

MICRO COMPUTER

PRINTOUT

A PLAIN MAN'S GUIDE TO
PERSONAL COMPUTING

*Top of
the Pops*

PET

SINCLAIR

APPLE

TANDY

VIC-20

ACORN ATOM

VIDEO GENIE

TEXAS TI99/4

SHARP MZ80

RM 380Z

Your 10 most
asked questions

Secrets of the VIC

Do Businesses Need 16-bit?

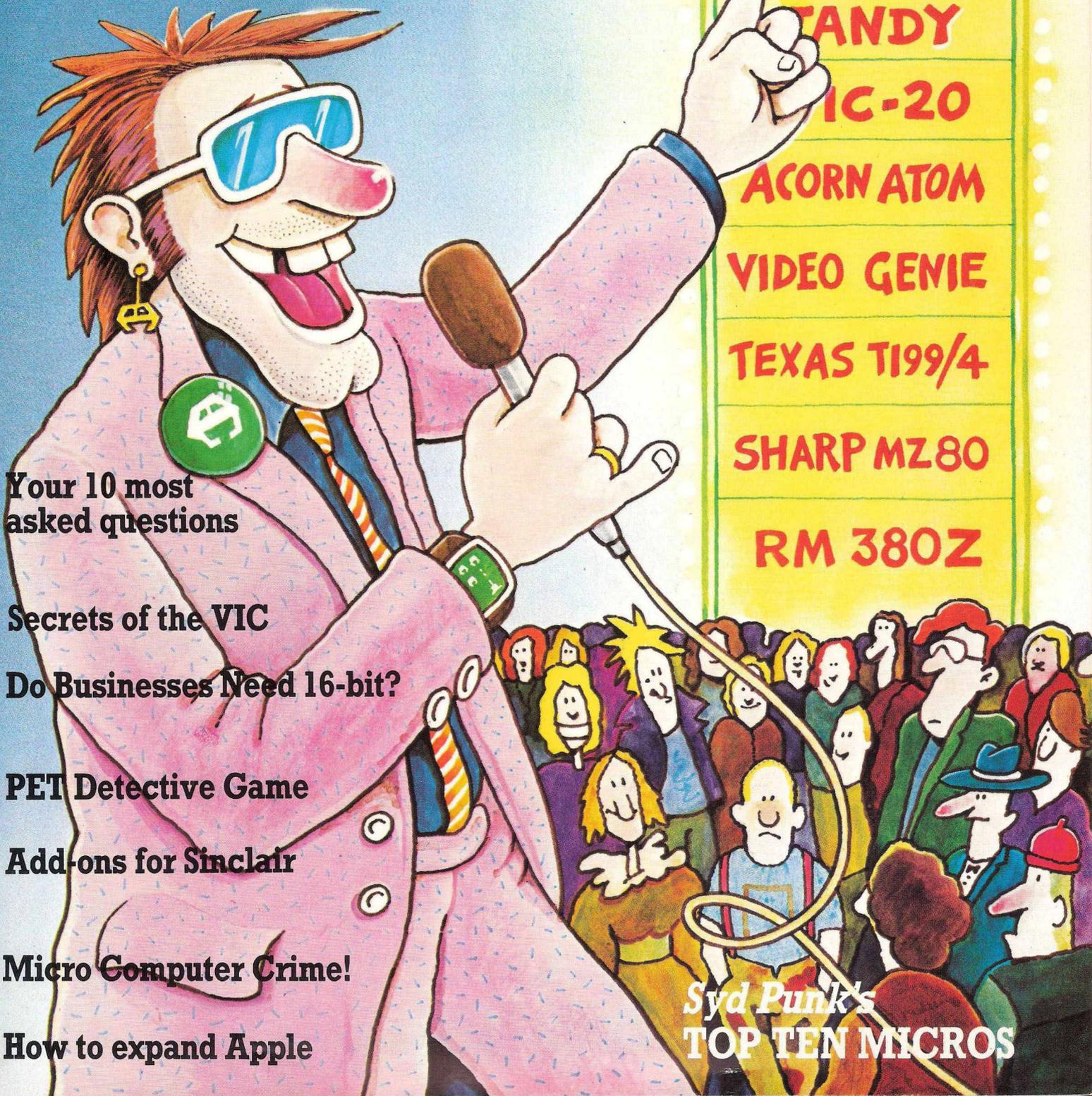
PET Detective Game

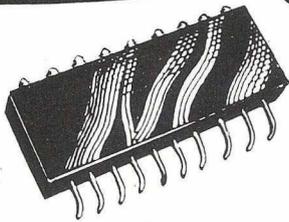
Add-ons for Sinclair

Micro Computer Crime!

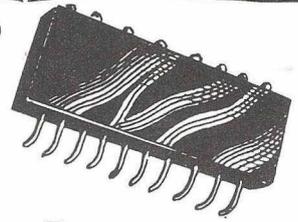
How to expand Apple

Syd Punk's
TOP TEN MICROS





audiogenic LTD CHIP SHOP



EDEX 2.0 & 4.1

adds commands to BASIC for use within your Program

**IF THEN ELSE ● PLOT ● BEEP ● PRINT USING ● SWAP
MERGE ● HARD COPY ● PLUS A RANGE OF TOOLKIT
TYPE FUNCTIONS AND A FAST EDITING SYSTEM**

EDEX is an extension to BASIC which considerably enhances the potentialities of the Commodore PET/CBM. It consists in a 4K-BYTE ROM which installs inside the PET/CBM.

EDEX is compatible with Commodore disk devices as well as with the DOS Support Program.

EDEX operation is fully transparent towards the Microsoft Basic Interpreter

EDEX is fully compatible with prior programs written without EDEX.

AUTO

Activates automatic line numbering.

APPEND *

Allows the creation of a program with a subroutine library

BEEP

Gives a sound of programable pitch and duration

CALL

Calls a machine language subroutine with transmission of up to 16 arguments

DELETE

Allows multiple line suppression

DUMP

Lists all variables in a program, together with their values

EDITING *

e.g. a M prints MIDS

ERROR

Shows where an error has occurred

FIND

Lists all lines where a given character string is present

EDEX 2.0 for use with BASIC 2.40 Column Pets **£39.50**

HARD COPY □

Dumps screen to printer

IF THEN ELSE

With up to 16 nested conditions

MERGE □

Merge two programs files

PLOT

Plots curves of 50 x 80 or 160 resolution

PRINT USING

Formats printing on screen or any printer

RENU

Program renumbering

RESET

Suppresses a dot (contrary of PLOT)

SWAP □

Swap one program for another keeping variables

TRACE □

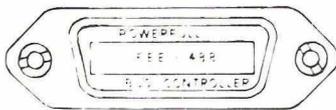
Single line execution (displayed at top of PET)

* EDEX 2.0 only □ EDEX 4.1 only

EDEX 4.1 for use with 80 Column Pets **£49.50**

EDEX 3.0 for BASIC 4.0 40 column PETS **£49.50**

IEEE-488 PACK



The end of instrumentation's problems. It resolves all kind of troubles:

- Time-out
- Special characters ("null", and so on...)

IEEE-PACK allows the use of IEEE-488 Universal Commands:

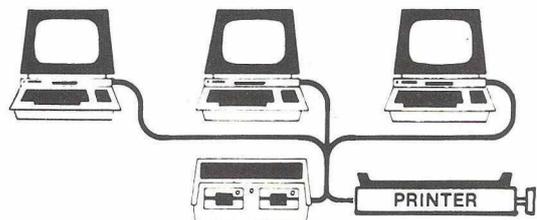
- | | |
|---------------------------------|------------------------------------|
| - DCL (Device clear) | - SDC (Selective device clear) |
| - SPE (Serial poll enable) | - SPD (Serial poll disable) |
| - LLO (Local lockout) | - GTL (Goto local) |
| - PPL (Parallel poll configure) | - PPU (Parallel poll unconfigured) |

IEEE-PACK also allows BASIC interrupt with functions:

- ONKEY "X", line number
- ONSRQ line number (On Service Request)

IEEE-PACK comes complete with two ROMs. **£89.50**

MULTEX



MULTEX allows several CBM 8032 to work together on the same peripherals.

MULTEX is a ROM which replaces a ROM of the CBM 8032.

Except the substitution of this ROM no other modification is required on the CBM 8032.

MULTEX is much cheaper than any other system.

MULTEX £69.50



DINERS

ALL PRICES INCLUDE V.A.T. & P.P.

AVAILABLE FROM ALL GOOD DEALERS OR DIRECT FROM



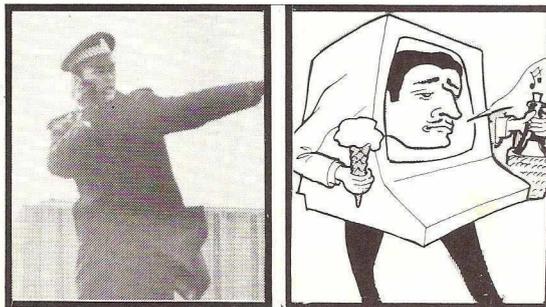
AUDIOGENIC, P.O. Box 88, 34-36 Crown Street, Reading, Berks. Tel: Reading (0734) 595269

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Syd Punk offers some pungent comments on the most popular machines.



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State-of-the-Art Report on the latest generation of micro-computers.

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How it is done. How to prevent it happening to you.



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EDITORIAL

Publisher Julian Allason
Editor Richard Pawson
Art Editor Denis Appleby
Technical Editor Chris Preston
Contributing Editors Dennis Jarrett
Mike Gross-Niklaus Lindsay Doyle
Nigel West Tim Hartnell
Production Manager Wendy Cheetham
Complaints Flanagan O'Mbutu
Editorial Address: P.O. Box 48,
Newbury, England RG16 0BD
Telephone Hermitage (0635) 201131
Telex 444423 Attention Printout

SUBSCRIPTIONS

Annual Rates (12 issues)
UK £11.40 Europe £17.40
USA airspeeded \$29 Eire £15.60
Rest of World surface £16.50
Rest of World airmail £30
Subscription Address:
Stuart House, Perrymount Road,
Haywards Heath, West Sussex,
Permit to mail second class postage at
New York, NY. USPS#598-610
US Mailing Agent: Expeditors of the
Printed Word Ltd, 527 Madison Avenue
Suite 1217, New York, NY10222, USA.

ADVERTISING

Advertising Manager Jonathan Horne
Advertising Address Printout Advertising Office, North Warnborough,
Basingstoke RG25 1PB.
Telephone Odiham (025671) 2724
Telex 444423 Attention Printout

Printed in England

ISSN 0 261-4499

THREE PET TITLES

from

Nick Hampshire

LIBRARY OF PET SUBROUTINES

A book which will save the software designer considerable time by providing 55 proven subroutines to integrate with his own programmes.

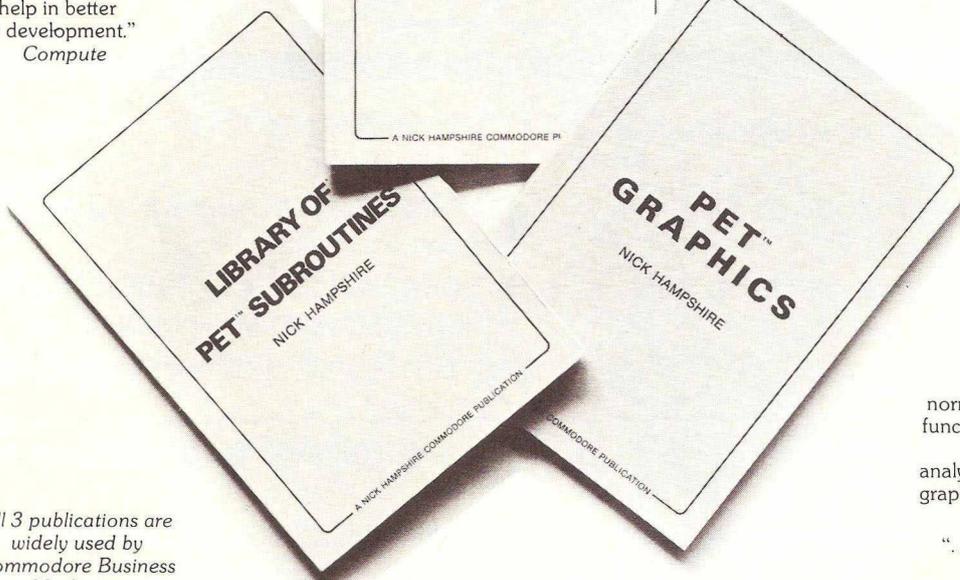
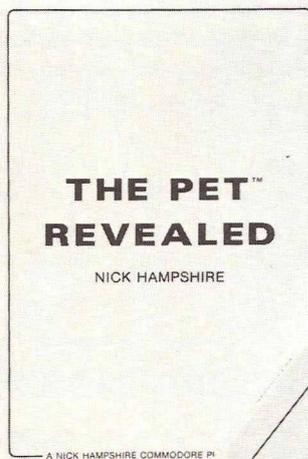
Each subroutine is preceded by a page of general information describing its purpose and implementation and possible problems that may arise. Basic, machine language and a combination of both, are used throughout this publication.

"... We like this book very much and thoroughly recommend it."

Printout

"... well prepared, fun to use, and will help in better program development."

Compute



All 3 publications are widely used by Commodore Business Machines.

THE PET REVEALED

A reference book which details everything you need to know about the workings of the PET. Containing information helpful to writing more elaborate programmes, which in turn create more interesting functions.

"... Should be congratulated.

Supplies some much needed, useful and correct documentation."

Compute

"... 'PET Revealed' will save you an awful lot of time. I rate this book as good value for money."

Printout

PET GRAPHICS

This book has two objectives. One, to provide the reader with an introduction to the programming techniques used to generate graphic displays.

Two, providing the programmer with a complete package of machine code routines giving a wide range of normally unavailable graphic functions. The book contains many comprehensively analysed routines and photographs to illustrate the effects created.

"... an invaluable guide to graphics on the PET."

Micro Forecast

Please send me:

..... copy/ies of Library of PET Subroutines
@ 10.00 each

..... copy/ies of The PET Revealed
@ £10.00 each

..... copy/ies of PET Graphics @ £12.00 each

I enclose a cheque for £ payable to
Computabits Ltd., P.O. Box 13, Yeovil, Somerset.

Name

Address

..... Postcode

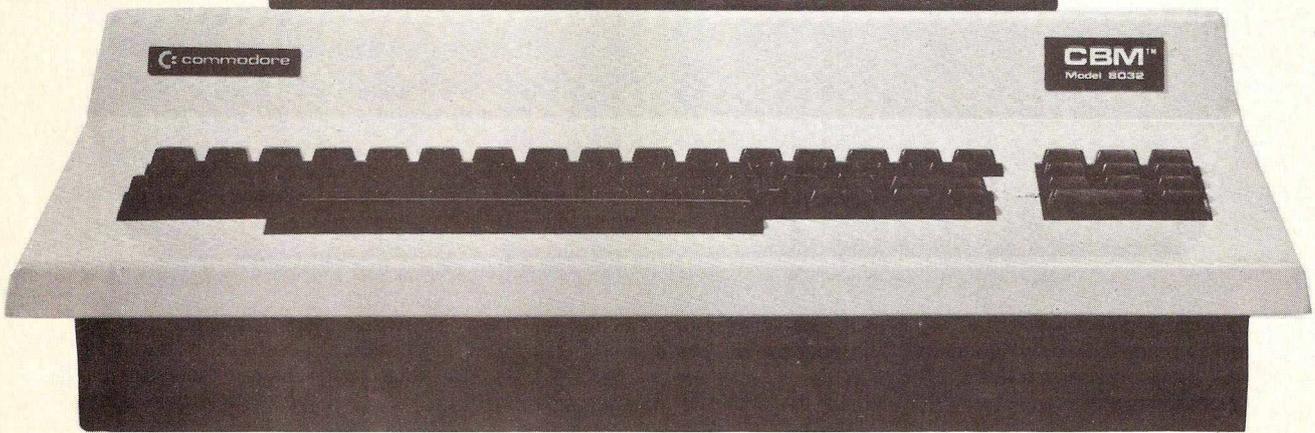


POWER

Professional Software Introduces

POWER

by Brad Templeton



ADD POWER TO YOUR COMMODORE COMPUTER

£49

POWER produces a dramatic improvement in the ease of editing BASIC on Commodore's computers. POWER is a programmer's utility package (in a 4K ROM) that contains a series of new commands and utilities which are added to the Screen Editor and the BASIC Interpreter. Designed for the CBM BASIC user, POWER contains special editing, programming, and software debugging tools not found in any other microcomputer BASIC. POWER is easy to use and is sold complete with a full operator's manual written by Jim Butterfield.

POWER's special keyboard 'instant action' features and additional commands make up for, and go beyond the limitations of CBM BASIC. The added features include auto line numbering, tracing, single stepping through programs, line renumbering, and definition of keys as BASIC keywords. POWER even includes

new "stick-on" keycap labels. The cursor movement keys are enhanced by the addition of auto-repeat and text searching functions are added to help ease program modification. Cursor UP and cursor DOWN produce **previous** and next lines of source code. COMPLETE BASIC program listings in memory can be displayed on the screen and scrolled in either direction. POWER is a must for every serious CBM user.

Call us today, for the name of the Professional Software dealer nearest you.

Professional Software, Ltd.

153 High Street

Potters Bar

Hertfordshire EN6 5BB

Tel: (STD 0707) 42184 / (STD London 77)

A Beginners Guide

"Don't plug Commodore" said the man from Commodore. "Write us an essay that people will find useful instead." It was an offer I couldn't refuse.

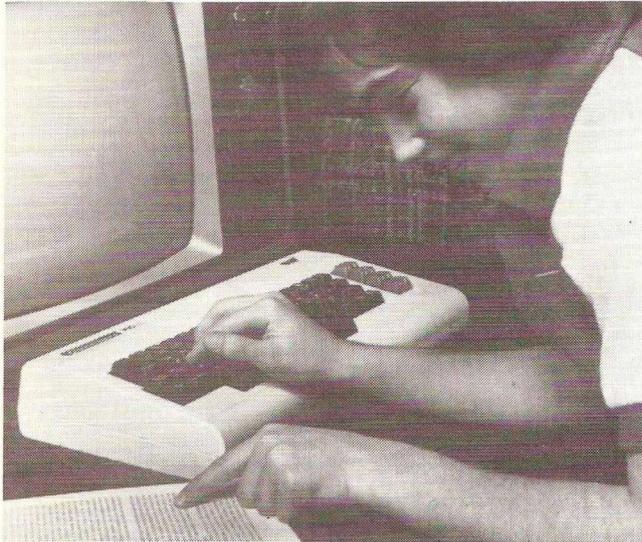
First things first then. Money. What do the darn things cost?

At Home

Anywhere between £70 and £7000. Maybe more. What you need spend is, of course, another matter. To a large extent you get what you pay for. But for a real computer that you can use at home the VIC-20 at £189 including VAT has to be a strong candidate. Why?

Colour graphics (assuming you have a colour TV) and a proper typewriter keyboard for a start. And sound. And plug-in program cartridges.

Budget another £45 for a cassette recorder to store your own programs; typing them in from



scratch everytime is a real pain. It is likely you will want to add some additional memory to the 5K of Random Access Memory (equivalent to about 5000 characters of text) the VIC-20 arrives with. That's because only 3K is actually available for programming. Plugging in an extra 8K RAM cartridge will make a £45 hole in your pocket – but it will allow you to play Space Invaders!

Other popular and currently available home micros to consider are the ZX80 at £73, and the Atari 400 at £345.

In the classroom

Schools have tended to opt for machines like the PET, the most popular choice, at £550 +

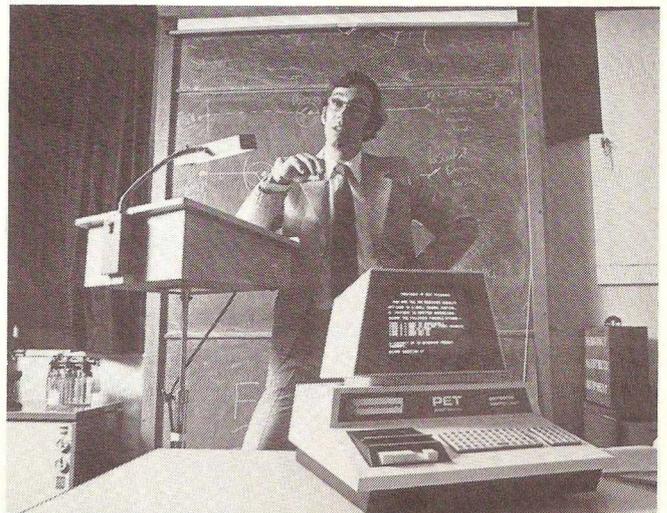
VAT for 16K version, or the more expensive Research Machines RS380Z. For this you get a built-in black and white screen, for giving upper and lower case letters plus graphics. As with all Commodore machines, the BASIC language – very easy to learn – is built in.

The other major plus is the software. Lots of it available from independent suppliers. Commodore even give it away free if you are a school. Or you can swap with other teachers.

In business

Advising businessmen on the right micro is tricky; so much depends on the quality of the programs. In fact some experts recommend looking for the program first. Fortunately for Commodore I can put hand on heart and say that no system offers a wider range of off-the-shelf business programs than the PET.

There are a few businessmen that get by with 16K of RAM memory and a cassette drive – but not many. A more sensible configuration would be 32K of memory and a floppy disk unit. Quite a few companies offer this specification including Apple and some of the new Japanese machines.



to Micro Computers

by C.R. Oppenheim

To give you an example of pricing, the 32K PET with 337K bytes (characters) floppy disks costs £1390 + VAT. The Apple price would be similar but with much lower capacity disks. Add £395 ex VAT for a dot matrix printer and you have a pretty effective business system for around £1800.

A good sales/purchase ledger package will cost around the £300 mark on the most popular microcomputers, perhaps twice this price on the others. Economies of scale you see.

Word Processing

Word Processing is probably the single most popular business application; it is so useful for sending personalised letters and maintaining lists.

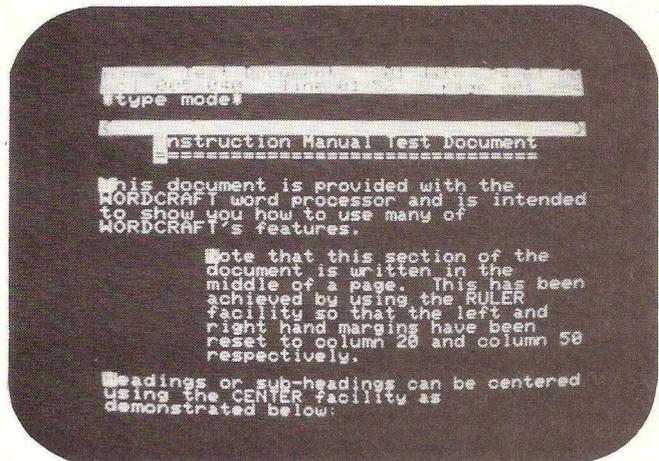
After looking at more expensive systems I chose a SuperPET; its larger screen giving me lines of up to eighty characters long. Keyboard layout is QWERTY like a typewriter, so my secretary's happy too.

After the American *WordStar*, which runs on CP/M based machines, *Wordcraft* is probably the best known word processing program, and at £375 + VAT it has the merit of being cheaper. After careful consideration that is what I chose.

Whilst dot matrix printers, which as the name suggests create the letters out of dots, are fine for accounts, a typewriter quality printer is better for word processing. Commodore's new daisywheel at £850 + VAT looks like a bit of a bargain; if you are feeling rich you could pay £2000 for another make which would get through your letters even quicker.

Adding up the cost of a Word Processing system based on the 32K SuperPET with the powerful 1 megabyte disks (they store 1 million characters approximately, the length of a Dickens novel!), the price comes in around £3000 + VAT. That's including the software!

That's about all I have space for, for now. But if you have any queries, drop me a line c/o Commodore. Or alternatively fill in the coupon for further details and the name of your nearest dealer.



Send to: Commodore Information Services,
P.O. Box 109, Baker Street, High Wycombe.
Tel: Slough 79292

Send me more information about Home/Business/School
Computing.

NAME:

ADDRESS:

.....

POSTCODE:

TEL:

THIS MONTH'S LATEST INTERFACE

*** I.F. 1 PET PRINTER PACKAGE** Replacement Cover, paper tear off and 'PAPER CUT' device. All used for PET printer.
Special package price of only £18.00.

*** I.F. 2 E-SOCKET. 1792 BYTES ADDITIONAL ROM SPACE DECODER BOARD.** Allowing user to add in own software using 4K ROM £12.95. 4K ROM available containing EXTRAMON £8.95

I.F. 3 Reset/Restore Button
Recover from 'crashes' easily without losing your MACHINE CODE or BASIC program. Simple to instal. For 3000, 4000, 8000 series only.
£8.80

*** I.F. 4 Light Pen**
Improve your programs, use light pen input and selection. Simply plugs onto the user port. Demonstration program supplied with the unit.
£16.50

I.F. 5 Soundbox
On/off switch, volume control and tape cue/listen device switch. PP3/PP6 battery required. Connects to user port.
£16.50

I.F. 6 T.V./Video Interface
Connect PET to a T.V. or to a Video monitor. This unit has its own fully fused power supply included -no need to use your valuable cassette connector. Three picture adjustment controls included.
£33.50

I.F. 7 Replacement for error light on disk unit, thus enabling you to tell when the disk is on. LED glows green, changing to red when you get an error; also gives audible warning.
£12.00

I.F. 8 Joystick
360° rotation using analogue to digital conversion, extremely fine control of cursor movement. Fire button included.
£16.00

*** I.F. 9** Disk safety device: if there is a break in mains supply, the disk will not come on again until the reset button is pressed. Saves you possibly months of work. Ideal for the business user.
£11.95

***SUITABLE FOR COMMODORE VIC.**

We will combine interfaces onto single connectors wherever possible thus giving YOU the user more on line devices.
P&P £1.25. Please add 15% VAT to payment. Access, Barclaycardn accepted.

We reserve the right to alter the design and specification without notice.
(Prices effective from NOV. 1st.)

I.F. 10 Video RAM Duplicator Board
Add a 'second' screen RAM to your PET giving a completely different screenful of information.
£18.00 or £20.00 if software selection required.

I.F. 11 Character Generator ROMs
Design your own character set or buy our Qwerty designed sets. Simply replace the existing ROM. A four character set can be purchased which is software selectable.
Qwerty Set £10.00 User defined £12.50 Four Character Set £25.00

I.F. 12 ROM Expander. At £19.95 this plug in board allows two ROMs, e.g. Toolkit, Visicalc, to occupy the same socket. Switch Selectable.

I.F. 13 Programmable Sound & Music Generator
Uses the latest LSI chip technology to give you: 3 tone generators, 1 noise generator, 3 tone mixers, 1 envelope generator, 3 digital to analogue converters, plus two programmable 8 bit input/output ports (equivalent to two user ports - data lines). Very simple to use from BASIC. Demonstration program is supplied along with examples of sounds, e.g. sirens, whistles, bombs etc.
Price £35.00 inclusive of VAT etc.

*** I.F. 14 Extra 16K, 32K Memory Price Breakthrough**
Qwerty Computer Services once again brings you a first class quality product at a very competitive price. (prices 16K

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Name

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Please allow 28 days for delivery

P2

INLAB



NEW
COMMODORE PET/VIC
APPLE II/ITT 2020
SUPERBRAIN/TRS 80
HP 85/83 (IEEE 488)
SHARP MZ80K/MZ80B
S100 COMPUTERS
RS 232C

The complete Analog/Digital I/O to suit your computer

3D Digital Design & Development, the specialists in the field, present their new modular system for configuring convenient, moderately-priced, and versatile multi-channel input/output systems. Specially designed for use in industrial and laboratory environments – the industry standard Eurocard based 19" rack can be driven from most popular microcomputers.

Main features

- monitoring analog signals from thermocouples, strain gauges, pressure transducers etc.,
- reading parallel data (BCD) from DVMs, electronic scales, spectrophotometers, counters, and other digital inst.
- actuating external circuits, lamps, heaters, motors, alarms etc.
- controlling instruments with BCD or logical inputs
- sensing contact closures, limit microswitches
- driving analogue signals into proportional power controllers, DC motors, with accurate indexing
- communicating information with remote terminals over a serial link
- any variations on these themes

LINK-UP

LINK-UP is a firmware package allowing several Commodore computers to share the same peripherals (disk drives, printers etc.) and, in its enhanced version, communication between computers themselves.

MAIN FEATURES

- Simple installation – NO external hardware.
- Solves the file handling problems with both sequential AND random access files.
- Makes the user aware of the 'transactions' on the IEEE Bus by displaying messages on the screen's status line.
- No theoretical limit on the number of computers in the system. Practically limited only by length of IEEE cable and peripheral access time.
- Three modes of operation; transparent; programmer – controllable; and stand-alone.
- Low cost compared to existing hardware solutions.

FUTURE ENHANCEMENTS

- Programming aids
- Printer spooling
- Messages between PET's
- File security options

INSTALLATION

The whole system consists of two EPROMS, one to exchange the existing F-ROM and another in 9\$ – or A\$ – slot (both versions are available).

FILE HANDLING

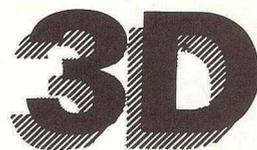
The firmware has been designed to cope with the problem of two computers reading simultaneously from the same file, so that no errors occur.

SCREEN MESSAGES

While the Bus is not free, a message is displayed on the screen of a computer that tries to access the disk, so that the user is aware of the fact and doesn't have to worry about the idea of the system having 'hung up'.

MODES OF OPERATION

In the transparent mode the computer performs as if it were the only one in the system. In the manual mode Bus access can be fully programmed so that in an application package, the disk and printer handling can be optimized for a distributed processing environment. In the stand-alone mode the computer would act exactly as in a stand-alone system.



softbox

Simply by plugging the SMALL SYSTEMS SOFT BOX into the PET IEEE port and loading the CP/M disk, the PET will run under the world's most popular disk operating system, CP/M (tm). No internal connections or modifications to the PET are required.

Applications packages designed to work with specific terminals (e.g. Lear Seigler ADM3A, Televideo 912 or Hazeltine 1500) will need no modifications to work with the PET screen, as the SMALL SYSTEM SOFT BOX allows the PET screen to emulate any of these devices.

Specifications

- Full 60k byte RAM
- CP/M version 2.2
- Z80 CPU running at 4Mhz with no wait states.
- Dimensions : 25cm x 9cm x 16cm
- Operates with any series 2000, 3000, 4000, or 8000 PET
- Supports up to 8 Commodore disk drives in any mix of 3040, 4040, or 8050 drive types.
- Diskette containing CP/M system with utilities, and full documentation included in price lists. Please specify 3040, 4040 or 8050 disk format when ordering.
- Optional RS232 serial interface (with user definable baud rates) for use with a terminal or printer.
- Optional Corvus drive interface.

SoftBox prices

SoftBox	£550
SoftBox with RS232 interface	£595
SoftBox with hard disk interface for Corvus drive	£615
SoftBox with RS232 and hard disk interface options	£660
Softbox Manual.....	£5

HARDISKS

CORVUS DRIVES

Well proven systems with the nationwide support and maintenance.

- 5, 10, 20MB capacity
 - Up to 4 drives can be daisy chained
 - Backup onto standard video cassette using the Mirror unit
 - Up to 64 users with the Constellation multiplexer unit.
- | | |
|--------------------------|-------|
| 5MB Corvus drive..... | £2295 |
| 10MB | £3595 |
| 20MB | £4495 |
| Mirror back up unit..... | £4495 |
| Constellation | £495 |

SSE MINI WINCHESTER

Drive and Hardbox housed in one small desktop unit. Single user. Prices inc. Integral Hardbox

3MB	£2300
6MB	£2500
12MB	£2800

Designed and developed by Small Systems Engineering in conjunction with Unicorn Software Ltd.

Softbox CP/M® software

Package name (author) price with manual/manual only

Languages

ALGOL-60 (Research Machines) £130/£20
ALGOL is a powerful block structured language featuring economical run-time dynamic allocation of memory. The compiler is very compact (24k) and supports almost all Algol-60 report features

BASIC-80 (Microsoft) £175/£20
This is Microsoft Extended BASIC interpreter, version 5. It is a powerful, ANSI compatible disk BASIC with many features not found in PET BASIC, such as WHILE/WEND, chaining, variable length file records, double precision floating point, PRINT USING facility, error trapping, hexadecimal numbers and more.

BASIC COMPILER (Microsoft) £195/£20
This compiler is language compatible with the Microsoft version 5 interpreter but generates 8080/Z80 machine code, so that program execution is typically 3 to 10 times faster.

C COMPILER (BD Software) £80/£15
This compiler supports most major features of the language, including structures, arrays, pointers and recursive function evaluation. The compiler produces compact, relocatable 8080 code for use with the linker and library supplied.

C COMPILER (Whitesmith's) £325/£20
This compiler conforms to the full UNIX version 7 implementation of the C language, which has more facilities than Pascal or BASIC and produces faster code.

CBASIC (Software Systems) £75/£12
This is a non-interactive BASIC used by many business application programs. It supports full file control, chaining, formatted output and sequential and random disk file access, 14-digit arithmetic, WHILE/WEND and optional line numbering.

S-BASIC £155/£20
A structured BASIC compiler generating 8080 native code, combining structured programming and the speed of machine code while maintaining the convenience of BASIC.

CIS-COBOL (Microfocus) £425/£30
An ANSI '74 standard COBOL compiler fully validated by U.S. Navy tests to ANSI level 1. The compiler also supports many features of level 2 including dynamic loading of COBOL modules and a full Indexed Sequential (ISAM) file.

COBOL-80 (Microsoft) £375/£20
An ANSI '74 COBOL compiler producing relocatable modules compatible with FORTRAN-80 or MACRO-80 output. COBOL-80 has a complete ISAM facility and interactive screen handling.

NEVADA COBOL £80/£15
A subset of the ANSI '74 standard with 18-digit precision, a built-in debugging facility, interactive ACCEPT and DISPLAY screen handling commands, and very fast execution time.

FORTRAN-80 (Microsoft) £230/£20
The popular science and engineering language, complying with the ANSI '66 standard (except for the COMPLEX data type), with enhancements such as mixed mode arithmetic.

muLISP £110/£15
LISP is an interactive programming language widely used for artificial intelligence applications.

PASCAL/M £95/£15
This compiler produces p-code and is an extended implementation of standard Pascal, with long (32-bit) integers, a SEGMENT procedure type (for overlays) and an added STRING data type.

PASCAL/MT £135/£20
This is a subset of standard Pascal, which generates ROMable 8080 machine code and supports interrupt procedures, CP/M file input/output, and assembly language subroutines.

PASCAL/MT+ £265/£20
A Pascal-compiler meeting the ISO standard, with many enhancements including full string handling capability and random access files.

PASCAL/Z (Ithaca Intersystems) £205/£15
A compiler producing ROMable, re-entrants Z80 macro-code highly optimised for speed, supporting variant records, strings, direct I/O and debugging aids such as IMBED and TRACE.

PL/I-80 (Digital Research) £265/NA
A general purpose application programming language giving mainframe capability for developing large-scale structured programs in a microcomputer environment

TINY C £55/£30
An interactive, scaled-down version of the C language, ideal for teaching structured programming techniques.

TINY-C TWO £130/£30
A compiler written in TINY C. The source code is included on disk.

WORD PROCESSING

WORDSTAR (MicroPro) £265/£35
A powerful screen-oriented word processor designed for non-technical personnel. Text formatting is performed on the screen, so that what you see is what you print-out will look like. WORDSTAR's advanced facilities include justification, pagination, underscore, boldface, subscript and superscript, block movement of text,

WORDINDEX (MIDAS) £100/NA
A program to assist WORDSTAR users by generating a table of contents and index from a WORDSTAR document.

MICROSPELL £130/NA
This is a spelling help program which scans through a document file stopping at each dubious word, offering correctly spelt alternatives and allowing you to correct the word with a keystroke.

SPELLGUARD £155/£15
A spelling proofreader to assist in eliminating spelling mistakes in document files.

WP Workshop £75/NA
A self teaching system for Wordstar. Invaluable.

TEX (Digital Research) £55/£10
A text formatter to create paginated, page-numbered, justified copy from a text file. Output may be directed to the printer or to a disk file.

TEXTWRITER III £75/£15
A text formatter to justify and paginate letters and other documents.

LETTERIGHT (Structured Systems Group) £105/£15
This program can be used to create, edit and type letters and other documents.

MAILING LIST SYSTEMS

MAILMERGE (MicroPro) £80/£15
MAILMERGE is an add-on utility for WORDSTAR users allowing the production of personalized form letters or other documents from a mailing list made using DATASTAR or NAD. Requires WORDSTAR.

POSTMASTER £85/£12
A comprehensive, menu-driven package for mail list maintenance.

NAD (Structured Systems Group) £60/£15
NAD is an interactive Name and Address system, allowing a mail list to be created and maintained. Custom name and address labels may be printed, and reports may be generated.

TELECOMMUNICATIONS

BSTAM £105/NA
This telecommunications utility permits any type of CP/M file to be transferred to or from another computer also equipped with BSTAM. Transmission occurs at full speed with CRC error checking and automatic error recovery.

BSTMS £115/NA
An intelligent terminal program permitting communication with a mainframe computer.

NUMERIC PROBLEMS SOLVING TOOLS

T/MAKER II £145/£15
An advanced utility for preparing management reports with tabular data, combining visual calculator with a full screen editor.

software

for the Commodore PET.....

MICRO MODELLER £425/NA
The number one Financial Modelling and forecasting program.

ANALYST (Structured Systems Group) £130/£12
A customised data entry and reporting system in which the user specifies up to 75 data items per record, and can use interactive data entry, retrieval and update facilities to make information management easy.

FPL £365/£20
A Financial Planning program so advanced that it's like having a mainframe computer on your desk. FPL creates, modifies, displays and prints financial forecasts.

muSIMP/muMATH £135/£20
A package of programs including muSIMP, a high level programming language for symbolic and semi-numeric processing, and muMATH, an interactive symbolic mathematics system written in muSIMP.

STATPAK £260/£20
A professional statistics and probability package which can rapidly handle large files of data.

DATEBOOK £185/£20
This program allows you to manage your own time (and others') efficiently, just like an office appointment book but with the speed and memory of a computer.

DATA MANAGEMENT SYSTEMS

NEW.....

dBASE II £385.00
An interactive relational database management package with full screen formatting and its own fully structured high level command language. Interactive data entry and Validation with WordStar-like commands. Allows you to develop application packages in days rather than months.

CBS £210/£25
Configurable Business System is an easy to use, interactive data management system with the capacity to define and implement custom accounting applications without recourse to programming languages such as BASIC and FORTRAN.

HDBS £160/£20
A CODASYL-like Hierarchical Data Base System with user-defined SETs, RECORDs and ITEMs, bringing mainframe data-base management capabilities to your systems.

MDBS £475/£20
Micro Data Base System is a full network data base with all the features of HDBS, with fixed or variable record length, read/write protection at the ITEM, RECORD, SET and FILE levels.

MDBS.DRS £160/NA
Dynamic Restructuring System option for MDBS. This is a stand-alone program allowing data-bases already containing data to be re-designed without affecting the data.

MDBS.QRS £160/ENA
Query/Report Writing System for DBMS is a stand-alone program which provides an English-like query language, allowing non-programmers to interrogate the data base.

MDBS.RTL £160/NA
Recovery/Transaction Logging module for MDBS, which records any data base changes in a transaction log file which may be used by the recovery processor to update a back-up copy of the data base.

ACCOUNTING PACKAGES (GRAFFCOM)

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ADD £255/£35
TIME RECORDING SYSTEM £375/£35
LEASE RENTAL AND HP SYSTEM £375/£35

LANGUAGE APPLICATION TOOLS

BASIC UTILITY DISK £40/NA
This disk consists of the CRUNCH-14 compacting utility to reduce the size of and-increase the speed or programs written in Microsoft BASIC-80. Also included is DPFUN, a set of double precision routines including square root, natural log, sinh, arsin - runs at high speed.

DATASTAR (MicroPro) £195/£35
A powerful, comprehensive forms control and display system for key-to-disk data entry. DATASTAR is menu driven with built-in learning aids such as help messages on the screen, and input fields may be verified by length, mask, or type (upper or lower case, numeric).

FORMS 2 FOR CIS-COBOL (Microfocus) £110/£12
A screen editor which automatically creates a query and update program of indexed files using CRT protected and un-protected screen formats.

FABS £105/£15
FABS gives you rapid access to large data files by using balanced tree structures containing up to 65,000 records. Instructions are included for use with CBASIC2, S-BASIC, BASIC-80, BASIC compiler, PL/I-80, Pascal/MT+ and FORTRAN-80.

MAGSAM III £75/£15
A sophisticated, versatile ISAM file management support system for use with CBASIC-2 and BASIC-80 business applications, allowing real-time enquiries, updates, additions and deletions.

MAGSAM IV £185/£15
A high-speed machine code version of MAGSAM III for CBASIC-2 only. It has a 75 percent faster execution time.

M/SORT FOR COBOL-80 £130/£12
A record-sorting utility for COBOL-80 conforming fully to the ANSI '74 level 2 sort/merge standard (except for alphabet-name collating sequence).

PSORT £55/NA
A high speed machine language sort-merge utility for files with fixed length, aligned field records, such as random access files created under BASIC-80.

QSORT (Structured Systems Group) £55/NA
A fast sort/merge program written in 8080 assembly language for files with fixed record length but variable field length. It can sort on up to five ascending or descending keys.

STRING/80 £50/£15
A set or routines to allow string handling as well as direct CP/M BDOS calls from FORTRAN-80 and other compiled Microsoft languages.

STRING/80 SOURCE CODE available separately £185

STRING BIT £40/£15
FORTRAN character handling routines allowing the FORTRAN user to find, fill, pack, move, separate, concatenate and compare strings.

SUPERSORT (MicroPro) £125/£25
A superior sort, merge and extract utility supplied both as a complete program and as a relocatable module in Microsoft format. SUPERSORT sorts up to 500 records per minute.

ULTRASORT II £105/£15
This high speed sort utility, equipped with select and exclude capabilities, will sort, merge and select data files either in stand-alone mode or called via CBASIC-2 subroutines. It sorts on five keys, each independently ascending or descending, with fixed or variable length field lengths.

SYSTEM TOOLS

MAC (Digital Research) £65/£15
A full Intel standard macro assembler including the pseudo-ops RPC, IRP, REPT, TITLE, PAGE and MACLIB. Macro libraries are included for CP/M sequential field access, assembling Z80 instructions (uses non-standard mnemonics), etc.

SID (Digital Research) £65/£10
An 8080 symbolic debugger with full trace, pass count, and breakpoint facilities plus back-trace and histogram utilities. SID works uses symbol files produced by MAC or the Microsoft linker to give a full symbolic display of user labels.

ZSID (Digital Research) £70/ENA
A version of SID which uses Z80 mnemonics.

MACRO-80 (Microsoft) £85/£15
A Microsoft utility package comprising a powerful macro assembler which will accept both 8080 and Z80 mnemonics producing a relocatable output file compatible with COBOL-80, FORTRAN-80 and compiled BASIC object files.

XMACRO-86 (Microsoft) £155/£15
An 8086 cross assembler which uses mnemonics slightly modified from the Intel ASM86 assembler. All the macro features and utilities of MACRO-80 are included.

XASM 05, 09, 18, 0 48, 68, F8, 65, COPS 400 and 51 £95/£10
Cross assemblers for the Motorola 6805, Motorola 6809, RCA 1802, Intel 8048, Motorola 6800, Fairchild F8, MOS Technology 6502, National Semiconductor 400 and Intel 8051 families.

PASM (Phoenix Software Associates) £70/£15
A Z80 macro assembler using Intel/TDL mnemonics, which will generate output in either Intel hex format or TDL object format or PSA relocatable binary format.

PLINK II (Phoenix Software Associates) £185/NA
A two-pass disk-to-disk linkage editor capable of producing ROMable code. It has full library facilities, and input can be PSA relocatable, TDL object or Microsoft REL files.

NEW... BASIC 48 - Enhanced Basic Compiler £195/15
Produces highly optimized assembly source for 8048 family. Includes XASM48

BUG and µBUG (Phoenix Software Associates) £70/£15
A Z80 interactive machine language debugging tool with full mnemonic trace and interactive assembly, using PASM-compatible mnemonics.

DISTEL £60/NA
Disassembles 8080/Z80 machine code file to Intel 8080 or PASM/TDL mnemonics.

DISILOG £60/NA
A version of DISTEL for Zilog Z80 mnemonics.

ZDT £30/NA
A Z80 debugging tool to trace, break and examine registers with standard Zilog/Mostek mnemonic disassembly displays. Useful features include the ability to directly access input/output ports, search for hex or ASCII strings, and compare memory areas byte by byte.

Z80 DEVELOPMENT PACKAGE £70/NA
This package consists of a line editor, a relocating Z80 assembler using Zilog/Mostek mnemonics with conditional assembly and cross reference table facilities, and a linking loader producing in Intel format hex file.

WORDMASTER (MicroPro) £75/25
In one mode this text editor has a superset of CP/M's ED commands including global search and replace, both forwards and backwards in the file.

RAID £130/£15
Real-time Assembler Interactive Debugger, for 8080 software emulation and real-time debugging.

RECLAIM £40/NA
A utility to validate disk media under CP/M. It checks a diskette or hard disk surface for errors, collecting any bad sectors into invisible files so that they cannot be accessed. The remainder of the disk can then be used as normal.

DESPOOL (Digital Research) £45/NA
A utility to permit the simultaneous background printing of a data from a disk file while the user executes another program from the console. DESPOOL occupies 3K of memory.

Please note - the prices in this catalogue are subject to change. Certain packages may require a software license agreement to be complete and returned before shipment can be made.

PET BITES VIC!

VIC/PET programmers: How would you like to be able to connect all of your PET peripherals, through your PET, to your VIC? Print VIC programs, save or load on disk, or use a VIC joystick on the PET. Basic programs can call HESCOM subroutines to transfer any amount of memory in either direction between two VICs, two PETs, or a PET and a VIC.

For example, a 3.5K Basic program can be transferred in half a second! Or, you could use an existing PET disassembler to look at the VIC ROMs by simply changing the input routine to get single bytes via HESCOM. Similarly, three-voice VIC sound can be used by PET programs. Full handshaking ensures reliability in block transfers; another mode allows real-time sampling of the user port for applications like two-machine games! Includes 5' cable, machine language software for PET and VIC, demo program, and documentation. (VIC or 8K PET) \$49.95

by Jay Balakrishnan

HESEDIT: change 22 lines of data by merely over-typing and insert, delete, and even duplicate lines—all at once! Scroll forwards or backwards by any amount — it's also easy to edit files bigger than your memory. Why code a program to maintain each file? Use HESEDIT for mailing lists, notes or prepare assembler source for HESBAL. All keys repeat. FAST - written in BASIC and assembler. \$12.95

6502 ASSEMBLER PACKAGE: HESBAL, a full-featured assembler with over 1200 bytes free (8K) & HESEDIT; for less than \$25! HESBAL is *THE* best 8K assembler available: it uses only 1 tape or disk, yet includes variable symbol sizes, pseudo-opcodes, over 25 error messages and more than 70 pages of documentation. \$23.95



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NEW RELEASES

HESCOUNT by Jerry Bailey. A totally new concept in debugging! Machine language monitor aids debugging of any Basic program by counting the number of times each line is executed. Pinpoints bottlenecks to help you improve run times up to 50%. Shows code that was never executed, and lets you verify that loops and conditional statements are working as expected. (VIC or 8K PET) \$23.95

HESLISTER 2.0 by Cy Shuster. Now 35% faster, reveals program structure by untangling complicated Basic lines and indenting IF, FOR..NEXT statements, etc. Inputs from disk; outputs to screen or printer. (8K PET) \$15.95 (includes disk)

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Business Disk

The versatile program that will help every small businessman.
This is **THE PROGRAM YOU LEAVE IN YOUR COMPUTER ALL DAY.**

BUSINESS DISK combines an easy-to-use **wordprocessor** with a **filing system, electronic jotters, desk diary**, and much more. Very powerful searching/editing functions. Wordprocessor can use information from any of your files. Print totals of conditional searches. **TOTALLY FLEXIBLE** and easy to set up to suit your exact requirements. Change your mind later? Easy to alter/create sub-files/etc. You can be halfway through editing a letter; go to your product file to look up some prices; print out an invoice for someone who wants to pay cash; **and then continue editing your letter!**

Free leaflet gives full details of this advanced program which will run on the 8032 PET. Extensive User Handbook available separately for £15 (refundable). Business Disk for your business desk, costs £350 plus VAT.

CBM Dealer enquiries welcome. This is the program all your 8032 customers will want; and you'll find many uses for it yourself. Demonstration pack available soon for £30.

How have we managed to get what is virtually a small S*1*c*n Off*c* into a 32K PET? By writing all the commonly used subroutines in very efficient machine code and putting these in ROM. These are also available separately and you can write simply BASIC programs to use these superb subroutines. The ROM is called the **Business ROM** and costs £120 plus VAT. Full details on request.

ROM Pager: A small board that fits neatly inside PET and allows up to 8 different ROMs to be fitted at once. Fitted in seconds, software controlled; price £45 plus VAT.

EPROM PROGRAMMER: Very many facilities including disassembler; programs ALL common EPROMS. £250 plus VAT. (2532 EPROMs from £5.50.....10 off)

Assemblers: Complete easy-to-use packages for ALL PET's, including 80 column. Disk or cassette. From £25 plus VAT.

Accessories: Floppy Disks; Paper; USA Software (eg VISICALC £99); and other PET products. All software is post free. Send for free catalogues. Demonstrations any time.

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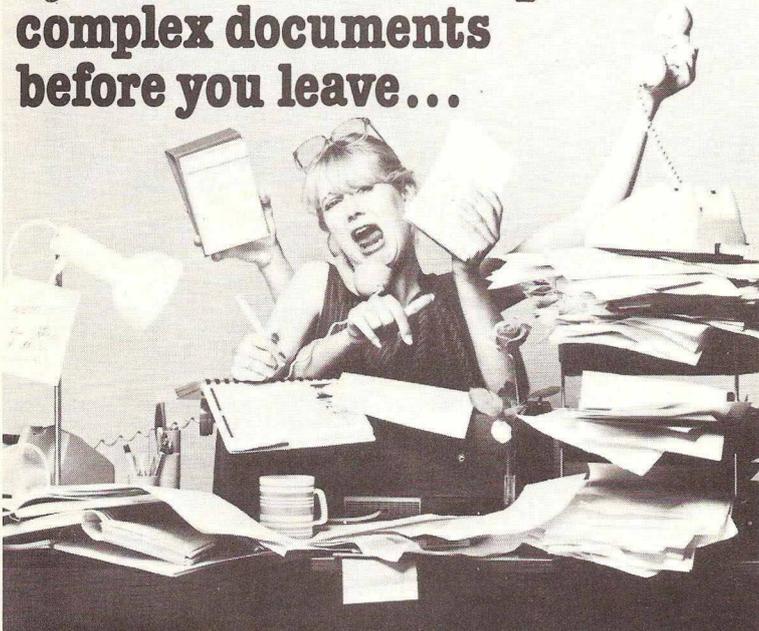
Commodore PET, Apple, Northstar Horizon, Hewlett Packard, Shelton, Xerox Diablo, Sharp. In fact, you name a system and you'll be surprised how much we know about it.

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There's only one word for a boss who expects 200 letters by coffee break, 100 mailings by lunchtime, 250 price lists by teatime and a couple of complex documents before you leave...



Wordcraft. It transforms your PET microcomputer into a word processor. But Wordcraft Software isn't just about producing large quantities of work.

Retyping becomes a thing of the past. Corrections can be done on the machine before the final copy is typed. Everything is stored in the memory so you can have as many perfect copies as you want, as and when you want them.

Commodore-approved Wordcraft takes advantage of today's 'daisywheel' printer's features. Just to make sure you get the kind of quality of typing you're used to. At very reasonable cost.

Finally, using Wordcraft doesn't affect the PET's equipment — so think how handy it could be in your business.

For further information:

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CSM LTD Birmingham	021-382 4171	MICRO COMPUTER CENTRE London SW14	01-878 7044
MICRO ASSOCIATES Birmingham/Walsall	021-328 4574	LOGIC COMPUTER SYSTEMS London SW1	01-222 1122
JOSEPH WARE & ASSOCIATES Birmingham B1 1LS	021-643 8033	CYBERNETIC TEACHING SYSTEMS Long Eaton	0332 810639
DIXON-MARTIN SYSTEMS LTD Birmingham B26 3NX	021-742 8771	H.B. COMPUTERS (LUTON) LTD Luton	0582 416887
PEACH DATA SERVICES Burton-on Trent	0283 44968	CYTEK (UK) LTD Manchester	061-872 4682
DAVIDSON RICHARDS LTD Derby	0332 366803	CLAREMONT CONTROLS Newcastle	0632 610210
DAVINCI COMPUTER SHOP Edware	01-952 0526	KEY COMPUTER SERVICES Newcastle	0632 815157
A.C. SYSTEMS Exeter	0392 71718	C.S.E. (COMPUTERS) Reading	0734 61492
MICROFACILITIES Hampton Hill	01-941 1197	COMPUTER CENTRE (SHEFFIELD) LTD Sheffield	0742 588731
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PET/CBM IEEE-488 Printer Interface

Compatible with NEC Spinwriter and other parallel printers. Fully assembled and attractively enclosed. Addressable as Device No. 4 to 30. Switch selectable PET to ASCII code conversion. No software drivers required. PRICE: £80.00

Serial Interface

Baud Rate 100-4800. Includes Power Supply. PRICE: £50.00

UART & Baud Rate Generator

Converts Serial to Parallel and Parallel to Serial. On board Baud Rate Generator 110, 150, 300, 600, 1200, 2400. TTL compatible. All characters contain 5 to 8 data bits, 1 or 2 stop bits and either odd or even parity. PRICE: £50.00

CB2 Soundbox

Ideal soundbox for any PET. Comes complete with user programming instructions and demo tape. Plugs into PET user port and cassette port. PRICE: £22.50

4-Channel A/D Converter

Connect joystick to PET. Control temperature. Remote Control the world. Comes complete with power supply and drive program. PRICE: £45.00

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This well-built unit connects to either your domestic TV or a monitor. Nothing to adjust. Connects to user port and second cassette port. PRICE: £35.00

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(Specify relay contact rating required) Supplied with drive program. PRICE: £45.00

PET MACHINE LANGUAGE GUIDE

Complete guide on all you have to know about PET's language. PRICE: £8.00

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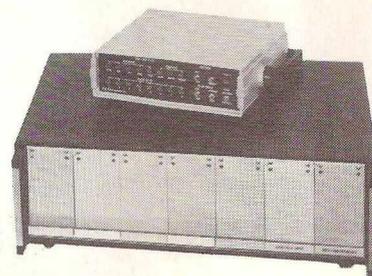
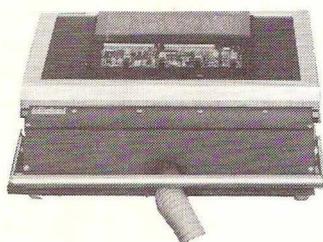
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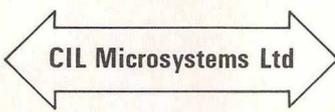
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We do occasionally have secondhand Commodore computers and peripherals, we also have one or two secondhand programs such as word processing and business programs – ask for details.

Sole UK Distribution of Matrix Astrological Software

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Ten 5 1/4" double density diskettes for Commodore Single Sided at £16.50 incl. postage (VAT extra)

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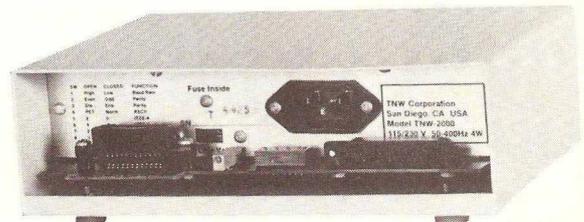
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The **TNW 2000** (as illustrated) a rugged single ported bi-directional IEEE 488/RS232 interface:

- Conversion of both PET and true ASC11.
- Daisy Chaining.
- Standard RS 232.
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The **TNW 3000** – a bi-ported, bi-directional IEEE 488/RS232 interface as per TNW 2000 plus:

- Crystal controlled Baud rate.
- Fully implemented RS232.
- Power supply for a current loop.



Both the TNW 2000 and 3000 are mainly used for interfacing PETs to printers.

KINGSTON

Kingston Computers Limited, Electricity Buildings, Filey, North Yorkshire YO14 9PJ. Telephone: (0723) 514141. Telex: 52163.

READ/WRITE

Pipped at the Post?

I am a newcomer to the computer scene and came into it by purchasing a ZX80 after seeing adverts in the Sunday glossy magazines. Two weeks after getting the ZX80 I was surprised (to put it mildly) to see adverts for the ZX81 which was not only better but cheaper. I have learnt a lot of the ways in which the computer jungle works and now consider myself a wiser person.

I now have a problem. I am awaiting delivery (that is another story) of the VIC 20 which I hoped would solve any problems of expansion etc., and was ideally suited to my particular needs. The only niggle I had (in common with others) was the 20 character line of the VIC. However, I was prepared to accept the VIC as it was, warts and all.

What is the problem then? I read in an educational computing magazine that Commodore were well aware of the fact that many people were not happy with the limitation on line length, but not to worry

at fairly low cost.

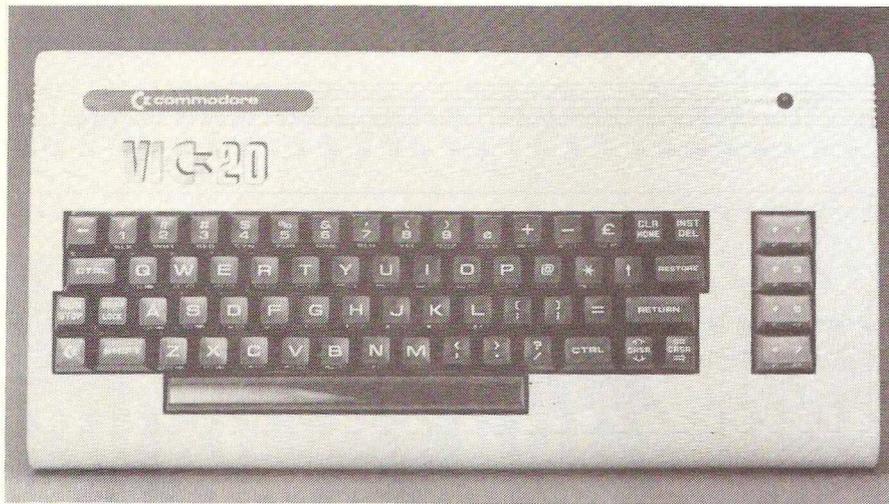
Healthy Computers

I am involved in a project looking at the utilisation and implications of the micro technology on health care. I wonder if you would help me by (a) inviting correspondence on this subject and (b) publishing my letter and inviting your readers to contact me.

I am interested to learn of companies specifically specialising in the health industry, developing contact with other health workers, discovering what patients feel about the future computerisation of medicine.

P. Duffy, S/N,
c/o Cooke Ward,
The Warneford Hospital,
Warneford Lane,
Headington, Oxford.

Your word is our command!



because early next year – wait for it – they are bringing out a prototype with 40 columns. A VIC40?? Am I back in the thistle patch again? Is there a machine in the offing fully compatible with the PET? Am I, and many others, going to find ourselves losers in chipland?

I would be very grateful to hear (or see) your comments on whether or not my fears are groundless.

Tom Williams,
Winsford, Cheshire

Twice bitten, three times shy, Mr Williams? Seriously though, you are not the only one to have been caught out by the rapid advance in computer technology.

As far as the VIC40 goes, the news is not so bad. Commodore's original intentions were to introduce such a machine about a year after the VIC20, as an upmarket machine – possibly to replace the 40-column PET entirely.

The latest news is, however, that Commodore are developing a 40-column add-in board which will be available in the Spring, to upgrade a VIC20 to 40-columns,

Secret Observer

I happened to be present at the Commodore Product Obfuscation Committee Meeting (CPOCM) under an assumed name (AN) and moustache (AM); the meeting where they make the final decisions about how to make things difficult for the user. It went something like this:

Chairman: "Now each of you was instructed to bring to this meeting one viable VIC obfuscation recommendation. Scombrey, you start the ball rolling."

Scombrey: "Right, Chief! My idea is that we number the colours 1 to 8 on the keyboard but 0 to 7 everywhere else."

Chairman: "That's the spirit, Scombrey! Although it's so simple they'll soon catch on. Tupwell, I hope your contribution is a bit more arcane than that!"

Tupwell: "Right, Chief! You know that there are sixteen one-byte registers for storing the instructions to the VIC chip about display size, colours, sounds, and so on. My suggestion is that we fix it so part of an instruction is mixed in with part of another in the same register, but no two are mixed in the same way."

Chairman: "Tupwell, you are a credit to the firm. That'll take 'em months to figure out. Besides, they've got no business POKEing around in those registers anyhow! Be sure to include a few mistakes in the text of the instruction book. OK, Mastoid, stop foaming and tell us what monstrosity you propose."

Mastoid: "Right, Chief, sir! My idea is simply..."

Chairman: "Scratch that word 'simply' from the minutes Mabel, and make a note to put Mastoid down for three lashes."

Mastoid: "Sorry, Chief. My idea is complexly to name the normal character display the HIGH RESOLUTION MODE. That way, the customer may think he's getting what everybody else means by 'high resolution', to wit, the ability to address any dot individually."

Chairman: "Has elements, Mastoid. Mabel, scratch two lashes. But what will you call the low-resolution mode where you only get effectively 4 by 8 dots?"

Mastoid: "That I call the multicolour mode, because it allows for four colours per character instead of two."

Chairman: "But what good is four colours per character if you only have 32 dots and considering that, as you well know, 'due to colour transition limitations of TV sets, closely-spaced dots of different colours will not appear sharply defined on the screen' and like that?"

Mastoid: "Chief, sir, you took the words out of my mouth!"

Fingergin: "Say Chief, we have this here mode where you get like 16 by 8 dots instead of 8 by 8, that will be great for graphics like chessmen and stuff: let's definitely not call that the 'high-resolution mode' (All cheer!) "and let's not explain how to call it up or any details."

Chairman: "Well, of course we never put anything like that in the instruction book, we let those things leak out to reviewers so they can pretend to have discovered them, but maybe in the dealers' notes..."

Fingergin: "labelled 'preliminary', and only available to the customer at extra cost, with no update service..."

Scombrey: "and scattered around the text..."

Tupwell: "with notes by someone who has only read the original Japanese manual and doesn't understand it!"

(All jump spontaneously to their feet and begin dancing around the table widdershins, singing "Obfuscate the Customer!")

Lindsay Doyle
Norristown, PA, USA

Vital Statistics

I was particularly interested in Fibonacci's 'Rabbit' program for ZX81 users, featured in your October edition. Your readers may be interested to know that this brilliant Italian mathematician spent much of his career studying the relationship between numbers in the Fibonacci series (1,2,3,5,8,13,21 etc) and the natural constant ϕ (Phi).

It can be seen that the ratio between consecutive numbers in this series

READ/WRITE

The Editor welcomes your letters, but if you require a personal reply please enclose an S.A.E.

gradually approaches the value of ϕ , sometimes referred to as the Golden Ratio. Write the following two lines into the Rabbit program to see how this works:

75 SCROLL
77 PRINT, A/B

Don't be fooled into thinking that the resultant answer 0.61803399 is the precise value of ϕ because, like Pi, it tends to go on forever. ϕ has been evaluated to 2,878 decimal places in less than four minutes on a TRANSACS-2000 computer in California.

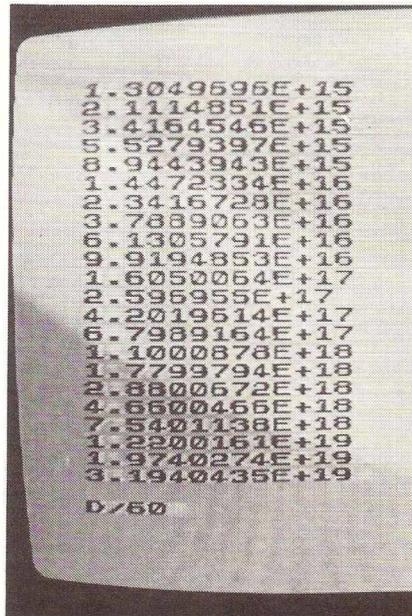
Now consider the following:

- 1 + Phi gives the same result as 1/Phi.
2. Square any number in the Fibonacci series and subtract from your answer the product of its preceding and succeeding neighbours. Better still, write this into the Rabbit program. The answers will be alternately +1 and -1.
3. The head of a sunflower consists of clockwise and anti-clockwise spiral arrangements, in the ratio 34:55 (6 inch head) or 89:144 for larger heads and 21:34 or 13:21 for smaller heads. All are successive numbers in the Fibonacci series.
4. The dimensions of the Pyramids of Egypt incorporate the Phi ratio (built long before Fibonacci's time...)
5. Lastly, the navel height of your wife, compared with that of her body length should give an approximate value of Phi. If

this experiment proves unsuccessful then try it with your friend's wife.

John Alexander,
Banstead, Surrey

We are sorry to report, Mr Alexander, that your last suggestion was taken up rather too



enthusiastically by certain members of our staff. Inside Trader took the opportunity of applying his measuring tape and copy of VisiCalc to the inside legs and busts of all and sundry down at the Waggonload of Monkeys. He reports that he has found no statistical significance in the correlation of vital statistics, but has made a good few introductions!

Wordy disaster

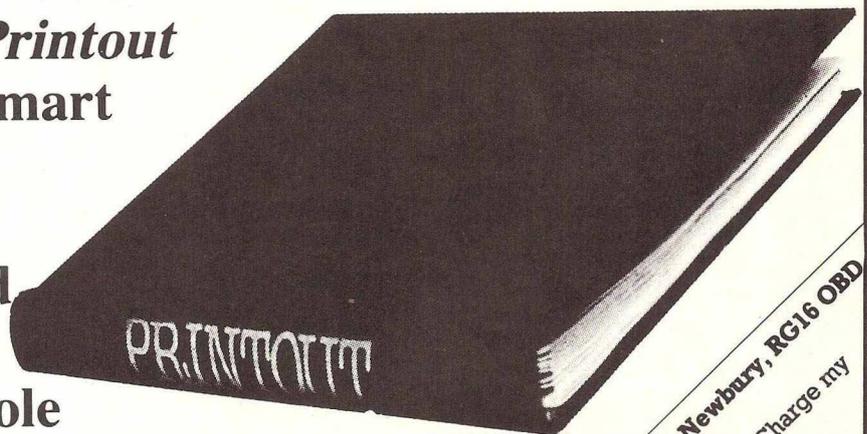
Everyone highlights the advantages of word processors but not the disadvantages, such as the girl working for the Quebec Government who took advantage of a quiet period to type a letter to a friend on a word processor. Unfortunately, when she had finished, she entered the wrong code into the terminal and instead of producing a single copy, the entire letter ended up in the middle of an official transcript of a Quebec National Assembly Debate, 70 copies of which were delivered to the city's newspapers the same day!

Mrs S Taylor
Hove, Sussex

We are in the process of compiling a thesaurus of Great Computing Disasters, Mrs Taylor - your amusing contribution is much appreciated, as would be those of any other readers who care to send them in.

DON'T LOSE THIS ISSUE!

Keep it safe in a handsome **MicroComputer Printout Binder**. Made in smart brown simulation leather with the name gold blocked on the spine, each binder holds a whole volume of **MicroComputer Printout** - that's 12 issues. The cost - just £3.95 inclusive of U.K. postage.



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ROM INVADED !

They said it couldn't be done! We've managed to put INVADERS into ROM for the 8032 - and it uses the full width of the screen. All you need to do is unplug the chip in UD7 - it's not soldered in - and replace it with our new ROM INVADERS chip. Normal operation of the 8032 is entirely unaffected, but type SYS 59648 and you'll find yourself struggling to survive against a massive alien fleet. When you hear the boss coming just press the escape key and then - well, back to work!

ROM INVADERS makes full use of the built-in 'bleeper' to add appropriate sound effects. It's the most self-contained game ever, and at £19.95 plus VAT really good value.

INVADERS is the only game we currently offer in ROM, but on cassette we've got ASTEROIDS, SUPER GLOOPER, METEORITES, and GIDDY GHOULS at just £8 each (plus VAT).

HI-RES

The HR-40 High Resolution Graphics Board is easy to fit - no soldering, no tracks to cut, no links to make or break. The resolution of 320 by 200 is as good as you'll get, and the picture is rock steady. It has 8k of its own RAM, and utility software in EPROM, so you'll have a full 8, 16 or 32k of memory for your own programs. Don't worry about those plug-in chips you've bought - sockets UD3 and UD4 are duplicated on the board!

Fully assembled, the HR-40 board fits any large keyboard PET/CBM computer other than the new 12in models. If you have a 'FAT-40' machine then you should order the HR-40B version, but they're both the same incredible price, just £149 plus VAT. The HR-80 board for the 8032 should be available during December - write or phone for up to the minute information.

DON'T BUY ONE

That's right - don't buy a word processor until you've seen MicroScript, the new ROM-based word processor for the 8032. Because it's in ROM up to 30000 bytes are available for text - that's nearly three times as much as with other systems - and it's not only easier to learn, but faster in operation!

Ask your dealer to demonstrate how easily MicroScript handles standard letters - and how the exact format of any document can be displayed on the screen. You'll notice too that there's no need to wait whilst documents are being printed - once you've started a print run you can continue to use the computer and disk regardless!

If word processing is a relatively minor task for your PET/CBM system you're probably not prepared to spend hundreds on a word processor, however sophisticated. PAPERMATE is a word processor with most of the features you'll find on more expensive programs - yet it costs just £35 on tape or £36.50 on disk!

All you need to use PAPERMATE is 16k of memory - whether you've got 40 or 80 columns, disk or tape just doesn't matter. And since this advert is being written using PAPERMATE you can see how good it is!

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VIC Computing

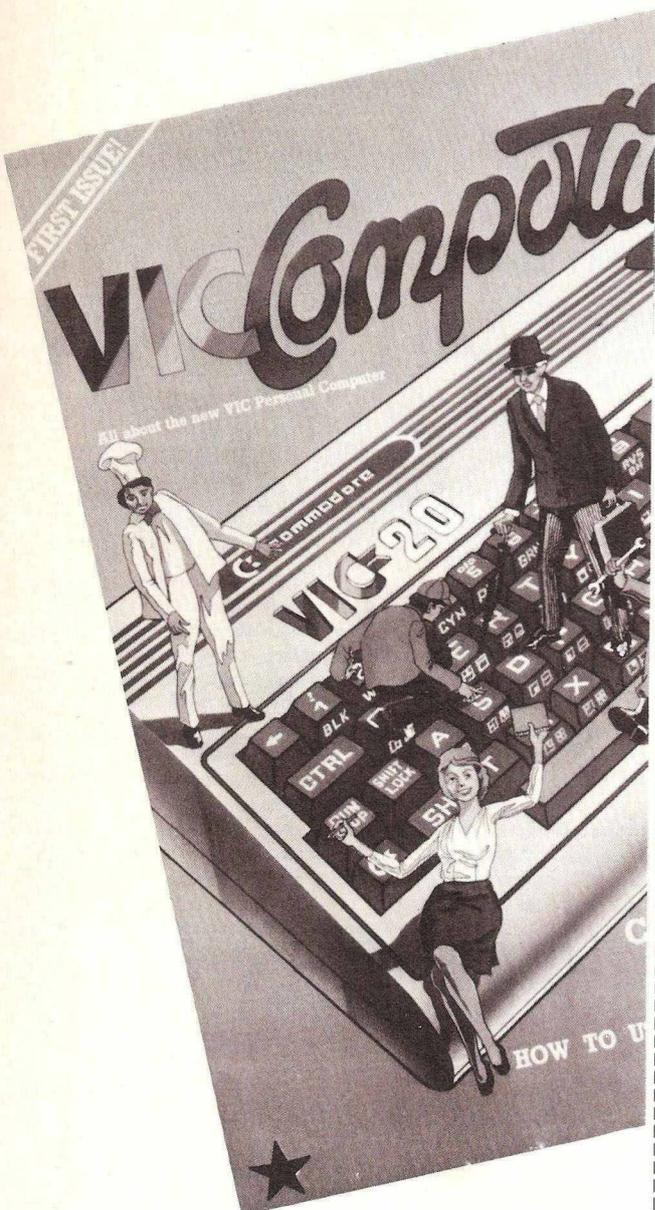
The 'how-to' magazine all about Commodore's VIC computer

VIC Computing is a great new magazine for users of the VIC. Each issue is packed with valuable programming hints, software reviews, 'how-to' articles and program listings.

You don't have to be an expert to enjoy *VIC Computing*. It is written in straightforward English for beginners – not computer experts.

Features in the first colour packed issue included: "Anyone can Program", an article to teach you to program in one hour; "But What Can It Do?", an introduction to VIC's capabilities; "Expansion of the VIC", a guided tour of its add-on capabilities; "Using Graphics" covering programming in colour; "Converting Software for VIC" – how to convert PET programs; "VIC Sound", data sheet on sound generation; plus "Dear VIC", "Beginners Queries" and "VIC hints".

It costs just £6 a year to subscribe to *VIC Computing*. Can you afford not to?



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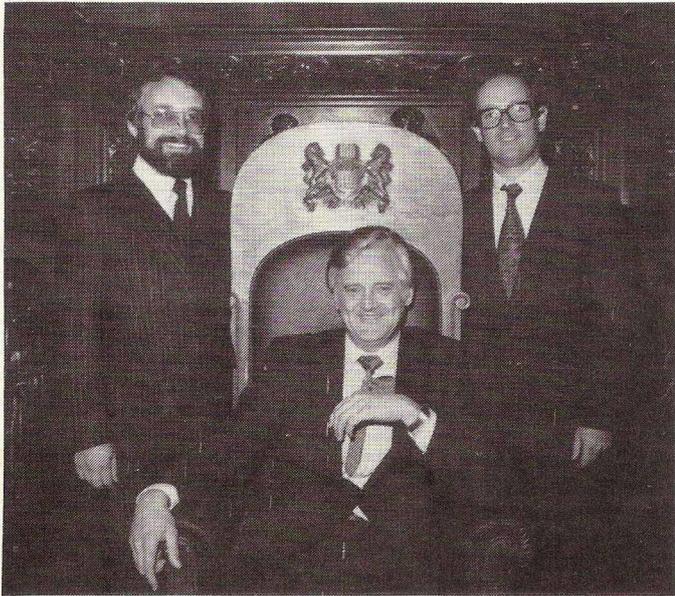
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VIC Computing

FAB THREE TO PUBLISH PROGRAMS



The ancient doorman managed an arthritic salute as he swung open the massive doors of Caxton Hall. "Fans Mob Fab Four" announced a yellowing newspaper cutting pinned to the wall.

But this time it wasn't a pop star wedding the Press had turned out for. This dimly lit, echoing monument to Edwardian self-confidence was to be the venue of a Very Important Software Announcement.

In contrast to the studied shabbiness of the media, the trio on the platform were sleek and pinstriped, exuding experience and confidence. On the left Desperate Dave Tebbutt, bearded and beaming computer journalist extraordinaire; at the centre ensconced on a massive throne, Bill Barrow, tall and distinguished, late of Data Logic; on his right Alan Wood, smaller, Irish and positively fizzing with energy. Lurking at their feet was a packaging expert whose name noone caught.

"Good Morning Gentlemen" greeted Wood, cheerfully ignoring the fifty percent of females in the Press Corps. He got no further. For a great sound of hammering punctuated by strange oaths, arose as if from Hades, reverberated around the rafters before returning earthwards to drown out that beguiling Irish brogue. The rarely heard sound of

the English workman.

The conference was adjourned to the bar, where with refreshment in sight, the scribes settled down to absorb details of an intriguing new publishing venture.

Caxton is to be its name, and like all true publishers, it will commission, edit, promote but not *write* software for micros. Authors will receive encouragement and commission. "What we are looking for is the Freddie Forsyth of Software" said the quotable Mr Wood. The new imprint is to concentrate on Apple and CP/M programs, but should also be amongst the first to launch products for 16-bit micros.

"What would the first product be", asked a pretty girl from one of the trade papers. Aah! That was a secret but the packaging was ready.

Catching his cue, the unnamed packaging man flourished a box, announced that he was a very naive person, and sat down again.

A deal with a major American Software house was hinted at. 'Lifeboat Associates' concluded the trade press, nodding knowingly. Wood was saying nothing, but he did switch on an Apple. The program was Olympic Decathlon by Microsoft.

This could be the start of something big.

Caxton are at 10/14 Bedford Street, London WC2. Telephone 01 379 6502.

WORLD SCOOP

Stop the presses! Hold the front page! The Twinlock Stationary people have discovered an amazing new device which will shortly revolutionize business as we know it.

Their press release which is headed 'Embargo Not for publication or broadcast, before 00.01 hrs 20th October' quoted their National Sales Manager, a Mr Wharton, on this exciting new invention: "We at Twinlock have a record of innovation, introducing such innovations in their times as loose leaf binders, machine accounting equipment, suspension filing and one-writing systems.

The provision of filing for floppy disks and the disks themselves is a further step..." HOLD IT Mr Wharton. Floppy disks? New? Innovation?

Silly boy!
Get the presses rolling again.

Kirk Out!

With Captain Kirk, Mr Spock and the delicious Lt. Ohura all flying PETs in the third Startrek movie, you would think micro computer designers would have cottoned on to the sales appeal of the space age before now.

David Swale of Traffic Technology has. He has designed a desk console for the Sinclair computers. Apart from recesses to take the ZX80 or '81, there is room for expansion RAM, cassette recorder, pencils and pocket phasers.

A control panel has an LED power indicator and switches that earth the unused input to the computer or recorder.

Cheques for £29.99 should be beamed down to Mr Swale at P.O. Box 2, Warminster, Wilts.

Kirk out.

AUNTY ALLASON'S AGONY COLUMN

Dear Aunty,

I am 22, single, blonde and run my own small business. I find my PET takes too long to store and retrieve information on tape, and anyway I can't get cassette files to work properly. Unfortunately £695 for a dual floppy disk drive is more than I can afford. Please help. I am getting desperate.

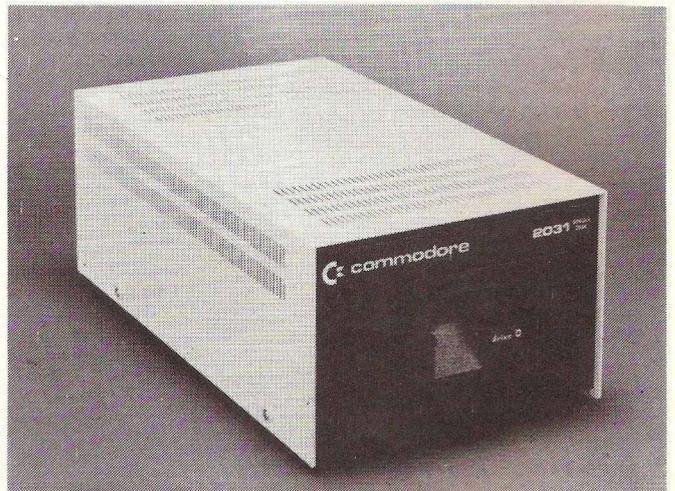
Debbie

Dear Desperate Debbie,

The answer to your (and many a maiden's) prayer is Commodore's

new single floppy disk drive, which costs £395 plus VAT. Just released, it provides 171K bytes of storage and should be compatible with most existing software. The only drawback is that you won't be able to make back up copies as you can with a dual drive. As it happens my nephew Julian is passing your way on Saturday evening and has generously offered to give you a personal consultation.

Aunty



by Julian Allason



'Three' for the road **Multi user Macho Magic**

This is the computer they dubbed the Edsel of Micro Electronics. It has been more roundly criticised than any other personal computer ever. Even its operating system is called S.O.S.

Apple III. It goes on sale this month, at £2695 plus VAT and including VisiCalc, and I have a suspicion it will make Apple richer and more powerful than ever.

So what has happened since its US launch and dramatic Titanic style disappearance ten months ago? Quite a lot it would seem.

features; Business BASIC; UCSD Pascal (the best and, please-God, the standard implementation); VisiCalc; the Applewriter III Word Processor; Business Graphics III, a package to generate line, pie, and bar-charts from VisiCalc or other data files; a communications package called Access III; and something called Script II which is apparently used to format and print Pascal editor files.

When you analyse it that list doesn't look quite so impressive. However software houses

nowhere in any of the specs, technical backgrounders, and overviews, let alone the brochure, is the floppy disk capacity given. Another interpretation is that a double density drive is imminent. Up to three more floppy drives can be added externally however.

What Apple have done is upgrade the original 96K of RAM to 128K - to outgun IBM, it is said, of whom they are understandably nervous.

More importantly Apple III is now being offered with the Profile mass storage system. Although hard disk devices have been available from other vendors this is the first time Apple have introduced one of their own.

At any rate Profile offers 5 million bytes of online storage, which is equivalent to 35 Apple floppy diskettes, and accesses data ten times as fast.

"The storage capacity of Profile will bring true database management applications to personal computing for the first time" says Apple's President, Mike Markkula, cheerfully ignoring the existence of sundry other micros offering hard disk; not to mention the absence of any true database software for Apple III. Perhaps he knows something we don't.

Profile costs £2256 plus VAT, and up to four can be connected.

Apple III needs further digestion but I suspect the doomsters may be indulging in some dangerous wishful thinking.

A mess-mate, whose opinion I value, recently had to spend several sunny weeks in California, poor fellow, looking at the coming generation of multi-user micros. He came back with a short list of three.

One of them was TeleVideo's TS Series now available here from Encotel of Croydon. It is hard-disk based, the largest model being capable of supporting up to 16 intelligent work stations (!) under TeleVideo's own operating system MmmOST (try saying that after a glass or two of Californian 'burgundy'). I think it must stand for Multi-user, multi-tasking, multi-processor Operating System. Either way it links local work stations running CPM.

The hard disk systems feature 5 1/4" mini-Winnies or 8" Winchester, so we are talking about 23.5 megabytes of storage. Cheap it obviously ain't.

TeleVideo, one of the world's largest manufacturer of computer terminals, have based the TS system on a single board design with a Z80A CPU. An odd choice of chip perhaps, at a time when the tide is running in the full 16-bit direction? To keep the number of components down they have used 64K bit RAMs, which must make them one of the first volume users of 64K chips.

Obviously this isn't a system for small businesses, but as Encotel's M.D., Bob Jones remarked: "Why share one Z80A between four users when, at little extra cost, 16 users can have one each?"



Although the first Apple III I tried worked, most of the others didn't and were displaying a marked tendency to get hot and bothered. Apple watchers tell me the company have now licked these problems, although not without considerable loss of face and dollars.

Problem number two was software. There wasn't any to speak of. That's been put right - up to a point. UK dealers will be offering eight packages: the aforementioned SOS (pronounced Sauce!) Operating System, which has some fascinating and novel

currently offering Apple II products are positively falling over themselves to announce applications packages for the new machines. Indeed Vlasak already have a networking package called Orbit. So the Brits may yet bale Apple out.

The third problem, although it wasn't clear at the time, was online storage capacity. The trade had expected something more than the measly 140K bytes offered by the single built-in disk drive.

I suspect Apple are still a little embarrassed about this, as

Printer Progress

It is no more than a matter of months since the wise ones were shaking their venerable heads over the products of premier printer fabricator, Centronics.

Now marking the place in my penny dreadful - "Cybernetic Campaigns - tales of chivalry from the edge of the Galaxy" - is a very interesting press release.

Centronics, a company possessed of a certain gravitas, are promulgating a printer that is,

well, flashy; there is no other word for a dot matrix device offering proportional and fixed space printing, true descenders, expanded print, compressed print, under-lining, superscripts, subscripts and a whole panoply of word processing features.

The flash one, more properly known as the 739, will cost you about £500 + VAT, and print 100 characters a second.

ZX81 Lab

It is a relief to learn that others share my resistance to manuals.

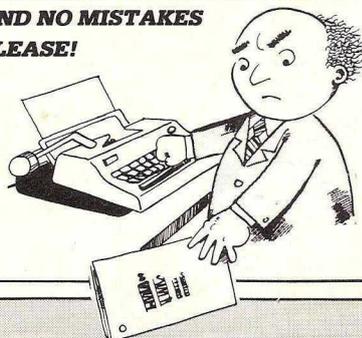
Uncle Clive has put his Sinclair BASIC manual onto cassette. Eight cassettes actually. Six contain programs demonstrating aspects of ZX81 programming, whilst two are blank for you to use. Not bad value for £19.95

But what's this? The 'Learning Lab' (that's what he calls it) comes with a 160 page manual.....

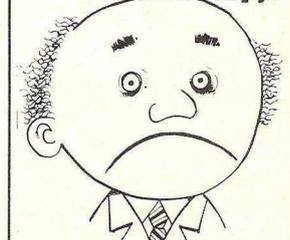
Is there no escape?

Meet Mr T.A. Mibs (The Average Man in Business) whose cartoon adventures illustrate different aspects of word processing. Congratulations are due to computer dealers, Intex Datalog Ltd., on a novel way of explaining a complex subject. Ring them on Eaglescliffe 781193 for a free copy if you are interested in word processing.

AND NO MISTAKES PLEASE!



... now do me another copy!



What's in a name?

Brace yourselves, PET-lovers; it is about to happen again! First some history.

After two years of building the PET into Britain's best known micro, the Commodore, in an entirely uncharacteristic action of folie de grandeur, changed its name to C.B.M. You know, like I.B.M. Inexplicably, some eighteen months after this masterstroke of marketing, it is still universally known as the PET.

When the big screen 80-column PET appeared last year, this column duly christened it the Super PET. The name stuck.

The next product to surface was the fascinating hybrid PET developed at Waterloo University, in Canada, with two processors - a 6809 to execute 16-bit code, as well as the standard 6502 - 96K of RAM, and is exceedingly powerful.

Some prodigy at Commodore came up with the name *Micro Mainframe*.

Just as we were all getting used to that, it was learned that said prodigy had done rather less than his homework; someone else already owned the name *Micro Mainframe*.

What then to call it? The Commodore Obfuscation Committee were swiftly convened. After due deliberation they have now arrived at a sublime solution. Henceforth the *MMF* shall be known as the *SuperPET*.

It remains only for the Commodore's goon squad to uncover the identity of our prodigy, and administer the requisite retribution.

Whisper it not then that he sits no more than a pace or two from my desk, wearing the green eyeshade that is the badge of his present office.

Light Program

Have you ever used a light pen? Nor had I until recently. What a revelation it was.

A light pen can be thought of as a pointer used on the computer C.R.T. With it you can select from menus, and move, or modify the images on the screen. Pointing at the screen is actually much easier than manipulating a keyboard.

Here's how it works. The image on the screen is actually made up of a single spot scanning back and forth across the C.R.T. So swiftly does it move that the image appears to be static. In fact the whole image is being updated and redrawn 60 times each second.

The light pen has at its tip a photo-cell. When the pen is pointed at the screen, the photo-cell senses when the spot passes, and sends a signal back to the computer, which calculates the position of the pen on the screen. The computer can then perform its preprogrammed task, which

might be to move the cursor to that point, thereby avoiding the need to use the cursor control keys.

Light pens are widely used on graphics terminals for computer assisted design, but they can also be employed to speed up the more mundane tasks of data entry.

In response to the question "WHAT COLOUR IS YOUR HAIR?" it is quicker to point to one of: BLACK: BROWN: RED: BLONDE than to type in the answer.

A very superior looking light pen for the PET is made by Altek Instruments of 1 Green Lane, Walton-on-Thames, Surrey. At £149 + VAT it isn't exactly a snip, but you are getting a professional quality product with a touch switch, stainless steel case and its own interface to PET BASIC.

Altek have also produced a free booklet called 'Understanding Light Pens'. I recommend it if you are interested in learning more.

156 172	180 184	135 139	141 142	151 171	181 186	159 175	189 190
166 153	150 169	165 154	173 158	157 174	167 155	182 185	183 187
138 133	168 148	162 145	161 146	137 134	152 164	163 147	178 177

MAGIC NUMBER IS 319

"In the last resort read the manual." Tommy probably had his tongue in cheek when he quoted this classic piece of programming lore. Having waded through some truly awful manuals in my time, I can but sympathise.

One of the most thoughtful features of the *Wordcraft* word processing software is its crib card, summarising the various text editing commands. How nice, I thought, of someone were to do an equally good job potting BASIC manuals.

Someone has. The someone is actually a husband and wife team called Paul and Shirley Nanos. They have produced a simply superb BASIC and Assembler Reference card for the Tandy TRS-80. It is, as far as I can judge, accurate to boot.

16 pages concertina open to reveal a Level II memory map, what are described as "Resequence Graphics Characters for quicker eyeball contact", a useful summary of the Z80 language, Editor and Assembler commands, BASIC and System commands, screen layout addresses, and a whole lot more. I reproduce the graphics section complete with a "magic" number for graphics, the exact use of which I leave up to you to discover.

The reference card has clearly been designed for the TRS-80 Model I, but Model III users should find it equally useful. An International Money Order for \$6 to Nanos Systems, P.O. Box 24344, Speedway, Indiana 46224, USA (wonderful address!) secures one.

PET, Apple, Sinclair etc entrepreneurs please copy. There is money to be made here.

Do-it-Yourself ZX-82

For some reason Uncle Clive Sinclair has not taken me into his confidence about the ZX-82.

There will be one; we know that much. But what will it be like?

Since my own sleuthing has revealed nothing more than the fact that Uncle Clive has a weakness for Scampi in the basket, I thought I would throw the matter open to you, dear readers. Design me - on one side of single sheet of paper - your conception of the next Sinclair computer. The one most closely resembling the new machine when it arrives will receive a ZX-81, or, if I can twist Uncle Clive's arm, a ZX-82.

I would like a sketch, a brief list of any *new* features you feel may be incorporated, and your prediction of the eventual selling price.

It is usual in such competitions to exclude employees and advertising agents on the grounds they might have inside knowledge. In the interests of espionage, I think it would be more fun if we didn't. Young Crispin Sinclair once won £10 offered by Desperate

Dave Tebbutt to anyone who could reveal the author of ZX-80 Basic.

For what it is worth, Inside Trader reckons the ZX-82 will have a built in miniature flat screen, and the ability to generate colour graphics on a proper T.V.

Closing date is December 31st 1981 or two weeks before the ZX-82 launch; whichever is sooner. Entries to me at P O Box 48, Newbury, RG16 0BD. I will print the most interesting designs as they are received, with 12 months free subscription to all published.

A Good Read

Several readers have asked about PET Newsletters. Commodore UK's famous Russian organ, CPUCN is splendidly transformed into *Commodore Club News* at £10 a year. I also recommend the independent American newsletter *The Paper*, which costs \$30 for a UK subscription from 98 Emily Drive, Centereach, N.Y. 11720.



by Julian Allason



Software on T.V.

BBC TV will soon be broadcasting some original programs (which will make a nice change after all those repeats). Yes, I did say programs – not programmes. *Tomorrows World*, as part of a special feature on Personal Computers scheduled for December 3rd, hope to transmit at least one micro program.

Sinclair owners should be able to record the program as a short burst of sound with a microphone onto a cassette recorder. The theory is that this will then load like any other program.

The original plan was to broadcast programs for the PET and Apple. But as I warned Trevor Taylor of *Tomorrows World*, this probably wouldn't work. Alas, Commodore's cassette decks are modified to accept pulse position modulation instead of frequency modulation so the

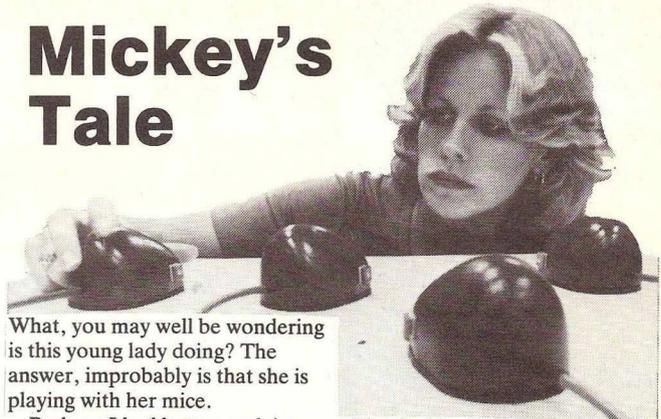
signal wouldn't broadcast satisfactorily. Commodore's recording is also faster than Sinclair's and hence far more liable to error in reproduction – as commercial cassette software duplicators have discovered to their cost.

As for Apple, hardly anyone uses cassette any more. So Sinclair it is.

The Editor, a confirmed pessimist, reckons there is about half a per cent chance of the experiment working. I'll just pray that the Murphy family (of legal fame) are on holiday on December 3rd.

Footnote: If you tune in you should also be able to hear our Votrax speech synthesiser say its party piece. I deny all responsibility for anything it may say.

Mickey's Tale



What, you may well be wondering is this young lady doing? The answer, improbably is that she is playing with her mice.

Perhaps I had better explain.

Comshare are very much the big banana in computer services (for which read 'time sharing'). A fattish part of their profits have derived from financial modelling during recent years.

Then, Sapristi! Along come *Micromodeller*, *Plan-80*, and the other financial planning packages running on cheap personal computers.

The prospect of a mass exodus by blue chip clients being rather less than beezey, Comshare's UK management react by trying to buy Intelligence UK Ltd. purveyors of *MicroModeller*. At the last moment, however, a cable arrives from Comshare's Stateside H.Q. saying "Intelligence Acquisition Situation Negated."

The deal is off but no-one is quite sure why.

I think I have the answer. It is called *Execuchart*, and it is Comshare's own stand-alone computer-aided graphics system. What it does is turn facts and figures into brightly coloured bar, line and pie charts.

Just like *MicroModeller* et al. But at about ten times the price. However, we shouldn't forget the mouse.

The mouse, so named for its shape, tail and buttons/eyes is an electromechanical rodent, which, when moved across a special pad, causes the cursor to move on the computer screen.

It is a great idea, first dreamed up at Xerox's Palo Alto Research Centre, and much easier than using cursor keys but I dunno that I would want to pay the extra £27,000 for a mouse.

Back to the drawing board, Mickey.

Very Silly

Microcomputer manufacturers appear to be engaged in an energetic competition to discover who can put out the silliest/most misleading press release.

As a warning to others I shall be printing one of these each month with the name and telephone number of the person responsible.

To set the ball rolling, I offer you a neat piece of (I think) self-parody from Digital Acoustics Inc. of Santa Ana, California.

"*DTACK UNBOUND* has announced its entry into the burgeoning 68000-based small business computer market. The system is utterly unique, having a keyboard, CRT, dual floppy disks and compatibility with several letter quality printers..... Asked whether the language implementations were standard Mr Slick (sic) stated: "Our languages are the standards. Any differences with other implementations are the result of deficiencies in those other implementations" The price of the DU68000 is said to be "quite reasonable, given its fantastic potential". Delivery is estimated to be "soon".

Quite.

Mystery Corner

I have seen the future, and it works. Oh boy, how it works!

It is a 16-bit computer created by a famous micro designer (clue: he developed a well known chip and an even better known computer; not the Apple - for whom he once worked).

It is more than twice as fast, and will be less than half the price of comparable machines.

It has the best high resolution graphics I have seen on a micro, and the cheekiest demo program. Screen brilliance is adjusted under software control: just consider the possibilities of that!

It is also embargoed until a week after this issue goes on sale. An embargo is like a time bomb in reverse: if you break it before the appointed hour, all sorts of trouble blow up.

So I am afraid you will have to buy next month's issue.



Ah yes, bar codes! You will have seen those little grids on your Shreddies (on the box, dummy!), or disfiguring the cover of American magazines.

The idea is that the light sensitive wand is 'stroked' across the code and converted into a number the computer, which might be a till, can compare with those stored in its memory. Appropriate price or stock control calculations can then be made.

The neat little unit illustrated above is a code generator from Sound Techniques Ltd. of Mildenhall, Suffolk. It will accept serial characters from any computer and produce both conventional text and formatted bar codes on a low cost dot matrix printer.

I really must take Sound Techniques to task for gross sexism, however. The other photo they sent showed, rather unsubtly I thought, a blonde person behind bars in her birthday suit.

Naturally, after a democratic vote by the Independent (Feminist) Chapel of our union we decided to throw out this chauvinistic rubbish and print the more interesting, more responsible picture of the reader unit you see above.

Memo to Editor: Richard, see if you can sneak in the picture of the naughty little number when the girls are out at lunch.



tions and the programs necessary to use them) feel they are stepping out into the dark, unsure of the difficulties they are likely to encounter.

This is not an isolated phenomenon, the realms of corporate finance, tax allowances and private company share valuation are equally complex and difficult, but in these latter fields most businessmen have built up relations with specialists whose advice they can rely on. The computer is an animal isolated from the everyday reality of running a small to medium-sized business. It seems to be an electronic world of boffins who, unlike accountants and bank managers, do not speak the everyday language of business. This breakdown in communication is certainly the fault of the computer industry, since if it were not for their business customers, they would be out of a job. Nonetheless, mystery can make for easier sales. Low cost micros are bringing computer people down to earth, but it should be remembered that if a micro user does not understand some technical difficulty, it is not the user's fault but the computer specialist's. It is unfortunately true that many bad micro systems are being bought and are losing their users money because of this diffidence bred by technicalities which are irrelevant in most cases.

...The system has full security controls, unfortunately we can't understand how to use them from the manual, so we ignore them.

Financial Controller.

If there were no fools and no rogues, then we would live in a much better world than the one we have, but it is worthwhile remembering that the only reason fools and rogues prosper is because they either live off each other or they feed on honest men who allow them to:

These days, with more and more businessmen computerising at least a part of their operations, we have to ensure that the computer cuts down the scope for fraud and bungling. It is hard enough to keep a company solvent with market forces as they are,

without loading the odds against yourself by making fraud and inefficiency easy.

The possibilities of corporate bungling have been increased lately due to two main factors: the relatively inexpensive microcomputer, and the availability of cheap off-the-shelf software packages. The elimination of costly and labour-intensive clerical tasks by micros has led many businessmen to look closely at the savings offered by a fairly unsophisticated microcomputer setup. The problem is that disinterested professional advice is hard to come by, so many micro users (non-computer people buying installa-

Security

This article sets out to provide a very basic run-down on some of the things that can go wrong and cost a company money, and it is hoped that a simple systematic approach to user requirements will breed confidence and eliminate loss.

Going back to the Rogues and Fools, all computer security boils down to Controls, the checking procedures which will detect both fraud and error as quickly as possible.

Many of the people buying micros are First Time Users; they have never had a computer installation before. General experience

Micro COMPUTER CRIME

What it is. How it's done. How to avoid it happening to you.

By Kevin Delaney

shows that they have a very good idea of what it is they want the computer to do for them, but there are many areas which they do not consider, and *security is the one most often overlooked*. Be warned: this can be an expensive oversight. A computerised accounting system will have to be audited, and if the system is "Up and Running" before the auditors are informed, there could be expensive surprises in store.

Fairly large companies have been known to buy systems which their auditors subsequently informed them were totally deficient for audit purposes. The ideal system will provide an exhaustive Audit Trail (the means of tracing all transactions through the system from, say, order taking to customer payment) so that specimen random transactions can be checked from beginning to end. In real terms this is not always feasible, but it is a useful yardstick for system control.

Even if auditors are brought in from the outset to ensure that a system meets their requirements, bear in mind what those requirements are. The auditor must be happy that the accounts present a fair and realistic picture of the firm's trading position. If there are obvious possibilities for fraud he will say so, but he is not a walking security consultant. The user should have far higher security standards than that.

If an auditor tells his client that a system is so deficient that a Qualification has to be written into the accounts, then remedial work on the system will be very expensive indeed. It is always cheaper to do the work at outset than it is to bodge up later.

The Drip and The Tickle

This leads us on to the question of possible fraud and the ways in which it is likely to affect a business. The two broad categories will be the "steady drip" and the "big tickle".

The *steady drip* is going to be the work of an employee. It will result in the regular theft of small amounts, establishing a pattern at such a level as to be unnoticeable in any overall trading figures. The auditors will not see any massive fluctuations to put them on guard and neither will management. This type of fraud can only succeed where there are inadequate checks and controls in a system, or where controls are ignored. The only good thing about it is that, being parasitic, it needs the host business to continue so it is unlikely to bankrupt anyone.

The *big tickle* is every crook's dream and

should be every management's nightmare. It is the sudden theft of large amounts of cash or goods, and it can be perpetrated by anyone, with or without inside help.

Other things one has to guard against are extortion, vandalism and the disclosure of confidential information.

Dealing first with the completely "in house" fraud, it is necessary to look at the level of technical expertise among staff. This will give an indication of the danger areas to be studied. Software can be acquired as off-the-shelf programs or individually written for specific tasks.

Secret Accounts

High level, sophisticated fraud consists of altering programs so that they do more than they are supposed to. A well tried *steady drip* works on the rounding principle. Typically, the program will be altered so that each time the calculation of a sum such as a commission percentage results in a rounding down, the surplus fraction of a penny is accumulated in a specially prepared account which is periodically milked. Similar program alteration can be applied to such calculations as salesmen's commission figures, where instead of rounding, a periodic deduction of a penny or two is made, since this is unlikely to be noticed after tax and other deductions, where there are dozens of items per salesman per month.

To carry out a fraud of this type, there must be a highly qualified employee on the fiddle, and many installations manage without computer professionals. It should be remembered that micro installations are not always small. Indeed, the attraction of micros is that, even now they can support seven terminals, either video display keyboards or printers. Within the next twelve months, this capacity will be greatly increased, and first time buyers are likely to progress to the stage where they set up a full-blown Data Processing Department staffed by specialists. One strange thing about members of Data Processing Departments is that they tend to think of themselves as computer people since they come from a computer background and they may lack some of the ingrained loyalty of staff brought up in the employer's trade. It is not unusual to hear a man who works in the D.P. Department of a retail shoe chain say that he is in computers, when asked what he does for a living.

Self Defence

At the sharp end of computer fraud an employer's defences are twofold. The first is to ensure that there is only one person who could possibly have done it, and the second is to have systems geared to eliminate or minimise losses. Unauthorised program alterations can be detected by specialist security consultants, but this costs money, and would have to be done on a random check basis to stop a thief replacing the correct program when he knew a check was due. A more practical approach is to have systems and audit procedures which can run spot checks internally to detect any shrinkage as transactions move through.

The cheapest and easiest means of stopping any fraud is to establish the tightest possible control over the fraud's end produce — usually cash. It is very easy to fall into a routine of accepting that if the computer produces a cheque listing, all the items on it are correct until a customer queries one. Most *steady drip* frauds involve the setting up of bogus accounts to which the proceeds are credited, and this will do no great harm to a company provided the cash can never be withdrawn from that bogus account. There is no real substitute for the experienced managerial eye here. The computer system can offer a great deal but building in ultra sophisticated controls costs money. In complex systems this is necessary, but in simple ones it may not be cost effective. Careful scrutiny of payments, even on a random basis, is never a waste of time in any installation.

...I don't know exactly how they're doing, but their clerical costs are down.

Junior Partner of auditors

The typical employee fraud is for fairly small amounts, but on a regular basis, and is not limited to the expert manipulating programs. Indeed, it is usually the people with access to terminals and enough day-to-day operating experience to make entries who end up with their hands in the till. Someone finds that there is a weakness in the system by making an incorrect entry that the machine does not challenge, and from there it is only a short step to making similar entries for profit. One accounts employee did just this, the first time out of curiosity and a sec-

Micro COMPUTER CRIME

ond time for profit. At that stage he called a halt because he felt he could easily get into a habit and it would escalate to the stage where discovery was likely. Fortunately, his firm started discussing the possibility of getting a new integrated system and he did his bit to see this was done in case his resolve should waver.

Anyone thinking about buying a micro will have many questions to ask a supplier, and one of them will be "Can I expand the system?"

What goes wrong

This is important from the security angle too, because Integration makes system control easier. To explain integration, let us take a typical case. A business needs to computerise its stock control system, because turnover has reached the point where a manual system will not cope. This is the prime requirement, but payroll may be put on the computer as well. There is no interlinking between these two areas and no cross-checking can be carried out between them. However, it is likely that at some time soon, the customer order system, the production control system and the accounts will be computerised. If this is done using integrated systems it will be possible to cross check all the relevant data arising in any of the separate areas with corresponding figures in the others. The most obvious would be checking invoiced goods against ordered goods against goods despatched, and it would be possible to trace



each transaction through from one system to the other.

...I was glad when we got a new integrated system, in fact I pushed hard for it. It would stop me, anyone, nicking off the firm.

Employee of company with deficient old system.

Integration is desirable but by no means common over the range of software packages on offer. Part of the reason for this is

that software houses tend to specialise in specific areas. If anyone trying to push through a bogus invoice has to manipulate information not only in the invoice settlement program, but in the current suppliers file, the orders placed and received program etc., the chances are they won't bother. Obviously, complete counter checking will not be realistic in most cases, but as long as it is possible on integrated systems a user can select the appropriate level of security for himself. Integration provides better management information and security.

Besides cross checking control totals and other identifying information a micro system will have Validation parameters built in, primarily to detect errors. An example would be a maximum weekly wage check of, say,

Examples of Computer Crime

The Famous Union Dime

Off course bookmaking is illegal in the USA, and one man is very sorry this is the case, because it led to his conviction on charges of stealing ONE AND A HALF MILLION US Dollars.

One day police raided an illegal bookies and found a particular name in the accounts which interested them because this man was betting up to \$30,000 a day. On investigation, they found that he was the chief teller of the Union Dime and Savings Bank, Park Avenue.

Once they checked his income, it was obvious that he was stealing from the bank to gamble and eventually the whole story came out. He was robbing dormant accounts, those where there were seldom any withdrawals. The bank did not issue statements at that time, relying on entries in a passbook to provide evidence of transactions.

The chief teller was in charge of counter staff training and he used computer error correction techniques (supervisor's over-ride) to understate balances in deposit accounts. He was also in charge of issuing passbooks to new customers, and he used to take two books for a new account. One would go to the customer correctly entered, but the account would be opened in the second book's number. Once the customer had gone the second book was torn up, the deposit entry deleted, and the cash pocketed.

Interest was payable quarterly, and he arranged for the necessary payments to be

credited to the accounts he had milked by using the switching techniques already mentioned. Fortunately, quarterly interest payments did not fall due at the same time. Errors were blamed on trainee staff, or on the computer, and corrected in front of the customer. Audits were always done in a standard way, so he was able to move money around as they progressed, and avoid detection.

If only he hadn't been a betting man.

One Little Entry

A man walked into a New York bank one day and saw the manager. He said he was a West Coast businessman, setting up a new factory in the East. There would be a substantial credit coming through from his West Coast bank to pay for the new plant.

In due course \$2 million was transferred to his new account via the computer system used for major inter-bank transfers. Both the man and the money had vanished before the fraud was discovered.

There was no West Coast business and there wasn't even a West Coast bank account; there had simply been a fraudulent entry input into the computer in California.

The entry could have been made by one of four women but since one of them had just resigned from the bank after an unhappy love affair, she was the prime suspect. It turned out that her erstwhile lover and the conman were one and the same.

He had told her that the entry was a joke on

a friend of his who worked as a computer operator in the New York installation. "He'll sure get a laugh out of it when he sees the entry," the conman had said.

He was never caught.

So simple it would make you cry

A young man opened a bank account and was given a chequebook and a paying-in book. Both these books were printed with the MICR (magnetic ink character recognition) system. He analysed the magnetic printing, then pocketed from the bank a sheaf of blank paying-in slips, the type left for use by people without a paying-in book. He took these slips to an office which had an MICR typewriter and typed his own account number on them all. This number was invisible to the eye but recognisable to the computer.

He put the doctored slips in the rack at the bank, a few at a time. Regardless of the fact that customers paying in cash wrote their own account numbers in ink, the automatic computer sorting machine processed their slips and credited the cash to the crook's account. Only slips not bearing MICR codes were rejected by the machine for manual processing.

Eventually customer complaints led to the discovery of the fraud, but by then the young man was gone, and he was never seen again.

£500, so if anyone earned more than this the computer would query it.

Security Tools

There are many similar controls which can be specified by users to improve security, error detection and management information. One very useful security tool which is widely used on mainframe computers is the Exception Report, but it is not so widespread on micro's. This report is mainly for management infor-

mation and lists all the exceptions to normal standard procedure. Suitably drafted exception reports should eliminate all the straightforward steady drip frauds. For example, to attack a "rounding scheme" one could arrange for a Report (i.e. a computer print out) to be prepared each time a very small sum is credited to any account. This will not stop such entries being made but will give details of them to management for investigation. Bona fide entries, such as adjust-

ments will bear scrutiny, but small credits of a penny or two from frauds will not. The criteria for exceptions can be drawn from any users specific needs and could be frequency, showing any unusual level of activity with too many credits being made to any account in a day. The actual figures or limits of the exception parameters are set by the user so that he only has to check a few exceptional entries each day. The whole point of the report is wasted if it is not read and followed up. Many computer crimes have been "detected" or at least indicated by computer systems only to have the warnings ignored or left unread by management or supervisory staff.

THE SCALE OF THE PROBLEM

The figures available on the scale of computer fraud are incomplete because many victims of it tend to keep quiet and avoid the publicity; what figures there are, are frightening.

The Local Government Audit Inspectorate has just reported that out of 319 firms responding to their survey, 67 had discovered some form of computer fraud in the last five years. That is a hefty 21% and the total loss was £905,000. The report points out that firms who have suffered computer fraud loss may well have been amongst those who declined to respond to the survey, to avoid embarrassment. The report also states that white collar crime is increasing, as is the use of, and abuse of computers by sophisticated criminals.

While the average surveyed loss is not large, the frequency of fraud is frightening, with one in five installations being hit every five years.

The result of our own enquiries is disquieting to say the least. Recent investigations of

thirty computer fraud victims showed an average loss of £30,000. With the total number of computer installations, especially micros mushrooming, the annual national loss must be frightening. We calculate the current population of microcomputers at 260,000, of which an estimated 88,000 are used for business purposes.

In the USA, some forms of fraud must be reported by law, and computer crime was showing losses of \$300,000,000 a year in 1978, and increasing all the time. The average take has increased by 70% in the three years since then.

Taking Gross National Product as a basis for comparison, one arrived at a figure of some £31.4m for UK computer fraud last year. Investigators specialising in this area believe the true figure to be significantly higher.

With the arrival of some 80,000 new business computers this year, computer fraud looks set to sky rocket.

The first time user starts with a grain of distrust of the actual micro hardware, although this is usually much more reliable than the software. For this reason, he tends to require printed confirmation of everything that happens so that if the machine Goes Down (breaks or blows up), he can go to the written word and continue in business. The end result is that first time users tend to end up knee-deep in paper that they do not use. Leaving aside the advantages of electronic information storage, it is always much more sensible to produce a little paper and use it. If so much paper is coming out that it cannot be absorbed, then the system should be examined to cut it down.

Detection

Having covered a few of the controls available, let us take the point about acting on information. The trump card with employee fraud will always be increasing the possibility of detection, to a certainty of being found out. Obviously speed of detection is secondary, the

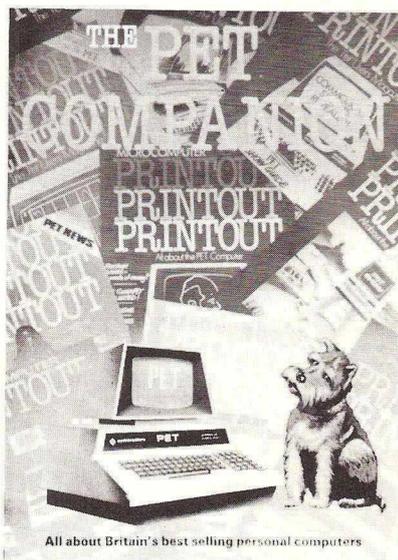
Kevin Delaney is a tax consultant specialising in computer fraud. His background includes accountancy and systems analysis.



"Every PET owner should read it"

Chuck Peddle, Inventor of the PET

"The PET Companion" is a fascinating collection of essential PET information from the pages of *Microcomputer Printout*. It contains all of the editorial from the 1979 & 1980 issues, including 105 PET programming hints and tips, 116 news reports, reviews of 54 peripherals ranging from light pens to printers and 27 major articles on PET programming. All of it written in straightforward English.



Some of the topics covered:

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Programming Style
Graphics
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THE SOFTWARE

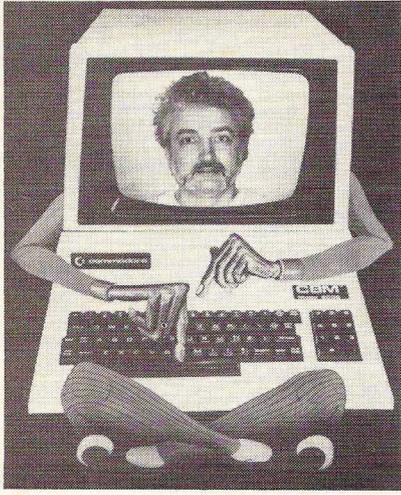
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THE FA

Commodore have launched a new version of the 4032 PET. It has a big screen, but still only 40 columns. PET supremo **Jim Butterfield** recently conducted an exhaustive test and christened it: **The Fat 40.**

A new style of 40-column PET has arrived. It looks like an 80-column CBM, and it has many of the 8000 series features, but it's still 40 columns wide. Because of the big twelve-inch screen, screen characters are large and crisp. I call it "The Fat 40" or more formally "The Fat 4.0 40", since it's Basic 4.0 in a new package.

It looks like an 80 column unit on the outside, except for the label and the graphics keyboard. It looks like an 80 column on the inside - the processor board has the same architecture as the 8000 series. One wonders: is Commodore just upgrading the 40 column units and incidentally standardizing their processor layout ... or will we be seeing a dual 40/80 column unit one of these days?

The Fat 40 arrived with no advance fanfare. That's somewhat of a surprise, since some effort has been made to enhance the features of the 40 column machine. I've seen no documentation yet - I hope it will be available soon, for there are many features which are not immediately visible to the user.

Convenience features

The moment they switch on, users will notice a new feature of the Fat 40 - there's a sounder or chiming device built in. It rings on power up, and whenever you approach the end of a line. If you have two 40-column rows linked together to make an 80-column line, the bell will correctly sound only when you near the end of the second row. The sounder is tied into the CB2 line, which is used for many game sound effects. Now your games will chuckle, chime, chirp and chatter without the need for an external amplifier and speaker.

A number of keys now repeat automatically if you hold them down for a moment. These include the cursor movement keys, the Space bar, and the Insert/Delete key. It's handy to be able to zip around the screen, especially for those of us who make mistakes.

The screen can now be switched from its normal Graphics mode to Text mode (upper and lower case) with PRINT CHR\$(14), and returned back to graphics with PRINT CHR\$(142). The effect is somewhat different than the POKE 59468... command. When the screen switches to text mode the lines are spaced more widely, giving a more pleasing appearance. Some computers may need a minor adjustment of the screen size control if the top and bottom lines partly disappear from the display.

Memory reallocation

New memory locations have been called into

use to allow implementation of the Fat 40's extra features. Standard Basic programs will not be affected, but users should check some of the following locations closely if they have problems.

Location 151 decimal (hexadecimal 97) is often used to tell if a key is being held down or not. It's still useful for that purpose: it will contain 255 as before if no key is pressed. If you have a program that peeks this address to see which particular key is down, you may have problems: the coding has changed and each key is now represented by a new value.

Locations 1001 to 1017 (hex 03E9 to 03F9) are now used by the operating system; if your program uses these locations, better rewrite and use some other part of memory. Some of these locations are changed by the system, and others are used but not changed; leave them alone.

A particularly deadly location is 1003 (hex 03EB). It governs the size of the keyboard input buffer: change it to a higher value (it's normally 9) and you'll be able to type ahead more characters. The extra space used for your characters is in the first cassette buffer - safe enough if you're not using it for something else. The catch is that a value of zero placed in location 1003 gives you a keyboard buffer size of zero, and your keyboard is out of business. It can happen accidentally ...

Decimal	Hex	Usage	80-col
1001	03E9	New key marker	E6
1002	03EA	Key repeat count-down	E5
1003	03EB	Keyboard buffer limit	E3
1004	03EC	Chime time	E7
1005	03ED	Decisecond timer	-
1006	03EE	Key repeat flag	E4
1007	03EF	Tab work value	-
1008-17	03F0-9	Tab stops	03EE-F9

Equivalent locations in 80-column machines are given when applicable. The Decisecond timer is active only in unusual circumstances.

New Cursor Commands

The Fat 40 doesn't have an Escape key, which makes it a bit harder to implement new commands as programmed-cursor characters. It's worth while knowing how to do them since it gives you program compactness. A couple of examples will illustrate how it's done.

Example 1: Ringing the bell. We wish to print HELLO and ring the bell and then continue the line with THERE and ring the bell again.

Start by typing in PRINT "" - be sure to type



“.... not quite an 80 column PET”

even by just loading some programs.

As a result of these new memory allocations, it appears that the second cassette can no longer be used for reading or writing sequential tape files. Most serious file people use disk these days; but users who are thinking of a twin cassette system should approach the Fat 40 with caution.

A brief summary of the new area is given in the following table:

in both sets of double quotes - and then press the Delete key once. You'll be left with PRINT " and you'll be out of programmed-cursor mode. Now type in the HELLO, and then press the RVS (Reverse) key. If you've done it right so far, you will *not* get a reverse letter R printed on the screen. Now we press the G key, and should get a reverse G on the screen. Turn the reverse feature off by pressing shifted RVS, and then type in THERE (don't

T 40

forget the space before the word). To arrange for the bell to ring the second time, we repeat the RVS, G, RVS-OFF sequence.

If you've followed directions, you should have a line that looks like:

```
PRINT "HELLO G   THERE G
```

.. with the G's showing in reverse. Press RETURN, and printing and bell-ringing will all take place as part of the one statement.

This works on the Fat 40 and on 80 column machines, but will not work on earlier (skinny) 40 column machines even with an external speaker attached.

Tab stops

Example 2: Setting and using tabulation stops. We wish to set up tab stops and then print something using them.

Type a line onto the screen that would print, say, the letter T wherever you wanted to put a tab stop. Be sure it starts with PRINT"... and ends with a final quotation mark, but don't press RETURN yet. Now back up the cursor to each T you have typed, and type the following sequence: RVS, Shift-I, RVS-OFF, Insert (Shift-DEL), Space. The Shift-I should print as a "curved corner" graphic in reverse. The line will get longer, but that's all right: the tab-set characters will end up in the right place.

When you've replaced all the T's with the reversed graphic, press RETURN and the tab stops are set. You can clear them later with exactly the same statement. Now let's use these tabs in a print statement.

Enter a line such as PRINT "THIS IS A NICE FEATURE", but don't press RETURN. Move the cursor back and replace all of the spaces with RVS I. This time, you won't get a graphic, just the reversed letter I between the words. When you're finished press RETURN and the words will arrange themselves at the tab positions you have previously set.

It takes a little practice to get used to these new features. They are worth the trouble: they are quite handy. The 8000 series machines have the same – and more – features, plus an Escape key to make coding easier. In either case, you may also use the CHR\$(.) equivalent to do the same job.

Here's a table of the Fat 40 features:

CHR\$	Programmed Char (reverse)	Effect
7	G	Ring Bell
135	Shift G	Ring Bell Longer
9	I	Tabulate
137	Shift I	Set/Clear Tab Stop
14	N	Switch to Text mode
142	Shift N	Switch to Graphics mode
16*	P*	Clear line from cursor
150	Shift V	Clear line before cursor

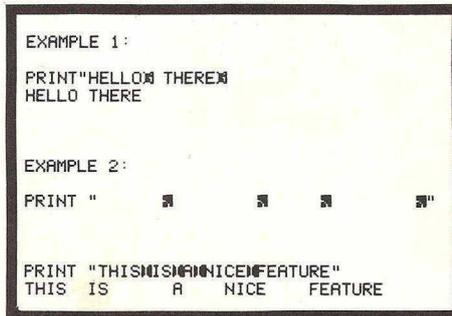
The control character which clears from the

cursor to end-of-line appears to be an error. Compatibility with the 80-column unit and consistency with the other characters suggest that CHR\$(22), or reverse V, should do the job. Instead, it's CHR\$(16) that works on the Fat 40. Since decimal 22 equals hexadecimal 16, one suspects a simple programming oversight has taken place, and that Commodore will correct this one in a subsequent release. In the meantime, I would suggest using both in any programs that you write using this feature: PRINT CHR\$(22);CHR\$(16) .. will work nicely on any machine. The clear-from-cursor feature is very useful, by the way: it allows you to clear a screen line before writing on it.

Not quite an 80 column

Some of the features of the 80 column machine don't seem to be available on the Fat 40. You can't set up screen "windows"; the commands for line insertion and deletion are not in place; and programmers will search in vain for the input/output vectors such as the 80 column provides.

Something that is common to the Fat 40 and the 80 column machines is a standard set of screen entry points. These will be useful to machine language programmers who



want to do certain screen/keyboard operations. The table is given here without details:

E000	Initialise screen
E003	Get a key
E006	Input a line
E009	Print a character
E00C	Interrupt routine
E00F	Timer, keyboard service
E012	Interrupt exit
E015	Clear screen
E018	Set text mode
E01B	Set graphics mode
E01E	Set CRT controller
E021	Scroll down
E024	Scroll up
E027	Scan keyboard
E02A	Ring bell

It should be emphasised that these entry points do not exist on previous (skinny) 40 column machines. Only 80 column machines and the Fat 40 have them.

Adding it all up

The Fat 40 has many advantages and only a few drawbacks compared to its 40 column predecessors. In hardware, we have a bell and a new CRT controller. The operating system offers us some splendid new features for the screen. On the negative side, the second cassette appears to be virtually out of business and a number of programs will need cleaning up before they can graduate to Fat 40 operation.

All in all, it's a welcome change. Most users will be quite pleased with the bonus features that come with the Fat 40.

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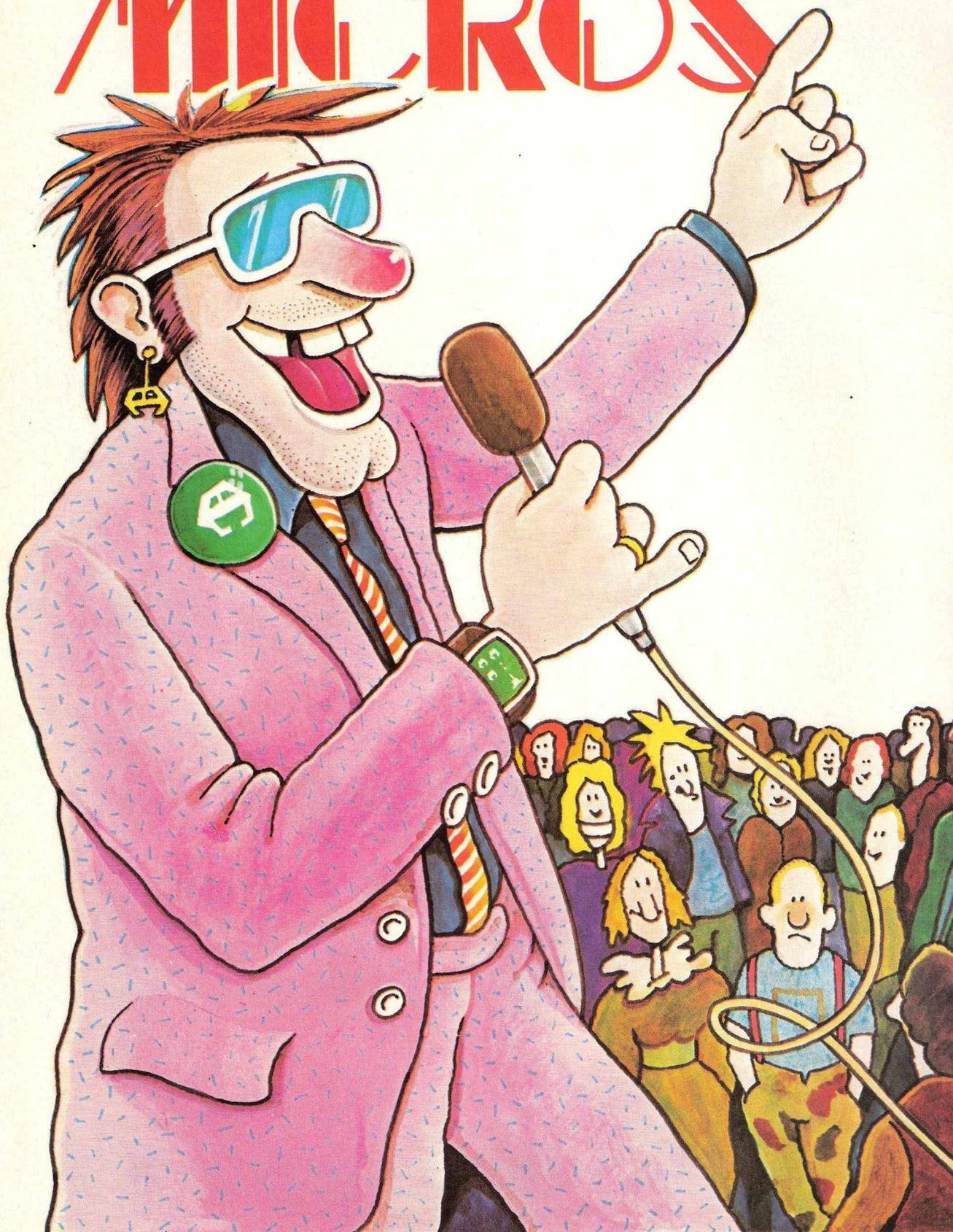
NAME..... ADDRESS.....

..... POSTCODE.....

Syd Punk's

Self-styled Peoples Computer Spokesman, Syd Punk, presents a new wave guide to his ten most popular micros.

TOP TEN MICROS



1

2

3

4

5

6

7

8

9

10

PET Another crate with a load of fantastic games programs – and they're real cheap too. Pity the telly's attached to the unit – can't rip it off and heave it through the window! Like the large screen best – get more space to play games on. Little screen's a bit cramped, to say nothing of the Michael Mouse keyboard on the cheaper versions. Been around a long time though – so me and me mates have got to know it inside out. Lots of other punks got them too – so we can swap (rip off) all that expensive so-called copyright software. Saved 400 quid on a fantastic word processing program – about 20 of us are using it now. It's great for threatening letters. Got one of them Prestel adapters too – sending really rude messages to me mates using this new Mail Box facility – wot a laugh, and it's cheaper than the Post Office. Me old man's got one to run his debt collection business too. He says the new 8050 disk drive's got enough capacity to keep tabs on every shopkeeper between here and Putney Bridge. Never replace bicycle chains though.



ZX-81 This one's so small I nicked it from Smiffs. Just put it in me jacket pocket and ran like the clappers. Bells going all over the place. Asking for bovver leaving computers lying around like that. Knocked off some cassettes as well – though there was only half a dozen to choose from. Dunno if it was worth it. Gave it to me kid sister – she's got to start somewhere. Just hope she don't get too many ideas and get her sticky mitts on my PET. Funny though – me Dad seems to like the ZX-81. He sits in front of the telly with this on his lap. (Mum says she prefers Coronation Street). He's got so annoyed with the 1K memory though that I'm going to have to lift a 16K expansion unit for him.



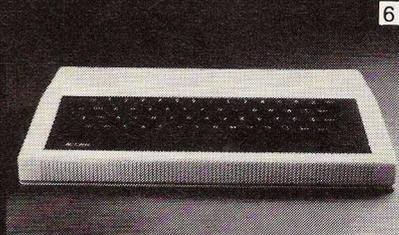
APPLE Great for playing Space Invaders. These colour crates are really fantastic – especially with sound. Can't get on with the keyboard though – too easy to push the reset button and crash the bleeder. Amazing load of programs available – lots of games, and they make fantastic use of the high resolution graphics. Frigging slow on number crunching – and the word processing software leaves a lot to shout about. Can't write a letter to *Sounds* without going through the most incredible hassle. Good bit of kit for kids; dunno why it's so popular with the City crowd. My Probation Officer says it's also popular with them nurds wot study Computer Science at school, apparently they can run Pascal and CP/M just by plugging an extra card in the back. Mind you, never could understand the need for all those poncey new languages – I mean, BASIC: even the word's got style!



TRS-80 The original model I is a bit long in the tooth now. Got into the Model III – seems a far better bet. Mosied down the local Tandy store and showed me brass knuckles to the assistant who obviously knew sweet F.A. about computers. Great fun! He got really uptight. Lots of programs for the III – most of the old model I stuff runs with a bit of prodding around. Well made crate – bashed it around a bit with the knuckles and it seemed to be OK. Liked the idea of hooking it up with fifteen others. Got all me mates in and we were swopping programs and things – like sending messages. Bit primitive though, when compared to the Atom network.



SHARP MZ-80K Another Mickey Mouse keyboard crate. Can't get used to them meself. Me fingers keep pressing two keys at once. Graphics are full of space ships, tanks and the like – again great for games but little else. Integral cassette player useful – see Video Genie – wish it had BASIC, or something, in ROM. Takes ages to reload if one of me mates pulls the plug out for kicks. The built-in speaker's evidently designed for head-banging – you can't adjust the volume!



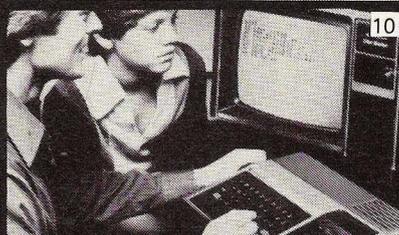
ACORN ATOM Didn't rate this when it first appeared but I'm beginning to change me mind. Got quite a bit going for it now – cheap colour graphics. Naff awful BASIC though. Alright if you want to control something but difficult for simple games. Like the idea of 255 of them being connected up to one central console. That really gives you POWER! See the Beeb's gone and modified one for its show. Hope they've got over that peculiar BASIC problem. Lots of me mates built them from kits. Didn't really save much money – but kept them off the streets for a few nights. Fuzz should dish them out at youth clubs – might get the local crime rate down. 12K RAM is a fair bit of memory for a £175 machine.



RESEARCH MACHINES RM380Z Only ever seen this in schools – nobody else seems to want 'em. Heard one of the teachers sounding off about Government strong arm tactics, fascist tendencies, etc. Wish I knew what he was on about – sounded interesting – especially the fascist bit. Really well built crate – you can throw it out the third floor window and it still carries on working – we tried it. Great fun. Needs a lot of bits and pieces to do anything useful. The hi res graphics are quite good for drawing pictures of birds, but the whole thing's a bit of an egg-head's machine. All those four-eyed weirdos in the sixth form doing Computer Science are about the only ones who seem to spend much time on it.



VIC-20 Only played with this at one of those exhibitions in town. Unfortunately it was glued down. Managed to kick some kid off the machine and played with it for three hours. Survival of the fittest, my Social Worker calls it. Good colour and a decent keyboard, which makes a change on these cheap computers. Pity there's only 22 characters to the line. Liked the plug in modules – easier to pocket than a disk. Won't be able to copy the programs so easily, which means nicking the ROM packs. Got great potential though. I'm going to hang around until a 40-column version comes out before "acquiring" one. Sound and colour were pretty good – there's even a White Noise Generator so it should be possible to play some really decent music. I mean, who wants *harmony* for cryin' out loud!



VIDEO GENIE Cheaper than the TRS80 Model I – and runs all the same programs. Liked the cassette deck being integral with the keyboard. Me mates always rip off the cassette player if it's separate. Idiots think they can play their Sex Pistols tapes on them. Usually find the cassette player with a boot print in it 'cos it's got no speaker! Like the idea of both T.V. and video output. Some games programs don't seem to like a T.V. and have to use a monitor to get best video. Crates a bit large, though. Awkward to carry around. Bit ugly also. Still programs are cheap – and me mates with TRS80s can let me have copies for nothing.

TEXAS TI99/4A Couldn't stand the old Michael Mouse keyboard. New one's a lot better – and they've knocked a few hundred quid off. By far the best of the lot for games, though it doesn't seem to do much more. Great idea the sound synthesiser though. Programmed the one in the local library to shout certain oaths at the passing old dears – fantastic.

TOMMY'S TIPS

In this month's thrilling installment, there are a couple of small PET programs, one totally useless but quite fun, the other quite useful but otherwise of no interest at all! The useless-but-quite-fun program is called 60 times per second by the PET's internal clock, and moves the whole of zero page onto the top of the screen. You can then run a BASIC program and watch the display flashing the values as they are changed by BASIC. The only problem is that you cannot LOAD a program when this routine is running, so you must load the routine. LOAD another program, then start the display. I think it's worth it anyway!

```
10 DATA 162.0,181.0,157.0,128,232,208,248.76,85,228,120
20 DATA 169,128,133,144,169,2,133,145,88,96
30 FOR I=640 TO 663 : READ J : POKE I,J : NEXT
40 REM 1 LOAD AND RUN THIS PROGRAM
50 REM 2 TYPE OR LOAD ANOTHER PROGRAM
60 REM 3 TYPE SYS 653
70 REM 4 RUN THE NEW PROGRAM
```

Spaced-out!

Now to the quite-useful-but-no-fun-at-all-program (sounds like the Editor, he's Q.U.B.N.F.A.A!) A common trick to try to reduce the space taken up by programs is to leave out all the spaces, but this means that the program can be hard to read. The Q.U.B.N.F.A.A. program runs on any PET and any Commodore disk, and copies the program to another file, putting in extra spaces as it goes. You can then load the new program and list it on a printer.

```
10 OPEN1:8,0,"0:OLDPROG"
20 OPEN 2,8,1,"00:NEWPROG"
100 Z$= "" : FL= 0 : FOR I= 1 TO 4:GET #1,A$:IF A$= ""THEN A$= CHR$(0)
105 Z$= Z$+ A$:NEXT I:IF LEFT$(Z$,2)= CHR$(0)+ CHR$(0)THEN 600
110 GET #1,A$:IF A$= ""THEN 500
120 IF A$< > CHR$(34)THEN 130
122 IF FL= 0THEN FL= - 1:GOTO 130
125 FL= 0
130 IF FL< > 0OR ASC (A$)< 128THEN 200
140 Z$= Z$+ A$+ " " :GOTO 110
200 Z$= Z$+ A$:GOTO 110
500 PRINT# 2,Z$+ CHR$(0):GOTO 100
600 PRINT# 2,LEFT$(Z$,2):DCLOSE #2:DCLOSE #1
```

Characters and Values

Dear Tommy,

Can you explain the differences between the pairs of functions STR\$, CHR\$, and ASC and VAL. They both seem to change numbers into strings, so what is the difference?

H.C. Lucas

The difference boils down to the different ways there are of storing data in a computer. Numbers are held in a form suitable for use in arithmetic operations, whereas strings are held as a series of bytes, one byte for each character in the string. The value in the byte is determined by what is called the ASCII code. Each character has a unique code, A is 65 and ! is 33 for example. The ASC function gives you the corresponding code for any character. To find the code for the character Z, we would say:

```
PRINT ASC("Z")
```

The 'opposite' function is CHR\$, which is used to get the character from the code. If we know the code of a character is 54, we can say:

```
PRINT CHR$(54)
```

which should print the digit 6. This is especially useful for printing characters which do not appear on the keyboard, or those like CLR, CHR\$(147), which disrupt listings on some printers.

Whereas ASC and CHR\$ involve single characters, STR\$ and VAL work on strings of characters. If we have a value of

4.9 in a variable A, it is held in the best form for performing calculations, not the best for printing. You may want to 'pad' the value out to 10 characters for printing in a table. To do this you first of all convert the NUMBER 4.9 into a STRING 4.9:

```
A$ = STR$(A)
```

Whether you say PRINT A or PRINT A\$, your machine will print 4.9 the difference being that you can now pad the string out to 10 characters as follows:

```
A$ = "[ten spaces]" + A$ : A$=RIGHT$(A$,10)
```

The string A\$ will now always be 10 characters long, regardless of the value originally in A. This means you can print the value in a table where each column is 10 characters wide.

The VAL function just converts a string such as A\$ back into numerical format.

Flag Days

Dear Tommy,

I have written a suite of programs to help my administration. However, one additional piece of information I would be interested in is a routine which would accept a variable containing a date, compare that with the current run date and if the difference is greater than three years, set a flag.

I would be very grateful if you could give me any tips or hints on how to go about this.

Garrick S. Wales

Garrick signs himself as an 'Erstwhile Programmer'. If so, he should be giving me advice rather than vice versa, so I'll proceed on the assumption that he is a 'Would-be Programmer'. The method of solving this depends upon exactly how you define a year. If you want to know the number of days between two dates, you will have to do it the hard way. The way to go about it is to convert all your dates into 'base date' format, that is you pick a base date, say JAN 1 1980, which becomes 1, then JAN 2 1980 becomes 2, FEB 1 1980 becomes 32 etc. Parts of years are handled by having a 12-element array containing the number of days in each month. If you have a date, say 26 March 1981, you start off with 366 (the number of days in 1980), add the number of days in the first two months of the year (because you're now in month 3) and last of all you add 26 for the number of days into March. If you then have two dates to compare, both in base date format, you simply subtract them to get the number of days apart they are.

If your needs are more simple, then this may not be necessary. If you buy a new car on 15 June 1981, then you would hold this date as 150681. To test for the car being three years old and requiring an MOT, all you need to do is to test if the current date is 150684, that is the same calendar date but 3 years on. To give you some advance warning of the dreaded date, you could arrange for the program to print a message if the month is 05 and the year 84, ignoring the day completely.

Incidentally, while searching my Thesaurus for a long word meaning 'would-be', I ended up with 'hell-bent'. Is this what happens to programmers when they die?

Up-tempo

Here we have courtesy of Paul Haley, the first of (I should imagine) a long line of musical programs for the 8032. Following my tip on how to produce a constant note from

the bleeper, the office has been buried in letters enquiring about tuneful programs. I hope that this will give you something to be going on with.

```

210 TEMPO=40
220 POKE59467,16:POKE59464,0:POKE59466,104
230 READ F,D
240 D=D*TEMPO
250 POKE59464,F:FOR I=1 TO D:NEXT
260 POKE59464,0:FOR I=1 TO 10:NEXT
270 IF D>0 THEN 230
280 POKE59466,0:POKE59467,0
290 DATA190,6,150,6,190,6,126,6,190,6,94,6
295 DATA100,2
300 DATA112,2,126,2,112,2,126,2,142,2,150,2
310 DATA142,2,150,2,169,2,190,2,0,5
320 DATA150,8,126,8,150,8,94,8,126,8
330 DATA74,2,62,2,70,2,62,2
340 DATA74,2,62,2,70,2,62,2
350 DATA74,2,62,2,70,2,62,2
360 DATA94,2,74,2,84,2,74,2
370 DATA94,2,74,2,84,2,74,2
380 DATA94,2,74,2,84,2,74,2
390 DATA112,2,94,2,100,2,94,2
400 DATA112,2,94,2,100,2,94,2
410 DATA112,2,94,2,100,2,94,2
420 DATA134,8,169,8,112,8,134,8,94,8,112,8
430 DATA84,2,74,2,84,2,94,2,100,2,94,2
440 DATA100,2,112,2,126,2,112,2,126,2
445 DATA142,2,150,2,0,5,112,2,126,2,133,2,126,2
450 DATA134,2,150,2,169,2,150,2,169,2
460 DATA190,2,201,2,190,2,201,2,227,2,255,2,0,5
470 DATA126,08,2,201,64,8,126,08,8
480 DATA226,76,9,133,71,15,126,08,20,0,0

```

Lunatic Asylum

I was quite taken with the article in October's PRINTOUT entitled 'FREUD OR FRAUD' describing the use of micros as pseudo-psychiatrists (on second thoughts, strike out the pseudo!) It reminds me of an experiment which took place in a lunatic asylum, which is probably the best place to hold an experiment involving a computer. A selection of psychiatrists and patients were given a terminal to play with, and were involved in a question-and-answer routine similar to the ELIZA program described in the article. At the end of the session, each person was asked whether they thought there was another human at the other end of the line, or a computer. It was in fact a computer, and the interesting fact was that most of the inmates saw through the deception, whereas most of the doctors thought they were talking to another psychiatrist! A case of the blind leading the blind perhaps.

A nice pair ...

Dear Tommy,
I am a beginner with a ZX81 and I would appreciate your help with the following. Given a series of 12 values (say N1 - N12), how can I extract these values TWO AT A TIME and multiply them together.

e.g. N1*N2
N1*N3
N1*N4
etc.

R.G. Allen

The way round this problem is to use a special kind of variable called an ARRAY. An array is really just a list of variables, all with the same name, and with a special way of deciding which one you wish to access.

First of all, at the start of your program, you have to 'declare' that you want to use an array. This is done by a 'DIM'statement. In your case, you want to use an array of 12 values, or elements, so you start your program with:

```
10 DIM N(12)
```

This just tells BASIC that you are going to use an array called N.

Array elements are used in exactly the same way as normal (or simple) variables, so if you want to access the third element in the array, you use N(3). N(5) means the 5th element and so on. The next stage is to replace the constant 3 with a variable I; you can access the Ith element by saying N(I). To print all the values in the array, we say:

```
10 DIM N(12)
20 FOR I = 1 TO 12
30 PRINT N (I)
40 NEXT I
```

Now to answer your question. Assuming that you have already put some values into the array N(), the following routine will print out all the products of pairs of values:

```
100 FOR I = 1 TO 12
110 FOR J = 1 TO 12
120 PRINT N(I) * N (J)
130 NEXT J
140 NEXT I
```

I'll leave it to you to find a way of avoiding printing the product of an element with itself.

Lured by the APPLE

Dear Tommy,
I have just moved from a school which has a PET to one with an Apple. On the PET I used to be able to write exciting games using the GET statement to test if a key had been hit, and the continuing if not. The GET instruction on the Apple stops the program until a key is hit. Is there any way round this?

A.O. Allen

You don't know how lucky you are finding two enlightened schools. When I was at school the abacus was considered 'High Technology'! But enough of my problems. Just as the PET has a number of locations devoted to various I/O chips, so has the Apple. The one we want is location -16384. If you say:

```
100 X = PEEK(-16384)
```

you can test if a key has been pressed by saying:

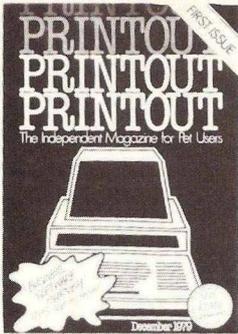
```
110 IF X > 127 THEN PRINT "A KEY HAS BEEN  
PRESSED"
```

and X will contain the code for the key pressed in standard Apple format. Once you have detected a key press, you must clear the flag in -16384 by:

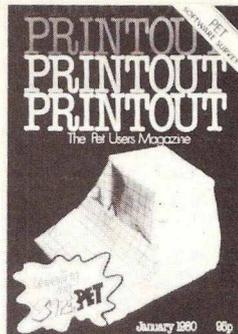
```
120 POKE -16384,0
```

Otherwise the next time you get to line 100 the Apple will think another key has been pressed.

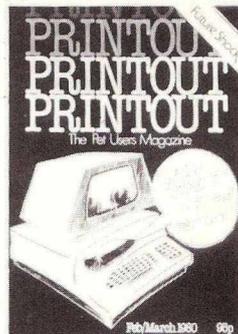
If you have a programming problem or would like a simple explanation of some aspect of microcomputing, write to our resident genius - Tommy, c/o Microcomputer Printout. Beginners and Newcomers queries especially welcome.



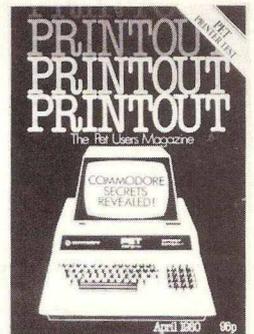
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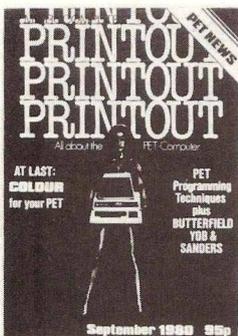
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 PET in Public Relations - A Visit to the Commodore - CompuThink Disk Drive evaluation - Survey of Programming Aids - PET's Video Logic - WordPro II review - Modular Programming (article & listing) - Basic ROM addresses.



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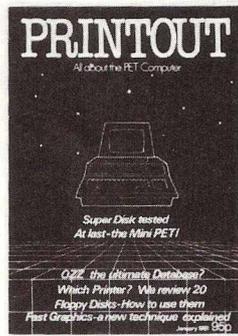
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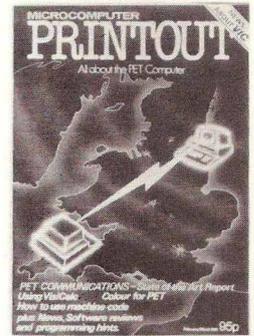
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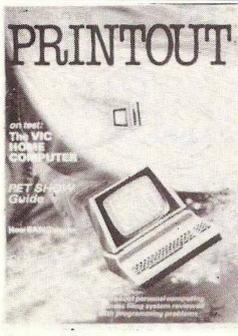
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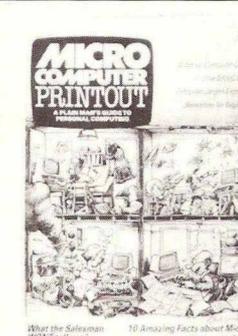
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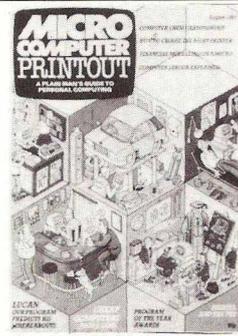
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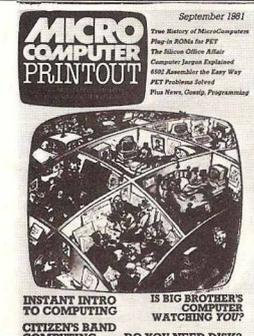
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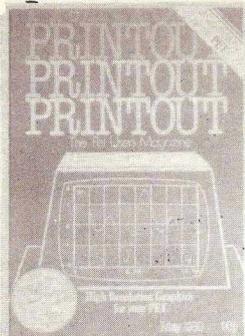
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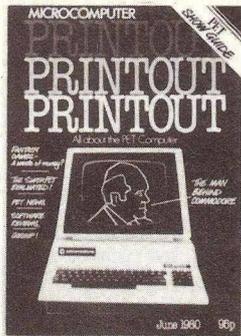


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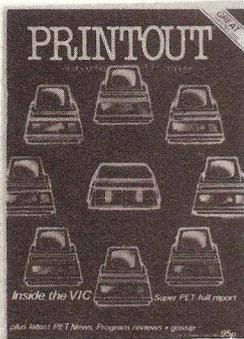
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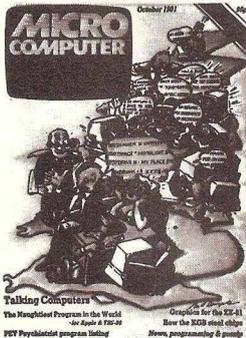
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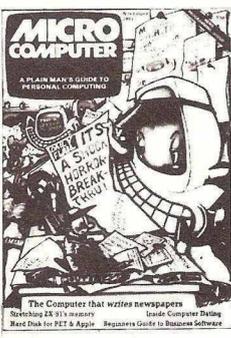
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1 Computers are getting cheaper all the time: shouldn't I wait?

Very much the same question used to be asked about pocket calculators. Some people struggled with tedious long division sums for years on the grounds that eventually they would get a calculator free in a Cornflakes packet!

It's all a question of cost savings really – the best reason for buying a micro in the first place is to save time and increase personal productivity. Besides which, the cost of a business system is *not* falling. What is happening is that the same money buys you more powerful hardware than before. But with software costs rapidly becoming the major component in the total system cost, it is unlikely you will save more than around £300 a year by deferring purchase. If your micro isn't saving you at least three times that figure each year, you aren't using it to full capacity. Alternatively, you have succeeded in computerising an application that didn't need it!

2 How much information can the computer store?

Information is actually *stored* in the floppy disk drive unit, the capacity of which is measured in KBytes (approximately 1000 bytes), or on larger systems MBytes (millions of bytes). Since each byte can hold one character of information, then a typical disk system with, say, 300KBytes could hold about 300,000 characters; that is equivalent to 200 A4 pages of solid typing. Although you can swap diskettes over to increase the storage, 300KBytes remains the maximum amount you can access at any one time.

Unless you are dealing solely with Word Processing, the figure of 200 pages is pretty meaningless. It is therefore important when buying a business system to find out its limitation *in terms of what you are processing*. In an Accounts Ledger, this could be the number of accounts or the number of ledger entries per month. In a Payroll, the key factor is the number of employees.

3 Why does software cost so much?

Perhaps one of the most surprising things to the newcomer in computing is that while hardware costs seem to be dropping fast, the price of off-the-shelf business software packages is rising. Indeed, on current projections, the software will comprise at least 80% of the cost of buying a business system in ten years time. But with an off-the-shelf package, surely all you should be paying for is the reproduction costs – say £10 for the diskettes and the same again for the instruction manual – with the rest being pure profit?

Alas, not! The real costs in software are in the development – and the reason these are rising is that business programs are becoming much more sophisticated. Whereas three years ago, you could get away with developing a couple of hundred lines of BASIC, a contemporary product may involve tens of thousands of lines of machine code – for which the development time may be measured in man-years rather than days. The good news is that a sophisticated business system will now perform more functions, more reliably, faster and with greater user-friendliness. The disadvantage is that the huge development costs have to be written-off over the expected number of sales. Many business packages, incidentally, sell no more than a hundred or so copies over their entire lifespan!

4 Why do I need two Disk Drives?

Although most microcomputers either have two floppy disk drives built in, or rely on a similar twin unit as an external peripheral, some manufacturers offer a single drive unit. So who is right?

The main advantage in having two drives is the ability to copy information from one diskette to another. It also enables you to keep different disks for different purposes. In some business systems, for example, the diskette containing the program is always located in the right hand drive, with its partner being reserved for the user's own data. This allows the program diskette to be Write Protected (see *Do You Need Disk?* September issue) to prevent the user from accidentally erasing or overwriting the program itself.

The ability to copy from one diskette to another is most often used for making regular backup or security copies; this is necessary to guard against the possibility of a database becoming corrupted by hardware failure to operator incompetence. The theory is that even if you lose everything, it should only be necessary to backtrack to the

THE 10 ASKED QUESTIONS

Richard Pawson polled the computer dealers to

The important thing when buying software and trying to assess the value for money is to find out what level of support is included in the price. Many reputable suppliers will include a Software Maintenance Contract, which guarantees that any bugs will be corrected, and that you will automatically receive a free copy every time the program is revised or updated. Sometimes the price will include a fixed amount of staff training – and instant advice at the end of a telephone every time you run into a problem.

A good yardstick is to find out how widely a program has sold. If you know that a particular product has been on sale for several months and is widely advertised by a number of manufacturers or dealers, then it is reasonable to assume that the quality relates to the price.

The need for caution arises when buying specialist software – sometimes referred to as the Butcher, Baker and Candlestickmaker Accounting packages! You may find that the program was originally written as a consultancy job for a client, and that the dealer is trying to make a fast buck selling you a copy for £500. There is no guarantee that the program is bug free, the documentation was probably written by an engineer, and the programmer, who is the only person who can even read the source code, has long since retired to the Bahamas!

6 Why are there so many keys?

time when the last copy was made – which should be daily or weekly, if you are a gambler.

Partial copying of information is used to prepare copies of, say, the week's results, to be fed directly into another microcomputer system somewhere else.

There are some applications which you can get away with using a single drive unit. These tend to be more concerned with computing power, than the storage of long-term and critical information. Two such examples are management calculations (such as *VisiCalc*) and simple Word Processing. Providing that you have been supplied with one back-up copy of the program – the loss of data on such a diskette would not usually cause a calamity.

One important point is that there is no advantage in having more than two drives. Though some systems demand three or four drives, this is solely because the storage capacity of two is insufficient. The result is not only clumsy to operate, but can be less reliable, and you should seriously consider going to an alternative supplier for higher capacity drives.

Full typewriter-like keyboard – say the advertisements, though none of them exactly resembles a typewriter. Historically, the computer keyboard evolved from the punched card tabulator and has brought with it a number of anachronisms. The '*' symbol is used in place of a multiplication sign, for example.

Some of the additional keys have standard meanings, others vary from machine to machine, so we will briefly review the various different types.

First the number or *numeric* keys 0-9. Rival suppliers seem unable to agree on whether these are best located above the QWERTYUIOP row as on a typewriter, or on a separate calculator-style numeric keypad, which is faster for entering large amounts of numeric data. Some machines overcome this design dilemma by featuring *both* sets of numbers, which can be a little confusing for the beginner. In this case, the result will be the same whether the 9 key is pressed on the top row of the keyboard or on the separate keypad.

The next group are the Screen Editing keys. These allow you to modify whatever is on the screen by inserting and deleting characters, whole lines of text, or diagrams. The most important are the Cursor keys which may be marked CRSR or with direction arrows. Their purpose is to move the small flashing square, or cursor, in the direction indicated by the arrows. Any action specified by pressing further keys, will take place from where the cursor is currently positioned.

There are usually also a number of Control keys which govern the running of a program. There may well be one marked RUN, which starts the program, and another marked BREAK or STOP, to halt temporarily the execution. Others such as CTRL and ESC, act like the Shift key in the sense that they only work in conjunction with another key (A-Z), to activate some special function.

Finally, some of the newest and most user-friendly systems have User Definable Keys, also known as Programmable Function keys. These are usually blank or labelled F1, F2 ... F10 etc. They may be assigned special functions by the user or by an applications program. This not only saves time by replacing oft-used sequences of keystrokes with a single button push, but can make the program much easier to operate by people unfamiliar with computer techniques. Some keyboards even have small labels above these function keys on which you can write your own legends.

MOST STIONS

find out what the first-time buyer wants to know.

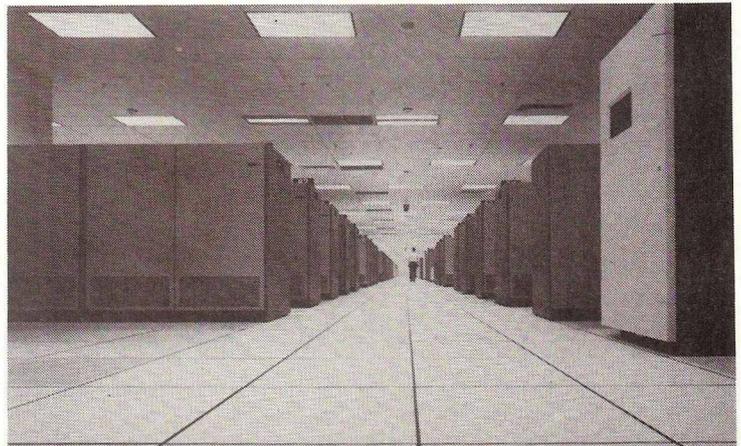
5 Does the computer need a special kind of environment/power supply?

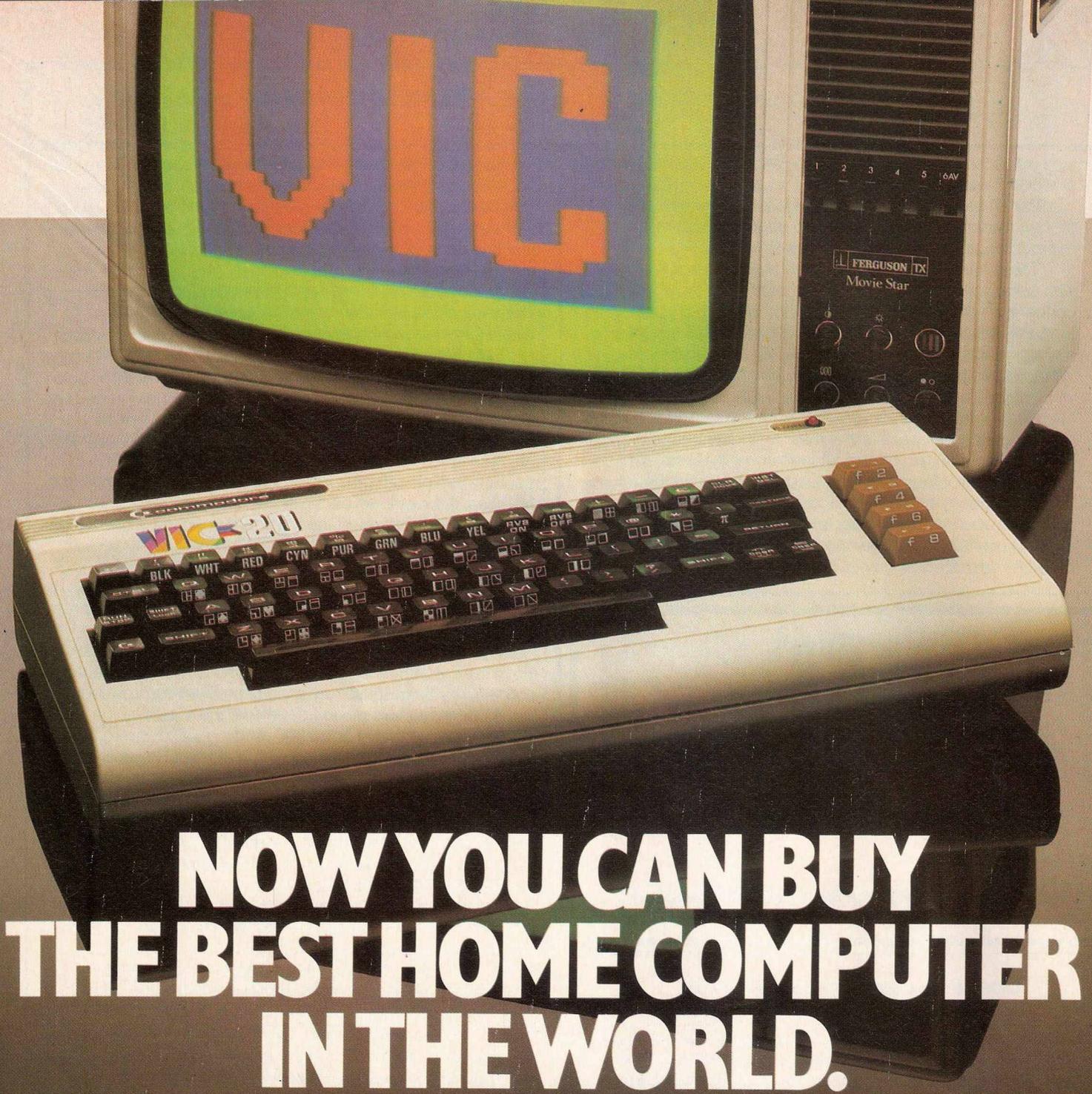
The days when computers needed a special room of their own equipped with a massive air conditioning and power supply unit, are thankfully gone. Nor, incidentally, do you need a staff of men in white coats and horn rimmed spectacles to operate a microcomputer! Unless, of course, you are making a T.V. film!

All desktop computers run from an ordinary domestic mains socket, and actually consume much the same amount of electricity as a single light bulb. Unless you are working in an industrial environment, where there might be extremes of temperature or condensation, you shouldn't have too many problems with your micro.

Electronic equipment, however, is susceptible to electrical interference, either from heavy duty industrial machinery, or from mains voltage fluctuations. The latter, which is what you are experiencing every time a light bulb flickers, can cause a microcomputer to 'crash'. Although this should not damage the hardware, it can mess up software on disk, and be generally inconvenient.

If your home or office is particularly prone to this affliction, you can buy (for around £100) a mains regulation unit which will smooth out any irregularities in the supply.





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For more information on the VIC 20, telephone or write to: Commodore Information Centre, Baker Street, High Wycombe, Bucks, or Tel: Slough 79292.

7 How fast can the computer retrieve information?

Paradoxically, the answer is that it depends on how much you know about what you want to find out! Confused? We will start at the beginning.

If you ask for the Stock Record for product number 1463, the program will know exactly where on the disk it is stored and need only wait for the recording head to move to the right place. Result: you can see the Stock Record in about a second.

Now suppose that you know the product is called a *widget*, but can't remember the number. The program almost certainly maintains a cross-index of these two items, so it should only delay the process for another couple of seconds or so.

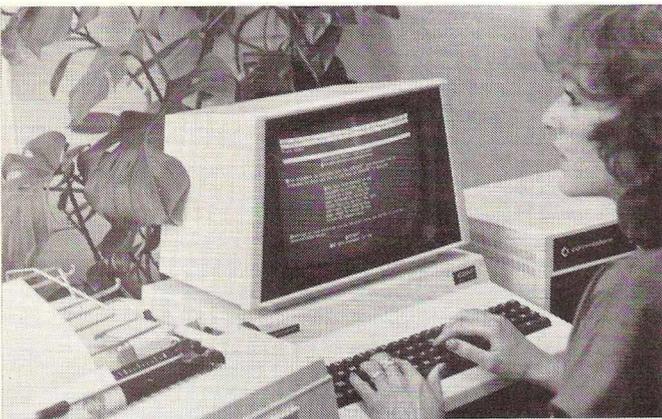
However, if you request something along the lines of "that product which is supplied by the ABC Company" – then the computer may have to inspect each record individually until it finds a match.

Don't be fooled by the salesman's impressive demonstrations – the chances are that his disk only contains ten example stocklines. So if your business demands a thousand or so, then the process could be slowed down by a factor of as much as one hundred.

Any software house worth their salt should be able to quote you a maximum and typical search time – based on the amount of data you intend to store.

8 Can I see the answers on the screen before they are printed?

This question usually relates to applications like Invoicing, where the final result is clearly intended to be a printed document. The answer is usually yes, where you are producing a single sheet. However, many accounting-related programs work on a batch system, where you leave the computer alone (sometimes for several hours or even over night) to sort and collate the week's or month's entries, printing the statements as it goes. In this type of application, it is obviously less important to see the results on the screen.



The corollary, however, is more interesting – "Can I get a printed copy of *anything* I see on the screen?" Though some computers (usually only those with a built-in printer) have a special button marked *Copy Screen* which literally copies everything that's on the screen onto the printer, on most microcomputers it is up to the applications program to provide the various printing facilities.

Yet despite the fact that it is incredibly simple to program in such a feature, surprisingly few packages do allow you to print a copy of the screen. Once again, don't rely on the vague statements made in sales brochures – ask to see it done!

9 Can a Word Processor be used as a simple typewriter?

It is important to realise, when installing a spanking new W.P. system, that there are still occasions when the old-fashioned typewriter is more efficient. Typing a single address label, or compliment slip, for example.

Surprisingly, none of the best known Word Processing packages currently offers a facility whereby simply pressing a key prints that character onto the paper.

The answer, if you want to avoid having both Word Processor/Microcomputer and typewriter at loose in the



same office, is to purchase a Daisywheel printer with a keyboard built-in. Converting to a typewriter is then simply a matter of pressing the on-line/off-line button.

Incidentally, Discom (tel. 0386-881962) are offering an interface for £250 ex. VAT which will convert any electronic typewriter (such as the Olivetti ET221) into a computer printer. This not only solves our problem, but could save you several hundred pounds hardware costs to boot, providing that your printer use is not too heavy.

THE 10 MOST ASKED QUESTIONS

continued

10 How fast can it print?

To answer this, we will assume the computer has already retrieved and prepared all the information it needs before starting to print – otherwise the speed we are dealing with depends on factors other than the specification of the printer.

Unfortunately, just as in advertisements for new cars, manufacturers are prone to quoting the results of only those tests which favour their own product. Two printers which, from their spec. sheets, appear to have identical speeds, may return widely differing performances when printing out a real document. This is because some mechanisms can print both forwards and backwards; some are good at skipping over the blank spaces in a typical page; whilst others merely offer a high burst speed – the rate at which a solid line of characters can be printed.

The most meaningful figure for comparison is *Lines per Minute*; from this you can calculate the average time taken to print a letter. However, as even this is not a wholly reliable yardstick (unless all your lines are the same length), there is no substitute for a demonstration.

Ask your dealer to print out a couple of average letters on a number of different printers. You'll soon find out if you can live with the speed and print quality – and you'll also discover how noisy it's likely to be!

A plain APPLE can be transformed into an exotic fruit – if you believe what the papers say. Indeed it can speak and listen, play music, turn on remote appliances, even see (through a camera) what you're up to. All sorts of devices can be plugged in to the APPLE to extend it – and if all this gets too much for its little brain, you can transplant in one more powerful. It is pretty much a "Soft Machine", to mould into what you want – but from what do you start?

As a plain man's computer you want it to do some pretty ordinary things. You need a video display, a disk drive, and possibly a printer. Then you can really get going. The devices usually plug into the 8 expansion slots provided.

Video Display

This is not as clear cut as in the

the modulator will do, to get black & white from a TV. Or, as most businessmen do, get a small monitor. Crofton electronics do one for £55, or the Hitachi one in the adverts costs £127. Usually, the more you pay, the better the display. And if you want your APPLE to display 80 characters per line for Word Processing or Pascal, you need an 80 column card (like the Doublevision or Videoterm, from £150), which in turn requires a good 12" monitor, like the BMC for £173. Incidentally, the Portatel is also good enough for this.

Disks

80% of APPLE users, according to APPLE, have a disk system. Often just one disk drive will do (a second drive may be useful for copying disks, but even this can be

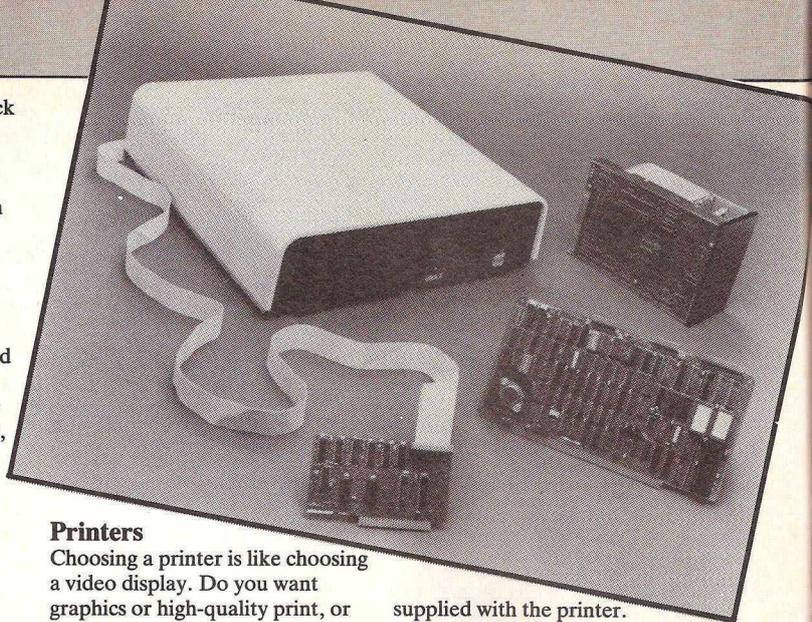
done simply on one). Many programs are written for just one disk – like VISICALC, Word Processing, and games. The disk drive plugs into a APPLE slot via a "Controller Card". This card can connect up a second drive. The first disk, with controller, operating system, sample programs and manual costs £397, and the second costs £311. Third and fourth drives (and more!) can be plugged in, but if you need that much capacity, you should be looking at bigger disks.

There are various big disks, like the 8" floppies from Eicon and Vlasak, giving you one megabyte (equivalent to 8 ordinary disks) from £1400, to Corvus Winchesters giving you 5 to 20 megabytes from £2500. Also worth considering is the Cameo hard-disk which gives you 10 megabytes, of which half is removable so solving the problem of backup, for £3,830, which can also be shared by several users!

PET, where you have no choice of display. If you want to use graphics, and you can afford it, go for colour. There are some really good games, like Pegasus, which are as good as the Arcade machines. Colour is not essential though for business use, where you usually use the text screen, which is monochrome anyway.

If you want colour you need either a Colour Card (for £75); and a UHF modulator (for £14) to connect to your TV (but it's a good idea to pack up your TV and test it out first at your dealer's as the odd TV may be disappointing). Or you can connect your Colour card to a TV monitor – like Redifusion's. Or for the best picture, forget the colour card, and connect your APPLE direct to Portatel's purpose built monitor for £350.

If you don't want colour, just



Printers

Choosing a printer is like choosing a video display. Do you want graphics or high-quality print, or both?

What complicates matters is the Printer Interface, which connects the printer to an APPLE slot. The "Centronics" interface is most often used, although there is a

supplied with the printer.

Epson have the MX80 printers, from around £350. These also print graphics although you also need their interface, at around £85, to do this. Up to 132 characters can be printed per line,



serial interface for other types of printer. Interfaces cost from £65, such as those from Simon Computers.

The cheapest printer at the moment is APPLE's own Silentype, with interface included at £203. This has the advantage of being able to print the graphics from the video display at the touch of one key. But a drawback is having to use special thermal paper, at about twice the cost of ordinary paper. This comes in rolls of ten, although one is

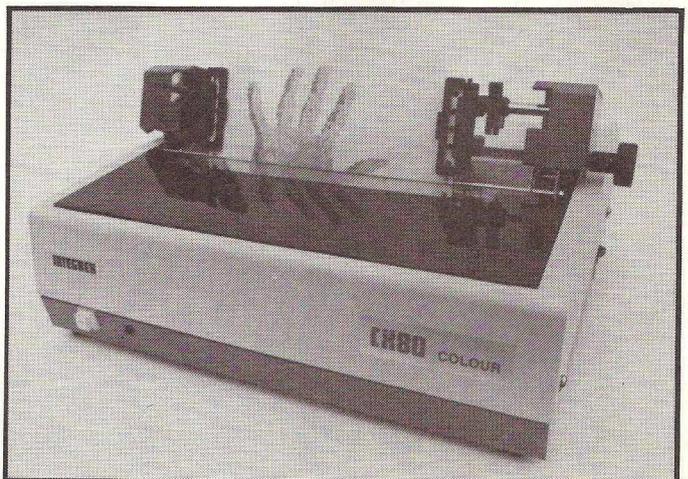
and you can get "bold" print which is almost up to typed letter quality.

Centronics have the 737 and 739 printers. The Centronics 737, at around £400, is slightly better than the Epson for print quality, but doesn't have graphics. The 739 though, has graphics, but costs over £500.

Colour printing is still a bit of a novelty, but it can be done with the Integrex CX80 for £895, plus £125 for the interface.

For fast printers, over 100 characters per second, consider the Anadex 900's and Paper Tigers. These have graphics capabilities, and cost from £700.

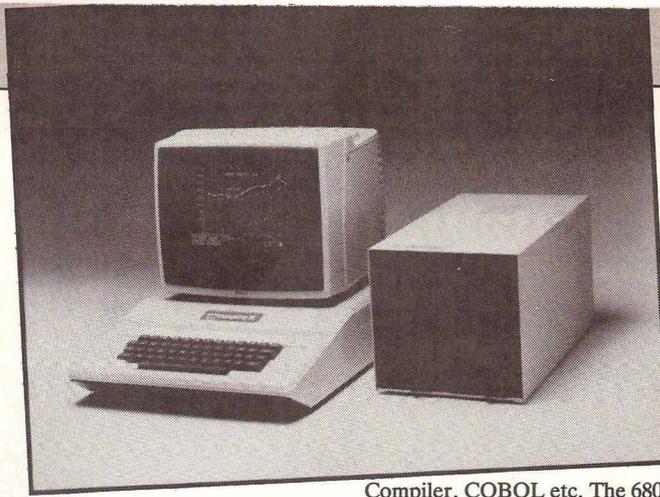
Daisywheel printers are too expensive for many, but offer the best print quality. They are not



goodies

the most reliable piece of equipment, so do get them from someone who can look after them, or arrange for a service contract. Worth considering are the Ricoh, TEC, and Qume. These are all quite fast, and cost from £1100 to £1700 depending on options like form-feeding, buffers, and warranty. The Scripta from Olympia is basically a typewriter, so is a bit slow, but cheap at £840.

Also worth considering are adapted electric typewriters. Second-hand IBM Selectric input/output printers are available from £250 and can be adapted for £150 by Aculab. Also Olivetti 121 and 221's can be adapted, and Olivetti should have this sorted out themselves, otherwise Vlasak and Discom will advise. The 121 can be bought from about £650, and the adaption will cost around £150, which many dealers can do.



Toolkit is worth its £42. This contains some useful programming tools, (except Search/Replace), and an Assembler. It also contains a "soft text screen handler" which replaces the standard capitals only character set with upper and lower case, AND gothic, greek, slanted, upside down and user-definable character sets! Finally, it helps to do Animation.

Compiler, COBOL etc. The 6809 card is useful where you want some really fast number-crunching.

Rather useful is a Real-time clock. This remembers the time, and can provide interrupts for sophisticated programming. March Communications's card costs £50, and California Computer Systems one costs about £85 including battery-

just the usual organ. It costs £312. But best of all is the Alphasyntauri. It includes a proper keyboard and everything you need for serious music composition, though it is rather expensive at £1000. Also available is the Vista Music Machine for £100 rather like ALF.

Analogue input for the laboratory and industry is rather a specialised market. There are many analogue and digital input and output boards. They tend to start at around £200. Typical is Mountain Hardware's 16 channel A/D & D/A converter at £225. A new development where many devices need controlling is to have them connect to a partyline wire instead of direct to the APPLE. This is the REMDACS systems which costs £495 for the Controller card, plus £20 per device connected.

For apple

How to expand your Apple with plug-in goodies by Ted Davbutt

Getting Going

There is really a lot of choice now of what extras to plug in. Some products though have been around rather a long time, particularly in music, speech and analogue interfacing. A lot of these are now carried by Data Efficiency if you look at their ads, and are quite cheap. They recently announced a price war and cut off those naughty dealers who had the impudence to change their allegiance to other cheaper and faster importers.

A lot of people will want to use the graphics to the full. So it's a good idea to get Versawriter, the graphics input tablet. This lets you trace over pictures to reproduce them on the screen. Also it lets you edit pictures, draw electrical/chemical/architectural/etc. shapes, and quite a lot more. It costs around £120.

Perhaps bit too exotic is a Video Camera Input. But it's quite popular in industry for pattern recognition. An ordinary camera costing £150 connects to a card from U-microcomputers, costing £265, and the picture appears on the graphics screen, and then can be analysed.

For the games freak, a joystick is a good idea. Games paddles come with the APPLE, but can be awkward for fast games. A good joystick that centres, can be bought for £20.

Not hardware, but the DOS3.3

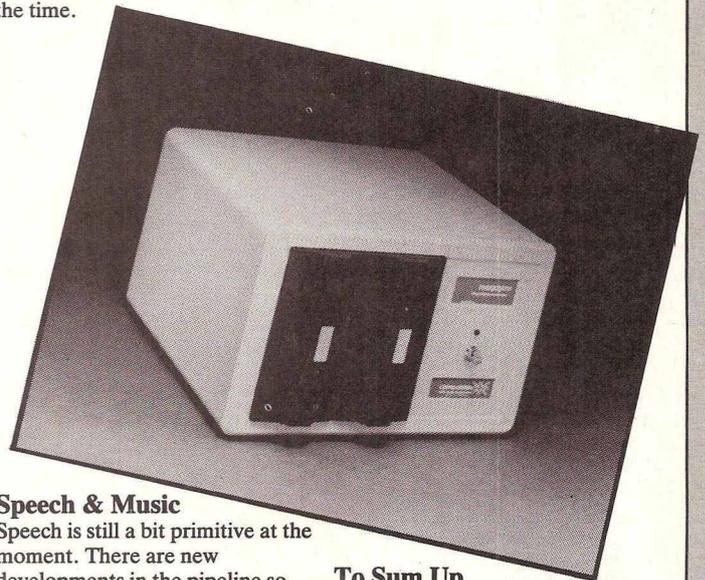
Languages

Pilot, the language, is also useful for graphics. Its primary aim is to help prepare lessons for children. So it makes it easy to draw pictures, make up tunes on the built-in speaker, and of course it makes question & answer sequences and quizzes quite simple. Pilot costs £84.

Most languages require a plug-in card. In particular for Pascal you need the Language system. This costs £263, which in my view is quite overpriced for a simple card, a few disks and a manual: the card and manuals alone can be got for £130! This has really got to encourage copying. But once you have got the language card, you can run Integer Basic, in which a lot of good old programs are written. You also get an extra 12K bytes of memory, if you don't want Integer.

If you don't like APPLE's 6502 processor - why not replace it with a Z80 or 6809? The Z80 softcard from Microsoft at around £250, or its cheaper equivalent at £125 from U-microcomputers, lets you run CP/M. Microsoft also include MBASIC which is one of the best Basics I've seen, and it really speeds up disc handling. The trouble with CP/M is that it eats up memory - so you may want a RAM card, or better still the language card above. Once you've got CP/M, you can use the superior Wordstar word processor, Basic

backup to save continually setting the time.



Speech & Music

Speech is still a bit primitive at the moment. There are new developments in the pipeline so wait awhile and go to the exhibitions and listen. Speech recognition is quite advanced: try Heuristics Speech Link, which can recognise 32 words with over 85% accuracy. This costs about £180.

While the internal loudspeaker can be programmed to make some unusual noises, if you want to make music there are several systems available. The cheapest, and it's still quite fun, is ALF. It costs from £90 for 9 voices. Next is the Musicsystem from Mountain Hardware. This lets you define any instrument you like besides

To Sum Up

There is a bewildering amount of things to connect to your APPLE, and new things appear regularly. It is a good idea to go to your APPLE dealer for advice, and go to the exhibitions. All the above is obtainable from your APPLE dealer. And all the prices exclude VAT.

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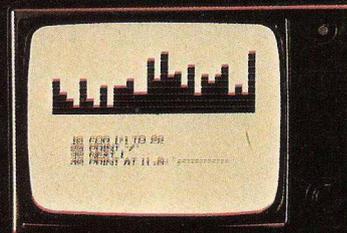
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sinclair ZX81 PERSONAL COMPUTER



Sinclair ZX81 Personal Computer the heart of a system that grows with you.

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. Not surprisingly, over 50,000 were sold.

In March 1981, the Sinclair lead increased dramatically. For just £69.95 the Sinclair ZX81 offers even more advanced facilities at an even lower price. Initially, even we were surprised by the demand – over 50,000 in the first 3 months!

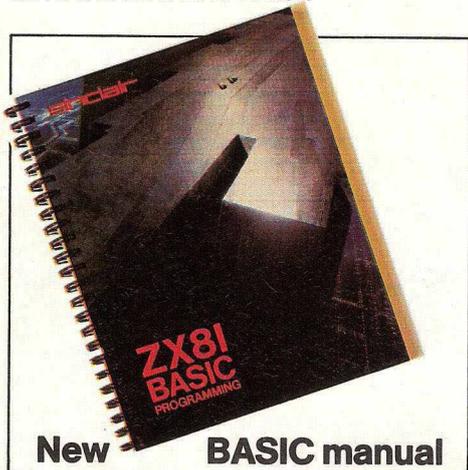
Today, the Sinclair ZX81 is the heart of a computer system. You can add 16-times more memory with the ZX RAM pack. The ZX Printer offers an unbeatable combination of performance and price. And the ZX Software library is growing every day.

Lower price: higher capability

With the ZX81, it's still very simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, and to drive the new ZX Printer.



New BASIC manual

Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs.

Kit: £49.⁹⁵

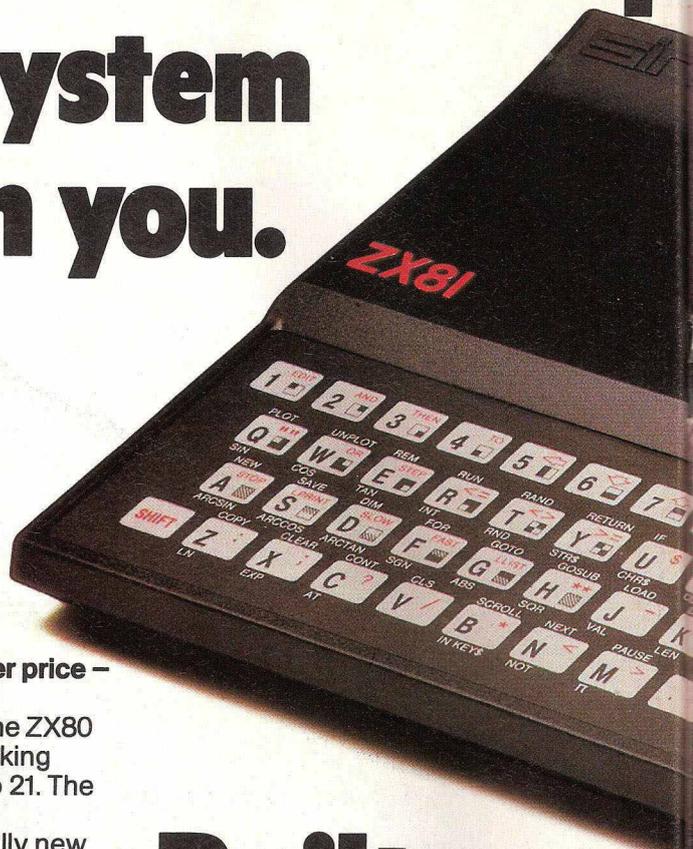
Higher specification, lower price – how's it done?

Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

New, improved specification

- Z80A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
- Graph-drawing and animated-display facilities.
- Multi-dimensional string and numerical arrays.
- Up to 26 FOR/NEXT loops.
- Randomise function – useful for games as well as serious applications.
- Cassette LOAD and SAVE with named programs.
- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
- Able to drive the new Sinclair printer.
- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.



Built: £69.⁹⁵

Kit or built – it's up to you!

You'll be surprised how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 600 mA at 9 V DC nominal unregulated (supplied with built version).

Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.



uter-



**Available now-
the ZX Printer
for only £49.⁹⁵**

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alpha-numerics and highly sophisticated graphics.

A special feature is COPY, which prints out exactly what is on the whole TV screen without the need for further instructions.

How to order your ZX81

BY PHONE - Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day.

BY FREEPOST - use the no-stamp-needed coupon below. You can pay

At last you can have a hard copy of your program listings - particularly useful when writing or editing programs.

And of course you can print out your results for permanent records or sending to a friend.

Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your computer - using a stackable connector so you can plug in a RAM pack as well. A roll of paper (65 ft long x 4 in wide) is supplied, along with full instructions.

by cheque, postal order, Access, Barclaycard or Trustcard.

EITHER WAY - please allow up to 28 days for delivery. And there's a 14-day money-back option. We want you to be satisfied beyond doubt - and we have no doubt that you will be.

**16K-byte RAM
pack for massive
add-on memory.**

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.

With the RAM pack, you can also run some of the more sophisticated ZX Software - the Business & Household management systems for example.

sinclair
ZX81

6 Kings Parade, Cambridge, Cambs., CB2 1SN.
Tel: (0276) 66104 & 21282.

To: Sinclair Research Ltd, FREEPOST 7, Cambridge, CB2 1YY.				Order
Qty	Item	Code	Item price £	Total £
	Sinclair ZX81 Personal Computer kit(s). Price includes ZX81 BASIC manual, excludes mains adaptor.	12	49.95	
	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
	Mains Adaptor(s) (600 mA at 9 V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack.	18	49.95	
	Sinclair ZX Printer.	27	49.95	
	8K BASIC ROM to fit ZX80.	17	19.95	
	Post and Packing.			2.95

Please tick if you require a VAT receipt

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*Please delete/complete as applicable. _____ Please print.

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MPP12

How the ZX81 compares with other personal computers

SYSTEM IDENTIFICATION		ZX81	ZX80	ACORN ATOM	APPLE II PLUS	PET 2001	TRS 80 LEVEL I	TRS 80 LEVEL II
ROM		8K	4K	8K	8K	14K	4K /	12K
GUIDE PRICE	Basic unit - inc. VAT Unit plus 16K RAM (*12K RAM)	£70 £120	£100 £150	£175 £285*	£630 £630	£435 £530	£290 £360	£375 £375
COMMANDS	LIST, LOAD, NEW, RUN, SAVE	●	●	●	●	●	●	●
STATEMENTS	PRINT, INPUT, LET, GOTO, GOSUB/RETURN, FOR/NEXT IF/THEN	●	●	●	●	●	●	●
	STEP	●		●	●	●	●	●
	TAB	●			●	●	●	●
ARITHMETIC	ABS, RND	●	●	●	●	●	●	●
FUNCTIONS	INT	●			●	●	●	●
	ATN, COS, EXP, LOG, SGN, SIN, SQR, TAN	●			●	●		●
	ARCSIN, ARCOS	●						
STRING	CHR\$	●	●		●	●		●
FUNCTIONS	LEN	●		●	●	●		●
	ASC(CODE), STR\$, VAL, INKEY\$	●				●		●
NUMBERS	FLOATING PT ±10 ⁻³⁸	●			●	●	●	●
	INTEGERS		●	●	●	●		●
NUMERIC	A-Z			●			●	
VARIABLES	AA-ZØ				●	●		●
	An-Zn, n=any alphanumeric string	●	●					
STRING	A\$ & B\$						●	
VARIABLES	A\$ to Z\$	●	●	●				
	An\$ to Zn\$, n=any alphanumeric character				●	●		●
NUMERIC	SINGLE DIMENSIONAL		●	●			●	
ARRAYS	MULTI DIMENSIONAL	●			●	●		●
DISPLAY	ROWS	24	24	16	24	25	16	16
	COLUMNS	32	32	32	40	40	64	64
	LOW RES GRAPHICS (<7000 pixels)	●	●	●	●	●	●	●
	HI RES GRAPHICS (>40000 pixels)			●	●			
SPECIAL	USR (CALL, LINK)	●	●	●	●	●		●
FEATURES	PEEK, POKE (OR EQUIV)	●	●	●	●	●		●

Sinclair software on cassette.

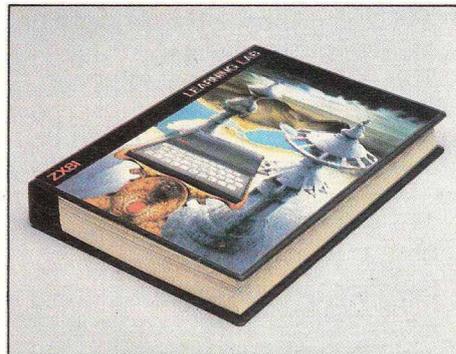


The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with others to form single-subject cassettes.

Software currently available includes games, junior education, and business/household management systems. You'll receive a Sinclair ZX Software catalogue with your ZX81 - or see our separate leaflet.

The ultimate course in ZX81 BASIC programming.



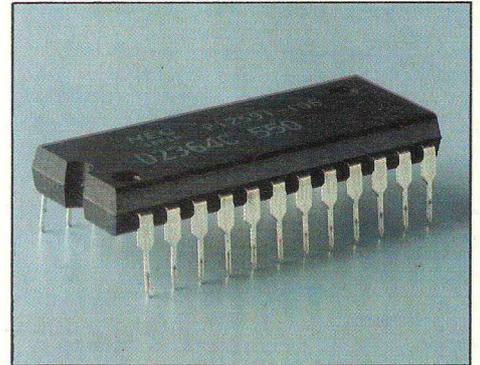
Some people prefer to learn their programming from books. For them, the ZX81 BASIC manual is ideal.

But many have expressed a preference to learn *on the machine, through the machine*. Hence the new cassette-based ZX81 Learning Lab.

The package comprises a 160-page manual and 8 cassettes. 20 programs, each demonstrating a particular aspect of ZX81 programming, are spread over 6 of the cassettes. The other two are blank practice cassettes.

Full details with your Sinclair ZX81.

If you own a Sinclair ZX80...



The new 8K BASIC ROM used in the Sinclair ZX81 is available to ZX80 owners as a drop-in replacement chip. (Complete with new keyboard template and operating manual.)

With the exception of animated graphics, all the advanced features of the ZX81 are now available on your ZX80 - including the ability to drive the Sinclair ZX Printer.

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The suppliers of the first Basic Compiler for the Pet,
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Also available from OXFORD COMPUTER SYSTEMS (SOFTWARE):

COMPILED INTEGER BASIC — a very fast Integer Compiler for ALL Pet models. Compiled Basic is for those applications where the speed of the machine is required without the inconvenience of assembly level programming.

"admirably fast code . . ."
"exciting extra commands . . ." *Printout*
(the Pet users magazine)

Compiled basic is already widely used in education and research. It is ideal for applications that do not require floating point arithmetic e.g.

- **DISC HANDLING** — disc operations in Compiled Basic are much faster than in Pet basic. Compiled Basic provides a set of extra IEEE commands to speed up the process even further.
- **FAST INPUT/OUTPUT** — Compiled Basic is ideal for fast I/O such as Datalogging, driving fast peripherals etc.
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- **SPEED** — Compiled Basic programs run at up to 150 TIMES the speed of Pet Basic

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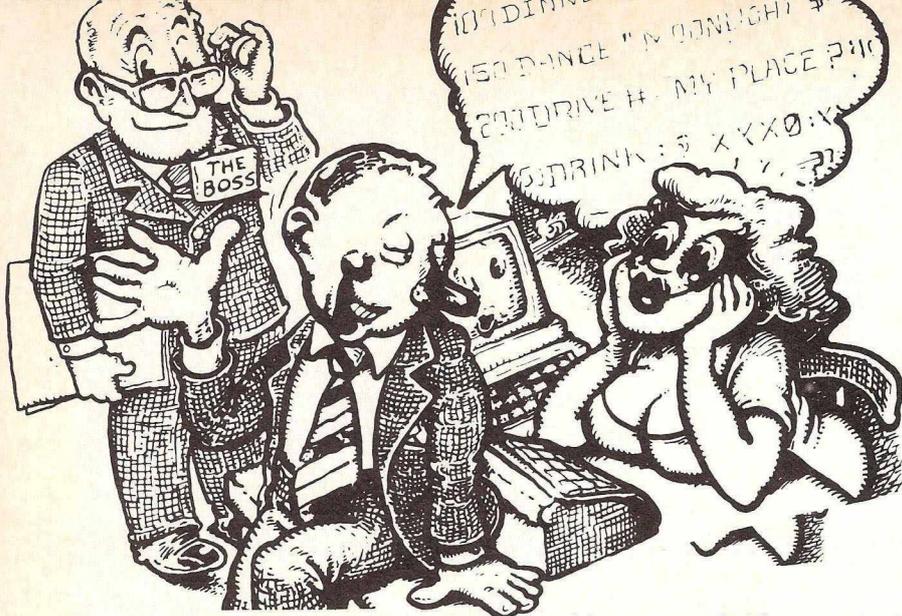
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Telephone: Oxford (0865) 722872



The Com Conv A Bluffers

The hounds of whasit being on winter's traces, your chances to star are improving once again. I assume that others have gained from the summer, being perfectly-proportioned well-tanned tennis players with open-topped sports cars.

But Computerbluff is a winter game, and anyone can play. As the Blessed Stephen Potter wrote, in *'Oneupmanship'*, quoting with approval the unpublished remark of Rilke, "if you're not one up (Bitzleisch), you're one down (Rotzleisch)".

By the by, Potter recommended Rilke along with Kafka as OK names for 1945-50; but times move on. OK names for the 1980s are Samuel Palmer, any non-American writers of science fiction, any feminist author (preferably dead) – and Steve Wozniak.

For the new technology is today the way to be one-up. And fortunately, it is entirely possible to achieve that state without in-depth knowledge of the stuff. All you need is this kit containing:

- § Four sorts of Keywords
- § Only two Rules
- § Six conversational Gambits

Lesson One: Computerbluff Keywords

In computerbluff there are certain Keywords to be learnt. Some of these are definitely to be used at every possible opportunity, because they constitute the essential method of saying not very much at all with the self-assured air of a competent insider. Other Keywords are to be avoided at all costs, either because they do mean something or because non-OK people use them.

The OK words come in three grades. They are distinguished in the present text by one, two or three asterisks. Three-star words carry most weight; but they should be used sparingly, since several of them do almost mean something. Still, nearly all the OK Keywords are basically unnecessary and esoteric terms for which there are perfectly adequate but definitely non-OK equivalents in normal English.

On the whole approximately half the terms used in a Computerbluff conversation will come from the one-star list, 30 per cent will bear two stars, and 10 per cent will be three-star words. Of the balance, 5 per cent will be non-OK words (well, you can't win them all); and 5 per cent will be brand-new multi-star words (usually invented by you on the spur-of-the-moment.)

It is recommended that you cut out the Keyword lists and paste them somewhere discreet. Practice using them while waiting for trains, brushing your teeth, etc. You will then be able to call upon them instantly as required.

Lesson Two: Rules of the game

"In conversation play" writes Potter, "The important thing is to get in early and stay there". This, of course, goes without saying. But life being what it is, that ploy may not always be possible. So as an addendum to the main strategy, here are the Only Two Rules of Computerbluff.

§ Rule One – the one-m k-not-c principle.

You should always spell 'program' with one 'm' and 'disk' with a 'k', especially in conversation – the adept bluffer will practice this before the bathroom mirror, and will also be alert to detecting 'mme' and 'c' in other people's speech.

The point is that it gives you an opening

NON-OK KEYWORDS (do not use!)

- electronic
- integrated circuit
- core
- disc
- programme
- personal computer
- electronic brain
- tape
- data
- data bank
- on-line
- real-time
- punched cards
- firmware
- operator
- COBOL
- assembler
- "chips with everything"

gambit to show your class. Here are some appropriate gambits you might use:

§ "I think it's important that language evolves"

§ "New concepts should require new language"

§ "Americanisms? No, no, micros make for a new Internationalism ..."

§ "It seems a bit silly to talk about 'disquettes' with a 'k' and 'discs' with a 'c'?...."

§ Rule Two – the Instant Get-Out

No-one knows everything about computers. And people who know a lot about one aspect invariably know very little about any other.

For instance, you may come across an expert in systems software. So you should emphasise the practical. "Theorising and bit-twiddling in the nuts and bolts of the machine is all very essential of course. But I like to look at computing from the point of view of the user. What do we get out of it?"

Note that 'bit-twiddling' is a three-star Keyword and 'machine' is also on the list. Bit-twiddling [****] is a particularly important term in Computerbluff: it can be used derogatively, to suggest that the said twiddlers are either ivory-tower theoreticians or mere mechanics.

Such conversations will normally be reinforced by multiple Keywords like: response time [**], terminal dialogue [*], and ergonomics [****].

But 'bit-twiddling' can also be used to refer to oneself with self-deprecating charm. Say your conversation is with an expert designer of end-user systems, someone say who writes software that actually does something for the user. Then your ploy would involve a shy smile and "I'm afraid I am just a bit-twiddler myself. My interest lies in the nuts and bolts of the thing ..."

And you might continue: "We're putting together some novel ideas for optimised [****] bit-slice [*] micros [****] or multifunction [**] networks [*] or resource-sharing [*] interconnections [*] and so on.

Lesson Three: Actual conversation

Armed with your new-found knowledge and your crib sheets you may repair with equanimity to the pub, cocktail party or user group meeting.

You will there search for Openings. These are distinguished by (a) affording the opportunity for you to optimise three-star output while maximising from the one- and two-star lists, while you (b) adhere to Rule One and (c) seize opportunities to go one-up via Rule Two.

However, your major chances will come (d) in non-competitive situations. These you enter by first making sure that the target group contains no other Computerbluff graduates. You can then drop your computer-awareness casually into the conversation.

Recommended gambits are

§ "Funnily enough something similar

pleat Computer ersation Kit Guide to Micros

happened with me and my computer
....."

§ "Just as well I have the computer,
I'd never have been here on time oth-
erwise"

§ "I really had to tear myself away"

By Dennis Jarrett

Hopefully, someone in your audience will then pick up the ball and run with it. You may, however, have to do some more groundwork. Either way, you will find that one of six stand-ard conversations will invariably start.

1. The gas-bill story.

This perennial tale of final demands for £0.00, has been joined by the Book Club Boob – a situation in which it is impossible to stop the computer from sending you unwanted and unrequested 'on approval' material.

Your response should be a sorrowful shake of the head, a wry smile reflecting on the vagaries of the human race, and a comment to the effect that computers only do what they're told. (You can slag off programmers at every opportunity during Computerbluffpersonship, if you want, as long as there are none present).

2. The 'How do they work' enquiry

Modify your answer accordingly to your ultimate sexual intentions vis a vis your partner: but in all cases you'll have to side-step.

Fortunately, no-one has ever explained satisfactorily how a computer works. That in itself is one suitably dry riposte. Or you can switch back into lovable self-deprecation – "I don't really care how they work, I just like to use them."

If pressed, you can resort to incomprehensibly basic electronics. The important Key-phrases here are unique to this situation and should never be used elsewhere. They are "switching", "streams of electrons", "the presence or absence of pre-specified voltage levels (best remembered via the mnemonic TPOAOPSVL), and "combinations of these".

3. The "my cousin/husband/aunt/next-door-neighbour has just started a systems analysis course" remark.

This is usually produced as the speaker's most intimate contact with computers, so you have a clear field.

Again, choose your response according to desired effect. On the one hand, you can shake your head sadly again and comment on the inadvisability of committing one's career to the decaying branch of the industry (big computers which need systems ana-

lysts) rather than the sex-drugs-rock-'n'-roll liveness of the micro market.

Alternatively you can commend the far-sightedness of that career choice, with approval for the idea of getting into a growth industry on the ground floor. But either way, don't get involved in any discussion of what exactly a systems analyst *does*: not even systems analysts know the answer to that.

4. The "will they take over my job?" paranoia —

The fear of personal and then mass unemployment.

And will computers replace people? Yes, they will. Or at least, they'll replace some

of political will, about the importance of redistributing the workforce for the good of the country, etc., etc.

5. The "bet they can't write novels, ho ho" syndrome.

That's right, they can't. Still, you can't tell them that, so that correct reply uses the two-star term 'artificial intelligence' in some expression like "well, the Americans/Japanese/Swedish are doing amazing things with computer-based artificial intelligence ..." That'll shut them up, ho ho.

6. The "Don't you have to be good at maths?" ploy.

This enables the speaker to feel artistic and therefore superior to the more boring and probably numerate technophile. This is because the follow-up is always: "I couldn't do it, I'm no good at figures – I think I'm too sensitive/emotional/sensuous to get on with computers."

This one is extremely tricky, since you are clearly vulnerable to accusation of non-sensuousness – and who wants to be non-sensuous? So your response should be airy: "No, actually that's an old fallacy. I don't understand science and maths myself, and look at me".

From there you move quickly into some-

OK KEYWORDS

one star ☆

two stars ☆ ☆

three stars ☆ ☆ ☆

I		
N chip	code	bit-twiddle
T bit-slice	response time	
E resource-sharing	network	
R memory		
N ROM		
A RAM		
L machine-code		
S		
E end-user	terminal	workstation
X system	buzzword	buzzphrase
T machine	application	Wozniak
E program	microcomputer	micro
R terminal dialogue	package	computer literacy
N word processing	database	electronic mail
A microprocessor	COMAL	mini-Winchester
L diskette	mini-floppy	
S BASIC	artificial intelligence	
A		
D		
J intelligent	networked	ergonomic
E interconnected	top-down	optimised
C modular	configurable	structured
T flexible		
I integrated		
V expandable		
E		
S		

people. Frankly (you can say knowledgeably) computers can get rid of the duller, more mechanical jobs that people do: and indeed, this will mean fewer people employed on production lines, copy typing, and the like.

At this point you should look earnest. Start musing about the need to change people's views about work and leisure, about the lack

thing like "When it comes down to it, there really are too many fallacies surrounding computers. The educational system should be changed to improve 'computer literacy' [***] ..."

.... And that's it. Let us know how you get on.

Dear Mr Editor, Which computer should I buy?

David Eldridge continues his workshop for newcomers

Dear Sir,

Please can you help me – I want to buy a computer that will suit my needs, but those needs are, I think, unique. At home I regularly play a brain game which I invented, based on word phrases selected at random. I am sure it would be even more fun on a home computer. The problem, however, would seem to be storage space.

My limited knowledge suggests that phrases could be stored as strings – though I believe that only a small percentage of RAM is available for this purpose. How many sayings could each string hold? Am I looking for something impossible in the £100-£300 range?

I would be happy if I thought that tape storage might be the answer, but could a home computer get at the tape while it was outputting one of the sayings to the screen?

The phrases are allocated to around 10 groups (Historical Events – Cliches – Musical Personalities etc.) each with 40-50 separate entries. The phrases themselves have an average of around 20 characters, e.g.:

THE
BATTLE
OF
WATERLOO

so I would like these to be displayed in the largest size letter possible. Incidentally, is it possible to store graphics on tape also?

The computer selects a message at random, from a random group, or one of the player's choice. Whilst displaying a countdown of 5-10 minutes, the computer would be selecting the next message.

I look forward to some clarification from you – I am not sure that all the salesmen I've spoken to are quite as knowledgeable as they ought to be.

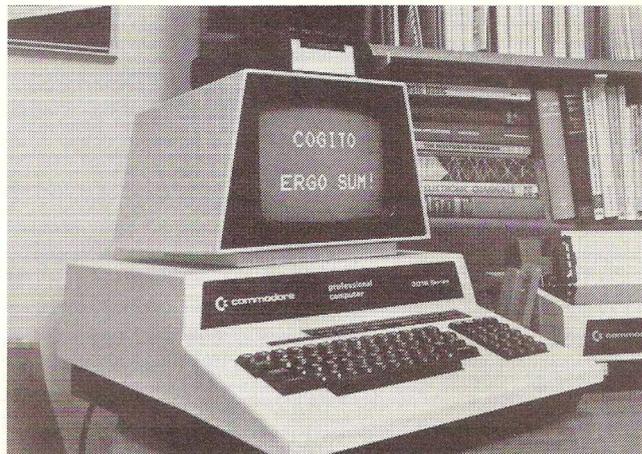
Laurie Beens,
5 Garden Road,
Burley, Hants

With all this free advice, Mr Beens, I hope you are going to send us a copy of the finished program! As a little boy, I was never very good at 'eating up my greens' so I am going to deal with the easy parts first.

Yes, you can store graphics on tape or disk, or in memory – using string variables again. To most computers, graphic characters appear identical to alphanumeric ones and can be manipulated in exactly the same way. By incorporating programmed cursor controls, you can store within a string a whole sequence of keystrokes from the keyboard. This will help you to produce those nice large characters on the screen: creating, for example, the letter E from four lines of small squares, moving the cursor around as needed.

Secondly, there is no problem in asking the computer

If you are thinking of buying a microcomputer for a particular application and would like advice through this column, we invite you to send us details. We also welcome correspondence from existing owners regarding their experiences of buying or using any machine.



Large style cliches on your screen?

to do one thing while displaying another. Performing a countdown is not an intensive operation, so it would be quite permissible to select the next phrase in the meantime.

Now onto the meaty question of storage. In my last column I dealt with the subject of accessing data from tape, so I suggest you read that first. Most cassette systems are buffered which means that you can read an item from tape while displaying another. The problem is that you can only read the *next* item – you can't jump forwards and backwards using a simple cassette. Although you haven't let me in on the aim of the game, random selection is clearly specified – so tape is out.

The good news is that RAM is in. You are correct in saying that for most applications only a small percentage of memory is taken up with strings – but that is not a restriction. If your program so demands, then 90% of RAM could be allocated to strings. The computer maintains a number of *pointers* which show whereabouts in the computer's memory the program is stored, as well as the areas of RAM for variables and strings. During the running of a program these will be constantly changing, as new variables are encountered and stored.

To decide how much RAM will be required, use the rule of thumb: one byte per character. In fact it is possible to condense this by about 25% using a technique known as Packing; the programming is so hairy, you have more or less got to be *Tommy* to do it!

Taking the details from your letter: $10 \times 50 \times 20 = 10,000$ bytes will be sufficient for your needs, and I estimate that another 3-4K will be needed for the various pointers and the program – which makes the random selections, displays the phrases in large letters and times the countdown. So you really only need a machine with 16K at most – though of course the more you have, the more you can expand the game later.

It is important that the machine you buy has dynamic strings – translation: an array of strings need not all be of the same length – since your messages will obviously vary. (For a fuller explanation see 'How to translate BASIC', this issue – Ed). In practice this means a Microsoft BASIC, or Chinese copy thereof. You will find these implemented on the Commodore VIC, or BBC Microcomputer from Acorn. Both machines would in fact be suitable for your purposes, and they offer a good range of colour and graphics facilities to boot.

Dealers, we'll help you out of the microcomputer jungle.



The small business market is where the action is. But that's where it's a real jungle. The small machines are running out of steam and the big ones are priced too high. In between, there are some good products. But how often do they provide the mix of reliability, software back-up and maintenance support you'd really like? Not often! And that's a situation we'd like to rectify.

Easier said than done, of course. But then we are part of the multi-million pound MBS group which specialises in many aspects of the computer business – from equipment sales and rental to maintenance, repair and software development.

Our first step has been to find the right micro. After looking long and hard in Japan, the US and Europe, we selected Altos. This is a range of computers which

has won a reputation for continuing standards of build quality and long-term reliability (in the 1981 Datapro[®] survey 100% of users said they would recommend Altos to other users).

The entry level Altos is a 64K, Z80A³ based system with two highly dependable 0.5 Mb 8-inch floppy drives. All at a remarkable end-user price tag of £2,200. For more capacity, the range also includes multi-user, Winchester-based systems and an advanced 16 bit machine (to be released next month). Altos runs CP/M¹, MP/M² and the super-fast OASIS operating systems (CP/M-86⁴, OASIS-86⁵ and UNIX⁶ for the 16 bit system).

Right now, because we want these beautiful machines to be seen at work, we're busy recruiting a first-class dealer network. So dealers, if you want a way out of the jungle, we'd like to hear from you.

We'll explain what Microtex support is all about...software expertise...training...dealer stocking plans...leasing, rental, hire facilities...seven repair centres offering 4-hour response for field service. And we'll prove Altos is tops for quality engineering.

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²Datapro Research Corp. ³Zilog Inc. ⁴Digital Research Inc.
⁵Phase One Systems Inc. ⁶Bell Laboratories

A whole cottage industry of support for the ZX81 has sprung up since the computer was launched in March this year. Peripherals, software and books abound. Even Clive Sinclair, the inventor of the ZX81, says he is surprised at the number and variety of additional products. He also said he was most impressed with the ways manufacturers have stretched the ZX81 beyond its initial capabilities.

"High resolution graphics and floppy disks show just what can be done with a bit of application," he said.

There's an impressive list of hardware available for the ZX81 at the moment, and the list is growing monthly.

Keyboard Bleeper

Goodies available include a keyboard bleeper, cassette amplifier, inverter and video amplifier (D Bruce); motherboard

board, but it offers saving on the expansion port to use a wide range of interface cards, such as parallel, IEEE, and an opti-isolator card for controlling domestic appliances.

48K RAM

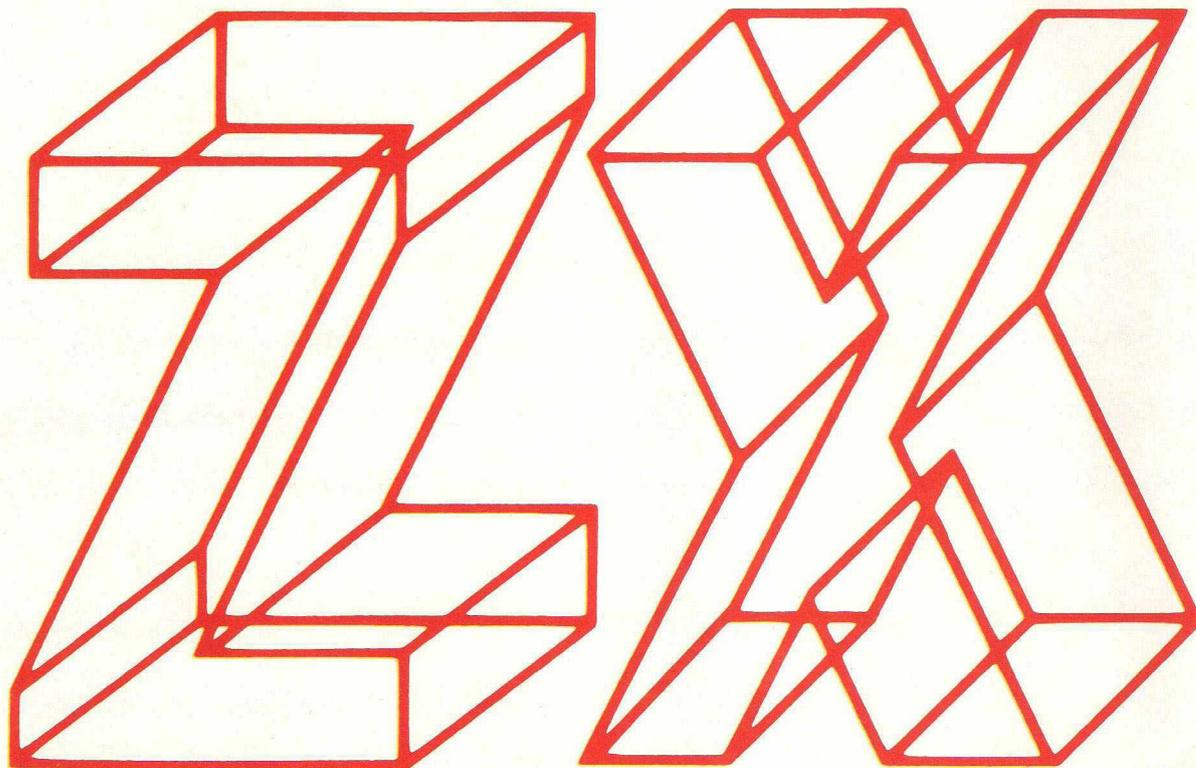
Memotech in Oxford provide a 48K memory extension for the ZX81 which allows the ZX81 to run 48K BASIC programs which may include up to 16K of assembly code. The ZX81 sits on a custom built case which contains the Memotech memory and a power supply, which not only supplies power to the memory, but also to the ZX81. The Memotech memory board has a fully buffered control-data-address bus, with a PCB 40-way header plug. It costs £109 plus VAT for the kit, £129 plus VAT assembled.

Compshop also supply extra memory. The 16K RAM comes with expansion board, offering three slots with extra power supply.

programmable sound generator board using the versatile AY-3-8910-chip. It offers three pitches, three volumes, noise source, two 8 bit input and one output port, plus envelope shaper, all under BASIC control. The soundboard needs to be plugged into an external amplifier. Quicksilva also offer a characters board (£25) which gives two programmable character sets of 64 characters each, using the graphics key to shift between the two sets.

This is only a selection from the hardware available for the ZX81. The software is even more extensive, so the selection below can be no more than an overview of the whole field.

Sinclair Research themselves are offering a cassette-based ZX81 Learning Lab with a 160-page manual, and eight cassettes. Twenty programs, each demonstrating a particular aspect of ZX81 programming, are



Tim Hartnell catalogues many of the Software and

(Quicksilva); soundboard (Quicksilva); cassette switch (Abacus Electronics); overheating prevention kit (Bramfit); keyboards (Stephen Adams, Redditch Electronics and others); P.I.O board (a programmable input/output port encased in epoxy resin, with a connector to the expansion or interface, with the output taken from the 24-pin socket at the front) as well as a video upgrade kit by Compshop to enable new ROM ZX80 owners to operate their machines in the SLOW mode.

Audio Computers of Southend on Sea are providing memory expansion packs, at prices considerably below those charged by Sinclair. They offer a 16K kit for £33, as well as 32K (£45) or 64K (£87). The packs actually fit inside the ZX81, under the keyboard. It is a little inconvenient that the user has to solder the connector between the logic board and the Sinclair computer

The 16K pack is £79 plus VAT, with a 4K version at £59 plus VAT. Compshop's SLOW modification is a kit for £12.95 plus VAT. This kit is not for beginners; it is fairly difficult to assemble, and the instructions are incomplete.

Quicksilva have one of the largest ranges of hardware mods for the ZX81. The QS motherboard, which is £10, extends the existing port to allow any RAM pack and two other boards to be fitted. On board 5 volts is offered, plus two 23-way double-sided edge connectors for add-ons. The Quicksilva 3K RAM board (£18) is a reliable static RAM board which combines with the ZX81's internal 1K to give a total of 4K. It plugs direct into the ZX81 or into the motherboard.

Sound Generator

The Quicksilva soundboard (£25) is a

spread over six of the cassettes. The other two are blank practice cassettes. Sinclair also sells a number of cheap (£3.95) software cassettes which includes ones for 'junior education' and 'games'. Some users have reported difficulty in loading Sinclair cassettes.

Assembler

BUG-BYTE of Liverpool have, among their products, a ZXAS machine code assembler on cassette for just £3.95. This assembles standard Z80 mnemonics written into REM statements. It has overwrite protection, and is supplied with written documentation. The same company offers ZXDB, a debugging program, which includes disassembler, single-step, string search, block transfer and other routines in one compact machine code program.

JRS Software of Worthing have a

programmable moving display routine for the old ROM (4K) ZX80 for just £4.95. This allows the user to write continuous, flicker-free routines on a 1K ZX80. The routine is entered by the user using a numeric coding system devised by JRS Software. The same company provides two 16K ZX81 programs SLALOM and BLACKHOLES, which are £2.95 each, for cassette and instructions, or £4.50 the pair.

Space Invaders

Macronics, Solihull, run by Ken Macdonald and Ron Bissell, the first people to devise flicker-free graphics for the ZX80, have a 1K SPACE INVADERS for the ZX81, written in machine code at £4 for the listing, £5 for the listing of a more flexible 3K version. They also offer a routine to get high resolution (192 X 184) pictures on a 16K ZX81. Mr Macdonald told *Microcomputer Printout* that

16K ZX81/new ROM ZX80 DATABASE program, which blends BASIC menus with over 1K machine code to give a dynamic file or name/address/interest codes/text. The selectable display formats include address labels for printing. The user can search any element type by any key. Tape and full documentation is supplied for £10.

Timedata, Basildon, supply flicker-free ZX80 programs for £4 (two programs per cassette) and a 23 way edge connector socket for just £3.50.

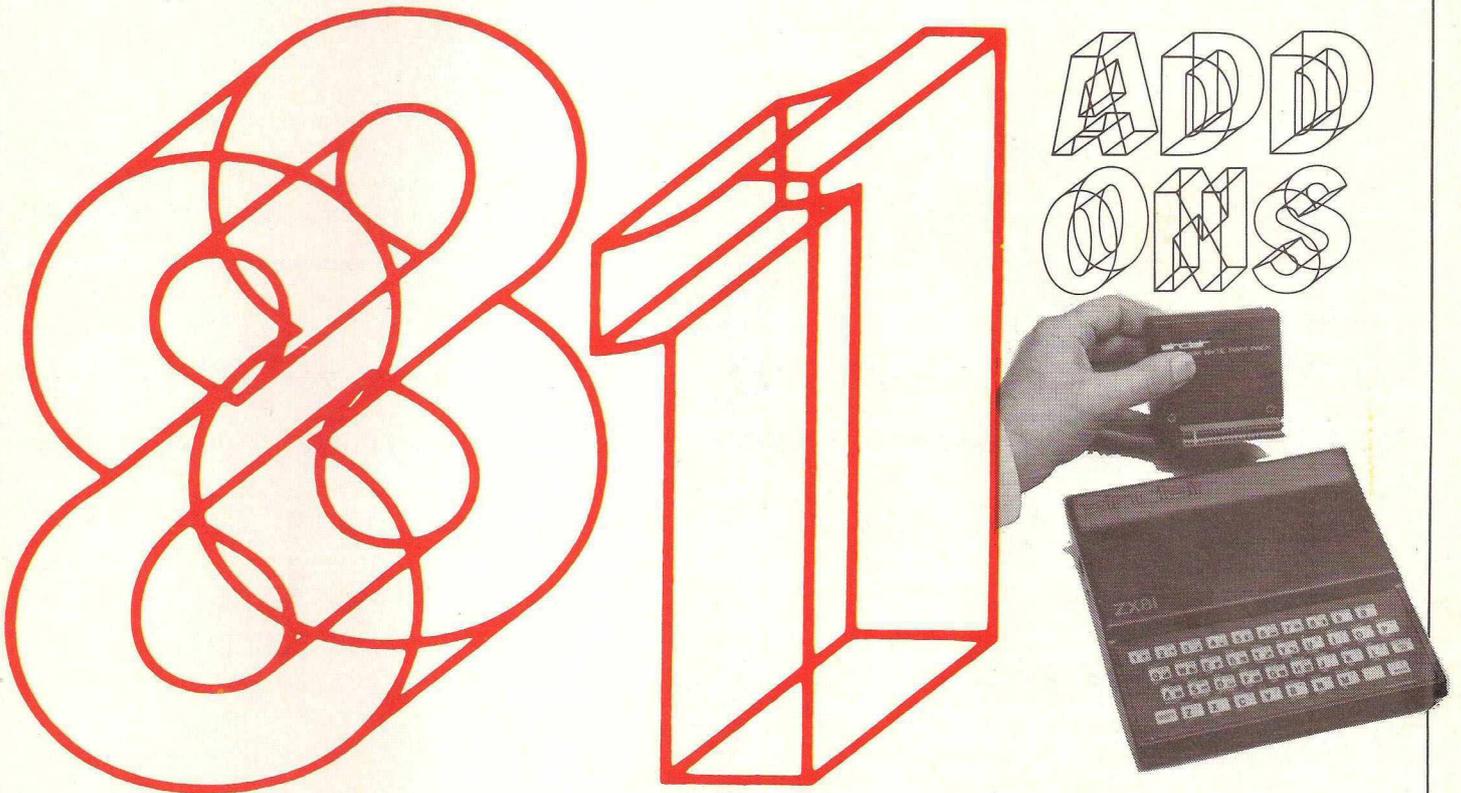
There are a large number of ZX81 books now on the market. The users' club publishes several, including Mastering Machine Code on your ZX81 or ZX80, by Tony Baker (£5.95), The Gateway Guide to the ZX81 and ZX80 by Mark Charlton (£5.95), 30 Amazing Games for the 1K ZX81, Alastair Gourlay (£3.95) and my own Getting Acquainted with Your ZX81 (£4.95)

Your ZX81 ROM, for £8.95 plus 50p post and packing. The same company provides 1K machine code cassette programs Super Invasion and Double Breakout, at £6 each.

Linsac have produced The ZX81 Companion for £7.95 which includes sections on real-time graphics and the monitor, while Richard Francis of Cambridge has 30 1K programs in his The Cambridge Collection, which sells for £4.95.

Users Club

The National ZX80 and ZX81 Users' Club produces a monthly magazine for ZX80, ZX81, Acorn Atom and Proton users, which has programs for each machine, along with letters and hints and tips. This is £1 for a sample copy, £8.50 for a year's subscription. Other suppliers of cassettes and publications for the ZX81 include CDS Microsystems, Doncaster; SCS, Wrexham;



Hardware Add-ons that can enhance your Sinclair.

their most popular program was one called NIGHTMARE PARK, which occupies 9K, and sells for £3.75. The Macronics asteroids program - PLANETOIDS' (£3.95) - was also proving popular.

Artic Computing, run by two lads in Hull, have an impressive range of software. It includes ZXBUG, which runs 4K or 16K, and allows the user to set registers, set quit points in machine code programs, run programs, display only 64 bytes in Hex or characters, display registers, search for a byte or word, copy a block of memory or set a block of memory to any value. This is £5. Artic have also developed a very strong ZX81 chess program (9K machine code) which is available from them (and from the users' club) for £10.

Database

Campbell Systems, Buckhurst Hill, have a

Timedata have added a ZX81 supplement to their The ZX80 Magic Book (£4.75).

ROM Convertor

Hints and Tips for the ZX81 from Hewson Consultants, Blewbury, for £4.25, includes techniques for chaining programs and information on converting ZX80 programs for the ZX81. If you don't want to go to the trouble of converting your ZX80 programs yourself, you can get a cassette program to do it for you from Team 4 of Romford. This program ZX81/new ROM CONVERTER, which costs £7.95, allows the user to load old ROM programs into a new ROM ZX80 or ZX81.

The Essential Software Company, London, W1, have a book called "Not Only 30 Programs for the Sinclair ZX81 ...1K" for £6.95 plus 50p post and packing, and another by Dr Ian Logan: Understanding

M Orwin, Willesden; and Control Technology, Hyde.

Below is a list of suppliers of add-ons for your ZX-81. Additional information is available through the ZX-80 and ZX-81 Users Club, 44-46 Earls Court Road, London W.8.

Artic Computing	396 James Reckitt Avenue, Hull	-
Audio Computers	87 Bournemouth Park Road, Southend-on-Sea, Essex	0702-613081
Bug-byte	96-100 The Albany, Old Hall Street, Liverpool	-
Campbell Systems	15 Rons Road, Brickhurst Hill, Essex	-
CDS Micro	10 Westfield Close, Tickhill, Doncaster	-
Computer Publications	Unit 3, 33 Woodthorpe Road, Ashford, Middx	-
Control Technology	39 Gloucester Road, Gee Cross, Hyde, Cheshire	061-368 7558
D. Bruce	The Beacon, Coast Road, Blackhall, Hartlepool	0783-863612
Edmonds	29 Chestnut Avenue, Grays, Essex	-
Essential Software	47 Brunswick Centre, London E.C.1.	-
Hassoft	14 North Court, Hassocks, W. Sussex	-
JMJ Interfaces	Old School House, Rettendon Turnpike Battles Bridge, Winkford, Essex	-



```

360 next:form1=1to3:ifh(n1)=11(n)+20thenforz=1to4:e(n+10,z)=1:next
365 next:next:print"DDDDO your clues,"t$(t(2))":- ":form=4to6:print"DD";
370 ifh(n)>20thenprint$(n(n)-20):goto385
375 ifh(n)>10thenprint$(n(n)-10):goto385
380 print$(n(n))
385 next:gosub875
390 print"CDO";t$(t(2));":print"DO have you solved it (y/n)? ":gosub865
395 ifa$="y"thenxx=1:print"CDO the denouement?? DD":goto430
400 print"CDO which sleuth will you grill? "
405 print"DD1 ";t$(t(1)):print"DD2 ";t$(t(3)):print"DD3 ";t$(t(4))
410 gosub865:ifa<1ora>3then410
415 ifa<>1thena=a+1
420 a1=a
425 print"CDO"
430 form=1to5:print"D";n;s$(ss(n)):next:print"DDO you suspect? "
435 gosub865:a2=a
440 ifa<1ora>5then435
445 print"CDD":form=1to5:print"D";n:w$(ww(n)):next:print"DDO which weapon? "
450 gosub865:a3=a
455 ifa<1ora>5then450
460 print"CDD":form=1to5:print"D";n;l$(l1(n)):next:print"DDO where? "
465 gosub865:a4=a
470 ifa<1ora>5then465
475 z=2:gosub480:goto515
480 print"CO the murder of ";s$(s(6))" "
485 ifxx=1thenprint"DD";t$(t(z));" deduces:-":goto495
490 print"DD";t$(t(z));" alleges toD":print$(t(a1))":-
495 print"DD O murderer F : ";s$(ss(a2))
500 print"DD O weapon F : ";w$(ww(a3))
505 print"DD O location F : ";l$(l1(a4))
510 gosub875:print1$:return
515 ifxx=0goto530
520 ifss(a2)=s(5)andww(a3)=w(5)andl1(a4)=1(5)thenprintan$:end
525 printw$:xx=0:goto580
530 printt$(t(a1));r$:ifa1=1thenn1=1
535 ifa1=3thenn1=7
540 ifa1=4thenn1=10
545 gosub895
550 form=n1ton1+2:ifh(n)=ss(a2)thenprint$(ss(a2)):goto580
555 ifh(n)=ww(a3)+10thenprint$(ww(a3)):goto580
560 ifh(n)=l1(a4)+20thenprint$(l1(a4)):goto580
565 next:printn$:ifa1=1then580
570 rv=int(1v*rnd(1)+1):ifrv>1vthen580
575 e(a2,a1)=2:e(a3+5,a1)=2:e(a4+10,a1)=2
580 gosub875:z=3
585 a1=int(4*rnd(1)+1):ifa1=3then585
590 gosub595:gosub600:goto665
595 a2=int(5*rnd(1)+1):a3=int(5*rnd(1)+1):a4=int(5*rnd(1)+1):gosub480:return
600 f2=0:f3=0:f4=0
605 print1$:print$(t(a1));r$:ifa1=1thenn1=1
610 ifa1=2thenn1=4
615 ifa1=3thenn1=7
620 ifa1=4thenn1=10
625 gosub895
630 form=n1ton1+2:ifh(n)=ss(a2)thenprint$(f2=a2:goto660
635 ifh(n)=ww(a3)+10thenprint$(f3=a3:goto660
640 ifh(n)=l1(a4)+20thenprint$(f4=a4:goto660
645 next:printn$:ifa1=1then660
650 rv=int(1v*rnd(1)+1):ifrv>1vthen660
655 e(a2,a1)=2:e(a3+5,a1)=2:e(a4+10,a1)=2
660 gosub875:return
665 z=4:a1=int(4*rnd(1)+1):ifa1=4then665
670 gosub595:gosub600:z=0:a1=0:form=1to5:ife(n,1)=2thenz=e(n,0)
675 form1=2to4:ife(n,n1)=0thena1=n1:a2=e(n,0):n1=4:n=5
680 next:next:ifa1=0then750
685 z=0:form=6to10:ife(n,1)=2thenz=e(n,0)
690 next:ifz<>0thena3=z:goto700
695 a3=int(5*rnd(1)+1)
700 z=0:form=11to15:ife(n,1)=2thenz=e(n,0)
705 next:ifz<>0thena4=z:goto715
710 a4=int(5*rnd(1)+1)
715 z=1:gosub480:z=1:gosub600:rv=int(1v*rnd(1)+1):ifrv>1vthen390
720 iff2=0goto730
725 form=1to4:e(f2,n)=1:next:goto390
730 iff3=0goto740
735 form=1to4:e(f3+5,n)=1:next:goto390
740 iff4=0goto390
745 form=1to4:e(f4+10,n)=1:next:goto390
750 ifz<>0thena2=z:goto760
755 a2=int(5*rnd(1)+1)
760 z=0:a1=0:form=6to10:ife(n,1)=2thenz=e(n,0)
765 form1=2to4:ife(n,n1)=0thena1=n1:a3=e(n,0):n1=4:n=10
770 next:next:ifa1<>0then700
775 ifz<>0thena3=z:goto785
780 a3=int(5*rnd(1)+1)
785 z=0:a1=0:form=11to15:ife(n,1)=2thenz=e(n,0)
790 form1=2to4:ife(n,n1)=0thena1=n1:a4=e(n,0):n1=4:n=15
795 next:next:ifa1<>0goto715
800 form=1to5:ife(n,1)=0ande(n,2)=2ande(n,3)=2ande(n,4)=2then810
805 next:goto855
810 a2=e(n,0)
815 form=6to10:ife(n,1)=0ande(n,2)=2ande(n,3)=2ande(n,4)=2then825
820 next:goto855
825 a3=e(n,0)
830 form=11to15:ife(n,1)=0ande(n,2)=2ande(n,3)=2ande(n,4)=2then840
835 next:goto855
840 a4=e(n,0):form=1to9:print"CDDO ";t$(t(1));" has solved it!! "
845 form1=1to300:next:print"C":form1=1to200:next:next:z=1:xx=1:gosub=80
850 print"CDD elementary, my dear ";t$(t(2));"! ":print"DD":end
855 print"error":stop
860 return
865 geta$:ifa$="":goto865
870 a=int(val(a$)):return
875 print$a
880 geta$:ifa$="":goto880
885 ifa$=" "thenreturn
890 goto875
895 form=1to1000:next:return

```

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	2716
	2532
	2732
	2764
	27128 (conforming to Intel standard)
	2816 (EEPROM)

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HOW TO WORK FASTER NOT HARDER



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There are two kinds of beings who write reviews; the tame ones, whose livelihood depends directly or indirectly on the survival of the product, and the feral ones (once tame but now wild), who make a living in some other field and so can say what they wish. I am of the latter persuasion. In this article I shall present a PET-owner's view of the VIC-20 as it is currently supplied, without any of the plug-in bits. If anything I say conflicts with what you have read elsewhere, you may take it that my information was derived from hands-on experience with the beast, and not from publicity handouts or promotional material.

What You Get

My VC-20 as the carton names it, arrived well-packed in fitted foam plastic containing the unit, a "power pack", and an RF modulator. A spiral-bound book, "Personal Computing on the VIC 20", was also supplied. (Incidentally, Inside Trader informs me that VC-20 is the continental name: VIC in German being pronounced in the same way as their word for).

The piece referred to as a "power pack" or "power supply", depending on which bit of literature you are perusing, turns out to be nothing but a transformer to convert the mains voltage to low-voltage AC. It is rated for 220v input, 11v output, at 38va. On a 240v supply, this calculates out to 12vac, which leads to the interesting question of whether one could plug in 12vdc and operate aboard one's 58-foot Moonraker cabin cruiser or executive jet. It is unfortunate that the factory, in a misguided attempt to economize, has made the transformer's leads too short, though it is possible that this will change

when the mass production models hit the market. The transformer remains cool in operation, but the instructions advise that it be unplugged when not in use, an inconvenience which cannot be got around unless you have the luxury of a switched power point.

RF Modulator

Turning now to the RF modulator, another external 'black box' which fits between the VIC and your T.V. aerial socket. One cable plugs into the back of the VIC by means of a HiFi type DIN plug. A separate cable of similar length is supplied to connect the modulator to your telly. This is provided with a phono plug to mate with the modulator and a TV coax plug at the back end. As I found the combination too short for viewing my 25" screen, I attempted to extend it with a standard Hi-Fi cable. This resulted in a considerable change for the worse in the appearance of the display, proving if it were not known already that shielded wire supplied for Hi-Fi use is not up to transmitting UHF signals. If you, too, have a large screen, you may need to get your dealer to make you up a longer low-loss cable or to lengthen the other part of the cable with a five-pin DIN extension. You may also want to invest in an *aerial switch* which can be mounted on or adjacent to your telly and will allow convenient switching between VIC and the Beeb. If there is no channel allocation conflict, a *combiner* can be used in place of the switch.

Cassette Recorder

The tape recorder originally supplied with my 3016 PET plugged into the Cassette Interface slot on the rear of the VIC and proceeded to work correctly without any fuss. My only reservation here is that when the connector is pressed into place it lies within the body of the VIC, so that when the time comes to remove it, one must grasp the cable and pull on the wires. Also, as engineers will be aware, edge connectors on printed circuit boards are not designed to stand up to multiple insertions and withdrawals: they wear relatively rapidly, and the gold flash which is provided in the better types to forestall oxidation disappears after a few gozintas. Expect trouble from this source when you start collecting expansion cartridges.

WORTH THE WAIT?

Over the past three years, Commodore have upgraded their PET range several times - and corrected most of the little niggles in its design.

The VIC, however, is a brand new home computer - arriving in the shops this month. We put our test machine through the dreaded Microcomputer Mincing Machine - alias **Lindsay Doyle**.

The Documentation

My heart fell as I perused the spiral-bound "friendly computer guide" for the first time. Where were the typos of yesterday? Where the dozens of factual errors? Where the tortuously illogical sequence of presentation, the ignorance, the inability to communicate? Loth though I am to say it, Commodore US has apparently hired a professionally capable outfit, Avalanche Productions, to generate a good beginners' handbook, comparable to the best that Apple has provided. One hundred and four well-illustrated pages guide the beginner, answer his questions as they occur, offer hands-on experience, and generally provide a trauma-free introduction. Forty-seven pages of appendix provide all the necessary tabular information for the more advanced programmer such as abbreviations for BASIC words, POKES for screen and border colour combinations and musical scales, screen position codes, ASCII, and CHR\$ codes, pinouts for all connectors, error messages, and, wonder of wonders, a reasonably-good index in the back as well as contents pages in the front!

There are also seven pages of sample program listings over and above those in the text. Errors are few and far between. One can somehow understand how R5232 sneaked in for RS 232 or POKE 7608 appeared where POKE 7680 was intended. Even so, these and a few other errors which prevent some of the sample programs from working as printed could easily have been picked up and corrected in one reading by a dedicated amateur.

Additional Volumes

There is also a set of three loose-leaf binders supplied to dealers, which may be made available later to customers at extra cost. Volumes 1 and 2, which I have not seen, are said to be given over to maintenance information. Volume 3, which I was able to peruse in camera, left me feeling on much more familiar ground error-wise, though it did contain a whole host of useful reference data on everything from ROM entry points, to details of the 6560 Video Interface Chip, from which the VIC derives its name. I can't help feeling that some of the fun of exploring the machine has been lost. Even two years after the launch of the PET, we were still finding fascinating yet fundamental tricks that could be done - largely from lack of good documentation! Still, at least we have the familiar bunch of errors to spot.

The issue of "3:Software" that I was

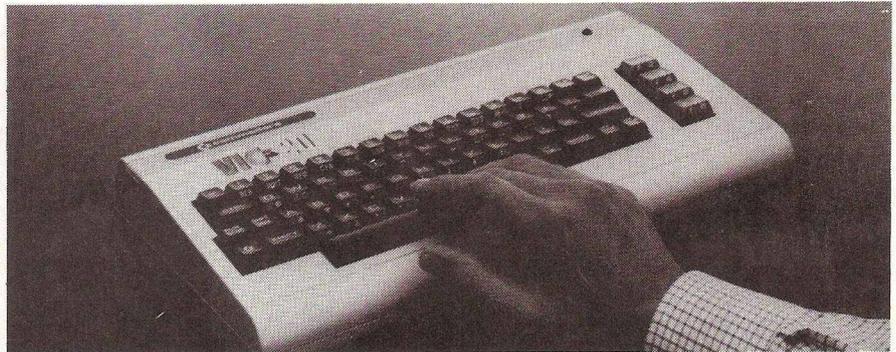
privileged to see claimed to be a "preliminary draft copy" if it ever achieves a final version, I would like to have one, but I wouldn't pay anything for it in its present condition.

Software

I would like to be able to say that a nice cassette of demonstration programs was included with the machine. Perhaps you will be luckier than I was. I received a cassette, right enough, but eight of the programs on it were defective, by which I mean that portions of them loaded as garbage, the same garbage every time. Why do we never hear of someone being fired from COMUK's Quality Control Department? Come to think of it, why do we never hear of COMUK's Quality Control Department at all?

Depressing Keys

Previous articles have covered the differences between the PET and VIC keyboards, including the welcome repeat on cursors



which can be POKEd to all keys and the fact that hitting RETURN without an input no longer aborts a program. The new key with the Commodore logo, which acts as an alternative shift to give access to the graphics on the left front of each key, is going to need a familiar name: I suggest we call it CHIFT as opposed to SHIFT.

Graphics mavens who are familiar with all the quirks of the PET know of the four "secret" characters which do not appear on the keys but become accessible when in the lower case mode. They will be pleased to hear that these are still available. One may toggle from Upper-Case-with-Graphics (UC Mode) to Upper-Case-with-Lower-Case (LC Mode) and back by pressing the CHIFT and SHIFT keys simultaneously. When in LC Mode, one has access to a number of graphics which could not be accessed in LC Mode in the PET.

This could have been very helpful in designing forms where it is desired to use both upper and lower case for appearance's sake and improved readability. However, whoever decided which symbol should go in which shift mode was not a graphics maven. He put all the members of the quarter-pixel or little-square family on the CHIFT key for a good start, but after that it was downhill all the way. Six of the eight horizontal lines appear on the SHIFT key, with the other two on the CHIFT. They are scattered about the keyboard so as to make them difficult to find and relate to each other. The family of vertical lines is treated similarly. In each case the limit lines, the ones which match up with the rotated-capital-L graphics, are on CHIFT, but the capital-L types are not, which means that boxes made up of these cannot be used with lower case. What a shame! A little perspicacity in these key allocations would have given so much more flexibility!

Big Characters

All characters as they appear on the screen have an aspect ratio of 2, which is gobbledygook for saying they are twice as wide as they are high. All horizontal lines are thin, all vertical lines fat. If you want to draw squares, you have to use the vertical rectangles. I could swear I was getting two kinds of "flying saucer" symbols there for a while when I first plugged my new VIC in, but they must have departed again. In searching through all the possible combinations I confirmed one sport reported by others:

CONTROL R turns reverse on but not off: no other alpha key has any such effect with the CONTROL key.

The Sound Effects

Gavin Sanders says that three of VIC's voices "produce a sine wave, if you want to be technical". He must have been misled by something he read, as the sound which emanates from my TV is far from sinusoidal, nor would I expect it to be, considering the method of generation. For "sine wave" read "square wave" and you won't be too far wrong. Whatever the reason, the lower notes sound out of tune, even to this tin ear, and one would be hard put to use the bottom octave of the low voice in harmony with higher notes in other voices. However, chords in the upper registers are quite mellow.

DO YOU NEED 16 BITS ?

What exactly does '16-Bit' refer to? Who are the leaders in the 16-Bit micro-computer race? Will all existing personal computers become redundant? And what about software compatibility? **John Gowans** answers these and more questions in this month's State-of-the-Art Report.

In the beginning, the semiconductor business created the microprocessor; both 4-bit chip and memory created it them.

And the populace, even unto Jim Callaghan when prodded, lifted its hands crying "a new industrial revolution", and saw that it was good.

And 4-bit begat the digital watch and calculator, and the holy rule of falling prices; and the industry analysts cried Hallelujah!

And 4-bit begat 8-bit, and lo, the micro-computer business sprang from its loins, at a speed even unto that of a rat in a drainpipe. And the home user saw that it was good.

And Yea, the semiconductor makers saw that they were on to a good thing and begat 16-bit; and a wailing and a gnashing of teeth arose, as it looked as though 8-bit investment was heading verily down the tubes....

Programmer's twitch

Even unto the *n*th generation – the chip makers don't seem to know where to stop. The first 32-bit microprocessor chips are in the sweaty hands of favoured customers before most people have even got their minds round 16-bit, and programmers are beginning to twitch – with pleasure or horror – at the prospect of dealing with operating systems or bits of operating systems built into the processor chips themselves.

But hang on a minute, micro owners tend to say, aren't these big chips meant for big computers to run banks and things? And what could I do with a 16-bit system that I couldn't on my Z80A? Most owners have enough trouble with the number of bits they've got, without thinking of multiplying them by two or four.

Even so, you can't stop progress (as the rabbit said under the combine harvester) and 16-bit systems are coming to market. David Jackson, founder of highly-rated US firm Altos, goes so far as to predict that 90% of his company's systems will be 16-bit within five years. Let's try to carve a hole in the mystique and take a dispassionate look at what's going on.

It's true that 16-bit processing – operating on pieces of data each made up of 16 binary '1's and '0's – used to be the province of £20,000 minicomputers like Digital Equipment's highly-successful PDP-11. But the semiconductor industry has now come up with a whole range of 16-bit microprocessors, and following a time-honoured tradition these are getting cheaper by the minute as production volumes go up. As an example,

Texas Instruments' TI 99/4 home colour computer, though you might not guess it, has a 16-bit microprocessor running it and is now on sale for around £250. Of course, there are economic reasons for this drastic price-cutting by TI – the main one being that they couldn't offload the 99/4 at its original price – but it shows what is possible.

So assuming that the economics of putting 16-bit microprocessors into small computers are right or nearly right, what does this mean in practical terms?

More Memory

The most obvious difference between 8-bit and 16-bit has already been mentioned; 16-bit chips operate on lumps of data twice the length of 8-bit chips. This instantly increases the maximum integer value the processor can cope with in one go to 65,535 instead of 255. Of course, 8-bit systems can handle higher integer values than this, but the processor chip itself cannot and has to go through several cycles to build up these high values, and that's why the phrase 'in one go' is important. Adding two big integers together is practically instantaneous with a 16-bit chip, and much slower in 8-bit.

The next most obvious thing is the amount of memory the processor can get at directly.



There is no arcane reason why the vast majority of 8-bit micros have a maximum memory capacity of 64K bytes; it's just that this is the largest number of memory locations that an 8-bit processor can address without fiddling about. The 8-bit chips generate addresses 16 bits long, and this gives 65,536 (64K) locations each holding one byte. There are ways of getting round the 64K limit on 8-bit systems, by arranging the memory in separate sections and switching between them as the program demands. This is how the Nascom 2 can address 192K bytes using three blocks of 64K and a Z80A 8-bit processor.

Apart from Texas Instruments' 9900 series, the first of the 16-bit single chip processors on general sale, all the brand leaders in the 16-bit market can address vastly more memory than this directly. The two latest chips, Motorola's 68000 and National Semiconductor's 16032, can both address a staggering

"Most owners have enough trouble with the number of bits they've got, without thinking of multiplying them by two or four."

16M bytes – or 16,777,216 bytes, which looks more impressive – which is the same as a giant IBM 370. They manage this by generating addresses 24 bits long instead of the 16 bits of 8-bit processors. But that is not all. Those 24 address bits specify *locations* in memory, so if memory chips were organised with 16 bits per location instead of 8 the 68000 and 16032 could actually get at 32M bytes directly – and this is where the numbers start getting beyond comprehension, like astronomical distances.

Higher speed

Apart from these hefty advantages, 16-bit processors can address more peripherals, have larger and more complex instruction sets for the programmer to use, and execute programs faster. These last two are connected; because of better chip design, the new chips have higher clock speeds than most 8-bit processors and so run faster. But the more powerful instructions mean that the programmer can do in one single instruction what before took a subroutine of instructions, and this too increases running speed. One example is the inclusion of multiply and divide instructions in the sets of the 16-bit chips. (Most 8-bit processors can do nothing more sophisticated than adding together two bytes).

With all these advantages in mind, the chip makers lost no time in getting 16-bit development programs under way for the volume sales they anticipated from system manufacturers.

But the microcomputer firms showed a

State-of-the-Art Report :

marked reluctance to build 16-bit processors into boxes. First, they were expensive. Second, a 16-bit data bus meant that new support chips like I/O ports were needed and that stocks of cheap 8-bit support chips could not be used. Third, the new instruction sets meant that all the software written to run on 8-bit processors was useless, and that a vast amount of money would have to be spent on program conversion and development.

The slow take-up of their products caused the chip companies to backtrack a little and release 'hybrid' processors – chips combining 8-bit and 16-bit features. We'll go into these in more detail later.

But having said that (© Ron Greenwood, 1979-?), systems built around the new 16-bit chips are coming out at an increasing rate, and there are signs of a shakeout in the computer makers' choice of processor. The front runners are sorting themselves out into some kind of order.

Unsung Success

Before going into the successes and failures in the 16-bit chip race, it's only fair to give credit to an unsung success in 16-bit processors – Western Digital of the U.S. Readers may have been saying to themselves that 16-bit systems have been around for *ages*, and the better informed will be preening themselves on coming up with names like Digital Equipment's LSI-11, Alpha Micro's AM-1010, Heath/Zenith's WH-11A, the UK's own Equinox with the System 300 (albeit using US boards), and – to be really trendy – Western Digital's Pascal Microengine. What all these systems have in common is that they use processor chips from Western Digital.

So to clear up why I'm not going to mention these systems or Western Digital again after this short diversion, let's look at these processor chips and how they developed into systems.

Some years ago (as we journalists say when our research is faulty), Digital Equipment (DEC) commissioned Western Digital to make a processor for its planned low-end systems, which eventually emerged as the LSI-11 and LSI-11/2 systems. The result was not a single chip 16-bit microprocessor, but a chip set; and the main feature of this was that two or three chips in the set were ROMs containing the processor's instruction set. This was fine for DEC, since it could put into these ROMs the same instructions that ran its PDP-11 minicomputers, and upgrade the instruction set any time just by changing the contents of the instruction ROMs.

Of course, DEC did not want other companies buying chip sets complete with the instructions of the big-selling PDP-11 range, so Western Digital was barred from selling these LSI-11 chips to anyone else. But if the instruction set ROM contents were changed, there was no objection, and the system builders needed no more prompting. Alpha Micro commissioned its own instruction set from Western Digital; Industrial Microsystems (who provides the boards for Equinox) bought the chips with an 'improved LSI-11-like' instruction set developed by Western Digital itself; and Heath/Zenith just bought LSI-11 processor boards straight from DEC.

Pascal Microengine

Western Digital then spotted how the programming language trends were going, and came up with the Pascal Microengine, a system that executed Pascal 'P-code' directly. In Pascal, the first compiler translates the program into 'intermediate' or 'P' code which is then interpreted into machine code. With the flexibility of the chip set approach, Western Digital just programmed the instruction set ROMs so that the processor chip itself accepted P-code statements as its machine code, thus cutting out an interpretation stage and speeding up execution of Pascal programs.

Interestingly, Dicoll Data Systems of Basingstoke has just launched its own version of the Microengine using the P-code-programmed processor set. And QUPRO of

nyaah), TI immediately became the market leader – not too hard when there is so little competition.

The 9900 showed its minicomputer background in its design. It is a 64-pin chip, which can only address 64K bytes of memory; this seemed a lot five years ago, but loses one of the big selling points of 16-bit systems. But it has its good features. It is easy to use for beginners, since the address and data buses are separate, and the ability to use any amount of memory for processor registers takes some construction off microprocessor programming.

Hybrids

TI had admitted (to me at least) that by today's standards the 9900 architecture looks 'moribund'. But the software provided



Newbury have done similar – this time with the appellation 'Q Engine' – and featuring 64K RAM and 2MBytes worth of 8" disk. As a complete aside, incidentally, QUPRO say their machine has a fibreglass casing which means (wait for it) you can order it in any colour you like!

Now what I'm leading up to is that these systems do not fall within the scope of this article, mainly because we are not likely to see these processor chip sets in personal computers. They are basically a halfway house between micros and minis, as the prices – £7,500 and up for Alpha Micro, £10,000 and up for the Equinox 300 – tend to indicate. Heath/Zenith's WH-11A is available in kit form, but even so ... And by the way, don't, as I did, try to sort out Western Digital's numbering systems for these various chip sets. That way madness lies.

Meanwhile, back in the single-chip mainstream, things started to stir in 1976. Texas Instruments, in its infinite wisdom and needing a chip-level processor for its growing minicomputer lines, skipped the 8-bit stage completely and launched the 16-bit 9900. As the first in the 16-bit race (and please don't write in about Data General's mN601 microNova chip or Fairchild's microNova-compatible 9440 Microflame; these are too specialised in the minicomputer market for discussion here, so nyaah, nyaah,

by TI for the chip is extensive, and the later chips in the series – 9940, 9980A, 9981, and the UK-designed 9995 give full software compatibility. The 9980A and the 9981 were the first of the 'hybrids', 16-bit microprocessors with 8-bit data buses to allow standard 40-pin packaging and the use of standard 8-bit support chips, while retaining 16-bit internal operation for higher performance. Unfortunately, these two TI chips had memory addressing capacity cut down to just 16K bytes, and I have an unconfirmed suspicion that it is one of these that runs the 16K RAM 99/4 home computer. The 9940 and 9995 are basically the 9900 with some on-chip ROM and

“16-bit processors can address more peripherals, have larger instruction sets, and execute programs faster.”

RAM provided, but have higher speeds and performance figures.

So the 9900 can just about be written off for the next generation of home computers, the ones with big memory sizes. Even the





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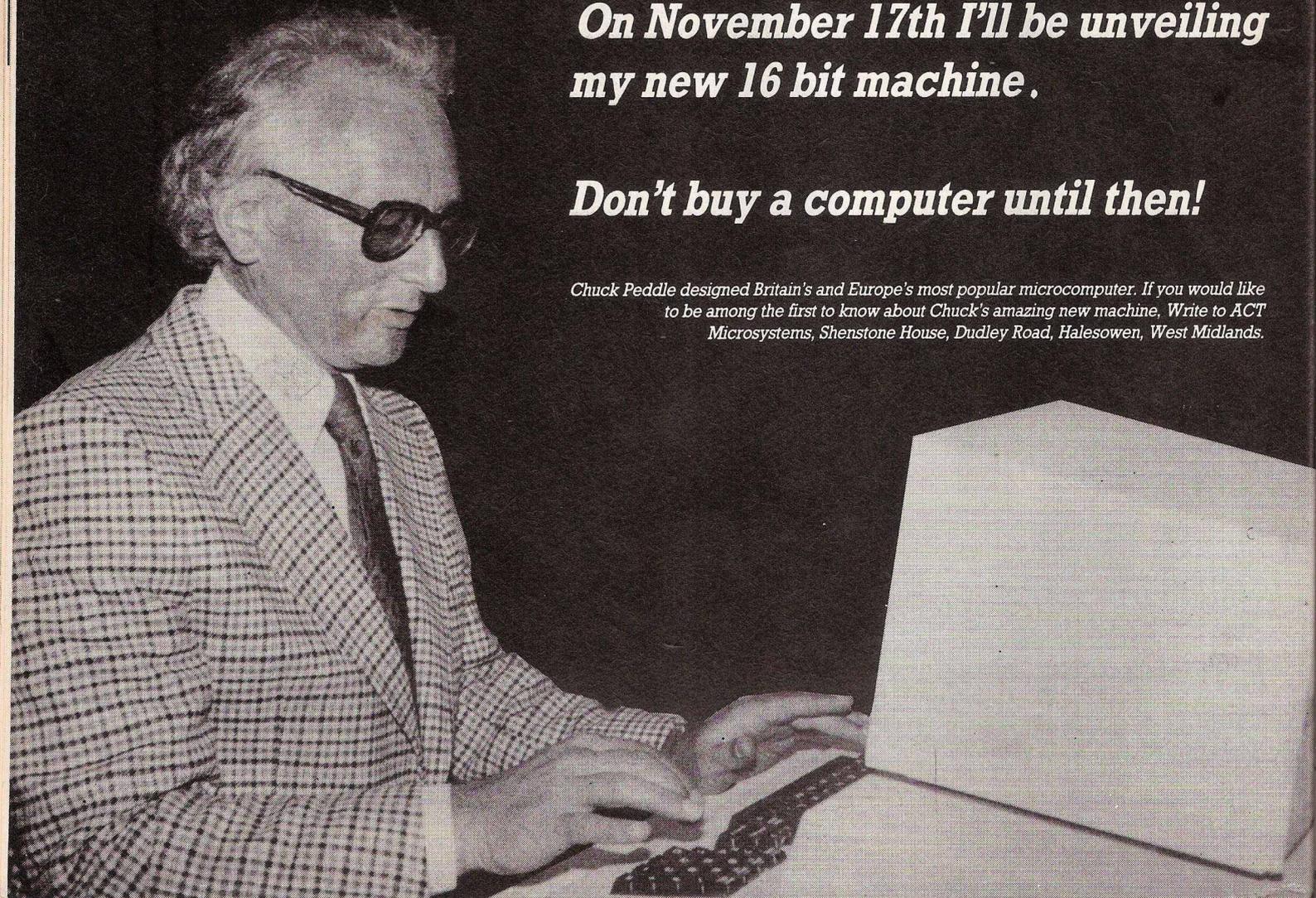
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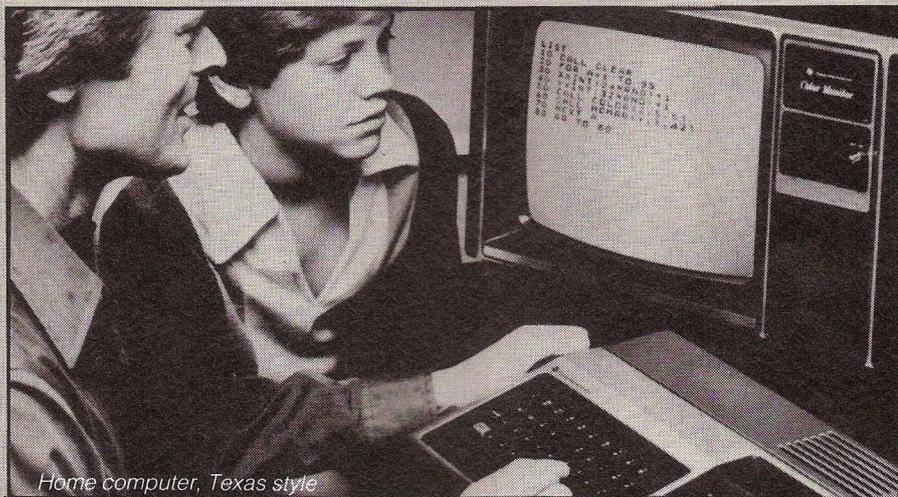
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State-of-the-Art Report :

mentioned) they are only filtering in slowly, with Onyx the best-known name. The Onyx C8002 system uses (confusingly) the Z8001, and comes with up to 1M bytes of RAM and a built-in 8in. hard disk giving 10 or 18M bytes. It got some good reviews, but now Onyx is in the throes of one of the industry's perennial distribution disputes, with lawsuits flying about on both sides of the Atlantic. At the time of going to press, the news was that Onyx systems were not going to be sold by the original UK source any more.



Home computer, Texas style

Another name just emerging here is Piiceon, and I don't know how it's pronounced either. Sold by Micro Networks of London, the Piiceon PM1000 is an intelligent (!) terminal built around the 8086 with up to 256K bytes of RAM and twin floppy or hard disk drives. It uses the CP/M-86 operating system, offering BASIC from Microsoft, CIS Cobol from Micro Focus of the UK, and Pascal in due course. Piiceon's own word processing package is also on the market.

BBC News

From UK companies, BMG Microsystems has the MS5000 in a 8086 version for up to eight users, with up to 768K bytes of RAM and 8in. floppy or hard disks. And Equinox, already selling the System 300 with the Western Digital chip-set processor, has designed its own system built around the Motorola 68000 chip. Few details as yet, but the System 68000, complete with a new operating system written by Equinox, should be at Compec in November. And Future Technology Systems of Beith in Scotland has Systems 88, made up of 8088-based workstations and a central 8086-based file server.

Acorn, the BBC's favourite, has some hot news. As you may know by now, the BBC Microcomputer will allow the user to plug in an extra processor – and the 16-bit plug-in will be NatSemi's 16032. This is likely to be the first 16032 system in the UK, and according to Chris Curry of Acorn it was chosen because it was the fastest and because Acorn has 'a close relationship' with NatSemi. Acorn has its first samples now. Most recently announced on the British scene, however, is the Series 500 from SYSTIME – again based on the 8086.

So far, that seems to be all the end-user systems on sale here, at least all those built

round the new single-chip 16-bit processors. Even the prices are vague, but are sure to be high to start with; the 16-bit multi-chip systems like the Alpha Micro will probably be undercut just a bit until sales volume of the new systems rise.

Meanwhile, here are some names to watch out for from the US that should appear on this side of the water sooner or later.

Wicat Systems of Orem, Utah, has a 68000-based system, called System 150. Standard features are 256K bytes of RAM

and a 10M byte Winchester hard disk, and operating systems include Wicat's own MCS, Bell Labs' Unix Version 7, and CP/M. A variety of languages are offered. Wicat also has a Z8002-based graphics terminal.

“The new instruction sets meant that all the software written to run on 8-bit processors was useless...”

Ithaca Intersystems of Ithaca, New York, has a Z8001 processor board to plug into its standard S100 bus, while Dual System Control Corp. of Berkeley, California, has a 68000 board for the same bus; and CompuPro of Oakland has an S100 bus 8088.

MicroDaSys of Santa Monica in California has also gone for the 68000 in its 68K Mini-Frame system. And for once there is a price example; a six-user system with 512K bytes of RAM, 24M bytes of hard disk, and the Unix operating system costs under \$25,000. (MicroDaSys puts an exclamation mark here.)

Computex of Chicago has System 3, based on the Z8001 with 256K expandable to 16M bytes of RAM and up to 268M bytes of hard disk. Price for the basic system without hard disk is just over \$7,000.

TecMar of Cleveland, Ohio, has an 8086-based system, supplied as a set of S100 boards.

Quasar Data Products, also of Cleveland, has the 8-bit QDP-100 system that is upgradable to a coyly unnamed 16-bit processor by plugging in a card.

And ASC Computer Systems of the quaintly named St Clair Shores, Michigan,

will put together any 16-bit system you like using the Z8000, 8086, 8088, 68000, or even the LSI-11 processors.

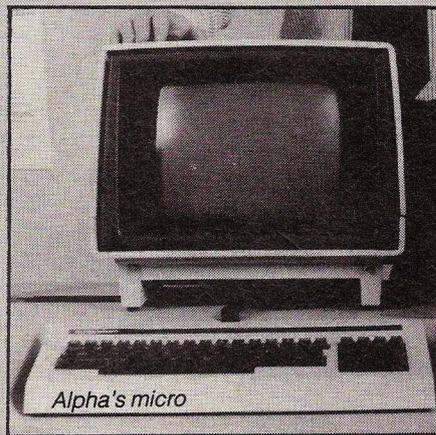
Big Boys

This quick run through of some of the 16-bit systems on sale in the US might have whetted your appetite. But if you are anything like me, you will never have heard of any of these companies before. What are the big boys doing?

There are some reasonably firm rumours to go on. Apple should be coming out with a 68000-based Apple IV (or is it V) very soon, but no firm date has been set. Tandy has an 8088 system – like IBM's Personal Computer – on the stocks for quick release. And Commodore; well, it seems that the company's chip-making subsidiaries MOS Technology and Frontier Semiconductor will bring out 16-bit chips of their own that might – just might – run 6502 code as well as 16-bit code so that PET programs will run on it. And this highlights the tricky problem for the big sellers. The vast amount of software written for PET and Apple just will not run on any 16-bit processor, and no-one can afford to junk that investment without very careful thought. Of course, 16-bit systems tend to be for a different market, so it might not be too bad.

That different market seems likely, from what we've seen so far, to be in the multi-user business applications previously handled by minicomputers. It is significant that the operating system tipped for stardom in the 16-bit market is Bell Labs' Unix, designed initially for DEC's bigger PDP-11 minis. Paul Idings, who converted CIS Cobol to run under Unix, summed up the possibilities of 16-bit very nicely. “To run Unix you really need a 16-bit processor and 512K bytes of RAM,” he said. And when my jaw dropped he looked surprised. “That's nothing,” he said with a straight face.

One comforting thought is that 16-bit systems won't make 8-bit redundant overnight; that's like saying that cars have made bicycles redundant. Even 4-bit microprocessors are still doing very nicely, and 16-bit systems will use 8-bit processors to handle input/output and disk controlling functions. And anyway, until the price of the 68000 comes down to the £4.50 of the Z80 from its current £200 or so, I wouldn't bother saving your pennies. Unless, of course, you have that application that has to sort through 16M bytes in half a second



Alpha's micro



MIKE'S MUSES



by Mike Gross-Niklaus

Micros, Micros, everywhere.

How many electric motors do you have in your house? - 3? 5? - Counting them may give you a surprise. Washing machine, vacuum cleaner, mixer, sewing machine, cooker fan, ventilation fan are some obvious locations that spring to mind. There are also the less obvious such as those in cassette players, gramophone turn-tables, some clocks, toys, to say nothing of electric drills, saws, mowers, windscreen wiper motors and all the others found in the car, garage and garden shed. In my own humble abode, when we really started looking, we found over 30 of these useful slaves. The point I'm making is that the electric motor is taken so much for granted nowadays that it requires a major investigation to add up one's total stock.

If I now ask "How many micro-processors do you have in your house?", you may reply "Just one", if like many readers of this magazine, you have a microcomputer and "None" if you don't. But are you sure? The latest sewing machines and washing machines have micro-processors built in, they are becoming common in toys and are now starting to be found in cars. The chances are that you have or soon will have five or ten of the multi-legged little beasties working for you in your home, taken completely for granted as are those electric motors.

But because the micro is so much more versatile than the electric motor and so much cheaper and so much smaller and uses so much less energy to operate, it will appear in more places in the home than we can currently conceive. I used to joke about "The Micro-Processor Controlled Toaster", but it's here! Look at the advertisements in your weekly colour supplements.

In many instances, micros allow their 'hosts' to talk to you. Toys led the way, (Speak'n Spell for example). There is at least one television set that you can order about by speaking to it and which responds in a willing cheerful voice.

The time is coming when we will use and take for

granted:- cookers, kettles, doors, televisions, radios, telephones, room lighting, windows, curtains, dog collars, (No, not you, Vicar), showers, (and so on in a never-ending list) all of which listen for your commands and respond with a microcomputer generated voice. My personal favourite dream is of a micro-processor controlled teddy-bear that speaks words of love and comfort in response to a voice spectrum analysis of it's little owner. If the little mite is happy the teddy bear will chuckle, for example, whereas tears bring soothing words of sympathy. Ahhhhh.

Where will it stop? Well O.K., you gadget producers, how about a micro controlled tin of baked beans that you can order to heat itself and tells you when it's ready, or a micro computer in every pair of Wellington boots telling you when it's time to change your socks! I'm only joking, of course.

More Computer Tales of Yesteryear

One of the most common tasks carried out by computer bureaux is PAYROLL. In the early days, the bureau for which I worked did the payroll for, amongst others, the Ford Motor Company at Dagenham, various Gas Boards and a well known photographic equipment and materials manufacturer. The payroll programs were not standardised in those days and each contained a fair number of both known and unknown glitches. I can remember the processing of Ford's payroll coming to a sudden and frightening halt because a supervisor had entered a short dash on some of the clock cards to indicate zero hours worked on a particular day. The data-preparation girls had punched up these dashes as minus signs and the program, not expecting minus hours, promptly hung up. We had to go through 20,000 clock cards looking for these dashes and correcting the paper tape to read zeros, before the payroll production could proceed.

Sometimes the glitches are not so obvious, and this month's tale concerns what happened to the payroll for the

photographic equipment company when the program met unusual data. An employee had been hired and fired on the same day. The joiner and leaver documents were submitted for punching onto paper tape, unfortunately in the wrong order. The program couldn't understand how someone could leave and then join on the same day, and, in the highly technical language that we computer buffs use, it hiccuped!

The result affected the next payslip to be processed, belonging to some honest toiler with payroll data in perfect working order. He will never know how close he came to receiving a bumper pay-packet that week. Because what the glitch did was to print on his payslip in the 'Net pay this week' space, his Net pay for the year to date! - a sum of over 600 pounds in the days when the average weekly wage was around 15 pounds.

The glitch adjusted all the reconciliation totals correctly and might never have been discovered had not the payslip landed on the desk of a new clerk in the payroll department of the firm concerned. He was making up pay-packets, and approached his supervisor with a pay envelope in one hand, a worried frown on his face and a large wad of over 600 one-pound notes in the other hand.

"Where are the large envelopes", he requested, "I can't get all these pound notes into the standard one!"

A Modern Fairy Tale

(To Be Read Out Aloud In The Same Tone Of Voice You Use For Children's Bed-Time Stories.)

Once upon a time, a micro computer owner looking for an application decided to interface it to a building-site crane. He did the program development in 3 stages.

STAGE ONE just allowed the rotation, jib angle and hook height of the crane to be controlled by a joystick and a paddle.

STAGE TWO allowed him to press a key when the crane rotation, jib and hook were at a desired point. The program then 'remembered' that point. When later that key was pressed, the program moved the hook back to that particular remembered point in space.

STAGE THREE allowed the operator to feed in the positions and dimensions of obstacles. The program remembered these volumes of space. When a 'Go To Remembered Position' command was given, the program moved the hook around the remembered obstacles, and dropped the hook in exactly the right spot without colliding with anything.

The microcomputer owner was very proud of his program, but the firms who make building site cranes turned him away, saying "Our cranes remotely controlled by building site workers are more versatile and give valuable employment opportunities."

Our programmer hero was very dejected until one night, when the moon was full, a little fairy flew in the window and whispered in his ear. Next day, acting on the fairies advice, he took his program to the United States Military at the Pentagon Washington.

"A program which drives an object through space, avoiding collisions with remembered obstacles and dropping it's load at exactly the selected spot!" the generals exclaimed. "Just what we need!" And so saying, they bought our hero's program for many thousands of dollars to use as the software for the guidance system of the cruise missile!

Now this is of course a fairy tale, but I wonder just how many micro programs there are around which, if viewed in a different light from the authors original intention, duplicate or even surpass the facilities of expensive 'computerization' projects. Keep hacking folks, your latest "Zap the Klingons" masterpiece may be exactly what the engineers are looking for to control industrial lasers.

The Dotty Problem

The problem was to place the digits 1 to 7 on the following grid:

problem	solutions	
. . .	4 6	3 5
. . 8 .	7 1 8 2	7 1 8 2
. . .	3 5	4 6

so that no consecutive digits lay next to each other. The example given wasn't in fact a valid solution, sorry! There are only two, one the mirror image of the other, as shown. The first correct solution and readable program out of the hat was from: M I Constantine of East Grinstead, W. Sussex

This month's prize problem

Write a program that counts from 1 to 200 on the screen.

The first program pulled from the hat on Christmas Day that does this and is well laid out and readable wins one of our exclusive Space Invader lapel badges (see below). Oh, just one more thing. The count must be in Roman Numerals.

E.g. I, II, III, IV, V, VI ... CXCIX, CC!!

The Microcomputer Printout Silver Space Invader will be offered as a prize each issue, for ingenious programming or imaginative writing. These lapel badges have been designed and commissioned exclusively for Microcomputer Printout and are manufactured from solid Sterling Silver. Because only a very limited number have been made, and they cannot be purchased, winning one of these badges makes you a member of a very exclusive club indeed!



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There is now a bewildering number of micros on the market, nearly all of which run BASIC in one form or another. Most of these BASICs are produced by Microsoft, a US based company specialising in compilers and interpreters on micros. Despite their common origin, the different BASICs are not 100% compatible. The main reason for this is that BASIC was developed as a teaching aid rather than a serious programming language, and was not taken seriously by the Establishment. In fact, it was not until 1977 that the fact that people were writing large volumes of professional software prompted ISO (the International Standards Organisation) to produce a BASIC language standard. By that time there were already as many BASIC dialects as there were BASIC interpreters, so the cause was pretty well lost. Added to the fact that micro manufacturers seem to regard it as their duty to disregard existing standards wherever possible, often to their own disadvantage, and you have the perfect recipe for chaos. I don't mind - it means I can extract large sums of money from people for the benefit of my 'knowledge'!

Popular Micros

In this series, we will look at the BASIC implementations of several popular micros, at how they differ and how they conform, and the best way to write programs which can most easily be converted to run on another machine. It is obviously impractical to cover every possible situation in a table labelled "How to convert PET to APPLE", or "How to convert SINCLAIR to VIC", but hopefully by explaining the rules, readers will be able to apply them to their own particular problems.

Some machines have very specialised features which are really outside the scope of this article, such as the Apple's high resolution graphics facility or the PET's internal clock. These features have not been discussed. I have also decided, for reasons of space, to keep clear of file handling, as every machine is a law unto itself in this respect. The only way to convert I/O from one machine to another is to get both manuals and memorise them!

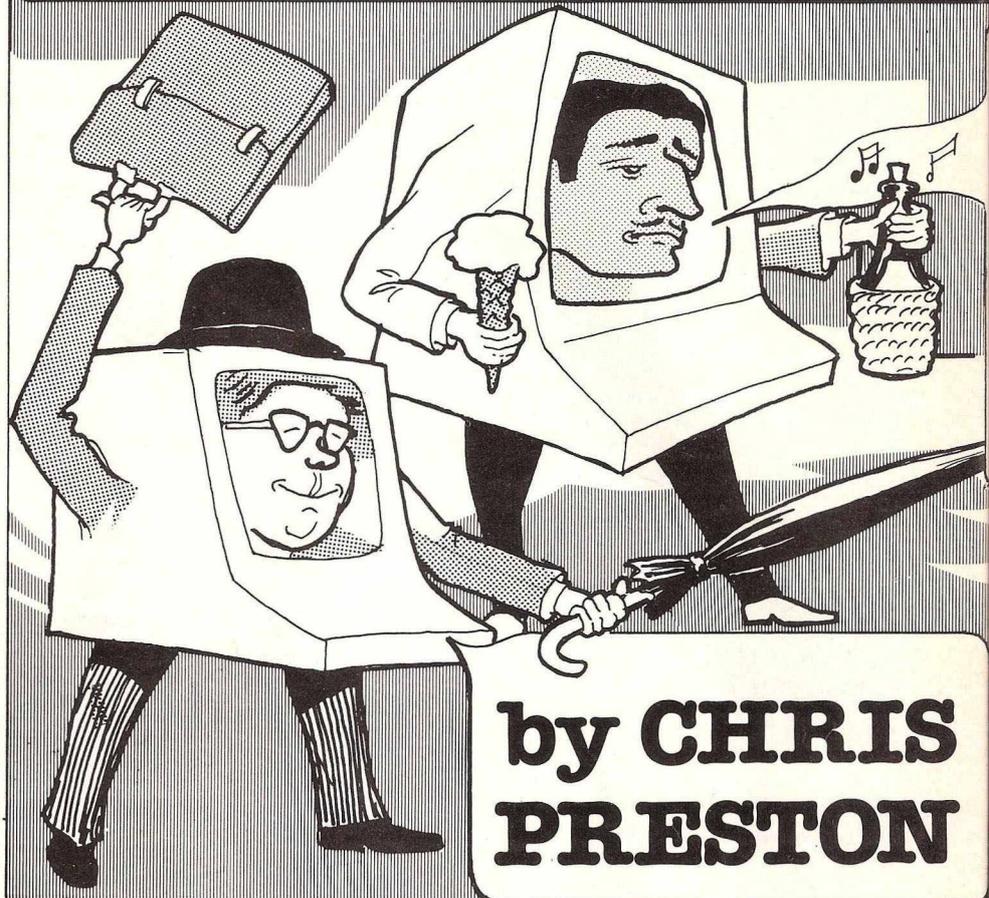
It is important, when converting a program to a different machine, to read the small print in the language manuals for both machines; there may well be little gremlins lurking which can't be covered by general rules.

In this first article, we will just look at different BASICs in a fairly general way without actually getting down to any one machine - that will come later. The aim, this time, is to make you aware of some of the differences in structure which are likely to crop up in converting programs from one BASIC to another, such as limitations on variable names and types.

Minis and Mainframes

Many schools and colleges have access to minis and mainframes on a timesharing system via telephone lines. The BASICs used on these machines differ dramatically from that on the PETs and Apples which may also be used for teaching. Without being specific about names of machines, I have tried to point out some of the features which may cause problems in converting programs in either direction.

How to tran



In particular, programs which do a lot of PEEKing and POKEing will not transfer to a different machine easily, which is a good argument for being more restrained when using these statements. There is not enough space in this series to give any sort of conversion tables for PEEKs and POKEs, so anybody trying to convert programs which use them ought to try to find another way of achieving the same effect.

There are two words which crop up in looking at languages and are sometimes misunderstood, so it is probably best to get them sorted out at the start by reference to natural English. The first is 'syntax'. This means the rules by which a sentence is constructed. 'Man the has a dog' is syntactically incorrect, because 'the' and 'Man' are in the wrong order. The second word is 'semantics', and this refers to the actual meaning of a sentence. 'Beer is blue' is syntactically faultless, but is not semantically correct (leaving out the Editor's Homebrew, which it is best not to know about). It is important to remember the distinction between syntax and semantics, because in the following discussion there are occasions where two BASIC statements may look identical on the printed page (syntax) but in fact do different things when executed (semantics). I will also refer to 'source machine' and 'source BASIC', meaning the

BASIC you are starting with, and 'target machine', which is the machine you hope to end up with.

BASIC Language Structure

Before we look closely at differences between various statements, there are several important structural differences between BASICs, especially older implementations on minicomputers. There are a lot of people converting minicomputer programs to micros, because a current micro is as powerful in many respects as a mini designed in the late 60s.

Some BASICs do not allow multiple statements on a line. This is not a problem if you are converting from a program written one statement to a line, but if your target machine has this limitation, then you will have to split up a line like:

```
100 A=15 : GOTO 1500
```

so it becomes:

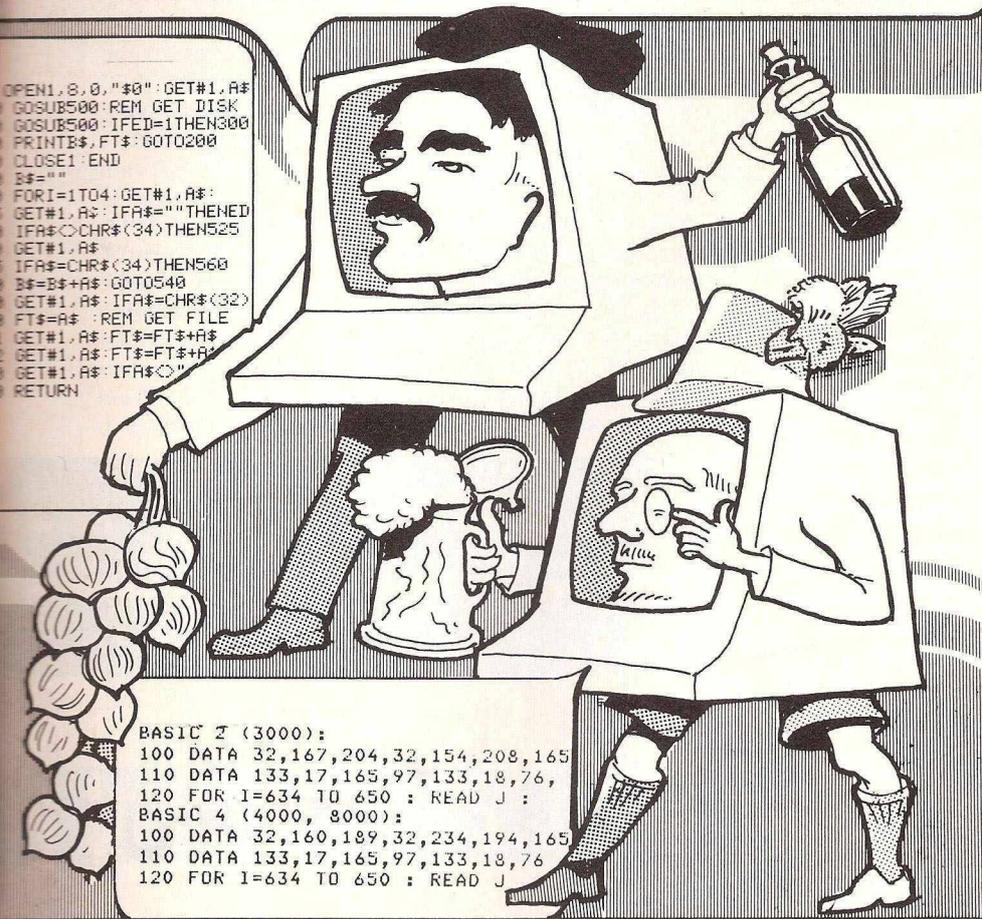
```
100 A=15
101 GOTO 1500
```

The colon delimiter used in Microsoft BASICs to separate statements is sometimes replaced by a semicolon (;), slash (/), or

slate BASIC

```

OPEN1:8,0,"$0":GET#1,A#
GOSUB500:REM GET DISK
GOSUB500:IFED=1THEN300
PRINTB$,FT$:GOTO200
CLOSE1:END
B$=""
FORI=1TO4:GET#1,A#
GET#1,A#:IFA$=""THENED
IFA$=CHR$(34)THEN525
GET#1,A#
IFA$=CHR$(34)THEN560
B$=B$+A$:GOTO540
GET#1,A#:IFA$=CHR$(32)
FT$=A$:REM GET FILE
GET#1,A#:FT$=FT$+A$
GET#1,A#:FT$=FT$+A$
GET#1,A#:IFA$=""
RETURN
    
```



```

BASIC 2 (3000):
100 DATA 32,167,204,32,154,208,165
110 DATA 133,17,165,97,133,18,76,
120 FOR I=634 TO 650 : READ J :
BASIC 4 (4000, 8000):
100 DATA 32,160,189,32,234,194,165
110 DATA 133,17,165,97,133,18,76
120 FOR I=634 TO 650 : READ J
    
```

backslash (\). Furthermore, some BASICs have a feature called 'multiple assignment', where you can say:

```
100 A=B=0
```

to set several variables at once. In Microsoft BASICs, this is treated as a relational expression, as A=(B=0). If B=0, A is set to -1 (or +1 on the Apple. The differences in 'logical arithmetic' will be described fully later.) If B <> 0, then A is set to 0.

The example of multiple assignment above will have to be rewritten:

```
100 A=0 : B=0
```

While on the subject of assignments, some BASICs insist on the LET, which is optional in Microsoft BASICs, so you have to type LET A=4, instead of just A=4.

Arrays and Subscripts

Array subscripts also vary somewhat, some older BASICs using square brackets, A[5] instead of the now standard round brackets A(5). What look like string arrays may in fact be the equivalent of LEFT\$, MID\$ and RIGHT\$. This is explained in depth later when we deal with string handling in detail.

Some BASICs have a MAT (short for mat-

rix) facility. This is very useful in scientific applications where a large amount of matrix algebra is used. It allows whole arrays to be manipulated without using FOR-loops, as in MAT A=C, which sets every element in array A(...) equal to the corresponding array element in C(...). These can quite easily be rewritten using FOR-loops. There may be facilities to perform matrix operations such as transposition and inversion, which will also have to be rewritten using FOR-loops. For example:

```
10 DIM A(100), B(100)
20 MAT A=B
```

becomes:

```
10 DIM A(100), B(100)
20 FOR I=0 TO 100 : A(I)=B(I) : NEXT
```

You may find that your target BASIC requires spaces to be inserted between keywords, as in FOR I=45 TO 55. This obviously makes the program easier to read. There are also varying restrictions on variable names. On some machines the rule is that variable names may be any length, but only the first two characters are used (so FRED and FRED1 are the same variable in

fact!), and characters after the first can be letters or digits.

String Handling

Nearly all the Microsoft BASICs handle strings in the same way. The method used is called 'dynamic string storage', because the amount of memory allocated to the string varies with the length of the string. String data is stored in an area of memory called 'string space'. Each time a string variable is assigned (A\$="FRED"), the new string data is copied to the bottom of string space, the old data remaining in the middle of string space as 'garbage'. Eventually of course, you run out of memory, so a routine called a 'garbage collector' is called to clear out all the garbage. This can result in a machine going completely dead for long period of time, and this is the disadvantage of storing strings in this way. The latest PETs (4000 and 8000 series) get round this very well, but at the cost of an extra two bytes for every string used. The other method of storing strings is called 'static string storage', where the maximum length of a string is specified at the start of a program in a DIM statement:

```
100 DIM A$(200)
```

This does not dimension a string array, but allocates space for a 100 character string. The value of A\$ is always stored in the same 100 character area of memory, and if at any time A\$ is only 10 characters long, then the other 90 are wasted, so static allocation gets round garbage collection delays at the cost of inefficient storage of the data. BASICs using this system may say DIM A\$(I,J) to dimension a string array of J elements, each one I characters long.

String concatenation is always indicated by a '+' operator in modern Microsoft BASICs (A\$=B\$+C\$), but some BASICs may use a "&" or a ":",

Microsoft BASICs select sections of strings by three functions, LEFT\$, MID\$ and RIGHT\$. Older BASICs may use what looks like an array reference:

```
A$(5,10) means MID$(A$,5,6)
A$(1,3) means LEFT$(A$,3)
```

These are fairly easy to convert, but watch out for MID\$ occurring on the left hand side of an assignment:

```
MID$(A$,5,4)="FRED"
```

```
A$=LEFT$(A$,4)+"FRED"+MID$(A$,9,LEN(A$)-9)
```

Another little nasty which can crop up is if you say LEFT\$(A\$,J) when J = 0, or MID\$(A\$,20,5) when A\$ is only 5 characters long. Some BASICs return a null string, others may give an 'ILLEGAL QUANTITY ERROR'.

In the next article in this series, we will get down to some specific machines, notably the PET, Apple (Applesoft), Tandy, Sinclair and VIC.

It is important when designing an efficient program to think about the form in which the program's input data is held. Just think how difficult it would be to phone up the guy/girl of your dreams if the phone book had all its names and addresses in a random order! In this article we'll be looking at different ways of arranging data to speed up searching times.

Sorting data

One of the best methods of improving search times is to 'sort' the data. Sorting data means ordering the data according to some predetermined system. The most common system is ascending (or descending) based upon the code of the characters of some 'key'. Each character ('A', 'B', etc.) is assigned a corresponding code in the range 0-255. For example 'A' is 65, 'B' is 66, '!' is 33. The most common code system is ASCII (American Standard Code for Information Interchange), and these codes can be accessed via the BASIC functions CHR\$ and ASC. A key is just part of a record which the system designer has decided to use to sort his data, such as Account Number, or Customer Name, and different programs will use different fields in a record as their key.

To compare two keys, we start with the first character in each key, and look up their code values. We go along the keys comparing characters until we find a position where the two characters differ. Whichever key contains the character with the lower code comes first, in 'sort order'. All subsequent characters have no effect. So, comparing CASH and CAST, we find:

C (67)	A (65)	S (83)	H (72)
C (67)	A (65)	S (83)	T (84)

That is, CASH comes before CAST, because H(72) is less than T(84). Another common sequence is 'numeric order', which is not necessarily the same thing! Let us compare 5 and 15 by the method we have just used:

1 (49)	5 (53)
5 (53)	

In the first character position, 1 (code 49) is less than 5 (53), so as all subsequent characters are ignored, 15 is less than 5. This shows that it is important to separate numeric data (such as prices) from alphanumeric data (such as names) because the numeric characters (0-9, . and -) have no special significance in an alpha sort system.

By Chris Preston

Basic Operations

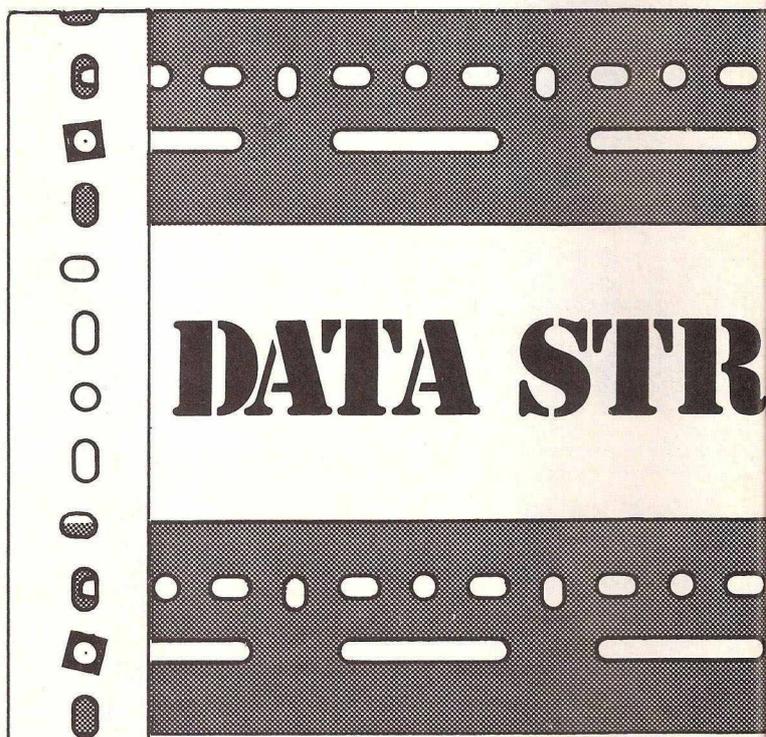
Before looking at the various methods of storing data, it is as well to think about the types of operations we will want to perform on the data. The basic set of operations is:

1. SEARCH. Determine if a given item is present in the set, and remember its location if present.
2. INSERT. Add a new (null) item into the set.
3. DELETE. Remove an item from the set.
4. FETCH. Read an item previously identified by the SEARCH or GET NEXT operation.
5. GET NEXT. Select the next item according to some sequence. The definition of the 'next' item depends upon criteria laid down by the designer. In

an employee file in a payroll system for example, it may be the next employee code, the next employee name, the next highest salary, the oldest employee or the next longest standing employee.

6. AMEND. Change the contents of one of the items.

More complicated operations can be built up from combinations of these. For example, to read the next item we would use a GET NEXT followed by a FETCH. The relative efficiency of these operations varies depending upon the data structure used, but also upon the size of the structure. As an example of this, let us look at the insertion sort. This sort is the fastest sort known for very small volumes, say less than 20 items, because it is so simple. You simply take an item from a list of unsorted items and put it into an output list. You then take another item and compare it with the one item in the output list. If it is greater, you put it after the first; if less, you move the first one along one and put the new item in before it. This process continues until all the input data has been sorted. The insertion sort rapidly slows down as the number of items increases because moving a list of 50,000 items to put a



new one in at the start takes a long time! We can say that the INSERT Operation on a list is fast for a small number of items, but not for a large one.

Simple list

The simplest way of arranging data is in a list. A list is just a sequence of items and is usually held in an array. An example of a list is the days of the week:

(MONDAY, TUESDAY, WEDNESDAY, THURSDAY, FRIDAY, SATURDAY, SUNDAY)

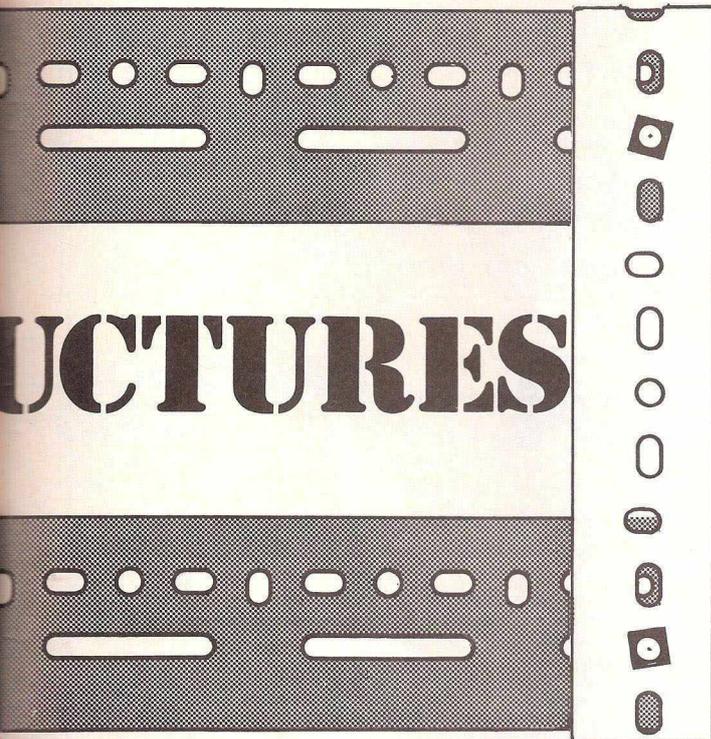
As we mentioned above, a simple list is not very good from the point of view of INSERT and DELETE, as we have to move large numbers of items around. If another SMITH has a telephone installed, then not only the other SMITHs but everyone after SMITH in the telephone directory has to move down when the next year's directory is issued.

What about the SEARCH operation? Let's suppose that I have a large disk file containing all my friends' names and addresses (well, fairly large anyway). If I want to find a friend called Inside Trader (I must be desperate!), I could

start at the start of the file and read records one after the other until I found the one I wanted. Now the first thing to notice is that disk accessing is slow. To read a file record could take as long as half a second, which is a long time if I have to read several hundred of them. To read the value of a string variable in memory is about 1000 times faster. Good! I can speed up my search times by holding all the keys in memory. If I find that the 325th key is the one I want, then I know that the record I want is record 325. So now my SEARCH time is out by 1000, and to all intents and purposes, the 'retrieve' time for any record (SEARCH and FETCH) is just about the time taken to do one disk access – the FETCHing of the record – because the SEARCH time is so fast.

Trade off

There is, however, a catch (as the actress said to the archbishop). Assuming that I have allowed 30 characters for each name, I may be holding 1000 strings, each of 30 characters, that is 30,000 bytes even without allowing for an additional overhead of several bytes per string array element imposed by BASIC. "Not much room for program",



I hear you say. Full marks for observation! How can we get round the problem, apart from investing in a PDP 11/70 with 3 megabytes of memory? We can replace the complete or 'dense' index with a 'coarse' index by only holding every tenth key in memory, which divides the memory requirement by 10. The first 5 keys held in memory now represent records 1, 11, 21, 31 and 41 and say that the key I am searching for is greater than the 3rd memory key but less than the 4th. This means that the record I want is somewhere between records 21 and 31 so I may have to read 9 records to find the one I want (22,23,23 ... 30). We say that 9 disk accesses is the 'worst case'; on average (assuming an even distribution of records) the time required will be 4.5 disk accesses (like the average man with 2.5 children, an average time can include fractions of a disk access!) By the same argument, if I held every 20th key in memory, the memory requirement would be 1/20th that for the dense index, and the worst case access time 19 disk accesses. We can therefore trade off memory requirement against access time depending on our exact requirements.

How can we speed up the process of searching a table in memory? There are many applications which involve

table searching where time is quite critical. On my microcomputer, to search 1000 array elements in BASIC using a simple FOR-loop takes over 6 seconds worst case, 3 seconds average, so our assumption above that the SEARCH time is negligible is an over-simplification.

```
100 FOR I = 1 TO 1000
200 IF K = A(I) THEN 500
300 NEXT
400 PRINT "NOT FOUND"
500 PRINT "FOUND"
```

Search time

Fortunately there is a technique which allows us to find any element in 1000 with at most 10 comparisons – speeding up the SEARCH time by another 100 times. Like the simple comparison system we have used so far it requires a sorted list.

The technique we are going to look at is called a Binary Search or Binary Chop and it is really quite simple. Say we have 1000 records in sort order, R\$(1) to R\$(1000), and our search key, K\$. Instead of starting at one end and working our way down to the other, we start in the middle, with R\$(500). If R\$(500) is less than the K\$ then we know that the record we want is in the top half, from R\$(500) to R\$(1000) and we can forget the bottom half completely! We can now take the middle of the top half, that is R\$(750) and compare it with K\$. Let's say that R\$(750) is too high, so the record we want is between R\$(500) and R\$(750). We can go on like this until we find the record we want. For those who are interested in such things if we have n records, we can find the one we want in k comparisons, where:

$$k = \log_2(n)$$

so in fact we can search 1024 records with 10 comparisons, and 65536 in 16!

Listing 1 is a short program to perform a binary search on an array A\$ which can easily be turned into a subroutine if required.

Fewer comparisons

One snag is that each comparison takes longer than in the simple case, but the saving in time is still very good. In fact the average time to find a record here is about 0.25 seconds, whereas for the simple search the average is over 3 seconds, so this system is 12 times faster for 1024 records. For 128 records, the binary search is only twice as fast; for 8 records it is slower! This is because, although the binary search makes fewer comparisons, each comparison takes longer than for the simple systems.

The binary search is one of the fastest methods of searching a sorted list, despite its simplicity. It can be speeded up in various ways, but as these need to be tailored to fit the particular data being analysed, we will be content with the general program given below.

Next month, Chris Preston will continue his explanation of useful data structures – with a look at linked lists, pointers, stacks and queues.

```
100 DIM A(1024)
200 FOR I=1 TO 1024: A(I)=I: NEXT
300 L=1: H=1024
500 INPUT "ENTER NUMBER (<1-1024>):" : K
600 T=1
1000 M=INT((H+L)/2)
1100 IF K=A(M) THEN 3000
1200 IF K<A(M) THEN 2000
1300 REM K > A(M)
1400 L=M+1
1500 T=T+1
1600 IFL>H THEN PRINT "NOT FOUND IN "; T; "TRIES." : END
1700 GOT01000
2000 REM K < A(M)
2100 H = M - 1
2200 GOT01500
3000 PRINT K; "FOUND IN "; T; "TRIES." : GOT03000
```

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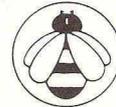
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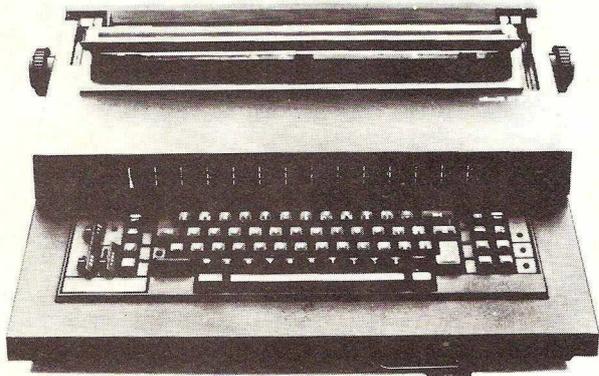
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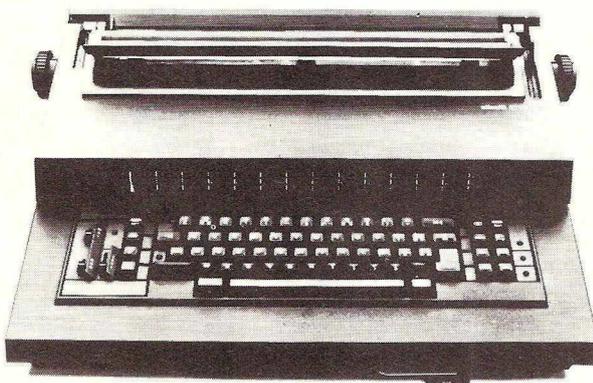
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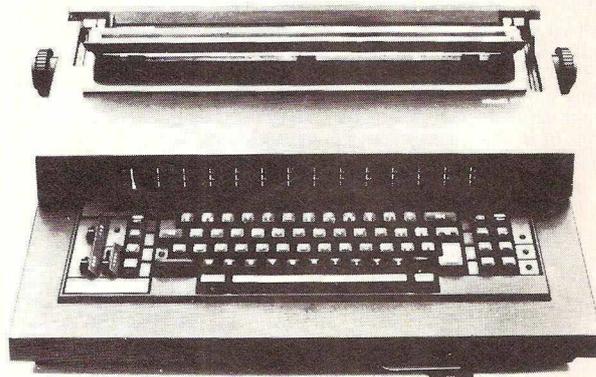
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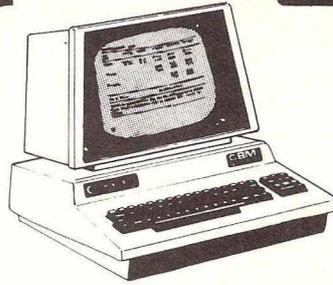
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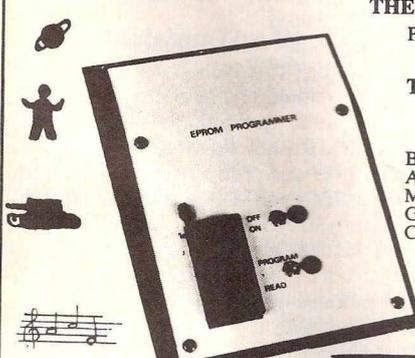
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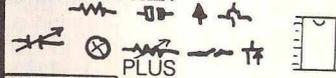
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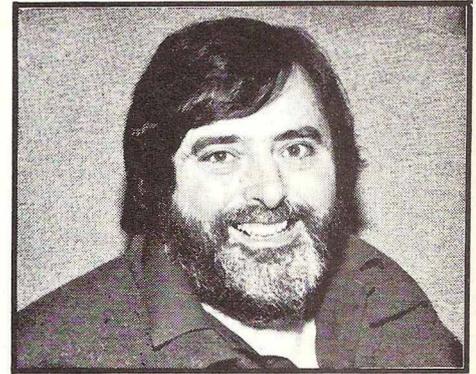
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ASSEMBLY LANGUAGE FROM SCRATCH

In this, the final article of the series, we will see how to add extra keywords to BASIC, then summarise the ground which the series has covered.



Adding New Keywords To BASIC

You might think, as we all did when the PET first arrived, that because the BASIC interpreter is in ROM, the only way to add new commands is to replace one of the ROM chips by a home-brewed EPROM. However there is one subroutine which 'leaks' into RAM and by very good fortune it happens to be exactly right for our purpose. An examination of how new words are added provides a useful consolidation of what we have covered in this series.

The routine, known as CHRGET/CHRGOT is copied from ROM into RAM locations Hex \$70 to \$87 at power-up reset. It is one in a sequence of routines used for interpreting input from the screen and from BASIC text.

We can patch into CHRGET with a jump to our own interpreter code. We must carry out the CHRGET operations which were overwritten by the jump, test for new keywords, and jump back to CHRGOT if we aren't interested. If we find a new keyword, an appropriate machine code subroutine must be called, the text pointer moved on beyond the new keyword statement and a jump back to CHRGOT performed.

The CHRGET/CHRGOT routine can be represented by the following (psuedo) source code:

```

CHRGET INC TXTPTR ;Step on the text pointer in $77
      BNE CHRGOT ;and in
      INC TXTPTR+1 ;$78 if necessary.
CHRGOT LDA ?? ?? ;Get a chr from text
      CMP #COLON ;If chr ASCII > colon ($8)
      BCS INTERP ;so and interpret it!
      CMP #SPACE ;If it's a space
      BEQ CHRGOT ;ignore it!
      SEC ;Manipulate so as to
      SBC #48 ;leave it "as is" but with
      SEC ;carry set for digits and
      SBC #208 ;unset for everything else!
      INTERP RTS ;Now let the ROMs take over.
    
```

The question marks are to show that this address, 2 bytes at \$77 and \$78 is modified by CHRGET. In other words this address is TXTPTR. TXTPTR may point to the input buffer in page 2 of memory or to the current position in BASIC text. Obviously the programmer decided this was quicker/shorter than setting up an indirect pointer.

By replacing the first three bytes of CHRGET with a jump to our own code, we

can check for new keywords. In the Source code (see Listing 1) SETOWN inserts the jump, putting \$4C, the op code for JMP into the first byte of CHRGET and the address of the extra code in the next two bytes.

The next routine, UNDOIT, restores CHRGET to it's former glory. By including appropriate SYS calls in your program, in this case SYS 826 and SYS 850, the extra keywords facility can be turned on and off.

The first thing your own code must do is the work that CHRGET would have done if you hadn't bypassed it. In the listing, routine OWNCODE calls INCTXT which is a faithful reproduction of the CHRGET routine.

Now our code must scan the characters in the text looking for new keywords. It's not a good idea to do it by stepping TXTPTR in locations \$77 and \$78, because if no keyword is present, then you must let CHRGOT get on with it's normal procedures and it will expect these bytes to be as CHRGET left them! Since the routine is in zero page, you can use TXTPTR as an indirect pointer and scan the text by incrementing the Y register. The routine headed CHKCHR does this.

In this example I have catered for only one new keyword, '!f', which calls a machine code flash routine. (Yes, boring old Flash again, but we've got enough on our hands implementing the new keyword decode without adding to our problems with bells and whistles at this stage - I'll leave the clever stuff to you after you've finished the article!)

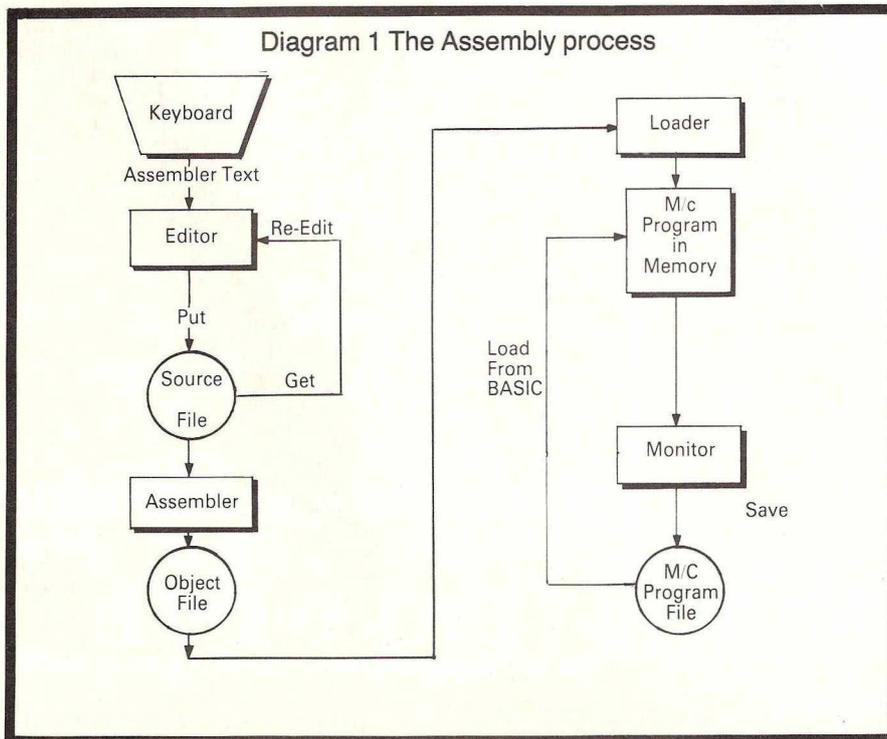
CHKCHR checks to see if the character is a '!'. If it isn't, it's handed over to CHRGOT for normal processing. This means that for the bulk of the BASIC statements only one character has to be examined before the normal routines are rejoin. The program will run only a little slower than normal.

If the character is '!' then as many extra characters are scanned as are necessary to identify the command. In this case we are only looking for 'f'. The Y register is incremented so as to access the next character in the text. If it isn't an 'f' then once more CHRGOT is asked to take over. You could well check for other letters representing various new keywords, '!k', '!j', '!m', etc, or for longer keywords such as '!flash', '!explode' and so on.

In this case, supposing an 'f' following an '!' has been found, then the FLASH subroutine is called.

On returning from the keyword implementation, you need to step on TXTPTR to point beyond your keyword, otherwise the real interpreter will complain. Since the keyword consists of just 2 characters in this case, two

Diagram 1 The Assembly process



```

1000 ; put "@0:flshcmd.s"
1010 chrset = $70
1020 chrset = $76
1030 txtptr = $77
1040 scrtop = 32768
1050 scrbot = scrtop+2048
1060 point = 1
1070 ;
1080 *=826 ;sys to activate own keywords
1090 ;
1100 setown
1110 lda #$4c ;patch the chrset routine
1120 sta chrset ;with a jmp ($4c)
1130 lda #<owncode ;to one's own code.
1140 sta chrset+1
1150 lda #>owncode
1160 sta chrset+2
1170 rts
1180 ;
1190 *=850 ;sys to deactivate own keywords
1200 ;
1210 undoit
1220 lda #$e6 ;restore chrset as new
1230 sta chrset
1240 lda #$77
1250 sta chrset+1
1260 lda #$d0
1270 sta chrset+2
1280 rts
1290 ;
1300 owncode
1310 jsr inctxt ;do chrset code
1320 ;
1330 ;
1340 chkchr
1350 ldy #0 ;reg y is used as text indexer
1360 lda (txtptr),y ;set 1st chr from text
1370 cmp #'! ;is it sign for extra keyword?
1380 bne setout ;no, so treat normally
1390 iny ;try next chr alone
1400 lda (txtptr),y
1410 cmp #'f ;is it flash command?
1420 bne setout ;no!
1430 jsr flash ;implement flash
1440 jsr inctxt ;adjust text pointer to skip
1450 jsr inctxt ;2 chr keyword
1460 ;
1470 setout
1480 jmp chrset ;rejoin normal decoding
1490 ;
1500 inctxt
1510 inc txtptr ;increment text pointer low
1520 bne inctx1 ;and
1530 inc txtptr+1 ;high if necessary
1540 inctx1
1550 rts
1560 ;
1570 flash
1580 lda #<scrtop ;set up top of screen pointer
1590 sta point
1600 lda #>scrtop
1610 sta point+1
1620 ldy #0 ;keep reg y at zero
1630 ;
1640 flchr
1650 lda (point),y ;set chr from screen
1660 eor #%10000000 ;flip bit 7
1670 sta (point),y ;and put it back
1680 ;
1690 inc point ;increment the screen pointer
1700 bne chkend ;low and if necessary
1710 inc point+1 ;high
1720 ;
1730 chkend
1740 lda point+1
1750 cmp #>scrbot ;end of screen yet?
1760 bne flchr ;no, so do next chr
1770 rts
1780 ;
1790 .end

```

Listing 1

calls to INCTXT will do the trick.

Once TXTPTR has been adjusted all that remains to be done is a jump back to CHRGET.

FLASH itself should be pretty familiar now, which is why I used it as an example.

Listing 2 shows a BASIC routine using the new keyword 'lf' to flash the screen appropriately when an unauthorised user tries to access the system. You will find that the new keyword 'lf' can be included in the middle or at the end of a line.

Summarising The Series

By now I think you realise that Assembly language and machine code are two different entities. You can program the 6502 knowing machine code and without knowing Assembler, but not the other way around. Assembler simply provides a convenient way of representing machine code instructions and calculating the various addresses and offsets for us.

This representation is called Source Code. It can include symbols, labels, names and comments which can be as verbose as you

like because unlike, BASIC they are stripped off when Assembly takes place.

The source code is assembled from disk into object code which is again sent out to disk as the assembly proceeds. This allows the largest possible machine code program to be loaded into user RAM, the only pre-empted space being that taken up by the Loader routine. Assembly takes two passes, the first accumulating all the symbols, labels and calculated addresses, the second actually writing machine code in hexadecimal to disk, the Object code.

The Object code is loaded using whichever version of the Loader resides in an area of RAM not required for your machine code routines.

Diagram 1, reproduced from part 1 of the series, summarises the Assembly process.

The machine code operation codes are represented by mnemonics which are standard for most 6502 users. The methods of representing the various addressing modes are also standard. Diagram 2 is a summary of these representations.

The Assembler provides a means of

reserving bytes as working locations or variables. Diagram 3 shows two ways of doing this. The .BYTE directive in the second example of the diagram can also be used to create constants as shown in diagram 4.

Diagrams 3 and 4 also show the identification of particular points in the program by labels. Calculating offsets for branching is a mucky chore, and the Assembler does it for us, requiring us only to specify the actual location being branched to, or, even more convenient, the label associated with that location. Diagram 5 shows an example:

Diagram 6 shows various ways in which addresses can be calculated for us by the Assembler.

Finally the '*' symbol is used to indicate where the program is to reside in store, and the .END directive to signal the end of the source code for Assembly.

There's More To It

There are several aspects of Assembler code not covered by this introductory series. Let me point them out to you and recommend the forthcoming revised Commodore Assem-

▶ 83

SCRTOP=32768, POINT=1, SPACE=32, START=826

Absolute	LDA SCRTOP
Absolute indexed by X	LDA SCRTOP,X
Absolute indexed by Y	LDA SCRTOP,Y
Zero base	LDA POINT
Zero base indexed by X	LDA POINT,X
Zero base indexed by Y	LDA POINT,Y
Indexed indirect with X	LDA (POINT,X)
Indirect indexed with Y	LDA (POINT),Y
Immediate	LDA #SPACE
Implied	TAX
Accumulator	ROR A
Branch relative	BNE START
Jump indirect	JMP (POINT)

Diagram 2 Addressing mode representations

```
HOLDAR .BYTE 0,0,0,P 0,0,0 ; RESERVE 7 LOCATIONS AS HOLDING
```

```
COUNTR **+1 ; RESERVE 1 BYTE AS A COUNTER AREA
```

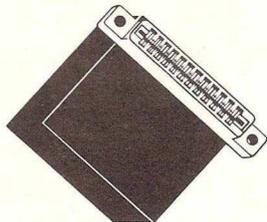
Diagram 3 Reserving working locations

```
MESSGE .BYTE 'FRED'S PET' ; OPENING TITLE
```

```
LIMIT .BYTE 40 ; MAX VALUE
```

Diagram 4 Creating constants

tfowSera dMeaf aeS



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```

SAVZ01 LDH #6      ;DO 7 CHRS
SAVZ02 LDA ZERO,X ;COPY NXT CHR
STA HOLDAR,X     ;TO HOLDING AREA
DEX              ;MOVE TO NXT CHR
BPL SAVZ02       ;BRANCH IF MORE TO DO
RTS              ;DONE!

```

Diagram 5 Branch to label

```

PAGE =256
SCRTOP=32768
SCRPG1=32768+256
SCRPG2=SCRPG1+256
SCRPG3=SCRPG2+PAGE
LDA #<MESGE
LDY #>MESGE
LDA #<OWNCDE

```

Diagram 6 Calculating addresses

```

10 rem example of new keyword (!f - flash screen)
20 rem m j s-n
30 rem for printout articles
40 rem screen display formatted for 80 column
99 rem "
100 rem activate new keyword decode
110 sys 826
199 rem "
200 rem set system password
210 input "Password please"; pw$
220 if pw$="wow" then print"*****";tab(35);
    "WELCOME" : goto 400
230 print"*****";tab(35); "INTRUDER"
299 rem "
300 rem flash screen using new keyword !f
310 for i = 1 to 10
315 !f
320 for j=1 to 200 : next j,i
399 rem "
400 rem deactivate keyword
410 sys 850
499 rem "
500 print"Again?"
510 set a$: if a$="" then 510
520 if a$="y" then run
599 rem "

```

Listing 2

bler manual if you want to pursue them further. There are several formatting directives, which route and curtail the Assembler listing. There are .WORD and .DBYTE directives to store data in slightly different forms than .BYTE. In a Source code text you can call Library Source code routines to be inserted at particular points in the main text. You can link Source code files in a chain to provide a massive Assembly or by using the

conditional expressions available in the Commodore Assembler, link one or another sequence of files depending on the values of symbols in the initial source text.

Where Do You Go From Here?

Good Assembler programmers typically command £25.00 per hour!! Need I say more? Practise and keep on practising Assembler. Read all published source code

you can lay your hands on, provided it is properly annotated. (Poorly annotated text is a waste of time to you as well as the author!) Tackle small projects to gain confidence and build up to bigger applications. Write to me with your queries if you wish. If and when we get enough of general interest, we will run a follow up article. Meanwhile, I wish you well.



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employee will not be a professional criminal operating under a false identity (unless your personnel procedures are lax) so he is unlikely to escape by running away. There should not be any complacency because of this. As we have seen, most frauds start as idle entries, and if these are detected and acted on promptly they can deter crime.

In the case of the big tickle, delays are fatal. While some inside help is often required by the criminal, it is not always necessary nor is it always active, so the criminal is unknown. If your system is penetrated leaving no trace, then you must live with the loss. If the theft was shown up in some warning by the system and this was not acted on for three days or more, then the money or goods will have vanished along with the criminal, and it will be the user's fault, not the system's.

Extortion and vandalism are problems related to physical security and the average micro user is not too worried about having his programs hijacked or his business interrupted because backup facilities are generally adequate to deal with the threat. The only point to remember is that your records be in machine readable form, so that copying from security duplicates can be done quickly. If historic information has been stored on, say video tape, this cannot be fed into the machine and copied: all the data will have to be re-entered by hand.

Password

There are systems in use which have security features that are not used. If someone is "locked out" from getting at computer data by a request for his security password appearing on the video screen, he can always try tapping out "PASSWORD" because even these days some users have not got round to thinking of the problem. More worrying are the systems where users do not use the security features because the supplier did not provide adequate staff training, and his User Manuals, or instruction books, are so badly drafted that nobody can understand them. Make sure that a realistic training period is offered by any supplier. If possible insist on a system guarantee, where the supplier guarantees to return your money if the system as agreed and specified does not work. These terms are available but they will come as part of an all-embracing package and they will not be cheap. However, they do stand a better chance of working than the faded £200 off-the-shelf package.



Reactions To Colour

As has been competently explained elsewhere, the display on the colour screen consists of three elements: an outer margin or frame whose colour can be selected as one of "eight" (six colours plus black and white) but which cannot be written in; an inner rectangle which can be written in and for which the background colour can be independently selected as one of "sixteen" (black, white, the six colours, and shades of the six); and the characters themselves, for which the six colours plus black and white can be independently selected.

The effect of reverse is to exchange the colours of the character and background. Some colour combinations generate noise: try writing a screen full of characters after POKE 36879,8 and CONTROL 2. Some combinations generate a video modulation which causes the characters to be unreadable. These phenomena are not discussed in the documentation except for one disclaimer in the dealer's manual in microscopic type which states "... due to color transition limitations of most TV sets, closely spaced dots of different colors will not appear sharply defined on-screen." Readers familiar with Apple and other colour systems will already be aware that there are definite limitations to the possibilities of presenting a clearly-defined vertical edge between colour areas. This is a shortcoming of the TV set, not of the computer, and is not seen when the computer is used to drive a high-quality colour monitor. Don't be surprised, though, if you

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get a yellow blush along the edges of your black characters, or a shaded edge effect along the left edge of some red areas, they tell me it can't be helped, and if you're so particular why don't you save up and buy a monitor?

If you've just bought your first micro-computer, or upgraded to a new machine, why not drop us a line - giving us your very first reactions or experiences. In future issues of MicroComputer Printout, we shall be filing reports from first time users and hardened hackers on a number of new micros.



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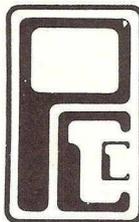
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The VIC's mystery colour fault has at last been solved, and in true Gilbert & Sullivan fashion. Engineering remedies having failed, a squad of opticians and psychiatrists were deployed. Cause of the problem? Commodore Technical Ace, Dave Briggs, and VIC Manager John Baxter turn out to be colour blind. I look forward to hearing what the Chief Executive Officer has to say when he finds out.

My friend Dr Stefan Marinov, the Bulgarian dissident physicist, has discovered an infallible means of getting rich quickly. Marinov, who lives in Italy, writes inflammatory letters to the Soviet dissident, Andrei Sakharov, thereby guaranteeing their interception by the KGB. The letters are sent by insured mail at a cost of £2 each. After six months the Italian post office pays him £170 for each undelivered item, recovering the money from the Russians. Marinov who has bought himself a handsome villa on the proceeds, reckons that if enough people adopt his scheme he can bankrupt the KGB.

Who is Ted Davebutt? Mystery surrounds the identity of this astonishingly well informed computer journalist whose work appears in this issue and elsewhere. However I can allay rumours that he might in some way be related to Desperate Dave Tebbutt. DDT's contract with *Personal Computer World* expressly forbids his writing for other organs.

I am sorry to learn of the resignation of ACT Microsoft's Mathew Wauchope from the Special Constabulary. The news may come as something of a relief to the hard pressed burghers of Birmingham, where Constable Wauchope's unusual approach to community relations was legendary.

Q. When is a camera not a camera?

A. When it is a computer. Staying with my friend Masahiko Morizono, chief executive of Sony in Japan, I am lent their new *Mavica* filmless camera. It looks like an ordinary 35mm still camera, but employs a very mini floppy disk to store picture information for up to 50 snaps. "Kodak-san quaking in honourable boots" says my Nipponese friend, as he demonstrates instant playback on a colour T.V. When I ask if the very-mini-floppy will be built into Sony's top secret pocket computer Masahiko turns scarlet (quite difficult for a Japanese) and starts talking about Sumo wrestling.

I see that what company spokesman described as Apple III's 'clock chip non-viability situation' has been resolved in imaginative fashion. It has been left out. Meanwhile National Semiconductor, less than happy at having Apple III's previous 'non-viability' blamed on their chip, are plotting a terrible revenge.

I hear that Commodore are considering the adoption of the Texas Instruments' Badge Scheme. Employees wear different coloured name badges denoting the number of years with the company. At Commodore (latest casualties: Chief Engineer and 87½% of the design team) badge colour will denote number of weeks service.

Fraternal greetings to the comrades of Britains first feminist computer group. Alas, plans for a leading computer mag editor to address the club have had to be dropped, after Messrs. Budgett, Pawson and Laurie all failed anti-chauvinist-vetting procedures. A visitor rather ungallantly describes the atmosphere as "like Tony Benn without the jokes."

My congratulations to PCW on their widely advertised 'world scoop' review of the IBM Personal Computer in their November issue. I would be the last one to draw readers' attention to the comprehensive report in our *October* issue. The telephone number of the Advertising Standards Authority is 01-580 5555.

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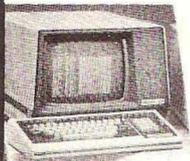
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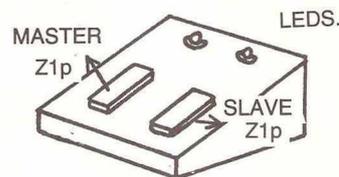
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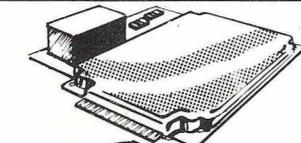
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£25



VIC-MEMORY 19k
This memory expansion allows the user a large programming memory, 16k of which is battery protected so that programmes may be kept in memory for up to 1 year even when the Vic is unplugged. A 4k removable module is incorporated which has its own battery back-up circuit. Switches allow the memory to be configured at various locations thus making use of VICs auto-start ability.

FEATURE The 4k removable module will plug directly into the spare ROM sockets on PET and can be programmed or read on both PET & VIC.

£198

NOW AVAILABLE

£49 VIC - RS232 INTERFACE Fully implemented (true levels) RS232C-V24 BI-DIRECTIONAL INTERFACE

Allows Vic to work as Mainframe Terminal, Drive a Qume Daisywheel or a Paper Tape Punch etc. etc.

FEATURE The RS232, fully-implemented interface that we offer contains a master power unit which can double Vics ability to support add-ons and has an external socket to allow the supply voltages plus 5V, plus 15V, -15V to be used for other devices, memory expansions, cassette drives, light pens, printers etc.



NOW AVAILABLE



VIC-TOOLKIT
For those who know toolkit on Pet we now have same facilities for VIC.

Renumber, Auto, etc.

This may be used with the Stack VIC Rom Switch Board.

£25



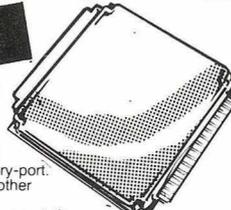
LOW COST

VIC-MEMORY 3k

Small size - Low cost memory expansion. Plugs into Vic and reproduces memory-port. Can be used with other expansions. Gives a total of 6k user static ram on Vic.

FEATURE This board allows Vic to move Basic to begin at 1024 (\$0400) as in Pet, and enables the use of **HIGH RESOLUTION COLOUR GRAPHICS**.

£39



VIC JOYSTICK

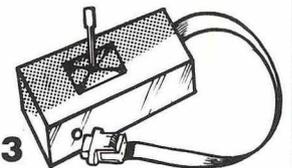
Single

Hand-held joystick units for games use available in Pair or Single configuration

£13
(each).

Pair

(2 singles will not work together without multiplexer)



VIC-Games port adaptor cable

games port plug

LOW COST

two games ports



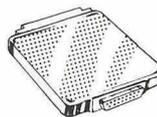
A two into one adaptor for use with both joysticks and light pens. A must for those who require full control of games with graphics.

FEATURE Low-cost High-quality - Robust - Stackable.

£17.25

ULTRA LOW COST BIDIRECTIONAL RS232 INTERFACE

This unit whilst very low cost does not cut corners in performance but uses true positive and negative data states. The interface is configured as a conventional pin-out to a 25 way 'D' - type connector.



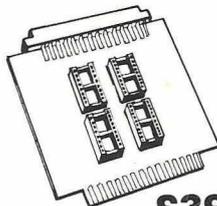
£17.25

VIC Rom Switch Board

An inexpensive unit which plugs direct onto Memory Expansion Port of the VIC and allows the insertion of up to 4 ROMs for games packs or toolkit aids etc.

Feature Simple software switch exchanges each pair of ROMs into VICS Rom Space allowing 'clashing' Rom's to be used.

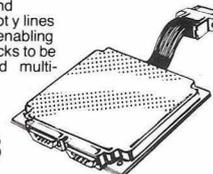
Feature Plug in Zero Force sockets are available as optional extras to help eliminate pin damage to valuable ROMs.



£39

GAMES PORT MULTIPLEXER

This device connects to the games port of the Vic and multiplexes pot x and pot y lines under software control enabling pairs of analogue joysticks to be used for sophisticated multi-player games.



£33

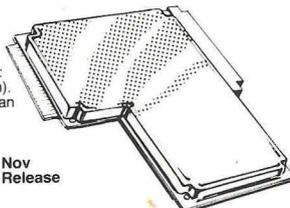
VIC ACCESSORIES

1 Audio/video/TV port plug	50p
2 Audio/video/TV port socket	50p
3 Audio/video/TV port splitter lead (1 plug 2 sockets)	£2.50p
4 Printer/Disk Serial port plug	50p
5 Printer/Disk Serial port socket	50p
6 Printer/Disk Serial port splitter lead (1 plug 2 sockets)	£2.50p
7 Cassette port connector (socket)	90p
8 User port connector (socket)	£1.20p
9 Hood for user port connector	£2.00p
10 Memory expansion connector (socket)	£2.50p
11 User port splitter - A small board plugs into the VIC and has 2 user ports reproduced at rear/side	Dec Avail
12 Dust covers for VIC 20	£3.00p
13 Dust covers for C2N Cassette	Dec Avail
14 C2N Cassette Decks	£39.00p
15 Blank Cassettes	£4.40p (10)
16 Tape Head Demagnetisers	£4.00p
17 Tape Head Cleaner	£1.50p
18 Tape Storage Box	P.O.A.
19 VIC Printer Ribbons	£4.00p
20 VIC Printer Paper (2000 sheets)	£15.00p

MEMORY EXPANSIONS

In addition to the units listed above we offer twelve more memory options. These are available in two device types: NMOS (for lower cost) and CMOS (For lower power drain). Each type is offered in three memory sizes with or without an optional switchable 3K ram in the lower address space. i.e.:-

CMOS (low power)	£82	NMOS (low cost)	Nov Release
8k	£103	8k	
8k plus 3k	£124	8k plus 3k	
16k	£146	16k	
16k plus 3k	£167	16k plus 3k	
24k	£184	24k	
24k plus 3k	£11.50	24k plus 3k	
1 RAM			



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