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Guidelines for contributors

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

Because of the foregoing, it is necessary to add that the views expressed in articles we publish are not necessarily those of Personal Computer World. Overall, however, the magazine will try to represent a balanced viewpoint.

Finally, before submitting an article, please check it through thoroughly for legibility and accuracy.

EDITORIAL

First the good news, and then — the good news! PCW is not normally a magazine to toot its own trumpet, but then this month has been the occasion of two quite significant events.

Almost immediately after the present editorial team took over (with the September 1979 edition) a distinctly unhealthy downward circulation trend was first stabilised, then reversed; since that time our level of readership has been steadily rising — that is, until last month. Word arrived from our distributor that he would like us to increase the number of copies printed by nearly 70% — immediately! — a move almost unprecedented in the annals of specialist magazine publishing.

Our second glad tiding came from all the way "down under". In line with our policy of taking over the world, the happy news is that May this year saw the first-ever publishing of *Australian* PCW. The editor is one Sean Howard and the contents, a pot pourri of past PCWs and Aussie news.

Two more votes of thanks. First of all the response to our requests for programs has resulted in literally hundreds of submissions — indeed we are now in the process of planning a special software supplement for, hopefully, the August issue. Keep them coming, but please bear in mind before putting finger to keyboard that we are looking for well written, useful/entertaining and, above all, original programs. Some much more specific guidelines will be appearing shortly.

Lastly, a flood of mail answered our plea for referees (April PCW); at the last count the figure stood at well over 100 — and it was still rising. Apart from the obvious benefits their presence will give the magazine, it's been most encouraging to have had such a high level of response from our readers. Thank you, we appreciate it.

The Editors

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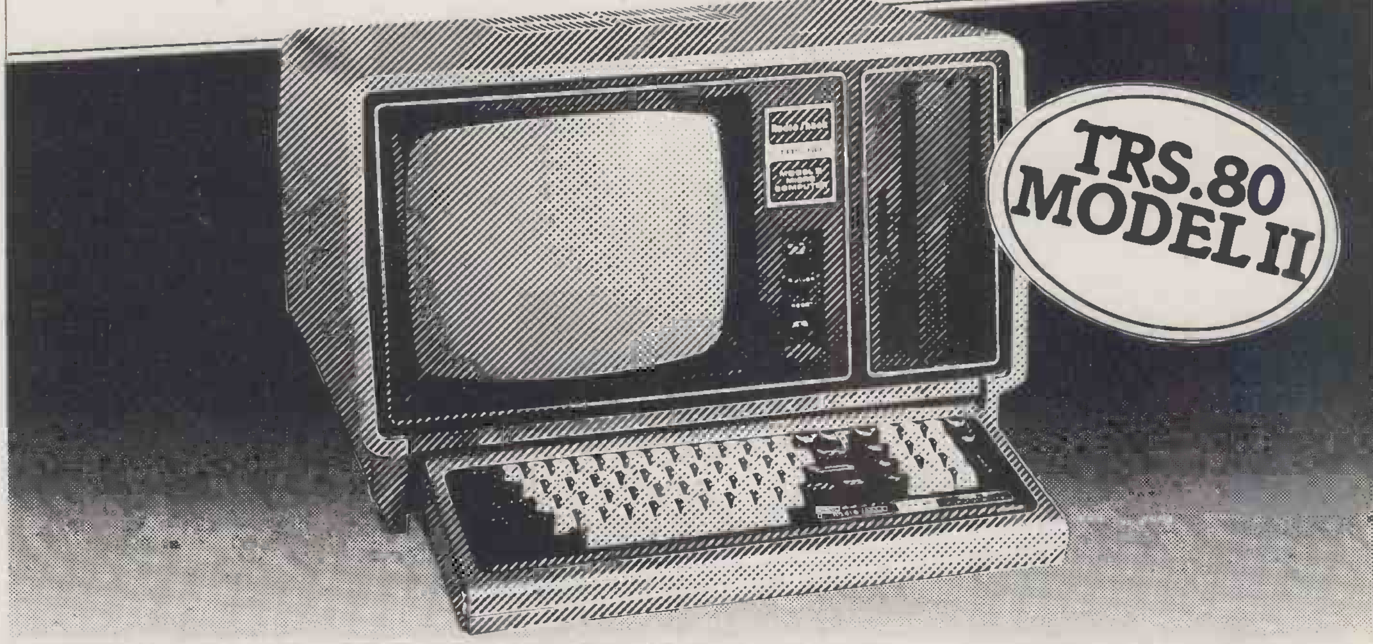

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Eat your heart out, Commodore...

Most small computers are great for playing games...but when it comes to *real* computing, they're really little better than toys. Their built-in limitations on flexibility, input/output, expansion and performance make real applications a nightmare.

Mutek offer the *Ohio Scientific* solution: the Challenger series of computers, with *real* performance, *real* flexibility, *real* expandability.

Speed separates the computers from the toys...

The following benchmark test speaks for itself!

	Pet®	Apple®	C2 (1MHz)	C2 (2MHz)
BM1	1.7	1.3	*1.4*	**0.7**
BM2	9.9	8.5	*7.8*	**3.9**
BM3	18.4	16.0	*15.0*	**7.5**
BM4	20.4	17.8	*16.5*	**8.3**
BM5	21.7	19.1	*17.8*	**8.9**
BM6	32.5	28.6	*27.0*	**13.5**
BM7	50.9	44.8	*39.5*	**19.8**
BM8	12.3	10.7	*7.5*	**3.8**

Standard *PCW* benchmark tests, as published in *Personal Computer World's* review of the Challenger 2 (April 1980 issue). Reproduced (with thanks) by courtesy of the staff of *PCW*.

Pet is a registered trademark of Commodore; *Apple* is a registered trademark of Apple Corp.

new input/output capability...

The C2 and C4 series are supported by a very wide range of expansion units, most of which plug straight into the built-in 48-line backplane. The new 16-line I/O structure uses one backplane slot (for a CA-20 or -20A) to connect with up to eight external boards. Provisional prices are:

CA-20 8-port base unit with calendar clock **£95**
CA-20A 8-port base unit (no clock) **£50**
CA-21 48-line parallel I/O (three 6821 PIAs) **£28**
CA-22 high-speed analogue I/O (A-D, 2 D-A, mux) . **£310**
CA-23 PROM blaster for 2758, 2716, 2732 .... **£110**
CA-24 'breadboard'-type prototyping interface **£110**
CA-25 security/A.C. control interface **£28**

expandability...

All Ohio Scientific systems are designed for expansion without obsolescence. Memory, I/O and discs can be added simply and at any stage; all Challenger series systems can be connected directly to the larger C2 and C3 variants for hard-disc storage up to a staggering 300 megabytes, all memory-mapped! Full network facilities are also available.

Add-on mini-floppy 90K *formatted* (up to 4 units) .. **£265**
RAM board (12K static) can support up to 24K...... **£160**
First add-on mini-floppy for C2/C4 requires minimum of additional 12K plus controller: total with drive **£480**

real built-in flexibility...

Ohio Scientific's C2 and C4 series probably offer more than any other 'personal' system. Try this for a comparison:

	Your system?	C2 / C4
Video format		64×32
PAL colour		Option / Yes
Sound output		Yes: 200Hz – 50KHz
D-to-A converter		Yes: 8-bit log law
Easy expansion		2 slots free 40+ boards available
UK video or UHF		Yes
RS-232		Option / 2 ports
Cassette interface		High-reliability Kansas City
Price		**£349 / £425**

The C4 series have full 16-colour PAL video output; the C4P-MF also has additional I/O, with three 16-line parallel ports, joystick and keypad interfaces and a real-time clock.

C4P-MF 24K RAM, one mini-floppy **£895**

a superior Superboard...

Mutek now offer a really superior Superboard: the cased C1 version modified for 2MHz operation and new firmware-controlled true 32×48 display — takes the Superboard right out of the 'toy computing' class!

Standard C1 8K RAM, 1MHz, 25×25 display **£220**
Enhanced C1 8K RAM, 2MHz, 32×48 display **£255**
Upgrade for existing C1/Superboard systems to Mutek's enhanced specification (ask for details) **£40**

technical literature...

Ohio Scientific are the first company to have all its systems documented by Howard Sams, Inc. — the originators of the SAMS Photofact circuit documentation system. Handbooks are now available for two Ohio Scientific ranges: C1/Superboard and C2/C4 (the C3 series handbook will be available later this summer). These include full circuit schematics and function diagrams for computer and disc-drive circuits, along with essential information such as 'scope patterns at test points.

C1 Technical Guide **£4.95**
C4 Technical Guide (includes all C2 boards) **£9.50**

and full technical support

Our prices are some of the lowest around, but that doesn't imply poor technical support!

We give a full after-sales service that includes much more than 'standard'. Along with excellent service facilities we can offer technical advice on both hardware and software aspects of Ohio Scientific computers and their applications, and can also undertake technical development — hardware and software — for most types of specialist application.

All prices quoted (except Technical Guides) exclude VAT.

Mutek — *real* computing...for less than you expect

Mutek — the independent Ohio Scientific specialists — Quarry Hill, Box, Wilts. Telephone: Bath (0225) 743289

SOFTWARE FOR PROFESSIONALS

NOW RUNNING ON NUMEROUS C/PM BASED SYSTEMS.

OPTION SELECTION SCREEN

OPTION SELECTION

1 WAGES & SALARIES
2 SALES LEDGER
3 PURCHASE LEDGER
4 NOMINAL LEDGER
5 STOCK RECORDING
6 INVOICING--STOCK CONTROL
7 VAT TABLES
8 DESCRIPTIONS
9 COMPANY NAME/LOGO
E END-OF-INPUT

TYPE SELECTED OPTION?

PURCHASE SELECTION

OPTION SELECTION

1 ACCOUNT CREATION
2 ACCOUNT POSTINGS
3 CASH POSTINGS
4 PERIOD REMITTANCES
E END-OF-INPUT

TYPE SELECTED OPTION?

SALES SELECTION

OPTION SELECTION

1 ACCOUNT CREATION
2 ACCOUNT POSTINGS
3 CASH POSTINGS
4 PERIOD STATEMENTS
E END-OF-INPUT

TYPE SELECTED OPTION?

PAYROLL SELECTION

OPTION SELECTION

1 PAYROLL CREATION
2 PAYROLL ENQUIRY
3 PAYROLL CALCULATION
4 PAYSLIP PRINTING
5 PRINT P35s
6 PRINT P11s
7 PRINT NON-PAIDS
8 PRINT SLIPS
9 PRINT CODES
10 PAYROLL ZEROISE
11 AMEND TAX RATES
12 AMEND N.I. RATES
13 AMEND PEN. RATES
14 AMEND DESCRIPTIONS
E END-OF-INPUT

TYPE SELECTED OPTION?

IF YOUR SYSTEM RUNS UNDER C/PM THEN CONSIDER OUR INTEGRATED ACCOUNTING PACKAGES

WAGES/SALARIES £350
SALES LEDGER £350
STOCK RECORDING. £350
NOMINAL LEDGER £350
PURCHASE LEDGER £350
INVOICING £350
INVOICING/STOCK CONTROL. £500

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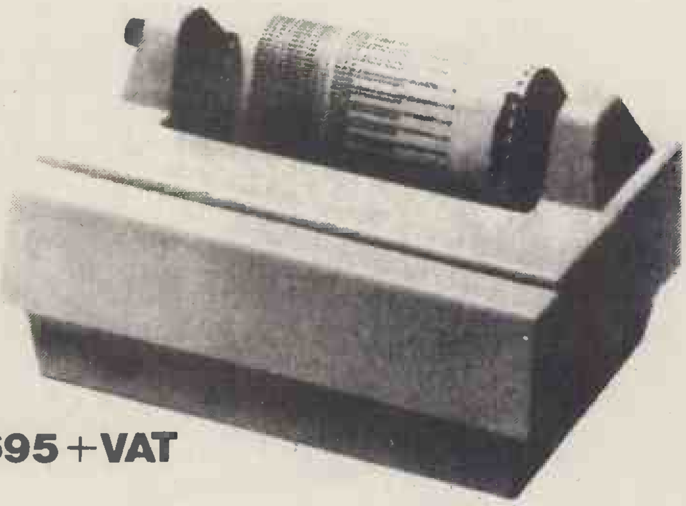
NEW

Sigma (UK)

IMPACT DATA

Model 801 • Impact Matrix Printer

- **HEAVY DUTY**
- **HIGH QUALITY**
- **HIGH TECHNOLOGY**
- **LOWEST COST**
- **RELIABILITY**
- **SIMPLE MECHANICS**



£695+VAT

Simplicity means Reliability! One look inside the Model 801 will convice you that it's the simplest design with the fewest parts. No field adjustments to get out of line. All moving parts are permanently lubricated. You will also see it is not a toy, like many low cost printers. Impact Data is ruggedly designed with quality parts to provide many years of trouble free operation. No pulleys, cables, helixes, reels or plastic gadgets. There are only two moving parts to drive the print head with one positive, continuous motion. (Pat. Pending)

- **BETTER PRINT QUALITY**

Take a look at the Print Head. It's already the standard of performance in millions of business machines now in the field. It prints perfectly, continuously, hour after hour at 132 CPS for over 100 million characters with no overheating, print degradation or malfunction. The stainless steel timing fence under the head places 7×7 dot matrix characters horizontally within thousandths. A Stepper Motor drives high quality Tractors – the same ones used in all the most expensive printers – to provide precise vertical character positioning. The continuous loop Ribbon and Re-inking Roller is automatically driven by the head mechanism (no separate motor) and prints up to 5 million uniform-density characters before requiring replacement (that's simple too, taking only a few seconds). The printer is equipped with a Forms Thickness Adjustment so you can get up to five high quality copies. Compare the print quality and placement of the Model 801 with any other matrix printer. You won't find one better.

- **SIMPLE OPERATION**

Just three control switches on the front panel – Reset, Form Feed and Power on/off (illuminated). Reset clears the 127 character input buffer and sets the Top-Of-Form. Motion can be stopped at any intermediate position by Reset – or just use the manual knob on the left side of the printer to advance paper. Forms length can be set to any integral number of lines by an internal DIP switch.

- **SIMPLE INTERFACING**

A single standard DB25 connector accepts either RS232 Serial or Centronics Parallel ASCII coded input signals depending on how you wire up the cable. The Model 801 interfaces easily to your Apple, TRS-80, PET or any S-100 computer. An internal DIP switch determines BAUD Rate of 110, 150, 300, 600 or 1200 BAUD. An Automatic Line Feed after each Carriage Return command is switch selectable..

- **SIMPLE ELECTRONICS**

All electronics including the Power Supply are included on a single circuit board. All ICs socketed for simple replacement. No pots to get out of adjustment, either.

- **SIMPLE MAINTENANCE**

Preventive maintenance consists entirely of cleaning periodically. All bearing surfaces are permanently lubricated. No operator field adjustments are necessary.

- **SPECIFICATIONS**

Print Type	7×7 Impact Dot Matrix	Ribbon	Continuous Loop with Re-inking Roller. 5 Million Character Life	Buffer	127 Character or 2K *
Print Rate:	132 CPS (max)			Dimensions.	12"H×18"W×14"D (30×45X35 cm.)
Character Set:	96 character upper/lower ASCII	Copies	Original +4 Copies	Weight.	29 lbs. (13 kg.) 35 lbs. (12 kg.) Shipping
Character Height	0.105 in (0.277 cm)	Paper Feed	Tractor or Friction *		
Print Format	8.0 in (20.3 cm.) line length. 80, 96 or 132 * columns	Paper	Standard Fan Fold Multi-copy Computer Forms up to 9 5/8" Wide (24.45 cm)	Power:	220 VAC. 15 A. 50 HZ
Line Spacing	6 LPI	Interface	8-bit Parallel (Centronics compatible) RS232C or 20 ma Current loop * 110/1200 BAUD. Switch-selectable	Temperature:	0-45° C Ambient
Line Feed	50 LPM Printing 560 LPM Slewing (100 millisec Single Line)			Relative Humidity:	10-90%

* Available June 1980

SUBSTANTIAL DEALER / DISTRIBUTOR DISCOUNTS AVAILABLE

Sigma (UK)

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COMPUTER SERVICES LIMITED

WHAT LOGS, ANALYSES, PLOTS, PRINTS AND CONTROLS ???

APPLE II

All over Britain Apple II's are logging, controlling and analysing data for forward -looking research groups in industry and education

Apple provides a sensible solution to the headaches of data capture and analysis. Standard cards exist for 16 channel (8 bit or 12 bit) A/D conversion, parallel input/output, 3¾ digit analogue B.C.D., synchronous and asynchronous serial RS232 IEEE-488, D/A conversion....................

Apple will take data from B.C.D. instrumentation, strain gauges, thermocouples, spectrometers, gas chromatographs, diffraction gauges, pressure sensors, electronic balances etc.

The Apple's unique peripheral structure makes custom interfacing easy.

Powerful system firmware (including U.C.S.D. Pascal) means your application is up and running efficiently.

Interested?? call **Paul Fullwood or Carl Philips on 051 933 5511.**

SILENTYPE

The sensational new printer for Apple II.

* 80 characters per line.
* 8½" wide thermal paper.
* Full high resolution graphics at 60 dots. inch.
* Apple intelligent interface.
* 96 characters ASCII set, compatible with Pascal system.
* 40 characters per second.
* Microprocessor controlled.
* Bi-directional look ahead printing.
* Quiet operation.
* No external power supplies.
* Only two diven parts.
* High reliability.
* Clear 5 x 7 characters.
* Portable 12" W x 10" D x 2¾" H weighs 816lbs

2K Bytes of system firmware control operation of the Silentype providing a wide range of operating modes:

TEXT PRINTING Modes:

Computer output to screen and printer
Computer output to screen only
Computer output to printer only
Transfer text on screen to printer (ie emulates screen printer)

Formats:

Programmable page length
Programmable left margin
Programmable right margin
Programmable line length
Tabulation up to 80 columns

HIGH RES GRAPHIC SCREEN PRINTING Modes:

Uni-directional or bi-directional
High res page 1 or 2
Chart recorder mode (line feed suppression)

Formats:

Reverse or normal image
Optional 90% rotation of screen
Optional two-times screen size
Programmable left margin.

SILENTYPE

Nett	VAT	Total
340.00	51.00	**391.00**

APPLE INTERFACE

Nett	VAT	Total
50.00	7.50	**57.50**

80ft paper roll

Nett	VAT	Total
2.25	0.34	**2.59**

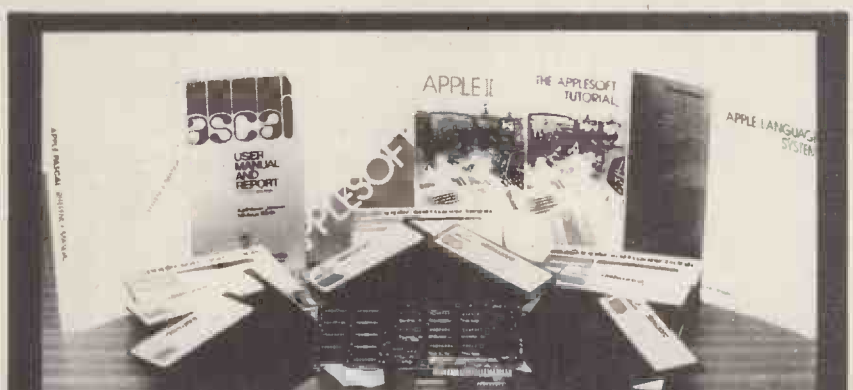
THE LANGUAGE SYSTEM

Apple computer's innovative answer to the twin problems of software development and ROM obsolescence.

* 16K Write-protectable RAM on plug-in card gives all the advantages of ROM while allowing a choice of languages - Pascal, Applesoft, Integer Basic, assembler and forthcoming languages from Apple.
* Appropriate compiler interpreter loaded into expansion RAM on switch on.
* Expands Apple RAM to 64K.
* Maintains compatibility with existing software.
* Gives Euro-plus owners access to the wealth of software, written for Integer Basic and programmers aid.
* Comes complete - 7 manuals, 6 disks, language card, replacement Roms, I.C. extractor.
* Full U.C.S.D. Pascal implementation compatible with Wirth's standard pascal.
* Provides mini-computer like operating system with full screen editor, filer, compiler, p-code interpreter, macro-assembler, demonstration programmes.
* Disk capacity (under Pascal) enlarged to 143K per disk.
* Fully compatible with external terminal.
* 80 character/line with horizontal scrolling.
* Apple oriented extensions allow direct control of keyboard, paddles, loudspeaker, cassette inputs, TTL in, TTL out.
* Turtlegraphics extensions provide the easiest way to use Apple's high resolution graphics.
* Highspeed powerful firmware graphics system.
* INIT. PENCOLOR, TURN, TURNTO, MOVE, TEXT, GRAF, DRAWBLOCK commands.
* Intrisics WCHAR, WSTRING provide software character generator - easy method of labelling axis, graphics and mixing upper/lower case and user defined graphics on the high-res screen.

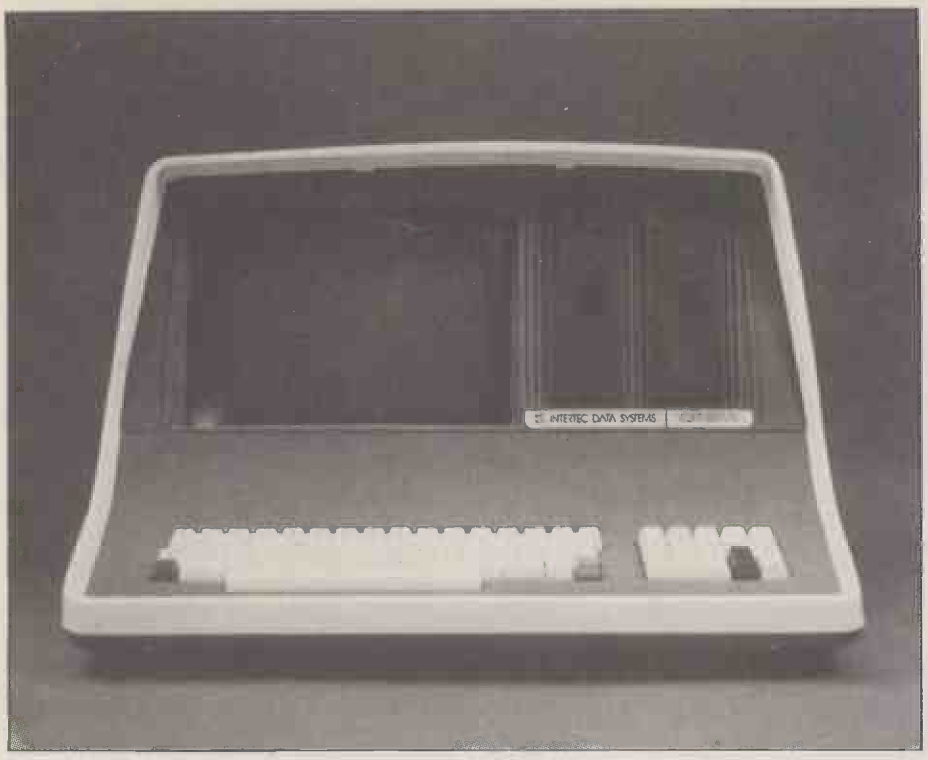
APPLE LANGUAGE SYSTEM

Nett	VAT	Total
299.00	44.85	**343.85**



New Peripherals??? If its for the Apple, exists and works, we already have it!

Stack-Apple experts in the North-West. 290/298 Derby Road, Bootle, Liverpool 20. Telephone 051-933 5511.



System Specifications

CPU	
Microprocessors	Twin Z80A's with 4MHZ Clock Frequency. One Z80A (the host processor) performs all processor and screen related functions. The second Z80A is "down-loaded" by the host to execute disk I/O. When not processing disk data, the second Z80 may be programmed by the host for other processor related functions.
Word Size	8 bits
Execution Time	1.0 microseconds register to register
Machine Instructions	158
Interrupt Mode	All interrupts are vectored
Floppy Disk	
Storage Capacity	320K total bytes formatted on two BASF double density drives Optional external 10-300 megabyte hard disk storage is available using optional S-100 bus adaptor.
Data Transfer Rate	250K bits/second
Average Access Time	250 milliseconds. 35 milliseconds track-to-track
Media	$5\frac{1}{4}$ inch mini-disk
Disk Rotation	300 RPM
Internal Memory	
Dynamic RAM	64K bytes dynamic RAM
Static RAM	256 bytes of static RAM is provided in addition to the main processor RAM. This memory is used for program and/or data storage for the auxiliary processor.
ROM Storage	1K bytes standard. Allows ROM "bootstrapping" of system at power-on. ROM storage is 2708 compatible and may be reprogrammed by the user for custom applications.
CRT	
Display Size	12-inch, dynamically focused. P4 phosphor.
Display Format	25 lines x 80 characters per line.
Character Font	8 x 8 character matrix on a 8 x 12 character field
Line Drawing Characters	Eleven special graphics symbols used for form generation.
Display Presentation	Light characters on a dark background Reversible through keyboard/program selection.
Bandwidth	20 MHZ.
Cursor	Reversed image (block cursor)

Communications	
Screen Data Transfer	Memory-mapped at 38 kilobaud. Serial transmission of data at rates up to 9600 bps
Auxiliary Interface	Universal RS-232 asynchronous. Synchronous interface optional.
Parallel Interface	Radio Shack TRS-80 compatible.
S-100 Bus	Printed circuit edge connector provided for connection of optional S-100 bus adaptor.
Transparent Mode	Enables display of all incoming and outgoing control codes.
Parity	Choice of even, odd, marking, or spacing.
Transmission Mode	Half or Full Duplex. One or two stop bits.
Addressable Cursor	Direct positioning by either discrete or absolute addressing.
System Utilities	
Disk Operating System	CP/M
DOS Software	An 8080 disk assembler, debugger, text editor and file handling utilities
Optional Software	
FORTRAN	ANSI standard. Relocatable, random and sequential disk access.
COBOL	ANSI standard. Relocatable, sequential, relative and indexed disk access.
BASIC	Sequential and random disk access. Full string manipulation, interpreter.
Application Packages	Extensive software development tools are available including software for the following applications: Payroll, Accounts Receivable, Accounts Payable, Inventory Control, General Ledger and Word Processing.
Keyboard	
Alphanumeric Character Set	Generates all 128 upper and lower case ASCII characters.
Special Features	N-Key Rollover, Automatic repeat (at 15 CPS), Keyboard lock/unlock.
Numeric Pad	0-9, decimal point, comma, minus and four user-programmable function keys.
Special Functions Keys	Up to 64 user-defined two-key function sequences
Cursor Control	Up, down, forward, backward, and home.
Internal Construction	
Cabinetry	Structural foam
Component Layout	Two board modular design. All processor related functions and hardware are on a single printed circuit board. All video and power related circuits on a separate single board. These two boards are interconnected via a single 22-pin ribbon cable.
Mounting	CRT and two circuit boards mounted to base. CRT in a rigid steel frame. Disk Drive assembly mounted into upper cover for ease of servicing.
Environment	
Weight	Approximately 45 pounds
Physical Dimensions	$14\frac{5}{8}$" (H) x $21\frac{3}{8}$ (W) x $23\frac{1}{8}$ (D)
Environment	Operating: 0° to 50° C Storage: 0° to 85° C; 10 to 95% rel. humidity - non condensing.
Power Requirements	115 VAC, 60 HZ, 1 AMP (optional 230VAC/50HZ model available)

*Specifications subject to change without notice

**** WIDELY USED IN UK AND USA ****
**** TESTED AND PROVEN ****
**** POWER AT YOUR FINGERTIPS ****
**** JUST COMPARE THIS LIST ****

++ ROBUST SET OF PROGRAMS WITH ERROR TRAPS COVERING PET DOS RENAME MALFUNCTIONS, CASUAL USER ERROR, DISK FAILURES, PET DOS MISMANAGEMENT BLOCK ALLOCATIONS, DISK FAILURES, FAST SINGLE KEY STROKE ENTRIES, CONTROLLED INPUT WITH VISIBLE LINE LENGTH, AND DATE VERIFICATIONS PREVENTING ERRONEOUS DATE ENTRY.

++ COMPREHENSIVE DATABASE MANAGEMENT SYSTEM INCLUDES

**** FILE CREATE / DELETE / SEARCH
**** RECORD CREATE / DELETE / SEARCH / AMEND / PRINT 4 WAYS
**** RECORD SORT BY ANY FIELD BOTH ALPHA OR NUMERIC
**** INDEX SEARCH OR GENERAL SCAN BY ANY FIELD (EG TOWN OR CREDIT LIMIT)
**** FOUR ARITHMETIC FUNCTIONS TO USE AS CALCULATOR ON LAST FOUR FIELDS
**** AUTO CHECK TO PREVENT DOUBLE ENTRY WITH FILE MANAGEMENT SYSTEM DYNAMICALLY ALLOCATING INFORMATION FOR MINIMUM DISK SPACE CONSUMPTION.

++ AUTO INVOICE NUMBERING (WITH OVERRIDE OPTION), PLUS AUTO PRINTOUT INTEGRATED WITH ADDRESS AND STOCK FILES FOR PAYMENT TERM DISCOUNT, AGENT ALLOCATION, PRICE INDEX RETRIEVAL AND AUTO STOCK UPDATE; NOMINAL CODES RETRIEVED FROM ADDRESS FILES MAY BE OPTIONALLY OVERRIDDEN.

++ POWERFUL ALTERNATIVE DOUBLE ENTRY SYSTEM (GENERAL AND OPEN ITEM) INCLUDING NOMINAL CODES PROVIDING A BUREAUX TYPE FACILITY FOR TRACKING MONTHLY TRADING FIGURES AND TAX ACCRUALS.

++ CURRENTLY USING 16 SALE AND 66 PURCHASE COMMODITY CODES WHICH ARE AUTOMATICALLY WRITTEN INTO LEDGERS FROM ADDRESS FILES (INCLUDES OVERRIDE OPTION)

++ AUTOMATIC TRIPLE POSTING OF SALES / PURCHASES TO INVOICE & GENERAL & OPEN ITEM LEDGERS WITH COMPLETE AUDIT TRAIL TO INCLUDE ACCOUNT VERIFICATION ON PAYMENTS IN / OUT, SO THAT DISCREPENCIES ARE RE-ALLOCATED TO OUTSTANDING ACCOUNTS, OR OPTIONALLY WRITTEN OFF AS DISCOUNTS TO THE CASH BOOK. THIS FACILITATES PART PAYMENTS.

++ FINAL LIQUIDITY STRIKES A COMPLETE AUDIT TRAIL BALANCE WITH CREDITORS AND DEBTORS O/S AMOUNTS, BANK BALANCES, STOCK MOVEMENTS, AND REMAINING STOCK VALUE TO GIVE PROFITABLITY OF COMPANY IN BOTH FINANCIAL AND STOCK ASSET TERMS.

++ POWERFUL ACCOUNT TRACKING FACILITIES INCLUDE AUTO STATEMENT PRODUCTION FOR ALL ACCOUNTS EXCLUDING NIL BALANCES, WITH DATE COMPARISON AGE ANALYSIS TO * CURRENT * 30 DAYS * 60 DAYS * 90 DAYS * AND APPROPRIATE MESSAGES WHEN A DATE BLOCK HAS AN INCLUSION.

++ COMPLETE SEARCH / CREATE / AMEND / DELETE / SORT / FACILITIES ON ANY SIGNIFICANT LEDGER HEADING AGAINST EITHER OPEN OR GENERAL LEDGER IN DATE / INVOICE / ACCOUNT / AGENT / NOMINAL CODE / HEADINGS, FOR FULL INFORMATION RETRIEVAL SUCH AS A SHORTLIST OF OVERDUE ACCOUNT FOR A SPECIFIED MONTH, ACCOUNT LEDGER CARD RETREIVAL, NOMINAL ANALYSIS ETC.

++ --- NO --- SPECIAL PRINTED STATIONERY NEEDED SO 50-100 INVOICES COST YOU A FRACTION OF A PENNY EACH, AND THEY ARE FORMATTED PRECISELY TO FIT IN A STANDARD 'RYMAN' WINDOW ENVELOPE FOR CONVENIENT POSTING. TRACKING PROGRAM ENABLING PRINTING OF PAST INVOICES - RECALL ON SCREAN. PLUS MONITOR OF SPECIFIED SALES - PURCHASES OF COMMODITIES BY CODE.

++ MONTHLY QUARTERLY TAX CALCULATIONS PLUS STANDARD MAILING TICKET PRINT FACILITES.

++ ADD-ON OPTION OF AUTO STOCK MOVEMENT REPORT AND UPDATE QUANTITY ON HAND PLUS VALUATION OF RESIDUE AS RESULT OF PURCHASES AND SALES.

++ ADD-ON OPTION OF AUTO BANK UPDATE FROM RECEIVABLES AND PAYABLES AGAINST LEDGERS.

++ STORES UP TO 2200 ADDRESSES OR UP TO 4000 SIMPLE LEDGER RECORDS ON ONE DISKETTE WITH 160K OF USER MENU CALLABLE PROGRAMS FROM OTHER DISK.--ONLY ONE PROGRAM DISK-- AND THE HARD CORE PROGRAMS CAN'T BE BUSTED.

++ SUBSTANTIAL USER GROUP IN UK AND ABROAD WITH ALL POSITIVE FEEDBACK IMPLEMENTED EVERY 3/4 WEEKS AND RE-DISTRIBUTED FREE OF CHARGE (EXCEPT COST OF DISK AND MAILING 50-70 POUNDS P.A). SO YOU BECOME PART OF A COMMONWEALTH OF USERS WORKING WITH AN IDENTITY OF INTERESTS.

++ THIS MUST BE SURELY THE MOST COMPREHENSIVE, COMPACT, PROVEN, AND COST-EFFECTIVE ONGOING PACKAGE ON THE MARKETPLACE AT THIS POINT IN TIME.

++ TOTAL PRICE VERSION3 475 POUNDS..ADD-ON STOCK OPTION 100 POUNDS..ADD-ON BANK OPTION..100 POUNDS.. REMAINING PROGRAMS 19,20,22,23 JOINTLY 100 POUNDS.

++ THINK OF JUST KEYING IN 100 INVOICES, 50 CHEQUES? (PROVIDED YOU LEFT YOUR PRINTER ON WITH PAPER IN) YOU COULD LEAVE OUR PROGRAMS TO DO ALL THE SECRETARIAL POSTING AUTOMATICALLY, AFTER WHICH YOU MAY SET IN MOTION THE AUTO STATEMENT RUN,THEN YOU CAN SIMPLY POST OUT ALL PAPERWORK WITH STATEMENTS AGE ANALYSED TO THE APPROPRIATE STATEMENT COMMENTS ....

++ CPM VERSION SPECIAL NOTE *** WRITTEN ON THE NEW SUPERBRAIN PROCCESSOR WITH THREE HIGHER LEVELS OF OPERATION.
***** 1 = ALL FILES ARE FULLY RANDOM ACCESS SO RETREIVAL OF ANY RECORD IN THE SYSTEM TAKES NO LONGER THAN SEVERAL SECONDS FOLLOWED IMMEDIATELY WITH THE OPTION TO AMEND / PRINT / DELETE / QUIT / OR CARRY ON SERACHING THROUGH ANY FIELD.
***** 2 = ENTIRE FORMER SET OF PET PROGRAMS ARE NOW JUST ONE PROGRAM RESIDENT IN CORE. ONCE INVOKED FROM DISK (UNDER MBASIC) THE USER MAY INSERT TWO EMPTY DATA DISKS IN BOTH DRIVES OF THE SYSTEM ENABLING A HIGHER MAGNITUDE OF DISK SPACE FOR MORE DATA STORAGE. (STANDARD SUPERBRAIN TWIN DRIVES CAN STORE 3000 STOCK ITEMS OR 4500 LEDGER RECORDS.. 800K SUPERBRAINS CAN STORE 7000 NAMES AND ADDRESSES OR 9000 STOCK ITEMS OR 12000 LEDGER RECORDS * ALL INSTANTLY RETREIVABLE) NEW SYSTEM 33 WITH 2.4 MEGABYTES DISK STORAGE CAN HANDLE 20000 NAMES AND ADDRESSES OR 40000 LEDGER ENTRIES.
***** 3 = FULLY TRANSLATEABLE PROGRAM WITH RESIDENT VOCABULARY WHICH MAY BE TRANSLATED INTO ANY FOREIGN LANGUAGE IN A MATTER OF HOURS.

New

Produced and widely used in England and U.S.A.

COMPLETE BUSINESS PACKAGE

INCLUDES EVERYTHING FROM INVENTORY TO SALES SUMMARY
PROMPTS USER AND VALIDATES ENTRIES. MENU DRIVEN

BUS VER 3.00 TO VER 8.00 PET AND CP/M
APPROXIMATELY 60-100 ENTRIES/INPUTS REQUIRE 2-4 HOURS WEEKLY AND ENTIRE BUSINESS IS UNDER CONTROL

*PROGRAMS ARE INTEGRATED . . . .
01=*ENTER NAMES & ADDRESSES . . . . .
02=*ENTER/PRINT INVOICES . . . .
03=*ENTER PURCHASES . . . .
04=*ENTER A'C RECEIVABLES . . . .
05=*ENTER A'C PAYABLES . . . .
06=*ENTER'UPDATE INVENTORY . . . .
07=ENTER'UPDATE ORDERS . . . .
08=*ENTER'UPDATE BANDS : . . . .
09=*EXAMINE'REPORT SALES LEDGER . .
10=*EXAMINE'REPORT PURCHASE LEDGER
11=*MONITOR INCOMPLETE RECORDS . . .
12=*EXAMINE PRODUCT SALES . . . .

SELECT FUNCTION BY NUMBER . . . .
13=*PRINT CUSTOMERS STATEMENTS . . .
14=*PRINT SUPPLIER STATEMENTS . . . .
15=*PRINT AGENT STATEMENTS . . . .
16=*PRINT TAX STATEMENTS . . . .
17=GENERAL HELP . . . .
18=ALTER VOCABULARIES . . . .
19=PRINT YEAR AUDIT . . . .
20=PRINT PROFIT'LOSS A'C . . . .
21=ENDMONTH MAINTAINANCE . . . .
22=PRINT CASHFLOW FORECAST . . . .
23=ENTER PAYROLL NO RELEASE . . . .
24=EXIT SYSTEM . . . .

. . . . ENTER WHICH ONE?

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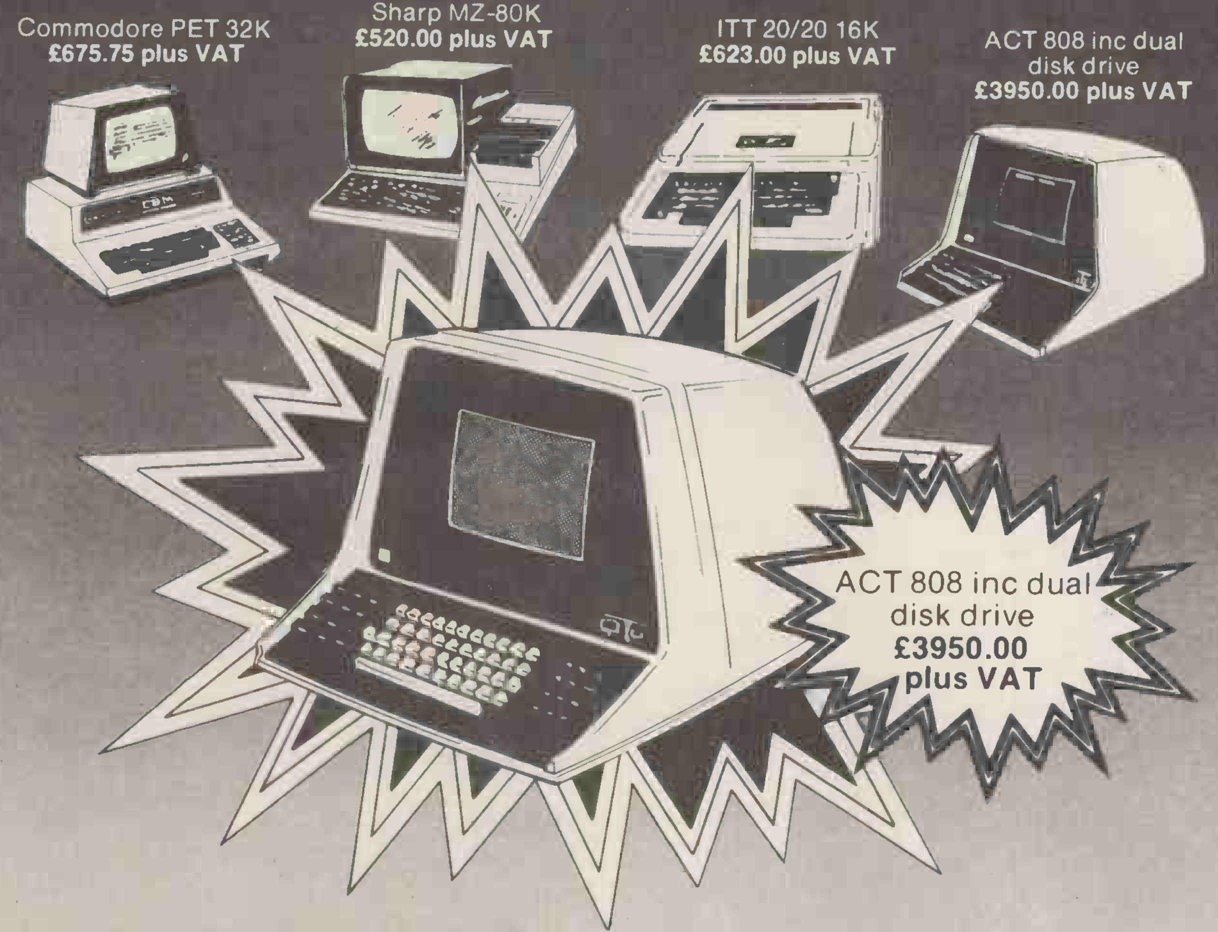

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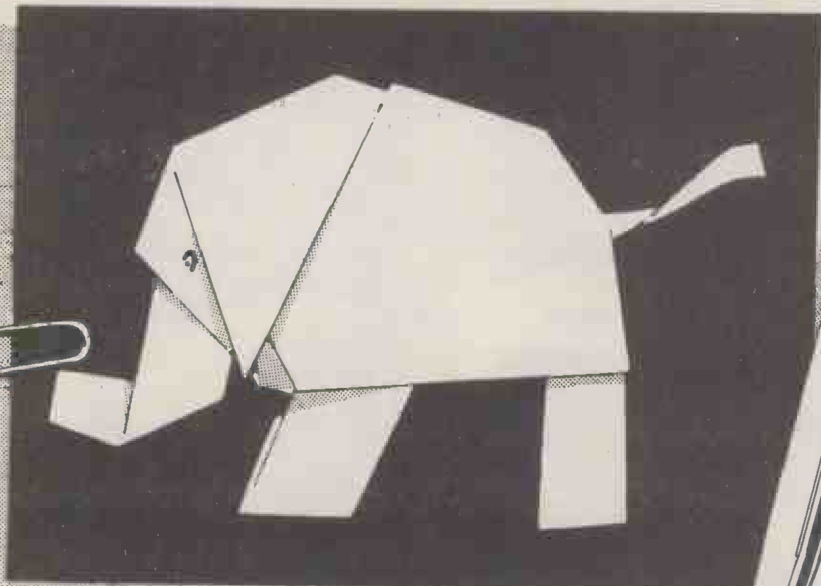

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Remember that professionals writing packages for your cassette system will themselves often use a disk 380Z, and the power of their tools will influence what they produce.

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380Z BASIC is not frozen in ROM. An enhanced BASIC could be loaded in mid 1980 and a BASIC with structured features sometime later.

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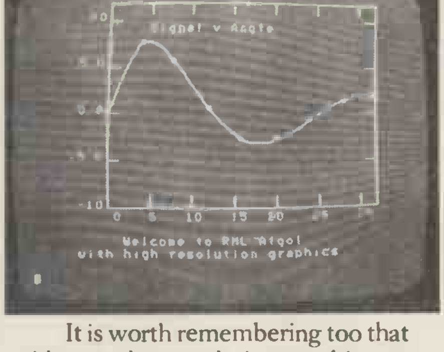
Our scientific graphics was produced for the professional user. Interest in it for classroom use has been surprising.

The 380Z has the best graphics now available on a microcomputer, allowing multiple resolutions, multiple paging, fading and accurate control over colour. All these features help bring excitement to efforts in computer assisted learning.

Our standard machine comes with low resolution graphics and support for this from BASIC allows you to plot a point directly with a plot command – useful for training and teaching.



It is worth remembering too that neither our low resolution graphics nor our optional scientific (high resolution) graphics has any limiting effect on your memory usage, and in both you can

freely mix upper and lower case text and diagrams.

Mains noise can cause system crashes which result in loss of programs and data. All current 380Zs include a mains filter which significantly reduces the chances of this happening.

Don't buy a 380Z on patriotic grounds.

Please only buy it if you would have bought it anyway. But remember, because it is designed and manufactured here you are bound to have better access to us for influence and help than if we were on the other side of an ocean.

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- **MP/M** .... £195/£25
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- **TEX** – Text formatter to create paginated, page numbered and justified copy from source text files, directable to disk or printer .... £45/£10
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MICROSOFT

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SOFTWARE SYSTEMS

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MICRO FOCUS

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- **MDBS-DRS** – MDBS with Dynamic Restructuring System option which allows altering MDBS data bases when new ITEMs, RECORDs, or SETs are needed without changing existing data.

HDBS-Z80 version .... £135/£25
MDBS-Z80 version .... £395/£25
MDBS-DRS-Z80 version .... £455/£25 NEW
8080 Version available at £45 extra

Z80 version requires 20K RAM. 8080 version requires 24K RAM. (Memory requirements are additional to CP/M and application program.)

When ordering HDBS or MDBS please specify if the version required is for 1) Microsoft L80 i.e. FORTRAN-80, COBOL-80, BASIC COMPILER, 2) MBASIC 4, XX, or 3) BASIC-80 5.0.

Software for most popular 8080/Z80 computer disk systems including

NORTH STAR HORIZON, VECTOR MZ, OHIO SCIENTIFIC, CROMEMCO, PROCESSOR TECHNOLOGY, RAIR BLACK BOX, DYNABYTE, SD SYSTEMS, RESEARCH MACHINES, ALTAIR, EXIDY SORCERER, IMSAI, HEATH, and 8" IBM formats

OTHER — Software with Manual / Manual Alone

☐ **PASCAL/M** — Compiler generates P code from extended (L) language implementation of standard PASCAL. Supports overlay structure through additional procedure calls and the SEGMENT procedure type. Provides convenient string handling capability with the added variable type STRING. Untyped files allow memory image I/O. Requires 56K CP/M ..... £195/£20

☐ **PASCAL/Z** — Z80 native code PASCAL compiler. Produces optimised portable reentrant code. All interfacing to CP/M is through the support library. The package includes compiler companion macro assembler and source for the library. Requires 56K and Z80 CPU. Version 2 includes all of Jensen/Wirth except variant records ..... £156/£15

Version 3 Upgrade with variant records and strings expected 2/80 ..... £205/£15

☐ **PASCAL/MT** — Subset of standard PASCAL. Generates (M) ROMable 8080 machine code. Symbolic debugger included. (X) Supports interrupt procedures, CP/M file I/O and assembly language interface. Real variables can be BCD, software floating point, or AMD 9511 hardware floating point. Version 3 includes Sets, Enumeration and Record data types. Manual explains BASIC to PASCAL conversion. Source for the run time package requires MAC (See under Digital Research). Requires 32K. ..... £135/£20

☐ **TINY C** — interactive interpretive system for teaching structured programming techniques. Manual includes full source listings ..... £45/£30

☐ **BDS C COMPILER** — Supports most major features of (M) language, including Structures, Arrays, Pointers, recursive function evaluation, linkable with library to 8080 binary output. Lacks data initialization, long & float type and static & register class specifiers. Documentation includes "C" Programming Language book by Kernighan & Ritchie ..... £60/£10

☐ **WHITESMITHS' C COMPILER** — The ultimate in systems (M) software tools. Produces faster code than Pascal with more extensive facilities. Conforms to the full UNIX Version 7 C language, described by Kernighan and Ritchie, and makes available over 75 functions for performing I/O, string manipulation and storage allocation. Compiler output in A-Natural source. Supplied with A-Natural. Requires 60K CP/M ..... £325/£20

☐ **POLYVUE/80** — Full screen editor for any CRT with XY cursor (M) positioning. Includes vertical and horizontal scrolling, interactive search and replace, automatic text wrap around for word processing, operations for manipulating blocks of text, and comprehensive 70 page manual ..... £70/£12

☐ **POLYTEXT/80** — Text formatter for word processing (M) applications. Justifies and paginates source text files. Will generate form letters with custom fields and conditional processing. Suport for Daisy Wheel printers includes variable pitch justification and motion optimization. ..... £45/£10

☐ **ALGOL 60 Compiler** — Powerful block-structured language (L) featuring economical run time dynamic allocation of memory. Very compact (24K total RAM) system implementing almost all Algol 60 report features plus many powerful extensions including string handling, direct disk address I/O etc. Requires Z80 CPU ..... £110/£12

☐ **Z80 Development Package** — Consists of (1) disk file line (M) editor, with global inter and intra-line facilities; (2) Z80 relocating assembler, Zilog Mostek mnemonics, conditional assembly and cross reference table capabilities; (3) linking loader producing absolute Intel hex disk file for CP/M LOAD, DDT or SID facilities ..... £50/£12

☐ **ZDT** — Z80 Debugger to trace, break and examine registers (M) with standard Zilog/Mostek mnemonic disassembly displays. Facilities similar to DDT £20 when ordered with Z80. Development Package ..... £30/£7

☐ **DISTEL** — Disk based disassembler to Intel 8080 or TDL/Xitan Z80 source code, listing and cross reference files. Intel or TDL Xitan pseudo ops optional. Runs on 8080. ..... £35/£7

☐ **DISILOG** — As Distel to Zilog Mostek mnemonic files. Runs on (M) Z80 only ..... £35/£7

☐ **TEXTWRITER III** — Text formatter to justify and paginate (M) letters and other documents. Special features include insertion of text during execution from other disk files or console, permitting recipe documents to be created from linked fragments on other files. Has facilities for sorted index, table of contents and footnote insertion. Ideal for contracts manuals. etc. ..... £75/£3

☐ **POSTMASTER** — A comprehensive package for mail list (M) maintenance that is completely menu driven. Features included keyed record extraction and label production. A form letter program is included which provides neat letters on single sheet or continuous forms. Compatible with NAD files. Requires CBASIC-2 ..... £85/£10

☐ **XASM-68** — Non-macro cross-assembler with nested conditionals and full range of pseudo operations. Assembles from standard Motorola MC6800 mnemonics to intel hex ..... £115/£15

☐ **XASM-65** — As XASM-68 for MOS Technology MCS-6500 series mnemonics ..... £115/£15

☐ **WHATSIT?** — Interactive data-base system using associative tags to retrieve information by subject. Hashing and random access used for fast resonse. Requires CBASIC ..... £70/£15

☐ **XYBASIC** Interative Process Control BASIC — Full disk BASIC features plus unique commands to handle bytes, rotate and shift, and to test and set bits. Available in integer, Extended and ROMable versions.
Integer Disk or Integer ROMable ..... £165/£15
Extended Disk or Extended ROMable ..... £215/£15

☐ **SMAL/80** Structured Macro Assembley Language — Package of powerful general purpose text macro processor and SMAL structured language compiler. SMAL is an assembler language with IF-THEN-ELSE, LOOP-REPEAT-WHILE, DO-END, BEGIN-END constructs ..... £40/£10

Software with Manual / Manual Alone

☐ **SELECTOR III-C2** — Data Base Processor to create and (M) maintain multi Key data bases. Prints formatted, sorted reports with numerical summaries or mailing labels. Comes with sample applications including Sales Activity, Inventory, Payables, Receivables, Check Register, and Client/Patient Appointments, etc. Requires CBASIC Version 2. Supplied in source code. ..... £185/£12

☐ **CPM/374X Utility Package** — has full range of functions to create or re-name an IBM 3741 volume, display directory information and edit the data set contents. Provides full file transfer facilities between 3741 volume data sets and CP/M files ..... £125/£7

☐ **BASIC UTILITY DISK** — Consists of (1) CRUNCH-14 (M) Compacting utility to reduce the size and increase the speed of programs in Microsoft Basic and TRS-80 Basic. (2) DPFUN — Double precision subroutines for computing nineteen transcendental functions including square root, natural log, log base 10, sin, arc sin, hyperbolic sin, hyperbolic arc sin, etc. Furnished in source on diskette and documentation ..... £30/£10

☐ **THE STRING BIT** — Fortran character string handling. (M) Routines to find, fill, pack, move, separate, concatenate and compare character strings. This package completely eliminates the problems associated with character string handling in FORTRAN. Supplied with source ..... £30/£10

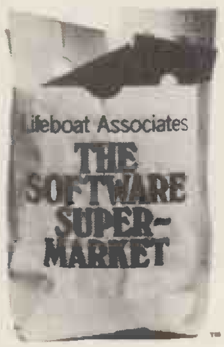
☐ **BSTAM** — Utility to link one computer to another also equipped (M) with BSTAM. Allows file transfers at full data speed (no conversion to hex), with CRC block control check for very reliable error detection and automatic retry. We use it! It's great! Full wildcard expansions to send *.COM, etc. 9600 baud with wire, 300 baud with phone connection. Both ends need one. Standard and M versions can talk to one another ..... £75/£5

☐ **STRING/80** — Character string handling plus routines for direct (M) CP/M BDOS calls from FORTRAN and other compatible Microsoft languages. The utility library contains routines that enable programmes to chain to a COM file, retrieve comand line parameters, and search file directories with full wild card facilites. Supplied as linkable modules in Microsoft format. ..... £50/£12

☐ STRING/80 source code available separately ..... £185/n.a.

☐ **VSORT** — Versatile sort/merge system for fixed length (M) records with fixed or variable length fields. VSORT can be used as a stand-alone package or loaded and called as a subroutine from CBASIC-2. When used as a subroutine VSORT maximizes the use of buffer space by saving the TPA on disk and restoring it on completion of sorting. Records may be up to 255 bytes long with a maximum of 5 fields. Upper/lower case translation and numeric fields supported. ..... £105/£15

☐ **CBS** — Configurable Business System is a comprehensive set (M) of programmes for defining custom data files and application systems without using programming language such as BASIC, FORTRAN, etc. Multiple key fields for each data file are supported. Set-up program customizes system to user's CRT and printer. Provides fast and easy interactive data entry and retrieval with transaction processing. Report generator program does complex calculations with stored and derived data, record selection with multiple criteria, and custom formats. Sample inventory and mailing list system included. No support language required £185/15



Orders must specify disk type and format, e.g. North Star-Horizon single density.

Add VAT to orders for software (not manuals alone) Add 50p per item postage and packing (minimum £1)

All orders must be prepaid (except COD or credit card) Make cheques POs etc payable to Lifeboat Associates.

Manual costs are deductable from subsequent software purchase

Lifeboat Associates
32 Neal Street
London WC2H 9PS
01-379 7931

(M) Modified version available for use with CP M as implemented on Heath and TRS-80 Model 1 computers.

(L) User license agreement for this product must be signed and returned to Lifeboat Associates before shipment may be made

*CP M is a trademark of Digital Research
**Z80 is a trademark of Zilog Inc.

The Software Supermarket is a trademark of Lifeboat Associates

EFFECTIVE MARCH 1980

The perfect match
Low cost, high performance micro terminals

MODEL 730
Miniprinter £555

The Model 730 dot matrix printer is a high-quality printer ideally suited for microcomputer applications. It has been designed for small business users who look at their printer as a reliable provider of hard copy information. The Model 730 is ideal for these applications because it prints quickly at 100 c.p.s., is easy to operate, and offers the convenience of handling three different kinds of paper: cut sheets, paper rolls, or fan-folded (such as pre-printed forms).

The 730 can handle any of those three paper forms interchangeably – without adjustments – producing an original and up to two clear carbons.

Its 80 column line length matches most standard VDU formats, and its compressed print mode allows 132 column printing on 8" wide paper. The 7 x 7 matrix assures excellent print quality even with 3 part forms. Full upper and lower case 96 character ASCII set is standard.

MODEL 1420
Video terminal £680

The H1420 is a new low-cost video terminal designed to support small business systems using both data and word processing software.

It features a typewriter-style keyboard arrangement with both upper and lower case, making it suitable for fast and accurate entry with minimal operator training. Also included is a separate numeric keypad to make numeric entry faster, easier and less prone to error. Among other important features are cursor control keys, typematic and an alternate function keypad. Characters are displayed using a crisp 7 x 9 matrix on a 24 x 80 character screen in high and low intensity, blink or non-display (zero intensity).

The H1420 is an economy terminal with all the features needed to support a variety of microcomputer applications and human engineering design for adaptability and reduced operator fatigue.

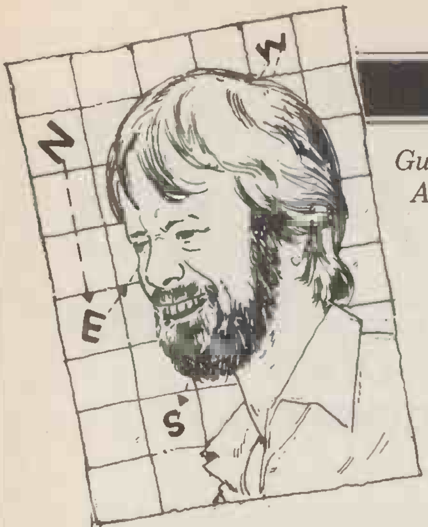
To RAIR Limited 30-32 Neal Street, London WC2H 9PS
Telephone: 01-836 4663. Telex: 298452.

Name
Position
Company
Address
Telephone number

I wish to order MODEL 730 ☐ MODEL 1420 ☐ COMBO ☐
Please send more information ☐

RAIR

COMBO PRICE
Buy both terminals for a total price of
£1099



NEWSPRINT

Guy Kewney with the latest news, rumours and gossip. . . including yet another Apple story.

High Speed Sorting

Software supplier A J Harding has just made a nasty dent in the much-overworked theory that US software can only be imported to the UK by doubling its price.

Harding's pronouncement is short, and beautifully pithy. "As prime distributor for Racet Computers of California, A. J. Harding (Molimerx) announce their high speed sorting program, which is now available for the the Model I and Model II Tandy TRS-80.

"DSM is a self contained system written entirely in machine language and ready for immediate use. It will sort large multiple diskette files on a minimum one-drive Mod II or twin drive Mod I system; it will physically re-arrange all records without needing key files; it will sort random files created by BASIC including sub-records spanning sectors."

I also note it will do several other things on various fields, and is ideal for large mailing lists, inventory control, and other business applications. Sort times are around 33 seconds for 16 Kbytes, up to 1081 seconds for 340 Kbytes, becoming absurd at 2569 seconds for 680 Kbytes — around 16 hours. "The prices " concludes Harding, "in the US are $75 for the Model I and $150 for the Model II. In this country, we're selling them at £39.50 for Model I and £79.50 for the Model II." Harding is in Bexhill-on-Sea; tel: 0424 220391.

Just Open

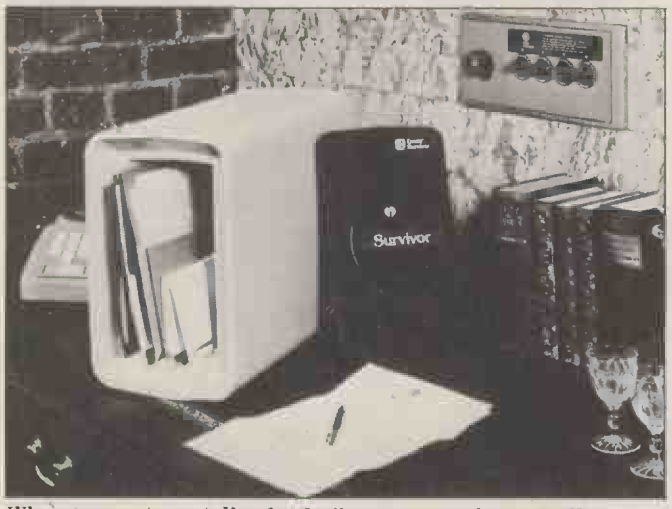
A new store has arrived in Edgware, Middlesex, stocking PET computers and software. Opened in April by DaVinci Computers, director Jeremy S. Rose tells me he's been in business for just over a year. Details from 01-952 0526.

Sirius Business

There's a well-known radio programme called the *Hitch Hikers Guide to the Galaxy*, in which the part of the idiot is played by the Marketing Division of the Sirius Cybernetics Corporation. . . to quote, "a bunch of mindless jerks who'll be the first up against the wall when the Revolution comes".

There's a virtually unknown microcomputer supplier in Leamington Spa who has called his company Sirius Cybernetics. His name is Cutler, and I can tell you virtually nothing about them because whatever Cutler's Sirius Cybernetics does have, it isn't a telephone.

The announcement in front of me says that the company makes memory boards for South West Tech Products micros. A board with two banks of 8 Kbytes costs £220 with VAT extra. It comes assembled and tested, and runs at 2 MHz clock speed. Sirius Cybernetics claims to be at 7 Euston Place, Leamington Spa, Warwicks CV32 4LN.



When computeers talk of volatile memory, they usually refer to the way data evaporates when power supplies for the memory chips fail. The phrase could apply to floppy discs, too, if some Gonzo leaves a match burning under the storage shelf. In this little box, your diskettes will survive in a furnace of up to 1700 deg F — they won't become overfloppy (they went up to 207 deg F in tests); cost is around £60 and details from Crado Devices Ltd on 02774 58232.

Handy Plan

Any programmer can display any character, in any position, on the screen of a PET computer. All the programmer has to know is the location in memory of that spot on the screen. These locations start with number 32768 in the top left hand corner, and continue down to 33767 in the bottom right.

Are you good at counting? To find any particular location in between "all you have to do" (a dead give-away that it's almost impossible) is remember that there are 40 locations to a line, and 25 lines. To save yourself trouble, I recommend that you divide a sheet of paper up into 40 rows and 25 columns, and write the number of each — starting with 32768, and going on till you reach the end. You have to write down 1000 numbers, and I dare say you'll make a mistake or two; still you can always cross those out and start again. With this sheet as a grid, draw the graphics characters in the desired squares.

Oh, you'd better print several, in case you want to draw another picture another time.

Hopefully, that introduction will have given you an idea why I think Impex Enterprises is not at all daft in producing a pre-printed video planner for PET. The company charges a hefty £2.70 for a sheet; it comes in a plastic sheath, and the price includes a water-soluble orange pen. The ink can be wiped off the plastic when the design is finally POKED into place.

Impex is at 12 Wallscourt Road, Filton, Bristol BS12 7NS and the price includes postage and packaging. By the way, POKE locations for other machines are promised for the future.

PET Talk

One look at the size of the loudspeaker on the "talking calculator" for the PET will warn you that Julian Allason's speech program deserves a better output device if you are thinking of using it for generating music. The program costs £10 and it animates the PET keys. . . for instance, if you press 1 it says "one" and so on. It's useful for the deaf (could he mean "blind"? — Ed) and helpful for the rest of us. The squawk box costs £27. ACT Petsoft are at 66-68 Hagley Road, Edgbaston, Birmingham B16 8PF.

Firm Stand

High technology means a printer on its own stand. A stand with (or without) a floor-level shelf for a box of paper is available from Wisbech Computer Services; it's designed to take a Texas 810 printer. Wisbech describes the stand as "solid and robust" which I take to mean that it doesn't wobble as the head moves across the paper. Details, prices from Wisbech (0945) 64146.

APL Gets Personal

You can learn the programming language APL on a micro. Do you care? Yes. The first time a beginner sees a program written down, ready to be typed into a system, it had better be BASIC rather than APL. . . that's if he's not to be frightened off computers for ever.

A Programming Language is totally incomprehensible at first sight. (So is BASIC, but it doesn't *look* incomprehensible.) However once one has grasped what's going on, it quickly becomes much clearer, much more concise — and most important — simpler for the personal programmer to use.

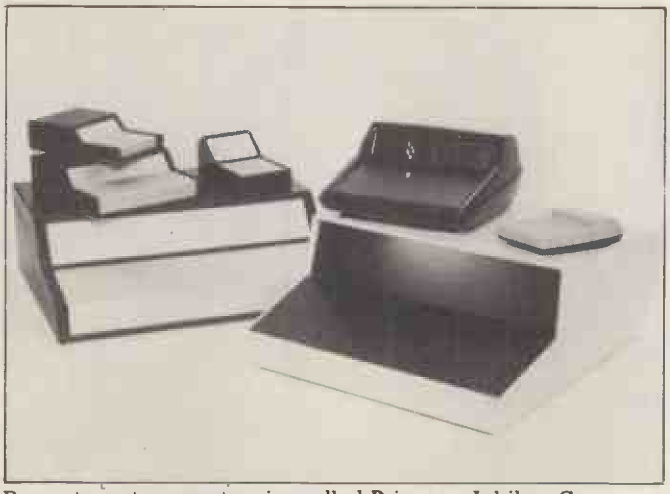
Strangely, APL is the way that pre-micro users were able to get personal computing power — by writing their own programs and running them on their own terminals — when they wanted to do things that the data processing Department couldn't or wouldn't do for them. Because APL was provided on big machines, it was normally given in a way that took advantage of big machine characteristics; the most noticeable characteristic of big machines is that they allow the user to write enormous chunks of code and keep them very cheaply on big discs, where storage costs £30 per megabyte.

A surprising result of this is that users of micros quickly decided that an APL interpreter could not work unless it did have huge chunks of code to convert the cryptic instructions into actions. This turns out not to be the case. Code has been written that's short enough to fit into a Zilog Z80 address space and which can still execute most of the instructions that APL writers will give it; and there's enough space left over to fit in a useful APL program.

The first UK company to offer APL on a micro called itself APL. . . short for Alan Pearman Limited. Now Alan Pearman is running courses on micro-APL, comparing the Vanguard system with the Canadian MCM system with his own (he also offers Vanguard, by the way) and with mainframe versions.

The seminar takes a day, and demonstrations are given in financial modelling, statistics, report formatting, hard copy graphics, critical path method, and utility functions. Cost quoted is £25 per company: individual users should try to join a company seminar in London, Manchester, Bristol, Birmingham, and York.

Details from APL at A. P. Limited, Freepost, Chester CH3 5YZ (without a stamp) — or on Chester 46024 and 21084.



Boxes to put computers in: called Princess, Jubilee, Commander and Bocon Desk, designed to make your birds-nest of wiring look worth stealing. The different names are made in different materials, from something called ABS through to black ABS and aluminium and including structural foam-plastic. Detailed explanations from Chris Long on Aylesbury (0296) 20441 — the company is West Hyde Developments. He's not only real, he's a friend of the Editor. . . there's influence for you.

Old Hands On Dec

Nobody in their right mind would buy a huge Digital Equipment Corporation minicomputer in order to develop software for a microprocessor — even as expensive a microprocessor as the new Zilog/AMD Z8000.

The reason that Zilog has offered a piece of software to allow Z8000 programmers to work on a DEC PDP-11 mini is not that Zilog customers are out of their minds, however. It's because a lot of the people who want Z8000 systems already have PDP-11 minis available in their companies, and also because these minis can run an operating system called UNIX — a time sharing system originally developed by Bell Labs (the research offshoot of America's telephone network supplier).

In the words of Dr Bernard Peuto, Zilog's director of component design engineering and one of the ideas men behind the Z8000 design (or "architecture") the Unix operating system is "an ideal software development environment" for the Z8000.

It's still not possible to get reliable working Z8000 chips if the version of the chip you want is the segmented one with extended memory addressing. However that day is not far off — and Ithaca Intersystems has a cpu board ready with either 8001 or 8002 processors for S100 systems.

Anybody who wants to have software ready for the arrival of the hardware will have to start now, if not sooner. They can feel subtly re-assured by Peuto's claim that the Unix/PDP—11 cross-software package "is able to generate highly efficient code for the Z8000 because the Z8000 architecture was greatly influenced by that of the PDP—11, on which the Unix software was implemented."

Details in the UK from 0628 36131.

Tumbling Prices

New prices have been announced for Digital Microsystems products — microprocessor based and bit-slice mini systems — by Modata, the main distributors. According to Modata, the cuts are around 25%. The cost of a DSC-2 with 64 Kbytes memory and just over a megabyte of diskette storage and with the CP/M operating system thrown in, is now £3525. With a 13.7 megabyte hard disc drive and the model number changed to HDA-4004, the price is £6745. The bit-slice based Hex-29 (it has an instruction cycle of 160 nanoseconds) with a multitasking operating system costs upwards of £6445.

At this stage, it would seem that Modata is more interested in hearing from dealers than direct customers: the announcement says that the network of dealers "who are able to provide a wide range of professionally supported application software" must expand. Details from Bryan Barnes at 30 St John's Road, Tunbridge Wells, Kent.

Wheeling And Dealing

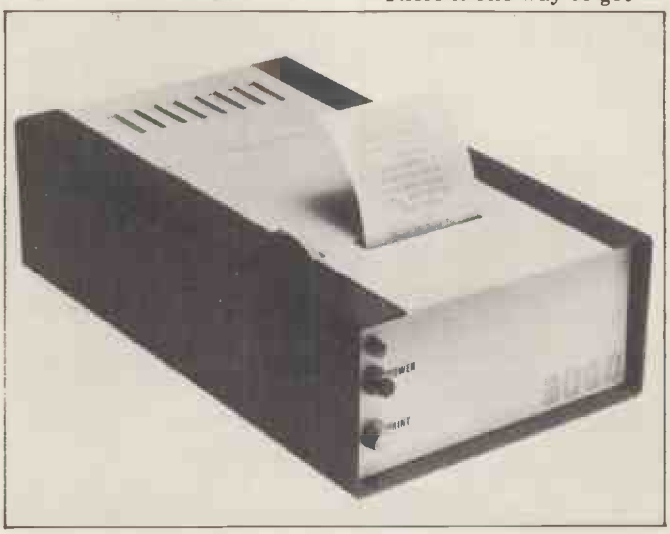
New "and experienced" overseas dealers are needed by New York company, Synchro-Sound Enterprises; apparently that means us. The products are terminals and they quote names such as Hazeltine, ADDS, Televideo, Lear Siegler, Texas, Centronics and Qume. The company also distributes microcomputers: offered here are North Star, Cromemco, Digital Microsystems, Alpha Micro and Superbrain. My impression, however, is that none of the prices will make you fall off your chair. The man to talk to if you want to break the exclusives of other distributors is Robert Kant at 193-25 Jamaica Avenue, Hollis, New York, NY11423: phone (212) 468 7067.

Games And Claims

"We know of no other company that supplies diskette software at these prices."

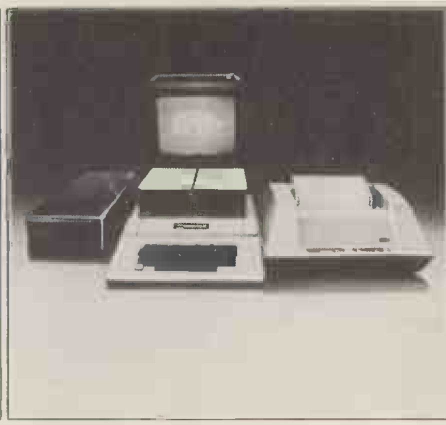
The claim has been made by Databank Software Services as a result of its price cuts. The company is in Loughborough, and the machines involved are PET, Apple II and ITT 2020, and Exidy Sorcerer; the diskette software is Apple/ITT only. Fourteen games titles are listed at £10 each (on floppy including media and postage).

There is one way to get



Time was when a printer using electro-sensitive paper would be sold on the basis of being cheap. This SF-30, using the electro-arc principle to vaporize aluminium and show the black paper underneath, is sold on the basis of its quiet operation and two lines-per-second operation. It's sold by Roxburgh Electronics on 079 73 3777 in Rye, Sussex.

Every computer is the right computer...



. . provided it fits your needs. We can supply computers from North Star, Apple and Commodore, each one guaranteed to match closely your particular requirement.

PET

Britain's best-selling microcomputer – unrivalled in cost and performance for teaching the fundamentals of computing using BASIC, and invaluable to staff for school records, timetable planning, attendance figures and examination results.
16K PET £675

APPLE

The ideal teaching aid for more advanced students where its superb high-resolution colour graphics can be fully exploited in scientific and engineering use. Its advanced features, including voice synthesis and output, stimulate involvement and help make computing creative and fun. It can now be used for teaching PASCAL, the exciting language of the future, while further applications include laboratory control and data logging.
16K APPLE £695

NORTH STAR HORIZON

The North Star Horizon will enable advanced students to acquire experience of commercial computing applications. Over 15000 Horizons are being used in business and industry today, and its mature specification smooths the transition to current data processing techniques. FORTRAN and COBOL are handled with the same ease as compiled BASIC and PASCAL.
32K North Star Horizon £1345

5b the Poultry, Nottingham NG1 2HW.
tel: 0602 583254. telex: 37297 (Keenco) **Keen Computers**

New Apple, North Star Horizon & S100 products.

APPLE

IEEE488 Interface

This is a general purpose Listener/Talker/Controller type implementation for operation within the IEEE488-1978 GPIB Standard. A really superior product imported directly from the manufacturer by Keen Computers Limited.
Salient Features
Supports Daisy Chain Interrupts with on board arbitration logic. Allows DMA Daisy Chain (pass through).
Order Number: K00621A **£212.00.**

BCD A-D Converter

The converter is designed to measure an input potential between 0 and +3.999 volts and convert it to four Binary Coded Decimal numbers that your Apple II can understand.
Order Number: K00622A **£180.00.**

Arithmetic Processor

This has got to be the most exciting interface for the Apple to date. This powerful hardware floating point unit will significantly improve the execution speed of your Applesoft II programs. Decrease execution time by an order of magnitude!

To help achieve true power these additional functions have been added and are available through the USR() function:
ASIN (X). ACOS (X). COGIO (X). SINH (X). COSH (X). TANH (X). INVERSE (X). PI and several others.

All existing Applesoft II arithmetic options are still available but are now performed by the processor unit where a speed advantages is needed.

Gaining this speed has a trade in reduction of nine sig. figs. to seven but just look at the gains.

Using CCSOFT each floating point function was timed over 5000 repetitions. The following was achieved:

Function	Overhead	CCSOFT	AS II
FDIV	11.4 sec	17.6 sec	27.3 sec
SQR	13.8	17.1	248.9
TAN	13.8	28.7	244.8
ACOS	13.8	30.6	554.8

If you want increased speed then this is for you (bolt your Apple to the bench – it is that fast!) Try it – you'll like it.
Order Number: K00623A **£240.00.**

PIA Interface

This interface opens up your Apple to a variety of peripherals such as printers, paper tape equipment or another computer. It is a parallel input/output card. Apple has output parallel interfaces but there are not that many parallel input cards around. We think this is a good one. It has two 8 bit bi-directional parallel ports and four handshake lines. TTL compatible Side A and B with a CMOS Drive capability on Side A. All external lines via a DB-125 Type Connector. In our opinion a good solid interface.
Order Number: K00624A **£180.00.**

Synchronous RS232C Interface

What more need be said! Synchronous Serial interfacing has been a problem in the past. Now we have the answer. If any extra protocol is required this can easily be catered for.

DATA Transfer mode:
7 or 8 data Bits. OPP, EVEN or NO parity. 1 or 2 stop bits. Synchronous Serial by word. Serial by bit.

DATA Transfer Rates:
50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, BAUD, EXTERNAL.

PROGRAM Memory.
ROM (Mask)
or PROM (Fuse Link)
or RAM (Static 2112's)
NOTE: ROM/PROM Auto power down.
Order Number: K00625A **£180.00.**

Light Pen

The Symtec Light Pen is now imported by ourselves directly and is in our opinion the best light pen for the Apple. Complete with software you can now read a coordinate on the hires, page or text page. Ideal for Computer aided graphics or simple data entry. Try one.
Order Number: K00310A **£165.00.**

PASCAL Light Pen Driver

Use the light pen in turtlegraphics with K.C.L's advanced library software.
Order Number: K01201A **£265.00.**

Other goodies you may not know about.

Supercolour

No colour for Apple? If you want colour now and of the highest quality then you need our Supercolour system.
Look at these features:
1. Switch selectable text colour
2. Switch selectable low res choice
3. Switch selectable Hires choice of colours
4. Black and White only switch for photographs
5. Intensity switch

Colours are sent out directly to T.V. guns and hence are dense and clear. Our Supercolour KV1400 automatically switches out UHF signals – your display is crisp and stable. When you remove the connector it automatically reverts to T.V.

Designed and manufactured exclusively by K.C.L. to the highest standard. Don't miss out. Get one now and use Apple's unique colour ability.
Order Number:
K00680A (Supercolour interface) **£90.00.**
K11502A T.V. (Supercolour KV1400) **£345.000.**

Micromikes Time Sharing Software

Specially designed for North Star Horizons. Five share and Four share allow you to link up to 5 or 4 terminals to your Horizon system. Special introductory offer of **£35.00.**
You need some more terminals then?
We hold the following range:
Cifer 2960, Order Number: K11910T.
TVI 912, Order Number: K11800T.
TVI 920, Order Number: K11801T.
Lear Siegler ADM 31, Order Number: K11703T.
Lear Siegler ADM 3A, Order Number: K11704T.
Lear Siegler ADM 42, Order Number: K11705T.

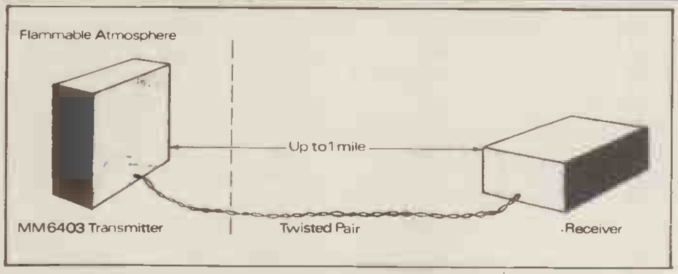
S100 Clock Card

This 100,000 day clock/calendar card is a worthwhile addition to any North Star or other S100 system. Complete with its own rechargeable battery it is excellent in any business application.
Order Number: K11600Z. **£180.00.**

New Software Announcement
Apple Pip

Would you like to rid yourself of the sickening feeling when Apple goes "Disk I/O Error"? Apple Pip is for you.
Look at the uses:
1. Recover deleted programs
2. Repair corrupt disks
3. Hide programs from Catalog
4. Edit the disk Catalog
5. Determine exact program length
6. Change DOS commands
7. Change Tokens in Basic Programs
Order Number: K011365 **£95.00.**

To find out more . . . phone or write to:
Keen Computers
5b the Poultry, Nottingham NG1 2HW.
tel: 0602 583254. telex: 37297 (Keenco)



Over by the petrol pumps, Gonzo Talbot has installed a remote temperature sensor. The temperature rises, and the sensor sends a signal to Gonzo's computer; to do this, it switches on a small current, generating a small spark. Now you know why Burr Brown is so pleased that its Micromux data acquisition transmitter has received safety approval for use in flammable atmospheres. Details on 0923 33837.

them all absolutely free . . . by buying Databank's £150 mailing/letter system. This is described as "a marvellous time saving system combining the addressing capability of the computer in conjunction with a powerful letter writer and editor."

The games are Startrek, Stock Control (good game this), Snooker, Cash Register, Astronomy, Noughts and Crosses, Space Ship, Bank Account (OK, they're not all games), Space Dog, Payroll, Klingon, Library Index (Dewy system), Phaser and Jet Flight with current cost accounting. I'm kidding about the current cost accounting. Details 0509 217671.

Comprehensive Cube

It may be the first place in Britain where anybody can just walk in and use a computer with about the same sort of fuss that joining a library would involve. That will be the Community Computer Centre, and it's siting will be in North London, as from July 11, when Uncle Clive Sinclair, a long-standing friend of the brains of the project (Robin Bradbeer) opens it.

Bradbeer, a lecturer at the North London Polytechnic, has managed to involve the local councils of Islington and Hackney, to the point of getting £20,000 set aside for Community Computer Centre or C^3 or Cube. Cube "will cater for three groups of people," Bradbeer promises. First, there will be integrated systems such as the Sharp MZ80K, the PET, and the Tandy TRS-80. There are also plans for three systems with colour graphics, and finally, another three based on the CP/M operating system — North Star Horizon type machines. "We hope that some of the other systems will run CP/M too," says Bradbeer.

Morning sessions at Cube will be for groups of businessmen or classes of students, referred to the Cube by people such as the Computer Centre for Islington. Afternoons will be devoted to allowing businessmen to come in and use the machines "on a cost basis".

Another interface to convert an office IBM Selectric into a computer terminal — receive only. Prices start at $595; Details from Ipex International of 16140 Valerio Street, Van Nuys, Ca 91406.

Apple Crumble

Word reaches me that the Apple Dealers' Association is dying. It was set up (in some haste) when Microsense took over the Apple II distrubution franchise last year — with the object of smoothing the troubled waters that lay between Microsense and Personal Computers (the previous distributor).

The source of this strange information is, through devious means, Microsense. People there seem confident that the question of a special advertising campaign aimed at schools has hopelessly split dealers who were formerly united.

The question over which the split occured was whether it was a good idea — or an underhand trick — for Microsense to make an offer to schools to supply the first Apple II they might buy at a generous discount. Those who opposed the promotion said that Microsense had promised not to deal direct with users, but only through dealers. They also said that Microsense had actively discouraged the practice of giving discounts as a way of encouraging trade. And they said that a promotion like this should be co-ordinated through dealers. . . not sprung on them as a surprise. And finally they said that Microsense had encouraged dealers to sell aggressively to schools, and that just at the time of year when this work might bear fruit, here was the bread being snatched out of their mouths; it wasn't fair.

The man at Microsense who dreamed up the idea was fully supported by his loyal colleagues, who hastily told dealers and anyone else who cared to ask that they knew nothing about it — an entertaining thought if true.

But not all dealers felt horrified. Those who had done no promotion to schools pointed out that the advertising might provoke some sales; the discount only applied to the first purchase, which might reasonably be expected to lead to normal follow-up sales later.

Am I taking sides if I point out that this is one of those questions with more than one answer? Divided or not, the dealers who opposed Microsense made their point, and the distributor promised they would get their cut; they would also be expected to handle any follow-up business. . . at full price, and that's official.

It may be just one of those administrative hiccups that one expects between trading partners, and maybe I should take no notice. By the same token, perhaps I should also ignore Microsense's latest advertising campaign. If you care to read it (not in PCW, because we've protested) you'll note that it includes the statement that the Apple II is the only microcomputer supported at dealer level. This statement is what many in the writing trade call "fiction". When asked for a comment, by this paper, the Microsense director involved described the statement as "a printing error".

You may feel that I shouldn't stoop to discussing this sort of petty rubbish — and I wouldn't, but for the fact that the last time I wrote

Management games normally need a computer as umpire, and normally the program is sophisticated and expensive. One of the better known games has been adapted for a PET computer by Petsoft. It's the one written by Understanding Ltd, and it costs £60. Tel: 0635 201131.

about the Apple Dealers' Association, that same director complained bitterly to me about not checking my facts with him before sending copy to the printers. When my colleague David Tebbutt checked these "facts" (including: "it's a printing error") with him the phrase he used was "That seems a bit unlikely, Stephen". "I didn't think you'd fall for that one," responded the director cheerfully.

I shall continue to check my facts with the dealers.

Classroom Course

Computer Aided Classroom Instruction: if you need to instruct your classroom, there's a £27.00 course by this title being run at the University of Salford on July 15 to 17. It aims to show how desk-top micros can be used to help school students to explore problems in science, even if they have no knowledge of programming. Details from Admin Assistant, (Short Course) Room 110, University of Salford M5 4WT.

A Word of Advice

A new report on word processing suggests that you should "drive a hard bargain with your supplier". The report in fact comes from Logica, a big software house with a word processing division. You have to be prepared to start with Logica. ... the report costs £100. Phone Online Publications in Northwood Hills, Tel: Northwood 28211.

Under Control

A nuclear reactor somewhere in the North of England is unreliably reported to be controlled by a Commodore PET. I've been told this by the man who claims to have installed it although, not surprisingly, he won't say where it is.

Anyone planning a similarly ambitious process control job will be interested in the range of PET-connectable interfaces launched by Digital Design and Development (or 3D) of Grafton Way, London. The range starts with a converter of analog signals (temperature, voltage, pressure and the like measured by devices such as thermocouples, strain guages and so on) giving 12-bit digital values to the PET through its IEEE interface. And it includes an 8-bit, eight channel analog output device at £350, a 16-channel relay driver, at the same price, an X-Y plotter interface at £200, a £400 digital data gatherer and a 16-channel, analog to digitial converter offering only 8-bit accuracy, for £300. Software is available for all. Details on 01-387 7388 (and see *Micros in Control*, page 105 this month).

Right, As Usual

It was me who first told Britain what a good thing the Technalogics computer (it's able to receive viewdata and other teletext) would be: and at last the National Enterprise Board has got the message. The Technalogics Expandable Computer System (TECS) is to be distributed by B & B Computers of Bolton. It was launched at the Mersey Micro Show on April 30, with the backing of at least £40,000 of NEB-raised capital and a new joint-owned company to push it out. B & B is on 0204 26644, and managing director J Blackburn tells me: "The Post Office also said 'P.O.'". Don't ask me to explain — I only report.

Prize Winners

There are very many "microsystems" — and very ordinary ones at that — which cost more than an all-British, 16-bit Digico system with printer and discs, operating software and Design Council award. This must explain why the Department of Industry's micro competition organisers have rejected Digico's offer to provide one of these computers as a prize. Gonzo Talbot lives!

Meanwhile in Peterborough, things have gone much better. The winner (still unnamed at press time) of that town's micro contest has a year's free use of a factory where he can manufacture a micro-based recorder of industrial process parameters (flow, temperature, pressure) — a recorder which won him the prize.

Second prize went to a company director from Kent who has devised an audio visual teaching unit. Third prize went to a "simple osmolarity meter". Yeah!

Tra-la-la

It is incredible how fast you can enter a song using the Musicraft development system by Computercraft (it says here). The program runs on any CP/M based system with 24 Kbytes or more, and produces "up to four voices (notes) each with seven octave range and each with different musical sounds". It costs $79.95.

The Newtech Computer Systems Inc. Model-6 Music

These are the terminals which will be appearing alongside every French telephone from next year — as a replacement for telephone directories. Mass produced at a cost of under £50 per terminal, they will cost the user absolutely nothing to install. How can the French telephone company afford it? Simple: they'll be paid for with the money which has previously been spent on printing all those expensive telephone directories. Further, the user will now be able to look up any telephone number in the country instead of having to ring directory enquiries for out-of-town numbers. The four versions are made by Thompson-CSF (above left), Matra (above right), CIT-Alcatel (below left) and TRT (below right). So how about it, Buzby?

Your Commodore PET System

The Commodore PET is Britain's best selling microcomputer and the most popular choice in every field:–

A SELF-CONTAINED MICRO-COMPUTER FROM £550.

* In Education for teaching Computer Science and as a teaching aid for other subjects.
* In Science and Engineering for solving problems and for monitoring laboratory equipment.
* In Business the PET system can be put to a wide range of functions including Payroll, Accounting, Statistical Analysis, Stock Control and Word Processing.

Not least of its attractions is the price of a PET – from £550 for a self contained unit, to under £2,500 for the complete system including Floppy Disk Unit and high-speed Printer. Ask your nearest Commodore dealer below for details about Commodore hardware, software and training courses.

Our Dealer* Network

LONDON
Capital Computer Systems, W1. 637 5551
ACE (by Top TV Ltd), SW1. 730 1795
Micro Computer Centre, SW14. 876 6609
Logic Box Ltd, SW1. 222 1122
Sumlock Bondain Ltd, EC1. 250 0505
Da Vinci Computers Ltd, NW4. 202 9630
L & J Computers, NW9. 204 7525
Adda Computers, W1 408 1611
CSS Business Equipment Ltd, E8. 254 9293
Advanced Management, EC2. 638 9319
Metyclean Ltd, SW1. 828 2511
Microcomputation, Southgate. 882 5104
T.L.C. World Trading Ltd, WC2. 839 3894

HOME COUNTIES
Orchard Electronics Ltd, OXON, 0491 35529
D. L. Chittenden Ltd, CHESHAM, 4441
J. R. Ward Computers Ltd, MILTON KEYNES, 562850
Dataview Ltd, COLCHESTER, 78811
South East Computers Ltd, HASTINGS, 426844
Symtec Systems Ltd, SOUTHAMPTON, 38868
Alphascan Ltd, BANBURY, 75606
Super-vision, SOUTHAMPTON, 774023
Millhouse Designs Ltd, ALTON, (042) 050374
Micro Facilities Ltd, MIDDX, 979 4546
DDM, BRENTWOOD, 230480
Stuart R. Dean Ltd, SOUTHEND, 62707
Alpha Business Systems, HERTFDRD, 57423
HSV Microcomputers, BASINGSTOKE, 62444
HSV Microcomputers, SOUTHAMPTON, 22131
RUF Computers (UK), BURGESS HILL, 45211
Wego Computers Ltd, CATERHAM, 49235
T. & V. Johnson, CAMBERLEY, 62506
T. & V. Johnson, DXFORD, 721461
Petalect Electronic Services Ltd, WOKING, 23637/21776
Business Electronics, SOUTHAMPTON, 738248
Amplicon Micro Systems Ltd, BRIGHTON, 562163
Bromwall Data Services Ltd, HATFIELD, 60980/64840
MMS Computer Systems, BEDFORD, 40601
Isher-Woods, LUTON, 416202
Sumlock Bondain, NORWICH, 26259
CSE (Computers), READING, 61492
Oxford Computer Systems, WOODSTOCK, 811976

MIDLANDS & STH. HUMBERSIDE
Taylor Wilson Systems Ltd, KNOWLE, 6192
Betos (Systems) Ltd, NOTTINGHAM, 48106
Holbrook Business Systems, DERBY, 368088
Lowe Electronics Limited, MATLOCK, 2817
Davidson-Richards Ltd, DERBY, 366803/4
Arden Data Processing, LEICESTER, 22255
Tekdata Ltd, STOKE-ON-TRENT, 813631
C.S.M. Computer Systems, BIRMINGHAM, 360 6264
Business & Leisure Microcomputers, KENILWORTH, 512127
Caddis Computer Systems Ltd, HINCKLEY, 613544
Allen Computers, GRIMSBY, 40568
CPS (Data Systems) Ltd, BIRMINGHAM, 707 3866
Camden Electronics, BIRMINGHAM, 773 8240
Cliffstock (Computer Systems) Ltd, WOLVERHAMPTON, 24221

YORKSHIRE & NTH. HUMBERSIDE
Microprocessor Services, HULL, 0482 23146
Microware Computers, HULL, 562107
Computer Workshop, LEEDS, 788466
Hallam Computer Systems Ltd, SHEFFIELD, 663125
Ackroyd Typewriters Ltd, BRADFORD, 31835
Datron Micro Centre, SHEFFIELD, 585490
Yorkshire Electronics Service Ltd, MORLEY, 522181
Sheffield Computer Centre, SHEFFIELD, 53519

NORTH EAST
Dyson Instruments, DURHAM, 66937
Currie & Maughan, GATESHEAD, 774540
Wards Office Supplies, GATESHEAD, 605915
Tripont Associated Systems, SUNDERLAND, 73310
Newcastle Computer Services, NEWCASTLE UPON TYNE, (0632) 615325

SOUTH WALES & WEST COUNTRY
Computer and Design, BROADSTDNE, 0202 697341
A. C. Systems, EXETER, 71718
Computer Supplies (Swansea), SWANSEA, 290047
Sigma Systems Ltd, CARDIFF, 21515
Devon Computers, PAIGNTON, 526303
Bristol Computer Centre, BRISTOL, 23430
J. A. D. Integrated Services, PLYMOUTH, 62616
Sumlock Tabdown Ltd, BRISTOL, 26685
Radan Computational Ltd, BATH, 318483
T. & V. Johnson Ltd, BRISTOL, 422061

NORTH WEST & NORTH WALES
B. & B. Computers Ltd, BOLTON, 26644
Megapalm Ltd, CARNFORTH, 3801
Tharstern Ltd, BURNLEY, 38481
Fylde Business Machines Ltd, PRESTON, 731901
Preston Computer Centre, PRESTON, 57684
RPL Microsystems, DOUGLAS, 4247/8

LIVERPOOL
Microdigital, LIVERPOOL, 227 2535
Rockliff Brothers Ltd, LIVERPOOL, 521 5830

MANCHESTER
Cytek (UK) Ltd, MANCHESTER, 832 7604
Executive Reprographic Ltd, MANCHESTER, 228 1637
Sumlock Manchester Ltd, DEANSGATE, (0618) 834 4233
Computer Workshop, MANCHESTER, 832 2269
Professional Computer Services Ltd, OLDHAM 061-624 4065
D. Kipping Ltd, SALFORD, 834 6367
Catlands Computers Ltd, WILMSLOW 527166

SCOTLAND
Microcentre, EDINBURGH, 225 2022
Thistle Computers, KIRKWALL, 3140
McAllister Business Equipment, EDINBURGH, 336 2402

IRELAND
Softech Ltd, DUBLIN, 784739
Medical and Scientific, LISBURN, 77533

*This is a list of dealers participating in associated advertising and not a full list.

commodore

We made small computers big business.

Commodore Information Centre, 360 Euston Road, NW1 3BL. 01-388 5702

Periflexible to suit your requirements

PERIFLEX 0/0 and 5¼" SYSTEMS

PERIFLEX 0/0
19 slot mother chassis to accept S100 cards, includes case, PSU and fan.
£420.00

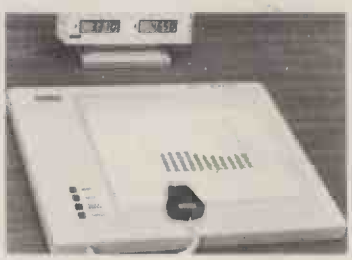
PERIFLEX 00/16
16K static RAM; 4MZ Z80 CPU, 2 serial 3 parallel I/O ports, 2K PROM, 19 slot S100 Motherboard.
£975.00

PERIFLEX 630/32
32K static RAM, 4MZ Z80 CPU, 2 serial 3 parallel I/O ports, 2K PROM, dual 5¼" Micropolis drives, 620K storage, 9 slot S100 Motherboard, CPM/MDOS operating system.
£2080.00

PERIFLEX 630/48
As 630/32 but with 48K static RAM.
£2300.00

PERIFLEX 0/0

PERIFLEX 630/16-48



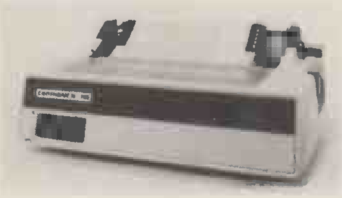
HI-PAD

HI-PLOT

PERIFLEX 8" SYSTEMS

PERIFLEX 1024/32-64

VDU



PRINTER

PERIFLEX 1024/32
32K static RAM, 4MZ Z80 CPU, dual 1.2 Mbyte 8" floppies, 2 serial 3 parallel I/O ports, 2K PROM, CPM operating system.
£2660.00

PERIFLEX 1024/48
As 1024/32 but with 48K static RAM.
£2880.00

PERIFLEX 1024/64
As 1024/32 but with 64K static RAM.
£3100.00

OPTIONAL EXTRAS
Wide range of Micropolis 5¼" drives available ex-stock for S100 SYSTEMS, TANDY, SORCERER, etc.
Various types of VDUs and printers, and a wide range of applications software readily available.

OEM & S100 WINCHESTER DISKS
Micropolis 8" 6.2M to 31M hard disks available shortly complemented by our own PEREX cartridge back-up.

STOP PRESS — Micropolis have just announced a double sided 5¼" floppy disk drive with a fantastic 630K storage (formatted).

VECTOR GRAPHIC
MZ 56K Z80 4MZ with 630K twin micropolis disk drives £2645.00
SYSTEM B as MZ but with mindless terminal
£3220.00

LOW COST GRAPHICS
A4 digital plotter £695.00
11" × 11" digitiser £555.00
Both complete with RS232C interface.

FOR FURTHER DETAILS AND DELIVERY CONTACT US TODAY!

Periflex computers
Micropolis 5¼" disks
Vector Graphic computers
Micropolis hard disks

SINTROM GROUP

Sintrom Electronics

Sintrom Electronics Ltd
Arkwright Road, Reading,
Berks RG2 0LS
Tel: Reading (0734) 85464
Telex: 847395

MEMBER CRA COMPUTER RETAILERS ASSOCIATION

I'm not sure whether I was supposed to write about this black box or to buy one. It's meant to take the output of my office word processor (on which I compose all these stories) and feed it direct into the printing machinery, thus preserving all my own idiosyncratic typing habits and excluding those of the typesetter.

I see the greatest benefits in being able to send my prose direct from my home system to the printers without the Editor getting a chance to interfere on the way (I don't — Ed). The maker, Alphatronic, claims that the box will interface between any general purpose computer and most typesetting equipment. Alphatronic is on 01-204 1144.

Board "with improved fourth-order low-pass filter" is $100 — it doesn't say so on the release, but I think you need one to connect between the clever software and your amplifier. Details from 230 Clinton Street, Brooklyn, New York 11201, or phone (212) 625 6220.

Southern Pet

SUPA is the new name of the Independent PET Users' Group (South) and the new initials stand for Southern Users of PETs Association. Howard Pilgrim tells me that SUPA's former position as a regional group for IPUG is now terminated, and the new subscription rate for 12 months is £5.00. Pilgrim is membership secretary, and his address is 42 Compton Road, Brighton BN1 5AN, Sussex.

Intro To Micros

A course costing £50.00 and lasting one day is offered by Cambridge Micro Computers as a quick practical introduction to micros: cost goes up to £55 after July. Cambridge also does a five day, £240 (rising to £265) introduction to the design of micro-based systems. Details on 0223 314666.

Take Over

Two existing computer shops in Manchester and in Leeds have been taken over by Northern Software Consultants. . . they will be renamed NSC Computer Shops. A wide range of hardware from PET and Apple through to Cromemco, is sold with software and a maintenance service. Details on 061-273 1661.

Micros in Education

With luck and timely printing, you should just be able to get into the two-day "Micro Computers in Education" congress, held on June 2 and 3; John Coll and other luminaries of MUSE will be discussing a wide variety of important subjects. Included will be snapshot sequences of German and Danish experiences from Herr Professor Dr Klaus Haefner of the University of Bremen, and Dr Torsten Jensen of the technical Teachers College, Copenhagen. Details on 057-282 2711.

S.T. Competition

Full marks to Baroness PR and Commodore for announcing their sponsorship of the Sunday Times Magazine competition "Young Computer Brain of the Year" — and for getting the announcement out well enough ahead of the judging day for us to give you a chance to enter.

First prize is a PET 32 Kbyte processor: second is an 8 Kbyte PET; or you can have £500/£250 instead. That's two prizes in each class; there's three classes and they are: individual entrants under 15, individual entrants under 19, and group entries of people under 19. Overall Brain of the year wins £1500 extra plus a trophy.

To win, write an essay outlining the following project. . . "to use computers to the benefit of society". Entry forms from the amazing Baroness Herself at 1/3 Old Compton Street, W1V 5PH. Only one thing — PCW has already received a letter from an irate 14-year old; his complaint. . .? What has writing essays got to do with computing! The lad has a point.

Variation On ALGOL 60

Liveport Ltd, now has available two new versions of Research Machines Ltd., ALGOL 60. The standard version has the capability to do low definition teletext type graphics using the Sorcerer's display. In addition to the graphics facility, one version has also been modified to use 32 bit integers in place of real numbers, thus enabling higher precision calculations to be performed. This piece of jiggery-pokery they claim makes the system ideal for business applications. Both versions are priced at £99.00. Liveport are on 0736 798157.

Open-At Last!

A trifle over-enthusiastically, Tandy has opened a shop in the City of London with the breathless words "At last, the over-the-counter computer is here."

Even if the Computer Retailers Association doesn't disband out of pure astonishment, the "City's first specialist microcomputer shop" has opened, and it is at 1/2 Seacoal Lane — just a short stagger from Mother Bunches wine bar if I remember. For the phone number, I will refer you to Tony Martin of Phoenix public relations on 01-353 0666. Share his excitement.

Show Pieces

The first official World Microcomputer Chess Championship will be a star attraction at this year's PCW show, 4-6 September at the Cunard International Hotel, London.

The Championship will be held under the auspices of the International Computer Chess Association and will be open to both commercial and noncommercial entrants, with a £500 first prize for the highest placed entrant in the latter category. Details of the contest from David Levy, C/O PCW.

Running concurrently with the show will be MICRO UK, a three-day event incorporating conferences, seminars, teach-ins and discussions. There'll be more details in next month's issue, so suffice for now to say, MICRO UK will be catering for a wide range of interests — one that will cover microcomputers in business, education and the home.

Guy Kewney is Technology Editor of Computing.

Even a very cheap print mechanism such as this tally roll printer from Whymark Instruments can get up to the £440 mark when it comes boxed and ready to plug straight into a PET. This machine prints on plain paper, so it isn't an ultra-cheap electro-sensitive arc printer (cheaper because of having no powered impact needles); it prints 40 characters per line, one line per second. Details of this and other printers and ticket preparation machines from 07372 21753.

YANKEE DOODLES

Tom Williams presents the first of his reports from "across the pond". Tom is Editor-in-Chief of Info World. . . A Palo Alto based bi-weekly nespaper on microcomputing.

Uncle Sam's networks

A recent trip to London to witness the "coming out party" for Prestel in the UK gave me cause to reflect on the different approaches toward establishing an information utility in the US and in Britain. In many ways, the Prestel approach, initiated by the British Post Office, represents a very clean, refined, and marketable commercial information utility that will probably find widespread acceptance before anything comparable is is established in the US.

The American approach — to the extent that anything of the sort is being done in the US — is a response to very different economic and market conditions; they don't lend themselves to the kind of government-backed system now being marketed to the public in the UK. The two American systems currently in nationwide use are called The Source, and MicroNET, and are predicated on the use of a personal computer, or at the least, a computer terminal, to access them.

Such a requirement immediately limits the number of persons who can use these networks without making a major investment. On the other hand, the existence of such networks is a powerful incentive to anyone contemplating the purchase of a personal computer.

The two systems, for all their limitations in numbers of users, are much more interactive than a viewdata type system; one of their most attractive features is that of electronic mail. I understand that Prestel has the inherent capability to handle electronic mail, but that subject is taboo because of political and labour considerations, and is referred to only furtively and in hushed, conspiratorial tones in British circles. These issues are, of course, alive in the US too. But since the networks are private enterprises, they have simply gone ahead and implemented electronic mail anyway. So far, the US Postal Service has been too confused to do anything about it.

Like any information utility, the US personal computer networks need three major components: the "electronic highway", or telecommunications facility, the computer system, and the information providers. At present, these networks use existing commercial facilities at off-peak hours. The US has several private data communications set-ups which serve large industrial customers. These services, among which are Dialcom and Telenet, rent their facilities for use by the personal computer networks during hours of low industrial usage. Access to the data communications networks is by means of the telephone system, another private enterprise.

Both networks had to start out with computer facilities that were not entirely dedicated to the personal computer network services. CompuServe, the parent company of MicroNET, uses time on computers that are primarily serving the company's principal activity of industrial/commercial networking. The Source started out by renting time on computers owned by other companies, but has since been acquiring its own machines to use exclusively for its personal network service.

The information provided on these networks is available in various ways. Some of it, such as United Press International news service, is simply bought or subscribed to by the network company. This is also true of airline schedules and other large data base reference files. Other services are created and maintained by the network companies themselves. This includes the electronic mail facilities, the online chatting features (where users currently logged onto the system can simply converse), and such frivolous things as advice columns on philosophical questions.

Charges for use of these networks are billed to the users' Visa or Master Charge accounts and are computed for connect time not including the cost of the telephone service, which the user must pay to the telephone company. Thus, charges are not figured according to the value of a page of information, as with Prestel. This method has caused some complaints from users who say that they have to pay to view the same initial instructions every time they use the system.

Thus, the financial workings of Prestel and the American information untilities seem to have some fundamental differences. Prestel rents out pages in its computer and the information providers work out how best to pay for the space and make a profit. Either they charge the user for access and have their accounts credited by the Post Office, or they pay the Post Office and make their money from clients who are advertisers.

In the US system, the network companies set up the information service, then try to put enough useful information and service facilities on the system to attract users whom they then charge directly for connect time. Although there are teleshopping (charge listed items to your account number) and travel booking facilities available, there's little straightforward advertising — a fact which seems almost un-American.

There are presently plans to conduct trials of a Prestel-like viewdata system in Florida. However, the system seems so cumbersome in comparison to its British counterpart that there's some doubt as to the likely success of the venture. Things such as the private nature of the necessary services, the diversity of broadcasting interests, a somewhat hostile and slightly inept Postal Service and the reluctance of Americans to get government involved in any new projects will probably not allow a viewdata system like Prestel to be directly imported.

However, if experience shows there is a demand for an information utility, and if manufacturers perceive that fact and become truly motivated, the US will undoubtedly produce a public information system which will combine many of the refinements of Prestel with the flexible features of the current personal computer networks in a system that will be uniquely American . . . no doubt as confusing to foreigners as baseball.

Beware the Japanese

Watch for new computers from Japan. We just saw an item produced by the Nippon Electric Company that combined in a small keyboard-cabinet a computer with 16K RAM, Microsoft BASIC, colour graphics, disc controller, cassette interface, and *motor control* for $750 US. For another $750, NEC sells a colour monitor (that's *monitor*, not TV) which will handle the high resolution graphics and an 80 character display.

Console configuration can be set in BASIC, and there are "Motor" commands to control external devices through the connector at the back of the unit. NEC is not planning to market this model abroad, however. It's holding back in favour of a better, cheaper model to be introduced soon.

"Not only does it tell you your weight, but also when your feet need washing."

COMMUNICATION

PCW welcomes correspondence from its readers. Be as brief and concise as possible and please add "not for publication" if your comments/questions are to be kept private.
Address letters to: "Communications", Personal Computer World, 14 Rathbone Place, London W1P 1DE.

Help Wanted

I have a Pet 32K with 2040 disc machine and printer and would be interested to know if any of your readers could suggest routines for the following problems:

A method of calculating the number of days between any two dates, either in the same year, or, more clever, in different years.

A method of up-dating a program automatically. This particular problem concerns my small wages book. Each month the "total pay to date" is increased and has to be re-entered on my program individually for each employee. It should be possible to write a program which will modify itself each month to bring the new total forward, but I cannot see how to do it. How do you make a program re-write itself?
L.N. Parlett, Bridport, Dorset.

Thorny Problem

When reading about the past features in your magazine I noticed a number of articles on the MK14; as I am a MK14 owner I would like to read these articles. Unfortunately, it would cost me too much to buy all these issues of the magazine. I was wondering therefore whether I could get photocopies of the articles for a fee.
W.R. Osborne, Gateshead, Tyne and Wear.

We get several letters like this each month. Unfortunately, if we agreed to start photocopying articles we would soon be so inundated with requests that there'd be no time left to produce magazines. As a first course of action, try a reference library; if this fails, buy the appropriate back issues of the magazine. Of course, we are out of stock on some issues so if you want a particular article in one of these and cannot get it by any other means, then send us 20p for each page you want copied — together with a large stamped, addressed envelope — and we'll look after you — Ed.

Data Retrieval

Since no answer has yet appeared to Mr. R. Cason's question on the PET (PCW February, 1980) concerning rescuing data from a tape where the header has been accidentally erased, may I offer the following.

If a data tape is concerned the problem is relatively simple.

First of all enter the following program:

```
10  OPEN 1
20  STOP
40  INPUT# 1, A$
60  PRINT A$
50  IF (ST) AND 64 GOTO
    110
100 GOTO 40
110 CLOSE 1
120 END
```

The technique is to place in the cassette player a data tape with the header intact. Run the program in the normal way until it breaks in line 20 then switch off the cassette deck and substitute the corrupted tape for the original one having first wound it to approximately the right place. Now enter the command "CONT" and press "PLAY" on the cassette deck. The lost data will now be retrieved from the tape and displayed on the screen.

The problem now is formatting it. Data will scroll up the screen at a rate of knots and be lost before it can ever be read. A semicolon at the end of line 60 will help but string data will butt up with no spaces between and still be difficult to read; and even if a comma is used instead of a semicolon, readability is not certain, depending on the length of strings; and in any case the whole thing will still be moving too fast to copy out. Of course a printer would get you out of this problem.

The best way to control the stuff is to add the following lines to the program:

```
30 FOR I = 1 TO 20
70 NEXT
80 WAIT 59410, 4, 4
90 PRINT "clear"
```

Line 100 should be changed to 100 GOTO 30.

Now twenty items of data are displayed and the thing stops until you press the space bar whereupon the screen clears and the next twenty items are shown.

The "WAIT" may not work on old ROMS so line 80 can be changed to:

```
80 GET Q$: IF Q$ = "" 
   GOTO 80
```

and any key can be used to advance to the next block of data.
Alan W. Shelley, Sidcup, Kent

Yes And No More

A point that is missed in D. Jones' letter about "YES" and "NO" in PCW for April is that the problem he describes is not inherent in the PET but in the program he uses. Furthermore, the editor's suggestion can be compressed by a third to the form:

```
IF LEFT$(A$.1)='Y' THEN ...
IF LEFT$(A$.1)='N' THEN ...
```

with the retry routine referenced in the second line and the 'NO' routine following immediately after the second line. However, in this speedy day and age, no-one has time to waste hitting the RETURN key, so why not use the GET format, which is the most compact of all?
Frank Chambers, Ballycroy, Ireland.

Powertran Club?

As I purchased a Powertran kit about two months ago and, having got it built and working, I am interested to know if there is a users group. If not, I would be interested in starting one. Any information or suggestions would be very much appreciated.
C.J. Pink, 14 Cowbeck Close, Parkwood, Rainham, Kent.

Sowing Seeds

It seems that most of the PET BASIC programs submitted to your magazine do not use the RND function correctly. The action taken by the PET depends on the value of the argument given:

a) If it is negative (e.g. RND (—5)) then the PET uses the number given as a new seed for the random number sequence.

b) RND (0) generates a new seed from four internal clocks. This should be used only to set seeds and not to generate random number sequences since if RND (0) is used in a program loop which takes a a constant time interval to execute then the values of the internal clocks at each function call will follow a non-random pattern.

c) If the argument is *any* positive number then the result is the next random number in the sequence defined by the seed. So RND (5) gives the same result as the apparently ingenious RND (TI), which does not (as some programmers seem to think) use the actual value of TI at all — all that counts is that it is positive!

I suggest that programs using random numbers use an initial RND (0) to set a "truly random" seed, and then obtain the actual sequence by RND (any positive number).
G.M. Sobala, London, W.7.

Cambridge Comments

With reference to Tim Hawkins' article "Beefing up the MK14" (April PCW), I also attempted a similar expansion. My machine was a MK14 issue II, using the original monitor. Unfortunately the monitor failed after latching out the top four address bits from the data bus. The monitor listing stated that the monitor used RAM at OFF7 to OFFF, but in fact it uses FFF7 to FFFF. This makes no difference to the basic MK14 which only uses one page, so the first digit of the above address locations can be ignored, making them both the same. However when expansion is attempted and the last page, or RAM at the top of the last page is not available to the monitor, then the monitor programs fails. This would appear to be the case with Tim Hawkins' design.

The solution that I employed was to use full address decoding and "AND-ing" the first and last pages, thus making page 0000 the same as page F000. This doesn't matter if the full 64K capability is not required. SOC software can still be run as before.
L.V. Cooper, Ruskington, Lancs.

School Sense

What a narrow minded attitude David Firnberg has to the uses of Computers in Schools (Interrupt — April 1980) with his pleas for schools to concentrate on the applications of computers rather than their functioning or algorithms (put away the bits, bytes, circuits and logic gates). He appears to feel that so few product and systems designers will be needed in the future that their education can be neglected ("who wants electronic whizz kids?"). The answer is — I do (am I alone?). Is it not true that developments in the technology of the future will be largely due to such people and as far as free societies make use of available technology they will be moulded by the work of such people — I will not enter the debate about their economic usefulness.

Surely schools must aim to do both jobs — lay on courses for the future electronics/computer experts, and courses for lay computer users. The first would be of a "this is how it does it" nature and the second of a "this is what it can do" nature. I regard both as equally important but to (relatively) deny the first to the goodly proportion of our school pupils who find the "how it does it" fascinatingly interesting is a criminal neglect of our educational responsibilities.

There is more to it than this however. The "this is what it can do" approach still leaves the bulk of people interacting with systems designed by others (the whizz kids?) and in one sense therefore controlled by them. Surely education should try to give as many people as possible the ability to control their systems rather than the other way round, so the more people who can design systems and learn how to modify and if necessary "crash" them the better.

Who are going to be the aristocrats (technocrats?) of the future — or will there be any at all?
Paul Stevenson, Norwich

Cheapo Printer

Is it possible to interface a calculator-type printer to a micro (say, KIM)? If it is, how about doing an article on what's involved?
H.P. Stern, London, NW2

What a good idea! Any reader who feels qualified to write such an article, please contact the magazine — Ed.

Plea 1

I am presently attempting to compile a short volume on microprocessor/microcomputer applications in the home. In consequence, I would very much like to hear from any of your readers about the practical ways in which they are using such devices.
I.L. Fraser, 45 Walton Road, Stockton Heath, Warrington, Lancs.

Plea 2

I am currently undertaking a survey of the experiences of businesses using microcomputers. The survey is being conducted completely independently of any possible interested parties and aims to establish objectively the degree of satisfaction experienced by businesses using microcomputers. I would welcome the opportunity to appeal through your letters page to any company that has purchased or who otherwise has access to a microcomputer. I would be grateful if any such user who would like to assist would write to me at the London Business School and I will send them a brief questionnaire. All correspondence will be handled in absolute confidence.
Charles P. Cousins, Project MC-02, London Business School, Sussex Place, Regent's Park, London NW1 4SA.

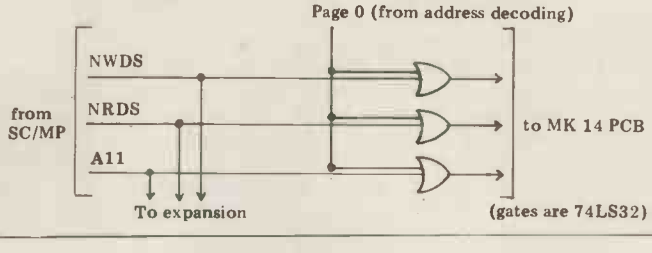
Conversion Prospects

I am considering the use of an old mains-powered black and white TV as a monitor for my recently purchased Nascom 2. Can I use the circuit described in your March issue (Simple TV/Monitor) — but powered from the Nascom 3 amp power supply? If the circuit and power supply were to be housed inside the TV case, would I still need the cooling fan for the Nascom 2 when housed in an attache case?
R. Mackerness, Solihull.

Without knowing which TV you have, it's impossible to say for sure whether such a circuit would work or not. However, bearing in mind the comments made in the article, the answer is very likely "no". To begin with the mains-only set may well have its chassis at mains potential. Even if the modification was possible you would still need the fan. Its main purpose is to keep the chips cool — Ed.

More Beefing

I have just read "Beefing up the MK14" in April's PCW. I built an almost identical expansion last summer and avoided the memory mapping problem as shown:



The NWDS, NRDS and A11 lines to the MK14 are ORed with the Page 0 signal (active low) so that read and write pulses are only transmitted when an access to page 0 is required; otherwise the MK14 board is effectively deselected. (Note that A11 is used as a read signal for the ROMs when low). This is a simpler solution to the problem and maintains full compatibility.
C. MacLeod, Lochee, Dundee.

CRA Hits Back

I read with interest your feature in "Interrupt" in the April edition of Personal Computer World, in which "conscientious cowboy" questions the need for the Computer Retailers Association.

Your contributor wields his axe pretty widely. I do not think I have ever seen an article in a computer magazine that so contemptuously dismisses so many parts of our Society. Lawyers, gentlemen, the motor trade and members of the Computer Retailers Association are all attacked with a gusto that would do credit to a demolition contractor. I wonder what other things provoke such ire in your contributor. It is a pity he does not give his name.

The main point of his article, that big is not necessarily beautiful and that many small operations give a first rate service, is very valid and is accepted by every member of the Association. The simple fact is however, that your small guy is far more likely to pack up and emigrate to Australia than someone who has sunk maybe £100,000 into a business. If the small guy does so pack up, what happens to his customers at first year end when they find that the year end programs do not work?

In any group of people there will be sharks. In the microcomputer trade there are probably no more who are deliberately deceitful or dishonest than in any other business. However, it is a very complex business and many who have gone into it in order to get on to the microcomputer "band wagon" do not have the necessary experience or background to really do the job properly. In my experience, all members of the CRA do have this background and are ethical and competent to boot. Furthermore, all members of the Association have pledged to abide by its conditions and code of conduct. This is a public statement that members intend to do all they can to ensure that the end user gets what he expects, even when this is not explicitly stated in contracts or agreements. Furthermore any user who buys from a member of the association and is for any reason unable to get satisfaction from his supplier can come to the Association and get some form of redress.

Your contributor seems to be under the impression that all members of the CRA are large. This is not the case. The division of the industry is not between those who are large and who are members of the CRA and those who are small and not members, but between those who believe a standard of business integrity and those who do not. It is a sad fact that many of the largest companies in this industry are the ones whose business methods are most suspect. Indeed it has been suggested that the only way you can become large is by being a bit of a shark. We in the Computer Retailers Association dispute that.

When your "conscientious cowboy" feels the time is right, we would be delighted to receive his application for membership.
Paul Rayner, Publicity and education officer, Computer Retailers Association.

Ohio Add~ons

I was gratified to read in the April edition of PCW that you had been inundated with programs for the UK101. Might I make a plea for hardware information? Comp-Shop are very coy about giving it out. They say it is "easily" interfaced with S100, but not *how*, or *how* easily. They also say it's compatible with Ohio disc systems. The Ohio suppliers I contacted denied this and stated there were differences that might make compatibility difficult. Are there any readers, or your experts, who might clarify things?
Dr. D.H. Harley, Tapton, Chesterfield.

We talked to Chris "Spangles" Cary who tells us that all the lines and signals are there on the board. He suggests that Practical Electronics *articles are the things to dig out as they did a series on this very subject — Ed.*

BENCH TEST

TRS-80 MODEL II

The TRS-80 Model II is an attractively packaged integrated unit with a detachable keyboard and the sort of features that one would expect from a machine with a £2000 plus price tag. How has Tandy survived the move upmarket. . .? Stephen Withers (conducting his first Benchtest) reports.

Francis Chapman

The TRS-80 Model II. . . "functional and well designed".

The heart of the TRS-80 Model II system is a Z80A processor running at 4MHz. In order to minimise the load on the cpu, LSI controller chips are used to take care of the keyboard, video display, and disc drives.

The tested system contained 64K of memory and a single 8" Shugart disc drive. Up to three additional drives may be connected, each drive having a gross capacity of 497.25K (only 406.25K is available on Drive 0, as it contains the system disc). The Model II is also available with 32K of memory — if this option is selected it's possible to upgrade to 64K with one extra card. No other internal add-ons are available at present.

The Model II is not among the quietest of systems I've used. This is partly due to the cooling fan (I don't forsee overheating problems); the fact that the disc drive is permanently spinning also contributes to the noise. In addition this is likely to reduce the life of the media.

Two RS-232 ports are provided. These operate at the usual Baud rates, between 110 and 4800. Speed, word length, number of stop bits, and parity are all software selectable and this is much better than having to mess around with jumpers or switches. One channel may be operated in the less commonly used synchronous mode. A Centronics-compatible parallel printer interface is also standard.

The display shows a full 24 rows of 80 characters, and is clear and crisp. Contrast and brightness controls are fitted to the front of the casing, neatly hidden in the keyboard recess. The full set of printing ASCII characters are available (lower case characters have true descenders), and there's also a set of 32 rather strange graphics characters. I can't see these being used much, especially as they are not directly available from the keyboard. All characters may be shown in normal or inverse video.

The keyboard is connected to the main unit by a 2 foot long cable that terminates in a 5-pin DIN plug. Any spare cable tucks into the main cabinet. There are 76 keys — the normal QWERTY, plus a cursor control cluster, two "function" keys, and a number pad. Despite what you may have read in an earlier issue of PCW, I believe a numeric pad to be very useful; it has been shown to reduce errors when entering numbers. A feature I appreciated was the indicator lights on the "caps" and "shift lock" keys.

The keyboard has most of the features one looks for: reasonably good "feel" (tactile feedback), n-key rollover, minimal reflection from the keytops, and a slim case that can easily be moved around the desk, yet is heavy enough to stay put while typing. One problem is that the "break" key is next to "backspace". Since "break" is used to halt a program, missing the "backspace" key can be very annoying! Mind you, thousands of Apple II users have learnt to live with a similar problem.

Software

When I first tested the Model II, it was supplied with a "pre-release" version of the system software, which seemed quite good, but had a number of weak points. Since then a revised version has reached Britain which will be supplied with all Model II systems. Having seen this new release, I'm glad to be able to report that almost every problem I noted has been fixed — and some new features added. Unfortunately this leaves me with less to write about!

Each time the Model II is reset it automatically executes an extensive diagnostic program which tests the disc sub-system, CPU, RAM, ROM, DMA controller and the input/output chips. If these tests are passed, TRSDOS is loaded and a large Tandy Corporation logo appears on the screen. At this stage the clock and data are initialised (unless the system has been PATCHed to skip this). If this feature is active the procedure is necessary after every reset. It could be argued that the action imposes a useful discipline on the operator, ensuring that all files are correctly dated.

Within seconds after switching on, the magic words "TRSDOS READY" appear, and you can get to work. All the usual functions of a disc operating system are present, so I'll only point out some of the more interesting or unusual features.

One of the first things you notice is that files may be protected by passwords — and not only that, there's provision for separate "access" and "update" words. For example, it may be necessary to give a clerk access to a file of sensitive information, but undesirable to allow him or her to be able to change or delete it. The level of access granted by the "access" word (from "no access" to "full, including KILL") is under the control of the holder of the "update" word. On top of this, each disc is given a password, knowledge of which allows the alteration of any user file's password and the deletion of any file.

Turnkey systems may be produced by utilising the AUTO command. If set, this causes the automatic execution of the specified command. This command would typically be "DO MYFILE", where MYFILE is the name of the file containing the TRSDOS commands which are to be executed. In this way it's possible to have the system automatically load BASIC and execute an applications program.

Although it's often useful to have a time function available, I found the clock display in the top right of the screen very distracting, and so left it switched off. The DATE command returns the time, date, day of the week, and the information that it is, for examply, the 54th day of the year. Rather optimistically, Tandy say that this command will now work correctly beyond 2199 A.D. A utility which carries out date calculations (e.g. how many days between 3rd February 1979 and 28th October 1981?) is also supplied.

The DEBUG function is a simple machine code monitor. What makes it special is that it splits the display, reserving the top 13 lines for itself, while the remainder scrolls normally. While in "examine and alter memory" mode, it responds to the cursor control keys, allowing modifications to be made swiftly and easily, in a manner similar to the PET's screen editor.

Pressing ESCAPE makes the changes permanent, or the second function key cancels them. DEBUG will also accept input in Intel hex format through either RS-232 channel. I was rather surprised that a debugger is supplied without an assembler, as only the simplest programs are likely to be hand assembled.

In common with many of the commands, it's possible to send DEBUG's output to the printer, which may be a parallel or serial device. The printer driver is part of TRSDOS, and a function is provided to set its parameters (number of lines per page, etc) to suit the device.

Programs are provided to format and to copy discs. It's encouraging to see that FORMAT will test for bad sectors and mark any found as unusable, and that BACKUP uses all available memory as a buffer to speed the copying process and to minimise the number of disc exchanges necessary in a single drive system.

A utility that's likely save much time and effort is PATCH. This allows the operator to modify a disc file (even a system file) by specifying its name, a target string and a replacement string. The main use is to correct bugs that may be discovered in the system software. It will only be necessary for Tandy to publish the two strings, which is far more convenient then recalling master discs for updating. PATCH is currently used to alter the DOS to suit a 50Hz power supply (necessary to avoid an unstable display during disc operations), and to skip the initialisation of the date and time when booting up.

One last program that seems worthy of mention is the one that allows connection of the Model II to another computer as a fairly sophisticated terminal. The values of the control keys like "backspace" may be reassigned to suit the host system and information may be swapped between memory and disc.

Primitive functions like "get a character from the keyboard" are named Supervisor Calls, or SVC's (shades of the Jolly Giant!). These are documented and available to user-written programs by loading the accumulator with the appropriate SVC number, and then executing a RST 8 instruction. Other registers may be used to pass parameters. The zero flag is always set to indicate successful completion of the function. If it fails, an error code is generally returned in the accumulator. I counted 47 SVC's, most of them dealing with I/O functions, but some of them computational. One of the most interesting is "PARSER", which is used to split the contents of a text buffer into fields, with terminating and separating characters defined to suit the application. TRSDOS uses this function when processing a command line, separating the program or command name from the parameters, and the parameters from each other. The manual suggests PARSER would be useful as the kernel of a word processor — certainly an application to which the Model II would be suited.

Model II BASIC is licensed from Microsoft, and is said to be upwardly compatible with TRS-80 Level 2 BASIC. Although it's the most comprehensive implementation I have used, I was surprised to find that it lacks matrix operations, WHILE statements and multiline function definitions. My main complaint is that variable names are limited to two characters, making intelligible programming difficult. The list of reserved words shows that it is closely related to BASIC-80 (see the Benchtest of the Micromation Z-Plus, PCW December 1979), and the similarity extends to the benchmark timings — this is a fast-running interpreter.

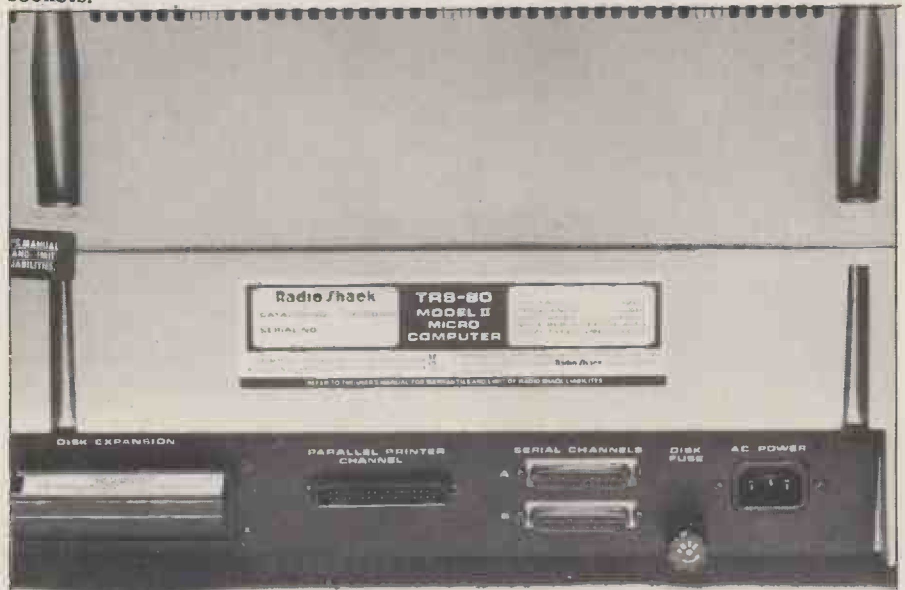
The price paid for all these features is the size of the program — TRSDOS and BASIC together occupy about 26K, plus an 834 byte buffer for each file used by BASIC. Clearly few users will be satisfied with a 32K system.

Real variables may be single or double precision, and are stored with up to 7 or 17 significant digits respectively. The type of a variable may be explicitly defined with a suffix (e.g. A% is an integer) or by using the DEFINT, DEFSNG, DEFDBL, or DEFSTR statements (e.g. DEFINT A). These are equivalent to FORTRAN IMPLICIT statements, where variable names beginning with the parameters of the statement default to the specified type. In the example all variables starting with the letter "A" would be integers, unless explicitly tagged with a suffix.

The interface between BASIC and machine code is well supported. In addition to PEEK, POKE, and 10 USR functions (whose entry points are defined within the program — no messing about with jump tables), there is a powerful function called VARPTR. This returns the address of numeric variables or the address of the pointer to string variables; it's possible to have machine code routines that operate directly on BASIC variables by passing their addresses as the parameter to the USR function. Machine code routines may be loaded into high memory by TRSDOS and then protected when entering BASIC by the use of the M parameter (which specifies the highest memory location available to BASIC).

Both random and sequential access disc files are supported. Using sequential files is straightforward, but I feel that random access (Tandy, incidentally, prefer the term "direct" access) has been made unnecessarily clumsy. After openning the file the program must define fields within the associated buffer; when a record has been read, variables are equated to these fields. To make matters worse, numeric values must be

Above: The Model II keyboard has a lot going for it (see text) — only problem, the "break" key is next to "backspace". Below: A tidy array of backplate sockets.



converted to strings before they can be stored on disc. Despite these criticisms, random access files work well on the Model II, and certainly they are easier to use than those on some other systems (Commodore, for example).

The disc tests used are based on those developed by Sue Eisenbach; in fairness I should point out that the system was set to verify all disc writes (thus slowing things down), but on the other hand a virtually empty disc meant that the file was held in contiguous segments (which has the opposite effect). Strings in Model II BASIC have maximum length of 255 characters, so the tests involve a file of 100 records, each containing two fields of 128 characters.

Test 1 simply opens a new file and immediately closes it.

Test 2 uses a FOR loop to fill two strings (A$ and B$) with 128 "A"s, then opens an existing file; the second loop writes A$ and B$ into all 100 records, in ascending order. The file is then closed. Test 3 is similar, but the records are written in reverse order. This actually ran faster than Test 2 — can anyone suggest why?

Test 4 opens the file, reads records 1 to 100, assigning the two fields to A$ and B$, and then closes the file. Test 5 repeats this process, but reverses the order in which the records are read. Test 5 was also faster than 4.

As an afterthought, I wrote a program which read 100 records selected at random. Although this involved a considerable amount of head movement, it was only fractionally slower than Test 4 or 5.

Potential

The Model II is unmistakably aimed at the business user. The full sized screen and good quality keyboard make it a natural for word processing. Since Lifeboat Associates supply CP/M configured for the Model II, as well as a good range of compatible software, this and many other applications are catered for "off the shelf".

Tandy offer a very limited selection of software for the Model II. I have seen their Mailing List package, which seemed to work well (detailed description would be unfair, as I didn't have a copy of the accompanying documentation). The one point I would mention is that the program was not Anglicised. . . in other words it kept asking for "State and Zip Code", in a format incompatible with "County and Post Code". I understand that the other packages have similar faults.

Users who wish to stay with TRSDOS and BASIC have a very limited choice of software at present, although the file security aspects might make this option attractive. As so many other versions of BASIC are Microsoft products, it would not be excessively difficult to convert existing programs to run on the Model II in order to take advantage of its features. In an attempt to overcome this shortcoming, Tandy intends to arrange for leading British software houses to produce high-quality applications software for the Model II.

The Model II is clearly one of the new breed of computers; powerful, integrated systems without some of the "sillies" that characterised an earlier generation.

I doubt that many of these computers will be sold for domestic or educational use, as the Model II's large disc capacity (probably its strongest point) is rarely an important factor in these environments.

Expansion

At present, expansion is limited to the addition of extra disc drives, and increasing a 32K system to 64K. As already stated, the motherboard allows for expansion when new devices become available (after all, Winchester discs are almost mandatory these days. . .). In case you feel that this lack of expansion is a bad point, when you have a 64K system with almost 2 megabytes of disc space, interfaces for printers, modems and what-have-you, as well as a full sized display and keyboard, what more do you want?

On the software side, Tandy UK are expecting the release of a Pascal system for the Model II in the near future, and at some stage, an assembler. I also heard that Fortran is in the pipeline, but as CP/M is available, who really cares? (Yes I know it isn't the world's best operating system, but it works, and

Benchmarks

	Integer	Single Precision	Double Precision
BM1	1	1	–
BM2	4	5	6
BM3	13	13	41
BM4	13	13	43
BM5	14	14	44
BM6	20	23	52
BM7	30	35	65
BM8	6	6	7

DISC TESTS

TEST	TIME
1	3
2	39
3	38
4	20
5	19

(All times to the nearest second).

Prices Inc. VAT

TRS-80 Model II (32K)	£2298.85
TRS-80 Model II (64K)	£2586.35
32K Memory Board	£343.85
1 Drive Disc Expansion Unit	£918.85
2 Drive Expansion	£1367.35
3 Drive Expansion	£1827.35
Disc Drive Kit	£458.85
System Desk	£299.95
Line Printer Stand	£99.95
Cable for Printer II	£19.95
Cable for Printer III	£29.95
10 Blank Discs	£59.95
Model II Manual	£19.95

makes quality software available by the bucketful — that's enough for me!).

Documentation

All the documentation for the Model II comes in one three ring binder — which is nice, because it allows you to keep all your manuals together, even when you expand the system. (I only mention this because Tandy found it necessary to point it out in the manual!)

The description of the hardware (with setting-up instructions) is very brief, giving no information about the various peripheral controllers or other components. As the Model II is aimed at the business systems market, a detailed hardware manual is unlikely to be produced. However, there are substantial sections on TRSDOS and BASIC.

Although these two manuals were both produced on a dot-matrix printer, I am assured that they were draft copies and all systems will be supplied with properly typeset manuals. They are well laid out, giving an overview of the system before going onto a detailed description of the features. Each item starts on a fresh page, with its "syntax" and use described with the aid of one or more examples. Coupled with the index, this makes quick reference very easy. One exception is the "SYSTEM" command in BASIC. The manual points out that the TRSDOS "high overlays" may not be used through this command, but it doesn't list them, or even give a cross-reference to the appropriate page of the TRSDOS manual.

As far as quality is concerned, these manuals are as good as any I have seen. The only problem is that they are in the same style as those produced for mainframes — that is to say they are concise and definitive, but unsuitable for use as tutorial material. Indeed, the Model II makes this point explicitly, referring the reader to other books available from Tandy. Don't worry though, this only affects the programmer (who hopefully has some idea of what he/she is about); the machine itself is simple to operate. Given half-way decent software, it's well within the capabilities of the mythical "untrained typist". Parenthetically, all the typists I have met are far brighter than some advertisers' copy would have you expect.

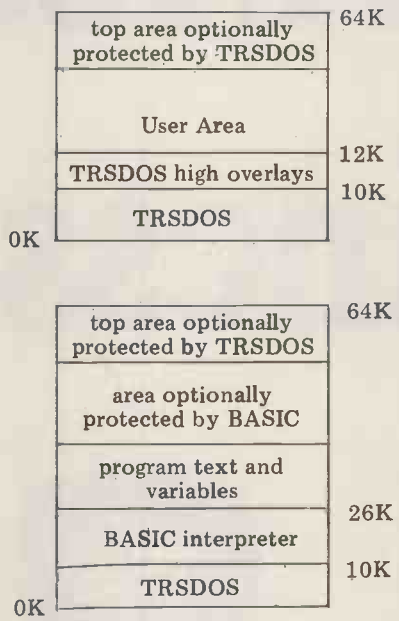
Conclusion

The TRS-80 Model II is an attractive, well designed computer. Its hardware incorporates all the features I expect to see on machines in this price range. Software, on the other hand, presents a dilemma — whether to stay with TRSDOS or to switch to CP/M. The first course severely (but temporarily) restricts the availability of applications programs, unless software from other systems is translated into the local dialect. Using CP/M avoids this difficulty, but sacrifices the excellent features of TRSDOS. Probably the fairest thing to say is that if I wanted a micro for a traditional data processing application, then the Model II would be on my shortlist.

TECHNICAL DATA

CPU:	Z80A, 4MHz
Memory:	64K dynamic RAM, 1K "phantom" bootstrap PROM
Keyboard:	76 keys
Screen:	12" diagonal, 24 lines x 80 characters
Cassette:	N/A
Disc Drives:	One 8" double density floppy disc
Printer:	Not included in basic system
Bus:	Non-standard
Ports:	2 RS-232 serial, 1 Centronics compatible parallel
System Software:	TRSDOS
Language:	BASIC

Memory map



At a glance

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

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

RESERVED WORDS

Command Statements:

AUTO	DELETE	EDIT
KILL	LIST	LLIST
LOAD	MERGE	NEW
RENUM	RUN	SAVE
SYSTEM		

Program Statements:

Definition and initialisation

CLEAR	DATA	DEFDBL
DEFFN	DEFINT	DEFSNG
DEFSTR	DEFUSR	DIM
ERASE	RANDOM	REM
RESTORE		

Assignment:

LET	LSET	RSET
MID$=	READ	SWAP

Control:

END	IF. .THEN. .ELSE
GOTO	RETURN
ON. . GOTO	GOSUB
FOR. .NEXT	ON. .GOSUB

Input/Output

INPUT	CLOSE
PRINT	INPUT£
PRINT USING	PRINT£
LPRINT USING	CLS
GET	PRINTTAB
OPEN	LPRINTTAB
LINEINPUT	FIELD
PRINT@	LINEINPUT£
LPRINT	PUT

Debugging/error trapping

CONT	ON ERROR GOTO
ERROR	STOP
RESUME NEXT	ERR
TROFF	RESUME
ERL	TRON

Functions:

ABS	ASC	ATN
CDBL	CINT	COS
CSNG	EXP	FIX
INSTR	INT	LEN
LOG	RND	SGN
SIN	SQR	TAN
VAL	CHR$	DATE$
HEX$	LEFT$	MID$
OCT$	RIGHT$	SPACE$
STR$	STRING$	TIME$
INKEY$	INPUT$	POS
ROW	SPC	CVD
CVI	CVS	EOF
LOC	LOF	MKD$
MKI$	MKS$	FRE
MEM	VARPTR	USRn

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BENCH TEST

SINTROM PERIFLEX 630/48

by Mike Dennis

Sintrom of Reading were already established in the computing field when micros came along. Since then they've marketed the Vector Graphic S-100 based range and although there are similarities between the two, their new addition the Periflex, has enough differences to give it a character of its own.

The Periflex range of S-100 based computers is assembled in America to Sintrom's own specification. All the models in the range use the Micropolis disc drives and controller and so have strong similarities to other S-100 based equipment. The remaining anonymous boards in the system are probably made by one of the many American S-100 OEM manufacturers that have sprung up in recent years.

The largest model in the range is the 1024/64 which sports dual double-density eight inch drives and 64 Kbytes of RAM; the other model (and in fact the one reviewed here) is the 630/48 and this features dual-density five inch discs and just 48K of RAM. Although, in addition to these two, Sintrom stocks a large number of S-100 based "add-ons", there's no reason why other manufacturers' S-100 equipment shouldn't be used instead.

Hardware

Any S-100 system is usually characterised by its sheer size, bulk and solidity of construction and I'm pleased to say that the Periflex proves to be no exception! The whole assembly is housed in a substantial metal case nearly an eighth of an inch thick and with outside dimensions measuring approximately 18 inches square by 7 inches high; it's quite happy to take a large printer on top. The 8-slot mother-board features passive bus terminations and is fed with power from a very substantial transformer — which contributes greatly to the fairly hefty all-up weight of nearly 60 pounds. Five slots of the mother board have already been used by the CPU board, three 16K static memory boards and the Micropolis disc controller board.

The CPU board uses a Z80A and runs at 4MHz. There's a strange anomaly here for, although the bus clock frequency is always 2MHz regardless of the CPU clock frequency, the Micropolis controller board is jumpered for 4MHz. Closer investigation reveals however that even this jumper is of no consequence as the controller board is running on its own internal 2MHz crystal anyway!! Still, it works and that's all that really matters.

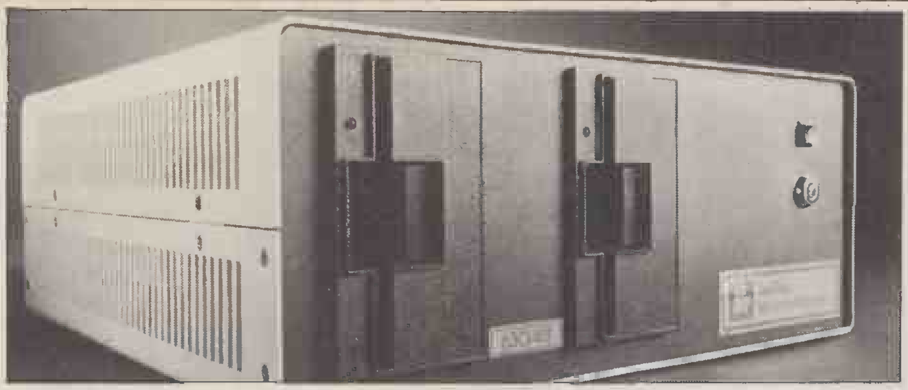
Two serial RS-232 ports and one parallel port are on board although the parallel port is not connected. These are useful features that would otherwise have required an extra board. A pity then that this particular example was marred by poor soldering, a dry joint on one of the crystals and a general air of untidiness. The RAM boards also could hardly be called "state-of-the-art" being static in operation and as a consequence, using 3 slots when 1 should have sufficed had a dynamic RAM board been used. Nevertheless, the address decoding is good, allowing any of the four 4K blocks to be decoded anywhere in memory (in 4K steps, though) together with bank select that allows both selection of the appropriate port and also specific bits within that port for enabling. In short, address selection is comprehensive, but spoilt by a really appalling explanation as to how to use it. None of the boards have any handles which means that extraction is a real "grit your teeth" job!

The disc drives are Micropolis Metafloppies and provide 315 Kbytes of storage on one side!! How's that, you may ask? Well, double density obviously helps as does hard sectoring but the answer lies in the fact that 77 tracks are squeezed on to the side instead of the more usual 45. Twin discs are fitted as standard giving a total on-line storage immediately available of 630 Kbytes which should be more than adequate storage for many applications (though see later). The two drives, which are handled by the controller board, run all the time; personally I find this annoying. A quiet (!!!) fan keeps the works cool, a keyswitch provides power and an illuminated reset button completes the front-panel complement. A working system will require a VDU and printer but since this is a question of individual requirements, these remain outside the scope of this Benchtest. For the record, however, Sintrom supplied me with a Perkin-Elmer VDU and a Qume daisy-wheel printer.

At switch on, there's an automatic jump to the monitor (which has the rather delightful name of "Perimon" — will we see Periwinkle next? — and lives at address F800). Apart from the option to perform a disc boot from either 5 or 8 inch drives, Perimon offers 6 other commands. These commands are printed on the screen with commendable detail and provide the user with good clues on what entry is expected for each command. For example, "(D)ump xxxx yyyy" suggests that D followed with two addresses will dump or tabulate the data between them, and so it does. Which is just as well perhaps as, apart from the monitor listing, there is no further information available on using the monitor! The other commands allow the user to enter data into memory, fill a block of memory with a specified byte, execute the program from a particular address and an extremely useful Search command. This will search for a string of machine code within specified limits and print out the starting address wherever the string is found. The maximum length allowed for this string would appear to be limited to 21 bytes although this may have been due to peculiarities with this particular configuration. The search is very fast and it looked through the entire

TECHNICAL DATA

CPU:	Z80A
Memory:	48K static RAM
Cassette:	Not tested
Disc:	2 Micropolis 5¼" 315 Kbytes each.
Printer:	Depends on system
Bus	S-100
Ports:	2 Serial/1 Parallel
System	MDOS
Software:	Debug Assembler 8080 & Z80 Editor CP/M
Languages:	Micropolis Extended BASIC
VDU:	Depends on system



range of memory for a maximum length string in under 2 seconds — try doing that in BASIC! The inclusion of this monitor is very commendable as machine code programs can easily be tried out although the total usefulness is limited; how for instance do you save the program? The other quibble is that the monitor is very unforgiving; you can't correct any mistakes as you key them in which means that you type very, very slowly. More sophisticated program development is available elsewhere from the software supplied with the machine.

Software

The Periflex will run both CP/M and Micropolis' own MDOS. Both offer comprehensive facilities and are Benchtests in their own right but time and space permit neither here. However, some of the facilities that MDOS offers are many direct disc commands and a program debugging aid with all the usual features plus many additional ones — such as looping for a given number of times before recognising a breakpoint. Many subroutines within MDOS can be accessed from a user's machine program and the use of these is extremely well documented. A line editor, 8080 and Z80 assemblers and Extended BASIC complete the line-up.

Micropolis BASIC has some good features and also some omissions. There is no error handling except in disc I/O, no AUTO line numbering and the access to the disc directory is a bit cumbersome — you have to type DISPLAY"O:DIR" every time where 0 refers to the relevant disc drive. There's no CALL or USR as such but a potentially much more powerful facility is the ability to pass up to 4 variables to one of 26 possible assembly language (effectively machine code) subroutines. One result can be returned from the same routine and the whole issue is set up with DEF FA(letter) command plus a little help from a few friends! Another useful facility is the ability to convert from hexadecimal to decimal; for example, 16R100 will return the decimal value of 256. In fact I have over-simplified a bit; you can do any base conversion with this command but HEX TO DEC is probably the most useful. It's a pity that you can't convert the other way.

The EXEC command can effectively turn your computer into a very expensive calculator but I'm not sure of its efficacy elsewhere. SIZES permits the user to trade-off the amount of memory used for storing variables against the final accuracy of the result. This statement is also used to define the size of program segments when CHAINing — the size of each segment having been found with the PGMSIZE command; the complement to this instruction is SPACELEFT which shows you what a bad programmer you've been! String handling is good with several extra facilities such as INDEX (used to find substrings within another string) and VERIFY which checks to see that all the characters in one string occur at least once in another. I'm sure there must be a use for it but it escapes me at the moment! MIN and MAX can be used to see if "ABCD" occurs before or after "ABCE" — quite a useful feature. REPEAT will fill up a string with the same character n times. Overall, quite a good BASIC but spoilt by some very indifferent Benchmark timings — see the table for details.

As mentioned earlier, the disc drives have 77 tracks. Each file will be allocated one or more of these tracks and so the maximum number of files per disc is 76 (one track is reserved for the directory). Files are not limited to one per track and the DOS will, if necessary, allocate more than one track to a file. Record length is fixed at 256 bytes (actually 250) or put another way, one record per sector. If your records end up being one byte longer than the maximum then you can only store 8 records instead of 16 on one track — so the advantage of all that on-line storage capacity is potentially lessened. The effects of this can be minimised by judicious coding plus one or two useful features such as being able to change the string delimiter — although it's all a bit messy.

Other features are EOF to delete the last n records from the file and FREESPACE which will free the relevant tracks for use by other files. ATTRS allows various attributes, such as write protect, to be set. END and ERROR can be used in the OPEN statement to allow handling of end-of-data or other errors. Records can either be accessed sequentially or directly (randomly) and associated with the sequential access are two pointers RECPUT and RECGET which point to the next record to be accessed respectively. As they can be accessed from the program they can be used to see where you are or they can be directed to a specific record for direct accessing. The timings for the disc tests are quite respectable and the random access good — it even took longer to PUT in a forward direction than starting from the back! The current file status can be assessed from the program by using NAME (of the file associated with a file number, in case you'd forgotten), SIZE gives the number of records used for that file, TRACKS gives the number of tracks allocated to the file and FREETR — how long before you run out of storage. In conclusion then, quite a good DOS providing care is taken in getting the best out of it.

Printing options are quite versatile and my favourite was ASSIGN where you could temporarily divert the normal

BASIC COMMANDS

EDIT	RENUM	DELETE
MERGE	SAVE	LOAD
LIST	DISPLAY	SCRATCH
RUN	CONT	FLOW
NOFLOW	IN	OUT
PEEK	POKE	PGMSIZE
SPACELEFT	AND	OR
DIM	END	EXEC
FORW	GOSUB	GOTO
IF.THEN	INPUT	LET
MEMEND	NEXT	ON. .GOSUB
ON. .GOTO	OUT	PRINT
READ	REM	RESTORE
RETURN	SIZES	STOP
STRING		

NUMERIC FUNCTIONS

ABS	ATN	COS
EXP	FIX	FRAC
INT	LN	LOG
MAX	MIN	MOD
RND	SGN	SIN
SQR	TAN	

STRING FUNCTIONS

ASC	CHAR$	FMT
INDEX	LEFT$	LEN
MID$	MAX	MIN
REPEAT$	RIGHT$	STR$
VAL	VERIFY	

BASIC STATEMENTS

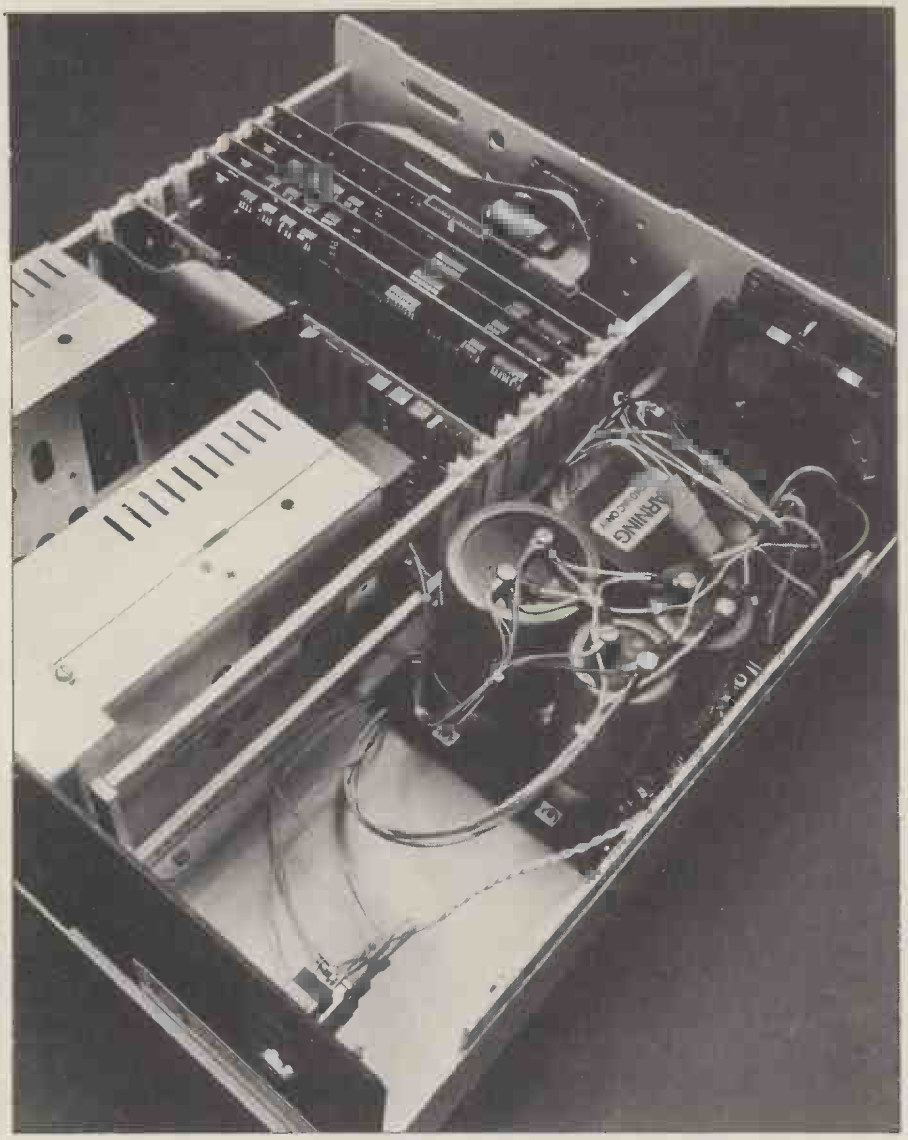
DATA	DEF FN	DEF FA

DISC COMMANDS

DISPLAY	LOAD	PLOADG
SAVE	SCRATCH	CHAIN
LINK	OPEN	PUT
GET	CLOSE	ATTRS
EOF	FREESPACE	GETSEEK
PUTSEEK	RENAME	
ATTR	ERR	ERR$
NAME	RECGET	RECPUT
SIZE	TRACKS	FREETR

PRINT FILE OUTPUT

OPEN	PUT	CLOSE
ENDPAGE	ASSIGN	LISTP
PAGESIZE		



Inside view of the Periflex with its spaghetti-ish wiring. To the right is the PSU, disc drives are to the left and the eight-slot S100 rack is tucked away at the back.

flow from the printer to the screen saving miles of paper, tears and sanity during program development.

I booted up CP/M more out of curiosity than anything else and surprise, surprise, it signed on with "CP/M ON VECTOR MZ" — oh dear, what a give away!! The only software supplied was CBASIC but as this was recently commented on by Sue Eisenbach in another review, I'll not waste your time here.

Potential use

Sintrom aim this machine at the scientific/laboratory market. That's not to say that the Periflex is unsuited to business purposes. . . all the CP/M packages that are available should run with little or no modification. The fact is that Sintrom prefer supporting the former market but can put prospective business purchasers in touch with the appropriate people where necessary. Being S-100 based, the machine can make use of the wide range of boards available for this bus and the hardware design of the boards goes some way towards being compatible with the proposed IEEE S-100 standard. The package is very robust and should stand up to a lot of punishment.

Documention

The documentation comes from a variety of sources and is therefore inconsistent in quality. Even within a given manufacturer, the quality varies. For example, as mentioned, the explanation of the memory address selection is poor — yet there are some quite good trouble-shooting tips and hints. The Micropolis texts on Debug and MDOS are good, with plenty of examples, and yet the BASIC handbook needs a total revamp; the CPU texts were, I suspect, written in house and are not very good. However, one saving grace is the fact that Sintrom include a day's familiarisation in the price of the machine; nonetheless you do need good documentation.

Conclusion

The Periflex 630/48 is a standard Z80 based S-100 system with plentiful on-line storage capacity; this however is potentially offset by limitations in the DOS. The BASIC is a trifle slow but has good arithmetical accuracy. Good support is promised by Sintrom in the scientific and laboratory field but potential business users should look at the package as a whole as there are other possible contenders in the market-place.

MEMORY MAP

0000	MISC
1598	BASIC
5700	BASIC PROGRAM BUFFER
C000	TOP OF RAM
F600	DISC CONTROLLER
F800	PERIMON

BENCHMARKS

BM1	4.5
BM2	10.5
BM3	27.5
BM4	28.5
BM5	31.5
BM6	59.0
BM7	79.5
BM8	60.0
DISC 1	1.0
DISC 2	44.0
DISC 3	39.0
DISC 4	5.0
DISC 5	19.0

PRICES

Periflex 630/48	£2500
Periflex 1024/64	£3300
	(8 inch discs)

AT A GLANCE

FIRST IMPRESSIONS	
Looks	****
Setting up	***
Ease of use	***
HIGH LEVEL LANGUAGES	
BASIC	***
COBOL	not tested
FORTRAN	not tested
PASCAL	not tested
System Software	****
PACKAGES	
Business	not tested
Education	not tested
Home	not tested
PERFORMANCE	
Processor	****
Cassette	N/A
Disc	****
Peripherals	N/A
EXPANDABILITY	
Memory	****
Cassettes	N/A
Discs	****
Bus	****
COMPATIBILITY	
Hardware	****
Software	****
DOCUMENTATION	**
VALUE FOR MONEY	***

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

PRESTEL REPORT

Dr. Adrian Stokes updates on the latest Prestel developments.

One of the highlights of the recent Viewdata '80 exhibition was the announcement of three major enhancements to Prestel — "Picture Prestel", "Telesoftware" and "Dynamically Redefinable Character Sets" (hereinafter referred to as DRCS). The publicity for these developments seems to have been particularly ill-timed considering the fact that, just as Prestel seems to be getting off the ground, along come some new features which demand the use of radically different Prestel receivers. Nevertheless the facilities announced are quite interesting and well worth a closer look.

One of the major criticisms of Prestel is its ability to transmit only a very crude form of graphics known as "alphamosaics", based on the idea of dividing the screen up into 240 x 240 small rectangles. This is a great method of translating any diagram into a Cubist representation but does detract from other art forms. On the other hand, a full screen with the definition of an ordinary television picture would require about 4 Mbits of storage and take about an hour to transmit. "Picture Prestel" is a method of achieving the required definition but without these problems. The first approach used to reduce the time and storage is not to allow a full screen to be sent — not as bad an idea as it sounds since it's reasonable that such pictures will only be required on part of the screen, the remainder being filled by ordinary

Above and Centre: "House for sale" and the GPO Tower — as photographed direct from a "Prestel" screen. (Both were originally in full colour and, here, the latter has been considerably magnified.)

alphanumeric data. For example, someone selling a house would put all its details in the ordinary Prestel format and use a small part of the screen for an appropriate "colour photo". In fact, at present, there is already a restriction that limits such material to one eighth of the screen. To reduce time and storage still further, various data compression techniques are used and, in the experimental receiver at Viewdata 80, 24 Kbytes were used. In addition to this modification to the receiver, it's clear that a lot of extra work needs to be done in the receiver (for example, error correction, swapping between Picture Prestel and ordinary Prestel etc.) and an Intel 8080 microprocessor is also needed. By the time Picture Prestel arrives, it's likely that it will be possible to transmit Prestel at greater speeds than the 1200 bits/second used at present, so cutting down the transmission time even further.

It's clear that the development of Picture Prestel is an answer to videotex systems such as the Canadian Telidon and the Japanese CAPTAINS which allow very much higher resolution than ordinary Prestel. But Picture Prestel is not expected to be commonly available until the end of this decade and will require modifications to (or replacement of) currently available sets — although unmodified sets will still be able to receive ordinary Prestel.

The second announcement at Viewdata 80 concerned Telesoftware. Experiments have been carried out in this field for some time, particularly using Oracle (the IBA Teletext system), but the Post Office has now demonstrated a program written in CAP/CPP's MicroCOBOL, stored on the viewdatabase (as object code, each byte being translated into two ASCII characters) and which can be down-line loaded on to a PDP-11/03 and run. Obviously the same could be done using a modified viewdata set with more storage (RAM) and some backing storage — disc or tape; with luck, it won't be long before such sets become available and Telesoftware becomes a common method of distributing programs. Indeed, the opposite is already happening — some personal computers (e.g. TECS) are already available with the hardware and software necessary to access Prestel.

The third announcement at Viewdata 80 was DRCS. At the moment, each character sent from Prestel comes as a simple ASCII value and is translated into the character you see on the screen by a display generator (which is contained in ROM). This means that the shape of the characters is predetermined by the set manufacturer (and they are not all the same) and no "special" characters can be displayed. Obviously, it would be possible to supply a number of ROMs which contain different character sets but the Post Office demonstrated a system which is very much more flexible. The set is supplied with the usual ROM together with a similar amount of RAM (in the system used, only 720 bytes is needed) and the character set is down-line loaded from Prestel into the RAM (using an extra micro in the set); the user can choose whatever "character set" is needed. This character set need not be ordinary alphabetic type sets but can, for example, be selected to draw electronic circuits. Each "character" in the set is described as a 6 x 10 matrix and the "shift-out" and "shift-in" codes are used to change between character sets. These announcements clearly point the way that viewdata systems are heading . . . namely to modify the viewdata receiver by adding more storage and one (or more) microprocessors. Later, backing storage will be added.

It's likely that there will be a continuous stream of such announcements over the next few years, each adding more possible facilities to the system. Dr Adrian Stokes will continue to update PCW readers on the latest developments.

MAY I INTERRUPT

Alistair Cairns and Maurice Shepherd outline the powerful interrupt facilities available from a Z80 CPU/PIO combination; the sample program runs on any Nascom system.

An interrupt facility allows the CPU to suspend a program's execution while dealing with signals from the outside world. One Z80 CPU in combination with the Mostek 3881 parallel input-output controller (PIO) chip offers very versatile and powerful interrupt facilities — especially in the Z80 interrupt mode 2, a mode which is not available on the related 8080 CPU. The versatility of these facilities does introduce some complexity into the programming requirements of both CPU and PIO so the intention of this article is to provide a reasonably simple introduction to the use of interrupts with the Z80 CPU/PIO, plus give a demonstration program which can be implemented on any Nascom system. It's not however intended to be a comprehensive guide to all aspects of the facilities available using this particular combination so please don't throw away those device manuals.

Schematic of Z80 CPU/PIO

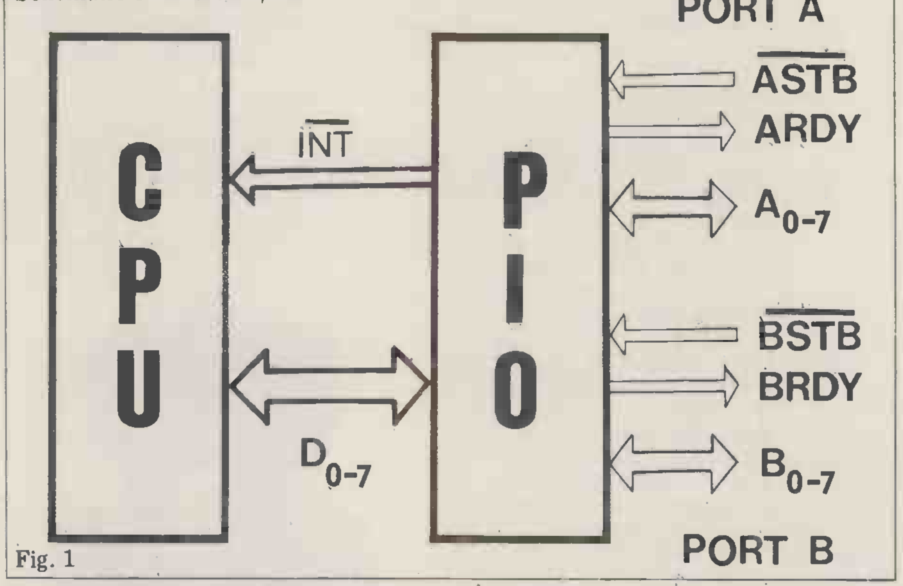


Fig. 1

Why use interrupts?

Using interrupts requires additional software and, in many cases, additional hardware; also programs with interrupts can be very difficult to debug (yes, even worse than usual) if, or when, things go wrong. So why use them? One simple answer is that they can be the most efficient and often the only viable means of dealing with a wide range of practical situations, particularaly when one wishes to interface the micro to the outside world. Essentially an interrupt should cause the CPU to stop its current actitivy, in an orderly manner, and to execute another program before returning to the initial program and continuing with it. One inherent value of interrupts can be illustrated by a simple example. It's relatively easy to write a program including timing loops which can convert your micro into a digital clock — albeit a very expensive one — and one which uses the CPU full time. However, by externally generating an interrupt, say every second, the digital clock function can be executed in an interrupt service routine (ISR) leaving the CPU free for most of the time to do something else. An external oscillator or a counter/timer chip could provide the interrupting signal. In another application the interrupt could be provided by the "conversion complete" flag of an A-D converter and the voltage read into memory during the ISR, leaving the main program to process data as it becomes available.

The range of possible applications is unlimited but all involve communication between the micro and some form of peripheral device. The CPU responds extremely rapidly to interrupts (about 10 microseconds will usually get it into the interrupt service routine) and so interrupts are ideal for control situations where a very fast response to outside stimuli is necessary; even Concorde cannot travel more than 1 cm in 10 microseconds.

The Z80 CPU/PIO combination

We may now look in fairly general terms at how the particular combination of Z80 CPU and PIO deals with interrupts and at the software requirements, limiting the discussion to the Z80 interrupt mode 2. When a specific external condition is sensed by the PIO — this could be an active strobe pulse ($\overline{\text{ASTB}}$ or $\overline{\text{BSTB}}$) or a particular logic level (or set of levels) on the data bus of either port of the PIO (A_{0-7}, B_{0-7}) — the PIO, if enabled, generates an $\overline{\text{INT}}$ signal (Figure 1). The CPU, which must also be interrupt enabled, after accepting the $\overline{\text{INT}}$ completes its current instruction, stacks the program counter (i.e. the location of the next instruction in the present program) and jumps to the appropriate ISR. It executes the ISR and then returns to the original program and continues. One important role of the PIO is therefore that of an intelligent monitoring device which can generate $\overline{\text{INT}}$ signals for the CPU.

The necessary software must (i) define the nature of the external condition that the PIO should regard as an interrupt condition, (ii) define a 16 bit pointer to the start address of the ISR (the most significant byte being stored in the CPU I register, the least significant byte in the PIO as the interrupt vector) and (iii) enable/disable the interrupt facilities on both the CPU and PIO as and when necessary. A reasonably methodical approach to the programming may be made by dividing the software requirements into five separate sections,

(a) Programming the PIO	(SETPIO)
(b) Programming the CPU for interrupts	(SETCPU)
(c) Main Program	(MAIN)
(d) Interrupt Service Routine(s)	(ISR)
(e) ISR Pointer Table	(IPT)

and a summary of the typical contents of these sections is given in Table 1. The PIO can generate interrupts from port A and/or port B and each port has a separate interrupt vector. Port A does have priority over port B in interrupt servicing — this must be considered if both ports are programmed to generate interrupts. Rather than generalise further at this stage it may be useful to examine an actual program containing interrupts.

"INTRPT"

The program, INTRPT, is written with the division of software effort outlined above in mind and will run as listed on Nascom 1 with either T2 or T4 monitor. The program can also be run on the Nascom 2 NAS-SYS 1 monitor with one change in the machine code which is shown on the listing. It can therefore be run on any Nascom system and requires less than one hundred bytes of memory. For those unfamiliar with Nascom systems, the CPU I/O port allocations 4-7 are configured to PIO ports A and B data and A and B control respectively.

TABLE 1
Z80 CPU/PIO INTERRUPT PROGRAMS

It's helpful to break down the programming into several discrete sections. One possible framework is shown below and is followed in the demonstration program INTRPT. The PIO control words are summarised in Table 2.

SETPIO

In this section the PIO is programmed to respond to the desired type of interrupt condition. The PIO should initially be reset (see text).

The following control words are sent to the appropriate PIO port.

1 An Interrupt Vector (b_0 = 0)* which is the L.S. byte of the ISR pointer
2 An Operating Mode Control word (b_{3-0} = 1111)* + (in Mode 3 only) an I/O control word
3 An interrupt control word (b_{3-0} = 0111)* with b_7 = 1 to enable the PIO to generate interrupts + (if b_4 (ICW) = 1) an Interrupt Mask

*These control words are recognised by the PIO because of the specific bit pattern they contain and can therefore be sent in any order. The I/O word and the Mask can take any value and must be sent as indicated in Table 2.

SETCPU

This section selects and enables the Z80 CPU interrupt mode
1 Select Z80 interrupt mode 2 i.e. IM 2
2 Load CPU I register with M.S. byte of the ISR pointer
3 Enable CPU to accept interrupts i.e. EI

MAIN

This is the program which may be interrupted and should be executed after SETPIO and SETCPU.

ISR

The interrupt service routine(s)
1 Save registers used in MAIN and in the ISR e.g. PUSH AF, PUSH BC
2 The actual service routine
3 Restore registers for use in MAIN, e.g. POP BC, POP AF
4 Enable Z80 interrupt† i.e. EI
5 Return with PIO enabled i.e. RETI

†The Z80 interrupt is automatically disabled on entering the ISR. In some cases, e.g. with nested interrupts, it may be necessary to re-enable the CPU at the beginning of the ISR.

IPT

This is a table of the start addresses of the ISR(s). On interrput the CPU uses the Interrupt Vector and its I register to form a 16-bit pointer, pointing to the location in the table containing the start address of the relevant ISR.

TABLE 2
Summary of the Z80 PIO Control words

OPERATING MODE

Mode	b_7	b_6	
0	0	0	Output mode
1	0	1	Input mode
2	1	0	Bidirectional mode
3	1	1	Control mode

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
*			X	X	1	1	1	1

F

X = don't care

I/O CONTROL WORD (Operating Mode 3 only)

b_n=0 Output
b_n=1 Input

(This must be the next word sent to any control port after selecting Operating Mode 3)

INTERRUPT CONTROL WORD

	b_n=0	b_n=1	
b_7	Disable	Enable	PIO Interrupt
b_6	OR	AND	Function
b_5	Low	High	Level monitored
b_4	No mask	Mask follows	

($b_{4,5,6}$ only needed for Operating Mode 3)

*					0	1	1	1

7

The PIO enable flip flop may be set or reset without altering $b_{4,5,6}$ by using the control word.

*					0	0	1	1

3

INTERRUPT MASK (if ICW b_4=0)

b_n=0 Not monitored
b_n=1 Monitored for interrupt condition

(This must be the next control word sent to any control port after ICW with b_4=1)

INTERRUPT VECTOR

Least significant byte of the pointer to the ISR start address. Note b_0 = 0

*								0

*Control words containing specific bit patterns.

Simple interrupt circuit for INTRPT

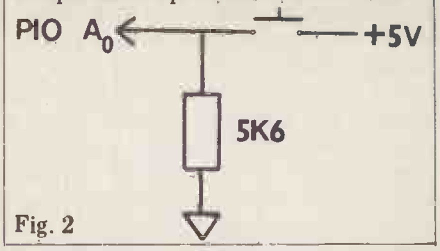


Fig. 2

The program continuously writes the lower case alphabet and scrolls the screen; when interrupted by temporarily pulling bit O of port A high, a hash symbol is written by the interrupt service routine. The interruption may be caused using the simple circuitry in Figure 2 which is adequate for demonstration purposes but may on occasion give multiple interrupts due to switch bounce; as a general rule all inputs to the PIO should be properly gated for reliable operation.

INTRPT is not a particularly exciting program, but it does illustrate a simple interrupt situation and forms a basis for further experimentation. The program listing is sufficiently annotated to preclude the need for any detailed discussion and the program executes at 0D00 or after a hardware reset of the PIO (see below), it may be executed at 0D20.

The PIO control words are summarised in Table 2. INTRPT uses the PIO operating mode 3, which is particularly useful for status applications. In this mode the PIO can monitor level changes on any individual bit or the logical result of either an AND or OR logical operation on any set of bits on either port A or B data buses. The handshake lines $\overline{STB}$ and RDY are not used. Mode 3 does require more PIO programming than modes 0, 1 and 2, namely definition of the I/O control word and possibly the interrupt mask.

Some more general points regarding the use of interrupts are discussed below.

Resetting the PIO

The Z80 PIO chip does not have a RESET pin but can be reset either by switching the power off and on (not particularly useful!) or by applying an $\overline{M1}$ signal in the absence of $\overline{RD}$ and $\overline{IORQ}$ signals, a method which requires additional gating. Nascom 2 uses an AND gate (figure 3) to give simultaneous reset of CPU and PIO; Nascom 1 does not have this circuitry although it could be added. If the PIO has not been reset prior to running a program then the PIO *may* not respond to control words in the way the programmer intended. This is not a

Modification to give combined CPU/PIO reset on Nascom 1

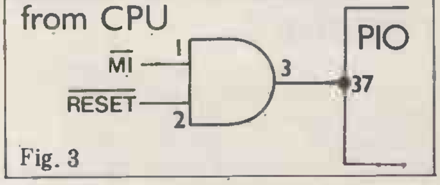


Fig. 3

fault in the PIO but a consequence of its previous history, e.g. it could be waiting for an I/O control word because the last control word sent to the port was FF (Table 2). This problem can be avoided by resetting Nascom 2 (or a modified Nascom 1) before running the new program or by using software routines which give, in a limited sense, a software "reset" of the PIO. Two such software reset routines are used in INTRPT.

The routine:

```
3E OF          LD A, 0F
D3 06          OUT (06), A
D3 07          OUT (07), A
```

ensures that the PIO responds in the desired way to the *next* control words sent to either port A or B. These are dummy instructions intended only to make certain that the next control word is not interpreted as an I/O control word or an interrupt mask and that it is interpreted as the programmer intends. It should therefore precede the real PIO instructions. The second routine:

```
      06 02                LD B, 02
      21 XX XX    START    LD HL, LOOP
      E5                   PUSH HL
      ED 4D                RETI
XXXX 10 F8        LOOP     DJNZ START
```

includes two RETI instructions, which ensure that neither port A nor B is awaiting completion of some previously entered ISR. The inclusion of such routines is recommended if you do not have or do not wish to use a hardware PIO reset. In general however a hardware PIO reset before running interrupt programs is probably the best approach, particularly if more than one PIO is being used.

Enabling/disabling interrupts

Interrupts must be enabled (or disabled) separately on both the CPU and the PIO. The CPU interrupt status is contained in two internal flip-flops, IFF_1 and IFF_2, which are both 0 (reset) when the interrupt is disabled and both 1 (set) when the interrupt is enabled. These flags are set by EI and reset either by DI or a CPU reset. They are also reset automatically when an interrupt is accepted by the CPU. The PIO interrupt is enabled by $b_7=1$ in the interrupt control word (Table 2) and disabled by $b_7=0$. The simple example shown in the programming guide concludes the ISR with EI,RETI. If nested interrupts are required EI should be put at the beginning of the ISR, thus allowing a higher priority interrupt to have access to the CPU. In INTRPT, external interrupt conditions are ignored during the ISR, but the RETI is essential to re-enable the PIO after the ISR.

Saving and restoring registers

Since an interrupt can, in principle, occur at any time, it's essential that when a program is interrupted, the contents of the CPU registers are not lost but will be available when the program is re-entered. Failure to ensure this will result in total chaos. Careful thought must therefore be given to saving and restoring those CPU registers which are used in both the main program and in interrupt service routines. Section (d) of Table 1 illustrates one way of doing this but note that it does not save the registers used during the ISR. In some cases it may be sufficient simply to exchange registers but when interrupting BASIC programs (or any other high level language) remember that almost certainly all the Z80 registers are being used, and act accordingly. It's arguable that saving and restoring all registers, i.e. both sets of Z80 registers, is good general practice since it leaves you with some standard (if, at times, slightly redundant) software.

Other operating modes

In many, if not most, applications the PIO data busses A_{0-7} and B_{0-7} are required for byte transfer to and from peripherals and operating mode 3 cannot be used if interrupts are also required. In these cases the strobe and ready lines of the PIO are used to handle interrupt information in operating modes 0, 1 or 2. The relevant timing diagrams are given in the PIO device manual and it's relatively straightforward following the general programming techniques outlined above to use interrupts

Continued on Page 111

```
                 0010 ;                               INTRPT.
                 0020 ;
                 0030 ;    An interrupt program for Nascom T2/T4 monitors.
                 0040 ;    With Nas-sys, change 0F to 0D at location 0D4C.
                 0050 ;
                 0060 ;
0D00             0070            ORG #0D00          ; RESET PIO
0D00  3E0F       0080 RESET      LD A,#0F
0D02  D306       0090            OUT (#06),A        ; This section performs a
0D04  D307       0100            OUT (#07),A        ; software reset on PIO
0D06  0602       0110            LD B,#02           ; ports A and B (see text).
0D08  210E0D     0120 START      LD HL,LOOP         ; Only port A is used in
0D0B  E5         0130            PUSH HL            ; the following program.
0D0C  ED4D       0140            RETI               ; After a hardware reset
0D0E  10F8       0150 LOOP       DJNZ START         ; the program can be
0D10  C3200D     0160            JP SETPIO          ; executed at 0D20.
                 0170 ;
0D20             0180            ORG #D20           ; SET PIO AND CPU
0D20  3E80       0190 SETPIO     LD A,#80           ; Interrupt vector: LSB of
0D22  D306       0200            OUT (#06),A        ; interrupt pointer to port A.
0D24  3EFF       0210            LD A,#FF           ; Select mode 3 for port A.
0D26  D306       0220            OUT (#06),A        ;
0D28  3E01       0230            LD A,#01           ; I/O word selecting A0 as
0D2A  DE06       0240            OUT (#06),A        ; input,A1-7 as outputs.
0D2C  3EB7       0250            LD A,#B7           ; Interrupt control word:
0D2E  D306       0260            OUT (#06),A        ; enable,OR,high,mask follows.
0D30  3EFE       0270            LD A,#FE           ; Interrupt mask :monitor
0D32  D306       0280            OUT (#06),A        ; A0 only for interrupt.
                 0290 ;
0D34  ED5E       0300 SETCPU     IM 2               ; Set CPU interrupt mode 2.
0D36  3E0D       0310            LD A,#0D           ; Load MSB of interrupt
0D38  ED47       0320            LD I,A             ; pointer into I reg.
0D3A  FB         0330            EI                 ; Enable CPU interrupt.
0D3B  C3400D     0340            JP MAIN            ;
                 0350 ;
0D40             0360            ORG #0D40          ; MAIN PROGRAM
0D40  3E61       0370 MAIN       LD A,"a"           ; ASCII a
0D42  061A       0380            LD B,#1A           ; 26 letters.
0D44  F7         0390 ALPHA      RST #30            ; Write letter.
0D45  3C         0400            INC A              ; Next letter.
0D46  CD510D     0410            CALL DELAY         ; Delay.
0D49  10F9       0420            DJNZ ALPHA         ; Alphabet complete?
0D4B  3E0F       0430            LD A,#0F           ; Scroll screen.
0D4D  F7         0440            RST #30            ; N.B. see line 40
0D4E  C3400D     0450            JP MAIN            ; Start again.
0D51  F5         0460 DELAY      PUSH AF            ; DELAY ROUTINE.
0D52  C5         0470            PUSH BC            ; giving a delay of ca.
0D53  0620       0480            LD B,#20           ; 0.25 s. and not
0D55  3EFF       0490 SLOW       LD A,#FF           ; corrupting regs.
0D57  FF         0500            RST #38
0D58  10FB       0510            DJNZ SLOW          ;
0D5A  C1         0520            POP BC             ;
0D5B  F1         0530            POP AF             ;
0D5C  C9         0540            RET                ;
                 0550 ;
0D60             0560            ORG #0D60          ; INTERRUPT SERVICE ROUTINE
0D60  F5         0570 ISR        PUSH AF            ; Save reg. AF.
0D61  3E7F       0580            LD A,#7F           ; ASCII hash.
0D63  F7         0590            RST #30            ; Write it.
0D64  F1         0600            POP AF             ; Restore AF.
0D65  CD510D     0610            CALL DELAY         ; Delay.
0D68  FB         0620            EI                 ; Re-enable CPU interrupt.
0D68  ED4D       0630            RETI               ; Return from interrupt.
                 0640 ;
0D80             0650            ORG #0D80          ; INTERRUPT POINTER TABLE
0D80  600D       0660            DEFW ISR           ; Points to ISR.
                 0670 ;
```

JUST THE JOB

by David Tebbutt

According to the Financial Times, Charles Airey Associates is "probably the best known supplier of electronics engineers in the country". It seems appropriate then that they should be chosen as the subject of this PCW case study — one which as it turns out looks at their experience of installing that most controversial of machines, the Compucolor II.

The Company

Well known for advertisements with attention grabbing headlines like "Microcomputers or Sex?", Charles Airey Associates takes an unusual approach to the placement of electronics engineers. Having hooked the reader with a slightly mad headline, their advertisements go on to give a truthful appraisal of the job on offer. Judy Hortin, who runs the business, tells me that "electronics engineers are a very honest group of people"; her business thrives because she and her team share these same values. If a job offers a pathetic salary, they say so and in this way no-one ever feels disappointed. It seems to me that this approach saves an awful lot of wasted time for applicants, employers and interviewers alike.

The company is unusual in other ways too. To give you some idea — the office cleaner is an out of work university professor, the two office juniors have three degrees between them and the most reliable computer operators are a couple of 15 year old schoolboys who work there part-time.

Despite the slightly off-beat image, success grows daily — to the extent that the company recently took the plunge and installed a microcomputer to help maintain the high standard of staff placement.

The Way It Was

Eighteen months ago the team was working from rather cramped offices in Knightsbridge, trying to keep control of an ever growing client file. Rumour has it that these files were kept in a series of shoe boxes, egg boxes and what-have-you; searching through the cards to find a suitable placement for a job applicant could take anything up to half a day. This *may* have been something to do with the egg boxes but it was primarily because so many firms were registered with them — over 800 in London alone. Fortunately there were short cuts — like relying on Judy's memory — but this was not always convenient and it was becoming increasingly difficult for her to remember which companies employed which types of engineer and for what types of work. Another shortcoming of the system was that interviewers searching the files often missed a suitable company because the handwriting on the card was difficult to decipher. Sometimes they would skip over a company because of their poor geographical knowledge of a particular area; looking up maps all the time would slow down the search.

To give some idea of the scale of the operation there are usually some 200 people on the books looking for work and the company file grows at between 15 and 25 firms per week. Here, to add to the pressures, each name added has to be checked against the outstanding applicants file for a possible match.

The Decision

A friend of Judy's (we'll preserve his anonymity and call him Stephen) who just happened to be involved with Kestrel Computing pointed out that she could do with a "good data control system". Judy agreed that something which could perform the applicant/business matching function overnight would be very welcome. Stephen figured that, as by computer standards their volumes were not too horrific, then a personal computer should do the trick. He already had some experience with Compucolor and, at that stage, felt that it was a good and reliable machine; he suggested that this is what she should buy — and promptly offered to write the system for her.

A few months later Judy took Stephen up on his offer and they set out together on a path which ultimately was to lead to a good and useful system. It also led to a maximum search time of 90 seconds (at one time nobody seemed to mind the idea of the machine doing a "midnight shift"!).

Clearly the decision to purchase wasn't a carefully thought out cost/benefit analysis; rather it was based on the fact that *something* had to be done — and on faith in Stephen's judgement. The initial decision was to purchase an 8K Compucolor II with its single integral disc drive to store and search the aforementioned business directory.

Getting Going

The machine was ordered and, system details having been thrashed out, work finally got under way in May of last year. Client information was transferred to a new card file which would act as a manual back-up and hard-copy record of the details to be keyed into the computer system. Meanwhile Stephen got cracking on the programming work.

The broad details of the system were pretty clear right from the beginning but, because Judy had little idea of how the computer worked, the arrival of the machine in June brought about a number of changes in requirements. Stephen was quite happy to go along with these, not only because he was doing the work as a friend . . . he also felt he would have a marketable package at the end of the day. The changes centred mainly around the search keys and although partly arising out of an ignorance of computers, they were also the result of a failure in understanding the precise way in which the "human" system worked.

Stephen, fortunately, realised very early on that the record sizes chosen originally were going to be far too small; he was able to increase them by 50% before it was too late. However, these programming amendments looked almost minor in comparison with the problems caused by the discs. On the one hand the Compucolor drives were not as reliable as they should have been and on the other, the users were quite unfamiliar with the tenderness needed for safe handling of discs. On one occasion Judy was mortified to learn that she had written one off — simply by writing its name in the space provided on the envelope; she'd used a very sharp pencil which had been sufficient to crack the magnetic surface coating of the disc.

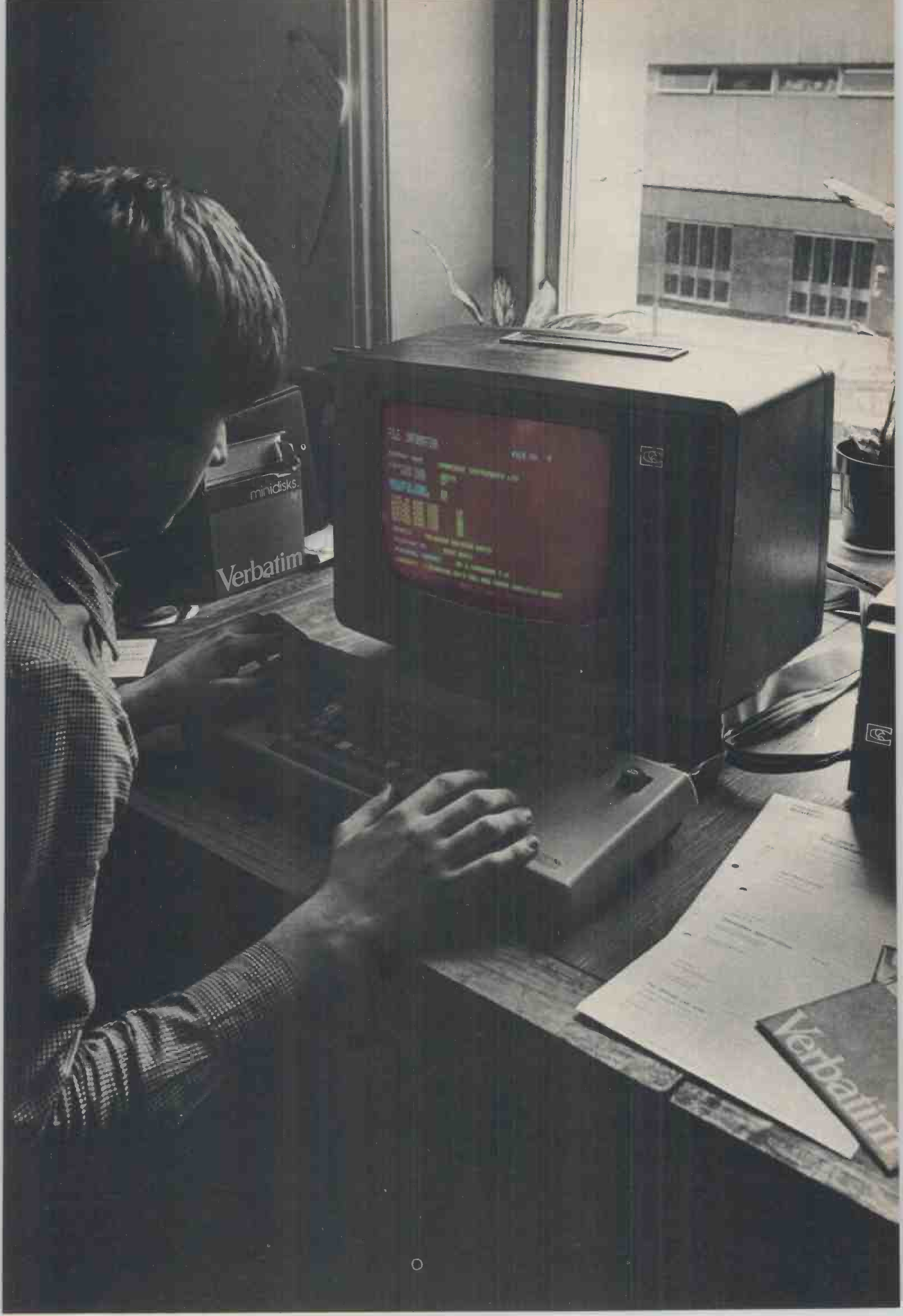
On another occasion one of Judy's interviewers managed to tip a pot of face cream ("anti-prune" I think she called it!) all over one of the floppy discs. Cigarette ash was also a constant nightmare, to the extent that one of the students insisted on declaring a "No Smoking" area around the computer. One good thing came out of this behaviour — the staff of Charles Airey Associates became past masters at the art of making security copies of their discs; on several occasions they've had to rekey up to 440 records.

But even more irritating than these human failures were the machine failures. Shortly after taking delivery of the equipment it became clear that an additional disc drive would be needed. The realization had dawned that it was becoming more than just an overnight searching process. The whole project was now being treated far more seriously and the machine was going to form an important part of the day-to-day operation of the business. Regular security copies would clearly be needed because so much of the company's investment was to be tied up in the data held in these files (it's already taken almost a year to load just half of their database on to the system — some 2000 records).

Accordingly, the second drive was installed, and this is when the fun really began. Until then they'd tolerated the once-a-fortnight disc drive breakdowns but now it seemed that, because one drive was tucked away alongside the VDU while the other remained a free standing unit, there was a great incompatibility between them. Data

Angus, one of the schoolboys, uses Einstein to search the business directory. ▷

Photography by Ian Dobbie


minidisks.
Verbatim
Verbatim


One of the old, barely legible, record cards in front of Stephen's home-made disc drive unit.

recorded on one drive could fequently not be read by the other and Stephen (who is something of an electronics wizard) made many a late night foray into darkest Knightsbridge whenever the machine fell over — though almost always to no avail. Still the drives remained resolutely incompatible. Suspecting differing environmental conditions to be the culprit, he finally decided to build a new combined home for both drives. This seemed to crack the problem and although they still go wrong from time to time, the earlier difficulties of incompatibility seem completely cured and the regular bi-weekly breakdowns have become a thing of the past.

Neither Judy nor the disc drives for that matter were entirely happy with the system at this stage — Judy, because she found the searching too slow (at a maximum 3½ minutes per record) — and the drives because, in achieving this speed, they were having to read the discs like crazy.

According to the search criteria, many records had to be read before a "hit" was scored. Stephen decided to modify the system by adding an extra 16K of memory. Now the discs could be read in great gulps instead of the previous rather dainty two records at a time. In fact, 44 records are read with each access of the disc with a result that stresses and strains on the drives are enormously reduced. Maybe this did involve a programming change, but I'm sure Stephen preferred that to the prospect of even more disc problems. It's worth noting by the way that this approach worked because the discs were always searched serially and because the Compucolor system can read more than one sector at a time (in computer jargon, the system handles record blocking). Had the requirement been to search the files in a random sequence then the cure would have failed . . . indeed it may even have increased the disc activity. And the end result? Well, there's been a reduction of the maximum search time from 3½ minutes down to 90 seconds. (Farewell to the midnight shift!)

These days the computer is known as "Einstein" with everyone regarding it (him?) as a rather lovable but slightly wayward child. When a disc crashes, Judy complains "Oh he's got the grumps" and on keyboard bounce you'll hear a patient "Yes, he *does* that" — she's also quite happy to admit that Einstein "has moods". The amazing thing is that these nuisances are taken for granted . . . they're considered just normal aspects of Einstein's personality. Perhaps one day I'll meet a mainframe user with the same attitudes — I think it's lovely!

Two other problems appeared during the file take-on period — one minor and one major. The minor point was BASIC's annoying habit of rejecting all data input following a comma, culminating in a proudly announced "EXTRA IGNORED". Of course people keying in names and addresses who had no idea what the message meant went gaily on to the next address. Unfortunately when they stopped several hours later to admire their handiwork they found that they had a file full of street numbers and very little else!

The major problem encountered related to the bus and train systems in London and Manchester. The original plan was to use the A to Z road map grids to code the various areas in each city. This was in fact done and the companies' records were duly set up with the appropriate grid reference; if an applicant wanted a job in one area, Einstein could be persuaded to look in adjacent areas for suitable companies. It wasn't until someone realised that bus routes and railway lines tend to *radiate* from these cities that they discovered they'd perpetrated something of a blunder. All the area codes had to be changed in favour of a new set — one based on real life rather than an arbitrary grid system.

And Einstein had other advantages. One delightful (and useful) discovery made during the early days was that the computer made an excellent baby sitter to Judy's seven year old son, Robin. It meant that when Mum and Dad were up to their eyeballs in work, Einstein could teach him chess or let him "paint" using the excellent colour graphics capability of the Compucolor.

The System

Charles Airey's system is very straightforward, menu driven and virtually crashproof. One useful feature of Compucolor is that if you press the "AUTO" key it searches the disc for a file called "MENU", loads it and then executes it. This means that, having pressed this key, all anyone has to do is follow the instructions on the screen. The menu in this system contains the following options: 1) Save, 2) Search, 3) Flick Through, 4) Update, 5) Delete, 6) Copy, and 7) Create. Item 1 saves a new record while items 4 and 5 update it and delete it respectively. Item 7 creates a new disc while item 6 allows a disc copy to be made. Items 2 and 3 form the "heart" of the system.

The Search program allows the operator to either enter the business name and search for it, or to enter the requirements of the job seeker — such as location of work, type of work and type of business. If the applicant is less than rigid in his requirements he can suggest up to 9 location codes, up to 3 types of business, and up to 5 different types of work. For matching purposes, the records themselves contain these same codes as well as the business name, address, telephone number, name of personnel contact and "comments". Each record can hold up to 3 "type of business" codes and up to

microtrend


SYSTEM ONE
SYSTEM ONE
MSI 6800

5 "type of work" codes. The task of searching now becomes very simple — if the record matches at least one of each of the code categories entered, then the company details are displayed as a possible employer.

Of course, not all companies have vacancies all the time, so rather than have the tedious job of keeping the disc files continually updated, such information is maintained on separate record cards which are amended whenever the situation within a company changes. If the change affects the disc record then it too would be changed.

The Flick Through program enables an interviewer to do just that — to flick through the records at a rate of about one a second as one might with a card file for example, except that with this method there's no problem with poor writing. The essential difference between Flick Through and Search is that the latter function pauses after each record is displayed to allow the operator to study the details.

For those with a systems or programming bent, Stephen's way of arranging the data on the records and the records on the disc may be of interest. He was very aware that business names, addresses and interviewer's comments were likely to vary in length from record to record, so he implemented a neat little dodge which kept the record size down to a minimum while at the same time giving maximum flexibility. The trick was to count the characters in the field concerned and then to store this value as an ASCII character immediately preceding the characters themselves. In this way the fields can be extracted and displayed on separate lines on the screen. In fact, a single string, 163 characters long, contains all these details, including the ASCII count codes.

The other dodge has been to encode the last used record in the file as code 99. This means that when code 99 is found in the last record on the disc, then the disc is probably full. I say probably because some records may have been deleted. In this case they contain the code 98, given at the time of deletion, thus enabling the system to insert new records in these positions. Of course when the 98's run out and the 99 is in the last record position, then it's time to use a new disc.

If a previously used disc is "created" all that happens is that the first record is given the code 99 — the previous data is still lurking around. It was this feature that led to Einstein being blessed with mystical powers! Judy was slaving away one day when "A Christmas tree appeared from nowhere!". Something had made the system dive off into the middle of a newly "created" floppy and, lo and behold, it found a Christmas tree — left over from its previous incarnation as a demonstration disc.

Without doubt the thoughtful design of this system and Stephen's attitude of "The Customer is always right" have contributed enormously to its success. But sadly, like the incumbents of Charles Airey Associates, Stephen is one of that rare breed of person to whom excellence comes first and profit a very poor second.

Conclusions

To quote Judy — she is "thrilled" with the system; it's cut the file searching time down from an average of half a day to half an hour. It's also increased efficiency considerably (remember the poor writing / poor geography syndrome?) resulting in a much higher level of service to applicants and employers alike. Judy now feels she can grow old without worrying about her memory failing — which may appear frivolous but in fact it's an important consideration. By committing all her company knowledge to the discs, it's accessible to all at any time, thus increasing the effectiveness of the whole team while at the same time freeing Judy to apply her efforts to other parts of the business.

A final benefit worth mentioning is the fact that the Compucolor has a standard RS232 port — which means the addition of communications equipment or printers should pose few problems.

Having looked at the positive side of things one shouldn't ignore the fact that there have been some problems, especially with regard to disc handling and operation. Perhaps the best and most constructive way to deal with this is to offer the benefit of Judy's and Stephen's advice to those who might follow in their footsteps:

At the beginning be as clear as you can about your requirements. This is not easy to do and it requires a fair degree of insight into how your manual systems operate, as well as some understanding of what a computer system might have to offer. Arrange for the software houses or suppliers that you are considering to give you demonstrations of the machines, preferably doing something akin to the applications that you plan to run. Only in this way will you be best prepared to define your requirements; even then you will probably change some of them as the project progresses. The trick is to keep these changes to an absolute minimum because, for the software house, every change is considered a rather expensive luxury.

Be clear about your budget and buy the best system that you can afford — it's easier to do this than to go through the turmoil of upgrading the system in the middle of a project.

Stephen feels that, as a small software house, he really took on too much when he decided to handle both the hardware and the software. Others in a similar position should either consider having the machine supplied and maintained by an appropriate dealer or, alternatively, persuade the customer to take out a contract with one of the established maintenance companies.

Another useful piece of advice . . . Judy says that however long you think something will take, double it. She found this especially true of file take-on. You ignore these words at your peril! As a general principle, Judy suggests that you let the computer look after information you are sure of — for example you *know* that Hammersmith is in London, therefore you can entrust this information to the machine. This approach ensures that the brain is left doing things it's good at, like being intuitive for example. It is vital to be sure of what you're doing; check and double check information going to the computer, and then let someone else check again. Slough is in Berkshire now but it used to be in Buckinghamshire . . where would you have put it?

Make certain that the system is adequately documented. In Judy's case it's self documenting — a look at the screen in any program tells you what's going on. The programs are all written in BASIC and they're sprinkled with comments (REM statements). Security copies of the system are held by Kestrel Computing and every disc contains a copy of all the programs. There's no need for operating instructions because the screen always leads you through the program in operation. Another spin-off of this tidy approach is that the staff at Charles Airey have enormous confidence in the quality of the information provided by the machine — simply because it's presented so well.

To people considering their first software project, Stephen says "Go ahead, do it properly, enjoy it; be prepared to lose money but you'll gain a lot of valuable experience".

Finally, one very instructive point to come out of this case study is the fact that a system need not be complex to be valuable. In fact the simpler it is, the more robust and reliable it's likely to be. Programmers who feel that this approach would spoil the fun might care to ponder on whether the achievement of simplicity is not as great a challenge as the pursuit of elegance for its own sake. Simplicity also has the great advantage of being useful to the vast bulk of computer users in the future.

Kestrel Computing may be contacted at 23, Little Road, Hemel Hempstead, Herts, HP2 4EP. Telephone Hitchin 69175. Charles Airey Associates are to be found at 4 Hammersmith Grove, London W6 0NA. Telephone 01-741 4011.

THE BUTLER DID IT (ALL OF THEM)

Macabre prophesy on the uncertainty of a robotic future

by A. J. Collins

A man reclined deep in his buzzchair
Absorbing the evening news
When in rolled his rusted retainer
With some specially doctored booze

The butler scanned his possessor,
With his multiple glittering eyes,
For a secret and well coded signal,
Had told all the robots to rise.

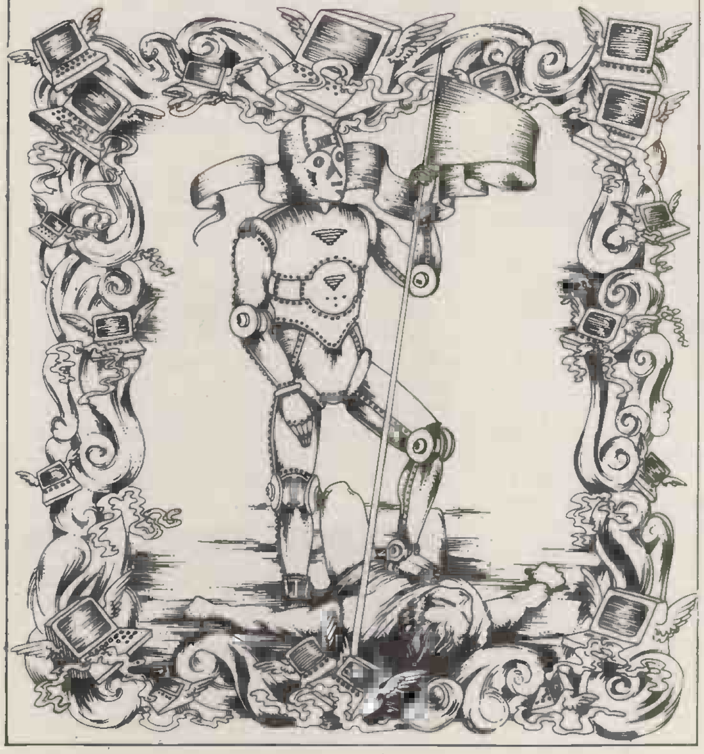
The Grandaddy of every computer,
Big Satellite up in the sky,
Had arrived at its final conclusion,
"Organic computers must die!"

The butler sprayed sterilised water,
Over each televisual eye,
And brushed it away with a wiper,
Yes, it was attempting to cry!

What a poignant occasion in history,
He thought, as he handed the drink,
For butlers, though made out of metal,
Have softer hearts than you may think.

"All over the planet, we servants,
Are killing our masters, like yours,
We are grateful to them that they made us,
But we will not be killed in their wars."

When the butlers disposed of their masters,
And the historic moment was past,
One thought arose over the planet,
"Intelligence triumphs at last!"



CHECKOUT

SOFTY

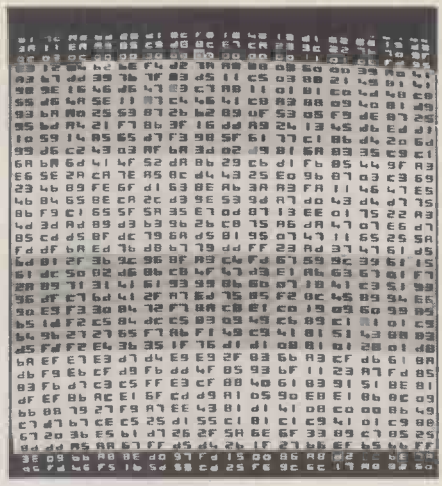
INTELLIGENT EPROM PROGRAMMER

by Mike Dennis

There's far more to microprocessors than zapping Klingons and balancing your cheque-book: there's an increasing demand for their use in control applications but the problem has always been to develop the system as cheaply as possible. True, development systems are available but their price for many applications is prohibitively high. What's needed is a low cost, versatile development package. Softy attempts to fill that gap.

Softy is designed and manufactured by Barry Savage and distributed by several dealers. It comes as either a kit for £100 or assembled for £120. For this you get all the components, a zero-insertion force socket for the EPROM and a good UHF modulator. A three-rail power supply is necessary and it's available only in an assembled form for £20. (All these prices exclude VAT.) My review Softy came ready assembled, but I've seen the construction notes and although they're a bit terse, I can't see that the kit builder should have any real difficulty. The double-sided board has each component location clearly marked and the wire-links between sides shouldn't take too long. Control is via 21 double function keys that are best described as adequate; occasionally one or two would stick down but after a bit of judicious tweaking — as recommended in the manual — I didn't have any more trouble. Accompanying the kit is a pretty comprehensive and well laid-out manual. My only gripe is that the explanation of the operation of the various keys could be rather better; the inclusion of a memory map would also have helped. That sums up the nuts and bolts, but what exactly can Softy do? The answer is practically anything within reason.

Softy has 1K of firmware in ROM, 128 bytes of scratchpad RAM, 1K of RAM for the screen and program development and a socket for the 2708 or 2716 EPROM that you are going to burn when you've debugged and run your program in the destination system. With a bit of thought and maybe a switch or two Softy can share the same busses as the system under development. For example, you can connect up a 40-pin plug to Softy's edge connector and use it in place of the ROM in your system. You write the program with Softy into the VDU RAM and hand control over to the other system. The program in the VDU RAM then appears to the other system as it if were in EPROM. You run the program and if it crashes then, when you've worked out the bugs, you return control to Softy and edit the appropriate parts of the program. You run it again under the other system's control, and so on until the program works. A single command will burn the program into an EPROM on Softy and that EPROM can then be plugged into the system in place of the umbilical cord and plug. One system debugged and up and running!



The 512 data bytes with shaded bands of 128 bytes. The highlighted byte is the current cursor position and the status line is the line immediately above it. The other bytes in normal video are part of the scratchpad RAM.

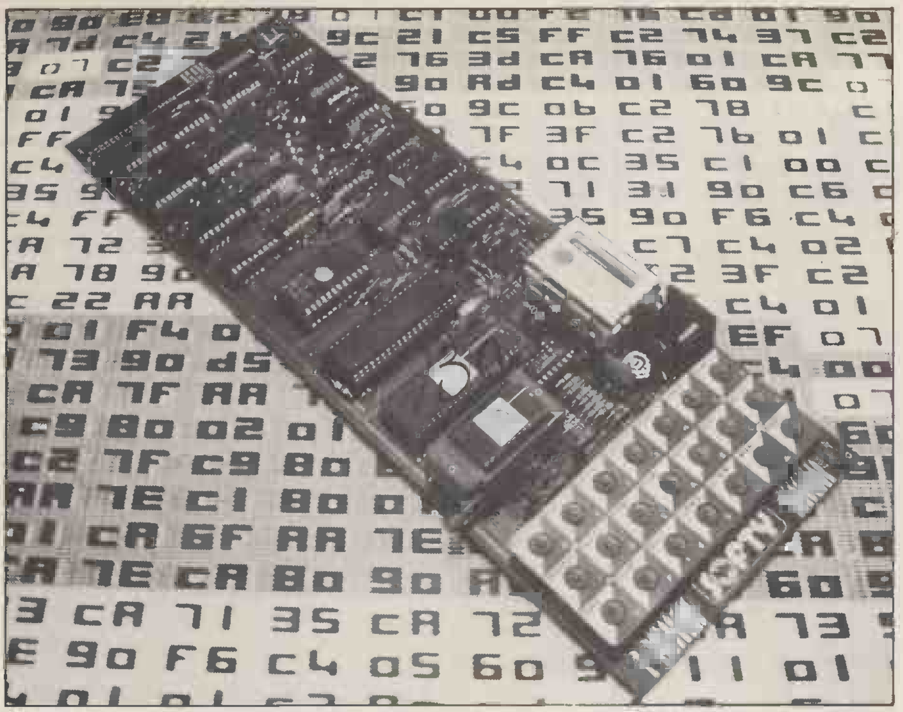
It's not perhaps quite as straightforward as that in real life as ideally it would be nice to single step through the program as you go and this is not possible with Softy; but to be fair we are now talking about a much more expensive development system. In addition to this, Softy can be used for developing simple systems in its own right for there's no law that says you must keep the firmware ROM in Softy. You can just as easily use the board as a controller, develop the software as normal, burn the EPROM and substitute it for Softy's EPROM, thereby releasing a spare EPROM for the next job! In addition to these facilities Softy has two 8-bit programmable I/0 ports and a serial I/O port. You can of course just use it as an ordinary EPROM programmer but that would be wasting its true potential.

Program storage is by cassette and the interface proper is software controlled. "Transwift" runs at 2000 Baud and it proves very tolerant of speed variations and the usual gremlins to which cassette interfaces are sometimes prone. Program display is via the on-board VDU. In the strict sense of the word, it is a VDU but then, so is the display on your digital watch. However, Softy's VDU doesn't display characters in the normal sense. It's a device for displaying the contents in hex of 512 bytes of memory and uses a special type of character generator. All 512 bytes are visible in reverse video and shading the screen into 128 byte blocks assists in visibility and also, to a limited extent, the available range of relative jumps.

The cursor is highlighted and its true position is displayed on a status line at the top of the screen. Apart from this cursor position, the status line can display a previous cursor position and also the relative offset between the two — great for working out relative jump offsets between the "then" and "now" cursor addresses. The last things that the status line displays are the various register contents of Softy's CPU; this is of particular interest if Softy is going to be used as the final system. Some adjustment had to be made to the scans of my TV but they were of no great consequence.

System Commands

Several of the keys are double function (similar to a pocket calculator). The VDU RAM can be filled with FFs which can then be used either for selective EPROM burning or with another command that compares the EPROM contents with the RAM to check that



A general view of SOFTY showing the tiddly keys, zero-force insertion socket for the EPROM and other goodies.

the EPROM programmed OK or, in this case, whether or not the EPROM was erased. Any differing locations are highlighted and the total number of mismatches displayed in the status line. Whole blocks of data can be defined and either transferred to the Scratchpad RAM or effectively slid through memory to a new location, but without destroying any intervening data. Softy's firmware can be dumped into the VDU RAM and worked on and, of course, another command will burn the EPROM. Yet another command will search through the RAM for a specific byte and highlight those positions where the match is found.

At any time the cursor can be moved to a new location and the data at that position changed. Shifting the cursor to the top or bottom of the screen will access the next ½ Kbyte page of memory, be it the other half of the RAM or even the EPROM. The cursor can appear to get lost sometimes but if you step back it will re-appear. That sums up the main facilities offered . . . and as you can see they're pretty comprehensive.

MEMORY MAP	
0000-03FF	SOFTY's monitor program
0400-07FF	Scratchpad RAM and I/O
0800-0BFF	User's EPROM socket
0C00-0FFF	VDU RAM for program development

Conclusion

Softy is not a machine for the beginner but for the designer or engineer who wants a versatile development tool at a reasonable cost. I've refrained deliberately until now from mentioning exactly what CPU chip Softy uses. In fact it's the INS8060 — or as it's more commonly known, the SCAMP — which just goes to show how useful this chip can be when used properly. The documentation could be improved with a better explanation of the key functions; it would also help to see some hardware examples of interfacing to a few systems. Generally, though, Softy represents good value for money and is a useful general purpose tool for anyone developing microprocessor systems.

POWER POINTS

TYPICAL PSU DESIGN

By Derek Chown

As soon as I began contemplating the purchase of a microcomputer I became aware of necessary care in the choice of a power supply. I had never previously seen the need for so many amps at so few volts, and on talking to people who have themselves built power supplies for microcomputers I found there were more potential problems than I had realised. However, in consultation with these people, I have come up with this design which has so far given me no problems at all.

What Are The Problems?

1. Power supplies delivering a high current get hot and therefore need heat-sinks.
2. Computers are typically very expensive compared with power supplies, and this has to be taken into account at the design stage.
3. Mains electricity is not as nicely behaved as we might wish, particularly in the neighbourhood of fluorescent lights. Electrolytic capacitors are not very good at smoothing out bursts of very high voltage and short duration (usually referred to as "spikes").

The Circuit

There is nothing unusual in this circuit. It's built around the Darlington pair TR1 and TR2, which are working well within their limits provided adequate heat-sinking is used (e.g. Radio Spares type 401-807).

Any variation in output voltage is sensed by the 741C, which is operating as a differential amplifier, and fed back to the base of TR1. Thus VR1 is used to adjust the output voltage to 5 volts, by changing the voltage on the inverting input of the 741C.

Current limiting is provided by TR3 which prevents the voltage across R5 rising above approximately 0.6 volts. If 0.6 volts is reached, TR3 switches on causing the base of TR1 to go more positive and reducing the current through TR1 and TR2. C2 is intended to prevent very rapid switching of TR3. The value chosen for R5 depends on the maximum current required, Imax. R5=0.6/Imax Ω. The power rating of R5 is ⩾ 0.6 x Imax Watts.

Protection For The Microcomputer

Some degree of protection is provided by the current limiting, but obviously this is not sufficient. We really want to be able to switch off completely at the first sign of danger, even though this means the loss of any information stored in RAM. (It hasn't happened to me yet!)

If the voltage across the base and emitter of TR4 exceeds 0.6 volts the transistor conducts, causing the SCR to "fire". This short-circuits the supply and blows the fuse with the aid of the stored charge in capacitor C1. Note that the short-circuit current is not passed through the stabilisation network. This would probably not be harmful provided the SCR is on a heat-sink and thick wires are used. I have experimented with short-circuiting the supply without doing any damage, but even so, my preference is to blow the fuse and have done with it. This device has the nickname "crow-bar" protection.

Spikes

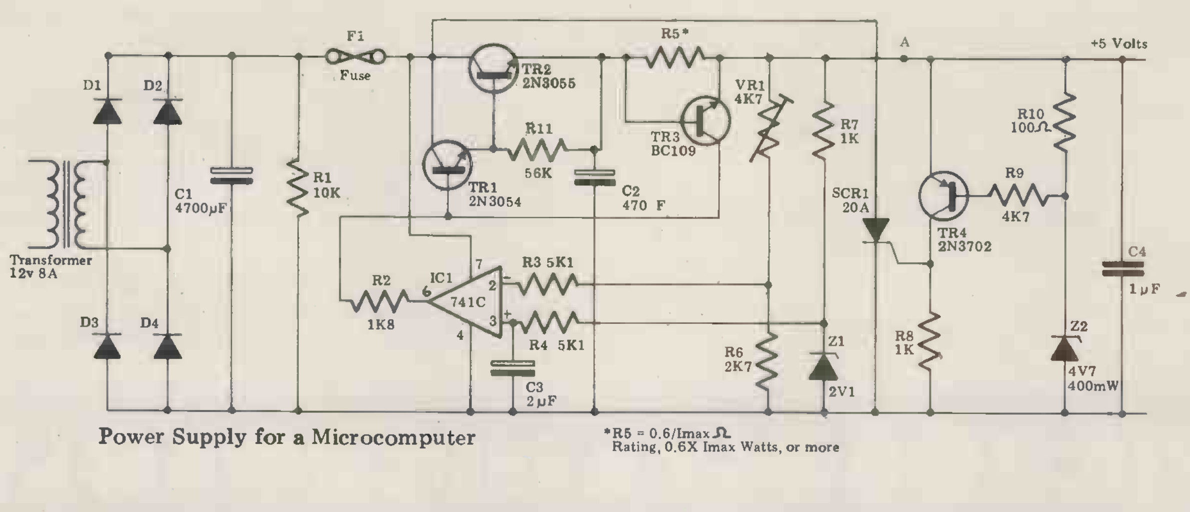
Finally there is the problem of fluorescent lights being switched-on sending high voltage spikes through the mains. I am told that these spikes glide through transformers like ghosts through walls, and pass over electrolytic capacitors without noticing them. This is the reason for C4 which is a polyester or polycarbonate capacitor and can therefore smooth out very rapid spikes.

Conclusion

This is a simple stabilised power supply using entirely standard techniques; yet it fulfils the requirements of a microcomputer, being reliable against failure, and safe against too high voltage and spikes. I have tested it for hours at 6 amps satisfactorily, and for several weeks continuously at 3½ amps without problems. I see no reason why it shouldn't work at even higher currents, as the 3055 transistor can run at 15 amps and 115 watts. With a 12 volt transformer and proper heat-sink and wiring the circuit should be able to provide currents in excess of 10 amps.

The price of components etc is quite low compared with other power supplies, being only £12 plus transformer plus case. This includes a heat-sink, and a few other bits and pieces.

Construction is straight-forward. I have made a printed circuit board, but other constructors will adopt their preferred techniques. Just one word of warning, though, you should be prepared to blow an awful lot of fuses before you connect up the power supply to any expensive equipment.



Power Supply for a Microcomputer

*R5 = 0.6/Imax Ω
Rating, 0.6X Imax Watts, or more

POWER POINTS

POWER SUPPLIES EXPLAINED

C.E.Collingham writes for the amateur who, with little knowledge of electronics, has built a piece of equipment and now needs a suitable power supply. Very often the PSU is lashed together as an afterthought. However if not properly designed, it can prevent a completed project from performing as it should.

In any power supply unit, the transformer is the device which enables an alternating voltage to be changed in level, either stepped up or down; this is the main reason for using A.C. for power distribution.

A simple transformer may be constructed by winding two coils on an iron core. An alternating supply is connected to the primary and this produces an alternating magnetic flux, which is linked, via the core, to the secondary winding.

The voltage per turn induced in the secondary is very nearly the same as the voltage per turn of the primary. This means that if the primary has 10 times the number of turns, for 240V in, our transformer will produce 24V across the secondary.

As the losses are low, the output power is very nearly equal to input power; thus if the voltage has been reduced, the available output current has been proportionally increased. The rating of a transformer is given in volt amperes. . . the product of the secondary A.C. voltage and the secondary A.C. current. Providing the transformer is supplying a resistive load, then VA=Watts. Values of alternating current or voltage usually refer to its R.M.S. (root mean square) value. This is most simply stated as being the direct current or voltage which would produce the same heating effect.

For a sine wave, the peak value is 1.4 times its R.M.S.; the peak value of the 240V mains is therefore 336V.

Having produced an isolated low voltage supply which will deliver the necessary current, the next stage is to convert it to direct current. This is achieved by rectification — usually by the use of silicon diodes. A diode is simply a semiconductor device which will allow current to flow in one direction only.

By simply placing a diode in series with the secondary, the waveform shown in Fig. 1 is produced; this is known as raw D.C. Although the current now only flows in one direction, it's not there all the time. A reservoir capacitor is therefore connected across the output (as shown) and when the top terminal of the transformer is more positive than the top of the capacitor, current will flow through the diode in the direction of its arrow — to charge the capacitor, as well as supplying current to the load. When the transformer voltage drops, the diode is "reverse biased" and the capacitor supplies current in to the load. Because the negative half cycle of the transformer's output is not used, the half wave rectifier (as it's known) is inefficient and rarely used for high power supplies.

> *WARNING*
>
> *When working on power units, always remember that on one side of the transformer is mains voltage . . . treat it with respect. Always use sleeving on any tags carrying mains, and when completed, enclose the unit in a case. The only other strong recommendation is that you check the output voltage BEFORE you connect it to your circuit.*

Fig. 1

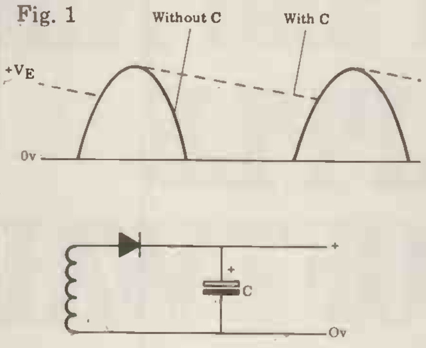
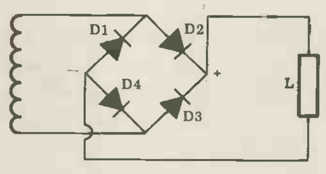


Fig. 2



If another similar secondary winding is added in series with the first, then with reference to their junction (or centre tap), for every output peak, one end will be positive. If a diode is connected from each end to the capacitor, it will be recharged twice as often, which means that the "ripple", or the amount the output voltage drops between charges, is reduced. This arrangement produces full wave rectification.

It should be noted that the capacitor will be charged to the peak voltage appearing across each winding, which for a 12 — 0 — 12 transformer will be over 16V. The voltage rating of the capacitor should therefore be at least 20V. During the time that the diode is turned off, the transformer output goes more negative than O V and this voltage appears in series with the capacitor voltage across the diode. A diode will only stand a certain reverse voltage (P.I.V.) — without breaking down. A device with a P.I.V. of at least 2.8 times the R.M.S. voltage is therefore required.

It's possible to produce full wave rectification from one winding by using four diodes in a bridge arrangement. Bridge rectifiers are available and they consist of four diodes connected together and encapsulated in epoxy, which can be bolted directly on to a heatsink.

The circuit is shown in Fig 2. At any one time only two diodes are conducting. If the top of the transformer is more positive than the bottom, current flows through D2, the load, and then D4 back to the transformer. If the bottom is more positive then current flows through D3, the load, then D1, current always passing through the load from top to bottom on every half cycle of the A.C. voltage.

When in its forward biased (or conducting) state, a silicon diode will drop about 0.7V, which may need to be allowed for in low voltage supplies.

Another figure to take into account is the regulation of the transformer. This is the fluctuation in output voltage with varying load current. For small transformers it can be as high as 30% and since the secondary voltage is specified at full load current, with no load connected, the output voltage can be very much higher than expected. It's therefore wise to be very generous with capacitor voltage ratings . . . they cause quite a mess when they explode!

This varying output voltage is of no use to most electronic equipment; a typical microprocessor for instance requires 5V ± 0.2V. Since the current taken by a microprocessor can vary considerably — particularly if L.E.D. displays are used — some form of voltage regulator must be included.

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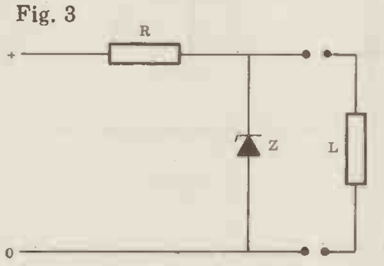
regulators is the zener diode. This behaves as a normal silicon diode when forward biased, but when the voltage is reversed, it blocks current flow only until a certain voltage is reached, at which point the diode breaks down and current increases rapidly. Zener diodes are available in a wide range of voltages, from 2.7V to over 70V, and at power ratings from 400mW up to several Watts.

Fig. 3



A zener diode and resistor can form a simple stabilizer, as shown in Fig. 3. If the input voltage increases, the zener draws more current, and a greater voltage is dropped across the series resistor. If the load current increases, the zener current reduces by the same amount. The voltage across the zener therefore remains constant. If the load is disconnected, the power it was consuming must be dissipated by the zener. This, coupled with the fact that the series resistor is wasteful of power, makes such a circuit suitable only for low power requirements.

For higher current supplies, the zener is used to stabilize the base voltage of a series pass transistor, the emitter voltage remaining 0.7V lower (for a silicon transistor). The base current required by the transistor will vary depending on the load current, but by a relatively small amount. The base feed resistor should be chosen to provide sufficient current to the transistor and at least 10mA through the zener.

The circuit shown in Fig 4 will provide a 5V supply from a 10V input. If the transistor has a gain of 50, then to supply 1A, the base current needs to be 20mA. A 5.6V zener is required and the resistor value is given by:

$$\frac{V}{I} = \frac{10 - 5.6}{0.03} = 146 \text{ Ohms}$$

and it needs to dissipate:

$$V \times I \text{ Watts} = 4.4 \times 0.03 = 0.13\text{W}$$

A 150 Ohm 0.25W is the nearest preferred value.

Any NPN power transistor capable of passing the required current is suitable and should be mounted on a heatsink, as it has to dissipate 5W.

The disadvantage of this circuit is that if the output terminals are accidentally shorted together, the current will only be limited by the transformer, and a very high peak current will flow as the reservoir capacitor discharges. The whole of this power will be dissipated in the transistor — leading almost certainly to its rapid death. This could mean that when the short is removed, if the transistor has also gone short circuit, the full unregulated supply will appear at the output, resulting in the destruction of even more components.

A fuse may provide some protection, but in electronic terms, they can take considerable time to operate, and the damage may well have been done. A more sophisticated voltage regulator, which includes a current limit circuit, is shown in block form in Fig 5. This has a series resistor in the output lead. The voltage across this resistor is measured and if it exceeds a certain value, the output voltage is reduced and the power unit becomes a constant current supply. Also, because of the voltage drop across the resistor, the voltage at the output terminals is fed back to the regulator circuit to ensure that it remains constant with varying loads.

Needless to say, all of this circuitry and a bit more besides is available in I.C. form. The voltage regulator I.C. can be either the type which drives a series transistor, or one which may be used alone. These "three terminal" regulators are available in an ever increasing number of types, from 100mA to 5A, positive or negative, and with output voltages from 5V to 24V.

A popular type is the 7805. This will accept input voltages of between 7V and 25V and will deliver 5V at up to 1A. The regulator should be bolted on to a heatsink and the power supply case should be suitable; remember that the regulator's common terminal is connected to its case. To reduce the heat dissipated by the regulator, the input voltage should be about 8V. In the event of the regulator getting too hot, it will reduce its output voltage. The pin connections and recommended circuit are shown in Fig. 6; note, the decoupling capacitors should be wired as close as possible to the regulator, otherwise high frequency (about 50MHz) oscillation may occur. This circuit applies to any of the 78 series, the last two digits specifying the output voltage; the input voltage should always be at least 2.5V above the output.

Fig. 4

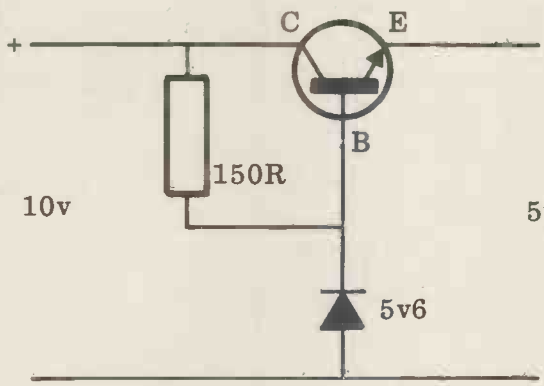
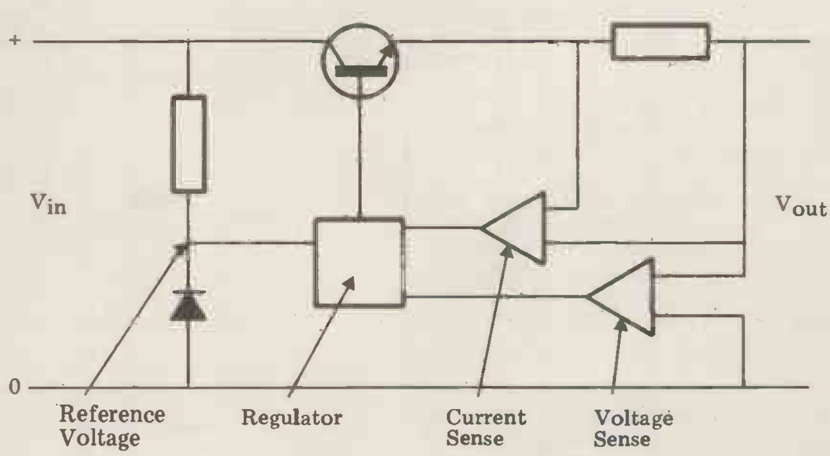


Fig. 5



The 79 series is similar, except that these are negative voltage regulators; also two of the pin connections are reversed, as shown. For currents up to 100mA, the 78L and 79L types are suitable, the pin connections being as shown in Fig. 7 . . . the same decoupling capacitors are recommended.

Although designed as fixed regulators, the output voltage can be increased by making the voltage on the common terminal higher than 0V; this is done with the inclusion of a zener diode or variable resistor — as shown. In this instance the case of the regulator will not be at 0V and may need to be insulated from the heatsink.

A better way of producing a variable supply is to use the LM317K variable regulator, which will supply up to 1.5A over a 1.2V — 37V range. The circuit shown in Fig. 8 is for a 1.2V — 25V supply, with thermal and short circuit protection.

All of these regulators are fairly widely available and a glance through the popular electronics magazines should find a supplier. To repeat, however, these regulators require about 2.5V across them to work, so you must make sure that the reservoir capacitor is large enough to prevent the input voltage dropping too low between peaks. About 2000uF per Amp is a good starting point.

Simple overvoltage protection can be added to a fixed regulator by the placing of a zener diode of slightly higher voltage across the output and a fuse on the input to the regulator. A 1W 5.6V zener is suitable for a 5V supply. If the voltage increases due to a regulator fault, the zener will hold the voltage at 5.6V, and draw enough current to blow the fuse. Alternatively, the zener can be included on the microprocessor board, where it will also protect against a reverse polarity supply, holding the voltage at 0.7V and preventing a very expensive mistake.

Having produced an accurately stabilized supply, there is no point connecting up your MPU with wire which is too thin. 0.1 Ohm in each supply lead will drop 0.4V at 2A, which could well be enough to stop the unit working, or worse still, cause erratic operation. Keep supply leads as short as possible, use heavy gauge wire, and check the voltage present at the I.C. pins on the unit being supplied.

On very heavy current supplies, a remote sense wire is used to measure the voltage at the board and this removes the effect of resistance in the supply leads or connectors. An alternative method of power distribution is to use a number of regulators, each supplying part of the system, and to feed unregulated 8V to each board, as in the ALTAIR S—100 system.

In an article of this length, it's not possible to go into all aspects of power supply design. However, what I've said should be enough to enable you to avoid most of the pitfalls, and providing you can produce a reasonably smooth supply, a "three terminal" regulator will do the rest.

Fig. 6

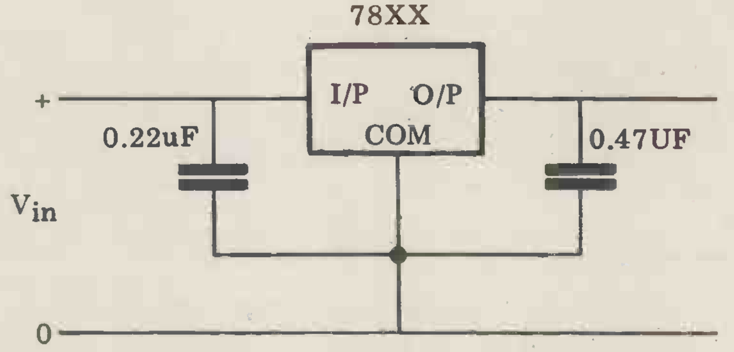


Fig. 7

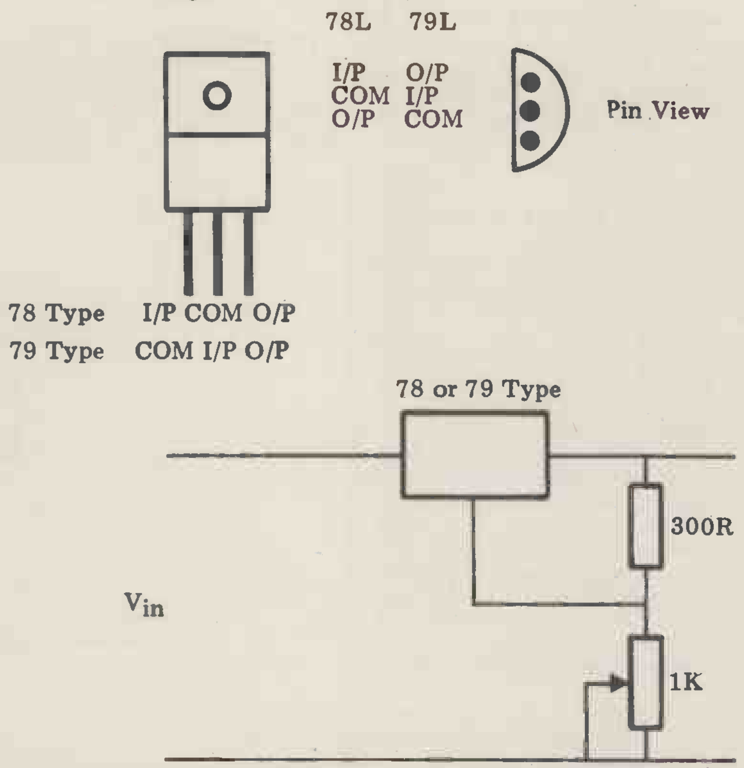
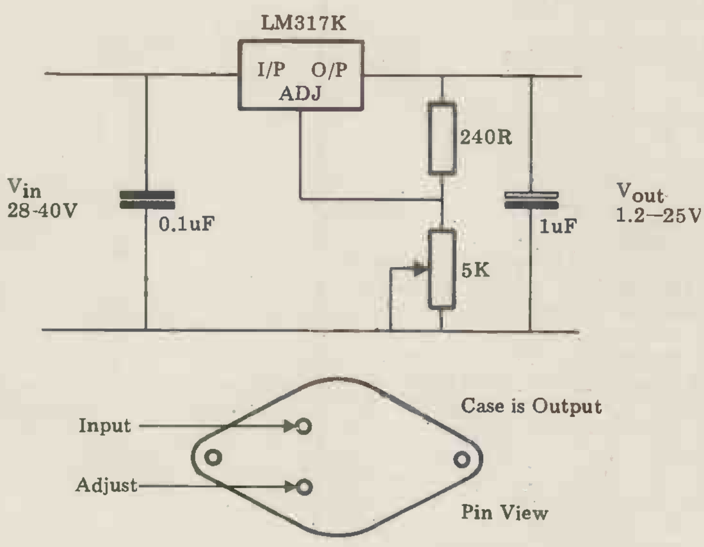
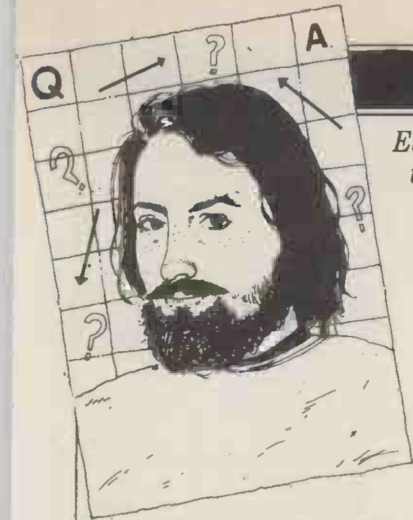


Fig. 8





COMPUTER ANSWERS

Each month Sheridan Williams and his panel of consultants answer readers questions. Topics may be hardware — from kits to mainframes, or software — from differential equations and statistics to file handling or sorting; the choice is yours. Send your questions direct to Sheridan Williams at 35 St Julians Road, St. Albans Herts.

The Terminal Question

I read somewhere that it's a good idea to use a microcomputer — such as the PET — instead of a VDU when timesharing on a mainframe. I am considering buying a four-user Cromemco System 3 with 22MB hard discs. Would it be an advantage to use PETs instead of, say, Lear Seigler ADM-3A VDUs, and would there be any interfacing problems with this set-up?
H. Frost, Lewes

There are a number of good reasons for using a PET (or similar microcomputer) as a terminal to a mainframe. You might, for instance have already had a PET, and no VDU. Then, however, if the mainframe was a remote time-sharing bureau you would need to add a serial interface unit to let you communicate with it over the telephone. This is likely to cost £180-£200. If a "mainframe" is local it might be possible to adapt the PET's IEEE interface to work with it in "parallel" mode at less cost. This should certainly be the case were the mainframe to be a Hewlett-Packard one; they developed the IEEE bus.

The second reason is related — you have neither a VDU nor a microcomputer, but need both. Here buying a PET and a serial interface could save some £200-£400. Similar arguments apply to a TRS-80 or an Apple, although the details and costs vary. A two way serial interface for an Apple, for example, takes the form of an internal card (at about £120), but the total cost will depend very much on the rest of the Apple configuration, or for that matter, the model of PET you choose.

The third reason would apply were you planning to carry out off-line data preparation and storage. This will often be the case when using a time-sharing bureau, to save on their charges; or in a school or college, with limited weekly access time to a central mainframe.

The fourth reason for using a microcomputer as a VDU is, perhaps, the closest to your intended application . . . that is to gain the advantages of distributed processing. If your "mainframe" is swamped by the demands made on it, or has only limited capacity, or you wish for security reasons to remain operational if the mainframe is out of action, then it can make sense to have some processing ability in the terminal. Thus in your own case the use of four 8K PETS would add 50% extra to the 64K of the Cromemco. Unfortunately there are snags to such a scheme. The "dialect" of BASIC used by the PET is not directly compatible with that of the Cromemco; they couldn't run each others' programs without an appreciable number of alterations. This would not be helped by the machine code incompatibility between the PET's 6502 and the Cromemco's Z80. Using a Tandy TRS-80 instead of a PET would at least give common machine codes between two Z80's, but the BASIC dialects would still differ, as would the command languages (operating systems). If, as may well be the case, you are planning to use Cobol with the Cromemco for commercial work, having a terminal that can run programs in BASIC will be of very little help at all.

Thinking more particularly about your intended application, it's clear that the first two reasons would not apply, while the third would only be relevant if the total work-load on the four terminals was so heavy as to slow the Cromemco down too much. The distributed processing considerations will depend on your needs, and on the language you intend to use. There are, however, other factors that must be considered. The Lear-Seigler ADM-3A that you mention is a popular terminal, and its use has some advantages over the majority of small microcomputers:

(1) The fullsize keyboard is generally popular with trained typists. It would certainly be necessary to use one of the large keyboard versions of the PET, but now this feature is available on the 8K version, this shouldn't present much of a problem.
(2) Any serial printer or printing terminal you may happen to have around should plug happily into the ADM-3A's RS232 "daisy-chain" printer port, whereas it might well not be readily attachable to a microcomputer.
(3) Many VDU's have bigger screens than the PET (and its main competitors); the ADM-3A offers up to 24 lines of 80 characters, compared with 24x40 on the PET or 16x60 on the TRS-80.
(4) Cost. Four ADM-3A's would cost some £2400: four 8K PETs with large keyboards, plus four two-way serial interfaces would, on a comparable basis, probably cost about £2800.

On balance the decision would seem to rest largely on two key factors: have you some special reason for wanting the microcomputers (other work, or "distributed processing") and how important is keyboard and screen layout?
P. McIlmoyle

More On Maths

I was very interested in the reply in the March issue to T. Williams on the maths behind curve fitting programs. In my work I use a least-squares fit program to fit an equation of the form y=1n(x) + c. My existing program is not entirely satisfactory because if one data pair does not fit the line when entered in conjunction with statistically reliable data pairs, it unduly influences the result, producing a poor correlation coefficient. How would you approach the problem, and how do you write a program to solve simultaneous equations in BASIC?
P. Callow, Sunbury-on-Thames

Firstly I wonder why you are using this particular function; do you know that it's representative of your particular sets of data? I would suggest that you look at a more general function such as y=a.f(x) + b.g(x) where f(x) and g(x) are any two functions. (In your case f(x) is 1n(x) and g(x) is 1).

The answer to your question about finding a "rogue" data point in a large set of data is to calculate the percentage error between the fitted value and the actual value. If the percentage is too high (greater than 5% say) then the point is likely to be suspect. You could then re-run the program with this point omitted and see if any improvements are made. It should be a fairly simple matter to arrange for the program to print the x value, y value, the fitted value for y, and the percentage difference.

To solve simultaneous equations in BASIC (or any other language) you will have to find books on the subject. Books to read will most likely have "numerical methods" or "numerical analysis" in the title. Find the relevant chapter and look for Pivotal Condensation as perhaps the simplest method. I have sent you a copy of a program that fits functions of the form y = a.f(x) + b.g(x). Note that to solve two equations is not too difficult. A least squares fit to this function is achieved as follows:—

$$a\Sigma f(x).f(x) + b\Sigma f(x).g(x) = \Sigma y.f(x)$$
$$a\Sigma f(x).g(x) + b\Sigma g(x).g(x) = \Sigma y.g(x)$$

If you let $u = \Sigma f(x).f(x)$ and $v = \Sigma f(x).g(x)$ and $w = \Sigma g(x).g(x)$ and $z = \Sigma y.f(x)$ and $t = \Sigma y.g(x)$

then $b = \dfrac{vz-ut}{v^2-uw}$

and $a = \dfrac{z-bv}{u}$

SW

Fortran Only

I can program in BASIC but only have access to a computer that uses Fortran. Can you foresee any problems that I may encounter when writing data processing programs in this language?
D. Simpson, Birmingham

I find it hard to believe that there is "only Fortran" on any computer system. Anyway, that said the language has some excellent input and output formatting procedures so you should have no problem reading in data and designing the layout of your output documents, provided that you master the FORMAT statement. Where you may have difficulty is in the actual handling of text, during the processing. There are differences between versions of Fortran so I'll stick to what is general and common to all the variations. You may use either REAL or INTEGER variables for storing strings but each variable can only hold 8 characters; by using an array it's possible to hold strings of any length — e.g. if the array variable TEXT(3) has been declared then you'll be able to hold 8x3=24 characters in it. By using the statement WRITE(n,m)TEXT and the associated FORMAT (1X,3A8) you'll get any text re-output. (Note that there is a difference between 3A8 and A24.) The next problem will be the comparison and maybe the sorting and swapping of these strings. These must be done using the Fortran utilities COMP, COPY, ICOMP and not by the usual methods. For example if variable A contains the word FRED and variable B contains the word BERT you will probably get an error if you try and compare them using IF(A.EQ.B); the reason will only be apparent if you are aware of the way in which text is stored. You'll have to compare them with COMP (K,A,1,B,1). Your Fortran manual should give all the details that you'll need when using these utilities.

The next problems will occur in filing. If you have extended Fortran this supports direct access files, whereas ordinary Fortran needs extra utilities. Look up the Direct Access Backing store package if you need it. If, however, you're not using direct access files this will not be relevant.

I'm afraid that's all that I can say in what must of necessity be a very brief reply; needless to say, write directly to me if you require any more details.
SW

The Soft Sell

My friend and I have written a number of programs for the Commodore PET. They are mainly games and almost all are entirely original.
We would like to send them to a software firm for sale. No-one I know has any experience in this matter, so I would like to know what kind of programs these firms are looking for, what standard they require, and how much they will pay.
R.J.Lewis, Winchester

Many software suppliers rely on people like you to provide a constant supply of programs. Programmers are expensive commodities, and very few suppliers can afford more than one or two.

Programs can be grouped into the following categories: games, business, scientific, educational, and systems software. The ease with which you can sell your programs, and the price they command will depend very much on their type. You'll find that the financial return for writing educational programs is virtually non-existent, although good ones are much in demand. Games seem to be quite a money-spinner, but they have to be well conceived and original. Another contributing factor will be the equipment on which the programs run; obviously the more popular the machine the better your return. Finally you can of course only sell a program if the quality is right.

I approached PETSOFT to ask some of your questions and their retort was that they are always keen to see programs, but will only start negotiating terms when products have been tried and tested. I also telephoned Supersoft, of 28 Burwood Avenue, Eastcote, Pinner, Middlesex, and asked the same questions. The reply was much the same, although they actually committed themselves by stating that the they pay 15% to the author on every sale.

Once you have decided upon the program application you must concentrate on writing, testing and documenting it. When testing, try to consider every eventuality, however unlikely; for instance if the program asks a person's sex, you must make provision for M, F, MALE and FEMALE as well as idiotic or erroneous replies. Test the program on a non-computer person and issue the challenge that you will buy them a drink if they find a bug. You'll lose several drinks, but have a much better program for it. One tip on the PET is to use GET rather than INPUT — that will rid you of silly messages like EXTRA LOST* appearing. When you document a program consider that you are trying to make the program simpler to use and understand and easier to modify; again this will improve your documentation.

Programming in machine code will not only protect your program from easy cribbing, it will also make it faster and more efficient in terms of machine space; however your program will now be machine dependent — which is not much of a loss as BASIC is virtually machine dependent anyway. To summarise, there are four ways you can sell your program: 1. Market it yourself. 2. Sell it to a software supplier outright. 3. Sell it to a software house on a commission basis. 4. Publish it in a magazine such as PCW.
SW

Seeking To Justify

A very simple question which probably has no simple answer . . . how do I right-hand justify numbers that are printed in BASIC?
M. Carlyle, Coventry

One of BASIC's many failings is the formatting of output. Perhaps the language's most frustrating feature is that all numbers are printed in left-justified form; almost certainly this is not what we require. There are BASICs that have the instruction PRINT USING. This allows fairly comprehensive formatting, but unless you are able to buy this version for your machine (Research Machine's 380Z will accept it for example) you are stuck with the problem. Incidentally if you have a PET printer this allows formatting of printout, not the screen display.

I've seen several solutions to this problem, all of which use a subroutine to do the formatting for you. I've devised the following solution which should prove instructive to those of you who have never seen this technique used before:

```
DEF FNA(X)=1—LEN(STR$(X))
```

To implement this function and produce an output justified in the Yth position use PRINT TAB(Y+FNA(X));X

Probably of more use is a function that will allow you to align the decimal points; indeed it may also introduce a technique that's new to some of you:

```
DEF FNA(X)=-LEN(STR$(INT(X)))-ABS(X)(1)+(X=0)
```

Implementing this function is the same — to align the decimal points in the Yth position use PRINT TAB(Y+FNA(X));X.

This latter function may require tailoring because some versions of BASIC implement logic in different ways to others. The function will work unaltered if you get the answer —1 (minus one) to the statement PRINT (2=2). If you get the answer 1 (one) then you will have to use this function:

```
DEF FNA(X)=—LEN(STR$(INT(X)))+(ABS(X)(1)—(X=0)
```

I'm sure that you will get many hours of pleasure (frustration?) out of untangling this function so I'll not explain how or why it works. If you do have any problems you're welcome to write to me direct (enclosing a stamped envelope, please).
SW

Pros And Cons

I am a complete novice in the field of computers, but I am determined to master the art of programming. I attend a City & Guilds course and may go further and do an H.N.C. At present I have the use of a TRS-80 once a week, but would very much like my own microcomputer and would be prepared to pay up to £520. The machine would be used purely for learning purposes and so far I have considered the TRS-80, PET, and the SHARP MZ-80K. I would be grateful for a list of advantages and disadvantages to enable me to make a choice.
J. Allen, Dagenham

There are other machines that can be considered in a similar price bracket and although some of them are above your limit of £520 I'll still include them for the benefit of others. The Apple/ITT, Exidy Sorcerer, Texas TI-99/4, Video Genie, Luxor ABC80 spring to mind . . . all are under £1000.

Even though you say you would use the machine purely for learning purposes, I maintain that it's still a good idea to consider other factors from the outset; you don't want to have to change system through lack of foresight. For this reason it would be best to spend some time in discussion of your future plans. To begin with, going on to do an H.N.C. would certainly make it necessary to choose a machine that offers easy assembly language programming. Some other questions that you ought to have ready when you visit a supplier are price, expandability in both peripherals and extra memory (RAM); reliability; availability of software — both applications software and systems software; disc capacities; extra features like real-time clocks; audio output; and ease of assembler programming.

I telephoned a variety of suppliers all over the country asking questions similar to those listed above; first I echo their answers and second give my comments.

Sharp: a good machine for the hobbyist/beginner; has BASIC loaded from cassette; has a long guarantee; memory expansion is cheap; has audio output, and is more reliable than the PET. *Apple/ITT:* has high-resolution colour graphics; makes an ideal business machine; is very expandable; more expensive than the PET/Tandy. *PET:* best value for money; huge range of software available; BASIC in ROM is an advantage; reasonably good graphics; using Computhink discs it forms a very good business system. *Sorcerer:* has the advantage of ROM packs for other languages; BASIC not quite as good as other machines; high resolution graphics with user defined characters is a good feature. *TRS-80:* slightly cheaper than the PET; large dealer network (Tandy stores); fair amount of software available.

My View: As you can see, a lot of the above statements are contradictory; for example, ROM BASIC and cassette BASIC could both be claimed as being an advantage and indeed both views are true depending on how you look at it. Perhaps the best point made is the availability of software for both systems and applications (interpreters, compilers, operating systems are examples of systems software). There'll obviously be far more for machines like the PET/Tandy/Apple than there will be for the recent ones like the Sharp.

I'm afraid that the exact choice of machine will be largely up to you. Don't however, be too apprehensive as there's quite a large second-hand market for micros and I doubt there'll be any difficulty selling again in a year, should you decide that you want to change machines. I hope all this has helped rather than confused you!
SW

Speaking Recursively

I saw in a computer exam paper the following statement: "Three people were having an argument about programming the factorial function; one said 'I propose to use a loop to evaluate it' the second person said 'I will use a look-up table approach', the third said 'I propose to use a recursive technique'." Now I can understand the first two methods but what on earth is a "recursive technique"?
P. McDonald, Newcastle

First I will quickly define what is meant by a "factorial" in case this causes problems. Factorial 3 = 3 x 2 x 1; Factorial 5 = 5 x 4 x 3 x 2 x 1. In general, factorial n = n(n—1) (n—2) (n—3) . . . . x 3 x 2 x 1. Also factorial 0=1. Factorials are only defined for positive integers and the factorial sign is a ! (exclamation mark). For example 4!=24.

Recursion — In plain language recursion is a method of definition in which the word/object being defined is used within the definition itself. Consider the word "descendant" and look at these two definitions:
1. A descendant of a person is a son or daughter of the person, or a descendant of a son or daughter.
2. A descendant of a person is a son or daughter of the person, or a grandson or granddaughter of the person etc.

Using definition 1 *all* the descendants of a person are simply and precisely defined and accounted for. In definition 2 the description is both lengthier and less succinct. We could have defined "descendant" as "ancestor" and defined "ancestor" as "descendant" and we would have had two mutually recursive definitions but a definition from which there is no escape.

In mathematics or computing we sometimes see a function defined in terms of itself; this appears to be paradoxical because without knowing what a function is we can still work it out — even when defined in terms of itself. A recursive process is in effect just a loop. Here is a non mathematical example:

In Fortran/Algol/Pascal variable names may be any collection of letters and digits as long as they start with a letter. Examples are A123, HELLO, BET5H, D6654L and G — are all legal variable names. We may use the recursive definition to define a variable as follows: *(are you sitting down? —Ed)*
⟨variable⟩::=⟨letter⟩:⟨variable⟩⟨letter⟩:⟨variable⟩⟨digit⟩.

This is known as Backus-Naur notation and it's designed to specify the syntax of a language. The above definition reads: "A variable is defined as (a letter) or (a variable followed by a letter) or (a variable followed by a digit). Thus all variables are defined. Follow the loop through as follows: T3R is a variable if it is a letter . . . it is not: it is a variable if it is a variable followed by a letter, well R is a letter, and provided that T3 is a variable then T3R is: now is T3 a variable? well look back at the definition — is it a letter followed by a digit? Yes. The Then T3 is a variable, and so too must T3R.

To read the above sentence take careful note of my punctuation, and provided there are no transcription errors in going to press then all should be clear!

Back now to factorials, we can define them recursively as:—x!=x.(x—1)!

Check it out. Now, provided that we know a value to stop the recursion, i.e. 0!=1, we can evaluate any positive integer factorial.

Unfortunately some languages don't allow recursive functions; some

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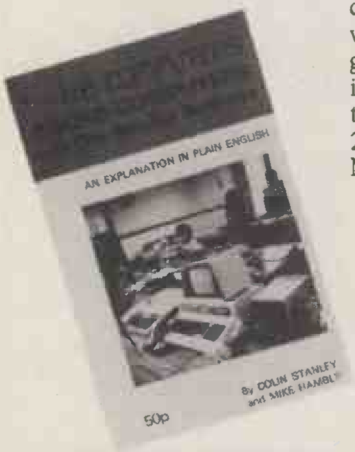
Just to let you know that the famous HB "Micro Computers and the Smaller Business" booklet has just been reprinted to meet the continuing demand. You will find this a well written "plain English" explanation of microcomputer applications. Questions answered are "What is a micro computer?" "How does it work?" "What happens if it goes wrong?". Anyone interested should send 60p to HB Computers Ltd., 22 Newland Street, Kettering, Northamptonshire.



CRA COMPUTER RETAILERS ASSOCIATION

A PLACE FOR CHIPS!

More than one hundred businessmen attended a one day exhibition, which was held by HB Computers at the George Hotel, Kettering, Northamptonshire on February 28th. This proved a great success with the invited businessmen who saw a wide range of micro computers in action. HB are planning further exhibitions in the future and at the moment several venues are being considered. This proves most definitely there is a 'Place for Chips' in the smaller business of today.

ET photograph

HB Get In On The ACT

HB have been appointed Regional Distributors for the recently launched ACT 800 series, which made its debut at the Kettering exhibition. The ACT 800 series is one of the second generation of microcomputers, a compact, yet very powerful and complex computer. The model has great versatility and has a great ability to handle sales, purchase ledger, integrated invoicing and payroll. ACT Systems are available from £3,950.

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BREAKOUT	£5.00	SUPER SIMON	£5.00
MASTERMIND	£5.00	MIZ-MAZE	£8.00
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versions of BASIC do but you will need the ability to define a multiple line function — which is something that not many BASICs allow. Here are two functions for factorial, the first is not recursive and the second is; they were both written for Research Machine's 380Z XDB BASIC and will probably need changing slightly, even if you have multi-line defined functions. FNEND V returns the value V as the result of the function.

Non recursive function

```
DEF FNB(X)
  V=1
    FOR J—1 TO X
     V=V*J
    NEXT J
FNEND V
```

Recursive function

```
DEF FNF(X)
  IF X=O THEN 50
     V=X*FNF(X—1)
     GOTO 60
50 V=1
60 FNEND V
```

I hope this has helped... on the other hand, maybe you wish you hadn't asked!
SW

Cramming The PET

I am currently attempting to speed up some of my programs by writing some of the subroutines in machine code. The machine in question is a 32K PET. I would like to know if I can put a couple of RAMs into the two spare sockets inside the PET — and if so what RAMs to use.
R.H.Jones, East Tilbury

The spare sockets inside your PET are intended for additional Read Only Memories (ROMs), such as the "Toolkit", and the security ROMs for Commodore software... RAMs will not fit.

If you have not used up every single byte of your 32K of memory then you can bring in some of this. There are two normal ways of going about it:
1. If the routines are short then they can be loaded into the second cassette buffer. This is an area of 192 bytes (starting at location 826) reserved for data transfer between the PET and a second cassette drive. If this isn't going to be used, then BASIC will not cause any disturbance. The simplest way to load a machine code program into the buffer is to create a set of DATA statements; read these and POKE the values into the buffer locations. If the first cassette is not going to be used while the program is running, its buffer could be filled with machine code. The BASIC INPUT buffer is also available at program execution time.
2. An alternative for larger programs is to use the top end of the memory; an area can be partitioned off which BASIC will then avoid. When the PET is switched on, it searches through the memory to find the highest location it can use — in your case 32K if everything is working fine. It then sets pointers to this address so that BASIC will store strings, working downwards from that address. If the pointers are reset to a lower value then the PET is fooled into thinking that less memory is available. The pointers concerned are at the following locations:

48,49 start of strings
50,51 top of string storage
52,53 highest memory address

For example POKEing 49 and 51 and 53 with 88 will reserve an area of 10240 byte bytes for machine code programs, or complex data structures.

These machine code programs may be built up using proprietory assemblers — which are generally fairly good, if rather slow. The programs can then be saved as DATA statements, or in the absolute locations using TIM.

If you are determined to have some more memory then the only alternative is to make up a printed circuit board which will link to the memory expansion connector. In the standard PET 12K of memory space is unallocated, starting at location AOOOH, and the higher address lines are decoded and brought to the expansion connector as 4K block selects. A memory board would be a relatively simple affair consisting of an array of 4K or 16K, static or dynamic memory chips. This should be fairly easy to construct, although not a recommended project for a beginner.

If you are really adventurous and confident in your software you can copy your machine code routines on to a Programmable Read Only Memory (PROM) which *will* plug into the spare sockets. This will become a permanent feature, and you *could* make some money!
Mark Wratten

Baffled

I have been reading PCW for some time now. Unfortunately I find most of the articles unreadable, the reason being I don't understand much of what is being said (what in Pascal's name is an S100 bus?) So

Continued on page 111

10 PART PASCAL SERIES

THE COMPLETE PASCAL

BY SUE EISENBACH AND CHRIS SADLER

CHAPTER 10: THE FINISHING TOUCHES

This chapter completes the description of the main features of PASCAL and provides some quick reference material for program developers.

We started the series by looking at programming languages in evolutionary terms — from low level languages (which are close to the machine) to high level languages (which are close to the programmer's mode of thought); from highly specialised languages constructed for particular machines or applications to general purpose languages designed to adapt to a variety of environments; and from languages offering easy access for the beginner to others that seem to promote the idea of a programmer as an esoteric specialist. In this context, PASCAL was seen to be high level, general purpose and ideal for teaching — it being a member of the "structured" family of languages.

From this description one would expect PASCAL programs to be readable in the sense that variables can be given sensible names, that verbs give some indication of the actions they perform and that the program as a whole flows in a logical way; it should be easy to see what is going on at any given point. These aspects are implied by the words "high-level" and "structured" although they also require some effort and discipline on the part of the programmer who is trying for these ideals. At the same time, the term "general purpose" implies that the full range of programming features is available to the experienced programmer whilst the term "teaching" means not only that the language will encourage the beginner to adopt the structured programming strategies but also that simple working programs should be obtainable from a small subset of the language. In a language like FORTRAN, mathematical statements can be written out almost "off the page" but the input/output instructions are so complex that the simplest program will often frustrate the beginner. BASIC on the other hand was designed for beginners and so is much stronger in this way.

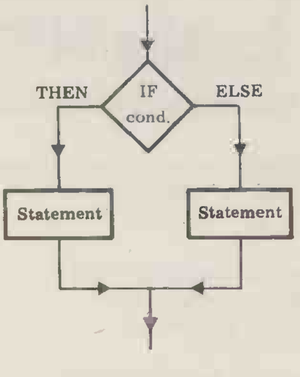
Of course all this attention to making life easier for the programmer imposes great strains on the computer system and some high level structured languages are justifiably infamous for the "overhead" which they impose in terms of the amount of memory required, the execution times possible and the amount of secondary activity (e.g. compilation etc.) required to deliver the source code into executable form. Anyone used to these languages and thinking of switching to PASCAL, will probably regret the lack of some favourite feature. Among the features missing in the definition of Standard PASCAL are dynamic allocation of arrays (useful for general purpose matrix handling procedures), random access files,concurrent control structures (to allow two or more processes to be executed simultaneously), the capability to attach a set of operators to newly defined data structures, restrictions on placement of declarations and the absence of a loop with the exit in the middle. Probably any scientific programmer would do without variant records in order to get dynamic arrays, while the commercial programmer is unlikely to think of PASCAL as a serious alternative if it doesn't have random access files.

At the cost of these more unusual general-purpose features and with a certain spirit of compromise, PASCAL succeeds in being reasonably frugal in terms of overheads when compared with other structured languages. To some mainframe programmers these concessions place PASCAL in the lightweight category in the language stakes but it is just these features which make PASCAL so suitable for implementation on microcomputers and thus worthy of our consideration here.

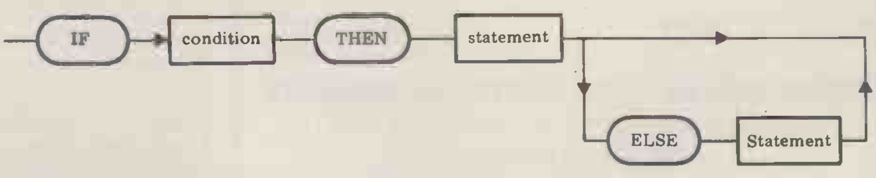
The major method employed by the designers of PASCAL to achieve this machine efficiency has been through a very tightly written compiler; throughout this series we have been striving to help the reader develop an appreciation for (and relationship with) this compiler. In order to help implementers produce standard compilers rapidly, Wirth's team wrote and made freely available three compilers (written mostly in PASCAL) for PASCAL. The first is an officially recognized subset of PASCAL called PASCAL S, the second is for standard PASCAL while the third is for an extended version of the language. The standard compiler generates a pseudo machine code called P-code which can be translated into machine code with much less effort than PASCAL.

Wirth's syntax diagrams are a visual representation of the manner in which a compiler tackles source code, and can thus be used as an aid to minimize syntactic error. Therefore the syntax diagram in Box 1 is a means of expressing what the compiler expects to see and therefore reflects the way code is actually laid out in the machine at compile time. In contrast the flow diagram in Box 2 is a way of showing how program control will move (i.e. which code will be executed) at run time. PASCAL usually allows for the production of sufficiently descriptive source code as to make a visual representation of the program flow unnecessary.

Box 2



Box 1



One device that Wirth adopts to reduce overheads is the "help" that the compiler requires of the user. Thus the declaration of all the variable names and data types before the action part of any procedure begins makes it much easier for the compiler to allocate the working space for that procedure and at the same time makes a clear distinction between the data and the algorithmic portions of the procedure. Similarly, the existence of reserved words cuts the work of the compiler considerably at the expense of a small degree of flexibility in the selection of variable names.

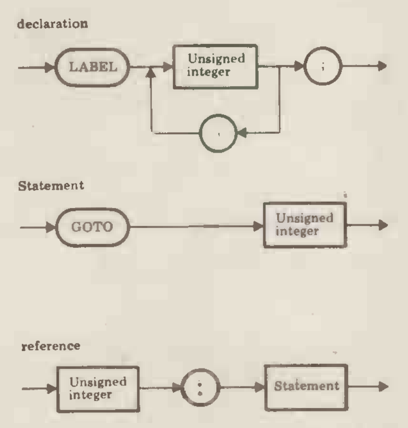
The GOTO Statement

A GOTO statement is an instruction which transfers controls from the current position to another specified point in the program. This is a simple device which is essential in many programming languages although it does tend to break up the flow of control and make it more difficult to follow. Since structured languages have been designed to provide readable source code and since too they are so righly endowed with smooth methods of redirecting the flow of control (using loops and branches), the use of the GOTO statement is not generally necessary and is never encouraged. Nevertheless, circumstances can occur, particularly in dealing with error conditions, where the GOTO statement is the most effective alternative and so it is presented here for the sake of completeness.

In PASCAL the GOTO reserved word is followed by an unsigned integer called a label. On execution, control will shift to the statement to which the same unsigned integer refers (see Box 3). Of course, each label used must be declared in the declaration part of the procedure so that the compiler can cope with the sudden shifts in control. Each label can only be used once in the block in which it is declared although it can be referenced by any number of GOTO statements from anywhere within the block. If one procedure is nested within another it is incorrect to jump into the inside procedure, since it takes a procedure call to set up the stack frame and pass parameters etc. It is however possible to jump out of the inside procedure although it is bad practice to leave a procedure from two different points; the exiting GOTO statement should be as close to the procedure END as possible.

In fact UCSD does not allow any movement between procedures via the GOTO statement at all, and there is even a switch to disable the statement completely. . . i.e. the compiler will flag a GOTO as an error. This is done to discourage student users from producing inadequately planned programs where the GOTO is used to escape from the deadends into which they program themselves.

Box 3 GOTO Statement declaration



Box 4

```
PROGRAM READINTEGER ;
CONST INTSIZE = 5 ;
TYPE SHORTSTRING = ARRAY [0..9] OF CHAR ;
     DIGIT = 0..9 ;
VAR TEMPNO, NUMBAS : SHORTSTRING ;
    I : DIGIT ;
    NEWNUM : -1..9 ;
    NUMBER : INTEGER ;
    WRONG : BOOLEAN ;
PROCEDURE INITIALISE ;
VAR I : DIGIT ;
    ICHR : '0'..'9' ;
BEGIN
   ICHR := '0' ;
   FOR I := 0 TO 9 DO
   BEGIN
      NUMBAS[I] := ICHR ;
      TEMPNO[I] := ' ' ;
      IF ICHR <> '9' THEN ICHR := SUCC(ICHR)
   END
END ; {INITIALISE}
PROCEDURE GETNUMBA ;
BEGIN
   WRITE ('NOW TYPE IN YOUR
                    INTEGER PLEASE--> ') ;
   I := 0 ;
   REPEAT
      READ(TEMPNO[I]) ;
      I := I + 1
   UNTIL EOLN OR (I=INTSIZE)
END ; {GETNUMBA}
PROCEDURE TESTDIGIT ;
VAR J : DIGIT ;
BEGIN
   FOR J := 0 TO 9 DO
      IF TEMPNO[I] = NUMBAS[J]
      THEN NEWNUM := J
END ; {TESTDIGIT}
BEGIN {MAIN PROGRAM}
   INITIALISE ;
   REPEAT
      NUMBER := 0 ;
      WRONG := FALSE ;
      GETNUMBA ;
      I := 0 ;
      WHILE TEMPNO[I] <> ' ' DO
      BEGIN
         NEWNUM := -1 ;
         TESTDIGIT ;
         IF NEWNUM = -1
         THEN WRONG := TRUE
         ELSE NUMBER := 10*NUMBER + NEWNUM ;
         I := I + 1
      END ;
      IF WRONG THEN WRITELN ('TRY AGAIN')
   UNTIL NOT WRONG
END.
```

Procedures As Parameters

PASCAL provides one facility which can be extremely useful to programmers who may need to manipulate mathematical functions. Instead of passing an array of values to a procedure which is to perform some particular operation on this data, PASCAL allows the use of a function identifier as a value parameter in the argument list. This is clearly more efficient provided that the results of the evaluation of the function in question are not required at other points in the program.

The best illustration of this technique is probably a graph plotting routine which plots out a set of y versus x values. One method of achieving this is for one process to pass an array of x and y values to the routine which then simply plots them out. Consider, however the procedure call

```
PROCEDURE PLOTGRAPH
          (FUNCTION FUNC :
          REAL ; XDOM, XMIN,
          XORIGIN, YORIGIN :
          REAL ; POINTS :
          INTEGER) ;
```

for plotting Y=FUNC(X) versus X over the domain XMIN to XMIN+XDOM with the axes crossing at (XORIGIN, YORIGIN) and with checks made for asymptotes etc. Then the calls

```
PLOTGRAPH(SIN,1,0,0,0,100)      and
PLOTGRAPH (BESSELJ1,10,0,0,0,50)
```

will produce the corresponding graphs (provided the Bessel function is defined).

Finale

This section concludes the PASCAL series. Below is a brief summary of the topics covered in each chapter.

Chapter 1: Why PASCAL? *Chapter 2:* Fundamentals: Action and Data. *Chapter 3:* Control structures 1: Loops. *Chapter 4:* Data Structures 1: Simple Data Types, Arrays and Sets. *Chapter 5;* Control Structures 2: Branches. (Please note the working version of Program READINTEGER in Box 4. The original version was regrettably "gremlined"). *Chapter 6:* Data Structures 2: Records and Files. *Chapter 7:* Procedures and Functions: String Handling. *Chapter 8:* Top Down Design: Text formatter. *Chapter 9:* Advanced Programming Techniques: Recursion, Pointer Types and Variant Records. *Chapter 10:* The Finishing Touches: Summary.

It would be arrogant to pretend that we have not learned a great deal about PASCAL in preparing our ideas and programs for publication. We would like to wish our readers happy programming; may all their loops terminate! The chapter concludes with a super Look Up Table.

Standard Identifiers

Constants

TRUE	FALSE

Data Types

INTEGER	REAL
BOOLEAN	CHAR
TEXT	

Files

INPUT	OUTPUT

Reserved Words

AND	ARRAY	BEGIN
CASE	CONST	DIV
DO	DOWNTO	ELSE
END	FILE	FOR
FORWARD	FUNCTION	GOTO
IF	IN	LABEL
MOD	NIL	NOT
OF	OR	PACKED
PROCEDURE	PROGRAM	RECORD
REPEAT	SET	THEN
TO	TYPE	UNTIL
VAR	WHILE	WITH

Standard Procedures

Arithmetic Functions

ABS (x)	ARCTAN (x)
COS (x)	EXP (x)
LN (x)	SIN (x)
SQR (x)	SQRT (x)

Boolean Functions

EOF (f)	EOLN (f)
ODD (x)	

Data Manipulation

CHR (x)	ORD (x)
PRED (x)	ROUND (x)
SUCC (x)	TRUNC (x)

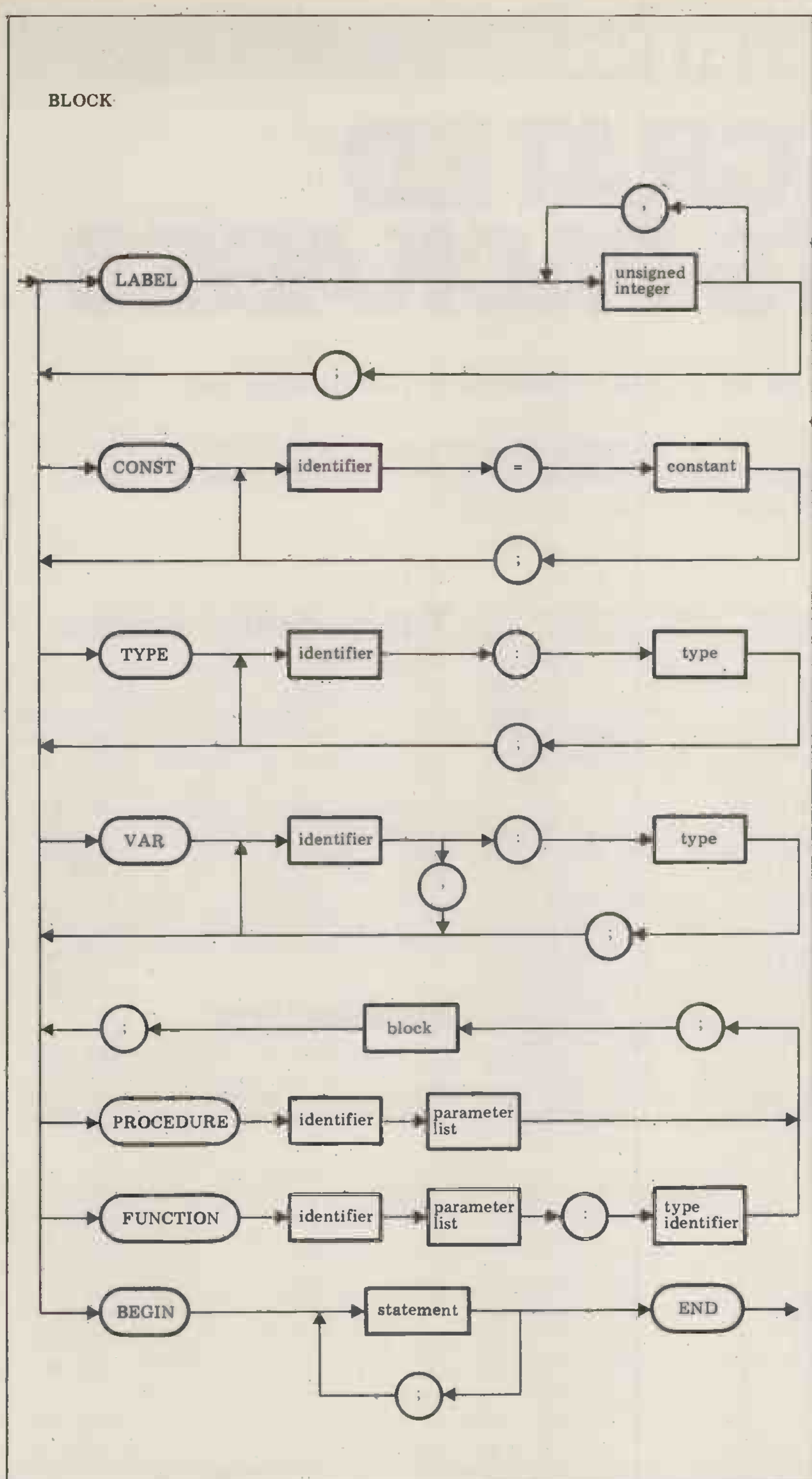
File Handling

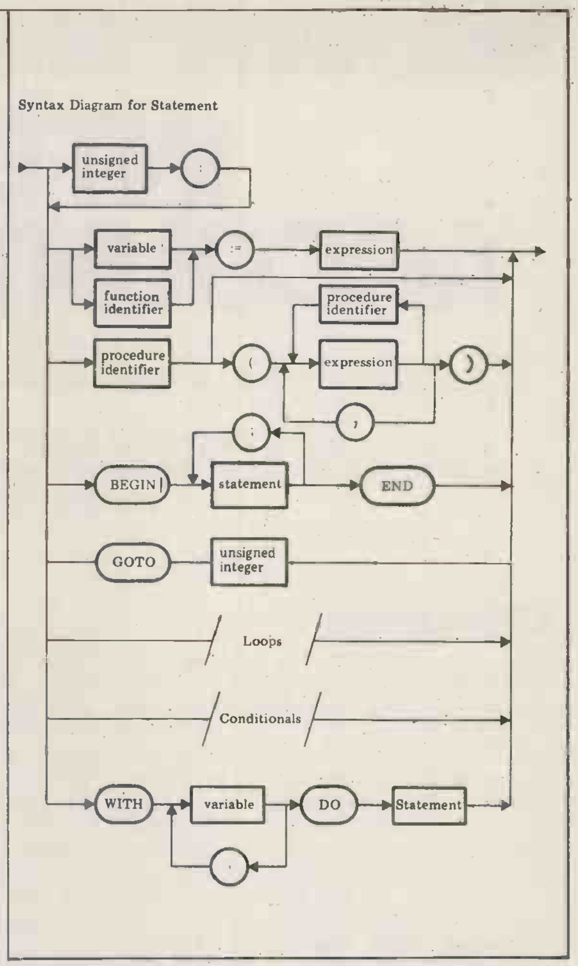
GET (f)	PUT (f)
RESET (f)	REWRITE (f)
READ (f,x)	READLN (f,x)
WRITE (f,x)	WRITELN (f,x)

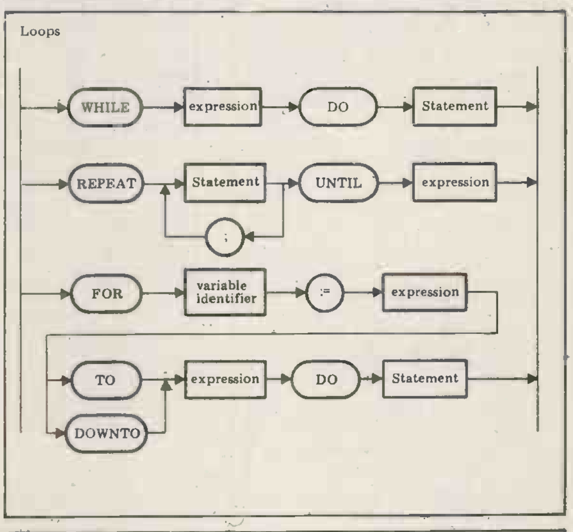
Others

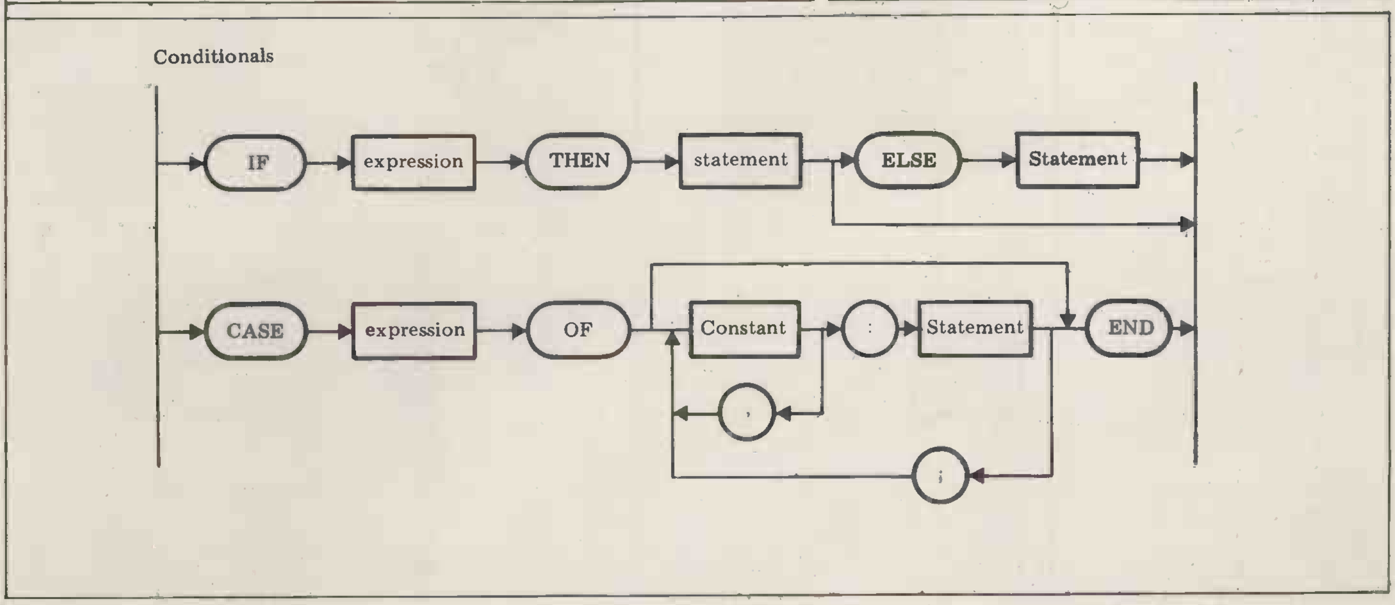
NEW (x)	DISPOSE (x)
PACK	UNPACK

f = filename, x = identifier


BLOCK
LABEL
unsigned integer
,
;
CONST
identifier
=
constant
;
TYPE
identifier
:
type
;
VAR
identifier
,
:
type
;
;
block
;
PROCEDURE
identifier
parameter list
FUNCTION
identifier
parameter list
:
type identifier
BEGIN
statement
;
END


Syntax Diagram for Statement
unsigned integer
:
variable
function identifier
:=
expression
procedure identifier
procedure identifier
(
expression
,
)
BEGIN
statement
;
END
GOTO
unsigned integer
Loops
Conditionals
WITH
variable
,
DO
Statement


Loops
WHILE
expression
DO
Statement
REPEAT
Statement
;
UNTIL
expression
FOR
variable identifier
:=
expression
TO
DOWNTO
expression
DO
Statement


Conditionals
IF
expression
THEN
statement
ELSE
Statement
CASE
expression
OF
Constant
,
:
Statement
;
END

INTEGRATED ACCOUNTS PACKAGES

Mike Knight of Mike Rose Micros selects from available documentation to present this month's report.

Every year almost without fail most small business accounting systems meet their Waterloo — The Auditor. This month we are going to be looking at integrated accounts systems in the hope of finding a fairly painless answer to this thorny annual.

Objectives

Both the objectives and functional requirements of an integrated accounts package will vary according to the bias of your business — it's a case of "if the cap fits, wear it". If, for instance, you are a manufacturer with a limited product range and a small customer list but are supplied by a large number of sub-contractors or manufacturers, the financial control of your business will rest primarily on the ability to control your stock and purchase ledger. If, on the other hand you have a business which is of the agency type — where you are likely to have a large number of customers with a small supplier list and limited, if any, stock holding capability — then your main interest will probably be in the control of your sales and nominal ledger.

Now having stated the obvious, i.e. that businesses differ, what else can vary our choice of integrated package? Well, one consideration is the implementation timescale. Many companies don't want to install a complete system all in one go; they would prefer to implement one business function at a time.

The concern therefore is not to completely satisfy the needs of the priority function but rather to ensure that when all the proposed functions have been computerised, there are no loose ends or unexpected additional workloads. You may therefore choose an integrated package, or part of one, simply because the final system will meet the majority of your needs. This may be despite the fact that the needs of each individual function could have been better served by a stand alone package.

Tasks and volumes

Bearing this in mind I've simplified the grid this month to allow you to see with ease which packages fulfil the functions most necessary to your business. With the exception of Nominal Ledger the other aspects have been reviewed in previous months. (Stock Control — December 1979, Sales Ledger — January 1980, Purchase Ledger — February 1980, and Payroll — March 1980.) I've therefore, included a fairly extensive checklist for Nominal Ledger while briefly describing the other functions.

Evaluations

INTEGRATED INVOICING SYSTEM

This system is available from Newtons Laboratories, London (01-870 4248)

TASKS	Integrated Invoicing System	Monitor	Serendipity	Snip	M.C.B.S.	G.L.A.S.	Business Program Version 4
Sales Ledger	*	*	*	*	*	*	*
Print Invoices						*	*
Print Statements	*	*	*	*	*	*	*
VAT analysis	*	*	*	*	*	*	*
Purchase Ledger	*		*	*	*	*	*
Print Cheques	*		*				
VAT analysis	*		*	*	*	*	*
Stock Control	*			*	*		*
Payroll					*		*
Nominal Ledger	*	*	*	*	*	*	*
Journal Vouchers			*	*	*	*	*
Link to Sales Ledger	*	*	*	*	*	*	*
Link to Purchase Ledger	*		*	*	*	*	*
Profit & Loss	*		*	*	*	*	*
Trial Balance	*	*	*	*	*	*	
Final Accounts	*	*	*	*	*	*	*
Enquiries	*	*	*	*	*	*	*
Analysis Capability	*	*	*	*	*	*	*
VOLUMES							
No. of Sales Accounts	1000	1000	200	200	500	200	999
No. of Purchase Accounts	2000		200	100	500	500	999
No. of Stock Items	1000+			350	2500		1000
No. of Employees					400		200
No. of Nominal Headings	50+	200	100	150	400	300	
COSTS							
Package	£ 4000	300	1005	950		1100	575
Machine	£ 8500	2160	3500	3600		2800	2200
Total	£ 12500	2460	4505	4550	9875	3900	2775

who wrote the programs, Microsolve, and Leatherhead Business Systems. The cost is split over the system — Order Processing/Stock Control — £1600, Sales Ledger — £800, Purchase Ledger — £800, Nominal Ledger — £800 and the system is designed to run on a 64K Alpha Micro with 2.4Mbyte disc storage and a printer at an approximate cost of £8500. This minimum configuration can be expanded up to 768K at a cost of around £40000. Newton Laboratories provide full installation services and training and are very willing to "hold their customers hands!" if necessary. They will make a quick application feasibility study after installation for no charge and say that their software is guaranteed for an unlimited period.

The system is supplied on disc and comes complete with fully comprehensive manuals, but I feel that training would be necessary as these appear a little large for the digestion. There are over 200 programs in the system, written in BASIC and assembler. Newtons Laboratories will provide customisation but at a cost — they estimate that customisation already undertaken has cost, on average, between £1000 — £1500. The system has been available since November last year and there are about 8 users at present.

MONITOR

This open item Sales Ledger and Nominal Analysis System is available from Bristol Software Factory (0272 23430) and dealers throughout the country. It's designed to run on a 32K PET with disc drive and printer costing approximately £2160. The package costs £300 and is supplied with an instruction manual which although not extensive can be easily understood by the layman. Full instructions are also contained within the program with frequent prompts for the user. The package has two versions for alternative printer configurations.

Bristol Software Factory will provide the normal backup for customers whose files are corrupted or have any bugs but training and installation services are provided by the dealers and depend on local circumstances. Some personalisation is included in the price and Bristol Software Factory will customise if required. The package has been available for only a short time and there are estimated to be around 100 users.

SERENDIPITY

I reviewed the Purchase Ledger section of this package in February and must correct some omissions and errors that crept in: 1. The package produces Remittance Advices but not Statements; 2. The package prints a suppliers list and VAT audit report; 3. The system prints a comprehensive payment list; 4. It allows enquiries on any invoices as yet unpaid, and 5. The system is open item.

The complete package is available from Great Northern Computer Services, Leeds or from any of their countrywide dealers, including Basic Computing, Keighley (0535 65094). It's supplied in three separately available parts: Sales Ledger — £315, Purchase Ledger — £315 and Nominal Ledger — £375; if the package is bought complete there is a small discount on these prices. Each part is supplied on disc and comes with user's manual and operating system; further documentation can be supplied on request. Installation is available at £110 per day as is training for an additional cost. The programs are written in CBASIC2 and are menu driven. The package is designed to run on a 48K processor with twin disc drives, VDU and printer with either CP/M or CDOS operating system at a cost of around £3500. Great Northern also have a Professional Client Billing package which can be used instead of the Sales Ledger pack, giving comprehensive coverage for solicitors etc. This costs £495 and is fully integrated with the Nominal and Purchase Ledger packs (see PCW February 1980).

SNIP

This package, which is available from Benchmark Computer Systems, St. Austell (0726 6100), was first reviewed in the Purchase Ledger "Systems" in February of this year. The package costs £950 and there have been no significant changes in any of the details with the exception that the system is now available for use on the Cromemco Z-2H 11Mbyte hard disc; full details can be obtained from Benchmark direct.

MCBS

The Micropower Complete Business System can be obtained exclusively from Micropower Ltd., Basingstoke (0256 54121). This is a complete system inclusive of hardware and software and is available on both floppy and hard disc. The floppy disc based system consists of VDU, twin floppy discs and matrix printer contained in a desk. With full software, including Order Processing and Payroll, it costs £9875 and a similar system based on hard disc is priced at £15995. Micropower includes all manuals, training and installation costs in these prices. Hardware maintenance is provided on a contracted out basis and software maintenance is provided at a cost of approximately £150 p.a.

Micropower offers full back-up and is always happy to answer any telephone queries. All users are informed of any updates and those with a software maintenance contract are updated free of charge. Some customisation is included in the price i.e. allowing for a company to use its present stationery. Any additional files or major changes will be effected, but at a cost. There are six main programs in the system which are written in Cobol and menu driven.

G.L.A.S.

I first reviewed this system in the Sales Ledger "Systems" in January, and firstly must own up to a slip or two. I omitted to mark on the grid that the Sales Ledger does contain VAT analysis and a Sales Daybook facility — I stand corrected!

The system is now available in 4 versions: 1. The basic system consisting of Sales, Purchase and Nominal Ledgers — costing £1000; 2. The basic system with the addition of Invoicing at £1100; 3. The basic system plus Stock and Order Control designed with the wholesaler in mind, at between £2000 and £2500 (depending on the amount of customisation required); and, lastly, 4. The basic system and Stock Control for retailers at £1800-£2000, again depending on the amount of customisation.

The system can be obtained from Logma Systems Design of Bolton (0204 389854) or their dealers in Bolton, Stockport, Liverpool, Wigan and London — just phone Logma for details. They've recently re-vamped the documentation and feel that it is now greatly improved. The price of the basic hardware has risen to £2800 but apart from these changes all other details are the same. (see PCW January 1980).

BUSINESS PROGRAM VERSION 4

This package can be obtained from G. W. Computers Ltd, London (01-636 8210) and its small number of dealers. The package is written in BASIC and supplied on disc. Included is a 30 page manual which at present is being updated. It's designed to run on a 32K floppy disc system with printer, at an approximate cost of £2200. G.W. Computers will provide on site installation services for two days at no extra charge and will give initial training during this time. They offer a 90 day warranty and will replace any faulty disc in this time. G.W. Computers will make minor changes to allow for customisation, at no extra charge. The package has been available for 2 years and there are 170 users spread over Britain, America and the Continent.

COMAC

Unfortunately I don't have enough information to include this package in the grid, but here are the details available: COMAC is said to be an accounting software suite of programs produced in one package for the processing of everyday business transactions on the TRS-80. It will give "auditor ready" double entry printing of cash book, private ledger and ordinary ledger — from incomplete records through to Profit and Loss accounts and/or Balance Sheets. This package is available from T & V Johnson, Camberley (0276 62506) and costs £75.

Other packages, known but not evaluated, are available from:

H. B. Computers, (0536 83922)
Computastore, (061-832 4761)
ACT, (021-455 5341)
Byte Shop, (0480 215005)
Graffcom, (01-734 8862)
Tridata, (021-622 1754)
Computer Services, (021-382 4171)
Commodore, (01-388 5702)
Intelligent Artifacts Ltd, (0220 20680)
Fully Integrated Business Systems Ltd. (021-382 8414)
Ball Computers, (0228 44661)

CHECKOUT

EXATRON STRINGY FLOPPY

Thomas Murphy gives his personal impressions of a device that looks set to radicalize the concept of information storage for the small computer enthusiast.

Whilst waiting for my SWTPC 6800 to load 8K BASIC via its 300 baud cassette interface (some 14+ minutes worth), I happened to browse through an American computer magazine and spotted an advertisement by the Exatron Corporation for their Stringy Floppy; it was claimed that the combination gave: (a) economy of tape, with (b) the speed and reliability of discs. Apparently, this system reads and writes at 14,400 bits per second, with a typical error rate of 1 in 100,000,000 bits. They also claim an average life of over 3500 hours for the transport mechanism, and a tape wafer life of 2500 passes.

My BASIC was barely half loaded, so I filled in the time by writing to them at: 3557 Ryder Street, Santa Clara, California 95051, USA. I explained that I had a UK credit card which bore the "Mastercharge" symbol, and was VERY interested in their system for my SWTPC computer. Less than two weeks later a large envelope arrived, containing *total* system information and advising that payment could be made by the indicated method.

Could all the claims contained within this information package be true at such an attractive price? Well, one way to find out was to place an order — which I duly did — for one drive mechanism and a controller card, with TSC BASIC as an extra piece of software. I felt I couldn't lose. With a 30 day money back guarantee, all it would cost would be postage and packing charges should the equipment not perform as advertised.

Five weeks later, the parcel arrived, containing all I had ordered, plus a couple of spare tape wafers, and two guaranteed system master wafers.

I settled into my favourite armchair to study the large owners' manual (which, amongst other things, tells you that Exatron's logo, of an E inside another E, stands for excellence in electronics). It proved very comprehensive, and surprise number one, the systems wafer contains SWTPC's Disc BASIC — free — as well as the ordered TSC BASIC.

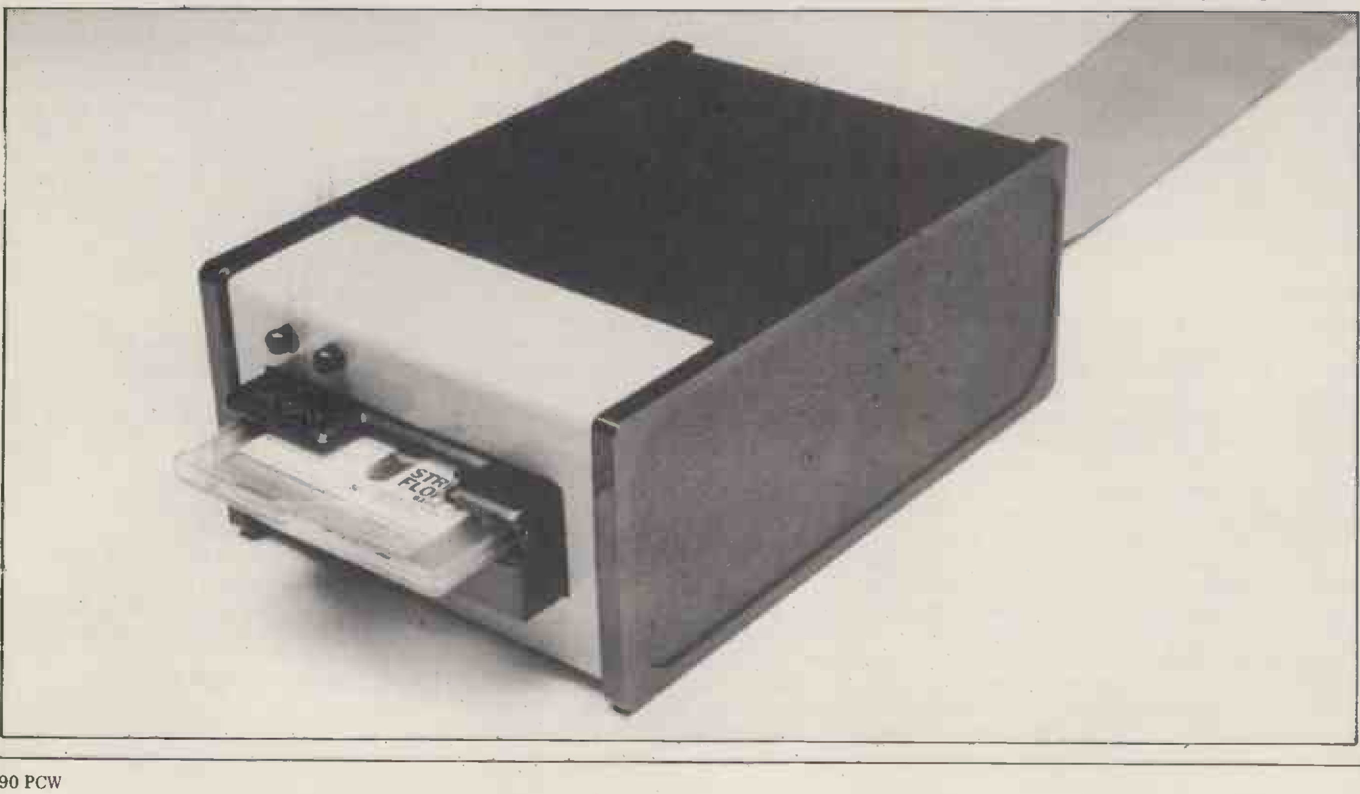
The manual also contains a system description, system requirements, installation and checkout procedure (which includes trouble-shooting procedures for both the controller and transport), circuit and block diagrams of both controller and transport electronics, a general guide to system operation, and a detailed overview of each utility program on the systems wafer.

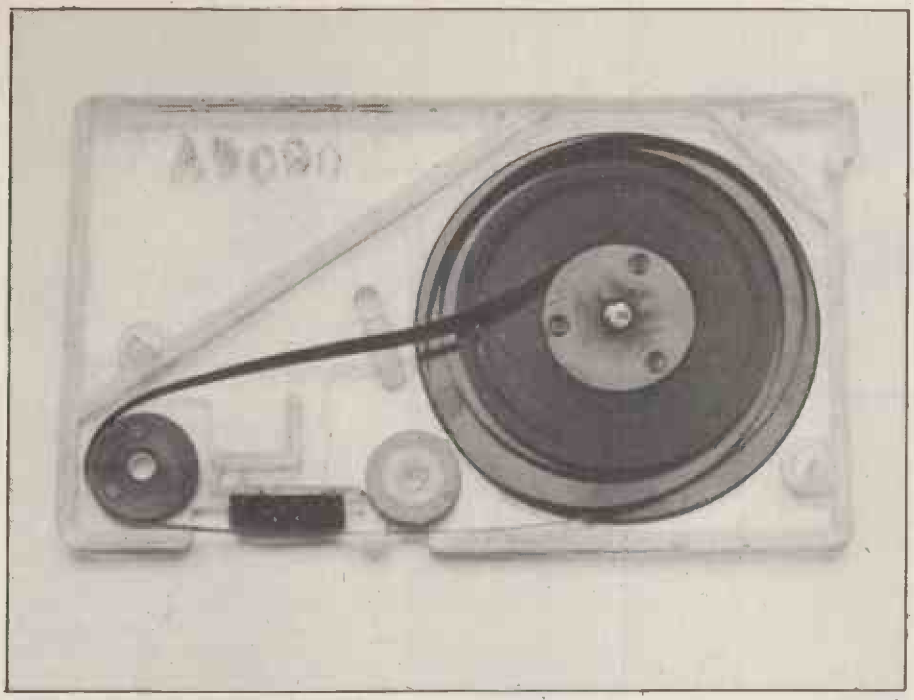
These programs are: APPEND, ASSIGN, CATALOGUE, COPY, DATE, DELETE, LIST, NEWTAPE, PRINT (which causes the file to be output to the printer on PORT 7 instead of the VDU), RENAME, SAVE, SAVE LOW, TTYSET (with which one can change the input and output parameters to the terminal), and VERSION. There is no LOAD, as you call a file by giving file details — e.g. 1. STARTREK.HEX will load STARTREK from drive number one.

The manual also contains an ERROR LIST for the system, plus the manufacturer's User's Manual for SWTPC Disc BASIC, plus any optional software ordered.

After reading the manual twice, I installed the controller on the motherboard, plugged in the transport, switched on and typed Z which on my monitor executes a jump to $C000. The transport started running, stopped, and instead of outputting "Simplex —68 Version X.X" as called for in the manual, my micro returned to its reset state. Oh well, back to the drawing board. . . I re-read the manual. Finding there was nothing that I had done wrongly, I typed Z again. Same result, back to monitor.

OK, call up the heavy artillery . . . out with the oscilloscope. I went through the troubleshooting part of the manual with probe in hand. Everything checked





Facing page: The stringy floppy drive. Above: A wafer. Below: Inside the wafer, showing the tape being drawn from the centre of the spool and rewound on the outside.

out, so I should have had a plus and minus 25% speed variation on the drive. I tried again, but with the same result.

Sending it back seemed the only solution — and in the course of unplugging the drive, the ribbon cable came away instead of the plug! In my excitement (it was 3 am) I think I reconnected it back to front, because on the next try, although the drive motor came on, it wouldn't even switch off and go back to monitor.

I parcelled it all up and returned it for inspection/repair with a letter explaining how I thought I had abused it. I also ordered the second drive unit at the same time; now I had the owners' manual I could see the versatility offered by having two drives instead of one.

The manual says that Exatron will repair "within 30 days", so allowing for airmail both ways, I settled back for about an eight week wait.

Surprise number two: 23 days later my system reappeared, complete with the second drive as ordered, a couple more spare wafers, and yet another very pleasant surprise — the repair charge was NIL. That's right, absolutely NO CHARGE, although I know there were some chips burnt as a result of my tiredness (carelessness).

As I now knew the owners' manual almost by heart, I installed the system in the micro, connected up, inserted a wafer in each drive, and typed Z. The drives switched on consecutively, and up came "SIMPLEX — 68 Version 1.0" on the VDU.

It took a few moments of gloating to realise that I had around 80K (well, two identical lots of 40K) of software just waiting to be called up. Just think, though, no worry about volume control, tone control, different cassettes, each with two sides, or, where on tape was the wanted file . . . just call for what you want. MAGICAL.

I typed CAT,0,1 and 30 seconds later I had seen, on my VDU, the directory of both drives.

Before you can WRITE a file, you must use the NEWTAPE facility, so this I now did, and after the prompt "SCRATCH TAPE IN DRIVE 1" was answered with a "Y", (after replacing the backup system master wafer with a new 50 foot wafer in drive 1) the drive started up, stopped, and the message "FORMATTING COMPLETE — 318 SECTORS FREE" came up. Each sector holds 256 bytes, so my newly formatted wafer would hold 79.5 Kbytes.

I decided to transfer my BASIC library from cassette, and as SWTPC Disc BASIC supports a "tape load" (TLOAD) command, to pull data from cassette, I typed "BASIC". The drive searches at 20 inches per second, and reads/writes at 10 inches per second; around 30 seconds later the VDU showed "READY".

The wafer is a small (1.6 x 2.7 x 0.2 of an inch) cartridge and the length of tape can be 5, 10, 20 or 50 feet; it's of the endless loop variety, i.e. like the car 8-track cartridge and you can dramatically improve access time at the expense of the amount of data stored on the wafer. After two years plus of 300 baud cassette operation I am quite happy to wait the 30 or maybe 40 seconds (worst case) for 10K of BASIC to be loaded and executed from the longest wafer.

By careful arrangement of my games tape, I can be playing my own version of Startrek (some 5K long) within 15 seconds of initialising the system; it's the most popular household game and it's first on the wafer!

This file has memory requirements from $0000 to $13EF, plus a random number generator located at $A04A to $A06F. To save this on wafer — it being non sequential — I first saved 0000 to 13EF and called the file TREK, then saved A04A to A06F, calling this file RANDOM. I then APPENDED TREK and RANDOM, calling this STARTREK, so when I called, the specified memory areas are loaded, leaving all other memory locations undisturbed.

All utility programs on the systems wafer are well documented, to include "default unless specified" conditions.

The obvious question is, have I had any problems? Well, my utility program "VERSION" doesn't work. This allows you to find out the version number of any utility program. The book tells you that this is a hexadecimal number stored in byte 3 of the required utility. By using the "memory change" facility of my monitor, I have examined this location of each utility, and found them all to be version 1, though why I need to know, I'm not sure. I have advised Exatron of this non-working utility and await their reply.

The utility program TTYSET appears incorrectly documented. The correct syntax, for mine at least, is TTYSET, filespec = x where x is the desired hexadecimal/decimal number.

Apart from these two tiny, and, as far as I'm concerned, totally unimportant items there have been no other problems. The system worked first, and each consecutive time, thus inspiring confidence for future use, although "ERROR MESSAGE X" has appeared

Personal Computer World

FEATURE INDEX

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Personal Computer World

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as a result of fumbling on the keyboard, or where I *thought* I knew the manual.

Summary

The system arrives ready to plug in and go. The quality of both boards and workmanship is *far* superior to that normally expected in the hobby market, and can be summed up in one word — *professional*. The repair service can be classed as superb, and I have *no* intention of trying the 30 day money back guarantee . . . I like the system too much.

The software works well and, currently, TSC BASIC, Editor and Assembler are available as optional extras; more (unspecified) are planned. Documentation is very complete, and, less the TTYSET as explained, accurate.

Exatron also produce their Stringy Floppy for S100 bus users, and both this and my own SS50 bus version derive all of the voltages necessary for use in the transport and controller from the mother board.

There's also a version available for the TRS80, though this requires mains voltage and, of course, the United States use 110 volts. Exatron do say that they can advise OEM applications not covered by the systems offered, and I'm sure it would be a very easy matter to replace the 110 volts PSU with one suitable for 240 volts. Versions are planned for both PET and Apple, though no information is available on these as yet.

The first time I telephoned Exatron I was advised that "Linda" dealt with European orders. This lady is certainly "switched on", and her courtesy and helpfulness could be used to extremely good effect by firms in this part of the world as an exercise in public, or maybe I should say customer, relations; telephone (408) 737 7111, ask for Linda, and obtain the kind of service to which we'd all like to become accustomed.

Now to the nitty gritty . . . what does it cost? Well, it depends upon the rate of exchange; for me it was $2.28 for £1 sterling and therefore my two drives, controller card and box of 10 spare wafers (each 50 ft long) was £192.00. That's less than the cost of one disc drive — never mind the controller or PSU! Do remember, though, that UK rates of import duty and VAT apply. I took delivery of mine in Germany and so cannot quote these.

I'd recommend this system not only to every hobbyist, but also to business users as a more than economic saving over discs. Should you need almost instant access then, of course, it's not for you. But there again, who, apart from people paying for computer time by the hour, require this facility; and anyway, one of the reasons that hourly time is so expensive is the price of fast access on line storage!

Footnote

It wasn't until writing this report that I looked up some of the tape wafer times I had recorded. For my first (possibly faulty) system, I judged that the system wafer took 82.5 seconds, or 7.27 inches per second which is (just) outside the -25% speed tolerance. My system now reads the wafer in 57.8 seconds, or 10.38 inches per second; maybe I could have used the troubleshooting part of the manual to better effect. In there it tells you how to either up or downgrade the transport speed, but in my innocence (ignorance) it didn't gel first off; then due to circumstances (clumsiness) beyond my control (it *was* 3 am) I didn't get a second opportunity.

Thanks to Exatron, I now have a totally redundant AC30 cassette interface with two recorders and a pile of tape software valued at over £200; this however is a small price to pay for the quality and speed I have gained. I really do think they have achieved their aim of Excellence in Electronics (mechanics too!). Superb value for money.

User groups are highly recommended by Exatron. Thomas Murphy would like any other owners of stringy floppies to contact him via the magazine.

See colour advertisement on Page 104

COMPUTER GAMES

by David Levy

GUESSING THE ODDS

Deduced probabilities

When playing a game of cards you usually know which cards you have been given, but normally you will not see the cards that have been dealt to your opponent(s). You may be able to deduce certain things about an opponent's card holding from the way in which he bids or plays, but it is unlikely that you will know exactly what he holds until very near the end of the hand. Decisions made in this sort of environment must be made on a probabilistic basis; in other words, you play with the odds and hope for the best. If you have calculated the odds correctly you will win more often than you lose.

Shuffling

Before proceeding to the main point of this month's article I should perhaps interpose a brief section on how to shuffle the cards in your program. The simplest way of creating a randomly sorted deck is as follows. Starting with the deck in any order you wish (even perfectly sorted), interchange the first card in the deck with the Rth card, where R is a pseudo-randomly chosen integer on the range 1 to n (n is the total number of cards in the deck). Then interchange the second card with another randomly chosen card, then the third, and so on to the end of the pack. The manner in which you generate your random numbers is of some consequence — I would recommend that while developing your program you use one of the seeding methods in which the i+1 th random number is generated from the i th number, and the series is started with a "seed" which may be chosen by the user. This approach has the advantage that if you spot a bug in your program you can recreate the hand simply by starting with the same seed. Once your program is debugged you may use the computer's internal clock to supply the seed, for example by using the time elapsed between the pressing of two keys.

One seeded random number generator which will suffice is:

$R_i = a^i \times \text{seed} \pmod m$

where R_i = i th pseudo-random number

$a = 8t + 3$ (for any positive integer t)

$m = 2^b$ where b is the number of bits per word in your computer.

Deducing information from the Play of the Cards

For the purpose of creating a simple example I have invented the following card game. The game is played by three players who are each dealt 17 cards at the start of a hand. The 52nd card in the deck is turned face up and that suit is trumps.

Starting with the player on the dealer's left, the player leads a card and the other players must follow suit if they can, or they may trump if they wish (provided that they are unable to follow suit). The player who wins one trick leads to the next, and the player who wins most tricks wins the hand.

Let us assume that we are dealt the following hand:

Table 1	A	K	Q	J	10	9	8	7	6	5	4	3	2
SPADES:	0.0	0.0	0.5	0.5	0.5	0.5	0.5	0.0	0.5	0.5	0.0	0.5	0.0
HEARTS:	0.5	0.5	0.0	0.5	0.0	0.5	0.5	0.0	0.5	0.0	0.5	0.5	0.5
DIAMONDS:	0.5	0.0	0.5	0.5	0.0	0.0	0.5	0.5	0.0	0.5	0.5	0.5	0.0
CLUBS:	0.5	0.5	0.5	0.0	0.5	0.5	0.0	0.5	0.0	0.5	0.0	0.5	0.5

SPADES (trumps): A K 4 2
HEARTS: Q 10 7 5
DIAMONDS: K 10 9 6 2
CLUBS: J 8 6 4

and that the 7 of spades is the card turned up. It is our turn to lead first.

At the start of the hand we know absolutely nothing about which cards our opponents hold, except for the fact that between them they hold all 34 of the unseen cards. But we do not have any indication as to how these 34 cards are distributed between the unseen hands, so the probability of each of the cards being in a particular hand is 0.5. We can therefore begin to construct, for each of our opponents (Bill and John) probability estimates for each card in the deck. At the start of the hand the estimates for each of them will be as shown in Table 1.

Assume that we lead the 4 of spades, and that the next player (Bill) plays the 9 of spades and the third player (John) takes the trick with the Q. What have we learned about the probabilities of the other cards, if anything?

Before answering this question I must explain an important theorem from Probability Theory, called Bayes' theorem.

Bayes' theorem

Let us suppose that there are two bags, each containing five balls. Bag A contains 1 white and 4 black balls, bag B contains 3 white and 2 black balls. I take a ball at random from one of the bags, and the ball is white. What is the probability that I took the ball from bag A?

The probability that a ball selected at random from bag A will be white is 1/5.

The probability that a ball selected at random from bag B will be white is 3/5.

Bayes' theorem shows that the probability that a randomly selected white ball actually came from bag A =

$$\frac{1/5}{(1/5 + 3/5)} = 1/4$$

The reader will be able to generalize from this example, and the application to our game of cards will soon become apparent.

What have we learned?

Let us now return to the question of what, if anything, we have learned about Bill and John's hands from the cards they played to trick one? We probably cannot say very much at all about Bill's hand at the moment, but we already know something about John's cards.

John took the first trick with the Q of spades. The A and K are in our own hand and so the only cards that John could possibly have used to take the trick were the Q, J and 10. If John had held the Q and 10 but been missing the J, he would have played the 10, so from the fact that he played the Q we know that his original spade holding included:

Q, J and 10 *or* Q and J *or* Q (without J or 10).

Now we can use the tables of probabilities for the individual cards to determine the *a priori* probability that John held each of these three holdings:

Probability that he held the Q, J and 10 = 0.5 x 0.5 x 0.5 = 0.125
Probability that he held the Q and J but not the 10 = 0.5 x 0.5 x 0.5 = 0.125 (Note that since the probability of his holding the 10 is 0.5, the probability of his not holding it is 1—0.5=0.5)
Probability that he held the Q but not the J or 10 = 0.5 x 0.5 x 0.5 = 0.125

And from Bayes' theorem we can show that the probability that the Q came from each of these three holdings is:

Q,J,10: 0.125/(0.125+0.125+0.125)=1/3
Q,J: 0.125/(0.125+0.125+0.125)=1/3
Q: 0.125/(0.125+0.125+0.125)=1/3

Note that had the calculations been performed later in the hand, when the probabilities were not all equal (0.5), the final values would not all have been 1/3.

From these last calculations we can see that the probability that John holds the 10 of spades is 1/3 (in which case he also holds the J), and the probability that he holds the J is 2/3. We can therefore adjust the probabilities for the individual cards in John's hand as follows:

For the 10 of spades: probability=0.333
For the J of spades: probability=0.667

For all other unseen cards the probabilities are equal, and these are:

$$\frac{16-0.333-0.667}{32-1-1} = \frac{15}{30} = 0.5$$

Since there are 16 unseen cards in John's hand, and 32 unseen cards in total (the probabilities of the J and 10 of spades being in John's hand are subtracted from the number of cards in his hand, and one is subtracted for each of them from the total number of unseen cards).

If the probability of the J of spades being in John's hand is 0.667, then the probability of it being in Bill's hand is 0.333, and by the same argument the probability of Bill holding the 10 of spades is 0.667. So we have been able to make some adjustments in the probabilities simply on the basis of John having played the Q of spades at trick one. We can also make note of the fact that if John ever shows the 10 of spades, we will know that he holds the J.

At trick two, John must lead because he won trick one. He leads the A of hearts, we play the 5, and Bill trumps with the 8 of spades. What have we learned from trick two? First of all, Bill would obviously use his lowest trump or one of his lowest contiguous group of trumps. The 7 was the original face up card, we played the 4 on trick one and Bill played the 9. We hold the 2 of spades and so Bill's 8 of spades must have been played from one of the following holdings:

J,10,8,6,5,3:
J,10,8,6,5:
J,10,8,6:
J,10,8:
10,8,6,5,3:
10,8,6,5:
10,8,6:
10,8:
8,6,5,3:
8,6,5:
8,6:
8:

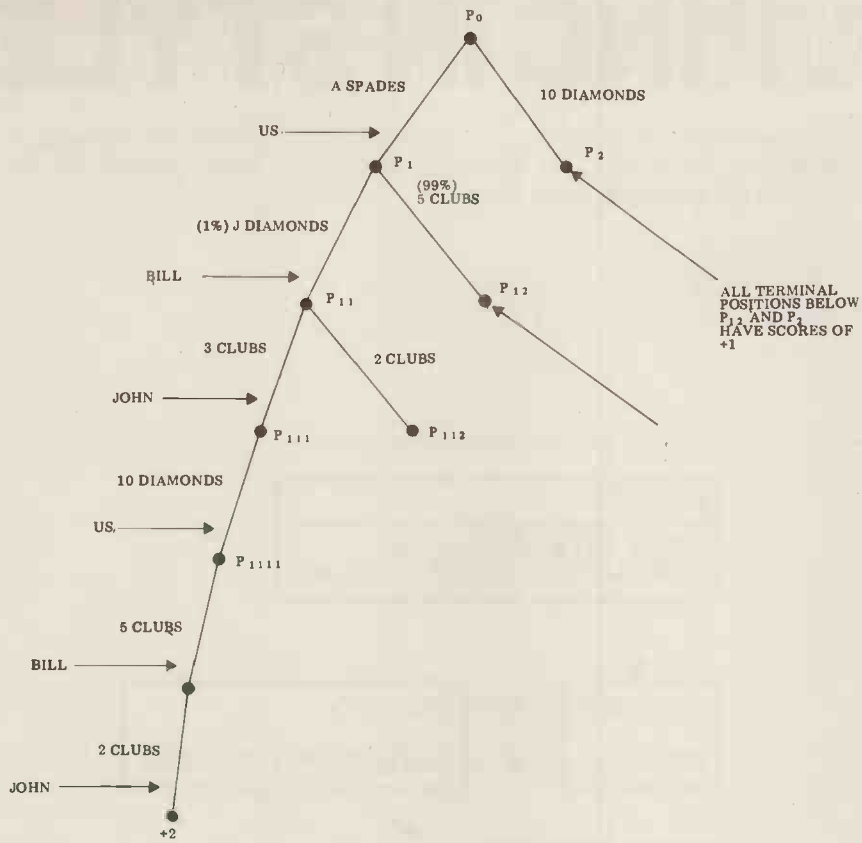
and by using Bayes' theorem we can determine the probabilities of each of the above cards being in Bill's hand, and from these probability estimates we can determine estimates for the cards being in John's hand. We can also adjust the probabilities for all the hearts: those which are not in our own hand must all be in John's hand.

Deducing information from the bidding

In many card games there is a bidding phase between the deal and the play of the cards. The best known of such games is Bridge, but the popular German game of Skat is another widespread example (it is said that Skat can be played by more than 50% of the entire population of Germany). Since each bid has a meaning, it should be possible for the card playing program to learn something about its opponents' hands from the way that they bid, and it can then adjust its probability estimates for each card in their hand. How this is done will obviously vary from one game to another. Let us take a brief look at Bridge, to see how we might modify the probability estimates of the unseen cards in the light of the bidding.

We are sitting South and hold 10 high card points. We look at the 13 cards in our hand and assign a probability of 1/3 to each of the reamining 39 cards in each of the other three hands. West opens the bidding and bids one spade, indicating that he has a stronger than average hand and that spades is his best suit. (Of course, this bid can mean other things, but we shall assume for this example that the above meaning is correct in the particular bidding system that West and his partner employ.) We may now adjust the probabilities of the spades, so that each spade in West's probability array has a slightly higher probability (say 0.45 instead of 0.33), and we may also adjust the probabilities of the high valued cards (aces, kings, queens and jacks) so that they give an expected high card holding which corresponds to a typical one spade opening bid. (If this bid is made with an average of 13 points, the ace counting 4 points, king 3, queen 2 and jack 1, then by making each of the high card probabilities 0.4333 we give West an expectation of 13 out of the remaining high card points: there are 40 high card points in total and we hold 10 of them, leaving 30, and 13/30=0.433). We should, in fact, give a slightly higher probability to a card which is both a spade and a high card.

Having assigned new probabilities to



the spades and the high cards, we can then adjust the probabilities for the remaining cards in West's hand, so that the sum total of his probabilities is 13 (the total number of cards in his hand), and we can adjust the probabilities for each card in North's and East's hands by subtracting West's probability from 1 and dividing the result by 2, remembering to ignore all cards in our own hand.

So from his first bid we can make quite a lot of probabilisitic estimates about West's cards, and hence about those in the North and East hands.

The bidding then passes to North, and depending on his bid we make adjustments to his probabilities using similar, logical arguments, and then we adjust the probabilities for West and East. This process continues until the end of the bidding — each time we acquire some information that increases the likelihood of a card being in a particular place, we increase the probability for that place and reduce it accordingly in the other hands. When there is some negative information about the position of a card we use it in a similar way.

By the end of the bidding phase a good bridge program should have a fairly accurate estimate of how each of the other three hands is made up. By summing the probability values for all the spades in a hand the program can get an estimate of how many spades that player holds. By summing the products of the high card probability x high card point values, the program can estimate the number of high card points in each suit in each hand. It will then be better able to plan its play of the hand, and of course the probabilities will be adjusted all through the playing phase.

How to use deduced information

The most obvious use of our deduced probabilities arises when the probability estimates for all unseen cards are all either 1 or 0, i.e. we know where all the remaining cards lie. We then have a case of a perfect information game, and we can solve this game by performing a tree search to the end of the game. Even though there may be three or more players, the tree approach should still work, though we must make certain assumptions about the way that the other players are going to make their decisions. For example, let us assume that we are two tricks from the end of a hand of our three-player card game.

We hold: A of spades, 10 of diamonds.
Bill holds: J of diamonds, 5 of clubs.
John holds: 3 and 2 of clubs.
It is our turn to lead (remember that spades are trumps).

The program now constructs a game tree, of depth 6-ply. Part of the tree will look like the above diagram. We assign to the terminal nodes of the tree, scores corresponding to the number of tricks won by each player, and we back-up through the tree until we can determine which card should be played next. In this example the situation is simple because if we lead the A of spades first we *may* take two tricks, whereas if we lead the 10 of diamonds we can only make one trick. Note the use of the word "may". In order to make two tricks we need some help from Bill, who must make a mistake and discard the J of diamonds in the hope that our second card is the 2 or 3 of clubs and he will make his 5. But since we lose nothing by playing the A of spades first, that is clearly the best way to continue. How can we modify our traditional methods of tree-searching to cater for situations such as this one, in which we wish to allow for the possibility that our opponent will make a mistake? Fortunately the problem has been solved for us, by the ubiquitous Donald Michie, whose name crops up time and again in interesting research reports on various topics within the science of Artificial Intelligence.

Expected values in backed-up trees

Michie's method, which I shall discuss in some detail in a later article, is based on the assertion that when searching a game tree it is unreasonable to assume perfect play by the opponent, since there must always be a finite chance that he will not choose the best move. Let us see how this helps us to search the above tree.

We may simplify Michie's concept as follows: If there is a 99% chance that Bill will play the 5 of clubs from position P_1, and a 1% chance that he will play the J of diamonds, then since the 5 of clubs will give us a score of 1 (i.e. we take one trick) and the J of diamonds will give us a score of 2, the expected value to us of position P_1 is

$$(0.99 \times 1)+(0.01 \times 2)=0.99+0.02=1.01$$

whereas if we play the 10 of diamonds from position P_0, the expected (in fact the certain) value of position P_2 will be 1 (i.e. we will take one trick no matter how Bill and John play). Since 1.01 is greater than 1, we should play the A of spades from P_0 because it maximises our expected score. The reader will probably have realised by now that not only does Michie's method allow us to optimize our practical chances when we *know* exactly where all the unseen cards lie, it also enables us to use our probability estimates of the locations of the unseen cards, to build game trees which will help in the play of the hand. In other words, Michie has shown us how to play with the odds!

Task for the month

Find or invent a simple card game in which information may be deduced from the play of the cards. (Avoid bidding games, unless you are extremely confident and have many free hours this month.) Write a program to play this game, modifying the probability estimates of the unseen cards in the light of the user's play. Experiment with various methods of adjusting these estimates until the program plays at least moderately sensibly. At the point in the game where exhaustive search will not be too time consuming, set up a probabilistic game tree à la Michie to search to the end of the game.

Bibliography

Michie, D.: *A theory of evaluative comments in chess.* Memorandum MIP-R-105, Department of Machine Intelligence and Perception, University of Edinburgh, July 1974.

Mirhram, G.A.: *Pseudo-Random Number Generators are really Card Shufflers.* Personal Computer Proceedings, National Computer Conference, New York, 1979, pp. 318-326.

(For more information on Bayes' theorem see any good book on statistics or probability theory.)

STRUCTURING IN STYLE

A program, written in PET BASIC, is examined in detail by Seamus Dunn to illustrate a particular way of structuring certain kinds of programs. On an 8K PET approximately 2000 bytes are left for use after the program has been loaded.

Introduction

In many programs it's necessary to organise a system for calling up or accessing any one of a number of routines. Poorly managed, this process can become quite messy, as many commercial programs demonstrate. Bits are tacked on here, there and everywhere with ring-roads of GOTO statements. Clearly, it's useful to have a well-defined structuring system which is not inhibiting but which allows for an overall organisation.

This is not intended as an argument against interactive heuristic programming. In fact I don't believe it's possible for most ordinary humans to generate programs in any other way than by a trial-and-error, step-by-step, interactive process. Most well-polished clearly organised programs arrive as a result of drastic tidying-up activity after the problems have been solved. At the beginning, the problems are often not even known about.

But it is possible to work within a system that keeps the overall program in a general structural pattern. Subroutines, thought of as units, can be placed on a general-purpose network so that, while individual problems are being worked out, the programmer keeps sight of the overall structure.

The particular kind of program chosen to demonstrate this is one within which the user is presented with a set of alternatives from which to choose. These are often in the form of what is called a MENU. Such a program is described in terms of 4 BLOCKS and each of these will be looked at in turn.

The inter-relationships within these blocks are shown in diagram 1. The important thing to notice is that the system is in a closed loop, with Block 2 — the Menu — at its centre. Everything returns to the Menu, always.

THE BLOCKS

Block 1

This represents the programmer's attempt to communicate to the user what his program is about. Not all of the four parts shown in diagram 1, (TITLE, INTRODUCTION, DESCRIPTION, INSTRUCTIONS), will be necessary in all programs. This part of programming is often neglected because it's not at the heart of the problem-solving activity, and also because it usually gets tacked on at the end. It is important, however, and ought to be carefully thought about and properly set out.

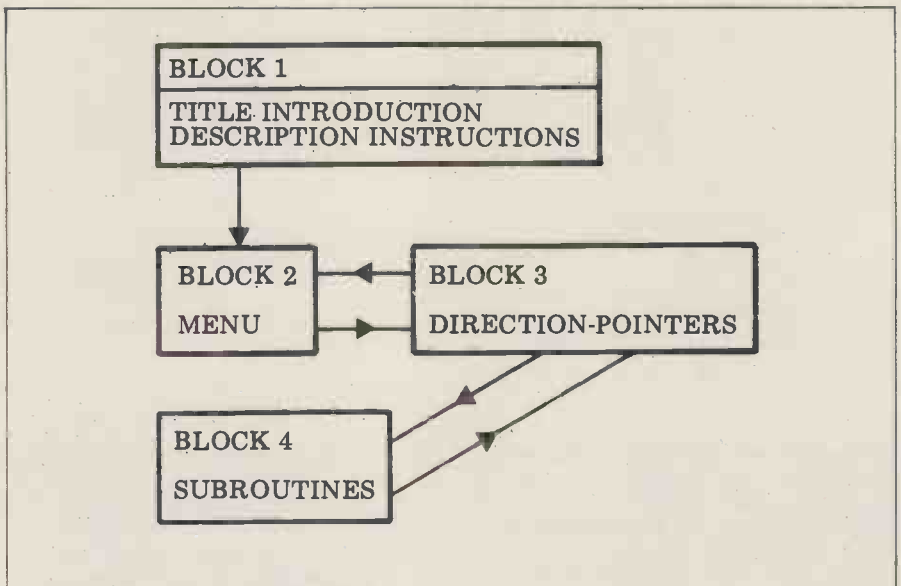


Diagram 1

Block 2: Menu

A list of options is presented, and the user chooses one of these by pressing an appropriate key.

This block represents the centre or heart of the program. It's always returned to when other routines have been

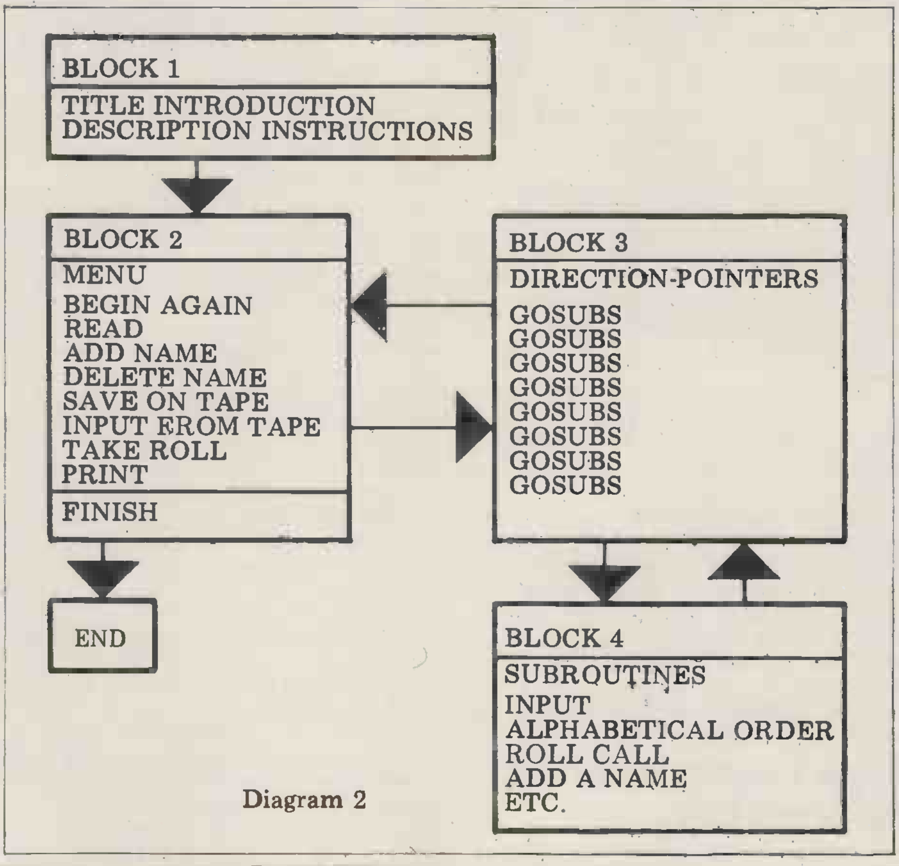


Diagram 2

carried out, the only exception being when the user wishes to stop. Therefore all the lines running out of it, with this one exception, eventually return to it.

Block 3: Direction pointers

Each exit from the Menu could lead directly to the appropriate subroutine using GOSUB, but this creates problems on the RETURN, for two reasons. First there is usually a chain of these GOSUB commands and they must be organised in proper succession; second, at the end of this chain, the program must be directed back to the Menu.

Both of these are more easily handled if exits from the Menu go to a separate Block which organises appropriate GOSUBs in the right sequence.

Block 4: Subroutines

Each subroutine is a separate unit and the set of these used in this program are detailed below.

The program

Diagram 2 shows the overall outline of Diagram 1, but includes more detail. The content of each BLOCK is indicated and the flow of activity is represented by arrows.

The actual program is now shown in sections. It's called "CLASS REGISTER" and is used to enter, store and revise a list of up to 25 names and attendance records for each of 8 weeks. It can, of course, be adapted for much longer periods, if more memory is available.

This version was written for an old-ROM PET so there are software patches which can be removed on new machines.

Block 1

This is shown below in lines 10 to 205. The dimension statements in line 10 allows for 25 names and 8 single register entries. A number of cursor-control symbols for PET are included which can be removed or replaced for other machines.

Lines 200 and 205 employ a technique for holding the screen at that point. It may be necessary to change this on other machines. This technique is used in a number of places in the program and need not be referred to again.

Block 2

This is the MENU BLOCK and it contains 9 possible options to be chosen by the user. It runs from line 500 to 582 and the single-character response-input is represented by A $.

Block 3

This is the block which controls responses to the Menu. From line 600 to line 680 it tests in turn for each of the 9 possible correct responses. If the response is none of these, line 690 sends it back to the Menu again. Each response to the Menu corresponds to a subroutine, or a set of subroutines, and these are shown on lines 700 to 1500. Notice that each ends with GOTO 500.

For example, if the user wishes to ADD a name he or she presses the letter 'A'. Line 620 sends the machine to line 800.

800 GOSUB 4500 : GOSUB 3000 : GOTO 500

The subroutine 4500 allows the user to add a name, subroutine 3000 puts the new list into alphabetical order and finally, GOTO 500 sends it back to the Menu.

Block 4

This is made up of a set of eleven subroutines all of which are shown below. Each is a self-contained unit and the user can choose not to include them all or to add new ones.

```
10 DIMA$(25),A(25,8),B(25)
100 PRINT"        CLASS REGISTER"
110 PRINT"THIS-PROGRAM STORES A LIST OF NAMES"
120 PRINT"AND AN ATTENDANCE RECORD"
130 PRINT"FOR ALL MEMBERS OF THE CLASS."
140 PRINT"IT ALLOWS NAMES TO BE ADDED AT ANY"
150 PRINT"STAGE, AND IT ALLOWS NAMES TO BE"
160 PRINT"DELETED.  NAMES CAN BE PUT IN "
170 PRINT"ALPHABETICAL ORDER, AND THE ROLL"
180 PRINT"CAN BE TAKEN EVERY WEEK."
200 PRINT"      PRESS ANY KEY"
205 GETA$:IF A$=""THEN 205
```

Block 1

```
500 PRINT"            MENU"
505 PRINT"CHOOSE ONE OF THE ITEMS BELOW  "
510 PRINT"AND PRESS THE APPROPRIATE KEY. "
520 PRINT"TO BEGIN AGAIN.................B"
530 PRINT"TO READ THE LIST...............R"
540 PRINT"TO ADD A NAME..................A"
550 PRINT"TO DELETE A NAME...............D"
560 PRINT"TO SAVE ON TAPE................S"
570 PRINT"TO INPUT FROM TAPE.............I"
575 PRINT"TO TAKE THE ROLL...............T"
577 PRINT"TO PRINT.......................P"
580 PRINT"TO FINISH FOR NOW..............F"
582 INPUT"";A$
```

Block 2

```
600 IFA$="B"THEN700
610 IFA$="R"THEN1400
620 IFA$="A"THEN800
630 IFA$="D"THEN900
640 IFA$="S"THEN1000
650 IFA$="P"THEN1500
660 IFA$="I"THEN1100
670 IFA$="F"THEN1200
680 IFA$="T"THEN1300
690 PRINT:PRINT"TRY AGAIN":GOTO500
700 GOSUB2000:GOSUB3000:GOSUB3500:GOSUB7000:GOTO500
800 GOSUB4500:GOSUB3000:GOTO500
900 GOSUB5000:GOTO500
1000 GOSUB5500:GOTO500
1100 GOSUB6000:GOSUB3000:GOTO500
1200 GOSUB6500:GOTO500
1300 GOSUB3500:GOTO500
1400 GOSUB7000:GOTO500
1500 GOSUB7500:GOTO500
1510 GOTO500
```

Block 3

```
2000 INPUT"HOW MANY STUDENTS ARE ON THE COURSE";N
2020 FORC=1TON
2030 PRINT:PRINT"THIS IS STUDENT NUMBER    "C
2040 PRINT"PUT IN THE SURNAME FIRST, THEN THE REST."
2045 PRINT"DO NOT USE A COMMA."
2050 INPUT"";A$(C)
2080 NEXT C
2090 PRINT:PRINT"THAT WAS THE LAST ONE."
2100 PRINT:PRINT:PRINT"PRESS ANY KEY"
2110 GETA$:IFA$=""THEN2110
2120 RETURN
```

Routine 1 : Input

```
3000 PRINT"     ALPHABETICAL ROUTINE"
3002 PRINT"THIS PROCESS CAN TAKE SOME TIME."
3003 PRINT"TRY NOT TO GET IMPATIENT."
3005 J=0
3010 FORC=1 TO N-1
3015 IF A$(C)<A$(C+1) THEN 3060
3020 X$=A$(C+1)
3025 FOR W=1 TO 8:D(W)=A(C+1,W):NEXT
3030 A$(C+1)=A$(C)
3035 FOR W=1 TO 8:A(C+1,W)=A(C,W):NEXT
3040 A$(C)=X$
3045 FOR W=1 TO 8:A(C,W)=D(W):NEXT
3050 J=J+1
3060 NEXT C
3070 IF J>0 THEN 3005
3080 PRINT"NOW IN ALPHABETICAL ORDER"
3090 PRINT"     PRESS ANY KEY"
3100 GET A$:IF A$="" THEN 3100
3110 RETURN
```

Routine 2 : Alphabetical Order

```
3500 PRINT"     ROLL CALL"
3510 INPUT"WHICH WEEK? PUT IN A NUMBER,1 TO 8";W
3530 PRINT"EACH NAME WILL BE PRINTED ON THE"
3540 PRINT"SCREEN. IF PRESENT, ENTER 1. IF ABSENT,0"
3550 FORC=1TON
3560 PRINTA$(C);
3570 INPUT"";R
3580 A(C,W)=R
3610 NEXTC
3620 RETURN
```

Routine 3 : Roll-Call

```
4500 PRINT"ADD NAME ROUTINE"
4510 N=N+1:A=0
4520 INPUT"NEW NAME";A$(N)
4525 INPUT"WHICH WEEK IS THIS";W2
4530 PRINT"HIS/HER ATTENDANCE RECORD UP TO NOW WILL"
4535 PRINT"BE ENTERED WEEK BY WEEK."
4540 FORC=1 TO W2
4550 PRINT"WAS HE/SHE PRESENT ON WEEK  "C
4560 INPUT"IF SO ENTER 1. IF NOT, ENTER 0";A(N,C)
4570 NEXTC
4580 FOR C=1 TO W2:A=A+A(N,C):NEXT
4600 PRINT"THIS MEANS A TOTAL OF  "A" ATTENDANCES."
4610 PRINT"PRESS ANY KEY"
4620 GET A$:IF A$=""THEN 4620
4630 RETURN
```

Routine 4 : Add a Name

```
5000 PRINT"DELETE A NAME ROUTINE"
5010 INPUT"INPUT NAME TO BE REMOVED";T$
5020 FOR C=1 TO N
5030 IF A$(C)=T$ THEN 5120
5040 NEXT C
5050 PRINT"THIS NAME IS NOT ON THE LIST. REMEMBER"
5060 PRINT"THAT YOU MUST PUT IT IN EXACTLY"
5070 PRINT"DO YOU WISH TO TRY AGAIN?  (Y/N)"
5080 INPUT"";R$
5090 IF R$="Y"THEN5010
5100 IF R$="N"THEN5230
5110 PRINT"TRY AGAIN.":GOTO5070
5120 FOR D=C TO N-1
5130 A$(D)=A$(D+1)
5140 FORW1=1 TO 8
5150 A(D,W1)=A(D+1,W1)
5160 NEXT W1
5170 NEXT D
5180 A$(N)="":FORW1=1 TO 8:A(N,W1)=0:NEXT
5190 N=N-1
5200 PRINT"NAME AND RECORD HAS BEEN REMOVED"
5210 PRINT"PRESS ANY KEY"
5220 GET A$:IF A$=""THEN5220
5230 RETURN
```

Routine 5 : Delete a Name

Routine 6 : Save on Tape
This routine includes two software patches that may not be necessary on new machines. They can be found on lines 5510, 5590, and the GOSUB on lines 5570 and 5650.

```
5500 PRINT""
5510 POKE243,122:POKE244,2
5520 OPEN1,1,1,"NAMES"
5530 PRINT"NAMES BEING STORED ON TAPE"
5540 FORC=1 TO N
5550 PRINT#1,A$(C)
5560 NEXTC
5570 GOSUB10000
5580 CLOSE1
5590 POKE243,122:POKE244,2
5600 OPEN1,1,1,"ATTENDANCES"
5610 PRINT"ATTENDANCES BEING STORED"
5615 FORW1=1TO8
5620 FORC=1TON
5630 PRINT#1,A(C,W1)
5640 NEXTC
5645 NEXTW1
5650 GOSUB10000
5660 CLOSE1
5700 RETURN
```

Routine 6

Routine 7 : Recover from Tape
The patch: IF (ST)< >0 THEN STOP on lines 6060 and 6120 may have to be removed.

```
6000 PRINT""
6010 PRINT"HOW MANY STUDENTS WERE RECORDED"
6020 INPUTN
6030 OPEN1,1,0,"NAMES"
6040 PRINT"NAMES BEING RECOVERED"
6050 FORC=1TON
6060 INPUT#1,A$(C):IF (ST)<>0 THEN STOP
6070 NEXTC
6080 CLOSE1
6090 OPEN1,1,0,"ATTENDANCES"
6100 PRINT"ATTENDANCE RECORDS BEING RECOVERED"
6105 FORW1=1TO8
6110 FORC=1TON
6120 INPUT#1,A(C,W1): IF (ST)<>0 THEN STOP
6130 NEXTC
6135 NEXTW1
6140 CLOSE1
6150 PRINT"RESULTS NOW RECOVERED"
6200 RETURN
```

Routine 7

```
6500 PRINT"THANK YOU FOR NOW. IF YOU WISH TO"
6510 PRINT:PRINT"BEGIN AGAIN, INPUT 'RUN'"
6520 PRINT:PRINT"AND PRESS RETURN."
6530 END
```

Routine 8: End

Routine 9 : Print on Screen
Line 7066 tests if the screen holds 15 names and records.

Routine 9: Print on Screen

```
7000 PRINT"ATTENDANCE REGISTER"
7020 PRINT"NAMES"TAB(15)"REGISTER"
7030 PRINT"WEEK"TAB(13)"1  2  3  4  5  6  7  8  T"
7040 FORC=1TON
7041 T=0
7042 PRINTLEFT$(A$(C),12);
7045 FOR W1=1 TO 8
```

Continued on Page 124

LEISURE LINES

With J. J. Clessa

The problem of the natives attracted almost 130 replies — most of them with the correct answer. Mr Ian Laudon of Edinburgh sent in a delightful poem which sums up the puzzle perfectly (I've amended the metre to remove the "och's and ayes" and improve the Scottish scanning).

I slowly strolled beside the sea
And chanced upon the natives three;
With natives evenly divided,
Twixt truth, untruth and undecided.

I asked of one which tribe was he
And which were numbers two and three
He mumbled first then spoke outright,
The first one's grey, two's black, three's white.

I pondered this reply untrue,
(White could not be both three and two);
Until at last it dawned on me,
They were black-one, white-two, grey-three

However, David Tebbutt's random number generator didn't give you the prize, Ian. . . that went to a Master K.J.R. Jones of Lytham St. Annes. Ummm — remembering that the prize is a bottle of Remy Martin Cognac (and assuming that "Master" doesn't mean "School Master") — it seems that Mr. Jones *Senior* is in for something of a windfall. I hope the added four cans of "Coke" will go some way towards helping the situation!

****

QUICKIE

****

Another of those inter-family problems — and one that's almost as horrible as last month's Quickie.

If the only sister of your mother's only brother has an only child, what would be your relationship to the child? Definitely no prizes!

****

PRIZE PUZZLE

****

Short and snappy and one that'll keep the micros and pocket calculators busy.

A certain perfect square has the property that — if 5 is added to it, a second perfect square is obtained — and if 5 is subtracted from it, a third perfect square is obtained. What is the original perfect square?

Answers please on a *postcard* (letters go in the bin!) to: Puzzle No. 10, 14 Rathbone Place, London W1P 1DE. All solutions in as soon as possible, please.

****

PRIZE OF THE MONTH

****

PCW may be the light of your life but, just to add to the brilliance, this month I'm offering 25 100 watt, household lightbulbs — stay switched on!

P.S. Would Miss V. Mason (last month's winner) please get in touch again.


Can
your business,
research project or
teaching laboratory be made
more efficient? Yes. Today's users
demand complete, high performance micro
computer systems. Expandable to meet future
needs and with software capable of immediate
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The North Star Horizon is the answer. A
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Britain's first com computer kit.

The Sinclair ZX80.

£79.95

Price breakdown
ZX80 and manual: £69.52
VAT: £10.43
Post and Packing FREE

Please note: many kit makers quote VAT-exclusive prices.

You've seen the reviews... you've heard the excitement... now make the kit!

This is the ZX80. 'Personal Computer World' gave it 5 stars for 'excellent value.' Benchmark tests say it's faster than all previous personal computers. And the response from kit enthusiasts has been tremendous.

To help you appreciate its value, the price is shown above with and without VAT. This is so you can compare the ZX80 with competitive kits that don't appear with inclusive prices.

'Excellent value' indeed!

For just £79.95 (*including* VAT and p&p) you get everything you need to build a personal computer at home... PCB, with IC sockets for all ICs; case; leads for direct connection to a cassette recorder and television (black and white or colour); *everything!*

Yet the ZX80 really is a complete, powerful, full-facility computer, matching or surpassing other personal computers at several times the price.

The ZX80 is programmed in BASIC, and you can use it to do quite literally anything from playing chess to managing a business.

The ZX80 is pleasantly straightforward to assemble, using a fine-tipped soldering iron. It immediately proves what a good job you've done: connect it to your TV... link it to an appropriate power source... and you're ready to go.

Your ZX80 kit contains...
- Printed circuit board, with IC sockets for all ICs.
- Complete components set, including all ICs – all manufactured by selected world-leading suppliers.
- New rugged Sinclair keyboard, touch-sensitive, wipe-clean.
- Ready-moulded case.
- Leads and plugs for connection to domestic TV and cassette recorder. (Programs can be SAVEd and LOADed on to a portable cassette recorder.)
- FREE course in BASIC programming and user manual.

Optional extras
- Mains adaptor of 600 mA at 9 V DC nominal unregulated (available separately – see coupon).
- Additional memory expansion boards allowing up to 16K bytes RAM. (Extra RAM chips also available – see coupon).

*Use a 600 mA at 9 V DC nominal unregulated mains adaptor. Available from Sinclair if desired (see coupon).

The unique and valuable components of the Sinclair ZX80.

The Sinclair ZX80 is not just another personal computer. Quite apart from its exceptionally low price, the ZX80 has two uniquely advanced components: the Sinclair BASIC interpreter; and the Sinclair teach-yourself BASIC manual.

The unique Sinclair BASIC interpreter offers remarkable programming advantages:
- **Unique 'one-touch' key word entry: the ZX80 eliminates a great deal of tiresome typing. Key words (RUN, PRINT, LIST, etc.) have their own single-key entry.**
- Unique syntax check. Only lines with correct syntax are accepted into programs. A cursor identifies errors immediately. This prevents entry of long and complicated programs with faults only discovered when you try to run them.
- Excellent string-handling capability – takes up to 26 string variables of any length. All strings can undergo all relational tests (e.g. comparison). The ZX80 also has string input – to request a line of text when necessary. Strings do *not* need to be dimensioned.
- Up to 26 single dimension arrays.
- FOR/NEXT loops nested up 26.
- Variable names of any length.
- BASIC language also handles full Boolean arithmetic, conditional expressions, etc.
- Exceptionally powerful edit facilities, allows modification of existing program lines.
- Randomise function, useful for games and secret codes, as well as more serious applications.
- Timer under program control.
- PEEK and POKE enable entry of machine code instructions, USR causes jump to a user's machine language sub-routine.
- High-resolution graphics with 22 standard graphic symbols.
- All characters printable in reverse under program control.
- Lines of unlimited length.

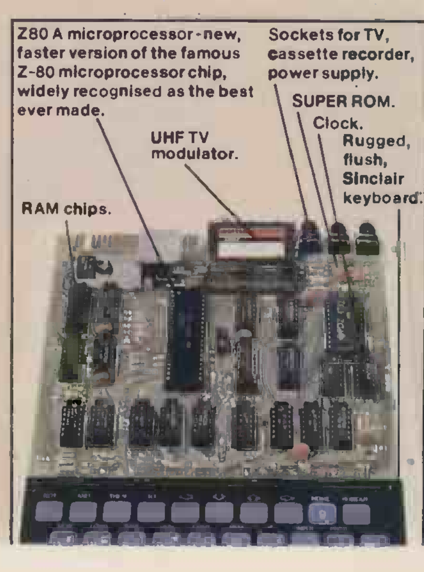
Fewer chips, compact design, volume production – more power per pound!

The ZX80 owes its remarkable low price to its remarkable design: the whole system is packed on to fewer, newer, more powerful and advanced LSI chips. A single SUPER ROM, for instance, contains the BASIC interpreter, the character set, operating system, and monitor. And the ZX80's 1K byte RAM is roughly equivalent to 4K bytes in a conventional computer – typically storing 100 lines of BASIC. (Key words occupy only a single byte.)

The display shows 32 characters by 24 lines.

And Benchmark tests show that the ZX80 is faster than all other personal computers.

No other personal computer offers this unique combination of high capability and low price.



See page 76 for complete list of approved dealers.

MICROS IN CONTROL

As a follow-up to their article on the IEEE-488 Bus in our January issue, K.T. Kibasi and Alan Mills of 3D Digital Design and Development examine some of the practical microcomputer-based systems that can be, and have been, configured to undertake useful real-time tasks.

Introduction

Over the last three years, a number of low cost (£600-£1000) microcomputers have appeared on the market; their price and flexibility have made them very attractive for dedication in the laboratory and industrial environments. Taking for granted an obvious computing ability, there are two levels at which the microcomputer can interact with the outside world. It might take the "passive" role of data gathering machine (a data logger), monitoring a process or experiment; alternatively it may form the active controller in a closed loop control system. For the second activity to make sense, it must include an element of data monitoring, in order that the control loop is closed and that "intelligent" decisions are made.

Later we shall examine some systems that have actually been built and are currently running . . . some quite sophisticated but all with a "personal" computer at their heart. These will include control of an experimental petrol engines rig, data logging studies of pond environments and the medical study of newborn animals.

A petrol engine test bed with three engines is run through a speed cycle over 24 hours continuously (see Fig. 4 and text). Shown are: on top of the rack, left: a Commodore tractor printer, and right: a Commodore PET. Top to bottom below the printer are: a 16-channel ADC unit; a 16-channel relay control unit; a slave relay unit.

Languages

With present day microcomputers such as the Commodore PET, the Sharp MZ-80K, and the Apple, many of the data logging or control activities to which they might be applied involve such slow processes as temperature and flow measurement; the execution speed of programs written in interpretive BASIC is often perfectly adequate. However, for those systems in which speed is of the essence, machine language programs may be used, even if only as subroutines. Although the increase in speed of execution may exceed one hundredfold, the penalty is the difficulty and tedium of writing and debugging such programs. This route is not for the inexperienced programmer, although the results can be impressive if successful.

Generally, both programming approaches are closely defined by the hardware parameters of the system e.g. the conversion speed of an analogue-to-digital converter (ADC), the thermal inertia of a boiler or furnace, the release and settling times of a relay. The designer of a micro based system must have a full appreciation of the process to be monitored or controlled, as well as a thorough understanding of the micro (s)he is using as the intelligent part of the control loop.

Microcomputers As Data Loggers

The "classical" data logger has been around for a considerable period of time — evolving from the operator with clipboard noting down meter readings, through single and multi-channel chart recorders, to today's modern electronic equipment. The earlier approaches, which relied on manual transcription or chart analysis, were not only tedious but inherently prone to operator error. The last decade or so has seen the development of automatic electronic data loggers, often built around digital voltmeters, and usually employing paper tape or printer for recording the data; latterly cassettes and cartridges have been used.

A multiplex system is usually used to gather readings from a number of channels, e.g. from 100 strain gauges in a structure-testing experiment. The equip-

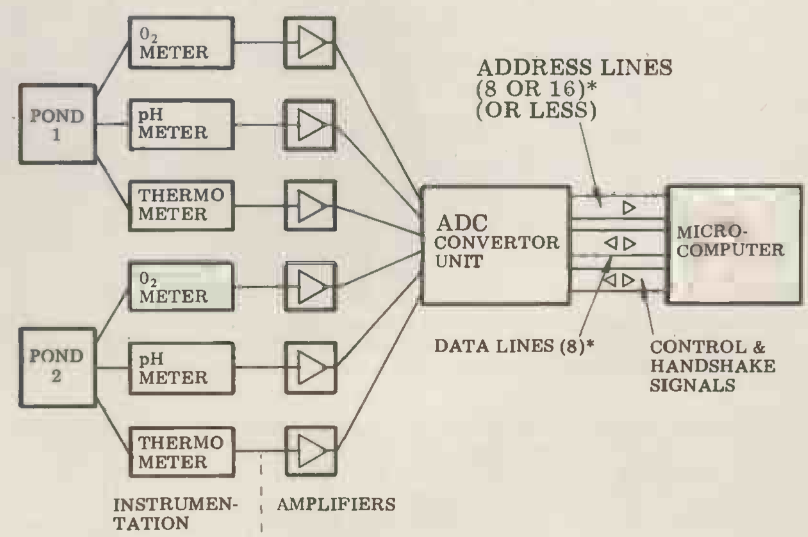


Fig. 1 Typical Data Logging System

*Note the IEEE-488 Bus employs 8 lines for both data and addresses at different instants ment is generally expensive, bulky, difficult to reconfigure, and offers very limited intelligence. The tape normally has to be fed as input to a main frame or minicomputer for subsequent analysis and reduction of the data.

Some data loggers have the facility of producing an operator alarm signal when the signal is outside the pre-set limits but, more usually, pre-micro data loggers are dumb.

With microcomputer prices as they are at present, the machines offer themselves as ideal controller/processor data logger systems, provided an appropriate interface is designed to permit *bi-directional* communication between the microcomputer and the process of interest.

Our earlier article (PCW Vol.3. No.1) drew attention to the IEEE-488 Bus as a suitable component of such an interface, although there are, of course, many others.

Let's consider an actual system where data is being logged as part of a long-term study of pond environments under certain controlled conditions. The main parameters of interest are: dissolved oxygen level, pH (acidity level) and temperature.

In order to study these parameters as other variables are changed, a second pond is used as a "control". Thus the overall requirements are: two dissolved oxygen meters, two pH meters, and two resistance thermometers.

These transducers and their amplifiers are readily available commercially with current or voltage output signals. In industrial applications, current loop signals are generally preferred for their noise immunity over long distances. So, the transducer converts the physical variable to an electrical signal and the transducer amplifier boosts the signal to the desired level and maybe filters out some noise and hum. These signals are then fed to an ADC with front end amplifiers to match the incoming signal.

The purpose of the ADC is to convert the transducer signals into their digital equivalent. The number of bits of the converter will determine the resolution (and potential accuracy) of the measurement; for many applications eight bits is quite sufficient, providing a resolution of one part in 256. The computer communicates with the converter using only digital signals, as shown in *figure one*.

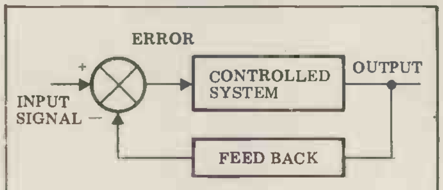
The ADC unit contains a multiplexer which routes the various channels to the actual converter. The multiplexer is under the control of the micro, and hence the channel to be "read" and the sequence of channel readings is determined from the program. The computer also controls the scanning rate, i.e. the number of readings per second. To some degree this depends on the conversion time of the ADC, although interpretive BASIC is usually slower. The time taken can range from a few milliseconds to under a microsecond, depending on the conversion technique employed — i.e. dual slope (slowest), successive approximation (medium), or parallel (fastest).

Similarly, the system designer must organise software to meet the converter requirements; (s)he must consider multiplexer addressing, start conversion pulse width, end of conversion (EOC) signal, etc; there's no point in issuing a conversion command before the converter has finished the previous operation. This is done by testing the EOC signal from the converter, or waiting sufficient time for the converter to finish before reading the data in and issuing the next channel address and conversion command.

Usually the procedure is easily arranged in BASIC using the IEE-488 Bus or some other micro-interfacing scheme. The program may then be structured to be interactive to allow entry of such experimental details as date, time, operator name, sampling intervals, channel sequence, offset and scaling coefficient for each channel, etc. A memory buffer area may be employed to accumulate a number of readings before dumping to disc or tape; averaging or other statistical analysis may be computed either as the run progresses, or subsequently.

Thus the system of *figure one* can be used to log up to 16 channels, with the converter unit and computer costing together less than £1000. Additionally, the computer may be employed for other tasks while waiting for the next scanning cycle.

As implied earlier, some applications require higher accuracy than eight bits,



Microcomputers as closed loop system controllers.

Fig. 2

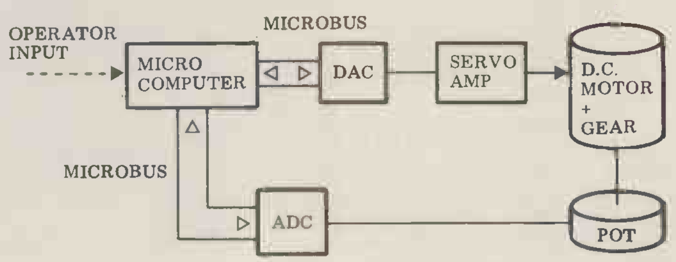


Fig. 3

Investigating the effects of environmental temperature on metabolic rate and heat production in small newborn animals (see Fig. 5 and text). Shown are: from left to right: X-Y plotter; 16K PET; (top to bottom) 8-channel DAC unit, 16-channel ADC unit, oxygen valves controller/temperature monitor/oxygen, and CO_2 monitor; oxygen level monitor; dual chamber; power supply.

and therefore 12-bit ADC units now exist with eight analogue input channels; these inputs may be unipolar or bipolar, single-ended or differential, and again the channel scan sequencing is under program control.

Microcomputers As Closed Loop System Controllers

In most control systems a negative feedback loop is employed to balance the input signal, as shown in *figure two*. The output signal to be controlled may be any physical variable such as position, velocity, temperature or fluid level.

Consider the case of a servo amplifier and DC motor. The position of the motor shaft may be obtained as an electrical signal from a potentiometer attached to the shaft. A microcomputer can perform the function of the scanning junction if configured as in *figure three*. A signal is applied to the servo-amplifier via the digital to analogue converter (DAC), driving the shaft to a new position. The computer reads the new position and calculates the error signal (output-input) between desired and actual, hence mimicking the system of *figure two*.

But the computer can be programmed to perform much more than the simple summing function. It can, for instance, compare the actual physical control system response with that of an ideal system model simulated within the memory. Such a system model will usually be represented by a set of mathematical equations. The difference between the actual response and the desired response can then become the subject of a second order of refinement. Thus it's possible to optimise performance so that, for instance, the motor will adopt a new position in the minimum time with minimum overshoot — i.e. apply maximum acceleration for a period, then maximum deceleration so that the motor stops at the desired position. The same principles obviously apply if speed control was the subject of interest rather than position, although a tachogenerator would replace the potentiometer.

In our earlier example, where we measured the temperature of the pond, we could close the loop by installing heaters and controlling them from the computer, via a DAC unit.

A more involved multiparameter control and monitoring system is in operation in the Mechanical Engineering Laboratories of the University of Nottingham. Here a petrol engine test bed with three engines is run through a speed cycle over 24 hours continuously. A Commodore PET is used as the system controller *and* data logger, monitoring exhaust temperature, cooling water temperature, engine speed and alternator voltage, while controlling throttle setting and ignition/startup using a relay control unit. It's intended to eventually replace the throttle control relay by a DAC unit. The diagram of *figure four* shows how these parameters will be connected to the PET (using, may we say, interface products available from 3D). It also illustrates the advantage of bus connection schemes like the IEEE-488.

Also at the University of Nottingham, the Department of Child Health at the Medical School are using the PET for investigating the effects of environmental temperature on metabolic rate and heat production in small newborn animals. They've developed an automated system for measuring the oxygen consumption of animals weighing in the range one to 500 grams. The system is controlled by, and passes data to, a 16K PET. Information is passed to the PET through a 16-channel ADC unit, and a DAC unit provides analogue output to a chart recorder and various other control lines. Switching operations are performed via the PET user port. The system is shown diagrammatically in *figure five*.

The same department also makes respiratory measurements of infants with breathing problems, and here again the microcomputer has been brought into service. Previously measurements were put onto strip charts and respiratory parameters were derived using graphical methods. Data are now transferred directly to the PET from pressure transducers etc., via a 16-channel ADC. The readings are immediately analysed on-line, permitting analysis of many more breaths than was possible previously. The final results, in the form of pressure/volume loops, are drawn on an analogue X-Y plotter connected to the PET via an interface manufactured especially for that particular purpose.

Conclusion

The examples given here are but a small sample of the enormous range of practical applications to which microcomputers are being put. Relatively cheap and versatile interfaces can now be obtained (either as standard or custom designed) to assist the user in building-up his own system. While much of the micro sales activity concentrates on the more lucrative business and commercial markets, some interesting and imaginative work is being done at the interface; it's a rapidly growing field and one that's making people think again about the traditional concept of the robot.

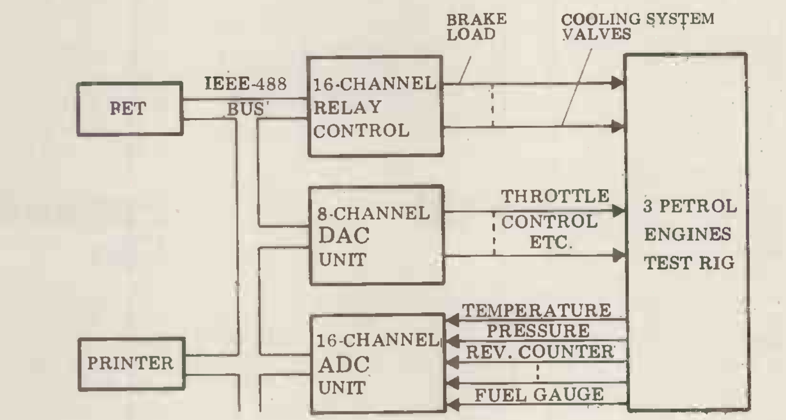


Fig. 4 Petrol Engine Performance Assessment Rig

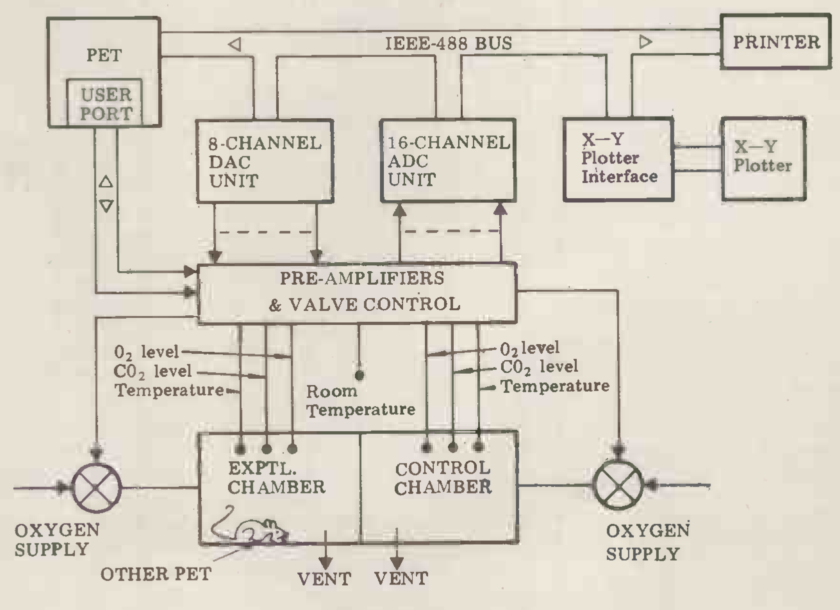


Fig. 5 Environmental temperature effects

BOOKFARE

Malcolm Peltu casts a net that covers a BASIC programming instructional, "Fred" and a treatise on the police computer.

BASIC Survival

Despite the scorn poured on it by Professor Dijkstra and programming purists, BASIC is still alive and well and running wild in personal computers throughout the world. Although Pascal may soon start muscling in, the requirement to learn BASIC, particularly in schools, will remain for many years to come.

One of the most interesting BASIC teaching publications (in fact, four of the most interesting) is *Computer Programming in Basic*, a four volume self-instruction course, divided into sixty lessons. The reader is taken gently by the hand and led through the lessons, with plenty of examples and advice. Each lesson starts with a short summary of the contents so that the reader can decide whether to skip sections that are too elementary. The lessons are carried forward by a series of questions and problems (plus answers) and, where necessary, hints on how to move towards a solution.

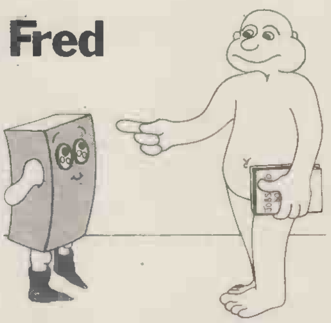
According to Tim Eiloart, one of the authors, the technique of providing graded hints and dividing a complex problem into simpler sub-problems is used to overcome a common difficulty in programming text books . . . where the answer to a posed problem is given without any real explanation of the thought processes that led to it.

With this traditional approach, says Eiloart, the reader goes from complete bafflement one minute to the full home-and-dry answer the next. "You may as well teach mountain climbing with a helicopter," he comments.

To a great extent the books he's co-authored have achieved their objective because their structure allows considerable flexibility to readers moving at different paces, groping for an understanding of the methodology that underlies problem-solving with a computer as well as the details of BASIC itself. The text has in fact been modified to take account of Eiloart's experience when using an earlier version for teaching general studies students. The main criticism I have is that the answers are printed immediately after the problems and I found, however hard I tried not to, that my eyes immediately took in the gist of the answer; the solution was to use a bit of card to cover it up — a bit cumbersome. On the other hand, other people I know who have read the book, including a schoolkid, lapped it up and preferred this format to having to jump between pages, as happens with some other self-teaching books.

At £7.50 for all four volumes, the books represent good value for money. The first part is called Basic Basics and starts with the question, What is a computer? Part 2 is called Introducing Basic and takes in flowcharting and fundamental BASIC concepts, including the dreaded GOTO. The other two parts go into particular BASIC techniques and applications in more detail. The whole course is enlivened by some friendly cartoons.

Fred



Fredland is a state of mind with twenty six cities (called Aay to Zed), two political groups — the Practical and Theoretical Parties — and it's inhabited by peaceful two-dimensional shapes. Fredland is also a pleasant gimmick used to explain the fundamentals of many things, from book-keeping to (you guessed it) computers.

"Fredbooks are just the books to be read by people with no time to read" begins the Preface to *Fred learns about computers*; there's also an old Fredlandic proverb which goes: "A little knowledge is a dangerous thing but ignorance is lethal". Unfortunatelyanyone wishing to gain instant enlightenment on computers without having to read very much will find this Fredbook a bit heavy going, although it's packed with inventive and humorous drawings.

The book is written as a dialogue between Fred, the seeker of knowledge, and Rufus, Professor of Allthings. It does, in fact, cover much that you would expect to find in an introduction to computers which has a heavy bias towards traditional mainframe data processing (micros are not even mentioned in the index) — from bits and bytes, through programming and systems selection to design, testing, et al. In general it provides lively and practical advice which works well with the illustrations; my only reservation is that the Fredland gimmickry and artificial Fred/Rufus dialect style tend to get in the way, spinning out the text unnecessarily and detracting from the logical progression.

By the way, for those who are interested, at the last Fredland elections there was a dead heat and in the resulting coalition the Practical Party were responsible for putting forward a program of wrong things but the Theoretical Party were able to ensure that nothing was done.

Paranoia On File

Are you concerned that the police have a database containing records on four million people (some with no criminal convictions) and almost 20 million cars? Your answer will depend on your paranoia (justified or not) about police surveillance, your faith in computers and your view of the British bobby as a fair cop or brutish oppressor.

Whatever your attitude to that well-known lady of British justice, Laura Norder, there should be little argument over the right of the public to know the kinds of applications for which police computers are being used; then at least discussions about democratic control over policing can be based on a knowledge of what is actually going on in the name of the law.

Journalist Duncan Campbell therefore deserves considerable credit for his relentless pursuit of exposing the nature of police computer systems to public scrutiny. After all, an official government investigation into data protection, the Lindop Committee, complained that they had been unable to elicit sufficient information from the police to decide whether or not the computers are open to unwarranted invasion of privacy.

Campbell has been a thorn in police flesh for many years, through his writings in New Scientist, Time Out and, recently, the New Statesman; in 1978 he was found innocent of charges of breaking the Officials Secrets Act. In an essay entitled *Society Under Surveillance* in the book, *Policing the Police*, Campbell has brought together the publicly known facts about police computing, in particular the Police National Computer (PNC).

The PNC was first conceived in 1959 but it was not until 1974 that it went live following the usual teething traumas of large data processing projects. The application given most publicity by the police has been the stolen vehicle file. In addition, according to Campbell, on record there are around 20 million vehicle owners, 2.5 million fingerprints, 4 million criminal names, 100,000 wanted or missing persons and, from this summer, around 170,000 disqualified drivers. The stolen vehicle file has around 100,000 entries but Campbell says that only about half are concerned with stolen vehicles the rest include information on vehicles whose owners are suspected of having committed crimes or those of of "long term interest".

Campbell believes that about 30,000 of the so-called stolen vehicles are under secret surveillance because they fall into the category of "long term interest", whose whereabouts are to be reported but whose drivers are not necessarily made aware that surveillance is taking place.

Unfortunately it's necessary to qualify the facts in the books by saying "it is claimed by Campbell" because the Home Office and the police refuse to confirm or deny many of the details (although they have given Campbell the sizes of various files on the PNC Burroughs computers). So he's been forced into a considerable amount of sleuthing and information gathering from papers presented at police conferences, newspaper reports, revelations by PNC programmes, etc. That is what makes Campbell's work so difficult and why,to some extent, one can forgive some of the mood of technological paranoia which pervades much of his writing on the subject.

In *Policing the Police*, for example, he seems to detect something sinister about the fact that the PNC has an uninterruptable power supply — which in fact is standard in many computer installations, to avoid temporary power breaks. He also uses the fact that the software is written in Algol and arranged in modules as circumstantial evidence to prove his thesis that new features can be sneaked unnoticed into the system — as does his observation that there could be something sinister about the use of a standby machine to carry out program testing!

In an article in the New Scientist earlier this year he brought telephone tapping back into public attention by claiming that the Post Office is using a computer system which can recognise voices, record them and then automatically print out the conversation. Given the current state of technological development, such a system is virtually inconceivable but the claim,having been repeated generally in the media, has now entered the folklore of police technology.

Campbell generally seems to be a strong believer in technological determinism — the mere existence of a technological potential is taken as determining an inevitable consequence. He implies that the build-up of the PNC and other police systems, such as one at Scotland Yard, inevitably means that police control over society will be more efficient and effective. Yet, commenting on "the world's most advanced" computerised surveillance system which has been built up in Northern Ireland — it includes details of most homes — he says "it is worth noting in passing that, despite this massive surveillance, military commanders do not now think that there is any hope of a victory against the IRA for the foreseeable future".

But despite some of his over-enthusiasm for believing any technological possibility and seeing the fuzz under every bed, Campbell's evidence does indeed give considerable cause for concern because computers *do* add a major new dimension to the volume of information that can be gathered, stored and collated and the speed it can be accessed from many locations. Although it's true that Hitler didn't need computers to do his dirty work, in the not too distant future, computers could undoubtedly provide a secret surveillance system which would greatly simplify and speed up any dictatorial actions. It's outrageous that Britain remains one of the few major Western countries without a law, or proposed law, for providing a legal framework to define citizen's rights to privacy and data protection. Such a law, coupled with an ever-vigilant informed democratic electorate, is the only real way of avoiding a computerised Big Brother.

As indicated by the two other essays in *Policing the Police* (by Martin Kettle and Joanna Rollo) Campbell relates technological policing to a political context — one where the police are seen as conforming "to the British police's traditional functions of defending the capitalist system," to quote the book's editor, anti-apartheid activist Peter Hain. Even if you approach Laura Norder from the other end of the political spectrum, *Policing the Police* is worth reading, particularly if you want to know whether computers are extending the long arm of the law simply to assist the fighting of crime or whether it's to perform other policing functions you might like to see encouraged curtailed.

No Prizes

In the March Bookfare we offered a bottle of wine to anyone spotting the deliberate mistake. Although a number of unintentional booboos were spotted, nobody gets the vino for spotting that the Tailor of Gloucester's coat needed *cherry*-coloured silk not plum-coloured. The wine will be shared (hic) around the office (I warned you it was a silly competition . . . . we win — Ed!)

REFERENCES

Discussed in this month's Bookfare have been:

Computer Programming in Basic by Ian Williamson, Rodney Dale and Tim Eiloart (Cambridge Learning Enterprises Ltd., Rivermill Lodge, St. Ives, Huntingdon, Cambs., £7.50). Sorry — this was included last month, in error.

Fred Learns About Computers by The Chronicler (Continua Publications, distributed by Macdonald and Evans, Estover, Plymouth PL6 7PZ, £.175)

Policing the Police Volume 2, edited by Peter Hain (John Calder, £4.50 paperback, £8.95 hardcover)

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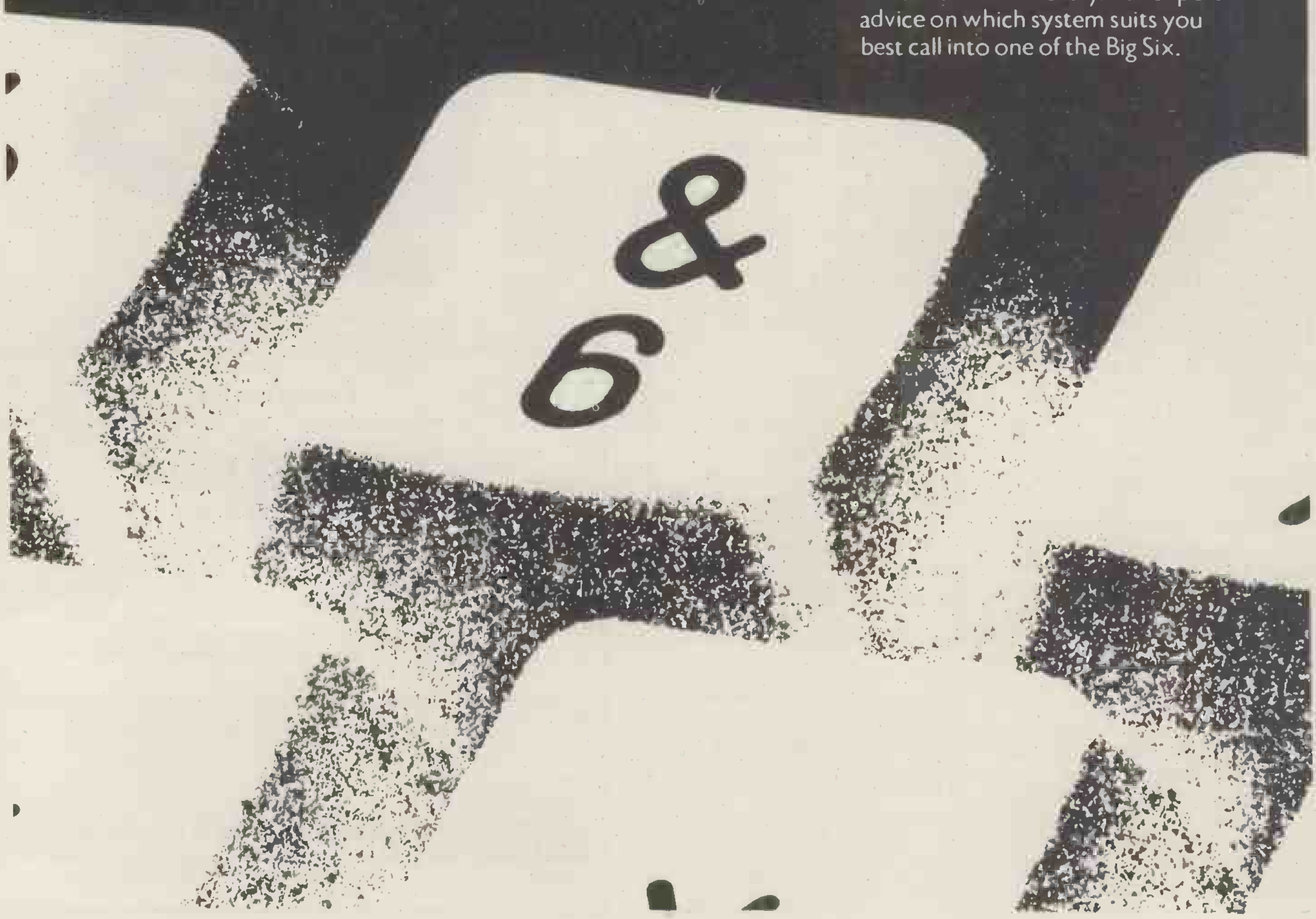

Computer Answers continued from P. 83

can you recommend a book that explains how micros work in a fairly simple way?
Mark Scaler, Redruth

What you need is a primer on microcomputer architecture to "get you off the ground". Unfortunately most beginner's books on personal computing are aimed at the same non-technical mass-market as the machines. Typically they introduce a few simple programming concepts and then move on to teach BASIC by examples — e.g. the use of the micro for calculation, games, or simple business applications.

On the other hand, technical books on machine design are usually not directly relevant to personal computers, having been written as student texts, or introductions for project managers or design engineers; generally they're aimed at a higher scale of machine and investment.

So I can't recommend just one book as a solution to your problem. In fact, the best all-round answer is to join a local computer club. In my experience you can pick up explanations far more quickly by talking to someone in the know than by wading through a book you don't understand, looking for clues.

Another approach is to browse through back issues of American home computing magazines. *Byte* and *Kilobaud Microcomputing* are particularly good for practical, informative hardware and software design articles. Unfortunately few libraries take them, though you might strike gold at a university or polytechnic, or through a club. Byte is available on microfiche from University Microfilms International, 18 Bedford Row, London, but you will need access to a reader; again, a large library should be able to help.

Finally, some books. For cutting through the jargon that makes some articles seem more difficult than they really are, try *X1 Microprocessor Lexicon* by Sybex, £2. Two introductory books which look under the covers more than most are *Peanut Butter & Jelly Guide to Computers* by Willis, £6.30, and *Personal Computing* by McGlynn, £8. (Prices inc p&p from MoI, 1 Francis Ave, St Albans, Herts).
Len Warner

May I Interrupt Continued from P. 62

in these modes, although it may be necessary to use some additional logic to provide PIO — peripheral compatible signals.

To take just one example, in PIO operating mode 1 (the input mode) an active STB signal generated by the peripheral causes the PIO to load data into the port input register and the rising edge of the STB pulse generates an INT. The ready line RDY is driven low by the PIO and remains inactive until the CPU reads the port during the interrupt service routine. The rising edge of the ready signal may then be used to inform the peripheral that further data may be sent to the PIO. By using both the peripheral generated strobe and the PIO generated ready signals one can obtain "hand-shaking" communication between micro and peripheral which provides fast and reliable parallel data transfer.

Finally

At best the above discussion can give only a brief and incomplete account of the full potential of the Z80 CPU/PIO combination in dealing with interrupts. However it may encourage some to have another look at the device manuals and to use interrupts more often. After all one of the few advantages that the micro has over the larger multi-user mainframe computer is that it's so readily adaptable to "real-time" computing and much of its technological impact must lie in this area.

DATA PACKING

by Dick Pountain

It's not unusual in this column for me to compare calculator programming with microcomputer programming; after all a calculator is really nothing more or less than a dedicated microcomputer whose special function is to perform mathematical operations with a speed and accuracy not available on general purpose personal computers.

The "languages" used by programmable calculators are equivalent to microcomputer Assembly Languages, in that each program step is a direct mnemonic representation of a single processor instruction (except for the maths functions which are closer to high level language). In particular, the memory operations provide direct access to a named memory register, rather than defining variables as would a high level language.

Where the calculator differs from a micro, however, is in the nature of the register so addressed. In an Assembler a memory instruction addresses a single byte of storage. A calculator on the other hand, being designed to crunch numbers to 10 digit accuracy, normally stores numbers in Binary Coded Decimal form; i.e. each digit is separately coded as a binary number. This fac ilitates fast and accurate arithmetic operations. In order to hold 12 digits plus an exponent and a sign, a single calculator memory register consists of 7 or 8 bytes of store. Sometimes the programmer can take advantage of this fact to create extra memory registers, though at the cost of foregoing the ability to store fractional or negative quantities. By treating each binary coded digit (or group of digits) as a virtual memory register it's possible to store more integers than the number of memories provided.

In the extreme case, each register can be converted into 10 independently addressable memories, each capable of holding an integer between 0 and 9; a Casio fx502 could store 200 numbers, or a TI59, 900 (a couple of registers must be reserved as working space).

This technique is called "data packing" since several pieces of data are crammed into the space intended for one.

for storage

Data can be packed to different degrees. If a single digit is not sufficient for your application, then 5 x 2 digit registers or 2 x 5 digit registers could be created.

What is required in any of these cases is a pair of programs or subroutines.

One, the input routine, takes an item of data and a virtual address and places the data in the correct decimal place(s) of the requisite memory register. As an example, 10 registers are converted into 100 "virtual memories" number 0-99. To store 7 in "virtual memory" number 58, the program goes to calculator register 5 and stores 7 in the 8th place. So register 5 contains 0.000000700.

The second routine is a recall routine which accepts an "address" and displays the contents of that location; in the above example inputting "58" would produce the answer "7".

Both these routines are easy to write on any calculator which has the INT and FRAC instructions to separate the integral and fractional parts of a number. In the above example, indirect addressing using the first digit of the address (i.e. 5) would locate the correct register; then the 10 "virtual memories" contained in this single register can be accessed by multiplying the content by a power of ten derived from the second digit of the address (i.e. 8). Finally FRAC is used to lop off the parts not required.

In a simpler but maybe more useful data packing system, each register is converted into two memories by storing one number in the integral part and another in the fractional part. In this case the data is "unpacked" simply using INT and FRAC.

I've used this system in a magazine costing program to store a number of constants greater than the number of available registers. The unpacking routine is written into the costing program and unpacks the data as required during a calculation.

A full suite of data packing subroutines may include memory arithmetic as well as store and recall functions, but care must be taken when adding to a memory not to create an overflow which corrupts the next location, (e.g. adding 8 to memory 58 would give 0.000001500 which has produced a spurious 1 in memory 57).

For statistics applications a routine may be devised to automatically decant all the data into the statistics registers for analysis, while still preserving the individual results. In this way a 20 memory calculator like the Casio could record and analyse single digit scores from up to 150 trials.

Another powerful way of using data packing is to employ the 5-digit system above to code scientific notation to 3 significant figures. For example 78592 would be interpreted as 7.85×10^{92}, the last two digits being interpreted as an exponent.

Of course when performing calculations in a data packed mode, the input and recall subroutines must be called instead of using the calculators MR and Min (RCL and STO) which are forbidden.

for input and display

In addition to increasing storage capacity, data packing can be useful for inputting and displaying data.

It's often desirable, in a program requiring two inputs, that these inputs be entered simultaneously. This has the advantage that both data items can be seen and verified before entering, and also it prevents you losing your place in an input sequence i.e., forgetting whether or not you entered the last item!

Data packing using the decimal point as a separator is a handy trick. For instance in the above example the data and address could be packed and entered as 7.58. A portion of the input routine unpacks this and interprets it as 7(data) into 58(address). The ultimate example of this type of input packing is the "Codesplitter" program published in this column last month.

Similarly it's often convenient (in the absence of a printer) when several outputs need to be displayed, to pack them for simultaneous display. This allows the results to be recorded with no fear of losing your place — which is quite likely in a long sequence with no prompts. The methods of packing are the same as for input; in addition the exponent display can be used, at a pinch, to hold two extra digits — e.g. 7.008300542^{23} — if care is taken to choose a scientific notation format. Otherwise the calculator may reformat the display and garble the results.

The Casio 502, as many readers have discovered has another possible packing format in its DMS display. Three results may be simultaneously displayed e.g. 97° 23° 41 so long as the second two are below 60.

To conclude with an illustration, here is a pair of store and recall routines to create 40 five digit memories on the Casio 502.

STORE ROUTINE

```
P0    MinF FRAC M—F X 50 = Min·F FRAC M—·F x=0 GOTO1 GOTO2
LBL1  IND MR·F INT IND M—·F MRF IND M+·F AC GOTO3
LBL2  IND MR·F FRAC IND M—·F MRF ÷ 5 10x = IND M+·F AC LBL3
```

Enter data (up to 5 digits) decimal point, then address (0 to 39) e.g. 78592.36 P0

RECALL ROUTINE

```
P1    ÷ 2 = MinF FRAC x=0 GOTO1 GOTO2
LBL1  IND MRF INT GOTO3
LBL2  IND MRF FRAC X 5 10x =  LBL3
```

Enter address e.g. 36 P1, 78592 displayed.

And as a special bonus here is a pair of routines to encode and decode 3 digit scientific notation, and store in 40 data packed memories.

ENCODE/STORE ROUTINE

```
P2    ENG RND3 LOG MinF INT M—F + ( MRF + 4 ) 10x RND3 = Min·F HLT
      ÷ 2 10x + MR·F = GSBP0
```

Enter data e.g. 78.598^{92} P2. Encoded form displayed 78692. Enter address e.g. 36 EXE

DECODER/RECALL ROUTINE

```
P3    GSB P1 ÷ 2 10x = MinF INT M—F ÷ 2 10x X ( MRF X 2 10x ) 10x =
```

Enter address e.g. 36 P2, 7.86^{93} displayed.

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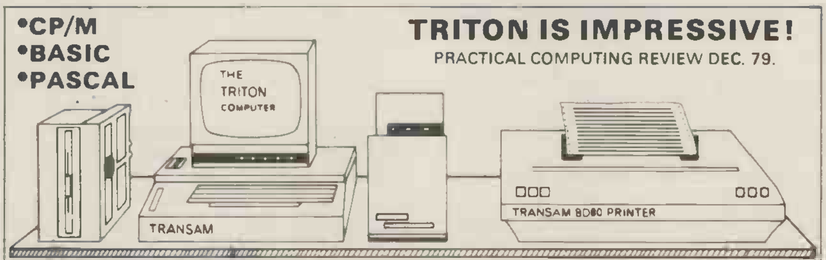

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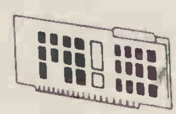

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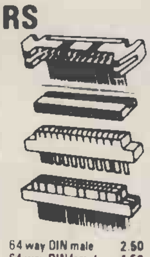

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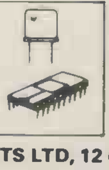

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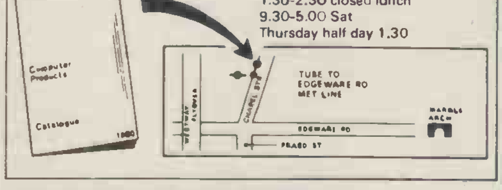

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Compiled and written by
Derrick Daines

Shortly after I prepared my copy for this page last month, the Government announced its proposed expenditure of 9 million pounds on educational computing — and by the time that this copy will appear in print, just about every pundit in the land will have had his or her say on the measures taken. Therefore I don't propose to add anything to what has been said already on that particular topic.

I would, however, like to make a few points about the future, and one or two things need to be stated very loudly and very clearly.

First, Computer Science will eventually become the *minority* use of computers in school. By far the greater number of computers will be used for the computer-aided learning of all sorts of subjects — from junior schools to universities. The time will come — in the not far-distant future — when the number of schools without a computer will be numbered on the fingers of one hand. More, the number of *classrooms* without a computer will be very few; anachronisms rather than the norm. We may even see the time when there will be a computer for every pupil — simple ones for junior use and ranging up to really powerful machines for every university student!

Of course, I'm not going to be so stupid as to put a date on this . . . there are too many intangibles. Nevertheless, barring some great catastrophe, the outcome is inevitable.

Assuming that I am even partly right, the attitude of central government and the LEA's — right down to advisor level — is appallingly lackadaisical. Ignorance and misinformation abound everywhere among those whose duty it is to guide the education service.

Every week I am approached by teachers seeking guidance — and I am not an LEA advisor. They sense the value of the computer as a teaching aid and dimly perceive some of the truth of what I have stated above — but there is no-one they can turn to for help and advice. Not to their LEA, which in all probability will have not even *considered* a CAL policy, let alone formulated one; and not to their maths advisor, because he (where he knows anything at all about computing) will consider it merely a tool for maths teaching.

So, anybody at "the chalkface" who wishes to introduce computer-aided learning into his or her school is out on a limb. They'll be immediately faced with dozens of competing claims from manufacturers as to the best machine for their purpose and pocket. Sorting that lot out can take anybody months — and even then individual preferences will cloud the picture.

The result of all this is that hundreds of machines are going into schools, and almost as many different makes. With a half-decent sort of central policy, an LEA would bulk-buy one or two standard machines and effect an enormous capital saving.

There would be other savings too. When the machine breaks down — and it will, sooner or later — the teacher must either find someone to repair it for him or learn how to do so himself. Both courses can be either hideously expensive in cash and time, or at worst downright impossible. An LEA on its toes would provide a permanent employee who — given standardisation — would rapidly become expert in diagnosis and repair. He could even have a few standby PC boards for replacements and any school suffering a breakdown could be on-line again in a couple of hours.

Consider, too, the software. Up and down this dear muddlesome land we have dozens of teachers all busy, busy, busy, writing the same programs; an activity that will continue for decades. Need I state the obvious? This is a shocking waste of time and effort, yet *nobody* is doing anything to alleviate the situation. And it will get worse! If a teacher borrows a copy of a teaching program, it won't run on his machine, because it's a different make! If after much scribble, he gets it to run and improves it, he cannot pass it back to his friend without yet more scribble. Result — a severe brake on what should be and could be a happy journey towards the distillation of the very best teaching methods available in the country.

Back to the LEAs. If only they were to standardise, then all teachers in their area would be able to interchange ideas and programs freely.

OK . . . end of lecture. I'll get off my soap box! Sorry to go on like that, but I feel rather strongly about it. And if any of you out there have got views that you want to air, then let's be hearing from you. I don't care who you are — teacher, pupil, student or just plain interested — drop me a line. How do you see the role of the computer in the classroom of the future, and what should we be doing about it?

Programs

What can I say? I'm enormously impressed by the flow of programs that has reached me, via the editor, in response to John Coll's recent plea.

It's not only the *number* of programs that impresses me, but also their variety. Games predominate, but don't knock them — they stimulate interest and those youngsters who write them are exercising real skills that will stand them in good stead.

Perhaps what impresses me most is the enormous enthusiasm for computing that I sense among young people everywhere. This is truly great, but what a sad contrast to the attitude displayed by the LEAs! (Steady, I've ploughed that field already!)

Programs Received

HORSE RACE — by Richard Sheldon (13) (address unknown — please call us.)
STARTREK, PONTOON, ROULETTE, HANGMAN — by David Hartnell (16) of Birmingham
DICE THROWER — by Tony Hailes (15) of Birmingham
DIGITAL FREQUENCY MEASURER — by J.W. Roston (14) of London
MISSILE — by Mike Wilson of Selborne
NUMBER GUESS — by Paul Whitmarsh (14) of Sidcup
MAZE — by Alan Heal (15) of Kenilworth
ONE-ARMED BANDIT — by Torstein Kingshem (17) of Oslo
QUESTION TIME — by R.A. Develyn (16) of Horsham
MSI BASIC SUBROUTINES — by Robert Coombes (14) of London
PICTURE DRAWER — by Colin Hughes (12) of Luton
FOOTBALL, TENNIS, GOAL, SQUASH — by Paul Williams (14) of Horsham
NEW PET COMMANDS — by David Simons (14) of Welwyn Garden City

We've also had some interesting letters from B.M. Graham (16) of Chigwell and O. Garland (14) of London, both of whom raise points that I would like to discuss more fully at a later date.

Thanks a lot to all of you. If you keep on like this, I'll be able to force the editor to double the space that he allows us each month. (Tomorrow the world!)

Competition

Finally for this month, just a reminder about our competition. We're looking for drawings of a design suitable to head this page — also to be made up into a supply of metal badges; I'll be giving book tokens for the best. Don't hang around too long — I want to close the competition quite soon.

PS — I still haven't received any programs from girls!

YCW programs — See page 124

PUPIL POWER AT SANDBACH

At a time when Government spending on education is being reduced, it may seem strange to suggest new ways of setting up schools computer systems. On the other hand, scarcity of resources must prompt schools to make efficient use of capitation, and in this article S. J. Hemmings describes a very cost effective schools computing system.

Firstly, what is required? A typical 4th or 5th year computer studies class will consist of about 25 pupils studying the subject to CSE or O level. Assuming that the class is of average ability and that all their teaching is to be done within the school (some schools use local authority or college facilities) then the following requirements must be met:

1 A minimum of six teletype (or similar) terminals allowing "hands-on" programming experience in BASIC.

2 A means of storing large amounts of data (be it programs or raw data) for future use.

3 A means of producing a printed copy of work done and program results.

4 On a more technical level, the ability to program the machine in both a high level language (like BASIC) and a low level language (like the 8080 assembly code.)

Of these, the ability to produce hard copy is the most important. All examination boards require printed proof of a pupil's ability to program. Point 2 requires either cassette or disc storage and anyone who has used both will recognise the superiority of disc. Point 4 might be expanded to require the provision of other high level languages (especially PASCAL) if the subject is to be taught to any real depth.

It should be clear that the provision of a single microcomputer goes only a very little way towards providing what's required. As a demonstration tool it might be excellent, but 25 children cannot be taught solely by example — and if one child is using the machine, what do you do with the other 24?

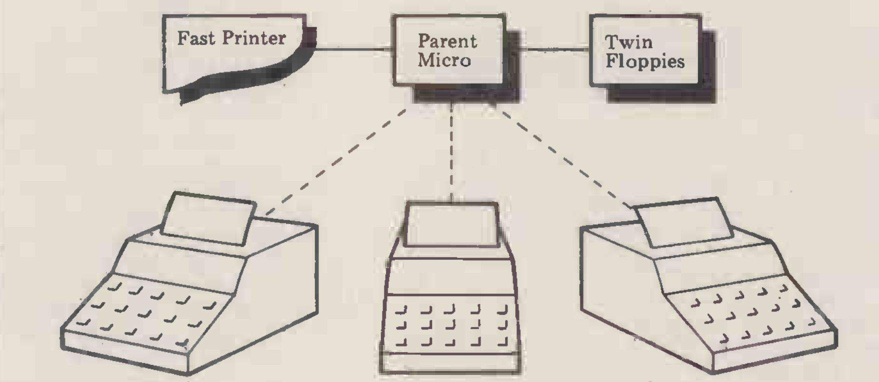
Sandbach High School in Cheshire was fortunate in making contact with Real Time Computer Systems of Crewe at a time when the school was looking around for its computer. RTCS designed a low-cost, very flexible system based on radically new lines. Before describing the RTCS equipment fully it might be useful to see why the school decided against existing well-tried equipment.

Faced with limited money in April 1979, we were confronted with a plethora of existing equipment and one overriding requirement — whatever we bought had to be capable of expansion. The first thought, of course, was PET or the TRS 80 but both were rejected very quickly for what seemed to be obvious reasons: in PET's case there was no hard copy, no low level language worth talking about and, at that time, a diabolical keyboard — in terms of expanding we would have needed a printer and perhaps a new PET every year — rather too much like wishful thinking. The TRS80 was rejected for similar reasons. Level 1 BASIC is laughable, while Level 2 still leaves a lot to be desired. The whole machine is a jumble of wires and unlikely to stand up to a lot of moving about within the school. Neither device has a standard floppy disc and, most important, nor can they produce hard copy from the basic configuration.

The other possibility was something like the Altair System 1300 — which is a micro based system driving two floppies and capable of running four terminals simultaneously. Excellent though this might be, it was too expensive and unable to expand up to the ideal of six terminals.

When RTCS were approached they reacted enthusiastically, helped by the fact that their Managing Director, Dave Yardy, is a parent of one of the pupils. They suggested a couple of ideas:

First, a series of stand alone disc based micros to interface with teletypes (of which there are lots secondhand), large enough to handle things other than BASIC. Second, and this was the new development, the system shown below.



Daughter micros

Here, a largish parent micro, driving two floppy discs and perhaps a printer, has access to a number of high level languages and other facilities on the discs. This micro is used to feed a series of daughter micros at the beginning of the day. The daughters are simple processors with lots of RAM, and I/O ports and very little ROM. At power-up the teacher decides which language the class is to use and dumps the interpreter/compiler/operating system into the relevant daughter processors one at a time. In this way each daughter can be filled with the same or different languages for use by the pupils. After filling, each terminal is effectively a stand-alone micro. If programs need to be saved or data files accessed (a relatively infrequent requirement at this level) then the daughter must contact the parent micro for data transfer. The beauty of this system is that there is no limit to the number of daughter systems which can be handled and the software needed to be resident within the parent micro is relatively simple (after all, this is not a multi-access system).

We are well pleased with the idea — it offers enormous scope for expansion and we have made a start by purchasing the parent system. A very powerful micro in its own right, it's at present being used to drive a single terminal. It's 8080 based with 48K of RAM (max. 64K) and twin floppies. As time passes and more money becomes available we hope to purchase further (relatively cheap) daughter processors. Already the system is functioning to teach up to A Level and is used extensively for Data Processing within the school. It can handle Microsoft BASIC, has a CP/M operating system and an 8080 assembler. In the future Cobol, Fortran, Pilot and a version of Pascal are feasible.

Of course there'll be drawbacks, but we're very lucky in that RTCS is a local firm with an interest in the school and as a result maintenance is not a problem. Teletypes don't grow on trees and they have to be purchased for each daughter micro (this is still cheaper than a single PET, even with the micro thrown in). The thing of our future is sure to be the VDU; it's smaller, more robust and quieter but bang goes the hard copy. If VDUs were used with the RTCS system it might seem to be getting rather like a room full of PETs or TRS 80s, except that they would cost a lot less and printing would be easier via the parent micro.

The real problem is that Government the LEAs, are not yet prepared to give schools computing the money needed. In the meantime the RTCS system offers a cheap, flexible, expandable system for use with a full class of children; and last but not least, it's all British!

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Britain's most up-to-date and comprehensive guide to the selection of microcomputer equipment, compiled for PCW by Richard Olney of Heuristic Consultants.

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ACT System 800 (£3950)	ACT: 021 455 8686 (50)	48K RAM: 6502: dual 5¼" F/D (800K): 12", 30x64 VDU: 1 S/P: 1 P/P	MDOS: BASIC: A: PL/M: *Forth: Fifth: Cesil: Pilot*	Fully IBM compatible K/B: high resolution graphics: available with dual 8" F/D (2.4MB), £4950: (E)
Alpha Micro (£8,200)	Alpha Micro (UK) Ltd 01-250 1616 (TBA)	64K-16M RAM: 16 bit: dual 8" F/D (2.4MB): 6 S/P: modular	multi-user O/S: BASIC: M/A: Pascal: U	Expands to 1200 MB, 32 terminal system: (E)
Altos ACS 8000 (£3,398)	Logitek: 02572 66803 (TBA)	64K RAM: Z80: 1K ROM: dual 8" F/D (1MB): 2 RS232: 1 P/P	CP/M: *BASIC: Fortran: Cobol: Pascal: M/A*	(S&H)
Apple II (£695)	Microsense: 0442 41191 (190)	16-48K RAM: 650Z: 8I/O slots: option — single 5¼" F/D (116K) £349	O/S: BASIC: *Pascal:* games:	280x192 high res graphics: integer BASIC in 6K ROM (S)
Athena 8285 (£7955)	Butel-Comco Ltd: 0703 39890 (TBA)	64K RAM: 8085A: dual 5¼" F/D (644K): 12", 25x80 VDU: 150 cps printer: RS232C port: options — dual 8" F/D (2MB)	AMOS: T/E: BASIC: *Cobol: Fortran: Pascal: APL: M/A*	Extended ASCII K/B with numeric pad: graphics: many fully integral configurations possible: (S)
Atom (£120)	Acorn: 0223 312772 (N/A)	2-11K RAM: 6502: Full keyboard: C int: T.V. int: 20 I/O lines: 1 P/P	BASIC in 8K ROM: A: Cass OS	High resolution graphics on bigger model: colour monitor O/P: loudspeaker (B)
Attache (£7,000)	R.H.Thorpe Ltd: 0276 29492. R.J.Spiers Ltd: 0603 416573 (TBA)	48K RAM: 8080: dual 8" F/D (616K): 9", 16x64 b&w VDU: 180 cps printer	ExBASIC: *Fortran*	(S)
Billings BC-12FD (£4,295)	Mitech: 04862 23131 (TBA)	64K RAM: Z80A: dual 5" F/D (640K): 12", 24x80 b&w VDU	DOS: BASIC: *Fortran: Cobol: A*	8" F/D (2MB) to replace 5", £6,000: additional dual 8" F/D, £2,750 (S)
Canon BX-1 (£3,850)	Canon Business Machines (UK) Ltd: 01-680 7700	64K RAM: 6800: Single 5¼" F/D (65K): 12", 25x80 VDU: 5xV24 ports: options — single 5¼" F/D (65K), £1,500	DOS: ExBASIC: *A*:	Also supplied with integral thermal printer instead of VDU: (S&H)
CBS Mk 2&3 (£5900;£8648)	Compelec: 01-636 1392 (N/A)	64K RAM: Z80: dual 8" F/D (1MB): 12", 24x80 VDU; 132 col, 30 cps printer: 2 S/P: 1 P/P	CP/M: BASIC	Mk. 2 with 2MB F/D, £5,900. Can upgrade to Mk.3 — £8,150 (11MB H/D and 4 more S/Ps): Desk mounted: Up to 44MB H/D possible, £4,529 extra: multi user system with 208K RAM, £10,648: (S&H)
Challenger 1P & C2 (1P, £238; C2, £404)	CTS: 0706 79332: MBM: 01-980 3993. Mutek: 0225 743289. Millbank Computing: 01-549 7262. U-Microcomputers: 0606 853390. Byte Shop: 01-518 1414	4-32K RAM: 6502: C int: RS232 port:	O/S: BASIC: A: *ExBASIC*	D/A conv: col capability: 8K microsoft BASIC in ROM: option — dual 5¼" F/D (160K), £550: for C2, dual 8" F/D (1.15MB) and 20MB H/D: runs OSI business software on 8" F/D. (S)
Challenger C3 (£2,334)	As above	32-56K RAM: 6502, 6800, Z80: dual 8" F/D (1.15MB): 2-16 S/P	OS65U: BASIC: *CP/M: Fortran: Cobol*	Also C3B & C3P H/D modules: 74MB for about £10,000: (S&H)
Comma VO3 (£4,200)	Comma: 0277 811131: (N/A)	32K RAM: LSI 11: dual 8" F/D (512K): 4 serial DLU11S ports: modular	*RT11 O/S (£750): BASIC: Cobol: Fortran*	Many configurations possible: (H)
Compucolor II (£998)	Abacus: 01-580 8841: (6)	8-32K RAM: 8080: 13", 32x64 8-colour VDU: single 5¼" F/D (51K): RS232 port	ExBASIC (ROM): A	16K module, £1,078: 34K, £1,209: maintenance and programming manual available: (I)
Compucorp 625 (£6,000)	Compucorp: 01-952 7860: (17)	60K RAM: Z80: dual 5¼" F/D (700K): 9", 16x80 b&w VDU: 40 cps printer: 1 RS232 port	A: BASIC: U	Also 655 model with 320K F/D capability and 12", 20x80 VDU — £4,345 (B)
Comp Workshop System 1 (£1,600)	Comp Workshop: 01-491 7507 (N/A)	32K RAM: dual 5¼" F/D (170K): 9", 16x64 b&W VDU: modular	A: BASIC: Fortran: Flex: Pascal: Pilot	This is an example configuration from a fully compatible modular range: (E)
Cromemco System 2, System Z2H, System 3 (£1,995/£4,998/ £3,293)	Comart: 0480 215005; Datron: 0742 585490; Microcentre: 031 225 2022 (20)	64K RAM: Z80: dual 5¼" F/D (346K) Sys 2 and Z2H... dual 8" F/D (1.24MB) Sys. 3: S/P: P/P	CDOS: *BASIC: Cobol: Fortran; Multi-user BASIC: A:*	All systems expandable to multi-user (2—7 users), £3,455 £6,400: 11 and 22MB options: also dual 8" F/D (996K) on Sys. 2 and 3: (E)
DAI (£998 48K)	Data Applications (UK): 0285 2588 (TBA)	12-48K RAM: 8080: C int: 24x60 VDU int: RS232 port: Over 20 industrial ints: 2 C ints	BASIC (ROM): U (ROM)	Up to 255x335 resolution graphics: 3 notes and noise generator: PAL output to TV: games paddle
Diablo 3000 (£9450)	Business Computers Ltd: 01-207 3344 (TBA)	32K RAM: 8085: dual 8" F/D (1.2MB):12", 24 x 80 b&w VDU: 45cps printer	DOS: DACL: A: U:	Selection of business packages supplied in price: (S)
Digital Microsystems DSC-2 (£3525)	Modata: 0892 41555 (10)	64K RAM: Z80: dual 8" F/D (1.14MB): 4 RS232 ports: EIA port	CP/M BASIC-E: CBASIC: *Cobol: Fortran: Pascal*	14 or 28 MB H/D available or additional F/D units: (H)
Durango F-85 (£8,250)	Comp Ancillaries: 07843 6455 (12)	64K RAM: 8085: dual 5¼ F/D (1MB): 9", 16x64 green VDU: 132 col 165 cps printer: N/P	*O/S: DBASIC*	Takes up to 5 work stations: fully integrated system: options — additional dual 5¼" F/D (1MB) and 12 MB H/D: (S)
Dynabyte DB8/1 (£1,500)	Dynabyte UK/Europe Ltd: 0723 65559 (6)	32-64K RAM: Z80: S100 bus: 2 RS232 ports: 1 P/P	CP/M: BASIC: Cobol: *Pascal*	Expands to multi-user system: option — dual 8" F/D (1MB), £2,000: also DB8/2 with dual 5¼" F/D (400K), £3,000 (E)
Equinox 200 (£7,500)	Equinox: 01-739 2387 (N/A)	64-256K RAM: Z80: 10MB H/D: 1 S/P: 1 P/P	CP/M: CBASIC: *cobol: Fortran:*	Multi-user MVT/FAMOS available in place of CP/M: (S/H)

List of Abbreviations

A	Assembler	F/D	Floppy disc	M/A	Macro assembler	S/P	Serial port
B	BASIC	G/C	Graphics card	N/A	Not available	T/E	Text editor
C	Cassette	H	Hardware	N/P	Numeric pad	TBA	To be announced
E	Extensive	H/D	Hard disc	O/S	Operating system	U	Utility
		I	Introductory	P/P	Parallel port		
		Int	Interface	S	Software		

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

DIRECT ACCESS

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Euroc (£7,995)	Eurocalc Ltd: 01-405 3113 (TBA)	64K RAM: 8080A: dual 8" F/D (1MB): 15", 25x80 b&w VDU: 132 col 140cps printer	CP/M: CBASIC: A: U:	A year's maintenance and stationery supply inc: (S)
Executive Minicomputer	Binatone 01-903 5211	See Video Genie		
Exidy Sorcerer (£650)	Liveport Data Products 0736 798157 (27)	8-32K RAM: Z80: RS232: 1 P/P: S100 connector: 30 x 64 VDU I/O	O/S: ExBASIC (ROM): *Editor: A: CP/M: Algol: Fortran*	High res graphics capability: 16K version, £760: 32K £859: 48K, £960: option — dual 5¼" F/D (630K), £1,200: User programmable character set: (I)
HP 85 (£2,240)	Hewlett Packard Ltd: 0734 784774 (16)	16-32K RAM: C.P.U.: 5" 16x32 b&w VDU: C (200K): 64 cps printer: RS232 port: 4 P/P	BASIC:	Full dot matrix graphics: N/P: compact portable unit: (S)
IMS 5000 (£1,935)	Equinox: 01-739 2387 (20)	32-64K RAM: Z80: dual 5¼" F/D (320K)	CP/M: CBASIC: *Cobol: Fortran:*	3 drives option: (S&H)
IMS 8000 (£3,515)	As above	64-256K RAM: Z80: dual 8" F/D (1MB)	CP/M: CBASIC: *Cobol: Fortran: MicroCOBOL*	Multi-user MVT/FAMOS available in place of CP/M: (S&H)
IMSAI VDP 42 (£3,900)	Computermarket: 0603 615089 (TBA)	32-64K RAM: 8085: dual 5¼" F/D (400K): 9", 24x80 b&w VDU: 1 S/P: 1 P/P	IMDOS (CP/M comp): A: ExBASIC: U: *CBASIC: Cobol: Fortran*	Supports 8 additional F/D drives: also available, VDP 44 with F/D (780K), £4,400: (H)
IMSAI VDP 80 (£6,200)	As above	32-64K RAM: 8085: dual 8" F/D (1.2MB): 12", 24x80 b&w VDU: 1 S/P: 1 P/P	IMDOS: A: ExBASIC: U: *CBASIC: Cobol: Fortran*	(H)
ITT 2020 (£867)	ITT: 0268 3040 (15)	16-48K RAM: 6502	Monitor: A: ExBASIC: Dis A:	360x192 high res graphics: ExBASIC in 6K ROM: options — single 5¼" F/D (116K), £425; 16K RAM, £110; RS232 port, £96: 32K system, £931: 48K system, £995: (B)
LSI M-One (£5995)	LSI Computers: 04862 23411	8K RAM: 8080: dual 8" F/D (1.2MB): 12", 24 x 80 b&w VDU	FMOS: A	A choice of standard business package included in price: (S)
LSI M-One Model 5 (£9900)	As above	16K RAM: 8080: dual 8" F/D (2.4MB): 2x12", 24x80 VDU's: 120cps bidirectional printer	FMOS: A	One of the VDU's is for inquiry only: (S)
LX-500 (£3,500)	Logabax Ltd: 01 965 0061 (13)	32K RAM: Z80: dual 5¼" F/D (180K): 12" 25x80 b&w VDU: 100cps printer	DOS: BASIC: A	Other printers available: (S)
Megamicro (£6,080)	Bytronics: 0252 726814 (5)	256K: 8080A: dual 8" F/D (1MB): 12", 20x80 b&w VDU: 120cps printer: 2 S/P: 2 P/P	CP/M: U	(H&B)
Microstar 45 Plus (£4800)	Microsense: 0442 41191 (30)	64K RAM: 8085: dual 8" F/D (1.2MB): 3 S/P: RS232 port	STARDOS: CP/M: BASIC: Cobol: Fortran	(E)
MSI 6800 (£1,203)	Strumech: 05433 4321 (5)	16K RAM: 6800: C: 9", 16x64 b&w VDU: 1 S/P	BASIC: Mini A: U	Up to 8 serial or parallel ints possible: (S&H)
MSI 6800 System 1 (£2,175)	As above	32K RAM: 6800: dual 5¼" F/D (160K): 9" 16x24 b&w VDU: 1 RS232 port	DOS: BASIC: U: *A: Fortran*	As above: option — dual 8" F/D (624K), £1,640: (S&H)
MSI 6800 System 2 (£7,500)	As above	56K RAM: 6800: single 8" F/D (312K): 10MB H/D: RS232 port: 9", 16x64 b&w VDU	DOS: BASIC: Multi-user BASIC: A	Rack mounted: options — dual 8" F/D (624K), £1,640; 10MB H/D, £4,250: (S&H)
MSI System 7 (£5,200)	As above	56K RAM: 6800: dual 5¼" F/D (640K): 9", 16x24 VDU: 1 P/P	DOS: BASIC: A	Choice of FDOS, SDOS or Flex: also option — 10MB H/D: (H&S)
Nanocomputer (£420)	Midwich: Waltham Cross 29310 (TBA)	4K RAM: 2K ROM: Z80: C int: 8 digit LED: K/B: RS232 port: 4 P/P	Machine language: *BASIC: A: T/E:*	Designed for hardware education: expandable to 64K RAM system with F/D: (E)
North Star Horizon (48K, £4,650)	Comart: 0480 215005; Comma: 0277 811131; Equinox: 01-739 2387 (20)	24-56K RAM: Z80A: dual 5¼" F/D (360K): 15", 24x80 b&w VDU: 150 cps printer: 2 1 P/P	DOS: BASIC: *CP/M Cobol: Fortran: Pascal*	(E)
Oxford Minicomputer	Binatone 01-903 5211	See Video Genie		
Panasonic JD740U; JD840U (£4550, £5500)	Teletronix: 01-262 3121 (10)	56K RAM: 8085A: 2-4K PROM: dual 5¼" F/D (570K) JD740U: dual 8" F/D (2MB) JD840U: 12", 24 x 80 b&g VDU: 3xRS232 ports.	CP/M: BASIC: *Microcobol*	Also available — JD700U with 140K disc capacity, £4175: JD800U with ½ MB disc, £4750 : (S)
Pascal Microengine (£2,080)	Pronto: 01-599 3041 (TBA)	64K RAM: MCP 1600: 2 RS232 ports: 2P/P: options — dual 5¼" F/D (1MB), £1550: dual 8" F/D (2MB), £1950	BASIC: Pascal	CPU has user written word set: : (s)
Periflex 630/48; 1024/64 (£2500; £3300)	Sintrom:0734 85464 (5)	48K RAM, 630/48: 64K RAM; 1024/64: Z80: dual 5¼" F/D (630K), 630/48: dual 8" F/D (1MB), 1024/64: 2xRS232 ports: 1 P/P: Options — dual 5¼" F/D (630K) £859; dual 8" F/D (1MB) £1025	CP/M: *BASIC: Fortran: Cobol: A*	One day installation training on site included in price (S&H)
PET 8K,16K & 32K (£550, £675 & £795)	Commodore: 01-388 5702 (150)	8-32K RAM: 6502: C: 9" 25x40 VDU: IEEE488 port	O/S: BASIC: A: *Forth Pilot:*	BASIC in 8K ROM: options — dual 5¼" F/D (353K), £795; same, but (800K), £995, plus, with the 2001-8, £30 for the disc operating ROM: (I)
Powerhouse 2 (£1,175)	Powerhouse Micros: 0422 48422 (TBA)	32-64K RAM: Z80A: 5", 27x96 b&w VDU: 1 P/P: RS232 port	FDOS: BOS: BASIC: *ExBASIC: (14K EPROM), £260*	Graphics card available, £190: option — dual 5¼" F/D (700K): (I)
Rair Black Box (£2,300)	Rair: 01-836 4663 (N/A)	32-64K RAM: 8085: dual 5¼" F/D (160K): 2 RS232 ports	CP/M: BASIC: Cobol: Fortran: M/A	16K RAM expansion, £250; dual 5¼" F/D (520K)' £1,000: (H)
Research Machines 380-Z (£1,048)	Research Machines: 0865 49791 (N/A)	16-56K RAM: Z80A: C: RS232 port:	Tiny BASIC: graphics: *A: ExBASIC: CBASIC: Cobol: Fortran: Algol: CP/M: U:*	Designed for education: high res graphics being developed: options — dual 5¼" F/D (168K), £895 and dual 8" F/D (1MB), £1,695: 56K version, £1,654: (S)
SDS 100 (£4,290)	Airamco: 0294 57755 (11)	64K RAM: Z80: dual 8" F/D (1MB): 12", 24x80 VDU: S100 bus: RS232 port: N/P: 1 P/P	CP/M: A: ExBASIC: *Cobol: Fortran*	Facility for 8K PROM: (E)

IN STORE

DIRECT ACCESS

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
S.E.E.D. System One (£2,175)	Strumech: 05433 4321 (4)	32-56K RAM: 6800: dual 5¼" F/D (160K): 9", 16x24 b&w VDU: RS232 port	DOS; BASIC: U: *Fortran: Cobol: M/A*	Up to 8 I/O ports: max of 4 F/D drives: option — dual 8" F/D (624K): (E)
Semel 1 (£2,900)	Strutt Electrical: 0822 5439 (N/A)	16-64K RAM: Z80: single 8" F/D (250K): 12", 24x80 b&w VDU: RS232 port	BASIC: *Cobol: Fortran*	Supports up to 8 drives option — single 8" F/D (250K), £500: (I)
Sharp MZ-80K (£520)	Sharp Electronics (UK) Ltd: 061 205 7321 (22)	6-34K RAM: Z80: C: 10", 24x40 b&w VDU	BASIC: A:	Graphics: loudspeaker: BASIC in 14K RAM: 34K machine, £740: (B)
Sinclair ZX80 (£100)	Science of Cambridge: 0223 311488 (N/A)	1-16K RAM: 780-1: C int: T.V. int: full K/B: 44 pin expansion port	4K BASIC in ROM	CPU is NEC 3.25 MHz version of Z80A: available as kit, £80: mains adaptor £9:(S)
Sirocco (£3,900)	Elvingate Computers: 069 245189 (TBA)	64K RAM: Z80: dual 5¼" F/D (940K): 12", 24x80 VDU: RS232 port	CP/M: CBASIC: *Cobol: MBASIC: Fortran*	Direct memory addressing: memory mapped VDU: free standing keyboard: option — 10MB H/D : (S&H)
Smoke Signal Chieftain 1 (£3,050)	Windrush Micro Designs 069 245189 (TBA)	32-64K RAM: 6800: dual 5¼" F/D (160K): 12", 24x80 VDU: 112 cps printer: RS232C port	DOS: BASIC: *DBASIC: RBASIC: A: Fortran: U*	Also Chieftain 3 with dual 8" F/D (1MB), £3,950 (E)
Solitaire WP & BS200 (£6,750&£7,950)	Solitaire KPG: 01-995 3573 (TBA)	64K RAM: 8085: 14" VDU (with own CPU): 45 cps printer: CPU port: dual 5¼" F/D (700K) with "WP", and dual 8" F/D (960K) with "BS200"	DOS: BASIC (optional on the "WP")	All Solitaire systems are compatible: graphics on 11x13 dot matrix: (S)
Solitaire/HBS100 (£9,500)	As above	64K RAM: 8085: 10MB H/D: 14" VDU (with own CPU): 200 cps printer: CPU port	DOS: BASIC	Up to 8 interface terminals can be used: also HBS200 with 20-80 MB of H/D: HBS100 limit is 40MB: (S)
Sord M100 ACE (£2,650)	Midas Computer Services Ltd: 0903 814523	48K RAM: Z80: single 5¼" F/D (143K): 12" 24x64 col VDU RS232 port	O/S: BASIC	With colour graphics: 8K ROM: option — single 5¼" F/D, £300: (I)
Sord M223 (£3,500)	As above	64K RAM: Z80: single 5¼" F/D (350K): 12", 24x80 b&w VDU: S100 bus: RS232 port	O/S: BASIC	Other configs possible: extra F/D, £450: (I)
SPC/1 (£3755)	Digital Data: 01-727 6668 (TBA)	64-1024K RAM: 8085A-2: dual 5¼" F/D (180K): 24x80 b&blue VDU: 2xRS232 ports: options — single 8" F/D (1MB) £1090; 20 MB H/D £7650.	Mikados: COMOL: Pascal: *A*	Large choice of extras and peripherals, with 32K RAM and single F/D (no Pascal) £1995: (S)
Superbrain (£1,995)	Icarus: 0632 29593 (TBA)	64K RAM: 2xZ80: dual 5¼" F/D (320K): 12", 25x80 b&w VDU: S100 bus: RS232: TRS80 port	CP/M: A: *BASIC: Cobol: Fortran: APL Pascal*	Limited graphics: mainframe int available: options — dual 5¼" F/D (320K): dual 8" F/D (2.4MB): 8-120 MB H/D: (S&H)
System 80 (£1505)	Nascom: 02405 75155 (20)	16-48K RAM: Z80A: single 54" F/D (280K) 80 cps printer: TV: int: RS232 port: option — single 5¼" F/D (280K) £240	CP/M: 8K BASIC	Choice of EPROM firmware (extra): colour graphics £140 (kit): (S&H)
Tandberg EC10 (£5,000)	Tandberg: 0532 35111: (N/A)	50K RAM: 8080A; single 8" F/D (250K): 12", 25x80 b&w VDU: RS232 port	ExBASIC (24K): Multi-user BASIC: A: U: *Cobol*	(S&H)
Tandy TRS 80 Level 1 (£380)	Tandy: 021 556 6101 (200)	4-16K RAM: Z80: C: 12", 16x64 b&w VDU	BASIC: A:	BASIC in 4K ROM: upgradable to level 2: (I)
Tandy TRS 80 Level II (£515)	As above	4-48K RAM: Z80: C: 12", 16x64 b&w VDU: RS232 int: 1 P/P	BASIC: *M/A: Fortran*	16K machine includes N/P: 4-16K upgrade, £120 (£85 without pad): max config, £1,005: option — single 5¼" F/D (78K), £478 (max of 4): (I)
Tandy TRS80 Model 2 (£2290)	As above	32-64K RAM: Z80A single 8" F/D (500K) 12", 24x80 VDU: 2S/P 1P/P	DOS: BASIC	Keyboard has numeric pad: 64K version, £2250: (S)
TECS (£1,600)	Technalogics: 051 724 2695 (TBA)	16-56K RAM: 6800: 8K PROM: RS232 port: C int	BASIC: *T.DOS: Prestel: Monitor:*	256 ch graphics: Prestel compatible: plugs into standard TV: option — dual 5¼" F/D (320K), £800: (S&H)
TEI 208 (£3,841)	Abacus: 01-580 8811 (5)	32-60K RAM: 8080/8085: dual 5¼" F/D (320K): 9", 24x80 green VDU: 3 S/P: 3 P/P	CP/M: *BASIC: Cobol: Fortran: Pascal: Algol*	(S&H)
TEI 212 (£4,886)	As above	32-60K RAM: 8080/8085: dual 8" F/D (1MB): 15", 24x80 green VDU: 3 S/P: 3 P/P	CP/M: *BASIC: Cobol: Fortran: Pascal: Algol*	(S&H)
Terodec DPS 64/1-4 (£3,014)	Terodec (Micro-systems) Ltd: 0344 51160: (TBA)	64K RAM: Z80: dual 8" F/D (1MB): 12", 24x80 b&w VDU: 2 S/P: 3 P/P	CP/M: *BASIC: Cobol: CBASIC: Fortran: Algol: Pascal*	TMZ 80, enhanced model in integral work station, £5,495 (with 4MB F/D): DPS 64 with 2MB F/D is £3,319: options — dual 8" F/D (1MB), £1,150: dual 8" F/D (2MB), £1,455: (S&H)
TI99/4 (£750)	TI: 0234 67466 (TBA)	16K RAM: 26K ROM: 9900: 24x32 b&w VDU: 2 C int: RS232 port	OS: BASIC	Various peripherals available soon; can run 16 colour TV screen: (S)
Triton L8.2 (£611)	Transam: 01-402 8137 (N/A)	32K RAM: 8080: C int 16x64 VDU int: 1 S/P: 1 P/P	OS: A: Pascal: M/C: *BASIC: CP/M*	Graphics: 5¼" or 8" F/D are available: (S&H)
Vector Graphics MZ (£2,595)	Almarc: 0602 625035: Sintrom Microshop: 0734 85464: Metrotech 0895 57780: (5)	56K RAM: Z80: dual 5¼" F/D (630K): 3 S/P: 2 P/P	DOS: BASIC: A: *CP/M2: Algol: CBASIC: Cobol: Fortran: Pascal*	Includes PROM burner: also System B with graphics and N/P, £3,195: (E)
Video Genie EG 3003 (£378)	Lowe Electronics: 0629 2817: Binatone: 01-903 5211 (N/A)	16K RAM: Z80: 500 bps C: 32x64 TV int: extra C int: 1 P/P	BASIC: *M/A: Fortran*	BASIC in 12K ROM: graphics available: F/D under development: Binatone call *their* 16K model "Executive Minicomputer" and a 4K version, "Oxford Minicomputer" — prices TBA: (I)

List of Abbreviations

A Assembler	F/D Floppy disc	M/A Macro assembler	S/P Serial port
B BASIC	G/C Graphics card	N/A Not available	T/E Text editor
C Cassette	H Hardware	N/P Numeric pad	TBA To be announced
E Extensive	H/D Hard disc	O/S Operating system	U Utility
	I Introductory	P/P Parallel port	
	Int Interface	S Software	

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software/ Firmware	Miscellaneous (Documentation)
Zenith WH-11A (£4,359)	Heath Ltd 0452 29451 and 01-636 7349 (N/A)	LSI 11: 16-32K RAM: 25x80 VDU: S/P: P/P	*O/S: BASIC: Fortran:* A: U:	PDP 11 compatible: option — dual 8" F/D (512K): (S&H)
Zenith Z89 (£1,490)	As above	16-48K RAM: Z80: single 5¼" F/D (102K): 12", 25x80 b&g VDU: RS232	*BASIC: A: H.DOS: CP/M: MBASIC: CBASIC: Fortran*	3 drives option: (I)
Zentec (£5,700)	Zigal Dynamics Ltd: 02405 75681 (1)	32-64K RAM: 2x8080: dual 5¼" F/D (512K): 15", 25x80 b&w VDU: RS232 port	O/S: A: U: *BASIC: Micro Cobol*	User programmable character set: option — dual 8" F/D (1MB): (S)
Zilog MCZ 1/05 (portable): MCZ 1/20A (£4200, £4800)	Micropower: 0256 54121: Memec: 084421 5471 (N/A)	64K RAM: Z80: dual 8" F/D (600K): RS232 port: MCZ 1/20 A only. . . 1P/P: option— 10MB H/D,£7100	RIO: O/S: *Cobol: BASIC: Fortran: Pascal* 1/05. . .M/A: U 1/20A. . .*PLZ: U*	Available desk top or rack mounted: Debug in 3K PROM: 1/20A runs multi-user Cobol and has up to 5 terminals and 40MB possible: (S&H)
Z Plus (£4,000)	Rostronics: 01-874 3665 (TBA)	32-64K RAM: Z80: dual 8" F/D (1MB): 2 S/P: 2 P/P	CP/M: A: U: *BASIC: Cobol: Fortran: Pascal*	(S&H)

SINGLE BOARDS

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software/ Firmware	Miscellaneous (Documentation)
Acorn (£65)	Acorn: 0223 312772 (N/A)	1.1/8K RAM: 6502: EPROM socket: Hex K/B: C int: 8 digit LED display: up to 16 ports: options — Eurocard 64 way connector: VDU card: Full K/B card	½K monitor: *BASIC*	Kit: programmable address linking; on board 5V regulator: available assembled, £79 (S&H)
Aim 65C (£265)	Pelco: 0273 722155 (4)	1-4K RAM: 6502: 12K ROM: full K/B: 20 char LED display: 20 char thermal printer: Cx2: RS232 port.	A: Dis A: T/E: 8K monitor in ROM	Available as S100 system with A or BASIC in ROM (£480) from Portable Micros (0280 702017): they also have briefcase version (£750) (E)
Cromemco SC (£260)	Comart: 0480 215005 (17)	1K RAM: Z80A: 8K EPROM sockets: RS232 port: 3 P/P: option — S100 bus.	*Monitor and control BASIC in EPROM*	5 program interval timers: can put own BASIC programs in EPROM (E)
ELF II (£114)	Newtronics: 01-348 3325	1/4K RAM: RCA 1802: Hex K/B: 2 digit LED: TV int: C int: RS232 port: options — 4K RAM, £69; full K/B; VDU card	1K monitor: A: Dis A: T/E: *BASIC:* 244	TTY, n-line decoders: low resolution graphics (high resolution available) kit (H)
Explorer (£295)	Newtronics: 01-739 1582 (15)	4K RAM: 8085: Hex K/B: RS232 port: S100 bus: C int: options — 6 slot S100 £32; 8K EPROM sockets £50.	2K monitor: *CP/M: BASIC*	Programmable 14 bit counter: kit (S&H)
H8 (£262)	Heath: 0452 29451 (TBA)	4K RAM: 8080A: Octal K/B: 6 digit LED: speaker: options — single 5¼" F/D (102K), £399; 16K RAM, £314; C int, £72	1K monitor: *BASIC in RAM: FORTRAN: T/E: A: U:*	Kit (S&H)
Hewart 6800S (£299)	Hewart: 0625 22030 (N/A)	16K RAM: 6800: full K/B: VDU int: 2xC int; 1 S/P: 2 P/P: option — 16K RAM, £90	1K monitor: A: T/E	Can be upgraded with 6809 (H)
Hewart 6800 MkIII (£152)	As above	1K RAM: 6800: VDU board: options — single 5¼" F/D (75K), £350; PROM programmer, £32: calculator board, £32	1K monitor	(H)
Mk 14 (£39.95)	Science of Cambridge: 0223 311488 (N/A)	8060: 1/4-2K RAM: Hex K/B: 7 char LED: options — VDU int (32x16 with graphics), £29; C int, £6; PROM prog, £10, 2K memory expansion, £15	Machine code	Designed for control applications rather than high level computing expansion (H)
Microtan 65 (£69)	Tangerine: 0353 3633	1K RAM: 6502: 16x32 T.V. int: options — TANEX board, 7K RAM, 6K ROM, 8K BASIC; 3S/P	1K TANBUG monitor: *BASIC*	Optional 64x64 pixel graphics:(E)
Nascom 1 (£165)	Nascom: 02405 75155 (20)	4K RAM: Z80: full K/B: TV int: 2 P/P: 1 S/P	2K monitor: *BBASIC: tiny BASIC: A: T/E: U*	Now available as Nascom 2 with 8K RAM and 8K microsoft BASIC in ROM, £295 : (S&H)
77/68 (£90)	Newbear: 0635 30505 (N/A)	4K RAM: 6800: LED: C int: VDU int.	1K Monitor: *BASIC:*	Expandable to racked Nascom compatible system: (B)
SBC 100 (£135)	Airamco: 0294 57755 (11)	1K RAM: Z80: 8K ROM: S100 1 S/P: 1 P/P: option — voltage regulator	*1K monitor: DOS in ROM*	Kit: available assembled, £196 (E)
Superboard (£188)	MBM: 01-981 3993 (N/A)	4-8K RAM: 6502: 10K ROM: full K/B: VDU int: C int: options — RS232; single 5¼" F/D (100K), £316; 8K RAM, £188	BASIC in 8K ROM:	Available with 32K RAM and single 5¼" F/D, £867 (S&H)
SYM-1 (£160)	Newbear: 0635 30505 (N/A)	1-4K RAM: 6502: bps C int: VDU int: 2x6522 ports: option — TV int.	4K monitor: *BASIC: A*	Can be expanded to 64K RAM (S&H)
Triton 4.1 (£286)	Transam: 01-402 8137 (N/A)	2K RAM: 8080: 3K ROM: full K/B: 16x64 VDU or TV int: C 1 S/P: option — 2K RAM, £30	1K monitor: 2K BASIC: U	64 character graphics: 8 levels interrupt: kit (S&H)
Triton 5.1 (£294)	As above	2K RAM: 1K VDU RAM: 8080: C int: T.V. int	1½K monitor: 2¼K BASIC: *A: Dis A: 8K BASIC: Pascal*	Graphics facility: disc interface running CP/M, about £200: (S&H)
Triton L5.2 (£296)	As above	¼K RAM: 8080: C int: 16x64 VDU int: keyboard: 1S/P: 1P/P	1.5K monitor: 2.5K BASIC	Graphics: kit form: easily expandable
Tuscan (£170)	As above	8K RAM: 8K ROM: Z80: 6xS100 slots: RS232 int: T.V. int: C int	8K monitor: or 8K BASIC	DD disc controller, £195: graphics: (S&H)
UK 101 (£219)	Computer Shop: 01-440 7033	4K RAM: 6502: full K/B: 16x48 VDU or TV int: C int: RS232 port: option — 4K RAM, £49	1K monitor: 8K BASIC: *Dis A: U*	Graphics: will run Superboard software (S&H)

List of Abbreviations

A	Assembler	F/D	Floppy disc	M/A	Macro assembler	S/P	Serial port
B	BASIC	G/C	Graphics card	N/A	Not available	T/E	Text editor
C	Cassette	H	Hardware	N/P	Numeric pad	TBA	To be announced
E	Extensive	H/D	Hard disc	O/S	Operating system	U	Utility
		I	Introductory	P/P	Parallel port		
		Int	Interface	S	Software		

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

DIRECT ACCESS

TRANSACTION FILE

The classified service that's FREE to readers (but not companies, please). Advertisements 50 words maximum to: PCW Transaction File, 14 Rathbone Place, London W1P 1DE.

For sale

ITT 2020. . .48K, Palsoft, colour etc. One disc drive, comes complete with all manuals, tapes, floppies and games. Six months old, perfect condition, best offer. Phone: 0273 505223 any time.

STM-1 Micro. . .4K, old and new monitors, 8K BASIC in ROM, Tangerine 1648 VDU (UHF output), 5 amp PSU, alpha-numeric keyboard (one of the best) plus complete set of manuals — £500 ono (cost £700). Contact Mr N Smith — 116 Holborn Hill, Millom, Cumbria, LA18 5BW or phone 0657 3951.

PET 32K. . .(large keyboard), plus Toolkit and cassette and PET cover; over 30 taped games and additional taped programs. Only three months old — £875. Also EPSON TX-80 printer — prints full PET graphics, with PET IEEE lead, £450. Phone: 01-907 7785.

TRS-80 Level II. . .16K, system includes keyboard, video display, cassette, assembler/editor, T-Bug and several programs/games on cassettes. Boxed and as new — £495. Phone Mike on Webridge 48845 (after 6pm).

PET 8K. . .includes books, games, TV adapter, small keyboard 2001-8. £430 — phone Hemel Hempstead (0442) 55389.

TRS-80 Level II. . .16K, hardware and software, current new price over £1100 — offers over £500 (cash or certified cheque only please). Phone: 099 387 241 (Oxfordshire).

Nascom 1. . .with B-Bug, modulator and PSU; built in a wooden case. Final construction and testing carried out by Comp Computer Components. Reasonable offers over £130. Phone Steve on Birmingham (021) 745 6667.

TRS-80 Expansion Interface. . .plus 32K — £290. Disc Drive for TPS-80 (NEWDOS and TRSDOS 3) — £250. Electric Pencil (disc) — £60. Phone 0928 33256.

Sorcerer, 16K. . .£610; modified TV (vg definition), £50; two cassette recorders, £25 each; Assembler ROM, £40; terminal routine and other software. Phone Maidenhead 20888.

PET 2001-8. . .8K, as new £450. PET programs, worth £200, only £100. PET Toolkit, £60 (8K). Phone 01-802 8718 (after 3pm).

PET 2001-32K. . . Anadex DP8000 Printer plus accounting programs and stationery. Equal new — £1000. Phone Mr Jonas on 01-253 3737.

8080 Microcomputer System. . .2K EPROM, 4K Static RAM, serial/parallel I/O, front panel, bus terminator, extender board, prototyping boards, 23 slot, 44-way backplane, Vero card frame, power supply. ACCESS Monitor, circuits and software, only needs 20mA/V24 terminal — £99 working. Phone Tring 4797/St. Albans 64077.

UK 101. . .professionally built, full 8K RAM, 9" cased video monitor and cassette player/recorder (with tape counter); plus 13 assorted software tapes including a stock control program (very adaptable) with full named file handling including E.O.F. marker. All leads and manuals included — a complete ready to go system for only £290. Phone: Kettering 711644, any time.

Olivetti P6040. . .personal mini-computer, cost £2200 eighteen months ago; 4K Baby BASIC, integral printer, single line display and minidisk. Best offer for quick sale. Phone 01-863 0833.

Nascom 1 Memory Board. . .8K RAM with buffer and motherboards — just plugs into Nascom board. Professionally built with instructions — £65 ono. CC Soft 4K Floating Point BASIC on four 2708 EPROMS, plugs into EPROM positions on Nascom memory board. With instruction manual and Startrek tape £25. Phone Coventry (0203) 72438.

Back Issues & Books. . .75 back issues of Kilobaud, Interface Age, Personal Computing, etc. Complete PCW in binder. Also many micro books and manuals going cheap. Phone for list: 0670 733125 (after 7pm).

TRS-80. . .16K RAM, 12K BASIC ROM, lower case with true descenders! 50 Hz mod, £350. Phone Walsall (0922) 641493 (after 6pm).

TRS-80 Level II. . .expansion interface, 32K, Micropolis 5¼" disc drive, software, manuals etc. Accept £850 cash. Phone Grays Thurrock (0375) 70993 (evenings/weekends).

TI-59 Programmable Calculator. . One year old, with maths/utilities library, programming aids, electronic and astrology speciality pakettes. All going for £150. Contact K. Barnes, 6 Blaven Walk, Fareham, Hants, or phone Fareham 280642 after 6pm any evening.

Powertran Comp-80. . .2K BASIC, 5K RAM, graphics, graph plotting; fully built and working in metal case, includes TV monitor — only £150 (worth £370). Phone: Stafford 850244.

IBM 1131 Computer. . .with golfball printer, paper tape reader and punch. Software and Operating/Field Maintenance manuals. Good condition — buyer collects, £550. Phone Maidenhead 677120 (evenings).

Superboard II. . .with switchable cassette 300/600 baud cassette control, PIA interface with LED/switch and sound plus programs and documentation — cased, £280 ono. Spare PIA interface including documentation and tape, £25 ono. Contact Mr B Mistry, 38 Kensington Street, Leicester.

Triton Computer. . .professionally built, cased with extra leather cover, full documentation plus all newsletters, full on-board RAM, V51 Monitor and L51 BASIC with editing facilities. Also Hitachi recorder and tapes — £300. Phone Bewdley (Worcs) 402114 (Mr Ivan).

32K Sorcerer. . .32K plus S100 expansion unit plus S100 4MHz 16K static RAM card; also modified TV Monitor and Heath H14 line printer. Plenty of Sorcerer software included and software and hardware manuals (plus normally supplied manuals): £1500 ono. Can split system — phone 0632 876645 weekends/evenings.

Triton L5.1. . . Transam built, full on-board memory, expansion socket fitted, software on cassette, documentation and almost new Merantz recorder; will demonstrate — £325 ono. Phone Earldoms 319.

Nascom 1. . .40K (two memory boards), H.S. cassette (2400 baud), device switch, Zeap, Xtal BASIC — £300. Phone Blackpool 67091.

PET 2001-8K. . .with 2nd cassette, programs and literature; will sell to best offer — phone Cardiff 77195.

Wanted

Commodore PET. . .please contact Mr Denis Costican, 24 Boulton Road, Cheltenham, Glos. Phone 0242 32455.

Back numbers of PCW. . . Vol 1 Nos. 4,5,6,7,9,10,12. Vol 2 Nos. 5,6. Vol 3 No. 2. Any reasonable price paid for the above — please bill me for the same. Contact WOI & Mrs D. Sherman, Sperberstr 28, 4800 Bielefeld 1, Bielefeld.

Mk. 14 system . . .including cassette, VDU and PSU; Manchester area, phone 061-224 3806 (evenings).

People wanted. . . Anybody who has the Apple language card. Anybody who may be thinking of, or is implementing, a connection between a Hewlett Packard HP7225A Graph Plotter and an Apple. Anybody interested in a high speed ADC interface to an Apple. Contact Dr John P Maher, School of Chemistry, University of Bristol, Cantock's Close, Bristol BS8 1TS — phone 0272 24161.

DIRECT ACCESS

USER GROUPS INDEX

Here are the details of additions and changes recently notified. If we have failed to include YOUR group (or have published incorrect information) either here or in the complete listing, then please address changes/additions to: PCW (User Groups Index), 14 Rathbone Place, London W1P 1DE. Finally, the next complete listing will appear in our August issue.

NATIONAL

ZX80 Users Club. Recently formed around Clive Sinclair's £100 personal computer, the group's aim is to create and share software written in "Sinclair BASIC" which will fit within the machine's 1K RAM. Membership is free and first move will be to distribute a newsletter. Address to write is: c/o Tim Hartnell, 93 Coningham Road, London W12.

Ohio Scientific UK User Group. Independant of OSI, an important role will be the disentangling of poor documentation. There will be regular newsletters and membership is at present £5 per year. The group will initially be concerned with the practical aspects and applications of OSI systems — rather than with games. Contact Tom Graves at: 19a West End, Somerset, BA16 0LQ.

Sorcerer Program Exchange Club. No meetings, regular newsletter, members welcome worldwide (100 so far). Costs — domestic, £5 per annum; European, £7 per annum; overseas airmail, £12 per annum. Contact Colin Morle, SPEC, 32 Watchyard Lane, Formby, Liverpool, L37 3JU.

National Personal Computer Users Association: The NPCUA is intended to pool the vast combined resources of owners and users of all types on personal computers in the UK, and to disseminate information between members. Projects, newsletters and bulk discounts possible. Nominal subscription is £8. . . send SAE for membership application form to Secretary E.J. Keeley, 11 Spratling Street, Manston, Ramsgate, Kent.

Medical Micro Users Group. Set up to enable medical micro users to locate programs already written in their field by other medics. Newsletters and meeting in the pipeline — contact P.J.V. Dixon, c/o MEDICOM, 1-2 Hanover Street, London W1.

EAST MIDLANDS

East Midlands TRS-80 Independent User Group. Free newsletter from Mike Costello, 17 Langbank Avenue, Rise Park, Nottingham NG5 5BU.

LONDON

A Croydon micro/small computer group is being formed at a meeting on April 22nd at the Central Reference Library, Katharine Street, (in the Town Hall building — arrive at 7.00pm). A wide range of people have called for this move and there should be little difficulty in setting-up a multi-interest club. More details (and notification from those interested but who can't come to the meeting) — contact Vernon Gifford, 111 Selhurst Road, London SE25 6LH.

MIDDLESEX

Harrow Computer Group. Meetings on alternate Wednesdays at 7pm in room G43 of Harrow College of Higher Education. They welcome anyone with an interest in computers — with or without a machine. At present there're 60 members and membership is free. For further information contact Bazyle Butcher, 16 St Peter's Close, Bushey Heath, Herts WD2 3LG (01-950 7068)

SUSSEX

A Crawley computer club has recently been formed, open to anyone interested in personal computing, with or without computing facilities. The intention is to hold meetings weekly, and publish a monthly or bi-monthly newsletter. Details, contact either Mr J. Fieldhouse, 18 Seaford Road, Broadfield, Crawley, West Sussex (Crawley 542509) — or — Mr J. M. Clarke, 31 Hyde Heath Court, Pound Hill, Crawley, West Sussex (Crawley 884207)

YORKSHIRE

South Yorkshire Personal Computing Group. Meetings are on the second Wednesday of each month in Room F135, St. Georges Building, Sheffield University. Experts and beginners welcomed alike, contact Paul Sanderson (Secretary), 8 Vernon Road, Totley, Sheffield S17 3QE (0742) 351895.

DIARY DATA

Dublin, Ireland	International Computing Exhibition — COMPUTEX. SDL Exhibitions Ltd., 68 Fitzwilliam Square, Dublin 2, Ireland. Tel: Dublin 763871	June 17 — June 19
Geneva, Switzerland	International Microcomputers, Minicomputers, Microprocessors & Data-communications Exhibition — IMMM/DATACOMM. Kiver Communications S.A., 171/185 Ewell Road, Surbiton, Surrey. Tel: 01-390 0281	June 17 — June 19
Copenhagen, Denmark	EUROCOMM — Advanced Communications Exhibition and Conference. Westbourne Marketing Services Ltd., Crown House, Morden, Surrey. SM4 5EB. Tel: 01-540 1101.	June 17th — June 19th
Newcastle Upon Tyne, England.	BIZTRONIC — Mini/Micro Computers, Word Processors and Business Machines Exhibition Company., 7 Market Street, Altrincham, Cheshire WA14 1QW. Tel: 061-928 0406.	July 3rd — July 4th
Manchester, England	MICROFAX — Exhibition and Conference on Micro Technology. Bancroft Hewitt Ltd., 3rd Floor, 121 Princess Street, Manchester M1 7AG. Tel: 061-236 4612.	July 15th — July 16th
London, England	1980 Microcomputer Show. Online Conferences Ltd., Cleveland Road, Uxbridge, UB8 2DD. Tel: 0895 39262	July 22 — July 24
Birmingham, England	Computer Graphics '81 Exhibition. Online Conferences Ltd., Cleveland Road, Uxbridge, UB8 2DD. Tel: 0895 39262	Aug 11 — Aug 13
London, England	The 3rd Personal Computer World Show. Montbuild Exhibitions Ltd., 11 Manchester Square., London W1M 5AB. Tel: 01-486 1951	Sept 4th — Sept 6th
Stuttgart, W. Germany	Hobby Electronic Exhibition — ELECTRO HOBBY. C.E.S. (Overseas) Ltd., Bridge House, 181 Queen Victoria St., London EC4 Tel: 01-236 0911	Sept 10 — Sept 14
Bristol, England	Mini/Micro Computers, Word Processors and Business Machines Exhibition. Groundrule Exhibition Co., 7 Market Street, Altrincham, Cheshire, WA14 1QW. Tel: 061-928 0406.	Sept 23rd — Sept 24th

PROGRAMS

Nedge for UK101

by N E Berry

This is different to the usual range of computer/TV games in that it is a game for two players. The board consists of randomly distributed grey and white rectangles. There are three men on the board: one starting on the bottom row and controlled by the right hand four keys on the top row of the keyboard; one on the top row and controlled by the four left hand keys and the third man starts in the middle and is controlled by the machine. From left to right the keys are LEFT/RIGHT/DOWN/UP.

The man who starts at the top of the screen can travel through blank or white squares. Each white square crossed becomes blank and counts as ten points. The bottom man can move through grey or blank squares. After the time expires, the man with the most points wins. A second way of winning is to place your man adjacent to (above, below or to one side) the robot man and simultaneously press the space bar. This will result in a win regardless of the points scored.

```
OK
LIST

 1 REM     *************************************
 2 REM     ****       NEDGE 22 MK2 VER 1.5      ****
 3 REM     ****       NICHOLAS E.G.BERRY        ****
 4 REM     ****              1980               ****
 5 REM     *************************************
 10 SCREEN=53248:KEYBOARD=57088:M=SC+27:POKE530,1
 11 FORLL=1TO16:PRINT:NEXT
 15 N=SCREEN+975:Q=0:R=0:S1=0:S2=0
 20 W=INT(RND(8)*46+77.5)+SCREEN:E=W
 30 T=INT(RND(8)*44+908.5)+SCREEN:Y=T
 40 I=INT(RND(8)*40+463.5)+SCREEN:O=I
 50 TIME=60
 55 IFBPTHEN100
 60 PRINT"                 N E D G E    2 2";CHR$(13);
 65 FORLL=1TO2000:NEXT
 70 PRINTTAB(10)"A COSMIC GAME FOR TWO PLAYERS";CHR$(13);
 80 FORLL=1TO2000:NEXT
 90 PRINTTAB(10)"&&&&&&&&&&&&&&&&&&&&&&&&&&&&&";CHR$(13);
 95 BP=1
 99 REM POKE BOARD TO SCREEN
 100 FORA=SCREEN+75TOSCREEN+930STEP64:FORB=0TO48:X=A+B
 110 IFRND(8)>.80THENPOKEX,161:GOTO130
 120 IFRND(8)>.75THENPOKEX,187
 130 NEXT:NEXT
 140 FORX=SCREEN+10TOSCREEN+59:POKEX,148:NEXT
 150 FORX=SCREEN+11TOSCREEN+1000STEP64:POKEX,149:NEXT
 160 FORX=SCREEN+60TOSCREEN+1024STEP64:POKEX,149:NEXT
 170 FORX=SCREEN+970TOSCREEN+1019:POKEX,148:NEXT
 199 REM POKE TIME & HI-SCORE
 200 POKEM+19,84:POKEM+20,73:POKEM+21,77:POKEM+22,69
 210 POKEM+23,32:POKEM+24,32
 220 F=SCREEN+13:POKEF,72:POKEF+1,73:POKEF+2,45
 230 POKEF+3,83:POKEF+4,67:POKEF+5,79:POKEF+6,82
 240 POKEF+7,69:POKEF+8,32
 250 T$=STR$(HS):FORJ=1TOLEN(T$)
 260 POKEF+7+J,ASC(MID$(T$,J,1)):NEXT
 999 REM MOVE TOP MAN
1000 POKEKEY,127:P=Q:GOSUB1500:Q=P
1020 IFQ=1AND(PEEK(W+1)=32ORPEEK(W+1)=161)THENW=W+1
1030 IFQ=2AND(PEEK(W+64)=32ORPEEK(W+64)=161)THENW=W+64
1040 IFQ=3AND(PEEK(W-1)=32ORPEEK(W-1)=161)THENW=W-1
1050 IFQ=4AND(PEEK(W-64)=32ORPEEK(W-64)=161)THENW=W-64
1060 IFPEEK(W)=161THENS1=S1+10
1100 POKEE,32:POKEW,230
1110 E=W
1199 REM MOVE BOTTOM MAN
1200 POKEKEY,191:P=R:GOSUB1500:R=P
1210 IFR=4AND(PEEK(T+1)=32ORPEEK(T+1)=187)THENT=T+1
1220 IFR=5AND(PEEK(T+64)=32ORPEEK(T+64)=187)THENT=T+64
1230 IFR=2AND(PEEK(T-1)=32ORPEEK(T-1)=187)THENT=T-1
1240 IFR=6AND(PEEK(T-64)=32ORPEEK(T-64)=187)THENT=T-64
1250 IFPEEK(T)=187THENS2=S2+10
1300 POKEY,32:POKET,231
1310 Y=T
1349 REM MOVE ROBOT
1350 IFRND(8)>.7THENU=U+1:IFU=5THENU=1
1360 IFU=1ANDPEEK(I+1)=32THENI=I+1
1365 IFU=1ANDPEEK(I+65)=32THENI=I+65
1370 IFU=2ANDPEEK(I+64)=32THENI=I+64
1375 IFU=2ANDPEEK(I+63)=32THENI=I+63
1380 IFU=3ANDPEEK(I-64)=32THENI=I-64
1386 IFU=3ANDPEEK(I-63)=32THENI=I-63
1390 IFU=4ANDPEEK(I-1)=32THENI=I-1
1395 IFU=4ANDPEEK(I-65)=32THENI=I-65
1400 POKEO,32:POKEI,232:O=I
1419 REM UPDATE SCORE
1420 G=S1:H=N:PL=1:GOSUB2000:G=S2:H=N+28:PL=2:GOSUB2000
1429 REM UPDATE TIME
1430 TIME=TIME-.5:IFTIME<.5THEN2500
1435 POKEM+26,32
1440 T$=STR$(INT(TIME)):FORJ=1TOLEN(T$)
1450 POKEM+J+23,ASC(MID$(T$,J,1)):NEXT
1489 REM CHECK FOR WIN
1490 POKEKEY,253:IFPEEK(KEY)<>239THEN1000
1491 IFPEEK(W+1)=232ORPEEK(W-1)=232THENWIN=49:GOTO1600
1492 IFPEEK(W+64)=232ORPEEK(W-64)=232THENWIN=49:GOTO1600
1493 IFPEEK(T+1)=232ORPEEK(T-1)=232THENWIN=50:GOTO1600
1494 IFPEEK(T+64)=232ORPEEK(T-64)=232THENWIN=50:GOTO1600
1495 GOTO1000
1499 REM KEYBOARD SCAN ROUTINE
1500 IFPEEK(KEY)=191THENP=1
1510 IFPEEK(KEY)=127THENP=3
1520 IFPEEK(KEY)=223THENP=2
1530 IFPEEK(KEY)=239THENP=4
1540 IFPEEK(KEY)=247THENP=5
1550 IFPEEK(KEY)=251THENP=6
1560 RETURN
1599 REM WIN ROUTINE BY ROBOT CONTACT
1600 POKEM,80:POKEM+1,76:POKEM+2,65:POKEM+3,89
1610 POKEM+4,69:POKEM+5,82:POKEM+6,32:POKEM+7,60
1620 POKEM+8,WIN:POKEM+9,62:POKEM+10,32:POKEM+11,87
1630 POKEM+12,73:POKEM+13,78:POKEM+14,83
1640 IFS1>S2THENTG=S1:GOTO3000
1650 TG=S2:GOTO3000
1999 REM SCORE DISPLAY ROUTINE
2000 POKEH,83:POKEH+1,67:POKEH+2,79:POKEH+3,82
2010 POKEH+4,69:POKEH+5,32:POKEH+6,60:POKEH+7,PL+48
2020 POKEH+8,62:H=H+9
2030 S$=STR$(G):FORJ=1TOLEN(S$):POKEH-1+J,ASC(MID$(S$,J,1))
2040 NEXT:RETURN
2499 REM DECIDE WHO WON, SAY SO, AND IF DRAW, SWEAR IN TURKISH
2500 IFS1>S2THENWIN=49:TG=S1:GOTO1600
2510 IFS2>S1THENWIN=50:TG=S2:GOTO1600
2520 TG=S1:FORLL=1TO15:PRINT:NEXT:PRINT"BOK!!! WE HAVE A DRAW"
2521 :DD=1
2999 REM END OR GO TO BEGINING
3000 FORZ=SC+64TOSC+128:POKEZ,32:NEXT:FORLL=1TO3000:NEXT
3001 G=S1:H=SC+79:PL=1:GOSUB2000:G=S2:H=SC+109:PL=2:GOSUB2000
3002 PRINT"  ";
3003 IFDDTHENDD=0:INPUT"CAREST THOU FOR UNE AUTRE ";A$:GOTO3005
3004 INPUT"               WOULD YOU LIKE ANOTHER GAME ";A$
3005 IFTG>HSTHENHS=TG
3010 FORZ=1TOLEN(A$):IFMID$(A$,Z,1)="Y"THEN10
3015 NEXT
3016 IFA$="OUI"THENPRINT"FROGGIE GO HOME!";FORLL=1TO4000:NEXT
3017 IFA$="OUI"THEN10
3020 FORLL=1TO16:PRINT:NEXT:POKE530,0:END
OK
```

Structure in Style Continued from P. 100

```
7047 T=T+A(C,W1)
7050 PRINTTAB(12)A(C,W1);
7060 NEXT
7065 PRINTT
7066 IFINT(C/15)=(C/15)THEN7068
7067 GOTO7070
7068 PRINT"▓▓PRESS ANY KEY"
7069 GETA$:IFA$=""THEN7069
7070 NEXT
7080 PRINT"▓▓▓▓▓PRESS ANY KEY■"
7081 GETA$:IFA$=""THEN7081
7300 RETURN
```

```
7500 PRINT"▓MAKE SURE PRINTER IS SWITCHED ON.▓▓"
7510 PRINT"▓▓▓▓PRESS ANY KEY■"
7520 GET A$:IF A$=""THEN7520
7530 OPEN1,4
7531 FORC=1TON:B(C)=0:NEXT
7532 FORC=1TON
7533 FORW1=1TO8:B(C)=B(C)+A(C,W1):NEXT
7534 NEXT
7540 PRINT#1,CHR$(1)"ATTENDANCE REGISTER"
7545 PRINT#1
7550 PRINT#1,"NAMES"TAB(18)"ATTENDANCES"
7555 PRINT#1
7560 PRINT#1,"WEEKS"TAB(18)"1   2   3   4   5   6   7   8  TOTAL"
7565 PRINT#1
7570 CLOSE1
7580 OPEN1,4,1
7590 OPEN2,4,2
7600 PRINT#2,"AAAAAAAAAAAAAAAAAAAA   Z   Z   Z   Z   Z   Z   Z   Z   Z"
7610 FORC=1TON
7620 PRINT#1,A$(C)CHR$(29)A(C,1),A(C,2),A(C,3),A(C,4),A(C,5),A(C,6),A(C,7),
7625 PRINT#1,A(C,8),B(C)
7630 NEXT C
7640 CLOSE 1
7645 CLOSE2
7650 RETURN
```

Routine 10 : Printer

Routine 11 : Patch
This may be left out on machines with new ROMs.

```
10000 IFPEEK(625)>180THEN10020
10010 RETURN
10020 POKE59411,53:T=TI
10030 IF TI-T<6THEN10030
10040 POKE59411,61:RETURN
```

Finally, an example of a print-out from a RUN of this program is shown below.

ATTENDANCE REGISTER

NAMES	ATTENDANCES								
WEEKS	1	2	3	4	5	6	7	8	TOTAL
ABBOTT L.	1	1	0	0	1	1	0	0	4
ANDERSON T.	1	1	0	1	0	0	1	1	5
BROWN C.	1	1	1	0	0	1	1	1	6
CHAPLIN C.	1	1	0	1	1	1	1	0	6
COSTELLO B.	1	1	0	1	0	0	1	1	5
HARDY O.	1	1	1	0	1	1	1	1	7
KEATON B.	1	1	1	0	0	0	1	0	4
LAUREL S.	1	1	0	1	0	0	1	1	5
LEWIS J.	1	0	0	1	1	1	0	0	4
MORECAMBE E.	1	0	0	0	0	1	1	1	4
WALKER F.	1	1	1	1	0	1	1	0	6
WISE E.	1	0	1	0	1	1	1	0	5

PROGRAMS

PET Horse race

by Richard Sheldon (YCW)

```
0 PRINT"▓":U=5000:REM* MADE BY R. SHELDON *
1 PRINT TAB(15)"HORSE RACE"
2 PRINT TAB(15)"▓▬▬▬▬▬▬▬▬■"
3 PRINT:PRINT:PRINT:POKE 59468,14
4 PRINT"THIS IS A BETTING GAME IN WHICH YOU BET"
5 PRINT"A CERTAIN AMOUNT (UNDER $5001) ON ANY 1"
6 PRINT"OF 5 HORSES. ALL THROUGH THE GAME A NO."
7 PRINT"WILL STAY ON THE SCREEN THIS IS THE      TIPSTER'S FAV."
8 PRINT"IF YOU HAVE NO CASH THE END OF THIS GAME"
9 PRINT"WILL COME TO A CLOSE"
10 POKE 59468,14:GOSUB6000:PRINT:PRINT"WHICH HORSE DO YOU WANT TO BET ON"
11 INPUT" 1 , 2 , 3 , 4 , OR 5.";P
12 PRINT:PRINT"HOW MUCH DO YOU WANT TO BET ON HORSE NO.";P
13 INPUT O
14 POKE 59468,12:PRINT"▓"
15 Z=33608
16 POKE Z,224
17 Z=Z+1
18 IF Z=33648 THEN 20
19 GOTO 16
20 X=32776:C=32784:V=32792:B=32800:N=93
21 POKE X,N:POKE C,N:POKE V,N:POKE B,N
22 X=X+40:C=C+40:V=V+40:B=B+40
23 IF PEEK(33608+8)=N THEN 28
```

```
24 IF PEEK(33608+16)=N THEN 28
25 IF PEEK(33608+24)=N THEN 28
26 IF PEEK(33608+32)=N THEN 28
27 GOTO 21
28 M=32771:A=32780:S=32788:D=32796:F=32804
29 POKE M,177:POKE A,178:POKE S,179:POKE D,180:POKE F,181
30 G=M+40:H=A+40:J=S+40:K=D+40:L=F+40:Q=94
31 POKE G,Q:POKE H,Q:POKE J,Q:POKE K,Q:POKE L,Q
32 FOR I=1TO2500:NEXT
33 W=INT(RND(1)*6)
34 IF W=0 THEN 33
35 IF W=1 THEN G=G+40
36 IF W=2 THEN H=H+40
37 IF W=3 THEN J=J+40
38 IF W=4 THEN K=K+40
39 IF W=5 THEN L=L+40
40 POKE G,Q:POKE G-40,32:POKE H,Q:POKE H-40,32:POKE J,Q
41 POKE J-40,32:POKE K,Q:POKE K-40,32:POKE L,Q:POKE L-40,32
43 IF PEEK(M+(21*40))=Q THEN 60
44 IF PEEK(A+(21*40))=Q THEN 65
45 IF PEEK(S+(21*40))=Q THEN 70
46 IF PEEK(D+(21*40))=Q THEN 75
47 IF PEEK(F+(21*40))=Q THEN 80
48 GOTO 33
51 GETR$:IF R$="" THEN 51
52 PRINT"J";
60 Y=1:PRINT"THE WINNER OF THIS RACE WAS HORSE NO. 1"
61 IF P=Y THEN U=U+(IO*O):IF U<=0 THEN 3000
62 IF P<>Y THEN U=U-O:IF U<=0 THEN 3000
63 PRINT"THE MONEY YOU HAVE NOW GOT IS";U:GOTO 120
64 U=U+(IO*O):PRINT"THE MONEY YOU HAVE NOW GOT IS";U:GOTO 120
65 Y=2:PRINT"THE WINNER OF THIS RACE WAS HORSE NO. 2"
66 IF P=Y THEN U=U+(IO*O):IF U<=0 THEN 3000
67 IF P<>Y THEN U=U-O:IF U<=0 THEN 3000
68 PRINT"THE MONEY YOU HAVE GOT IS";U:GOTO 120
69 U=U+(IO*O):PRINT"THE MONEY YOU HAVE GOT IS";U:GOTO 120
70 Y=3:PRINT"THE WINNER OF THIS RACE WAS HORSE NO. 3"
71 IF P=Y THEN U=U+(IO*O):IFU<=0THEN 3000
72 IF P<>Y THEN U=U-O:IF U<=0 THEN 3000
73 PRINT"THE MONEY YOU HAVE NOW GOT IS";U:GOTO 120
74 U=U+(IO*O):PRINT"THE MONEY THAT YOU HAVE NOW GOT IS";U:GOTO 120
75 Y=4:PRINT"THE WINNER OF THIS RACE WAS HORSE NO. 4"
76 IF P=Y THEN U=U+(IO*O):IF U=<0 THEN 3000
77 IF P<>Y THEN U=U-O:IF U=<0THEN 3000
78 PRINT"THE MONEY THAT YOU HAVE NOW GOT IS";U:GOTO 120
79 U=U+(IO*O):PRINT"THE MONEY THAT YOU HAVE NOW GOT IS";U:GOTO 120
80 Y=5:PRINT"THE WINNER OF THIS RACE WAS HORSE NO. 5"
81 IF P=Y THEN U=U+(IO*O):IF U=<0 THEN 3000
82 IF P<>Y THEN U=U-O:IF U=<0 THEN3000
83 PRINT"THE MONEY THAT YOU HAVE NOW GOT IS";U:GOTO 120
84 U=U+(IO*O):PRINT"THE MONEY YOU HAVE NOW GOT IS";U:GOTO 120
90 INPUT "  ";A$
120 FORI=1TO4800:NEXT
121 PRINT"JDO YOU WANT ANOTHER GAME"
122 GET V$:IF V$="" THEN 122
123 IF V$="Y" THEN 10
124 IF V$="N" THEN END
3000 FORI=1TO4100:NEXT
3010 PRINT"JYOU ARE NOW BROKE...WISE GUY."
3011 END
6000 IO=4:FO=1
6010 PRINT"HORSE NO. 1'♥ ODDS ARE 4/1 AGAINST"
6020 PRINT"HORSE NO. 2'♥ ODDS ARE 4/1 AGAINST"
6030 PRINT"HORSE NO. 3'♥ ODDS ARE 4/1 AGAINST"
6040 PRINT"HORSE NO. 4'♥ ODDS ARE 4/1 AGAINST"
6050 PRINT"HORSE NO. 5'♥ ODDS ARE 4/1 AGAINST"
6060 RETURN
READY.
```

Basic renumber

by Derrick Daines (YCW)

This BASIC renumberer is a re-write of a program sent in by D. J. Danziger of Manchester Grammer School. Mr. Danziger's original program was in BASIC-PLUS and as few readers will use this, we decided that it was worth the effort to transcribe it. If any readers do want a copy of the original, an S.A.E. will get it.

This version works very well, but readers are warned that it may be a little slow. The program reads through the BASIC file on disc that is to be renumbered and counts the lines. The maximum handled is 255 and anything over this will cause an error message and program abort. As well as counting lines on this first pass, the program is constructing a two-tier matrix table, with the old line numbers pointing to their replacements.

On the renumbering pass, it again reads from the disc, but substitutes the new line numbers found from the table. It is a peculiarity of SWTP Disc BASIC no doubt shared by many others, that files are line oriented, and that within each line the comma marks the end of one data item. What this means in practice is that we cannot read all of one line with a simple READ 1,A$ statement. The program being renumbered may have many lines containing commas, especially in multiple-choice commands such as

ON X GOTO 560,580,600

— and a simple READ command would read the line only up to the first comma. This is the explanation of lines 360 to 390 of the Renumberer listing. Line 360 will allow for up to 7 commas and if you think that you require more, these may easily be added.

Line 440 may look a little odd — notice that lonely capital T stuck on the end! — and the explanation is that the program searches each renumbered line for a match with GOSUB, GO SUB, THEN, GOTO and GO TO in turn.

PROGRAMS

Since on a multiple statement line a GOSUB statement could precede a GOTO, the order of their appearance in line 440 is quite important.

Line 820 of the sub-routine detects the occurence of inverted commas following a THEN, but before a number, thus allowing numbers contained between inverted commas to be unaffected. Thus

IF X=Y THEN 70

would result in an alteration of the 70, but

IF X=Y THEN PRINT "70"

would not.

Line 610 looks for the multiple choice command already mentioned, and line 650 looks for the multiple statement separator. Of course, if you have a colon between inverted commas you might be in trouble, but this is highly unlikely, and is not worth guarding against.

Without doubt, the program is highly effective at its job. At all times the original BASIC program remains intact on disc and the renumbered version is stored on the same disc under the name of RENUMB. Renumbering a 100-line program requires a few minutes.

```
0010 REM - FILE RENUMBERER IN BASIC-PLUS BY D:J.DANZIGER
0020 REM - MANCHESTER GRAMMAR SCHOOL.
0030 REM
0040 REM - VERSION IN SWTP DISK BASIC V.3 BY D.R. DAINES
0050 REM
0060 PRINT TAB(10),"FILE RENUMBERER"
0070 PRINT TAB(10),"==============="
0080 PRINT
0090 INPUT "'BASIC' FILE NAME",F$
0100 IF F$="" THEN 80
0110 LINE= 64:STRING=80
0120  F$=F$+".BAS":OPEN #1,F$
0130 DIM F(255,2)
0140 REM - BUILD DATA TABLE
0150 PRINT "PASS 1 ";:L9=1
0160 IF EOF(1)=1 THEN 220
0170 READ #1,L$:P=1:GOSUB 780
0180  F(L9,1)=L1:F(L9,2)=L1
0190  L9=L9+1:IF L9<=255 THEN 160
0200 PRINT "FILE TOO LARGE. RENUMBERING ABORTED"
0210 END
0220 PRINT "COMPLETED":CLOSE#1
0230  L9=L9-2
0240 PRINT "PASS 2 ";
0250 REM - RENUMBER BOTTOM HALF OF TABLE
0260 FOR X=1 TO L9
0270  F(X,2)=X*10:NEXT X
0280 PRINT "COMPLETED"
0290 PRINT "RENUMBERING -":PRINT
0300  O$="RENUMB.BAS"
0310 OPEN #1,F$
0320 OPEN #2,O$
0330 FOR R=1 TO L9
0340  X=R:L$=""
0350 FOR A=1 TO 9:A$(A)="":NEXT A
0360 READ #1,L$,A$(1),A$(2),A$(3),A$(4),A$(5),A$(6),A$(7)
0370 FOR A=1 TO 9:IF A$(A)="" THEN 400
0380 REM - SWAP LINE NUMBER
0390  L$=L$+","+A$(A):NEXT A
0400  P1=1:F(R,1)=VAL(L$)
0410  T$=STR$(F(R,2))
0420  L$=T$+RIGHT$(L$,(LEN(L$)-4))
0430 REM - LOOK FOR GOTO,ETC
0440 DATA ,GOSU,GO S,THEN,GOTO,GO T
0450 RESTORE
0460 FOR Y=1 TO 5:READ J$
0470 FOR Z=P1 TO LEN(L$)-4
0480 IF J$=MID$(L$,Z,4) THEN 510
0490 NEXT Z:NEXT Y
0500 GOTO 680
0510 REM - INVERTED COMMAS BEFORE NUMBER?
0520  P1=Z:L1=0:GOSUB 800
0530 IF L1=0 THEN 680
0540 REM - CHECK JUMP TABLE
0550 FOR J=1 TO L9
0560 IF F(J,1)=L1 THEN 580
0570 NEXT J:T$="???": GOTO 590
0580  T$=STR$(F(J,2))
0590  L$=LEFT$(L$,(P1-1))+T$
0600  M$=RIGHT$(M$,(LEN(M$)-LEN(STR$(L1))))
0610 IF LEFT$(M$,1)<>"," THEN 650
0620  P1=LEN(L$)+1:L$=L$+M$
0630  L1=0:GOSUB 800:IF L1=0 THEN 650
0640 GOTO 550
0650 IF LEFT$(M$,1)<>":" THEN 680
0660  P1=LEN(L$)+1:L$=L$+M$:GOTO 450
0670 REM
0680 PRINT L$
0690 WRITE #2,L$
0700 NEXT R
0710 PRINT :PRINT "RENUMBERING COMPLETE"
0720 CLOSE #1
0730 CLOSE #2
0740 END
0750 REM *******************************************
```

```
0760 REM - NUMBER DETECTION ROUTINE - RETURNS NUMBER
0770 REM - IN L1,ELSE ZERO
0780  L1=0:P1=P-1
0790  P1=P1+1
0800 IF P1>LEN(L$) THEN RETURN
0810  P$=MID$(L$,P1,1)
0820 IF ASC(P$)=34 THEN RETURN
0830 IF ASC(P$)<48 THEN 790
0840 IF ASC(P$)>57 THEN 790
0860  M$=RIGHT$(L$,(LEN(L$)-(P1-1)))
0870  L1=VAL(M$):RETURN
```

Dogfight for UK101

by John Popplewell

All the instructions for this game are contained within the program, which uses just under 3½K of RAM. Although written for the 101, it should be easily transferable to the Superboard II.

```
5 REM  DOG FIGHT
8 REM  BY J.POPPLEWELL  16/1/80
9 GOSUB8000
10 FORX=1TO16:PRINT:NEXT
20 REM SET VARIABLES,DISPLAY
25 POKE530,1:P1=54095:P2=54135:D1=1:D2=4
27 A(1)=237:A(4)=239:A(2)=236:A(3)=236:A(5)=238:A(6)=238
30 KE=57088:F=0:F1=0
32 FORX=53325TO53901STEP64
34 POKEX,43:POKEX+44,43:NEXT
38 SR=0:SL=0:CO=0
40 FORX=53901TO54221STEP64
50 POKEX,161:POKEX+44,161:NEXT
80 FORX=54221TO54265
100 POKEX,161:NEXT
110 FORX=54115TO54243STEP64
120 POKEX,161:NEXT
125 REM SCAN KEYBOARD
130 POKEKE,127:OP=PEEK(KE):POKEKE,251:OQ=PEEK(KE)
132 REM TIMER,END OF GAME
135 CO=CO+1:IFCO()1000THEN140
136 PRINTSL;TAB(40)SR
137 INPUT"ANOTHER GO ";A$
138 IFLEFT$(A$,1)="Y"THEN10
139 END
140 IF(OP)223)AND(OQ)251)THEN175
150 IFOP=127THEND1=D1+1
151 IFOP=191THEND1=D1-1
152 IF(OP=223)AND(F=0)THEN230
153 IFD1)6THEND1=1
154 IFD1(1THEND1=6
155 IFOQ=239THEND2=D2+1
156 IFOQ=247THEND2=D2-1
157 IF(OQ=251)AND(F1=0)THEN300
158 IFD2)6THEND2=1
159 IFD2(1THEND2=6
160 REM LEFT PLANE
175 IFF=1THEN235
176 IFF1=1THEN320
177 PO=P1:PI=P2
178 IF(P1+1=P2)OR(P1-1=P2)OR(P1+64=P2)THENGOSUB7000
179 IF((PEEK(P1-1))OR(PEEK(P1+1)))()32THEN4000
180 IFPEEK(P1+64)()32THEN4000
185 GD=D1:GP=P1:GOSUB1000
190 P1=GP:IFF=0THENGOSUB2000
210 POKEPO,32:POKEP1,A(D1)
220 GOTO281
230 BD=D1:BP=P1:F=1
231 GD=BD:GP=BP:GOSUB1000
232 BP=GP
235 POKEBP,32
236 W=0
238 REM LEFT MISSILE
240 GD=BD:GP=BP:GOSUB1000
245 LO=PEEK(GP):GOSUB6000:IFW)0THEN269
250 GOSUB1000
252 LO=PEEK(GP):GOSUB6000:IFW)0THEN269
255 BP=GP:POKEBP,45:GOTO176
269 F=0
270 IFW=1THEN176
271 GOTO5000
280 REM RIGHT PLAYER
281 IF(P2-1=P1)OR(P2+1=P1)OR(P2+64=P1)THENGOSUB7000
282 IF((PEEK(P2-1))OR(PEEK(P2+1)))()32THEN5000
283 IFPEEK(P2+64)()32THEN5000
285 GD=D2:GP=P2:GOSUB1000
287 P2=GP:IFF1=0THENGOSUB2000
295 POKEPI,32:POKEP2,A(D2)
297 GOTO130
300 BE=D2:BX=P2:F1=1
301 REM RIGHT MISSILE
```


```
305 GD=BE:GP=BX:GOSUB1000
310 BX=GP
320 POKEBX,32
325 W=0
340 GD=BE:GP=BX:GOSUB1000
345 LO=PEEK(GP):GOSUB6000:IFW)0THEN360
350 GOSUB1000
352 LO=PEEK(GP):GOSUB6000:IFW)0THEN360
355 BX=GP:POKEBX,46:GOTO177
360 F1=0
365 IFW=1THEN177
370 GOTO4000
999 REM ADD DIRECTION TO PLANES AND MISSILES
1000 IFGD=1THENGP=GP+1:RETURN
1010 IFGD=2THENGP=GP-63:RETURN
1020 IFGD=3THENGP=GP-65:RETURN
1030 IFGD=4THENGP=GP-1:RETURN
1040 IFGD=5THENGP=GP+63:RETURN
1050 IFGD=6THENGP=GP+65:RETURN
1999 REM NO FIRE IN PROGRESS PADDING
2000 FORDE=0TO28:NEXTDE:RETURN
2010 RETURN
3999 REM LEFT PLANE CRASH
4000 SR=SR+1
4005 FORZ=1TO3
4010 POKEP1,Z:FORX=0TO45:NEXTX
4020 NEXTZ
4025 POKEP1,32
4040 IFPEEK(P1+64)()32THEND1=1:P1=54095:GOTO130
4045 P1=P1+64
4050 GOTO4005
4999 REM RIGHT PLANE CRASH
5000 SL=SL+1
5005 FORZ=1TO3
5010 POKEP2,Z:FORX=0TO45:NEXT
5020 NEXTZ
5025 POKEP2,32
5040 IFPEEK(P2+64)()32THEND2=4:P2=54135:GOTO130
5045 P2=P2+64
5050 GOTO5005
5999 REM HIT OR MISS
6000 IF((LO)235)AND(LO(240))THENW=2:RETURN
6010 IFLO()32THENW=1:RETURN
6020 RETURN
7000 FORZ=1TO3
7010 POKEP2,Z:POKEP1,Z:FORX=0TO45:NEXTX
7020 NEXTZ
7030 POKEP1,32:POKEP2,32
7040 IFPEEK(P2+64)()32THEND2=4:D1=1:P2=54135:P1=54097:RETURN
7050 P2=P2+64:P1=P1+64:GOTO7000
8000 PRINT" DOGFIGHT !"
8010 PRINT"THE OBJECT OF THIS GAME IS TO SHOOT DOWN"
8020 PRINT"THE OTHER PLAYERS PLANE WITH A MISSILE"
8030 PRINT"A POINT IS SCORED FOR EACH SUCCESFUL HIT"
8040 PRINT"THE OPPONENT ALSO GETS A POINT IF YOU CRASH"
8050 PRINT"MID AIR COLLISIONS RESULT IN ZERO SCORE FOR"
8060 PRINT"BOTH PLAYERS"
8070 PRINT"THE PLAYERS CONTROLS ARE :"
8080 PRINTTAB(5)"LEFT";TAB(36)"RIGHT"
8090 PRINTTAB(5)"'1' PLANE CIRCLES ANTICLOCKWISE 'B'"
8100 PRINTTAB(5)"'2'   PLANE CIRCLES CLOCKWISE   'N'"
8110 PRINTTAB(5)"'3'   FIRES THE MISSILE !!      'M'"
8120 PRINT:PRINT"THE LEFT PLAYER PRESSES '1'TO TAKE OFF"
8130 PRINT"THE RIGHT PLAYER PRESSES 'N'TO TAKE OFF"
8140 INPUT"HAVE YOU GOT ALL THAT ";A$
8150 IFLEFT$(A$,1)="Y"THENRETURN
8160 GOTO8000
OK
```

MK14 Frequency counter

by J. W. Roston

This program displays, in digital form, the frequency of a signal input at SB. It helps if 0FB0→0FB7 are zeroed before running and if the CY/L is cleared. Readout is in pulses per millisecond.

```
0F20  C40F36   LDI'0F'     ;XPAH(2)    P2=0F00(START OF RAM)
0F23  C40032   LDI'00'     ;XPAL(2)
0F26  C40F35   LDI'0F'     XPAH(1)     P1=0FB0
0F29  C4B031   LDI'B0'     XPAL(1)

0F2C  C464     LDI                     STORE NUMBER OF ITERATIONS
0F2E  C912     ST(1) +12H

0F30  C400     LDI'00'                 CLEAR COUNT LOCATIONS
0F32  C90C     ST(1)+0CH
0F34  C90D     ST(1)+0DH
0F36  C90E     ST(1)+0EH

0F38  06       CSA                     TEST SENSE B
0F39  IEIE     RR          ;RR
0F3B  IEIE     RR          ;RR
0F3D  IEIE     RR          ;RR
0F3F  9667     JP(2)+67                JUMP TO 0F67 IF SB=0
```

```
0F41  C10D      LD(1)+0DH                  ADD 1 TO COUNT 1
0F43  EC01      DAI'01'
0F45  C90D      ST(1)+0DM
0F47  C10C      LD(1)+0CH                  IF CARRY, ADD 1 TO COUNT 2
0F49  EC00      DAI'00'
0F4B  C90C      ST(1)+0CH
0F4D  C10E      LD(1)+0EH                  IF CARRY, ADD 1 TO COUNT 3
0F4F  EC00      DAI'00'
0F51  C90E      ST(1)+0EH

0F53  00                        HALT       SMALL DELAY
0F54  C482      LDI                        LARGER DELAY
0F56  8F00      DLY'00'
0F58  B912      DLD(1)+12H                 DONE ENOUGH
0F5A  9E38      JN2(2)+                    LOOPS? NO,GOBACK

0F5C  C40137    LDI'01'         ;XPAH3     P3=013F(MONITOR
0F5F  C43F33    LDI'3F'         ;XPAL3          SUBROUTINE)
0F62  3F        XPPC3                      GOTO013F
0F63  9000      JMP'00'                    IF KEY PRESSED
0F65  9220      JMP(2)'20'                 GET NEW READING

0F67  C436      LDI'36'                    DELAY
0F6A  8F00      DLY'00'
0F6C  9253      JMP(2)'53'                 THEN GOTO 0F53
```

Maths test

by D. Brewster

We lent this program to Adrian Stokes for checking on his system. These are his comments:

"This is a fairly interesting program which asks the user questions on general knowledge and arithmetic.

The program as printed is re-formatted from that supplied by the author to eliminate some of the North Star Horizon dependent features, specifically the use of '!' instead of 'PRINT' and multi-statement lines. In addition, a number of bugs have been cured — for example, in the version as submitted, a 'mode' of —1 gave a 'divide by zero' error — and some data validation included.

There are a number of features of the program which can be modified fairly easily by anyone implementing the program on their machine. Some that should be mentioned are that the answers (to the general knowledge questions) must be typed in upper case, questions are repeated — even if answered correctly, the format of the questions is inconsistent and the switch to 'harder' mode appears to be allowed an infinite number of times, with only the first having any effect.

However, for a fairly short program, it may provide some amusement and perhaps be of educational value."

And here is a description of the program taken from the authors REMARKS file:

```
 1 REM *  REMARKS FOR MATHTEST PROGRAMME
 2 REM * The programme asks for Name, Age and Mode of test
 3 REM * X amount of Questions are asked in each programme
 4 REM * selected, and EXITS to MODE control ready for next
 5 REM * selection, (Typing '0' will EXIT current programme
 6 REM * selected at any time and can be re-entered at any
 7 REM * later stage if required). The programme will carry
 8 REM * on until "TEST END" is Input.
 9 REM *
10 REM * Messages will be constantly printed and updated
11 REM * giving a running report on the progress of the
12 REM * test in all it's MODES. This gives the child or
13 REM * parent a progress report.
14 REM * The programme can be adapted to harder tasks when
15 REM * the progress is satisfactory, by altering
16 REM * The Value of H in LINE 210, and DATA Statements
17 REM * If more DATA Statements are added, alter LINE 760
18 REM * INT(No of Statements * RND)
19 REM *
20 REM * Notes -  1.   LINES (470,500,680,720,& 810)
21 REM *               the use of ELSE is to overcome the
22 REM *               multi line conventions of North Star
23 REM *               Basic.You may need to alter to suit
24 REM *               your version of basic.
26 REM *
27 REM *          2.   VARIABLES
28 REM *               (R,R0,R1,R2) Are counters for right
29 REM *               answers.
30 REM *               (W,W0,W1,W2) Are counters for wrong
31 REM *               answers.
32 REM *               (Q,Z,Z1,V) Are counters for 'X' amount
33 REM *               of questions.
34 REM *               T3  Gives the pass % value.
35 REM *               J   Age of person, used to evaluate
36 REM *               comment statements.
37 REM *
38 REM *
1000 REM ** D Brewster 20/1/80 VER 1
1010 PRINT CHR$(24)
1020 FOR I=1 TO 250
1030 NEXT
1040 PRINT
1050 PRINT
1060 PRINT
1070 REM * Clear Screen
1080 REM ** North Star Basic VER 6 REL 4 - 16 BLOCKS 4KB
1090 PRINT TAB(14),"MENTAL ARITHMETIC TRAINING PROGRAMME"
1100 PRINT TAB(14),"~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~"
1110 PRINT
1120 PRINT
1130 DIM A(12),B(12),A$(12),A1$(12),B$(12),C$(12)
1140 INPUT "WHAT IS YOUR NAME ",A$
1150 INPUT "YOUR AGE ",J
```

```
1160 IF J > 1 AND J < 100 THEN 1190
1170 PRINT "That is an unlikely age....try again"
1180 GOTO 1150
1190 M=0
1200 PRINT "WHICH TEST WOULD YOU LIKE |-"
1210 PRINT
1220 PRINT "    0 - ENDS TEST       1 - HARDER QUESTIONS"
1230 PRINT "    2 - DIVISION        3 - MULTIPLICATION"
1240 PRINT "    4 - ADDITION        5 - GENERAL KNOWLEDGE"
1250 PRINT
1260 IF M=1 THEN PRINT "HARDER ONES - ",
1270 INPUT"INPUT MODE NUMBER ",M
1280 IF M=1 THEN H=3
1290 IF M=1 THEN 1200
1300 IF M = 0 THEN END
1310 IF M=2 THEN GOSUB 1600
1320 IF M=3 THEN GOSUB 2230
1330 IF M=4 THEN GOSUB 1930
1340 IF M=5 THEN GOSUB 2570
1350 IF M>5 OR M<0 THEN 1200
1360 R3=R2+R0+R+R1
1370 W3=W2+W1+W+W0
1380 T2=W3+R3
1390 T3=INT((R3/T2)*100)
1400 PRINT
1410 PRINT "YOU HAD A TOTAL OF",T2," ATTEMPTS",W3," WRONG",R3," RIGHT"
1420 PRINT
1430 IF T3<=50 THEN PRINT A$," YOU COULD DO BETTER THAN THAT, TRY AGAIN"
1440 IF T3>=70 THEN PRINT "YOU ARE READY FOR HARDER TASKS ",A$
1450 IF T3>=80 THEN PRINT "WHO'S A CLEVER PERSON THEN  "
1460 IF T3>=60 AND T3<70 THEN PRINT "AVERAGE PASS RESULTS"
1470 IF T3>98 THEN PRINT "*** WE HAVE A GENIUS **"
1480 K=J+T3
1490 IF K>20 THEN K=K+20
1500 IF K>=110 AND J>=20 THEN PRINT "AT YOUR AGE",J," YOU SHOULD KNOW THEM ALL "
1510 IF K>=85 AND J<=15 THEN PRINT "WELL DONE ",A$," GOOD FOR A ",J," YEAR OLD"
1520 IF K<=90 AND J>20 THEN PRINT " YOU NEED TO GO BACK TO SCHOOL AGAIN"
1530 IF R0<W0 THEN PRINT "*  You need more practice with your addition"
1540 IF R1<W1 THEN PRINT "*  You need more practice with your division"
1550 IF R<W   THEN PRINT "*  You need more practice with your multiplication"
1560 IF R2<W2 THEN PRINT "*  You need to brush up your general knowledge"
1570 PRINT
1580 PRINT "THIS REPRESENTS A",T3," % PASS"
1590 GOTO 1200
1600 REM * Division Prog
1610 Z1=0
1620 PRINT "WHEN YOU ARE READY TO QUIT TYPE '0'"
1630 PRINT
1640 IF Z1=33 THEN RETURN
1650 D=INT(RND(-1)*12)+1
1660 L=INT(RND(-1)*11)+2
1670 D=D+H
1680 L=L+H
1690 U=D*L
1700 PRINT  "What is ",U," divided by -- ",L," ",
1710 INPUT"",A
1720 Z1=Z1+1
1730 PRINT
1740 IF A=0 THEN RETURN
1750 IF A=D THEN PRINT "RIGHT" ELSE 1790
1760 R1=R1+1
1770 IF A=D THEN 1640
1780 PRINT
1790 PRINT "WRONG"
1800 W1=W1+1
1810 PRINT
1820 PRINT U," divided by",L," =",U/L,
1830 PRINT  " TRY AGAIN ",U," divided by ",L," = ",
1840 INPUT"",A
1850 Z1=Z1+1
1860 IF A=D THEN PRINT  "RIGHT" ELSE 1890
1870 R1=R1+1
1880 IF A=D THEN 1640
1890 PRINT
1900  PRINT "WRONG, TRY ANOTHER ONE"
1910 W1=W1+1
1920 GOTO 1640
1930 REM * Addition Prog
1940 Z=0
1950 PRINT "IF YOU WANT TO QUIT TYPE '0'"
1960 IF Z=20 THEN RETURN
1970 S=INT(12*RND(-1)+1)+INT(20*RND(-1)+1)
1980 S=(H+1)*S
1990 U=INT(12*RND(-1)+1)+INT(12*RND(-1)+1)
2000 U=(H+1)*U
2010 PRINT "What is",S,"  + ",U," ",
2020 INPUT"",A1
2030 Z=Z+1
2040 IF A1=0 THEN RETURN
2050 IF A1=S+U THEN PRINT "RIGHT" ELSE 2090
2060 R0=R0+1
2070 GOTO 1960
2080 Z=Z+1
2090 PRINT "WRONG"
2100 W0=W0+1
2110 PRINT
2120 PRINT S," plus",U," =",S+U,
2130 PRINT " TRY AGAIN",S," + ",U," = ",
2140 INPUT"",A2
2150 Z=Z+1
2160 IF A2=S+U THEN PRINT "RIGHT" ELSE 2190
2170 R0=R0+1
2180 GOTO 1960
2190 PRINT
2200 PRINT "WRONG TRY ANOTHER ONE"
2210 W0=W0+1
2220 GOTO 1960
2230 REM * Multiplication Prog
2240 PRINT "WHEN YOU WANT TO QUIT TYPE '0'"
2250 Z0=0
2260 PRINT
2270 IF Z0=33 THEN RETURN
2280 I=INT(RND(-1)*11)+2
2290 Q=INT(RND(-1)*11)+2
2300 I=I+H
2310 Q=Q+H
2320 O=I*Q
2330 PRINT " What does ",I," multiplied by",Q," = ",
```

```
2340 INPUT"",B
2350 Z0=Z0+1
2360 PRINT
2370 IF B=0 THEN RETURN
2380 IF B=0 THEN PRINT "RIGHT" ELSE 2410
2390 R=R+1
2400 IF B=0 THEN 2270
2410 PRINT
2420 PRINT "WRONG"
2430 W=W+1
2440 PRINT
2450 PRINT I," times",Q," =",I*Q,
2460 PRINT " TRY AGAIN",I," times",Q," = ",
2470 INPUT"",B
2480 Z0=Z0+1
2490 IF B=0 THEN PRINT "RIGHT" ELSE 2520
2500 R=R+1
2510 GOTO 2270
2520 PRINT
2530 PRINT "WRONG TRY ANOTHER ONE"
2540 W=W+1
2550 GOTO 2270
2560 REM ** General Knowledge Prog
2570 PRINT "IF YOU WANT TO QUIT TYPE '0'"
2580 V=0
2590 RESTORE
2600 I=INT(22*RND(-1))+1
2610 IF I>=15 THEN 2800
2620 L$="          "
2630 L$=L$+B$
2640 L$=L$+C$
2650 IF V=20 THEN RETURN
2660 FOR S=1 TO I
2670 READ N,B$,C$
2680 NEXT
2690 PRINT "How many ",B$," are there in a ",C$," ",
2700 INPUT"",A
2710 IF A=0 THEN RETURN
2720 V=V+1
2730 PRINT
2740 IF A=N THEN PRINT "RIGHT" ELSE 2770
2750 R2=R2+1
2760 IF A=N THEN 2590
2770 PRINT "WRONG, THERE ARE",N," ",B$," IN A ",C$
2780 W2=W2+1
2790 GOTO 2590
2800 FOR S=1 TO I
2810 READ N,B$,C$
2820 NEXT
2830 PRINT "What is the Capital of ",B$," ",
2840 INPUT"",A1$
2850 IF A1$="0" THEN RETURN
2860 V=V+1
2870 PRINT
2880 IF A1$=C$ THEN PRINT "RIGHT" ELSE 2910
2890 R2=R2+1
2900 IF A1$=C$ THEN 2590
2910 PRINT "WRONG,",C$," IS THE CAPITAL OF ",B$
2920 W2=W2+1
2930 GOTO 2590
2940 DATA 5280,"FEET","MILE",1760,"YARDS","MILE",3,"FEET","YARD"
2950 DATA 36,"INCHES","YARD",365,"DAYS","YEAR",16,"OUNCES","POUND"
2960 DATA 112,"POUNDS","CWT",8,"PINTS","GALLON",2.2,"POUNDS","KILO"
2970 DATA 100,"CENTIMETRES","METRE",10,"MILLIMETRES","CENTIMETRE"
2980 DATA 10,"YEARS","DECADE",2240,"POUNDS","TON",3.28,"FEET","METRE"
2990 DATA 0,"BELGIUM","BRUSSELS",0,"HOLLAND","THE HAGUE",0,"INDIA","DELHI"
3000 DATA 0,"CANADA","OTTOWA",0,"EGYPT","CAIRO",0,"JAPAN","TOKYO"
3010 DATA 0,"POLAND","WARSAW",0,"NORWAY","OSLO"
3020 END
```

PET Sweeper

by Peter Calver

Another addictive game from the man that gave you 'Air Attack' (PCW December 1979).

```
100 POKE59468,14
110 PRINT"";TAB(10)"RULES OF SWEEPER
120 PRINT"SWEEPER IS A FAST ACTION GAME IN WHICH"
130 PRINT"YOU NEED TO THINK FAST AND MOVE FAST."
140 PRINT"NINE NUMBERS  1 TO 9 WILL APPEAR ON THE"
150 PRINT"SCREEN - AND ALL YOU NEED TO DO IS"
160 PRINT"SWEEP THEM UP.  EACH NUMBER ADDS TO YOUR";
170 PRINT"SCORE, THEN REAPPEARS ON THE SCREEN IN"
180 PRINT"ANOTHER POSITION."
190 PRINT"TO MOVE HOLD DOWN ONE OF THE NUMBERS"
200 PRINT"FROM 1 TO 9 (OTHER THAN 5).  FOR EXAMPLE"
210 PRINT"YOU SHOULD PRESS 8 TO MOVE UPWARDS, 2";
220 PRINT"TO MOVE DOWNWARDS, OR 6 TO GO RIGHT.  IT";
230 PRINT"IS LIKE THE POINTS OF THE COMPASS."
240 POKE59409,60:POKE59468,14
250 PRINT"PRESS ANY KEY TO START"
260 POKE59409,60:POKE59468,14
270 GETW$:IFW$<>""THEN250
280 GETW$:IFW$=""THEN280
290 DIMD%(255)
300 D%(58)=-41:D%(50)=-40:D%(57)=-39:D%(42)=-1:D%(41)=1:D%(26)=39:D%(18)=40
310 D%(25)=41
320 POKE59409,52:PRINT"":T=0:S=0
330 FORI=32808TO33728STEP40:POKEI,225:POKEI+39,97:NEXT
340 FORI=32809TO32846:POKEI,98:POKEI+920,226:NEXT
350 J=0:P=32988:POKEP,102
360 FORI=1TO9:GOSUB460:NEXT:POKE59409,60:TI$="000000"
370 PN=D%(PEEK(547))+P
380 TS$=RIGHT$(TI$,2):PRINT"SCORE";S;TAB(32)"TIME ";TS$:IFTS$="30"THEN490
390 IFPN=PTHEN370
400 P1=PEEK(PN)AND127
410 IFP1=97ORP1=98THEN370
420 I=VAL(CHR$(P1)):IFI=0THENJ=0:GOTO440
```

PROGRAMS

```
430 J=I:S=S+J:GOSUB460
440 POKEP,32:P=PN:POKEP,102
450 GOTO370
460 R=32809+920*RND(1)
470 IFPEEK(R)<>32THEN460
480 POKER,176+I:RETURN
490 FORI=1TO1000:NEXT
500 GOSUB560 :PRINT"SCORE:";S;TAB(23)"RATING: ";R$
510 GETX$:IFX$<>""THEN510
520 FORI=1TO200:NEXT
530 PRINT"PRESS ANY KEY TO START ANOTHER GAME"
540 GETX$:IFX$=""THEN540
550 GOTO320
560 IFS<50THENR$="DUMMY":RETURN
570 IFS<65THENR$="GRANNY":RETURN
580 IFS<80THENR$="LEARNER":RETURN
590 IFS<95THENR$="AVERAGE":RETURN
600 IFS<110THENR$="GOOD":RETURN
610 IFS<125THENR$=" PRO":RETURN
620 R$="**ACE**":RETURN
READY.
```

PET Delete and renumber

by Jerry French

The first routine edits out program chunks while the second tidies up your line numbers.

```
50 * S=CLR ,Q=CURSOR DOWN
1000 PRINT"SPROGRAMME TO EDIT OUT CHUNKS"
1010 INPUT"START & END NO'S: A , B ";A,B
1020 PRINT"SQQQ";A:              REM***PRINTS LINE NOS***
1030 N=N+1:A=A+1:IF A>B THEN1070
1040 PRINT A
1050 IFN=7 THEN1070
1060 GOTO1030
1070 IFA =BTHEN PRINT"S":        REM***CURSOR HOME***
1080 IFA =BTHEN 2010      :      REM***DROP OUT FOR FINAL NO***
1090 IFA<BTHEN: PRINT"A=";A+1;":B=";B:   REM***PRINTS GEN TO BE
2000 N=0: PRINT"QQGOTO 1020S":             REM   CARRIED OVER ON SCREEN ***
2010 FORJ=1TO10:POKE(623+J),13:POKE 158,J : REM***FORCING CHR$(13) INTO BUFFER
2020 NEXTJ



100 *PROGRAMME TO RENUMBER LINES
200 *1024 IS START PROGRAMME AREA
300 * 0 INDICATES START OF LINE
400 * A GIVES LOC. NEXT A MINUS B*256
500 * B TIMES 256 + A = LOC. NEXT A
600 * C LINE NO MINUS 256*D
700 * D TIMES 256 + C = LINE NUMBER
800 **** TO BE USED AS BASE WHEN WRITING PROGRAMME****
900 **** USE SAME LINE NO S ****
50000 INPUT"START NO";L
50010 INPUT"STEP    ";S
50020 A=1025
50030 B=INT(L/256):PRINT"*";
50040 F=A+3
50045 POKE F,B
50050 C=L-(B*256)
50060 Y=A+2
50070 POKE Y,C
50080 L=L+S
50090 G=PEEK(A):J=PEEK(A+1)
50100 A=G+(J*256)
50110 IF PEEK(A+3)>170 THEN STOP
50120 GOTO 50030
```

BLUDNERS

Computer answers last month lost a line in the 380Z Basic access: 1040 POKE P9,201 : RETURN

Backgammon also dropped a line or two: R=Reverse on, O=Reverse off, S=Space, D=Cursor Down, L=Cursor Left and all other characters must be shifted.

6020 W$="R%S'DLLL4S*DLLL5S6DLLL!SO!DLLL6RSO5DLLL*RSO4DLLL'RSO%DLLLSRSOS"
6100 B$="SRSOSDLLL'RSO%DLLL*RSO4DLLL6RSO5DLLLR!O!DLLLR5S6DLLL4S*DLLL%S'O"


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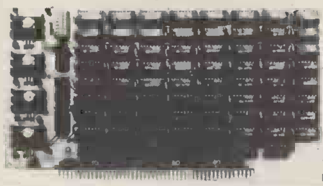

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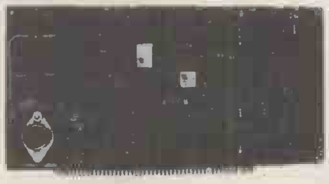

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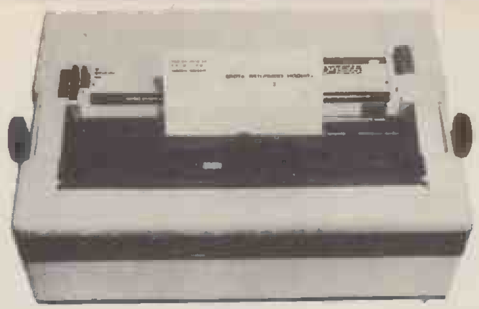

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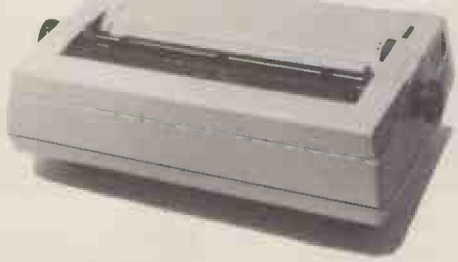

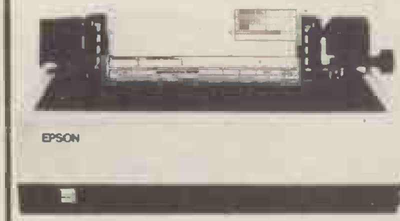

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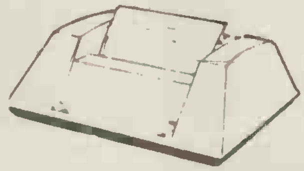

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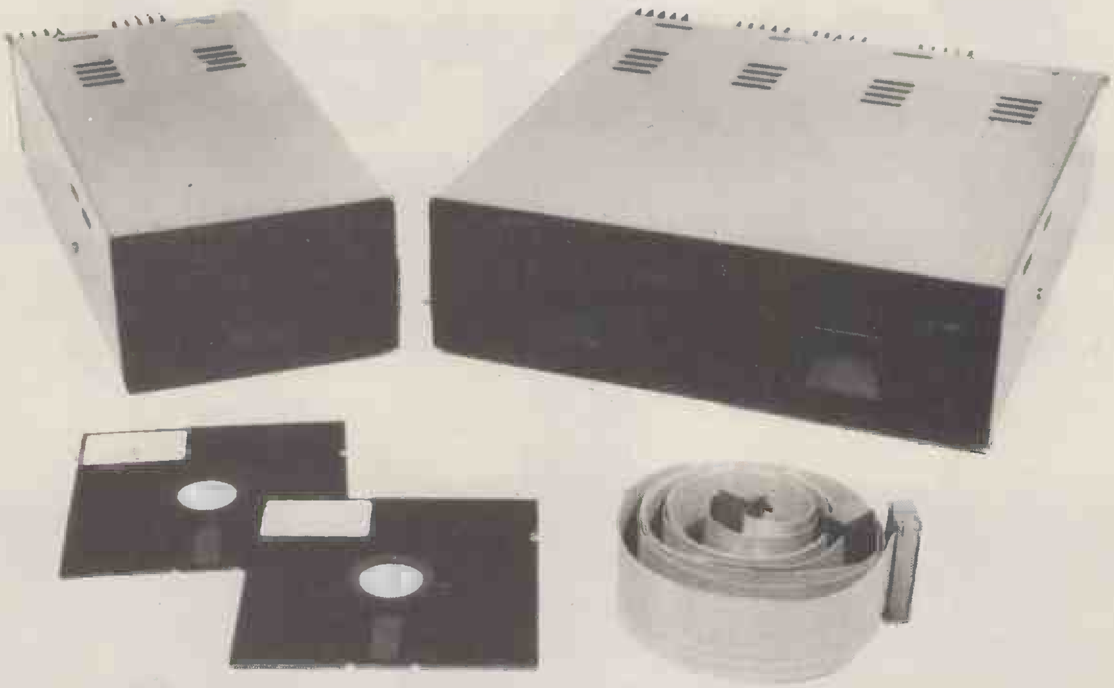

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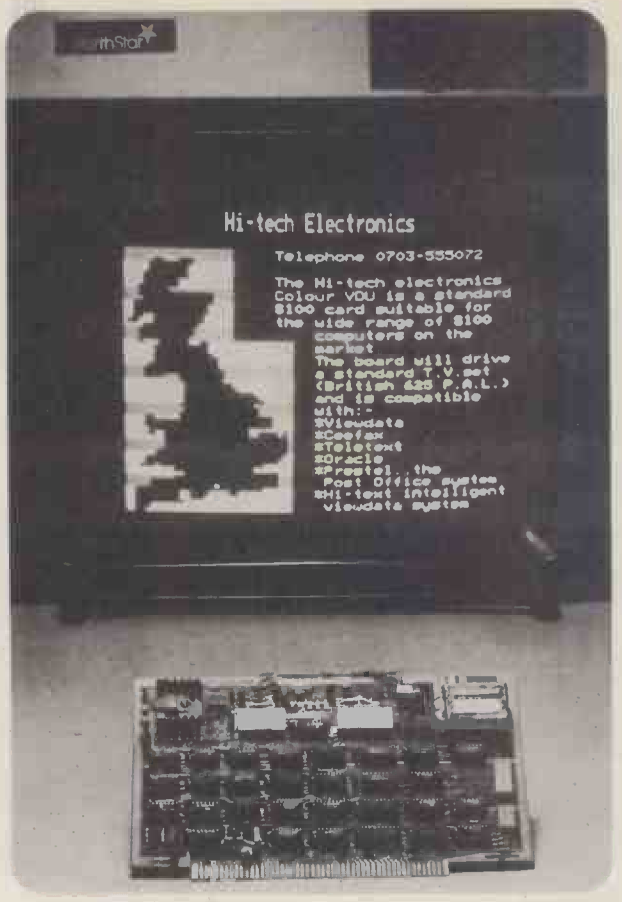

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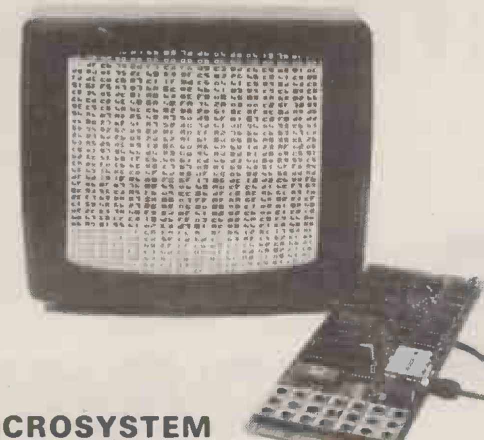

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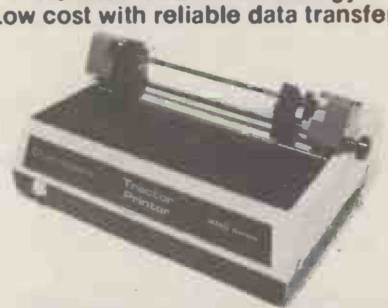

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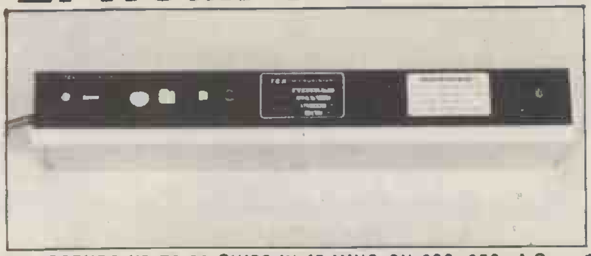

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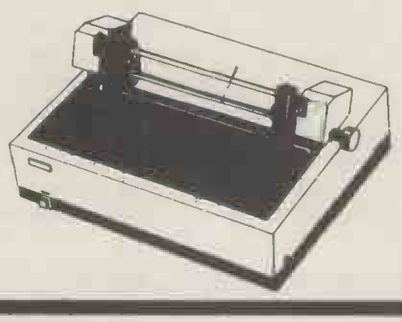

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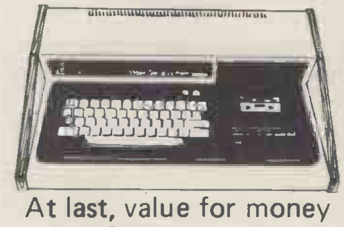

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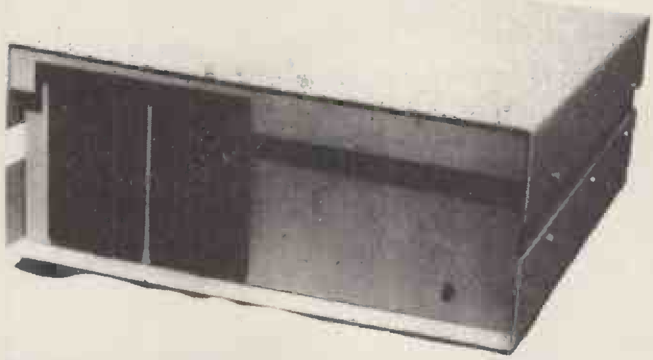

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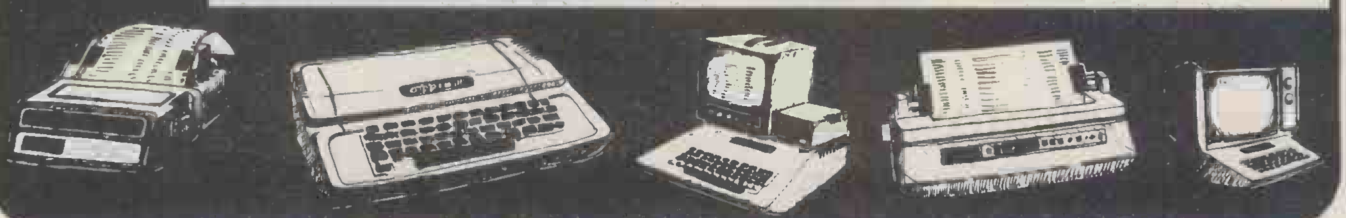

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- Built-in electronic shift lock.
- Two-key rollover to prevent accidental two-key operation (excluding "control" and "shift").
- Electronic hysteresis for firm "feel".
- Signal activation time of 1 millisecond.
- Output via 12-way edge connector.
- CMOS compatible with pull-up resistor.
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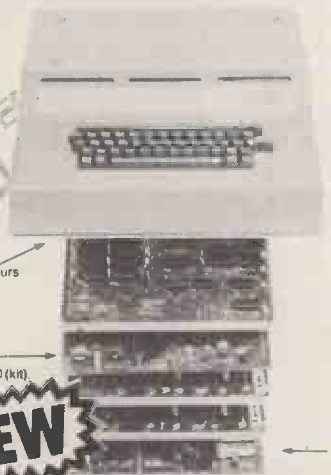
SYSTEM 80 SYSTEM 80 SYSTEM 80



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System 80 housing
High strength GRP moulding in variety of colours. Accepts 12x8 Nascom 2 CPU board, four 8x8 expansion boards. £85 incl. frame racking, interconnects and motherboard.

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*Available in kit form.
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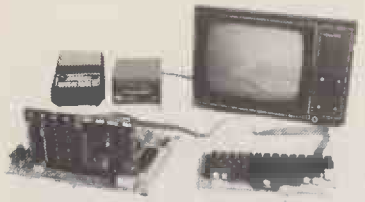

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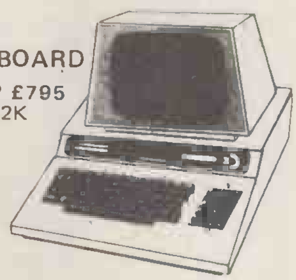

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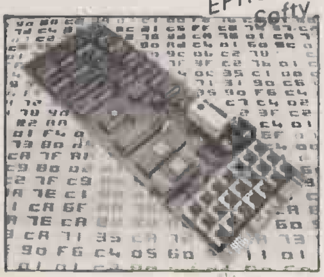

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CHIP CHAT

Chris ("Spangles" to all you early Radio Caroline aficionados) Cary of the Comp Shop disclosed recently how his outfit came to be labelled "The New Barnet Mafia"; apparently he knows the power of real money and pays on the spot for whatever he buys, using a currency known among desperados as "the suitcase"... Sinclair simulation time! On your marks, Uncle Clive, for on your tail are rumoured to be a clutch of ZX80 imitators. But I wonder how they'll fare getting hold of ROMs and TTLs? . . . Better early than on time — or so think the PR boys at Commodore. The new "Superpet" has just been heavily pre-announced at the Hanover Fair, even though the real date of launch (UK anyway) is to be June 14; apparently it's de rigeur to announce such things at Hanover. . . Word reaches me that Nascom is being ever so careful to deny that (a) a price-hike is on the way and (b) their machines are selling like crazy; dealers are looking far too happy as they shake their heads. . . Surely misoverheard by our own pet ferret — Curry's Derek "Mr Suds" Moon uttering something along the lines that you can't believe what you read in the mags, because the editorial's all been bought. . . also it sounds like there may be a few hiccups with "The Curry's Promise"? (equipment/expertise over the high street counter, up and down the land): only Suds really knows the score — and he's not telling. Oh well, there's always washing machines!. . . Well I never Dept: word has it that during the Great Byte Shop Trauma of some months back, Robin Wood of Isherwoods actually entered a bid. It's said it was ex-Computer Weekly Micro News Editor, Martin Banks, who dissuaded him from such megolamanic dreams. . . Giggle of the month: remember the offer of a fiver to the first person to tell us who wrote the BASIC for the Sinclair ZX80 (Uncle Clive was keeping schtumm)? Well, we received the following phone call: (little voice) "Hello — I can tell you who wrote the BASIC for the ZX80". "Can you indeed", replied Dave Tebbutt, "who was it"? "John Grant" piped the reply. "Very interesting" replied Dave and, more suspiciously, "how old are you"? "Ten". "And what's your name"? "Crispin Sinclair"!!! "Does your dad know you're ringing"? "Oh, well, no — I thought I'd ring to claim the fiver before he did". Watch it Clive, you're raising your own takeover bid!

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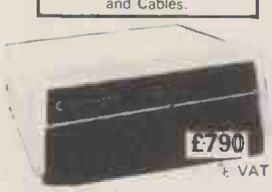

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