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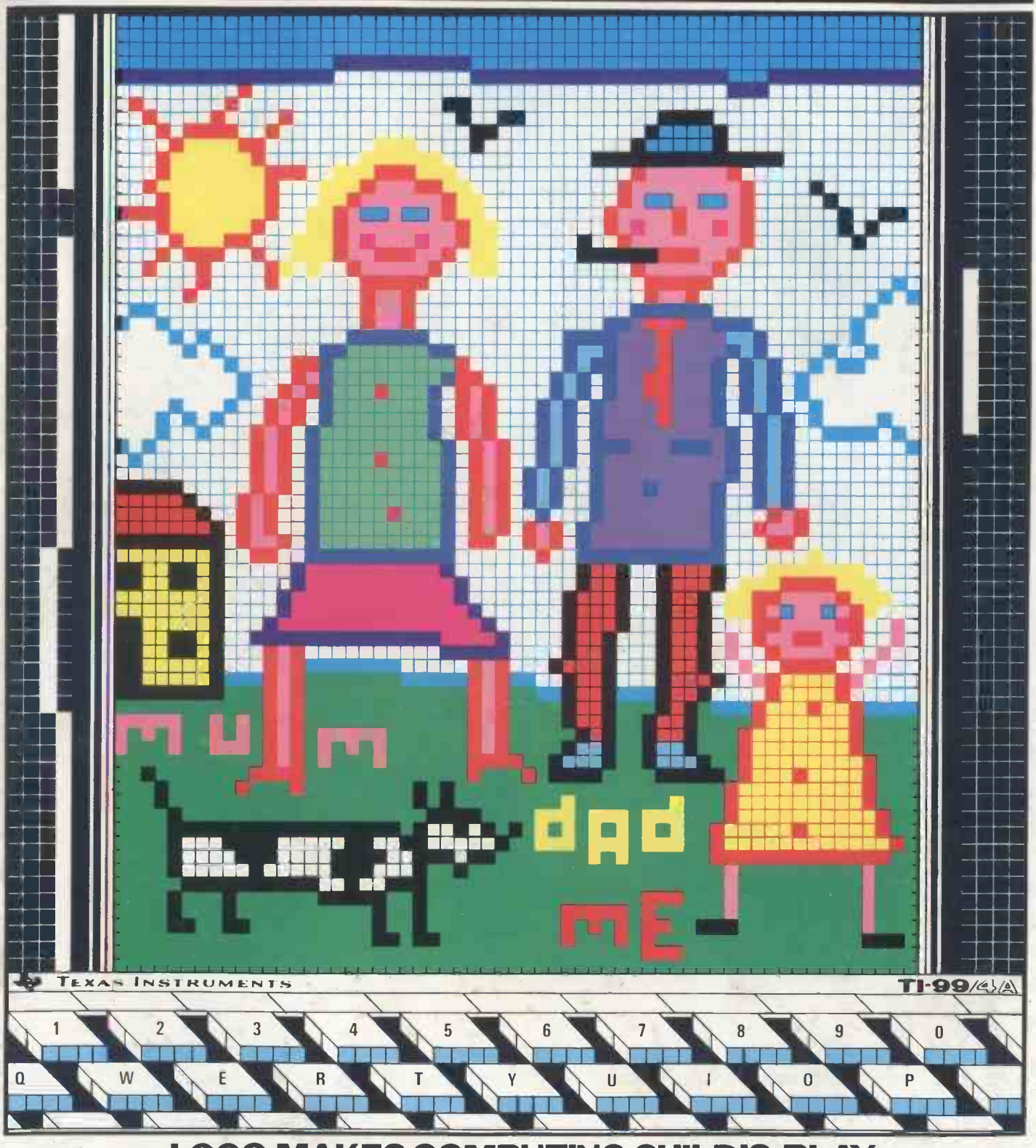

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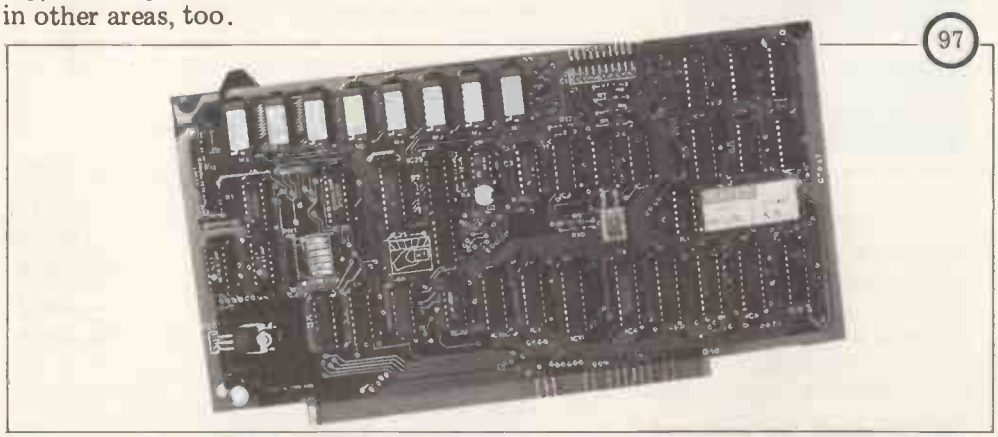

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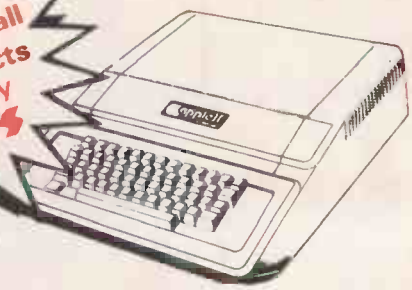

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DOS 3.3 Upgrade	39.00	5.85	44.85
Autostart Rom Pack	33.0	4.95	37.95
Graphics Tablet	485.00	72.75	557.75
Apple Tel System	575.00	86.25	661.25
Pascal Language System	245.00	36.75	281.75
Applesoft Firmware Card	95.00	14.25	109.25
Integer Card	95.00	14.25	109.25
Language Card	97.50	14.63	112.13
Apple Pilot	79.00	11.85	90.85
Apple Fortran	105.00	15.75	120.75
Apple Prototype/Hobby Card	12.00	1.80	13.80
Vero Prototype/Hobby Card	10.00	1.50	11.50
Parallel Printer Interface Card	87.50	13.13	100.63
Communications Card	103.00	15.45	118.45
High Speed Serial Interface Card	94.75	14.21	108.96
Centronics Card	103.00	15.45	118.45
Controller Card	100.00	15.00	115.00
● Eurocolour Card	69.00	10.35	79.35
IEEE 488 Interface	230.00	34.50	264.50
Thermal Paper for Silentype	2.75	0.41	3.16
Vinyl Carrying Case	16.00	2.40	18.40
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Silentype Printer	195.65	29.35	225.00

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Disc III	381.74	57.26	439.00
Pro-file	2251.30	337.70	2589.00
Silentype III	216.52	32.48	249.00
Universal Parallel Interface	134.78	20.22	155.00
Pascal III	146.96	20.04	169.00
Visicall III	146.96	20.04	169.00
Mail List Manager	86.09	12.91	99.00
Vinyl Carry Case	47.83	7.17	55.00

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● Visicalc (3-3)	105.00	15.75	120.75
Visidex	110.00	16.50	126.50
Visiplot	98.00	14.70	112.70
Visi Trend/Plot	140.00	21.00	161.00
Visi Term	82.00	12.30	94.30
Desktop Plan II	110.00	16.50	126.50
CCA Datamanagement	56.00	8.40	64.40
● D.B. Master V.2.4.	105.00	15.75	120.75
Word Processing			
Apple Writer	39.00	5.85	44.85
Magic Window Text Editor	49.00	7.35	56.35
Easywriter (80 Col.)	155.00	23.25	178.25
Mailmerge (80 Col.)	68.50	10.28	78.78
Easywriter (40 Col.)	51.30	7.70	59.00
The Address Book	27.00	4.05	31.05
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Animation Pac	31.00	4.65	35.65
Saturn Navigator	15.00	2.25	17.25
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Higher Text	20.50	3.08	23.58
3D Super Graphics	22.25	3.34	25.59
Apple World	33.00	4.95	37.95
Memory Management System	25.25	3.79	29.04
Alien Rain/Typhoon	15.43	2.32	17.75
Sneakers	16.30	2.45	18.75
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HP-85 Computer	1816.52	272.48	2089.00
16K Memory Module	164.35	24.65	189.00
ROMS			
Input/Output ROM	199.77	29.97	229.74
Assembler ROM	199.77	29.97	229.74
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HP-IB	260.94	39.14	300.08
RS232 Serial Int	260.94	39.14	300.08
GP-IO	335.21	50.28	385.49
BCD	335.21	50.28	385.49
Parallel Printer Int.	199.77	29.97	229.74
Plotter & Accessories			
Plotter	1619.00	242.85	1861.85
Personality Module	496.00	74.40	570.40
Vinyl Carrying Case	151.80	22.77	174.57
Printers & Accessories			
Printer Impact	637.81	95.67	733.48
Printer Line	2611.00	391.65	3002.65
Printer Stand	227.00	34.05	261.05
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Graphics Presentation	135.44	20.31	155.75
VisiCalc Plus	135.44	20.31	155.75
Surveying	135.44	20.31	155.75
Flexible Disc Unit			
Dual Master (540K bytes) 5¼ Disk	1693.00	253.95	1946.95
Dual Add-On (540K bytes) 5¼ Disk	1489.84	223.48	1713.32
Single Master (270K bytes) 5¼ Disk	1015.80	152.37	1168.17
Single Add-On (270K bytes) 5¼" Disk	858.78	128.82	987.60
Dual Master (2400K bytes) 8" Disk	4515.00	677.25	5192.25
Dual Add-On (2400K bytes) 8" Disk	3821.00	573.15	4394.15
Single Master (1200K bytes) 8" Disk	3299.00	494.85	3793.85
Single Add-On (1200K bytes) 8" Disk	2605.00	390.75	2995.75
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MZ 80 FMD Master Disk and Manual	20.00	3.00	23.00
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MZ 80 FO5 Extra Disk Cable	7.00	1.05	8.05
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MZ 80 TIOB Basic Tape	9.50	1.43	10.93
MZ 80 T20C Machine Language	18.00	2.70	20.70
MZ 80 TU Assembler	36.00	5.40	41.40
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ZEN MOD	10.43	1.57	12.00
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Music Composer/Editor	10.43	1.57	12.00
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Cosmecad 12K	8.00	1.20	9.20
Home Budget	5.47	0.83	6.30
Space Invaders	5.47	0.83	6.30
Startrek	5.47	0.83	6.30
UFO	5.47	0.83	6.30

PC1211	NETT	V.A.T.	TOTAL
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CE122 Printer/Cassette Interface	60.86	9.13	69.99
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EA 800R Ink Ribbons	1.80	0.27	2.07

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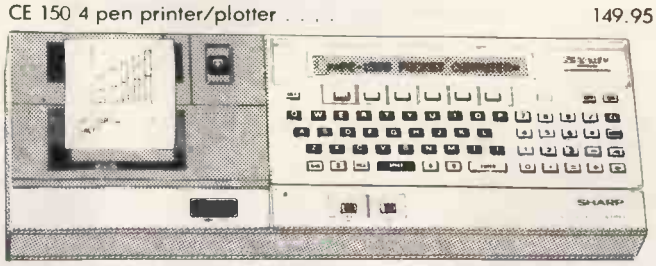

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MZ 80B	NETT	V.A.T.	TOTAL
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MZ 80 FD Dual Disks	560.00	84.00	644.00
MZ 80 P5 Dot Matrix Printer	387.00	58.05	445.05
MZ 80 P6 Dot Matrix Printer	440.00	66.00	506.00
MZ-8BP51–P6 Interface	30.00	4.50	34.50
MZ-8BP5C–P6 Cable	24.00	3.60	27.60
MZ 80 FI Disk Interface	94.00	14.10	108.10
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Assembler Editor ROM	39.95
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Microsoft Basic	59.95

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MX80 T Newtype 2	390.43	58.57	449.00
MX80 FT/1	346.95	52.05	399.00
MX80 FT Newtype 2	390.43	58.57	449.00
MX100	564.34	84.66	649.00
Epson Interfaces			
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Epson/Sharp Disk	120.00	18.00	138.00
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Epson/TRS 80 Bus	59.00	8.85	67.85
Epson/TRS 80 Expansion	25.00	3.75	28.75
Epson Ribbons	7.00	1.05	8.05
Epson MX100 Ribbons	8.50	1.28	9.78
• Microline 80	270.00	40.50	310.50
• New Microline 82A	395.00	59.25	454.25
Microline 80 Tractor	45.00	6.75	51.75
Diplomat Card (Apple-Microline)	85.00	12.75	97.75
Microline Ribbons	2.25	0.34	2.59
Seikosha			
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• Seikosha GP80D (for MZ-80)	252.13	37.82	289.95
• Seikosha GP100	215.00	32.25	247.25
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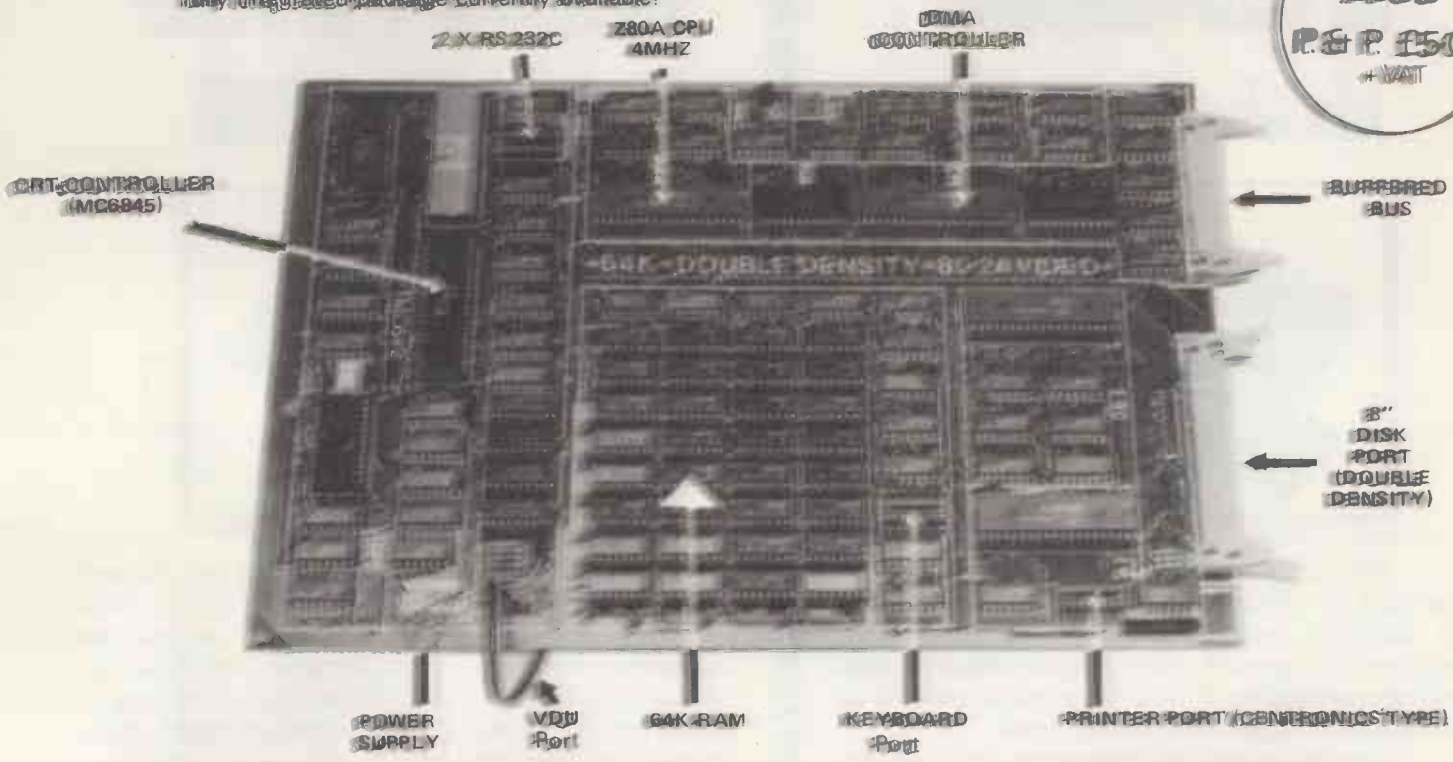

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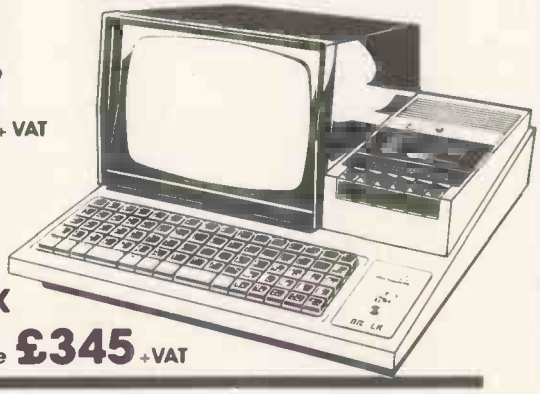

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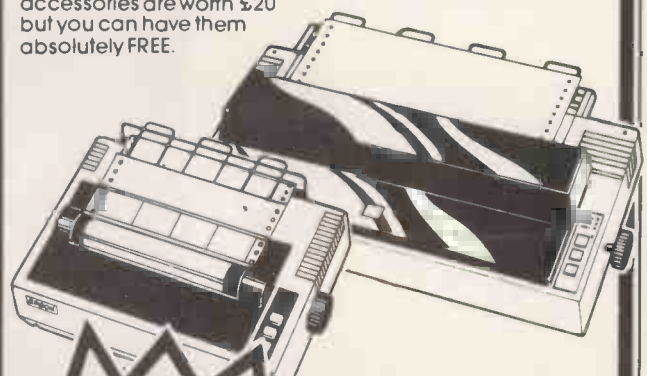

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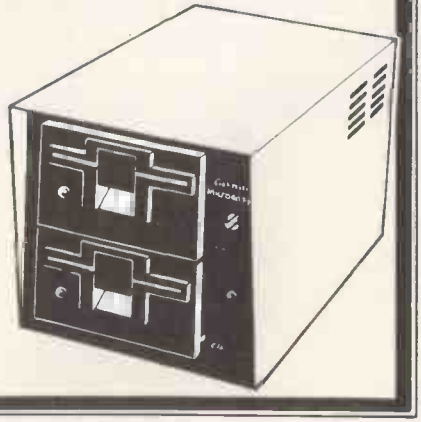

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INNOVATIVE

TRS 80-GENIE SOFTWARE

from the professionals

SUPER UTILITY +

Super Utility Plus is probably the most extensive disk orientated utility available on the market at the moment. It is important that it should be differentiated between a zap alone program such as our Prozap or Superzap. Both of those programs are specialised disk repair and investigation utilities. Whilst SU + includes these functions it is also aimed at a broader spectrum. We introduced the original Super Utility almost a year ago but the present SU + is a complete re-write with many new functions. Existing owners of Super Utility (who bought it from us) may update for the difference in price and should contact us accordingly. SU +, unlike the original, supports double density as well as the usual single density, zapping. There are seven sections to the program, each with many commands as follows:

Disk Zap

1. Display Sectors
2. Verify Sectors
3. Compare Sectors
4. Copy Sectors
5. Copy Sector Data
6. Zero Sectors
7. Reverse Sector Data
8. Exchange Sectors
9. String Search
10. Sector Search
11. Read ID Address Marks
12. Alter Data Address Marks

Disk Purge

1. Kill Selected Files
2. Kill by Category
3. Remove System Files
4. Remove all Passwords
5. Disk Directory
6. Zero Unused Entries
7. Zero Unused Granules
8. Change Disk Name
9. Change File Parameters
10. Check Directory

Disk Format

1. Standard Format
2. Special Format
3. Format without Erase
4. Build Format Track
5. Write Format Track
6. Software Bulk Erase

Disk Backup

1. Standard Disk Backup
2. Backup non standard disks

Disk Repair

1. Repair Gat Sector
2. Repair Hit Sector
3. Repair Boot Sector
4. Read Protect Directory
5. Un-Read Protect Directory
6. Recover Killed Files
7. Move Directory
8. Display Directory
9. Check Directory
10. Clear Unused Entries

Tape Utilities

1. Read Tape
2. Write Tape
3. Verify Tape
4. Copy Tape

Memory Utilities

1. Display Memory
2. Move Memory
3. Exchange Memory
4. Compare Memory
5. Fill Memory
6. Reverse Memory
7. Test Memory
8. Jump to Memory
9. String Search
10. Input Byte from Port
11. Output Byte to Port
12. Memory to Sectors
13. Sectors to Memory
14. Memory to Track
15. Track to Memory

File Utilities

1. Display File Sectors
2. Compare Files
3. Copy Files
4. Disk Directory
5. Free Space
6. Offset a File
7. File Locations
8. Drive Status
9. Sector Allocation
10. Build a File
11. Clear a File
12. Disk Allocations
13. Compute Hash Code
14. Compute Passwords

In addition to the above, SU + itself may be configured to read single/double density, tracks up to 80, any standard stepping rate, any directory track, any standard delay, high or low speed clock and printer configuration.

SU + is very difficult to copy so a backup copy is included in the price. In other words you get two disks.

Super Utility Plus. Minimum 48K 1 disk for TRS-80/Video Genie . . . . . £46.00 + V.A.T. = £52.90

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from the professionals

LDOS

First there were the TRSDOS's, 2.0, 2.1, 2.2 and 2.3. Then came Newdos+, essentially a patched version of the TRSDOS's but with a number of very useful commands and utilities added. Then VTOS 3.0 and VTOS 4.0. These constituted a departure from the earlier DOS's and featured Device Independence so that devices such as the keyboard, printer, VDU and disk drives could interact directly together. Then came Newdos80 which is a rewrite of Newdos+, adding new utilities and new Basic commands, its main features being the ability to mix different capacity drives on the same cable and the ability to use variable length records. Now from LOBO International comes LDOS, the fifth generation disk operating system for the TRS-80 microcomputer. It combines most of the advantages of the preceding disk operating systems and unlike some of them, is accompanied by a complete and readable set of documentation, which includes a Technical Section containing relevant addresses.

It is impossible to describe all of the features of LDOS in an advertisement. For instance it includes no less than 35 library commands as follows:—

APPEND	COPY	DEVICE	DIR	DO	FILTER	KILL
LIB	LINK	LIST	LOAD	MEMORY	RENAME	RESET
ROUTE	RUN	SET	SPOOL	ATRIB	AUTO	BOOT
BUILD	CLOCK	CREATE	DATE	DEBUG	DUMP	FREE
PROT	PURGE	SYSTEM	TIME	TRACE	VERIFY	XFER

All of the useful abbreviations in Newdos are included and the System Commands In Basic (CMD) now number eleven. A program called LBASIC/FIX is included, with which the normal TRSDOS Disk Basic may be patched to include a number of new commands and features. A Job Control Language is included and in fact is one of the most powerful features of LDOS. It allows the user to compile a sequence of commands or key strokes for later execution as a chain, with or without user intervention. There are too many new features to list them herein, but examples are: The ability to provide an audible signal, output through the cassette port. To flash or blink a one line message on the video display. A WAIT feature is included so that the machine can be put into a "sleep" state until such time as the system clock matches the time specified. And so on!

Hard disks in addition to single/double density, single/double sided, 8" and 5¼" floppies are supported although they may, of course, require hardware modifications. Utilities included in the package are:

BACKUP	COMMAND FILE	FORMAT	LCOMM
PATCH	RS232	KEY STROKE/MULTIPLIER	PRINTER FILTER

A Basic Renumber facility is included, as is a Basic Cross Reference function. Both are similar to the ones in Newdos+ and Newdos80. Most of the utilities are library commands which were existent in the previous DOS's, have been improved with the addition of new functions or facilities.

The prime development team of LDOS consisted of no less than 8 first rank programmers and they had the support and advice of six other well known programmers. They have done an excellent job to bring to the user what must be the best disk operating system so far produced for a microcomputer, which is destined to become the Standard DOS.

LDOS is totally upward compatible with TRSDOS, that is to say LDOS will be able to copy files and programs from TRSDOS disks onto LDOS formatted disks. As they are competitive disk operating systems, it is not suprising that the manual states that disks created under Newdos are not guaranteed to be compatible with LDOS, but we have not experienced any difficulty. We have done some work on investigating the compatibility of LDOS and the Video Genie and at the time of going to press we have found no incompatibilities. LDOS appears to run on the Video Genie without any problems at all. LDOS is compatible with either the Tandy or Electric Pencil lowercase modifications and Scripsit. LDOS is available for the Model I and Model III. A Model II version will be available shortly.

LDOS .....£85.00 plus VAT and £1.50 P&P.

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A remarkable breakthrough in price/performance, the CompuStar boasts nearly 1 megabyte of online Winchester disk storage (almost 2 megabytes on CompuStar II) and can be easily expanded to 20, 36 or 96 megabytes of hard-disk in just seconds. And since each user station can accommodate up to 64k of RAM, a total of over one million bytes can be incorporated into the system to tackle even your most difficult programming tasks.

CompuStar user stations can be configured in a countless number of ways. A series of three intelligent-type terminals are offered. Each is a perfect cosmetic and electrical match to the system. The CompuStar 10 – a 32k programmable RAM based terminal (expandable to 64k) is just right if your requirement is a data entry or enquiry/response application. And, if your terminal needs are more sophisticated, select either our CompuStar 20 or CompuStar 40 as user stations. Both units offer dual disk storage in addition to the disk system in the CompuStar. The Model 20 features 32k of RAM (expandable to 64k) and 350k of disk storage. The Model 40 comes equipped with 54k of RAM and over 700k of disk storage. But, most importantly, no matter what your investment in hardware, the possibility of obsolence or incompatability is completely eliminated since user stations can be configured in any fashion you like – whenever you want – at amazingly low cost!

COMPUSTAR™

Functional characteristics
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Answer *what-if's*	Employees records	Tabulate values
Print reports	Sort files	Edit records

Within hours perform all the above in French or German.
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Within the appropriate frames of reference you could ask questions like the following.
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Find all stock items that are codes *micro-computers* that are either in warehouse 1 or warehouse 2, where the quantity on hand is more than 50 units, the cost is less than 1000.00, the selling price higher than 2000.00; that are not in cartons, bought from supplier 52, allocated more than 20, rated for tax at .15% and weigh less than 50 lbs. *When you find such categories* then print a report showing the description, cost price, quantity on hand, lead time for refills, what the selling price *should be if raised by 12.3%* as well as the profit in either per-cent or round figures of that projected selling price.
Find all patients who suffered from cold, that are either girls or women younger than 23 years old, and who live in London at a socio-economic grade higher than 3; do not smoke; have more than 3 children, are currently at work and where treatment failed to effect a cure in under 6 days. When you find such persons then print a list showing their age, marital status, income, and frequency of illness in the past 2 years.
Currently you can ask 5 types of questions 20 times for a single selection criterion, and then you can compute 10 mathematical relationships between the questions for the individual as well as for the total number of matches. In all some 60 bits of information relating to one record or a group of records on simply one permutation of the selection criterion, with a cross referencing facility as well.
Every word in the system, as well as the file architectures, print masks, and field attributes, is capable of alteration by you without programming expertise (but with some thought).

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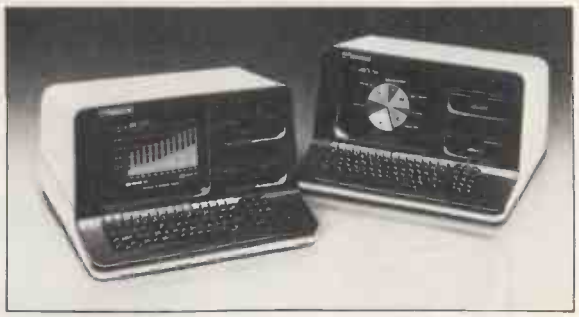

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Due to long term contractual commitments, we are only giving restricted demonstrations by appointment at one of our London offices. We export to all countries. Contact Tony Winter on 01-636 8210 or 01-631 4818 and if unavailable then leave a call-back message (clearly stating your telephone number and name) on the 24 hour answer phone, we call back anywhere in the world.

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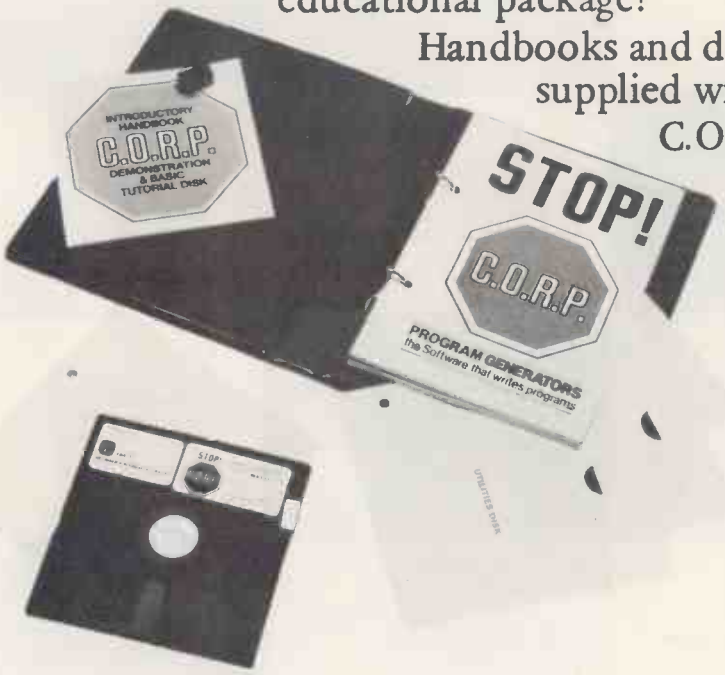

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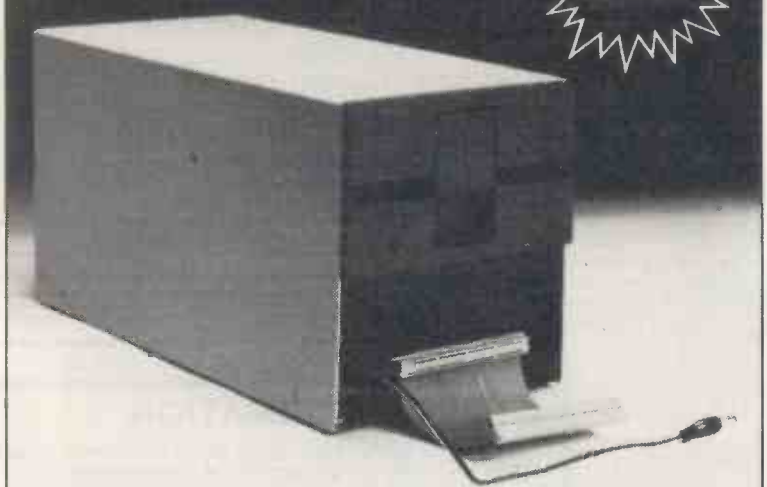

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ACORN COMPUTER
Acorn Computers Ltd.,
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The disk operating system (DOS) decodes the following commands used to control the storage of files on disk:—

* CAT catalogue files on disk * LOAD load image of memory contents as file * SAVE save image of memory contents as file * DELETE delete file from disk * SPOOL store all printer characters on disk
* EXEC read characters from disk as if from keyboard

The DOS also replaces the cassette operating system vectors as used by BASIC to allow the use of the following commands in Atom BASIC:—

LOAD load BASIC program from disk SAVE save BASIC program to disk FOUT open file for output
FIN open file for input SHUT close file EXT find extent of file PRT find value of pointer into file
PUT put number to file BPUT put byte to file SPUT put string to file GET get number from file
BGET get byte from file SGET get string from file

These commands provide full random access of up to 5 disk files simultaneously.

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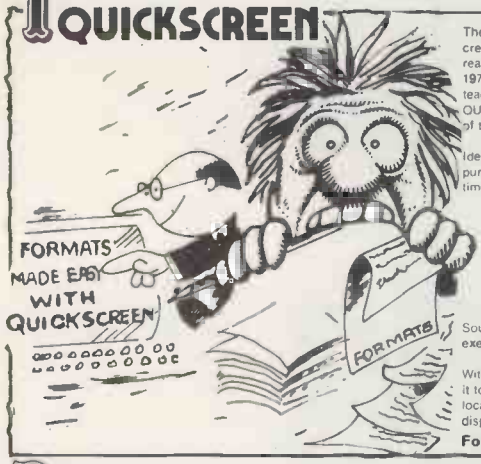

The purpose of QUICKSCREEN is to provide a simple, carefree way for people to create screen forms on the computer. The uses for these forms can be as varied as the reasons people buy computers. With the computer revolution that has occurred since 1975, computers are finding their way onto the desks of managers, professionals, teachers, and students. M.P.I. Ltd. welcomes this development. We hope that QUICKSCREEN will find a home on all those desks and help everyone to get more out of their computer.

Ideally, information should be displayed clearly, with titles, headings and other punctuation. However, in most computer programming languages, this is clumsy and time-consuming:

For each phrase, word, or title, you must identify the exact line and column where it appears. Then you must type each of these locations into the computer. Once you see the results on your VDU, you may not like the appearance, so you would want to rearrange things. This means you will have to recalculate all the line and column locations and type them in again.

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2 CIS COBOL

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3 SELECTOR V

is a totally self-contained system providing complete data, procedural, query, and report definition functions. It allows records to be managed on a one-for-one basis as well as in 'batch' mode where several files can communicate with each other in a variety of ways. It uses the capabilities of an addressable terminal making the entry and editing of data and definitions, smoothly efficient.
The facets that make SELECTOR V more functional than any other system of its kind include:

MULTIPLE 'KEY FIELDS'
Of the up to 80 data fields each record can contain, any or all may be assigned to be 'keys' so that records can be recalled, individually or consecutively, by the contents of those fields.

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SELECTOR V can process records from several different files at the same time. It can freely move information from one file to another. It can do it on a conditional basis, can arithmetically process one field against another or a constant value, it can convert MANAGER to MGR, delete redundant records, multiple the QUANTITY in a Transaction file against the STOCK PRICE of inventory records, add the results to a Receivables file, and update a Journal file, all as the result of a simple procedure definition that can be executed whenever needed.

DATA DEFINITIONS
Records can be structured just as you require. Files can be re-defined and converted as necessity dictates.

SELECTION UTILITIES
SELECTOR V allows records to be selected, in any order according to the most definitive, compoundable criteria either for reporting purposes, or to create uniquely defined new data bases. It can conditionally transform records into new formats and perform arithmetic procedures in the process

REPORTS
With two report generators at your disposal, your data can be made absolutely productive. Both allow inputs from several different files, with conditional and arithmetical processing. The first is oriented to reporting to you about your data. We take care of the formatting. You just specify what information you want. You can designate up to 80 actual and derived fields to be reported upon.
The second report generator produces output in any form that you want. Anything from gummed labels, to dated, automatically sequentially numbered invoices, complete with text paragraphs, can be produced on printed continuous forms of plain paper.

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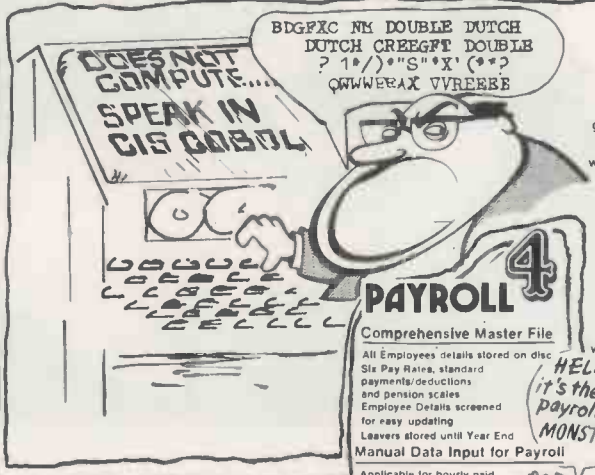

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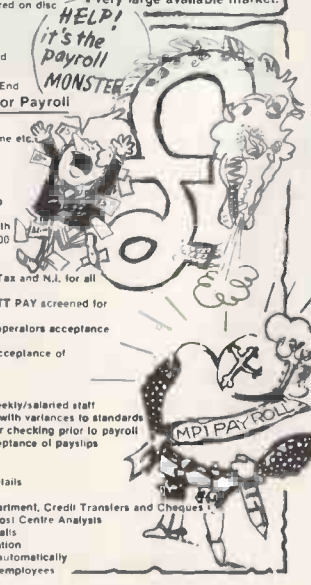

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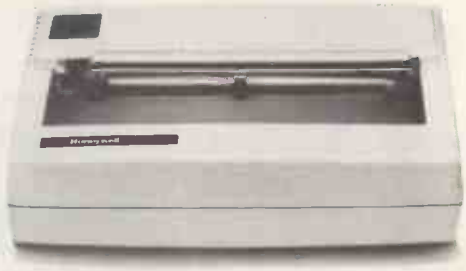

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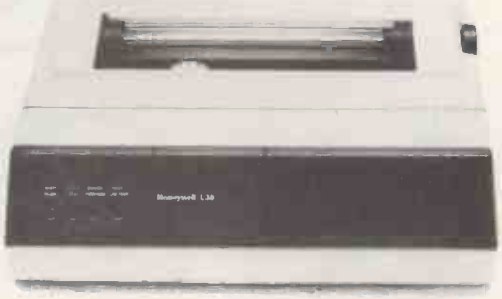

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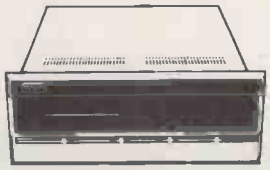

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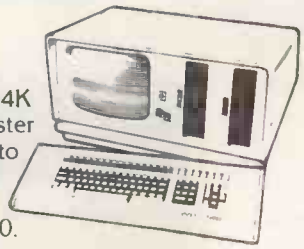

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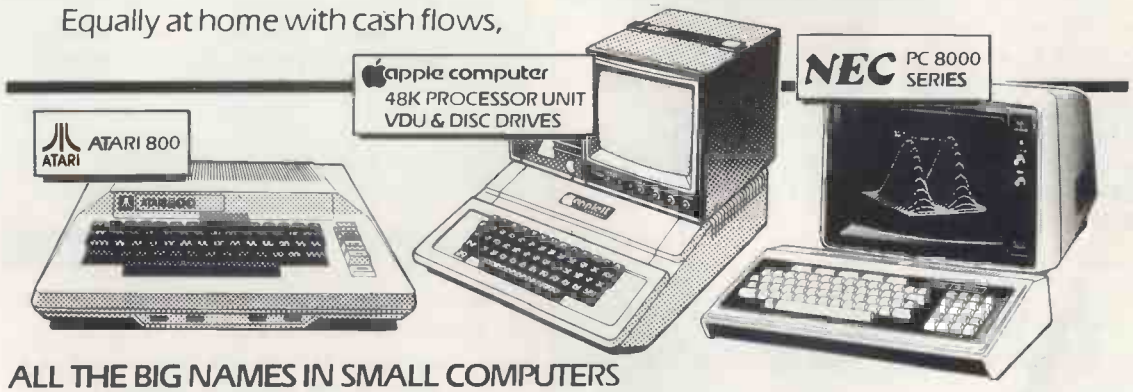

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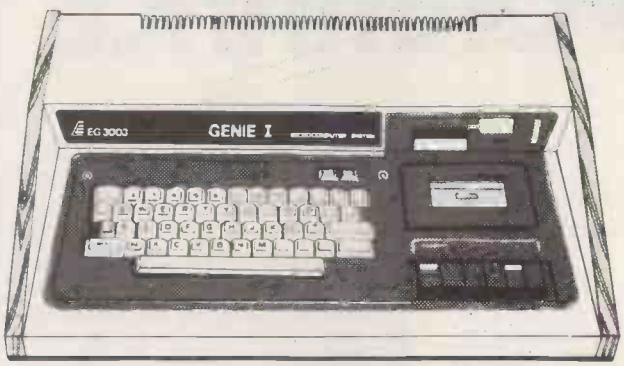

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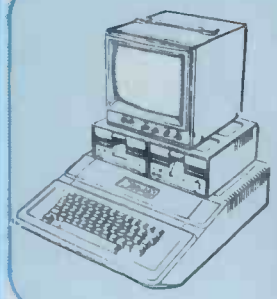

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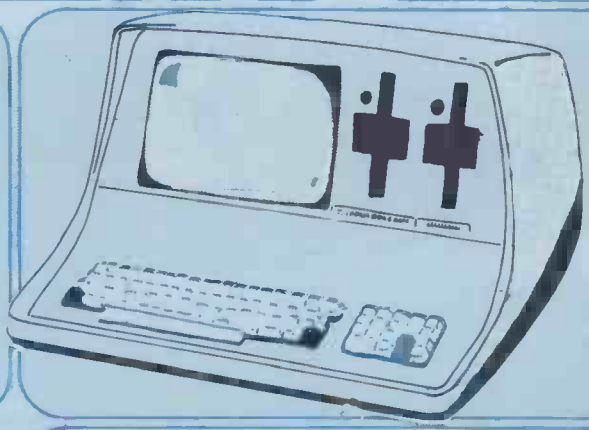

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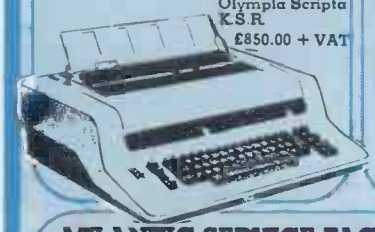

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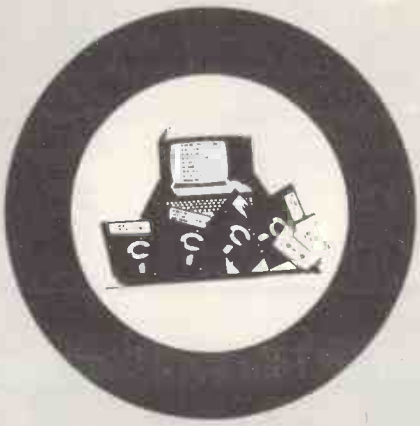

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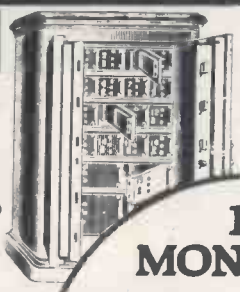

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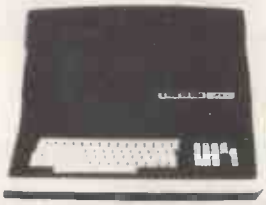

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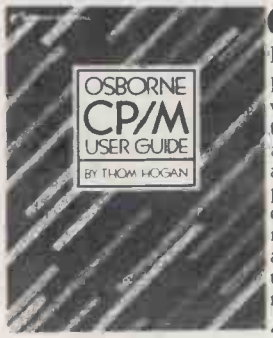

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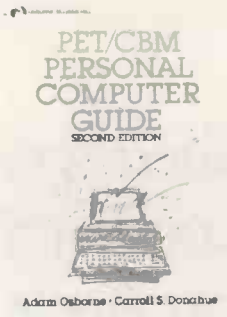

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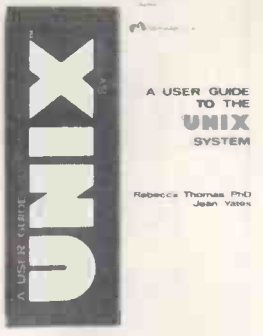

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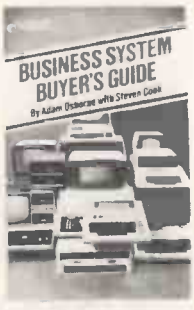

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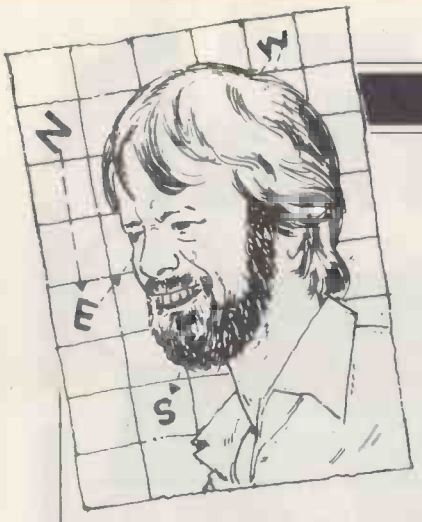


Edited by Guy Kewney

16-bit battle takes shape

Two machines, the Sirius 1 and the Canon CX-1, which appeared on exhibitors' stands at Info 82, a new exhibition in the City of London, almost made the show worth visiting.

The show started out in February with so little evidence of the micro that it was hard to believe it was Info 82, not Info 72.

The Canon was announced last year, and then its Japanese suppliers went very quiet for a long while, because the machine didn't work. Now, although it is not cheap, it is available at last, and on the Canon stand executive Tim Barker was able to show off some of the applications software he has designed for it.

The Sirius was on the Zenithplan stand, together with the range of ACT software, with typical prices quoted as £350 each for sales ledger, purchase ledger and so on.

There is quite a contrast between these two machines. The Canon uses an uncommon central chip, the Motorola 6809, while the Sirius uses the Intel 8088 (the same as that in IBM's Personal Computer).

It also happens that both chips are half-way between the old eight-bit machines (the Intel 8080 and the Motorola 6800) and the new super-powered 16-bit machines, the Intel 8086 and the Motorola 68000. The main difference is that Intel has gone to the trouble of making sure that users can move from this 'stepping stone' to the big chip (Motorola has not), while Motorola has produced a big chip which is actually several degrees more sophisticated than the old (Intel has not, yet).

So the companies are about level overall, with first the one, then the other having the more modern chip.

On the one hand, anybody prepared to wait a year can get a better chip than is on offer today. On the other hand, anybody who waits a year will have to have something for the rest of us to buy this year, and will (generally, unless you are ITT and pick a nice old favourite to start with) want to grab the most effective chip available.

At the moment the 6809 has been available for a lot longer than the Intel 8088, and should logically have sold more chips. Converting systems from the 8080 to the 6809 would have been a hard task, harder than converting to the 8088 (because of XLT-86 which converts 8080 source code to 8088 or 8086 source code). Although Intel produced both 8080 and 8088, and though the numbers are similar, there is no similarity between them. Software which runs on one will not run on the other, and you can't plug the new one into the empty socket on the old boards. Without starting the philosophical argument as to why, it seems certain that people using the 6809 have been less effective in getting products to market than have IBM and Sirius with Intel's 8088.

Canon is a good example of what can go wrong. The machine first appeared with its essential operating software more than a year ago and then could not be released onto the market until November because that software was faulty.

A year ago, the 6809 was a very powerful micro engine. A machine with that chip plus 128 kbytes of memory was a winner, because it would have twice the internal storage capacity of any 8080-based system, a great deal more processing power and the ability to work on longer words.

It is often suggested that a 16-bit word length isn't significantly more important than an 8-bit one and that what really counts is the program which the chip runs.

This simply isn't true.

In a really powerful, comprehensive word and text processing program, the computer has to keep track of simple characters, and keep them in order on the screen, no matter what order they occur inside the computer memory. It also has to keep track of flagposts, such as paragraph indents, special boldface type or underscore words, superscript and subscript notation, and printing commands such as new pages, proportional spacing, and so on. It is also nice to be able to use the text to index the document automatically. All these things are possible with an 8-bit design, but are far easier, and far quicker, on a 16-bit design.

Even at its simplest, a sixteen-bit code can contain a character and 255 different 'characteristics' such as type face, and so on.

Another advantage of 16-bit engines, frequently overlooked by the 'do we really need them?' brigade, is that most can address vastly more memory than 8-bit machines. You can therefore keep a larger amount of text in memory if you're processing words, which is easier and quicker than shuffling it to and from disk.

The actual power increase of the 6809 over the 8080 and its older brothers can be illustrated by the release last year of the Unix operating system by South West Technical Products. SWTP called it Uniflex (because it differed very slightly from the Bell Telephone original, and for copyright reasons). Uniflex turned out to run acceptably fast, according to experts who were used to Unix.

But it is accepted by most operating system designers that ordinary 8-bit systems would take so long to work their way through the Unix system that they would almost never get round to running any software the user wanted. So, although the 6809 has many characteristics of an 8-bit micro, it also has enough of the nature of a 16-bit machine to run an operating system which was designed for 16-bit Digital Equipment minis.

If the 6809 is to succeed it must appear in sufficient different machines — and those machines must be sold in sufficient numbers, to attract software writers. Software writers are very pragmatic: they use the machine they have in front of them and, if they think they can sell the code they have written they will. But if they find that there are only two or three other users in the country, then they won't bother.

The IBM micro is selling in enormous numbers, and other microcomputers use the same 8088 chip or its big 8086 brother. These are now appearing on the market in twos and threes, and some of them are already selling in tens and hundreds.

If the Canon had been on the market, actually selling in tens and hundreds, for the last year, there would now be several thousand, all attracting their programmer owners to write code for their colleagues. But it has been under wraps for a year — and now it is neither ultra-modern, nor particularly powerful, nor particularly cheap. A year ago, it was all of these.

All other things being equal, the 6809 chip would, nonetheless, now start appearing in greater numbers

New microcomputers, called Eagles, have been launched by Mediatech, together with a word processing package based on Spellbinder but 'improved'. Let's hope the improvement is substantial: the price of a system with just one disk drive, CP/M and a nice screen is well over £3000 with VAT, and the bigger system, with some accounting software too, costs nearly £5000.

than the Intel 8088. However, IBM's choice of the 8088 means that all things are no longer equal, nor is there any chance of their becoming so.

The next chapter, now unfolding before our eyes, is the emergence of the true 16-bit chips, starting with the relatively primitive 8086, and moving up through the Intel family with the iAPX 286.

The difference between the 8086 and the chip inside the 286 processor are enormous, but they don't get in the way of old software. With people moving from the old 8-bit 8080 to the 8088 or 8086, the problem was literally one of translating all the software in the new vocabulary used by the bigger chip. But the 8086, although bigger than the 8088, has the same instruction vocabulary and so does the even more sophisticated iAPX 286, officially announced in February, by Intel.

This processor is not a single chip. It obeys the same instructions, but needs a totally different circuit board to power it up and feed it signals. Having done that, the system builder gets six times the processing speed of the 8086 and 16 times as much memory — 16 megabytes worth — to load programs into. More to the point, programs running in that large block of memory are watched and monitored by the electronics of the processor, rather than having to be monitored by the system builder's own operating system.

The important effect of this is that a user can now look forward to the day when his systems runs two or three more different operating systems — such as CP/M, Unix, Pick and Pascal — simultaneously, without any confusion. And this means that if your word processing package runs under CP/M and you want to link it to a communications package that calls up remote computers automatically under Pascal and pass information to a Unix-based database manager, then this can (theoretically) be done. On the current range of 16-bit micros, it isn't even theoretically possible, because they don't have the iAPX ability to segment its memory, translate program addresses and protect data in the segments.

Motorola, perhaps a bit behind on the 6809 compared to Intel's 8088, has a lead in the true 16-bit market. Its 68000 is now appearing in commercially available systems, culminating in the Radio Shack (Tandy) announcement of an upgrade for its Model II micro, using that chip.

This machine already has the ability to segment and manage its memory — or would have if Motorola could produce more than a few samples of the important memory management chip — and is regarded as more sophisticated than anything Intel can make today, or perhaps for the next year.

However its life is not all mapped out in terms of sweetness and roses, because behind the 68000 there is already a much more powerful 32-bit processor available from National Semiconductor. And companies like Acorn now have systems with this 32-bit chip working (in prototype). Zilog's Z8000 family is not much less sophisticated than Motorola's 68000, and that company is known to be working on the next family too.

Don't do anything so stupid as betting that the 6809 is therefore dead, or at least doomed to the obscurity of technological ideas such as the 72rpm record. But on the other hand, don't bet on seeing more 6809 chips than Intel 8088 ones, either.

Canon (UK) is in Croydon on 01-680 7700.

Caxton's first

We've been ribbing *PCW*'s ex-editor David Tebbutt for some months now about the lack of products from his newly-formed software publishing company, Caxton. But now he's been and gone and brought out his first product.

It's called Optimiser, costs £295 (+ VAT), and runs on a 48k Apple II. It's a little difficult to describe what it does in a few words, but it's a spreadsheet program, not unlike VisiCalc at first glance but working in the opposite way. You define your objectives (say, profit from an industrial process) first, then enter the constraining factors and define the relationships between them. Optimiser then allows you to find the, er, optimum way to achieve your objectives. If you want to be technical about it, it's based on linear programming techniques — a tutorial which comes as part of the package explains this, together with elemenatry computing concepts for those new to the subjects. There's also a reference manual on Optimiser itself plus a reference card and *two* disks — one to keep as a back-up, the other for normal use.

More details from your Apple dealer or from Caxton on 01-379 6502.

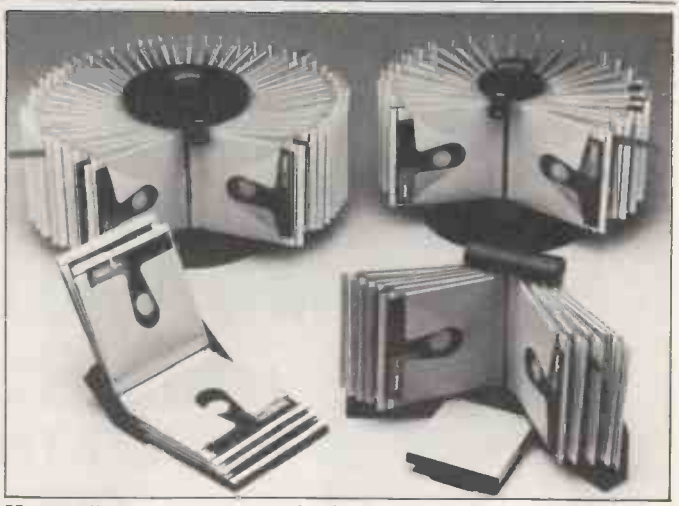
Apple Logo

When teaching people to program, it's tempting to make it as easy as possible and start with Basic. Not everybody agrees this is a good idea, because of the habits of thought which get learned (unconsciously) along with that language and which can prevent the programmer from ever becoming as skilful in analysing problems as he might have been, had he learned some other way.

That, at least, is the theory behind the language Logo, which Apple has adopted 'because of the widespread use of Apples in education', said the Logo company, Logo Computer Systems Inc.

The deal between Logo and Apple should bring the language to British and Irish schools, since Apple now has world-wide distribution rights. What we won't know until April is how much the selling price will be.

For more on Logo, see pages 120-122.



You really want to know why hard disks are coming? Read these prices : the cheapest single tier Twinlock stand shown above for storing 5¼in floppies costs £40. The 50-floppy rotary stand costs £85, the 100-floppy rotary stand costs £121. Or you can pay a mere £26.65 for the 'desk organiser capable of tdking up to 10 disks.' Details on 01-650 4818.

RML for BBC

Research Machines, the company whose large-scale micros are favoured in many schools, has produced a helpful four-page guide to allow users of its 380Z and Link 480Z models to join in on the BBC/National Extension College 30-hour Basic course. It shows the differences in RML's Basic and the course version. Details on Oxford (0865) 49866.

Fair fun

The third London Computer Fair and the first *Educational Computing* Conference will take place on 15-17 April at the Polytechnic of North London. The conference will consist of three main sessions, including seminars on such subjects as the use of computers in teaching non-science subjects, software design and classroom management. Time is also allowed for group discussion. Delegates will be entitled to free admission to the fair and the three days with full board will cost £75. It is possible to attend for one day only. Application forms are available from: The *Educational Computing* Conference Organiser, Dept of Electronics and Communications Engineering, Polytechnic of North London, Holloway Road, London N7 8DB.

The Fair is the only show in 1982 which has an educational theme. Attractions include the London trials for the National Micromouse Competition, a continuous showing of the BBC computer series, and a repeat of last year's successful bring and buy sale of computer-related articles. Anything to be sold can be accepted only on the Thursday and Friday, and the sale will be on Saturday 17 April.

Exhibitors include Data Applications who will be demonstrating the DAI Personal Computer, the North London Hobby Computer Club, with details of their extensive activities in the area of home and educational computing and Chromasonic Electronics who will have the VIC-20 on its stand. A wide selection of publishers, software houses and peripheral suppliers and manufacturers will also be in evidence.

Honeymoon over?

The honeymoon is ending for Digital Research as users get to grips with the new version of CP/M — the one that runs on modern 16-bit micros like the Intel 8086.

Ironically, the serious doubt comes as Digital Research reaches a publicity peak, with first official news leading out (in the computer trade paper, *Computing*) of CP/M for the extremely powerful Motorola microprocessor, the 68000, expected to be universally used in five years time.

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On the other hand, £10.00 could *guarantee* that you will receive twelve issues of Britain's largest selling microcomputing magazine. If you are already a subscriber then send your £10.00 anyway and we'll add another dozen issues to those you still have due on your current subscription. Because as from *April 30th 1982 the cost of a subscription to *PCW* is going to have to rise. (When we tell you that to send an individual copy of *PCW* through the post these days, including wrapping and handling, costs over 50p per copy, we think you'll appreciate why we just cannot hold the price down to £10.00 any longer.)

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To qualify for this voucher you must use the coupon below or the subscription card stuffed inside this issue. Send it today. It's true you can't eat it, watch it in the dark, drink it or smoke it, but we reckon if you're interested in microcomputing in any shape or form £10.00 for 12 issues of *PCW* delivered to your office or home is excellent value.

Lastly, 'thank you' to all our existing subscribers and regular readers. The most recent figures from the Audit Bureau of Circulations shows that *PCW* is currently outselling its nearest rival in the UK by more than 15,000 copies. That's an increase of approximately 10,000 copies on the same period last year. We must be doing something right. . . but feel free to let us know if you think otherwise!

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version of the operating system proved invaluable in getting programs from old 8-bit systems running CP/M, and transferring them to big new 16-bit ones.

But programming companies writing new code for the modern machines — new programs that take advantage of the enormous data storage and processing power of the chips — are finding CP/M-86 inadequate.

Peachtree, one of the most successful applications writers (the company claims to be the biggest micro application producer in the world) and with a prestige agreement with IBM to write Official IBM Software for the new IBM Personal Computer, is very dubious about its ability to transfer software, even to a machine like the Sirius.

The reason is that the programmers cannot resist the temptation actually to use the power of the machine.

Normally program writers use all the aids that the operating system can give them — to save them the hard work of writing code to fetch data from disks, to read keyboards, to display characters on the screen, or to move blocks around memory.

But the old-fashioned options of CP/M, as carried forward into CP/M-86, are just not powerful enough, according to senior programming staff inside Peachtree. And the result is that programs which 'run under CP/M-86' according to the brochure, actually run according to themselves, and merely load under CP/M protocols and commands.

Normally, a dealer who stocks two ordinary CP/M machines will speak confidently about the task of taking a program which runs on one and transferring it across to the other, using a utility program called PIP (or, if it looks difficult, a more powerful program called BSTAM).

But Peachtree programmers are very dubious about the size of the job facing them in taking programs from the IBM machine (under CP/M-86) and transferring them to the Sirius (called the Victor in America) even though that has the same processor, obeying the same machine instructions and ostensibly using the same operating system.

They say that there is just too much code written in the base-level language of the machine, which would require programming effort at the level of translate into the alternative version. The version of CP/M for the big Motorola 68000 will have problems that would normally be expected to be unmanageably more difficult — but will merely be the same problem in a different language. The actual instructions will be different but, more to the point, the machine in which the instructions are carried out will be different but, more to the point, the machine on which the instructions are carried out will be different in its layout, its method of handling messages and of storing data.

What is needed is a new operating system, designed for the big-memory and complex-data abilities of the 16-bit microprocessors, which can run CP/M-86 as one of its sub-tasks the way CP/M runs applications.

And, until someone starts developing the tools that systems designers need for a mammoth task like this, we will have to rely on the normal, slow evolution of complex programs — giving us something useful in five to 10 years from now.

Alternatively, we can wait for results from the colossal sums being poured into Japanese research into the problem of providing these tools.

Tasty new HP

A new desktop computer has been announced to sit at the top of Hewlett-Packard's 80 series (which began with the HP-85). Called the HP-87, the machine has a considerably more luxurious spec than the other models and comes well supported with scientific, engineering and management software. (Like the 85, the 87 comes with an integral VDU but of larger size and of an unusual landscape format which can handle 80 character displays. The standard memory is 32k RAM, 16k video RAM and a huge 48k extended Basic in ROM. With its normal coyness over hardware HP does not say what processor is used, but memory can be expanded to 544k by add-on modules. Another add-on module contains a separate Z80 to allow CP/M to be run; Wordstar and DBase II are offered along with graphics, maths, circuit analysis and statistics package for starters. A new uprated Visicalc which can exploit the full memory expansion has also been produced.

The extended Basic is upwardly compatible with the 85 version so that 85 programs can be run, and the enhancements include label addressing and indented program listings. An assembler in ROM will soon be available, too.

Disk storage is on standard HP 5in systems or their new winchester drive which holds 5Mb and has a built in 5in floppy for backup. Communications are catered for by HP-IB, RS232 and the new HP-IL loop.

At £1650 for the basic computer, the HP-87 sounds uncharacteristically affordable, but the prices of add-on memory and peripherals dispel any vulgar notion that HP is going down-market; the CP/M system costs a bracing £927.

Announced at the same time is a new desk-top plotter, the 7470, which sells at £938 and can plot in two colours automatically, or more with manual pen changing.

Multi-system

Altos reckons to have gone about as far as is practicable in making it safe for more than one user to work with an 8-bit micro. The 'small box' has been announced in this country now by Logitek, at a price of £5200; this includes a big-storage hard disk and the ability to run three users on three jobs together. This machine's most unusual feature is the addition of a memory-checking 'parity' code to every character of storage which hopefully reduces the sort of accidental corruption that can occasionally ruin multi-user systems in full flight.

Details from Logitek on Chorley (025 72) 67615.

BCPL and Beta Basic

Recently I poured scorn on something called Better Beta Basic because you needed a language called BCPL to run it and because I knew of no micros with that (excellent) language.

But apparently I was wrong: John Richards of Richards Computer Products chides me gently for not knowing about his BCPL compiler under CP/M.

In the nicest possible way, Richards has observed that my ignorance is 'very reasonable, because until recently, the several implementations of BCPL language on micros have been by enthusiasts for their own use'. However, he goes on: 'A Z80 BCPL system by Fretwell-Downing Ltd, of 1 Onslow Road, Sheffield (0742)-682301, has been on sale for over a year.'

That acknowledgement over, RCP (Richards Computer Products) now has a new CP/M implementation which is aimed for wider distribution and to become a major option for micro-computer programmers'.

He modestly describes his compiler as 'incorporating many a programmer's dream, including very compact code, multi-tasking under CP/M (something I just have to see), overlays and symbolic debugging.

'The system is being sold by distributors including Metrotech and the Micro Solution, and a copy of the system is running on a Dynabyte in the NCC micro-systems Centre at 11 New Fetter Lane.'

Recommended price for the full development system is a very reasonable £250 but if you wish to sell programs your customers can buy the necessary interpreter to run your software for a £20 licence fee.

BBC prices up

Dealers got very excited when prices of the BBC micro went up in February because they thought the £60 increase was possible going to be paid to them, as their percentage in selling it.

Acorn has told me firmly that the reason for the price rises was, very simply, to stop Acorn going out of business.

The reason the machines cost more to produce lies mainly in the need for testing the Model A very thoroughly, so that if and when the user upgrades it to Model B status, it's still worth keeping.

See 'Tasty new HP'.

In other words, testing the As to the full B spec then unplugging the B bits.

New prices of £300 and £400 will have meant a lot of broad grins at the home of the VIC in Slough, and probably a delay in Ingersoll's plans to bring the Atari prices down to a more reasonable level (for example, something comparable with the US price would be reasonable).

Who knows, Texas Instruments might even start to sell one or two models of the 99/4A.

But dealers will not be selling the BBC Computer, unfortunately. I'm sorry, even though it means keeping the price down, because it would have made them better equipped to maintain the beast and would have helped convince potential exporters. . . . but I don't think it's critical.

Meanwhile, our Editor's 'as sick as a parrot' because the BBC prices went up before he'd put in his order. What, you thought we got micros for *free*? — no way!

Disk aids

Aids for the CP/M programmer: two $30 utilities which allow the machine code writer to examine and alter data on any disk are available from Electrokonsult in Norway.

DDUMP can modify any byte or bytes on any sector of any CP/M disk. The data on the disk is shown in either hex or ASCII code and can be altered in the same way, depending on whether it is machine code or text.

DTEST is a fast test utility which writes a test pattern on every sector of an initialised disk. When it finds an error, it can list it on the system console or on the printer.

One of the most important needs is a software tool which can edit the disk surface itself. Most programmers write their own (hasty) routines, which they alone can use.

Robust programs which could be passed on to junior programmers are rare — DDUMP and DTEST do fall into this category.

These programs are not yet distributed in the UK and Bolstad would like them to be. At the price, strongly recommended by programmer Henry E Fale (a Heathkit notable), they look impressive.

Supplier: Terje Bolstad, Electrokonsult, Konnerudgt 3 3000 Drammen, PO Box 846, N-3001 Drammen, Norway.

Disk convert

The problems of reading from one floppy disk using two different computers are almost exactly the same as trying to watch a 625-line TV programme on a 405-line set. Not only can't the machine see the data, but it isn't tuned to the right programme, anyway. Even using the most standard 'format for information' on eight-inch soft-sectored disks, the different machines which use the basic format will find it impossible to understand what they find there.

Hence MicroSec's announcement of a product called FileStar, which can take disks to IBM 3740 format or Motorola's and Intel's development system (MDOS or ISIS) or mini-computer DEC's RT/11, and make sense of them on any Z80-based CP/M system, or produce output which those systems will understand.

Details from MicroSec at 49b Market Parade, Havant, Hants PO9 1PY.

Beeb club

Delighted recipients of the BBC's wonderful micro are having a little trouble with the user manual.

John Coll at Acorn, the man who produced it, has assured me that in the near future a second edition would appear, with a bit more information in it. 'We really don't plan to have quite so many entries listed as appearing on page 00,' he said.

All very well, since obviously the information filed on that page isn't available yet. What must really be puzzling users is the number of items listed as appearing on page 000. How can Acorn tell which is which?

Our own Sheridan Williams has at least part of the answer: the *Beebug Mag* ('The magazine of the Independent User Group for the BBC Micro') has been launched from 35 St Julians Road, St Albans, Herts, which just happens to be where I send letters for Sheridan.

I can't honestly say that the magazine is any good. That is, it may be very good but Sheridan, following on the best traditions of the BBC Computer didn't have one ready to send me when he announced it.

However the contents list looks impressive: it starts with 'background to the price increases and supply problems' and goes on to cover the confusing graphics options, to review software to provide an Othello program and to launch a software competition.

One thing I can tell new users of the BBC micro, however, is that the way to list a Basic program one screen at a time is exactly the opposite of the way described in the manual. That is, if you want to LIST just one page at a time, press CTRL- before typing LIST. When you want to list the whole lot, press CTRL-0 first.

One other thing: on the smaller model A, at least, don't try loading a program in any mode other than teletext (Mode 7) because if it is longer than about 20 blocks of code on the tape, it will start appearing on the screen. And it won't run.

And finally, there are, as everybody knows, 10 programmable keys on the keyboard, which you can set up to print messages or commands (for instance, if putting together a program with lots of CHR$ functions in it, you can set up a key to type that string of five keys for you). Actually, there are at least 11. The eleventh key (*KEY 10) is the BREAK key — in other words, you can change the way the machine resets. So if you program *KEY 10 to switch to MODE 4 (CR) the user will never be able to load a long program from tape and may never find out why. . .

Membership of this group costs £4.50 for six months, or £8.50 for a year once you are convinced it is a good idea.

New ITT

ITT's replacement for the Silver Apple, which it used to make under licence in the UK, is a CP/M system which it hopes to turn into a copy of the IBM Personal Computer.

Compared with the IBM package which Mick Punter of Microcomputerland is putting together, the ITT package includes a bit more software but costs noticeably more, even though Punter's system includes a voltage conversion kit.

The appeal of the ITT machine, says the company, is its reliability. Also, by the end of the year, it hopes to replace the Zilog Z80 chip with an 8086 (big 16-bit processor, takes the same code as the IBM's 8088).

Reliability up to the standard of Japanese-built micros like Sord and Sharp would give ITT a good chance in an important sector of the market. But the reliability (if it turns out to be what ITT hopes it will) comes at a price.

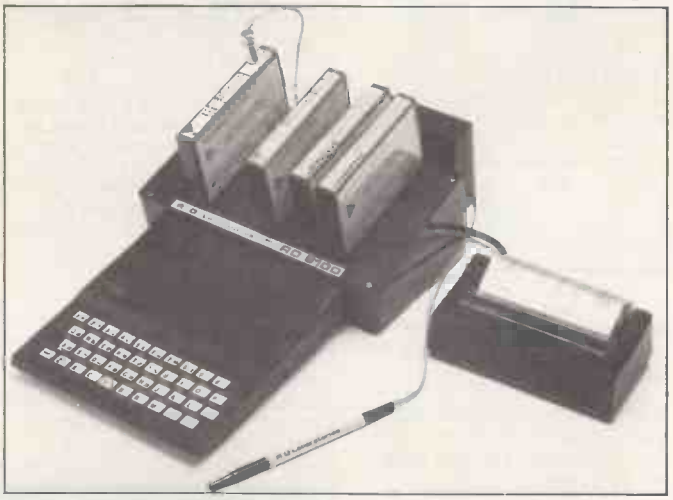
Supplier: ITT Consumer Products (UK) Ltd, Chester Hall Lane, Basildon, Essex; tel Basildon (0268) 3040.

Visi-everything

Visicalc is such a famous program that it was quickly followed by new programs with similar names. So where Visicalc did visible calculations, Visiplot did visible plots, Visitrend. . . and so on.

The company which sold all these things to us has decided to follow suit, and rename itself Visicorp. Personal Software, the most famous software company in the world, has changed its name, and will now sell thousands more programs as a result (?). Well, at least they'll be more easily recognisable as the company which gave us Visicalc (even if they didn't write it).

It seems to be all the rage.



Never forget that the Sinclair ZX81 is not a toy but the basis of a 'mouse which came very high up the Euromicro mouse contest'. The ZX81 is a powerful micro and there isn't anything strange about seeing it appear as the basis of this 'Catalyst' real-time computing system.

Catalyst, from RD Laboratories, starts at £40 for the system module and 'micro mum' motherboard. There are then five modules which you can plug into the thing — a logic output module, an analogue input, a multiplexer/amplifier and a light-pen as well as an analogue output port — all at £35 or less.

RD Labs expect to sell these things, not only to the hobby user who wants to drive toy cars (or mice), but also to professional industrial and academic laboratory applications. 'It allows automatic test measurement and control, where alternative equipment is still prohibitively expensive,' says the company. So it does, and even school labs could afford it. Details on Nutley (0825 71) 2568.

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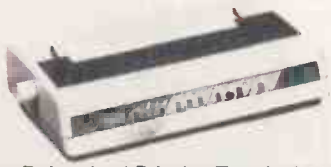

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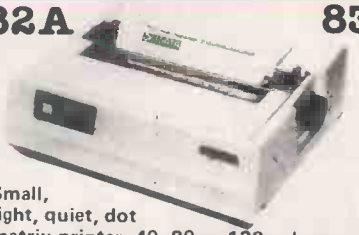

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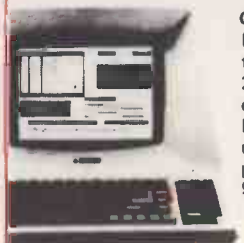

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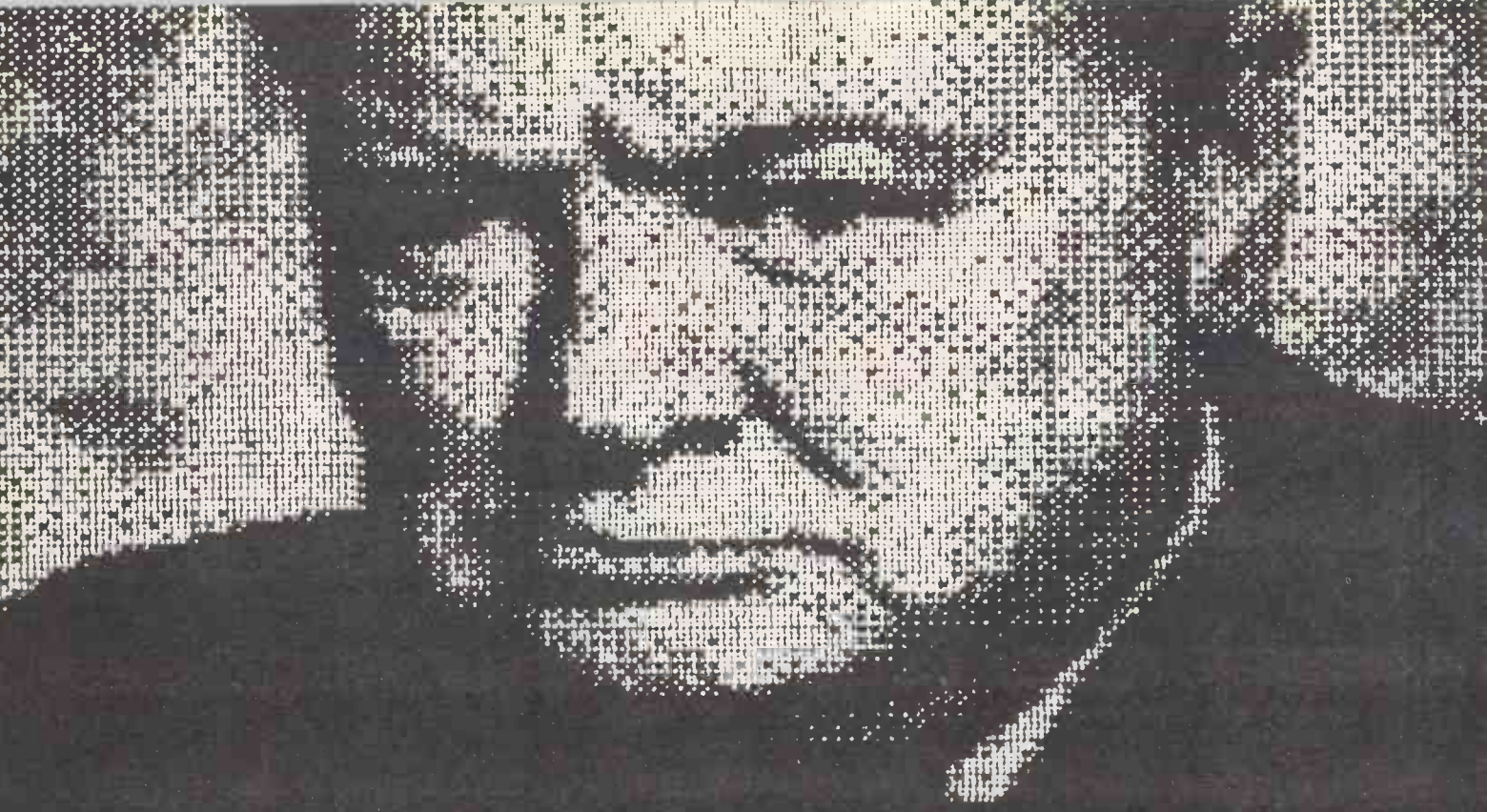

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Out in Canoga Park, they're doing it the other way round — renaming all the software to have the same name as the company. So the Micro Applications Group (MAG) has renamed its products, with PRISM becoming MAG/Base. Then less intelligibly, MAGSAM has been changed to MAG/sam, and MAGSORT has become MAG/sort.

Somebody ought to do a business studies thesis on all this.

Details from the US headquarters at 2859 Zanker Road, San Jose, California 95134 (in the case of Visicrap — please watch spelling, printers), and from 20201 Sherman Way, Suite 205, Canoga Park CA 91306.

Atom disks

Disk storage for Acorn Atom users means buying a device worth nearly twice the price of their computer, because the 92 kbyte Atom disk costs £345 including VAT.

There is a gentle irony about this product, in that disks for the newer Atom machine, the BBC2 Computer, aren't expected for a couple of months.

The commands used in the disk operating system are all preceded by asterisks, in the same way that Acorn's network, Econet, organises its commands. Also, all the Atom cassette commands have been adopted, allowing the programmer to get strings, files, characters or whatever direct from the disk.

My favourite feature, however, is the one introduced by the Acorn publicity machine, which has added a new hydrocarbon lubricant (I assume that's what it is) to 'allow phenomenol (sic) high speed'.

Details from dealers.

Linking up with Z-Net

Research Machines has carved a nice niche for itself in the educational microcomputer market with its RML 380Z, one of the first British micros to go into production. Now it has launched a networking system, again aimed at the educational market and called the 480Z Link.

More than anywhere else, networking makes sense in schools, where money to buy expensive peripherals such as disks and printers is tight and where, ideally, each student should have his/her own screen and keyboard and be able to work independently of others in the class. RML had been working on its own networking system and had gone quite a long way towards completing it when Zilog announced that its networking technology, Z-Net, would be available under licence to other manufacturers. And it turned out that RML's system was pretty close to Z-Net anyway, so RML went the Z-Net way.

The 480Z system is based around a workstation which incorporates a Z80A and 32k of RAM (expandable to 64k), running CP/NET. The basic workstation has low resolution graphics and can be upgraded to high resolution and colour graphics. Additionally, a further 128k of RAM can be added to a 64k system for use as a back-up store. The 480Z can also be used with a cassette machine as a stand-alone system.

RML says its system breaks even on cost (compared to buying separate systems) 'at the two to three station stage' and gives larger savings on bigger systems. The first release will cater for just eight stations but future versions will allow expansion to larger systems.

All very well, you might say. But there are deeper implications here, for there's quite a lot of software available now to run under CP/M (and also CP/NET). That software includes a lot of business applications stuff, so if you wanted a network system in your business the RML system could prove a very attractive, cost-effective way of going about it. Currently the only other Z-Net system available is Zilog's own, based on its rather expensive MCZ range of micros and, although no prices have been announced for the RML system, it's got to be considerably cheaper. More from RML on (0865) 49791.

Still on Z-Net, another British company has used it for a novel micro-based application. ARC (Automatic Revenue Controls Ltd) has developed a neat system for hotels, based on a micro in each room and a special key and lock combination, all linked to a central computer via Z-Net.

The system works like this: when a guest books into an hotel is issued with a room key. The key is a special plastic one with a number encoded as notches along the edges. Each key has a unique number and there are several million combinations. The desk clerk inserts the key into his own terminal and allocates that key to the guest's room number. That key will then only open the door of the room to which it has been allocated.

The beauty of the system is not only in its security but in its flexibility; a key can be programmed as a master key to open all doors and, if it's lost, another key is programmed as the master instead. Or a 'semi-master' key can be programmed, to open only the doors in part of the hotel. Trying to open a door for which the key has not been programmed causes the system to alert the desk clerk by printing out a report of what's happened.

The system incorporates plenty of other sophistications as well. Each door lock is linked to the room's own micro, which switches off the lights, etc, when you leave the room and lock the door. And each room's system is in turn linked by Z-Net to the central system, so that the status of all rooms can be instantly checked — to avoid booking two people into the same room, for example.

The system, called Guestkey, is on trial at London's Grosvenor House Hotel, where, apparently, the guests like it. More from ARC on Watford 44300.

Peter Rodwell

No chip butties

If the whole world is eventually to be controlled by microprocessors then it follows that sooner or later the technology will be applied to the making of sandwiches. Sooner rather than later because four American gentlemen have announced Compuserv 2000 — 'the world's first computerized submarine-type sandwich preparation system'. For the benefit of those unfamiliar with US gastronomics, a 'submarine-type' sandwich is an enormously long roll filled with a variety of foodstuffs (my favourite being hot meatballs) and it is not meant to be eaten underwater; it is also known as a 'hero' 'torpedo' or 'hoagie'.

The idea of Compuserv 2000 (imaginative name that) is to make 'subs' as fast as McDonalds make hamburgers, and all untouched by human hand. A boring old human takes nearly two minutes to make a sandwich that Compuserv will do in seven seconds, and this from a choice of 25 fillings.

It seems unlikely that we shall see this device in London's sandwich bars in the near future since the physics of handling Mother's Pride, margarine and brown sauce, to say nothing of meats in micron thicknesses, is not yet well developed.

Tangerine dream machine

Tangerine Computers is something of a low-profile company. For a while now it has been producing a rather smart, all-British, 6502-based system with considerable versatility and expandability and seems to have built up quite a cult following. And, of course, the company makes a £170 Prestel adaptor which saves you paying out a grand for a special Prestel TV set.

Now Tangerine has announced a new system, one which puts it more into 'mainstream' microcomputing. Yes, it's a twin disk, 64k, CP/M machine — exactly the spec which would normally have us all groaning with boredom here in our ivory tower because everybody's making them now.

Actually, though, the Tangerine Tigress is more interesting than the others. In fact the preliminary spec is quite spectacular. It has three processors, for a start: a Z80A to do the hard work, a 6809 to handle I/O, and a dedicated graphics processor.

The Tigress (which hopefully will come in a suitably striped case) has some other interesting features. For a start, there are the following I/O ports: IEEE-488, RS232, Centronics parallel, 1200 baud cassette, light pen and two video outlets (UHF and RGB). And there's more: a modem to Viewdata (ie, Prestel) standard is built in, complete with auto-dialler and auto-answer and there's a network interface, described in the preliminary documentation as 'a synchronous serial network'. It doesn't say whether this is to some existing standard or whether Tangerine has invented its

See 'Linking up with Z-Net'

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own network standard. If the latter is the case then it's a pity, for what we don't need right now is another low-cost micro network system; a better choice would have been to go for one of the existing low-cost systems, such as Zilog's Z-Net (as has RML — see story elsewhere) or the Acorn Econet.

Additionally, the Z80 and 6809 system buses are available for expansion, the latter being compatible with Tangerine's Microtan peripheral boards.

But it's on the video side that things get really interesting. The dedicated processor has 96k of display memory and is fully programmable for display formats and TV standards. Colour displays can achieve resolutions of 512x512 or 320x900 or any other desired format and there's a whole range of fancy functions, such as pan and zoom, vector and arc drawing, animation using memory planes, polygon infilling and fully programmable character sets — you can have up to 132 characters per line.

A non-disk version, which can also handle up to 16k of ROM is due for release later, at a cost of £600-£800; the disk version will cost 'proportionally more'.

More from Tangerine on (0353) 61161.

Peter Rodwell

MP/M II recall

Digital Research's claims that MP/M II is taking off commercially in a big way are being clouded by unconfirmed reports from UK dealers that the first version of MP/M II has been recalled for alterations.

The main problem with the first version of the second version of MP/M seems to be an unusual one. Digital Research took unusual care to ensure that users who wrote programs for the new system were not trapped in a corner, unable to sell their software to users with simpler CP/M or MP/M operating software. This was unusually thoughtful of them: normally when people announce improvements, they are for new customers only and the old ones have to find their own way into the future.

Unfortunately, one of the key improvements of MP/M II was the inclusion of user protection: if you are sharing a computer with other people, you don't want to have them all happily looking through your private documents just because the files they are kept in are computer files.

The system used was a password technique — without the password the operating software would not let the user peek. This was very nice until it was found that the system would (inevitably) run ordinary CP/M as well as the nice new MP/M. And CP/M or the old MP/M had no knowledge of passwords, so would allow any user to access any file. By invoking the old system, the whole security system could thus be circumvented.

I have this information from a programmer, so it may only be part of the whole story. This is not intended as an overall review of MP/M-11 (he added hastily).

DB on VIC

The VIC home computer from Commodore and the idea of serious business use don't obviously go together, but a database program is not for little boys and Stage One has announced such a program for the VIC 20. It is, unlikely it may seem, a database manager, expected to cost £50.

The program will run on an expanded VIC, that is, with the additional 16k byte additional memory pack, an expansion interface, and a disk and printer, so it isn't really the toy aspect of the VIC that matters.

Stage One claims this as 'the first serious business type program on the VIC'. Details on Poole (0202) 735656.

Microwriter link

Assuming you know how to use the one-handed, six-keyed Microwriter (I'm told it is much easer to learn than you might expect), it's worth your while getting a Triumph Adler Alphatronic micro, because the Microwriter can plug into that computer. Details from Triumph Adler on 01-250 1717.

Apple III on net

The big network secret for Apple's new micro, the Apple III, has at last been released by Zynar which has (as widely predicted before Christmas) launched its Cluster/One system for this machine.

Until February, the system was based solely on the original Apple II, connected to the network by a standard multiple-wire interface.

The power of the network is measured in the amount of storage it gets, not the software. Typical Zynar-installed networks, according to boss Colin Crook in Uxbridge, have hundreds of megabytes of disk storage shared between 10 or more Apple users, and they use the system almost exclusively instead of memos, internal phone calls and desk filing systems.

It is easier, once you know how to type, to simply enter a message at the Apple, knowing that it is ready to be

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examined instantly by the recipient, than to play with notes to secretaries asking Fred to ring back (and so on).

The fact that Cluster/One was limited to the Apple II was a serious shortcoming, Crook has said. In his recently launched search for a dealer network, he has been handicapped a little by his refusal to pretend that the system has no flaws and by his continued admission that 'any networking system which is based on one terminal design is doomed to failure'.

Of course it is clear that this honesty required less courage than seemed to be the case when Crook first said this because he did know about plans to expand the net system.

Ironically, when Nestar in California first announced the product, it was designed around PET, Apple and Tandy machines, and was actually shown live at a conference in San Francisco three years ago in this form.

However it quickly became apparent that, while simple text messages could be conveniently passed from one type of micro to another, most users inevitably strayed into the area of using special characters. PET graphics characters, for instance, simply could not be transmitted to Tandy machines, while Radio Shack codes tended to do awful things like clearing the PET screen, and Apple high resolution graphics functions could actually crash the network software.

Now, however, file transfer protocols are being developed which allow the system to interpret what it finds, rather than blindly transmitting codes down the wire. Eventually, more than just 6502-based Apple hardware can be expected on Cluster/One.

Eventually, also, the question of whether this system will be used rather than broadcast systems such as Z-Net, Ethernet, Net One and Casenet, or ring systems such as Econet, Cambridge Ring, and so on, will depend on popularity and cost. So far, with over 200 systems installed worldwide, Zynar is *not* as it claims, the most popular local net. Acorn's far simpler Econet with 300 UK installations is obviously far ahead. Its main drawback is simple: Acorn has yet to get round to putting a disk bigger than one megabyte capacity on Econet and in an office one megabyte would be used up by one user in one morning.

Now the Cluster system can include the much more powerful (though still struggling for market acceptance) Apple III, it will appear both more credible, and more profitable to dealers.

Zynar is at 122/3 High Street, Uxbridge, Middx UB8 1JT; phone (0985) 59831.

Prosper with Pascal

Professional programmers look likely to give a warm reception to the new Prospero Pascal compiler because it allows them to sell reasonably priced packages to users.

The growth of Pascal as a micro language has been phenomenal, with some Apple dealers reporting that the Pascal language card is outselling their previous staple product, Visicalc.

Programmer Jeff Strauss, who specialises in business software for CP/M machines, reports that this product, 'a proper compiler, not a half-baked interpretive thing', has enabled him to do fast development on big file management programs and still have room in the computer's memory for more code.

The funny crab is in fact a ribbon, used to make black marks on paper, and fitting inside a NEC (or is it 'an NEC?') Spinwriter printer. Or does it fit inside an Epson? Either way, it is cheap, with the NEC ribbon costing £3.70 and the Epson one costing £3.50, from AWS Computer Supplies of 81 Portsmouth Road, Guildford Surrey, phone (0483) 504234.

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Untidy and cluttered — the standard Apple II can certainly be that, with screen, processor, disks, numeric keypad and any other bits and pieces. So the idea of putting all the components into one box is one which was bound to occur to somebody sooner or later.

To Country Computers, it is 'What the Apple III should have been', and with a 6 megabyte hard disk drive, all their boxed Apple lacks is extra internal memory.

Country Computers sell this marvel of integration under the name Super AII, for £3995, with the added bonus of a detachable keyboard connected by a smart coiled cable. Details from the Evesham office of (0386) 45997 and ask for Paul Dearlove or Roger Sinden.

Typically of professional programmers, Strauss wants to write more powerful (and compact) code than is possible under Basic but isn't prepared to go to the sort of detailed sweat that would be involved in writing assembler language on an Intel 8080 micro. On the Apple, writing a program in Pascal limits the program's market to those people who have the Pascal card which interprets the Pascal code.

On many CP/M machines, the Pascal interpreter, when available, takes up a good deal of the 64 kbytes of memory which is the most the typical 8-bit micro can use. By writing Prospero standard Pascal, Strauss maintains, he can compile his code and then load it into the machine as a run-time, machine language package, which needs no back-up code. But the compiler would not be of much interest to the amateur programmer, who is trained (through using Microsoft Basic) to expect considerable live checking and editing of the program as it is developed.

Contact Prospero on 01-785 6848.

Onyx saga latest

The absurd farce when there were five 'exclusive' distributors of Onyx 16-bit micros in Britain has been reduced to a more manageable problem by the decision of Paul Joyce's company, Terodec, to sell off its Onyx associate to Scan Data.

So far the mess has cost two people inside Onyx US their jobs, with president Doug Broyles the latest to go. He has left for the closely connected company Corvus, which makes disk drives — around one of which the Onyx machine is built.

Paul Joyce said: 'Naturally we've lost money on the deal and it has left a nasty taste in the mouth, but we weren't going to get anywhere distributing machines when the customers could virtually auction the price around us.'

Joyce also observed that any attempt to get round the table and agree prices would have been fruitless, even if it had been legal (price fixing is not legal) 'because only one person dropping out of the agreement would have ruined it and someone would have done'.

Rumours following Joyce's move suggested that another distributor, Tim Keen, might also be dropping the range. Keen strenuously denies this: 'We're going to do £4.5 million worth of business with Onyx this year,' he said.

The only really unhappy people at the end of the day turned out to be Memec/Thame, who weren't in on the deal and got left out of all the publicity. A plaintive press release, mentioning the company's amazing commitment to a skill in selling the Onyx, arrived on editorial desks — with the pathetic rider that, if anybody was going to write about the Onyx, couldn't

It may look like an awful tangle, but if you had ever tried to develop a new operating system for a new micro, this in-circuit emulator for the Zilog Z8000 family of big 16-bit micros would look like the smoothest path to the future you had ever dreamed of.

This product is one of those little 'signposts' which tell you that a processor is a real, live product. Most chip manufacturers have some difficulty getting their processors to do the things that the manual says they will and most systems builders go cross-eyed trying to find out what is actually happening to their brand-new software (which is trying to output to a port and has managed to do no more than corrupt the disk controller).

The emulator allows the programmer to see what is actually going on while it is going on, and its production by the chip manufacturer is a dead giveaway — that they actually know what's going on themselves, at last.

This particular mode, the EMS 8000, has a lot of special features, most of which are not of interest to end users but which any serious system builder would probably need to know about. Details, then, from Zilog on its new number in Maidenhead (0628) 39200.

they please contact Thame as well as all the others (and please, don't print this press request with the release)? *(You cad, Guy — Ed)*

The deep shadows around the Onyx and its Onix operating system are not as black as they look. The main worry for those who ride the Onyx bandwagon is the chip inside it, the Zilog Z8000. This is suffering at the moment from eclipse, with Motorola's 68000 getting all the announcements (from Tandy and so on) and Intel's 8086, with its little brother the 8088, getting all the sales (from IBM, Altos, and so on). This probably won't matter as much as the operating system, Onix — ironically, the main attraction, and also the main handicap for the system.

The attraction of the Onix operating system is that Unix is something of a cult, especially among academics who compare it favourably with standard operating systems for 16-bit systems (the Onyx is a 16-bit system).

But Unix is getting out of date, even though it is still better than CP/M in many ways. And it is sold officially by Bell Labs, part of American Telephone and Telegraph but recently freed of its fears of prosecution under US Antitrust laws and in a mean marketing mood.

If Unix gets modernised as some say it is now being done, and if it gets cheap, as Bell has done its best to make it, Onix will be left looking rather like a fake Old Master without even a bargain price tag to recommend it.

Now, the microfloppy

The smallest floppy disk is not the 5¼in minifloppy design, but a portable three-inch 'compact floppy disk' announced by three Japanese companies.

The announcement was made in the UK by Matsushita, which uses the National, Panasonic, Technics and Quasar labels here. The three companies are Matsushita, Hitachi and Hitachi Maxell, Ironically, there are no plans to launch the product in the UK.

Important technical features: the disk is protected in a rigid case (as with the compact cassette). It has a toughened centre and a dust-excluding shutter. It is compatible with existing minifloppies in rotation speed and data transfer rate, so should operate with existing 5¼in disk controllers.

The main motivation for this Japanese launch is to get something with most of the characteristics of a 5¼in floppy, so that programs and data which have been written round it will fit on and run but without its known drawbacks.

Mainly, the drawback of the minifloppy is that no two users have the same design. It is bad enough on big eight-inch floppies, where no-one can be sure to load a disk produced from one machine onto another — but in the minifloppy market there is no compatibility whatsoever.

The drawback of the new design lies in its physical advantage — the rigid frame, instead of the old cardboard envelope. This is thick. The Japanese claim it is an advantage to be able to write a compact disk's title on the spine but it is obvious that ten of them will take up a lot of space and a hundred will take up a shelf.

Details from the UK publicity agents, National Panasonic in Slough, tel: 34522. Or contact Matsushita at Kadoma, Osaka 571, Japan; tel Osaka (06) 908 1121.

WP intro

Manager of the Computer Bookshop Margaret Maclean isn't one to tout her wares unnecessarily, so her prediction that the *Introduction to Word Processing* book which Sybex has just published 'will be our biggest seller' is unusual enough to pass on.

The book isn't startling for anybody who has come to terms with the idea that you can process words. But remembering that the average layman is only just getting used to the idea that processing is something you normally do with data, not peas, the idea of a book that isn't startling is probably a good one.

The Bookshop is at 30 Lincoln Road, Olton, Birmingham B27 6PA; phone 021-707 7544.

New printer

A printer with only one moving part — the paper — has been launched by the Swedish subsidiary of Dutch electronics giant Philips.

It is designed mainly to take copies of a screenful of data, printing at the high speed of 240 lines per minute. It uses thermal paper which goes black (or blue).

There isn't another printer like this and even at £675 for one (bulk discounts available) it looks interesting.

Details from Penzance; (0736) 66577.

Tree structure

Noting that there are a lot of expensive micros around, all sitting on grotty tables with tangled wires hanging out, joiner and cabinet maker Michael Reed is starting out with a simple data processing console in dark pine for the Apple II.

Reed does 'reasonable volumes' of mass-produced furniture and got into technology, he says, by mistake.

'I was asked to make a wood base for a theatre lighting set-up. I said I didn't make single bases, but I would make three. They said they only sold three in two years but eventually they gave in. And since then, they've come back for 30,' Reed relates.

His woodwork is something special, because he has a supply of ancient American pitch pine — hard, fire resistant and (naturally) seasoned the way wood cannot be seasoned nowadays.

Reed is open to suggestions for special features — disk storage, electricity points, ventilation ducts, paper storage, printer enclosures and so on — and hopes people will get in touch with ideas.

Last seen, he was wandering round the National Computing Centre's micro centre in London with a tape measure.

Michael Reed is at Arch 18, Kingsdown Close, Walmer Road, London W10; phone 01-229 5391.

Admin pack

Double recommendation for Stage One Computers and its Administrator program — a database manger — first by getting an American agent and second by recording over £20,000 worth of sales from health authorities.

The American distributor appointed is Professional Software, distributor, well-known word processing program Wordpro. And Professional Software reckons to be able to sell 6000 packages per year in America.

Stage One also reports that the program has scored particularly well in areas such as social services, outpatient and serious disease registers, where large volumes of historical data need to be stored per person, or on the register.

Long chain

Chips must have been around longer than we all suspect if BA Electronics has really tested its claim that its new memory chip 'can retain data with no power for 100 years,' so I suspect the claim is merely one passed on from the manufacturer, SGS Ates in Italy.

The chip is tiny by today's standards: instead of having the 65,536 code bits that you get on many computer chips, this one has just 1024. And it isn't quite as quick at giving up its data as normal memory, nor at receiving new input — but for the privilege of remembering for 100 years (or thereabouts) I suppose that is a forgiveable drawback. Details from BA on Yate (0454) 315824.

Dick Pountain kicks off a new PCW regular feature by sharing his adventures beyond the Basic World.

THE ROAD TO DAMASCUS.

This column is to be a new feature of *PCW*, and what it's really about, stripped of all pretensions, is giving Editor Rodwell and myself a space to sound off about things which have interested /amused/bored us in recent weeks but which don't fit anywhere else in the magazine.

To get us under way I've elected to relate my recent explorations in the realm of computer languages in the hope that readers planning to escape from Basic may find some help or encouragement herein.

Let me begin by saying that I'm not a Basic-hater; it was the first language I learned and it has served well as my way into microcomputing. Nor am I conceited enough to imagine that I have exhausted its possibilities in a few years and some relatively trivial programs. My Road to Damascus, however, was a Poker program which I began writing (using David Levy's algorithms) late last year. The program as it stands now is in Sharp Disk Basic running on the excellent MZ-80B, and is about 6k long. It plays a sufficiently entertaining game to give my friends severe doses of 'computer-eye', but it can only play one hand, which is not satisfactory to a Poker buff such as myself. Having done the donkey work and written some fairly complex code (yes, and documented it, too!), I figured that I could return in a few weeks and perform the simple task of modifying it to play a number of hands (ie, simulate a number of players). Horror of horrors, everything Uncle Borge warned me against came true!

Firstly, I discovered that most of each session was taken up in trying to understand how the damn thing worked; the enormous numbers of conditional branches involved are all but incomprehensible, REMs or no REMs. Secondly the inability of Basic to pass parameters rendered the amount of recoding for what I had assumed to be a simple task entirely spirit-sapping. The irony of having published all those articles on structured programming did not escape me.

That, then, is the trauma which led me to spend most of my spare time over the last three months learning Pascal, Lisp and Forth (I'm a firm believer in the belt-and-braces theory) to the detriment of my social life; the reward has been a degree of intellectual stimulation that I'd forgotten existed since I left university.

Pascal was my first attempt, in the shape of Sharp's own SB-4515 cassette-based, interpreted implementation of the language, which is also available for the MZ-80K. Compared to UCSD and other 'big' Pascals, this has several major omissions — namely, the absence of structured data types, of nested procedure and function declarations (though calls may be nested) and the ability to pass parameters by reference (only passing by value). Nevertheless, the interpreted nature of Sharp Pascal makes it very suitable for learning purposes for one coming from Basic, though I suspect that hacking it from the keyboard is somewhat in conflict with the spirit of the langugage. Having a full screen-oriented editor and being able to test your efforts immediately takes a lot of the sting out of learning to declare your variables and procedures and to terminate statements correctly,

'I discovered that most of each session was taken up in trying to understand how the damn thing worked.'

which I found to be the biggest initial obstacles. The interpreter checks syntax at run-time and gives clear and helpful error messages, so that by a process of try-and-debug the new syntax slowly sinks in. The interpreter also does some helpful things like automatically putting reserved words into lower-case and remembering the indent spacing for nested loops, thus encouraging one to adopt these good habits and produce aesthetically pleasing and readable listings. Within a week or so I became sufficiently adept to produce a recursive Turtle graphics program which worked and imperceptibly my conversion was completed: I suddenly realised that procedures, WHILE...DO and REPEAT...UNTIL had forever replaced GOSUB and GOTO in my affections. I now look forward to getting my hands on a grown-up Pascal and perhaps I might even translate that Poker program . . .

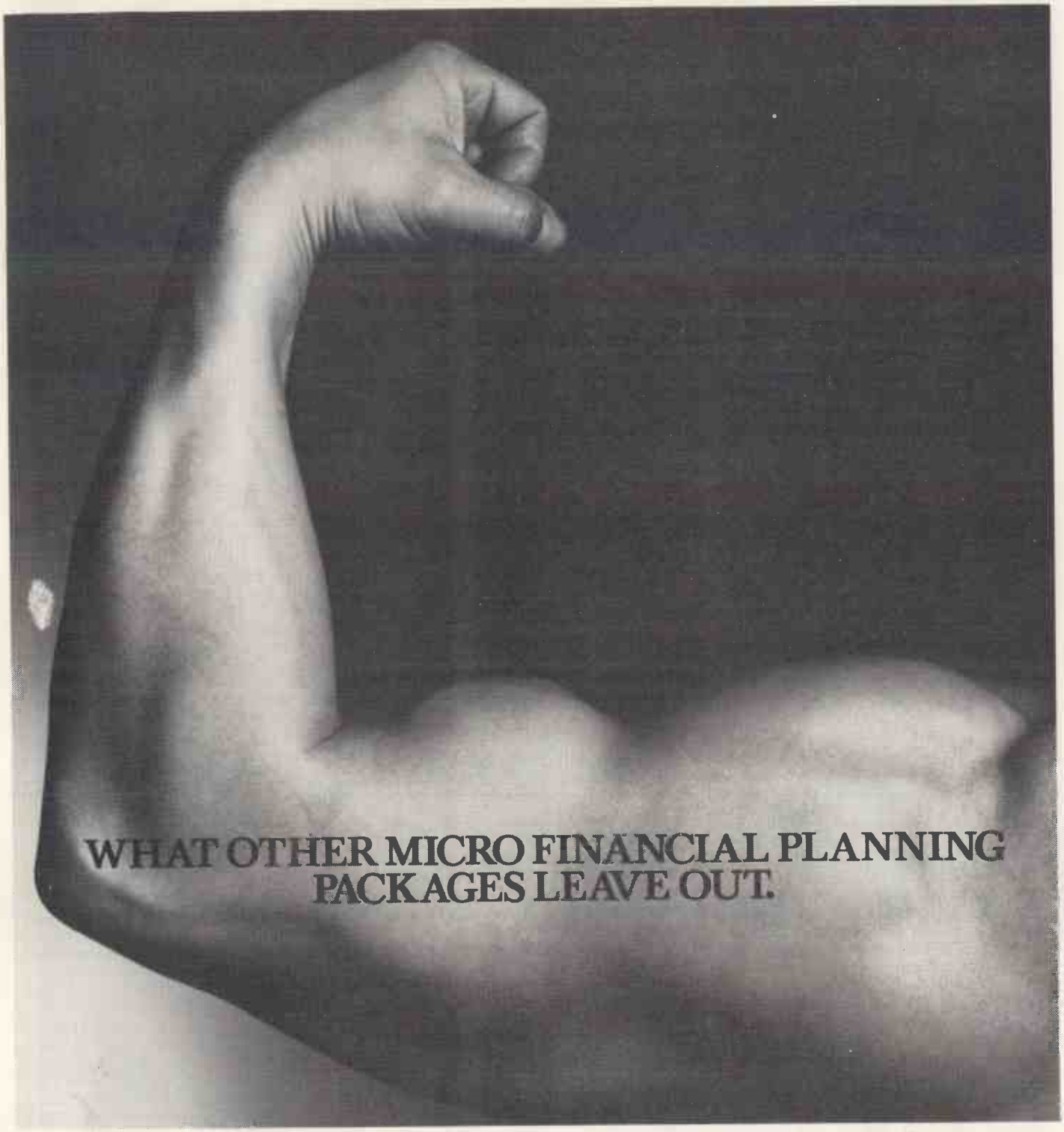
The next step was Lisp, which has not been quite such smooth sailing. Microtechnology Ltd kindly loaned me a copy of MuLISP/muSTAR (from the Soft Warehouse) which is a small Lisp system that runs under CP/M. MuSTAR is an excellent interactive screen editor for program development which I feel is a vital aid for anyone reared on Basic; no one would willingly submit to the barbarities of a line editor who has tasted better. My problem with Lisp has been that the manual is written for experienced Lisp programmers and only documents the differences between mu and 'standard' Lisp in terse and technical fashion. This is not a criticism as the authors clearly state that it is *not* a Lisp tutorial. Unfortunately the only textbook I have (Winston, Klaus and Horn) describes a variant so different that neither is of great assistance; as a result I have progressed only far enough to develop a certain awe for the potential power of the language. The unlimited capacity to manipulate words and text, and the ability to attach 'properties' to names tend to overwhelm the imagination of one used to the spartan string handling capabilities of Basic; my first crude program involved teaching the computer the names of objects and whether they are animal, vegetable or mineral; this occupied about five lines. I shall certainly persevere with Lisp and may have more to say in the future.

And so to Forth. At first I had some trouble finding a Forth to run on the MZ-80B but eventually chased up AIM Research of Cambridge via a *PCW* ad. AIM has developed xForth which runs under CP/M, and they were able to supply it on Sharp format disk. It is an extension of the Forth-79 standard and comes in various packages; the basic system, an assembler and debugger-tracer and a sophisticated filing system which includes pipelines. The manual again does not claim to be a tutorial, though it is readable and contains chapters which get you started and others which document the non-standard features of xForth. AIM recommend Leo Brodie's *Starting Forth* (Prentice-Hall) for the raw beginner and I heartily agree that this book is the only way to go; it must rate as one of the best programming language teaching books ever, with its combination of humour without condescension and depth of study.

xForth has some extensions which make life easier for the novice — such as one- and two-dimensional array declarations, a block-move which handles overlapping addresses and a running display of stack contents, plus a lot of extensions aimed at the professional programmer (this is not the place to go into details). A Forth 'kernel' is supplied in addition to the running package so that you can edit the source code and then generate a new system adapted to your hardware; by this means I have been able to incorporate all the special hardware features of the 80B into my system. A full screen editor is supplied as well as a FIG editor for those who are used to it.

I have to confess that within hours of starting Forth I was hooked. Having started out programming calculators and also having found Z80 assembler tedious

GOTO Page 187



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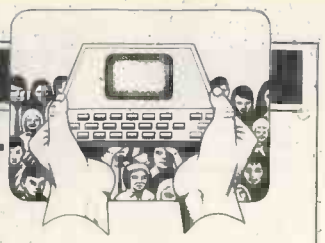


Out of hibernation.

It seems that everyone has come out of their winter hibernation this month. We've got six new ComputerTowns to announce and the names of another 16 potential 'Town organisers. Along with the joy, we have news of one or two 'Towns which have died. Let's start with the good news.

Mike Lay writes again from Prince Rupert School in Rinteln, West Germany to say that this ComputerTown got off to a splendid start on 1 February with nine machines — some provided by the school and others brought in by participants. It seems that the Guidelines document proved invaluable in 'selling' the ComputerTown idea to the headmaster and, from that point on, things progressed very swiftly.

Brian Taylor wrote two letters to tell us about the launch of ComputerTown Tonbridge. He intended to run sessions fortnightly, but already he has had to change to weekly meetings. In his words, he 'made about 25 new friends' with his Video Genie on the first night. Brian has managed to persuade his local computer store to lend equipment for the sessions. He will also be taking his micro out to activity sessions in other local children's libraries. Like Sue Kelly in Harrow, Brian thoroughly recommends that other librarians think about getting new ComputerTowns running. Contact Brian at Tonbridge Area Library, telephone 352754.

Another new 'Town starting in a library is in Billingham, Cleveland. Ray Skinner is the man responsible and he will have run a couple of sessions by the time you read this. Ray's address is in the ComputerTown addresses at the back of this issue of *PCW*. No doubt we will have more news from him soon.

It seems that a couple of ComputerTowns have been running for a while but, for one reason or another, I have only just got to hear about them. One is linked to Robin Bradbeer's splendid micro centre at North London Polytechnic and the other is run at Shawfield Norden Community Middle School in Rochdale. Robin runs ComputerTown sessions on Saturday mornings at Islington Central Library, Holloway Road, N7. Mr Kilburn, the headmaster of Shawfield Norden school, tells me that sessions are run at the school every Monday. Once again, you'll find the relevant addresses at the back of the magazine.

The sixth new 'Town was launched in Southampton and, wait for it, over 1000 people turned up on the day! Paul Maddison was the prime mover for this event, although he managed to secure plenty of support from local computer outfits, including Tandy, Micro-C and even IBM. At the end of the day the mayor was presented with a donation of £80, this being the amount raised by making people pay to play games on the machines. Paul hopes to run another event later this year. Watch this space.

It seems that our Newcastle friends have had a few problems: Pete Rowan who ran COMICS, has left the area, Steve Christian has run out of time to run ComputerTown sessions and Richard Powell has lost both his job and his means of transport. We're sorry to see you go, fellas, but thanks for all you did. To offset this unhappy news, we hear that Andrew Stoneman runs a mobile ComputerTown in the same area. John Bone knows all the details if you're interested in learning more. I'll try to find out what's happening there and report it in a future column.

Lots of people wrote this month expressing very serious interest in starting their own ComputerTowns. For anyone reading this who would like to join in and help, here are the relevant details:

Alison Hunt, 58 Princes Avenue, Walsall, W Midlands WS1 2DH, tel Walsall 23875; Douglas Elliot, 30 Ellerbrook Drive, Burscough, Ormskirk, Lancs L40 5SZ, tel Burscough 893021; Chris Woodford, 31 Hopley Road, Anslow, Burton on Trent, Staffs, tel Burton 32615; Frank Watson & Andrew Page, Dartington Inst of Community Studies, Shinners Bridge, Dartington, Totnes, Devon TQ9 6JE, tel (0803) 862271; Mr N Greenfield, 4 Stanley Road, Newmarket, Suffolk CB8 8AF, tel Newmarket 5593; Mr G M Flanagan, 11 Sundown Close, New Mills, Stockport, Cheshire SK12 3DH, tel New Mills 44051; W Beard, Craigmohr, Lostwithiel, Cornwall PL22 0DT, tel Bodmin 872263; Geoffrey Smith, County Librarian, Leics Libraries & Information Service, 1st Floor, Thames Tower, 2 Navigation Street, Leicester LE1 3TZ, tel (0533) 538921; R Woodbridge, Principal Lecturer, Bucks College of Higher Education, Queen Alexandra Road, High Wycombe HP11 2JZ; Dennis Fuller, 38 Uxbridge Road, Hampton, Middx TW12 3AD, tel 01-979 8993 (evenings); A Hayes, 67 High Beeches, Banstead, Surrey SM7 1NW; Ron Merson, Rokeby, Bishops Hull Road, Bishops Hull, Taunton TA1 5EL; Michael Scutt, 45 Lodge Close, Benged, Hertford, Herts SG14 3DH, tel Hertford 56038; N Day, 2 Glendale Close, St Austell, Cornwall; G Leon-Smith, Headmaster, Townmead School, Wise Lane, W Drayton, Middx UB7 7EU; M Maguire, Area Librarian, East Devon Area, Exmouth Library, 40 Exeter Road, Exmouth EX8 1PS.

Now, who would send me an empty cardboard tube? It's true, someone in Leeds sent me exactly that. Thanks very much, whoever you are. Maybe you'd like to tell me what I missed out on.

Finally, we also heard from the following areas this month: Pontypool, Walton-on-Thames (two people), Warley (two again), Malvern, Northwood, Edinburgh, London SW17, Blackheath, Glasgow, Sheffield, Leicester, Caterham, Clapham Common and Dunmow.

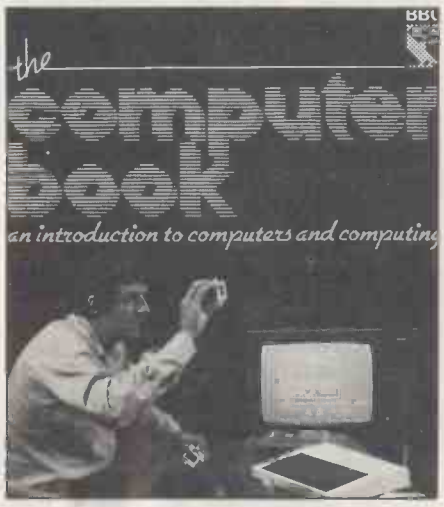
Thank you all for your letters and special thanks to those of you who went out and got a ComputerTown going. If you think you'd like to start a 'Town, write now for the Guidelines (the boxed section on this page gives the relevant details).

ComputerTown UK! is an ever-growing network of computer literacy centres, where members of the public are given free access to microcomputers, courtesy of those willing to volunteer their time and equipment. ComputerTowns might be found anywhere: in a church hall, a library or maybe in a school after hours. The emphasis is on making computing enjoyable and non-threatening and, because Computer Town is entirely non-commercial, overt axe-grinding of any sort is banned. Guidelines are available for those interested in setting up their own 'Towns: Write to CTUK!, 7 Collins Drive, Eastcote, Middlesex HA4 9EL and remember to enclose a large SAE (A4 would be fine) for your reply. Please don't try to telephone *PCW* for information because this project is entirely a spare-time activity.

'Isn't that sweet! Mother says she's knitting you a floppy disk'

Malcolm Peltu surveys the BBC's computer literacy efforts.

Beebook tops – but not the best



By the time you read this, the BBC's *The Computer Book* will probably be the best-selling computer book ever published in the UK. At the time of writing, a few weeks after it was published, it was in the national top 10 non-fiction books. Unfortunately, it doesn't deserve the success it is having.

The book, like the BBC Microcomputer, is selling well primarily because it has the BBC label on it – a guarantee, supposedly, of quality, independence, integrity and all that stuff that *used* to be automatically associated with the BBC. While the microcomputer is a good product in its own right, the book is not. There are very many other books which do the same job more effectively but which will sell far fewer copies. I will be looking at some of the newer rivals later in this Bookfare. But my main criticism of the book is that it fails to fulfil adequately its prime function, which should have been to support and extend the BBC's 'The Computer Programme'.

The TV programme is a thoughtful, thorough and generally high quality attempt to introducing computing concepts to a lay audience. Although there are 10 programmes, the need to appeal to a general audience inevitably means that 'The Computer Programme' can merely skim the surface of the topics covered. There was a wonderful opportunity in the book to follow through the concepts in the TV series. Instead, it's a mish-mash, written independently of the programmes, and failing to enlarge on the topics covered on television.

For example, the episode of the TV series on languages concentrates on getting over the general concepts. It uses a neat visual image of issuing an instruction to fire a gun to show how an overall command has to be broken into more detailed ones. It mentions various languages and says why different ones are needed, but it does not attempt to describe differences between computer languages in more detail. *The Computer Book* should have followed this up with a discussion of broad programming principles and an insight into the plusses and minuses of the main languages. This need not have got heavy – if Brian Reffin Smith can cover all computing fundamentals in about 30 pages of pictures (see review later in 'Bookfare'), it should not have been beyond the wit of the Beeb to do something attractive but practical on programming languages.

If the BBC was primarily concerned with computer literacy, and had avoided getting sidetracked into flogging a microcomputer which initially only has Basic, it would have done more in its book than merely describing the Basic language.

I would also liked to have seen a consistent use of imagery in the TV programme and the book. The programme generally uses very apt and imaginative analogies to explain concepts – although there are sometimes too many analogies falling over each other – and I can see no reason why exactly the same analogies could not have been used in the book. As few analogies are perfect, it is usually better for a beginner to stick to one set of images. Different ones tend to confuse. I know that the BBC claims the book is meant to be independent of the programme. But the beauty of, say, the BBC's 'Life on Earth' book is that it is consistent with the TV programmes. It allows a leisurely and more in-depth opportunity to think about the ideas, as well as containing pretty pictures.

My criticisms of *The Computer Book* do not end with my doubts about its relationship with the TV programme. But I also want to say some good things about it.

Firstly, and very importantly, it looks good. As I have frequently said in 'Bookfare', introductory books are more effective if they appeal visually to the reader. *The Computer Book* is stacked with pictures and diagrams and the typographical layout is clean and readable. This would make it attractive, whoever had published it. The chapters at the beginning and end, which mainly cover applications, are very good, sensibly telling their stories mainly in pictures. It is the meat in the middle that I find a bit off.

For example, the historical round-up is inaccurate and silly. Its description of computer use in the Second World War is particularly bad. It claims a Ferranti machine was used in the war – before it had even been built. It also confuses the British Colossus system, which was designed specifically to decode German messages for the American Eniac, which was used for ballistics and weather forecasting. (The Eniac was conceived during the war but only went fully operational in 1946.) These inaccuracies are unforgivable in a book like this and indicate a general sloppiness. It is not as if the facts were difficult to get hold of.

The historical section in *The Computer Book* also tries to be funny about maths: 'Then some bright spark invents the device of subtraction. . .' and 'another clever person invented symbols on paper to represent numbers . . .' This glib approach is both inaccurate and misleading – and represents a general arrogance which regards any development before personal computing circa 1975 as something which can be dismissed without much care.

On mainframe computers, for example, it says, 'Since this kind of machine is designed to be used by computer professionals, it is generally quite a tough business to make it work.' There is nothing about the complexities inherent in any large computer project and there is no feel for the actual way computing developments have gone or for the fact that the drive for easy-to-use high level languages came from the much maligned computer professionals.

On minis, it says, 'They may also allow timesharing'. There seems to be no appreciation that minis were developed primarily for real time operation.

I also cannot take a book seriously which says, 'Well, the printed word and mass literacy caught on quite well, and produced many changes in the then world that no-one foresaw – among them being, perhaps, the decline of Latin, the rise of national languages and nationalism, public opinion, mass marketing, bus tickets and other advantages too numerous to mention'.

The way the basic principles of computing are introduced is nowhere near as lucid as in the TV programmes. And the section on problem-solving is full of too much theorising and waffle about lateral thinking for a book of this sort. The introduction to Basic is a reasonable overview. My criticism is that this space would better have been used for a broader look at languages. Perhaps inevitably in a multi-authored book (five people were involved in the writing and editing), *The Computer Book* is curate's eggy – good in parts. The public has a right to expect more from the BBC, particularly when its imprint of 'quality' will cause people to buy it rather than other books, so many of which are of a consistently higher standard.

A thoughtful Beebview

It is a pity that the BBC Computer Programme has become swamped by the fuss over the microcomputer. It is a

worthy, although not wholly successful attempt at making computing comprehensible on the box.

In 10 episodes, the series attempts the ambitious task of describing the major underlying principles and applications of computing. Contrary to early indications, producer Paul Kriwaczek has thankfully steered the TV programmes away from programming and the BBC Microcomputer.

Kriwaczek must take much of the credit for creating programmes that are enjoyable but have a consistent, coherent and serious underpinning of computing knowhow. The series is the best of its type that I have seen, primarily because Kriwaczek has become computer literate himself and can act as the intelligent go-between to bring together the 'specialists' and the film-makers.

Another important ingredient in the programmes is Ian McNaught-Davis, one of the two presenters. As well as being an experienced TV presenter, he also has extensive expertise in the computer business (he is managing director of Comshare, a large computer services company). McNaught-Davis's informed enthusiasm creates an intelligent rapport with the audience that can never be captured by professional TV frontpersons. Such a media man, Chris Serle, plays the role of the novice in asking McNaught-Davis to explain things. The double act works excellently.

The main problem with the series is that its focus is a bit fuzzy. It seems unsure whether it is 'Tomorrow's World' or the Open University. In an educational programme, the main ideas would be continually reinforced. Kriwaczek deliberately avoids this in case the audience gets bored.

Although the first showings were aimed at schools, Kriwaczek would like to see it filling the 'Tomorrow's World' slot, just like another of Kriwaczek's works, a David Bellamy series.

Although it is valid to define the scope of the programme to avoid too much detail on social implications, I think it should add a bigger dose of practical scepticism. Everything shown works perfectly. All computer applications seem to be successful and beneficial. As with the rest of the BBC Computer Literacy project, it smacks too much of propaganda for the technology.

Behind the scenes, Kriwaczek had a great deal of trouble getting demonstrations to work. None of this familiar computing hassle really emerges on the screen.

Would you buy a new micro from. . .

In the opening episode, this gloss is particularly noticeable. It shows a lady using a PET to run a sweet shop and saying she was moving into computers because a bypass had been built and her shop was making a loss. This should have been — but wasn't — a cue to point out that computers cannot magically solve all business problems.

The episode also shows an airline reservation system and claims that, if it were not for computers, a £200 ticket would cost £1000. This is said without explanation and without pointing out the fact that the price of airline tickets is controlled by other factors as well.

The last programme (which I have not yet seen) could rectify the imbalance by looking to the future and the likely employment consequences of using information technology.

The 10 programmes start with a general introduction, which is a bit wishy-washy. Episode two introduces the concepts of processor, storage and algorithms (although the word algorithm is never mentioned). Number three is about language. The emphasis then moves more into applications, starting with information storage (programme 4), then moving onto telecommunications (5), graphics and sound communications (6) and modelling and simulation (7).

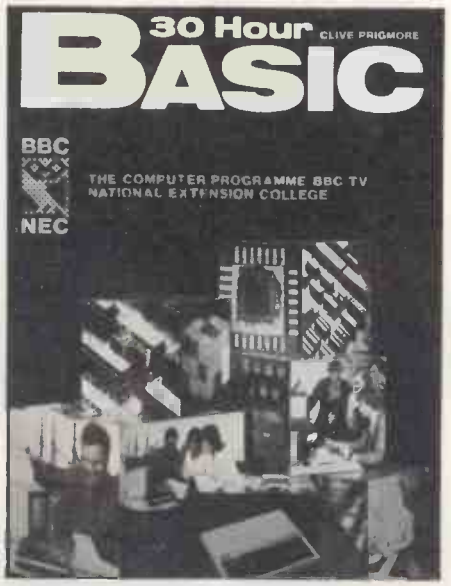
Programme 8 takes a step into the future by looking at artificial intelligence, while the penultimate episode

McNaught-Davis looms

examines a variety of control applications before the series winds up with a look at how computers will affect employment in banking and agriculture. (At the time of writing, the contents of some later episodes had not been finalised, so could change.)

Some of the early programmes describing the technical concepts move a bit too quickly with too many images, although most of the analogies are well thought out and presented. The most successful episode I have seen so far is the fourth one, which looks at information storage. By the time of this programme the pace is slowed down a bit. The presenters seem more relaxed, particularly McNaught-Davis who grows in assurance in each episode. With the focus moving away from techniques and onto applications, the style of the programme is a closer match to the content.

The series cries out for some support material — unfortunately, as I have said above, the BBC *Computer Book* is inadequate in reinforcing and expanding the TV programmes. On its own, the series is a useful introduction. Enriched by guidance from an experienced teacher, it could make an excellent centrepiece for providing computer awareness and training courses for all ages.



DIY Basic

As part of the computer literacy project, the Beeb has got together with the National Extension College (NEC) to publish a self-instructional Basic course. *30 Hour Basic* by Clive Prigmore is the workmanlike result.

It is available in two versions. The BBC one 'keeps to the common core of Microsoft Basic' and there's another version for the Sinclair ZX81.

The book is structured so that it could be used to teach yourself or as part of an NEC course, run by correspondence or with the Flexistudy scheme that works in conjunction with various local centres.

It is very much a straight up-and-down technical introduction which plods logically through simple statements, decision making, strings, lists, and PRINT before moving onto a few games, number handling, data processing and file management. The text is structured to provide many self- assessment questions to enable the reader to check understanding. There are also many program examples.

Although Prigmore says the book can be effective without a microcomputer to try out the examples, I think it would prove to be frustrating if you could not have a live go at problems. But then learning a language from any book is a problem without access to a computer to get hands-on experience.

It is by no means the best Basic book on the market but it is also far from being the worst. Whether it is for you will depend on how much you like this style of self-learning. I am sure it would be most valuable in conjunction with an NEC course. Its approach fails to provide any real perspective on how Basic fits into general programming con-

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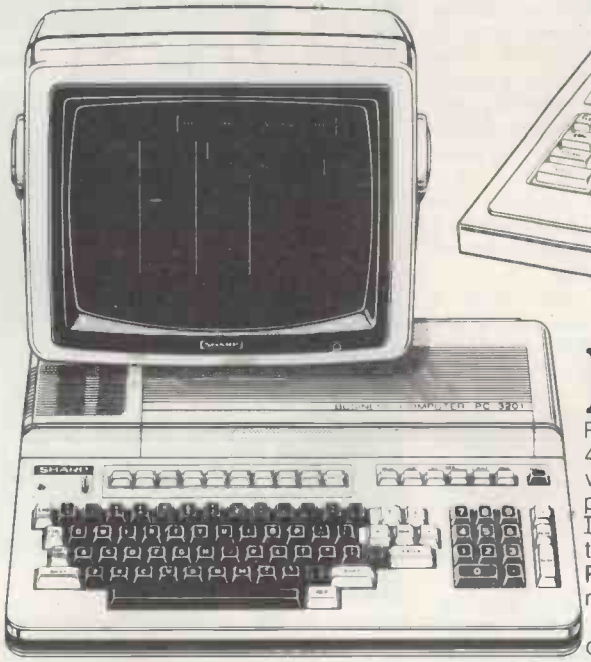

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Dealer enquiries welcomed.

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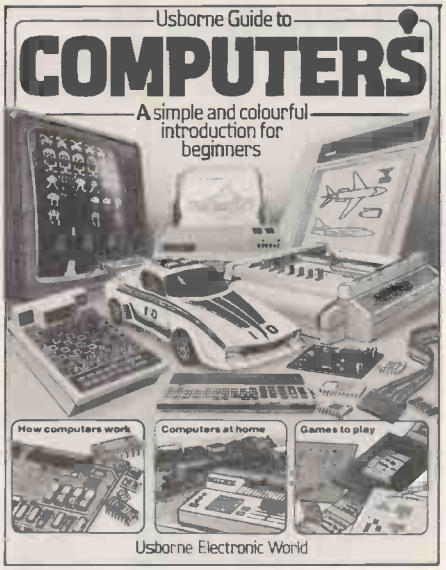
Royal Sussex Assembly Rooms, The Pantiles, Tunbridge Wells, Kent.
Telephone: (0892) 32116. Telex: 95441. MicroG.

cepts and real world situations. It is about just Basic programming rather than good programming. But for many people, unfortunately, this seems to be sufficient.

By the way, it will probably take you longer than 30 hours to complete if you key in all the program examples.



My bestest picture book

The Usborne Guide To Computers is, without question, the best general introduction to computing I have ever seen. Into only 32 colourful picture-book pages author Brian Reffin Smith and a team of artists have packed an amazing amount of useful information for beginners.

The Usborne Guide is something that must be seen to be believed. Each page is full of pictures, with space only for a few words. Yet somehow it manages to cover basic computer concepts, different types of computers, the making of chips, circuit logic, programming (Lisp, Fortran, Cobol and Pilot get a mention as well as Basic), flowcharts, applications, artificial intelligence, computer crime, viewdata, computer modelling, computers and art and a history of computing.

In style the book is clearly aimed at young people. But just as, for many years, the *Ladybird Book of Computing* was the best introduction for adults and children, so will Smith's picture book appeal to all ages. Smith has even developed 'do it yourself' games to help in learning, such as a computer made of cardboard (and using a spinning top as a random number generator) which can be used to write funny poems.

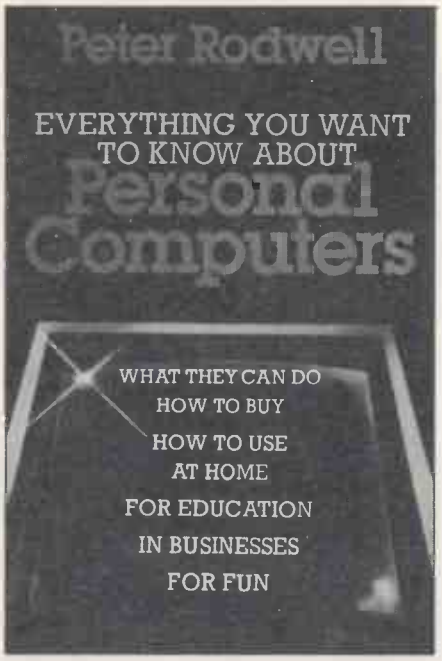
The book is probably so good because Smith has been forced to think visually and to put everything into the colourful format developed by Usborne for its *Young Scientist* series.

A good example of the technique is the two-page spread on computer models. On the left-hand page there is an introduction of less than 100 words. Then there are three illustrations with brief text showing a ship's bridge simulator; a frog simulator for 'dissecting frogs without cutting up real ones' and a diagrammatic model of queues in a canteen. The right-hand page is taken up by a flow-chart of an Adventure-type computer game, superimposed over drawings of woods, volcanoes, demons and witches. The flowchart can be followed as a game as well as illustrating important computing concepts.

Of course, the book does not go into great detail on any one subject, although it does dig beneath the surface. It is a starter book, not a be-all-and-end-all one. After reading it, the newly enlightened computernik can then decide where to go next.

What is particularly important is that Smith has synthesised historical and technical developments with some of the most advanced techniques in machine interaction, artificial intelligence, etc. So when the reader moves forward he or she will be carrying a secret store of knowledge which will blossom some time in the future.

At only £1.85, Usborne has provided a value-for-money package that is unbeatable. It deserves to oust the BBC *Computer Book* as a top seller in the computer literacy field.



The Editor strikes back

Editor Rodwell has joined the publishing game with a nifty little number, *Everything You Want To Know About Personal Computers*. In a succinct 100 or so pages he provides a readable, practical and honest guide for the micro punter.

Of course the 'everything you want to know' bit in the title must be tongue-in-cheek. Given that new micros are being spawned every day and prices are changing by the minute, no book can hope to be up to date. Rodwell has therefore chosen the sensible technique of providing an overview of the main developments in personal computers in order to give the reader a feel for the state of the market and the names to conjure with, but he does not go into specific detail on products or prices.

Unlike many other books that have jumped on the micro bandwagon, Rodwell is prepared to talk about the nasties of the computing business as well as the practical benefits. The two chapters on buying a computer and what happens when it goes wrong are particularly valuable in alerting the newcomer to the pitfalls and pratfalls that they may encounter.

The main disadvantage of the book is its format. It is pocket size with a dull cover and has no pictures, diagrams, etc. This means that it can sell for only £1.50, but it could look forbidding to the beginner.

This is a pity, because Rodwell writes in a relaxed and friendly style. He gets stodgy only in the chapter introducing the parts of a computer. This comes early on, instead of being out in an appendix or cut drastically and it might be a turn-off from the rest of the attractive road.

As well as his background to the computer market, Rodwell describes the variety of applications of personal computers. Once again, he is not afraid to point out the difficulties of practical implementation of some much-touted uses, like controlling home heating.

As a journalist, Rodwell writes racily — perhaps too much so at times. He uses phrases like 'in recent months' or 'at the time of writing' which are inappropriate in a book. There are also a few printing errors (like a reference to a £30 computer instead of £50) which indicate that a little calm editing would have helped. But it is natural in the micro world to want to get books on the shelves as quickly as possible.

Rodwell's contribution to the paper-flow makes an ideal companion to *PCW*. The book provides the background, while PCW keeps you up to date on the latest developments. It fits neatly between general introductions like *Usborne Guide* (reviewed elsewhere in this 'Bookfare') and detailed Basic language or other more specialised books.

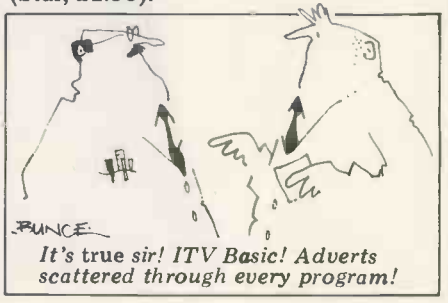
The Computer Book by Robin Bradbeer, Peter De Bono and Peter Laurie with additional material and editing by Susan Curran and David Allen (BBC Publications, £6.75).

'The Computer Programme' is being shown late night on BBC-1 during April and May and will be reshown in the autumn.

30 Hour Basic by Clive Prigmore (BBC/NEC, £5.50).

Usborne Guide to Computers by Brian Reffin Smith (Usborne, £1.85).

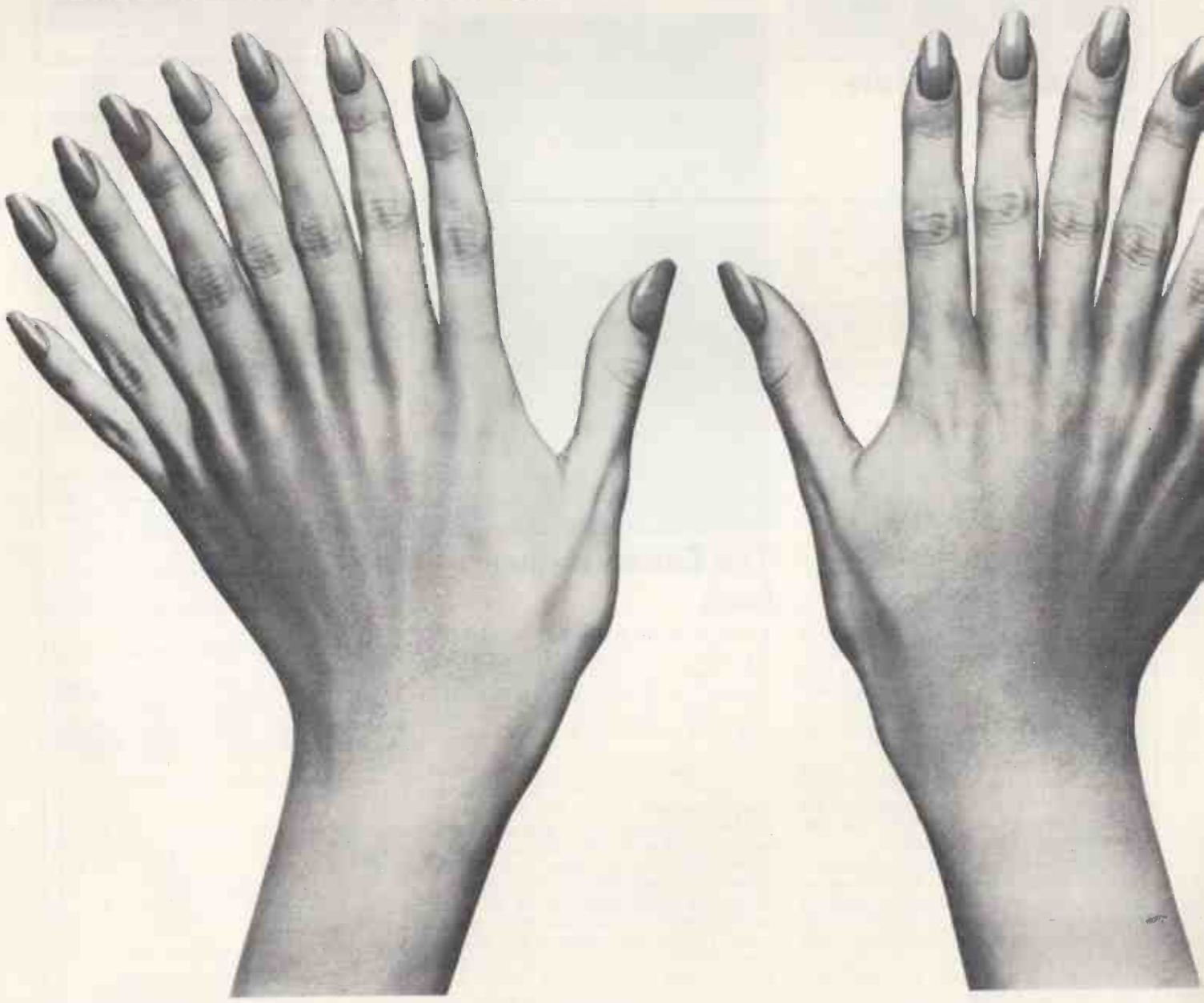
Everything You Want To Know About Personal Computers by Peter Rodwell (Star, £1.50).



It's true *sir! ITV Basic! Adverts scattered through every program!*

Now you can do all accounting with...

without...



the filing, typing and

Silicon Office is the latest microcomputer software program from the Bristol Software Factory.

Designed specifically for use with the Commodore PET 8096, it'll help you run your office with the minimum amount of effort and maximum efficiency.

Think of it like three normal software packages in one, each separate package totally interactive with the other.

For around £4,500, you can have the complete electronic office, the solution to practically all your business problems. The price includes Commodore hardware, a high quality daisy wheel printer and Silicon Office software.

Silicon Office is made up from a flexible information management system which lets you create and maintain an extensive filing arrangement. Allowing you to search quickly through your records, making cross references between files in order to gain the facts you require.

A highly sophisticated word processing program allows you to generate letters, documents and reports. Letting secretaries get on with the more important tasks.

And a fully comprehensive calculator means you can handle all the number crunching you're ever likely to do in a business situation.

Leaving the accounts department to concentrate on more profitable things.

But that's not all by any means.

Silicon Office also has a special programmability feature which means you or your dealer can expand and tailor the Silicon Office program to your business.

When Silicon Office is used in an everyday business situation, certain command sequences are inevitably repeated. By writing short, very simple programs which are entered into the computer's memory, Silicon Office can perform the necessary tasks, automatically.

And last, but by no means least is an optional communications facility.

It doesn't take much imagination to see the potential of Silicon Office in virtually any line of business.

So to get a better grasp, send away for our brochure. It'll only cost you a stamp. And it could save you a fortune. Or talk to your local Commodore dealer who has all the facts at his fingertips.

You'll soon see how you're much better off with Silicon Office. Than without.

SILICON OFFICE

I can't wait to get my hands on a free copy of the Silicon Office brochure.

Name_____

Position_____

Company_____

Address_____

B/PW1

I own a Commodore PET (Please tick box) YES ☐ NO ☐

BSF Send to: Bristol Software Factory, PO Box 14, Horley, Surrey.

SILICON OFFICE

the 8" Apple

Eicon's dual 8" floppy disk drive system gives the Apple over 2 Megabytes of on-line capacity, enough, for instance, for 15000 items in stock control, or an integrated business system with several thousand accounts.

Of if you need the extra capacity of a hard disk, a single 1 Megabyte floppy disk drive can be an ideal back-up medium.

Eicon's intelligent disk controller, with its unique EDOS firmware, provides complete integration with standard Apple software. DOS, Pascal and CP/M are all fully supported.

With additional software, Eicon drives allow the Apple to read and generate both IBM and DEC floppy disk files.

Prices are from around £1200 to £1900. S100 Bus floppy disk systems are also available.

Eicon disk systems have a full 12 months warranty, and are supported by the larger Apple Computer dealers throughout the UK. On-site maintenance is available if required.

Franchised distributor:
Access Data Communications Limited,
Tel: (0895) 30831, 59016, 59205

Apple make the computer . . .
Eicon make the difference.

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RESEARCH

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COMMUNICATIONS

PCW welcomes corespondence from its readers but we must warn that it tends to be one way! Please be as brief as possible and add 'not for publication' if your letter is to be kept private. Please note that we are unable to give advice about the purchase of computers or other hardware/software – these questions must be addressed to Sheridan Williams (see 'Computer Answers' page). Address letters to: 'Communications', *Personal Computer World*, 14 Rathbone Place, London W1P 1DE.

Atomic fuzz

In June last year I assembled an Acorn Atom kit, supplied direct from Acorn. It worked 'first time' but the quality of the video display on a 16-inch colour television, while adequate and completely stable, was rather fuzzy. Not knowing what quality to expect from the Atom, I put this down to the TV and/or bandwidth of the UHF modulator. However, when I tried a video monitor the display was still very poor.

The problem turned out to be transistors Q1 and Q2, supplied as BC309s. These are pnp transistors, not npn as the circuit requires and I am amazed that I achieved any display at all! Changing them to BC107s gave a perfect picture. By coincidence, a colleague came into the office two days later with exactly the same problem in his newly built Atom kit.

Acorn tells me that about 100 kits were sent out with BC309 transistors instead of BC239s (as intended) in about October 1981. However, my kit was supplied in June 1981 and my colleague's in January 1982 (through a dealer who was initially out of stock).

Therefore, it is possible that other owners of Atom kits are still putting up with a far worse display than the Atom is capable of generating.
J N Gray, Bucks

Tandy to the rescue

I am writing once again about the paper for the Quickprinter 1, as I have now been informed by Tandy that they have an alternative supply, their catalogue number 26=1405, at a lower price of £3.95 per roll.

I would like to apologise for troubling you, and giving a false impression of Tandy in this matter; it would appear that I have been misinformed, due to the fact that a change in supply of this paper to Tandy had involved a change in catalogue number and price.

Once again, please accept my apologies to you and to Tandy!
Martin Kennelly, Derby

In response to the 'Paper Plea' (page 78, February '82) I would like to reassure all Tandy Quickprinter 1 users that we have plenty of stocks and a continuing supply of the special paper rolls.

To avoid any further confusion, the Tandy catalogue number is 26-1405 price £3.95, and this item is available through all Tandy stores.

May I suggest that any TRS-80 users with unsatisfactory answers from their local Tandy store should contact TRS-80 Customer Service on 021-556 6101.
M Soble, Computer Merchandising

Not buried

Concerning your 'Newsprint' article in February entitled 'The Bear is Buried', your readers may be interested to know that I am alive and well and definitely *not buried*. It is natural for bears to emerge from hibernation around now and I am delighted to say that I can be found at Kuma Computers on 0628-71778.

As a point of interest, the photograph of Sister Mary Agnes's Sharp MZ-80B system (page 65 of the same issue) was installed in August 1981, the same month as the MZ-80B's release in this country. I know, as Jon Day, Stan Lawrence and myself supplied and commissioned it.
The Bear, (alias Tim Moore), Kuma Computers, Maidenhead, Berks.

Eliminate unsightly lines

Since the Christmas time 'Horizon' program on computer graphics, I have been working on pseudo three-dimensional representation of objects on a computer screen. As a result I am now able to present full perspective views of frameworks and translate, rotate and magnify them in 3-D space. So far, however, I have been unable to conceive of any method of producing hidden line elimination and so can plot only line drawings. Having devoted considerable time to this problem to no avail I would now like to ask you if you, or any of your readers, know of any method which I could use.

Also, after reading your February issue, I saw a letter claiming that BBC Basic doesn't support the PEEK and POKE commands, and I feel that your reply does little to clarify the situation. In fact the BBC Basic does support PEEK and POKE but in much more elegant form — viz the ? operator which is one of the better hang-overs from Atom Basic.
S Draper, Lincoln

This is your lucky year — in this month and last month's PCW *Alan Sutcliffe has been discussing hidden surface removed in Patterns — Ed.*

Hey Prestel!

The fate of Prestel in this country must lie in the volume of sales during the next couple of years. Those of us who wish to see Prestel as a success — not least British Telecom — must find a way to attract new subscribers.

Prestel should have a great attraction to the microcomputer owner. I have heard from many owners their envy at the great systems in the United States such as 'Source' and 'MicroNet', and why can't we have it here?

Dear friend, we do have it here. It's called Prestel. Prestel, they cry, that's far too expensive. Here are some facts about Prestel costs. If you have a telephone, it will cost £15 for installation of the necessary Prestel jack socket. The quarterly rental is 50p. If your telephone line is not a business one, then you have no other rental cost for Prestel. There is now a Prestel adaptor to turn your television set into a Prestel set for about £200. This adaptor has a RS232 I/O interface which makes it easy to connect your computer to Prestel. This gives the advantage of easy storage of pages, electronic mail and much much more. In fact, more than is offered in the USA systems.

And now for the best news of all, When you go 'on line' on the USA systems the cost for one hour, during the cheap rate, is about £2.50 plus the cost of the telephone call. How much for the same time on Prestel at the cheap rate? £1.20 *including* the telephone call charge and VAT. The only other cost that you may have is the page charge. Some of the information providers change a small sum for the information they supply. Most Prestel pages are free.

Another thing Prestel has is telesoftware. This is an expanding field and we microcomputer owners can make the most of it. I do hope that this letter has given you some new insight into a system that is leading the world. Look at your computer and think how Prestel will keep you in the forefront of viewdata.
John A Douglas, Dumbarton

Micro insurance

The enclosed may be of interest to you or your readers (ref page 158 of December issue). Royal Insurance have a department who specialise in computer insurance and are cheaper than at least one other firm I have seen advertising in another publication.

I doubt that it will be possible for insurance to be effected economically for this special insurance for very much smaller amounts, as the minimum charge rule comes into play.
P J Madden, Salisbury

The policy enclosed shows a premium of £25 per annum for £5140 of cover. Royal Insurance can be contacted at 7 Chancery Lane, London WC2, tel: 01-405 7600 — Ed.

More POKEry

You seem to have got a bit confused in your February 1982 issue about the BBC Computer's capabilities. On the one hand, in 'Communications' under the title 'Please don't POKE', your editor

agrees with the contention that the BBC computer does not support PEEK or POKE commands. However, in 'Computer Answers' in the same issue, Sheridan Williams directly affirms that it does!

What I think may have been confusing is that the BBC Basic is intended to support PEEK and POKE in the same way as the Acorn Atom — by use of the operators '?' and '!'.

The operator '?' acts as a word indirection operator — ie, ?X = 255 is the same as standard POKE X,255; while PRINT ?X means PRINT PEEK(X). The operator '!' is a byte indirection operator, PEEKing and POKEing bytes as opposed to words, not a simple POKE command as the letter 'BBC 2' implies.

I hope this letter clears up some of the apparent confusion.
David Booth, Dunkirk, Notts

We couldn't have put it better ourselves — or rather we didn't — *Ed.*

Cry for help

Can you please help me with a problem? My knowledge of computers and computing has been gained over the last couple of years from reading *PCW* (which I have taken from the first issue) and one or two books. I bought a 16k PET about 18 months ago and have been successful in writing a number of programs to enable me to do structural calculations and accounts.

However, there is a lot of written matter which I do not understand — including most of the articles in *PCW* and although I have made enquiries and on advice bought books they do not help me to understand what is obviously technical terminology associated with computers. I would like to get into machine language but until I can understand the terminology of computers that is impossible.

To try and explain in a little more detail what I mean, I find a lot of the more advanced information in the *PET User Manual* which is printed in heavy type difficult if not impossible to understand, and the purpose of hexadecimal completely baffles me! A further example taken from the manual: 'When printing to the screen, the print subroutine in the operating system automatically translates ASCII characters into the screen memory form.' References to memory maps and 'The first byte of text contains a zero. This is really not part of the first line but is a dummy line consisting only of a terminator' (whatever a terminator is) may be in a foreign language for all it means to me.

I have been recommended to buy *Programming the 6502* by Rodney Zaks which I am prepared to do if it will solve the problem but I do not wish to buy yet another book which I start reading with great enthusiasm only to find after a few pages that I have run into a mass of unintelligable gobbledegook.

I am a chartered civil engineer with hence a scientific/engineering background and I would have thought as a result that this subject should not be too difficult for me.

I have started watching the BBC programme on computers in the hope that they may shed some light in dark corners but so far they seem to be more interested in showing how steam organs work than a computer!!

Any help or advice which you can give to me would be appreciated.
D T Vaulkhard, Staines

We recommend a thorough reading of Adam Osborne's Introduction to Microcomputers *Vol 0 and 1* before *moving on to a 6502 machine code primer — Ed.*

School network

The 6th Form A-Level Group of our school is currently working on a network system for CBM 4032 Micros. At present, we have successfully programmed (in Basic) and implemented a system to allow keyboard conversation between two CBMs using a connector (constructed by ourselves) for use with the Parallel User Port.

Anyone wanting further information (ie, how to construct the connector, and a documentation of our two-way Pet-Talker) should write to the address given (Comp. Studies Dept).

Also, it would be appreciated if anyone who has done or attempted to do a similar system would write to us with their ideas.
Upper 6th Form A-Level Group, Computer Studies Dept, The Pringle School, Swadlincote, Burton-on-Trent, Staffs, DE11 0QA.

PEEK, POKE and toys!

After reading the letter from Nigel Cole ('Communications,' Feb. '82) I was surprised to see the editorial comment regarding PEEK and POKE.

I own one of the early, much maligned and reviewed NTSC T1 99/4s, and the lack of PEEK, POKE, and USR is a distinct disadvantage. I can see what Nigel means by 'advanced programming': programming a micro tends to be a 'learning' experience, and after a short while (shorter if you are in touch with programmers who have learned more than you), PEEK, POKE, and USR are likely to be regarded in a new light. Programs which hitherto were considered unworkable, by reason of slow execution, begin to look feasible. Sooner or later the interest switches from programs wholly written in Basic, to hybrids of Basic incorporating some tentative machine code, through to machine code programs with minimal Basic content.

My 99/4 has some fairly powerful Basic facilities, but, as time goes by and my awareness of the possibilities of user-written machine code routines (awakened by intermittent contact with a ZX81 — where would the ZXs have been without user-written machine code?) grows, I am beginning to be frustrated by its absence from TI Basic. It *can* be provided, but at an unacceptable price: you need Extended Basic (module £80) and 32K additional RAM (4300).

While your comments with respect to removing machine dependence are valid, I would submit that the majority of machine users would prefer a program which ran within the time required it to, by taking advantage of machine-specific code, rather than being able to say that their program might be slow, but it is 'portable'.

I am also concerned by the 'toy' image which is still attached to the ZXs. Recently I have seen two advertisements; one offers a trade-in to ZX owners who want to 'move up' to a PET, while the other offers a staggering range of additional memory at very competitive prices (and which is just becoming available for other machines like the PET), ranging from around 16k all the way up to 128k and beyond: one particular unit offers an incredible 422k, together with the very real possibility of turning the ZXs into 'turnkey' systems, with EPROMed utility routines.

It is odd that, with the range of peripherals either already on the market, or about to be released: colour, sound, speech synthesis, I/O control, programmable character generation, high resolution plotting, EPROM programmer, printer, disks, full keyboard, joysticks, etc, etc, the ZXs are generally regarded as the basic building blocks for user-configurated systems far superior to many currently available at far higher prices; and yet the Nascoms were regarded in that manner right from the beginning. In the last few months I have had a number of people asking me whether they should buy a ZX81 or gor for a 'real' computer — you must know what my answer was.
Peter Brooks, Oxford

The point I was trying to make about PEEK and POKE was that one shouldn't dismiss as completely useless a machine which doesn't support these facilities. Of course, as hundreds of readers have written to point out, the BBC micro has the equivalent, Atom-style '?' function. And you can include assembler code as part of a Basic program, eliminating the need for USR. Personally, if I'm writing a program in which speed is important, I'll code it in Basic first to check that it works and then convert it to assembler (because I'm too mean to buy a Basic — or other language — compiler).

I agree that the '81 isn't just a toy — some very sophisticated add-ons are now available, but I still wouldn't recommend it for business use. There are plenty in the mainframe world who regard all *micros as 'toys' — they'll learn, eventually — Ed.*

Conversation Pascal

In Borge Christensen's Comal-80 article in your November issue he says:

'Naturally, a Basic-like environment could be built around Pascal, but surprisingly this has not been done.'

Here is a copy of the first page of another article describing just such a system!
C.D. Castello, Malvern.

The enclosed copy is from a definition of COPAS by Atkinson and North of Sheffield University (published in Software — Practice and Experience Vol II 819-829 1981). On this subject, Sharp has released a subset of Pascal which is interpreted and conversational, for the MZ 80K and B — Ed.

Just fancy that!

Computer shows cheapest way to empty dustbins

The Times, 12/1/82
(submitted by David Hanstead)

We have sometimes suspected as much — Ed.

BENCHTEST SOFTWARE

FMS80 – A FILE MANAGEMENT SYSTEM

Continuing her series of database Benchtests, Kathy Lang reviews another CP/M-based system

FMS80 provides a wide variety of data management facilities for CP/M systems plus a number of others including CP/M-86 and Unix. It may be used either through the supplied programs, which give most of the common requirements, or through a special programming language called EFM, which gives the user 'building blocks' with which to assemble programs to meet pretty well any data management need. When used through the supplied programs FMS80 can process just one data file at a time; using EFM the user may access up to 19 files in a single processing run. For each file FMS80 must know the data structure, which must be the same for each record, and the way in which it is primarily to be indexed. This index is used for writing records in the file; it may be read by using this index, or by others constructed from any field in the data record. FMS80 originates in the US, but full support is available in this country from Infodata Systems of Winchester, which supplied my review copy.

Constraints

FMS80 stores data using one record for each set of data items; a record may contain a maximum of 255 items, each up to 255 characters long. All data items except the last in a record must be fixed in length; the last may be variable length, with the maximum length specified when the file is defined. Data may be characters or numbers; numbers are stored as integers. No special data format is provided, so dates have to be stored as Year-Month-Day for them to be sorted properly, There is no need to specify the number of records required when filing is created, and extra records may be added at will. Not so with extra fields, however; there is no supplied program to add fields to an existing file definition, although it is reasonably easy, using EFM, to create a new file with extra data items and to copy an existing file into it under EFM — an example EFM program to do this is given in the manual.

FMS80 uses a rather curious method of allocating files to disk drives. The system normally uses a special file called LOCATE.SYS. which tells it what drive to use for files of every kind of suffix known to FMS80. For instance, data files are created with a .DAT suffix, and all such files are created on one drive, specified by LOCATE.SYS. The user can change this destination but only for all files of that suffix. To be sure, this is an improvement on systems which put all the user's files on the B drive willy-nilly, but it has real limitations for users who want neither to write their own EFM programs nor to use the facility for manual specification of the disk to be used for every file.

Data input and updating

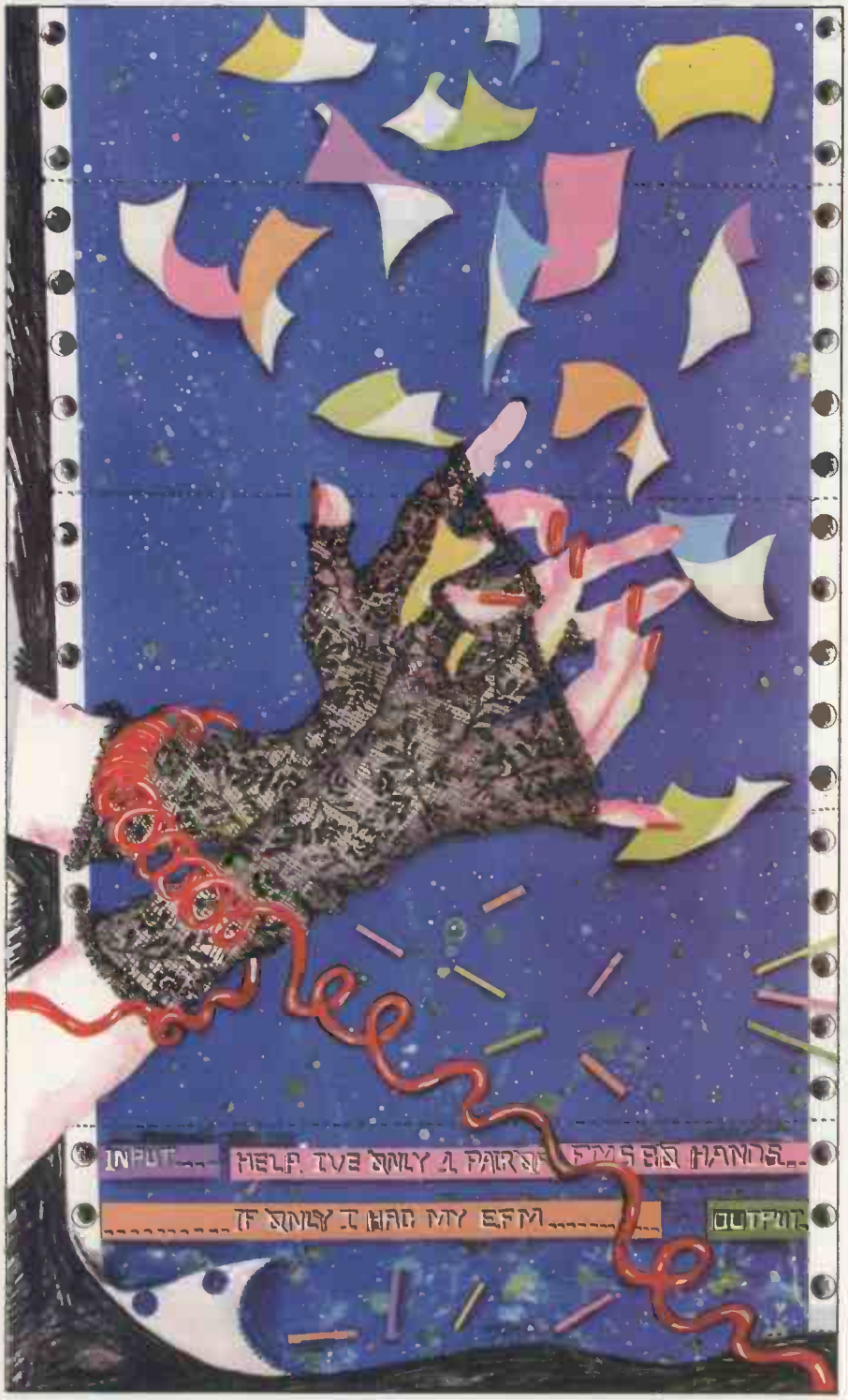
Before data can be input to an FMS80 file, the record structure must be defined. This is achieved using a crude screen editor, which allows you to enter the name, type and length of each record; for numeric data, you may also supply a 'picture' which shows how it should be printed. For instance, a number is always stored as an integer but it may be printed with a decimal point in any desired position. The screen editor displays the data items defined so far in the top half of the screen, while you enter the next data item in the bottom half. Once complete, the item is moved up into the middle of the list of data items, not appended to the end. I found this a bit confusing, especially when I was defining a large record — not all the items could be displayed at once, and I was shown the first five and the six most recent items, rather than having a sequence displayed. During editing, the cursor is moved by pressing letters — D for Down, etc, as the installer is not given the option of providing the codes for cursor movement even if the terminal has them.

The data definition file may be edited at will until data is entered into the file. Once the file contains data, you can only change the definition by copying the data into another file via an EFM program, to safeguard you against accidental corruption of live data. Before you can input data initially, you must define a control file to specify the keys to be used to index the file for input, initial sorting and updating purposes. One field must be the primary key, and others may be used as secondary keys; none need occupy any special position in the record. The values of these key fields in combination must be unique.

The index thus created for updating purposes may also be used for retrieval in reports, or you may create other indexes on any fields you wish for reporting purposes. The indexed records may be be accessed in ascending or descending order. The ways in which the data file is indexed are quite separate from the order in which the data is stored; you may keep the records themselves sorted in any desired order or you may simply use the indexing function to access them in any order you need. If you rely solely on indexes for ordering, there will be some limitations on your ability to access the data in a particular order, as you will see from my comments on reporting.

Initial data entry and updating are usually done using the TRANSACT feature. Records may be marked for addition, change or deletion; the system forms a transaction file from these instructions, which is then used to modify the master file as a batch operation. Any records for which an appropriate instruction has been given — for instance, a record marked 'delete' which did not exist in the master file — are written to a reject file, which may be edited and subsequently resubmitted to TRANSACT. The user can input data either by using the system's own prompts, or by means of a screen definition which can give additional prompts or restrict access to parts of records only. If the procedure supplied by FMS80 is used to carry out the full updating process, then the master index is updated as the data file is amended.

This combination of interactive data entry with batch updating of the master file is used to prevent errors at a crucial time; the data file is open for writing for the minimum possible time. However, there is also an online updating facility, which uses the same QUERY program that gives the user the ability to display records on the screen. The documentation advises against using direct updating because it is less safe, and FMS80 allows you to disable this function. You might well want to do this, since there is no transaction logging for online updating, ie, no printing record is made of your amendments when you make changes using the QUERY feature. QUERY can in any case be used only to



Connie Jude

change existing records — no additions or deletions are allowed — but you could change key fields in existing records, and thus render the master index inaccurate unless subsequently reconstructed and resorted in key order.

Displaying your data on the screen

The main method of screen display uses QUERY. This gives access by key to any file, by any key or keys for which you have constructed an index. Access is very fast — not more than three seconds for any record in the file of 1000 records I used for testing. Individual records can then be displayed by giving the key or keys for the index you are using. You don't have to know the whole of each key for character fields but you must know at least the first character of each, and for numeric fields you must be exact. For instance, I used as my test file a set of records of products, which included the price of the product and its type. I produced a subset of my data which included records of a particular type, whose price was greater than a specified amount, and indexed it on the price key in order to inspect the records in ascending order of price. However, as price was of course a numeric field, I could only persuade QUERY to display a record to get started if I knew the exact price of at least one product. Once begun, one can scroll forward and backward through the file at will. But it does put rather a premium on understanding exactly how selection and indexing interact with the display procedures to get the desired effect.

The only alternative to indexed access for screen display is to use one of the printing programs to display on the screen instead. However, diverting printed output to the screen can only be done by changing an entry in LOCATE. SYS. and that affects all the printing routines until the entry is changed back again.

Reporting on your data

FMS80 provides two ways of getting printed reports on files. One is a 'quick and dirty' routine, which simply prints each record using the item titles given in the data description file. The more sophisticated REPORT program involves setting up a report definition file to describe the layout needed for a particular report. These definitions can be reused and edited as necessary — a great time-saver. As is common with such facilities, the layout of the printed page is described in terms of absolute row and column numbers, so that it is a bit tricky to insert new items in the middle; the screen definition facility used with TRANSACT and QUERY describes the screen in the same way. The report generator uses a quite sophisticated set of accumulation procedures, enabling you to produce reports consisting of accumulated totals, or reports which print parts of each record and give summary totals at break-points in the records. This is particularly valuable where you have several subsets of data — information about, say, people in several different departments in a company. You can supply headings or titles for anything you can print.

Like most FMS80 facilities, the report generator can be invoked via one of the menus within FMS80, or direct from CP/M. When run from CP/M, you may specify an index file rather than a data file as the 'subject' of the report, and your report will appear in the order specified by that index. In either method of running, if there is a selection file (specifying a subset of the data) which has the same name as the report definition file, it will automatically be used and the report prepared using that subset.

Selecting sets of records

I've mentioned the selection facilities already : you can set up a file containing a set of selection criteria to be applied to a data file before it is processed by the programs which produce printed reports, sorted files and subfiles. Depending on the circumstances, the selection is used to select records for processing or actually to produce a file containing the required subset. Selection is done by combining tests into groups to give the effect of bracketing, with the ability to apply AND and OR tests between groups. Individual fields can be selected if equal to a constant (not another field in the record) or within a range of values. You can't edit a selection definition — if you give the editor the name of an existing selection file, it simply reuses the file without telling you.

Sorting records

The sorting procedure can be used either to sort a complete file, or to sort

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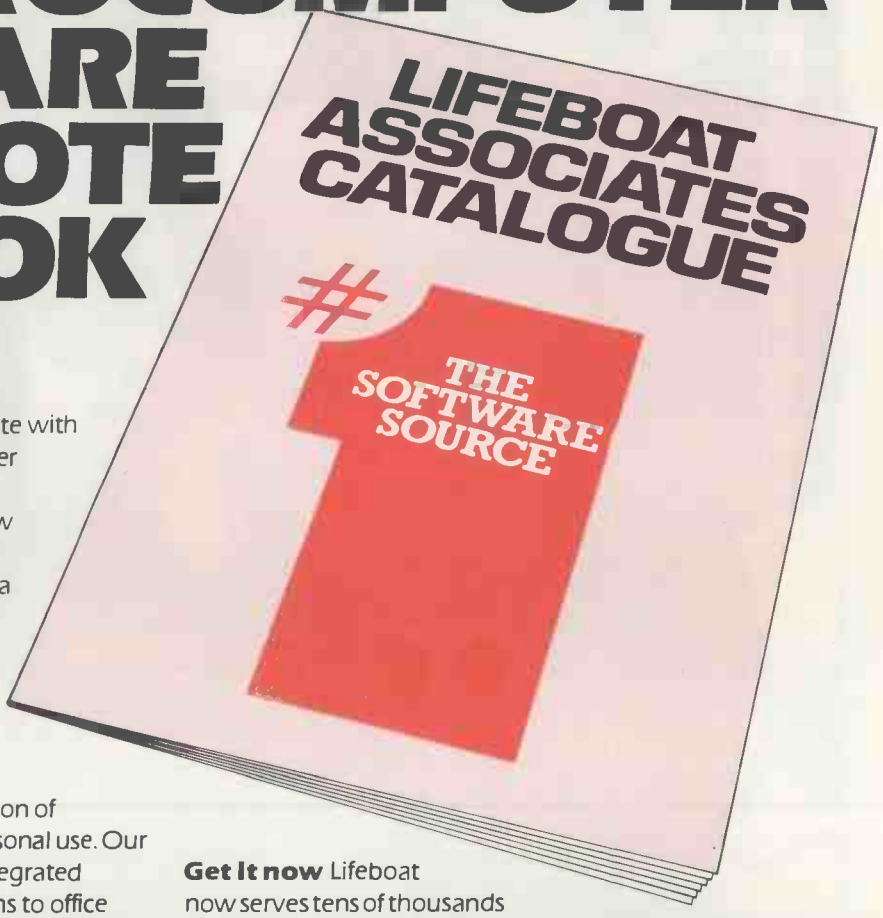

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FMS80

a particular index. Sorting may be in ascending or descending order, on any combination of fields in a record, but these must be complete fields — you can't for instance, sort on the first three characters of a field when sorting a data file. In most circumstances, it is sufficient to produce a sorted index and use that to access the data file. Indexing and sorting are related facilities but are not explicitly tied together in most circumstances. I got in quite a muddle early on by not realising this — the fact that the procedure to set up a control file for indexing and sorting purposes is called DEFSORT doesn't help — and accessed a file via QUERY which I had indexed, but I had not sorted the index. As a result, QUERY couldn't find large chunks of my file, much to my consternation! A user would be well advised to set up a command file to tie the two together — a simple and flexible process.

Calculations

Manipulation of totals and fields can be done readily and flexibly within the report generator, provided you don't mind doing arithmetic without brackets — perhaps in most commercial applications this wouldn't be a serious problem. If you want to calculate changes of fields within records and store these changes — you might, for instance want to increase all your prices by 5% — then you must write a short EFM program to do it. I found this quite straightforward to accomplish.

Security

The modular structure of FMS80 makes it quite a simple matter to build subsets of the facilities so that people have access only to the functions they need, as well as just the data files they need. As far as the access to data is concerned, there is no password protection for data files, but you can have people use the query facilities via the special screen masks which let them see only the data items you want them to see, The need to specify keys fairly exactly, which can, as I've noted, be a nuisance for the data manager, becomes a virtue in helping to curb unauthorised access to confidential data.

Tailoring

The facilities for tailoring FMS80 to meet the user's special needs are among the best I've seen in standard packages. There are three reasons for saying that. Firstly, there is the programming language EFM, which has a Basic flavour — but has statements specially designed for data management applications. EFM allows you to have up to 19 files in use at once, so you could use a field in records in one file to index records in another. Files can be read sequentially, or by using indexes built by FMS80. There are three types of conditional statement (although you can't nest the IF... THEN... ELSE type) and you can make use of existing FMS80 files such as file descriptions to speed up data declaration. There are a few nuisance points — you must have an input file and an output file statement, even if they're null; you can't use brackets or decimals in arithmetic; and fields are, as everywhere in FMS80, referred to by number which makes it difficult to make minor changes. A more serious deficiency is the absence of parameters for subroutines. But I have yet to think of something I might want to do to my data that I couldn't accomplish in EFM, albeit with some juggling in some cases. I also found it easy to use; I never took more than two runs to get a program compiled, and they all ran correctly first time, which is a personal all-time record. I don't know, though, how someone with no programming experience would get by — I found the tutorial on EFM much harder to understand than the reference chapter, mainly because it dived straight in to examples without giving me any idea of EFM's purpose or structure.

The other tailoring features I haven't yet mentioned are the user-supplied menus and the command files. You can add complete menus of your own to FMS80, and use them to call up not only FMS80 functions but also other CP/M programs as well. So you could have a menu which used FMS80 to set up a subfile in a particular format (using EFM) and then invoke WORDSTAR, say, to send those selected people a standard letter. The command facility allows you to set up a file of FMS80 commands for use either from CP/M or from user-defined or FMS80 menus, and gives the ability to substitute parameters, such as file names, when the command file is invoked.

User image

I have distinctly mixed feelings about the user-friendliness of FMS80 — 'tries hard' about sums up my overall reactions. My main problem was the lack of any attempt in the documentation to give a model of the way the package worked, a peg on which to hang the detailed information about the facilities. There were lots of examples in the tutorial sections of the manual, and also drawings of what the screens looked like, both essential features. But, after the tutorials, the manual dives straight into the reference material, which consists of a description of each element of FMS80 in alphabetical order — so some feeling for structure is essential by then. The manual also had several Application Notes, which I found quite helpful, but they were much more Function than Application oriented, and I thought a user would have some trouble relating them to real problems. However, the manual did appear to be comprehensive, itself not a universal trait — I did manage to find pretty well everything I needed to know by reading it carefully. The package itself provides an overall menu, from which one accesses three sub-menus dealing with different functions. They were divided rather arbitrarily, and I sometimes found it hard to remember where a particular facility was. A diagram showing how the menus related would have been very helpful. Almost all the functions can also be invoked from CP/M, often giving access to a wider variety of facilities within the program in that case. That makes it easy for new users to get started with the menus, then to move on to greater sophistication as they become experienced — unusually considerate. All the menus are in capitals, which I don't like — and nor do the reading buffs. I also found the frequency with which I was asked to confirm my responses a bit overpowering — confirmation needs to be used sparingly to avoid crying 'Wolf!'. There are several circumstances in which one must 'confirm with Y or N' on one line, and then on the next confirm with a file name or say 'no' by pressing RETURN. Several times I typed N then instead of pressing RETURN, and later found myself in trouble because the system tried unsuccessfully to locate a file called N!

Stability and reliability

FMS80 has been available in this country for some time but has not until recently been much publicised or supported, so there are few users as yet; in the States it is in widespread use, and the American reviews I've read speak highly of its reliability. Upgrades to the system come out from time to time, and are distributed to existing users at a cost, at present, of £35 — which includes, I'm told, a complete reissue of the manual. Support in this country is provided by Infodata, who have on the occasions I've telephoned them been extremely helpful and seem to know their product. As far as my own efforts to use the package are concerned, I didn't come across any complete failures in the system, though I did manage to find what seemed to be a bug in the sort routine, which didn't fail gracefully when I tried to sort out a file on a disk without enough space for the merged output.

Costs

FMS80 costs £640 for the complete package, supplied programs together with EFM, and some support and training. I understand that by the time you read this article it will be possible to buy just the supplied programs first, for about half this figure, and then add EFM if and when you need it. This should also ease the problem of having to document the two parts together, which results in a manual of somewhat intimidating size.

Conclusions

FMS80 might be called a Rolls-Royce at Rover prices; using EFM you can achieve most things you might need to do in data management if you had some programming ability, but if you buy the complete package it is among the most expensive data management packages on the market. I found some excellent facilities mixed in with rather poor presentation, and some areas in which the package of supplied programs was rather weak, notably the manipulation of numeric data. I would expect it still to be of more interest to the larger organisation wanting to tailor a package to suit a variety of applications, than to the very small concern without either specialist staff of its own or outside help to tailor the package to their needs.

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Banks Statement

A MACHINE FOR ALL SEASONS

Martin Banks speculates on the impact of Commodore's 64.

One of the minor inconveniences of writing for a monthly magazine like *PCW* is the time-scale involved in producing the beast. The words you read here were written towards the end of January, yet the mechanics of magazine production dictate that they do not appear until now.

This sometimes makes writing a trifle difficult, for occasionally something happens (or more specifically, looks as though it's about to happen) that is worthy of comment or prognostication at an early stage. By the time the words appear, however, the situation that prompted the prognostication may have changed.

That could well be the case with this month's subject: the first appearance of news about a new machine from dear old Commodore (which has surely been around long enough now to be promoted to Rear Admiral). The machine is called the Commodore 64 and it has been waved around at the Consumer Electronics Show in the USA. In Europe its first showing is expected at the Hanover Fair.

Now the problem is that information on the Commodore 64 — at the time of writing this — is somewhat scant and is likely to stay that way until the European launch, an event approximately coincident with the publication of this issue.

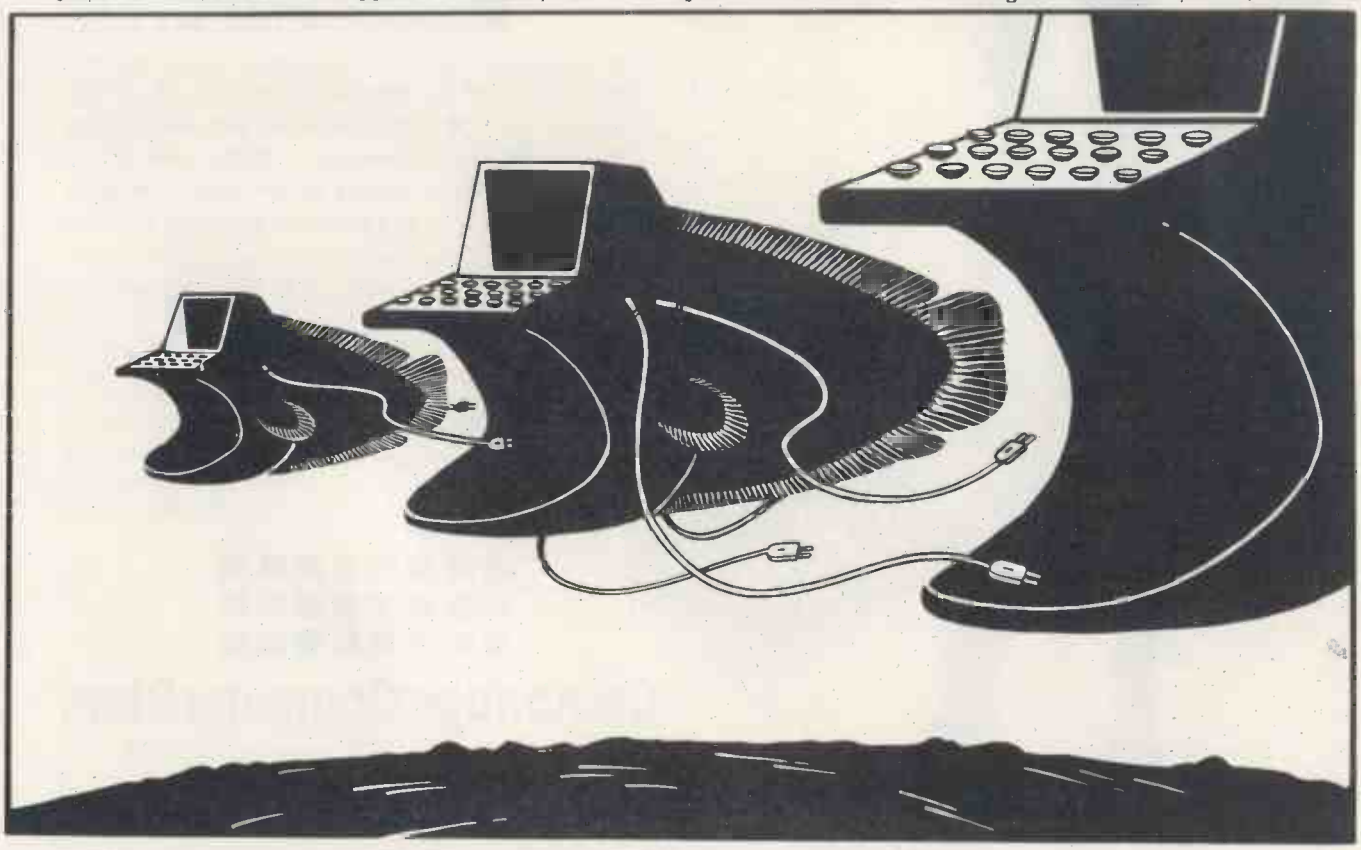
But even that would not be a problem in most normal circumstances, for what information there was available could be ignored until after the event and an article could be prepared then. Indeed, in most normal circumstances that is exactly what would happen. The Commodore 64, however, sounds interesting, both from what the early information suggests the company is trying to achieve and from the viewpoint of the company's products, post Chuck Peddle.

As most readers will by now be aware, the daddy of the Commodore PET, Chuck Peddle, left the company over a year ago to form his own show. That show is Sirius, a company that launched a comprehensive and competitively priced machine at the back end of last year. At the time of that launch, Chuck was questioned about his view of Commodore now he was outside the company. After all, since the PET, the company had come up with little in the way of internally developed new products, Most of the PET add-ons came from the approved-products scheme and even the VIC had strong Japanese ancestry.

His replies were interesting, especially in the light of recent events, 'Commodore management is primarily interested in shifting product,' Peddle said. He followed that with the prophecy that if the company chooses to stay with its predominantly low-end spectrum, it would continue to be around for a while.

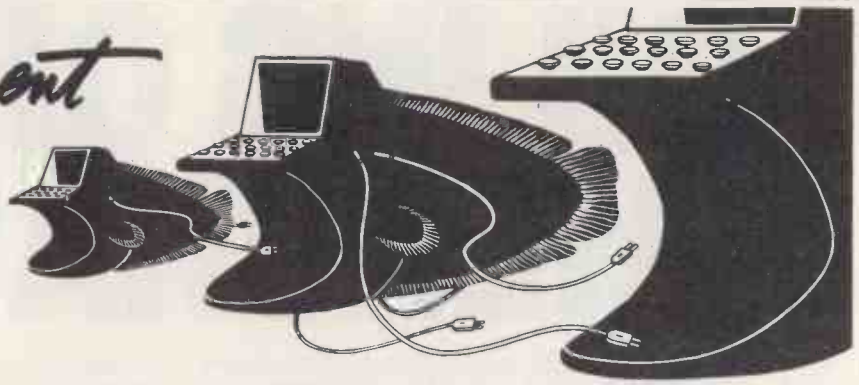
Well, recent developments from the company would tend to indicate that it does indeed intend to stay in the low end of the market place. The more long-term developments that the company appears to be making, moreover, will tend to keep it very much in the business of high volume sales — 'shifting product' as Peddle puts it.

The Commodore 64, on the current sparse information, does not sound spectacular, except for two points. One (almost of necessity) is price. In the US it will retail for $595 while providing a performance comparable to an Apple II retailing at around $1650. There is



COLIN HADLEY

Banks Statement



nothing amazing about that, really, for semiconductor technology is always driving down the price of systems, while maintaining their capabilities, or even pushing them up.

The second point is, in its own way, much more interesting and the previously mentioned comparison with the Apple II becomes more relevant, for the Commodore 64 can run Apple software. OK, so the software will have to be entered via the keyboard rather than from disk but Commodore reckons the necessary modifications for that function could be provided at negligible cost.

Why the hell should anyone stop at emulating just one type of system – why not the world?

Such 'negligible cost' means that it would be an easy step for Commodore to strike at the very heart of its great US rival, Apple, and produce a low-cost emulator of the Apple II that ran all the software available for the US market leader and that at a price that could seriously damage Apple financially. It is, for example, interesting to note how, since adopting Apple and others as the star stock market purchases of 1981, American stock analysts have rapidly become 'street-wise' enough to notice this possibility from within the Commodore announcement and bomb Apple's stock price by $2 in a single day.

Commodore apparently says that it has no plans to do that small thing, ever. Instead the company would appear to be after bigger fish. 'Bigger' in this context might sound derogatory towards Apple and as such this is not intended. Rather 'bigger' refers to the whole damned microcomputer business, which now includes some other minor inconsequential companies like IBM.

For Commodore would appear to have latched on to the obvious idea that once you have learned *how* to emulate another type of microcomputer system and found a *way* of achieving the emulation that is both simple and inexpensive, then why the hell should anyone stop at just emulating one type of system? Why not emulate the world — or at least all the relevant bits of it such as Apple, IBM, Tandy, Sharp, NEC or anything else you fancy?

In hardware terms this is now becoming a relatively easy task. Several people in this country have been looking seriously into the possibilities of doing it, and products in this area may well appear in the near future.

The key appears to be the use of gate arrays — that group of microelectronic devices that allows circuit designers to produce economically a whole range of sexy custom-design devices for whatever they want to achieve (this was covered by the 'Statement' of October last year). The arrays provide a very useful facility for the system designer who wishes to emulate another machine; for there are several ways of doing this trick, and many problems to be overcome. That facility is convenience.

The two main options facing the designer are : a) use bit-slice processors and microcoding to emulate the instruction set of the emulatee; and b) interface the main system processor with the same system processor as the emulatee. The first route is often the more elegant, and one followed by many of the minicomputer manufacturers to emulate their own products. Its major drawback is that microcoding instruction sets is an extremely complex black-art, and is not really feasible for emulating a range of different machines. The second route is better, because the emulatee processor(s) can be mounted on a circuit board, plugged into the main board of the basic system and away you go. Well, in theory anyway, for the two beasts have to be interfaced, and that means a gate array.

There are many subsidiary problems to be overcome after this decision has been made, and the gate array approach has a part to play here as well. The main problem is where different systems — and especially different operating systems — usually expect to find I/O devices, of different types, at different locations. This means interfacing both at the software protocol level and at the hardware device level. Again, this is the the type of application for which gate arrays might have been invented.

It would appear that this is the route that Commodore has selected to follow. The Model 64 would seem to be the basic system for a new range of modular emulators that will almost certainly cover such systems as the Apple II, Trash-80 and the IBM Thingie. It would also appear that, as might be expected, the cost of each emulator will be fairly low — probably around the $1000 mark. Each emulator will be a module that plugs into the back of the Model 64 (or a variant/development of that basic machine). No doubt that machine will also have the capability for considerable memory expansion, for though the Model 64 has 64 kbytes of RAM, it also uses the new MOS technology 6509 processor chip which has on-board memory management that allows up to 256k to be addressed. The processor chip also has on-board RAM, suitable for running a small set of commonly used instructions at high speed. This would be an ideal facility to have for controlling the operation of an add-on emulator board.

Microcomputers ... would become akin to commodity items like a can of beans

As one US stock analyst has already observed, if Commodore actually goes through with what it appears (and is rumoured) to be planning, it could dramatically change the shape of the microcomputer business, for it would have at last brought the hardware side of it down to the level of becoming an irrelevance. Potential users would no longer have to suffer the agonies of choice between rival and incompatible systems — a choice that immediately governs what software can be used.

Microcomputers, or more especially the variety of system emulators, would become akin to commodity items like cans of beans or Intel 8080 processor chips.

Whether this is a good thing for the business in the long term is open to question. The implication of such a move for the hardware companies is that they would all have to follow suit if Commodore's efforts proved successful. Prices would be savaged in an orgy of competition until such time as every potential user in the world was no longer potential — they were actual.

Now if such systems are as reliable as we know microelectronics *can* make them, all of a sudden the manufacturers' market will disappear. For, apart from anything else, such emulators would essentially mean that any user buying the basic box (say at $500) plus Apple, Tandy and IBM emulator cards (at $1000 each) would effectively have *the* universal system from $3500.

The only option open to the manufacturers would be, horror of horrors, built-in obsolescence and failure.

There is, of course, a good side to all this. Any degree of universality in hardware, even if it is only achieved indirectly through emulation modules, will allow software writers the opportunity of forgetting about the problem of which machine to write an application for. It will no longer matter too much — and it will also mean that once a program has been written and debugged, it won't have to be rewritten (and re-debugged) to run on another make of system. Universality of hardware will lead to the universality of software, and, as software is the *real* key to everything in this business, that can be no bad thing.

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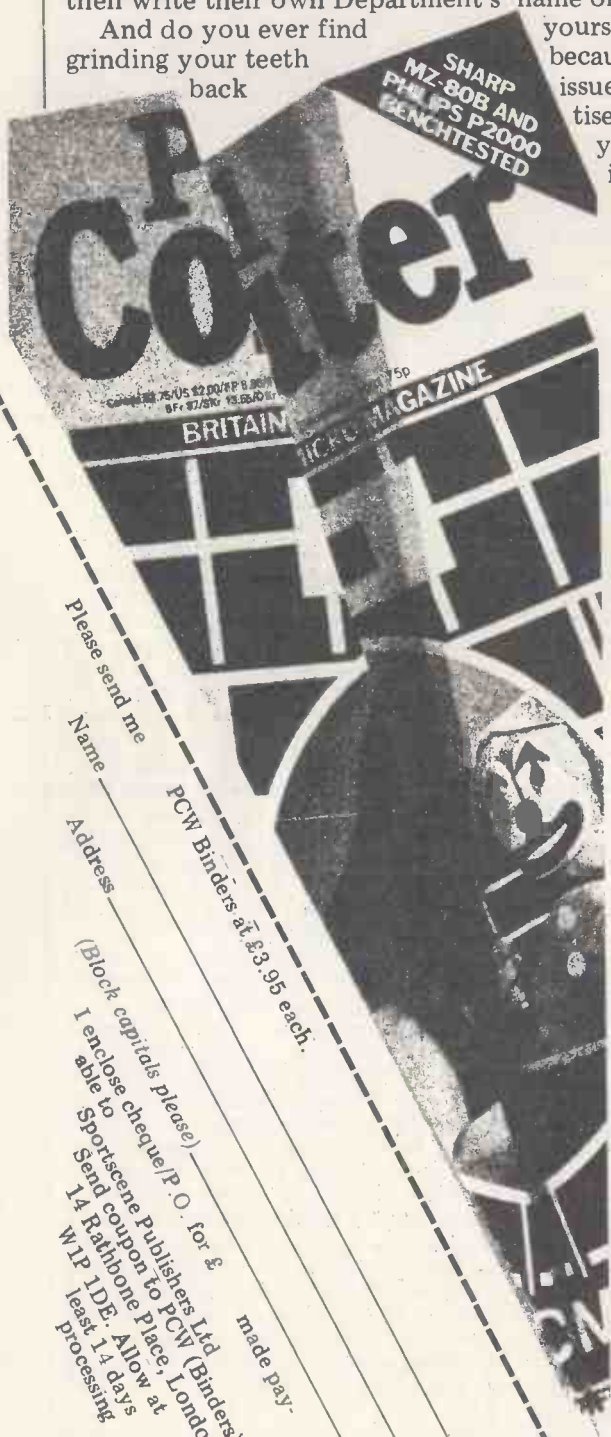

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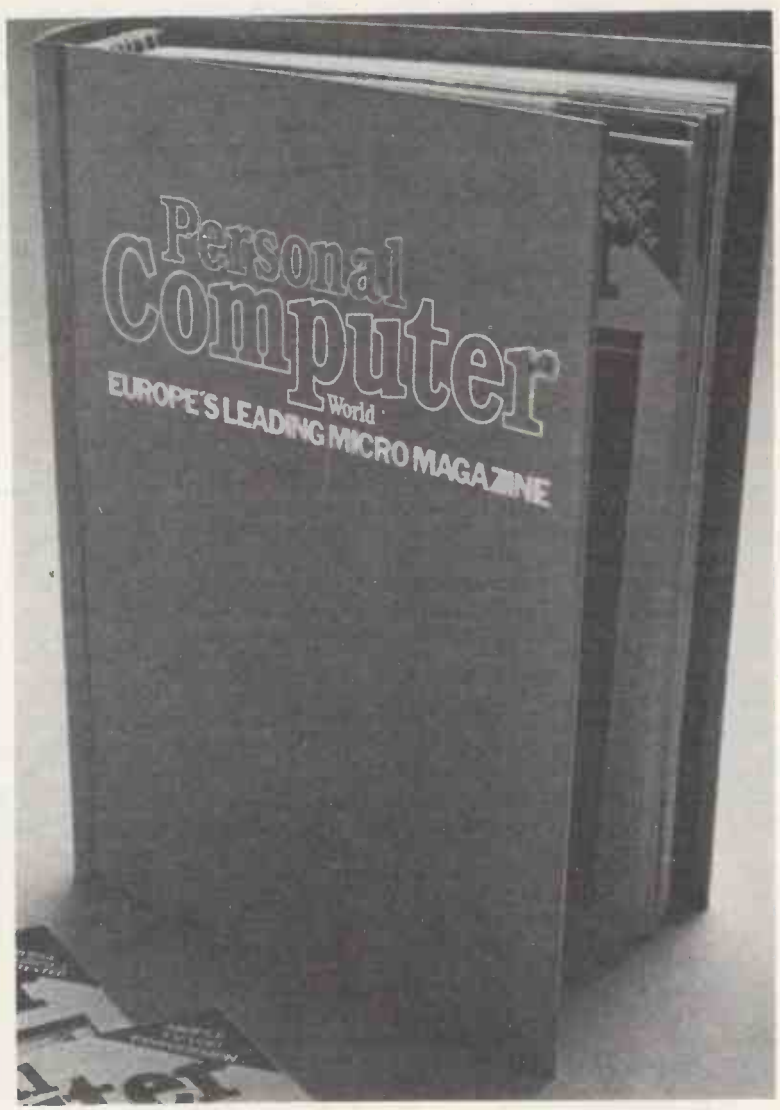

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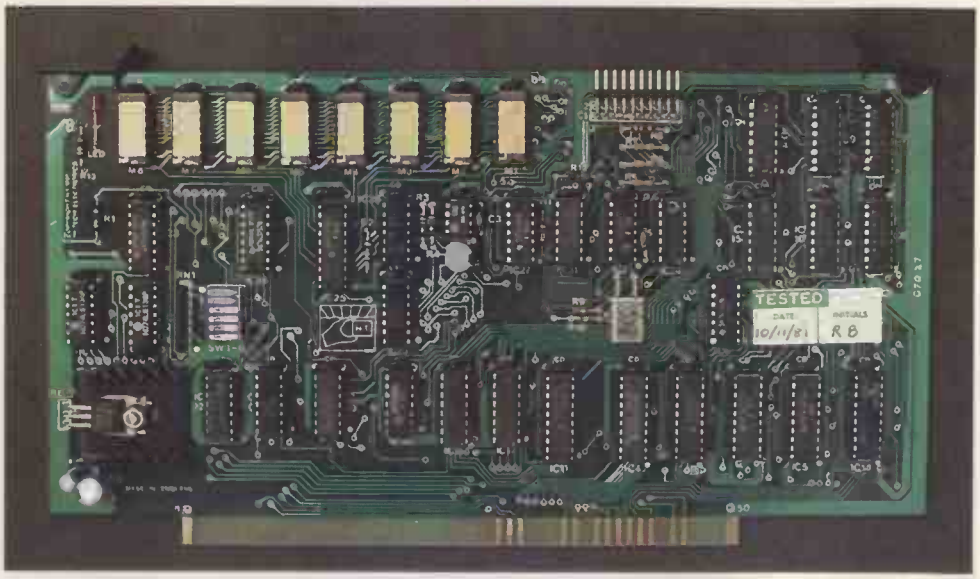


SID-1

COLOUR GRAPHICS BOARD

Steve Withers investigates a British S100 colour board

The latest addition to Hi-Tech Electronics' range of S100 cards is a high resolution ((312 x 290) colour graphics board. Each pixel is individually controllable, allowing full use of the eight colours available — red, green, blue, magenta, cyan, yellow, black and white.

Hardware

An interesting feature of SID (Simple Image Display) is that it may be programmed for different TV standards (eg, 525 or 625 lines), avoiding the need for a separate export version of the board. This information is stored in 64k of memory (8 x 4164 chips) along with the data for the display itself. Two pixels are stored in each byte of memory: three bits for each pixel selecting the red, green, and blue signals, while the seventh and eighth bits control flashing and blanking respectively.

It is essential to use a colour monitor with SID, as a television set cannot cope with the resolution of the device. The board provides both TTL and analogue video and sync signals from a 20-way connector mounted at the top of the PCB, as well as an interface for a standard (black and white) screen dump printer. Unfortunately, the mating connector does not have a polarising key and pin 1 is not very clearly marked, so it is very easy to plug it in the wrong way round. In the end I traced the conductors of the ribbon cable to the plug at the monitor in order to check the orientation. Both a colleague and I felt that the cable 'looked wrong' when it was correctly fitted, so perhaps it was fortunate that I took so much care. Apart from this minor difficulty, installation was a simple plug-in job.

The board is accessed through three consecutive ports, and so does not occupy any of the processor's memory space. The port addresses are selected by setting six switches. As there are six, rather than eight, switches it follows that they set the addresses to four port boundaries (eg, the base port may be set to 10 hex, but not 11, 12, or 13).

Two of the ports are used to address a particular byte in the display memory, while the third is the (bidirectional) data port. Whether reading or writing to the board, it is the writing of the low byte of the address to the 'base' port which activates the access circuitry. If, immediately prior to this, a byte had been written to the data port, then that byte is written into the addressed display memory location, otherwise the content of the location is placed on the port from where it may be read. If the most significant bit is set when writing to the board a flag is set in the port to indicate when the display has entered frame blanking. This allows the driving program to ensure that it only accesses the display memory during the intervals between successive scans of the picture, avoiding the 'snow' which would otherwise occur.

Although the nominal resolution of the display is 312 x 290 , the circuit is designed to produce an image which completely fills the screen, so a substantial number of points are lost. The largest fully visible rectangle I was able to draw measured 273 x 256. Due to the curved edges of the screen, it is possible to draw slightly longer lines in the centre of the display: 293 pixels horizontally and 287 vertically. For text display (achieved through software) a Hi-Tech leaflet suggests that 28 rows of 52 characters may be shown, while I found the limit to be 33 lines of 45 characters. The implication of this text capacity is that with the appropriate software it would be possible to use the board to emulate a Viewdata/Ceefax display.

Software

Software support is available for Microsoft Basic, Fortran, and Pascal (the first two were used in this review). This consists of a set of assembler language routines (approximately 500 lines of unannotated source code) which carry out functions like plotting points

SID 1 COLOUR GRAPHICS BOARD

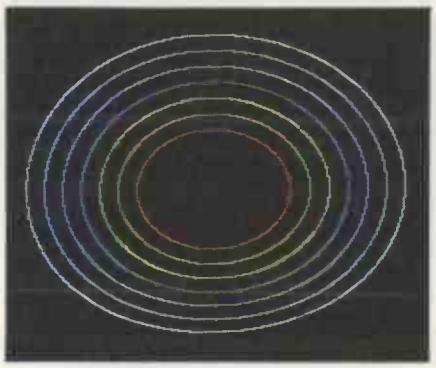
or lines, drawing ASCII characters and filling rectangles with a specified colour (a complete list of these functions is given in Table 1). Most of the functions work as fast as the eye can follow, but there are three exceptions. INIT and BACK (initialise and clear background) both take about four seconds because they must write to each byte in the display memory — this low speed is the penalty to be paid for a port-mapped device, memory-mapped displays being much quicker. FILL (used to colour in a rectangular area) also takes a significant amount of time, depending on the size of the rectangle. I would suggest that very careful design and programming would be needed in order to produce a good video game using SID. It may even be that it is just not fast enough for games like ABM or Asteroids, but where small amounts of movement occur (Puckman, perhaps) there should be fewer problems.

A customised version of Basic, giving graphic commands, has been produced by Xitan for the North Star Horizon and the Comart Communicator, but this was not reviewed.

I found the software unsophisticated. As Table 1 shows, all the basic operations are catered for but additional programming will be required for most real applications. For instance, to display the value of a numeric variable in Basic, it is necessary to use the STR$( ) function to obtain the string representation of the number, then VARPTR ( ) to obtain the address of the string before the string output routine can be called. Why can't the routine just accept a string expression as the relevant parameter? The Fortran programmer has an even harder time, since he can only use that routine to output literal strings. While it would have been a straightforward task to write some Fortran subroutines which could do the job, I felt my time was better spent examining the product itself.

The point is that the production of software is an expensive business in time or money. If Hi-Tech had provided all the frills from the outset, the price of the board would be much higher. Instead it has developed a minimum useful subset and hopes to market software written by its customers to provide the higher-level functions as well as the complete application programs. A potential example is support for three-dimensional drawings with hidden line removal.

The disk I received contained several demonstrations written in Basic, plus a pair of machine code programs which save and reload the contents of the video memory to and from disk, each operation taking approximately 10 seconds. As no compression techniques are employed, each picture file occupies 64k of disk space. This could be improved upon without excessive complication, but is it really worth the effort? If one wanted to set up an electronic slide show, the answer would be yes, but the only use I made of these programs was to store certain displays in order to save the time during the photographic session.



Conclusion

SID 1 generates good quality, high resolution colour images. It has a flexibility not always found with this type of device, in that it may be programmed for 625 or 525 line monitors, as well as providing analogue and TTL signals. My one concern is that most users will find they need to augment the software with their own routines for what may seem to be basic functions.

Because SID is a single S100 board, it is far cheaper than a colour terminal of similar specification, even when the price of a monitor is included in the calculations. With the growing awareness of the advantages of graphics (especially with colour) for communicating business and technical information, I am sure SID has a bright future.

Prices

SID 1	£390
Colour monitor (13in diagonal)	£328
'Package deal' (both items)	£689

MBasic	Fortran	Description
0	INIT	Initialise display, clearing to black.
1	SYNC	Re-write sync information, display memory unaffected *(I could not think why this would be necessary — SW)*
2	BACK	Fill screen with specified background colour.
3	POINT	Plot a point in specified colour at given coordinates.
4	CHAR	Draws a specified ASCII character in given colour at desired coordinates.
5	LINE	Given two endpoints, draws a line of specified colour.
6	STRING	Draws a string (in Fortran, string literal only) from given starting position, in specified colour.
7	FILL	Fills a rectangle in specified colour given coordinates of a pair of diagonally opposite corners.
8	READ	Reads the colour of the pixel at specified coordinates.

NOTES (quoted from manual)
All variables must be declared as integers. Any extra parameters are ignored. The origin for X,Y is the bottom left of the screen. Any out of range variables cause a return with no other effect.

Sample calls

Basic — CALL Z%(F%,C%,X1%,Y1%,X2%,Y2%)
Where
Z%=B000 hex
F%=5
C%=colour code eg, 1=red, 2=green
X1%,Y1%=coordinates of start of line
X2%,Y2=coordinates of end of line

Fortran CALL LINE (C,X1,Y1,X2,Y2)
Where
C=colour code
X1,Y1 and X2,Y2 = coordinates of endpoints

Table 1 — Function calls

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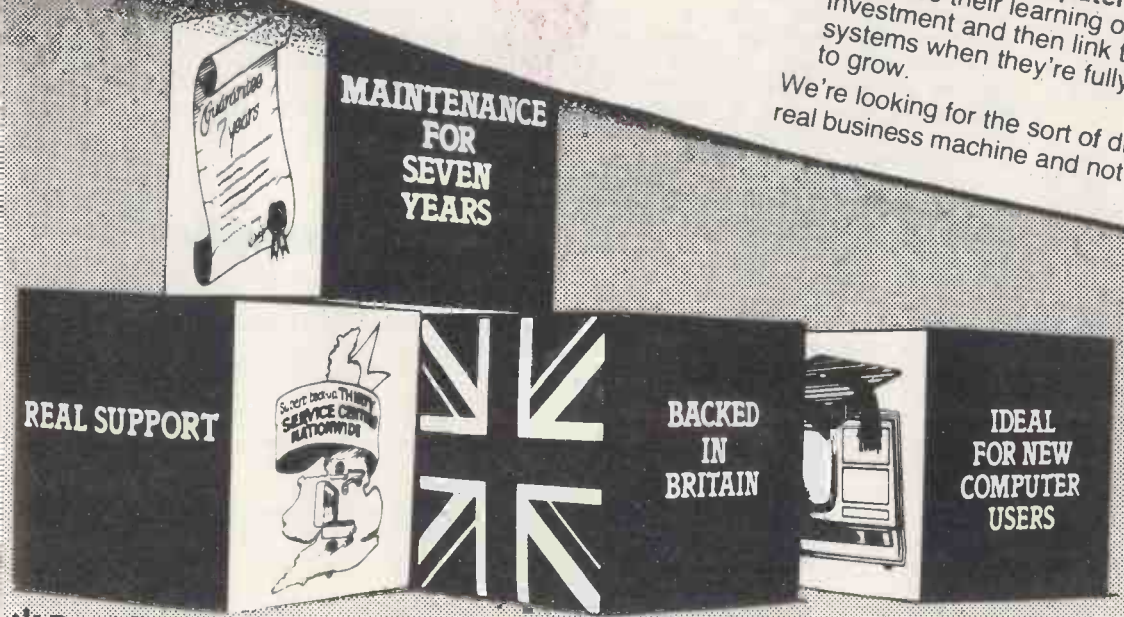

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FORMS:

A PROGRAM FOR DO-IT-YOURSELF DATA SCREENS

By Paul Overaa

Once you start developing programs that will be used by other people it becomes increasingly necessary to pay particular attention to the way you present information on the VDU screen. For programs that require a somewhat more professional-looking screen form appearance one approach is to have the various input forms stored apart from the programs that use them and then to produce the form when it is required by reading it from a disk file or other rapid storage/retrieval medium.

'Forms' is a simple text storage program designed to facilitate the design and storage of VDU display forms on the Hazeltine 1510 and other similar terminals with addressable cursor. The forms are stored in a compressed format and contain embedded cursor control characters. While Forms has been written for non-memory-mapped systems, sufficient detail has been given to enable similar programs to be written using any hardware/software configuration.

Forms produces a hard copy output of the designed form, showing the column and line positions being used. This enables rapid identification of possible data input areas.

Forms classifies a field as being any set of characters that are delimited by two or more spaces. Spaced field titles such as 'N A M E', etc, are thus classified as a single item and written as one field only.

The ASCII file produced may subsequently be read by applications programs to produce the form on the screen.

Benefits include:

1. An inherent standardisation in screen lay-out by virtue of a standard set of screen-forms being used. Since applications programs that set their screen-forms in this way are more compact, we also save on disk space.
2. Programs become easier to understand because they are uncluttered by screen set-up coding which is often messy.
3. Screen formats are changeable without altering the applications programs providing the data input areas remain invariant.

Forms version 1.1 supports the following cursor commands available on the Hazeltine 1510 terminal:

BACK-SPACE/LEFT-CURSOR
RIGHT-CURSOR
LINE-FEED
TAB
BACK-TAB (shift-TAB)
DOWN-CURSOR
UP-CURSOR
HOME-CURSOR
CLEAR-FROM-CURSOR-TO-END-OF-LINE (control CLEAR)

All printing characters including " (double quote) are supported, and the contents of the screen may be sent to the printer at any time during editing by using control Q.

Forms version 1.1 was written in Microsoft's Basic 80 running under CP/M version 1.4B. The following instructions assume that Forms has been placed on a suitable utilities diskette that auto-loads Basic 80 on power up. The terminal itself should have any wrap-around facility disabled to prevent scrolling once the bottom line of the screen has been filled (on Hazeltine 1510 the switch is under the front panel).

User instructions

'Forms' is brought into operation by:

1. Placing the library disk in Drive A: and the applications disk in Drive B.
2. Powering up or typing RESET if the interpreter is already loaded.
3. Typing RUN "FORMS"

Forms will ask for a form-name and this may be up to eight characters long. The name supplied should not be prefixed with the 'Drive B:' destination label and it should not have a CP/M extension name (see CP/M manual if in doubt).

Once a form-name has been entered, Forms will search the disk in Drive B: for the designated form. If found, the form will be loaded into the computer's working area and will be displayed on the VDU screen. If the form is not found on the disk in Drive B: it will be classified as a new form, a new file will be initialised and the screen will remain blank.

In both cases the cursor is positioned in the HOME (top left) position, and the program is ready to accept input.

All the keys designated in the introduction may be used to create and alter new or existing forms. The user should be aware that RETURN is used to signify the end of input and thus must *not* be used to skip lines during editing (use line-feed). If RETURN is inadvertently pressed the procedure to adopt is to allow the form to be stored and then re-run "FORMS", re-load the form in question and continue editing as required.

Control Q may be pressed at any time during the creation or editing of a form; and this will produce a hard copy of the screen contents in a numbered frame with the line numbers 0 to 23 at the sides of the form. Column numbers are shown at the top and bottom of the printed form and are limited to the MOD 10 equivalent due to character space limitations (see Figures 5 and 6.

Reading the forms

Each 'field' in the form is stored as the following sequence:

Hazeltine lead in character+Hazeltine DC1 Address Cursor command+Transmission value of X(column) coordinate +Transmission value of Y(line) coordinate+ Field String itself.

A simple LINE INPUT command followed by a PRINT statement will address the cursor and print the field in the correct screen position.

The applications program reading such a form will therefore have the following type of coding loop:

```
OPEN "I",1,FORM.NAME$
WHILE NOT EOF (1)
   LINE INPUT £1, FORM.FIELD$
   PRINT FORM.FIELD$
WEND
CLOSE 1
```

Program description

'Forms' has been designed using Warnier - Orr Techniques (see October *PCW*). The benefit of these techniques is that logically structured, easily readable programs are produced.

The general description in Warnier — Orr form is as follows:

The above general description tells us that Forms collects characters from the keyboard, ignores the Hazeltine lead in code (this may incidentally be TILDE or ESCAPE) and then either

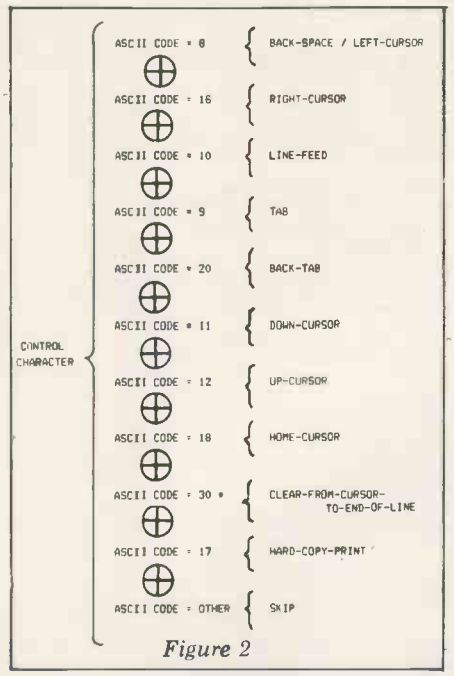

Figure 2

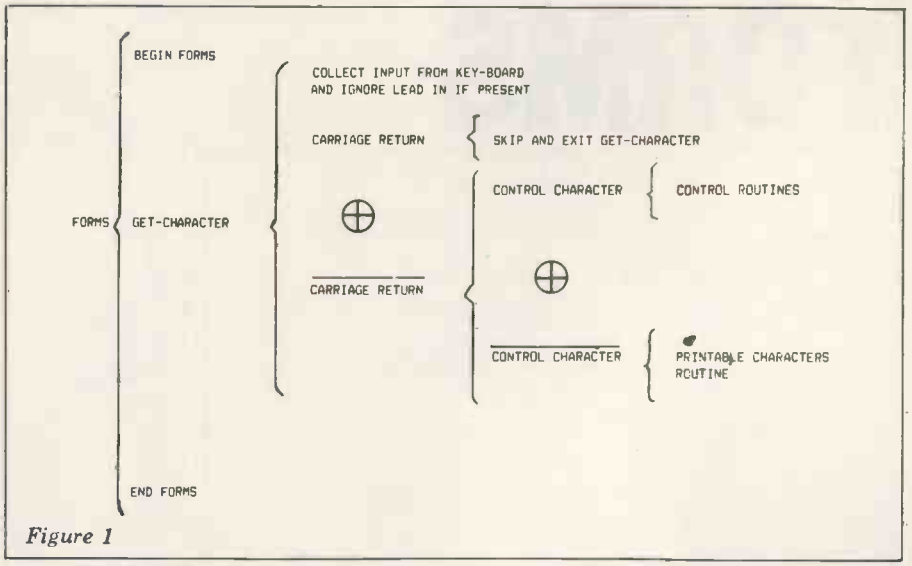

Figure 1

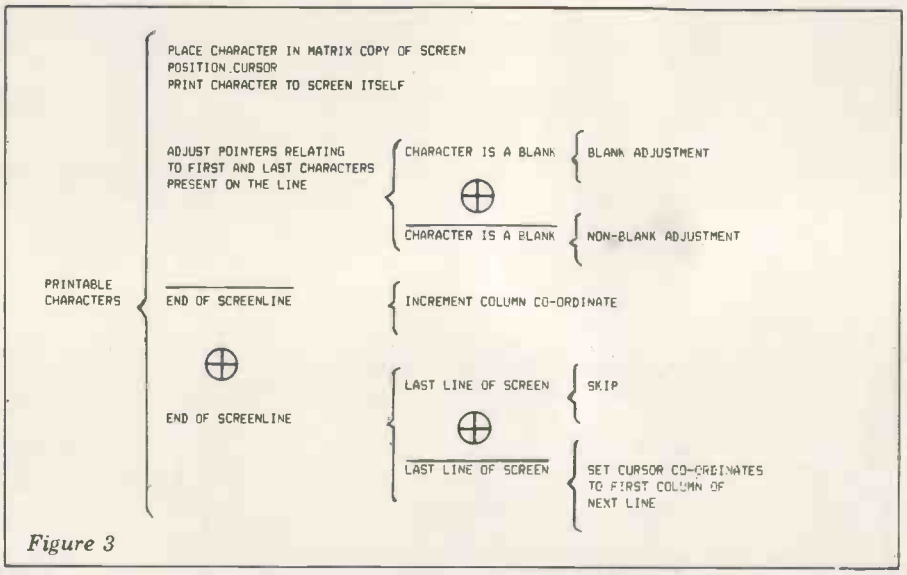

Figure 3

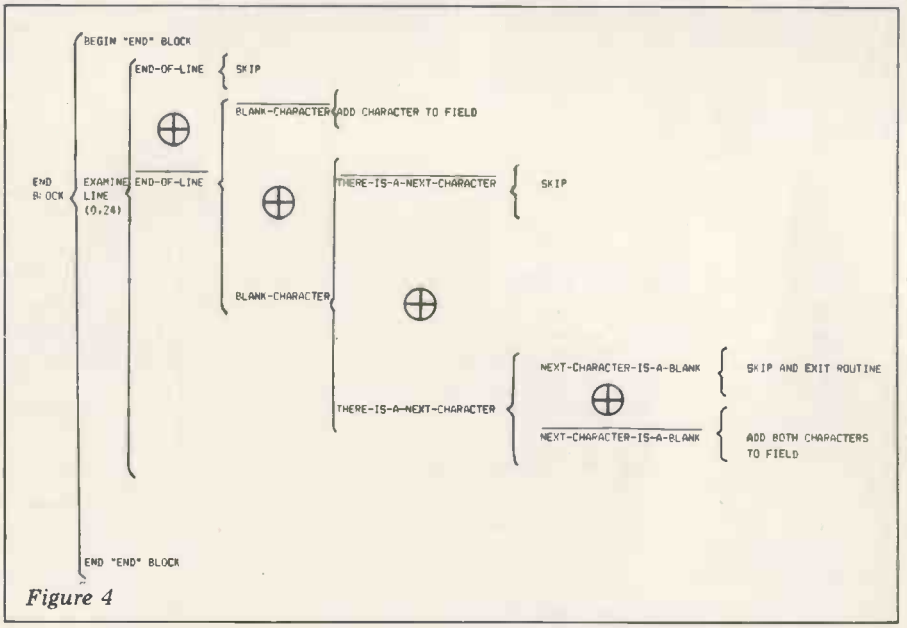

Figure 4

performs various control routines or performs a printable characters routine depending on whether or not a control character has been recognised. This process continues until a carriage character is detected.

Remember that these diagrams are read from top to bottom within each 'bracket' and that brackets to the right of a label indicate logical options related to that particular label. Remember also that a bar over an option represents the logical opposite!

Mutually exclusive operations are separated by the ⊕ sign and in these cases only one of the operations will be performed. As an example, if we collect a character from the keyboard and it is not a carriage return then it can be one of two character types: a control character in which case a control routine is performed; a 'non' control character, ie, a 'printing' character in which case a printable characters routine is performed.

The Warnier - Orr description of the control routines is perfectly straightforward. All options are mutually exclusive as would be expected (Figure 2). In the finished program each of the 'brackets' in Figure 2 will correspond to a particular subroutine.

In the final program the subroutines will be selected on the basis of the ASCII value of the input control character. On my Hazeltine terminal pressing control and clear together (which is the end of line function) generated ASCII code 30. According to the manual, control and clear should produce ASCII code 15. The solution was to look for ASCII-30 but then print the correct ASCII-15 code to actually clear the line.

The Warnier - Orr description of the printable characters routine is shown in Figure 3.

You will see in Figure 3 that we keep track of the first and last screen positions that have been used on each line. This enables us to reduce the time taken for storing the form in the finished program.

Probably the least obvious block of code in the finished program is the END block. It is the function of this block to analyse the screen contents, to isolate each individual field of characters and then write the field to the ASCII file, together with the cursor control information. This is done by searching each line that has been written between limits set by pointers that in the finished program are the variables called: FIRST.WRITTEN.TO%() and LAST.WRITTEN.TO%().

In Figure 4 the Warnier - Orr description of the END block is given. When you examine the final coding you will find it useful to refer back to figure 4 if there are any points about which you are uncertain. The variable SCREENFIELD $ is used in the END block coding to build up the field mentioned in Figure 4. ▶

(NB Forms is not connected in any way with the Micro Focus product FORMS II.)

FORMS

```
10 REM ===========================================================
20 REM                  PROGRAM NAME...."FORMS.BAS"....version 1.1
30 REM ===========================================================
40 REM                  BEGIN - FORMS - BLOCK
50 REM -----------------------------------------------------------
60 CLEAR:WIDTH 255:WIDTH LPRINT 255'Line Feed - Carriage Return are suppressed
70 LEAD.IN%=126'Select Tilde as lead in
80 PRINT CHR$(LEAD.IN%);CHR$(28)'Clear screen
90 DIM SCREEN$(81,25)'Holds image of screen plus an outside frame filled below
100 DIM FIRST.WRITTEN.TO%(24),LAST.WRITTEN.TO%(24)
110 FOR I%=1 TO 24:FIRST.WRITTEN.TO%(I%)=81:LAST.WRITTEN.TO%(I%)=0:NEXT I%'Initialise
120 FOR I%=1 TO 80:SCREEN$(I%,0)="-":SCREEN$(I%,25)="-":NEXT I%
130 FOR I%=1 TO 24:SCREEN$(0,I%)="|":SCREEN$(81,I%)="|":NEXT I%
140 FOR I%=1 TO 80:FOR J%=1 TO 24:SCREEN$(I%,J%)=" ":NEXT J%:NEXT I%
150 SCREEN$(0,0)="+":SCREEN$(81,0)="+":SCREEN$(0,25)="+":SCREEN$(81,25)="+"
160 X%=3:Y%=2:GOSUB 1380'Address cursor
170 PRINT"F O R M  -  U T I L I T Y  -  P R O G R A M"
180 X%=3:Y%=3:GOSUB 1380'Address cursor
190 PRINT STRING$(70,61)
200 GOSUB 1440'Getname subroutine
210 PRINT CHR$(LEAD.IN%);CHR$(18);:'Home cursor
220 X%=1:Y%=1'Initialise cursor co-ordinates
230 REM ===========================================================
240 REM                  GET - CHARACTER - BLOCK....with carriage return exit
250 X$=INPUT$(1):IF ASC(X$)=LEAD.IN% THEN X$=INPUT$(1)
260 WHILE ASC(X$)-13'<>0
270             GOSUB 700
280             X$=INPUT$(1):IF ASC(X$)=LEAD.IN% THEN X$=INPUT$(1)
290 WEND
300 REM ===========================================================
310 REM                  END - FORMS - BLOCK
320 REM -----------------------------------------------------------
330 OPEN"O",1,FORM.NAME$
340 FOR J%=1 TO 24
350 IF FIRST.WRITTEN.TO%(J%)=81 THEN GOTO 470'skip over lines that have not been written to
360 FOR I%=FIRST.WRITTEN.TO%(J%) TO LAST.WRITTEN.TO%(J%)
370 IF ASC(SCREEN$(I%,J%))=32 THEN GOTO 460'skip over blanks between fields
380 SCREENFIELD$=""
390 X%=I%-1:Y%=J%-1+96:IF X%<32 THEN X%=X%+96'prefered transmission values
400 FLAG%=1'Force entry into loop that will isolate all fields on a line
410 WHILE FLAG% AND I%<=80'note automatic exit at END-OF-THE-LINE
420 IF ASC(SCREEN$(I%,J%))=32 THEN GOSUB 520 ELSE GOSUB 620'is character a blank or not
430 WEND
450 PRINT #1,CHR$(LEAD.IN%)+CHR$(17)+CHR$(X%)+CHR$(Y%)+SCREENFIELD$'write details to file
460 NEXT I%
470 NEXT J%
480 CLOSE 1:RESET:END
500 REM -----------------------------------------------------------
510 REM                  BLANK - FOUND
520 IF I%<80 THEN GOSUB 560 ELSE I%=I%+1
530 RETURN
540 REM -----------------------------------------------------------
550 REM                  BLANK - FOUND - BUT - THERE - IS - A NEXT - CHARACTER
560 IF ASC(SCREEN$(I%+1,J%))=32 THEN I%=I%+2:FLAG%=0:RETURN'end of field located so force exit
570 SCREENFIELD$=SCREENFIELD$+SCREEN$(I%,J%)+SCREEN$(I%+1,J%)
580 I%=I%+2
590 RETURN
600 REM -----------------------------------------------------------
610 REM                  NON - BLANK - CHARACTER - FOUND
620 SCREENFIELD$=SCREENFIELD$+SCREEN$(I%,J%)
630 I%=I%+1
640 RETURN
650 REM ===========================================================
660 REM                  DO - NOTHING - SUBROUTINE
670 RETURN
680 REM ===========================================================
690 REM                  CONTROL - CHARACTER - DETECTION - SUBROUTINE
700 IF ASC(X$)>31 THEN GOSUB 740 ELSE ON ASC(X$) GOSUB 670,670,670,670,670,670,
670,960,1040,1000,1140,1180,670,670,670,1100,1790,1220,670,1260,670,670,670,670,670,
670,670,670,670,1310,670
710 RETURN
720 REM ===========================================================
730 REM                  PRINTABLE - CHARACTERS - SUBROUTINE
740 SCREEN$(X%,Y%)=X$
750 GOSUB 1380'Address cursor
760 PRINT X$;:
770 GOSUB 820'Adjust Pointers
780 IF X%<80 THEN X%=X%+1 ELSE IF Y%<24 THEN X%=1:Y%=Y%+1
790 RETURN
800 REM -----------------------------------------------------------
810 REM                  ADJUST - POINTERS
820 IF ASC(X$)=32 THEN GOSUB 860 ELSE GOSUB 910
830 RETURN
840 REM -----------------------------------------------------------
850 REM                  BLANK - ADJUSTMENT
860 IF X%=FIRST.WRITTEN.TO%(Y%) THEN FIRST.WRITTEN.TO%(Y%)=X%+1
870 IF X%=LAST.WRITTEN.TO%(Y%) THEN LAST.WRITTEN.TO%(Y%)=X%-1
880 RETURN
890 REM -----------------------------------------------------------
900 REM                  NON - BLANK - ADJUSTMENT
910 IF X%< FIRST.WRITTEN.TO%(Y%) THEN FIRST.WRITTEN.TO%(Y%)=X%
920 IF X%>LAST.WRITTEN.TO%(Y%) THEN LAST.WRITTEN.TO%(Y%)=X%
930 RETURN
940 REM ===========================================================
950 REM                  BACK - SPACE - CURSOR - SUBROUTINE
960 IF X%>1 THEN X%=X%-1:GOSUB 1380'Address cursor
970 RETURN
980 REM -----------------------------------------------------------
990 REM                  LINE - FEED - CARRIAGE - RETURN - SUBROUTINE
1000 IF Y%<24 THEN X%=1:Y%=Y%+1:GOSUB 1380'Address cursor
1010 RETURN
1020 REM ----------------------------------------------------------
1030 REM                  MOVE - CURSOR - TO - NEXT - TAB - SUBROUTINE
1040 IF X%>72 THEN RETURN
1050 X%=(X%-X% MOD 8)+9
1060 GOSUB 1380'Address cursor
1070 RETURN
1080 REM -----------------------------------------------------------
1090 REM                  ADVANCE - CURSOR - SUBROUTINE
1100 IF X%<80 THEN X%=X%+1:GOSUB 1380'Address cursor
1110 RETURN
1120 REM -----------------------------------------------------------
1130 REM                  DOWN - CURSOR - SUBROUTINE
1140 IF Y%<24 THEN Y%=Y%+1:GOSUB 1380'Address cursor
1150 RETURN
1160 REM -----------------------------------------------------------
1170 REM                  UP  - CURSOR - SUBROUTINE
1180 IF Y%>1 THEN Y%=Y%-1:GOSUB 1380'Address cursor
1190 RETURN
1200 REM -----------------------------------------------------------
1210 REM                  HOME - CURSOR - SUBROUTINE
1220 X%=1:Y%=1:GOSUB 1380'Address cursor
1230 RETURN
1240 REM -----------------------------------------------------------
1250 REM                  BACK - TAB - SUBROUTINE
1260  IF X%>1 THEN IF X% MOD 8 =1 THEN X%=X%-8 ELSE X%=X%-X% MOD 8+1
1270 GOSUB 1380'Address cursor
1280 RETURN
1290 REM -----------------------------------------------------------
1300 REM                  CLEAR - LINE - FROM - CURSOR - SUBROUTINE
1310 IF LAST.WRITTEN.TO%(Y%)>X% THEN LAST.WRITTEN.TO%(Y%)=X%
1320 GOSUB 1380'Address cursor
1330 PRINT CHR$(LEAD.IN%);CHR$(15);:
1340 FOR I%=X% TO 80 : SCREEN$(I%,Y%)=" ":NEXT I%
1350 RETURN
1360 REM ===========================================================
1370 REM                  ADDRESS - CURSOR - SUBROUTINE
1380 SCREENLINE%=Y%-1+96
1390 IF X%<32 THEN SCREENCOLUMN%=X%-1+96 ELSE SCREENCOLUMN%=X%-1
1400 PRINT CHR$(LEAD.IN%);CHR$(17);CHR$(SCREENCOLUMN%);CHR$(SCREENLINE%);:
1410 RETURN
1420 REM ===========================================================
1430 REM                  GET - NAME - SUBROUTINE
1440 X%=3:Y%=10:GOSUB 1380'Address cursor
1450 LINE INPUT"Please enter form-name.............. ";FORM.NAME$
1460 FORM.NAME$="B:"+FORM.NAME$
1470 PRINT CHR$(LEAD.IN%);CHR$(28)'clear screen
1480 ON ERROR GOTO 1700
1490 REM -----------------------------------------------------------
1500 REM                  FILE - EXISTS - SUBROUTINE
1510 OPEN"I",1,FORM.NAME$
1520 WHILE NOT EOF(1)
1530             LINE INPUT #1,SCREENFIELD$
1540             PRINT SCREENFIELD$;:'Already has lead in, etc.
1550             X%=ASC(MID$(SCREENFIELD$,3,1)):X%=X% MOD 96:X%=X%+1
1560             Y%=ASC(MID$(SCREENFIELD$,4,1)):Y%=Y% MOD 96:Y%=Y%+1
1570             SCREENFIELD$=MID$(SCREENFIELD$,5)'all characters from 5th to end of string
1580             FOR I%=1 TO LEN(SCREENFIELD$)
1590             SCREEN$(I%+X%-1,Y%)=MID$(SCREENFIELD$,I%,1)
1600             NEXT I%
1610             IF FIRST.WRITTEN.TO%(Y%)>X% THEN FIRST.WRITTEN.TO%(Y%)=X%
1620             IF LAST.WRITTEN.TO%(Y%)<X%+LEN(SCREENFIELD$)
                 THEN LAST.WRITTEN.TO%(Y%)=X%+LEN(SCREENFIELD$)
1630 WEND
1640 CLOSE 1
1650 KILL FORM.NAME$+".BAK"'remove previous back-up copy
1660 NAME FORM.NAME$ AS FORM.NAME$+".BAK"'current copy becomes back-up copy
1670 RETURN
1680 REM -----------------------------------------------------------
1690 REM                  FILE - DOES - NOT - EXIST - SUBROUTINE
1700 IF ERL=1510 THEN CLOSE:OPEN"O",1,FORM.NAME$+".BAK":CLOSE:RESUME 1670'Dummy 1st kill file
1710 IF ERL=1650 THEN CLOSE 1:RESUME 1660'Back-up was not available
1720 ON ERROR GOTO 0
1770 REM ===========================================================
1780 REM                  PRINT - SCREEN - CONTENTS - SUBROUTINE
1790 LPRINT TAB(20) "SCREEN FORM DISPLAY TITLE.......";: CHR$(34);FORM.NAME$;CHR$(34):LPRINT
1800 LPRINT TAB(7);:
1810 FOR I%=0 TO 79:LPRINT USING"#";I% MOD 10;:NEXT I%:LPRINT'Upper line column numbers
1830 LPRINT TAB(6);:
1840 FOR J%=0 TO 25
1850 IF J%>0 AND J%<25 THEN LPRINT USING"##";J%-1;:
1860 LPRINT TAB(6);:
1870 FOR I%=0 TO 81:LPRINT SCREEN$(I%,J%);:NEXT I%
1900 IF J%>0 AND J%<25 THEN LPRINT USING"  ##";J%-1 ELSE LPRINT
1910 NEXT J%
1920 LPRINT TAB(7);:
1930 FOR I%=0 TO 79:LPRINT USING"#";I% MOD 10;:NEXT I%:LPRINT'Lower line column numbers
1950 RETURN
1960 REM ===========================================================
```

```
                    SCREEN FORM DISPLAY TITLE.......*B:EXAMPLE*

    0123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789
   +--------------------------------------------------------------------------------+
 0 |        S Y S T E M - T W O     Version 1.1 Copyright 1981                      | 0
 1 |        ==========================================                              | 1
 2 |                                                                                | 2
 3 |                                                                                | 3
 4 |                                                                                | 4
 5 |                                                                                | 5
 6 |        1: Alterations to Record Description Indexes                            | 6
 7 |                                                                                | 7
 8 |        2: Addition of Data to Current Input Files                              | 8
 9 |                                                                                | 9
10 |        3: Process all Current Valid Input File Items                           | 10
11 |                                                                                | 11
12 |        4: Generate Current System Validation Parameters Report                 | 12
13 |                                                                                | 13
14 |        5: Generate Current Input File Status Report                            | 14
15 |                                                                                | 15
16 |        6: Generate Statistical Reports                                         | 16
17 |                                                                                | 17
18 |        7: Return to CP/M operating system                                      | 18
19 |                                                                                | 19
20 |                                                                                | 20
21 |                                                                                | 21
22 |                                                                                | 22
23 |        PLEASE ENTER OPTION AND PRESS RETURN TO CONTINUE ----------)            | 23
   +--------------------------------------------------------------------------------+
    0123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789
```

Fig.5 A typical menu

```
                    SCREEN FORM DISPLAY TITLE.......*B:EXAMPLE2*

    0123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789
   +--------------------------------------------------------------------------------+
 0 |              S Y S T E M - T W O - D A T A - I N P U T                          | 0
 1 |              ========================================                          | 1
 2 |                                                                                | 2
 3 |                                                                                | 3
 4 |RECORD NUMBER:                                                                  | 4
 5 |                                                                                | 5
 6 |RECORD DESCRIPTION:                                                             | 6
 7 |                                                                                | 7
 8 |DESCRIPTION OF TEST          VALUE              VALIDATION COMMENT$             | 8
 9 |-------------------          -----              -------------------             | 9
10 |                                                                                | 10
11 |                                                                                | 11
12 |                                                                                | 12
13 |                                                                                | 13
14 |                                                                                | 14
15 |                                                                                | 15
16 |                                                                                | 16
17 |                                                                                | 17
18 |                                                                                | 18
19 |                                                                                | 19
20 |                                                                                | 20
21 |                                                                                | 21
22 |                                                                                | 22
23 |          P L E A S E - C O M P L E T E - D E T A I L S                          | 23
   +--------------------------------------------------------------------------------+
    0123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789
```

Fig. 6 A typical data screen

PRISM-THE LOW COST QUALITY COLOUR PRINTER

The new Prism 132C colour printer manufactured by Integral Data Systems is the latest addition to the DE range of printers.

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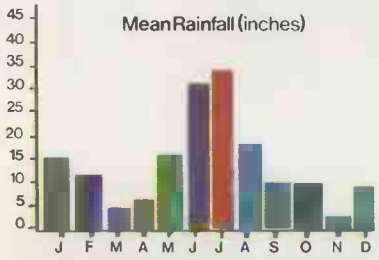

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Disk Capacity	1.2Mb-10 Mb	140K-1Mb	1.2Mb-10 Mb
Processor	16 bit	8 bit	8 bit
Operating Systems	CP/M-86, MSDOS	CP/M or Machine Specific	Usually Machine Specific
Languages	Microsoft BASIC Compiled BASIC COBOL PASCAL FORTRAN	Microsoft BASIC perhaps one or two others, eg PASCAL	BASIC and perhaps one or two others
Price	£2395	£1800-£3000	£4500-£8500

ACT Sirius 1 is a new generation personal computer. Quite simply, it has no competition at the price.

It's the first personal computer developed from the outset for business and professional use.

It's launched with more software than anything before it.

It's supported and distributed solely by ACT — the biggest name in personal computer software.

And it's developed by Chuck Peddle, formerly of Commodore and generally regarded as the father of personal computing.

SOFTWARE SPELLS SUCCESS

ACT Sirius 1 has more software than any other new personal computer:

A choice of two operating systems — CP/M-86 or MSDOS, from Microsoft.

For Software Houses

The ACT Sirius 1 has a language for you. Microsoft BASIC 80, two BASIC Compilers, two COBOLS, PASCAL and FORTRAN.

For Applications

Wordstar, Mailmerge, Pulsar, SuperCalc and MicroModeller — all the best sellers.

And the ACT Sirius 1 can run any software written for CP/M — that means hundreds of specialised packages.

THE BODY IN QUESTION

Ergonomics play a vital part in the design of ACT's Sirius 1.

The screen tilts and swivels to suit the user and glare is eliminated.

The display is razor sharp; and the brilliance and contrast can be adjusted using keys on the low-profile detachable keyboard.

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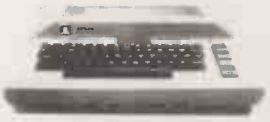

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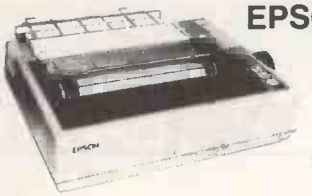

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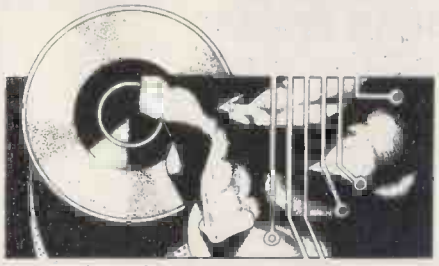
FRAMES OF REFERENCE



A DP MANAGER'S GUIDE TO MICROS

By Alan Wood

PART 4 SOFTWARE STANDARDS

For the first time in the history of computing, hardware is being designed around available general purpose software; in microcomputing we are at last learning to put the horse before the cart. When IBM decided to launch a personal computer it went to the micro software manufacturers and consulted them about the best approach to adopt to both hardware and software. Microsoft, who supplied the operating system, MS DOS, influenced the design of the IBM personal machine. Similarly, the wide following for Unix encouraged semiconductor manufacturers Zilog, Intel and Motorola to take that operating system to get their new 16-bit systems quickly to market. The expanding bank of CP/M software led established companies such as Hewlett-Packard and DEC to announce CP/M machines; and the new microcomputer manufacturers who have released 16-bit machines with CP/M-86 are making more rapid progress in the market than those with their own operating systems.

The standard software flag should fly above all others in microcomputing, whether you intend to use a selection of available packages or develop your own systems. The rule applies if you are a computer manufacturer bringing a new machine to market, a computer user developing in-house systems, or a software developer aiming to build and sell packages. New and second-time-around computer users have learned to choose programs first before selecting the 'micro centre' on which they want to play them.

The origins of standard software

In 1971 Intel introduced the first microprocessor, the 4004, and followed this three years later with the 8080 processor. In January 1975 MITS, a small company in Albuquerque, New Mexico, released the first microcomputer, the Altair. Based on the 8080, the Altair was sold for $400 in kit form. Advertised in *Popular Electronics*, it achieved a totally unexpected mass response. But with the 8080 assembler language, the Altair was usable only by real buffs. Two young software writers, Bill Gates and Paul Allen, wrote a Basic language interpreter for Altair. That Basic, now in its sixth release, has become a *de facto* industry standard Basic and is available in one release or another on virtually all microcomputers. It was the start of Microsoft Inc, the first source of machine independent languages in the micro industry.

The success of the MITS Altair encouraged other companies to start making computers to compete in the new market. Early members of the industry were Imsai, Processor Technology, Cromemco, North Star and Vector Graphics. The first machines used cassette recorders but a few innovative companies started making floppy disk units. The arrival of the floppy disk took the market for microcomputers beyond the hobby and educational field to business and scientific applications. While these developments were taking place, Gary Kildall, author of the CP/M operating system, was working for Intel on the PLM language. He secured a floppy disk drive and, while a friend set about developing a disk controller, implemented the software file manager which was to become part of CP/M. Imsai approached Kildall and expressed interest in the file manager. Out of those discussions came the concept of CP/M as a core operating system with all the hardware dependent portions in one section, so that anyone could buy a copy of CP/M and make his or her own modifications. Kildall started Digital Research in 1976 and since then CP/M has spread rapidly.

Many of the manufacturers took on CP/M directly, although some retitled and extended it. In 1978, a young Englishman, Tony Gould, recognised the potential of CP/M as a common operating system to run the same programs on many different machines. He encouraged the setting up of a CP/M user group and started a company, Lifeboat Associates, expressly to distribute CP/M software products. The ready availability of CP/M and its $150 price tag encouraged enthusiasts starting new hardware and software companies to adopt it. At about the same time, two other significant languages became available on microcomputers using CP/M — CBasic from Compiler Systems (now part of Digital Research) and CIS-Cobol, from the UK micro software manufacturer Micro Focus. The next three years saw the emergence of a stream of software products using Microsoft Basic, CBasic and CIS-Cobol, so that by 1981, as mainframe and mini computer manufacturers started their response to the micro industry, they automatically turned to the industry standard software to provide the market with usable microcomputer systems.

Fuelled by the success of MBasic, Microsoft started work on Fortran and Cobol. In 1978, it was offering to implement all three languages for microcomputer manufacturers for a fee of $100,000. The price was irresistible compared to the in-house cost of developing even one compiler, although some purchasers had to wait quite a long time for all three languages to come through. Micro Focus, structuring CIS-Cobol to make it easily portable as well as interactive, overtook and passed the Microsoft version of Cobol.

With their 8-bit products successful in the market, the software manufacturers turned their attention to the emerging 16-bit market. Semiconductor and computer manufacturers also turned to them to produce versions for new processors and machines. In a quite unprecedented sequence, CP/M was endorsed by IBM, Wang, Hewlett-Packard and DEC in successive months in 1981. Not surprisingly, industry analysts were projecting CP/M as the dominant operating system by the mid-eighties. New manufacturers leapfrogging into the market with 16-bit offerings recognised and further extended the place of the industry standard software. Sirius, the new machine from PET designer Chuck Peddle, Future Technology Systems, the UK brainchild of Martin Healy, and several others all came through with CP/M-86 machines.

The trend towards standard software to run on many (apparently) different machines continued down the line with system development aids, office automation products, timesharing

FRAMES OF REFERENCE

Features of CP/M operating system

Manufacturer: Digital Research, Box 379, Pacific Grove, CA 93950. Tel: (408) 649 3896.

Support languages: 8080, Z80 Assemblers: APL, Basic, Forth, Lisp, Fortran, C, Pascal, PL/1, Cobol.
Language system: 8080 assembler.
Network support: No
Minimum hardware: 20 kbytes RAM, console, floppy or hard disk drive.
Processor allocation/management: not available.
Peripheral management: CRTs, character and line printers, floppy and cartridge drives, modems. Device independence, DMA, spooling, mixed storage devices.
Memory management: Single contiguous allocation, overlays and chaining.
File management: Named file system, sequential and random organisation; allocation types — extents.

replacement software, general and specific business packages.

Below the level of operating systems and languages come all those aids and utilities that make it easier and quicker to develop systems. The first versions of these to appear were text editors and sorts. The text editors in turn bred the first word processors on microcomputers and the sorts were later to be embedded in more sophisticated information management and reporting systems. By 1980, a set of three products was to become as standard to microcomputers as operating systems and language. They were what virtually every office wants: an electronic word processor, worksheet and file cabinet. Today no microcomputer worth buying comes without these products. One of the first companies to tackle the need for system development and office aids was Micro-Pro. It first produced a text editor, WordMaster, and a sort, SuperSort. In 1979 it announced WordStar, a word processor which has become a best-seller on CP/M systems. This was followed by an equally successful file cabinet or information manager, DataStar. Since then, Micro-Pro has enhanced its product range with the SpellStar and Mail-Merge extensions to WordStar, CalcStar rows and columns electronic worksheet and StarBurst, a product to link all the others together to perform combined applications.

The ultimate system development aid is one which can be used to generate a complete system. These come in broadly two forms: program generators which automatically generate code, and system generators which are self-contained parameterised systems. None of the products have yet established the credibility or position of the standard languages. But some promising products have appeared, including Pearl from Computer Pathways (code generator) and Configurable Business System (no code) from Lifeboat. In 1981, all the ballyhoo around The Last One, a code generator from DJAI Systems, attracted a lot of attention, although the excessive claims implied even in its title did nothing for the credibility of this type of product.

Beyond the system generation tools come the general scientific and business packages. Several companies in the USA took up CP/M and either MBasic or CBasic and produced simple business systems. Graham Dorian chose CBasic, Structured Systems and Peachtree chose MBasic for their ledger, payroll, order processing and stock control systems. These packages are aimed at the first time computer user who often does not have very good manual systems. A second wave of packages has also emerged for the more sophisticated user; for example, products from newer manufacturers like Omicron in the UK offer facilities that overshadow many accounting packages on minicomputers. A range of vertical market packages are also starting to flow from different sources, as yet with no clear leaders.

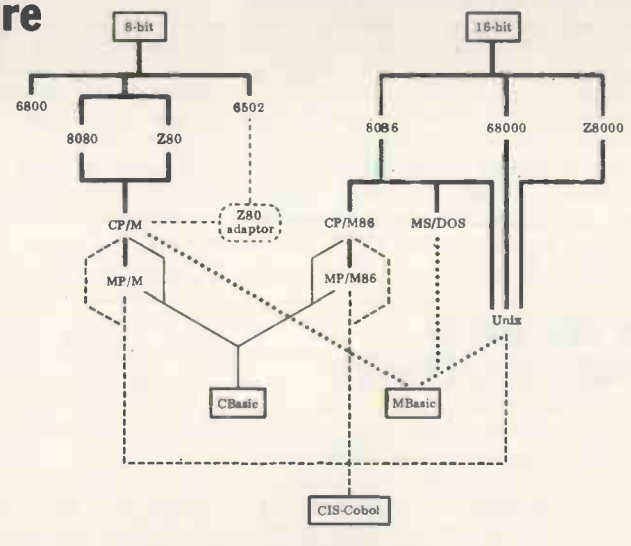
Timesharing replacement products are the latest of the standard software offerings on microcomputers. These are very attractive to users who spend considerably on timesharing services and who can readily justify the expenditure on a replacement microcomputer system. The trend was started by Visicalc, a rows and columns product that has created new users of the electronic worksheet technique as well as appealing to existing users. Visicalc whetted the appetite for more sophisticated products and Intelligence UK with MicroModeller, an FCS-like financial modelling package, has produced one answer. These have been followed by other timesharing replacement products. More will follow, especially on the new 16-byte machines which offer a megabyte of memory on the desk top and are ideal for number crunching programs.

The need for standard software

Adopting hardware standards provides obvious benefits in compatibility, communications, expandability and purchasing. However, because it is easy to specify a preference for the machine of one or two manufacturers, compared to establishing software standards, companies too frequently adopt preferred hardware as a simplistic solution to setting standards.

The objective of describing the history of software development on microcomputers is to provide an understanding of how we got to where we are today and to indicate where the industry is going tomorrow. If past performance is taken as a strong indicator to future trends, industry standard software is going to dominate microcomputing. In mainframe and minicomputing there has been a steady increase in the ratio of software/hardware costs. With micros there has been a quantum leap such that software and service costs now often far outweigh the hardware costs. The adoption of sensible standards can substantially reduce short and longer term

The software family tree



The illustration shows a simplified version of the micro software family tree. Like ordinary family trees it will change with each generation as different branches spread and mix. Until recently Digital Research and Microsoft developments have been closely aligned. The move by Microsoft into operating systems with MS-DOS and Xenix has brought a counter move by Digital which has acquired CBasic and Pascal MT. Microsoft is officially not supporting MP/M although market pressures may change its mind. Digital, on the other hand, may not make its language available on MS-DOS and Xenix. Micro Focus officially supports all operating systems except MS-DOS and it probably won't be long before CIS-Cobol is available on that OS as well. Consequently the British manufacturer offers the safest gateway to the future for software developers.

Features of MP/M 11 operating system

Support languages: as CP/M
Language system: 8080 assembler
Network support: Yes.
Minimum hardware: 64k RAM, etc.
Processor allocation/management: Multi-tasking; unlimited number of tasks can start/stop other tasks via queue-based intertask communication. Multi-usage; up to 16 users. Synchronising: flags, queues, poll list.
Peripheral management: Single contiguous allocation, chaining and segmentation; static and dynamic relocations; memory protection.
File management: As CP/M with the addition of password security protection; time and date stamping on files.
Note: MP/M-86 implemented in 8086 assembler provides the same features with the facility to manage up to 256 users.

software costs. Standard operating systems, standard languages, standard development tools and standard application packages should all be adopted.

Establishing the use of standard software not only creates portability of software but portability of skill and portability of data files. For example I started using WordStar on a North Star in 1979, transferred the same files and package onto a Cromemco in 1980, switched files and WordStar to Dynabyte and Communicator in 1981, using Rair and Superbrain in passing, and am now into WordStar on 16-bit machines. The beauty of using standard software is that no new application skills have been necessary to take advantage of more powerful machines and costly files have been transferred using the BSTAM facility under CP/M. WordStar looks the same on all machines, although it performs better on some than on others. This example can be repeated for many packages, eg, the Spellbinder or Magic Wand word processors and, of course, for all the common languages.

When you consider the cost of file creation, coupled with the cost of learning new software, as well as writing and documenting it, you should never want to work on anything but industry standard software.

Applying industry standard software

When you approach a requirement, there are two ways you can consider fulfilling it: 1, by use of an existing package or packages and 2, by full or partial systems development. The first will be cheaper and faster to meet requirements, providing the package largely fits or the user will bend towards its facilities. There will always be cases where packages are not suited and then the choice lies in what language and development aids can be applied. But once the requirement is clearly understood, the first question to ask is, 'What package will fit?' If there are no suitable packages, the next question to pursue is, 'What development aid will cut development costs and timescales?' This will lead you towards languages and their facilities, at which point existing available skills and subroutines may be more important, eg, you run a Cobol shop. Finally, once the software approach is established, you select the computer with the most suited software set.

The Requirement-Down approach contrasts with the Hardware-Up standard traditionally applied in the mainframe environment. Having selected an IBM machine and PL/1 as the language to support, all user requirements are translated in terms of these facilities. It is especially difficult to turn people bred in this environment over many years towards adopting a standard software approach. Only training and experience leading to an inner conviction will achieve the transition for those who want to make it. The consequences of not adopting standard software can be very costly indeed.

Pressure points on standard software

You have been hearing about standards for years and could be forgiven for being somewhat cynical about the continuation of software standards as the big boys come into the business. Surely IBM is not going to make it easy to migrate from their micros to those of its rivals? Surely it is not. But a number of pressure points have emerged which have modified the approach of even the world's largest computer manufacturer whose literature actually includes acknowledgments to Visicalc.

Many users are fed up with their data processing departments because of the cost, timescale and inflexibility associated with monolithic mainframe systems. On their own initiative, they have been the forerunners in going out to seek micro solutions to their problems. Equally, many new computer users not used to mainframe costs have come into the fold as a result of low cost hardware and software. Both these groups represent a vast, almost untapped, market for computer suppliers to maintain their growth in the eighties and nineties. They both have one thing in common: they insist on readily available cheap software. For example, one prospective purchaser of Hewlett-Packard micros insisted that he should have one of the industry packages on his machines and the manufacturer responded by arranging it for him.

The next pressure points in the chain are the computer dealers, the shops and systems companies that are the major outlets for micro products. Dealers are becoming more and more aware that it is software that sells machines and not vice-versa. Newer manufacturers approaching experienced dealers without software simply do not get in the door; those with their own special software don't get much further; whereas those offering industry standard software on advanced hardware are generally well received. From a dealer viewpoint, it is considerably more expensive to learn a new software package than it is to learn to operate a new machine. Dealers who have made an investment in a software set are understandably very reluctant to change to another unless it is much better . . . and available on a wide range of machines.

The market is so large (there are over two million microcomputers in use) that it has fostered a host of new software manufacturers, some of whom have produced excellent low-cost software. The software manufacturers want to reach the widest possible market and are attracted only to the best selling systems. Inevitably, CP/M attracts the biggest following, with Apple, PET and Tandy also popular targets for software. The software product vendors sell strongly to dealers, to end-users and to microcomputer manufacturers. The computer manufacturers have been quick to realise that if they go their own way, producing software will be much more costly and slower than tapping into available products. They have also witnessed the trend of users going out to buy Visicalc first and then choosing the machine on which they want to run it.

Some computer manufacturers have opted to go their own way on software and some manufacturers have produced CP/M versions of their products. There are not many who do not in some way or other support the industry standard software at least at language, if not at operation systems, level. Where the choice has been made to go it alone, the signs are that the manufacturer is restricting his growth largely to his existing customer base. Data General, one of the early specialist minicomputer suppliers, has chosen

Features of Xenix, the Unix based operating system

Support languages: C, Microsoft Basic, Cobol, Fortran, Pascal.
Language system: C
Network support: Yes
Minimum hardware: 192k RAM
Processor allocation/management: System vs user mode. Multi-tasking: 100 tasks restricted by table size. Multi-usage: up to 25 users.
Peripheral support: CRTs, character and line printers, floppy and cartridge drives, modems, magnetic and paper tape drives.
Memory management: Segmentation; swapping; dynamic relocation; binding during assembly/compilation, linking and loading times; memory protection.
File management: Named file system, multi-level directory, sequential organisation; allocation type; linked list of sectors; password/security protection.

FRAMES OF REFERENCE

this route, its micro offering being based on its own chip with no access to industry standard software. The eighties is an era in which open architecture is coming through strongly to correct some earlier deficiencies and create new possibilities. It may well be those pursuing a policy of closed architecture will suffer loss of market share as users refuse to get tied in to one manufacturer again.

At the beginning of the chain, the semiconductor manufacturers are investing vast sums in developing new products. Their interests lie in getting their products to market quickly and in quantity to recoup their investment and to fund the next development programme. While they all produce their own development languages, tools and operating systems to help customers build products using their chips, semiconductor suppliers are finding repeated implementations time consuming and costly. Zilog, which sells computer systems as well as chips, was the first to adopt industry standard software. On its MCZ 2 8-bit machine it has implemented CP/M and a CP/M interface to its Ethernet-like network. It has followed this move by adapting Unix (it calls it Zeus) for the Z8000, one of the first new 16-bit machines to market. Intel and Motorola have also taken to Unix for 16-bit processors and to provide a route through to their new 32-bit offerings. Intel announced CP/M-86 when it brought out its first general purpose computer in the winter of 1981. Software developers will be encouraged by these moves to produce the packages that will make the new devices useful. Customers, both dealers and end-users, will in their turn take more quickly to powerful machines offering familiar software, In fact, the best cushion against future micro shock is standard software.

What then are some of the standard options available?

General-purpose operating systems

There are many ways of classifying operating systems: development operating systems, realtime process control operating systems, timesharing operating systems, single user and multi-user operating systems. For the purpose of this section we are looking primarily at single and multi-user general purpose operating systems.

CP/M is the recommended single user operating system, not because it is the most sophisticated or technically excellent, but because it is the most popular. It is a sound, proven, functioning operating system, the primary virtues of which are its low cost and the access it provides to a bank of programs in which new deposits are made every day. There are many who will tell you their XYZ operating system is better; and indeed it must be to sell at all. CP/M is also improving with each release; like sound wine it is maturing. Furthermore, it has sired two other products in the family. CP/Net and MP/M, of which more later.

You should have CP/M as your main single user operating system, or at very least as an option. Failure to adopt a standard operating system will result in programs and files which are not transferable from one machine to another, difficulties in linking machines to exchange data, dilution of expertise across many systems, more expensive software developments costs, and no access to the software bank of inexpensive packages.

Among the manufacturers that support CP/M directly are Altos, Dynabyte, Hewlett-Packard, Intertec, NEC, Osborne, Micromation, Rair, Triumph Adler and many others.

Among the machines on which CP/M runs in addition to the operating system supported by the manufacturer are: Apple (with Microsoft Softcard), Commodore (with Softbox), DEC, IBM, Intel, North Star, Research Machines, Sharp, Tandy, Vector Graphics, Wang.

Among the machines on which CP/M is not presently available are: Data General, SWTP, Texas Instruments.

Two other machine independent operating systems merit attention, MS DOS from Microsoft in the USA, and BOS from Microsoftware Products (CAP Microsoft as was) in the UK. The latter is especially interesting in the UK because of the access it provides to a range of business software. Microsoft MS DOS leapt to attention when IBM announced that they had taken it for their own personal computer; the fact that it has hooks to enable CP/M programs to run under it is another attraction.

MicroSoftware Products BOS is arguably more sophisticated than CP/M. It does not have the universal following but can marshal a pretty impressive club of machines, including many that are not based on the Intel 8080 or 8086 families. These include some of the machines from BMG, Cromemco, DEC, Dicoll, Digital Microsystems, Durango, Hermes, IMS, MicroStar, Mostek, National Panasonic, North Star, Pertec, Siemens, Smoke Signal, Tandy, Texas Instruments, Transdata and Trivector.

A number of manufacturers have their own operating systems, not all derived from CP/M, in particular the leading personal computer suppliers. Apple, Commodore and Tandy, for which there are a substantial selection of programs.

A variety of multi-user operating systems are competing for wide acceptability in the market. Part of the competition comes from a new way of achieving multi-use through networking micros together. Two of the general purpose operating systems are set to take the lion's share of the machine independent market, MP/M and Unix derivatives.

Until the arrival of MP/M 11, which added file and record locking along with some other facilities, grave reservations were being voiced about the wisdom of using MP/M much beyond a simple two-station machine. The new release has changed views and further iterations are likely to achieve good market penetration for MP/M, especially as a multi-user successor for the CP/M user. Once the number of terminals is promising to build from a few to double figures, other solutions, including networking, come into contention. Digital Research, which has had a substantial injection of funds, can be expected to develop MP/M to a more sophisticated level, in conjunction with its OEMs, especially on 16-bit machines.

The Bell Systems Laboratories operating system, Unix, has been about for over 10 years and is a proven system with some very attractive features, especially as a development system. A few 8-bit versions are about, notably Cromix from Cromenco, but the operating system is really expected to come into its own for double-figure terminal systems on 16-bit machines. Microsoft and Morrow have developed versions for micros respectively known as Xenix and mUnix. The policy of supplying Unix virtually free to colleges has resulted in a big following in academic circles. Unix prices were high compared to CP/M until the end of 1981, when Bell announced very substantial reductions which will help Unix penetrate the commercial marketplace. It is also being used as a development route from 16- to 32-bit micros. A number of mini manufacturers have added Unix to their systems, such as Tektronix and Perkin Elmer.

Other multi-user operating systems

There are several less popular machine independent operating systems which nevertheless include some features superior to both MP/M and Unix. There are 8- bit and 16- bit implementations of both Multi-User BOS and Oasis. The latter, from Phase One Systems, is favoured by some computer manufacturers and end-users. The record, file locking and password protection systems in Oasis, essential to multi-user work, are superior to those in MP/M. Both BOS and Oasis provide ISAM access to files, a highly desirable feature in data processing applications. Various suppliers are now implementing hooks in their operating systems to make them behave in part like CP/M. For example on Cromix, the Cromenco version of Unix, you can run CP/M programs as one of the tasks.

There are problems in synchronising operating systems so that sometimes you can find difficulties in running all CP/M programs under an adapted system. For example, the CP/M system is too big to run because of the additional overhead in RAM taken up to accommodate it. As RAM sizes increase with 16-bit availability, these problems may occur less frequently. Manufacturers supplying alternative operating systems may also take on the responsibility of directly supplying CP/M programs which do not run under their offerings. You should not assume that all computers with a CP/M facility can run or have access to all CP/M programs.

Microcomputing languages

The most popular of all languages on microcomputers in Basic. Two-thirds of the available operating systems, both

GOTO page 189

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BENCHTEST
BUSINESS SYSTEM

MONROE 8820

Peter Rodwell tests one of the latest upmarket business micros from the States.

Monroe is an American company which has for some years now been known for its desk-top calculators; I'm sure you know the sort — those large things the size of a portable typewriter which professional number-handlers who don't actually require computing power still buy because, unlike pocket calculators, they're built to take a real pounding.

However, people must move with the times and, even if you don't need programmability or data storage facilities, you're supposed to have a desk-top computer these days; calculators are definitely not what the up-and-coming accountant wants seen on his desk.

Perhaps sensing this trend, Monroe has taken the logical step of going into the personal computer market. It still makes those large calculators (presumably there are still people around who just won't let go of an old technology), although they're no longer on sale in this country.

Two basic models make up the Monroe range: the OC 88XX, a business (or 'occupational', as the Monroe brochure puts it) micro, and the EC 8800, a rather nice-looking educational model with colour graphics, not yet available over here. Two business models are made, the OC 8810, which has a single minifloppy disk and the OC 8820, which has twin disks. This Benchtest is of the OC 8820.

Hardware

The 8820 is an all-in-one computer with the electronics, keyboard, screen and disks housed in a well-made and quite heavy two-tone beige ABS casing measuring 53cm deep by 48cm wide by 29cm high. The whole unit is solidly constructed and has a feeling of real quality about it — you're left in no doubt that this is a serious piece of office equipment, built to take the pounding of day in, day out commercial life.

The keyboard has 93 keys, arranged in six groups. The main group is, of course, a full qwerty keyboard of typewriter pitch and with a nice solid feel, eminently suitable for touch-typing. To its right is a numeric pad with arithmetical operators, and beyond this is a column of cursor control keys topped with a clear/home key. A solitary red key labelled 'STOP' sits in the upper left corner; to its right is a row of two blocks of four programmable function keys such as editing and caps lock controls. All the keys auto-repeat when depressed for longer than a second or so.

The 22.5cm screen at first looks rather small but, in fact, when you're seated at the machine and using it, it's just fine. The screen provides the first surprise of the system; it has orange lettering on a grey background. I found this fairly weird at first, being used to green on black, but I soon got used to it and found it quite pleasant to work with. The 80 x 24 display is rock-steady and clear, the lettering having true descenders, although it was slightly blurred around the edges of the screen. The full ASCII character set can be displayed plus a range of 'chunky' graphics; the latter are displayed not directly from the keyboard but by sending the appropriate codes to the screen from a program. Characters can also be displayed in double height, double width, inverse video or dimmed. A brightness control is mounted just below the screen in the form of a thumbwheel protruding downwards from the bezel.

The twin minifloppy disks are mounted horizontally, one above the other, to the right of the screen. The disks, made by Micropolis, are single-sided, double density soft-sectored units holding 320k each. They are almost silent in operation, making only a slight 'clunk' when they turn off and on.

Inside, a 3MHz Z80 sits at the centre of things, with 128 kbytes of RAM to play with plus 4k of video RAM and a 2k bootstrap PROM.

Along the bottom edge at the back is a row of connectors with which the Monroe communicates with the outside world. Three of these are RS232 ports, labelled 'Printer', 'Communication I/O' and 'Auxiliary service I/O'; the latter is designed for service engineers — a troubleshooting ROM pack plugs into it to aid with system diagnostics. Two other, larger connectors are labelled 'Expansion bus' and 'External disk' — more on these later. The reset switch is mounted at the back, too, but the on/off switch lives on the left side, low down towards the back.

A final note on the hardware design: this is one of the quietest machines I have come across (among those which have disks, of course). Not only are the disk drives virtually silent, but so is the fairly powerful fan.

Operating system

The mention a few paragraphs earlier that the system has 128k of RAM will have already alerted you to the fact that the Monroe is somewhat different to the majority of 8-bit machines now on the market. This difference gets larger the deeper one probes into the machine.

Although CP/M is available as an option, the standard operating system which comes with the machine is Monroe's own operating system, which I'll be abbreviating here to MOS, and which bears no relation to CP/M whatsoever.

MOS is a single-user multi-tasking operating system which takes the form of 43 kbytes of 'core' software (ie, it sits in memory all the time) plus a number of utility programs which reside on disk and are called in as needed.

On power-up, or on hitting reset, the system first performs a memory check (which takes seven seconds, during which a message on the screen tells you what's happening) and then, to the

accompaniment of a 'waiting' message on the screen, searches both disk drives for a disk containing MOS. It will boot from either drive but drive 0, the lower drive, is the preferred one. The operating system, all 43k of it, takes 10 seconds to load, during which the screen message changes to 'Loading'; once it's running, a green LED next to the disk drives lights up to say that MOS is active.

CP/M contains certain intrinsic commands such as 'DIR', the directory command, which are executed directly by the operating system without the need to load and run a separate program resident on disk. MOS has no such intrinsic commands; it considers anything typed in at the keyboard to be the name of a program on disk and goes to look for it on the currently-active drive, giving a terse error message if it can't find it.

To describe MOS in full detail would require a separate review of considerable length. The following description is, then, more a brief run-through of the system's facilities than an in-depth study.

Each utility program is kept on disk as a task file (the equivalent to a CP/M 'com' file — ie, a directly-executable program).

Allocate: allocates space on a disk as a direct-access file, either binary or ASCII.

Bootgen: used when creating a new disk; it tells the bootstrap loader where to find the operating system on the disk.

Close: takes a specified device off-line; has to be used before you remove a disk from the system.

Command: similar to, but more versatile than, CP/M's 'Submit'. This allows you to execute a number of commands by creating a text file of the commands and handing this to Command for execution. We'll discuss this in depth later.

Copya: this transfers ASCII between two devices; not only can this be used for copying, but it can also function between, say, the keyboard and a disk, so that the text can be typed straight onto disk.

Copyi: this performs an image copy between devices and/or files. It would be used, for example, for making back-up copies of disks.

Copylib: a fast transfer copy program; it can also be used to delete programs and operates in either an interactive or automatic mode.

Copyt: used for copying task files; task files can be either absolute or relocatable and this utility will copy either.

Creindex: allocates and creates an ISAM (indexed sequential access method) file.

Delete files: does exactly that.

Diskcheck: It's necessary to close files before changing a disk or switching off. If you forget to do this, Disckcheck gives you the chance to repair the damage by closing any files left open on the disk.

Diskinit: initialises a disk after it has been formatted by giving it a volume name and bit map.

Format: formats a blank disk.

Lib: display a disk directory. Typing L displays just the file names (which can be up to 12 characters long) and the type of file: Tsk for task, Asc for ASCII, Bac for Basic, etc. Typing L, F displays this information plus a good deal more, such as file sizes and the date and time they were created and last used.

Open: brings a device on-line; if you're using drive 0 and you want to see what's on the disk in drive 1, you have to close drive 0 and open drive 1 first before typing L for Lib.

Option: each file has certain attributes, which can be changed with this utility. Thus a file can remain in memory after execution or be deleted from it; and a task can be aborted by another task or not.

Priority: as MOS is a multi-tasking operating system, tasks can be given priorities to determine their order of operation. That's what this does.

Rename: renames a file.

Space: tells you how much space is left on a disk, in *sectors*, which isn't as immediately useful as a kbytes read-out would be.

Set: enables the creation of an auto-start disk, ie, one which would immediately start an application program on boot-up without the user having to work through a sequence of operating system commands.

Sort: sorts out the contents of a file, including ASCII and numeric data files.

Time: sets the internal clock/

Make the most of your Sinclair ZX Computer...

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

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Each cassette costs £3.95 (including VAT and p&p) and comes complete with full instructions.

Although primarily designed for the Sinclair ZX81, many of the cassettes are suitable for running on a Sinclair ZX80 – if fitted with a replacement 8K BASIC ROM.

Some of the more elaborate programs can be run only on a Sinclair ZX Personal Computer augmented by a 16K-byte add-on RAM pack.

This RAM pack and the replacement ROM are described below. And the description of each cassette makes it clear what hardware is required.

8K BASIC ROM

The 8K BASIC ROM used in the ZX81 is available to ZX80 owners as a drop-in replacement chip. With the exception of animated graphics, all the advanced features of the ZX81 are now available on a ZX80 – including the ability to run much of the Sinclair ZX Software.

The ROM chip comes with a new keyboard template, which can be overlaid on the existing keyboard in minutes, and a new operating manual.

16K-BYTE RAM pack

The 16K-byte RAM pack provides 16-times more memory in one complete module. Compatible with the ZX81 *and* the ZX80, it can be used for program storage or as a database.

The RAM pack simply plugs into the existing expansion port on the rear of a Sinclair ZX Personal Computer.

Cassette 1 – Games

For ZX81 (and ZX80 with 8K BASIC ROM)

ORBIT – your space craft's mission is to pick up a very valuable cargo that's in orbit around a star.

SNIPER – you're surrounded by 40 of the enemy. How quickly can you spot and shoot them when they appear?

METEORS – your starship is cruising through space when you meet a meteor storm. How long can you dodge the deadly danger?

LIFE – J.H. Conway's 'Game of Life' has achieved tremendous popularity in the computing world. Study the life, death and evolution patterns of cells.

WOLFPACK – your naval destroyer is on a submarine hunt. The depth charges are armed, but must be fired with precision.

GOLF – what's your handicap? It's a tricky course but you control the strength of your shots.

Cassette 2 – Junior Education: 7-11-year-olds

For ZX81 with 16K RAM pack

CRASH – simple addition – with the added attraction of a car crash if you get it wrong.

MULTIPLY – long multiplication with five levels of difficulty. If the answer's wrong – the solution is explained.

TRAIN – multiplication tests against the computer. The winner's train reaches the station first.

FRACTIONS – fractions explained at three levels of difficulty. A ten-question test completes the program.

ADDSUB – addition and subtraction with three levels of difficulty. Again, wrong answers are followed by an explanation.

DIVISION – with five levels of difficulty. Mistakes are explained graphically, and a running score is displayed.

SPELLING – up to 500 words over five levels of difficulty. You can even change the words yourself.

Cassette 3 – Business and Household

For ZX81 (and ZX80 with 8K BASIC ROM) with 16K RAM pack

TELEPHONE – set up your own computerised telephone directory and address book. Changes, additions and deletions of up to 50 entries are easy.

NOTE PAD – a powerful, easy-to-run system for storing and retrieving everyday information. Use it as a diary, a catalogue, a reminder system, or a directory.

BANK ACCOUNT – a sophisticated financial recording system with comprehensive documentation. Use it at home to keep track of 'where the money goes,' and at work for expenses, departmental budgets, etc.

Cassette 4 – Games

For ZX81 (and ZX80 with 8K BASIC ROM) and 16K RAM pack

LUNAR LANDING – bring the lunar module down from orbit to a soft landing. You control attitude and orbital direction – but watch the fuel gauge! The screen displays your flight status – digitally and graphically.

TWENTYONE – a dice version of Blackjack.

COMBAT – you're on a suicide space mission. You have only 12 missiles but the aliens have unlimited strength. Can you take 12 of them with you?

SUBSTRIKE – on patrol, your frigate detects a pack of 10 enemy subs. Can you depth-charge them before they torpedo you?

CODEBREAKER – the computer thinks of a 4-digit number which you have to guess in up to 10 tries. The logical approach is best!

MAYDAY – in answer to a distress call, you've narrowed down the search area to 343 cubic kilometers of deep space. Can you find the astronaut before his life-support system fails in 10 hours time?

Cassette 5 – Junior Education: 9-11-year-olds

For ZX81 (and ZX80 with 8K BASIC ROM)

MATHS – tests arithmetic with three levels of difficulty, and gives your score out of 10.

BALANCE – tests understanding of levers/fulcrum theory with a series of graphic examples.

VOLUMES – 'yes' or 'no' answers from the computer to a series of cube volume calculations.

AVERAGES – what's the average height of your class? The average shoe size of your family? The average pocket money of your friends? The computer plots a bar chart, and distinguishes MEAN from MEDIAN.

BASES – convert from decimal (base 10) to other bases of your choice in the range 2 to 9.

TEMP – Volumes, temperatures – and their combinations.

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PCW04

MONROE 8820

calendar. Unfortunately this is a software clock/calendar, so re-booting the operating system, such as is necessary when changing a disk, sets it to zero again. A hardware clock/calendar would have been more practical.

Vol: sets or changes the names of the system volume (ie, disk).

The above are all utilities associated with the system itself. An additional set of utilities is provided under the general classification of task handling utilities as follows:

Cancel: this cancels a task which is either current or in memory but dormant.

Continue: continues a task which has been paused.

Devices: displays information, including current status, of all the devices in the system.

Load: this loads one or more tasks into memory to allow multitasking to take place. The tasks are loaded in sequence and activated using the Start utility (see below).

Pause: this simply pauses a specified task.

Run: this combines the Load and Start utilities; tasks are brought into memory and immediately executed.

Slice: during multitasking, work is scheduled according to each task's priority or according to time slices within that priority. If two tasks have an equal priority, the first in the queue will take all the processor's time until it's finished. Slice allows you to allow them to execute simultaneously by allocating time slices (in milliseconds).

Start: as mentioned earlier, this initiates tasks which have previously been Loaded into memory.

Task: lists the status of each task currently in memory, showing its priority, status, etc.

At first sight, MOS appears both complicated and unfriendly, particulary if, like me, you have become accustomed to CP/M and its many and varied idiosyncrasies. The profusion of copying utilities, for example, seems very confusing at first; and there's no easy way to find out what's on one disk if you're logged into the other — you have to type 'Close fpy0: open fpy1:' and then Lib, for example, if you're logged onto the lower drive and want to see the directory of the disk in the other drive. Compare this to the equivalent CP/M command, DIR B:.

Keyboard feels nice and solid

But a closer look at the utilities not only reveals that things are not as bad as they seem but shows the philosophy behind the Monroe System.

A microcomputer system will be used by two types of users — programmers and end users. In our Benchtests, we look at systems from the end user's point of view, mostly, although the programmer's angle obviously cannot be neglected. Looking at this machine as an end user, it appears awkward, unfriendly, overly complex and unnecessarily nitpicking in its syntax. In short, most end users, particularly the 'naive' (in computing terms) business user at whom the machine is aimed, would be frightened silly by it.

But it not intended that the end user should have to grapple with the utilities directly. The facilities exist for the programmer, using the very powerful utilities, to insulate the user from the operating system completely — the user would buy his Monroe with the software already arranged so that he would never actually have to come face to face with MOS; the auto start, run, load and other utilities can be combined to allow the user to carry out any operation necessary, including disk formatting, housekeeping and full multitasking without needing to learn anything of MOS at all. Although it is possible to insulate the user to some extent from CP/M, software houses rarely seem to bother and, in any case, CP/M simply doesn't allow the same degree of insulation.

The above answers the question that immediately formed in my mind when I first looked at MOS: why did Monroe go to the trouble and expense of writing its own operating system when there are several off-the-shelf systems already around, such as MP/M-II and Unix? The answer, at least in part, must be that no existing operating system for micros allows the programmer to provide such a high degree of insulation. I feel that Monroe made the right decision in going the lone route. It has decided that it wants to sell microcomputers to businessmen and it has realised that these customers have neither the time not the inclination to learn the vocabulary, concepts and procedures of computing: to these users, the desk-top computer is another piece of office machinery and it needs to be as easy to use as a photocopier. Provided the programmer realises this and takes advantage of the machine's many powerful facilities, it should be easier to achieve this with the Monroe than with most other micros.

From the programmer's point of view, I feel the machine will prove an exciting and challenging beast. Programmers weaned on — or at least thoroughly accustomed to — CP/M will find it strange indeed, but those coming fresh from the mini/mainframe world will find it easy to live with. Which brings us to Monroe's other reason for developing its own operating system: although the official line is to deny it, there are strong and well-informed rumours that the company is developing a minicomputer; it seems reasonable to suggest, then, that MOS will have a good degree of compatibility with the mini's operating system and I'd go so far as to suggest that they were developed by the same team — MOS just has a mini feeling to it.

Rear view

Two neat boards house the major electronics.

One minor gripe; Monroe has provided eight programmable function keys (actually 16 as they can be shifted), yet MOS makes absolutely no use of these at all. I understand a future release will, hopefully in the style of Hewlett-Packard's softkeys.

Monroe Basic

Although Pascal is mentioned as an option in the literature, Monroe Basic is the system's main language. As 'MBasic' has already been used by somebody else, Monroe calls its Basic 'MEBasic' and it's certainly a very comprehensive and powerful implementation of the language.

Basic is called up by typing 'Basic' followed by the amount of memory you want to allocate to it; typing 'Basic,, 34000' gives you Basic (which takes up 34k) plus another 34k to play with. If you don't allocate any memory, the system gives you the default value of just 5 kbytes.

I found MEBasic one of the easiest and most pleasant to use of the various Basics knocking around these days. During programming and in command mode it accepts input in either upper

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the correspondent

by R. Wagner

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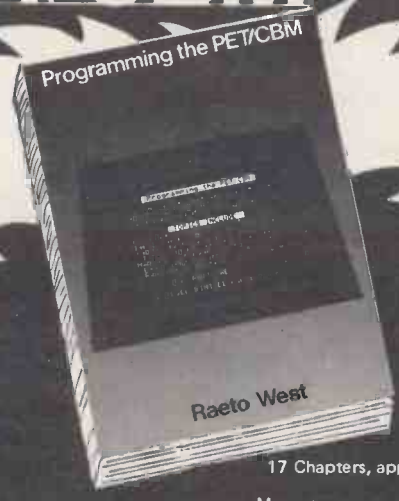

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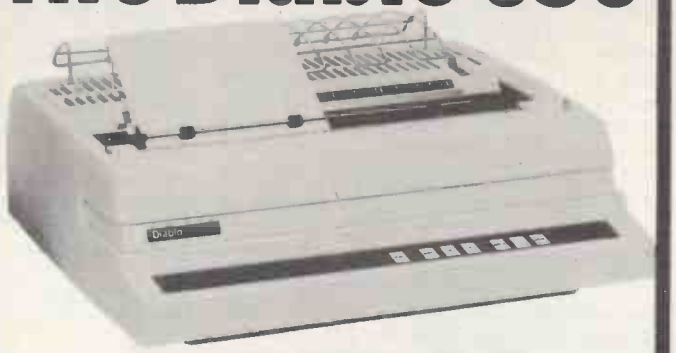

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MONROE 8820

programming, these are converted and stored in upper case, so that 'a' and 'A', if used as variable names, reference the same variable and both appear as 'A' when the program is listed.

MEBasic checks your syntax dynamically as soon as you hit return at the end of the line. If you make a mistake, it consults an 8 kbyte disk file of error messages and tells you what's wrong; if the file isn't present on the current disk it gives you an error code instead. If you've made an error, the machine also bleeps at you and automatically enters its editing mode, with the cursor positioned at the end of the offending line — you can't continue until you've corrected the mistake, and editing keys such as insert and delete are provided to make this very easy. Thus, once you've typed in your program, you *know* that it's at least free of syntax errors before you RUN it.

On entering MEBasic, you are allowed variable names of only one letter plus (optionally) one digit, ie, A-Z and A0-Z9. Typing EXTEND (or including it in a program) allows the use of variable names of up to 32 characters, all of which are significant. I would have preferred the EXTEND mode to be the default mode, thus encouraging more readable programming; there's also a NO EXTEND command which cancels the EXTEND mode. You need to exercise a little caution when using EXTEND, though: in the NO EXTEND mode the system, is indifferent to spaces, so that INPUTA: PRINTA will be accepted. Using EXTEND, though, makes spaces critical as INPUTA would be interpreted as a variable name, and, in this context, cause an error message.

As can be seen from the list of Basic reserved words, MEBasic contains as its core the 'standard' facilities found in most Basics and takes a standard syntax for these, thus making it easy to use for programmers coming from, say, Microsoft Basic. In addition, there's a vast range of facilities to delight the serious programmer and to make the writing of business applications packages a cinch.

Of greatest interest among these are the ISAM file-handling capabilities. Regrettably, time did not allow me to explore these as thoroughly as I would have liked, but, basically, they allow you to open, read, update and write ISAM files which you create with a special Basic program, the listing of which is in the MEBasic manual. I know of no other microcomputer Basic which incorporates ISAM handling; it's very powerful and very useful.

Scanning through the reserved words list, here's a rundown of those which are peculiar to MEBasic and whose use isn't immediately obvious.

ADD$: adds the value of two strings of numbers to a specified number of decimal places. SUB$, DIV$, and MUL$ similarly subtract, divide and multiply strings.

CLEAR: clears all variables and closes any files which happen to be open.

COMMON: allows you to share variables and their values between programs which are CHAINed.

COMP%: compares two numeric strings, A$ and B$, returning -1 if A$ < B$, 0 if they're equal and 1 if A$ > B$.

CVT: converts numeric values into ASCII for an I/O file.

FLSH: causes the string following it to flash when printed on the screen.

OCT$: converts a decimal value into an octal one. Similarly, HEX$ converts to hex.

OPTION BASE: Allows you to save memory space when using arrays; normally, DIM A (5) would give an array of *six* elements A(0) to A(5); OPTION BASE 1 would eliminate the default A(0) element to give an array of five elements.

OPTION EUROPE: Not an EEC get-out but alters the respresentation of numbers from the British and American format of, say, 10,000.55 to the European format of 10.000,55. Nice to see Americans remembering these little touches.

PDL: returns the x or y coordinates of a joystick. As joysticks aren't provided with the OC 8820, I assume this is for use with the educational micro.

POSIT: Positions the file pointer to the specified number of bytes from the start of the file.

SET TIME: like the Time utility, this lets you set the internal calendar/clock.

SLEEP: Wins my 'Basic Reserved Word of the Year' award for 1982. It does just what it says by suspending the current program for a specified time (in seconds).

MEBasic has been designed not only for the OC 8820 but also for the educational computer with its high resolution colour graphics. Thus, in addition to the listed functions there is a whole range more dealing with colour graphics; as these obviously don't work on the OC 8820, I haven't included them in the list of reserved words.

As can be seen from this very quick look at MEBasic, it's a powerful language, thoughtfully designed and implemented and easy and friendly to use. Programmers will find it an efficient Basic as it not only encourages good documentation through the use of EXTENDed variable names but has many powerful built-in features, too, including the ability to CALL the operating system's supervisor calls directly. With the system came a large number of various Basic programs, some of them utilities and others just games and demonstrations; all are thoroughly documented and most are designed to show you how to use various features of both language and machine.

Documentation

The system came with three bulky manuals, one on MOS, one on the utility programs and a third, *very* thick one, on MEBasic. They were all described as programmer's reference manuals and a warning inside pointed out that they had been designed for experienced programmers, not as tutorials. Fair enough, they certainly made no attempt to teach basic concepts but they all explained every feature of operating system, utilities and Basic very thoroughly. I'd go so far as to say that they're among the best examples of documentation I've seen, being clearly written, thoroughly and accurately indexed and including heavily-commented examples of each feature, leaving the reader in no doubt whatsoever of how each facility should be used.

Notably absent was any manual for the user, apart from some preliminary notes put together by Fi-Cord. The programmer's manuals would not normally be supplied to an end user and there is, apparently, a user's manual on its way from the States which, if the programmer's manuals are a guide, should be of excellent quality.

No hardware manuals were supplied with the machine, the only hardware information being a single-sheet sales leaflet with a summary of the system's specifications.

Basic reserved words

ABS	FNEND	PDL
ADD$	FOR..NEXT..STEP	PEEK
ASCII		PEEK2
ATN	GET	PI
AUTO	GOSUB	POKE
	GOTO	POSIT
BYE		PREPARE
	HEX$	PRINT
CALL		PRINT USING
CHAIN	IF..THEN..ELSE	PUT
CHR$	INP	
CLEAR	INPUT	RANDOMIZE
CLOSE	INPUT LINE	READ
COMMON	INSTR	REM
COMP%	INT	RENUMBER
CONTINUE	INTEGER	RESTORE
COS	ISAM OPEN	RESUME
CUR	ISAM READ	RETURN
CVT	ISAM UPDATE	RIGHT$
CVT$F	ISAM WRITE	RND
CVTF$		RUN
	KILL	
DATA		SAVE
DBLE	LET	SCR
DEF	LIST	SET TIME
DIM	LOAD	SGN
DIV$	LOG	SIN
DOUBLE	LOG10	SINGLE
		SLEEP
EDIT	MERGE	SOUND
END	MID$	SPACE$
ERASE	MOD	SQR
ERRCODE	MUL$	STDY
EXP		STOP
EXTEND	NAME	STRING$
	NEW	SUB$
FGCIRCLE	NO EXTEND	SVC
FGCOPY	NOTRACE	SWAP
FGCTL	NRML	SYS( )
FGDRAW	NUM$	
FGERASE		TAN
FGFILL	OCT$	TIME$
FGLINE	ON ERROR GOTO	TRACE
FGPAINT	ON..GOSUB	
FGPOINT	ON..GOTO	UNSAVE
FGPUT	ON..RESTORE	
FGROT	ON..RESUME	VAL
FGSCALE	OPEN	VAROOT
FIX	OPTION BASE	VARPTR
FLOAT	OPTION EUROPE	
FLSH	OUT	WHILE..WEND
FN		

Expansion

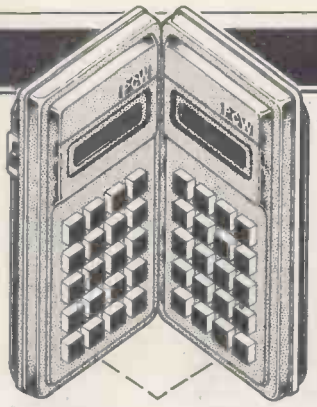
Although not officially announced yet, it seems probable that the memory will be expandable to beyond 128k, although by how much and whether this will be an internal expansion or an add-on box just isn't known yet.

Hard disks are on their way, either 5 or 10 Mbytes as an external unit with a built-in tape drive for back-up. Monroe feels this is preferable to the conventional approach of replacing one of the floppies with a winchester drive and backing up onto a series of floppies, although many users seem happy with the latter approach.

Monroe is shortly to announce another system, a visible ledger machine with either 32 or 64 kbytes of RAM and a 100k cassette tapes store which can hold either programs or data. This will link up to the OC 8820 through the latter's communications port for bi-directional data transfer and will have its own keyboard, 40-character strip diplay and integral printer which, apart from printing the ledger cards, will act as a general purpose printer too. It's an interesting idea — there are lots of people around who feel uneasy at trusting their business records entirely to disk or tape and who would like to combine computing with more traditional methods. Anticipated selling price of the visible ledger system is £2-2500.

I mentioned earlier that Monroe is thought to be working on a mini; if and when this appears, the OC 8820 should

GOTO page 187



CALCULATOR CORNER

Compiled by Dick Pountain

Casio FP-10 printer

Some months have passed since Casio launched the mini-printer to go with their 602p/702p calculators, but a backlog of material has prevented me from reviewing it until now.

The FP-10 is a compact mains/battery electrostatic printer which is probably the cheapest such unit in the world, squeezing in as it does just below the Sinclair ZX81 printer at £45.

Interfacing to the calculator is via a cable and the cassette port or via a socket on the FA-2 Cassette Adaptor; it is a stand-alone unit, unlike Sharp's integrated printer/adaptor. At 16x8 x4.5mm it is barely pocketable but the whole system will fit easily into a small briefcase. A box of five rolls of 35mm aluminised paper is supplied — each roll holding 30 feet (about 2,500 lines) and costing £2.50 for 5. Inserting the paper is remarkably simple since no spindle is used; the roll merely sits in a close fitting recess under the removable top cover. Threading is equally straightforward — this is done by inserting the loose end into a slot and pressing FEED (FEED and ON/OFF are the only controls on the unit). Four AA batteries sit in a compartment underneath, and a socket is provided for 6v DC from an optional mains adaptor which can drive the printer directly or charge a rechargeable battery pack. Four AAs will give roughly four rolls worth of operation. The standard of construction is very pleasing, from the matt/shiny finish ABS case to the diminutive print mechanism itself. The latter is a subunit which can be lifted out when the case is opened up; it occupies less than a third of the case volume and is surprisingly simple in design. A small motor drives a slotted cam through reduction gears; this engages a pin on the carriage and drives it back and forth along a rail — a far more robust-looking arrangement than Sinclair's daring belt design. The actual head consists of seven brass wires and it forms a whole new row of 7x5 characters at a pass. The characters are well- formed and legible but with only 20 to a line it is inevitable that when listing programs many lines will run over giving a rather untidy listing. Speed at around 40 cps is creditable but hardly relevant in this application as few printouts will exceed 20 or so lines. Print speed is unaffected by what is printed as printing is unidirectional and not logic seeking. A fine show of sparks occurs as the head traverses the paper.

The rest of the case contains two PCBs with a sprinkling of discrete components but no ICs; the printer is totally 'dumb'. Do-it-yourselfers would probably have little trouble rigging it to another computer if the right info can be got out of Casio.

Control from the 720p can be either manual or via a program; Mode 7 turns the printer on and Mode 8 turns it off again. When it's on the printer will record everything which is displayed, including direct mode calculations from the keyboard. In addition, a print-out of all variable contents may be had by the command LIST V, a program listing by LIST or you can go for the grand slam with LIST ALL, which dumps all 10 program registers and all variables on paper; you can always abort the dump with AC if you realise that you have 200 empty variables assigned!

Selective printing can be achieved in a program or manually by setting the appropriate mode.

The FP-10 can print all the characters which the 702p can display, and graph-plotting of a crude sort may be performed by using the CSR formatting instruction with an asterisk or point.

Using the printer with the 501/502p and 601/602p calculators is also possible. Operation is somewhat different as these machines do not have a print mode, the command INV SAVE INV EXE being used instead. The sequence could be stored in a program register and that key used as a 'print' button. Selective printing of results from within a program is possible by inserting INV SAVE INV EXE at appropriate points.

Listing programs is done by assigning a file name or number to the block and listing all 10 registers together in PCL mode. Similarly, data blocks must be printed as a named file.

It is possible to print data or program blocks from magnetic tape; by setting the selecter switch on the FA-2 to PRT/MT data will be printed out as it is loaded.

Now that the 702 is being offered at better discounts, a portable hard-copy calculating system which has quite sophisticated statistical processing capabilities can be put together for under £150; the next logical step would be some memory expansion and a fast digital micro-cassette recorder a la HP-41C — though there is no indication that either is planned in the near future.

Microl Procos

Although the Casio 702 can provide portable computing power at unprecedently low prices it is likely that some potential users will not exploit it because they lack the time or confidence to learn to program in Basic.

In order to reach some of these people a software company called Microl has produced a program called Procos for the 702 which allows data storage, retrieval and manipulation with a minimum of programming. It is virtually a mini operating system which sets up a sort of (much abbreviated) Visicalc sheet accessed by a few single key commands.

With under 2k of memory to play with space is at a premium and so, rather than choose a single compromise, Microl supplies four versions of the program on the cassette, each allowing a different amount of free data memory by omitting some features.

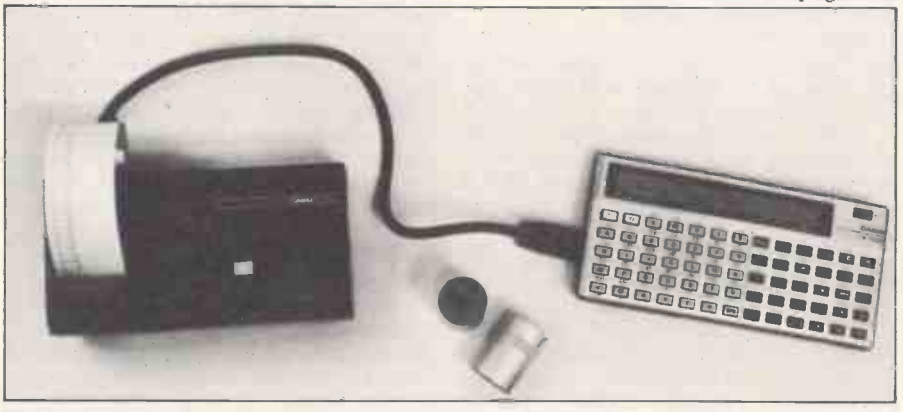
The largest, Procos B, occupies 437 steps, while C, the smallest, occupies only 236 thus freeing an extra 25 data registers.

All versions are loaded from cassette into memory P0 and are protected against listing or alteration. The remaining nine memories are available for the user's data manipulation programs.

Procos B, with the most features, will be discussed here. Before running the program you must clear all variables, choose the number of data entries on a 'page' (60 is around the maximum useful number) and then set the 702's partition accordingly with DEFM; a table in the manual tells you what to set.

Running the program then gives a sign on message 'Microl Procos B' followed shortly by a display of the first line number A0. Press = and the prompt 'NAME?' appears, upon which you enter the name of the first data

GOTO page 190



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LOGO LEARNING

Originally designed as a teaching language, Logo appears set to star in other areas too. Harvey Mellar reports.

Logo is a philosophy of education and a group of computer languages designed to assist learning; it arose from psychology, artificial intelligence and Lisp much as Basic arose from mathematics, engineering and Fortran.

Logo began in the late '60s with the work of Seymour Papert in the Artificial Intelligence Laboratory at MIT. Originally a mathematician, he was inspired by Piaget's view of children as active builders of their own intellectual structures. He also looked at the way AI workers were trying to construct intelligent programs and tried to apply the same techniques to children. He sums up his own philosophy of education in *Mindstorms* — an important book for anyone concerned with computers and education.

The conventional first computer language is Basic, but it suffers from two great problems: firstly, it is not as easy to learn as is claimed (teachers have such low expectations of many of their pupils' capabilities at programming that this is never noticed); and secondly, anything but simple programs in Basic become tortuous and hard to follow.

In the Logo environment children 'teach' computers and, by becoming aware of the structure of procedures and the ideas of planning and debugging, teachers and students develop a vocabulary in which they can talk about what they know and how they solve problems, ie, they become epistemologists.

Turtles

A Turtle is a robot 'animal' consisting of a glass dome on wheels with a retractable pen at the centre of the base; it can also have touch sensors, a horn and a light. The Turtle is connected to the computer via a cable, and signals are sent as characters in ASCII which are then decoded by a special interface (this arrangement simplifies connection to a variety of computers).

The Turtle obeys Logo commands typed at the keyboard, eg, FORWARD 40, RIGHT 90 (ie, turn 90 degrees clockwise), PENUP, PENDOWN. The delimiter is usually a single space. As Logo is an interpreted language, each command is obeyed as it is entered. Children as young as four can learn to program the computer to tell the Turtle to produce simple line drawings. Error messages are made as simple as possible ("TELL ME HOW TO FRWRD"), and to overcome typing problems most commands can be abbreviated to two letters, such as FD for FORWARD. To do the same set of instructions a fixed number of times, the command is REPEAT, as in REPEAT 4 or FD 30 RT 90.

If a drawing does not turn out as expected then there is a bug in the procedure and the process of debugging begins. The concepts of procedures, bugs and debugging replace the debilitating concepts of 'ability' and 'failure'; 'How can I do this better?' replaces 'I can't do this'.

A fundamental technique of debugging is the dry run or code walkthrough. With the Turtle this is exactly what we do, we walk through the program, so many steps forward, turn so many degrees and so on! We 'play Turtle'.

The Turtle is also often represented as a triangle on a VDU screen; lines can now be drawn much more quickly and can be erased (to correct mistakes or to produce animation).

There are two great advantages to beginning with the 'real' Turtle; it moves in the child's real three-dimensional world, rather than a two dimensional screen on which *up* is mysteriously called *forward*, and it better demonstrates the capabilities of the computer — for besides drawing pictures it can chase your friends and carry your books!

Teaching the computer

The computer can be taught new words (ie, define procedures, if you must have it in Latin). This definition also uses a variable.

```
TO TRIANGLE SIDE
   REPEAT 3 [FORWARD : SIDE RIGHT 120]
END
```

TO indicates that a definition follows, :SIDE means the contents to the variable SIDE, while "SIDE is used for the name of the variable.

TRIANGLE can now be used like any Logo command, so that typing TRIANGLE 20 will cause the Turtle to draw an equilateral triangle of side 20 units. The turn used is 120 degrees, as can be determined from the Total Turtle Trip Theorem: 'If a Turtle takes a trip around the boundary of any area and ends up in the state in which it started, the sum of all turns will be 360 degrees.'

Procedures can be saved on tape or disk for later use.

One very important aspect of this way of defining procedures is that it makes Logo an extensible language (like Forth and Smalltalk). This means that a teacher who knew no other language than Logo would still be able to define the commands that he wanted his pupils to use in their work. If pupils wanted to draw circles in their diagrams, a command CIRCLE could be defined for them:

```
TO CIRCLE SIZE
```

```
    REPEAT 360 [FORWARD :SIZE RIGHT 1]
END
```

This draws a 360-sized polygon, but can you tell the difference? And if you can't tell the difference, then what is the difference?

Planning

When more complex drawings are required we need to resort to planning (top-down programming, the breaking up of a procedure into sub-procedures).

A simple procedure to draw a house (Figure 1) might be:

```
TO HOUSE SIZE
   SQUARE :SIZE
   TRIANGLE :SIZE
END
```

We can now write the two sub-procedures SQUARE and TRIANGLE. TRIANGLE we have already seen and SQUARE can be defined in a very similar way. Because Logo is interpreted, the main procedure can be typed in before the sub-procedures are defined. Once the sub-procedures are defined we can run HOUSE and we get Figure 2. We have a bug; playing Turtle helps us find the bug and correct our procedure:

```
TO HOUSE SIZE
   SQUARE :SIZE
   FORWARD :SIZE
   RT 30
   TRIANGLE :SIZE
END
```

Figure 1

Figure 2

TRIANGLE and SQUARE both leave the Turtle in the state they found it; HOUSE can be made similarly 'state-transparent' by inserting LEFT 30 BACK :SIZE before the end. Procedures are best made state-transparent if they are to be used as sub-procedures in other procedures. We can now define a super-procedure called STREET which draws a sequence of houses, and by varying :SIZE can even suggest perspective.

Geometry

One of the aims of Logo is that there should be 'no threshold and no ceiling'. In other words, any child can begin to program immediately and *everyone* can be intellectually stretched in the Logo environment.

To look at more complex procedures we need more Logo commands. Logo can handle arithmetical expressions, assignments (eg MAKE "A 31), decisions (eg, IF:SIZE < 30 THEN FORWARD :SIZE ELSE FORWARD :SIZE − 30), and conditional loops (WHILE :TALLY> 0 THEN MAKE "SUM :SUM+ :TALLY). Logo procedures can call themselves as sub-procedures — they are recursive. Recursion is a very powerful programming control structure. Here is a procedure to draw a binary tree such as Figure 3.

```
TO BRANCH LENGTH LEVEL
   IF LEVEL = 0 THEN STOP
   FORWARD :LENGTH
   LEFT 45
   BRANCH :LENGTH/2 :LEVEL − 1
   RIGHT 90
   BRANCH :LENGTH/2 :LEVEL − 1
   LEFT 45
   BACK :LENGTH
END
```

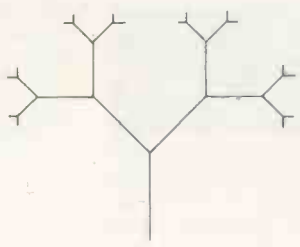


Figure 3

This program is taken from the book *Turtle Geometry* by Harold Abelson and Andrea diSessa. This book is based on their work with high school students and undergraduates and uses Logo to teach geometry through a genuine process of exploration; the students *do* mathematics rather than just learn about it. It should dispel anyone's illusions that Turtle geometry is for children. It begins with simple polygon programs and a discussion of the mathematical implications, goes on to discuss models of animal behaviour, escaping from mazes, spacefilling curves, curves on curved surfaces, topology, and finishes with a simulator for General Relativity.

Turtle geometry has been generally recognised as important and has been incorporated into certain versions of Pascal and into Smalltalk.

Sprites

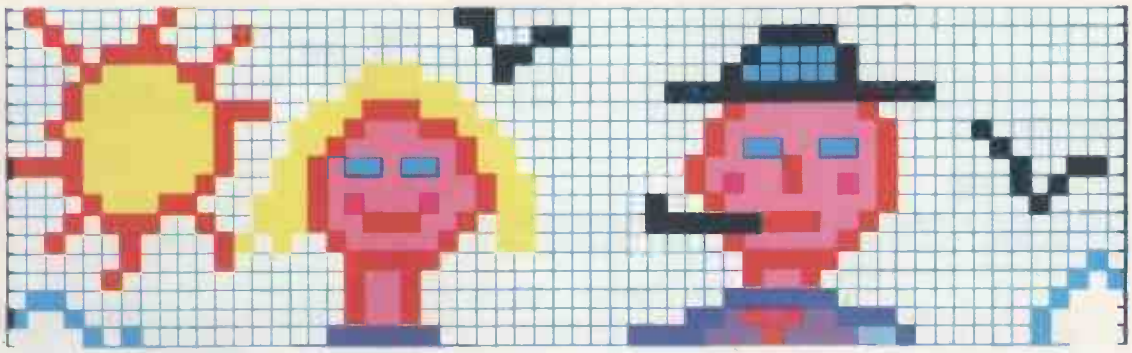
Turtle geometry is the best known example of the application of Logo but there are many more. Turtles can be programmed to use the information from their touch sensors to find their way around objects, and turtle-like robots can be programmed to balance a stick. Logo has been used in the composition of music, and in writing CAL programs.

An interesting application of Logo in physics is the DynaTutle, which is a point which moves with constant velocity (unless a force is applied), modelling Newtonian mechanics. In TI Logo this idea has been extended and gives rise to entities called Sprites. There are 32 Sprites, each of which can be told to carry a predefined or user defined shape in one of 16 colours in any direction at any speed. To the usual Logo commands is added the instruction WAIT (number) which causes the computer to wait for (number)/60 seconds before processing the next command. The result is an environment which is not as much for investigating Newtonian mechanics as for creating startling visual effects and animation and in which children should be able to program their own arcade type games.

List processing

Logo can operate on lists, on lists of lists and so on, reflecting its origins in Lisp. Logo procedures themselves are represented as lists of lists, so Logo procedures can construct, modify and run other Logo procedures.

LOGO LEARNING



Square brackets are used to delimit lists. Some of the basic list processing commands are FIRST (which gives the first item of a list), BUTFIRST (which gives all but the first item of a list), and SENTENCE (joins two inputs to make a list).

The OUTPUT command causes a procedure to quit and return to the level that called it, carrying a single value (this value could be a list, however). If we use this to implement a procedure, CALLUSER, that causes a procedure to halt, take input from the keyboard and use this as its output to the next higher level, we have a useful aid for top-down programming, for we can test the main procedure before the sub-procedures have been written. Edinburgh University has such a feature in the Logo used in its Artificial Intelligence course. (The lecture notes for this course are published as a book, *Artificial Intelligence*, edited by A Bundy, and include example programs in Logo dealing with problem solving, sentence generation, visual perception and learning.)

Here is a simple procedure that omits the first occurrence of a word from a list:

```
TO WITHOUT1 ITEM LIST
  IF :LIST = [ ] THEN PRINT [ITEM NOT FOUND] STOP
  IF :ITEM = FIRST: LIST THEN OUTPUT BUTFIRST
     :LIST OUTPUT SENTENCE FIRST: LIST WITHOUT1
     :ITEM BUTFIRST: LIST
END
```

So typing PRINT WITHOUT 1 BASIC [LOGO FORTH BASIC PASCAL] would produce the output [LOGO FORTH PASCAL].

The future

Earlier versions of Logo were implemented on mainframes and minis, the centre in the UK being Edinburgh University. Versions of Logo for microcomputers are now beginning to appear. Logo will shortly be available in this country from Texas Instruments on the TI 99/4A — the short programs in this article have been run in TI Logo. A rather different version of Logo has been written for Apple, but has only just been issued as this article is being written. Rumour has it that Logo is being written for the RML 380Z and the BBC Computer (In fact, Acorn says it will be available by March 1982 — *Ed*). Edinburgh University has produced 'real' Turtles, one of which is being used in junior schools in Hatfield by the Advisory Unit for Computer Based Education.

Logo has tremendous implications for education. It has been used with average children from four to 18, with highly-gifted high school students, with undergraduates, with autistic children and with children suffering from cerebral palsy. It 'works'. Once children have become able to think about their thinking in this way, the same problem-solving techniques can be applied in different areas, including physical skills. The Logo group at MIT have used this approach to teach juggling and stilt walking.

In this country Logo will probably find an increasing use in pioneering computing in junior schools and on the fringes of the secondary sector (eg, the gifted, or those with severe 'learning problems'). It is unlikely to be used very much within the main body of secondary education because it will not fit into the framework of subjects, exams and grades.

This framework, with its stress on 'ability' (and therefore its converse, 'failure'), tends to reinforce those class divisions which comprehensive education set out to ameliorate; the Logo philosophy, which instead emphasises procedures, bugs and debugging, has a distinctly egalitarian tendency.

As Logo is implemented on personal computers, a powerful educational tool will become available to families, alternative education groups, and any group in which informal learning takes place. If there were more software of this kind we could begin to think about freeing education from schooling, a process that would have great social consequences.

Further reading

Turtle Geometry, Harold Abelson and Andrea diSessa, MIT Press, 1981.

Artificial Intelligence, A Bundy, Ed, Edinburgh University Press, 1978.

Mindstorms, Seymour Papert, Harvester Press, 1980.

END

PCW welcomes approaches from would-be writers, even those who may never have appeared in print before. In this game it is often those with practical experience who have important things to say so we don't mind too much if their prose is less than perfect. Providing that submissions have a sensible structure and follow a logical sequence, we can take care of the polishing. Here are some tips:

If the article is already written, simply send it in, making sure that your name, address and 'phone number appear on both the article and the covering letter. If you have submitted the same work to other magazines you should tell us — it would be embarrassing (to say the least) if the same article appeared in more than one.

If you have an idea for an article or a series, write us a letter outlining your ideas. A one or two page synopsis giving the proposed structure, sequence and content will give us a sound basis for discussion. Please give us a daytime 'phone number if possible.

If you have nothing specific in mind but feel qualified to conduct case studies, Benchtests or whatever then drop us a line saying what you'd like to do and why you think you're qualified to do it. We're not particularly looking for strings of academic qualifications — experience carries just as much weight.

Dick Pountain is always on the look-out for interesting calculator features and we wouldn't mind seeing one or two readers getting on their soapboxes but remember: even articles such as this need a structure.

Reading *PCW* will give you a good idea of the style we prefer. You may notice that we try to avoid pomposity at one extreme and flippancy at the other (except in 'Chip Chat', that is).

Finally, have a look through back issue indexes and try not to re-invent any wheels. Oh, we almost forgot — *PCW* does pay for all published work.

IS BBC BASIC STRUCTURED?

Börge Christensen elaborates further on what constitutes a structured language

In the January issue of *PCW*, Chris Sadler and Sue Eisenbach reported on their Benchtest of the BBC Computer. Both in their article and in others about the BBC micro (in the December issue, for instance) a few references to Comal were made. In the Sadler-Eisenbach Benchtest I found two, both wrong. Let me explain one or two of the more subtle details of Comal-80; in the following I shall refer to the Commodore version (CBM Comal-80).

In the Benchtest it says 'If you try to access a local variable outside its procedure or function, the error message "No such variable" appears on the screen (unlike Comal).'

I don't know which version of Comal is meant, but the ones I know about most certainly *do* protest if a local variable is used outside its scope. Two short examples ought to clear up the case:

```
0010 INPUT A
0020 EXEC PRINTOUT(A)
0030 //
0040 PROC PRINTOUT(B)
0050    PRINT B
0060 ENDPROC PRINTOUT
```

In this program the identifier B represents a *formal parameter* called by value, and A is the *actual parameter*, whose value in this case is passed to B. Below is a sample run of the program:

```
? 5
5
```

As line 10 is executed, the number 5 is entered and assigned to A. In line 20 the procedure PRINTOUT is called; the value of A is passed to B and printed out in line 50. Simple enough. But now try to command the system to

PRINT A

and then to

PRINT B.

In the first case it will display the number 5 as it should, but in the second case it submits the message 'unknown variable', because, in Comal-80, *a parameter is always local.*

And now for another example.

```
0010 INPUT A
0020 EXEC PRINTOUT(A)
0030 //
0040 PROC PRINTOUT(B) CLOSED
0050    DUMMY:=B
0060    PRINT DUMMY
0070 ENDPROC PRINTOUT
```

Seen from the outside, this program does exactly the same as the former one. However, this time a so-called CLOSED procedure is used, and if you ask for the value of the variable DUMMY after running the program, you get the message 'unknown variable' thrown at you once more. The reason for this is that in Comal-80, *any variable introduced in a closed procedure is local.*

In my first definition of Comal-80 I had included a LOCAL statement as in BBC Basic, but the working group that sat down to standardise Comal-80 suggested that the concept of a CLOSED procedure be applied instead and we finally agreed to do it that way. It is simple and efficient. As long as a procedure is 'open' it works just like a normal subroutine in Basic, except for the parameters, but as soon as it is CLOSED you are secured against unwanted side effects, and it is highly advantageous if you want to use the procedure as a *library routine.* People do not need to know anything about what is inside or what variable names are used. Only specifications about its functioning and the structure and meaning of its parameter list need to be given.

Since Comal-80 allows you to pass parameters by value, it is only a short step to the use of *procedures as functions.* So we did that. In this program:

```
0010 INPUT K
0020 EXEC DISPLAY(Q(K))
0030 //
0040 PROC DISPLAY(M)
0050    PRINT M
0060 ENDPROC DISPLAY
0070 //
0080 PROC Q(N)
0090    Q:=3*N
0100 ENDPROC Q
```

the procedure Q is used as a function. This can be seen from the statement in line 90, where the value to be returned by the function is assigned to Q itself. And now — better hold your breath — the function is used as an actual parameter in the procedure call in line 20! So when line 20 is executed the following happens: first the functional procedure Q is called, passing the value of K to the formal parameter N in the head of Q. The value returned by Q is now passed to the formal parameter M in the procedure DISPLAY which finally displays it. Well, I am aware that I am 'killing sparrows with missiles' as we used to say over here, but nevertheless I hope my readers will be indulgent towards me and appreciate that I am trying to demonstrate subtle details using short sample programs.

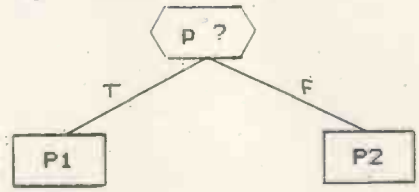
In the Benchtest report I read that BBC Basic 'can take parameters (passed by reference)'. Now, in order to preclude further misunderstandings let me state: so can Comal-80 of course. Take a look at:

```
0010 DIM A$ OF 30
0020 INPUT A$
0030 EXEC CUTLEFT(A$,3)
0040 PRINT A$
0050 //
0060 PROC CUTLEFT(REF B$,M)
0070    IF LEN(B$)<=M THEN
0080       B$:=""
0090    ELSE
0100       L:=LEN(B$)-M
0110       B$:=B$(M+1:L)
0120    ENDIF
0130 ENDPROC CUTLEFT
```

Here B$ is a formal parameter *passed by reference.* While a value parameter is assigned a value during the call of the procedure, a parameter passed by reference is not really 'its own master' but may rather be looked upon as a kind of 'nickname' of the actual parameter. Thus, in the example above, B$ is in fact just another — locally used — name for the variable A$. This means that anything done to B$ really happens to A$. Maybe this humble metaphor can be of some use to you: a boy named Jeremy is called Jim at home by the family — ie, locally *referred to* as Jim — so if Jim is overfed by his mother the rest of the world will see Jeremy grow fat.

And now to my next point. It is mentioned in the article that 'One entertaining command that was implemented is EVAL (borrowed from Comal)'. Apart from my not knowing exactly what EVAL really does — in the articles in the December issue it looks as though it is the BBC counterpart of Logo's DO, this extremely powerful 'ignition, lift-off, keyword', but in the Benchtest article it looks more like the well known string-to-numeric conversion function — to the best of my knowledge a facility of that name is not found in any of the Comal-80 implementations, though the string-to-numeric conversion is of course present under its usual name VAL.

The BBC Basic is said to be a structured Basic, 'The first thing we noticed was that it is a "structured" Basic.' And later on: 'It has IF..THEN..ELSE...'. I suppose we are talking about the one-line IF... THEN... ELSE that seems to be featured in just about every old Basic these days. I would like to settle the analysis of the branching problem as related to 'structured' Basic once and for all. Let us take a look at the fundamental problem: if a certain condition, say p, is met, some process P1 is going to be executed, but if the condition is not met another process P2 must be executed. In a structure diagram it may be pictured like this:



It is easy to program; you simply use:

IF [p] THEN [P1] ELSE [P2]

That's fine as long as P1 and P2 can be expressed in one or two short statements. If this is not the case you will have to resort to the old and ugly:

```
10 IF [p] THEN 40
20 [P2]
30 GOTO 50
40 [P1]
50 ...
```

GOTO page 191

HIGH DENSITY VDU CARD

Concluding his series on building a VDU, Brian Hawkins presents the full circuit diagrams and the software to control it.

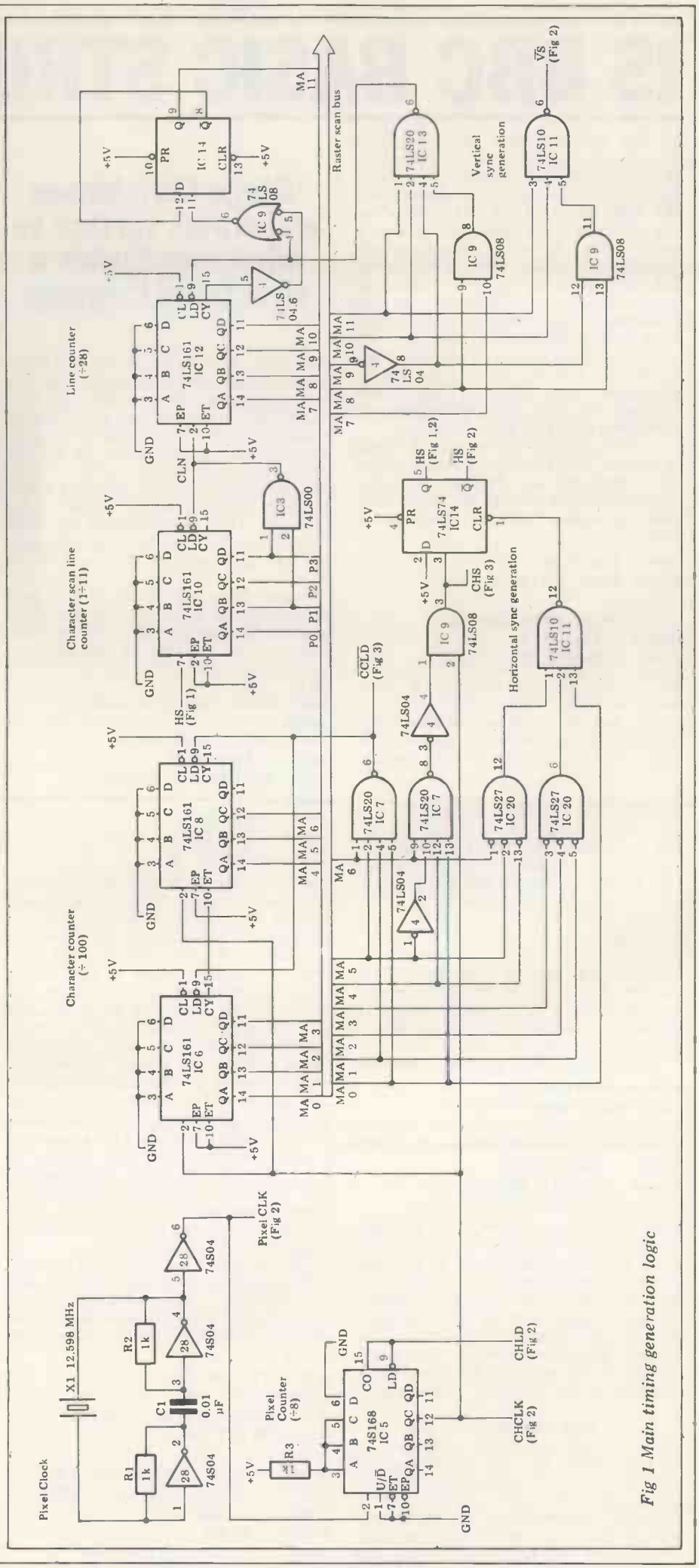


Fig 1 Main timing generation logic

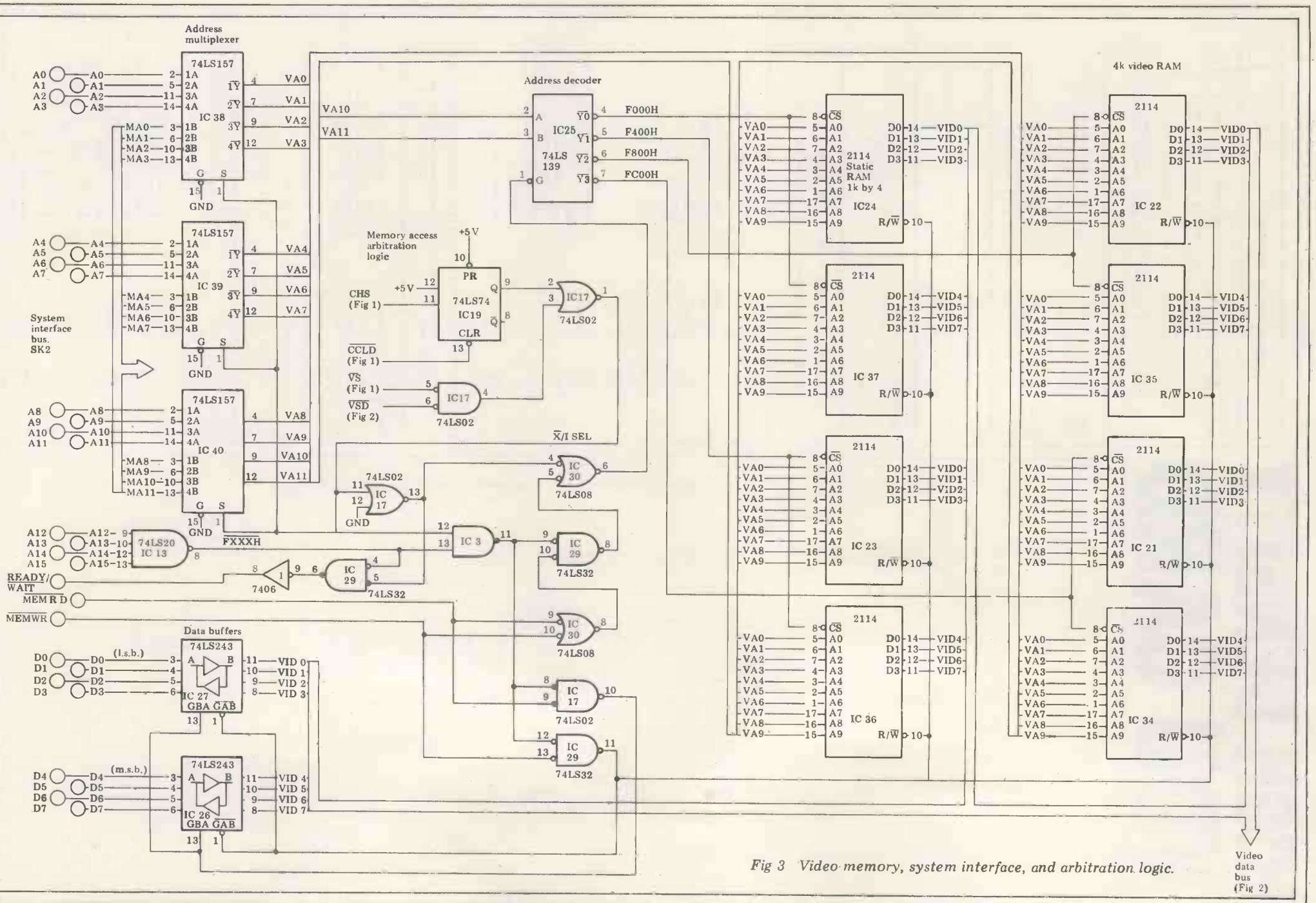


Fig 3 Video memory, system interface, and arbitration logic.

HIGH DENSITY VDU CARD

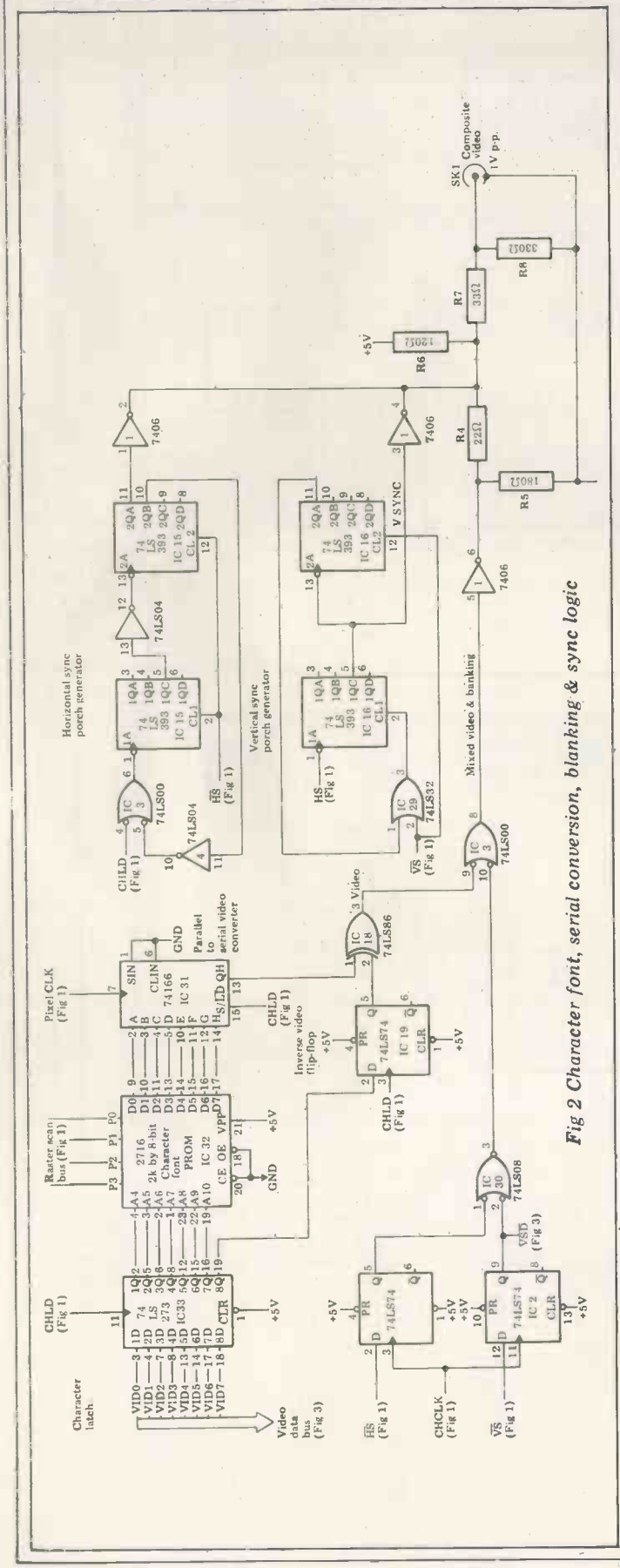


Fig 2 Character font, serial conversion, blanking & sync logic

```
;*****************************************************************
;
;       VDU SCREEN HANDLER ROUTINES
;
;*****************************************************************
;
;       Screen is memory-mapped from F000H.  The map is
;       not complete, ie:
;               the first line is from F000H to F04FH
;               the second line is from F080H to F0CFH
;               etc
;               the last line is from FC80H to FCCFH.
;
;       All memory not used by the screen, ie XX50H to XX7FH
;       and XXCFH to XXFFH in the range F000H to FDFFH is free
;       to be used for pointers, variables, etc.
;
;*****************************************************************
;
SCRSRT: EQU     0F000H          ; Screen memory start address
SCNLIN: EQU     0F080H          ; 2nd line start address
LOFSET: EQU     00030H          ; Line offset value
;
LINENO: EQU     0F060H          ; Line number counter
CHARNO: EQU     0F061H          ; Character number counter
SLINEN: EQU     0F0D0H          ; Scroll line number counter
SCHARN: EQU     0F0D1H          ; Scroll character number counter
;
;*****************************************************************
;
;       INITIALISE SCREEN SUBROUTINE
;
;       Initialises screen pointers, clears screen & sets
;       cursor position
;
;*****************************************************************
;
INSCRN: CALL    CSCRN           ; Call clear screen subroutine
        CALL    INVCLC          ; Set cursor to first character
                                ;  of first line
        RET
;
;*****************************************************************
;
;       FIND SCREEN MEMORY LOCATION SUBROUTINE
;
;       Produces the address in H & L corresponding to the
;       current line & character numbers.
;
;*****************************************************************
;
FNDLOC: PUSH    PSW             ; Save status, accumulator and
        PUSH    D               ;  D reg pair on stack
;
        LXI     D,SCRSRT        ; Load DE with screen start addr
        LDA     LINENO          ; Fetch line number
        MOV     L,A             ; Move into L
        MVI     H,00H           ; Clear H
        DAD     H               ; Multiply
        DAD     H               ;  HL
        DAD     H               ;  by
        DAD     H               ;  80H
        DAD     H
        DAD     H
        DAD     H
;
        DAD     D               ; Add screen memory start addr
        LDA     CHARNO          ; Fetch character number
        ADD     L               ; Add L
        MOV     L,A             ;  and store in L
;                               ; H & L now contain a screen
;                               ;  memory location corresponding
;                               ;  to the current line & character
;                               ;  number.
;
        POP     D               ; Restore D reg pair &
        POP     PSW             ;  status & accumulator
        RET
;
;*****************************************************************
;
;       INVERT VIDEO AT CURRENT LINE & CHARACTER POSITION
;       SUBROUTINE
;
;*****************************************************************
;
INVCLC: CALL    FNDLOC          ; Call find location to find
;                               ;  addr of cursor
        MOV     A,M             ; Pick up code at cursor pos'n
        XRI     80H             ; Invert video by inverting top bit
        MOV     M,A             ; Return it to memory
        RET
;
;*****************************************************************
;
;       SINGLE CHARACTER OUTPUT SUBROUTINE
;
;       Takes an ASCII code in acc and writes it to the
;       current cursor position.
;
;*****************************************************************
;
CHAROP: PUSH    PSW             ; Save registers onto stack
        PUSH    B
        PUSH    D
        PUSH    H
;
        CPI     08H             ; Test for backspace code
        JZ      BACKSP          ;  & jump to backspace if so
        CPI     09H             ; Test for cursor right code
        JZ      CURADV          ;  & jump to cursor advance if so
        CPI     0DH             ; Test for carriage return
        JZ      CARRET          ;  & jump to carriage ret if so
        CPI     0AH             ; Test for lfeed (cursor down) code
        JZ      LFEED           ;  & jump to line feed if so
        CPI     1AH             ; Test for cursor up code
        JZ      CUP             ;  & jump to cursor up if so
        CPI     0CH             ; Test for clear screen code
        JZ      CLRSCN          ;  & jump to screen clear if so
;
        MOV     B,A             ; Store code in B
        CALL    INVCLC          ; Remove cursor from screen
        MOV     M,B             ; Write to current line & char no
```

```
        CALL    CURINC          ; Call increment cursor
        CALL    INVCLC          ; Replace cursor
;
RETCH:  POP     H               ; Restore registers
        POP     D
        CALL    INVCLC          ; Replace cursor
;
RETCH:  POP     H               ; Restore registers
        POP     D
        POP     B
        POP     PSW
        RET
;
;++++++++++++++++++++++++++CARRIAGE RETURN++++++++++++++++++++++++
;
CARRET: CALL    INVCLC          ; Remove cursor from screen
CAR1:   CALL    FNDLOC          ; Calculate location
        MVI     A,20H           ; Load acc with ASCII space code
        MOV     M,A             ; Load screem memory
        CALL    CURINC          ; Incr cursor position
;
        LDA     CHARNO          ; Test for 1st loc in next line
        CPI     00H
        JNZ     CAR1            ; If not, jump to CAR1
;
        CALL    INVCLC          ; Replace cursor
        JMP     RETCH
;
;++++++++++++++++++++++++++CURSOR ADVANCE++++++++++++++++++++++++
;
CURADV: CALL    INVCLC          ; Remove cursor
        LDA     CHARNO          ; Pick up char no
        CPI     4FH             ; Test for end of line
        JZ      CURAD1          ; If so leave CHARNO alone
        INR     A               ; If not, incr it
        STA     CHARNO          ; Store CHARNO away
CURAD1: CALL    INVCLC          ; Replace cursor
        JMP     RETCH
;
;++++++++++++++++++++++++++BACKSPACE CURSOR++++++++++++++++++++++
;
BACKSP: CALL    INVCLC          ; Remove cursor
        LDA     CHARNO          ; Pick up char number
        CPI     00H             ; Test for start of line
        JZ      BACK1           ; If so, leave char no alone
        DCR     A               ; If not, decrement it
        STA     CHARNO          ; Store it away
BACK1:  CALL    INVCLC          ; Replace cursor
        JMP     RETCH
;
;++++++++++++++++++++++++++LINE FEED (CURSOR DOWN)+++++++++++++++
;
LFEED:  CALL    INVCLC          ; Remove cursor
        LDA     LINENO          ; Pick up line number
        CPI     25              ; Test for last line
        JZ      LF1             ; If so leave line no alone
        INR     A               ; Else incr it
        STA     LINENO          ; Store it
LF1:    CALL    INVCLC          ; Replace cursor
        JMP     RETCH
;
;++++++++++++++++++++++++++CURSOR UP++++++++++++++++++++++++++++++
;
CUP:    CALL    INVCLC          ; Remove cursor
        LDA     LINENO          ; Pick up line no
        CPI     00H             ; Test for first line
        JZ      CUP1            ;  & leave alone if so
        DCR     A               ; If not decr it
        STA     LINENO          ; Restore it
CUP1:   CALL    INVCLC          ; Replace cursor
        JMP     RETCH
;
;++++++++++++++++++++++++++CLEAR SCREEN++++++++++++++++++++++++++
;
CLRSCN: CALL    CSCRN           ; Call clear screen subroutine
        CALL    INVCLC          ; Replace cursor
        JMP     RETCH
;
;*****************************************************************
;
;       CURSOR INCREMENT SUBROUTINE
;
;       Increments cursor, adjusts pointers for new line and
;       scrolls screen when bottom line reached
;
;*****************************************************************
;
CURINC: LDA     CHARNO          ; Increment character no pointer
        INR     A
        STA     CHARNO          ; Test for end of line
        CPI     50H
        RNZ                     ;  and return if not at line end
;
        MVI     A,00H           ; Reset character no to zero
        STA     CHARNO
;
        LDA     LINENO          ; Incr line no
        INR     A
        STA     LINENO
        CPI     26              ; Test for end of page
        RNZ                     ; Return if not at page end
;
        LDA     LINENO          ; Decr line no
        DCR     A
        STA     LINENO
        CALL    SCROLL          ; Call scroll subroutine
        RET
;
;*****************************************************************
;
;       SCROLL SCREEN SUBROUTINE
;
;       Moves line 1 to line 0, line 2 to line 1, etc, line
;       25 to line 24 and clears line 25
;
;*****************************************************************
;
SCROLL: PUSH    B               ; Save regs
        PUSH    D
        PUSH    H
;
        MVI     A,00H
        STA     SCHARN          ; Clear scroll char number
        STA     SLINEN          ; Clear scroll line number
;
        LXI     B,SCNLIN        ; Load B with start of line 1
        LXI     H,SCRSRT        ; Load H with start of line 0
        LXI     D,LOFSET        ; Load D with line adjust value
;
SCNEXT: LDAX    B               ; Load from location in B into acc
                                  ie, pick up code from line N+1
;
        MOV     M,A             ; Store in A, ie, move to line N
        INX     B               ; Incr pointer in B
        INX     H               ; Incr pointer in H
;
        LDA     SCHARN          ; Incr scroll char no
        INR     A
        STA     SCHARN
;
        CPI     50H             ; Test for end of line
        JNZ     SCNEXT          ; If not, jump to move next char
        DAD     D               ; Adjust H & L to start of next line
        MOV     A,C             ; Adjust B & C to start of next line
        ADD     E               ;  by adding DE to HL
        MOV     C,A
        MOV     A,B
        ADC     D
        MOV     B,A
;
        MVI     A,00H           ; Clear scroll char counter
        STA     SCHARN
;
        LDA     SLINEN          ; Incr scroll line no
        INR     A
        STA     SLINEN
;
        CPI     25              ; Test for last line
        JNZ     SCNEXT          ;  & jump if not
;
CLRLIN: MVI     A,20H           ; Set acc to ASCII space
        MOV     M,A             ; Store in screen memory
        INX     H
        LDA     SCHARN          ; Incr scroll char no
        INR     A
        STA     SCHARN
;
        CPI     50H             ; Test for end of last line
        JNZ     CLRLIN          ;  & jump if not
;
        POP     H               ; Restore registers
        POP     D
        POP     B
        RET
;
;*****************************************************************
;
;       FILL SCREEN SUBROUTINE
;
;       Enter with code in acc
;
;*****************************************************************
;
FSCRN:  PUSH    B               ; Save registers
        PUSH    D
        PUSH    H
;
        LXI     H,SCRSRT        ; Load HL with start of screen map
        LXI     D,LOFSET        ; Load DE with incr to next line
;                                 start value
        MOV     B,A             ; Store code to fill with in B
        MVI     A,00H
        STA     LINENO          ; Set line no to 0
        STA     CHARNO          ; Set char no to 0
FSMEM:  MOV     M,B             ; Store code in screen memory
        INX     H               ; Incr memory pointer
        LDA     CHARNO          ; Incr char counter
        INR     A
        STA     CHARNO
        CPI     50H             ; Test for end of line
        JNZ     FSMEM           ; Jump back if not to fill next
;                                 char position
        DAD     D               ; Adjust HL to start of next line
        MVI     A,00H           ; Reset char counter
        STA     CHARNO
        LDA     LINENO          ; Incr line number counter
        INR     A
        STA     LINENO
        CPI     26              ; Test for end of page
        JNZ     FSMEM           ; Jump back if not to fill next
;                                 char position
        MVI     A,00H           ; Reset line number
        STA     LINENO
;
        POP     H               ; Restore registers
        POP     D
        POP     B
        RET
;
;*****************************************************************
;
;       CLEAR SCREEN SUBROUTINE
;
;       Clears the screen
;
;*****************************************************************
;
CSCRN:  MVI     A,20H           ; Load acc with ASCII space char
        CALL    FSCRN           ; Call fill screen subroutine
        RET
;
;=================================================================
```

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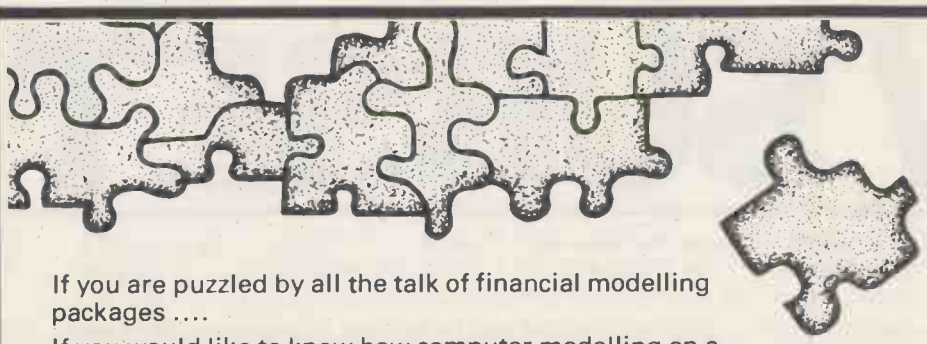

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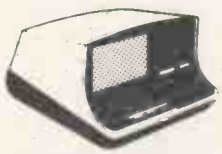

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PCW SUBSET

Alan Tootill presents more useful assembler-language subroutines. This is **your** *chance to help build a library of general-purpose routines, documented to the standards we have developed together in this series. You can contribute a Datasheet, improve or develop one already printed or translate the implementation of a good idea from one processor to another.* PCW *will pay for those contributions that achieve Datasheet status. Contributions (for any of the popular processors) should be sent to: Sub Set, PCW, 14 Rathbone Place, London W1P 1DE*

I hope Z80 users are still busy creating moving shapes on their memory-mapped screens, using last month's routines, so I have just a few small items for them this month. New Datasheets are for the 6502 processor. In February, we printed SNEG46 and SBAD46, from Dennis May of London, to negate a signed 4-byte binary number and to convert a signed 4-byte binary number to an ASCII-decimal string. This month we give Dennis's remaining routines to convert an ASCII-decimal string to a signed 4-byte binary number and to divide and multiply binary numbers.

As I am still waiting (at the end of January) for my BBC Micro, these 6502 routines have been checked for us by Dave Barrow of Hemsworth. The routine uses 16 bytes of contiguous zero page memory, designated M0 to MF in the assembler mnemonics and ZZ in the hex code.

ASCII to binary

In this first Datasheet a negative number, preceded by a minus sign, will cause a CALL to routine SNEG46, which was given in February.

Datasheet

```
;=SADB46 - ASCII-decimal to 32-bit binary conversion
;/CLASS: 2
;/TIME CRITICAL?: No
;/DESCRIPTION: Converts an ASCII-decimal string to a signed
;/             32-bit integer
;/ACTION: If there's a sign, get it & increment character
;/        pointer.
;/        Clear 32-bit accumulator
;/        Fetch digit & convert to binary
;/        Multiply accumulator by 10 & add digit
;/        Repeat until non-numerical character found
;/        Negate accumulator if sign was '-'
;/SUBr DEPENDENCE: SNEG46
;/INTERFACES: An area of RAM, pointed to by MA-MB, holds
;/            the ASCII-decimal string
;/INPUT: MA-MB (with the most significant byte in MB) point
;/       to first byte of the string to be converted, which
;/       may start with a plus or minus sign and is terminated
;/       by the first character that is not an ASCII-decimal
;/       digit.  If there is no sign, a positive value is assumed.
;/OUTPUT: For a valid string: M1-M4 contain the signed binary
;/        equivalent, with the least significant byte at M1 and
;/        the most significant at M4.  MA-MB point to the
;/        beginning character.  The carry is reset.
;/        For overflow: the carry is set.  MA-MB point to the
;/        beginning character.
;/REGS USED: A,X,Y,P,M0 to MC
;/STACK USE: 3
;/LENGTH: 115
;/PROCESSOR: 6502
;
SADB46: LDY     £0      ; character count           A0 00
        LDA     (MA),Y  ; get first character       B1 ZZ
        SEC             ;                           38
        SBC     £$2D    ; Subtract ASCII '-'        E9 2D
        STA     M0      ; save sign                 85 ZZ
        BEQ     SDB1    ; jump if sign minus        F0 04
        CMP     £$FE    ; is character '+'?         C9 FE
        BNE     SDB2    ; skip if not               D0 01
SDB1:   INY             ; point to next char        C8
SDB2:   LDA     £0      ; zeroise accumulator       A9 00
        STA     M1      ;                           85 ZZ
        STA     M2      ;                           85 ZZ
        STA     M3      ;                           85 ZZ
        STA     M4      ;                           85 ZZ
SDB3:   LDA     (MA),Y  ; fetch character           B1 ZZ
        SEC             ; is char a number?         38
        SBC     £$30    ;                           E9 30
        BCC     END1    ; jump if not               90 47
        CMP     £10     ;                           C9 0A
        BCS     END1    ; jump if not               B0 43
        STA     M5      ; save digit                85 ZZ
        LDX     £4      ; byte counter              A2 04
SDB4:   LDA     M0,X    ; get byte ctr from acc     B5 ZZ
        STA     M5,X    ; store to secondary acc    95 ZZ
        DEX             ; next byte                 CA
        BNE     SDB4    ; jump if not done          D0 F9
        STY     MC      ; save RAM point            84 ZZ
        LDY     £9      ; add nine times            A0 09
SDB5:   CLC             ; clear carry               18
        LDX     £0      ; byte point                A2 00
SDB6:   LDA     M1,X    ; add byte in acc to        B5 ZZ
        ADC     M6,X    ; byte in secondary acc &   75 ZZ
        STA     M1,X    ; store in acc              95 ZZ
        PHP             ; save carry                08
        INX             ; next byte                 E8
        CPX     £4      ; all done?                 E0 04
        BEQ     SDB7    ; jump if all done          F0 04
        PLP             ; restore carry             28
        JMP     SDB6    ; next byte                 4C YY YY
SDB7:   PLP             ; get overflow information  28
        BVS     OVFW1   ; jump if overflow          70 27
        DEY             ; do                        88
        BNE     SDB5    ; 9 times                   D0 E7
        LDY     MC      ; restore RAM point         A4 ZZ
        CLC             ; add digit                 18
        LDA     M5      ; to accumulator            A5 ZZ
        ADC     M1      ;                           65 ZZ
        STA     M1      ;                           85 ZZ
        BCC     SDB8    ;                           90 0C
        INC     M2      ;                           E6 ZZ
        BNE     SDB8    ;                           D0 08
        INC     M3      ;                           E6 ZZ
        BNE     SDB8    ;                           D0 04
        INC     M4      ;                           E6 ZZ
        BMI     OVFW1   ; jump if overflow          30 0D
SDB8:   INY             ; point to next digit       C8
        JMP     SDB3    ; repeat till non-digit     4C YY YY
END1:   LDX     M0      ; get sign                  A6 ZZ
        BNE     SDB9    ; skip if sign positive     D0 03
        JSR     SNEG46  ; negate if negative        20 XX XX
SDB9:   CLC             ; clear carry to show OK    18
        RTS             ;                           60
OVFW1:  SEC             ; set carry to show error   38
        RST             ;                           60
```

HLFHL

This is a Z80 routine, printed in February '81, to give, in the fewest possible bytes, HL=HL/2, when HL contains four BCD digits. It was done in 21 bytes. Gavin Every of Woking has shaved one byte off this by initialising BC in one instruction instead of loading B and C separately. Here is the amended code:

```
HLFHL:  PUSH    BC          ; C5
        LD      A,+4        ; 3E 04
        OR      A           ; B7
LOOP1:  JR      NC,JUMP     ; 30 01
        ADD     HL,BC       ; 09
JUMP:   LD      BC,0A004H   ; 01 04 A0
LOOP2:  ADC     HL,HL       ; ED 6A
        DEC     C           ; 0D
        JR      NZ,LOOP2    ; 20 FB
        DEC     A           ; 3D
        JR      NZ,LOOP1    ; 20 F2
        POP     BC          ; C1
        RET                 ; C9
```

Division

Back now to the 6502 arithmetic. Datasheet SDIV46 also uses February's SNEG46 and another routine, ABS4, the last of this month's Datasheets.

Datasheet

```
;=SDIV46 - 32-bit signed integer divide
;/CLASS: 2
;/TIME CRITICAL?: No
;/DESCRIPTION: Divides two signed 32-bit integers,
;/             giving quotient & remainder
;/ACTION: Get quotient and remainder signs
;/        Get absolute values of dividend and divisor
;/        Check for division by zero
;/        Clear accumulator
;/        Shift dividend left into acc
;/        Subtract divisor from acc
;/        If acc positive, set result bit
;/        else add back divisor
;/        Repeat 32 times
;/        Negate quotient and remainder if signs demand
;/SUBr DEPENDANCE: SNEG46 and ABS4
;/INTERFACES: None
;/INPUT: Dividend in M6-M9 with most significant byte in M9
;/       Divisor in MA-MD with most significant byte in MD
;/OUTPUT: For valid calculation: carry reset, quotient in M1-M4
;/        with most significant byte in M4
;/        For division by zero, carry set, arguments unchanged
;/REGS USED: A,X,Y,P,M0 to MF
;/STACK USE: 4
;/LENGTH: 117
;/PROCESSOR: 6502
;
SDIV46: LDA     M9      ; remainder sign            A5 ZZ
        STA     M5      ; = dividend sign           85 ZZ
        JSR     ABS4    ; get quotient sign and     20 XX XX
        STX     M1      ; absolute values           86 ZZ
        STX     M2      ; clear accumulator         86 ZZ
        STX     M3      ;                           86 ZZ
        STX     M4      ;                           86 ZZ
        LDA     MA      ; check for                 A5 ZZ
        ORA     MB      ; division                  05 ZZ
        ORA     MC      ; by                        05 ZZ
        ORA     MD      ; zero                      05 ZZ
        BEQ     ERROR   ; jump if so                F0 5A
        LDY     £32     ; bit count                 A0 20
SDV1:   ASL     M6      ; shift                     06 ZZ
```

PCW SUBSET

```
        ROL     M7      ; dividend                  26 ZZ
        ROL     M8      ; left                      26 ZZ
        ROL     M9      ; through                   26 ZZ
        ROL     M1      ; accumulator               26 ZZ
        ROL     M2      ;                           26 ZZ
        ROL     M3      ;                           26 ZZ
        ROL     M4      ;                           26 ZZ
        LDA     £4      ; byte count                A9 04
        STA     ME      ; to                        85 ZZ
        STA     MF      ; RAM                       85 ZZ
        LDX     £0      ; byte position             A2 00
        SEC             ; carry = 1 initially       38
SDV2:   LDA     M1,X    ; subtract divisor          B5 ZZ
        SBC     MA,X    ; from accumulator and      F5 ZZ
        STA     M1,X    ; store to accumulator      95 ZZ
        INX             ; next                      E8
        DEC     ME      ; all done?                 C6 ZZ
        BNE     SDV2    ; repeat if not             D0 F5
        BCS     SDV4    ; skip if acc. positive     B0 10
        CLC             ;                           18
        LDX     ME      ; byte postition            A6 ZZ
SDV3:   LDA     M1,X    ; add back divisor          B5 ZZ
        ADC     MA,X    ;                           75 ZZ
        STA     M1,X    ;                           95 ZZ
        INX             ; next                      E8
        DEC     MF      ; all done?                 C6 ZZ
        BNE     SDV3    ; repeat if not             D0 F5
        BEQ     SDV5    ; skip                      F0 02
SDV4:   INC     M6      ; set result bit            E6 ZZ
SDV5:   DEY             ; repeat                    88
        BNE     SDV1    ; 32 times                  D0 C5
        BIT     M5      ; check remainder sign      24 ZZ
        BPL     SDV6    ; skip if positive          10 03
        JSR     SNEG46  ; negate                    20 XX XX
SDV6:   LDX     £4      ; byte count                A2 04
SDV7:   LDA     M0,X    ; transfer remainder        B5 ZZ
        STA     M9,X    ; to MA-MD                  95 ZZ
        LDA     M5,X    ; transfer dividend to      B5 ZZ
        STA     M0,X    ; accumulator               95 ZZ
        DEX             ; next                      CA
        BNE     SDV7    ;                           D0 F5
        BIT     M0      ; check dividend sign       24 ZZ
        BPL     SDV8    ; skip if positive          10 03
        JSR     SNEG46  ; negate                    20 XX XX
SDV8:   CLC             ; clear carry to show ok    18
        RTS             ; return                    60
ERROR:  SEC             ; set carry to show error   38
        RTS             ; return                    60
```

Jumpless jumping

Focus now on the table to load error message addresses, labelled XMSG1 to XMSG5, in January's Z80 CP/M file-handling routines. If the routines want to load to HL the address of error message 1 (at MSG1) they jump to label XMSG1, which does the load and gets to the instruction EX DE,HL, after label XMSG5, without a jump. The address of error message 2, 3 or 4 is loaded by a jump to XMSG2, XMSG3 or XMSG4 and the EX DE,HL is reached without any further jump. This is because the intervening dummy byte DD converts the following LD HL (21) instruction into an LD IX (DD 21) and puts any unwanted error message addresses into IX, instead of overwriting the address selected at the label at which the table was entered. A neat trick for byte-misers but, as Roger Hargrave of Crawley brings out, one that should have been reflected in the documentation. Routines WRITE, OPEN, CLOSE and CREATE would all use the IX register after an error.

Multiplication

The Datasheet SMUL46, like the division, uses routines SNEG46 and ABS4.

Datasheet

```
;=SMUL46- 32 bit signed integer multiply

;/CLASS: 2
;/TIME CRITICAL?: No
;/DESCRIPTION:Multiplies two 32-bit signed integers in M6-M9
;/            (secondary acc) & MA-MD (tertiary acc)
;/ACTION:Get product sign and absolute values of arguments
;/       Clear accumulator
;/       Multiply accumulator by 2 and check for overflcw
;/       Get next bit and if it is 1 add multiplicand to
;/       accumulator and check for overflow
;/       Repeat 32 times
;/       Negate if product sign minus
;/SUBr DEPENDENCE: SNEG46, ABS4
;/INTERFACES: None
;/INPUT: Multiplicand in MA-MD, Multiplier in M6-M9, with the
;/       most significant bytes in MD and M9
;/OUTPUT:No error: Product in M1-M4, M6-M9=zero, MA-MD
;/       contains the absolute multiplicand, carry is reset
;/       Overflow: Carry set, all three accumulators
;/       indeterminate
;/REGS USED: A,X,Y,P,M0 to ME
;/STACK USE: 4
;/LENGTH: 71
;/PROCESSOR: 6502
SMUL46: JSR     ABS4    ; calculate sign of product 20 XX XX
        LDA     £0      ; and absolute values       A9 00
        STA     M1      ; zeroise                   85 ZZ
        STA     M2      ; accumulator               85 ZZ
        STA     M3      ;                           85 ZZ
        STA     M4      ;                           85 ZZ
        LDY     £32     ; bit count                 A0 20
SML1:   ASL     M1      ; shift                     06 ZZ
        ROL     M2      ; left                      26 ZZ
        ROL     M3      ; accumulator               26 ZZ
        ROL     M4      ;                           26 ZZ
        BMI     OVFW2   ; jump if                   30 2C
        BCS     OVFW2   ; overflow                  B0 2A
        ASL     M6      ; get next                  06 ZZ
        ROL     M7      ; bit of                    26 ZZ
        ROL     M8      ; multiplier                26 ZZ
        ROL     M9      ; into carry                26 ZZ
        BCC     SML3    ; skip if bit is a 0        90 14
        LDX     £4      ; byte count                A2 04
        STX     ME      ; to RAM                    86 ZZ
        LDX     £0      ; byte position             A2 00
        CLC             ; carry=0 initially         18
SML2:   LDA     M1,X    ; add byte in               B5 ZZ
        ADC     MA,X    ; acc to multiplicand       75 ZZ
        STA     M1,X    ; and store in acc          95 ZZ
        INX             ; next                      E8
        DEC     ME      ; all done?                 C6 ZZ
        BNE     SML2    ; repeat if not             D0 F5
        BVS     OVFW2   ; jump if overflow          70 0C
SML3:   DEY             ; repeat                    88
        BNE     SML1    ; 32 times                  D0 D3
        BIT     M0      ; test product sign         24 ZZ
        BPL     SML4    ; skip if positive          10 03
        JSR     SNEG46  ; negate                    20 XX XX
SML4:   CLC             ; clear carry to show ok    18
        RTS             ; return                    60
OVFW2:  SEC             ; set carry to show error   38
        RTS             ; return                    60
```

Datasheet

```
;=ABS4-Get absolute values of two numbers

;/CLASS: 2
;/TIME CRITICAL?: No
;/DESCRIPTION: Gets absolute values of two 32-bit accumulators
;/             in page zero RAM, leaving X=0 and the sign of
;/             the product of the accumulators in M0
;/ACTION: Exclusive OR the most significant bytes of the
;/        accumulators and store in M0
;/        Get secondary accumulator into accumulator
;/        If it is negative, negate accumulator
;/        Transfer accumulator back to secondary accumulator
;/        Get tertiatr accumulator into accumulator
;/        If it is negative, negate accumulator
;/        Transfer accumulator back to tertiary accumulator
;/SUBr DEPENDANCE: None
;/INPUT: Secondary (M6-M9) & tertiary (MA-MD) accumulators
;/       contain 32-bit signed numbers, with the most
;/       significant bytes in M9 and MD
;/OUTPUT: Secondary and tertiary accumulators contain their
;/        absolute values X=0 M0 has sign of the product
;/        of the secondary and tertiary accumulators
;/REGs USED: A,X,P,M0 to ME
;/STACK USE: 2
;/LENGTH: 57
;/PROCESSOR: 6502
ABS4:   LDA     M9      ; get secondary acc sign &  A5 ZZ
        EOR     MD      ; xor with tert acc sign    45 ZZ
        STA     M0      ; store to RAM              85 ZZ
        LDX     £4      ; byte count                A2 04
AB1:    LDA     M5,X    ; transfer byte from        B5 ZZ
        STA     M0,X    ; secondary acc to acc      95 ZZ
        DEX             ; next                      CA
        BNE     ABL:    ;                           D0 F9
        BIT     M4      ; test sign                 24 ZZ
        BPL     AB2     ; skip if plus              10 03
        JSR     SNEG46  ; negate                    20 XX XX
AB2:    LDX     £4      ; byte count                A2 04
AB3:    LDA     M0,X    ; transfer byte from        B5 ZZ
        STA     M5,X    ; acc to secondary acc      95 ZZ
        DEX             ; next                      CA
        BNE     AB3     ;                           D0 F9
        LDX     £4      ; byte count                A2 04
AB4:    LDA     M9,X    ; transfer byte from        B5 ZZ
        STA     M0,X    ; Tertiary acc to acc       95 ZZ
        DEX             ; next                      CA
        BNE     AB4     ;                           D0 F9
        BIT     M4      ; test sign                 24 ZZ
        BPL     AB5     ; skip if plus              10 03
        JSR     SNEG46  ; negate                    20 XX XX
AB5:    LDX     £4      ; byte count                A2 04
AB6:    LDA     M0,X    ; transfer byte from        B5 ZZ
        STA     M9,X    ; acc to tertiary acc       95 ZZ
        DEX             ; next                      CA
        BNE     AB6     ;                           D0 F9
        RTS             ; return                    60
```

Extra Z80 instruction

On switching from an M6800 to a Z80 processor, J Harwood of Reigate missed most the instruction LDX 0,X to load into the index register the value pointed to by the index register. He thinks an LD HL,(HL) would be useful for the Z80 and here is his class 1 code to do it:

```
PUSH DE     ;D5
PUSH HL     ;E5
LD   L,(HL) ;6E
EX   DE,HL  ;EB
POP  HL     ;E1
INC  HL     ;23
LD   H,(HL) ;66
LD   L,E    ;6B
POP  DE     ;D1
RET         ;C9
```

Alan Sutcliffe delivers more advanced graphics techniques

A few years ago the advertising agency Young & Rubicam asked me (that is, they paid me) to produce a graphic by computer suitable for the campaign they were running for Gilbey's gin. You may remember the ads: a piece of op art, frenteic at the top, gradually relaxing lower down the picture, above the caption 'The Unwinder.'

The idea that emerged from our discussions (that's what people say when someone else thought of the idea) was for a network of quadrilateral cells; irregular at the top, with a transition to soothing rectangles at the bottom. Figure 1 shows how far the work progressed — a mock up of an ad made by Young & Rubicam using many of my plots. I am sorry to say that they then decided that this was not precisely what they were for looking for, so I didn't have the satisfaction of seeing my work splashed across the colour supplements.

I have converted my program from the original Fortran to Basic to run on my DAI computer and this article is a commntary on the methods of the program and their detailed implementation. The original program was written for the Cyphenetics time-sharing system. One night when I was using the system believing myself to be interacting as usual with the computer in Slough, I was puzzled to see that the time of day was five or six hours slow. Only later did it dawn on me that my job had had been switched via satellite to another node in the network and was running on the machine in Dayton, Ohio. There was no noticeable difference in the response time, except that all the hard-copy plotting was done in Dayton, too, so that took three or four days to arrive by airmail.

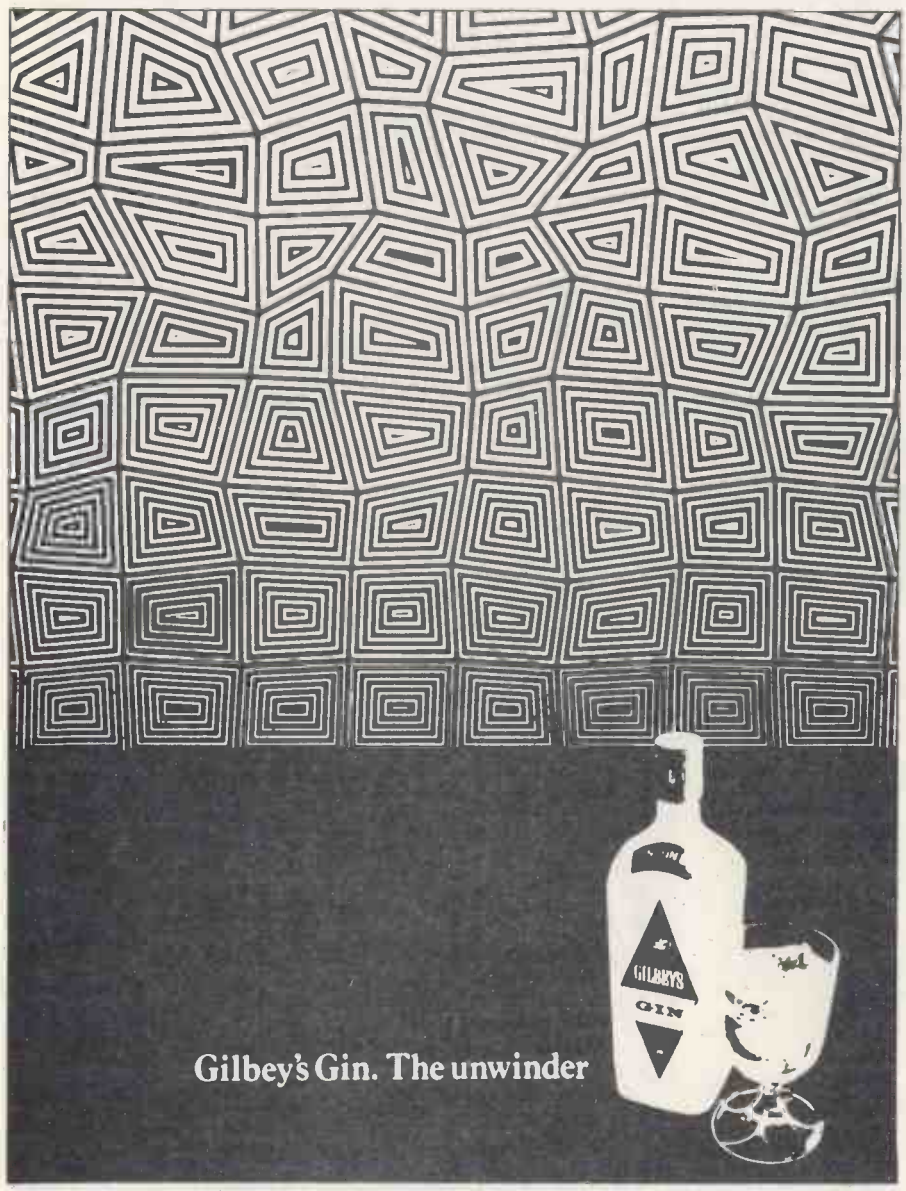


Figure 1

In outline, the program first computes a network of quadrilaterals. The grid points for the corners of these are almost regularly spaced at the bottom and moving up the picture there is an increasing random disturbance. The program then takes each quadrilateral cell in turn and draws inside it a set of decreasing concentric shapes. These are usually also quadrilaterals but in some cases they degenerate into triangles. The most tricky part of the program is determining when this transition takes place and when the shape has reached zero size so that the program can move on to the next cell.

Random network

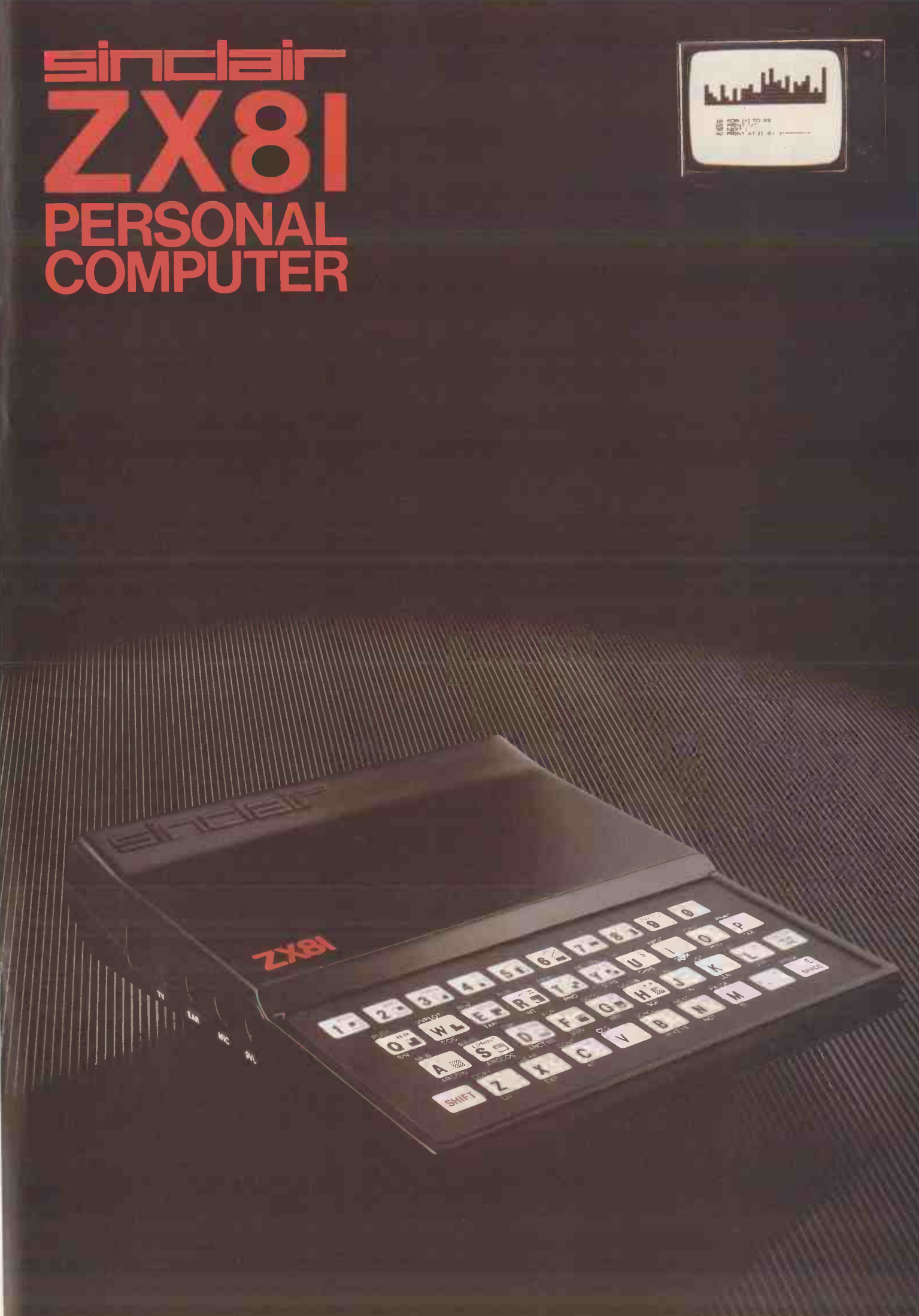
The first three lines of program are housekeeping for the DAI. NX and NY are the number of cells horizontally and vertically, while M and N are the dimensions of each rectangular cell before the random distortion. The arrays U and V hold the x and y coordinates of the grid, that is the corners of the quadrilaterals. R is a factor that increases from 0 to 1 from the bottom row of coordinates to the top row. R is used to multiply a random value in the range −0.5 to 0.5. Without the random disturbance the grid points are simply a rectangular grid with distances M and N between points: call this the cell block size. Even in the top row of points where the possible displacement is most, it is confined to half the cell block size on each side of the base point, so that one point cannot stray quite far enough to get into the region around the next point. If it could, quadrilaterals could result in which what should be opposite sides end up crossed like diagonals, as in Figure 2(a). Lower down the picture the rectangles within which the random distortion is confined are smaller by the factor R, as shown in Figure 2(b).

Having set the corners of the cells, the code starting at line 230 draws first all the (more or less) vertical sides and then the horizontal ones. Notice that the count for the number of lines starts from 0 while that for the number of sides in a line starts from 1: the number of posts is one more than the number of gaps between them.

The processing for each cell starts at line 500. First the coordinates of the corners are copied into the arrays X and Y. The calculation for the coordinates of the new inner corner depends on the two sides meeting at that corner and so on the coordinates of the corners on either side of it, as shown in Figure 3. To allow the computation to be done conveniently in a loop, therefore, the coordinates for the first two corners must be copied into the extra fifth and sixth elements in X and Y. I call this wrap-around, and wrap-around of only one set of values is needed for the other arrays.

ZD, which is set in line 330, is the distance between each concentric

sinclair ZX81 PERSONAL COMPUTER



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

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

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

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

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

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

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

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

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Higher specification, lower price – how's it done?
Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

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

New, improved specification
- Z80A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
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Kit or built – it's up to you!
You'll be surprised how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 600 mA at 9 V DC nominal unregulated (supplied with built version).

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

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Available now- the ZX Printer for only £49.95

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

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

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

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

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

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

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

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

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

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

How to order your ZX81

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

BY FREEPOST – use the no-stamp-needed coupon below. You can pay by cheque, postal order, Access, Barclaycard or Trustcard.

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

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. Order

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

☐ Please tick if you require a VAT receipt TOTAL £_____

*I enclose a cheque/postal order payable to Sinclair Research Ltd, for £_____

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Tel: (0276) 66104 & 21282.

How the ZX81 compares with other personal computers

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

Sinclair software on cassette.

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

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

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

The ultimate course in ZX81 BASIC programming.

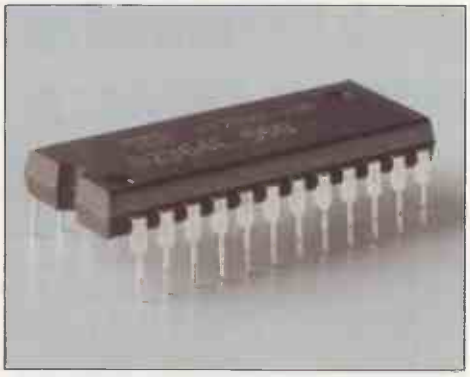
Some people prefer to learn their programming from books. For them, the ZX81 BASIC manual is ideal.

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

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

Full details with your Sinclair ZX81.

If you own a Sinclair ZX80...



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

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

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level. It might be more sensible to have it as another value that can be input but here it is set arbitrarily to five plotter units. in the original program there was a complication which I have left out of this version, which draws only one line at each level. It was required to have lines thicker than the single line from the plotter pen and this was easily attained by calling the concentric routine with a value of ZD small enough to make the adjacent lines overlap to form a thicker line. Because the plotter pen was not only of finite width but also rounded, there remained tiny gaps at the corners even though the lines overlapped along the main part of their length. Perhaps you can just see this in Figure 1. The cure was simply to reduce ZD. From Figure 1 you can also see that the lines used at the bottom were made thicker (more component lines) while those at the top were made somewhat thinner to increase the jazziness. I have left this refinement out to make the main processes clear: it is just a matter of manipulating ZD between each concentric level.

Now for the coordinate geometry and hard computation. At 1000 the length of each side is calculated and stored. The test at 1090 is to see whether any three corners of the quadrilateral are in a straight line. This is important because if they are then one of the factors used as a divisor in the next calculation will be zero and the program will fail. There are two possible ways out of this. In the original program I removed the middle point and carried on as for a triangle. In this version I decided that it was easier to shift one of the points out of line slightly — enough to make the factor non-zero but not enough to show in the plotting. In any case it is very unlikely, but still possible, that three points taken at random will be in a straight line. It depends on the precision used to represent floating point numbers but is one chance in many millions.

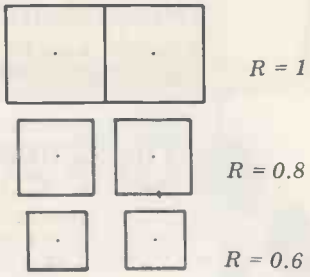
The computation of XPT and YPT, the coordinates of the new corners, is correct — you can see that from the illustrations — but I am not going to tire you with the algebra. If you are the kind of person who wants to see that kind of thing then you can probably work it out for yourself.

The next test, at 1200, is important. Notice that all the new coordinates have been calculated before this test is made. It determines whether one or more of the new sides has a zero or negative length. If just one has, the quadrilateral has degenerated into a triangle, as shown in Figure 4(a), and the next routine should be entered. If more than one has, this indicates that the figure has shrunk to zero size so that plotting can stop and the program go on to the next cell. This is shown in Figure 4(b). Otherwise the shape is still four-sided and plottable, so it is plotted. The coordinates of this figure are then copied into X and Y as the new outer shape and the process repeated for another concentric level inside it.

The routine to deal with triangles, starting in line 2000, is very similar to that for quadrilaterals, and I have given it in a form to make this clear. Half the statements are exactly the same, and the two could be made into a single subroutine with a couple of variables to manage the differences between the two cases. There are two main areas of difference: three points and sides instead of four, and the actions taken following the tests. The first set is easily taken care of by substituting 3, 4 and 5 for 4, 5 and 6 at appropriate places in the code. In the first test, if all three vertices of the triangle are in a straight line, then no more plotting is possible or necessary and the program can go on the next cell. In the second test the action is also straightforward: if one or more sides have become negative in length then the triangle is in the process of disappearing and again the work for this cell is complete.

The code at 1500 first tests whether more than one side is negative. If so, it returns for the next cell as this one is complete. With only one negative side II indicates which one. If the side length is exactly zero then two vertices coin-

2(a) A quadrilateral that cannot arise.



2(b) The limits of randomness.

Figure 2.

PATTERNS

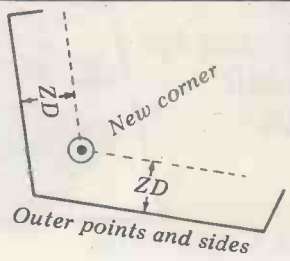
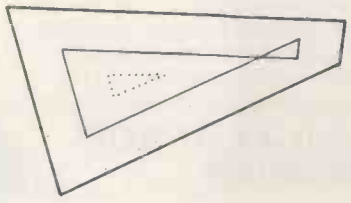


Figure 3. Dependence of a new corner on the sides ajoining the outer one.



4(a) A negative side appears: the next shape is a triangle.

4(b) 2 negative sides: there is no next shape.

Figure 4.

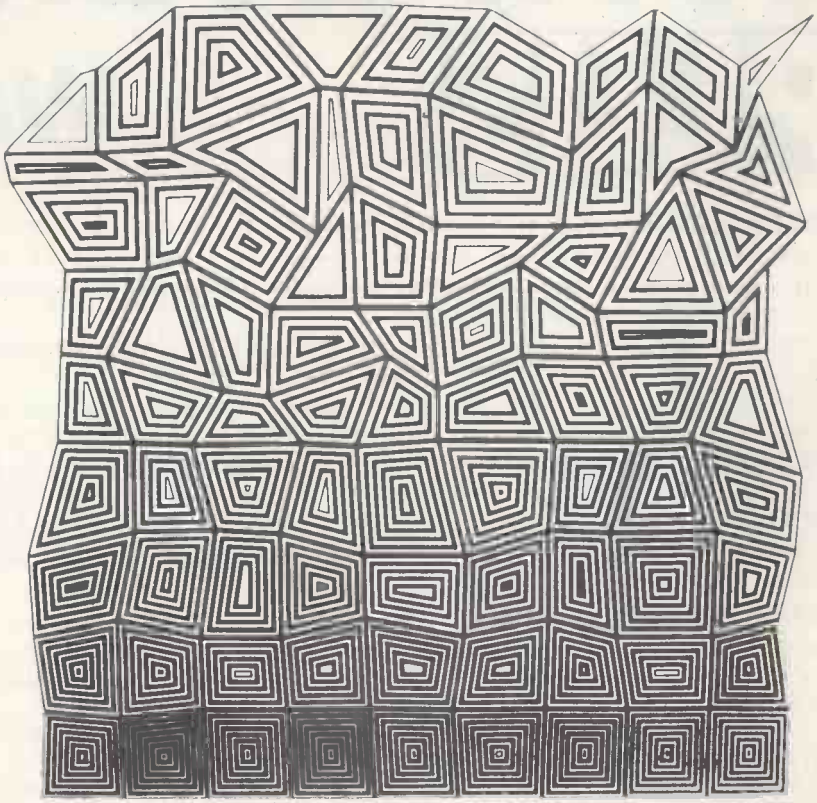


Figure 5

cide and this point is taken as the third side of the triangle, together with the other two points from the quadrilateral. For a side of negative length it is necessary to compute the point of intersection of the two lines leading to this one. This point is then taken as the third corner of the triangle. If you are up on coordinate geometry the calculation for this is straightforward, and if not then you can just accept that it works.

So much for commentary on the program. Figure 5 shows one set of output before the triangle routine was included.

Another plot

Output from a modified version of the program is shown in Figure 6. In this the cells are small and the concentric levels are not used. I noticed that in this kind of plot some of the cells at the top became small and confused, even though the average size was just the same as those at the bottom. So in this version I moved toward doubling the average size of the cells as you go up the picture. As you can see from the bottom few rows this is done by leaving out some of the cell walls — more and more higher up. Thus the cells become hexagons not quadrilaterals, though many of them appear to have only three, four or five sides because some points nearly coincide or are nearly in a straight line. It might be called the drunken spider's web: some actual experiments have been made observing the effects of intoxication on the form of spidery output.

I have not kept the program for this version, but it could be got from the one given here without too much trouble. Concentric shapes inside a hexagon would require some careful thought because of the different ways that figures with a smaller number of sides could appear.

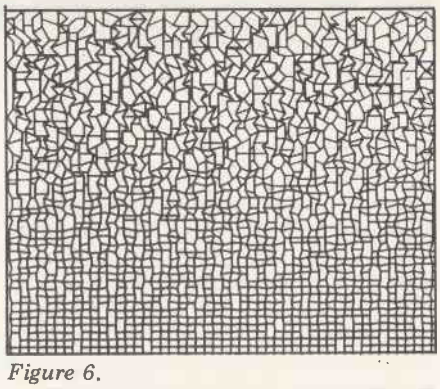


Figure 6.

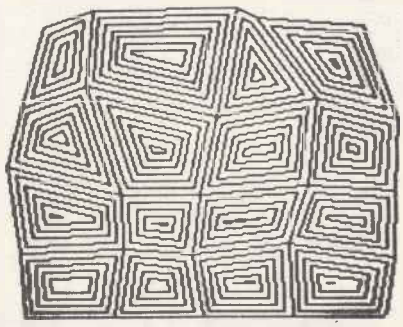


Figure 7. Output from the DAI.

Main program

```
IMP INT          (const & var integer unless stated otherwise)
IMP FPT 0-Z      (var starting letter 0-Z floating point)
Clear 10000                          clear space for arrays
100 INPUT "GRID SIZE";NX,NY:PRINT    input this grid size
110 INPUT "CELL SIZE";M,N            & the cell size
120 MODE 6                           set graphics mode
130 COLORG 0123                      set colours available
140 DIM U(NX,NY),V(NX,NY)            U&V are X&Y grid coords
142 DIM X(6),Y(6)                    X&Y are quadrilateral corners
144 DIM XA(5),YA(5)                  XA&YA are side lengths along X&Y axe
146 DIM XYS(5)                       XYS is side length
148 DIM XPT(5),YPT(5)                XPT&YPT are new inside corners
150 FOR J=0 TO NY                    for each line of cell corners
160 R=J                              float J
170 R=R/NY       (factor to scale randomness from Y value)
180 FOR I=0 TO NX                    for each cell corner along a line
190 U(I,J)=M*(I+1+R*(RND(1)-0.5))    X coord + scaled rand amt
200 V(I,J)=N*(J+1+R*(RND(1)-0.5))    Y coord + scaled rand amt
210 NEXT I                           next point
220 NEXT J                           next line
230 FOR I=0 TO NX                    for each vertical line
240 FOR J=1 TO NY                    for each cell of that line
250 DRAW U(I,J-1),V(I,J-1)
    U(1,J),V(1,J)1                   draw the cell side
260 NEXT J                           next cell
270 NEXT I                           next line
280 FOR J=0 TO NY                    for each row
290 FOR I=1 TO NX                    for each cell
300 DRAW U(I-1,J),V(I-1,J)
    U(I,J),V(I,J)1                   draw the cell base/top
310 NEXT I                           next cell
320 NEXT J                           next row
330 ZD=5                             dist between concentric figures
500 FOR AI=1 TO NX                   for each row of cells
510 FOR AJ=1 TO NY                   for each cell on the row
520 X(1)=U(AI-1,AJ)                  set the coords of the corners of
530 Y(1)=V(AI-1,AJ)                  the quadrilaterals into X&Y
540 X(2)=U(AI-1,AJ-1)
550 Y(2)=V(AI-1,AJ-1)
560 X(3)=U(AI,AJ-1)
570 Y(3)=V(AI,AJ-1)
580 X(4)=U(AI,AJ)
590 Y(4)=V(AI,AJ)
600 X(5)=X(1)                        copy the 1st & 3rd corners
610 Y(5)=Y(1)                        into the 5th & 6th places
620 X(6)=X(2)                        for wrap-around
630 Y(6)=Y(2)
640 GOSUB 1000                       draw concentric quadrilaterals
650 NEXT AJ                          next cell
660 NEXT AI                          next row
670 STOP                             the end
```

Quadrilateral subroutine

```
1000 FOR I=1 TO 4                    for each side
1010 XA(I)=X(I)-X(I+1)               set the side lengths
1020 YA(I)=Y(I)-Y(I+1)               along the X&Y axes
1030 XYS(I)=SQR(XA(I)*XA(I)+
     YA(I)*YA(I))                    calculate side lengths
1040 NEXT I                          next side
1050 XA(5)=XA(1)                     copy side 1 into side 5
1060 YA(5)=YA(1)                     for wrap-around
1070 XYS(5)=XYS(1)
1080 FOR I=1 TO 4                    for each side
1090 TST=XA(I)*YA(I+1)-XA
     (I+1)*YA(1)                     test for collinear corners
1100 IF TST<>0 GOTO 1130             jump if not collinear
1110 XA(I)=XA(I)+0.01                else disturb X coord slightly
1120 GOTO 1090                       & try again
1130 XYD=ZD/TST                      intermediate factor
1140 XPT(I)=X(I+1)+(XA(I)*XYS(I+1)-XA
     (I+1)*XYS(I))*XYD               compute new X&Y
1150 YPT(I)=Y(I+1)+(YA(I)*XYS(I+1)-YA
     (I+1)*XYS(I))*XYD               coords
1160 NEXT I                          next side
1170 XPT(5)=XPT(1)                   copy values for
1180 YPT(5)=YPT(1)                   wrap-around
1182 NUM=0                           clear number of neg sides
1190 FOR I=1 TO 4                    for each side
1200 TST=(XPT(I+1)-XPT(I))/
     (X(I+2)-X(I+1))                 test for neg or zero side length
1210 IF TST>0 GOTO 1240              jump if positive
1220 NUM=NUM+1                       increment number of neg sides
1230 II=I                            store index of this side
1240 NEXT I                          next side
1242 IF NUM=0 GOTO 1250              jump if no neg sides
1244 GOSUB 1500                      step down to triangle
1246 RETURN                          end of this cell
1250 FOR I=1 TO 4                    draw quadrilateral: for each side
1260 DRAW XPT(I),YPT(I)(XPT(I+1),
     YPT(Y+1)1                       draw side
1270 NEXT I                          next side
1280 FOR I=1 TO 5                    copy new coords
1290 X(I)=XPT(I)                     into X&Y
1300 Y(I)=YPT(I)
1310 NEXT I
1320 X(6)=X(2)                       copy for wrap-around
1330 Y(6)=Y(2)
1340 GOTO 1000                       ret for next concentric quadrilateral
```

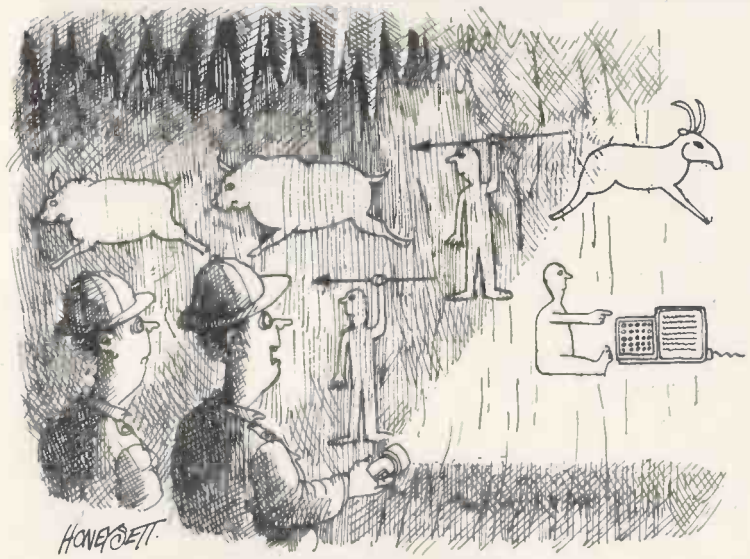
PATTERNS

Negative side test subroutine

```
1500 IF NUM>1 THEN RETURN              return if more than 1 neg side
1510 FOR I=1 TO 5                      copy coords from XPT and YPT
1520 J=(II+1+I)MOD 4                   into X&Y so that the neg
1530 IF J=0 THEN J=4                   side is in (3) and (4)
1540 X(I)=XPT(J)                       its position in XPT&YPT is
1550 Y(I)=YPT(J)                       marked by II
1560 NEXT I
1570 IF Y(2)=Y(3) THEN Y(2)=Y(2)=
     Y(2)+0.01                         increment to avoid division by zero
1580 TB=(X(3)-X(2))/Y(2)-Y(3))         compute equation of line
1590 TC=-X(2)-TB*Y(2)                  joining (2)&(3)
1600 IF Y(1)=Y(4) THEN Y(1)=Y(1)+
     0.01                              increment to avoid division by zero
1610 TD=(X(1)-X(4))/(Y(4)-Y(1))        compute equation of line
1620 TE=-X(1)-TD*Y(1)                  joining (4) and (1)
1630 YPT(3)=(TC-TE)/(TD-TB)            compute coords of point
1640 XPT(3)=-TB*YPT(3)-TC              of intersection of these 2 lines
1650 FOR I=1 TO 2                      copy coords back
1660 XPT(I)=X(I)                       into XPT&YPT
1670 YPT(I)=Y(I)
1680 NEXT I
1690 XPT(4)=XPT(1)                     extra pair for wrap-around
1700 YPT(4)=YPT(1)
1710 GOTO 2250                         go to plot triangle
```

Triangle subroutine

```
2000 FOR I=1 TO 3                      subr to draw concentric triangles
2010 #                                 simliar to that for quadrilaterals
2020 #
2030 #
2040 #
2050 XA(4)=XA(1)
2060 YA(4)=YA(1)
2070 XYS(4)=XYS(1)
2080 FOR I=1 TO 3
2090 #
2100 IF TST=0 THEN RETURN              end of cell if corners are
2130 #                                             all linear
2140 #
2150 #
2160 #
2170 XPT(4)=XPT(1)
2180 YPT(4)=YPT(1)
2190 FOR I=1 TO 3
2200 #
2210 IF TST<0 THEN RETURN              end of cell if any side zero
2240 #                                             or neg
2250 FOR I=1 TO 3
2260 #
2270 #
2280 FOR I=1 TO 4                      # for lines marked '#' use the
2290 #                                 corresponding line from subr
2300 #                                 1000: line 2010 is indentical
2310 #                                 to line 1010
2320 X(5)=X(2)
2330 Y(5)=Y(2)
2340 GOTO 2000
```



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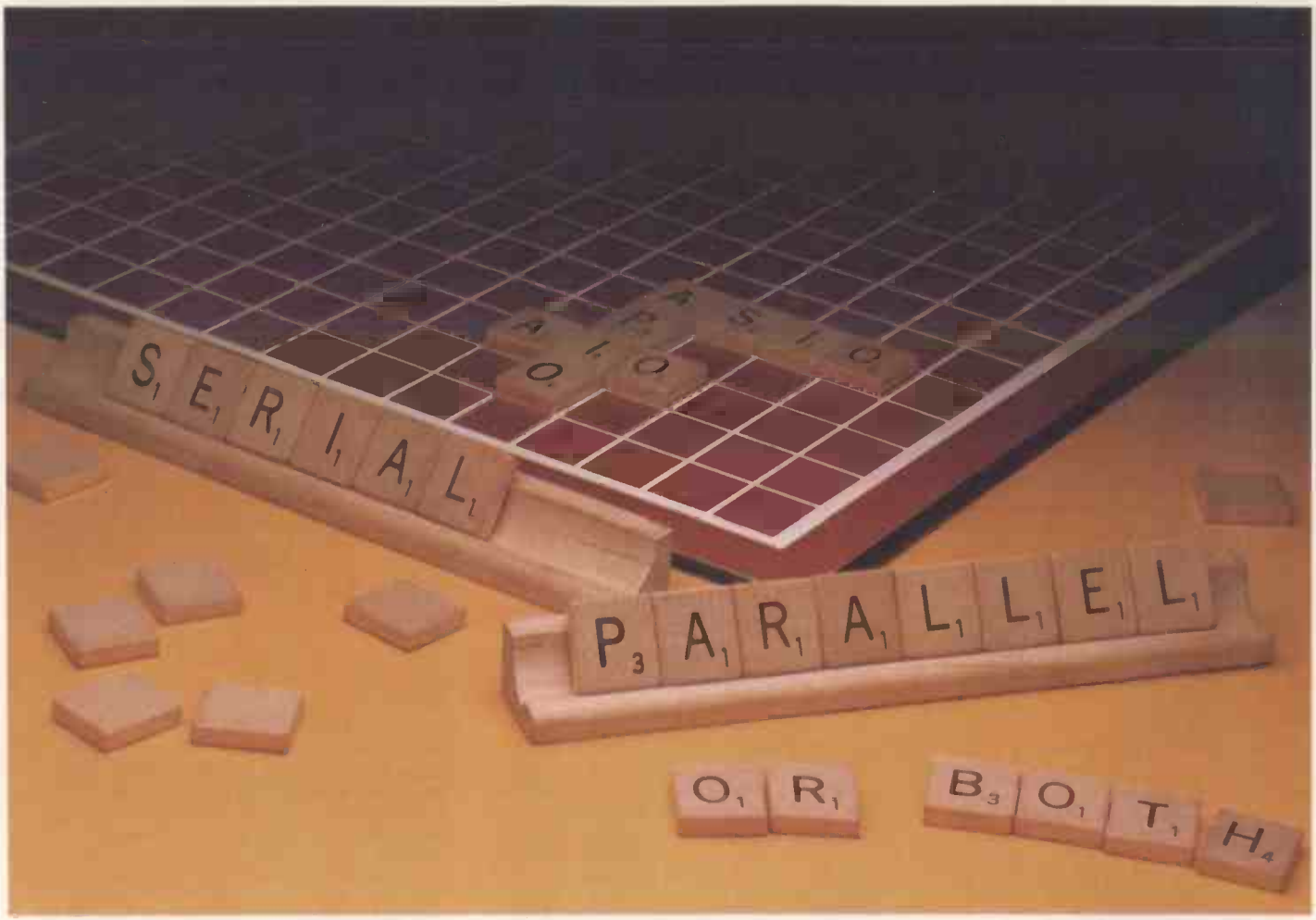

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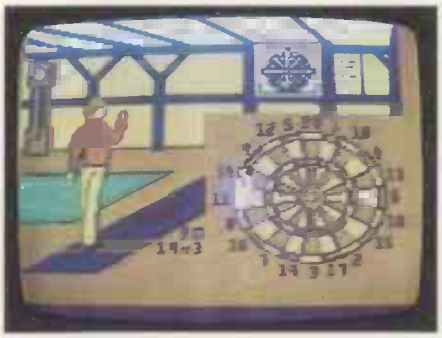
SCREENPLAY

Dick Olney checks out games for the Atari 400.

This month I have been looking at a wide selection of games for the popular Atari 400, a lightweight home computer designed specifically with games in mind from a well-established leader in this field. The standard 400 carries 16k of RAM and — though it is possible to upgrade this — I have included only those programs which will run on the basic system. Atari ROM packs plug directly into the machine, but for any other games you'll need an Atari 410 cassette recorder. The computer costs £345, with an extra £50 for the recorder and £6 each for joysticks (of which at least one is essential), making a total price for the system of around £400.

The rather garish touchpad keyboard takes a little getting used to, but it works all right; and anyway for most games you hardly use it. The joysticks, of which up to four can be used, seem fairly sturdy and have a comfortable feel to them (though I've heard that they don't last very well). Atari is renowned for its high resolution graphics and this, together with sophisticated games-oriented programming aids, makes the machines a popular choice for software publishers. In this review I have included the best that Atari presently offers as well as a selection from various other suppliers.



GAME: Darts
SUPPLIER: Thorn EMI
PRICE: £19.95

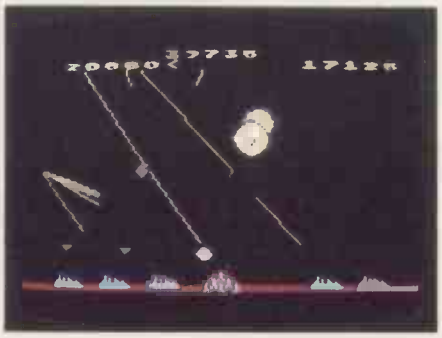
Since it first appeared this game has achieved general acclaim for its picturesque graphics, which are indeed superb. After an extensive title sequence, you are presented with the interior of a typical mock-Tudor local. In one corner hangs a dartboard and a safe distance away, but against the same wall, stands a grandfather clock, its pendulum quietly marking time. Up to four players can take part, with the option of one of them being the Atari (it's also quite happy to play by itself). After entering the player's initials you can select 301, 501, 901 or 1001 with standard rules (double to finish) and a choice of whether a double is necessary to start.

At the beginning of the game, a solitary player appears in position on the mat. I say solitary because the pub is otherwise empty and (presumably as a concession to a family audience) there is not a hint of beer or cigarettes. The dart is aimed by using the joystick to move a ghostly white hand poised over a blow-up dartboard in the bottom right hand corner of the screen. When the finger and thumb of the hand enclose your target position the dart is released by pressing the fire button. The graphic figure neatly performs the appropriate actions and a yellow fleck pursues a perfect parabolic path toward the 'actual' board.

Sounds easy, doesn't it? The trick is that the hand has an involuntary tremor and the higher the skill level (there are 10) the worse it gets; well, what do you expect in a dry pub? At skill level 9 — they are numbered zero to nine — this becomes infuriating but mostly it provides a realistic and thoroughly enjoyable game.

One rather endearing touch is the 'click' you hear when the dart hits the wire. Unfortunately, partly due to problems of proportion, and also, perhaps, that in real life the dart would often be deflected only slightly (whereas here it always completely rebounds) this happens much more frequently than one might expect. There's something very fishy about the computer playing this. In one game it beat me going out with a bull and I haven't been so outraged since I had a queen taken 'en passant' in a game of video chess. Playing this game involves little real skill, and would probably get quite tedious after a while, though the general presentation is excellent.

VALUE FOR MONEY: ****
PRESENTATION: ******
USE OF GRAPHICS: ******
ADDICTIVE QUALITY: ***



GAME: Missile Command
PRICE: £29.95
SUPPLIER: Atari

This is one of Atari's most popular arcade games. Your task is to protect six cities from waves of missiles which stream down at you from the top of the screen. You are provided with 30 defence missiles which appear six at a time on your launch pad. The joystick controls a small target sight and leaves a detonation mark when the fire button is pressed, towards which your missiles are launched. The trick is to place your detonation marks slightly in front of the approaching missiles so that they reach it at the same time as yours do. The game ends when all your cities have been destroyed, though you get a bonus city for every 10,000 points scored. Things are complicated by bombers flying across the screen dropping deadly bombs and by triangular 'smart missiles' which have the ability to avoid your defence detonations.

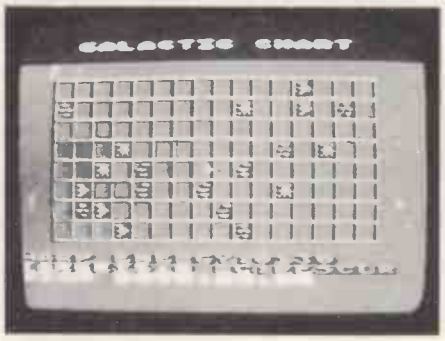
In the arcade version of Missile Command, you had three bases, each with separate fire buttons and the loss of this feature makes this game rather less interesting, albeit still highly addictive. Options include one or two players (not simultaneously), skipping any number of attack waves (thus starting at a higher skill level), fighting smart missiles only and nullifying the potential for bonus cities. The graphics are excellent, with the colours changing dramatically as you work through the attack waves.

Games like this often attract criticism on the grounds that they represent glorified reconstructions of real warfare. Generally I dismiss this suggestion by viewing the games as pure fantasy having no significant effect upon peoples' actual political attitudes. The military terminology which Atari uses in the Missile Command manual is, however, extremely disturbing. In the introduction you are told that 'For weeks now satellite surveillance has been sending you photographs showing unusual arms buildup. . . It's only a question of time now before the enemy launches ICBMs targeted for the only remaining free cities of the world.' I'm afraid the situation in contemporary America makes it impossible to take such remarks lightly and I wish that Atari had taken a different approach to what should be an entirely frivolous activity. Conclusion — love the game, hate the politics.

VALUE FOR MONEY: *****
USE OF GRAPHICS: ******
ADDICTIVE QUALITY: *****
RESPONSE SPEED: ****

GAME: Star Raiders
PRICE: £29.95
SUPPLIER: Atari

Just over five years ago, when I was programming PROMs (everyone thought I worked in the Royal Albert Hall), I used to spend many happy hours playing a game called Star Trek on an Intel development system. In those days colour graphics and real time space games were unheard of, so this game was mainly textual (with some primitive charts) but fairly complex and a lot of fun. Star Trek was very popular at that time, though its delights were enjoyed only by those working in the computer industry. Now Atari has taken this grandfather of games, added some impressive graphics and transformed the battles into fast moving extravaganzas to produce one of the best pieces of games software available.

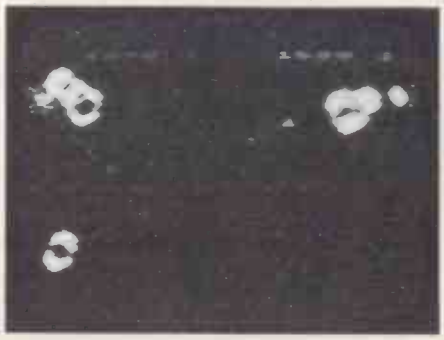


Star Raiders is a one-player game in which your mission is to destroy all enemy craft (Zylon Starships) before they disintegrate your star bases. The galaxy is divided into sectors on an 8 x 16 grid and the positions of all ships and bases are displayed on your galactic chart. You can move your ship between sectors using 'hyperwarp' and within sectors at any one of nine warp speeds, using the joystick to control direction. The ship's 'on board computer' helps track your prey, which you can then destroy with your photon torpedoes. At the touch of the button your screen can be made to display front and rear view as well as a long-range scan and your ship can be fully protected using shields.

At the beginning of each game you have 9999 energy units, which are used up mostly by movement and firing, though other functions also show a small drain. The game finishes when your ship is destroyed or runs out of energy, or if all your bases fall foul of the Zylon. In addition to this, enemy torpedoes can cause damage to any one of your ship's facilities, thus impairing its functioning. Extra energy can be obtained and repairs carried out by docking at one of your star bases. There are four skill levels, described as novice, pilot, warrior and commander, which mainly determine the number and efficiency of the Zylon craft. At novice level you do not need to steer your ship in hyperspace, and no damage can be inflicted on your ship (though it will be destroyed if you are hit with shields down).

This game has become almost synonymous with the Atari 400, and deservedly so. The graphics, sound effects and playing functions are all immaculate and combine to produce an intriguing and worthwhile game. If you're on the point of buying an Atari, I would thoroughly recommend that you include Star Raiders in your budget.

VALUE FOR MONEY: *****
USE OF GRAPHICS: ******
PRESENTATION: *****
ADDICTIVE QUALITY: ******



GAME: Asteroids
PRICE: £29.95
SUPPLIER: Atari

Asteroids has proved immensely popular in the arcades and, since Atari holds the copyright, this is just like the original. Just in case there's anybody left who hasn't seen it, the game involves eliminating waves of approaching asteroids and the occasional mindless flying saucer by firing missiles from a small triangular spaceship. Moving the joystick right or left rotates the ship clockwise or anticlockwise respectively, and forward gives acceleration (thrust). You can fire continuously, but only four missiles can be on the screen at any one time. Medium and large asteroids break into two when hit, while the smallest disappear altogether (and yield the most points). Up to four players can take part (assuming you have enough joysticks) and you get various options as to whether players can shoot each other and when the game actually ends. In addition, each ship can choose from any one of three special defences, activated by pulling the joystick towards you. These include impenetrable shields, hyperspace warp (disappearing for a few seconds and moving to an alternative random position on the screen) and 'flip over' (instantly turning your ship through 180°).

Asteroids combines crisp graphics and excellent response time in an exciting and addictive game. If you're into fast-moving space games this is a classic, though perhaps a little dull beside some of the recent games of its genre. It is, however, rather pricey (possibly due to the obscenely large packaging that Atari insists upon, literally 10 times the size of the cartridge it contains).

VALUE FOR MONEY: ***
USE OF GRAPHICS: *****
RESPONSE SPEED: ******
ADDICTIVE QUALITY: *****

GAME: Sunday Golf
PRICE: £12.50
SUPPLIER: Adventure International

This is an original one-to-four player game written in Atari Basic. You are given a wide selection of clubs with which to complete a nine-hole golf course. The direction of shot is assigned a number between one and 40; with zero as north (*up* on the screen) and 20 as south, going around clockwise. For each shot the player keys in the type of club he is using and the direction, whereupon, with a soft thud, the screen displays the progress of your ball across an aerial view of a bright green fairway. You can choose between a long or short course with relation to the average length of each hole but, apart from this, the fairways vary only slightly in length and shape.

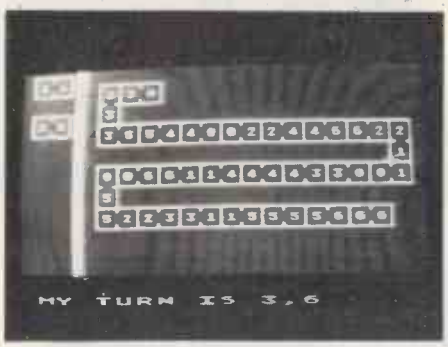
The blurb on the packet promises you the choice of the club you need to sink that elusive hole in one. Elusive is most appropriate here, since in fact the fairways are *always* much larger than the distance your most powerful club (a one wood) will ever take you, though I did get the ball down in two a few times. The accuracy and direction of each shot are subject to random variations and decrease considerably when you're in the rough. Every fairway has a white bunker which completely obscures any ball landing in it (since the ball is also white)! This screws up your accuracy, but you can always get out of it with one shot, which is a pity since it would be much more fun to get stuck in the sand every so often.

When all players are on the green the display changes to a vertical slice showing your ball, the hole, and the gradients on a line between them. To putt, you just key in a number between one and 50 to determine the strength of your stroke (directional accuracy is assumed!). Slopes are taken into account, and you have to be very precise to actually sink the ball. Upon completion of each hole, you are presented with a full scoreboard giving a breakdown of your performance and the par for each hole.

Sunday Golf is a well presented game which makes every attempt to recreate certain aspects of the real thing. Unfortunately, the actual task which you perform in playing it gets rather mundane after a while. This might perhaps have been alleviated by providing a more sophisticated and varied fairway

construction and spicing up the rather uninspired graphics. But the low price makes the game a worthwhile investment.

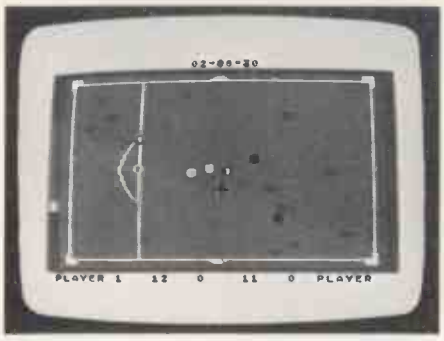
VALUE FOR MONEY: *****
PRESENTATION: ****
USE OF GRAPHICS: **
ADDICTIVE QUALITY: ***



GAME: Cribbage & Dominoes
PRICE: £14.95
SUPPLIER: Thorn EMI

In both of these games you play the computer (which uses the basic cartridge); there are no player options. The dominoes can be played at four skill levels and you can choose if a player is allowed to lay a tile on the same turn as he draws it. In Cribbage the only option is whether to play the 'muggins rule', which means that if you under-calculate your score, the computer collects the difference. These games are only in two colours — surprisingly for Thorn — and have none of the special features one might expect from games of this type. They do, however, provide competent opponents, so if you enjoy playing the games and often need a partner this package is for you.

VALUE FOR MONEY: ****
PRESENTATION: ***
PLAYING SKILL: ****
SPECIAL FEATURES: *



GAME: Snooker & Billiards
Tournament & Eight Ball Pool
PRICE: £19.95
SUPPLIER: Thorn EMI

I should hastily point out that the above are two different packages, each a pair of games costing £19.95. All four games are presented in the same way, however, so I shall deal with them as one (the basic rules of each are standard). They are two-player games requiring considerable skill, which could provide many quiet hours of amusement.

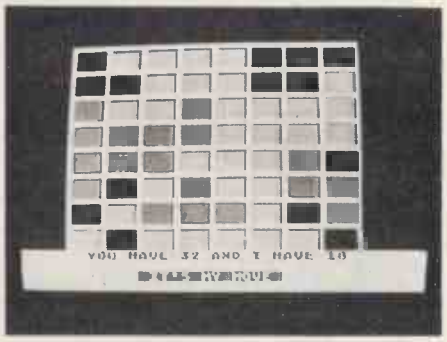
You are presented with a very clear aerial view of the table, with the balls appropriately positioned. Using your joystick you position a white cross in the spot where you want the cue ball to go. On the left of the board is a sort of thermometer affair which is constantly rising and falling, the height of which determines the power of your shot. When the level is where you want it, the fire button sends the ball off. Although the balls don't gradually lose momentum in quite the way they should, their final position is realistic.

These games (particularly the snooker) are quite difficult to play, though I suppose I only played as well (or, rather, badly!) as I might in a real game. I couldn't decide whether to position the cross actually on the ball I was aiming at, or to align it with the cue ball in the direction I wanted the latter to travel. This is one occasion where the joystick is perhaps a little *too* sensitive, making it very difficult to use accurately, but presumably with enough practice you would develop a reasonable technique. These games are particularly noteworthy for their sharp colour graphics.

VALUE FOR MONEY: ****
PRESENTATION: *****
USE OF GRAPHICS: *******
ADDICTIVE QUALITY: ***

GAME: Othello & Chomp
PRICE: £10.99
SUPPLIER: Dyncomp

Othello is played on a standard 8x8 chessboard. The aim is to enclose vertical horizontal or diagonal lines of the opposing pieces with two of your own and hence 'capture' them (they change to your colour). This game enjoys limited popularity and is an obvious choice for computerisation. You always play the computer (which has



two skill levels) and you can choose who starts. Each move involves positioning one piece on the board (you start with two each in the centre), though it is forfeited if you are unable to 'capture' any lines. The joystick is used to position a target marker and the fire button initiates the move.

After a little coaching from an Othello fan, I was playing somewhat better than the Atari but still was beaten fairly often. This is an interesting game, adequately presented, but hardly the most exciting games software I've seen.

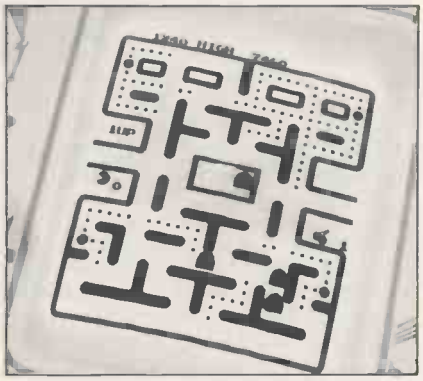
The second of the pair — Chomp — is a rather trivial, but very difficult, brain teaser. It is played on a board of up to nine rows and nine columns (you decide the dimensions) with a 'poisoned square' in the top left hand corner. The player who 'chomps' the poisoned

GOTO page 188

ARCADE ACE

This month I have chosen the old favourite Pac Man (also called Mazeman and Puck Man), one of the most popular of all arcade games, whose principles are quite different from the usual noisy battle scenes. The idea is to direct a yellow disk round a small maze, gobbling up the dots in the tunnels. You are pursued by four rather innocuous-looking monsters and your turn ends when they catch up with you (you get the standard three attempts). In each of the four corners of the maze there are large pulsating 'energy dots', and for a limited period after eating one of these you can turn and gobble the monsters — scoring 200 for the first, 400 for the second, 800 for the third and 1600 for the fourth. This sends them back to their lair in the centre where they remain for a few moments. Occasionally pieces of fruit and other objects appear near the centre of the maze, which yield bonus points if gobbled.

A single four-way joystick is your only control but, despite this, the game demands a lot of skill and quick thinking. The graphics are very clear and the whole thing is pleasantly presented giving the impression of innocent fun rather than deadly combat. *Time* magazine, in a recent article about the



computer games industry, claimed the Pacman is the most popular arcade game among women. It was suggested that this derives from the fact that the game involves not shooting but *engulfing*. I'd be interested to hear readers' comments on this — and on the reasons for the predominance of males in arcades generally. Anyway, if you like video games but aren't into fingertip death-dealing then this one is worth a try. Incidentally, various disguised facsimiles of this game are now available for many home computers (for instance Ghost Hunter on the Atari).

TJ's WORKSHOP

Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to: **'TJ's Workshop', *PCW*, 14 Rathbone Place, London W1P 1DE.**
Please keep your contributions as concise as possible. We will pay £10 for any tips we publish (think how much solder and/or Elastoplast that would buy).

UK101 STRING INSERT

Here is a handy string manipulation program for the UK 101. It allows the user to insert (by overwriting) a substring into a main string at any starting position. The command takes the form of: X=USR (X),X,MAIN$,SUB$ This means place SUB$ into MAIN$ starting at the Xth position of MAIN$. It is important not to exceed the length of the main string. The parameters may be either variables, expressions or constants.

eg, X=USR (X),3,
'ABCDEFGHIJKLM',
'ZZ' + 'QQ'

Try the following example:

```
 5 POKE 11, 74 : POKE 12, 2
10 SUB$ = "UK 101"
20 M$ = "IS THE BEST PERSONAL COMPUTER"
30 FOR I = 1 TOLEN (M$) - LEN (SUB$):
    REM ENSURES  LENGTH NOT EXCEEDED
40 MAIN$ = M$
50 X = USR (X), I, MAIN$, SUB$
60 PRINT MAIN$
70 NEXT I
```

Run the program and then LIST it - you will see that the string variable in line 20 (M$) has been changed! Now change line 20 to
20 M$ = " " + "IS THE BEST PERSONAL COMPUTER"
And run again.

This time you will get a different output and line 20 will not have been changed. This is due to Basic's string handling routines in ROM. The '+' causes the string to be duplicated elsewhere in memory, whereas in the first example the actual copy of the string in the listing was used.

Below the program is listed as data statements. It should be run and erased by typing NEW. It is not relocatable, ie, it must be put at $0240 onwards.

```
10 FOR I = 576TO 618 : READQ
20 POKE I, Q: NEXT: NEW:
30 DATA 32, 1, 172, 32, 193, 170, 76, 182, 178, 234
40 DATA 32, 2, 180, 202, 134, 240, 32, 64, 2, 138
50 DATA 72, 152, 72, 32, 64, 2, 168, 104, 133, 132
60 DATA 104, 133, 131, 230, 95, 165, 240, 32, 169, 178
70 DATA 76, 159, 178
```

For those machine-code addicts who want to change the routine to run at any address here is an assembler output:-

```
0240  20 01 AC    JSR $AC01
0243  20 C1 AA    JSR $AAC1
0246  4C B6 B2    JMP $B2B6
0249  EA          NOP
024A  20 02 B4    JSR $B402
024D  CA          DEX
024E  86 F0       STX $F0
0250  20 40 02    JSR $02420
0253  8A          TXA
0254  48          PHA
0255  98          TYA
0256  48          PHA
0257  20 40 02    JSR $0240
025A  A8          TAY
025B  68          PLA
025C  85 84       STA $84
025E  68          PLA
025F  85 83       STA $83
0261  E6-5F       INC $5F
0263  A5 F0       LDA $F0
0265  20 A9 B2    JSR $B2A9
0268  4C 9F B2    JMP $B29F
```

Stuart Smith

ZX81 TIP - RESETTING RAMTOP

David Lawrence's tip in your February issue on resetting RAMTOP without clearing the memory has more potential than he indicates. You can write the POKEs *into* a program that wouldn't normally require RAMTOP to be reset by direct commands each time before the program is LOADed from cassette.

Unfortunately, the USR 1040 routine lists the program in such a way that the program won't run after that line. The best I've managed is the following, which, when you LOAD from cassette, displays the program's title and the setting for RAMTOP:

```
400  SAVE "(program title)"
410  POKE 16419, 15
420  POKE 16420, 39
430  POKE 16388, 48
440  POKE 16389, 117
450  LIST 9999
460  PRINT USR 1040
      .
      .
      .
9999 REM (program title)
     - RAMTOP 30000
```

(The values 48 and 117 in lines 430 and 440 give a RAMTOP setting of 48 + 117 x 256, = 30000.)

If you SAVE a programme with this in by running line 400, when you LOAD it again from cassette RAMTOP will be reset to 30000 and the screen will then display line 9999 — you'll have to RUN to proceed. You should note, however, that you'll have problems if line 9999 takes up more than one line.

Geoff Wilkins

PET RESET

I have installed the reset switch, as decribed by W Austin in TJ's Workshop, January *PCW*, in my 2001 series PET (new ROMs — large keyboard). For those, like me, too mean to buy a commercial reset switch, the following may be of interest.

It was soon apparent that the eight-legged NE555 was not in the position indicated by W Austin's diagram. On my board the chip resides just in front of the cassette port at the back of the machine. To the right of the chip there are two resistors. To the right of these are two capacitors. The 1M resistor is the one nearest the capacitors. By connecting the 1K resistor to the keyboard end of the 1M resistor, the circuit as described by W Austin works. With no cassette straps to use as ground, I made the connection to pin 12 (chassis ground) of the IEEE port.

The switch works exactly as described in the article, except that entering $FF into the stack pointer sends my machine into yet another 'introverted inspection of its own innards'. I found that typing X to return to Basic, and then causing a syntax error, (eg, by typing *[RET]), produced the desired result.

I am sure that PET crashers like myself are grateful to W Austin (and *PCW* of course) for a very cheap and effective alternative to switching off.

John Brooman

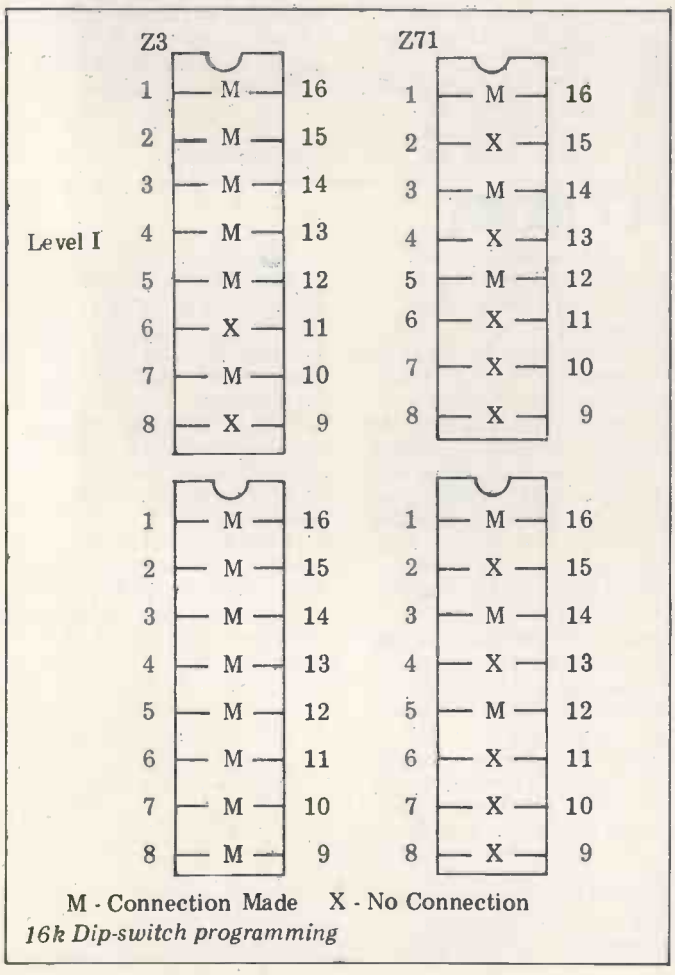
TJ's WORKSHOP

TRS-80 I 4k TO 16k UPGRADE

One of the most overpriced items in computing at present must be the 'official' Tandy 4k to 16k keyboard memory upgrade for the TRS-80 Model I which costs £69.95 at any Tandy store. Following the instructions below, the expansion can be completed, without soldering, for a cost of approximately £10 to £12. The parts required are:
8 x 4116, 200 ns memory chips
2 x 8 way DIL switches

The expansion is carried out as follows :
1. Ensure that the power is turned off, and remove all cables from the back of the TRS-80. Turn the keyboard upside down and remove the six screws, noting their different sizes to enable correct re-assembly. (NB. The removal of these screws will void the Tandy 90 day warranty.)
2. Find the eight chips, which are socketed, and identified as Z13 to Z20 on the circuit board. Before these chips are removed, note the position of the notch at the end to ensure that the eight new chips are inserted the correct way around. Remove the old chips and insert the new ones, taking care not to bend any of the pins.
3. To enable the computer to recognise the new memory, changes must be made to the programming of the two DIP shunts located at Z3 and Z71 on the circuit board (they are clearly marked). Looking at the circuit board with the reset switch at the top right, the two DIP shunts should be removed and replaced with the DIL switches, programmed as shown in the diagram.
4. After double-checking that there are no bent pins on the newly inserted chips; and that Z3 and Z71 are correctly programmed, replace the back of the TRS-80 keyboard, connect the cables, and turn on the power. Type "PRINT MEM" in command mode. The reply should be 15572 if you have an old ROM level II (MEMORY SIZE?) CPU like mine. I believe that the reply should be 15570 for the new ROM level II (MEM SIZE?) and 15871 if you have a level I machine.

Les Trigg



16k Dip-switch programming

SUSPEND PRINTING OPTION FOR NORTH STAR

Many systems use control S to suspend screen output during a listing to the screen. North Star DOS does not have this facility but a similar option may be provided. Upon examination, it becomes apparent that there are several advantages in installing such an option not in COUT as one might expect but in CONTC, with the obvious disadvantage of being dependent on the program running testing CONTC regularly (BASIC does).

The program shown is a generalised version for use with 5.1 I/O routines with DOS located at 2000H. In my own case I have been able to include the CONTS routine inside the allocated DOS I/O space.

To use — control S to suspend machine processing, any character to resume processing.

S. Sondergaard.

```
          CONTC     ; almost identical to original version
29F1      MVI A,0
29F3      CALL IST
29F6      STC
29F7      CMC
29F8      RNZ
29F9      CALL CONTS; patch in new address (originally CALL CIN)
29FC      CPI 3H
29FE      STC
29FF      RET

CODE      CONTS     ; new routine (A=0 on entry)
CD1020    CALL CIN  ; get character
FE13      CPI 13H
CO        RNZ       ;return if not control S
33        INX SP    ;throw away return address
33        INX SP    ;  "     "    "     "
3E00      MVI A,0   ;for CIN
CD1020    CALL CIN  ; get next character, wait if not ready
C31620    JMP CONTC ; and try again
```

AUTOMATIC FAST FORWARD TIMER FOR PET

My school and I have a lot of programs for PET. It is both messy and, with lots of children around, tempting fate to keep them all on separate cassettes.

Problem: the tape unit does not have a counter. Solution : head each tape with a contents/counter program as above.

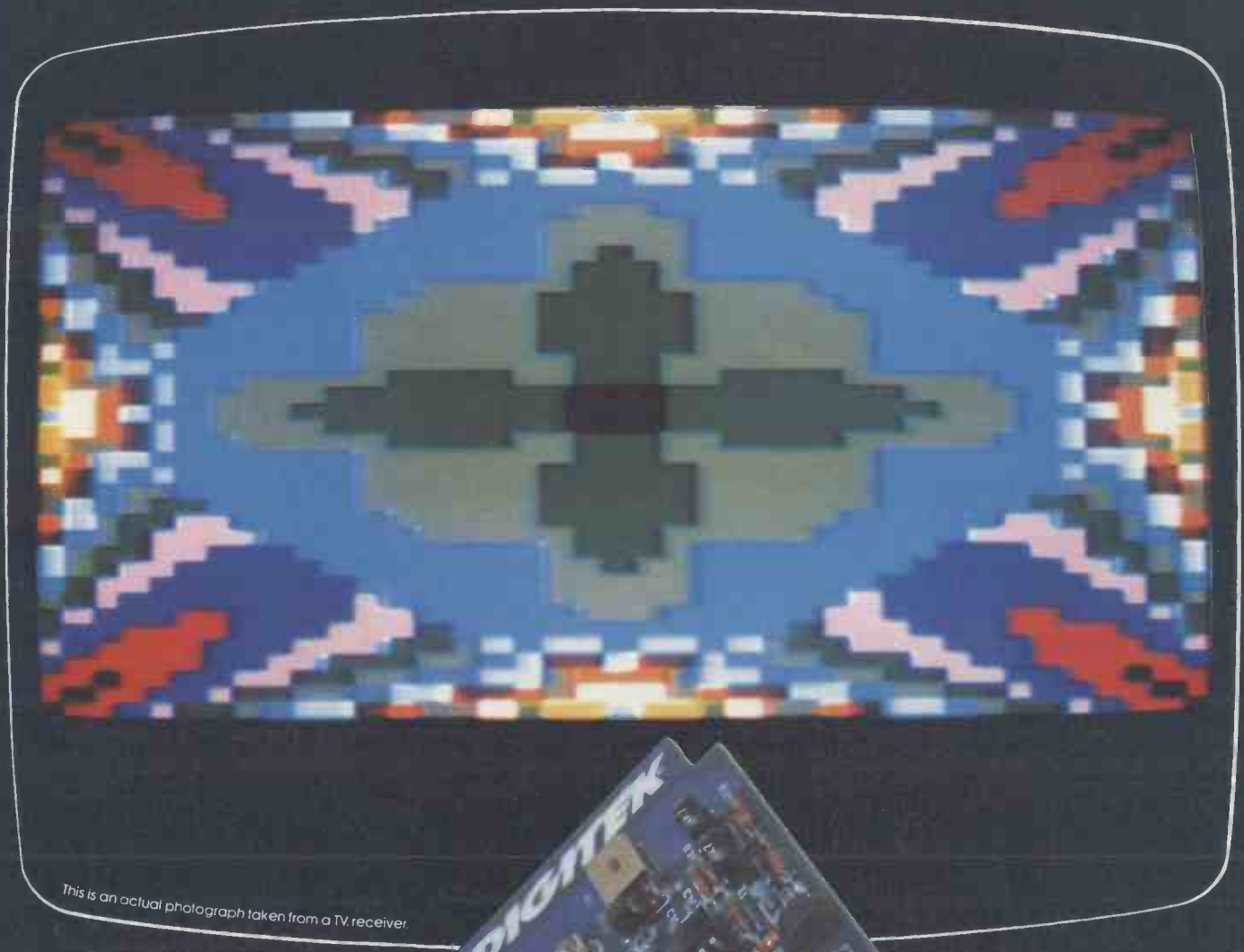
Problem: there is no easy way to work out the value of K for each program. Solution : experience!

Note that line 250 stops tape even though F. Fwd is operating. Lines 280 to 320 automatically load and run the program.

Victor Russell

```
 1 P=59408:IFPEEK(P)<>249THENPRINT"■STOP THE TAPE.
 2 IFPEEK(P)<>249THEN2
 10 REM TO 90 : TITLES, DESCIPTIONS OF PROGRAMS.
 100 PRINT"■■PRESS '1' FOR THE FIRST PROGRAM ON TAPE,";
 102 PRINT"'2' FOR THE SECOND ETC.
 105 PRINT"■(NOTE: TIMINGS ARE APPROX.)■■■■■■■■■■
 110 GETA$:IFA$=""THEN110
 120 IFA$="2"THENK=8.5
 130 IFA$="3"THENK=18
 140 IFA$="4"THENK=28
 195 IFVAL(A$)=0ORA$>"4"THEN110
 200 PRINT"■OK: ";:IFA$="1"THEN280
 210 PRINT"PRESS F.FWD ON TAPE.
 220 IFPEEK(P)<>233THEN220
 230 TI$="000000":PRINT"■OK
 240 IFTI<K*60THEN240
 250 POKEP+3,60:PRINT"■STOP TAPE.
 260 IFPEEK(P)<>249THEN260
 270 POKEP+3,61
 280 A=525:B=527:IFPEEK(50003)THENA=158:B=623
 300 PRINT"■■■LOAD■":POKEA,5
 310 FORI=0TO4:READI:POKEB+J,I:NEXT
 320 DATA13,82,85,78,13
READY.
```

DO NOT ADJUST YOUR SET!



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TJ's WORKSHOP

ATARI EXTRA GRAPHICS MODES

One grumble about the Atari is that, although 16 colours are available, only five can be displayed on a screen at once using just Basic. Only by using machine code could this be improved to five colours per TV line. However, this article will tell you about three more modes available in Basic, one of which allows 16 colours per TV line.

At the back of the Basic Reference Manual there is a table of nine modes and screen formats. To that table you can add three more graphics modes, each having a resolution of 80 columns by 192 rows (no split screen allowed) and requiring 7900 bytes of RAM. The modes 9 to 11 interpret the display data bytes in groups of four bits, thus giving 16 possible values.

Mode 9 uses this data as a luminance value for the colour in SETCOLOR register 4. Mode 11 uses the data as an actual colour value with the luminance of SETCOLOR register 4 (default lum of 6), although colour 0 is always at luminance 0. Mode 10 is more flexible. The value is used as an index to one of the nine colour registers available as shown in Table 1. For more details of mode 10, see later. To get you started with these new modes, try the program in Listing 1.

I can only speculate how these modes have remained unknown to most Atari users. All information in addition to the Basic Reference Manual, which all users have, comes from either the Technical Notes that be purchased from Atari dealers or from articles in American magazines, such as *Creative Computing* and *Byte*.

The Technical Notes, as mentioned last month, are rough drafts of internal documentation released (under duress?) by Atari. These are divided into two parts, Hardware Manual and Operating Systems User's Manual. The Hardware Manual is the more immediately interesting part as it reveals a lot of information about the graphics facilities built into the hardware. This includes details of how a customised chip, called ANTIC, is programmed to produce 14 different graphics modes, only nine of which are available from Basic. But the modes described above are not included in these 14, they are variations of Basic mode eight. The difference is due to the way that the display data is interpreted by another chip, called CTIA, one of whose jobs is to add the colour information to the data. This chip contains the colour registers, but it is not usual practice to access these directly but via duplicate registers maintained by the OS. These addresses are shown in Table 1.

There is no hint in the description of CTIA about the existence of modes nine to 11. That comes in the OS Manual. In the section which describes how to set up and use the screen as an input/output device, it states that there are 11 modes available but that modes 9 to 11 are only available if another chip is used in place of the CTIA. Now I believe that I had a CTIA chip as nothing I had read in the Hardware Manual or in magazines had suggested otherwise. But the Notes are dated November 1980. It seemed probably that if Atari had developed a replacement for the CTIA, they would be using it in production models by now since it would not cost them any extra to produce and the UK models must have required some rejigging anyway. So, I tried it and modes 9 to 11 were available on my 800! It was like finding another gear on a new car.

To use mode 10, you need to know the way a colour register is split up. The most significant half contains the colour number as defined in Table 9.3 in the Basic Reference Manual. The lower half contains the luminance value. Thus, to set the colour orange (2) with a luminance of 10 into colour register 2, use the Basic statement:-

```
POKE 710,2*16+10
```

To conclude, Atari have been hiding their light under a bushel. These three extra graphics modes make the machines even more attractive.

Neil Brooks

Register	Address	Mode 10 value
Player 0	704	0
Player 1	705	1
Player 2	706	2
Player 3	707	3
SETCOLOR 0	708	4 and 12
SETCOLOR 1	709	5 and 13
SETCOLOR 2	710	6 and 14
SETCOLOR 3	711	7 and 15
SETCOLOR 4	712	8,9,10 and 11

Table 1 Colour register addresses and mode 10 values

```
10 GRAPHICS 11
20 FOR J = 1 TO 39
30 FOR I = J TO 79-J STEP 2
40 COLOR I
50 PLOT I,J : PLOT I+1,J
60 NEXT I
70 NEXT J
80 T = I-2
90 FOR J = 40 TO 79
100 COLOR T
110 PLOT T,J : DRAWTO J,J
120 T = T-1
130 NEXT J
140 GOTO 140 : REM STOP WITH BREAK KEY
```

Listing 1

80k POKE

Phil Clark's interesting list of PEEKs and POKEs for the MZ-80K on page 151 of the November issue was very welcome, and I would like to suggest that someone should compile a full list of these for all the popular machines. Handbooks are lamentably bad on this point.

There is one POKE statement which I have only seen published once for the MZ-80K which can save a lot of paper using the P3 printer on short listings. Normally LIST/P results in a form feed before printing starts, but POKE 15478,0 inhibits the form feed and gives immediate printing on LIST/P.

G O Hayward

FASTER NOISE-FREE ATOM

Having read January's 'TJ's Workshop' about noise free graphics on the Acorn Atom, I would like to submit my own modification.

This is a hardware modification requiring the VIA chip and uses bit 7 of port B. The video generator gives a sync pulse at line frequency at pin 38 (IC31-6847), this should be connected to pin 17 of IC1-6522 by a length of wire. The wire runs almost the full length of the board but can be taken along the PCB side. Once this has been done a small software patch is used to call it up.

Lines 10-30 assembles software patch at #21C. Line 50 modifies the patch to jump to the correct plotting routine. Line 60 resets the pointer at #3FE to #21C. This should be re-executed if COLOUR is used and after every COLOUR change. Lines 70 - 90 demonstrate the routine in operation.

```
10 P=21C;P.$21
20 [LDA #B800; BMI P-3; JMP #F7AA;]
30 P.$6
40 CLEAR 4
50 !#222=!#3FE
60 !#3FE=#21C
70 MOVE 127, 95
80 DO PLOT 6, (A.R.%256),(A.R.%192)
90 UNTIL 0
```

This routine works by waiting for every line sync pulse before plotting a point. This is much faster than the routine in *PCW*, because the line frequency is 15625Hz and the frame frequency is at 60Hz. The routine only slows down the plot by about 25% so it is still very fast. The noise is totally eliminated in modes 1-4 but some noise is still present in the colour modes and in mode 0 but is only slight. The port should be set for input, ie ? #B802=0, but this is done after BREAK is pressed. If the port is used for other applications a switch could be added in series with the wire link.

G. Sutherland

COMPUTER ANSWERS

Send your queries to: Sheridan Williams, 35 St Julian's Road, St Albans, Herts. Please note that Sheridan can no longer answer questions on an individual basis, so please don't send an SAE with your query.

HP business

I am looking for a business microcomputer system. It must support CP/M, have hard disks and be extremely reliable. At some future date I will need to link the sytem to a mainframe computer so that I can recall data. Please don't point me in the direction of Apples and PETs as I require a system designed for the businessman, not the hobbyist.
GW Weston, Hull

If you are aware that Apples and PETs will not meet your requirements, then you should also be aware that I need far more detail to advise you on suitable systems. You are about to embark on a venture that will cost you between £5000 and £10000 for the hardware alone; so a few hundred spent on getting the best system would seem appropriate. Find a good systems analyst who specialises in micros. You could try the Association of Professional Computer Consultants at 11 West Halkin Street, London SW1X 8JL.

It so happens that I have been using a system that could be appropriate for your needs; it is the Hewlett-Packard HP125 business microcomputer. I have been using this since October 1981 and I have only two complaints: there is no keyboard buffer — a disappointing limitation; the speed of operation of screen and disk is very poor.

Apart from that it would appear to be a good (albeit expensive) system. And it has a 4 Mb hard disk drive. It also has a very good communications system should you wish to link it to other computers. It can use CP/M, although I suspect that it is probably CP/M that is making the system so horrendously slow. The hard disk is housed in the same sized case as the twin 5¼in drives; ie, the hard disk on one side and the 5¼in floppy on the other. I'll leave you to wonder how easy it is to back-up a 4 Mb hard disk onto a 250k floppy disk.

At the time of writing (Feb '82) *PCW*'s review had not yet been read by me and the only items of applications software available at present are portfolio/investment management, stock control, Visicalc, and Wordstar, although there will undoubtedly be much more by the time you read this. The main supplier (other than HP) is Sumlock Bondain Ltd on 01-250 0505.

HP stands for 'high price' (as Guy Kewney keeps pointing out), but they are certainly in the forefront for reliability. For the first time, Hewlett-Packard is allowing its suppliers to call in equipment for maintenance instead of sending it back to HP; the equipment will be serviced by a roving band of HP engineers.
SW

Missing matrices

How do I replace commands such as MAT A=B, MAT PRINT, etc. These are available on the DEC 10 that I use at college, but not on my brother's micro.
L Lee, Teddington (and many others).

Not many micros support these commands because of the amount of extra space the compiler/interpreter would use. Just in case some people have never heard of these commands I will briefly outline what they do.

The MAT commands handle and manipulate arrays using a single statement. The statements only know how to manipulate the arrays because they have already been dimensioned using a DIM statement. Suppose we have statement DIM A (10,3), B (10,3), C (10,3) then a statement such as MAT PRINT A will print the whole array A. MAT C=A will copy the whole array A into array C. There are many statements that can be used — for example, MAT C=A+D — and operators such as +, = and * can be used with many other functions possible.

There is insufficient space here to describe the full meaning of the words such as the 'transpose' of a matrix so I will just give their equivalent Basic constructs. The arrays must have been previously dimensioned as DIM A (M,N), B (M,N), C (M,N).
SW

```
MAT A=B
-------
10 FOR I=1 TO M
20   FOR J=1 TO N
30     LET A(I,J)=B(I,J)
40   NEXT J
50 NEXT I
Use the above program and make the changes below
MAT PRINT A - replace 30 PRINT A(I,J);
                insert 45 PRINT
MAT B=CON       30 B(I,J)=1
MAT B=ZER       30 B(I,J)=0
MAT B=IDN       omit line 20,40
                30 B(I,I)=1    matrix must be square ie M=N
MAT INPUT A     30 INPUT A(I,J)
MAT C=A+B       30 C(I,J)=A(I,J)+B(I,J)
MAT C=(K)*A     30 C(I,J)=K*A(I,J)
MAT C=A-B       30 C(I,J)=A(I,J)-B(I,J)
MAT C=TRN(A)    30 C(I,J)=A(J,I) matrix must be square
MAT C=INV too complex to do here, refer to a book on matrices.

MAT C=A*B
---------
Matrices must be compatible, ie, dimensions of M x N and N x P
  5 MAT C=ZER
 10 FOR I=1 TO M
 20   FOR K=1 TO P
 30     FOR J=1 TO N
 40       C(I,K)=C(I,K)+A(I,J)*B(J,K)
 50     NEXT J
 60   NEXT K
 70 NEXT I
```

Texas + TV

I would like some information on the Texas Instruments TI 99/4 microcomputer. In particular, can it be used to give colour displays with standard UK TV sets? The *PCW* benchtest of the DAI personal computer (October 1980) suggested that the TI 99/4 could not do this. I would also be grateful for any further information you can give on the TI 99/4.
M G Gordon, Newcastle-upon-Tyne

October 1980 was a long time ago in terms of microcomputing! Texas Instruments has now re-launched the TI 99/4 in the UK as the TI 99/4A. This now has full compatibility with the PAL television system used by UK TV sets. The price has also been substantially reduced to about £300, although a colour monitor is no longer included in view of the compatibility with UK TV sets. The TI 99/4A uses TI's own 16-bit microprocessor, has 26k ROM, including a 14k Basic, and 16k RAM, expandable to 48k.

This is an out-of-the-ordinary machine, with built-in high-resolution graphics in 16 colours, and a full music capability. Speech synthesis is available as an option. Another departure from the usual is the provision of a slot for ROM modules containing games, educational, and other programs in a somewhat similar manner to TV games machines.

Options include a thermal printer and a disk system, although data and programs can also be stored on an ordinary cassette recorder. The TI Basic does not allow access to machine code via PEEK and POKE but an assembler module is likely to be available soon. There is also provision for saving graphics screens on tape.
P L McIlmoyle

Graphics books

I have ordered the BBC Computer and wish to experiment in computer graphics. Can you recommend any books on the subject?
G Hetherington, Nuneaton

I cannot recommend any books in particular but I have found these two to be readable. The former is much newer and has about 60 more pages. The latter book aims more specifically at the micro user and in particular the Apple. The BBC's graphics are not as limited as the Apple's so the book may restrict you somewhat.
Principles of Interactive Computer Graphics (2nd Edition) by Newman & Spoull, pub McGraw Hill, price about £11.
Computer Graphics Primer by Mitchell Waite, pub SAMS price about £10.
SW

VIC Comal?

Would it be possible on the VIC-20 to use other languages like Comal-80? I am a very frustrated Basic user — a change would do me good!
G Doyle Pontefract, W Yorks

Basic is most popular on 8-bit microcomputers for a number of reasons, not all of which are still valid. Comal-80 has been implemented on the Commodore PET and there appears to be no reason why, given sufficient memory, a version could not be implemented on the VIC-20. As yet such a version does not exist, but it should not prove too difficult to do.
RD Geere, Editor, Independent PET/VIC Users Group

Weird sums

My ZX81 does very weird arithmetic:—

```
10 LET A=1234.99 +
   1234.99 + 1234.99
20 LET B=1234.99 +
   1234.99 +1235—0.01
```

30 PRINT A—B
gives an answer of
9.5367432 E-7
When the values are multiplied by 100 the problem disappears. I need such values in my work. What is going wrong?
A Sampson, Stroud, Glos

I don't want to repeat the answer to a question that was answered in the March '81 edition of 'Answers'. The problem with 'Computer Answers' is that people keep writing asking the same questions!

What I would like to do is to say that if you require precise accuracy then you must deal entirely in *integer* arithmetic. This can be achieved quite simply and can be transparent to the user of the program. Beware that the interpreter allows you sufficient accuracy to do your processing. Six to eight significant figures is all that you can expect on most systems without double-precision capability.

Your input statement should read:

```
50 INPUT "Invoice amount
   (in pounds)"; Q$.
60 Q=INT (100*(VAL(Q$)
   + .001)
```

When it comes to print your results, having done all the processing in pence use:—

```
200 Q$ = STR$ (Q)
210 PRINT "Amount is";
    LEFT$ (Q$, LEN (Q$)
    -2) + "." + RIGHT$
    (Q$,2)
```

Another advantage of printing in this way is that your output is formatted for you, ie, trailing zeroes are printed.
Sheridan Williams

Secondhand hardware

Can you recommend reading material on computer programming in Basic which should take me through from a basic to an advanced level and be applicable to the majority of hardware in the medium price range? What are your views on second-hand hardware and what should I be aware of if buying second-hand?

What machines would fill the following features? Cost: £500-£600; international manufacturer with probable worldwide agents; good graphics, sound and controls for games; 32k-48k RAM; reasonably priced peripherals, disk drives, etc; robust; and portable, or can be broken down.
D A Thomson, Thumrait, Sultanate of Oman

It is not easy to find one book which will take you through Basic from beginner level to advanced level. However, if I have to choose, I can have little hesitation in recommending *Computer Programming in Basic* by Peter Bishop (published by Thomas Nelson & Sons, 1979). This is arranged in a series of graded exercises, to cover a wide range of levels. It also gives a thorough grounding in programming, as well as in the Basic language . . . so many books cover one or the other, rather than both. Also highly recommended for the beginner is the Tandy Level I Basic Manual. Tandy Basic is similar to many of the versions of Basic found on many medium-price micros. The major differences between one version of Basic and another tend to be in string and file handling, and you will probably have to rely on the manual for your particular machine for information on how to handle these. There is quite a ready market in second-hand hardware, which must imply general satisfaction, although I have no direct experience of this. Certainly, microcomputing hardware seems to keep its value quite well.

The most important point to check must be to see the equipment in action, running various sorts of programs, preferably of a similar type to those you wish to use. You should also see the machine opened up, so that overheating, frayed leads, damaged tracks on circuit boards, etc, can be looked for.

Turning to the type of computer you are looking for, I can think of two machines which correlate with all your requirements: the Tandy TRS-80 Colour Computer, and the Texas Instruments TI-99/4A Home Computer. Two other machines meet all your requirements apart from, probably, the 'world-wide agents'. These are the BBC Computer and the Video Genie.

There are three 'runners-up'. The Atari 400 qualifies, except possibly on robustness (with its 'touch' keyboard), while the Atari 800 meets your requirements, except for price. The Acorn Atom makes it except for points 2 and 4, although it will accept sufficient external memory to meet 4. Finally the CBM VIC 20 should eventually be capable of expansion to meet your requirements.
P L McIlmoyle

UK market

I am having difficulty in obtaining information for a project I am carrying out at Leeds Polytechnic. Could you help me in finding where facts may have been published on 'The size of the UK market for home computer-units and value'? My attention was drawn to *PCW* by a printout from BLAISE.
H Davison, Wetherby

As you have found, information of the type you are seeking tends to be a closely guarded secret. Such information is usually available from appropriate consultants, but at a price! However, if your enquiry is for academic purposes and you can accept a fairly approximate answer, then I suggest you try the National Computing Centre's Microsystems Centre at 11 New Fetter Lane, London, EX4A IPU, tel 01-353 0013.

Should you be looking for full commercial information then a good place to start would be with Pedder Associates, part of the BIS Group. Pedder Associates carry out a well known annual census of the UK computer population.
PL McIlmoyle

Osborne maths?

Is the Osborne 1 reasonably accurate for use by a mathematician? Does it have high resolution graphics? Is colour available as standard or as an option? Does it have programmable function keys? If the answers to the first two are 'no', can you suggest an alternative, at no greater expense?
S Mahmood, Bradford, W Yorks BD3 0AD

I am not sure how much 'accuracy' you have in mind. In my general computing experience (as opposed to microcomputing) it is the accountants who tend to demand the highest level of precision, although certain physical sciences (especially astronomy) can demand accurate values for small differences between large numbers, which demands a high level of precision.

In any case, the number of significant figures accurately attainable is a function, firstly, of the 'word-size' of the CPU, and secondly, of the software. As you know, all 8-bit micros are limited to five significant figures (or even to four) when handling numbers without any special software or hardware. However, as the Osborne 1 runs under CP/M you should have little difficulty in getting software for whatever precision you need, or of adopting routines in high level languages if you want to do something like calculating pi to many places. If you use a Basic (such as North Star Basic, which can be modified to run under CP/M), which uses BCD coding for 'real' numbers, rather than the commoner pure binary notation, you will also eliminate errors due to the conversion from decimal to binary and back. MBasic (which runs under CP/M) supports the 'double precision' option, this allows around 12 significant figures.

I regret to say that the answer to all three of your other questions is 'no'. As regards alternatives to the Osborne 1, at no greater cost, which offer high resolution graphics, and colour, the first point is that none of the possibilities will offer the same degree of portability. Having said this, you may like to consider choosing from a wide range which includes the BBC Computer (if you're prepared to wait!), Apple II with extra cards, Atari 800, Compucolor II, DAI, Hewlett-Packard HP 45/85, Sharp MZ-80B, and Video Genie, suitably expanded.
P L McIlmoyle

Laser printers

For part of my A-level project I am collecting information on the different types of printers. I cannot find information on two types, and would be grateful for your help. The types in question are electrostatic and laser printers.
S Grimes, Sutton Coldfield

There are two types of printers which can be referred to as 'electrostatic'. The commoner type prints on special aluminium coated paper using a dot matrix technique. For each dot to be printed an electrically generated spark evaporates the very thin coating of aluminium, leaving the dark coloured paper to show through. The resultant print out is not very elegant, but does yield good photocopies! These printers are relatively cheap, and are often used as screen printers, with, for example, Prestel receivers. The new Sinclair ZX printer uses this technique.

The term 'electrostatic printer' is also applied to certain specialised printers based on the xerographic process, incorporated in 'communicating photocopiers'.

Laser printers are currently being developed, particularly by IBM, to provide a fast 'letter quality' printer for word processing in particular. These printers use semiconductor lasers to burn patters into paper, the patterns being letters, numbers or other special symbols, including 'graphics' if required. The technique is claimed to work with ordinary paper, and needs no ink or ribbons.

Have you included the 'ink-jet' printer in your collection? These very versatile, and increasingly popular printers operate by squirting small drops of ink onto the paper, in controlled patterns. The ink drops are often steered onto the paper electrostatically.
PL McIlmoyle

NEWCOMERS START HERE

This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in PCW. While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, **PCW** will be publishing this guide — every month.

We'll start by considering a microcomputer's functions and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, **processing** it, storing the results or sending them somewhere else. All this information is called **data** and it comprises numbers, letters and special symbols which can be read by humans. Although the data is accepted and output by the computer in 'human' form, inside it's a different story — it must be held in the form of an electronic code. This code is called **binary** — a system of numbering which uses only 0s and 1s. Thus in most micros each character, number or symbol is represented by eight binary digits or **bits** as they are called, ranging from 00000000 to 11111111.

To simplify communication between computers, several standard coding systems exist, the most common being **ASCII** (American Standard Code for Information Interchange). As an example of this standard, the number five is represented as 00110101 — complicated for humans, but easy for the computer! This collection of eight bits is called a **byte** and computer freaks who spend a lot of time messing around with bits and bytes use a half-way human representation called **hex**. The hex equivalent of a byte is obtained by giving each half a single character code (0—9, A—F): 0 = 0000, 1 = 0001, 2 = 0010, 3 = 0011, 4 = 0100, 5 = 0101 . . . . E = 1110 and F = 1111. Our example of 5 is therefore 35 in hex. This makes it easier for humans to handle complicated collections of 0s and 1s. The machine detects these 0s and 1s by recognising different voltage levels.

The computer processes data by reshuffling, performing arithmetic on, or by comparing it with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in **memory** as bytes. The rules are called **programs** and while they can be input in binary or hex (**machine code** programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the nearer the **programming language** is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is **Basic**. Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To **run** such a program the computer uses an **interpreter** which picks up each English-type **instruction**, translates it into machine code and then feeds it into the **processor** for execution. It has to do this each time the same instruction has to be executed.

Two strange words you will hear in connection with Basic are **PEEK** and **POKE**. They give the programmer access to the memory of the machine. It's possible to read (PEEK) the contents of a byte in the computer and to modify a byte (POKE).

Moving on to **hardware**, this means the physical components of a computer system as opposed to **software** — the programs needed to make the system work.

At the heart of a microcomputer system is the central processing unit **(CPU)**, a single microprocessor chip with supporting devices such as **buffers**, which 'amplify' the CPU's signals for use by other components in the system. The packaged chips are either soldered directly to a printed circuit board **(PCB)** or are mounted in sockets.

In some microcomputers, the entire system is mounted on a single, large, PCB; in others a **bus system** is used, comprising a long PCB holding a number of interconnected sockets. Plugged into these are several smaller PCBs, each with a specific function — for instance, one card would hold the CPU and its support chips. The most widely-used bus system is called the **S100**.

The CPU needs memory in which to keep programs and data. Microcomputers generally have two types of memory, **RAM** (Random Access Memory) and **ROM** (Read Only Memory). The CPU can read information stored in RAM — and also put information into RAM. Two types of RAM exist — **static** and **dynamic**; all you really need know is that dynamic RAM uses less power and is less expensive than static, but it requires additional, complex, circuitry to make it work. Both types of RAM lose their contents when power is switched off, whereas ROM retains its contents permanently. Not surprisingly, manufacturers often store interpreters and the like in ROM. The CPU can only read the ROM's contents and cannot alter them in any way. You can buy special ROMs called **PROMs** (Programmable ROMs) and **EPROMs** (Eraseable PROMs) which can be programmed using a special device; EPROMs can be erased using ultra-violet light.

Because RAM loses its contents when power is switched off, **cassettes** and **floppy disks** are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of audio tones and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, **floppy disks** are used on more sophisticated systems.

A floppy disk is made of thin plastic, coated with a magnetic recording surface rather like that used on tape. The disk, in its protective envelope, is placed in a disk drive which rotates it and moves a **read/write head** across the disk's surface. The disk is divided into concentric rings called **tracks**, each of which is in turn subdivided into **sectors**. Using a program called a **disk operating system**, the computer keeps track of exactly where information is on the disk and it can get to any item of data by moving the head to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: **soft sectoring** where special signals are recorded on the surface and **hard sectoring** where holes are punched through the disk around the central hole, one per sector.

Half-way between cassettes and disks is the **stringy floppy** — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. **Hard disk** systems are also available for micro-computers; they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the visual display unit **(VDU)**, which looks like a TV screen with a typewriter-style **keyboard**; sometimes these are built into the system, sometimes they're separate. If you want a written record **(hard copy)** of the computer's output, you'll need a **printer**.

The computer can send out and receive information in two forms — **parallel** and **serial**. Parallel input/output **(I/O)** requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial I/O involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device when a byte is about to start and when it has finished. The speed that data is transmitted is referred to as the **baud rate** and, very roughly, the baud rate divided by ten equals the number of bytes being sent per second.

To ensure that both receiver and transmitter link up without any electrical horrors, standards exist for serial interfaces; the most common is **RS232** (or **V24**) while, for parallel interfaces to printers, the **Centronics** standard is popular.

Finally, a **modem** connects a computer, via a serial interface, to the telephone sytem allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need British Telecom's permission; instead you could use an **acoustic coupler**, which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — British Telecom isn't so uppity about the use of these.

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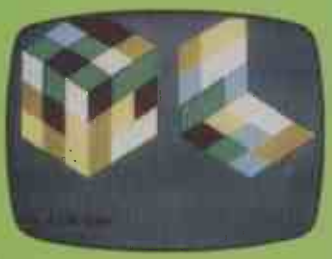

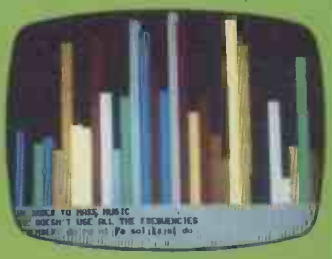

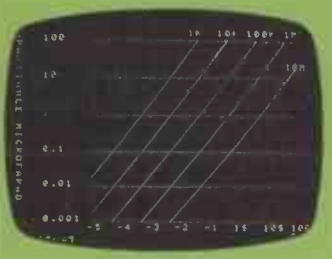

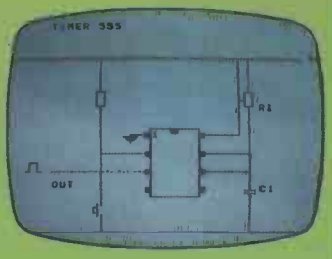

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A typewriter-style keyboard incorporates characters and symbols plus a numeric key-pad and ten user-definable keys for fast and simple operation.

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PCW/4/82

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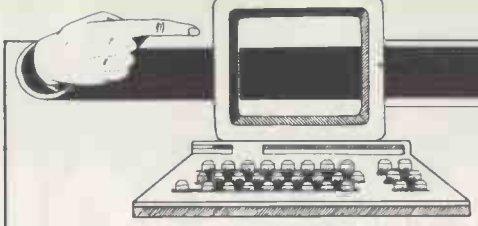

IN STORE

DIRECT ACCESS

Additions this month include the Xerox 820 and Gemini multiboard, both already benchtested in PCW, a new North Star machine from Comart and (finally) the legendary BBC micro. Please send any updates or additions to Dick Olney, 'Instore', PCW, 14 Rathbone Place, London W1P 1DE.

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
ABC 24 (£3195)	AI 09237-77139	64k RAM: Z80A: dual 5¼" F/D (640k): 12", 24 x 80 VDU: 2 x S/P: 2 x P/P	CP/M: *Basic: Cobol: Fortran: Pascal.*	BT 4/81 (S)
ABC 80 (£738)	Datormark Ltd: 97 44896	16-40k RAM: Z80A: C: 12", 16 x 40 b&w VDU: 4680 bus: IEE 488: RS232 port.	DOS Basic (16k ROM: *Fortran: Pascal: A: Multi user Basic.*	Colour video graphics with UHF output. Viewdata compatible. Loudspeaker. Numeric keypad. Options: dual 5¼" F/D (320k) £895: dual 8" F/D (2 Mb). BT 1/80. (1)
ACT Series 800 (£3495)	ACT: 021-501 2284 (50)	48k RAM: 6502: dual 5¼" F/D (800k): 12", 30 x 64 VDU: 1 S/P: 1 P/P: Multi-screen int. Option: 10-20 Mb H/D	MDOS: Basic: A: *CBasic:* PL/M: *Forth: Fifth: Cesil: Pilot: Fortran.*	IBM compatible K/B High resolution graphics. Available with dual 8" F/D (2.4 Mb) £4950 — 4.8 Mb maximum. BT 2/80(E).
ACT Sirius 1 (£2349)	As above	128-512k RAM: 8088: dual 5¼" F/D (1.2M): 12", 25 x 80 VDU: 2 x RS232 ports: 2 x P/P	CP/M 86: U: *Basic: Cobol: Fortran: Pascal*	High res graphics. Options: 10 Mb H/D: dual 5¼" F/D (2.4 M).(S)
Adler Alphatronic (£1600)	Adler 01-250 1717	48k RAM: 8085 A single 5¼" F/D (160k): 12", 24 x 80 VDU: S/P: P/P	CP/M: *Basic: CBasic: Fortran: Cobol*	With 80 cps printer and dual F/D £2345 (inc CP/M). (S)
Alpha Micro (£5650)	Alpha Micro (UK) Ltd: 01-250 1616 (TBA)	64k — 1 Mb RAM: 16 bit: dual 8" F/D 2.4 Mb): 6 S/P.	Multi-user OS: Basic: M/A: Pascal: U. *Fortran: Cobol*	Modular. Expands to 1200 Mb, 24 terminals or multiprocessor system. (E)
Altos ACS 800-2 £2995)	logitek: 02572 66803 (33)	64k RAM; Z80A; dual 8" F/D (1 Mb): 2 x RS232 ports: 2 P/P.	CP/M: *Basic: CBasic: Cobol.*	Single user. Options: DMA. Floating point processor. Phototyping board.
Altos ACS 8000-10 (£6675)	As above.	280k RAM: Z80A: single 8" F/D (500k): 10 Mb H/D: 6 x RS232 ports: P/P: network RS422 port: DMA	CP/M: *MP/M: Basic: Cobal: Fortran: APL: Pascal.*	Multi-user/multi tasking. Up to 4 users. Options: 10 Mb: mag tape backup (S + H).
APL Signet (£1750 or £130pm)	Micro APL: 01-834 2687	64k RAM: Z80A: dual 5¼" F/D (380k): 2 x RS232 ports.	CP/M: APL: *Basic: U: Fortran: Cobol: Algol: Forth*	Desktop APL computer with self teaching course. (S)
Apple II (£695)	Microsense: 0442 41191 (190)	16-48k, RAM: 6502: 8 I/O slots.	OS: Basic: *Pascal: Fortran: Cobol: Pilot*	280 x 192 high resolution graphics: Option: single 5¼" F/D (116k) £349.
Atari 400 (£345-16k)	Ingersoll: 01-226 1200 (40)	16k RAM: 6502: C int: cartridge slot: 12 x 20 TV int: RS232C port: touchpad k/b: Opt: C £40	OS (10k ROM): Basic (8k ROM). *Pilot: Forth.*	High resolution colour graphics. 4-channel sound. Four games controller/light pen sockets. BT 10/80. (I/B).
Atari 800 (£645-16k)	As above.	16-48k RAM: 6502: C int: 4 x cartridge slots: 12 x 20 TV int: RS232C port. Opt: single 5¼" F/D (90k) £345: 16k RAM £65.	As above.	As above. Software & RAM on cartridge modules. Up to 4 disk drives. BT 10/80. (I/B).
Athena 8285 (£5694)	Butel-Comco Ltd: 0703 39890 or 01-202 0262 (TBA)	64k RAM: 8085A: dual 5¼" F/D (644k): 12" 25 x 80 VDU: 150 cps printer: RS232 port.	AMOS: T/E: Basic: *Cobol: Fortran: Pascal: APL: M/A.*	Extended ASCII K/B with numeric pad: graphics. Options: dual 8" F/D (2 Mb): up to 1200 Mb H/D.
Atom (£120)	Acorn: 0223 312772 (35)	2-12k RAM: 8-16k ROM 6502: Full K/B: C int: TV int: 20 I/O lines: 1 P/P. Options: 80 col printer £199, Prestel adaptor £120.	Basic in 8k ROM: A Cass O/S.	High resolution graphics on bigger model: colour monitor O/P. Loudspeaker. Note also, systems based on Acorn SBC. BT 7/80(B).
Attache 201 (£8000)	COLT 01-572 3784 (10)	64k RAM: Z80: dual 8" F/D (2.4 Mb): 12" 24 x 80 VDU: 180 cps printer.	Basic: *Fortran: Cobol.*	Upgradable to multiuser system with 18 Mb H/D. Full range of business packages included software dealers TBA. (S)
BASF 7120 (£3600)	BASF: 01-388 4200 (12)	64k RAM: Z80A: 3 x 5¼" F/D (480k): 12". 24 x 80 VDU: RS232 port: P/P	DOS: (OASIS) *Ex Basic: Cobol U. A: CP/M*	H/D available soon. Also 7125 with *930k* F/D £4280 and 7130 with single F/D (430k) & 5Mb H/D £4950. Disk controller has own Z80A. BT 9/80
BBC Micro (£205)	BBC Micro Systems 14 Station Road Kettering Northants (no tel)	16-32k RAM: 6502: C int: TV int: RS423 port: P/P: Option: single 5¼" F/D (100k) £230	MOS: Basic A	Video text & second processor int. 32k model with Econet and disk interface £3.95. BT 1/82 (I)
Billings BC-12 FD: (£3995)	Mitech: 04862 23131 (TBA)	64k RAM: Z80A: dual 5¼" F/D (640k): 12", 24 x 80 b&w (or b&g) VDU.	DOS: Basic: *Fortran: Cobol: A*	With dual 8" F/D (2 Mb) £5995. Additional dual 8" F/D £300 option: 50Mb H/D. (S).

List of Abbreviations

A	Assembler	G/C	Graphics card	M/A	Macro assembler	S	Software
BT	Bench Tested	H	Hardware	N/A	Not available	S/P	Serial port
C	Cassette	H/D	Hard disk	N/P	Numeric pad	T/E	Text editor
E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

Two flexible multi-user systems

The Vector Graphic 5005 and 5032

with 5 megabyte and 32 megabyte Winchester hard discs

The Vector Graphic 5005 & 5032 are multiple-user, multi-tasking hard disc systems for general business and word processing applications.

Supporting up to a maximum of 5 users and giving up to 32 megabytes of high-speed totally reliable Winchester disc technology with Vector's automatic error correction feature.

Total flexibility means that the systems terminals can work independently which permits the widest possible range of usage.

One user could use Execuplan for financial planning whilst the second user is entering sales information with accounting software and the third may run correspondence simultaneously with Vector's Memorite III word processing software.
Most other standard CP/M compatible applications software will run on the system e.g. COBOL, FORTRAN, PASCAL, BASIC COMPILER, ALGOL, PL/I and other statistical and data based management packages.

Up to 5 terminals

The Vector Graphic 5005 & 5032 are ideal for application packages, such as accounts, stock control, payroll, word processing, financial modelling and solicitors packages, all available from Almarc.

For further information write or telephone Almarc. Complete sales and servicing facilities are available throughout the U.K.

Almarc
DATA SYSTEMS

Almarc Data Systems Ltd.,
Great Freeman Street,
Nottingham NG3 1FR
Tel: (0602) 52657/8/9
Telex: 37407 Almarc/G

Also at:
Green Street,
High Wycombe,
Bucks. HP11 2RF.
Tel: (0494) 23804

APPROVED ALMARC DEALERS

BALDOCK	Modus Systems	(0462) 894848	KETTERING	Shuttleworth Business Systems	(0536) 511357
BIRMINGHAM	Taylor Micro Systems Ltd.	(021) 358 2436	LONDON	Micro Systems Consultants	(01) 979 4098
BRISTOL	Johnson Micro Computers	(0272) 422061	LOUTH	Computa-Crop	(0507) 604271/2
CAMBERLEY	Johnson Micro Computers	(0276) 20446	NOTTINGHAM	Almarc Business Systems	(0602) 622501
DONCASTER	Reed Computing	(0709) 67087	OXFORD	Johnson Micro Computers	(0865) 721461
HIGH WYCOMBE	Common Sense Business Systems	(0494) 40116	SWANSEA	Business Microsystems	(0792) 474082
HARROGATE	Business Microsystems	(0423) 68224	TYNE & WEAR	H.P. Micros	(0632) 859923
			YEOVIL	Dale Computers	(0935) 23097

IN STORE

DIRECT ACCESS

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
C/09(£3500)	SWTP Ltd: 01-491 7507 7507 (16)	64k RAM: 6809: dual 5¼" F/D (700k) 9", 24 x 80 VDU: 2 S/P: 1 P/P.	TSC FLEX: *Basic: Fortran Pascal: A: Dis A: T/E: U.*	Expandable to S/09 UniFLEX *32 user system. (H)*
Canon BX-3 (£4250)	Canon 01-680-7700.	32k RAM: 6809: dual 5¼" F/D (640k): 28 char display: 80 cps printer: 3 x RS232 port: P/P.	OS: Basic: A. *Cobol: Pascal*	Fully integral unit. Extensive applications support offered on all Cannon Machines. Options: dual dual 5¼" F/D (640k) £1500.
Canon CX-1 (£6000)	As above.	128k RAM: 6809: dual 5¼" F/D (640k): 12", 24 x 80 VDU: 180 cps printer: 3 x V24 ports: P/P: light pen.	OS: Basic: A: *Cobol: Pascal.*	Price includes installation & training. Extensive application support offered. Options: dual 8" F/D (1Mb) £3300.(S)
Canon TX-25 (£1600)	As above.	16-32k RAM: 6809: C: 20 char display: 26 col, 2.4 lps printer. Option: 2 x RS232 port.	Basic: A	Fully integral unit. Cassette is Cannon's own design (8k). Can be used with communications. (S).
Challenger 1P & C4P (£220 & £395)	CTS: 0706 79332 Millbank Computing: 01-549 7262. Mutek: 0225 743289. U-Microcomputers: 0925 54117 Watford Elec: Watford 40588 (18)	4.32k RAM: 6502: C int: RS232 port. Options: dual 5¼" F/D (160k) £550: for C4P dual 8" F/D (1.15 Mb) and 20MB H/D	O/S: Basic (8k ROM) *Ex Basic:* A.	D/A conv: colour capability. Runs OSI business software on 8" F/D Plato educational software avail soon. BT 4/80. (S).
Challenger 2 (£150)	As above	48k RAM: 6502: dual 8" F/D (0.5 Mb): RS232 port.	OS65U: Ex Basic: A.	Designed as low cost business system (S).
Challenger C3 (£2334)	As above	32-56k RAM: 6502: 6800: Z80: dual 8" F/D (1.15 Mb): 2-16 S/P.	OS65U: Basic: *CP/M: Fortran: Cobol*	Expandable to multi-user (8) system. Options: C3B & C3C H/D units, 74 Mb for about £8500. (S&H).
Clenlo Conqueror (£2475)	Clenlo Computing Systems Ltd: 01-670 4202 (TBA)	64k RAM: Z80: dual 8" F/D (1 Mb): 3 S/P: 2 P/P.	CP/M: CBasic-2: Pearl 1: *U Fortran: Cobol: Pascal*	With 2.4Mb F/D £2950. Also H/D systems with 10 Mb H/D & tape drive £5430.
Comart Communicator (£1995)	Comart 0480 215005 (25)	64k RAM: Z80A: dual 5¼" F/D (780k): 2 S/P: P/P.	CP/M: *Basic: Cobol: Fortran: Pascal*	With 1.5 Mb F/D £2295. With 4.8 Mb H/D & 790k F/D £3795. Option: 18 Mb H/D. £3395 (S).
Compucolor II (£1175)	Dyad Developments: 08446 729 (TBA)	16-32k RAM: 8080: 13" 32x64 8-colour VDU: single 5¼" F/D (5lk): RS232 port.	DOS (ROM): Ex-Basic (ROM): A. *M/A: T/E: Fortran: U*	32k version £1295. High resolution graphics. 6-month subscription to user magazine inclusive BT 9/79. (S).
Compucorp 625 (£6000)	Compucorp: 01-952 7860 (17)	48-60k RAM: Z80: dual 5¼" F/D (630k): 9". 16x80 VDU: 40 col printer: RS232 port, P/P.	Basic: A: *Fortran: Pascal:* U	IEEE-488 Controller and S100 int. Many applications packages avail. (E).
Compucorp 655/ 665/675/685 (from £5050)	As above	60k RAM:. Z80: Up to 4x5¼" F/D(160k-2.4 Mb): 9", 20x80 or 12" 20x80 or 20" 60x80 VDU: 40-col printer: RS232 port.	As above	Prices incl installation and training. Opt: 10-20 Mb H/D
Computermart 2000 DS (£1500)	Computermart: 0603 615089	32-256k RAM: 8085: dual 8" F/D (1-2 Mb): S/P: P/P.	CP/M: *Cis Cobol: Basic: Fortran*	Expandable to multi-user, multi-tasking,, multi-processor 96 Mb H/D system (around £15000).
Cromemco System Zero/DDF, System 2, System 3, System Z2H. (£2627/£2873/ £4893/£6118).	Datron: 0742 585490. Comart: 0480 215005 MicroCentre: 031-556 7354 (18)	64k RAM: Z80: dual 5¼" F/D (346k) on System Zero, System 2 & Z2H: dual 8" F/D (1.2 Mb) on Sys 3: 10 Mb H/D on Z2H: S/P: P/P.	CDOS: *Basic: Cobol: Fortran: RPG II: Lisp:.A: W/P: Multi-user Basic. Cromix.*	System 2 & 3 expandable to Multi-user (max 7) £8373 System 2: £10252 Sytem 3. Options: dual 8" F/D (996k): 11.2Mb H/D. BT 10/79 (E).
DAI (£595)	Data Applications (UK): 0285 2588 (7)	48k RAM: 8080: C int: 24x60 VDU int: RS232 port: over 20 industrial ints. option: dual 5¼" F/D £5.95	Basic (ROM): U	Colour graphics up to 255 x 335: 3 notes & noise generator: PAL O/P to TV: Paddle int: H maths option. (1). BT 10/80.
Diablo 3000 (£6950) (TBA)	Business Computers Ltd: 01-207 3344	32k RAM: 8085: dual 8" F/D (1.3 Mb): 12", 24x80 b&w VDU: 45 cps printer.	DOS: Basic: DACL: A: U.	Selection of business packages included (S).
Digital Micro-systems DSC-3 (£3530)	Modata: 0892 41555 (14)	64k RAM: Z80A: dual 8" F/D (1.14Mb): 4xRS232 ports: EIA port.	CP/M: CBasic: *Cobol: Fortran: Pascal: PL/I*	Expandable to multi-user system with 10-28 Mb H/D. Extensive software avail. (S).
Digital Micro-systems DSC-4 (£4395)	As above	128k RAM: Z80A: single 8" F/D (500k): 11 Mb H/D: 4x RS232 ports: 2 P/P.	CP/M: Basic-E: CBasic: *Cobol: Fortran: Pascal.*	Also DSC-3 with 64k RAM. Options: 128k RAM £1295: up to 4 Mb F/D and 20 Mb. H/D. (H).
Durango F-85 (£4995)	Comp Ancillaries: 0784 36455 (12)	64k RAM: 8085: dual 5¼" F/D (1 Mb): 9", 16x64 green VDU: 132 col 165 cps printer: N/P.	O/S: D Basic: *CP/M: CBasic: Micro Cobol.*	Up to 5 work stations: fully integrated system. Options: additional dual 5¼" F/D (1 Mb): 12-24 Mb H/D.(S).
Dynabyte 5200 5900 (£2600)	Metrotech 0895 57780(15)	64k RAM:. Z80: S100 bus: 2 ser ports: 1 par port: any com of 5¼" F/D (630k), dual 8" F/D (1Mb), 9/27/45 Mb H/D, 32/64/96 Mb Cart Module Disk.	CP/M: MP/M: CP/Net, CBasic, MBasic Cobol, Fortran, Pascal, PL/1-80	All systems expandable to multi-user and net working: CP/M inc in base price for F/D system, MP/M for H/D systems.
Equinox 200 (£7500)	Equinox: 01-739 2387 (N/A)	64-512k RAM: Z80: 10 Mb-1200 Mb H/D: 6xS/P: 1 P/P.	CP/M: CBasic: *Cobol: Fortran.*	Multi-user MVT/FAMOS available in place of CP/M. 16-bit version (Equinox 300) £10,000. (S&H).

List of Abbreviations

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E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

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IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Exidy Sorcerer (£695)	Liveport Data Products: 0736 798157 (27)	48k RAM: Z80: RS232 port: 1 P/P: S100 connector: 30x64 VDU int. N/P.	O/S: Basic (ROM): *T/E: A: CP/M: Algol: Fortran: Basic: 80. Pascal: W/P.*	High-resolution graphics capability: user programmable character set. Option: single 5¼" F/D (316k) £600
Gemini 801 (£1075)	Gemini: 02403 22307 (7).	64k RAM: Z80A: Single 5¼" F/D (315k): 25x80 VDU int: RS232 port, P/P.	*CP/M Basic: Cobol: Fortran: Pascal: A: T/E.*	Up to two integral & two external F/D. Graphics. With no F/D and C int. £750. (S).
Gemini Multiboard (£602)	As above	64k RAM: Z80: 25 x 80 VDU int (with Z80): Option: dual 5¼" F/D £550.	CP/M: *Basic Cobol: Pascal Fortran*	Modular system. Other options inc ROM board & EPROM programmer. Complete cased disk system £1450 BT 2/82 (H&S).
Gimix System 68 (£2000)	SEED: 05433 78151: Windrush 0692 505189	16-64k RAM: 6800/6809: dual 5¼" F/D (500k): 2xRS232 ports.	OS-9: Flex *Basic: Pascal: A: Dis A: T/E:U*	With dual 8" F/D (2 Mb) £2900. Designed as development system for industrial control. (H).
Haywood 3000 (£1925)	Haywood: 01-428 0111. (TBA)	32-64k RAM: Z80A: dual 5¼" F/D (800k): RS232 port: P/P. Opt: 15" 28x80 VDU £799.	CP/M: *Basic: Cobol: Fortran: Pascal: W/P.*	Also system 7000 with 48-65k RAM and 8" F/D (2.5 Mb) £2999. (S).
HP 85 (£1830)	Hewlett Packard Ltd: 0734 784774 (16)	16-32k RAM: C.P.U.: 5", 16x32 VDU: C(200k): 64 cps printer: 4 P/P. Options: dual 5¼" F/D (540k) £1408: fusl 8" F/D (2.4 Mb) £3744.	Basic (ROM)	Full dot matrix graphics. Complete range of interfaces, peripherals and application packages avail. 16k RAM £222. (S).
IMS 5000 (£1500)	Equinox: 01-739 2387 (20)	16-56k RAM: Z80: dual 5¼" F/D (320k): 2xS/P: 1 P/P:	CP/M: C/Basic: *Cobol, Fortran.*	3 drives option: (S&H).
IMS 8000 (£2500)	As above	64-256k RAM: Z80: dual 8" F/D (1 Mb): 2xS/P: 1 P/P	CP/M: CBasic: *Cobol: Fortran: MicroCobol.*	Multi-user MVT/FAMOS available in place of CP/M. (S&H).
Intecolor 8000 (£2999)	Dyad Developments: 08446 729 (TBA)	8-32k RAM: 8080: 19", 80x48 colour VDU: single 5¼" F/D (90k): Option: up to 26 Mb H/D.	DOS(ROM): Ex-Basic: *A:M/A:T/E: Fortran: U*	High res graphics avail: Many options including size of F/D and VDU. (S).
ITT 2020 (£867)	ITT: 0268 3040 (15)	16-48k RAM: 6502	Monitor: A: ExBasic: Dis A.	360x192 high res graphics. Ex-Basic in 6k ROM: Options: single 5¼" F/D (116k): £425: 16k RAM, £110: RS232 port, £96: 32k system, £931: 48k system £995: (B).
Ithaca DPS1 (£3995)	Ithaca: 01-341 2447 (10).	64k RAM: Z80: dual 8" F/D (1 Mb): 2xRS232 ports: 4xP/P. Opt: H/D.	CP/M: *Basic: Cobol: Fortran: Pascal: A: U.*	Z8000 16-bit processor board avail. IEEE/S100 (8 or 16 bit) compatible. (E).
LX-500 (£3500)	Logabax Ltd: 01-965 0061 (13)	32k RAM: Z80: dual 5¼" F/D (180k): 12" 25x80 b&w VDU: 100 cps printer.	DOS: Basic: A.	Other printers available. (S).
LSI M-One (£4200)	LSI Computers: 04862 23411 (20)	8-16k RAM: 8080: dual 8" F/D (1.2 Mb): 12", 24x80 b&w VDU	FMOS: A	Choice of standard business packages included in price. (S).
LSI M-Two (£7900)	As above	64-128k RAM: 8085A: dual 8" F/D (1.2 Mb): 12", 24x80 VDU: 60 cps printer	Elsie: *CP/M: Basic: Cobol Fortran: Pascal: A: U*	Max 8 VDUs and 4 printers. Many applications packages available. Option: 10 Mb H/D £2600. (S).
Macro 1 (£3950 or £294 pm).	Micro APL Ltd. 01-834 2687 (TBA)	64k RAM: Z80A: dual 8" F/D (1 Mb): 4xRS232 ports.	CP/M: APL: U: *Basic: Fortain: Cobol: Word-2star Algo: Pascal: Forth.*	Designed as timesharing replacement. Macro 2 with 2 Mb F/D £4750 or £334 pm.
Megamicro (£6080)	Bytronix: 0252 726814(5)	56k RAM: Z80: dual 8" F/D (500k): 12", 20x80 green VDU: 180 cps printer: 2 S/P: 2 P/P.	CP/M: U: *Basic: A: M/A.*	Range of bus. packages now avail. from Ludhouse of Streatham. (H&B).
Micro Trainer 1 (£650)	Hewart: 0625 22030 (N/A)	16-32k RAM: 6800/6809: 10" 16x24 VDU: 2xC int: Opt: dual 5¼" F/D (160k) £595: 8k RAM £17.	Basic: A: *Pascal: PL/M: W/P*	SS50-based system. Graphics avail. Int card with real time clock £17. (1).
Microstar 45 Plus (£4800)	Data Efficiency Ltd: 0442 63561 (30)	64k RAM: 8085: dual 8" F/D (1.2 Mb): 3 S/P, RS232 port.	Stardos: CP/M: Basic: *Cobol: Fortran*	(E)
Microtan 65 (£69)	Tangerine: 0353 3633(6)	2k RAM: 6502: T Mint: Exp up to 277k RAM.	2k TANBUG monitor: 2k A, disassembler, cassette firm ware: *10k Microsoft Ex. Basic.*	Options: bulk I/O modules, hi-def graphics, CP/M, system racking, ASCII keyboard. Prestel adaptor (S&H).
Millbank Sys 10 (£2995)	Millbank: 01-788 1083(6).	65k RAM: Z80: dual 5¼" F/D (700k): 12", 24x80 VDU: 2x RS232 ports: RS4449 port: P/P.	CP/M: *Basic: Cobol: Fortran: Pascal: PLI: W/P.*	One high level lang. included. 12-month warranty. Main-frame comm. package. H/D avail. soon. (S&H)
MS5001 (£7450)	BMG Ltd: 0793 37813 (N/A)	64k RAM: 8085: dual 8" F/D (1 Mb): 12", 80x24 VDU: 80 cps printer: RS232.	CP/M: *Basic: Cobol: Fortran: MP/M.*	Price includes desk mounting and one computer. Hardware & software support. Leasing arrangements available. (E).
MSI 6816 (£1200)	Strumech: 05433 4321 (5)	16-56k RAM: 6800: dual 9" 16x64 b&w VDU: C int: 1 S/P: 1 P/P.	Basic: A.	Graphics & PROM programmer available. (S&H).
MSI System 12 (£8000)	As above	56-184k RAM: 6800: 10 Mb H/D: single 8" F/D (500k) 24x80 VDU: 1 S/P: 1 P/P.	SDOS: Basic: CBasic: U.	As above. Business packages avail. Up to four terminals. (H&S).
NEC PC 8001 (£599)	IBR 0734 664111	32k RAM: Z80A: P/P Option: dual 5¼" F/D (326k) £699	Basic N: (24k ROM) *CP/M: Fortran: Cobol: Pascal.*	Colour monitor £359 (low res) or £579 (high res) both 12", 25x80 many expansion units avail. (E) BT 6/81

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F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

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IN STORE

DIRECT ACCESS

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Newbrain MB (£199)	Grundy: 0223 350355 (TBA)	32k-2 Mb RAM: Z80A: Nat 420: 2xC int: TV int: 2xV24 ports.	CBasic (16k ROM): A.	Graphics. Battery or mains. Options: ½ Mb RAM £450 16 char display £30.(E).
North Star Horizon (£2230)	Comart: (25) 0480 215005. Comma: 0277 811131. Equinox: 01-739 2387(20)	48-56k RAM: Z80A: dual 5¼" F/D (360k): 15", 24x80 VDU: 150 cps printer: 2 S/P: 1 P/P.	DOS: Basic: CP/M: *Cobol: Fortran: Pascal.*	Options: 18 Mb H/D.
North Star Advantage (£2195)	Comart 0480-215005 (25)	64k RAM: Z80A: dual 5¼" F/D (720k): 12", 24 x 80 VDU: S/P.	GDOS: CP/M: *CBasic: MBasic: Fortran: Cobol: Pascal*	Price includes business graphics & demo software. 6 slot expansion.
Oki if 800 (£400)	Encotel.	64k RAM: Z80A: 2k ROM: dual 5¼" F/D (560k): 12", 24x80 VDU: 80 col printer: loudspeaker: RS232 port: 20k ROM cartridge.	Basic: A: *CP/M Cobol: Fortran:*	Fully integral unit. Graphics. Options: dual 5¼" F/D (560k): RS232 port: PP. (1). BT 10/81
Onyx C8000 (£6875)	Onyx Dist Ltd: 0734 664343 Colt 01-577 2150. (TBA)	64k RAM: Z80: 12 Mb Cartridge: 10 Mb H/D: 4 S/P: P/P	CP/M: *MP/M Oasis: Unix: Fortran: Pascal: W/P*	C8001 with 128k RAM £8220. Multi-user version avail. using Oasis.(E) BT 3/81.
Oscar (£2560)	IDS Ltd: 0908 313997(30)	64k RAM: Z80: dual 5 ¼ F/D (800k): 12", 25x80 VDU: RS232 port: 1 P/P	CP/M: *Basic: Pascal Fortran: Cobol: W/P:A*	Also avail. with dual 5" F/D(1.6Mb) £2905 and 8" F/D(2 Mb) £3380. Advanced video board. S&H).
Panasonic JD 800U, JD840U (£4275, £4950)	Panasonic Business Equipment: 0753 75841 (10 regional dist)	56k RAM: 8085A: 12-4k PROM: dual 8" F/D JD800U (500k): JD840U (2 Mb): 12", 24x80 green VDU: 3xRS323 ports.	CP/M: Basic: *Micro-Cobol.*	Also available with 5¼" F/D: JD740U (570k) £4095. H/D avail soon. BT 3/80 (S).
Pascal Microengine (£2295)	Pronto Electronic Systems Ltd: 01-554 6222	64k RAM: MCP 1600: 2x RS232 ports: 2 P/P.	Pascal.	CPU instruction set is P-code: no interpreter needed. Available with dual 8" F/D (2 Mb) £3900.
Pasca 640 (£3700)	Westrex Ltd: 01-578 0957 (TBA)	64k RAM: Z80A: dual 8" F/D (512k): 12", 24x80 VDU: RS232 port: P/P	CP/M: *Basic: Cobol: Fortran: Pascal: A: W/P: U*	Maintenance contracts avail. 10 Mb H/D avail. soon. (S) BT 5/18
Periflex 630z564 (from £2250)	Sintrom: 0734 85464(5)	64k RAM: Z80: dual 5¼" F/D(1.2 Mb): 2xRS232 ports. 1 P/P.	CP/M: *Basic: Fortran: Cobol:A*	One-day installation training on site included in price. Option: dual 5¼" F/D(630k) £464, dual 8¼" F/D(1 Mb) £1025. 35 Mb H/D. BT 6/80 (S&H).
Periflex 1024/64 (from £2750)	As above	64k RAM: Z80: dual 8" F/D (1.2 Mb): 2xRS232 ports: 1 P/P.	As above	As above
PET 16k, & 32k (£550, £695)	Commodore: 0753 79292 (150)	16-32k RAM: 6502: C: 9" 25x40 VDU: IEEE-488 port: Options: dual 5¼" F/D (353k) £695: same but (950k) £895	O/S: Basic (in 8k ROM): *Forth: Pilot: Pascal: Comal: Lisp: A*	8032 with 80-col screen (32k) BT 12/80. £895 Field service avail. (1).
Philips P2000 (£2444)	Philips Data	16-48k RAM: Z80: dual 5¼" F/D (140k): 12", 24x80 VDU: RS232 port.	PDOS: UCSD p-system: *Pascal: Basic Fortran:A.*	With 48k RAM, Pascal and Basic £3300: BT 12/81.(S).
Powerhouse 2 (£1125)	Powerhouse Micros: 0422 48422 (TBA)	32-64k RAM: Z80A: 5" 29x96 VDU: RS232 port: external bus.	4k Monitor: *FDOS: Basic: ExBasic (14k EPROM)*	VDU has flexible screen logic. Options: FDOS & Basic £210: graphics card £200. (H).
Powerhouse 3 (£2600)	As above	32-64k RAM: Z80A: dual 5¼" F/D (350k): 5", 29x96 VDU: RS232 port: external bus.	As above	VDU as above. With 1.2 Mb F/D £3500. ExBasic & FDOS in 14k EPOMs £300. (H).
Prince (£3045)	Digico: 04626 78172 (TBA)	48-64k RAM: 2xZ80: dual 5¼" F/D (800k): 2xRS232 port: 12", 24x80 VDU	CP/M: *Basic: Pascal: Fortran: Cobol: W/P:A:* T/E:U	High res graphics. Options: single 5¼" F/D (400k) £600: dual 8" F/D(2 Mb) £2000. Rentals avail. (S).
Raannd SPI (£4500)	Raannd: 0506 33372 (TBA)	64k RAM: MCP 1600: dual 8" F/D (2 Mb): 12", 24x80 VDU: RS232 port: P/P	Pascal *ADA: Basic*	Based on Microengine (with integrated P-code). Up to 4 F/D drives. 64k RAM expansion avail. BT 12/80. (S).
Rair Black Box 3/30 (£3750)	Rair: 01-836 6921 (N/A)	64-512k RAM: 8085: dual 5¼" F/D (260k): 10 Mb H/D: 2xRS232 ports.	CP/M: Basic: Cobol: Fortran: M/A	64k RAM expansion £500. 256k RAM £1250. Up to 16 RS232 ports.
Research Machines 380Z (£895)	Research Machines: 0865 49791 (N/A)	16-56k RAM: Z80A: 2xC: RS232 port. P/P.	ExBasic: A: T/E: U: *CP/M: Fortran: Cobol: Algol: Cesil: Pascal.*	High res colour graphics. Many possible systems. With 48k RAM & dual 8" 'FD (1 Mb) £3394.
S/09 (£7000)	SWTP Ltd: 01-491 7507(16)	128k RAM: 6809: dual 8" F/D (2 Mb): 12", 24x80 VDU: 2xS/P: 1 P/P.	UniFLEX: *Basic: Pascal: Fortran: A: Dis A: TIE:U.*	Expands to 32 users, 768k RAM, 90 Mb H/D, UNIX 'look alike'. (S&H).
Saracen (£1925)	Bytronix 0252 726814 (TBA)	32-64k RAM: Z80: dual 5¼" F/D (800k): 2xRS232 ports.	CP/M: *Basic: Cobol: Fortran: Pascal: A:*	Applications packages & maint. contracts avail. With dual 8" F/D (2 Mb) and 64k RAM, £2676. (E).
SBS 8000 (£1449)	Manhattan Skyline Ltd: 0801 3442: C Itoh 01-353 6090 (TBAz7	64k, RAM: Z80A: 12", 16 x 64 VDU: 1 P/P: RS232 port (extra £133)	ExBasic (24k ROM): *DOS*	Options disk control card £237: dual 5¼" F/D (368k) £795: dual 8" F/D (2 Mb) £1400. BT 11/80. (S)
SEED System 1 (£2000)	Strumech: 05433 4321 (5)	32-56k RAM: 6800: various disk options: 12", 24 x 80 VDU: RS232 port: P/P	DOS: Basic U: *Fortran: A: Pilot: Strubal: T/E*	Graphics. PROM programmer Also system 19 multi-user (£3000). (E)

List of Abbreviations

A Assembler
BT Bench Tested
C Cassette
E Extensive
F/D Floppy disk
G/C Graphics card
H Hardware
H/D Hard disk
I Introductory
Int Interface
M/A Macro assembler
N/A Not available
N/P Numeric pad
O/S Operating system
P/P Parallel port
S Software
S/P Serial port
T/E Text editor
TBA To be announced
U Utility

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)
Sharp MZ-80K (£460-34k)	Sharp Electronics (UK) Ltd: 061-205 2333 (22)	6-48k RAM: Z80: C: 10" 24 x 40 VDU: Option: dual 5¼" F/D (289k) £695	Basic, A. *CP/M: Pascal: Fortran: Forth*	Graphics: loudspeaker. BT 10/79 (B)
Sharp MZ-80B (£1095)	As above	64k RAM: Z80A: C: 9", 25 x 80 VDU: RS232 port: P/P.	Basic: *A: Pascal: FDOS*	High res graphics. Options: dual 5¼" F/D (560k) £800: 80 cps printer £415. (S)
Sharp PC3201 (£2995)	As above *CP/M: Cobol*	64k RAM: Z80A: dual 5¼" F/D (500k): C int: 12", 25 x 80 VDU: 70 1pm printer.	DOS: U: Basic: *CP/M: Cobol.*	Various expansion cards avail. BT 7/81 (I&B)
Sinclair ZX81 (£50-kit, £70-built-prices inc VAT).	Sinclair: 0276 66140 (100+)	1-16k RAM: Z80A: C int: TV inb: full K/B: 44-pin expansion port.	Basic (8k ROM).	Advanced 4-chip design. Printer now avail. soon BT 6/81
Signet 202 (£2145)	Interram 01-675-5325(N/A)	64k RAM: Z80A: dual 5¼" F/D (400k): 12", 24 x 80 VDU: 2 x RS232 ports: 80 col printer.	CP/M: *Basic: Fortran*	Options: dual 5¼" F/D (800k): dual dual 8" F/D (2M). (S)
Smoke Signal Chieftan (£1800)	Windrush 0692 405189: Seed 05433 78151 (TBA)	32-64k RAM: 6800/6809: dual 5¼" F/D (500k): 2 x RS232 port.	DOS: *68/FLEX: Basic: Fortran: Cobol: A: Disc A: Pascal: U.*	With daul 8" F/D (2 Mb) £2600. Designed as development system for industrial control. (H).
Solitiare WP & BS200 (£6750 & £8200)	Solitaire KPG: 01-995 3573 (TBA)	64k RAM: 8085: 14" VDU (with own CPU): 45 cps printer: CPU port: dual 5¼" F/D (700k) 8" F/D (1.02 Mb) with BS200.	DOS: Basic	All solitaire systems are compatible: anmd can be upgraded to multi-user H/D system. (S)
Sord M100 ACE (£2339)	Midas Computer Services Ltd: 0903 814523 Exleigh Bus. Mach. 0735-66577.(10)	48k RAM: Z80: 8k ROM dual 5¼" F/D (245k): 24 x 64 green VDU: RS232 port: N/P	O/S: Basic: *A: Fortran: Pascal.*	Up to 3 drives possible. Colour graphics avail. Option S100 bus. (I)
Sord M223 Mk II-VI (£4078)	As above	64k RAM: Z80: 8k ROM: dual 5" F/D (700k): 12", 24 x 80 green VDU: RS232 ports: S100 bus: N/P	*O/S:* Ex Basic: *CBasic: Multi-User Basic: Fortran: Cobol*	Expandable to 4 Mb F/D. 32 Mb, H/D, 5 screens, 2 printers. M243 with 192k RAM & 1.4 Mb F/D £5087.
SPC/1 (£3770) (TBA)	Digital Data: 01-573 8854	64-1024k RAM: 8085 A-2: dual 5¼" F/D (90k): 12", 24 x 80 VDU: 2 x RS232 ports: Option: single 8" F/D (1 Mb) £1090:	Mikados, Comal: Pascal: A.	With 32k RAM and single F/D (Comal only) £1995. Expandable to multi-user system (8 users). BT 7/80 (S).
Superbrain (£1950)	Icarus: 01-485 5574 (45)	64k RAM: 2 x Z80: dual 5¼" F/D (320k): 12" 25 x 80 VDU: 2 x RS232 port.	CP/M: A: *Basic: Cobol: Fortran: APL: Pascal*	Limited graphis, Mainframe int avail. Full range of appliation packages avail. Also avail with 700k & 1.5 Mb F/D. BT 8/80. (S&H)
System 10 (£2995)	Millbank 01-788 1083 (TBA)	64k RAM: Z80: dual 5¼" F/D (700k): 12", 24 x 80 VDU: 2 x RS232 port: P/P	CP/M: *Basic: Fortran: Pascal: Cobol: PL/1: W/P*	12 month warranty. Maint. contracts. Applications packages avail. Choice of high level language in price. (E)
System 20 (£3500)	Extel: 01-739 2041 (TBA)	64-512k RAM: Z80A: dual 8" F/D (1 Mb): 12", 24 x 80 VDU: 3 x V2	CP/M:E Basic: *M Basic: Pascal: Cobol: Fortran*	Maintenance contracts avail (132 field service engineers). Expands to multi-user system. Options 13.7 Mb H/D £5799: 27.4 Mb H/D £6674. (S)
System 80 (£1355-48k)	Nascom: 02405 75155 (32)	16-48k RAM: Z80A: dual 5¼" F/D (560k): TV int: RS232 port.	CP/M: Basic (8k ROM)	EPROM firmware avail. Colour graphics card £165. Many configurations possible. (S&H)
Tandberg EC10 (£4000)	Tandberg: 0532 774844 (N/A)	64k RAM: 8080 A: single 8" F/D (250k): 12" 25 x 80 VDU: 7 x RS232 ports: printer int.	CP/M: Ex Basic (24k) *Multi-user Basic: Pascal: Cobol:* A: U:	Up to 7 terminals, Includes V28 comms port. (S&H)
Tandberg TG 8450 (£2200)	As above	64k RAM: 8085: single 5¼" F/D (77k): C int: 12", 24 x 80 VDU: RS232 port: P/P	TDOS: *Basic: Cobol: Fortran: Pascal.*	TDOS is CP/M compatible. Opt: single 5¼" F/D (77k) £250 (up to four): dual 8" F/D (2 Mb) £1800. (S&H)
Tandy TRS-80 Model 1 (£252)	Tandy: 0922 648181 (200)	4-48k RAM: Z80: C: 12", 16 x 64 VDU: RS232: P/P	Basic (4k ROM): A.	Fully expandable. Option: single 5¼" F/D (175k) £320 (up to 4). Many extras available. 32k RAM £304. (I)
Tandy TRS-80 Model II (£2347)	As above	64k RAM: Z80: single 8" F/D (500k) 12" 24 x 80 VDU: 2 x RS232 port: P/P	Basic *M/A Fortran: Cobol*	Option: single 8" F/D (500k) £782 (subsequent £391, up to 4).
Tandy TRS 80 Model 3 (£500-£1700)	As above	See Model I Levels I and II		Fully integral unit. Up to 2 integral and 2 external 5¼" F/D. BT 8/81
Tandy TRS-80 Colour (£304)	As above	4-16k RAM: 6809: 8-16k ROM: C: 16 x 32 TV int: RS232 port.	Colour Basic.	With 16k RAM, 16k ROM & Extended Colour Basic £390 (I). BT 9/81.
TECS (£1200)	Technalogics Computing Ltd: 061-793 5293 B&B Computers Ltd: 0204 26644 (TBA)	4-56k RAM: 8k PROM: 6800/6809: 2xC: TV int: 2xRS232 ports: internal viewdata modem & printer port.	FLEX: Basci: *Pascal: TDOS: A: T/E: Pilot: Fortran: Cobol.*	Fully viewdata compatible. Options — dual 5¼" F/D (320k) £850: dual 8" F/D £120 £1200. (S&H).
Terodec PBM-1000 (£4095)	Terodec: 0734 664343 (40)	80k RAM: Z80A: single 5¼" F/D (819k): 2 S/P: 3 P/P	CP/M CP/Net CBasic: *Fortran: Pascal: Cobol*	System with Okidata 80 printer: TV1 910 VDU: W/P and various application packages £5995 (S&H)
Terodec DPS 64/2M (£3598)	As above	64k RAM: Z80A: dual 8" F/D (2 Mb): 2 S/P: 3 P/P. Options: 10 Mb H/D: Tape.	CP/M: *MP/M: CP/Net: CBasic: Fortran: Pascal: Cobol: Basic.*	2 user system with 10 Mb H/D £7400 4 user system with 34 Mb H/D & tape back up £11981. (S&H)
TI 99/4 (£299)	TI: 0234 67466 (TBA)	16k RAM: 26k ROM: 9900: 2 x C int: 24 x 32, 16 colour TV int: 3 tones & noise: P/P.	OS: Basic.	12 month guarantee. Options 32k RAM: 2 x RS232: 3 x 5¼" F/D (92k each): Speech Synthesiser.

List of Abbreviations

A	Assembler	G/C	Graphics card	M/A	Macro assembler	S	Software
BT	Bench Tested	H	Hardware	N/A	Not available	S/P	Serial port
C	Cassette	H/D	Hard disk	N/P	Numeric pad	T/E	Text editor
E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

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IN STORE

DIRECT ACCESS

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Tuscan CP/M Starter (£999)	Transam: 01-405 5240 (N/A).	24k RAM: Z80: single 5¼" F/D (190k): Cint: TV int: RS232 port: P/P: N/P.	CP/M: *Basic: Fortran: Pascal: Cobol:*	Options: single 5¼" F/D (190k) £155: single 5¼" F/D (370k) £285: 8k RAM £50. (S&H)
Tuscan Starter Kit (£299)	As above	8k RAM: Z80: Cint: 56-key K/B Options: Case £110: 5 x S100 sockets £20: TV int £3.50	8k Basic	Fully assembled version £499 BT 1/81 (H&S)
UDS 3000 (£2300)	Kemitron: 0244 21817. (TBA)	64k RAM: Z80A: dual 8" F/D 2 Mb: 2 x RS232 ports. Option: 10 Mb H/D	CP/M: *Basic: Cobol: Fortran: Pascal.*	Full range of industrial support cards, and applications software. (E)
Vector MZ (£2650)	Almarc: 0602 52657 (3)	56k RAM: Z80A: dual 5¼" F/D (630k): 3 S/P: 2 P/P.	CP/M: Basic: *Algol: Cobol: Pascal: Fortran: Coral: CBasic: A.*	High resolution graphics. Also system B with video board & terminal £3450. (E)
Vector System 2800 (£4600)	As above	56k RAM: Z80A: dual 8" F/D (2.4 Mb): 3 S/P: 2 P/P	As above	High-res graphics. Many Options. Fully expandable to 5005 multi-user system (max 5) £5400.
Vic 20 (£200)	Commodore: 0753 70292 (150)	5-32k RAM: 6502: Cint: 22 x 23 TV int: S/P: P/P: Games int.	Basic	Graphics 3 tone sound generator. Will interface to PET. Option: single 5¼" F/D (170k). BT 9/81(S).
VIP (£2650)	Almarc 0602 52657 (3)	64k RAM: 3k ROM: Z80B: single 5¼" F/D (630k): 12", 24 x 80 VDU: RS232 port, 3 x P/P	CP/M: *Basic: fortran: Cobol: Pascal: A.*	Up to 3 additional F/D drives. Options: dual 8" F/D (2 Mb) £1063, 32 Mb H/D (TBA). (H&S). BT2/81
Video Genie EG3003 (£300)	Lowe Electronics: 0629 4995 (N/A)	16k RAM: Z80: 500bps C: 16 x 64 TV int: extra C int: 1 P/P	Basic (12k ROM): *Pascal: A M/A: Fortran*	Graphics available with ex-Basic (13.5k) £3.50.
WH8 (£352)	Heath 0452 29451 (N/A).	16-64k RAM: 808A (or Z80): 4 S/P. Option: single 5¼" F/D (102k) £241.	OS: HDOS: CP/M: *Fortran: Pascal: Basic*	Kit. 3 drives max. Colour graphics avail. (S&H) BT 2/80.
Xerox 820 (£1750)	Xerox	64k RAM: Z80: dual 5¼" F/D (162k): 12", 24 x 80 VDU: 2 x RS232 ports: P/P	Monitor: *CP/M: Basic: Cobol: Fortran: Pascal.*	With 8" F/D (500k) £2250. CP/M £95. BT 1/82 (S + H)
Zentec (£4838)	Zygal Dynamics: 02405 75681 (TBA)	32-64k RAM: 2 x 8080: dual 5¼" F/D (256k): 15", 25 x 80 VDU: RS232 port.	OS/: A: U: *Basic:* Cis Cobol	User programmable character set. Option: dual 8" F/D (1 Mb). (S)
Zenith WH-11A (£2673)	Heath Ltd: 0452 29451 & 01-636 7349 (N/A)	LSI 11: 16-32k RAM: 25 x 80 VDU: S/P: P/P.	*O/S: Basic, Fortran:* A: U.	PDP 11-compat. Option: 2 x 8" F/D (1 Mb). £1717 (S&H).
Zenith Z89 £1570-£1710	As above	16-48k RAM: Z80: single 5¼" F/D (102k): 12" 24 x 80 b&g vdu: RS232.	*Basic: A: HDOS:* CP/M: *MBasic: CBasic: Fortran.*	3 x 5¼" F/D possible. Options: dual 8" F/D (1 Mb) £1717, 20 Mb H/D.
Zilog MCZ 1/05 (portable): MCZ 1/20A (£3250)	Thames Systems: 084421 5471 (N/A)	64k RAM: Z80: dual 8" F/D (600k): RS232 port: MCZ1/20A only 1 P/P: Option: 10 Mb H/D £7100	RIO: O/S: *Cobol: Basic: Fortran: Pascal: M/A: U.*	Available desk top or rack mounted. Debug in 3k PROM. 1/20A runs multi-user Cobol, up to 5 terminals with 40 Mb H/D. (S&H).

SINGLE BOARDS

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Acorn System 1-5 (£65-£1600)	Acorn: 0223 312772 (35)	11/8k 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. Pascal: Forth: DOS.*	Kit. Programmable address linking. On-board 5 V regulator. linking. On-board 5 V regulator. Can be expanded to disk-based system. (S&H)
AEX-09 (£750)	Micro Design 0908 663655	8k RAM: 32k PROM: 6809: 16 I/O lines: RS232 port: RS422 port.	OS-9: *(Basic: Pascal: Fortran avail soon)*	Full A/D & D/A conversion facilities. 4 x 8 but outputs. (H)
Aim 65C (£259)	Pelco: 0273 722155(7)	1-4k RAM: Full K/B 2 x C: 20 char LED: 20 char thermal printer: RS232 port.	A. Disc A: T/E: 8k monitor: *Basic (8k ROM): PL65. Forth*	Expandable using RM65 models to full disk systems. (E)
Bigboard (£450)	Maclin-Zand 01-837 1165 (N/A)	64k RAM: Z80, F/D controller: 24 x 80 VDU controller	2k monitor: *CP/M: Basic: Fortran: Cobol: Pascal: A.*	Many options. Will support up to four 8" F/D drives. BT 3/81. (E)
Biproc (£119)	B L Micros: 0494 44307. (TBA)	1k RAM: Z80: TV int: RS232 port. Opt: 4k RAM £8: K/B £30.	2k Monitor: A.	With 9980 instead of Z80 £155 as well as Z80 £180. Kit. (H)
Cromeco SC (£355)	Comart: 0480 215005 (25) Datron. 0742 585490.	1k RAM: Z80A: 8k EPROM sockets: RS232 port: 3 P/P. Option: S100 bus.	Monitor: *Basic.*	5 program interval timers. Can put own Basic program in EPROM. (E)
Elf II (£50)	Newtronics: 01-348 3325 (N/A)	¼-64k RAM: RCA 1802: Hex K/B: 2-digit LED: TV int: C int: RS232. Options: Full K/B: VDU card.	1k monitor: A: Dis A: T/E: Elf-bug *Tiny Basic: Basic,*	TTY N-line decoders. Low resolution graphics (high-res avail). Kits or built. Full range of peripherals. (H).
Explorer (£82)	As above	4-64k RAM: 8085: Full K/B. RS232 port: 6 x S100 bus: C int; 1k video RAM.	2k monitor: *Basic (8k) CP/M: Basic Fortran: Cobol.*	Supplied in kit or built. Full range of peripherals including F/D. (H)
Hewart 6800S (£299)	Hewart: 0625 22030 (N/A)	16k RAM: 6800: full K/B VDU int: 2 x C int: 1 S/P: 2 P/P: Option: 16k RAM £90	1k monitor: A: T/E.	Can be upgraded with 6809. (H)
Hewart 6800 Mk III (£152)	As above	1k RAM: 6800: VDU board	1k monitor.	Options: single 5¼" F/D (75k) £350: PROM programmer £32. (H)

List of Abbreviations

A	Assembler	G/C	Graphics card	M/A	Macro assembler	S	Software
BT	Bench Tested	H	Hardware	N/A	Not available	S/P	Serial port
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E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

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)
Microaxis 1 (£250)	Micro Design 0908 663655 (N/A)	1k RAM: 1-8k PROM: 6809: 8 channel A-D system: 12 optically isolated I/O lines.	1k monitor	Designed for industrial control. Can be expanded to F/D system. (H)
MPC 09 (£750)	As above	17k RAM: 48k PROM: 6089: RS232 port: 50 I/O lines: 4 timers: 1 W audio amplifier.	1k monitor: *Multi-tasking OS*	As above. New 64k version avail.
Microtan 65 (£69)	Tangerine: 0353 3633 (6)	2k RAM: 6502: 16 x 32 TV int: Options: 64 Pixel graphics £6.50	2k monitor, *Basic*	TANEX expansion kit with 7k RAM: 4k EPROM sockets: 14k Basic: 4 S/P: 32 P/P £145. (E)
Nascom 1 (£125)	Nascom: 02405 75155 (20)	4k RAM: Z80: Full K/B: TV int: 2 P/P: 1 S/P. Options: 16k RAM £140: single 5¼" F/D (250k) £240 (4 disk controller £127).	2k monitor: *B Basic: Tiny Basic: A: T/E: U.*	Kit. Built version £140. Also Nascom 2 with 8k Microsoft Basic in ROM £225 (no RAM). (S&H)
77/68 (£90)	Newbear: 0635 30505 (N/A)	4k RAM: 6800: LED: C int: VDU int.	1k monitor: *Basic*	Expandable to 64k RAM with F/D. (B)
79/09 (£65)	As above	1k RAM: 6809: P/P: S/P	2k Monitor.	Designed to upgrade 77/68. (H).
SBC 100 (£135)	Airamco: 0294 57755 (TBA)	1k RAM: Z80: 8k ROM: S100: 1 S/P: 1 P/P.	*1k monitor: DOS in ROM*	Kit. Available assembled £196. (E)
Superboard (£188)	(as Challenger)	4-8k RAM: 6502: 10k ROM: full K/B: VDU int: C int.	Basic (8k ROM)	Options: RS232 port: single 5¼" F/D (100k) £316: 8k RAM £188. (S&H)
Smoke Signal SCB 68 (£181)	Windrush 0692 405189 (TBA)	1k RAM: 6800/6809: 8k EPROM: 1 S/P.	2k monitor	Fully expandable to 64k RAM with F/D. (H)
SYM-1 (£160)	Newbear: 0635 30505 (N/A)	1-4k RAM: 6502: C int: VDU int: 2 x 6522 ports. Option: TV int.	4k monitor: *Basic A.*	Expandable to 64k RAM with F/D. (B).
Tuscan (£299)	Transam 01-405 5240 (N/A)	8k RAM: 8k ROM: Z80A: 5 x S100 slots: RS232 port: TV int: C int: 1 P/P.	*2k monitor: 8k Basic: CP/M: Pascal*	High res graphics available. Can be expanded to F/D system. BT 1.81. (S&H)
UK101 (£149)	Comp Shop: 01-441 2922 (4)	4k RAM: 6502: full K/B: 16 x 48 VDU or TV int: C int: RS232 port, Options: 4k RAM £16	2k monitor: 8k Basic: *Dis A: U.*	Graphics. Expansion & colour avail. Kit or fully assembled. (S&H)
Windrush 6801 (£175)	Windrush: 0692 405189	2k RAM: 6801/3/5: 12k EPROM: S/P: 3 P/P	2k Monitor	Designed for industrial control & dedicated small systems. (H)
ZCB (£260)	Almarc: 0602 625035 (3)	1k RAM: Z80A: 3 PROM sockets: RS232 port: 3 P/P	*Will take any 2708/16=32 software.*	S100 bus compatible. Expandable to full system. (E)

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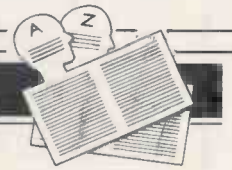

Here's an update of changes and new clubs. Full listing in July.

International
Norsk Data Samfunn- User Groups for HP41C and ZX81. Both groups publish bimonthly magazines, offer technical services and arrange meetings and courses. Contact: Christofer Solheim, Norsk Data Samfunn, Tuengen Alle 11, Oslo 3, Norway. Tel: (02) 147110

Spanish ZX81 User Group. Quarterly magazine/newsletter, hardware and software advice, program library & exchange, courses. Contact: Josep-Oriol Tomas Jr, Club Nacional Usarios Del ZX81, Avda de Madrid, No 203-207, 1º, 3ª, esc. A, Barcelona-14, Spain.

National
UK Comal User Group. Recently formed under the aegis of the North London Hobby Computer Club. Meetings 1st & 3rd Wednesdays monthly at 7pm. Venue: Community Computer Centre, Polytechnic of North London. Comal available on several machines, incl PET and CP/M. Newsletter to be published. Contact: Sandy Anderson c/o NCHCC, Polytechnic of North London, Holloway Rd, London N7 8DB.

MZ-80K National Software Exchange/Library Assoc. All kinds of cassette software, newsletter, advice, regular catalogue updates etc available. Membership £6 pa. Contact: Greenlands, Heathton, Nr Claverley, Wolverhampton.

TRS-80 National User Group, 40a, High Street, Stony Stratford, Milton Keynes. Tel: 0908-566660 (day) or 564271. Secretary: Brian Palin. Monthly Newsletter, free software library, special interest groups, workshops arranged for 1982. All Tandy systems and compatible micros welcome.

TRS-80 Educational User Group for TRS-80 I,II,III. Color and Video Genie users. Contact: Dave Futcher, Beaconsfield School, Beaconsfield Rd, Southall Middx. Extensive educational software library and facilities of National TRS-80 User Group available to members.

Regional
Birmingham/West Midlands area TRS-80 User Group. Sub group of National TRS-80 User Group. Meetings Monthly, newsletter available to non-members. Contact: Michael Gibbons, 1, New Street, Castle Bromwich, Birmingham 36, Warks. Tel: 021-747 2260.

Merseyside Microcomputer Group. Special interest groups: PET, Apple, 380Z, SC/MP, education (Mr M Trotter, 051-652 1596) Contact: Fred Shaw, 14, Albany Ave, Eccleston Park, Prescot. Tel: 051-426 5536.

North East TRS-80 User Group. Meetings 3rd Wednesday monthly room 2, School of Physics, Newcastle-upon-Tyne University. Contact: S Tetlow, 3, Highbury Close, Springwell, Gateshead, Tyne & Wear.

County
West Surrey Computer Club. Monthly meetings — members range from professional to hobbyist. Contact: Howard Webb, 101, Park Barn Drive, Park Barn, Guildford, Surrey, GU2 6ER.

INTRODUCING

Performance

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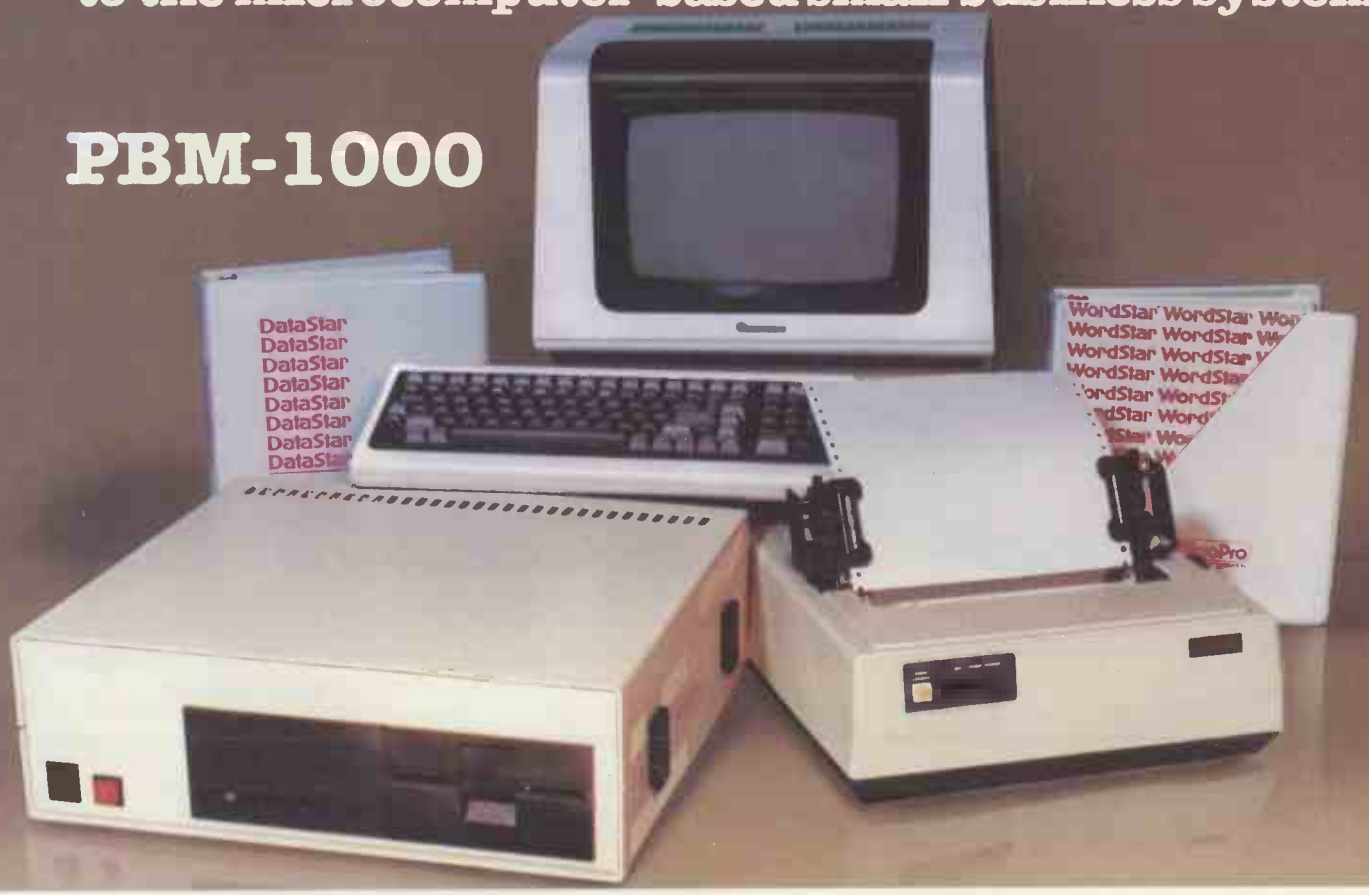
PBM-1000



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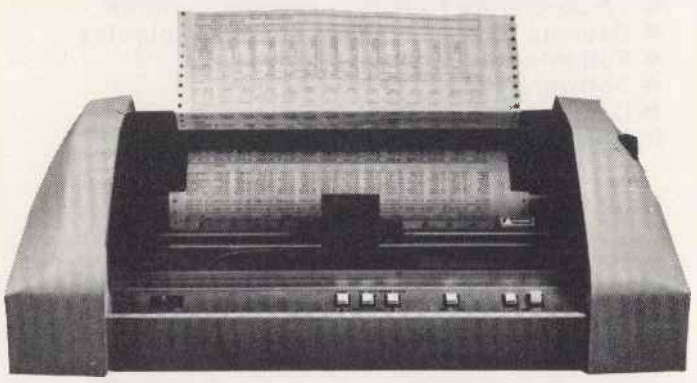

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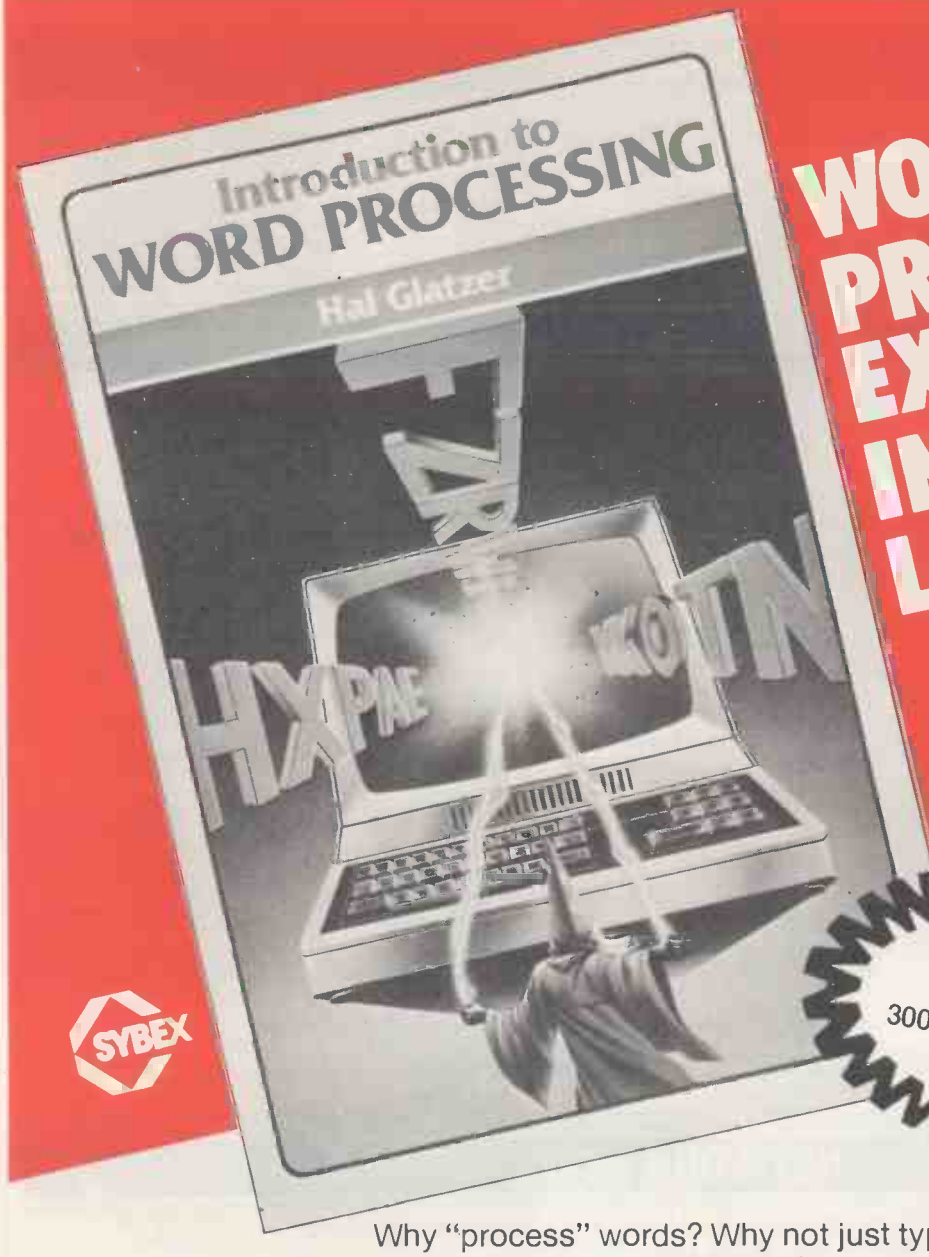

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USER GROUPS INDEX

Towns

Tandy Bristol User Group. Meetings 1st Tuesday monthly at the Tandy store, Colston Centre, Bristol. Membership £12 pa or £20 per company for 1st three members — additional members £8 each. Guest speakers welcome. Contact: Roger Bamkin 19, Wood St, Easton, Bristol BS5 6JA, Tel: Bristol 512283.

Crewe Computer Users Group — New venue for meetings: 8pm 3rd Tuesday monthly, Buffaloes Club, Earl St, Crewe. Details published in local press. Contact: Bram Knight, Nantwich 623375.

Hartlepool Amateur Computer Club. 1st meeting Feb 26th at the Welfare Hall for the Blind, Avenue Rd, Hartlepool. Juniors 6.00pm, Seniors 7.45pm. Contact: Harry Cuthbert, Hartlepool 71027 or David Jones, Hartlepool 66001 (eves).

Leeds Microcomputer Users' Group — new Secretary: Ian Clemmett, 27, Brudenell Mt, Headingley, Leeds, LS6.

Sheffield — Carisma Computer Consultants' MZ-80K User Group (newly formed). Enthusiasts welcome — annual subscription £3. Contact: Mr P. Erdine, 271, Meadowhead, Sheffield S8 7UN, Yorks.

CTUK! CENTRES

Paul Maddison, Gardenways, Chilworth Towers, Chilworth, Southampton, SO1 7JH

Lyn Antill, 1 Defoe House, Barbican, London

Peter J Kiff, 52 Stone Road, Broadstairs, Kent CT10 1DZ

Patrick Colley, 52 Queensway, Caversham Park Village, Reading, Berks RG4 0SJ

Pete Shaw, 15 St Vincent Road, Clacton-on-Sea, Essex C015 1NA

Andrew Stoneman, 135, Birchdale Avenue, Newcastle-upon-Tyne, Tyne & Wear

Derek Moody, 2 Victoria Terrace, Dorchester, Dorset DT1 1LS

Ray Skinner, 62, Central Avenue, Billingham, Cleveland TS23 1LN

David Tebbutt, 7 Collins Drive, Eastcote, Middx HA4 9EL

Vernon Gifford, 111 Selhurst Road, Croydon, London SE25 6LH

John Stephen Bone, 2 Claremont Place, Gateshead, Tyne & Wear NE8 1TL

Mike Baker, 5 Edinburgh Road, Hanwell, London W7 3JY

Vernon Quaintance, 50 Beatrice Avenue, Norbury, London SW16 4UN

R L Saunders, 14 St Nicholas Mount, Hemel Hempstead, Herts.

Brian Taylor, Tonbridge Area Library, Avebury Avenue, Tonbridge, Kent

Robin Bradbeer, Polytechnic of North London, Holloway Road, London N7

Steve Haynes, 5 Guinea Street, Kingsholm, Gloucester GL1 3BL

Ted Broadhead, 27 Cardinal Road, Leeds LS11 8EY

Andrew Holyer, 10 Masons Field, Mannings Heath, Horsham, Sussex RH13 6JP

Brigitte Gorton, 18 Purbright Crescent, New Addington, Croydon CR0 0RT.

Susan Kelly, Head of Reference Services, PO Box 4, Civic Centre, Harrow, Middlesex.

Philip Joy, 130 Rush Green Road, Romford, Essex.

Richard Powell, 22 Downham Court, South Shields, Tyne & Wear

Derrick Daines, 18 Cuttings Avenue, Sutton in Ashfield, Notts

Keith Taylor, Carter Hydraulic Works, Thornbury, Bradford BD3 8HG

Roger Shears, 18 Woodmill Lance, Bitterne Park, Southampton SO2 4PY

J.M.A. Kilburn, Headmaster, Shawfield Norden Community Middle School, Shawfield Lane, Norden, Rochdale OL12 7QR

Bill Gibbings, 3 Longholme Road, Retford, Notts DN22 6TU

Alan Northcott, Rushmoor, 464 Reading Road, Winnersh, Wokingham, Berks RG11 5ET

Alan Sutcliffe, 4 Binfield Road, Wokingham, Berks RG11 1SL

Tony Cartmell, 54 Foregate Street, Worcester WR1 1DX

Tom Graves, 19a West End, Street, Somerset BA16 0LQ

Alan S Waring, 50 Drayton Gardens, Winchmore Hill, London N21 2NS

NETWORK NEWS

These are all the European networks of which we're aware. Most are free — but phone them for details.

Forum-80 Hull. . . (Forum-80 H,Q) Tel: 0482 859169, System operator Frederick Brown. International electronic mail, library for up/down loading software. Forum-80 Users Group, Pet Users section shopping list system hours. 7 days a week midnight to 8.00am, Tues/Thurs 7.00pm to 10,00pm Sat/Sun 1.00pm to 10.00pm.

Forum-80 London. . . Tel: 01-747 3191. System operator Leon Jay. Electric mail, library for downloading. System hours: Tues/Fri/Sun 7.00pm to 11.00 pm.

Forum-80 Milton. . . (TRS-80 Users Group 80-Net) Tel: 0908 566660. System Operators: Leon Heller and Brian Pain. Electronic mail, library, newsletter, TRS-80 information system hours: 7 days a week 7.00pm to 10.00 pm.

Forum-80 Holland. . . Operator: Nico Karssemeyer, tel 01 313 512 533. Facilities: electronic mail, program up/downloading, shopping list. Hours: Tues-Sat 1800-0700 nightly, continuous from 1800 Sat — 0700 Tues.

CBBS London. . . Operator: Peter Goldman, tel 01-399 2136. Facilities: electronic mail, program downloading. Hours: Wed 0700-0930 & 1900-2200, Fri 1900-2200, Sun 1600-2200.

Mailbox-80 Liverpool. . . 051-220 9733, System Operator: Peter Tootill, Electronic mail, downloading TRS-80 information.

ACC. . . members bulletin board, Peter Whittle (0908 44262)

ABC-80. . . Stockholm, Sweden) Tel: 010 468 190522.

University Research Computer. . . Sweden. Tel: 010-468 23660, guests use password "66,66" for access.

Elfa. . . Sweden 010 468 7300 706

Tree Tradet. . . Sweden 010-468 190522.

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making travel arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.

Ipswich	(Gt White Horse Hotel) Computer Open Day Exbn. Contact: Couchmead Communications Ltd 01-653 1101	24 March
Guildford	(Metropolitan Exbn Hall) Computer Aided Design Exbn & Conf. Contact: IPC Science & Technology Press 0483-38085	30 March - 1 April
London	(Polytechnic of North London) London Computer Fair & Educational Computing Conf. Contact: Michele Kaye 01-607 2789 ext 2002	15-17 April
London	(West Centre Hotel) Peripheral Suppliers Exbn. Contact: IPC Exbns Ltd, 01-643 8040.	31 March - 2 April
West Germany	(Hanover) Hanover Trade Fair	21-28 April

LEISURE LINES

by J J Clessa

January's puzzle was too easy by far as become apparent during the month from the number of entries received (almost 200). Almost all entries gave the correct answer. Just in case there's anyone who couldn't manage it, the answer is that x=18, giving x^3=5832 and x^4=104976.

The winner by random selection was Mr D Astles of Potters Bar. Congratulations — your prize is on its way.

Incidentally, if any previous Leisure Lines winners still haven't received their prizes, would they let us know and we'll try to rectify the matter. Please include the date of the competition. We've now changed the system for prize distribution and we hope there won't be any problems in future.

Quickie

No answers, no prizes. A man drives to work at 30mph. How fast would he need to drive back to average 60mph for the total journey? The answer is *not* 90mph.

Prize puzzle

Six ladies are eligible for the offices of captain, vice-captain and treasurer (in descending order of seniority) in the local ladies' golf club.

Audrey won't serve if Elaine is captain or if Freda is treasurer.

Betty won't be treasurer if Cynthia is one of the officials.

Audrey won't serve with both Betty and Elaine.

Freda won't serve if Elaine is also an official.

Betty won't be vice captain.

Freda won't serve if she outranks Audrey.

Cynthia won't serve with Audrey or Betty unless she is captain.

Doris won't serve unless Betty is captain.

Betty won't serve with Doris unless Elaine is also an official.

Elaine won't serve unless she or Audrey is captain.

How can the three offices be filled?

Answers on postcards, please, to April Prize Puzzle, *PCW*, 14 Rathbone Place, London W1P 1DE to arrive not later than April 30, 1982.

PROGRAMS

PCW is interested in Basic or Pascal Programs for any popular micro — please tell us which one you wrote your program on and how much memory it uses.

Make sure your programs are fully debugged before you send them in on cassette (although we will accept disks) with a clear listing on plain paper. Documentation would be welcome, and if you want it returned please label everything with your name and address and include an SAE. Send contributions to Maggie Burton, *PCW* Programs, 14 Rathbone Place, London W1P IDE

TRS-80 Double Precision Maths and Trig

by B. Snell

Although the TRS-80/Video Genie keyboards offer a range of numerical and trigonometric functions, these are somewhat restricted and tend to output 'garbage' numbers after the first six figures when used in double precision mode — which can be inconvenient, to say the least, for those whose work with their computer demands high numerical accuracy.

This suite of subroutines will give a high standard of accuracy and an extended range of functions to the TRS-80/Video Genie user. It requires a 16k machine to run. It will not print meaningless numbers at the end of a result, which means that if a result contains twelve digits then all twelve digits are meant to be there. Accuracy is +1, −½ in the last digit.

PROGRAMS

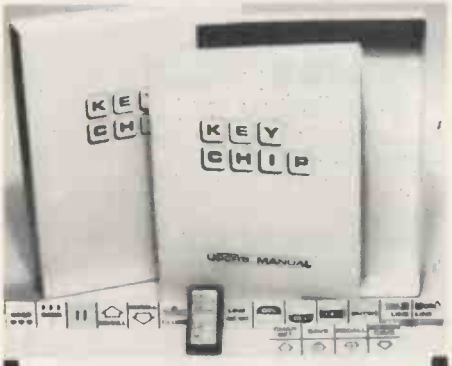
Using this package, the user can convert his computer into a reliable desktop calculator and single subroutines could be used as part of other programs. Video Genie users should type the program in as listed and press 'video cut' before running. TRX-80 users will need to incorporate CHR$ (23) after every CLS command. This simply tidies up the readout. The program presents a menu of all the functions available which is easy to follow and can be read from lines 1-300. Finally, the BREAK key is left disabled at the end of the program. This can be overcome by omitting the two POKE statements in line 5.

```
1 ' MATH & TRIG PRECISION SUBROUTINES. BARRIE SNELL. 1981.
5 CLS:CLEAR:CLEAR100:DEFDBL A-X:DEFINT Y,Z :
  POKE 16396,151 : POKE 16397,201
10 PI=3.14159265358979332:P2=2*PI
50 CLS:PRINT@64,"  WHICH TYPE OF PROBLEM DO
YOU WISH TO SOLVE :-----

 (A)  ARITHMETIC
 (B)  TRIGONOMETRIC
 (C)  NONE OF THE ABOVE"
55 A$=INKEY$:IFA$=""THEN55
60 IFA$="A"THEN100 ELSEIFA$="B"THEN200 ELSEIFA$="C"THEN CLS:END
   ELSEPRINT@960,"     TRY  AGAIN !";:GOTO55
100 CLS:PRINT@64,"DO YOU WANT TO FIND VALUES FOR

 (A)  FACTORIAL OF X
 (B)  'E' TO THE POWER X
 (C)  NATURAL LOG. OF X
 (D)  LOG. TO BASE 10 OF X
 (E)  SQUARE ROOT OF X
 (F)  CUBE ROOT OF X
 (G)  NONE OF THE ABOVE"
110 A$=INKEY$:IFA$=""THEN110
120 IFA$="G"THEN CLS:END
130 IFASC(A$) <65 ORASC(A$) >71 THENPRINT@960,
    "TYPE LETTERS 'A' TO 'G' ONLY !";:GOTO 110
140 ZV=ASC(A$)-64
150 ON ZV GOTO 500,600,1000,1000,1500,1600
200 CLS:PRINT@64,"DO YOU WANT TO FIND VALUES FOR

 (A)  SINE
 (B)  COSINE
 (C)  TANGENT
 (D)  COSECANT
 (E)  SECANT
 (F)  COTANGENT
 (G)  ANY OF THEIR INVERSE
      FUNCTIONS. E.G. ARCSINE
 (H)  NONE OF THE ABOVE"
210 A$=INKEY$:IFA$=""THEN210 ELSEIFA$="G"THEN270 ELSEIFA$="H"
    THEN290
230 IFASC(A$) <65 OR ASC(A$) >71 THENPRINT@960,
    "TYPE LETTERS 'A' TO 'H' ONLY !";:GOTO210
240 ZR=ASC(A$)-64:TR$="YOUR ANGLE WAS EQUIVALENT TO"
250 GOSUB 25000
260 ON ZR GOTO 2000,2050,2100,2000,2050,2100
270 CLS:PRINT@64,"DO YOU WANT TO EVALUATE

 (A)  ARC SINE
 (B)  ARC COSINE
 (C)  ARC TANGENT
 (D)  ARC COSECANT
 (E)  ARC SECANT
 (F)  ARC COTANGENT
 (G)  NONE OF THESE"
280 A$=INKEY$:IFA$=""THEN280
290 IFA$="G"ORA$="H"THEN CLS:END
300 IFASC(A$) <65 OR ASC(A$) >70 THENPRINT@960,
    "TYPE LETTERS 'A' TO 'G' ONLY !!";:GOTO280
310 ZR=ASC(A$)-64
320 ON ZR GOTO 3000,3100,3200,3300,3400,3500
500 CLS
505 PRINT@64,"FOR FACTORIALS, THE VALUE OF X
MUST BE A POSITIVE WHOLE NUMBER,
NOT MORE THAN 33.

ENTER YOUR VALUE FOR X   ";:INPUT X
510 IFX<0 OR X>33 OR X <> INT(X) THEN PRINT@512,
    "NOT VALID, TRY AGAIN.";:GOTO505
515 PRINT@512,CHR$(30);
```

PROGRAMS

```
520 XX=X:X=1:X1=0
530 X1=X1+1:X=X * X1 : CLS
540 IF X1<XX THEN530
545 IF XX=0 THENA$="    ( BY CONVENTION )" ELSEA$=" "
550 PRINT:PRINT:PRINT"FACTORIAL OF";XX:PRINT"EQUALS";X;A$
560 GOSUB 24000:GOTO5
600 CLS
605 PRINT@64,"X MUST BE IN THE RANGE FROM
-85 TO +85, INCLUSIVE.

ENTER THE VALUE OF X.":IFZ1=1THENZ1=0
607 INPUTX
610 IF ABS(X) >85 THENPRINT@576,"NOT IN RANGE, TRY AGAIN.";:
    GOTO605 ELSEPRINT@576,CHR$(30);
615 Y=0:XX=X:IFX=0 THEN X=1:GOTO675
620 IFX<0 THEN X=-X:Z1=1
625 IFX<.005 THEN640
630 IFX>=.005 AND X<.01 THEN640
635 X=X/2:Y=Y+1:IFX>=.005 AND X<.01 THEN640 ELSE635
640 A1=X*X:A2=A1*A1:A3=A1/2:A4=A1*X/6:A5=A2/24:A6=A2*X/120
  A7=A2*A1/720:A8=A2*A1*X/5040:A9=A2*A2/40320:AA=A2*A2*X/362880
  :AB=A2*A2*A1/3628800
645 X=1+X+A3+A4+A5+A6+A7+A8+A9+AA+AB
650 IF Y=0 THEN670
655 FOR Z=1TOY:X=X*X:NEXT
670 IFZ1=1THENX=1/X
675 YC=15:GOSUB 30000
680 CLS:PRINT:PRINT:PRINT:PRINT"'E' TO THE POWER":PRINTXX
    :PRINT"EQUALS":PRINTX
685 GOSUB 24000:GOTO5
1000 CLS
1005 PRINT@64,"NOTE THAT THE VALUE OF X
MUST BE BETWEEN 1D-34 AND 1D+34,
INCLUSIVE.

ENTER YOUR VALUE FOR X.":INPUT X
1010 IF X<1D-34 OR X>1D34 THENPRINT@576,"NOT VALID, TRY AGAIN"
    ;:  GOTO1005 ELSEPRINT@576,CHR$(30);
1020 XX=X:LE=X:T=1:Z=0
1025 IFLE<1THENT=-1:LE=1/LE
1030 IF LE<1.0055 THEN1060
1035 IF LE>=1.0055 AND LE<=1.011 THEN1060
1040 YR=2:GOSUB 23000:Z=Z+1
1045 CLS:IF Z/2=INT(Z/2)THENPRINT@448,"THINKING * * * *";:
    ELSEPRINT@448,"THINKING  * * *      ";
1055 IF LE>=1.0055 AND LE<=1.011 THEN1060 ELSE1040
1060 CLS:PRINT@448,"  NEARLY THERE NOW
  ----------------":FOR Y=1 TO 750:NEXT Y
1065 LE=LE-1
1070 A=LE*LE:A0=A*A:A1=A0*A0:A2=A/2:A3=A*LE/3:A4=A0/4:A5=A0*LE/5
  :A6=A0*A/6:A7=A0*A*LE/7:A8=A1/8:A9=A1*LE/9:AA=A1*A/10:
  LE=LE-A2+A3-A4+A5-A6+A7-A8+A9-AA
1075 IFZ=0 THEN1085
1080 FORY=1TOZ:LE=LE*2:NEXT
1083 IFZV=4AND (XX <=1D-15 OR XX >=1D15) THEN LE=LE+1D-10
1085 LE=LE*T
1090 IFZV=4THENLE=LE/2.302585092999519
    :A$="LOG. TO THE BASE 10 OF"ELSEA$="THE NATURAL LOGARITHM OF"
1095 YC=14:X=LE:GOSUB 30000
1100 CLS:PRINT:PRINT A$:PRINT XX:PRINT"EQUALS":PRINT X
1110 GOSUB 24000:GOTO5
1500 CLS
1505 PRINT@64,"  NOTE THAT THE VALUE OF X MUST
BE A POSITIVE NUMBER, OR ZERO,
NOT GREATER THAN 1D+34.

ENTER YOUR VALUE FOR X.":PRINT:INPUT X
1510 IF X<0 OR X>1D34 THENPRINT@640,"NOT VALID, TRY AGAIN.";:
    GOTO1505 ELSEPRINT@640,CHR$(30);
1520 YR=1:SQ=X:XX=X:GOSUB 23000
1525 X=SQ:YC=17:GOSUB 30000
1530 CLS:PRINT@192,"THE SQUARE ROOT OF":PRINTXX:PRINT"EQUALS":
    PRINTX
1535 GOSUB 24000:GOTO5
1600 CLS
1605 PRINT@64,"THE VALUE OF X CAN BE POSITIVE
OR NEGATIVE BUT WITH AN ABSOLUTE
VALUE NOT GREATER THAN 1D36.

 ENTER THE VALUE FOR X.":PRINT:INPUT X
1610 IF ABS(X)>1D36 THENPRINT@704,"NOT VALID, TRY AGAIN.";:
```

MICROMART



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  These features available while scrolling program:
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  - *New cursor-control chars.*
  - *Space between BASIC lines.*
  - *Jump to new program line.*
  - *Indent second line.*
  - *Variable speed scroll.*
- **SCREENSAVE** *store up to 10 different screen areas (or part of screen areas) & recall instantly + other features too numerous to mention.*

- *Delete REMs and/or spaces from program.*
- *Print contents of screen on printer (either char. set)*
- *Regain control if cursor-move keys produce chars. on screen.*
- *Move cursor up/down left/right in half-screen jumps.*
- *Auto-repeat all/some keys - variable - no cursor flash when on etc.*
- *Scroll screen up or down.*
- *Open up blank line on screen or close up screen.*
- *Change 80-char. line to two 40-char. lines & vice versa.*
- *Delete screen above/below cursor, or from line to line.*
- *Delete line right or left of cursor.*
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- *Call up to 10 of your own machine code subroutines.*
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ZX81 16K

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PROGRAMS

```
    GOTO1605 ELSEPRINT@704,CHR$(30);
1620 IFX<0THENYT=-1ELSEYT=1
1625 XX=X:X=ABS(X)
1630 IF X=0 THEN X1=0:GOTO 1636
1632 X1=X^(1/3)
1634 FOR ZC=1 TO 2:X2=((X/X1/X1)+2*X1)/3:X1=X2:NEXT ZC
1636 X=X1*YT
1638 CLS:PRINT@64,"THE CUBE ROOT OF":PRINT XX:PRINT"EQUALS";X
1640 GOSUB 24000:GOTO 5
2000 GOSUB 20000:X=1-XC*XC:YR=3:GOSUB 23000
2002 YC=15:GOSUB 30000
2004 IF ABS(XC) <> 1 AND XX >PI THEN X= -X
2006 IF XX <=1 THEN R$="RADIAN" ELSE R$="RADIANS"
2008 IF ZR=4 THEN 2014
2010 PRINT@64,TR$:PRINT XX;R$:PRINT:PRINT"ITS SINE IS":PRINT X
2012 GOSUB 24000 :GOTO5
2014 IF X=0 THEN 2020
2016 X=1/X:YC=15:GOSUB 30000
2018 PRINT@64,TR$:PRINTXX;R$:PRINT:PRINT"ITS COSECANT IS":PRINTX
   :GOSUB 24000:GOTO5
2020 PRINT@64,TR$:PRINTXX;R$:PRINT:PRINT"ITS COSECANT IS":PRINT
     "INFINITY":GOSUB 24000:GOTO5
2050 GOSUB 20000:X=XC:YC=16:GOSUB 30000
2052 IF XX<=1 THEN R$="RADIAN"ELSE R$="RADIANS"
2054 IF ZR=5 THEN 2058
2056 PRINT@64,TR$:PRINT XX;R$:PRINT:PRINT"ITS COSINE IS":PRINTX
     GOSUB 24000 :GOTO5
2058 IFX=0THEN2062
2060 PRINT@64,TR$:PRINT XX;R$:PRINT:PRINT"ITS SECANT IS":PRINT
   1/X:GOSUB 24000:GOTO5
2062 PRINT@64,TR$:PRINT XX;R$:PRINT:PRINT"ITS SECANT IS":
     PRINT"INFINITY" :GOSUB 24000 :GOTO5
2100 GOSUB 20000:X=1-XC*XC:YR=3:GOSUB 23000
2102 IF XX<=1 THEN R$="RADIAN" ELSE R$="RADIANS"
2104 IF ZR=6 THEN 2116
2106 IF XC=0 THENPRINT@64,TR$:PRINTXX;R$:PRINT
     :PRINT"ITS TANGENT IS":PRINT"INFINITY":GOSUB 24000 :GOTO5
2108 IF ABS(XC)=1 THEN X=0 :T=0 :GOTO2114
2110 IF XX >PI THEN X= -X
2112 T=X/XC:IF ABS(T) >.999999999999 AND ABS(T) <1
     THEN T=SGN(T) * 1
2114 X=T:YC=15:GOSUB 30000:PRINT@64,TR$:PRINT XX;R$:PRINT:PRINT
   "ITS TANGENT IS":PRINT X:GOSUB 24000:GOTO5
2116 IF XC=0 THEN X=0:GOTO2124
2118 IF ABS(XC)=1 THENPRINT@64,TR$:PRINT XX;R$:PRINT
     :PRINT"ITS COTANGENT IS":PRINT"INFINITY":GOSUB 24000:GOTO5
2120 IF XX >PI THEN X= -X
2121 X=XC/X:IF ABS(X) >.999999999999 AND ABS(X) <1
   THEN X=SGN(X) * 1
2122 YC=15:GOSUB 30000
2124 PRINT@64,TR$:PRINT XX;R$:PRINT:PRINT"ITS COTANGENT IS":
   PRINTX:GOSUB 24000:GOTO5
3000 CLS:GOSUB 3600:XX=X:X=1-X*X:YR=3:GOSUB 23000
3002 IF X=1 THEN T=0:GOSUB 17000:GOTO3010
3005 IF X<.8 THENGOSUB 15000 ELSEGOSUB 16000
3010 CLS:PRINT@64,RE$:PRINT"SINE IS ";:GOSUB 4000
3015 GOSUB 24000:GOTO5
3100 CLS:GOSUB 3600:XX=X
3105 IF ABS(X) <.8 THENGOSUB 15000 ELSEGOSUB 16000
3110 CLS:PRINT@64,RE$:PRINT"COSINE IS ";:GOSUB 4000
3115 GOSUB 24000:GOTO5
3200 CLS:GOSUB 3650:XX=X:X=X*X+1:YR=3:GOSUB 23000:X=1/X
3202 IF X=1 THEN T=0:GOSUB 17000:GOTO3210
3205 IF X<.8 THENGOSUB 15000 ELSEGOSUB 16000
3210 CLS:PRINT@64,RE$:PRINT"TANGENT IS ";:GOSUB 4000
3215 GOSUB 24000:GOTO5
3300 CLS:GOSUB 3700:XX=X:X=X*X-1:YR=3:GOSUB 23000:X=X/XX
3305 IF ABS(X) <.8 THENGOSUB 15000 ELSEGOSUB 16000
3310 CLS:PRINT@64,RE$:PRINT"COSECANT IS ";:GOSUB 4000
3315 GOSUB 24000:GOTO5
3400 CLS:GOSUB 3700:XX=X:X=1/X
3405 IF ABS(X) <.8 THENGOSUB 15000 ELSEGOSUB 16000
3410 CLS:PRINT@64,RE$:PRINT"SECANT IS ";:GOSUB 4000
3415 GOSUB 24000:GOTO5
3500 CLS:GOSUB 3650:XX=X:X=X*X+1:YR=3:GOSUB 23000:X=XX/X
3505 IF ABS(X) <.8 THENGOSUB 15000 ELSEGOSUB 16000
3510 CLS:PRINT@64,RE$:PRINT"COTANGENT IS ";:GOSUB 4000
3515 GOSUB 24000:GOTO5
3600 PRINT@64,"X MUST BE IN THE RANGE FROM
-1 TO +1, INCLUSIVE.
```

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PROGRAMS

```
ENTER X ";:INPUTX
3605 IFABS(X)>1THENPRINT@512,"  NOT VALID,TRY AGAIN";:GOTO3600
3610 PRINT@512,CHR$(31);:RETURN
3650 PRINT@64,"X MUST BE IN THE RANGE FROM
-1D15 TO +1D15, INCLUSIVE.

ENTER X ";:INPUTX
3655 IFABS(X)>1D15THENPRINT@512,"NOT VALID,TRY AGAIN";:GOTO3650
3660 PRINT@512,CHR$(31);:RETURN
3700 PRINT@64,"X MUST ONLY BE BETWEEN -1D15
AND -1, OR BETWEEN +1 AND +1D15.

ENTER X ";:INPUTX
3705 IFABS(X) <1 OR ABS(X) >1D15 THENPRINT@512,"  NOT VALID, TRY AGAIN";
  :GOTO3700
3710 PRINT@512,CHR$(31);:RETURN
4000 PRINT XX:PRINT:PRINT"= ";T;" RADIANS":PRINT"OR ";TD;
     " DEGREES":RETURN
15000 IFABS(X) <=.55 THEN YC=17 ELSEIF ABS(X) <=.65 THEN YC=15
      ELSEIF ABS(X) <=.7 THEN YC=14 ELSE YC=13
15020 DIMA(53),B(53),C(53),X(53)
15025 A(1)=-1:FORY=3TO53STEP2:A(Y)=A(Y-2)*(Y-2):NEXT
15030 B(1)=1:FORY=3TO53STEP2:B(Y)=B(Y-2)*(Y-1):NEXT
15035 FORY=1TO53STEP2:B(Y)=B(Y)*Y:NEXT
15040 FORY=1TO53STEP2:C(Y)=A(Y)/B(Y):NEXT
15045 X(1)=X:FORY=3TO53STEP2:X(Y)=X(Y-2)*X*X:NEXT
15050 T=0:FORZ=1TO53STEP2:T=T+C(Z)*X(Z):NEXT: T=T + PI/2
15060 IF XX <0 AND ZR=1 THEN T=PI+T:GOSUB 17000:RETURN
15070 IF XX <0 AND ZR=3 THEN T=(PI/2-T)+PI/2:GOSUB 17000:RETURN
15080 IF XX <0 AND ZR=4 THEN T=P2-T:GOSUB 17000:RETURN
15090 GOSUB 17000 : RETURN
16000 YC=13:Y=0:ZY=0
16010 IF XX >0THEN16040
16020 IF(ZR-1)*(ZR-2)*(ZR-3)*(ZR-4)=0 THENZY=1 ELSE ZY=2
16030 IF(ZR-2)*(ZR-4)*(ZR-5)*(ZR-6)=0 THEN X=-X
16040 IFX>=.99995 THEN16070
16050 X=(X+1)/2:YR=3:GOSUB 23000:Y=Y+1
16060 IFX <.99985 THEN16050 ELSE16070
16070 X=(2*X+1)/3:YR=3:GOSUB 23000:X=6-6*X:GOSUB 23000
16080 IF Y=0 THEN16100
16090 FORZ=1TOY:X=X*2:NEXT
16100 IF ZY=0 THEN T=X:GOSUB 17000:RETURN
16110 IF ZY=1 AND (ZR=1 OR ZR=4)THEN T=PI+X:GOSUB 17000:RETURN
16120 IF ZY=1 AND (ZR=2 OR ZR=3)THEN T=PI-X:GOSUB 17000:RETURN
16130 IF ZY=2 THEN T=PI-X:GOSUB 17000:RETURN
17000 RE$="THE SMALLEST ANGLE WHOSE":TD=T*180/PI:X=T:GOSUB 30000
      :T=X:X=TD:GOSUB 30000:TD=X: RETURN
20000 Y=0:IFX<=.084 THEN20030
20010 IF X>=.084 AND X<=.168 THEN20030
20020 X=X/2:Y=Y+1:IF X>=.084 AND X<=.168 THEN20030 ELSE20020
20030 A1=X*X:A2=A1*A1:A3=A2*A2:A4=A1/2:A5=A2/24:A6=A1*A2/720:
 A7=A3/40320:A8=A1*A3/3628800:A9=A2*A3/479001600
20040 XC=1-A4+A5-A6+A7-A8+A9:IFY=0THEN20060
20050 FORZ=1TOY:XC=2*XC*XC-1:NEXT Z
20060 IF ABS(XC) <5D-14 THEN XC=0
20070 RETURN
23000 X1=0:X2=0:X3=0
23002 IF YR=1 THEN X1=SQ
23004 IF YR=2 THEN X1=LE
23006 IF YR=3 THEN X1=X
23008 X1=ABS(X1)
23010 IF X1=0 THEN X2=0 : GOTO 23014
23012 X2=SQR(X1):FOR ZS=1 TO 2:X3=(X1/X2+X2)/2:X2=X3:NEXT ZS
23014 ON YR GOTO 23016,23018,23020
23016 SQ=X2:RETURN
23018 LE=X2:RETURN
23020 X =X2:RETURN
24000 PRINT@832,"    ANY MORE FUNCTIONS ?
        (YES OR NO)"
24005 A$=INKEY$:IFA$=""THEN24005
24010 IFA$="Y"THEN RETURN
24015 IFA$="N"THENCLS:PRINT@320,"G O O D B Y E":PRINT:PRINT:
      PRINT:PRINT:END
24020 PRINT@960,"  TYPE 'YES' OR 'NO' ONLY !";:GOTO24005
25000 CLS
25010 PRINT@64,"DO YOU WANT TO ENTER
THE ANGLE X IN :-----

 (A)  RADIANS
 (B)  DEGREES "
25020 A$=INKEY$:IFA$=""THEN25020
```

```
25030 IFA$="A"THEN 25050 ELSEIFA$="B"THEN 25090
25040 PRINT@640,"   TYPE 'A' OR 'B' ONLY !!";:GOTO25010
25050 CLS
25060 PRINT@64,"ENTER X IN RADIANS,
POSITIVE OR NEGATIVE, DECIMAL OR
OTHERWISE, BUT NOT GREATER THAN
ONE THOUSAND."
25070 INPUT X:IFABS(X)>1000THENPRINT@646,"NOT VALID. TRY AGAIN."
      ;:GOTO25060
25075 ZF=SGN (X):X=ABS(X):X=(X/P2-INT(X/P2)) * P2
25077 IF ZF<0 THEN X=P2-X
25085 XX=X:CLS:RETURN
25090 CLS
25100 PRINT@64,"ENTER X IN DECIMAL DEGREES,
POSITIVE OR NEGATIVE, BUT NOT
GREATER THAN TEN THOUSAND."
25110 INPUTX:IFABS(X)>10000 THENPRINT@646,"NOT VALID. TRY AGAIN"
      ;:GOTO 25100
25120 ZF=SGN(X):X=ABS(X):X=(X/360-INT(X/360)) * 360
25125 IFZF<0 THEN X=360-X
25130 X=X * PI/180:XX=X:CLS:RETURN
30000 ' ACCURACY OF RESULTS ROUTINE
30010 X$=STR$(X) : Y$="D"
30020 FOR Z=1 TO LEN(X$)
30030 IF Y$=MID$(X$,Z,1) THEN 30050 ELSE NEXT Z
30040 X$=LEFT$(X$,YC) : X=VAL(X$) : RETURN
30050 D$=MID$(X$,Z+1) : X$=LEFT$(X$,Z-1) : X$=LEFT$(X$,YC)
30060 X=VAL(X$+Y$+D$) : RETURN
```

PET Boot the Cat

by Jacky Cooke

As a gesture for the mad, merry month of April I have included this game, which is a race against time to perform the dubious act of kicking the rear end of an alley cat. The time limit you are set depends on the degree of difficulty you choose at the beginning of the program. You begin with the cat in the middle of the screen and the boot in the bottom right hand corner. The boot is moved using the numeric keys as illustrated on the screen with the instructions and the cat leaps about randomly with your boot in hot pursuit. When your boot is correctly positioned on the cat's tail the 'K' key is pressed for 'kick' or, if you don't feel up to this act of gross cruelty, you can Press 'Q' for 'quit'. When the cat is finally booted your time is shown on the screen along with an estimation of how well you did — the end of the game also includes a rather amusing graphic display of cats wailing as they disappear from a row of rooftops.

This listing is well annotated and should not be hard to convert to other screen memory-mapped machines. As published, it uses about 5.5k of memory but if REMs and instructions are left out only about 4.2k is necessary. It should run on 'old', 'new' or Basic 4.0 PETs.

```
70 RESTORE
80 REM***THIS STARTS THE PROGRAM***
90 PRINT"DO YOU WANT INSTRUCTIONS? (Y\N)"
100 GETA$:IFA$="Y"THEN1140
110 IFA$<>"Y"ANDA$<>"N"THEN100
120 FORK=1TO8:READB$(K),C(K):NEXT
130 PRINT""
140 INPUT"CHOOSE DEGREE OF DIFFICULTY (1-10)    ";DIFFICULTY
150 IFDIFFICULTY<>INT(DIFFICULTY)THEN140
160 IF DIFFICULTY>10THEN140
170 IF DIFFICULTY<1THEN140
180 REM*THESE ARE THE CHARACTER STRINGS USED FOR THE SCORING DISPLAY***
190 CD$=""
200 CR$=""
210 BL$="                                        "
220 A1$=" M M  ":A2$=" O/O/ ":A3$="/    ":A4$="      ":A5$="   SCORE"
230 PRINTLEFT$(CD$,20);A1$;A1$;A1$;A1$;A1$;A5$
240 REM***THIS PRINTS THE 'SCORE CATS' DISPLAY ON THE BOTTOM OF SCREEN ***
250 PRINTA2$;A2$;A2$;A2$;A2$
260 PRINTA3$;A3$;A3$;A3$;A3$
270 PRINTA4$;A4$;A4$;A4$;A4$
280 GOTO340
290 REM**** CATS REMOVED FROM ROOF AND THE SCORE DISPLAYED AS IT INCREASES ****
300 PRINT"";LEFT$(CD$,20);LEFT$(BL$,3*SC)
310 PRINT"";LEFT$(CD$,21);LEFT$(BL$,3*SC)
320 PRINT"";LEFT$(CD$,22);LEFT$(CR$,33);SC
330 RETURN
340 REM***THESE ARE VARIABLES USED FOR 'SCREEN POKING' THE CAT, ETC***
350 HEAD=83:THORAX=236:ABDOMEN=251:TAIL=75:BLANK=32:SHAPE=254:Z=RND(0):SC=0
```

PROGRAMS

```
355 REM***THESE ARE THE DATA STATEMENTS  WHICH MAKE THE 'BOOT' MOVE VIA***
357 REM***THE NUMERIC KEYPAD***
360 DATA"7",-41,"8",-40,"9",-39,"4",-1,"6",1,"1",39,"2",40,"3",41
370 EASE=DIFFICULTY/10
380 T=TI:REM*TIME*
385 REM****THESE ARE THE INITIAL SCREEN POKE LOCATIONS ***
390 BOOT=33567:CAT=33187
400 REM**THIS PUTS THE CAT + LIMBS ON  THE SCREEN **
410 POKECAT-3,HEAD:POKECAT-2,THORAX:POKECAT-1,ABDOMEN:POKECAT,TAIL
420 POKEBOOT,SHAPE
430 REM***** THIS UPDATES THE TIME AND CHECKS TO SEE IF IT HAS RUN OUT***
440 LETZ=INT(100*(TI-T)/60)/100
450 IFZ>200 THENPRINT"■■■■■■■■■SORRY YOU HAVE RUN OUT OF TIME":GOTO1420
460 REM**THIS WAITS UNTIL A VALID KEY  IS HIT AND BRANCHES AS APPROPRIATE***
470 GETA$:IFA$=""THEN440
480 IFA$="K"THEN800
490 IFA$="Q"THENPRINT"■DO WISH TO PLAY ANOTHER GAME (Y\N)":INPUT"  "■■■■";X$
500 IFA$="Q"ANDX$="Y"THEN10
510 IFA$="Q"ANDX$="N"THEN PRINT"■■■■■                    ■GOODBYE■":GOTO1470
520 IFA$="Q"ANDX$<>"Y"ANDX$<>"N"THEN490
530 REM***THIS BLANKS THE EXISTING BOOTAND CHECKS WHERE TO MOVE IT TO ***
540 POKEBOOT,BLANK
550 FORK=1TO8
560 IFA$=B$(K)THENBOOT=BOOT+C(K)
570 NEXTK
575 REMTHIS KEEPS THE BOOT FROM LEAVINGTHE 'PLAYING AREA'***
580 IFBOOT>33567THENBOOT=BOOT-40
590 IFBOOT<32768THENBOOT=BOOT+40
595 REM***** THIS PUTS THE BOOT ON THE SCREEN IN ITS NEW LOCATION***
600 POKEBOOT,SHAPE
605 REM***THIS GIVES YOU MORE GOES THAN  THE CAT IF YOU CHOOSE 'EASY'***
610 IFRND(1)>EASETHEN440
615 REM*** THIS JUMPS THE CAT RANDOMLY WHEN IT HAS A TURN TO MOVE***
620 R=RND(1)
630 POKECAT-3,BLANK:REM BLANKS CAT
640 POKECAT-2,BLANK:REM BLANKS CAT
650 POKECAT-1,BLANK:REM BLANKS CAT
660 POKECAT,BLANK  :REM BLANKS CAT
680 IFR<.25THENCAT=CAT-40
650 POKECAT-1,BLANK:REM BLANKS CAT
660 POKECAT,BLANK  :REM BLANKS CAT
680 IFR<.25THENCAT=CAT-40
690 IFR>=.25ANDR<.5THENCAT=CAT-1
700 IFR>=.5ANDR<.75THENCAT=CAT+1
710 IFR>.75THENCAT=CAT+40
720 IFCAT>33567THENCAT=CAT-40
730 IFCAT<32768THENCAT=CAT+40
740 REM***THIS PUTS THE CAT ON THE     SCREEN IN THE NEW POSITION***
750 POKECAT-3,HEAD
760 POKECAT-2,THORAX
770 POKECAT-1,ABDOMEN
780 POKECAT,TAIL
790 GOTO440
800 IFCAT=BOOTTHENGOTO910:REM**HAS CAT BEEN KICKED? ***
810 POKEBOOT,SHAPE:POKECAT,TAIL
820 REM**KICK MISSED***
830 FORKK=1TO7
840 PRINT"■                MISSED"
850 FORJJ=0TO12:NEXTJJ
860 PRINT"■                ■MISSED■"
870 NEXTKK
880 PRINT"■";
890 PRINTBL$
900 GOTO610
905 REM***DISPLAY FOR SUCCESSFUL KICK  AND SCORE UPDATE***
910 POKECAT-5,141:POKECAT-4,137:POKECAT-3,129:POKECAT-2,143:POKECAT-1,151
920 POKECAT,33:POKECAT+1,33:POKECAT+2,33
930 LETSC=SC+1:GOSUB300
940 REM***THIS GRADES THE PLAYERS IF   THE GAME HAS FINISHED***
950 IFSC=10THEN T=INT(100*(TI-T)/60)/100
960 IFSC=10ANDT>=170ANDT<200 THENPRINT"■■■■■■■■■■■■■■■■■■GRANNY"
970 IFSC=10ANDT>=140ANDT<170 THENPRINT"■■■■■■■■■■■■■■■■■■POOR"
980 IFSC=10ANDT>=100ANDT<140THENPRINT"■■■■■■■■■■■■■■■■■■FAIR"
990 IFSC=10ANDT>=75ANDT<100THENPRINT"■■■■■■■■■■■■■■■■■■AVERAGE"
1000 IFSC=10ANDT>=40ANDT<75THENPRINT"■■■■■■■■■■■■■■■■■■AMAZING"
1010 IFSC=10ANDT<40THENPRINT"■■■■■■■■■■■■■■■■■■FANTASTIC"
1020 IFSC=10THENPRINT"■■■■■■■■■YOU HAVE RID THE TOWN OF CATS"
1030 IFSC=10THENPRINT"■■■■■■■■■■■■■■■■■IN ";T;" SECONDS":GOTO1420
1040 REM*** SUCCESSFUL KICK DISPLAY***
1050 FORKK=1TO7
1060 PRINT"■                HIT!!!"
1070 FORJJ=0TO12:NEXTJJ
1080 PRINT"■                ■HIT!!!■"
1090 NEXTKK
1100 PRINT"■";
1105 REM**** THIS REMOVES THE 'HIT' MESSAGE AND THE CAT FROM THE SCREEN***
1110 FORKK=0TO18:PRINTBL$:NEXTKK
1115 REM***THIS STARTS THE BOOT BACK AT  THE BEGINNING LOCATION AGAIN***
1120 BOOT=33567
1130 GOTO390
1140 REM*** THE INSTRUCTIONS***
1150 PRINT"■THE AIM OF THE GAME IS TO KICK THE CAT  ON THE TAIL.(■■■■← ■■)"
```

PROGRAMS

```
1160 PRINT:PRINT:PRINT
1170 PRINT"TO KICK THE CAT, MOVE  THE BOOT ";
1180 PRINT"(BOTTOM RIGHT ▞■) ONTO THE CAT'S TAIL (^)."
1190 PRINT:PRINT:PRINT
1200 PRINT"THEN YOU  PRESS THE 'K' KEY (FOR KICK)."
1210 PRINT:PRINT:PRINT
1220 PRINT"IF YOU WISH TO QUIT PRESS THE 'Q' KEY."
1230 PRINT:PRINT"▞▩WARNING -■THERE IS A TIME LIMIT OF"
1240 PRINT"▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶200 SECONDS"
1250 PRINT"▶▶▶▶▶▩▩▩▞PRESS SPACE KEY TO CONTINUE"
1260 GETA$:IF A$=""THEN1260
1265 IFA$<>" "THEN1260
1270 PRINT"▞PRESS NUMERIC KEYS TO MOVE THE BOOT (▞■)"
1280 PRINT:PRINT:PRINT:PRINT
1290 PRINT"                    8       "
1300 PRINT"              7            9"
1310 PRINT"               \    |    /  "
1320 PRINT"                            "
1330 PRINT"          4 - -    ▞■   - - 6"
1340 PRINT"                            "
1350 PRINT"               /    |    \  "
1360 PRINT"              1            3"
1370 PRINT"                    2       "
1380 PRINT:PRINT:PRINT:PRINT
1390 PRINT"▩▩▶▶▶▶▶▶▶▶▞PRESS SPACE KEY TO CONTINUE"
1400 GETA$:IFA$=""THEN1400
1405 IFA$<>" "THEN1400
1410 GOTO120
1420 PRINT"▩▩▩▩▩▩▶▶▶▶▞DO YOU WANT ANOTHER GAME (Y\N)■"
1430 GETX$:IFX$=""THEN1430
1440 IFX$="Y"THEN10
1450 IFX$="N"THENPRINT"▞▩▩▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▞GOODBYE■":GOTO1470
1460 GOTO1430
1470 END
READY.
```

ZX81 Resistor

by M House.

This useful little program will run on a 1k ZX81. Using it, one can determine the colour codes for a resistor of a given value by inputting the value of that resistor (in ohms) when prompted by the computer. The value entered must be a whole number greater than, or equal to one. A '%' sign in this listing signifies a space.

```
 10 DIM B(3)
 20 LET C$="BLKBROREDORGYELGRNBLU
    VLTGRAWHTGLD"
 25 SCROLL
 30 PRINT "OHMS?%";
 40 INPUT X
 50 PRINT X
 51 SCROLL
 52 IF X>=1 THEN GOTO 55
 53 PRINT "TOO%SMALL"
 54 GOTO 25
 55 LET F=0
 57 IF X>=10 THEN GOTO 75
 58 LET X=X*10
 60 LET F=1
 75 LET X=INT X
 80 LET B(1)=VAL((SRT$ X)(1))
100 LET B(2)=VAL((STR$ X)(2))
120 LET B(3)=(LEN(STR$ X))-2
121 IF F=1 THEN LET B(3)=10
130 FOR I=1 TO 3
135 LET B(I)=B(I)*3+1
140 PRINT C$(B(I));C$(B(I)+1);C$
    (B(I)+2);"%";
150 NEXT I
160 SCROLL
165 SCROLL
175 GOTO 25
```

ZX81 Res Code

by M House.

Res Code is a companion to the previous program and works in the opposite way. The user inputs the colour code and the computer will give the corresponding resistor value for that code. You don't even need to enter the whole name of each colour — the computer will accept enough characters to uniquely identify each one. Colours should be entered in this order: most significant, middle, least significant. A '%' sign means a space.

```
 10 LET C$="BLACK%BROWN%RED%%%ORANGEYELLOW
    GREEN%BLUE%%VIOLETGRAY%%WHITE%GOLD%%SILVER"
 20 DIM A(3)
100 SCROLL
105 FOR J=1 TO 3
110 PRINT"BAND%";J;"?%";
120 INPUT B$
1£= PRINT B$
135 SCROLL
!$= FOR K=1 TO 11
150 IF B$=C$(K*6+1 TO K*6+LEN B$) THEN GOTO 180
160 NEXT K
170 PRINT "?"
171 SCROLL
175 GOTO 110
180 IF K=10 THEN LET K=-1
181 IF K=11 THEN LET K=-2
185 LET A(J)=K
190 NEXT J
195 SCROLL
200 PRINT "R=%";(10*A(1)+A(2))*10**A(3);"%OHMS"
205 SCROLL
206 SCROLL
207 CLEAR
210 GOTO 10
```

BRAIN DUMP

Continued from page 73

and time-consuming, Forth is for me an ideal compromise between interactive, structured, high-level programming and fast-running, dirty-hands byte-bashing. Somehow the kick I get out of successfully adding a word to *my* language can only be rivalled by the one I got when my very first program in Basic ran without a syntax error. On a less sentimental note, the language seems to be genuinely all-purpose; it's hard to think of applications for which it isn't suitable if you are prepared to take new approaches guided by Forth's unorthodox structure. For instance, in the field of commercial software Forth suggests a different kind of user interface from that presented by Basic and Pascal. In those languages, a program runs, then it stops and prompts the user for an input, then it runs again. You can of course do it that way in Forth (you can hide Forth completely from the user if you want). But Forth suggests another way in which you have a vocabulary of words which do all the work themselves when you type them, so that 45 SPANNERS adds these to your stock ledger or ITEM FLANGE-REAMER defines a new type of stock item and sets up a record for it.

I have even learned to love 8080 assembler since discovering that the Forth Assembler is fully interactive; one can test assembled code immediately without any linking and such by calling the word containing your code. Even better, you can use structured looping within a code definition (the Forth name for an assembler program).

Perhaps a word of advice is in order for those about to take the plunge from Basic into Forth. The weakness of all the literature I've seen for the likes of us is that it underestimates the strangeness of the part-compiled, part-interpreted, virtual memory environment to those reared on interpreted Basic. The first things you need to know are that the dictionary lives in RAM, that all definitions entered directly from the keyboard go into the dictionary and can't be edited, that definitions you can edit live in source form in disk blocks. You need to know how to find an empty block and how to get it into RAM and how to write into it and how to load the block and how to list the dictionary to see that your definitions are there. All these things need to be told to you at the very beginning but in practice they tend to be told to you halfway through the book and in scattered places because to Forth people they are, presumably, not a problem. To a Basic person, not knowing them produces a curious feeling of insecurity rather like walking on quicksand; you're never quite sure that your program is there or where 'there' is.

But enough of these ramblings; my craving for part-digested programming languages demands satisfaction and there's still C, APL, Smalltalk, Logo, Fortran, Prolog, Wonderpop, Mumps, Shingles and F***ing Ada to go. And so little time. . .

Microtechnology Ltd is at 62 Mount Pleasant, Tunbridge Wells, Kent TN1 1RB. AIM Research is at 20 Montague Road, Cambridge CB4 1BX.

MONROE 8820

Continued from page 117

be able to communicate with it and communication with other OC 8820s will be possible — it's a software requirement not a hardware upgrade.

Conclusions

The Monroe OC 8820 is a well-built micro which makes no pretensions at being other than a no-nonsense business tool. It places the onus firmly on the programmer/software house to provide the user with a friendly, easy-to-use system tailored to his/her specific requirements, but all the facilities to do this are provided.

At as near as dammit £3000 for the basic system, it's definitely an upmarket micro these days, especially considering that it's an 8-bit machine at heart. But the power and flexibility of its operating system compensates for the price and its quality construction equals that of Hewlett-Packard's HP 125, although, in a very definite swings-and-roundabouts comparison, it hasn't some of the HP 125's attractive features.

I disliked the Monroe at first and I feel that others, especially the programmer used to CP/M, may feel the same. But on getting to know it, and on investigating the philosophy behind it, I found it a powerful and pleasant micro aimed at a specific niche in the market, for which it is well suited.

Ultimately, though, the machine's

future will depend on the degree to which its applications software is tailored to it. Fi-Cord produces several packages of its own — sales and purchase ledger and payroll — which do exploit the machine's many facilities and would serve as excellent guidelines for software houses interested in producing applications programs for the Monroe.

Our thanks to Fi-Cord International (061-445 7716) for the loan of the review machine. END

Benchmark timings

BM1	2.1
BM2	4.2
BM3	9.9
BM4	10.5
BM5	11.0
BM6	20.1
BM7	32.0
BM8	33.0

All timings in seconds. For a full listing of the Benchark programs, see PCW Vol 4 No 11

Technical specifications

Processor:	Z80A, 3MHz
Memory:	128k user RAM, 4k video RAM, 2k bootstrap PROM
Disks:	Twin single-sided, double density, 320k each.
Screen:	80x24 amber on grey, double height, double width, dimmed, flashing, lo-res graphics.
I/O:	3xRS232 ports, expansion port, ext disk port.
Keyboard:	93 keys inc full qwerty, numeric pad, cursor controls, 8 prog function keys, screen editing keys.
System software:	Monroe operating system; CP/M (opt)
Languages:	Monroe Basic, Pascal

SCREENPLAY

Continued from page 148

square loses. Chomping involves typing the row and column of one of the squares whereupon all squares (asterisks in fact) to the right and bottom of this position disappear (including the one chosen). Again you play the computer — but you *always* go first. I failed miserably with this one, though I assume that once solved this puzzle would completely lose its attraction.

VALUE FOR MONEY: ****
PRESENTATION: ****
PLAYING SKILL: ***

Sneak preview

While working on this review, I managed to get a demonstration of two games shortly to be released by Thorn EMI. The first of these is a Jumbo jet flight simulator, whose working parameters were developed with the help of Imperial College. This is a true simulation and hardly counts as a game in many respects. The whole thing is immensely sophisticated and will take some considerable time to master. The second game, called Submarine Commander, is also quite complex and involves torpedoing merchant convoys in the Mediterranean. I'm sure that both of these will prove very popular and look forward to reviewing them next time I get hold of an Atari.

Conclusion

The Atari 400 is an excellent games machine with a very large selection of software, of which I have covered only a small portion. Reading cassettes into the machine can be irritating, especially as some suppliers make the lead tape too long, forcing you to search for the beginning of the data on a standard audio cassette player or by trial and error. At present only Atari supplies ROM packs, though I gather Thorn EMI may be producing these soon. The number of Atari software suppliers involves an extensive and varied stock of games which cannot fail to satisfy all tastes. One drawback, however, is the price, which at present is rather too high, though I suspect that Atari (or Ingersoll, the British distributors) will soon be forced to review its pricing structure in this country in the fact of increasing competition.

Next month I shall be looking at a rather different machine, the Tandy TRS-80 Model I.

My thanks to Richard Gibson-Robinson of Thorn EMI and Pat and Mike Woodroffe of Calinto computers for their assistance with this review. END

FRAMES OF REFERENCE

Continued from page 110

independent and machine dependent, support Basic. Fortran and Pascal are available on 50 per cent of available operating systems. Cobol is available on one-third of the operating systems and, with the emergence of more powerful processors and the call for data processing facilities, it will become generally available on 16-bit and widely available on 8-bit. C, the language of Unix, is now available on 20 per cent of the operating systems. Forth is also gaining in popularity and APL and PL/1 have emerged to satisfy their select band of followers.

There are a number of dependencies which dictate the languages you should choose for developing software. For example, if you are developing packages, a good case can be made for UCSD Pascal because it is structured and fairly portable across machines. If you run a data processing department and employ a gang of Cobol programmers, one of the machine independent Cobols is a likely choice. However, most companies find it pays them to support Basic plus one or two other languages.

The two popular machine independent versions of Basic are CBasic and Microsoft Basic.

The advantages of Basic are that it is widely available on a choice of machines, is relatively easy to learn and provides rapid implementation of conversational applications. Its disadvantages include the fact that it is an unstructured language, it's difficult to maintain Basic programs, and it has limited file handling capability.

Cobol is widely used for serious data processing tasks. It has the following advantages: it's common in computer departments, it's a structured language and it has good file handling suited to data processing. The disadvantages of Cobol are its slower development than Basic if not used with good tools and that it requires typically more machine capacity than Basic.

There are several versions of Cobol, including Ryan McFarland, Micro-Products, Microsoft and Micro Focus. The last mentioned is now the leader with its CIS Cobol established on CP/M, MP/M and Unix as well as a host of manufacturers' own operating systems for both 8- and 16-bit machines.CIS-Cobol is widely used in the USA, Japan and Europe as well as other places in the world where micros have penetrated. It has been adopted by Intel in the USA as iCIS-Cobol and purchased by a host of Silicon Valley 8-bit and 16-bit manufacturers. It is ANSI 74 compatible and has passed the US Navy standard Cobol tests.

Other languages

A variety of other high level languages is available. Many are subsets of languages on bigger machines and the absence of some features cause frustrations, for example with APL and PL/1 users on micros. These languages are improving and the general availability of 128k RAM machines with hard disks will provide the hardware to support full implementations.

Pascal is a structured, portable language, growing in popularity, but unfortunately with many variants. UCSD Pascal is the most generally available, and Pascal M is very popular with software products builders such as SuperCalc and MicroModeller.

APL is widely used in timesharing and consequently in timesharing replacement on micros; 8-bit implementations are usually a subset so that features need to be compared with your favourite APL.

Fortran is widely used in timesharing and scientific work and favoured for similar tasks on micros. Fortran IV soldiers on and is generally available; Fortran 77 is now becoming more widely available.

PL/1 is the language of many IBM installations and is implemented by Digital Research on micros.

C, the language of Unix, is growing in popularity as a development language, especially with colleges and software houses.

Compilers and interpreters

For serious applications users should be provided with a run-time system with which they cannot tamper. This provides control over the software and makes maintenance easier. While development can be slower in a compiled language, execution is faster. Microsoft has both a Basic interpreter and compiler. CIS-Cobol compiles to an intermediate code

and has an interactive development capability. Retention of the source on a central machine in the data processing department is one of the standard control mechanisms in managing multi-site micro systems.

Development aids

There are a variety of development aids on micro computers that can substantially reduce development time and cost; Basic is the language provided with the widest choice of development aids but a number are also appearing for use with Cobol. Unix includes a variety of utilities that are a great help in systems development. At their most sophisticated, development aids can be used to produce virtually a complete system without the necessity of writing any program code, or at least reducing coding to the barest minimum.

Several of the language manufacturers have produced additions or extensions to their languages. For example, Micro Focus provides Forms, a useful screen formatting and generation aid.

The fourth commandment of microcomputing

In microcomputing, software takes precedence in the line of succession. Ideally, you will limit the variety of machines on software standards. *The fourth commandment of microcomputing is: thou shalt commit software development to the industry standard operating systems and, especially, to the standard languages.* END

CALCULATOR CORNER

continued from page 118

item using up to seven characters, eg, WEEK 1 or SALARY. Pressing = again causes the name to be displayed with a ? prompt for you to enter the value. This completes data entry, and pressing + advances you to the next line numbered A1. In this fashion a page of named variables is set up which can be inspected by scrolling up with -, down with +, or going to start or finish with / or ↑. Values can be entered directly or as the result of a calculation and may be changed at any time. In Procos A and B, names may also be changed using the N command. The final result is like a single Visicalc column, through Procos B allows two such columns to be simultaneously stored, ie, two values for each name. These cannot be displayed simultaneously but may be exchanged (with E), or page 1 may be copied into page 2 using C to allow the last set of results to be preserved. Copy and exchange are quite slow, as Procos is written in Basic (machine code not being accessible on the 702) but since data volumes are not high this is not a disaster.

Once the data page has been set up, the data may be processed by programs written and stored in the other program memories. Where Procos simplifies this task is that each datum can be referred to by the line number — eg, A6 — so that a program may be little more than a formula such as A4=A3+A5, though of course line numbers must be used and each program must end with a Return. To apply the modification program to your data, use P from within Procos which then prompts you for the program number. On completion of execution you can inspect the new state of your data-sheet, compare it with the old values if saved in page 2 or copy it into page 2 to save it. The manual explains the writing of programs in a sufficiently simple way for anyone with school algebra to understand.

It is possible to exit from Procos and use the calculator for normal computation, and both tape and printer operations are supported within Procos. Using this package it would be possible for someone with minimal computer expertise to set up a small data storage system — eg, for calculating discounts or simple inventory control — which could be used by someone with even less expertise than themselves. Don't imagine, however, that you're going to set up a Codasyl database or do real time simulations in fluid dynamics; the 702 is a very small computer and should be used for appropriate tasks. What Procos can achieve for you is the provision of intelligible variable names and simple access to your data, which may well be useful even to those experienced in 702 programming who are not prepared to write and optimise the necessarily lengthy routines themselves.

Procos is being distributed solely through Tempus of Cambridge. Cost is £24.95 for the cassette and manual, though it is available at a lower price if purchased at the same time as the hardware. END

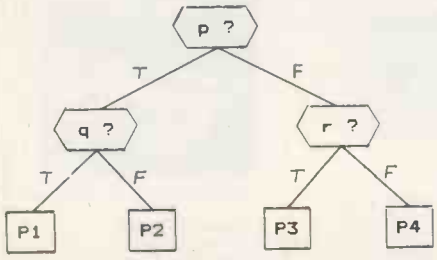
IS BBC BASIC STRUCTURED?

continued from page 123

You may of course utilise the one line IF... THEN... ELSE in the following manner:

```
10 IF [p] THEN 20 ELSE 40
20 [P1]
30 GOTO 50
40 [P2]
50 . . .
```

but I really cannot see that it is much better. And what if one or both of P1 and P2 contains a new branching as pictured in the following structure diagram?



If a process of that type must be coded in this manner

```
10 IF NOT [p] THEN 70
20 IF [q] THEN 50
30 [P2]
40 GOTO 110
50 [P1]
60 GOTO 110
70 IF [r] THEN 100
80 [P4]
90 GOTO 110
100 [P3]
110 . . .
```

you simply cannot talk about a 'structured' Basic.

The analysis and solving of the problem may be hard enough, but if that has been done properly the programming language should not be another obstacle on the stony road to a running and readable program. A structured language *must* offer something like

```
10 IF [p] THEN
20 [P1]
30 ELSE
40 [P2]
50 ENDIF
```

to deal with this type of problem. You must be able to handle branchings globally, ie, with several lines packed and controlled as *one block*. Comal and Waterloo Basic have this structure, and RML Basic has one that looks very much like it, *but BBC Basic has not!*

BBC Basic is definitely not a 'structured' Basic, not even in a moderate meaning of the word, and my advice to the BBC would be this. While the hardware people are improving the heat sink, or whatever it is that causes trouble, have the software folks finished their homework and implement the global IF... THEN... ELSE... ENDIF structure. If you do not want to look at Comal-80 because one of its fathers irritates you, then use Waterloo Basic.

END

BLUDNERS

In the March *PCW* someone seems to have mixed programs up with Leisure Lines — that is, they made a right brain-teaser out of it, but the answer to this particular puzzle is quite straightforward. If pages 178 and 179 are swapped with pages 184 and 185, all should become clear and programs should fit together properly.

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Benchtest: Tandy TRS-80 Model II/Benchtest: Sintrom Periflex 630/48 / Staff case study/Checkout: Softy Intelligent EPROM Programmer/Checkout: Exatron Stringy Floppy/ Practical examples of the IEEE-488 bus use/ Programs: Naming Nascom files, 380Z Pictures, Fuel tank calculations — PET, PET large numeral generator, PET tank battle, Basic string handling routines/Pascal: Final instalment.

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Benchtest: Microwriter/ Printerfacing: Series — Part 1/Sharp PC-1211 speed-up/Programs: TRS-80 Tarot, PET Cat & Mouse, PET Rebound, MZ-80K Alligator Swamp, PET Connect, UK101 Minefield, PET Simon

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Benchtests: Tandy Color Computer, Commodore VIC/Checkouts: Hi Tech Speakeasy, Tantel/ Multi-user Benchtest: HMSOS/ WP Benchtest: Memorite III/Word proc program for PET/Apple dealership run by spastics/Printerfacing extra/Calc Corner: Casio fx602p review/ Programs: PET Arithmetic test, ZX80 Eldorado, 380Z Memory test.

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Vol 5 No 3 March 1982
Benchtests: Texas Instruments 99/4A, Hewlett-Packard 125/Choosing a Database/Compsoft DMS reviewed/Screenplay (new series)/Calc Corner: Hewlett-Packard Interface Loop/Programs: TRS-80 Solitaire, TRS-80 Ducks, Nascom Business Documents, MZ-80K Race Chase, ZX81 Graphplot.

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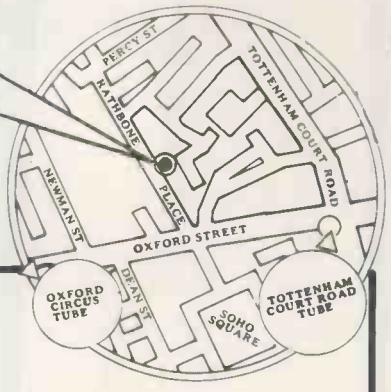

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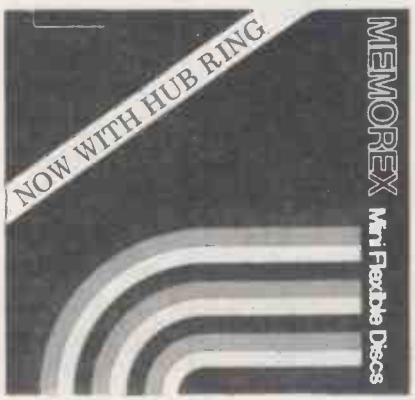

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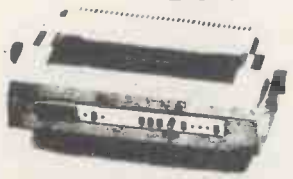

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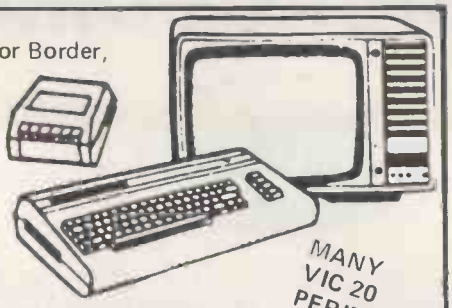

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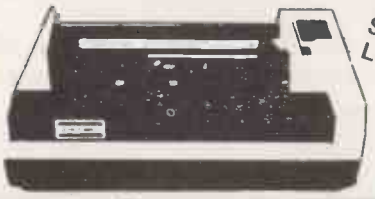

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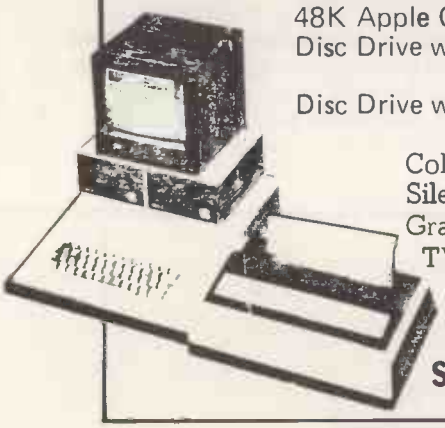

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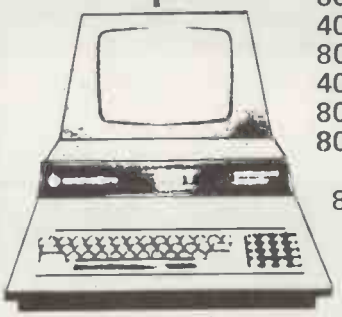

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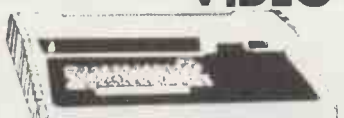

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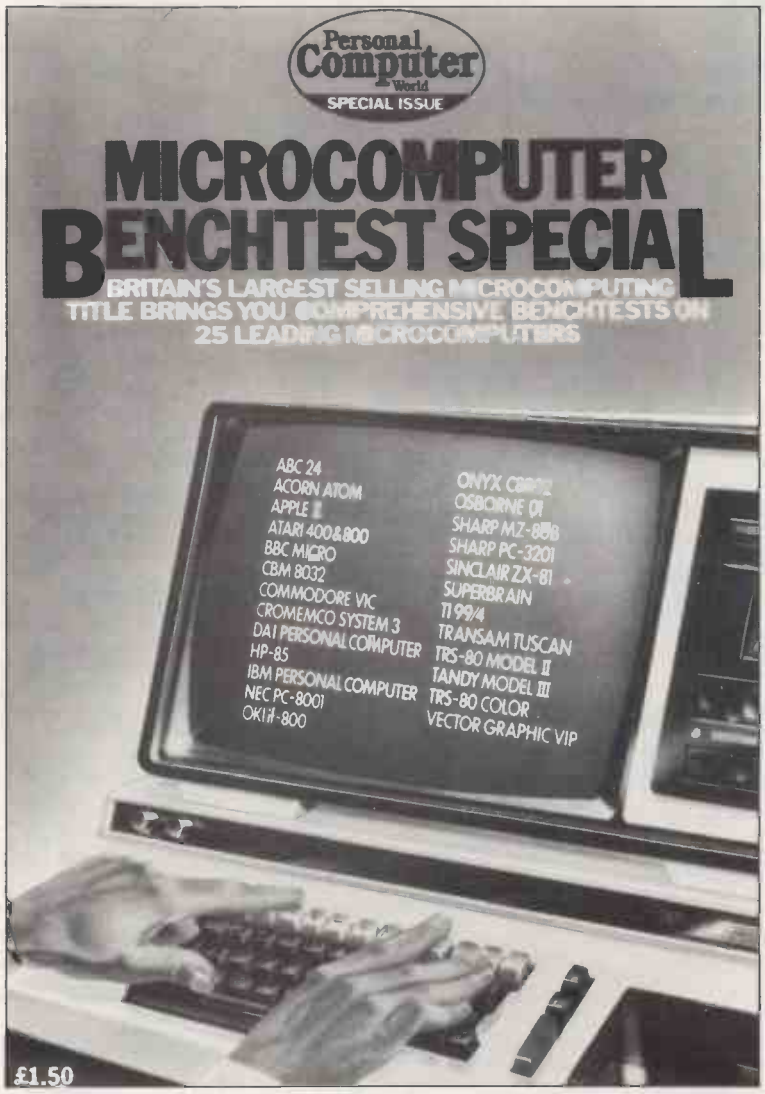

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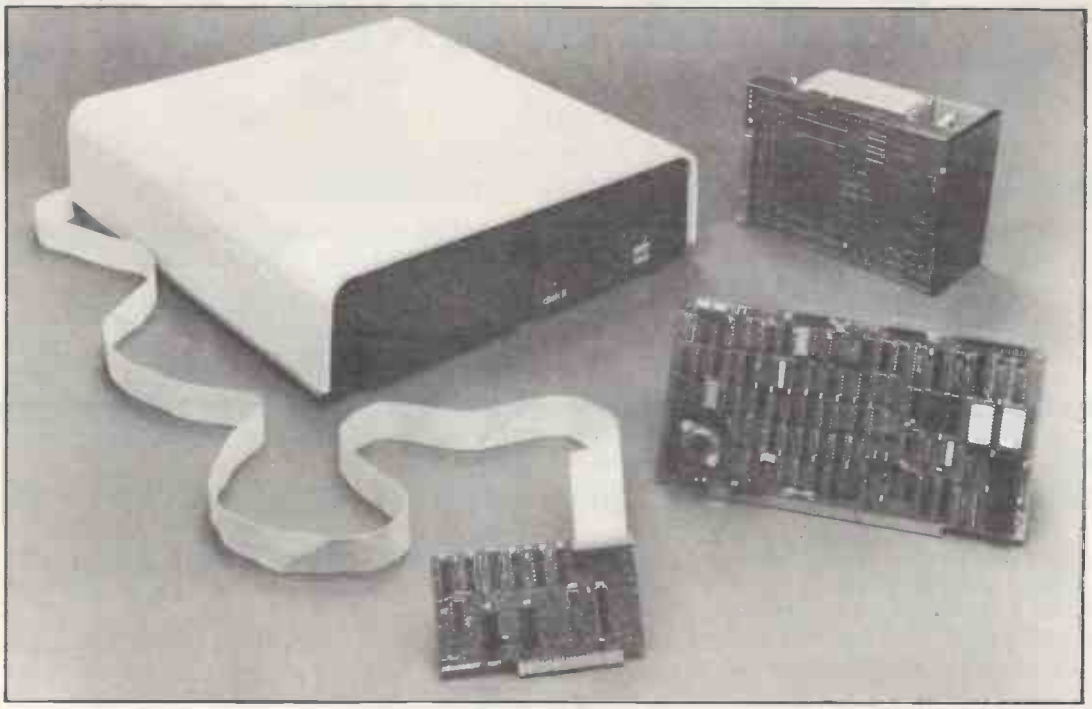

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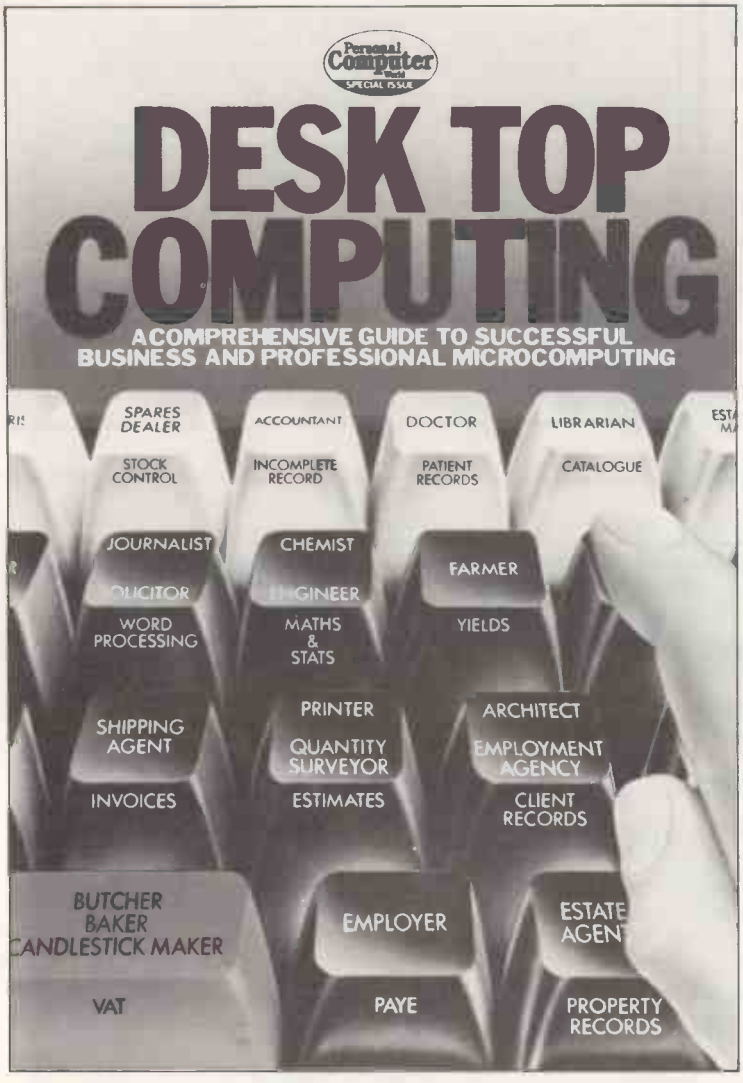

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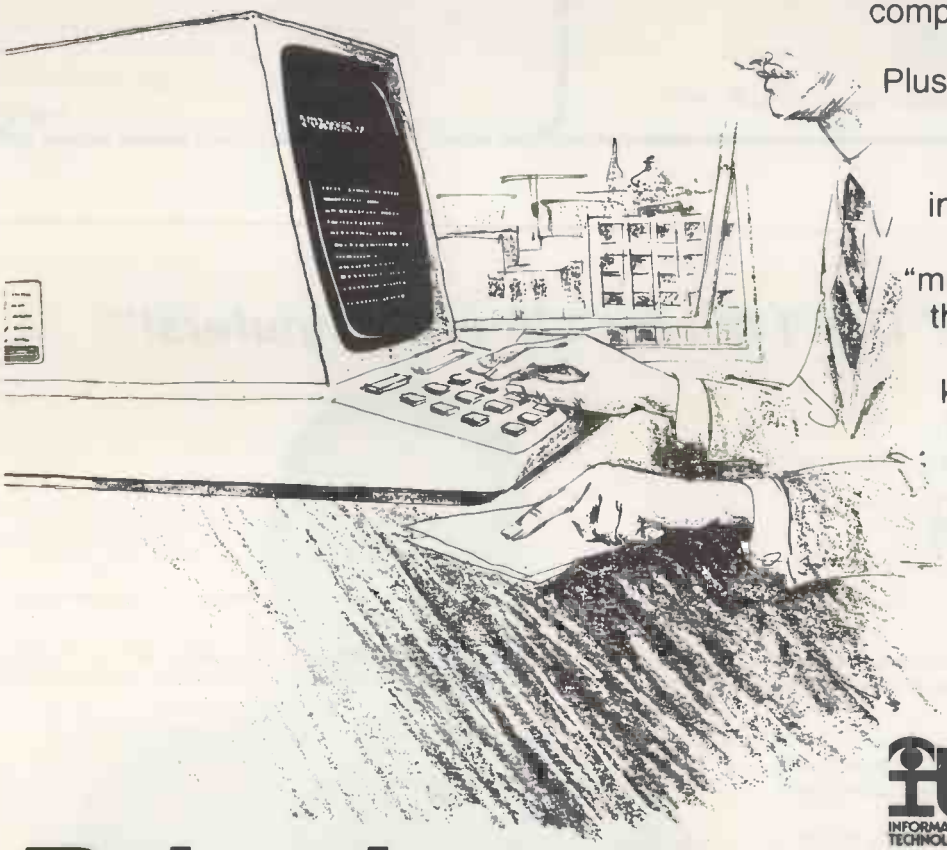

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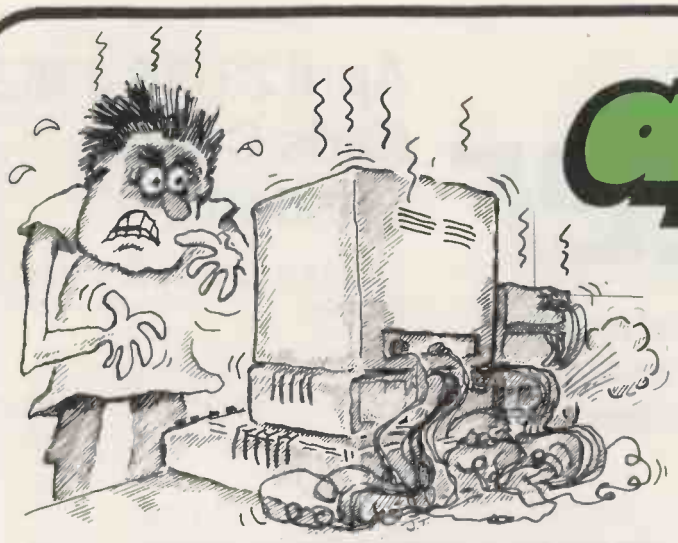

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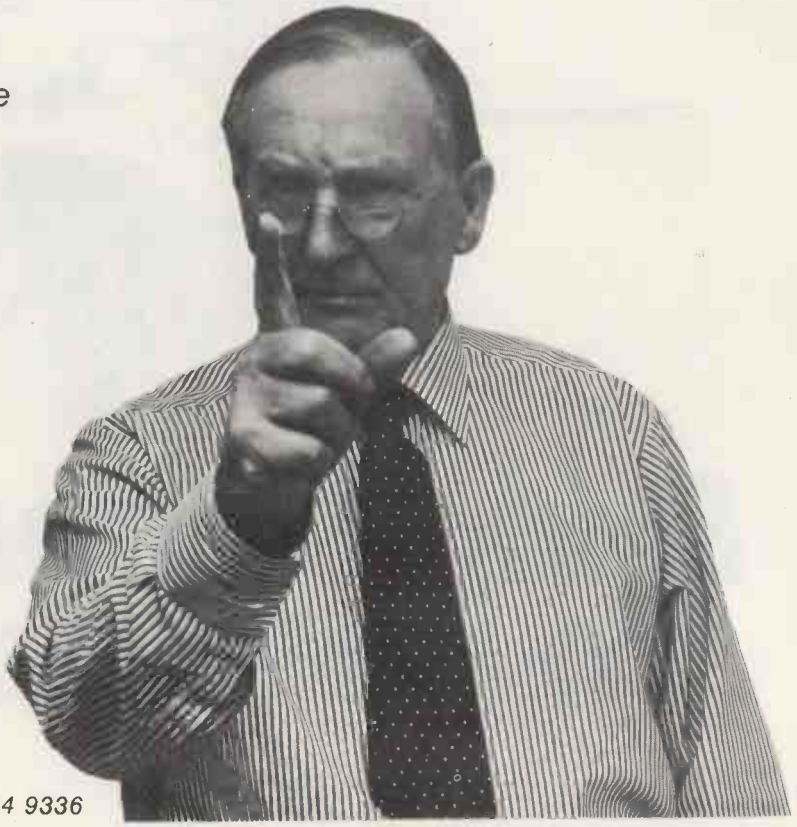

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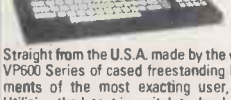

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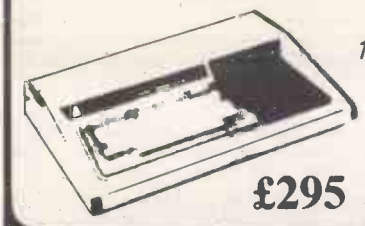

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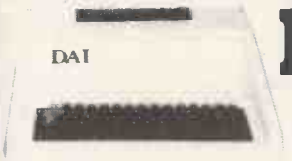

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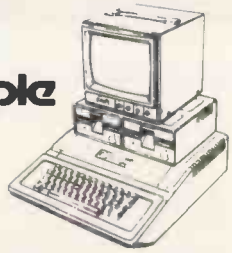

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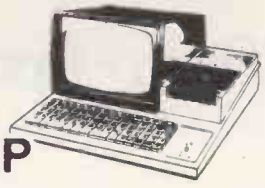

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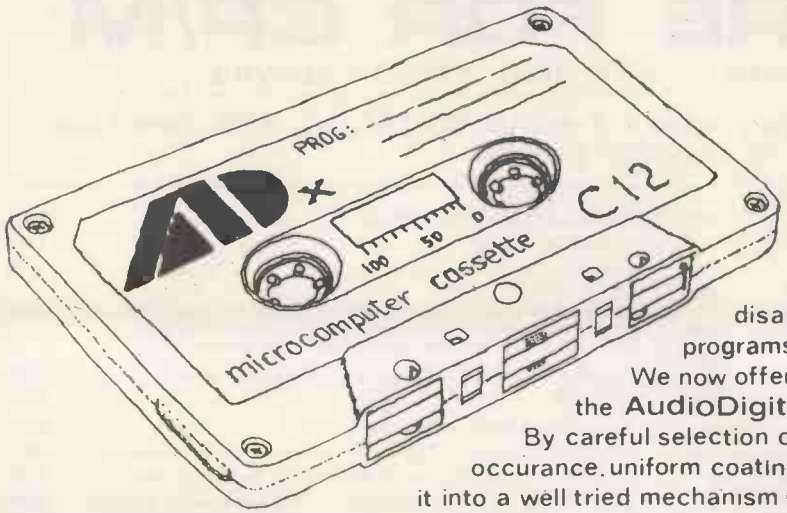

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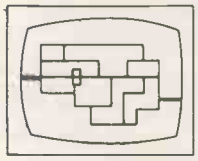

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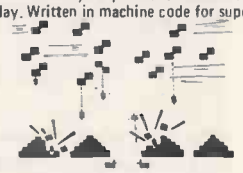

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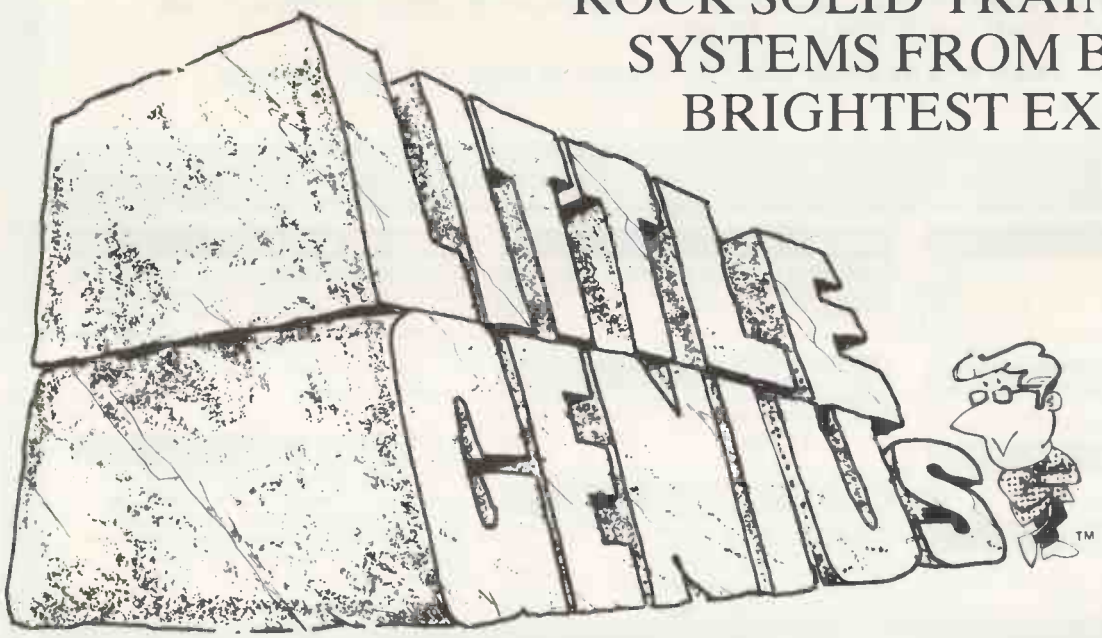

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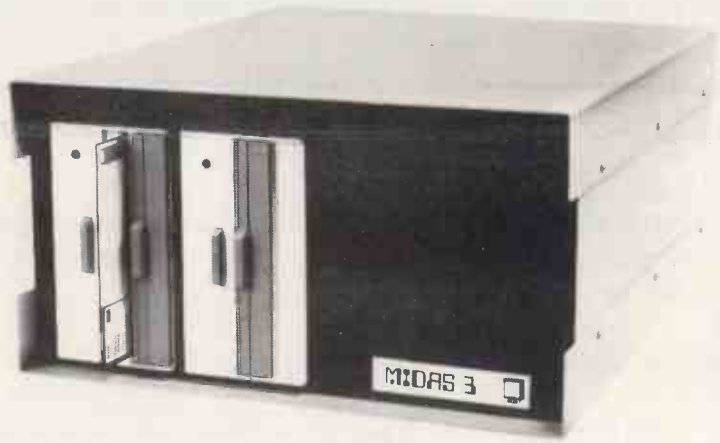

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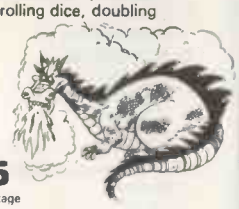

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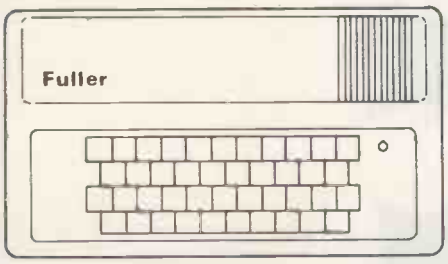

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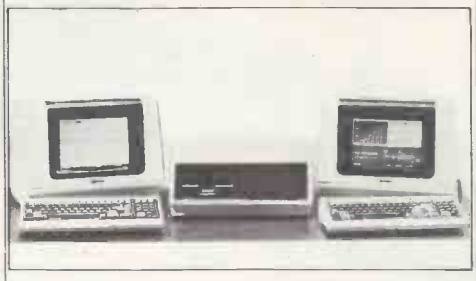

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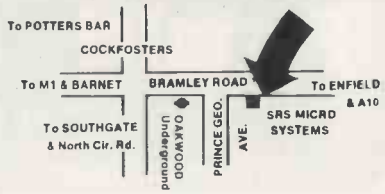

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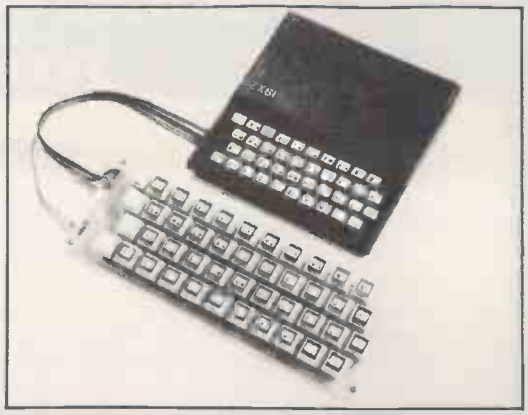

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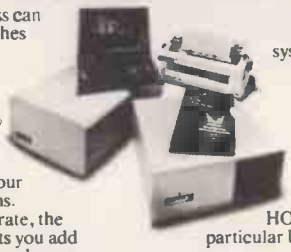

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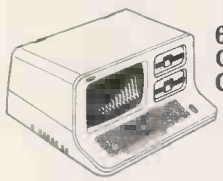

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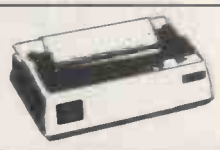

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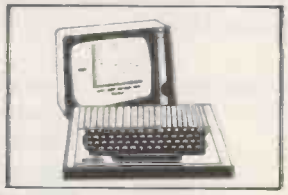

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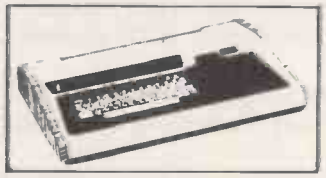

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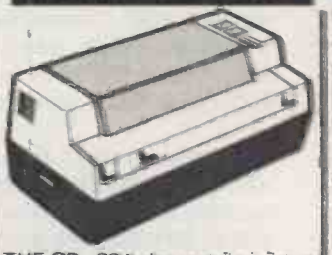

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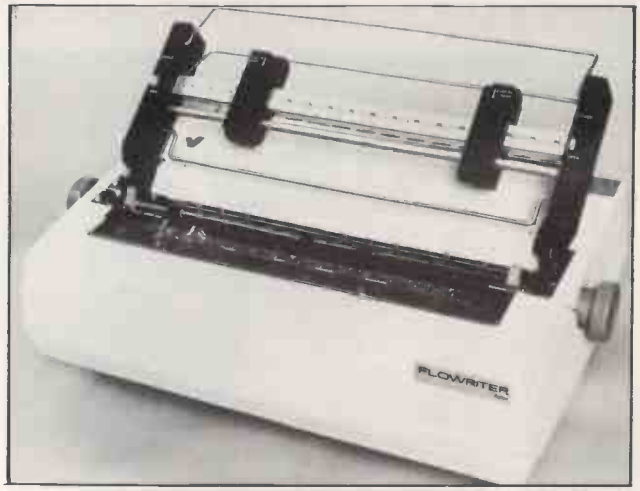

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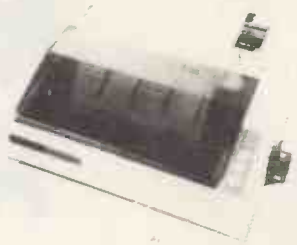

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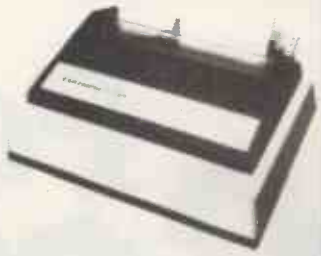

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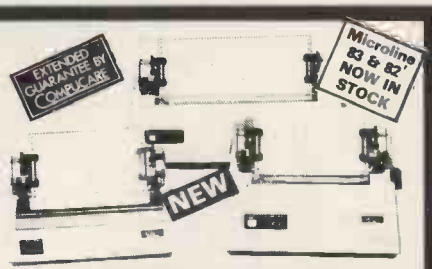
ADVERTISERS INDEX

CHIP CHAT

CHIP CHAT CHIP CHAT CHIP CHAT CHIP CHAT CHIP CHAT CHIP CHAT

A frantic phone call from an upset Tebbo caused unkind mirth here in the *PCW* ivory tower recently. Seems that somebody has stolen the Caxton nameplate from the front of his offices and he wants it back, pronto . . . The winner of our 'Just-for-the-hell-of-it' competition will be announced in next month's issue but the lucky person will have heard from us by the time this appears. So please, *don't* ring us to find out if you've won — if we haven't contacted you, it's because you didn't win. And please stop sending in entries — it's driving us bananas . . . Now here's an intriguing thought: having made a mint from the ZX81, invented a radical new flat screen television and designed an electric car, Clive Sinclair was recently asked what he wanted to do next. Instantly he replied, 'Be Pope' . . . If you're not going to the West Coast Faire this year (it's taking place more or less as this issue hits the streets) you're missing a couple of interesting seminars: 'How to leave and compete with your employer without getting sued' is one (will Chuck Peddle be in the audience, we wonder) and the other, which we're really kicking ourselves for missing, is 'Computer assisted design of Tiffany lamps' . . . Pope Clive announced some interesting statistics recently, when assorted microhacks gathered for an audience to hear that he's done a deal with Timex (which manufactures the ZX81) under which Timex in effect takes the '81 over and pays Sinclair a royalty. Some 300,000 machines have been sold and the Timex factory in Dundee stamps them out at the rate of one every 10 seconds; we calculate that at that rate it will only take 16½ years to make one for every person in the country . . . One of the problems with a monthly magazine is that there's quite a long lead time between our writing something and it appearing in print on the news-stands. This, for example, was written in mid-February. So it's very difficult to report on situations which change quickly — and those which are claimed to be about to change very quickly. One such situation is that of the BBC Computer. Recently we received a press release which stated that some 12,000 orders had been received, that 600 machines had been delivered and that there had been 135,000 enquiries about the machine. Production was being geared up to an eventual 2000 a week and the backlog was expected to clear by the end of March. We seem to have heard this somewhere before on more than one occasion from more than one company, so we're rather sceptical. Yes, of course, the backlog will eventually clear, but by the end of March? We're not convinced but would love to be proved wrong for once. The story behind the delays is, apparently, that prototype versions incorporated a prototype Ferranti ULA, which worked perfectly. But when the chip went into full production, a different type of silicon substrate was used, which didn't work — timing signals were delayed within the chip just enough to mess things up. Result: delays while the chip was sorted out. Meanwhile, our penchant for interesting statistics caused us to calculate that, assuming the average BBC order is worth £250, the Beeb is sitting on some £3 million; even if they cancelled the whole project and sent everyone's money back, the interest on that £3 million would provide a healthy boost to the Beeb's otherwise flagging coffers . . . Egg on face time: we often moan about companies announcing products, taking people's money and not delivering the goods for weeks; well, it seems we're also guilty. Due to production difficulties, our *Benchtest Special*, a compilation of lots of recent *PCW* Benchtests all in one book, has been delayed. But we've ganged up on our production manager and he promises it should be ready long before you actually read this and already have been sent out to all those who've ordered it. OK, Beeb, at least we have some idea of how you feel!



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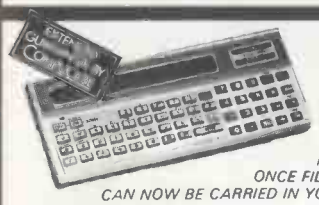

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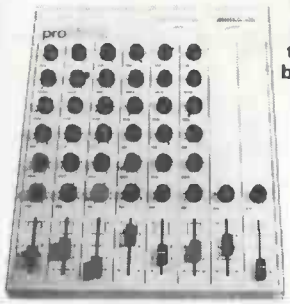

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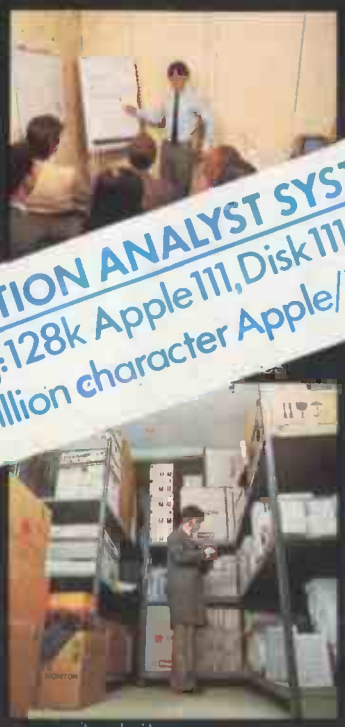
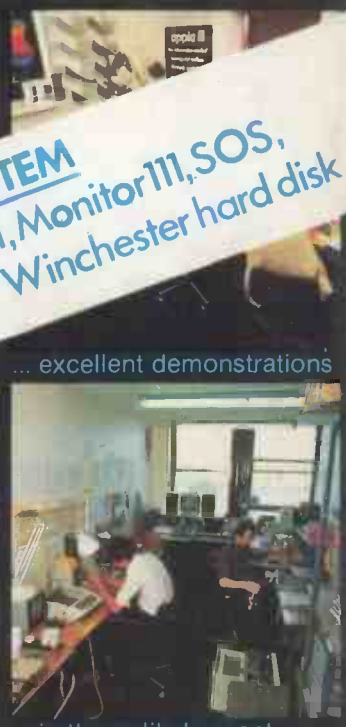
comprising: 128k Apple III, Disk III, Monitor III, SOS,
(optional) 5 million character Apple/Winchester hard disk





... excellent demonstrations

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To help you make the right choice we offer our highly-trained staff.

They know what makes computers whirr, and they know how to give you the right kind of support and maintenance.

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Such as Apple and Sharp units, with the latest additions like 16K RAM card.

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Once again ... Personal Computers Limited give the story a happy ending.

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