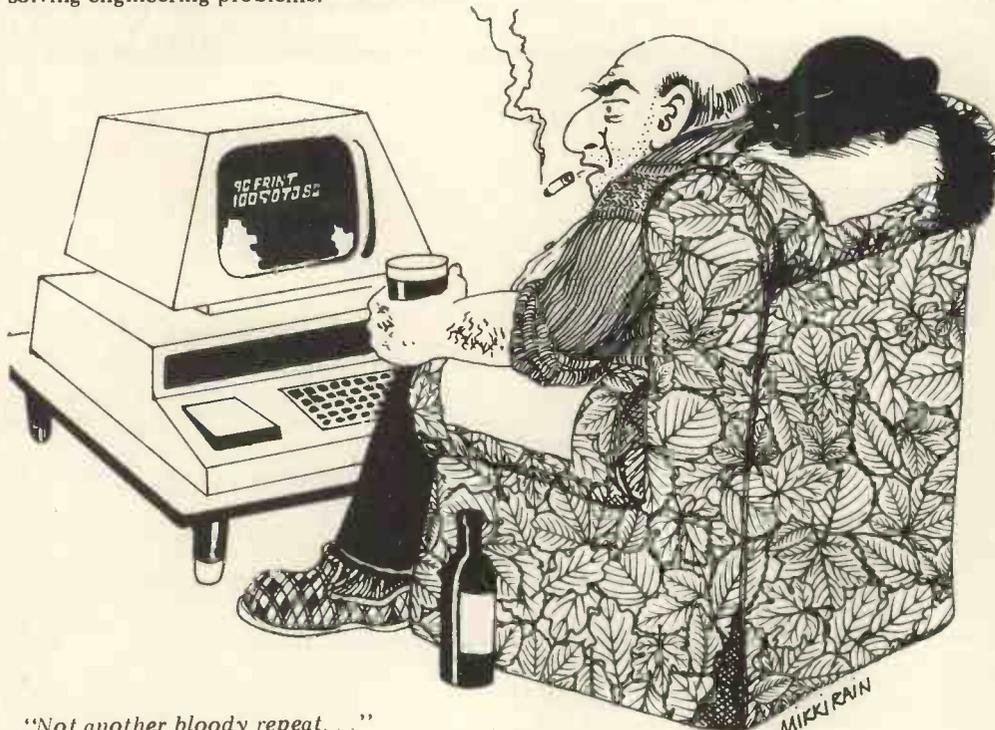
uses); but I am willing to learn. Can you advise me on how I can find out how to program it for myself? Burroughs, incidentally, don't seem very cooperative on this matter. A R Leeder. Norwich  
There are two assembly languages used on the L4000 series. SL3 is used on the smaller machines, while SL5 is used on the larger range i.e. the range which can be expanded to 64K. We suggest that you contact your local Burroughs salesman and ask him if he can provide you with the appropriate programming manual; it would also be worth asking if Burroughs still run courses. There are a number of software houses around that still write programs for L400s, the salesman could probably put you in touch with them. To create programs you need to use an assembler which needs some form of input as well as output. Burroughs tell me that the 12cps paper tape reader is not addressable from the processor, you would therefore need either a tape reader/punch or, perhaps, a magnetic tape unit. A visit to one or two brokers should produce results. Ed.

## Pascal—yes or no?

May I add some comments on Martin Beer's article on Pascal vs. BASIC? If you want to run a Pascal compiler you will need at least 32K bytes of RAM and floppy discs. As a rule of thumb, if you are into this kind of configuration, you will probably have some fairly heavy software to match and would therefore profit from using Pascal.

Despite all the usual reasons given for the use of BASIC — Ease of learning, width of use etc., the main reason for the popularity of BASIC is that it does not require this kind of expensive configuration (£2000+, if you are lucky). The other main advantage is that it is very easy to get something, even if it is the wrong thing, running.

However if you want your software to be user-proof, understandable to others, alterable and to shorten overall development time on large programs, then Pascal is better — provided you can run it. Alec Cawley, Newbury, Berks See our new Pascal series starting this month. Ed.

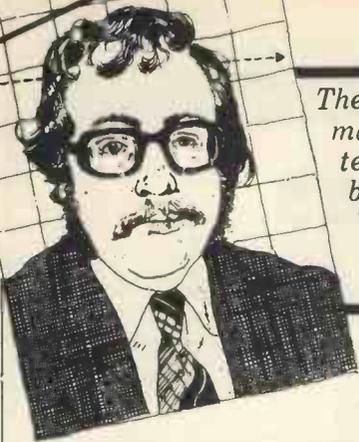


"Not another bloody repeat. . ."

# ON THE LINE

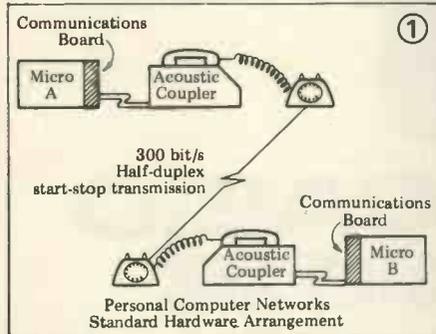
The increasingly widespread use of personal computers in the home and in the office makes for an exciting prospect. Equally, today's advances in telecommunications technology will soon be landing a significant impact on our way of life. The symbiosis of the two could well be the realisation of McLuhan's 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.

Lawrence Mynott



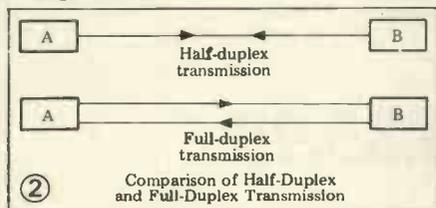
## Data link controls

In earlier articles, we have built up a hardware arrangement that enables us to send single ASCII characters from one micro to another. The general arrangement we shall be using for our Personal Computer Network is shown in Figure 1. This set-up will apply



regardless of the type of micro-computer you plan to use.

Our new piece of terminology appears in the schematic: 'half duplex'. This means that the link will be used in both directions but only one way at a time (sometimes called 'sequential both-way transmission'). Another technique is 'full-duplex' transmission whereby both stations may transmit at the same time ('simultaneous both-way transmission'). These concepts are illustrated in Figure 2.



Half-duplex working is most appropriate to inter-processor communications (but FDX might be useful for some games). FDX will be needed if you want to use your personal computer as a terminal connected to a larger computer system via a telephone link (more of this in a later article).

But what about datalink controls? Clearly, if two micros are going to talk to one another over a telephone line, they both must operate compatibly at the signalling, speed and data format levels. In addition, there must be an agreed procedure to handle the following situations:

- only one computer can transmit at any one time
- good transmissions must be acknowledged as such
- a transmitting station must be informed of bad transmission so that messages can be re-sent.

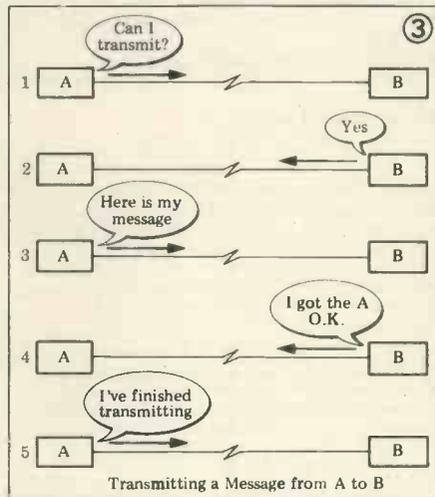
Procedures to meet the above requirements are called 'data link controls' or sometimes 'line protocols'. These vary a

lot according to the line characteristics and transmission technology employed, but we will adopt a relatively simple one which is fairly easy to program and which will meet most of our needs in networking.

Certain basic conventions have to be adopted:

- 1 Either micro may initiate transmission but it must ask the other if it is ready to receive.
- 2 In the case of requests to transmit being sent at the same time (head-on collision) the two stations must wait for different periods of time before re-attempting the sequence.
- 3 The program must assume that the other station might not respond (program failure, loss of power, etc).
- 4 All transmissions of messages must be acknowledged back to the sender.
- 5 The program must be able to retransmit any messages which arrived with parity errors.
- 6 The program must be able to recognise line failures or degradation in the quality of lines to the extent that further communication is impossible without dialling a new line.

Before going into the detail of how to implement such an arrangement let us take a look at Figure 3 to see the



basic technique. It may look long-winded but there is no easier way of doing it reliably and simply at low cost.

Either A or B can begin a transmission sequence. Each write off a control character or a message which must be followed by a read to determine the reaction of the other station. For example there can be three possible responses to the question "Can I transmit?" These are:

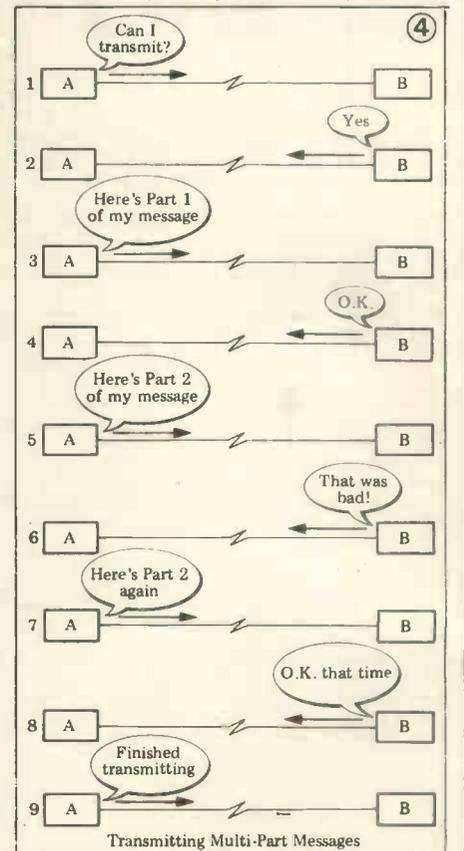
- Yes; go ahead, I am ready to receive.
- No; I am doing something else, try again later.
- Nothing; the other station did not react.

In the latter case, 'nothing' will obviously have to be determined by a time limit; otherwise the sender could be held waiting indefinitely. This limit needs to be built into the protocol program and is called a *time-out*. As we

shall be coming across another sort of time-out later it may be more precise to call this a *response time-out*. Response time-outs are usually set somewhere between three and ten seconds and it is a good idea for it to be adjustable interactively.

If both micros send "Can I transmit?" at the same time and they both have the same time-out setting, then they may continue to send the request ad infinitum (or both say 'go-ahead'). The answer to this is to ensure that each time-out is set differently (e.g. three seconds and five seconds) so that one station tries again before the second.

If the called station says 'go-ahead' then the caller can send a message, which may be complete or one part of a longer message. Segmenting a message like this (Figure 4) is necessary because



the error rate encountered on dial-up lines might be too great to transmit messages of more than about 80 bytes reliably. Even at shorter lengths, re-transmissions will be necessary. These should be counted as a means of monitoring line quality. When things get really bad you will find that you have to re-transmit your retransmissions! This is usually time to quit and dial a new circuit.

To make the protocol as efficient as possible, it is permitted to acknowledge a good transmission with a reply message (should one be available).

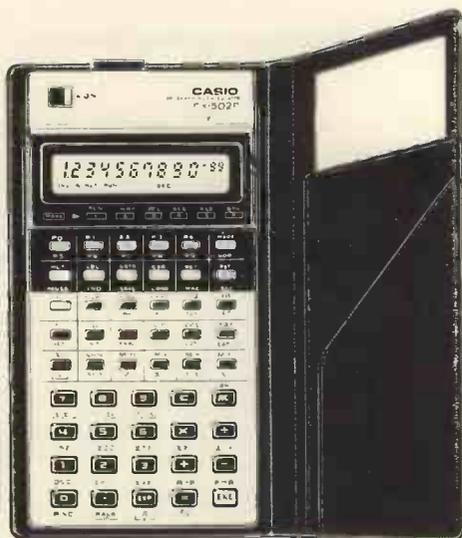
Next month, protocol implementation

David Ritchie

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PCW

# INTERRUPT

Continued from page 59.

shaking up the nervous systems of society as a whole.

No attempt to give categorical answers to these questions was contained in the French Government's report, a document which many may regard as being pessimistic. It does, however, contain the evidence on which these questions can be based and does not, in any way, attempt to brush them under the carpet. Moreover, is there likely to be a threat to the traditional sovereignty of states over their telecommunication systems? After all, direct transmission satellites — linked to databanks — will soon be operating regardless of national boundaries. Equally, is there a parallel danger to national security in the field of defence?

Made public early last year, a surprising factor of this report is that no political party in Britain (or for that matter the trade unions) made any comment on the far-reaching effects of its conclusions — especially in the areas of employment and industrial skills.

M. Simon Nora, and other members of the commission envisage a world in which the treatment of illness would rest with general practitioners, or perhaps even just medical auxiliaries. They would supplant the specialists whose knowledge the computer databank would make available to all. In education, the status of the teacher is seen as being changed profoundly by teaching aids. . . and many other professions and trades would be affected in the same way.

The question is — will civilisation be revolutionised by data processing and the new telecommunication technology and, if so, for better or for worse?

Melville Hawthorn

(Editor's note: Although originally submitted as a feature article, PCW felt this reader contribution to be well suited to the spirit of Interrupt.)

# MICROMART

David Levy is setting up a company to develop intelligent software for sophisticated microprocessor applications. Any readers interested in writing assembler programs on a contract basis please write to David Levy, Box 123, Personal Computer World, 62a Westbourne Grove, London W2. Anyone actively interested in speech recognition, music composition or robotics is also invited to apply.

# PROGRAMS

## CALCULATOR CORNER

### SPACESHIP fx201-P

Submitted by O. N. Bishop

This program for the Casio fx201-P simulates the controls and display panel of a spaceship manoeuvring in two-dimensional space in proximity to a planet. As a game for one person, there is a lot to be learned about handling the craft while blasting off from the planet and attempting to go into orbit. With too little thrust you find yourself crashing back on the surface of the planet. With too much thrust you head further and further out into space and without enough fuel to get back home again.

The program uses approximations at several stages in order to fit into the 127 steps available. One simplification is to use polar coordinates, yet to work with cartesian coordinates for computing the relatively small changes in position that occur from one move to the next. The program takes account of the loss in total mass as the fuel supply diminishes and, consequently, the handling characteristics of the spaceship alter perceptibly during the game. Skill is needed in allowing for this and also for the fact that gravitational attraction falls off in proportion to your distance from the planet, just as in real life. The response for a given amount of thrust depends on exactly where you are in space. Altitude may be gained by a downward burn or by making use of 'centrifugal force' as you accelerate tangentially.

To begin a flight the memories are loaded as follows:

1 K, the gravity factor, proportional to

the mass of the planet. Set this to 100 for your trial flights.

2 M, the mass of the spaceship. Set this to 200.

3 m, the mass of fuel. Allow yourself 500, though it's fun to load with a lesser amount and try to orbit the planet and splash down without running out of fuel.

4 X, your radial (vertical) distance from the centre of the planet. Set this to 20 if your flight begins from the surface of the planet.

5 x, your angular distance from the zero degree radius (see map). You may start from zero or any other value up to 360°.

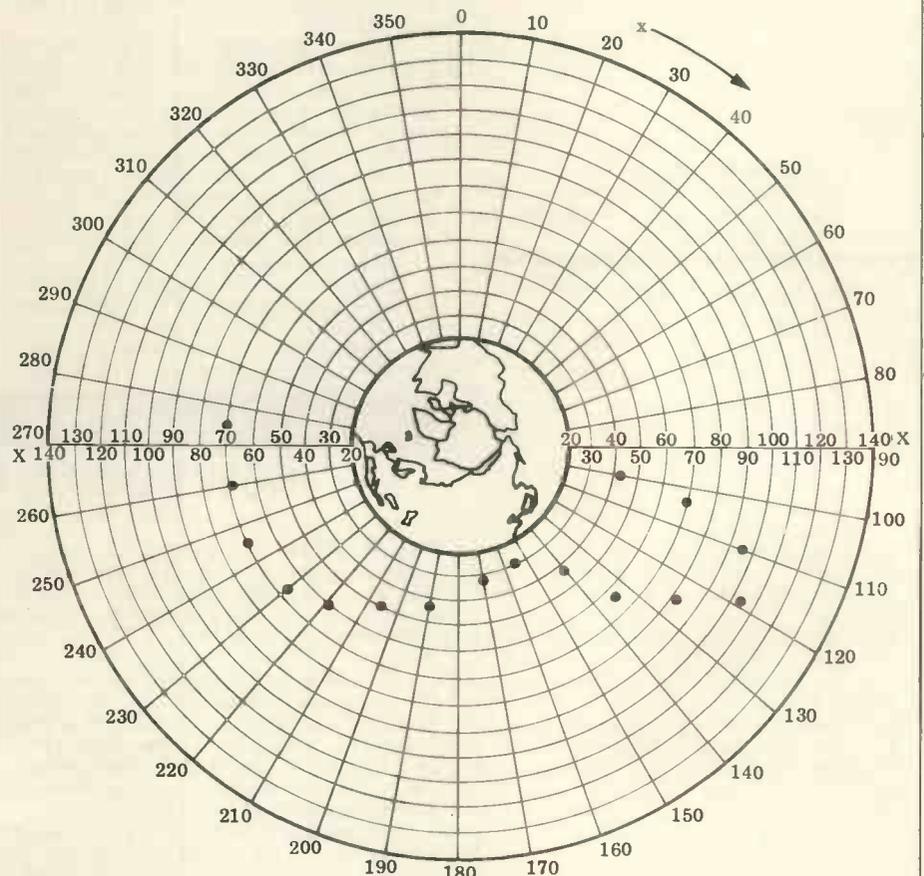
6 T, the rocket thrust in a vertical downward direction (eg for blast-off). In later turns this can be set to zero for coasting or to a negative value, if you wish to lose height.

7 t, the rocket thrust in a tangential direction anticlockwise, causing you accelerate around the planet in a clockwise direction. This too can be set zero or negative.

8 Total thrust used: the sum of T and t, ignoring negative signs, if any. One hundredth of this total is deducted from your fuel load.

Memories 9 and 0 hold V and v, respectively, your radial (vertically outward) and tangential (clockwise) velocities. These are zero to begin with.

The program calculates your new position after unit time (since t = 1, this



The space-map with the planet (Earth in this example) in the centre. The position of the spaceship is plotted by using small counters or plastic-headed pins, estimating fractions of the divisions. Here, the fx201-P has blasted off from Singapore (20,100°) and after nearly disappearing out into space and then nearly crashing on Africa is in a reasonably steady orbit over the Atlantic (70,275°).

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# PROGRAMS

simplifies equations a lot) and displays the amount of fuel left (memory 3), your new radial distance (4), your new angular distance (5) and your velocities V and v (9, 0). The program is *not* a real-time simulation, which is just as well, for you will need plenty of time to plan your next burns carefully. After recording the data and plotting your new position on the map, press the Manual Jump key (MJ) and the program will request that the next pair of thrust values be entered. If you wish to coast, these can be set to zero. To abort the mission press the Start button and begin.

To begin with it's difficult enough to

simply orbit and planet and splash down at a pre-selected spot with low velocities. Later you can try looping the loop, landing on a rotating planet (cut out the planet, lay it on the map, and rotate it 10° every turn), or docking with an orbiting satellite (use a small disc and move this by, say, 10° at constant radial distance each turn). You can increase K, to see what it is like to navigate close to a massive planet. Alternatively, with zero K you are simulating flight in deep space. With two or more calculators in use, you are all set for your own version of Star Wars, and the rules are yours to make.

## Step

1 MAC  
 2 ENT 1 : 2 : 3 : 4 : 5 :  
 13 MJ  
 14 ENT 6 : 7 : 8 :  
 21 3 = 8 x K · 0 1 + / . + 3 :  
 34 8 = 2 + 3 :  
 40 8 = K 1 - 8 :  
 47 7 = 7 x 8 :  
 53 6 = 6 x 8 :  
 59 8 = 7 - K 2 + 0 :  
 68 0 = 0 + 7 :  
 74 5 = 8 x K 5 7 - 4 + 5 :  
 86 7 = 8 x 8 - 1 - 4 + 6 :  
 109 9 = 9 + 7 :  
 115 ANS 3 : 4 : 5 : 9 : 0 :

## Starting parameters

Thrust of engines this period  
 $m_1 = m_0$  - total thrust/100  
 total mass,  $M_t = M + m_1$   
 $1/M_t$   
 tangential acceleration,  $a = t/M_t$   
 radial accel. due to thrust,  $A_t = T/M_t$   
 tangential distance travelled,  $d = v_0 + a/2$   
 $v_1 = v_0 + a$   
 $x_1 = x_0 + 57d/X_0$   
 total radial accel  $A = A_t + (d^2 \cdot K)/X_0$   
 $V_1 = V_0 + A$   
 New position and velocities, and amount of fuel remaining.

## Spaceship review

I was delighted to receive this game for review as I am the proud possessor of a battered Fx 201-P — something I had never previously thought of it as 'game-worthy'.

Lazy by nature, I Xeroxed up some copies of Mr. Bishop's chart to play on rather than draw up my own, and was soon engrossed in the problems of achieving lift-off.

The program works very well and the game is sufficiently difficult to retain the interest for hours on end. Unless you're far more adept than I, you need several hours of play just to achieve a stable orbit! And many variations are possible, such as attempting to land and take off again at several locations with limited fuel, or trying to achieve journeys with optimum fuel economy, or in the shortest time.

Considering the Fx 201-P has only 127 steps available, this is a remarkably sophisticated simulation. The only deviation from realism is that you can't achieve a stable coasting orbit without

small downthrust corrections every so often, due I imagine to the accumulation of small errors produced by the rectangular coordinates used for individual moves (the orbits are in effect polygons rather than true circles).

The only criticisms I have are rather unfair since they are dictated by the size of the 201's memory rather than by the inventor. One is that it's irritating to have to mentally sum and enter the total thrust figure 8 — when the machine ought to compute it from 6 & 7. Unfortunately the necessary steps can't be spared (especially as absolute values are involved and the 201 doesn't have an ABS function). The other minor gripe is that the earth's surface isn't "solid". The ship can sink right through it if you don't apply enough thrust on take-off, coming to rest at the earth's core! Again there just isn't room to write in a condition that  $X_1 \geq 20$ . Still it's good enough to show that micro owners don't have all the fun!

Dick Pountain

# FUN & GAMES

## HOW GOOD IS YOUR MEMORY

Submitted by Ray A Poynter

Presented here is a simple but exacting memory game. The object is to remember a continually increasing string of numbers — in an attempt to reach a perfect score of 31. (Why 31? ... why not?)

The program generates a sequence of 31 integers, in the range 0-9, storing them in an array A. The player is then presented with first one digit, then two digits etc. The player, when prompted, has to repeat the sequence of numbers, one digit at a time.

The program is written in a BASIC compatible with the interpreter on the APPLE II. The conversion, to make a program run on any other machine, should be simple.

Playing the game is made more pleasurable if a few extra lines are added to the program to give dialogue.

```

30 A(I) = INT (RND (I) * 10)
40 NEXT I
50 FOR I = 1 TO L
60 PRINT: PRINT "HERE IS YOUR SEQUENCE"
70 FOR J = 1 TO I
80 PRINT A (J)
90 NEXT J
100 FOR J = 1 TO TI: NEXT J
110 HOME: REM@@@ OR SOME INSTRUCTION TO CLEAR SCREEN
120 PRINT "ENTER THE SEQUENCE"
130 FOR J = 1 TO I
140 INPUT "ENTER DIGIT": A
150 IF A <> A(J) THEN GO TO 200
160 NEXT J
170 HOME
180 NEXT I: PRINT
190 PRINT "WELL DONE YOU HAVE WON": END
200 PRINT "YOU HAVE LOST": END
    
```

# PROGRAMS

## ACRONYMS

Submitted by Richard Forsyth

This program was designed by Richard Forsyth to convert any word (up to 25 characters) into any acronym. Suitable catch phrases are generated using a buzzword directory. In order to make the program more useful, an entire

selling blurb (containing more vital buzzwords) is produced. A useful feature of this program is that you can request any number of alternative blurbs for each acronym entered. Here is an example:

What is BRUCE?

BRUCE is a dramatic new development. It stands for Binary Record Unbundled Centralized Encoding a totally new concept in Encoding.

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Can you afford to do without BRUCE (Binary Record Unbundled Centralized Encoding)?

We had to remove the contents of line 9000 as it comprised eight variable-length anglo saxon words. These words were incorporated to enable the program to display the phrase in line 1560 (also deleted) to the rude user. You will, no doubt, want to create your own vocabulary.

Each record comprises two words W\$ and T\$ where W\$ is the word and

T\$ is a description A,AA,N or NN. A describes an adjective, AA an adverb, N a general noun and NN a specific noun.

The first few words in Richard's vocabulary are listed at the end of the program to guide you. You will notice that it is alphabetic on the initial letter only.

```

1  REM* PROGRAM TO MAKE UP CATCH PHRASES FROM BUZZ-WORDS:
2  REM* BY RICHARD FORSYTH, 1978.
10 DIM W$(1500),W(3),G(3,27)
20 DIM P$(25),P(25),S$(8)
25 MARGIN 80
50 REM* TABLE ADDRESSING FUNCTION:
55 DEF FNW(I,J)=366*I+J
60 RESTORE
75 RANDOMIZE
77 REM* READ IN SWEARWORDS:
80 READ S$(Z) FOR Z=1 TO 8
99
100 REM* MAIN LINE:
110 GOSUB 1000 ' INITIALIZE
115 GOSUB 1500 ' USER INPUT
120 IF LEN(I$)=0 OR B<1 THEN 160
122 PRINT
125 LET B=B-1
130 GOSUB 2000 ' GENERATE AND STORE
140 GOSUB 3000 ' EXPRESS
150 IF B>0 THEN 125
155 PRINT \ GOTO 115
160 PRINT "VOCABULARY LISTING (Y=YES)";
165 INPUT Y$
170 IF Y$="Y" THEN GOSUB 4000
175 GOTO 9999
999
1000 REM* DATA INPUT ROUTINE:
1001 FOR J=0 TO 3
1002 LET W(J)=0
1005 FOR I=0 TO 27
1010 LET G(J,I)=0
1012 NEXT I \ NEXT J
1015 LET H=0
1020 OPEN "WORD.FIL" FOR INPUT AS FILE #1
1022 IF END #1 THEN 1180
1023 INPUT #1, W$,T$
1024 IF H>1200 THEN 1180
1025 IF W$="***" THEN 1180
1030 LET T=0
1032 LET A=ASCII(W$)-64

```

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## PROGRAMS

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1040 IF T$="AA" THEN T=2
1045 IF T$="N" THEN T=3
1050 IF T$="NN" THEN T=4
1055 IF T>0 THEN 1070
1060 PRINT "INPUT ERROR: ";W$;" ";T$
1065 GOTO 1022
1070 LET W=T-1
1075 LET W(W)=W(W)+1
1077 LET W$(FNW(W,W(W)))=W$+""
1080 IF G(W,A)=0 THEN G(W,A)=W(W)
1085 REM* NOTES START OF EACH LETTER.
1088 LET H=H+1 \ GOTO 1022
1100 REM* END OF FILE:
1180 CLOSE 1
1182 PRINT H;"WORDS."
1185 FOR J=0 TO 3
1188 LET G(J,27)=W(J) ' LAST
1190 NEXT J
1195 PRINT W$
1199 RETURN
1499
1500 REM* USER INPUT ROUTINE:
1505 PRINT "GIVE YOUR WORD:"
1510 INPUT I$
1515 IF LEN(I$)>25 THEN PRINT "TOO LONG!" \ GOTO 1510
1520 FOR Z=1 TO 8
1522 IF INSTR(1,I$,S$(Z))>0 THEN 1555
1525 NEXT Z
1530 PRINT "HOW MANY BLURBS (0 TO HALT)";
1535 INPUT B
1550 RETURN
1555 REM* DIRTY WORD:
1560 PRINT
1570 REM* KEEP IT CLEAN!
1575 STOP
1999
2000 REM* PHRASE GENERATOR ROUTINE:
2005 LET L=LEN(I$)
2010 MAT P=ZER \ LET P$=""
2015 REM* FIRST WORD FIRST:
2020 LET T=INT(RND+1.5) ' ADJ/ADV
2022 LET P(1)=T
2025 LET A=ASCII(I$)-64
2030 GOSUB 2200 ' PICK WORD OF TYPE T
2032 LET P$(1)=W$+""
2035 LET P$=P$+W$+""
2040 FOR J=2 TO L
2045 LET A=ASCII(MID$(I$,J,1))-64
2050 IF J=2 AND P(1)=2 THEN T=1 \ GOTO 2065
2055 LET R=J/L
2060 IF R>RND THEN T=INT(3.5+RND) ELSE T=1
2065 LET P(J)=T ' TYPE OF JTH WORD
2070 GOSUB 2200 ' PICK WORD
2075 LET P$(J)=W$+"" \ P$=P$+W$+""
2077 NEXT J
2080 LET P$=LEFT$(P$,LEN(P$)-1)
2088 RETURN
2199
2200 REM* WORD SELCTION ROUTINE:
2201 LET W=T-1
2202 IF A=0 THEN 2300
2205 IF A<1 OR A>26 THEN W$="" \ RETURN
2210 LET G0=G(W,A) ' START OF THAT LETTER
2220 LET G=G(W,A+1)-G0
2255 IF G<=0 THEN W$="!" \ RETURN
2260 LET I=INT(G*RND)
2265 LET W$=W$(FNW(W,G0+I))+""
2275 RETURN
2300 REM* NO CHOSEN INITIAL:
2305 LET I=INT(RND*W(W)+1)
2310 LET W$=W$(FNW(W,I))+""
2325 RETURN
2999
3000 REM* OUTPUT ROUTINE:
3003 LET T1=0 \ A=0
3005 PRINT \ PRINT "what is ";I$;"?"
3010 PRINT "-"; FOR Z=1 TO L+9
3015 PRINT \ PRINT
3020 PRINT TAB(4);I$;" is a dramatic new development. It stands for"
3022 PRINT P$
3025 IF P(L)=3 THEN 3040
3030 PRINT "a completely new kind of ";P$(L);"."
3035 GOTO 3045
3040 PRINT "a totally new concept in ";P$(L);"."
3045 PRINT I$;" is not only";
```

# PROGRAMS

```

3048 GOSUB 3500 ' ADJ PHRASE
3050 PRINT \ PRINT "but also";
3052 GOSUB 3500 \ PRINT "."
3055 PRINT TAB(4);"It has the following attractive features:"
3060 PRINT \ LET N=INT(RND*4.4+2)
3065 FOR Z=1 TO N
3070 PRINT TAB(8);"** ";
3075 GOSUB 3600 ' NOUN PHRASE
3077 PRINT \ NEXT Z
3080 PRINT
3085 PRINT I$;" is";
3088 GOSUB 3500 \ PRINT
3090 PRINT "because of its";
3095 LET T1=4 \ GOSUB 3600
3099 PRINT "."
3100 PRINT "It also has";
3110 LET T1=3 \ GOSUB 3600
3115 PRINT
3120 PRINT "which makes it";
3125 GOSUB 3500 \ PRINT "."
3130 LET T1=INT(RND+3.33)
3132 PRINT "It is in a class of its own when it comes"
3133 PRINT "to";
3135 IF T1=4 THEN PRINT " the";
3136 GOSUB 3600 \ PRINT ","
3140 PRINT "and above all it is";
3145 GOSUB 3500 \ PRINT "."
3150 PRINT TAB(4);"Can you afford to do without ";I$
3155 PRINT "(",P$;")?"
3160 PRINT
3225 RETURN
3499
3500 REM* ADJECTIVAL PHRASE ROUTINE:
3505 IF RND>0.44 THEN 3520
3510 LET T=2 ' ADVB
3512 GOSUB 2200
3515 PRINT " ";W$;
3520 LET T=1
3522 GOSUB 2200
3525 PRINT " ";W$;
3530 IF RND<0.8 THEN RETURN
3535 PRINT " and";
3540 GOTO 3522 ' REPEAT
3599
3600 REM* NOUN PHRASE ROUTINE:
3605 IF RND>0.5 THEN GOSUB 3500
3610 LET T=INT(RND+3.33)
3615 GOSUB 2200
3620 PRINT " ";W$;
3625 IF RND>0.6 THEN 3610
3630 REM* LOOP AD LIB.
3635 IF T1=0 THEN RETURN
3640 LET T=T1 \ GOSUB 2200
3645 PRINT " ";W$;
3650 RETURN
3999
4000 REM* WORDLIST ROUTINE:
4005 PRINT
4010 FOR W=0 TO 3
4015 READ T$
4020 PRINT \ PRINT T$
4022 PRINT W(W)
4025 FOR J=1 TO W(W)
4030 LET Z=FNW(W,J) \ PRINT W$(Z),
4040 NEXT J \ PRINT
4050 NEXT W \ PRINT
4075 RETURN
8999
9000 DATA
9005 DATA ADJ,ADV,NOUN-GENERAL,NOUN-SPECIFIC
9999 END

```

Administration,N  
Administrative,A  
Always,AA  
Algebra,N  
Accumulator,NN  
Axiom,NN  
Abnormally,AA  
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## PROGRAMS

### PET AS A DIGITAL CLOCK

Submitted by Gordon Bell

The following program shows how the PET's real time clock can be monitored continually and how, when the time changes, the new time is displayed.

The program has been designed to use only hours and minutes as a new

display appearing every second would become irritating to the viewer.

The format on the screen is that used by digital LCD watches. This was deliberately chosen in order to make the program as compact as possible.

```

● 5 Q$=" "
● 10 DIM P$(4),A(70),V$(4),C(4)
● 20 P$(1)="*****":P$(2)="*":P$(3)="*":P$(4)="* *"
● 30 FOR X=1 TO 70:READ A(X)
● 35 NEXT X
● 40 DATA 1,2,1,1,4,1,2,1,1,1,4,2,3,3,4,2,2,3,4,4,4,2,3,3,4,2,2,3,4,4
● 50 DATA 4,2,1,1,1,1,1,3,1,1,4,2,2,3,3,3,4,3,4,3,4,2,2,3,3,3,4,3,4,3
● 60 DATA 1,2,1,1,3,1,1,3,1,3
● 70 B$ = LEFT$(T$,4)
● 80 IF A$ = B$ THEN 70
● 90 A$ = B$
● 100 C$ = LEFT$(A$,1)
● 110 D$ = MID$(A$,2,1)
● 120 E$ = MID$(A$,3,1)
● 130 F$ = RIGHT$(A$,1)
● 140 X$ = " "
● 150 C(1) = VAL(C$)+1:C(2)=VAL(D$)+1:C(3) = VAL(E$)+1:C(4)=VAL(F$)+1
● 160 PRINT " "
● 170 FOR X=1 TO 7
● 180 FOR Y=1 TO 4
● 190 V=A(10*X-10+C(Y))
● 195 V$(Y)=P$(V)
● 198 NEXT Y
● 200 IF X < 7 THEN 220
● 210 X$ = " "
● 220 PRINT " "
● 221 NEXT X
● 230 GOTO 70
● 240 END
    
```

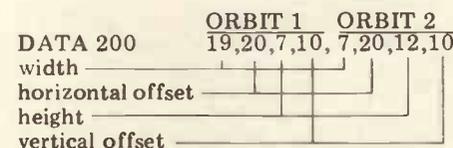
### AN ORBITAL SIMULATION

Submitted by Mike Naylor

Those people who have watched television programs such as "Horizon" will probably have seen those exotic computer screens. Well, here is the basis for a slightly less exotic graphical simulation of two contra-rotating orbital paths that will run with no trouble at all on a very unexotic Commodore PET.

The program listed could no doubt be expanded upon to the n'th degree to simulate whatever an astronomically minded computer fiend may wish to simulate. However, even this short program is extremely versatile. The eight numbers in the data statement at line 200 can be altered to

change the orbits of both planets:-



i.e. 19 = 19 columns wide, 20 = centre is 20 columns in, 7 = 7 rows high, etc. Care must therefore be taken in choosing the numbers, or the orbits will go outside the screen and fold back into the other side.

```

● 100 PRINT"J":POKE33267,81
● 110 FORJ=1TO8:READA(J):NEXT
● 120 FORJ=8TO2*3.14159265STEP3.14159265/10
● 130 X=INT(COS(J)*A(1)+.5)+A(2)
● 140 Y=INT(SIN(J)*A(3)+.5)+A(4)
● 150 POKEK,43:K=32847+Y*40+X:POKEK,81
● 160 X=INT(SIN(J)*A(5)+.5)+A(6)
● 170 Y=INT(COS(J)*A(7)+.5)+A(8)
● 180 POKEK,46:K=32847+Y*40+X:POKEK,81
● 190 NEXT:GOTO120
● 200 DATA 19,20,7,10,7,20,12,10
● 210 END
    
```

Orbital Simulation listing courtesy Byte Shop

## BELLS & WHISTLES

### A LIMITED-TIME-RESPONSE SUB

Submitted by D. R. Pains

A limited-time-response subroutine could be the most interesting and widely-used sub that you are ever likely to put into your computer. It has a multitude of uses. It will freshen up old games, enliven teaching or instructive routines, and open up a whole new field

of environment control by computer. Yet the sub-routine is small and simple, easily fitting in the spare RAM of Mikbug © (6,800 code).

What is a limited-time-response sub? Well, I hope that this is self-explanatory — the user has a limited time in which to respond to a prompt from the

# PROGRAMS

computer. Imagine playing your favourite computer game with limited — and lessening — time allowed before the computer sneaks another move! Imagine playing Startrek where the time allowed for decision depends upon game conditions. Imagine playing Lunar Lander when you have only seconds in which to respond. Immediately such games assume a new dimension and a new challenge. No longer are you able to coolly assess conditions, with perhaps hours available to you, the computer waiting patiently while you make up your mind. After all, isn't there something intrinsically inappropriate about a game in which you are supposed to be hurtling at 2,000 mph towards the face of the moon, but in which you can take as long as you like about deciding what to do?

This subroutine has great scope outside game situations, too. Instructive or testing programs of any type will benefit by its inclusion — and not merely from the point of view of hurrying the user. For example, a program

designed to give practice in typing (such as the one published in PCW, Vol 1 and 2) could be arranged to give the tyro some considerable time in which to find the right key; but as skill increases, the allotted time could be decreased. This could be accomplished automatically — say after so many hundred key depressings; — or, to speed up the process, the time actually taken could be used to ratchet — down the time allowed for the next.

On test-type programs which form the basis of some sort of standard, it obviously makes sense to give all users the same limited amount of time, thus differentiating between the prompt and the slow.

There are also situations in which a computer may be left unattended — say at an exhibition — and by means of the limited-time-response sub the computer could be arranged to switch itself into a 'ready' or 'standby' state if no-one depresses any keys for a while. As in so much of computing, uses are limited only by the imagination.

LIMITED-TIME-RESPONSE SUB		①	
A04A	5F	CLR B	ZERO COUNT HR
A04B	CE 0000	LD X	" " LR
A04E	08	INX	ADVANCE LR
A04F	DF 01	ST X	SAVE
A051	CE 8004	LDX	# P.I.A.D.
A054	A6 00	LD A,X	LOOK FOR START BIT
A056	2B 04	BMI	INEE
A058	BD E1AC	BSR	EXIT (1)
A05B	39	RTS	RESUME COUNT
A05C	DE 01	LDX	
A05E	8C FFFF	CMP X	
A061	26 EB	BNE	
A063	5C	INC B	TIMER
A064	C1 xx ←	CMP B	
A066	23 E3	BLS	# MESSAGE
A068	CE A06F	LDX	PDATA 1
A06B	BD E07E	BSR	EXIT (2)
A06E	39	RTS	
A06F-79	0D,0A,54,49,4D,45,20,55,50,20,04		
	(TIME UP)		

The subroutine is given in Table 1. It stands alone except that, for the sake of economy, I have used location 0001 as a temporary store. This might well be changed to A014. The routine is very simple, comprising an Index Register counting loop inside another counting loop using the B Register. At every pass of the Index Register, memory address 8004 is checked. For 6800 users, this address is the control device port — TTY or keypad — and goes high at the commencement of an incoming bit. The instruction at A056 is therefore the switchpoint, diverting the program to Exit 1 the instant the keyboard is touched, otherwise allowing the counting loop to continue.

At the conclusion of the time set by memory address A065, the program returns to main program through Exit 2, after printing a Time Up message.

It will be seen that Register A serves the dual role of condition flag and carrier of the incoming bit, if any. If, on return to the main program, Register A holds the value 04, then return was through Exit 2. Any other value indicates return through Exit 1, and the A register will hold the hex equivalent of the bit input.

The allowed delay is set by memory A065 as stated, and can be fixed on a once-for-all basis when initially programmed or may be altered under software control. Some actual times obtained on my own SWTPC 6800 computer are given in Table 2. Readers are advised to check their own times with a stopwatch. Note that FF in this memory will cause the timing loop to go on for ever.

Together, the B register and memory locations 0001/2 contain a record of the actual time elapsed before a key was hit — information that can be used in a variety of applications. One that springs to mind is in a driving simulation, with response time measurable in micro-seconds. The time taken is found by adding the value derived from Table 3 to that of Table 2. Where super-accuracy is required, it would probably be best to time the loops with a high value in A065 and then by consecutive divisions by 16, find the values of the various bits.

VALUE IN	DELAY TIME	②
A065 (OR B)*	∞ DO NOT USE	
FF	605 secs	
FE	602 secs	
FD	602 secs	
F0	569 secs	
80	303 secs	
40	151 secs	
20	76 secs	
10	38 secs	
08	19 secs	
04	10 secs	
01	2.5 secs	

\*when timing response — see text.

VALUE IN	TIME	③
0001/2		
FFFF	2.5 sec	
0FFF	.15625	
0800	.0781249	
0200	.0195312	
0100	9.7656x10 <sup>-3</sup>	
0010	6.1035x10 <sup>-4</sup>	
0001	3.81468x10 <sup>-5</sup>	

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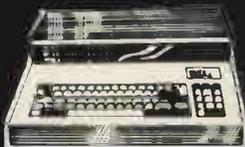
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# USER GROUPS INDEX

Recently PCW circularised clubs and user groups — in fact, all the addresses we were able to find. Surprisingly, many proved long defunct, and indeed, a few claimed never to have existed in the first place! The list published here is correct as of going to press. . . though obviously incomplete. If YOUR group hasn't been included then you can help us make amends by posting all relevant information to: User Group Index, PCW, 14 Rathbone Place, London W1P 1DE. Updates on alterations 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.

## Bedfordshire

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

## Berkshire

77/68 User Group. Quarterly Newsletter 45p, back issues available. 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

## Buckinghamshire

TRS-80 Users Group. Contact: Brian Pain, 40a High St., Stony Stratford, Bucks.

PDP-8 Users Group. Monthly Newsletter. Contact: Nigel Dunn, 21 Campion Rd., Widmer End, High Wycombe, Bucks.

## Cheshire

Anyone interested in starting a Chester club please contact: Mr. W. Collins, 37 Garden Lane, Chester, Cheshire.

## Devon

Exeter and District Amateur Computer Club. 3 Groups — Hardware, Software and Small Business. 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.

## Gloucestershire

Cheltenham Amateur Computer Club. Meetings 4th Wednesday monthly. Micro-processor workshop starting October 2nd — a series of 10 Tuesday evenings. Contact: Mr. M. Pullin, 45 Merestones Drive, The Park, Cheltenham, GL50 2SU.

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.). Special Interest Groups — Business, Machine Intelligence/Robotics, Games and 360 (Yes — 360!!!). Magazine — 'Benchmark'. 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. Anyone needing help or information on '11s with the minimum of fuss — this is the group for you. 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.

## Lancashire

Merseyside Microcomputer Group. Several sub-groups — Pet, Education, Nascom, 6800 etc. . . 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.

## London

MK14 Club. Open to any SC/MP people. Bi-monthly magazine called "Complement and Add" which circulates from member to member. 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: 01-886 6521.

UK Pet Users Club. Contact: Commodore Systems Division, 360 Euston Rd., 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

## 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

## Staffordshire

Central Program Exchange. Full membership (£25 Europe, £40 overseas), provides 30 free programs p.a. Small User Service (£10 Europe, £20 overseas) provides 10 free programs p.a. Contact: Mrs Judith Brown, The Polytechnic, Wilfruma St., Wolverhampton, WV1 1LY.

## Sussex

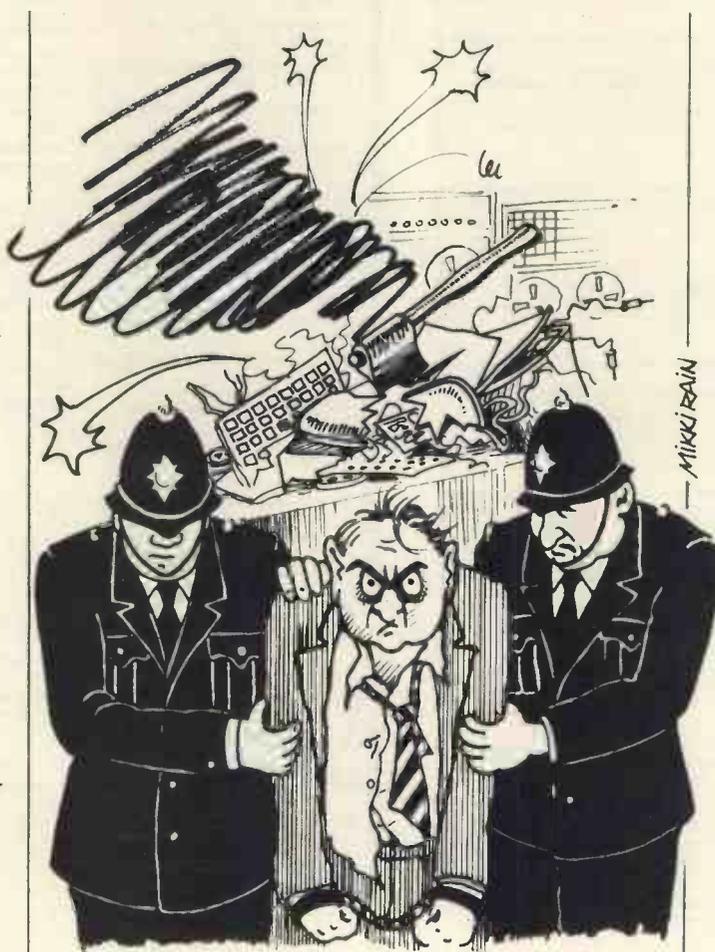
Independent Pet Users Group — South. Free membership. £1.50 to receive monthly newsletter. Contact: John C. Nuttall, 56 West St., Shoreham by Sea, Sussex, BN4 5WG.

## West Midlands

West Midlands Amateur Computer Club. Newsletter. Meetings 2nd Tuesday monthly. £2.00 p.a. or £1.00 if under 18 or a full time student. Contact: John Tracey, 100 Booth Close, Crestwood Park, Kingswinford, West Midlands DY6 8SP

## Scotland

Ithaca Audio S-100 bus UK User Group. Contact Dave Weaver, 16 Etive Place, Cumbernauld, Glasgow. G67 4JE.



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FOURIER	Fast Fourier transform	FPPACK	£ 10.00
MINV	Matrix Inversion	FPPACK	£ 10.00
MATPED	Matrix product	FPPACK	£ 7.50
RATPOL	Rational function and utilities	FPPACK	£ 7.50
SORT	Square root	FPPACK	£ 5.00
TRIGS	Sine, cosine, TAN, ATAN	FPPACK, RATPOL	£ 10.00
LOGEXP	Exponential, logarithm, y <sup>x</sup>	FPPACK, RATPOL	£ 10.00
FPIOPT	Floating point I/O	None	£ 7.50
FORMAT	Formatted floating point output	None	£ 7.50
NEFILES	North Star disk handler	None	£ 5.00
INOPS	Integer multiply/divide	None	£ 5.00

The complete set of modules (listed above) £ 59.00

EZ-80 — A tutorial on the PDS Z80 instruction set. Assembly language commands are interpreted individually and the resulting effect on register contents and flag status is displayed. £ 15.00

REGENT — Disk disassembler, generates source file compatible with EDIT and the MACRO Assembler in PDS £ 15.00

HDS — Hybrid Development System. Permits easier interfacing between assembly code routines and North Star BASIC £ 30.00

CDS — Compiler Development System. The CDS BASIC compiler enables portions of North Star BASIC programs to be compiled into assembly language to achieve increased speed and to protect proprietary sections of code. Includes COMPILER (which translates a subset of BASIC into machine code), IBASIC (an integer BASIC interpreter), and a set of interface routines which couple the assembly language program to North Star BASIC. Requires PDS and HDS. £ 65.00

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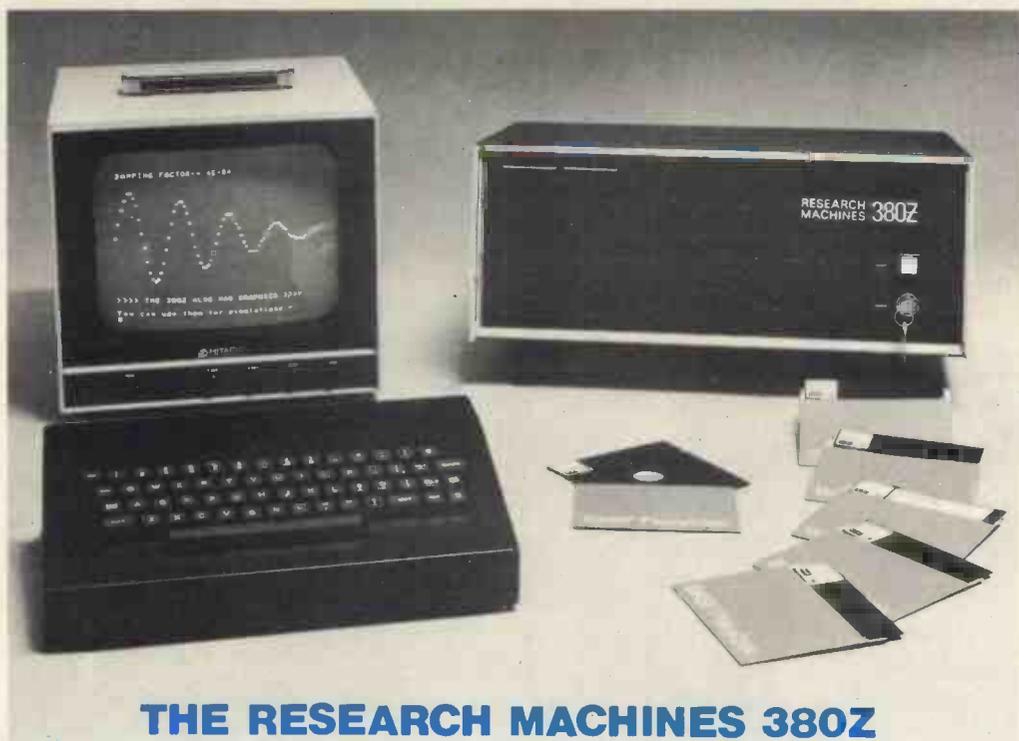
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Microcomputers are extremely good value. The outright purchase price of a 380Z installation with dual mini floppy disk drives, digital I/O and a real-time clock, is about the same as the annual maintenance cost of a typical laboratory minicomputer. 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 mini-computer, 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 Csil. 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

380Z/56K complete with DUAL FULL  
FLOPPY DISK SYSTEM FDS-2

**£3266.00**

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 occurrence 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.

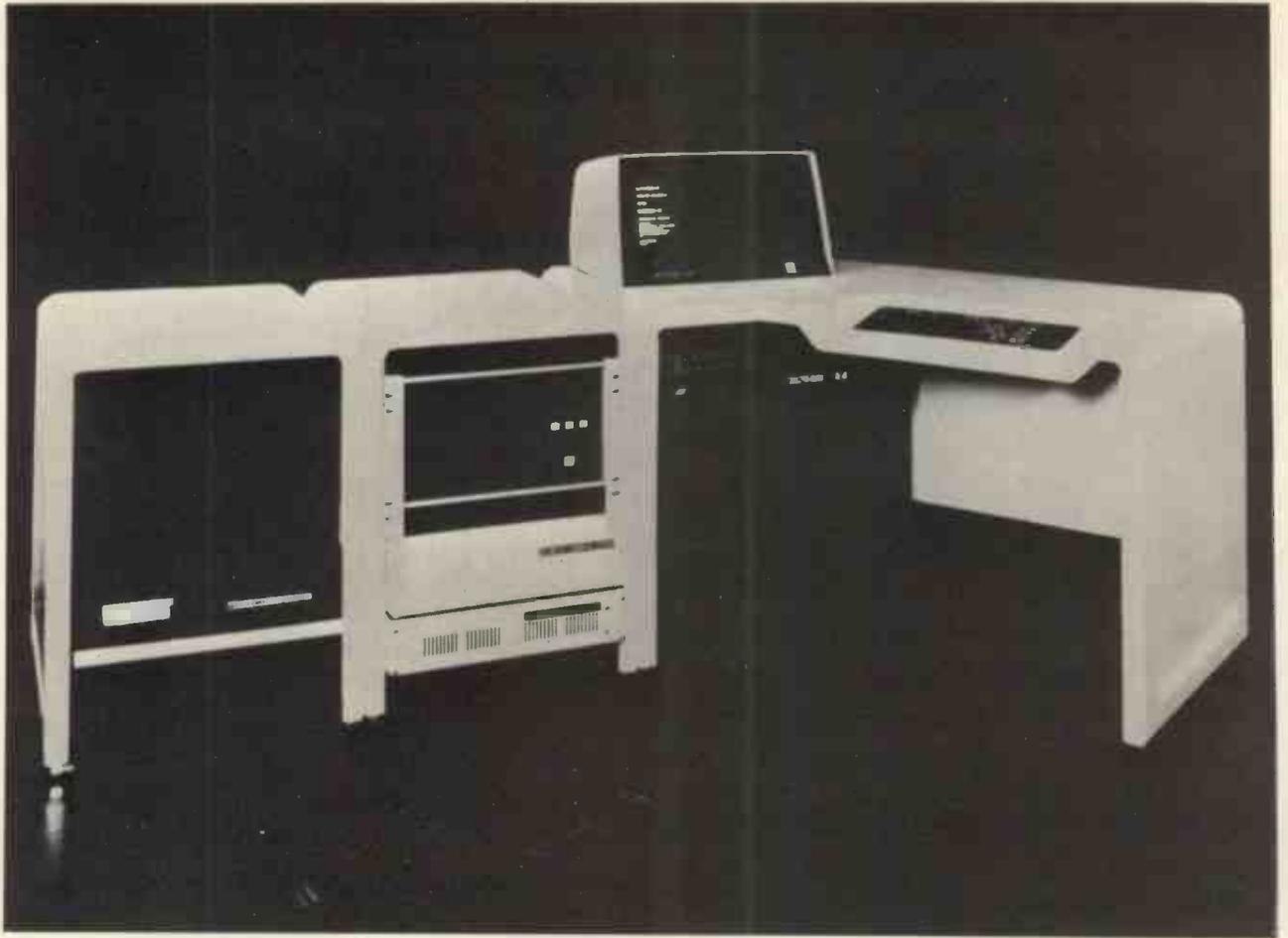
Versions of BASIC are available with the 380Z which automatically provide controlled cassette data files, allow programs to be loaded from paper tape, mark sense card readers or from a mainframe. A disk BASIC is also available with serial and random access to disk files. Most BASICs are available in 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/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%.



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7416	.25	74151	.95	74L00	.30	74LS195	1.15				
7417	.40	74153	.95	74L02	.30	74LS244	2.90				
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7426	.25	74156	.70	74L04	.40	74LS298	1.50				
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7430	.20	74161/9316	.75	74L20	.45	74LS368	1.25				
7432	.30	74163	.85	74L30	.55	74LS373	2.50				
7437	.20	74164	.75	74L47	1.95	74S00	.45				
7438	.30	74165	1.10	74L51	.65	74S02	.45				
7440	.20	74166	1.75	74L55	.85	74S03	.35				
7441	1.15	74175	.90	74L72	.65	74S04	.35				
7442	.55	74176	.95	74L73	.70	74S05	.45				
7443	.45	74177	1.10	74L74	.75	74S08	.45				
7444	.45	74180	.95	74L75	1.05	74S10	.45				
7445	.75	74181	2.25	74L85	2.00	74S11	.45				
7446	.70	74182	.75	74L93	.75	74S20	.35				
7447	.70	74190	1.25	74L123	1.95	74S22	.55				
7448	.50	74191	1.25	74LS00	.40	74S40	.30				
7450	.25	74192	.75	74LS01	.40	74S50	.30				
7451	.25	74193	.85	74LS02	.45	74S51	.35				
7453	.20	74194	.95	74LS03	.45	74S64	.15				
7454	.25	74195	.95	74LS04	.45	74S74	.70				
7460	.40	74196	.95	74LS05	.45	74S112	.60				
7470	.45	74197	.95	74LS08	.45	74S114	.85				
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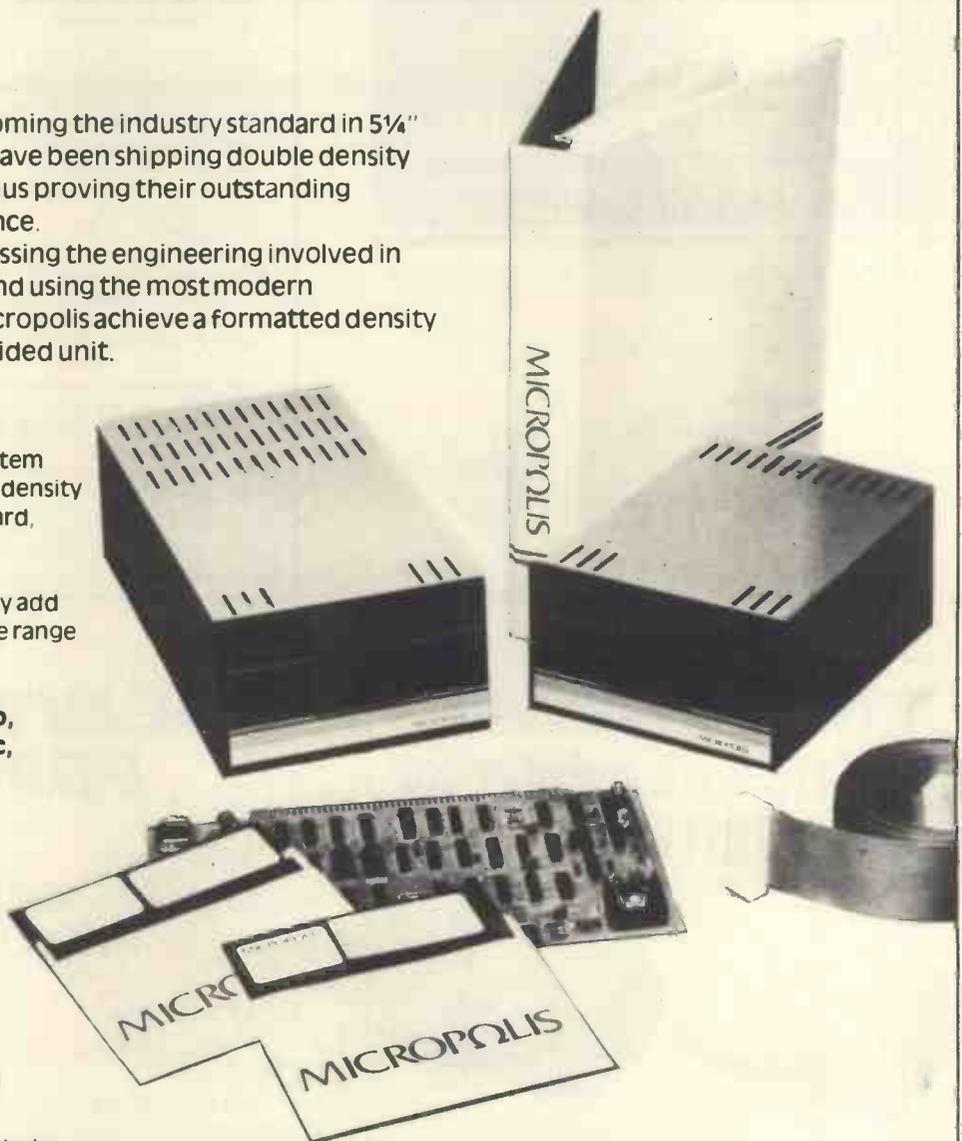
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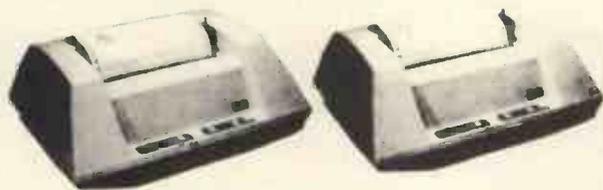
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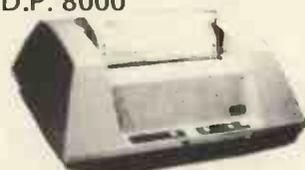
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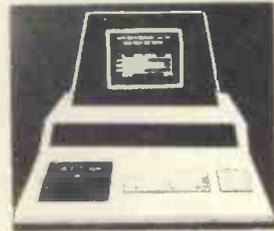
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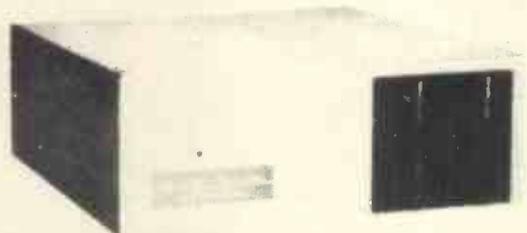
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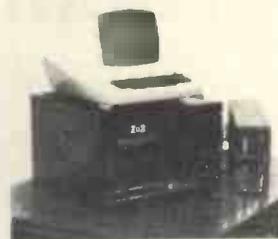
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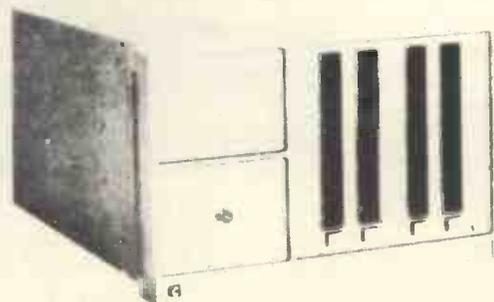
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### SUPPORTS

ABS	HDPOS	ON/GOTO	RIGHTS
AND	IF	ON/GOSUB	RND
ASC	INPUT	OR	RUN
CALL	LEFTS	PEEK	SAVE
CHRS	LEN	POKE	SGN
DATA	LET	POS	SIZE
DIM	LIST	PRINT	STEP
EXOR	LOAD	PUT	STOP
FOR	MIDS	READ	TAB
GET	NEW	REM	TO
GOSUB	NEXT	RESTORE	TRACE
GOTO	NOT	RETURN	

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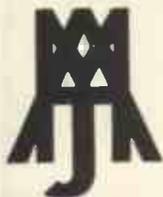
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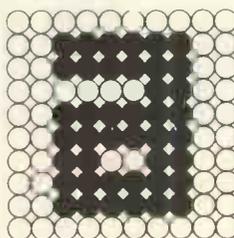


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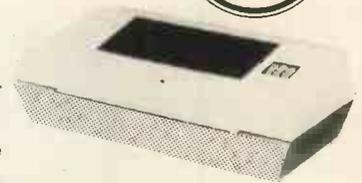
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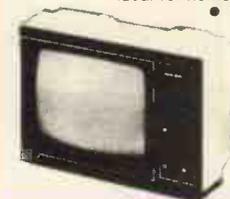
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At a price equivalent to learning one language, LEXICON offers you, English, Spanish, French, German, Italian and Greek. The LK3000 comes to you with the person to person module which contains 6 languages, de-luxe carrying case and a charger adaptor using its own power source which will give you 4-5 hours continuous use, and can easily be re-charged from the mains supply, wherever you may be in the world. Every additional module carries a concise and understandable instruction book. Your deluxe carrying case has room for two additional modules.



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Compucare is a company that has been set up to provide servicing and maintenance for the popular makes of micro-computers i.e. Sorcerer, Pet, Apple, TRS80, Nascom, Komputik. Our charges are £7 per hour plus parts. Because of the extensive range of spare parts stocked you can usually expect your micro to be repaired within 10 days for an average charge of £14 labour. Emergency 24 hour repairs can be handled for a £10 surcharge where possible. Komputiks and Nascoms unsuccessfully constructed will be charged a standard £25. Maintenance contracts for these machines are available, see your local dealer for a Compucare Maintenance Application Form.

Please add VAT to all prices — Delivery at cost, will be advised at time of purchase. Please make cheques and postal orders payable to COMP, or phone your order quoting BARCLAYCARD, ACCESS, DINERS CLUB or AMERICAN EXPRESS number. OPEN — 10am to 7pm — Monday to Saturday CREDIT FACILITIES ARRANGED



JUST COMPARE OUR CASH AND CARRY PRICES!

EUROPE'S FASTEST SELLING ONE BOARD COMPUTER —  
JUST CHECK THE SPEC'S.

SAMPLE TAPE  
WITH EXTENDED  
MACHINE CODE MONITOR  
AND DISSASSEMBLER  
INCLUDED FREE

AS SEEN IN  
P.E. AUGUST, SEPTEMBER  
OCTOBER 1979

# COMPUKIT UK101

## LOW COST SUPERBOARD IN KIT FORM

The CompuKIT UK101 has everything a one board 'superboard' should have.

- \* Uses ultra-powerful 6502 microprocessor.
- \* 50Hz Frame refresh for steady clear picture (U.S.A. products with 60Hz frame refresh always results in jittery displays)
- \* 48 chars by 16 lines — 1K memory mapped video screen providing high speed access to screen display enabling animated games and graphs.
- \* Extensive 256 character set which includes full upper and lower case alphanumerics, Greek symbols for mathematical constants and numerous graphic characters enabling you to form almost any shape you desire anywhere on the screen.
- \* Video output and UHF Highgrade modulator (8Mz Bandwidth) which connects direct to the aerial socket of your T.V. Channel 36 UHF.
- \* Fully stabilised 5V power supply including transformer on board.
- \* Standard KANSAS city tape interface providing high reliability program storage — use on any standard domestic tape or cassette recorder.
- \* 4K user RAM expandable to 8K on board £49 extra.
- \* 40 line expansion interface socket on board for attachment of extender card containing 24K RAM and disk controller. (Ohio Scientific compatible).
- \* 6502 machine code accessible through powerful 2K machine code monitor on board.
- \* High quality thru plated P.C.B. with all I.C.'s mounted on sockets.
- \* Professional 52 Key keyboard in 3 colours — software polled meaning that all debouncing and key decoding done in software.



\*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.  
? Equivalent to PRINT

Simple Soldering due to clear and concise instructions compiled by Dr. A.A. Berk, BSc.PhD

NO EXTRAS NEEDED JUST HIT 'RETURN' AND GO.

Build, understand, and program your own computer for only a small outlay.

KIT ONLY **£219** + VAT including RF Modulator & Power supply. Absolutely no extras.

Available ready assembled and tested, ready to go for **£269** + VAT

**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<sup>-32</sup> 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 AS-

**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\$(I) FRE(X\$) LEFT\$(X\$,I)  
RIGHT\$(X\$,I) STR\$(X)

LEN(X\$) MID\$(X\$,I..J)  
VAL(X\$)

### EXTRAS AVAILABLE SOON

**COLOUR ADD-ON** enables you to choose your foreground and background colour anywhere on the screen. Flash any character on the screen at will. Full documentation and parts in kit form.

**AD-A-RAM EXTENDER CARD** provides up to 32K Dynamic RAM Expansion, 8 Eprom sockets for 2708's or 2716's. Parallel Port (centronics compatible) and an RS232C serial port.

### WIN YOURSELF AN ANADEX DP8000 LINE PRINTER

There's never enough good software around. That's why COMPUKIT LTD. are sponsoring a software contest. There are 2 categories:

- 1) Business and Education
- 2) Fun and Games

One lineprinter will be awarded to the winner of each category. Send or bring along to the address shown below the following:

- 1) The program on cassette in the format used by the COMPUKIT UK101
- 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.

Name \_\_\_\_\_

Address \_\_\_\_\_

I agree to abide by the above mentioned rules.

Signature \_\_\_\_\_

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