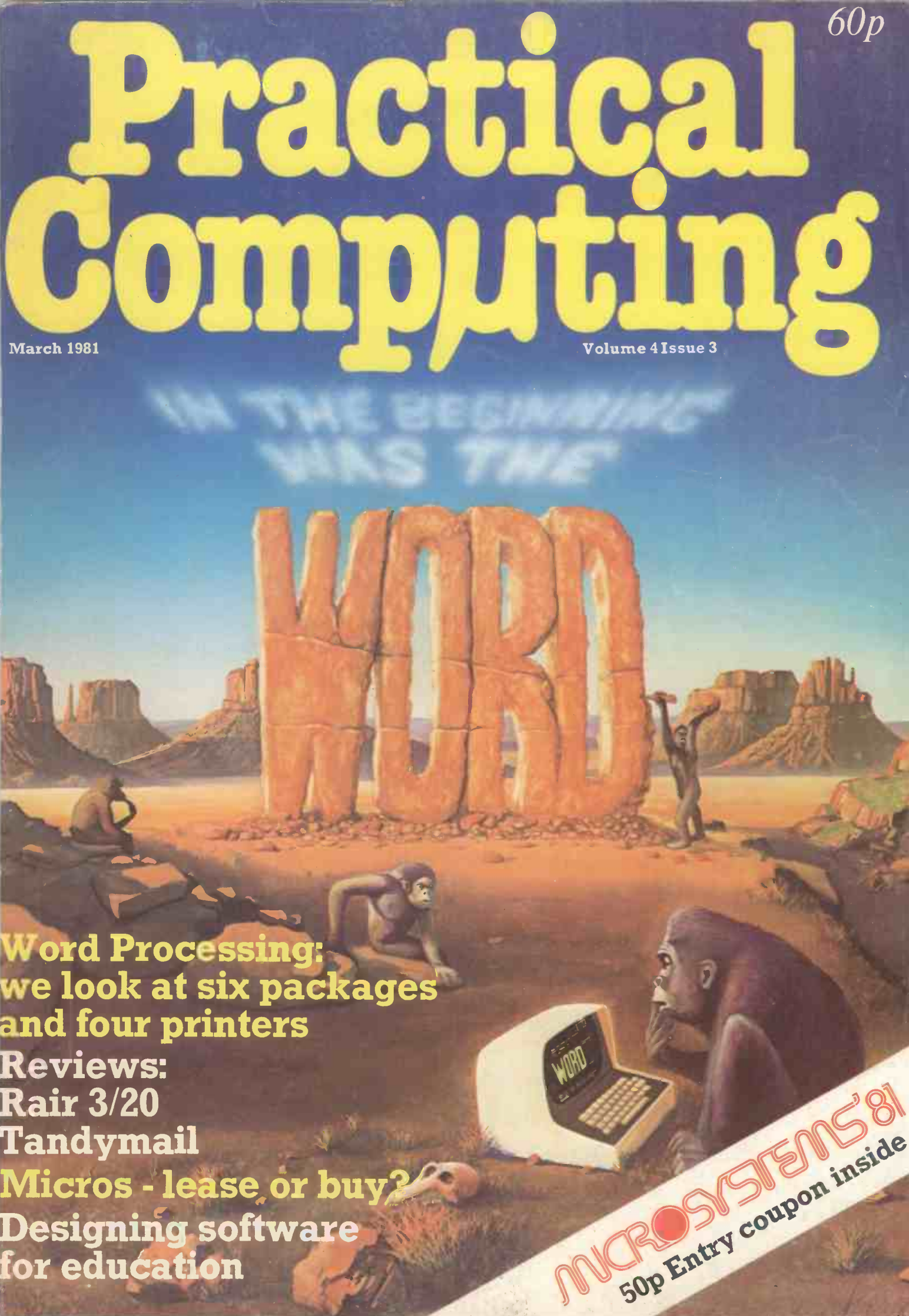
60p

Practical Computing

March 1981

Volume 4 Issue 3



Word Processing:
we look at six packages
and four printers

Reviews:
Rair 3/20
Tandymail

Micros - lease or buy?

Designing software
for education

MICROSYSTEMS 81

50p Entry coupon inside

MicroCentre introduce . . . . . System Zero

Basic System Zero £587
System Zero/D with DDF £2355

The System Zero is a small computer especially designed for dedicated applications. It is particularly useful in process control situations.
In the basic model you get Cromemco's famous Z-80A single card computer, 1k of RAM, 4k of ROM, Control Basic, and an attractive cabinet. The motherboard provides 3 extra card slots on the S-100 bus, for tailoring the system to particular applications. The basic model is designed for ROM-based programs, but it can be expanded by the addition of memory and I/O cards. It is fully compatible with all Cromemco peripherals, including floppy disks and hard disk systems. Suitably configured the System Zero can run any Cromemco operating system or software package.

New System Zero Computer with quad-capacity DDF disk drive. The system includes built-in diagnostics for a quick system test of memory, controller and disk drives

System Zero/D

This special version of the System Zero has 64k of fast RAM, and a model DDF dual disk drive. It includes two double-sided double-density 5 inch disk drives giving a total of 780k bytes storage; and RDOS-2, a new resident disk operating system with terminal and printer drivers, and self-test diagnostics.
The System Zero/D is an exceedingly inexpensive development computer ideal for setting up dedicated applications to run in the basic model. It will support Cobol, Fortran IV, Ratfor, Structured Basic, Lisp, RPG II, Word Processing, DBMS, and the full range of Cromemco's business applications software.

At the recent UK launch of the System Zero Computer, Cromemco's Technical Director Roger Melen presented a System Zero/D with 128k memory running Cromix. Here he is seen discussing the system with MicroCentre Director Andrew Smith (right).

Operating system

The System Zero/D will run any Cromemco operating system provided sufficient memory is available. The mimimun configuration of 4k ROM runs control Basic; with 64k RAM the system will run RDOS-2 or CDOS (compatible with CP/M); and with 128k the Zero/D will run the Cromix system (based on Unix).

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In the beginning was the word — page 61.

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Submissions should be typed or computer-printed. Hand-written material is liable to delay and error.

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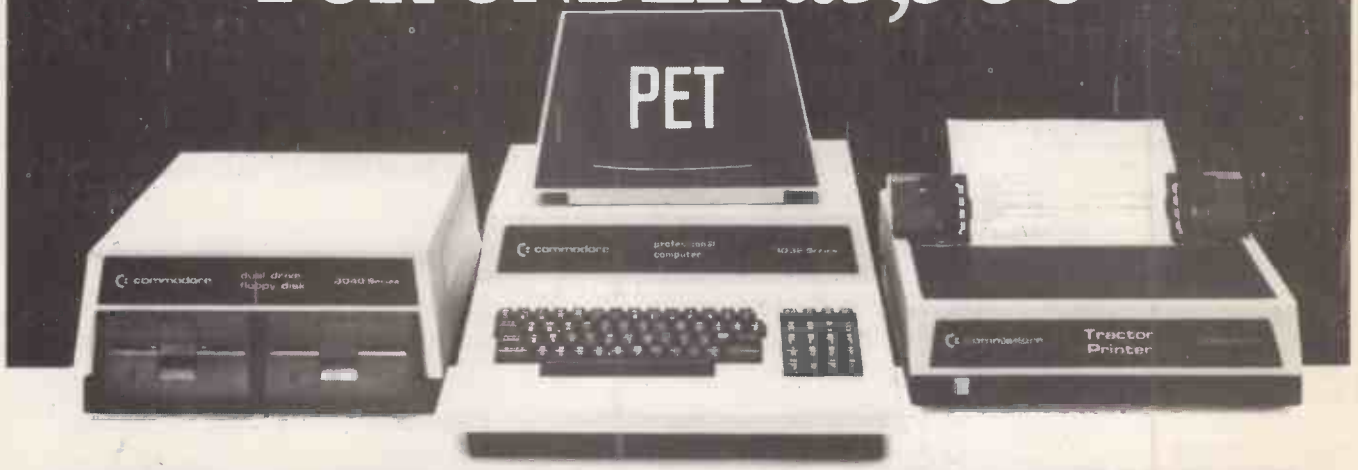
BUY A WORDPROCESSOR FOR UNDER £3,500



AND GET A MICROCOMPUTER FREE!

A wordprocessor can dramatically increase the speed and efficiency of running an office – by allowing one secretary to do the work of several. Consequently, many businesses have already invested in wordprocessors costing around £10,000, which were thought at the time to be extremely good value. And so they were, until now...

Now you can buy a Commodore Business System which provides the functions of the most sophisticated and expensive 'dedicated' wordprocessor, for as little as one third of the price!

In addition, unlike a 'dedicated' wordprocessor (whose software program is inextricably welded to the hardware), the Commodore system offers you the power of a microcomputer to help you control your business.

How can a Commodore Computer system cost so little?

A microcomputer-based system like the Commodore PET has so much more potential than an inflexible 'dedicated' wordprocessor, that demand for it is naturally many times higher. And through mass-production the price of the Commodore system can be kept very much lower. Additional cost savings are made through 'vertical integration', with Commodore making the silicon chips and handling all stages of manufacture and worldwide distribution.

These cost savings are passed on to the end user. So that now you can actually own a complete business system; including Europe's best selling microcomputer, a Floppy Disk Memory Unit and a High Speed Printer, for under £2,500. The alternative letter-quality Daisy Wheel Printer, plus a choice of wordprocessing programs, bring the price up to still under £3,500.

How can it add to the control of my business?

A wide range of first class programs is available from Commodore Business Software Dealers throughout the country. This range covers, in addition to Wordprocessing, such valuable applications as Business Information, Stock Control, Payroll, Accounting, Statistics and Planning. And with the added option of tailor-made programs, there is scarcely an area of business that cannot be controlled or supported by this system.

How does the Commodore Wordprocessor compare with others?

When linked to a letter-quality (daisy wheel) printer, the Commodore system will match a 'dedicated' wordprocessor. Moreover, when the Commodore Wordprocessor Program is combined with the Business Information Program, the system becomes really clever. For example, you could make a selective search of, say, all customers in a certain town or all suppliers of a certain material, and have personalised letters typed to each in turn.

What support do I get from Commodore?

Unlike other microcomputer manufacturers, Commodore are firmly established in the U.K. with a dealer network that is second to none.

Our dealers are happy to discuss your needs and to demonstrate and advise on which hardware and software will suit you best. Their trained engineers are always at hand and a 24 hour maintenance service is available. They can even arrange training courses for you or your staff, to maximise the benefit of owning Britain's best selling business system.

For further information about the Commodore Business System and the name of your local dealer, send off the coupon below. And remember that buying a Commodore wordprocessor today, gives you the free option to computerise your business tomorrow, simply by obtaining extra programs.

commodore

To: Commodore Information Centre, 360 Euston Road, London NW1 3BL. Tel: 01-388 5702. Please send me further information about the Commodore Business System. I am particularly interested in:

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Other applications* ☐

*Please tick where appropriate.

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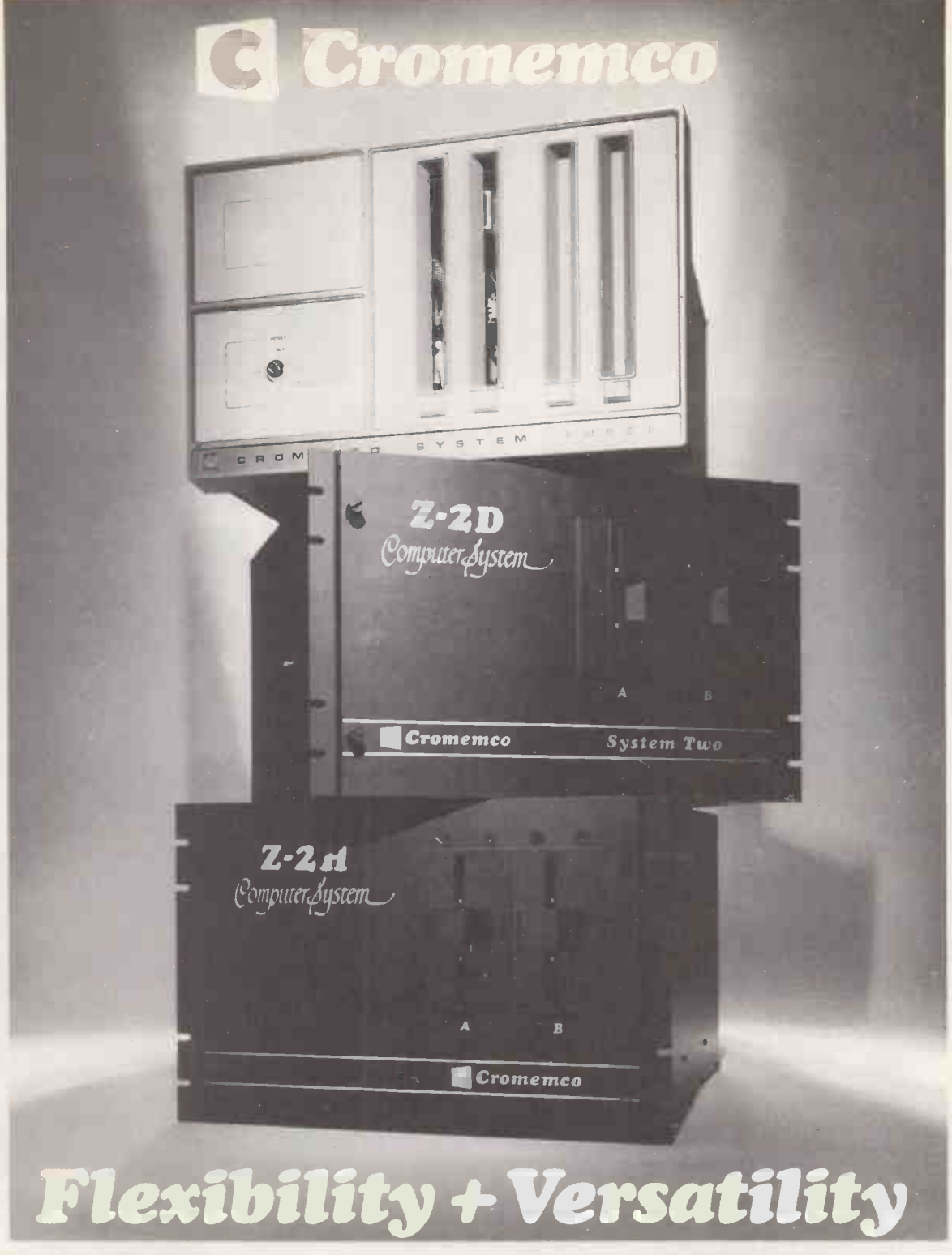

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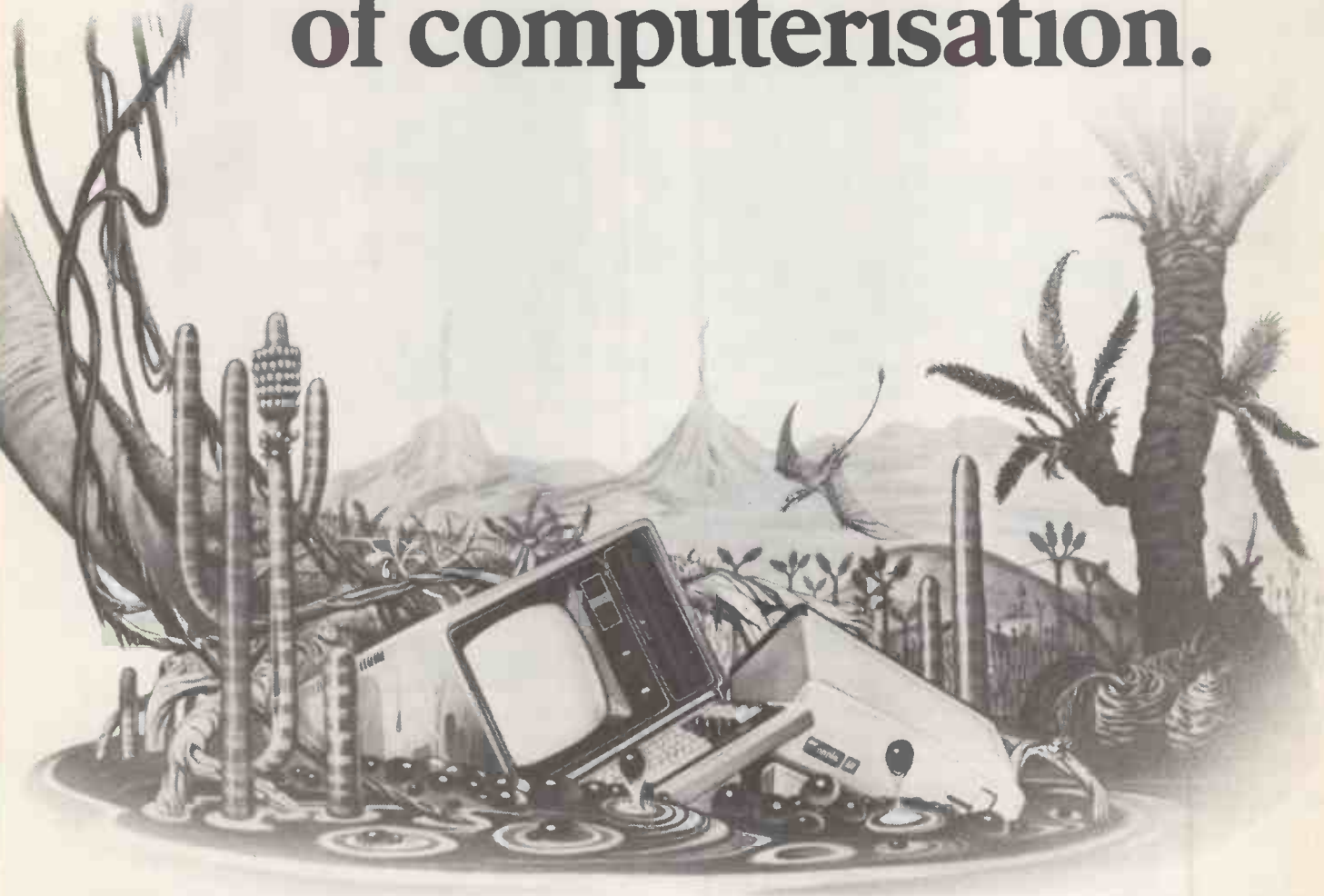
The Commodore PET offers you a safe passage through the primeval swamp of computerisation.



The miracle of microchip technology has made the main-frame computer seem like a dinosaur. But how many microcomputers will go the same way?

Without good software and support a micro-computer is less capable than your office calculator. So as competition grows amongst manufacturers in this industry, only those with the finest software and the best supporting facilities will survive.

SHARE A SECURE FUTURE WITH A COMMODORE PET

We at Commodore have been producing high technology products for over 20 years. And unlike most other manufacturers of micro-computers, we make everything ourselves (including the silicon chips) to keep our costs to a minimum.

These cost savings are passed on to you in excellent value for money. So you can now buy a self-contained Commodore PET microcomputer for **£450**, or a complete business system (including Floppy Disk Unit and High Speed Printer) starting from as little as **£2000.***

However, computer hardware can only be as good as the software available. That's why, to maintain our position as

Britain's most popular micro-computer, we have made sure that the quality and versatility of our software is second to none.

LARGEST, FINEST CHOICE OF SOFTWARE...

To complement our microcomputers, we have the finest and most comprehensive range of programs available in the U.K. today. This covers everything from such important business applications as Payroll, Stock Control, Accounting, Filing, Mailing; to our series in the field of Education. Each program is thoroughly tried, tested and tailored to BRITISH needs. You won't catch us palming you off with an irrelevant American version!

...AT SURPRISINGLY LOW PRICES

With over 30,000 Commodore PETs employed in Britain, the demand for programs is tremendous. And through mass-production we are able to keep our costs to you surprisingly low. So you can buy a Petpack program (on cassette) for between £5 and £50, while business programs (on disk) range from between £50 and £500.

OUR OWN UNIQUE TRAINING COURSES

Commodore programs are designed with operational simplicity in mind. Commands are in plain English and guidance is built into each package. So that even a stranger to computers can quickly feel at home with a PET.

Nevertheless, to maximise the potential of your Commodore system, you will find a certain amount of training of immense value. Of the well-known names in microcomputers, Commodore is the only one to offer a range of training courses and seminars. And these have already proved of great benefit to thousands of PET users.

KEEP IN TOUCH WITH THE PET USERS' NEWSLETTER

Another unique way in which Commodore helps you get the most out of your microcomputer is by publishing the regular PET Users' Newsletter. For an annual subscription of only £10 you can keep up-to-date with developments and share new ideas and applications with over 3,000 PET users.

WORDPROCESSOR AS WELL AS COMPUTER

In addition to Commodore's own high quality range of hardware and software, there are compatible products of other manufacturers which have gained our official stamp of approval.

Look out for this sign. 

You'll find it on such famous programs as WORDPRO and WORDCRAFT, which turn your PET into a first-class wordprocessor; as well as on hardware like the MUPET system, which allows a number of PETs to be run with a single letter-quality printer.

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In the microcomputer jungle
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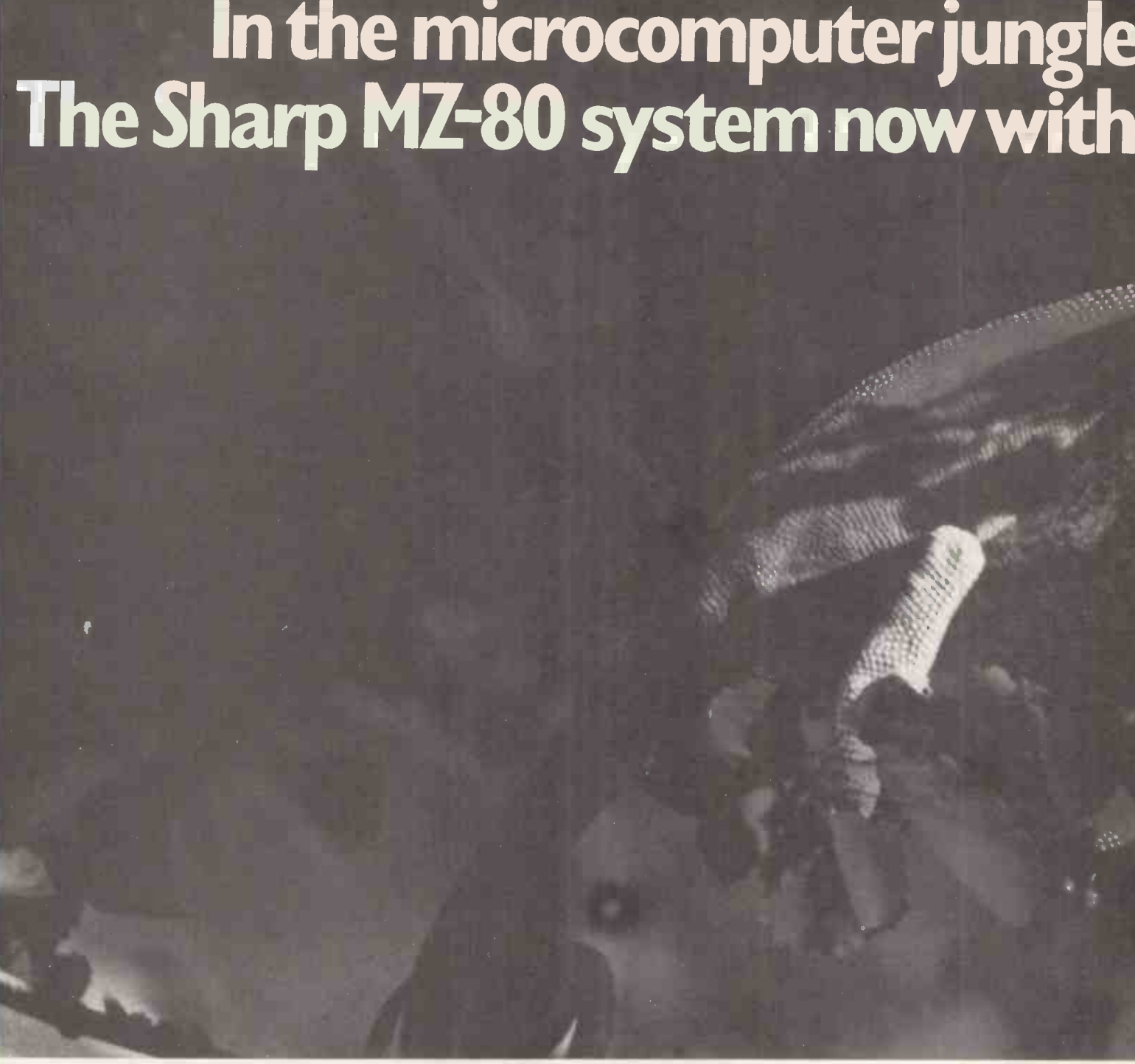

Since its introduction, the Sharp MZ-80 system has proved to be one of the most versatile systems in the micro jungle, for commerce, industry and enthusiasts alike.

Now the MZ-80 Computer system has even more versatility thanks to CP/M,™ giving greater adaptability to face the future. After all look what happened to the Dinosaur.

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10 = CORE PROGRAM MEANS YOUR MAIN DRIVE IS *** FREE *** FOR DATA.
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1) Equipment is burned and tested for a minimum 48 hours
2) Delivery in U.K. is free of charge
3) All goods & software are stocked on immediate delivery
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5) 24/48 hour mailing of any spare module free within warranty
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7) 10 free diskettes (28.50)
8) 10% of hardware value in free software (1795.00)
9) Positive before ** and ** after sales service
If the transaction includes a printer and the business programs then the following are also added:
10) All cabling between printer and SuperBrain free (25.00)
11) Ribbon and Thimble free (eg. Spinwriter 4.75 + 9.75)
12) Extra 10 diskettes free (28.50)
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A typical deal could look like this:

SuperBrain	1795.00
NEC Spinwriter	1695.00
	3490.00

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The total value of free items on this deal was in excess of 500 pounds in virtue of incidental items as well as extended warranty and software.
Do consider your purchase on the basis of some of the things you may be likely to need after your equipment purchase, and may either fail to obtain because the dealer has no stock or has lost interest in you, or because you aimed at the short term gain in price and are then compelled to pay heavily for small needs afterwards.

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07 = *ENTER 'UPDATE ORDERS
08 = *ENTER 'UPDATE BANKS
09 = *REPORT SALES LEDGER
10 = *REPORT PURCHASE LEDGER
11 = *INCOMPLETE RECORDS
12 = *USER DBMS AREA
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17 = LETTER TEXT AREA
18 = ALTER VOCABULARIES.
19 = PRINT YEAR AUDIT.
20 = PRINT PROFIT 'LOSS A'C
21 = OPEN AREA.
22 = PRINT CASHFLOW FORECAST
23 = ENTER PAYROLL (NO RELEASE)
24 = DISK SWAP'EXIT.

. . . . . ENTER WHICH ONE?

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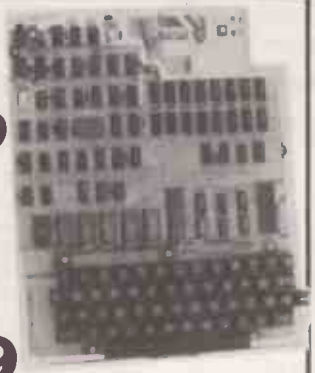

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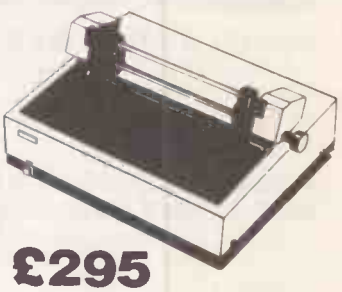

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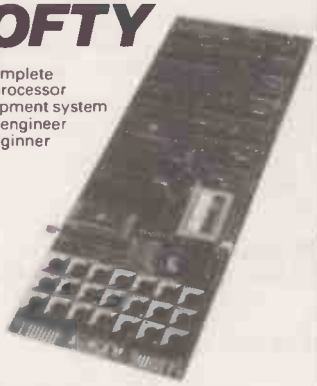

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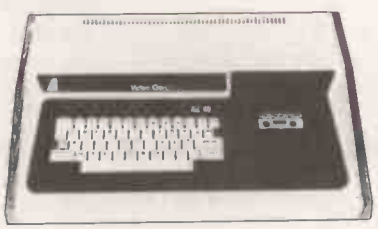

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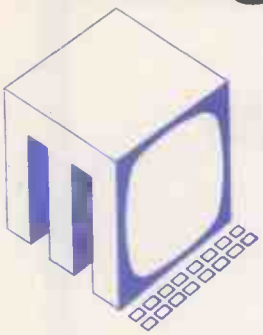

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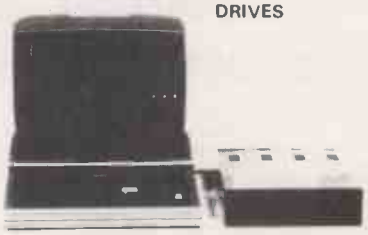

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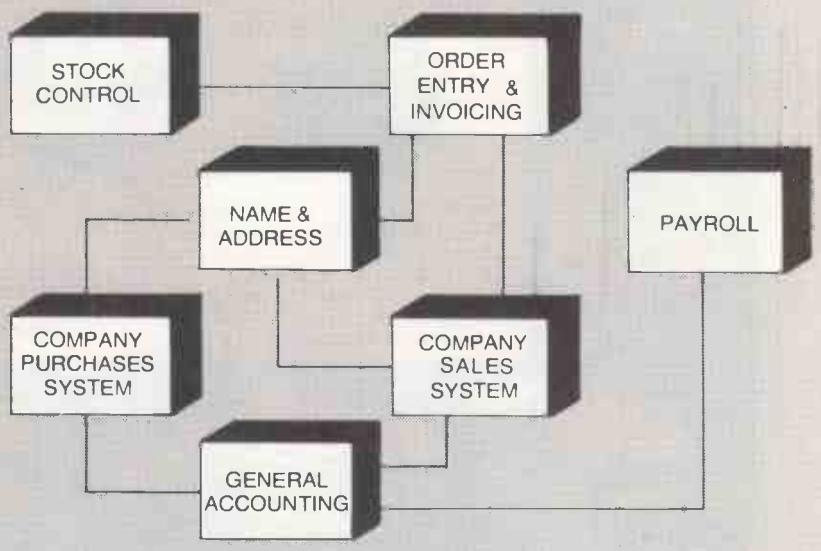

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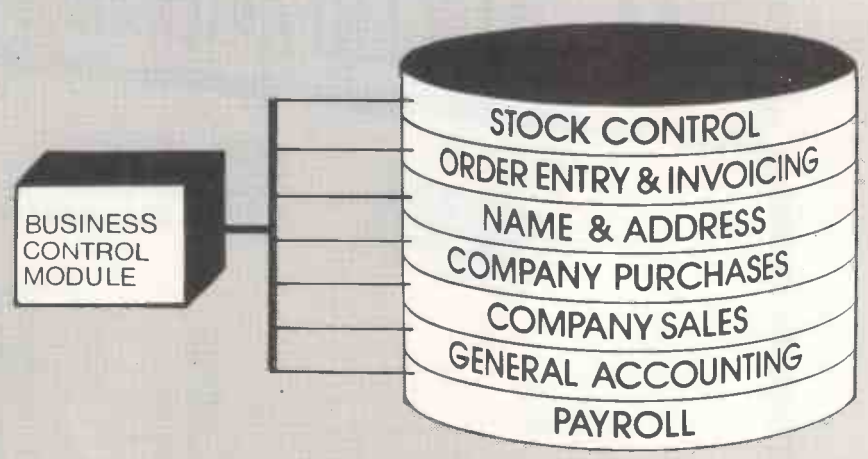

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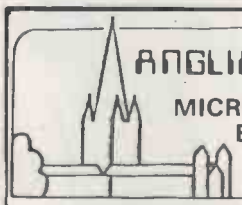

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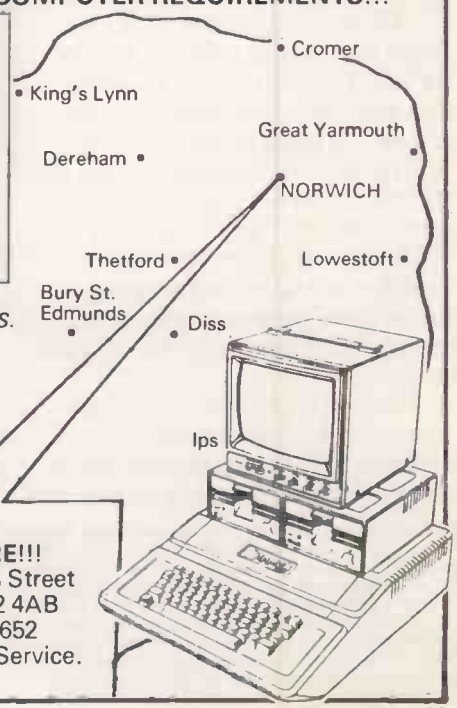

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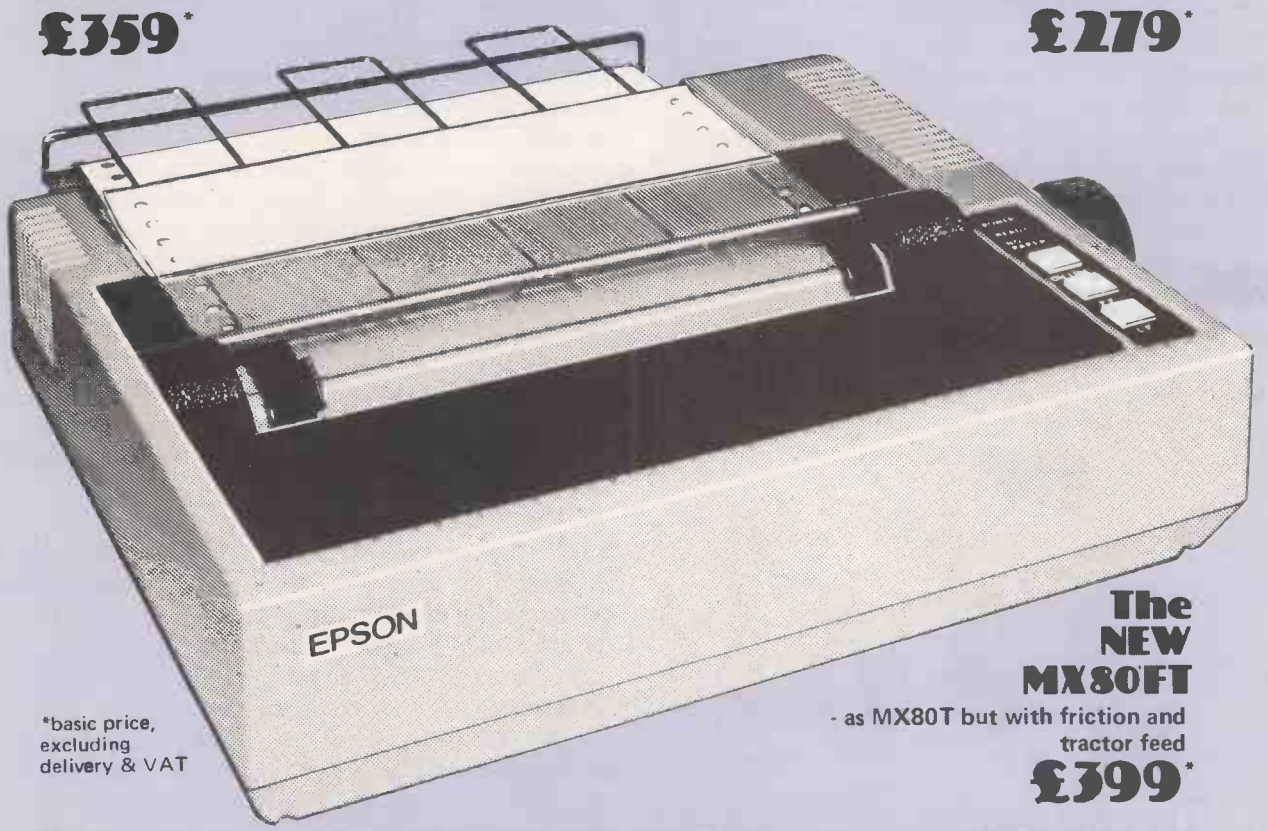

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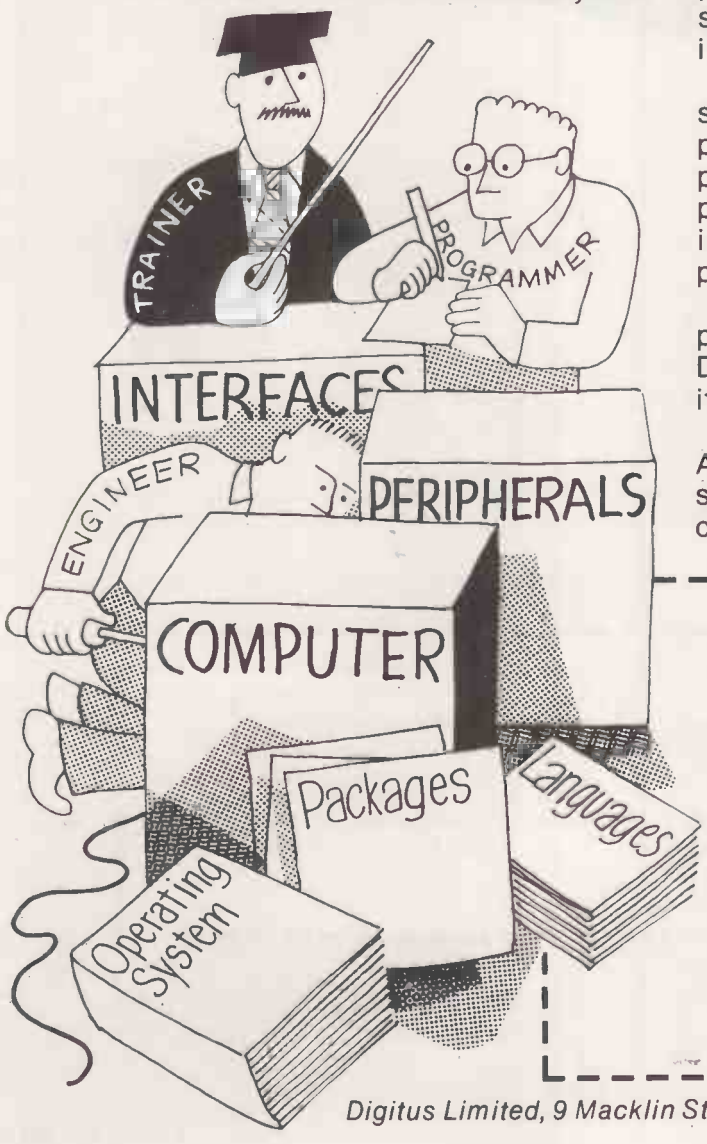

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Program or device?

THE MUCH-DISCUSSED question of software protection again rears its scaly head. The latest rash of court cases shows that, at last, micro software is becoming worth protecting — or at least, arguing about. That, in itself, is encouraging because it shows that our market is beginning to produce real sales to real people causing the real exchange of large volumes of cash. Unhappily, those volumes do not seem large enough to pay the £50,000 or so a definitive ruling will cost, but the fact that the actions have been started at all is encouraging.

So far, the arguments have been about whether software enjoys the protection of the Copyright Act. It seems to be accepted by the courts that this is so — see Printout Extra January 1981 — for if it were not, there would be no justification for the granting of the swingeing search order in the A J Harding (Molimerx) v. Tom Crossley case. Even though it might be argued that software is not covered by the Act, it may be safe for the moment to assume that it is.

We would like more protection than copyright can offer — we would like to be able to patent software as well. Why is that? Let us consider what you receive for your money with each form of protection.

Copyright is gained automatically in the U.K. — on affixing the message ©, date and owner in the U.S. — whenever a person writes some literary work or commissions someone else to write one. It protects the owner against unlawful reproductions of his work for his lifetime and 50 years after his death. That sounds fine, but copyright applies only to the specific words of the work.

There is protection against translation, but it does not protect the underlying alogrithm. So, young W Shakespeare's light musical, Hamlet, which deals with the romantic thrills and spills of the handsome Prince of Denmark, would be protected against translators into Flemish or Swahili. It would be protected against the ingenious fellow who turns Hamlet into Brian and sets the whole piece in Stoke on Trent.

Yet the Copyright Act does not protect the underlying algorithm — the basic idea of the young man wrestling with familiar psycho-sexual problems in upbeat surroundings. You are perfectly free to sit down and write the same story in your own words — but do not expect to get away with a great soliloquy which starts: "To was or not to was. That was the question".

In computing terms, that is rather unsatisfactory. You might write a payroll program and say:

```
FOR K = 1 TO MAXNUM
do individual payroll calculation
NEXT K
```

and some evil person might take that principle and translate it into:

```
WHILE PERSNUM ⩽ MAXNUM
DO — individual payroll calculation
WEND
```

We can see that is a translation, but the judge might not, and generally, there is a large grey area between the exact words you use to embody an algorithm and a totally different algorithm. Computer programs, much more than ordinary language, can express the same notions in many ways.

What we want is the protection of a patent. That protection is gained by inventing something new, or novel, and then by explaining to the Government, in the shape of the Patent Office, just how to do it. Providing the Patent Office agrees it is novel, no-one else is allowed to sell a device using that principle. Note that it must be a device. You cannot patent a mathematical formula, a form of words, an arrangement of marks on paper.

That would appear to be the end of the matter. A computer program seems to be just those outlawed things, but is it really? Incessant research in the department of constructive jurisprudence at *Practical Computing* reveals that there may be a way.

Let us suppose that you have a bright, patentable idea and wire together some discrete transistors to make it work. The result is certainly a device and can be patented. Suppose that you take an uncommitted logic array and configure it to work like the transistors? A device again, and patentable.

Suppose you abandon the dedicated device route and use a microprocessor controlled by a program in ROM. The ROM is physically changed by programming it, a suitably-qualified person could deduce that and recognise it as an embodiment of your wonderful — and protected — invention. The same program in EPROM is a device, even though the alteration to the basic structure is just in the distribution of charge — and again if the program is in RAM and the charge lasts only a millisecond.

Here, there is a ray of hope — if we sell software in ROM or EPROM it would seem that we could patent — not the program — but the configuration of the memory in which it is held. However, not much software is sold like that. What we want is to patent software on tape or floppy disc.

Well, happily, the 1977 Act rushes to our rescue, though we may be sure that was not the intention of its authors. Section 60 (2) introduces a new way of doing evil. A person can commit "contributory infringement" of a patent if he helps someone else to infringe the patent by, for instance, giving him instructions of how to do it. Now that neatly catches the software pirate.

He sells "instructions" in the form of software which the user loads into the memory of his computer. Once there, the RAM becomes a "device" which infringes the inventor's patent. However, in our market, the infringers are too diffuse to be worth attention. The man we want to stop is the publisher — the "contributory infringer" — who has had the temerity to take our brilliant notion and re-write it in his own code and sell it to an eager world.

It remains to be seen what kind of legal mayhem that idea will create if it catches on. It may well be that the cost of proceeding to a full patent — several £100 will deter all but those who have a very good idea. On the other hand, we may find enthusiasts patenting all kinds of programming notions simply to hold everyone else to ransom.

It becomes increasingly clear that the Government must take a firm grip of the whole software business and settle these questions — and soon.

Software in Japan

The London Chamber of Commerce, with the Department of Trade, is organising a British software fair at the British Export Marketing Centre in Tokyo. It will run from November 9, 1981 for 10 days. Participants will have a stand, equipment shipped-out free and the chance to present a 30-minute paper to an invited audience of Japanese experts — translation is provided by the DoT. We thought that though several micro software houses might like to present their products to the burdgeoning Japanese market, they might not feel up to the £4,000 the trip will cost. There is a possibility that *Practical Computing* might take a stand to present six to 12 packages, dividing the cost between the participants. Is anyone interested? If you are, write to *Practical Computing*, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS or telephone 01-661 3145.

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback—it is your chance to keep in touch.

Avoiding the crash

AN ANNOYING problem in some programs is the division by zero crash, which occurs sometimes most embarrassingly when an apparently-debugged program meets unusual or special conditions.

An easy way of avoiding that trap is to use a find-no-zero function call on the denominators of the program. The FNZ function changes nothing, when very near zero, except it returns a small positive value. The function is defined by:

```
DEF FNZ (D) = D + 1E — 30* (1 — SGN
(1E — 8 * D) ∧ 2)
```

When Poking values to the screen RAM or elsewhere using addresses which are variables or expressions, it is vital to ensure that the addresses stay within the required ranges.

A convenient and safe way of ensuring that is to use a function-needing-limits call on the addresses, where FNL(A) lies between user-specified upper and lower limits UL and LL. Such a function is:

```
DEF FNL(A) = 0.5 * (UL + LL + (A — LL)
— (A — UL) * SGN (A—UL))
```

Jack Pike,
Chawston,
Bedfordshire.

Risk of prejudice

I FEEL I must speak up for re-entrancy and recursion. Boris Allan's article in the December 1980 issue unfairly may have prejudiced many inexperienced readers into believing that recursion is always inefficient and thus to be avoided.

While unwary use of recursion can lead to inefficient programs which may use very large stacks, recursion may be the best way to handle data or algorithms which are themselves defined recursively.

Recursive algorithms should not be used when iteration is more efficient, but can often allow the programmer to leave the deepest analysis of the algorithm to be implicitly resolved at execution time. The Tower of Hanoi is a good example of that.

The programmer of a recursive solution does not need to know that odd-numbered pieces will move clockwise if the total number of pieces is even. He does not need to break down the move number into binary to calculate which piece to move. Nor does he even need an array to hold the current positions of each disc.

He just writes in Pascal this simple program which is easy to write, exceptionally easy to verify, and efficient to execute. Compare this, essentially six-line program, with Allan's 23-line Basic version and I think the merits of recursion become evident.

```
PROGRAM TOWEROFHANOI(INPUT,
OUTPUT);
VAR N:INTEGER;

PROCEDURE HANOI(N,SRC,DST:
INTEGER);
BEGIN
  IF N>1 THEN HANOI(N—1,SRC,3—SRC
—DST);
  WRITELN('MOVE DISC ',N,' FROM ',
SRC, ' TO ',DST);
  IF N>1 THEN HANOI(N—1,3—SRC—
DST,DST)
END;

BEGIN
  WRITELN('HOW MANY DISCS');
  READLN(N);
  HANOI(N,0,2)
END.
```

```
HOW MANY DISCS
3
MOVE DISC 1 FROM 0 TO 2
MOVE DISC 2 FROM 0 TO 1
MOVE DISC 1 FROM 2 TO 1
MOVE DISC 3 FROM 0 TO 2
MOVE DISC 1 FROM 1 TO 0
MOVE DISC 2 FROM 1 TO 2
MOVE DISC 1 FROM 0 TO 2
```

Chris Lasby Taylor,
Brussels,
Belgium.

RAM saving

IN BORIS ALLAN'S article on the Towers of Hanoi, *Practical Computing* December 1980, he suspects that his program would work on a ZX-80. In fact, when there are more than four discs, the display file is exhausted after 20 moves, even if there are no remarks, titles or printing of blank lines.

I therefore searched for a program using less RAM and produced the following — 11 lines excluding input and prints. The program is about five times faster than Boris Allan's — tested by removing the print line and running with D = 7.

```
 10 PRINT "HOW MANY DISKS?"
 20 INPUT D
100 FOR M = 1 TO 2**D—1
120 FOR K = 1 TO D
140 IF M—(M/2**K)*2**K > 0 THEN GO
    TO 200
150 NEXT K
200 LET C = D—K
210 LET A = (M—2**(K—1))/2**K
220 IF C—(C/2)*2 = 0 THEN GO TO 250
230 LET F = 2 + 2*A—((2 + 2*A)/3)*3
240 GO TO 300
250 LET F = 1 + A—((1 + A)/3)*3
300 PRINT "MOVE ";M;" : DISK ";
K;" TO PEG ";F
310 NEXT M
```

I then thought that perhaps ** was not one of the simplest operations within the meaning of Boris Allan's program and recast the program as follows — 17 lines excluding input and prints. That is still about four times faster.

```
 10 PRINT "HOW MANY DISKS?"
 20 INPUT D
 30 LET N = 1
 40 FOR I = 1 TO D
 50 LET N = 2*N
 60 NEXT I
100 FOR M = 1 TO N—1
110 LET L = 1
120 FOR K = 1 TO D
130 LET L = 2*L
140 IF M—(M/L)*L > 0 THEN GO TO 200
150 NEXT K
200 LET C = D—K
210 LET A = (M—L/2)/L
220 IF C—(C/2)*2 = 0 THEN GO TO 250
230 LET F = 2 + 2*A—((2 + 2*A)/3)*3
240 GO TO 300
250 LET F = 1 + A—((1 + A)/3)*3
300 PRINT "MOVE ";M;" : DISK ";
K;" TO PEG ";F
310 NEXT M
```

The first program runs on the ZX-80 up to the maximum the arithmetic can handle — 14 discs — without exhausting the display file. The following amendment improves the listing for large disc numbers.

```
 25 CLS
304 IF M—(M/22)*22>0 THEN GO TO
310
306 INPUT A$
308 CLS
```

Each press of new-line lists the next 22 moves. Stop, of course, by pressing BREAK during computation.

It seems to me that both programs are an improvement on Boris Allan's as they do not use arrays, thus using the same amount of RAM for all numbers of discs. Also, the second program would run on something even simpler than the ZX-80.

Paul Duckett,
Hassocks,
West Sussex.

More forceful argument

I AGREE completely with the main line of Boris Allan's argument in his article on Recursion in the December issue. However, his final example, a non-recursive Basic program to solve the Towers of Hanoi problem, is not nearly as forceful as it could have been.

The following non-recursive program achieves the same result but is less than half as long and uses fewer variables and only one vector.

```
10  PRINT "HOW MANY DISKS?"
20  INPUT N
30  DIM T(N)
40  FOR I = 1 to N
50  LET T (I) = 0
60  NEXT I
70  FOR M = 1 TO 2**N—1
80  LET T(0) = M—(M/3)*3
90 FOR I = 1 TO N
100 IF NOT T(I) = T(I—1) THEN GO TO 120
110 NEXT I
120 LET T(I) = 3—T(I)—T(I—1)
130 PRINT "MOVE";M;":DISK";I;"TO
    PEG";T(I)
```

(continued on page 44)

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• Circle No. 148

(continued from page 42)

```
140 NEXT M
150 STOP
```

A few notes: vector T keeps track of which disc is where, e.g., if T(3) = 2, then the third smallest disc is on peg two, though T(Ø) has a special function.

The main loop 70-140, which is executed once for each required move, works as follows:

- Select each peg in turn. Statement 80 does that by setting T(0) successively to 1,2,0,1,2,0.
- Locate the smallest disc not on the selected peg. That is done by FOR loop 90-110, which exits to statement 120 when the control variable I has reached the number of that disc. That loop always exits like this. It would only end "normally" if all the discs had already been moved to another peg. This never occurs as the main loop, 70-140, always terminates first.
- Move the selected disc to the remaining peg. Statement 120 does that.

The program is written in ZX-80 Basic. In other dialects, statements 80 and 100 might need alteration; also the program will require major surgery if zero subscripts are not allowed.

There is also another, rather different, solution to the same problem which makes amusing use of the GOSUB statement. The following program solves the four-disc version of the problem — no explanations or comments are given, as readers might like to work it out for themselves.

```
1  GOSUB 10
2  STOP
10 GOSUB 20
15 PRINT "MOVE DISK 4 ANTI-
   CLOCKWISE"
20 GOSUB 30
25 PRINT "MOVE DISK 3 CLOCKWISE"
30 GOSUB 40
35 PRINT "MOVE DISK 2 ANTI-
   CLOCKWISE"
40 GOSUB 50
45 PRINT "MOVE DISK 1 CLOCKWISE"
50 RETURN
```

Will Stevens,
Reading,
Berkshire.

Doncaster users

I WOULD like to form a micro users' group for the Doncaster area. The aim of the group will be to provide a forum for ideas for those people in the area who own micros and also to provide lessons in Basic for those who are interested but have no access to a computer.

If anyone is interested, they should telephone Doncaster 784854 or Doncaster 868378 between 6pm and 8pm for further details.

P Flinders,
Doncaster,
South Yorkshire.

Faster Fourier transforms

I READ Ben Rogers' article on the fast Fourier transforms in the December 1980 issue with interest. It is, however, possible to dispense with array T( ) — thereby saving space — by placing the generated data directly into the array RE( ) and using the following subroutine for bit reversal.

```
6000 REM **BIT REVERSAL**
6010 FOR X = Ø TO R
6020 Y = Ø
6030 B = X
6040 FOR V = Ø TO P
6050 Z = INT(B/2)
6060 Y = (Y—Z)*2 + B
6070 B = Z
6080 NEXT V
6090 IF Y < = X THEN GOTO 6130
6100 Z = RE(Y)
6110 RE(Y) = RE(X)
6120 RE(X) = Z
6130 NEXT X
6140 RETURN
```

The subroutine is based on the fact that in the original routine, if T(A) replaces RE(B) then T(B) replaces RE(A), i.e., the two values are swapped. Line 6090 ensures that the swapping occurs only once; also the code for generating the Y values — lines 6040-6080 — has been simplified.

The subroutine could be speeded by storing the Y values in a machine-code array accessed by Peek and Poke statements — that would limit R to a maximum value of eight, however — or by storing them in a Basic array, which would use a large amount of store.

P A Riebold,
Southend,
Essex.

Self-correcting correction

IN THE article on Hamming code in the January 1981 issue, the first paragraph in the first column of page 105 should have read:

- The first correction bit is a parity bit for the first two data bits.
- The second correction bit is a parity bit for the first three data bits.
- The third correction bit is a parity bit for the first four data bits.
- The fourth correction bit is a parity bit for the last three data bits.

The chip numbers for the circuits are:

IC1 7486	IC4 7408
IC2 7486	IC5 7432
IC3 7486	IC6 74157

John Lee,
Loughborough,
Leicestershire.

Sord improvements

WE WONDER why, in your article on the Sord M223 mark II in the January 1981 issue, you should review an obsolete machine which has been out of production for some 10 months.

The M223 mark III which was introduced for the beginning of 1980, has the following improvements over the mark II series:

- The clock speed was increased from 2MHz to 4MHz with the use of a Z-80A CPU.
- An AM9511 arithmetic processing unit — number-cruncher — was incorporated with a clock speed of 2MHz which improves mathematical execution times by a factor of four.
- The disc drives were changed from Micropolis to Teac.

Those improvements enhance the maximum throughput of work for Sord computers. To achieve that Sord has incorporated dedicated controllers for the display and floppy discs and all of the I/O facilities are interrupt-driven. Extensive use is also made of D M A techniques within the computer and the peripheral devices.

P K Warrick,
L E Jones,
Exleigh Business Machines Ltd,
Penzance,
Cornwall.

• We do not accept that the system is obsolete when so many of them are still in use.

Nascom article

IN THE DECEMBER 1980 issue of *Practical Computing*, in your article about Nascom, you associated John Marshall with my company. John Marshall has absolutely nothing to do with the running of any part of my business.

June Marshall,
A Marshall (London) Ltd,
London NW6.

Small-business answer

MY INTEREST in the microcomputer started two years ago when I felt that my company's accounting methods could benefit from the new revolution.

I do not think it unfair to say that, until recently, there have been few, if any, really suitable packages available. However, the time has not been wasted and I have, through your magazine and from a Pet 2001-8, gained a reasonable knowledge of the micro and its applications.

Furthermore, having discussed the problem with many other interested parties, it would seem that as yet, no-one has produced the simple answer for the small business — and yet the answer is simple.

The majority of small businesses in the U.K. use the Kalamazoo or a similar accounting method. All that is required, is a ready-to-go package, which will directly replace this system, remain familiar to the staff operating it, and cost less than £5,000.

Kalamazoo has, of course, recently marketed such a system, but at almost twice the price. It will be interesting to see who will be the first to exploit this ready-made market, now that the hardware is available at a reasonable price.

G D Herbage,
Gnomist International Ltd,
London E17.

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New Minister may give micros welcome boost

COMPUTING should receive a much higher priority in Government plans for industry with the appointment of Kenneth Baker as Industry Minister responsible for information technology. Baker, 46, who is MP for St Marylebone, London, is a long-standing computer enthusiast and has identified computer-related technology as "the key growth sector in the economy".

He replaces Adam Butler and has a much wider brief than his predecessor. He is also, in Civil Service terms, an expert in the field whose related sectors he will be expected to co-ordinate. He is an industrial consultant and has been a Junior Minister in the Department of Employment and the Civil Service Department as well as chairman of the Computer Advisory Council.

He has also been Parliamentary Private Secretary to Edward Heath and is regarded as something of a Tory leftist. In a speech reported by *The Guardian* last year, he contrasted unfavourably Government spending on microelectronics with the cost of supporting the ailing traditional industries such as steel. In the same newspaper, only a week before his appointment, he wrote an article on computer education which attacked Government spending in that area as "woefully inadequate".

In that article, he outlined a program of education which calls for:

- Every secondary school to have a British-built micro within 18 months.
- Several teachers from every school to attend a computer-assisted learning course on computing techniques.
- Every school leaver to have some hands-on experience and understanding of computers and their associated technology.
- Careers advisers to steer their charges away from "pure" science, where there is every prospect of unemployment, towards more directly useful computer-orientated skills.

At present, there are two Government-backed education projects on computing: a £9-million program from the Education Department to provide software and teacher training, which is supposed to cover the years 1980-84. Local education authorities are permitted to apply for extra grants to top up their own budgets. Then there is the Department of Industry Microprocessor Application Programme, which has a £55 million budget.

Kenneth Baker's brief is dauntingly wide: in addition to the high-profile subjects of micro applications, information technology, computer systems, robotics, information technology in space — presumably satellite communications — British Telecom and Cable and Wireless, he also oversees a whole raft of others.

Kenneth Baker MP.

Interface for Sharp

AN INTERFACE unit for the Sharp MZ-80K desk-top computer is now available from Mektronic. It plugs into the 50-way user port to give the MZ-80K eight input and eight output channels for user control. The unit enables the computer to monitor and control systems and display results and procedures.

The output voltage can be within the range 8V to 24V at 300mA depending on the connected supply. The input channels have variable switching point which means that the input voltage switching level can be set at any point between −24V and +24V.

Input/output operations can be performed using Peek and Poke commands. Because the unit does not impare the use of other I/O devices, results can be stored for later analysis or compared in real-time to known limits. Details from Mektronic on (061) 798 0803.

Enterprising sixth formers who started a software company

PUPILS AT a Bristol school will shortly be offering a commercial computer programming service. Sixth formers from the Portway School, Shirehampton, Bristol have formed a company, Software Six, under the national Young Enterprise scheme. Using the school's Cado 20 computer system, they will be writing programs for Cado users and that work will be paid for by the U.K. distributor.

Headmaster John Larkins with Robin Laney, left, and Michael Rees.

Over the past year, the pupils studying computing have played a large part in programming the Cado for a number of school functions, including timetabling, examination administration and pupil records. The next major project will be to computerise the school's accounts.

The three "executives" in charge of Software Six are Michael Rees, aged 17, who is managing director, his deputy Robin Laney, 17, and the financial director, Garry Naish who is also 17. Their job is to run the company as a properly-constituted commercial organisation with shareholders and company accounts. Any profits will go to the school.

Managers from ISC Chemicals of Avonmouth are the sponsors of the scheme and will supply commercial advice when necessary.

Superbrain extra power

MORE disc storage for the Superbrain microcomputer is now available. The previous best was 676Kbytes and that has now been increased to 1.5 megabytes. The new capacity now provides an ability to store up to 8,000 stock items depending on the amount of information held in each.

The new memory system has been developed by the Superbrain distributor Icarus Computer Systems. The Superbrain is an integrated desk-top computer based on the Z-80 chip and running the CP/M operating system. Details from Icarus on 01-485 5574.

Maintenance service

A MAINTENANCE, servicing and repair scheme, which offers full "health insurance" for microcomputers has been introduced by the Micro Computer Centre. The company is calling the scheme The Micro Clinic and it is available to Pet and Apple users within a 50-mile radius of London. Eventually the company hopes to extend the scheme to cover the rest of the country.

For an annual fee of between 10 and 15 percent of the capital cost of the equipment, subscribers will receive regular maintenance calls from MCC service engineers who guarantee that their system will never be out of action for more than 24 hours. Details 01-878 7044.

Administrative dog's-body for vets in form of Verifac system

VETS ARE the latest professional group to be offered the benefits of microcomputers with the release of a package to store animal records. Verifac, produced by B & I Systems of Stroud, Gloucestershire, has been designed to hold complete animal records which can be updated at each visit. Animals can be located by name, not code, and complete owner records can also be located by a rapid search for the name.

The package has automatic invoicing, using up-to-date drug prices, for examination fees and operation expenses, can keep a purchase ledger and calculate VAT returns. There are also vaccination reminders and calculations for the optimum animal feed for fertility analysis and planning.

Verifac consists of a microcomputer with two 8in. dual-density double-sided disc drives, a VDU and a matrix printer. The system can be upgraded to a full multi-terminal configuration with 140 million characters of hard-disc storage.

The turnkey prices start at £8,900 and include the system, program and full training and tailoring to individual requirements. Details from B & I on (0452) 812119.

InPet RS232 port widens range of printers used with Pet

AN RS232 port for the Pet has been developed by Impetus Computer Systems of north London. InPet enables the Pet microcomputer to use a wide range of printers which have the RS232 communications mode. The fully bi-directional InPet allows the Pet to be slowed to wait for the speed of the printer if need be.

All baud rates from 110 to 9,600 are available and the interface can be addressed to the IEEE bus as any device between one and 15. There is also a facility for automatic conversion from lower-case in the Pet to true ASCII lower-case.

The RS232 port is attached to the inside of the Pet and can be installed by a non-expert in about 10 minutes. Variations of the interface are available for all types of Pet from the old 8K models to the new 8000 series.

Further details from Impetus on 01-202 2726.

Guarantee of two years

A TWO-year guarantee on microcomputer sales is something of an innovation in an industry which has traditionally relied on 90 days' warranty. Microdigital, of Liverpool, now owned by the Lasky group, has announced a two-year guarantee on all its Sharp and Apple sales.

Despite the normal 90 days' warranty, most microcomputer buyers now realise that the consumer protection laws cover them for a reasonable period, which is normally understood, by the courts, to mean one year.

'Apple means business'

– who says so?

Mobil Oil Company Ltd. says so . . .

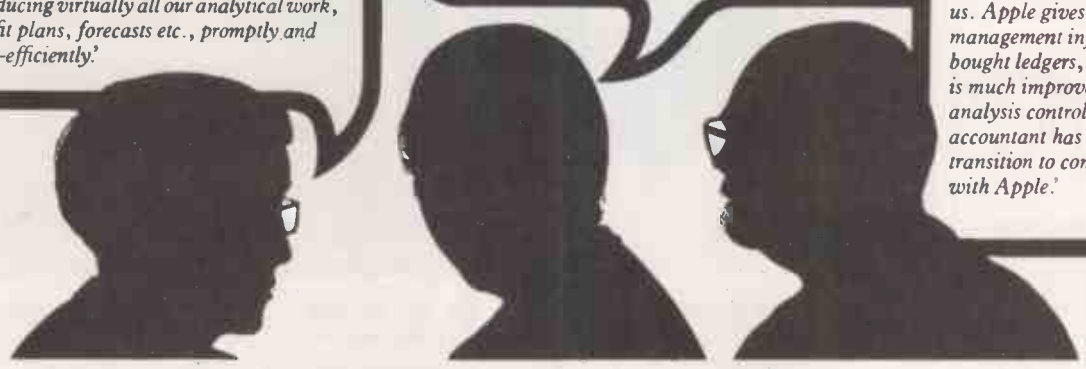
'Just one 48K Apple, VisiCalc, disc-drive and printer enabled us to save over £13,000 p.a. in outside computer bureau costs' states Mobil's Manager, Financial Analysis, Mr E.A.F. Peach. *'With this sort of saving it is hardly surprising that our use of Apples has grown from one Apple to five in under six months. Our trolley-mounted Apples bring the analytical powers of VisiCalc direct to the user's desk; and the simplicity and robustness of the system make it as easy to use as a desk calculator. Apples are now producing virtually all our analytical work, profit plans, forecasts etc., promptly and cost-efficiently.'*

RANK XEROX says so . . .

'If small businesses are to continue trading successfully during the next 10 years they cannot afford to let the business equipment revolution pass them by' observed Mr B.H. Nicholson, International Director of Rank Xerox Ltd., at the recent opening of the Xerox Store, Piccadilly, London. *'This store carries almost everything the small business needs, and that has to include Apple microcomputers, and the software programs that go with them. Our research has identified 500,000 small businesses in the UK: Apple will feature strongly in our service to this mass market.'*

CROWN JOINERY and LAMINATING says so . . .

'Faced with a 100% increase in turnover in our factories in Chesham and Aylesbury, we recently installed an Apple microcomputer in our Accounts Department' comments Mr R.F. Alderton, Partner of the Company. *'The results have been a revelation to us. Apple gives us prompt management information on sales and bought ledgers, our cash flow situation is much improved because of our debt analysis control, and my P.A. accountant has really enjoyed the transition to computerised accounting with Apple.'*



If you direct, manage or control a company or department then the Apple Computer can help you.

Apple means...business software which is available and in everyday use now. Below is listed just a small selection of business management programs available for users of the Apple Computer System:

- **Apple Cashier**
- **Apple Desk Top/Plan**
- **Apple Plot**
- **Mailing List**
- **Job Costing System**
- **Stock Control**
- **Time and Cost Recording**

Accounting Programs for Apple Users:

- **Apple Business Controller**
- **Fixed Asset and Plant Package**
- **Incomplete Records**
- **Invoicing System**
- **Sales Accounting and Invoicing System**
- **Sales and Purchase Ledgers**

Specific professions can benefit too:

- **Agriculture and Business Group Package**
- **Architecture**
- **Contract Costing**
- **Estate Agents**
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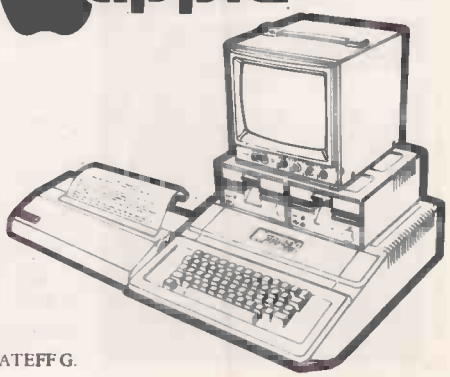

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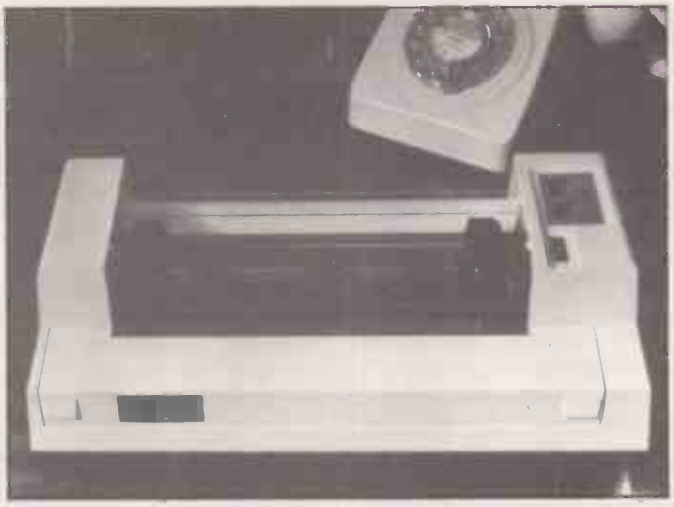
Computing for the unemployed

A £12,000 scholarship scheme to encourage the unemployed to take vocational courses in computing has been announced by the Belair Education Centre. The scheme will also cover other growth areas such as hotel, travel and the airline industries.

The Belair Scholarship fund will be awarding 60 scholarships per year to cover the entire cost to applicants from the U.K. and Europe over the age of 18. Ten of the scholarships will be for applications to the computer industry.

The criteria for winning a scholarship include knowledge of the EEC, real knowledge and understanding of the industry and a definite interest in learning the basic skills necessary to start a career in their chosen field. Details from Louise Lowe on 01-388 1811.



This five-by-seven dot-matrix printer is only 328mm. wide and is claimed to be the smallest plain-paper printer on the market. Manufactured by Seikosha the GP-80 is being sold in the U.K. for £250. The printer has 80 columns and prints the full ASCII character set, graphics and double-width characters at a normal speed of 30 cps. The GP-80 has a wide range of interface options including Pet, Tandy, Apple as well as TTL serial, 20mA loop and RS232. Industry-standard parallel interfacing is supplied with the basic printer. Special facilities include addressable print-start position, one-line data buffer, and mixed standard characters. It is supplied by DRG System Supplies, of Weston-Super-mare, Avon, through local dealers. Details from (0934) 415398.

Human speech digital store

A HIGH-speed printer for the new Commodore Pet 8000 series offers the standard ASCII 96 character set at speeds of 160-characters per second. The 8024 from Commodore will accept paper from 4in. to 15in. wide and is capable of printing an original with up to four copies. The nine-by-seven dot-matrix printer will sell from £1,160.

Commodore has also developed a small, lightweight modem and Communicator I, a software package designed to make the Pet 3000 and 8000 series perform as terminals capable of communicating to host machines.

The asynchronous RS232 Teletype interface has been specifically designed to interface to the Digital Equipment Corporation PDP range of hardware. Communicator I will also interface to other processors with some custom modifications.

The Commodore 8024 printer.

Those modifications may be relatively simple where, for instance, only the ESC sequences differ from the DEC definitions, but where the file-sends/receives protocol on the target host is different, it may involve substantial alterations. The system should reduce log-on times and transmission costs.

Venture-capital plan in jeopardy after NEB management changes

THERE were signs at the end of last year that the Government is aiming to lighten the load on small businesses and is prepared to underwrite bank loans, particularly for "new technology" firms.

Yet one specific scheme to bring U.S. technology and marketing experience to underdeveloped U.K. areas may be threatened by the state of flux within the National Enterprise Board, NEB. Four key members of the NEB, who agreed the deal with Jack Melchor, a "Silicon Valley" venture-capital specialist, left the NEB shortly after the scheme was finalised.

Small business users were hoping that one part of the Queen's Speech, which outlines Government legislative plans for the following session, indicated that a scheme to provide Government underwriting for bank loans to small firms "to permit (them) to expand and prosper" was on the cards. Yet Department of Trade officials denied that any specific measure was under consideration of any kind at that time.

The NEB had already reached a reasonably specific agreement with California-based Jack Melchor to develop new advanced-technology businesses in the assisted areas of the U.K. The aim is to find U.S. technological developments which can be exploited in development areas in the U.K. to replace jobs lost in traditional industries.

NEB has assigned £2 million for the creation of a wholly NEB-owned venture-fund company, Anglo-American Venture Fund, and a management company owned jointly with Melchor, Anglo-American Venture Management. The object is to market proven U.S. electronic products in the U.K., either by paying licensing fees, by acquiring all rights or by allowing U.S. companies a share in new U.K. companies. One of the areas which particularly interests Anglo-American is computer peripherals.

Although Melchor has had direct dealings with Industry Minister Sir Keith Joseph, his day-to-day dealings will be with the NEB whose chairman Sir Arthur Knight resigned shortly after the deal with Melchor was announced — along with deputy Sir John King, and Sir Robert Clayton and Alex Dibbs, four from the board of seven.

Less than a year previously, the full board headed by Sir Leslie Murphy resigned over the Rolls-Royce issue.

Vector Graphic now has high-resolution board

A HIGH-resolution S-100 bus graphics board for the Vector Graphic microcomputer has been released by the U.K. distributor Almarc Data Systems. It can be used with the standard Vector Graphic 8K RAM memory board.

The graphics board is designed to output either a 16-level grey scale or digital displays in composite video — 128 by 120 and 256 by 240 picture elements. In text mode, the multiplexed memory becomes free for general use.

A new 56K RAM addition to the Vector Graphic range of microcomputers has been announced. The VIP, Vector Intelligent Partner, is based on the Z-80A chip, has an S-100 bus and will run under the CP/M operating system. It will be sold for about £2,125 with a 315Kbyte floppy drive.

Keyboard sounder for ZX-80 removes data-entry problem

A KEYBOARD sounder for the Sinclair ZX-80 microcomputer has been developed which provides a short audible bleep whenever a valid keyboard entry is made.

On the Sinclair ZX-80, every keyboard entry causes a temporary collapse of the picture on the VDU screen. When typing in a long stream of data, the constant jumping on the screen can tire the eyes as it is at the moment of entry that the user tends to check the screen to receive confirmation that the data has entered. The audible bleep removes that problem.

Power for the unit, the KS-1, is supplied from routeing the computer supply lead via the KS-1. A lead with two 3.5mm. plugs is supplied with the KS-1 together with a signal lead. That is a high-impedance probe and is claimed to have no effect on the working of the computer. The lead is attached to a plated hole already on the Sinclair mainboard.

The KS1 is supplied complete with power-supply lead, probe, wiring diagram from D Bruce Electronics, The Beacon, Blackhall Rocks, Cleveland (0783) 863612 for £12 including P&P.

Catching the MBasic bug

THERE IS a bug in the Microsoft MBasic compiler, versions L-80 3.37 and earlier, which crashes the data areas. While searching for a later version, *Pratical Computing* discovered that Lifeboat Associates refused to disclose the release numbers on the grounds that they are "secret". The only answer is to write to Greg Cox, Technical Support Manager, Microsoft Inc, 10800 NE 8th, Suite 819, Bellevue, WA 98004.

High-speed Pet printer

A SPEECH-processing system which can store human speech in digital form has been introduced by National Semiconductor. The Speech Processor Set is a kit of several integrated circuits through which human speech can be stored and reproduced for applications using microcontrollers.

The technique used is one of waveform digitisation and compression which, National Semi-conductor claims, reduces significantly the amount of memory needed to reproduce speech originating from a human voice. About 100 words of male speech can be accessed, and slightly fewer for female speech.

Only custom vocabulary chips will be made by National Semiconductor and they should be available from June. National has also announced the industry's first 11MHz 8048 one-chip microcomputers. It should let users upgrade the speed of 8040-based systems. Details from National on (0234) 47147.

Medical package which will take pressure off overworked nurses

INTENSIVE care units in hospitals may soon be turning to the Commodore Pet to help them keep track of the fluid levels in ailing patients. The Medicom package, Fluid Monitor, is designed to help nurses measure the levels of blood, urine crystalloids and colloids. Medicom already has a number of medical software programs for the Pet on the market.

During the trials for Fluid Monitor, it was found that with the pressures of work in intensive-care wards, it was often difficult for nursing staff to remember the codes to be keyed in for each fluid and vessel. A digitiser pad has, therefore, been adapted to carry symbols for the different fluids rather than the standard alpha-numeric keyboard.

The nurse places the digitiser pen on the symbols and the Pet displays or prints a record of the patient, the vessel and the current level of fluid. Graphs are also produced to plot the fluids and two patients may be monitored at any time.

The Fluid Monitor configuration includes the computers, the digitiser pen, a cassette recorder and the programs for around £2,000.

Further details are available from 01-579 5845.

Software copyright again subject of inconclusive legal action

THE ISSUE of software copyright had another legal airing at the end of last year when ACT Microsoft combined forces with two U.S. companies to try and stop David Bolton of St Albans, Hertfordshire, from marketing a disc which, they alleged in court, infringed the copyright of their best-selling VisiCalc financial modelling program.

The case has several niceties from the legal and the computing viewpoint. The disc which David Bolton sells is, he claims, only a pre-formatted disc which allows a back-up copy to be made. That, he contends, is in line with proper professional practice, avoids needless expense for the customer if the original VisiCalc disc is damaged, and, in any case, is already offered by Apple in the U.S.

ACT Microsoft, U.K. agent for VisiCalc, which has specific features which protect it from direct copying to blank discs, is obliged to join forces with U.S. sources Personal Software and Software Arts to seek an injunction. An earlier, *ex parte* injunction, failed and on the second application ACT Microsoft also failed to obtain either an injunction or indeed an undertaking from Bolton not to market his pre-formatted back-up disc.

What they did obtain, though, was a "motion" by which Bolton undertakes to "keep a full record of all disposals" — against the day when he might be ordered to compensate ACT Microsoft for any alleged damages. In simple arithmetic, the selling price of a VisiCalc disc — reportedly the world's best-selling computer program and partly responsible for the increased successes of Apple — minus the cost of Bolton's back-up disc. Priced at respectively £125 and £16, that would leave Bolton with a bill of n × £109 where n is the number of discs sold.

U.S. Wordcheck is latest spelling-correction package

THE THIRD spelling corrector program to be developed in 12 months has just been announced by Microcomputer Industries of the U.S. Wordcheck has been designed to run with WordPro 3 and 4 and looks at every word in the letters and documents being typed to search for spelling or typographical errors.

The program contains a spelling list of about 2,000 of the most commonly-used words and suffixes. Any words that do not match the list are highlighted on the screen and can then be passed by or added to a 1,000 word auxiliary list without being re-typed. Wordcheck is available for the Pet 32K disc systems for $200.

IBM has a 50,000-word program which highlights those words it does not recognise and a U.K. company, Southdata has a program called Corrector with a vocabulary of 25,000 to which 20,000 words of your own can be added.

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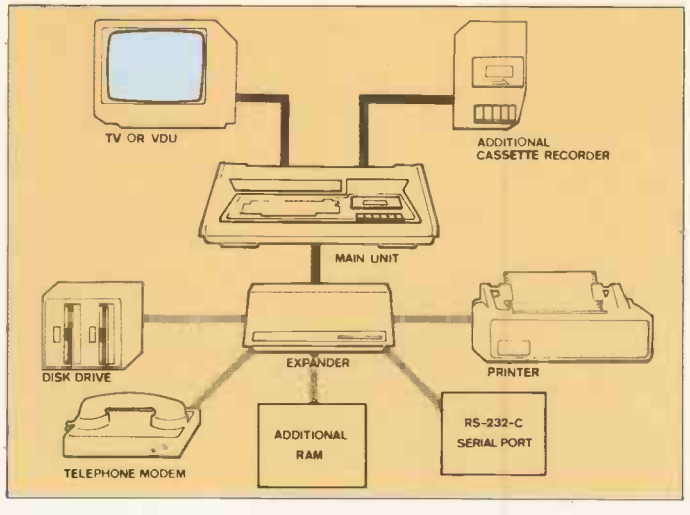

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Microsystems 81 preview

THE CONFERENCE and exhibition season is off to an early start this year with Microsystems 81, at the Wembley Conference Centre from March 11-13. It is the first of the year's events to be sponsored by *Practical Computing*.

As usual, the conference and the exhibition are run in parallel with conference speakers who give explanations of how the products on display were designed while the exhibition provides the practical embodiment of the conference speeches.

One of the themes this year is the use of microcomputers in networks and the more advanced use of microprocessors and

General Robotics Gemini computer.

microcomputers. Some of the best-known names in British microcomputing are displaying their latest products and add-ons including Research Machines, Rair, Comart, Transdata, Equinox and many others.

The personal computing session of the conference, on March 13, concentrates on showing how microcomputers can be used in almost any application. The day begins with a review of the latest hardware and software developments. Then a number of key figures in the microcomputer industry introduce their own ideas on how one "can go it alone" with a microcomputer in business, science and the professions.

There are also discussions on how to set-up a school computer department and devise a suitable computing curriculum. That will be followed by a lecture on computer-aided learning. The final talk on the day is entitled, More imaginative uses of microcomputers, when Peter Laurie, the editor of *Practical Computing*, discusses the uses of graphics, modelling, art, simulation and networking.

The first two days of the conference, March 11 and 12 are devoted to the interest of those involved professionally in the design, development and application of microprocessor-based systems and include a technical overview of the hardware, software and systems design aspects of microsystems.

The first section on March 11 concentrates on the merger of computer and communications technologies in local-area networks and the rest of the morning is devoted to the use of microprocessors in distributed processing. In the afternoon session, you can hear talks on development systems and software.

In addition to the conference sessions, Microsystems 81 will feature professional development courses presented by ICS Publishing, which were such a success at Microsystems last year. The three one-day courses cover the subjects:

- How to start with microprocessors — a hands-on introduction.
- Computer graphics — an overview of hardware and software applications.
- Pascal — the language of microsystems.

There are 110 exhibitor stands at the Microsystems 81 exhibition, shared between about 50 exhibitors. Overall, it seems as though 1981 will be remembered as the year when microcomputers were finally incorporated into networks, those multi-processing, multi-programming, multi-user, micro-based systems which are beginning to emerge as serious contenders in the business computing market.

Many manufacturers are developing their own network systems but already it seems that a popular choice is the CP/Net development which was reviewed in *Practical Computing* in February 1981. CP/Net is one of the systems which will be demonstrated on the Rair stand, number 83, where the new Rair Black Box range III will be on public display.

As used by Rair, the systems with CP/Net, which runs under the MP/M operating system, can support up to 512Kbytes of RAM. Up to 16 serial I/O ports can be added to each model in the range. From basic single-user support, each model can be expanded to provide multi-user, multi-terminal support on a single system or in a network using shared processor and file resources in a multi-computer distributed processing system of almost any size.

Equinox is another company which plans to exhibit a multi-processor, multi-user, networking microsystem and is hoping to sell the idea for educational use. On its stand, number 116, the company is also showing the recently-introduced, cartridge disc-based microcomputer, the Equinox 200.

Research Machines, the Oxford-based manufacturer of the 380-Z microcomputer, is showing its range of add-on boards on stand 2. Of particular interest to laboratory users is the new 16-channel, 10-bit resolution analogue/digital facility which will find applications in the field of data logging.

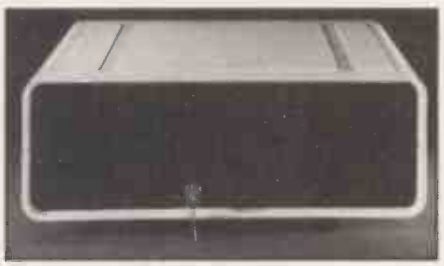
RML is also showing the new 40/80 character VDU board which has software-switching between the two modes, a user-definable character set of 128 characters, smooth scrolling and screen windowing as well as inverse video, dimming and underlining, selectable character by character.

On stand 52, the Bleasdale microprocessor development system will be attracting engineers and others involved in developing microprocessor-based systems. It provides facilities for eight- and 16-bit microprocessors. The Intel 8080/5 and Zilog Z-80 are already supported and others are soon to follow including the Motorola 6800, 6809, and 68000 and the Intel 8086/8088.

Also of interest to industrial users is stand 47 where Bowthorpe Microsystems is presenting a working demonstration of micro techniques in an industrial environment which is expected to include mechanical sorting, placements and administrative control.

Another of the new British microcomputers, the Comart Communicator, is on display and demonstration on stand number 17. The Communicator CP100, which was officially launched towards the end of 1979, has been designed round many of the standards which have emerged in the microcomputer industry; a Z-80A chip, S-100 bus and CP/M. There are slots for an additional seven S-100 cards.

Among the other exhibitors is Anadex, on stand 102, showing its latest printer, the DP-9500, reviewed this month in *Practical Computing*. On stand 89,



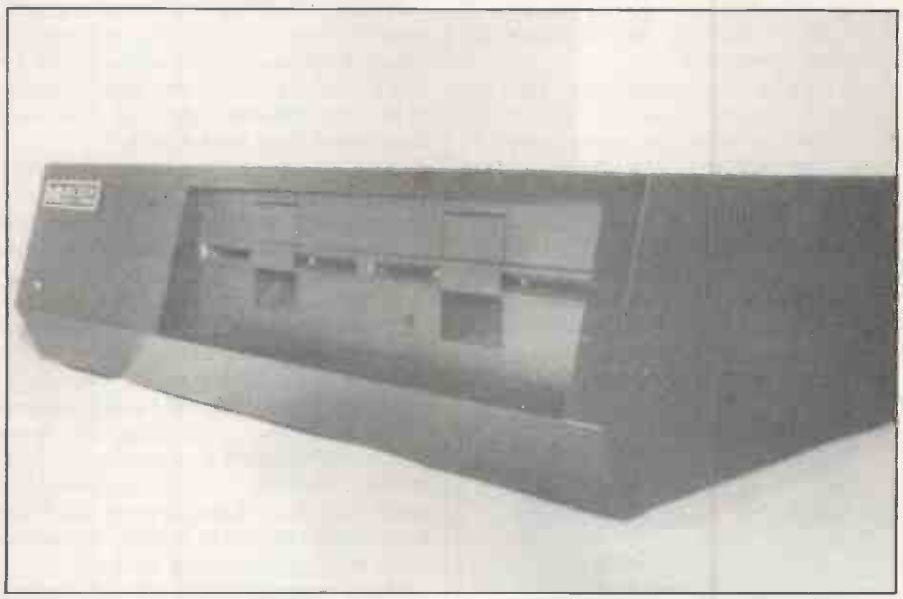
The Comart Communicator.

Wilkes Computing has the latest in the General Robotics Gemini range of microcomputers. The SuperGemini has a built-in 8in. Winchester technology hard disc and a single 1.25MB floppy drive. It retails from about £8,000. The system is based on the LSI-11/2 chip.

U.K. microcomputer and terminal maker Transdata is showing the new CX-500 range of microcomputers on stand 25 and on stand 68 Microscope will have the Telema 1000 system.

All in all, Microsystems 81 is an excellent occasion for keeping informed of the latest ideas and developments in British microcomputing. Admission to the exhibition will cost only £1 — *Practical Computing* readers can visit Microsystems 81 for 50p using the coupon on page 213 and tickets for the personal computing day of the conferences, on March 13, will cost £10 + VAT.

Rair Black Box 3/20 has stylish 10Mbyte Winchester



ONE OF the more distinctive microcomputers of the last few years is the Rair Black Box. Anyone who has seen it, either in the flesh or in pictures, will be familiar with its hi-fi-look design.

Based on the 8085A chip, it has proved one of the more durable of the eight-bit micros. The version with which most people are familiar has two 5.25in. discs mounted horizontally on the right-hand side of the case and three push buttons on the left.

Most systems sold have the dual-density, doubled-sided drives, giving 268Kbytes of unformatted disc space. The system can run under the standard CP/M operating systems, which, by now, must be familiar to most readers of *Practical Computing*.

The world of the micro has advanced relatively little since the dramatic introduction of the eight-bit CPU four or five years ago. Since the availability of the

by Nick Horgan

early micros — the best known of which in the U.K. is Altair — and their popularisation by the heavy marketing of companies such as Tandy, Apple and Commodore, there has been an explosion of machines in business use.

While the speed and capability of the processor has generally proved adequate for the majority of business users, the capacity of the disc drives has been lacking. As stated, the original Rairs were supplied with either single or dual-sided 5.25in. floppies that provided a maximum capacity, on two drives, of around 500Kbytes of usable disc storage.

Normally, half of that would be occupied by system utilities and application programs, allowing only 250Kbytes for file storage. For most commercial uses, that amount of storage is a real handicap. One of the other problems of the floppy disc is its slow speed in accessing a piece of data.

Early programs were designed using the same file techniques introduced for tapes. As the data transfer rate for floppies is many times that of cassette tape, their speed advantages were obvious. However, as file-access methods became more advanced, and the diskettes were asked to do more and more, their inherent slowness soon caused designers to look for better methods of data storage.

The problem of low storage and slow access times really came to a head with the introduction of multi-user software running on micros. Suddenly, there could be up to six or more users all trying to access data on the same disc drive. For all practical uses, a floppy-based business system can never support more than two or three users.

As in most problems of the micro world, that restriction had been faced, and overcome, in mainframe computers. The first disc drives available on mainframes had been, what is known as, hard discs. Those are expensive, heavy and environment-sensitive, and are not really suited to microcomputer users. Current capacities of that kind of disc are in the region of 800Mbytes with access speeds many 1,000 times faster than floppies.

As an aside, it was because of the expense of hard discs that IBM started using floppies for various housekeeping routines on its larger machines. The development of those floppies, by IBM, was a major force behind the availability of the current microsystems in business.

So, to overcome the inherent problems of micros, the industry was forced, once again, to turn to the mainframe world for a solution to its problems.

Disc performance

IBM had, of course, been investigating and improving all aspects of hard-disc drive performance. Gradually, various versions of that development were included under one heading, and known to the industry as Winchester Technology. Like all seemingly dramatic steps forward, and the Winchester is no exception, most of those advances are the results of a steady investigation into the various engineering problems.

To give one easily-understood example with the Winchester disc of the way the engineering problems were overcome: there are three major ways to increase the amount of data stored on a given bit of magnetic media, be this a disc or a UCR or a simple tape recorder.

- Increase the quality of the media.
- Increase the speed at which the media passes the read-head, or, vice versa, or in the case of some VCRs, both.
- Decrease the gap between the read-head and the media.

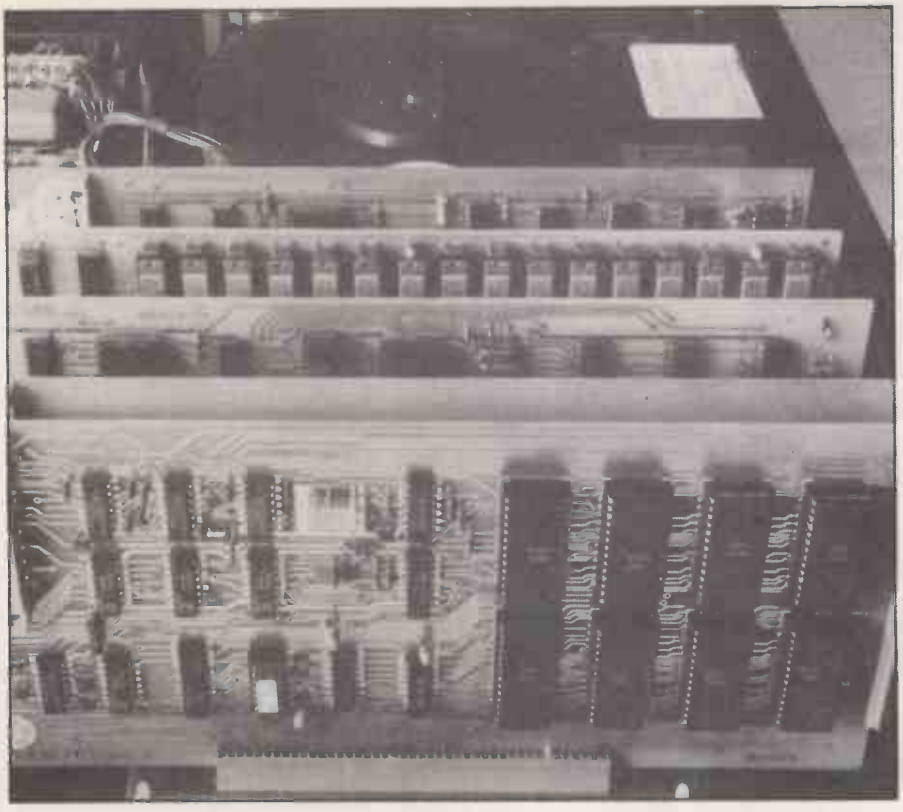
Let us briefly consider the second and third. For the normal tape recorder, the head touches the tape. Now for a tape which moves slowly and which passes under the head only once, that is acceptable.

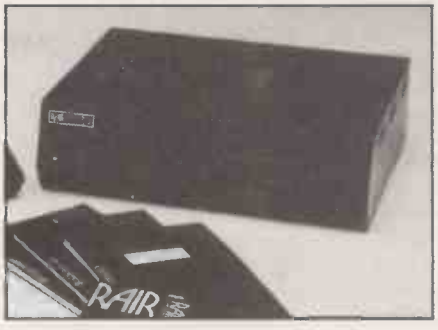
However, for a disc which is moving at up to, 3,600 rpm., and where the read-head is over the same bit of disc for long periods of time, that is not good enough. You would soon have a worn-out disc and a worn-out head. For those of you with a VCR with a pause button, that is why it turns itself off after a few minutes.

The problem is, therefore, to hold the head as near to the disc as possible without touching it. Various mechanical methods were tried but all proved to be lacking in one way or another. The solution was eventually found in the way that a rotating surface will drag air around with it. Obviously, the amount of air being dragged varies with the proximity to the surfaces of the disc.

The read-head was designed as a sophisticated wing section and allowed to float on top of that boundary layer of air. That method allowed the head to fly so close to the surface of the disc that recording densities could be dramatically increased.

However, if a small particle of dust settled on the surface of the disc, the dis-





tance between the head and the disc itself was so small that the head would crash into the disc. To overcome that problem required a power filter, which in turn required a bigger power supply, and so on. However, those problems were gradually solved and two years ago, Winchester discs began to appear on the market.

The advantages they have over floppies are:

- Increased data-transfer speed
- Increased head-movement speed
- Increased capacity
- Better reliability

and over the traditional hard disc:

- Smaller per byte
- Consume less power
- More environmental tolerance

However, it is only in the last year that they have been judged reliable enough for every-day usage.

The new Rair Black Box 3/20 now has a stylish addition. Designed in the same way as the processor, Rair now markets a 10Mbyte Winchester disc which can be attached to its basic processor range. Although some Winchesters are designed to fit into the same space as a floppy, Rair has decided, in my opinion wisely, to house the drive in a separate black box.

In sharp contrast to the floppy drives, when you look at the inside of the Winchester drive you see that all the innards are enclosed in an hermitically-sealed plastic case with the ominous warning that if the seal is broken, all warranties will be void.

Ribbon cable

Also, great care must be taken if you intend to move the drive without employing the head-locking screw. Prior to shifting the drive, you must remove the cover and lock the head carriage manually to avoid the head hitting the disc surface should it be tilted during carriage.

The drive would normally be placed under the processor box with a single ribbon cable between one and the other. Apart from these physical considerations, the user can assume he has a very fast, large-capacity floppy.

At the same time as graduating to hard disc, Rair has also gone to a multi-user operating system. Indeed, without the hard disc, a multi-user system would not really be practical in a normal business environment. The Rair 3/20 still runs under CP/M, but uses an enhanced version of CP/M 2.0 with additions for the multi-user capability.

The most significant operator provided is USER. Each user is allocated a number, and all files created under a given user are allocated the relevant user number. For example, an attempt by USER 3 to erase, ERA, any of USER 4 files will be blocked by the operating system.

The whole CP/M system has been enhanced to allow for multiple users. The PIP command allows the addition of user number to file names, to transfer files between users. The system supplied with the Rair is CP/M plus and will support the following functions:

- Four floppy drives.
- Eight hard discs.
- 16 serial I/O devices.

All I/O is under buffered interrupt control.

In addition to the 16 RS232 ports, an IEEE488 is provided to allow communication to most popular devices such as plotters and instruments. All the standard CP/M software is available; the review system had Fortran, Cobol, MBasic and Wordstar.

My only real criticism was the VDU supplied with the system. To my mind, it cheapened the overall impression of the system and, when it broke down, I was relieved to be able to substitute a Visual 200 terminal.

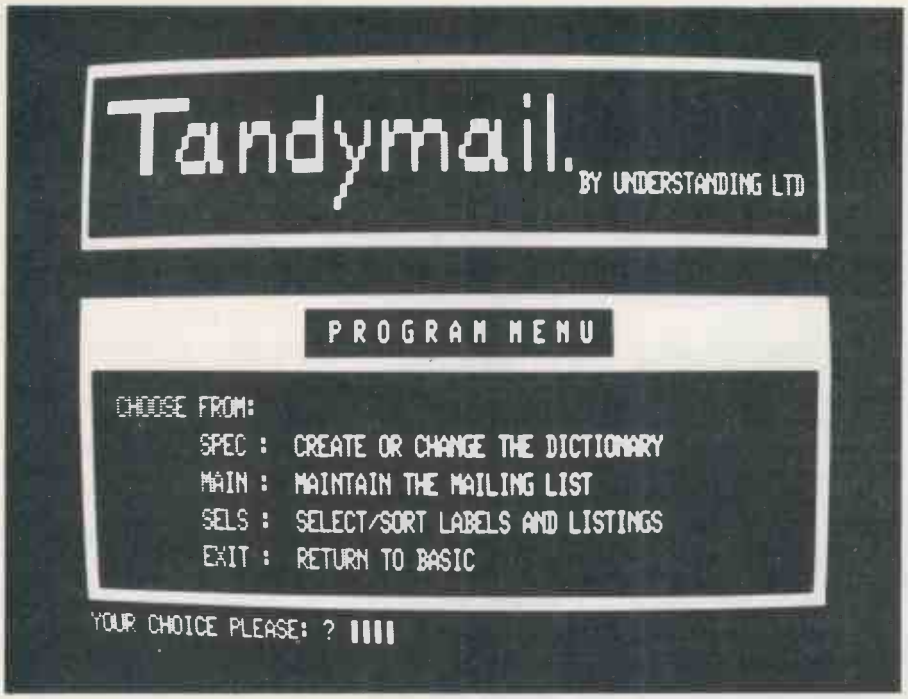
One of the problems with Winchester discs is that of backing-up your data. CP/M provides, via the back-up utility, a number of methods for overcoming the problem. From the point about not opening Winchester drives, it follows that, unlike floppies, the Winchester has a fixed disc. That means that all copies of your data must be on to floppies.

The Winchester contains 10Mbytes and the floppy .25M bytes, wherein lies the problem. As you can see, copying a whole disc requires at least 20 floppies, and the chance of doing that without errors is remote. Back-up allows the system to copy selected files to a floppy in various ways. The user may select files by name, user, or user and name. In addition, the system can be asked to only copy files which have changed.

Although the facilities in back-up help a good deal in the way they permit copies to be taken, I shall never be happy about Winchesters until a method is available to copy the whole disc to another disc, or tape, in under 10 minutes with no operator intervention.

Conclusions

- **A very attractive and well-designed system to which the addition of the hard disc is very welcome.**
- **As far as one can tell, the multi-user version of CP/M seemed well designed and worked.**
- **It is, of course, impossible to tell how the system will work with a large number of users.**
- **The power supply is of the high-voltage, switching type, of which I have seen many criticisms — mine, in fact, failed with a very satisfactory, and loud, bang.**
- **Nevertheless, the system works and is exceptional in that for most manufacturers, hard-disc systems are just a gleam in their eyes, while I have been able to use the Rair offering with success.**



Tandymail follows your instructions to the letter

by Ken Smith

TANDYMAIL is a mailing-list program and the hardware requirements are a Tandy TRS-80 Model 1 with Level II Basic and a 32K expansion interface — 48K total — a line printer and two disc drives. Tandymail is supplied on a standard 35-track, 2.3 TRSDOS diskette with the master files Spec, Main and Sels. The program generates Dict and Mail on a formatted disc in drive 1 as data storage. It allows storage of individual and company names, addresses and postcodes and keeps them updated. It also sets-up mailing lists with supplementary dates, values, codes, numbers, descriptions.

Four separate formats for the screen and printer are provided:

Labels : for mailing or any other use.
Index list : provides a check on mailings or as an index list.
Summary list : a complete, but highly-compressed, listing of all or selected addressees on file.
Full list : an easy-on-the-eye but heavy-on-paper listing of addressees in a highly-descriptive format.

You have full control over which labels you print using a very flexible sorting procedure for any of the supplied fields or one of the 20 optional user-defined areas. You can also have any number of copies of a label on a wide variety of label formats and there is a facility for bulk entries and alterations.

The package is supplied in a quality A4-sized ring binder with a disc and 86 pages of superbly-printed cartridge paper. The initial horror of the thickness of the documentation is replaced quickly by relief as the clear logic of the presentation emerges. The manual is divided into four sections:

- Part 1 : an introduction demonstration of the main facilities so you can practise and become familiar with the system before risking live data.
- Part 2 : is a basic guide to the computer, the programs, discs, operating rules, conventions, disc cataloguing and security of data. I would put this overview as part 1. It is well presented and gives plenty of hints on the system, even for an experienced computer user.
- Part 3 : the main user guide — a step-by-step explanation of every feature of Tandymail, in the logical order of use.
- Part 4 : master copies of all the forms required for setting-up and maintaining the program.

An initial 'Load And Go' with the programs copied over to NewDOS was a disaster. The programs are supplied on TRSDOS because it will only run on TRSDOS. Within each module is a machine-code check-sum routine to ensure an error-free load. Because of differences in the two DOS loading routines, there is a problem. You must, with the program as supplied, use TRSDOS.

The dictionary defines the format and contents of the records on a particular mailing list. Kept separate from the main data file, it is used every time the program needs to display a particular record. The format of the name and address portion for each record is fixed and the user has the option to define up to 20 extra fields to his/her own specification.

You must first define a four-character code and a name for the particular list you are building. You then define its dictionary on the form provided. You may use up to 20 fields, labelled A to T inclusive and each field may be up to eight characters in length. The maximum number of characters is 100. There is the facility for defining each field as a number, date or string and the process is straightforward. The screen display during that process is very helpful and the input routines are foolproof.

The possible uses of these extra fields are legion. Some examples might be:

Telephone numbers — one field for the exchange and the next for the number.
Date of the last mail shot sent or last reply.
Contact name — one or more consecutive fields.
Codes relating to geographical region.
Codes linking one addressee with another.

It is important to realise that the dictionary formats only the particular information which will be requested when the mailing list is assembled or corrected. No data is entered at this stage. Also, the limitation of eight characters per field is not as restrictive as it at first seems. Two or more fields can be strung together to produce a large entry.

A little thought in the design of your directory can prove a bonus later. Just because you design a field does not require you to fill it on the first run. There is a bulk fill/change facility to do that later. Also, the directory can be modified — but considerable care must be taken with that function or you risk a messy format — changing the directory does not change the mailing list data; just its format.

Once the design is completed, you can enter it using the Spec option from the main program. I had a little problem here — the door on drive 1 did not close properly. So, after typing in the directory, I requested that it be saved. The program informed me that it had done so and, returned to the menu. That form of error is indicated within Basic and can be

trapped easily. Because my drive 1 was not on-line, nothing was written, but the program ignored that — a small point which, I understand, is known to the authors and is corrected on later copies.

Once the dictionary is written, saved and known to the program, the mailing list can be assembled. That is achieved through the main program. There is a useful option; you may call the dictionary for this mailing list and display it, either to the screen or printer, to refresh your memory before entry begins.

The entry process is very straightforward, each field — fixed or optional — is prompted and a rather attractive cursor routine informs you of the number of characters allowed or expected. An (ENTER) alone will skip that particular field if you do not wish to add information at that point.

Each addressee is given a number within the mailing list. You can either define that yourself during the building phase or allow the machine to select the next available. Those numbers are used in the amendment section, where the record for any particular addressee can be called and amended as required. The creation

```
1 REM TANDYMAIL "MAIN" PROGRAM & MASTER MENU, BATCH 01
2 REM COPYRIGHT (C)1980 UNDERSTANDING LTD.
3 REM EDITED BY P.S. 6 AUG 80
4 GOTO 92
5 IFLEN(EN$)<SITHENEN$=EN$+STRING$(SI-LEN(EN$),32)
6 RETURN
7 FOR LY=1TO5:LM$(LM,LY)=LU$(LY):NEXT:RETURN
8 IF LEN(U$)<SITHEN U$=U$+STRING$(SI-LEN(U$),32)
9 RETURN
10 PR$=B$(21):NM$=B$(22):A1$=B$(23):A2$=B$(24):A3$=B$(25):A4$=B$
(26):GP$=B$(27):RETURN
11 EP=963+LEN(QU$) : PRINT @960, CL$ QU$;: RETURN
12 EN$="": PRINT @EP-3," ? ";
13 PRINT @EP,STRING$(SI,138);: CU=EP
READY
>_
```

date and last amendment date for any addressee is updated automatically by the program.

The use of the summary listing — using two lines per addressee — and the index listing — one line — are obvious. Once a mailing list is completed, a listing gives a fast reference for amendments. If a listing is called at this stage, the order will be dictated by the logical numbers assigned during input. However, the real flexibility of the program shows itself with the way that the records can be sorted into a defined order or priority before printing either a listing or labels from it.

The facilities for choosing and ordering records are contained in the Sels program. Before making any selections from the mailing list prior to sorting, printing or making bulk changes, the program needs to know the rules it should use to make those selections. Once those rules are defined, Sels will check the whole list to extract those records which pass the tests.

The specifications are defined as a series of tests. Each series of tests is known as a set and to access the selected list, an addressee must pass all the tests within one set. Each set can contain up to six tests and there can be six sets in all. Another way of thinking of that is to view the tests within a set as being 'and' and the sets 'or' conditions. Each addressee must pass at least one set to enter the list.

Any of the items in an addressee's record can be tested in the selection process. The standard items have the numbers 1-9 and the user-defined fields the letters A-T as in the dictionary. The standard items are numbered so:

1. Prefix
2. Name
3. Address line 1
4. Address line 2
5. Address line 3
6. Address line 4 — locations
7. Post code
8. Creation date
9. Last change date

For items 2-6, only the first eight characters are used. Dates are re-structured in memory so that logical tests work correctly — 12/09/80 is less than 09/12/80. Here are the tests which can be applied:

EQ (OR =) Addressee value equal to test value.
NE (OR <>) : Addressee value not equal to test value.
GT (OR >) : Addressee value greater than test value.
LT (OR <) : Addressee value less than test value.
GE (OR >=) : Addressee value greater than or equal to test value.
LE (OR <=) : Addressee value less than or equal to test value.

Each of the above requires you to enter a specific value for the test.

The two range tests allow you to define either:

- Addressee value greater than or equal to a lower limit and less than an upper limit.
- Addressee value less than the lower limit or greater or equal to the upper limit.

Although a little confusing, if presented in that way, with the tests, you may extract the addressees you wish from the list. Extracting a list of people who are vegetarians, purchased a Model 1 4K Level II on the fifteenth of any month, keep bees and subscribe to *Practical Computing* by bankers order is quite possible. Indeed, the amount of trouble to do that is zero which, by a strange coincidence, is exactly the number of people which the test extracted from my list.

The Lab option is available from both the main program and the selection routine. The only difference is that the reference number produced with each label will contain, not the logical record number as on the main program, but a number relating to the selection set that it passed to be on the list. The formatting ability of the routine is very good. It is capable of printing correctly on to all the types of labels I could find to fit my printer.

Tandymail is a well-written, carefully thought-out piece of software. It has a wide range of useful options for the serious and casual user alike. The ability to define specific user fields is a powerful plus and the bulk change options make for easy maintenance.

The most powerful feature is the sort and selection. In these times of rising mailing costs, it is essential that only suitable people are selected. The ability of the program to sort each field and then select from it is a very large plus. It sometimes takes a little time, as the sorts are in Basic, and it does not store the sorted file on disc but they are not really important problems.

Its failure to trap simple disc problems is rather a minus on the programming side, but I understand that is fixed and will be available on new copies. That should be read in context though, as it is the only fault in programming I could find in the time I have been running the program.

I particularly liked the documentation and screen presentations. Both were clear and uncluttered. The new and experienced user would have no real problems making full use of all the wide range of facilities offered.

Understanding Ltd is a small, London-based software company better known for its business simulation package Corplan. Understanding's activities are varied, from bespoke micro software for Industry to general packages such as Tandymail, Corpac and Corplan/Corplan II. Interestingly, the two founders of Understanding were lecturers in business studies at a London polytechnic who, after writing an embrionic version of Corplan on the college mainframe, caught the micro bug and decided to transfer it to the TRS-80.

Now that Tandy has introduced lower-case characters on the Model 1, Understanding Ltd has introduced a new version of Tandymail, the Tandymail 1, which will incorporate lower-case characters and a number of other improvements such as self-booting.

Conclusions

- **The documentation is very good. It is easy to follow and presented in a logical order.**
- **The use of the screen is clear and uncluttered.**
- **The use of the printer is flexible and offers many time and paper saving options.**
- **The package possesses suberb flexibility.**
- **The sorting is a little slow, but very powerful.**
- **The programming is bug-free, well-written, and easy to follow.**
- **Considering the flexibility offered in user-formatting 325 records per data disc, the use of discs is good.**
- **A special mention of the use of DOS is needed as the program runs exclusively under TRSDOS. I realise many owners use NewDOS or VTOS 3.0 and they will have to do a little REMing to allow the program to function under their systems.**
- **The most powerful and well-presented mailing list I have encountered for the Model 1.**
- **I am sure that it will fill the requirements of most medium and all small businesses or organisations.**

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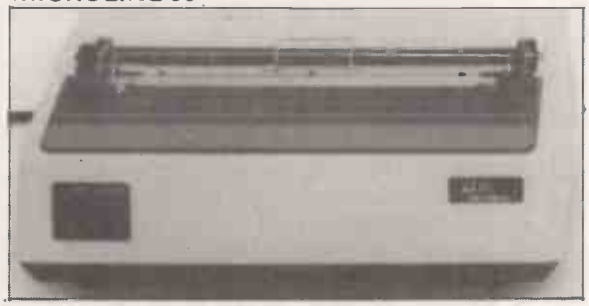

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• Circle No. 155

This 14-page special feature on word processing begins with a survey of four of the most popular word-processing packages which use the CP/M operating system — Auto Scribe, Electric Pencil, Magic Wand and WordStar. The author, Larry Press, runs the Small Systems Group in Santa Monica, California, which publishes product evaluations. Our regular software reviewer, Mike McDonald, studies Wordcraft 80 on the Pet 8000 and Dennis Jarrett assesses the word-processing module on the Exidy Sorcerer.

Four CP/M-based packages which spell document efficiency

by Larry Press

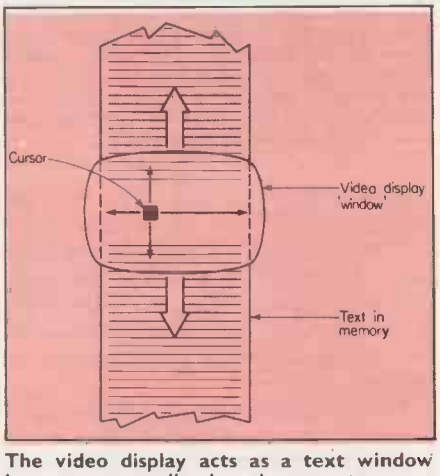
THE FIRST step in shopping for word-processing software is to ask yourself what you plan to do with your system. A small business which sends out much repetitive mail will want different features to those needed by a journalist who uses a word processor to write articles. Let us consider some people who might use a word-processing system.

An author could use a system to write and revise relatively lengthy documents such as articles, stories, and proposals. An author keys-in a large quantity of text and makes repeated revisions, so there is great interest in editing features. It is an advantage to be able to move the cursor quickly around on the screen and to have a system which scrolls the text rapidly. Deletions and insertions must be simple and quick.

Print-formatter features, such as the ability to read names and addresses from a disc file at the time a document is being printed or being able to vary the printout depending on what an operator keys in response to a arcane prompt, are not important to the author. On the other hand, some print-time features such as automatic page numbering, headings, and footnotes are important.

The marketing manager of a small business will use the word processor in a different way to that employed by an author. He may wish to send a new product announcement to 150 magazine editors or send a personalised letter to 3,000 past customers. Since the announcement or letter is fairly short and a new one is composed infrequently, the manager can live with an editor which is a little slower and more confusing to use. On the other hand, the kinds of print-formatting features which are of little interest to an author are critical to the marketing manager.

That formatter should be able to accept inputs like names and addresses from customer files on the disc or from the operator while it is printing. Features which give a degree of programming flexibility are important in such cases. For example, the marketing manager's system may be used to generate different letters for different people in the customer file, so the print formatter must be able to read information into variables and then test their values.



The video display acts as a text window into memory, allowing the user to see a portion of the text at a time. Within that area, the cursor can be moved round to add or delete information.

If the word processor is used to prepare and maintain mailing lists and other data files, there will be interest in having a system which can prompt the operator and which can write to the disc, as well as to the printer.

A secretary falls somewhere between the writer and the manager. In general correspondence, many one-off documents are composed. However, they will be relatively short and will not be subject to much revision. Therefore, editing features will be somewhat less important to a secretary, and it is acceptable if the system is slower when editing long documents.

While each letter is individual, each has a relatively similar format — date, address, salutation, body, etc. So, features which position various parts of a letter automatically are useful. Being able to display a close approximation of what will eventually be printed is also handy for that type of work, as is the ability to print copy without saving a file on the disc or leaving the editor to run a separate formatter.

A word processor may be used to prepare camera-ready material for printing. In that case, the documents will be large. Like an author, a newsletter writer will be interested in editing features during input and while correcting typographical errors, but will not spend as much time on revision. On the other hand, there will be more interest in print-formatting features.

Crucial ability

In composition, the ability to utilise the special features of the system printer is critical. For example, proportional character widths — i.e., wider spaces between wide letters than narrow ones — precise control over the distance between successive lines, bold printing, superscripting and subscripting, and justification — i.e., aligning the left- or right-hand edges of the text, as in a newspaper text column — are needed.

In addition, it is convenient for a newsletter writer to have control over formatting at the time of printing, in case trial and error is necessary. For instance, if an article is printed and it is discovered that it is slightly too long as formatted, the composer might want to reprint it with 1/48in. less space between each line. Again, it is useful to see a good approximation of the way the material will eventually be printed while it is being edited.

Software is the most important step in assembling a word-processing system, so

(continued on next page)

(continued from previous page)
be sure that whatever hardware you choose is compatible with the program you select. If you buy from a dealer, make certain that he will assume responsibility for starting the software running on your system.

If you attempt it on your own, the software manufacturer should be contacted to be sure that the hardware you plan to buy is compatible with its program. The ideal situation is to gain hands-on experience with your hardware and software before buying it, but that is not always possible.

With that background information in mind, let us look at four programs. I have used each of them for at least a month and have used them all for real work and a detailed comparison of 164 features was made — see table 1.

Auto Scribe has been designed for the computer novice, and has been kept relatively simple. The manual assumes no knowledge of computers. It is the only package in which the operating system, i.e., the internal controller program in a computer which takes care of the many technical details involved in computer operation, is even hidden from the user. When the system is set-up, the operator is presented with a menu list on the screen, and may choose to create, revise, or view a document or perform disc operations. Disc operations include copying files, deleting files, displaying directories, etc.

Creating, revising, and viewing of documents differ only in the way files are handled. In creating a document, a new file is produced. In revising a document, an old file is revised and a second file with a new operator-assigned name is created. When viewing a document, it may be altered, but no disc-file changes are made. In all cases, the operation of the editor seems to be identical.

Disc-to-memory transfers

When working with a file too large to be contained in the memory buffer, portions of it must be kept on the disc and brought into memory when needed. In keeping with the goal of serving the computer novice, those disc-to-memory transfers are handled automatically in Auto Scribe. Once a portion of a document has been automatically written on the disc, it is impossible to return to it without re-starting the operation.

The editor and print formatter are integrated into one program. A document is printed by turning the printer on while scrolling through it a screen at a time. The editing philosophy leans toward on-screen formatting prior to printing, though a number of formatter commands are used.

Electric Pencil is the grandfather of personal computer word processors — it has been available for several years. Like Auto Scribe, the system is designed for easy use by the novice. When the system is activated, it is in editing mode and it is possible to enter and revise text. To print material or perform disc operations, you strike a control key to switch modes. To return to editing after printing or disc operations, you strike the escape key.

The print formatter and the editor are fully integrated. At any time, it is possible to stop editing and print all or part of the text or to stop printing and resume editing.

When a document is revised, you must explicitly save the new version. You are free to re-name it, but if you use the same name, no back-up copy is kept. If a document is too large to reside in memory at one time, it must be broken into several smaller documents since Electric Pencil makes no provision for such cases.

Electric Pencil is able to operate only on systems using DMA video displays. Each of the others is capable of using a terminal as well.

Magic Wand, like WordStar, is considerably more ambitious than either Auto Scribe or Electric Pencil. It has more editing capability than either of the former packages, and many more print formatter features. The editor and main print formatter are two completely separate programs; however, the designers of Magic Wand have compromised by including a rough-draft print routine in the editor.

Word processor	Editor	Print formatter
Auto Scribe	20	19
Electric Pencil	30	24
Magic Wand	49	76
Word Star	69	48

Table 1. Number of features of the four word processors under review. The author looked for the presence of 164 features. That gives a rough measure of each system's power, but the results can be misleading. Many of the functions done with a single command on one system may be done using two or more commands on the others, and complexity can intimidate a beginner and slow even an experienced user.

You set-up the system by running either the editor or print formatter. The editor appears on the screen in an edit mode which is similar in facility and style to that of Electric Pencil. However, by switching to an extended edit mode, you have a much wider range of capabilities, particularly in the area of examining text which has been pre-stored on the disc and selectively including it in the document. You may also make draft copies of all or any portion of your document while in the extended editing mode.

When a file is revised, the operator has the option of giving it a new name or using the old one. If the old name is used, the new version is saved automatically and a back-up copy of the original remains on the disc. The second time a file is revised, the first original is deleted automatically.

Documents which are larger than available memory are allowed, but you must explicitly save all or part of memory when it becomes nearly full. Once saved, you cannot back-up to it without re-running the editor. However, Magic Wand has the largest memory buffer of any of these systems — see table 2.

When running the print formatter, the operator may print a file automatically, set or change any print control variables — such as margins and spacing — or input data to determine what will be printed. In fact, the operator is free to issue any of the formatter commands available on the system.

WordStar is also a very ambitious program. It has more editing features than Magic Wand, but fewer print-formatter features. The editor and the print formatter are run as one program, as with Auto Scribe or Electric Pencil. They are not, however, as tightly integrated, because a file must be saved on the disc before it can be printed.

While it is not possible to print the file being edited without first taking the time to save it on the disc, keeping the editor and formatter as one large program is a good idea, since it is possible to preview margins, page breaks, and line lengths during editing. WordStar, like Auto Scribe, tends toward formatting text as it will be printed and away from using embedded commands.

When WordStar is set-up, it is in editing mode, like Magic Wand. To perform other editing operations, disc operations or print, you must enter one of five subsidiary modes. That is a little overwhelming, especially if you are not experienced with computers. To help deal with that complexity, WordStar displays help menus at all times. They may be suppressed once you become proficient, and subsidiary menus do not appear at all unless you pause for a second or two while deciding what to do.

No back-up limitation

As in Magic Wand, it is possible to give a certain file a new name after it has been revised, or to save it under the old name with a back-up copy. It is possible to edit documents larger than memory, and the system handles transfers to and from the disc automatically, as in Auto Scribe. That is a good feature and there is no limitation on being able to back-up when the early part of the file has been saved.

I compared these four programs based on 164 features. The first aspect any word processor user encounters is the system manual. At first, it functions as a teaching tool. Then, after the operator has learned to use the system, it is a reference. The prompts and diagnostic messages that the program provides while it is running are also a part of the documentation. In looking at documentation, we must remember that Auto Scribe and Electric Pencil are relatively simple compared to Magic Wand and WordStar, so the authors of their manuals had easier jobs.

The Electric Pencil manual is clear and well-organised. It will not intimidate a beginner, and serves as a perfectly

adequate teaching tool for the new user. It is poor as a reference because it has no index. The reference card summarises the editing commands but not the print commands or disc operations.

The Auto Scribe manual is designed for the beginner, and since the system is relatively small, it could have been as good as the Electric Pencil manual, but it is not. It is poorly organised and verbose. Essentially identical descriptions of the editing commands are given three times, under the creating, modifying, and viewing of documents.

Word processor	Editor buffer size in bytes
Auto Scribe	32 K
Electric Pencil	46 K
Magic Wand	50 K
WordStar	31 K

Table 2. Editor buffer size. The amount of memory space set aside by the program for text. Magic Wand has the largest memory area for text during editing. That is achieved by using a separate program for the print formatter — thus the print formatter does not occupy valuable memory space during editing. Because of that, Magic Wand avoids the long delays necessary for disc transfers if the document being edited is too big for memory. On the other hand, you cannot see the final page and line lengths while editing because the formatter is not active. To do that, you must leave the editing program and run the formatter.

The Magic Wand manual is exceptional. It is type-set, bound, and contains many screen photographs. That alone makes it impressive and inviting to the beginner. The author of the manual had to teach the beginner about complex print formatting and programming, as well as the more straightforward editing and printing features, and he has done an excellent job.

Two-thirds of the manual is devoted to leading the user through a series of lessons. They utilise increasingly-complex sample text files which are included on the disc. That is an unusual and successful approach. The last third of the manual is a reference guide, and it is written in a very clear style. However, the index is incomplete. The Magic Wand reference card is excellent and nearly complete. If it included an index into the manual, Magic Wand would have been the best reference manual.

Comprehensive explanation

The WordStar manual is a thick loose-leaf book. It is well-written and comprehensive, but it is somewhat overwhelming even to an experienced computer user. It would intimidate a novice. Ironically, it is full of typographical errors, and like all but the Magic Wand documentation, it is a printout composed using the system.

The authors of WordStar also faced a difficult task in teaching the beginner to use its complex editing facilities. Rather than writing a teaching-orientated manual, they have provided extensive menu prompting during editing. The top half of the video display is used to display brief explanations of the meanings of available commands. When you change modes, you obtain a new prompt screen if you take more than a second or so to give a command — an excellent approach.

At first, you are overwhelmed by the explanations, but you soon learn to use them. Later, the experienced user can dispense with them altogether.

As a reference, the WordStar manual could also have been improved substantially by the inclusion of an index. There is a list of control commands with their page numbers, but no index and no reference card.

Auto Scribe scores more than the others as a reference manual because the index is more useful. On the other hand, as a teaching manual, only Auto Scribe is notably insufficient. Both Magic Wand with its lessons and practice files and WordStar with its on-line help facilities are inovatory and effective.

As with documentation, the simplicity of a system makes it easy to learn. Electric Pencil is the easiest to learn. Cursor movement, text entry, and revision are straightforward. The conceptual separation of the print- and disc-handling subsystems is clear and sufficient. My 11-year-old daughter was able to use Electric Pencil to create, revise, and print simple documents after about 15 minutes of instruction and practice.

Auto Scribe is more difficult to learn to use because the text is presented in screens during editing, rather than as one continuous document, and because separate modes are required for cursor movement, inserting characters, and deleting characters. In addition to being somewhat confusing, those restrictions inhibit learning because they slow editing.

The basic functions of the Magic Wand editor are as easy to learn as those of Electric Pencil. The advanced editing features which deal with blocks of text, searching and replacing, and examining and including information in disc files are also clearly designed and easy to learn.

The advanced print-formatting and programming features are more complicated and, therefore, more difficult to learn. The lessons mentioned are very good, but they take time. An experienced programmer would probably read the lessons without running them, but would still require time to become proficient in the use of those features.

Those advanced features may also be used to build custom applications, which can be used by complete novices. Since Magic Wand provides much facility for operator interaction, it is possible for an advanced user to set-up the system so that it prompts the operator, telling him exactly what he needs to do. There is no analogous capability in any of the other systems.

WordStar is the most difficult of the systems to learn to use. As mentioned, the designers of WordStar have leaned toward formatting material as it will be printed during editing, rather than embedding print commands in the text. As such, they have chosen to provide many editing commands, and have been forced to include others. Therefore, for even simple editing, there is more to be learned than with any of the others. Many of the simple editing commands require two keystrokes rather than one. The complexity is mitigated by the help menus, but it may nevertheless be an obstacle.

Because of reliance on formatting during editing and the omission of programming features, the print formatter commands in WordStar are easier to learn than Magic Wand. They are more difficult to learn than Auto Scribe or Electric Pencil because there are more of them.

For editing, Electric Pencil and Magic Wand are the easiest to learn, Auto Scribe is next, and WordStar is most difficult,

Feature	Auto Scribe	Electric Pencil	Magic Wand	Word Star
Cursor movement and scrolling	3	2	2	1
Block operations	N	2	1	1
Auxiliary disc file operations	3	4	1	2
Search and replace	2	3	2	1
Insert and delete	1	3	3	2
Screen and file control	3	3	2	1

Table 3. Editing power rankings, shown by categories. 1 indicates the highest ranking; N means none available. In some cases, two programs tied for third.

because there is so much to learn. Learning to use all of the advanced programming and formatting features of Magic Wand will be more difficult than learning Auto Scribe. Finally, a novice could easily learn to use Magic Wand for sophisticated applications if an advanced user had programmed it with prompting ability.

All of those editors allow you to key-in text, to make insertions and deletions, to scroll the screeen over the text in memory, and to move the cursor round on the screen. They also allow you to search through the text for a specified character pattern and possibly replace it with another. In some of them, you may mark blocks of text to move, copy, or delete them, or you may include blocks of text which have been stored on the disc in your document. Each system also allows you to control the display on the screen to some extent and to control the naming and backing-up of files after they are created or revised.

Table 3 summarises editing power of the four systems. In general, the ratings are based on the number of features available in each category. Where the function of a command in one system cannot be achieved even by using combinations of commands in another, or if it

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can only be done very awkwardly, it was weighted higher.

A quick glance at the table reveals that WordStar has more features than any of the others. Auto Scribe is ranked above it in insertion/deletion power because of the way in which deletes are performed. It is possible to delete from the cursor position through the next occurrence of a designated character. In addition, deletions are not executed immediately, but are displayed in lowered intensity until the operator verifies them. Magic Wand enjoys a substantial advantage over the others in its ability to examine selectively and include material stored in disc files. The user is able to create his own help menus, which guide the operator in the selection of text for insertion into the copy being edited.

While WordStar has more editing features than any of the others, it is not necessarily the fastest and easiest to use since many of the editing commands require two keystrokes and can be simulated using multiple commands in the other systems. If a two-keystroke command is used and the operator hesitates for a second or so between keystrokes, the system gives a help screen, which takes time because the disc is read.

Loss of speed

WordStar also slows down considerably when its memory buffer becomes full. As table 2 shows, WordStar has a relatively small memory buffer. That is part of the price paid for having the print formatter and editor in memory together. As mentioned, WordStar is fully automatic in transferring text to and from the disc if the document is too large to be held in memory at one time. That simplifies your conception of the system and enables you to back-up to the start of a file even if it has been written on to the disc. However, editing is slowed for files which are more than 31Kbytes of memory in length.

There are also questions of style, which are highly subjective. Auto Scribe and WordStar both restrict cursor movement to portions of the screen where there is text, while Electric Pencil and Magic Wand allow it to go anywhere. With Electric Pencil and Magic Wand, you have conceptual clarity — the cursor never surprises you by where it finishes — but you pay the price of needing extra keystrokes at times to place it where you want it.

Those extra keystrokes might be exasperating to people whose keyboards do not repeat when keys are held down. Electric Pencil is roughly equivalent to Magic Wand, but Magic Wand can perform many editing functions which Electric Pencil cannot. Therefore, Magic Wand ranks above it. Auto Scribe has to rank at the bottom of that category since it has the fewest features and they are awkward to use. Insertion, deletion, and cursor movement are all carried-out in separate modes. It is also slow for large documents, when it is necessary to read and write the disc. Unlike WordStar, it is not possible to copy material once it has been saved. Like WordStar, Auto Scribe attempts to preview margins, line, and page sizes, but does not do it as well.

Feature	Auto Scribe	Electric Pencil	Magic Wand	Word Star
Page lay-out	3	3	1	2
Page and paragraph control	3	3	1	2
Line control and justification	3	3	1	2
Type control	3	3	1	2
Programming	N	N	N	1
Printer control	3	2	1	3
Disc output	N	N	1	2
Miscellaneous	N	3	1	2

Table 4. Formatter power rankings, shown by categories. 1 indicates the highest ranking; N indicates none available. In some cases, two programs tied for third.

Because of stylistic differences and differences in document sizes, it is impossible to produce a strict ranking of the programs. At times, the power of WordStar will make it the fastest and easiest to use, but in other cases Electric Pencil or Magic Wand will beat it.

Table 4 summarises the printing power of the various word processors. Again, the ratings are primarily based on the number of features in each category.

The page lay-out features have to do with controlling the physical side of the page and margins. Page and paragraph control deal with headings, footings, page numbering, and automatic indenting and spacing between paragraphs. Line control refers to various sorts of justification and options for spacing between lines. Type control includes special font shifts, such as bold and double striking, as well as spatial shifts such as subscripting and proportional spacing.

Programming features, which are found only in Magic Wand, are the inclusion of variables, simple assignment statements, and conditional branching. Variables may receive values either from the operator, from a disc file, or by assignment. Magic Wand and WordStar are also able to write their formatted print output to disc.

The printer-control features deal with operator control of the printing process. Such things as starting and stopping printing and issuing formatter commands at print time are included in this category. I also considered eight miscellaneous features.

As WordStar dominates in the number of editing features, Magic Wand dominates in the area of print formatting. That is partially a reflection of the differing philosophies regarding formatting during editing versus using embedded commands.

With those comparisons behind us, let us return to the four hypothetical users.

The author usually creates and revises relatively large documents, so less emphasis is placed on printing than editing. Any word processor will be far superior to a typewriter, and I do not think that an author can go wrong with either Electric Pencil, Magic Wand, or WordStar. If it is possible to adjust to its style and complexity, WordStar will provide the most powerful editor. Also appreciated will be the fact that words and lines are in the same position on the screen and printout when revising from marginal notes. That makes it easier to find one's place.

If documents are consistently long, it will be necessary to break them into parts or an author must learn to live with the slowing due to the limited memory buffer size with WordStar. If the author does not like the WordStar style, I would advise the use of Magic Wand. The editor is more powerful than that of Electric Pencil and it is faster than WordStar for documents which are between 31K and 50Kbytes.

The marketing manager is concerned with printing multiple copies of similar documents — for instance, in doing mass mailings. The manager does relatively little editing but needs print-time power. That is the clearest choice of all. The programming features of the Magic Wand print formatter and its flexibility at selecting information from the disc during editing are designed with this person in mind.

The secretary is next. With general correspondence, many short documents are created. Much editing is done, but not as much revision as the author. Complex print formatting features are not really necessary for that kind of work. Any of those systems can be used. The relative simplicity of Auto Scribe and Electric Pencil will be appealing.

Infrequent revision

The newsletter composer works with relatively large documents, but does not revise them as frequently as an author. Thus, the editor will be less important here than it is to an author; however, the print formatter will be much more important.

That choice should be limited to either Magic Wand or WordStar because of their print formatting capability. The choice will hinge on some of the same factors as the author's. Editing style, power and disc speed will be important. The composer will tend to lean toward WordStar for the ability to see page and line breaks on the screen during editing. To do that with in Magic Wand, the text must either be printed or written on the disc in its final form, either of which requires running the separate print formatter program. On the other hand, the formatting power of Magic Wand will be appreciated, and also its capacity for interaction during printing, for example, to make quick changes in pitch and line spacing to stretch or compress a column. That is a difficult choice, but happily, both alternatives are good.

Vast option range in complex Wordcraft

WORDCRAFT 80 is a major word-processing package for use on the Commodore range of microcomputers. Wordcraft is marketed in the U.K. by Dataview Microcomputer Systems in Colchester, Essex, and has gained a wide popularity along with WordPro — reviewed in the January 1981 issue.

The package has been designed to turn the Commodore system, particularly the new 80-column screen systems, into a dedicated word processor, driving a variety of high-quality printer devices including;

Qume Sprint 5
Diablo 1640/1650
Ricoh RP40/RP1600
NEC Spinwriter

and most standard matrix printers including the Commodore 3022 and 8024. The package is designed primarily for use with those printers and there is no proportional spacing if output is routed to a matrix printer. Matrix printers can perform a carriage return without issuing a line feed.

We tested Wordcraft 80 on a configuration comprising

Commodore 8032
Commodore 8050 dual disc drive
Commodore 3022 matrix printer

Wordcraft 80 is supplied in the form of a floppy disc containing programs and example documents, an 85-page manual with both a learning section and reference section and card, and a security device — which plugs into the external cassette edge connector — known affectionately as a dongle.

The package runs on the standard combinations of Commodore hardware in the 3000, 4000, and 8000 series. Wordcraft 80 costs £325 and is available through most Commodore Business Software dealers.

Wordcraft is a direct word-processing package that is screen-based. That means that what is typed through the keyboard is

by Mike McDonald

acted on directly and represented on the screen in almost the same format as it will appear in the hard-copy output or printer, with a few minor exceptions.

Formatting of the document is performed with a series of embedded — non-visible — format-control characters input at the time of entry but which may be displayed and changed subsequently.

Text is input and held in the main memory or core of the machine in a series of pages which constitutes a chapter. Each chapter may be stored or retrieved from disc and the composite set of pages may be stepped through and modified or printed. Wordcraft allocates about 10,000 bytes in memory for each document chapter and the use of that space is as efficient and not representative of what is actually displayed on the screen, i.e., indented paragraphs, etc.

The trade-off of that packed data-format method lies in the speed of processing as a result of the conversion processes used to achieve the formatted display. The manual warns you of that, quoting a possible delay of up to four seconds in the course of editing a long chapter.

The data structure within Wordcraft 80 is based on the chapter system. Each document is formed from a number of chapters. A chapter represents a number of pages in much the same way as would a chapter in a textbook. The measure of how many pages may be allocated per chapter is a function of how much memory is available for the free text and associated formatting characters — 10,000 bytes in this case.

Each chapter is stored on disc as a complete unit or disc file and editing is restricted to each single chapter unless they are merged together. Single-page documents, such as letters, may be saved as single-page chapters. Associated with each chapter is the basic control information for that chapter which includes name, date, headers, footers, number of pages, page width, page length and, of course, the text and its format control characters.

Where a total document is comprised of a number of chapters, the page numbering is allocated automatically to reflect the position within the document. In theory, up to 99 chapters may be allocated to a single document although that will be limited by the amount of disc space available.

When loading the package, the user is confronted with a title screen showing the version and serial number of the software. At that stage, by the entry of a letter between and 2, you select the type of printer used. There are two options for each printer type indicating whether continuous or single-sheet stationery is being used. Once selected, the screen reverts to the standard input form for Wordcraft. Wordcraft uses the top five lines of the display to indicate the following information:

Line 1 : NAME: name of document chapter — 16 characters maximum
DATE: free form — eight characters maximum
Line 2 : COL: 005/070 — shows; cursor column position / number of columns
LINE: 00/066 — shows; cursor line position / number of lines
PAGE: 001/005 — shows; page number / of n pages
Lines 3 : MODE: this displays the mode currently active and messages
Line 4 : Command input line — and also messages
Line 5 : RULER: indicating margin/ indentation and tabulator settings

Free-space display

In addition, the 80-column version also displays the last disc drive accessed, the disc-file name, and how many characters of free space are available in memory. The balance of the display is available for the textual data.

The way in which Wordcraft 80 runs means that the user is always in one of three modes of operation: command mode, type mode, or control mode. When he enters the page, the user is placed automatically in command mode and a series of commands are available to facilitate disc handling, printer selection, page-size settings, name and date input, etc.

By pressing the stop key, you enter type mode and the cursor moves down from the status line to the blank screen text

area. The type mode is the standard text-input mode when data may be keyed directly on to the screen for formatting and editing.

During the course of text entry in the type mode, the control mode is available by pressing the reverse key. Once in control mode, you may press any of 34 keys to produce various formatting or editing functions such as delete, insert, move, copy, overprinting, searching, tab-setting, indentation, etc.

After a valid control character has been entered, Wordcraft returns the user to the type mode. The command mode may be re-entered by depressing the stop key while in the type mode. By using a combination of the type and control modes, you can build a text document on the screen in the desired format.

With the exception of a few features — such as proportional spacing — the document is displayed on the screen according to the control formats assigned, i.e., as it will appear on the printed output. Control characters input are transparent to the screen display and may be accessed on request only by moving the cursor on to each line and selecting an appropriate control character. Any applicable format characters are then displayed in the status line area at the top of the screen.

Function key

The 8032 computer already has a number of function keys associated with the Basic editor available within the computer. Those keys are clear screen, home cursor, delete, reverse, reverse off, return, escape, tab, insert, and cursor up, down, left and right.

Cursor movements, delete, insert and space are all self-repeating if held down for a short period. Each of those functions has been used within the package as it is implemented on the Commodore equipment, except for the delete key which deletes characters to the right instead of to the left.

Standard upper- and lower-case characters are available from the typewriter-like, QWERTY keyboard and the special characters offered on different printers are accessible through escape-code sequences.

Text is keyed-in and displayed on the screen according to the format option selected. As a document is formed, the user may cursor round the screen, altering, inserting and deleting text at will.

As modifications are made, the balance of the document is altered if the changes reflect through the page. When the end of each page is reached — subject to the lines-per-page setting — Wordcraft moves automatically to the next blank page format. Equally, the user may end the page by specifying a new page.

As the cursor is moved round the text, screen scrolling occurs automatically up or down — and left or right in the case of a 40-column screen. The page width in Wordcraft may be increased to 117 characters across. A pan facility also is incorporated for continuous scrolling through the text. Pages may be accessed directly by a control command.

In the course of entering textual data, a series of facilities are available through the control mode to help create the proper document format and editing of existing data. Those facilities are:

- Margins and tabulators — margins and tabulators are set and indicated on the fifth line of the status display at the top of the screen. That is done within the ruler mode accessed by a RVS ≠. Cursor movements are used to place the cursor in the desired position and a tabulator set by entering a one, and margins left and right respectively, with either < or >.

Text entered will be displayed within the settings and tabulators available. The margins and tabulators remain applicable to each line of text until altered. Once altered, any further text entered will conform to the new settings — each line may have its own settings if necessary. Tabulator stops may be cleared individually or totally with either of two key entries.

Tabulation is achieved by keying RVS followed by the tabulator key. Decimal tabulation is also available by entering a RVS '.'. On input at such a point, right justification of the data input is performed.

- Indentation — indentation may be achieved by re-setting the margins for the appropriate lines. That is adequate for most requirements until subtitling or paragraph numbering is required. Indentation is permitted by the entry of RVS [and] to denote the start of indented fields. That character will cause indentation at the first tabulator stop encountered after its entry on a line.
- Spacing — Wordcraft senses the end of a line automatically as set in the page-width parameter associated with the chapter. Text continues on to the next line automatically when it is entered. New lines may be forced by the entry of a RVS return which produces a line-embedded code.

New-line flags

Where a new line is forced, Wordcraft flags it by reversing the start character of the new line. Line and paragraph spacing may be achieved with the feature or by using the skip control. Once accessed with RVS +, the skip will produce X blank lines automatically according to what is entered, i.e., one to nine. Equally, a new page can be forced by the entry of RVS Home. That feature could be used where a natural break is required slightly before the normal end of page.

Movement between pages already entered is achieved only through a series of control-mode entries. They are:

RVS p followed by a cursor up or left key will place the cursor at the last text position of the previous or next page.

RVS p followed by a cursor down or right key will place the cursor at the first text position of the previous or next page.

RVS p followed by a clear key moves the cursor to the next free position at the end of the text on the last page of the current chapter.

RVS p followed by a home key moves the cursor to the top of the first page in the current chapter.

RVS p followed by a numeric key will go to the top of the page number entered. If the number is greater than nine, it must be entered in brackets.

The insertion and deletion of text may be performed by use of the edit keys directly on the text at the cursor position on the screen or through a series of control facilities.

RVS insert causes Wordcraft to insert a line of underscore characters between the current character and the previous character. Text may then be entered, overwriting the underscores and filling the gap created. If the input exceeds the allocated space, a new line is inserted automatically

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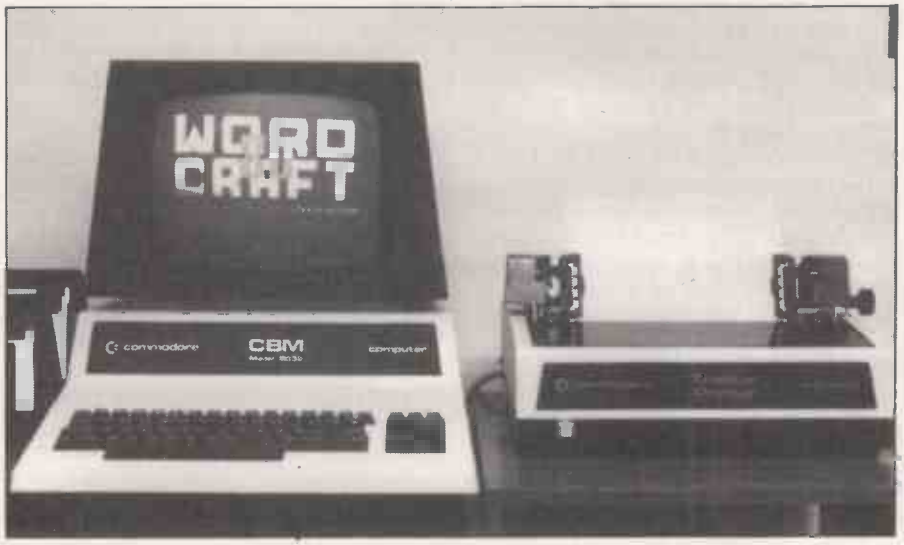

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and appropriately underscored. Any remaining space still underscored will close-up on entry of a RVS off which terminates the function. Paragraphs may be inserted into an existing document using that method after opening a new line with the skip control option.

Whole lines may be deleted by placing the cursor anywhere within the offending line and entering a RVS delete key. The line is then removed along with its format-character settings. Blocks of text may be reproduced, moved and deleted with the functions; RVS m, block move, RVS r, block reproduce, RVS e, block erase.

On entering those functions, the user may define the block from the current cursor position to any other point in the text. If block erase is selected, the block is removed directly once the end of block is identified with a RVS-off key. In the other two cases, the status line proceeds to request a block position for either the move or copy to be addressed to. That is achieved by placing the cursor at the desired position and another RVS off entered to complete the action.

Text is inserted automatically and the document re-formatted on the screen to reflect the changes. Words delimited by a space on either side may be removed with a RVS d, delete, control function. Whole-page deletion must be carried-out with the block delete routine as described.

A search and exchange — first occurrence or all occurrences — facility is obtained by entering a RVS s. The operator is invited by the status line to enter the search string at the top of the screen. The search input may be enclosed in any two characters which do not occur in the search string itself. Masking may be used anywhere in the search string with the use of the ?, i.e., h?t will match against hut, hat, hit, etc.

Exchange feature

If a match is found, the cursor moves on to the first character of the match and flashes. Once completed, an exchange feature may be accessed by RVS x. The operator must then enter a string which will be substituted for any match on the search. If a RVS z is entered, the exchange will be performed only on the first matching string.

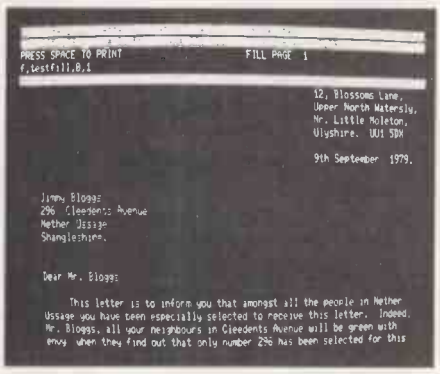
The data entered for searching and replacing remains stored while the system is still in use. A useful feature of the exchange lies in the fact that first character in a lower-case exchange string will assume the case of the first character of the string it is replacing, thus maintaining capital letters throughout the document.

The various control-mode facilities are extensive and provide the user with significant global and local control over the document format. We found that the sheer volume of double-key entries required for control-mode features made them difficult to grasp — considerable experience with the package would be needed by an operator before he became conversant with all those facilities. Some of the other control mode functions are:

RVS c — displays on the status line any embedded control characters applicable to the line on which the cursor is positioned.

RVS f — causes the cursor to jump to the next fill point in the text.

RVS n — deletes an embedded control which exists within a line. It must be followed by the control character to be deleted given that there may be several control characters allocated to any one line.



RVS o — causes the line following to be overprinted on the current line at the print stage.

RVS p — the page movement control and allows the operator to jump from page to page.

RVS t — or tabulator — the cursor will jump to the next set tabulator position indicated on the ruler line, fifth line, < of the status display.

RVS w — a wait point which causes the printer to halt execution. It can be used for a change of stationery or print-head.

RVS — puts Wordcraft into the ruler mode and allows tabulators and margins to be set.

RVS & — produces a separator line across the page — used mainly with fill documents.

RVS '—' — described as a soft hyphen which is to be used by Wordcraft only if the word in which it is embedded needs to be broken over two lines; otherwise the character stays transparent to the hard-copy output.

RVS = — causes automatic centring of the next portion of text on the print line — and on the screen.

RVS ? — defines a fill point used when the f command is executed.

RVS ?n — a labelled fill point either with a number or letter which is accessed when a fill file is brought into play.

RVS < — the start of a highlighted or emboldened field for use depending on the printer options available.

RVS > — terminator for a highlighted or emboldened field.

RVS [— start of indentation control character which causes indentation to occur at the first tabulation stop after the character.

RVS] — end of indentation.

RVS Cursor Up, Down, Left, or Right — causes a pan effect to occur, scrolling the text in the appropriate direction.

One of the features of Wordcraft referred to in the controls is filling. Document pages may be prepared with markers to indicate where text is yet to be inserted from other stored documents or from manual keyboard input. Applications using that feature are standard letters with insertion of names, addresses and details from data files or quotation documents or tenders.

Data may be inserted into fill points directly from the keyboard or deleted at will when the document is accessed through the RVS f function. Automatic filling is achieved by creating a blank document and identifying each fill field with a character or number. A corresponding fill file is created with up to 15 fields per page with a maximum of 254 pages to the chapter. The fill command is then executed to combine the two documents to produce a continuous printed output.

One option on the fill command provides the user with a fill-and-amend ability. Once the document has been filled with information from the first page of the fill file, the editing control is returned to the user for further input or amendments. Another function of the fill feature is that a non-printing line may be created in the document and flagged with a RVS ? @.

Printer embellishments

Wordcraft 80 has been designed for use specifically with high-quality specialist printers and has a number of embellishments which are applicable depending on the type of printer used. They are:

- Subscripting — two special embedded characters are available to cause negative and positive half-line feeding at the printer. They are ESC + and ESC — and will allow the user, whose printer is capable of such contortions, to produce mathematical formulae accurately.
- Bi-directional printing — a function of the printer device used and is supported except in the case of headers, footers, and directories.
- Even white-space justification — right-edge justification is available and calculated automatically using proportional spacing without the need for extra added spacing.
- Simplified overprinting — backspace permits the creation of character addition, say, for accenting, division signs, etc.
- Additional or special characters — they are available usually on the Qume and Diablo printers and are accessible from Wordcraft.
- Character and line spacing — character pitch and line spacing are software-selectable from within the package but apply to the whole of any document produced.
- Printer left margin set — a second left

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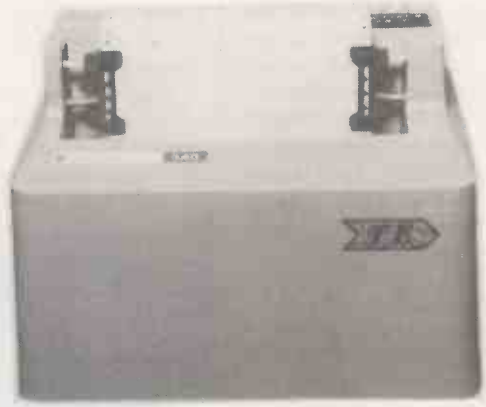
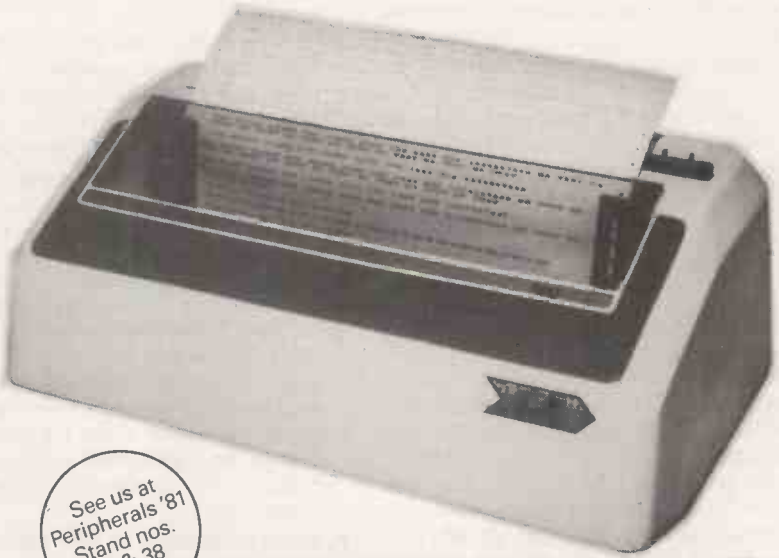
Paper Tiger matrix printers

– a choice of three from Teleprinter Equipment

When the Paper Tiger 440 was introduced, it set new standards and new sales records for low cost matrix printers.



It was soon joined by the Model 460 which has no less than ten desirable extra features.



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margin may be set to allow the document to begin anywhere within the printer's width. That can be used to print more than one document page side by side on a single sheet.

A note for prospective buyers — it will be very important to establish with your dealer exactly which features are necessary for your application and whether the printer device offered with the hardware configuration can do the job and is supported by Wordcraft.

The command set available on Wordcraft by pressing the stop key if in text mode is a series of commands which handle the house-keeping on the discs and management the printed output. Once in command mode, each command is entered as a single character which is then interpreted into its full form and is followed by a series of parameters or values needed for the execution, i.e., operator, operand.

Some of the commands are of a general nature and may be used to make the document more attractive or to set-up new formats;

d or date — allows the user to input or change the document date which may be optionally picked for use in the header or footer notes on each page of printed output.

n or new — clears any text held in memory after seeking confirmation from the operator. The document name may also be specified through that command at the time of input.

r or re-name — re-name alters the name of the document without the clear down of memory.

i or initial — sets the initial page number for the chapter in memory and is followed by a numeric field from one to 255.

l or length — specifies the page length in lines and is followed by a numeric value up to 98. Header and footer requirements are in addition to the page length set.

w or width — followed by a value from five to 117 which defines the width of each page in characters.

h or header — allows the user to enter his or her definitions for a header line which will be used at the top of every page in the chapter when you are about to print. The header may be specified for both left- and right-hand pages and may contain user-keyed fields or be programmed to use the existing information in the chapter data, i.e., date, name, etc.

t or trailer — the same as the header option except that output is at the bottom of each page.

j or justification — a simple operand of yes or no used to switch-on or off the justification feature, although Wordcraft 80 has a further option of the pitch setting of eight, 10, 12 or 15 characters per in.

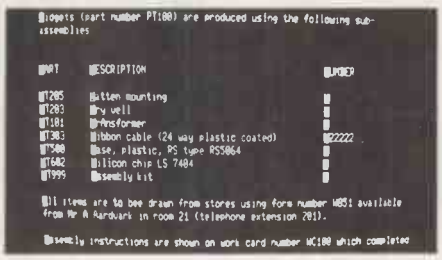
— used to reconfigure the package for different types of printer and is used to specify the device number and whether using a matrix printer or a Commodore matrix printer.

% and ! are used for changing printer options and tailoring the package to the specific type of printer being used.

" is a printer-related control to set the physical page length, the line-spacing, and specify whether continuous or hand-fed stationery is being used. Line-space options are three, four, six, eight, or 12 lines per in.

$ end is reasonably self-explanatory and exits the operator from Wordcraft back into Basic.

Most of those commands have default values which are set on loading the package or as a result of pulling-in different document chapters. Where commands conflict with possible limitations of the



system hardware, the user is warned by the status line and the command ignored, i.e., exceeding memory constraints with line or width commands.

The balance of the command set is disc- or printer-related and tends to be powerful in use. Here are the prime commands used in the course of normal day-to-day running;

p or print is the main print output command and has a number of options.

p, A-B will print-out a range of pages from the current chapter in memory where A and B are the page numbers.

p, A will output a single page of print, i.e., A.

p, —b will produce all pages from the start page up to B.

Once issued, the system requests confirmation which is given by pressing the space bar. Three further options on the print command are:

p, pages required, d where d defines that double-spaced output is required.

p, pages required, b where b will cause the default on highlighted printing to be emboldened characters rather than underscoring.

p, pages required, d or b or none, N will produce N copies of the complete document at print time.

The printer command always starts with the letter p and general disc commands start with a u. The disc associated commands are as follows;

w,i,N — causes initialisation of the discs in the disc-drive unit where N is the drive number required — 1 or 0.

u,v,N — in the same format as the Verification command which checks for any anomalies on the discs and free any wasted storage space.

u,p,N — produces a printed copy of the directory on the specified drive.

u,s,N — produces the same as the printed output except that display is given rather than hard copy.

s, file-name, drive number, chapter, option — the save command for storing text created.

g, file-name, drive number, chapter — the command for loading existing chapters into memory.

m, file-name, drive number, pages — the merge facility which will allow specific pages from stored chapters to be merged into memory at the current text-mode cursor position.

Other facilities are produced for disc formatting, disc back-up and copying and deleting of document files. A special command which is both disc- and printer-associated is the fill command — f,file-name,drive number, pages, etc.

The manual is broken into three main sections. The first is a training aid for the first-time user and is geared for use with the document examples provided on each program disc. The text takes the user straight into the package and familiarises the operator with a good cross-section of the command and control structure.

The second section is a reference manual which covers each command and facility in turn explaining its use and syntax. Finally, there are a number of appendices with sample printouts, a cross-reference index, error messages, etc.

Also provided is a handy reference card for command and control options. The manual is a well-thought-out document which introduces an interesting philosophy, i.e., both as a training text and reference guide.

Most of the packages we have examined have had manuals which are one or the other but not both. Certainly, it made what is a complex package considerably easier to understand although it represents a good deal of reading. The document was produced with Wordcraft but, alas, human error creeps in every now and again with the odd spelling or typing error.

Conclusions

- **The program is written entirely in machine code and is native to the machine throughout execution, i.e., there are no overlays or re-loading.**
- **The software appears to be of a reasonable standard, very secure both in machine and for disc I/O and is impressive in terms of the functions it performs.**
- **Because of its vast range of functions, it may appear somewhat unweildly to get to grips with quickly.**
- **It was disappointing that chapters could not be chained to produce a continuously-printed document.**
- **Instead, each chapter must be taken from disc and a print-request executed.**
- **We liked the decimal-alignment feature, indentation and multi-high-quality printer support.**

Powerful Sorcerer plug-in stops just short of pure magic

WE REVIEWED the Z-80-based Sorcerer in May 1979 and generally liked its design. Since then, it has acquired a new main dealer, Liveport Ltd, which sells through some 36 local agents. It has also made the transition from being a cassette-based personal computer, to selling almost always as a commercial, floppy-disc system.

We were interested in the word processor, which is one of the Sorcerer plug-in ROM modules. You insert the 4-by-4-by-1in. package into the slot at the side of the machine and that extends the Sorcerer micro-coded command set to include word-processing functions. The original approach was to use the standard cassette operating system for filing, and some users do that, but most would take a floppy disc system and utilise CP/M.

The standard Sorcerer keyboard is used, of course, which has a numerics pad on the right that also contains the cursor controls. While the machine is being used for word processing, the numeric keys are disabled and you use them for specific word-processing functions; indent, break text for inserts, delete, mode select. A conversion chart is printed in the accompanying manual.

When you switch-on with the ROMPAC loaded, the system starts in the word processor — you do not have to load it from disc. The word processor works in two modes, edit and command. Edit allows you to create and amend text in a straightforward way, command is used for relatively more complicated functions.

As with many word processors, the line on which you are working is always in the centre of the screen. If you are in the middle of a document, that means you can see the text immediately before and after the edit point, which can be useful. You can scroll in either direction, rolling text through the screen to reach the start or finish of the document.

by Dennis Jarrett

Checking the printout from the Exidy word-processing package.

You always start in edit mode — there is a status line at the top of the screen which tells you what mode is selected, on which line you are working — numbered from the start of the document — and the character position of the cursor. You start keying text in the conventional manner, with the system handling line endings automatically by wrapping the last word around if it is too long. Carriage returns are used only at the end of a paragraph.

The system overcomes the problem of large end-of-line gaps by providing a key for a forced or soft hyphen. In other words, say, the line would have ended with 'compositions', but the word overruns the right margin by two characters, so it is wrapped to the start of the new line automatically. You might not want that ugly gap, so you insert an artificial hyphen, say, before the 't'. The 'tions' starts the new line so improving the overall effect when it is printed.

Tabulators can be set — the system starts with a default setting every 10 stops, but you can alter that and the tab key can be used normally. Alternatively, you can use the indent key, which shifts the left-hand margin to the first tabulator stop.

You remove indents by holding down the key. That moves the margin progressively to each tabulator stop, shortening the lines and re-formatting text, until it reaches the end of the line. Then you are returned to the normal 64-character line with the standard left margin.

In edit mode, the cursor can be moved round to take you to an edit point via function keys for up, down, left and right, There is also a scan key which moves you quickly to the start and end of the current line — although all keys have a repeat function which moves increasingly faster the longer you depress it, it is still a relatively-slow method of moving around the text.

Error correction

The standard way to change text is to overtype and/or delete. Using the delete key puts a rub-out mark at the point where the cursor is, and the text is not closed-up and re-formatted until you hit the close key. That gives you a chance to spot and correct any errors. Using the space bar, incidentally, just overtypes with a space and without closing up.

To insert more text, you use the expand key. That creates a gap after the edit point automatically, moving away the text which followed it originally. If you type-in new material and hit function again, then the document is re-formatted to accom-

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modate the extra text to be inserted.

Also on the numeric keypad is a mode key, used for switching between modes. In edit mode, you can just hit the key to move to command and once there, there are several commands available.

- You can move the cursor forwards or backwards a specified number of lines — or all the way to the start or end of text. That is much quicker than using the function keys.
- You can delete any number of lines. If that would mean losing more than 1,024 characters, the system asks 'REALLY?' and will not proceed till you hit 'Y'. There is no command for deleting a specified number of characters. Presumably, the designers thought repeated use of the delete-function key would be sufficient. You can also delete the rest of a line by positioning the cursor inside it and using the command D1 — delete one line from the edit point.
- You can move a specified number of lines — but not a number of characters — into a holding buffer; the lines are counted from the current cursor position. You will probably return to edit mode then, move the edit point or type some more text, and subsequently enter command to recall the buffer's contents which are copied out at the new edit point. In other words, it is block-move capability.
- You can search for a specified character string and replace it with another. That can be manual — the search stops every time it finds a match and invites you to decide what you want to do — or it can be completely automatic. You must give a number for how many search-and-replace operations should be performed, but if you want to cover all occurrences, you can make it any large number. There is a wild-card option with that command where you can use a full stop to indicate any character — so searching for '.at' will produce 'rat' 'cat' and 'mat'.

Command groups

There are three other significant groups of commands. One provides file storage. The command 'R' reads a file from disc; the system asks you for the file name and goes and finds it. The write command is slightly less reasonable — it is 'W/C2' and if you do not have that right, you are likely to lose your whole document. If you manage the input, you are asked to specify the file name — up to eight characters preceded by the CP/M disc identifier.

Another group of commands provides for autocommands and macro-programming. An autocommand is a string of ordinary commands on the same line to be executed in sequence. We could not find many uses for that — not with macros available. The macro-programming function allows you to do "virtually anything", says Exidy enthusiastically. In practice, that means you can string together up to 512 characters' worth of commands — some commands take only one character, others need three or four — and put them into a macro buffer to be called and executed as often as you wish.

Macros like that are created in edit mode. You type the macro, position the cursor at its head, and use the command 'A' to load it into the buffer. You then have commands which can display the macro or execute it a specified number of times. Because it was treated as text in the edit mode in the first place, you can store a macro as a document-style file on disc, too.

Macro-programming

Macro-programming obviously requires a good deal of experience before you can really make the most of it. Liveport has an impressive printer-control demonstration file which illustrates that. The Exidy handbook includes a helpful section on setting up a microsystem which merges form letters with a previously-stored mailing list.

The final set of commands handles the printer. You define the output formats by using the 'Y' command which calls a table with default print settings you can change. There are 15 such settings which is rather more than most microcomputer word-processing packages would provide:

- Print device — can be a proportional-spacing printer or one of several I/O driver options.
- Stop page end — covers single-sheet insertion as opposed to continuous stationery or automatic sheet feeding.
- Lines per page — which you have to calculate on the basis of how many lines per inch you would like.
- CRs page end — takes the printer past the page break in continuous paper.
- Page title — allows repeated page heading, with a specified number of lines before text should start and automatic page numbering, too.
- Indent — sets the left-hand margin.
- CRs per line — sets the line spacing.
- Right-justify — can be selected.
- Width — is calculated in tenths of an inch and is complicated. You have to subtract margin widths from paper widths and divide by the number of characters per inch.
- LF size — sets the space between lines in 48ths of an inch — usually eight for pica, six for elite.
- Char space — is the gap between characters in 120ths of an inch — usually 10 for pica and 12 for elite.
- Special char provides for underlining or emboldening. Either way, when you are editing text, the on-screen characters so marked will appear as black on a white ground: when they are printed, they will be underscored or overprinted in bold face, depending on which you have selected in the 'Y' table. That commits you to one or the other during a print run.
- Proportional — is possible, provided you have the printer.
- Maximum space lets you set the largest possible interword gap in 120ths of an inch. That applies to proportional spacing and prevents the system from printing a justified but unevenly-spaced line automatically — printing stops until you make a decision about the ugly line.
- Minimum space provides the corollary.

To print, you set the cursor at the starting point — or you read in a file, in which case the cursor will be there automatically — and use a print command.

Printer control is undoubtedly one of the strong points of the Exidy Sorcerer WP package — particularly in comparison with the limited facilities usually offered with such software on microcomputers.

True, widow lines and orphans — those ugly single-word lines left floating by a harsh and insensitive word wrap-around algorithm — are not dealt with automatically. It is possible to set-up a manual check for them by using a verify command.

The Sorcerer package has many of the features you would expect from a purpose-built word processor — or indeed a professional word-processing system. One of the few significant facilities omitted from the system is decimal alignment — centring columns of numbers around the decimal point.

Another is the general lack of text-orientated editing, in the sense that word-processing units like whole words or sentences or paragraphs might be moved or deleted. The Sorcerer word processor is limited to user-defined blocks of text or system-defined lines. A really good word processor would allow you to position the cursor on a word and delete or shift it, defining a word as text between full stops; or a paragraph, text between carriage returns. That is not too difficult for word processor designers to incorporate, but you do need to think in terms of text rather than the computer's units of information.

Most other functions can be provided by macro-programming, which really is impressive once you are familiar with it. That allows, in particular, for selective information retrieval and document assemblies. Other facilities generally found on more costly systems include the multi-column operation sorts, and print/merge also permitted by macros. Even automatic insertion of page footings can be set up with a macro program.

Against that, it is worth considering just how much effort is required to use those facilities. No micro is designed for word processing; most are designed for program development of data entry. The

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Sorcerer keyboard has some eccentricities — as we found with a conventionally-trained typist used to an IBM Selectric lay-out.

The code - sequence - versus - function-keys argument has long been raging among word-processing system designers — is it better to type in an extended but explicit character string? Or is a single stroke from a tersely-labelled key the preferable alternative? Well, in the case of the Sorcerer, the situation has been complicated by using keys labelled with altogether different functions.

However good the macro facility is, the implementation is complicated enough to deter the less-than-committed user. A more long-winded, interpretive approach to the pseudo-programming might have been better.

Irritating aspects

There are, of course, several irritating aspects of the system — no-one has yet designed the perfect computer, yet some of the irritations could be corrected easily in software. For instance, a few lines of garbage are often added on to the end of documents written to file, so you obtain some rubbish printed-out if you subsequently output the file without checking.

If you want to print a succession of documents with numbered pages, you have to re-set the 'Y' table between each of them. Otherwise, the second document will just continue the page-heading and numbering sequence of the first.

A major disadvantage to the professional claim is the lack of filing discipline. The ideal filing system for word-processing documents would show the file name, but also its size in characters, date created, number of accesses, the date and time it was last referenced, the identity of the creator. In other words, enough information to identify it closely. The perfect word-processing filing system would include automatic housekeeping.

On the Sorcerer your only filing system is the CP/M one — perfectly good for programs, which is what it was designed for, but certainly not for supporting the amount of control and discipline a reasonable professional word-processing system needs.

The manual is not of a very high quality. Poor documentation must be the most important single failing of micro-computer systems these days. In fact, the Sorcerer one was better than most, but it still did not cover all the possible error conditions — especially the reasons why the cursor might sometimes disappear completely from the screen. In that case, the only possible recovery appears to be re-set, which, of course, wipes the memory and you lose your document.

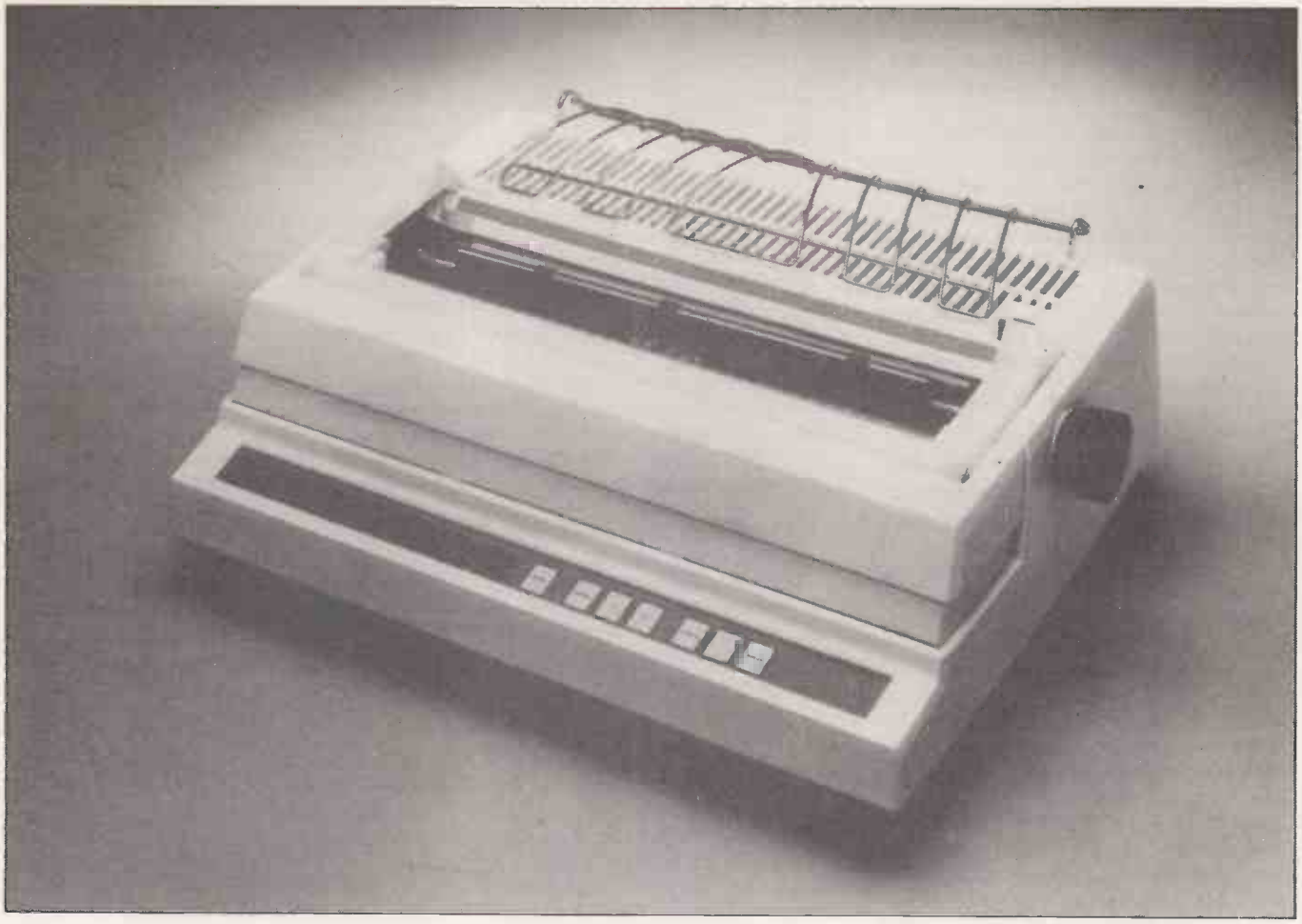
The other main deficiency is inherent in the use of a Z-80 and a data-processing architecture rather than a purpose-designed word processor; it is the speed, or rather the lack of speed when the files grow too full. That becomes particularly noticeable when using the more complex commands or changing modes. It becomes increasingly possible to beat the system by inadvertently typing too fast.

Also caused by the hardware restriction was the uncomfortably jerky movement of text on the screen when scrolling back and forth. The word-processor designers have, however, done a good job of minimising text re-formatting movements after an edit — some purpose-built word processors show enough on-screen activity to drive you mad after 10 minutes.

Similarly, the error messages are classically those of a micro rather than an end-user's system. There are not many of them, and they do not tell you much about what went wrong and what you can do about it.

Conclusions

- **The word processor ROMPAC adds £125 to the cost of a Sorcerer.**
- **Liveport supplies a system with one mini-floppy and a good proportional-spacing daisywheel printer for about £2,648.**
- **That buys you one of the best micro-based word-processing add-ons we have seen, loaded with facilities rarely provided at this level.**
- **It does not escape the deficiencies of adding any word-processor package to a micro designed for other functions.**
- **Given that restriction, it looks hard to beat.**



Daisywheel Diablo 630 fares well in all printer tests

THE DIABLO 630 is the first of a series of new daisywheel terminals designed to replace the 1640/50 range. Running at between 30 and 40 characters per second when driven through a standard RS232 serial interface, it is the first daisywheel machine able to use both metal and plastic print-wheels.

The 630 obeys all the driver escape-code protocols of the earlier Diablos and also has a code to switch on and off automatic bi-directional printing — but it is simpler than its predecessors. The electronic hardware has been reduced by half, and the number of moving parts by 30 percent to create a print mechanism which is claimed to need very little in the way of field adjustment.

Acoustic cover

Diablo admits to selling some of the noisiest daisywheel printers machines on the market. The new acoustic cover provided with the 630 is a large transparent plastic flap which fits over the printer module and certainly helps to trim the decibels, but is somewhat unwieldy. We suspect that many users may dispense with it altogether, particularly when single sheets are being fed to the machine.

The soft curves of the earlier Diablos have given way to a squared-off ranch-house-baroque-look, so that the machine

by Chris Bidmead

now resembles a Qume. Like the Qume, the case is cream-coloured tough plastic, and a rather unusual fibre resin base-plate serves to mount the internal hardware.

Manual control is through a front panel of membrane switches which respond to touch without any mechanical action. Their feel, or rather absence of feel, is initially disconcerting, but in practice they proved easier to use than the standard Plessey rocker-switches.

On power-up, the 630 can be made to execute a comprehensive series of self-tests to check separate elements of the command-chain, such as print-wheel, carriage movement, platen control. We added several tests of our own, which are designed to assess the manufacturer's claims for printing speed, as well as to test for deficiencies in the print alignment and ability to cope with graphics in non-text applications — see test results panel.

One disappointment is that the case can no longer be removed by pressing two levers in the style of the IBM golf-ball typewriter which inspired the styling of the earlier Diablo machines. Now, to comply with international safety standards, two bolts hold the cover in place. They can be undone with an ordinary screwdriver, but throughout the rest of the machine, the aircraft-type U.S. bolts Diablo has used since the first model are retained. A pity, because the tools are hard to find and expensive in the U.K.

Machine evolution

The evolution from the solidity of the 1640/50 range towards cost-paring simplicity shows dramatically once the cover is removed. The reassuring 1cm. thick alloy chassis of the HyType-2 printer

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unit has been replaced by a construction of bolted sheet metal less than 2mm. thick — the same solidity of carriage guides has been retained.

The print-head motor has been banished to the rear left-hand side of the machine, and the coil-protected cabling down which the main logic board talks to the moving print-head has become a flat flexible PCB sandwiched between two metal shields. The nett result is that the printer mechanism looks a good deal more disposable. That is not an accident — it is designed to be replaced as a modular unit.

Three main modules

In fact, the machine is built from three main modules, and Diablo envisages servicing as a simple module-switching operation. That is an improvement for the user, because it is faster and cheaper on labour — and better for Diablo because it places users, distributors and OEMs firmly in the hands of the U.S. manufacturers as far as support is concerned.

The cost-paring exercise includes a distinctly parsimonious provision for mounting the printed circuitry. As explained, chip-shrinking has reduced the space occupied by the electronic hardware by some 50 percent, but touches like piggy-backing the HyPro-5 board on to the main processor board instead of mounting it in its own motherboard slot lend a rather improvised air to the internal arrangements.

What is worse, the standard D-25 female connector, through which the data stream enters the machine, is mounted directly on to the thin sheet-metal shield round the PCBs. Once plugged in, the male connector projects some 5cm. from the back of the machine and a knock against it can apply considerable leverage, moving the logic PCBs in their mountings.

It would, of course, be pointless to judge the quality of the electronics by sight alone, but the physical solidity of the PCB sitings affects electronic reliability, and in our view, that was a distinctly weak area, which we hope will be improved later in the production run.

With fewer electronic components, it has become possible to dispense with a cooling fan — heat disperson is left entirely to heatsink fins at the rear. The model under test developed appreciable hot-spots soon after power-up, particularly around the region of the mains transformer. That worried us, but not, apparently, the machine, which over the course of about three weeks of workhorsing its way through the office drudgery appeared to be to be completely tireless.

Possible moral

Or almost completely — our unit went down towards the end of our test period. Obviously, no concrete deductions can be made from the failure of a single sample, a production prototype at that. Yet the moral may be that the early days of any new design, however good, carry potential hazards for the user who rushes in to be first on his block with the latest model.

That is underlined by Diablo which in its manual, draws attention to the fact that its reliability figures — a mean time between failures of 2,000 hours — relate to a mature product, which the 630 will not be until well into this year.

One-off, end-user price is around £1,650, though independent importers may be offering it for less. It is worth thinking twice about bargains: service is a big factor in any new model. At the moment, only a RO, receive only, version is available, but a KSR, keyboard send-receive, version is expected towards the middle of this year, by which time a basic parallel printer chassis will be on the OEM market at about £1,200.

A fast, 55cps, version of the 630 may be available, together with a home-computer product designed to sell in the States for less than $800 — that will be a 15cps machine using a simple stepper motor technology.

Machine tests

Test	Time taken	Comments
Standard text		
uni-direcional	1'54"	31cps speed on solid text matches
bi-directional	1'50"	32 cps manufacturer's claim. Bi-directional print not much advantage.
Formatted text test	0'56"	Not significantly slower than some printers claiming 55 cps.
Tabbing test	0'40"	Excellent. No discernible mis-alignment.
Graphics test	5'30"	Significantly faster than some printers claiming 55 cps.

Standard text is an A4 page of garbage selection of words modelling average prose. The sample used was solid and unparagraphed, so by contrast, the front page of a typical television script was chosen for the Formatted Text Test.

This requires indentations and centring, and assesses the thinking speed of the machine in optimising print-head movement. The Tabbing Test calls for absolute tabbing to print-out several rows of the vertical bar character, "|". That is a critical test for any daisywheel print mechanism, and with badly-adjusted, worn, or badly-designed print-heads, gives a ragged vertical broken line.

The Diablo performed perfectly, produced the best alignment we have seen. The Graphics Test sets the task of printing-out wallpaper patterns consisting of squares and arrows. Though the result has doubtful aesthetic value, it is a useful way of assessing the machine's ability to calculate and perform small incremental movements. Because of the speed of the 630 8085 CPU, the medium-speed printer far out-performed another printer claiming 55cps in the execution of the test.

Bi-directional printing

Automatic bi-directional printing, enabled on power-up and re-set but capable of being switched-out if necessary, speeds the printing process by running from alternate lines in a right-to-left motion, having reversed the order of the characters in the buffer.

Many word-processing systems include software resident in the host computer for doing that. The Diablo 630 now offers that as a standard feature. For that to work, the electronics requires, reasonably enough, to have at least a line's worth of data in the buffer ahead of printing. CP/M users will be disappointed to discover that the various CP/M printing features, like PIPping to LST:, TYPEing, and of course Basic LLISTing, avoid buffer overflow in simple peripherals by offering only one line at a time.

So a Basic program LLIST will not enable bi-directional printing on the Diablo 630. To do that, a special program needs to be written that sends the characters out in a single bit-steam and keeps an eye open for buffer overflow.

Conclusions

- **The Diablo 630 is a medium-speed printer which thinks very fast.**
- **The print-wheels and ribbons are easily second-sourced.**
- **The metal-wheel option offers superb print quality, though the excellent plastic-wheel quality should suit most applications.**
- **The 630 represents the spearhead of a radical departure for Diablo.**
- **Good value for money, but manufacturer's cost-paring is worth a look.**

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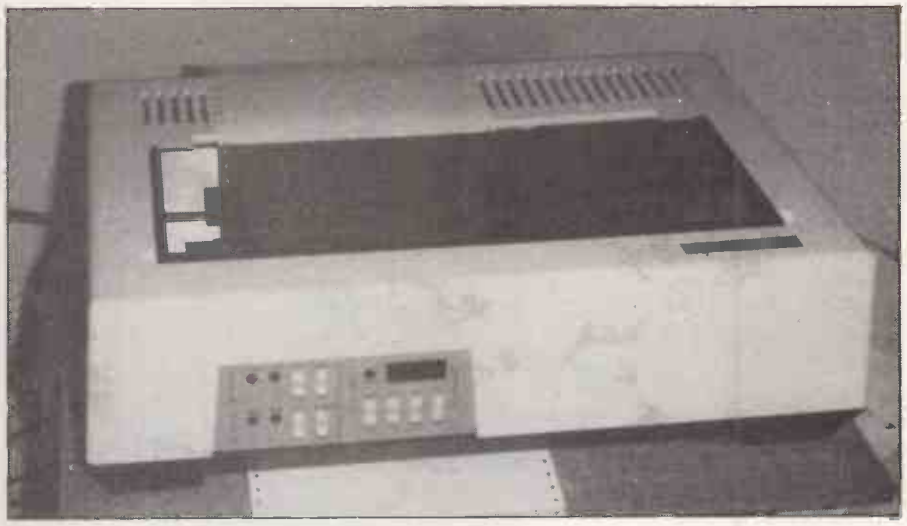
Datasouth DS-180 v. Anadex DP-9500



The Datasouth DS-180.

by Peter Laurie

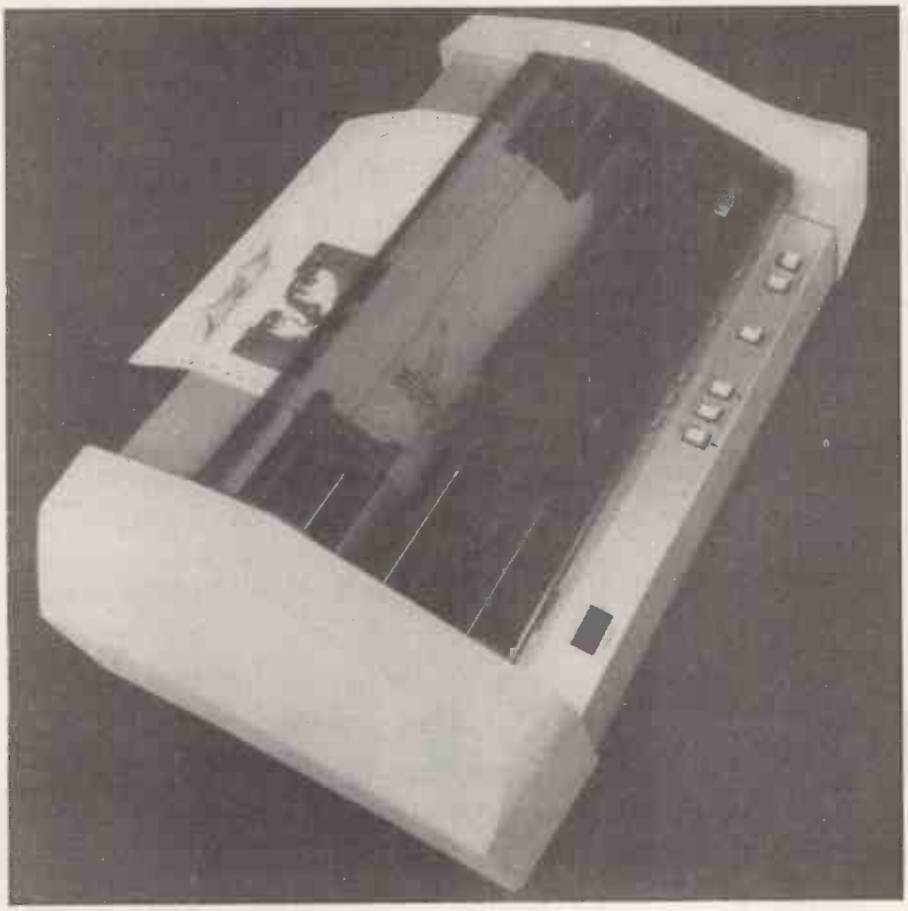
FIRSTLY, let us examine the similarities. Both dot-matrix printers are substantial, well-built machines which use fan-fold, pin-feed paper up to the full width of 18in. They both have dot-matrix print-heads which produce proper descenders. The printing is still traditional dot matrix, though, and does not aspire to typewriter quality.

Both machines are reasonably quiet in operation and both have smoked glass covers which further reduce noise. As both accept several layers of paper, their hammers are driven vigorously. If they were designed to print on a single thickness only, they could have been quieter.

Both machines have bi-directional printing and intelligent logic to return the head at the end of a short line. The nominal head speed is about 130cps which gives an average time for both of 17 seconds per A4 page over a long — 80-page — document.

So far, there is nothing to choose between the machines. The differences appear in the ease or difficulty of controlling the extra facilities each offered. The Anadex is controlled by five switches on the front and a row of 20 or more DIL switches hidden at the back inside a narrow slot, partly concealed by the paper. The Datasouth machine has an attractive set of buttons on the front and a calculator-type LED display. The display shows the code number of the function addressed, and on pressing another button, the value for that function stored in RAM in the machine. A battery-back-up preserves data when mains power is turned-off.

The Anadex DP-9500.



So, for instance, to change the line length, one cycles through the function numbers by pressing the appropriate number until the line-length code appears, and then displays the current value by pressing another button.

Both machines offer a huge number of options — probably more than the ordinary user will ever want. On the Anadex, to take advantage of those options, it is necessary to dive into the back, peering upside down into a small slot, hoping to hit the right tiny switch with a screwdriver. Having hit it, you then have to power-down and up again to make the alteration effective — losing, in the process, your top-of-form setting.

The difficulty of controlling minor functions may show itself if people, who write assembler, want narrow characters for their listings, and the people who process words want wide characters. So it can be necessary to switch from one to the other each time the machine is used.

Character size

The Anadex seems tiresome — tiresome enough to make it worth postponing a listing rather than change character size. The Datasouth is easier but not totally simple, since it is necessary to consult the manual to find the right code and then cycle through a good deal of other data. Perhaps surprisingly, the easiest printer to use is the office work-horse, a Zenith which has a large wide/narrow-character button on the front. You may even change in mid-line if you want.

The general design of the Anadex seems uninspired ergonomically. If you lift the smoked glass cover to adjust the paper, it pinches the paper so you cannot. The buttons on the front are arranged rather

badly so that you could easily hit "Top of form set" when you wanted "Top of form".

The Datasouth is easier, but still not totally satisfactory because often-used functions are mingled with once-in-a-lifetime functions. How often, if ever, do you want to change vertical tabbing?

In fact, both machines exemplify the current, universal computer problem. The hardware will do anything you like; it is the software that is the problem. Both manufacturers might consider more precisely what users want, rather than showering them with every function which occurs to the hardware designers.

The Anadex has a graphics mode; the Datasouth is said to be about to have one. We tried to make the Anadex do drawings but found it hard work. You have to draw with the six central pins of the head, so that it is necessary to consult a manual of graphics characters all the time. Moreover, you do not feed the machine an x,y co-ordinate and obtain a dot there. You need to say: go down three lines, indent 53 characters, print a graphics character.

It occurs to us that the ordinary small-business user will seldom want to wrestle with graphics except, perhaps, for printing bar codes, and an occasional histogram, but then his systems house would give him a routine to do that.

Correspondence quality from inexpensive 737

THE CENTRONICS 737 with RS232 interface at £475 looks like many other small dot-matrix printers, but with one very important difference; it has a special, close-spaced, dot-printed font which closely resembles ordinary typing.

In our opinion, that is rather better than a daisywheel which tends, when worn, to lose accuracy and look rather unkempt. What is perhaps not so wonderful about the 737 is that it also produces proportional spacing. Although book- and magazine-quality print is proportionately-spaced — each letter has the space it needs, rather than a standard space, as in typing — we are not sure that it necessarily makes less perfectly-printed text more easily read.

If one thinks about the extra processing the eye is required to make, that is evident. To read letters which are all spaced equally, the eye has to move on a fixed distance per letter. With proportionately-spaced text it has to read a letter, deduce the width and then move on — an extra calculation is introduced into the process which is made no easier if the letters are somewhat fuzzy.

Software switches

There are several other fonts available through software switches. The default font is ordinary seven-by-eight dot matrix at 10 characters per inch, cpi. The proportionately-spaced font is activated by sending the printer ESC, CTRL Q — ASCII 27, 17. Underlining can be turned-on at any time with CTRL O, ASCII 15 and turned-off with CTRL N ASCII 14.

That is done by using the ninth dot continuously; it touches the descenders of the typewriting-quality font, and leaves one dot's height clear below the ordinary dot-matrix font.

Double-width letters in any font can be turned-on and off again with equal ease. Those software switches work smoothly and well, particularly since the word-processing package used allows one to insert ESCapes and control characters into the text.

The print-head can be back-spaced for overprinting and the paper can be fed-up and down by half-line increments, making it possible to print complex letter combinations like X_r^2 with only a modest amount of difficulty.

From one to six dot's, 0.0066in., space can be inserted between letters by sending ESC n (n = 1—6) after each letter. That is obviously too much to do by hand, but it would not be hard to write some software to do it.

The Centronics 737 dot-matrix printer.

Another pleasing feature is that the machine will cope either with pin-fed or plain paper. Plain paper can be from a roll — a carrier is provided and there is an efficient tear bar. The mechanism will also accept sheet paper, though it is rather a performance to load it since the automatic advance will not work in the paper-out condition and you can not enter the paper easily without it. It is so easy now for letter paper to become stuck to fan-fold sheets that this will probably be used only occasionally.

There is a very useful DIL switch inside the printer which sets the machine for U.S., U.K. — the difference is £ for # — Germany, France, Italy, Sweden and Finland, which shows that someone in overseas marketing had taken some thought.

It is annoying to have to report that the 737 is only about 90 percent wonderful. The most obvious irritation is that it will not recognise a form feed — ASCII 12. In many printers, that command moves the paper from wherever it is to the top of the next sheet — with 11in. being the default setting — and that is obviously a useful accessory to have.

If your word processor uses FF to start a new page, rather than the appropriate number of line feeds, you will obtain rather odd-looking text, until, or rather if, you can have your word-processing package modified.

The next irritation is over the automatic line-feed on receipt of carriage return. You can have that on or off by dint of cutting a 220ohm resistor from the main circuit board. It has to be off for word processing, since the package calculates ends of lines and sends a carriage return, line feed when it feels like it. However, when you are listing Basic, it must be on, otherwise long lines overprint overflow, generate a carriage return without a line feed and overprint at the left-hand end.

If you have auto-line feed on for some reason, the machine throws two blank lines between printed lines, so it uses up a good deal of paper. Of course, there is the irritation of soldering and unsoldering the resistor when you want to change from word processing to program listing. We will probably mount a switch on the front somewhere to save on the soldering, but it will be less than satisfactory.

A third, minor grouse follows on from the first: there is no form-feed button, so one has to run the paper up by hand using the feed forward reverse command which is unnecessarily tiresome.

Value for money

Despite those disadvantages, the 737 is good value for money. It gives correspondence-quality printing for less than £500. That is so useful that one can, grudgingly, tolerate the irritations. No doubt later versions will be improved.

The fact that the 737 produces proportional-spaced printing means that a word-processing package which creates justified right-hand margins will be sabotaged. It will calculate the number of characters per line, and allocate that number of spaces, and then send extra spaces to fill, thinking that each character takes the same amount of space,

If it is driving the 737, its space calculations will be thrown out by the variations between letters. The answer is another dive into your word-processing package to gives it a look-up table for the different letters spaces.

Is it worth leasing a micro?

Advantages

- No large down-payments
- Counts as off-balance-sheet financing
- Can reduce interest charges
- Encourages investment

Disadvantages

- Can encourage over-expansion
- With bad terms, can mean expensive borrowing
- Equipment is not owned
- Vulnerable to changes in tax law

LEASING is emerging as an increasingly-popular way to finance the use of microcomputers. In the well-established mainframe and minicomputer markets, leasing has, for some time, been the main form of finance. Until recently, however, microcomputers have been regarded as too new and too inexpensive to find favour with the traditional finance houses. It is only the recent boom in business sales of microcomputers which has begun to make leasing more acceptable.

Part of the reason for the growing popularity of leasing for microcomputers

by Duncan Scot

has been the depth of the present recession. In many industrial and business sectors, orders have dropped so rapidly that the advantages of introducing microcomputers are now being appreciated.

Another effect, however, is that worried financial directors looking for ways to reduce costs pick the obvious and perennial target of the capital expenditure budget, placing a moratorium on investment in new equipment. The ways to elude that include credit in the form of a bank loan, hire purchase, which is normally a more expensive way of raising money, hiring, in the same way that one might hire a television, and leasing which can constitute one of the least expensive ploys.

The distinction between hiring and leasing can be subtle and is often only one of tax law and accounting practice. It is sometimes assumed that any agreement which runs for less than 12 months is renting and for more than 12 months is leasing.

One of the obvious advantages of leasing a microcomputer, beyond the savings on the capital budget, is that the cost of the lease can be financed from the profits

CCS Microhire of Letchworth, Herts.

or savings made by the computer once it has been installed.

Leasing can also help one's profits at a time when profits are depressed. Interest payments on borrowed money tend to be at their highest in the first years of borrowing and so have a greater effect on the balance sheet whereas lease payments can be evenly distributed over the period of the lease.

Partly as a result of those advantages, leasing has emerged as one of the fastest-growing areas of the financial sector in the U.K. In a recent report entitled, Investment in Leasing, the stockbrokers Greene & Co said: "It is difficult to think of any sector, be it in manufacturing or service, which increased by nearly £600 million in 1979".

According to Greene & Co, the rapid growth in leasing is also the result of the high interest rates of the past few years which have made it more economical to lease equipment than to borrow money to buy it — a saving which they claim can be as high as eight percent when interest rates stand at around 20 percent.

Interest charges

The reason why the interest charges on leases can be lower than those on borrowed money is that leasing is off-balance-sheet financing. As Greene & Co put it: "It may look like borrowing, it may feel like borrowing, it may very well smell like borrowing, but legally it is not borrowing".

The result is that the bank or leasing company can, in effect, borrow a tax allowance from the user to reduce its own tax charges on its profits. Another result is that a leasing arrangement will not normally affect the borrowing capability of the company in other areas.

In practice, there are two type of leases, finance leases and operating leases. A finance lease, which is the most common type of lease for microcomputers, is normally arranged by one of the subsidiaries of the main clearing banks. They are: Mercantile Credit of Barclays, Lombard Central of NatWest, Lloyds and Scottish and Lloyds of Lloyds and Forward Trust of the Midland Bank.

Finance leases usually have a fixed primary period of from two to five years during which time the payments have to cover the full cost of the equipment including the interest charges and some profit. At the end of the primary period, the user can continue to use the equipment for a nominal rent. If the user decides to sell the equipment at the end of the primary period, he is normally able to keep the bulk of the proceeds.

Operating leasing is more like renting in that specialist leasors, like television rental companies, buy the equipment and then

The West One Computer Services premises off London's Baker Street.

lease it not expecting to recover the full cost in the primary period. The leasing company normally assumes the responsibility of maintaining the equipment and so there is less risk for the user.

Operating leasing is normally only practical or profitable when there is a good and stable second-hand market for the equipment. The built-in obsolesence of many microcomputers often precludes that. The latest version of a range of microcomputers will sometimes cost the dealers less than the original value of old equipment. In practice, the second-hand market for microcomputers is limited to private buyers and sellers in the classified sections of magazines such as *Practical Computing*.

The largest forces in leasing are the subsidiaries of the main clearing banks but most of the merchant banks also have leasing arms and there are also many independent leasing companies.

There are, however, some areas of leasing which can be very expensive and, unfortunately, one of those areas tends to be in office equipment where the unwary buyer can be led into paying substantial interest rates.

Before entering into any form of leasing contract, the details should be checked thoroughly. Always calculate the true annual rate of interest. Figures which are presented as so many pounds per £1,000 worth of equipment per month over a number of years can be very misleading. If one leasing company cannot offer acceptable terms, there are plenty more to try.

It is only over the last two years that the leasing companies have learned to accept microcomputers. We recently heard of one company which was recommended by its local bank to lease a microcomputer to help look after its accounts, only to be turned down by the leasing arm of the same bank. That picture now seems to be changing.

London company

One recently-formed company in west London is trying another approach to bringing microcomputers to business users without forcing them to buy the system first. West One Computer Services, run by Malcolm Harvey and Roger Martin sometimes recommends that their clients should buy a microcomputer by leasing. West One Computer Services combines that service with a microcomputer bureau.

"We had a spell working for a mainframe company in Lagos, Nigeria", says Malcolm Harvey, "and when we returned to Britain, we kept on meeting these black boxes called microcomputers. We decided that the future lay with microcomputers although we were worried at the time that we might already have been too late. As it turns out we were perhaps a little early in our field".

Malcolm Harvey envisaged microcomputer bureaux developing as a general service in much the same way as the High Street photocopy and print shops. "Ten years ago", he says, "if you wanted a business card printed and you wanted only 200, you would have to pay for 5,000 or more at the same time. The new technologies in printing made it cheap and quick and local. We saw microcomputer bureaux starting whose clients would also work in the same geographical locations".

The business was started at the end of 1979 in some small offices in London's Great Marlborough Street, off Oxford Circus, where they stayed for about five months. "We decided quickly that we have to move to these new offices off Baker Street because we needed a shop front so that people can walk in off the street".

For a typical run for a small company, West One Computer Services charges a nominal setting up fee of about £100, a run charge of about £5, an additional fee of about 10p per posting through the account and then a final charge of 15p per

(continued on next page)

Background to the companies

TWO PARTNERS make an effective team, to judge from the two leasing operations featured. The two brothers, Alan and Ian Rees, who run CCS Microhire, have almost exactly complementary skills which divide conveniently into two headings — software and hardware. This is their first venture together, though they have stayed closely in touch with one another over the years, even to the point of doing the same Master's degree at Lancaster University.

Malcolm Harvey and Roger Martin, on the other hand, are long-time friends who have worked together for more than 10 years in data processing of one kind or another before importing their bureau service from Lagos, Nigeria, streamlining it and presenting it as a walk-in shopfront as West One Computers.

Alan Rees is the programmer for CCS and conceived the idea of a leasing service. He brings a background in systems engineering and a career in business systems analysis to CCS, which started life as a part-time operation with no capital whatsoever.

He was joined by brother Ian who gave up a well-paid position as general marketing manager for the British Oxygen company, Cryplants, to act as a one-man sales and service support operation for his brother's idea. After a slack period before Christmas, business is looking good; CCS is well beyond break-even point with nearly 20 systems on hire.

Alan Rees (left) and Ian Rees of CCS Microhire.

Malcolm Harvey and Roger Martin of West One Computers.

Malcolm Harvey of West One has been with some kind of financial data processing for more than 10 years. He started "in North London as chief stoker on a steam-driven ICL 1900", and says that he met Roger Martin "when he was trying to pick my pocket".

They teamed up to run a bureau service in Nigeria, where they did a great deal of work on ICLs — ironically enough for the Nigerian government's indigenisation programme — and also for Barclays Bank, when the Africans took exception to that bank's much talked-about South African interests. Their particular concept of batch-processing, combined with the option to buy machine and software, eases the customer through the tricky first stages of computerisation, when the client is still unfamiliar with the concepts of programming and has to handle more data than at any subsequent stage.

That, combined with their attractive storefront, has netted such useful accounts and social contacts as the Euthanasia Society, the City Squash Club and the Pineapple Dance Studio.

(continued from previous page)

statement. The total cost works out at about £110 per week per client on average, some costing far less and others more.

"Rather than specialising in any particular application", says Malcolm Harvey," our clients are all based in this area. If we wanted to expand the business, all we would have to do would be to set-up another office in another district".

"When the business started, we were receiving an enquiry every day. Now there are about three every week, with a reasonable proportion staying on as permanent clients".

Finding clients has been the most difficult problem for the bureau. "We do not have the resources", says Malcolm Harvey, "to advertise in the local press or the evening papers. That would be guaranteed to bring in a good deal of response since there are many small businesses in this area. Occasionally we hire a team of girls to distribute leaflets to a selection of potential clients and we would like to follow that with a mail shot in the hope that some of them will recognise that they need a computer service".

One of his tricks is to go through the evening papers for job advertisements for bookkeepers and then contact the advertiser. "Our computers are cheaper, more reliable and they don't take holidays".

Another company which has tried to take a share of the market by selling the use of microcomputers and not the hardware is CCS Microhire in Letchworth, Hertfordshire. Alan Rees, who runs the company with his brother Ian, concentrates on hiring microcomputers for short periods.

"We tend to go for the smaller equipment", says Alan Rees, "like the Pet, Apple, Tandy and the RML 380-Z. We try to avoid the larger systems like the Horizon and the Cromemco for the short term hires, as it costs so much more to stock the equipment".

First month refund

Most of the people who use the service are private individuals or companies needing a small computer for an exhibition or perhaps for evaluation work for a week or two before deciding to buy. "One of the deals we do", says Alan Rees "is that if a client decides to buy a system they have hired, we will give them a refund on the first month of hiring".

The company has daily and month rates which run for up to three months. If someone needs a system for longer, they have to take it for at least a year on a lease which CCS would finance. For periods longer than a year, CCS tries to help their customers arrange a lease with a finance house.

An 8K system costs £4 per day, 16K £5 and 32K £6. Disc drives are £2 a day each and printers around £4 depending on the quality of the print.

The yearly rates, financed by CCS, depend on the capital cost of the equipment, so it is different for each machine. A 32K Apple with two disc drives and a printer would cost £198 per month. "The equivalent hire-purchase cost would be £500 deposit and then £175 per month".

For any period longer than a year, one would have to turn to the leasing companies for finance. "Two years ago when we started, no-one in those companies knew anything about computers. One or two of the leasing companies were brave enough to have a go and now most of them will give two year leases on equipment worth about £5,000".

CCS Microhire has a credit licence, granted by the Office of Fair Trading, which means that it is formally allowed to advertise its service. Without a credit licence, a company is limited to renting for three months or less.

It is a mark of how much the industry has developed in the past two years that all these alternative means of financing the purchase of microcomputers have developed. One is now armed with the choice of cash, hiring, arranging a lease, or for trial periods using a microcomputer through a bureau.

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TIMESLIP

by John Abbatt

RAIN. Another squall swept the hillside, making the men hug their mudstained jerkins closer to their aching bodies. Ranulph Bradwardyn shot a concerned glance at the packhorse, which had twice before slithered on the treacherous, chalky mud. His main worry was the 130lb. body armour that he had nursed and cursed all the way from Harfleur. Every night he inspected it for dents and greased the joints carefully with mutton fat. Any lack of mobility could make all the difference between life and death in combat.

Fourteen men left; their feet wrapped in bloodstained rags, clothes torn, bodies racked alternately with hunger and the flux. For the last four days they had existed on handfuls of berries, some cobnuts, and four rabbits skilfully snared by Golding the poacher.

It was a far cry from the group of almost 100 that had excitedly embarked in the *Katherine de la Tour* in the Solent but two months earlier. Yeomen, who had never before left their Warwick villages, let alone seen the sea, cheered the King to the echo.

Henry V had ordered the mainsail to be raised on the *Trinité Royale*. It had flapped idly in the warm August breeze and the boat gathered way slowly. As it sailed past the flotilla, the noise of drums and trumpets rolled across the water. Red pavises were hoisted and sails, bannerets and pennons edged with feathers presented an avenue of colour to the proud monarch.

One by one the boats raised their anchors and merged with the heat haze, leaving the winking eye of the Needles lighthouse to starboard as the last tenuous link with Albion. The much-heralded attack on France had begun.

The grim, seven-week siege of Harfleur dispelled much of the illusion. The walls of the colourful, compact town were breached by the three great siege guns. Mangonels, springalds and bricoles had hurled 300lb. stones and flaming tar into the gaps. Starved, burnt and bleeding, with no prospect of relief from the divided French army, the townspeople had been driven to surrender with honour.

It was a hollow victory. Wounds and dysentery had depleted the English army to the point where the projected triumphal march on Paris was plainly impractical. The doomed town had bought the Dauphin enough time to weld together the bickering factions of his army. Henry's inspired zeal did not desert him.

He had, after all, pawned the Crown Jewels and run up astronomical debts and obligations to finance his claims to the French throne, against the promise of unlimited ransom and booty. He therefore proposed a *chevauchée*. They would march to Calais, ransacking all of the towns and great houses along the route.

The risk was enormous. The Dauphin was reported to have gathered a huge force at Vernon, and the Constable d'Albert another at Rouen. At Blanche-Taque the Marshal Boucicaut blocked the crossing of the Somme with some 6,000 men, so that the depleted English force was obliged to wheel inland to make a detour of more than 100 miles.

About their shoulders were strung the most advanced combat weapons that the civilised world had ever seen.

Now, as they neared Maisoncelles, they knew that all of the French forces had managed to combine, so that 20,000 armed men now blocked their path somewhere ahead. They were outnumbered by six to one and far from home. The task now as to locate the French, who were led by d'Albert and bore the blessings of both the King and the Holy Church. D'Albert had unfurled the Oriflamme, the sacred, red silk banner of St Denis, which served to unify the whole of the French feudal hierarchy.

Bradwardyn's band was one of many scouting and foraging patrols which preceded the main force. As they breasted the dripping hilltop, the men gasped at the view and flattened themselves to the damp grass. There was a farm, and then a village, and then a green plain surrounded by woodland. The plain was darkened by the vast French army and speckled with the spiralling smoke of camp fires.

Bradwardyn took one look and then scuttled down to the hobbled horse to unpack his writing case. Hurriedly he penned a note, patted it dry with blotting paper, scrolled it and sealed it. Then he summoned his page, Master Esmon Pyper, and despatched him post-haste to Henry's camp.

He crept back to his awestruck men and considered his next course of action. Prudence dictated that they retreat and survive; honour that they stay and observe. The stringencies of near-starvation demanded they forage in the nearby farmhouse.

The rapacious Frency army had scavenged the countryside, stealing from their own peasants, and this was the first building in 100 miles of forced march which looked intact. White smoke billowed from the crooked chimneys and fowl and swine pecked and grubbed around a muddy enclosure.

He wondered whether to don his armour, but rejected the idea immediately, it took fully half an hour. Instead he unpacked his belt, broadsword and dagger and fastened them about his waist. The yeomen had no protection other than conical hats of boiled leather, bound with iron bands. Each had a knife, axe or club tucked in a belt for hand-to-hand defence. About their shoulders were strung the most advanced combat weapons that the civilised world had ever seen: the Welsh longbow.

Each had a finely worked shaft of straight-grained yew, tapered and notched. The arrows were 3ft. long, steel-tipped, and flighted with goose quills. The quills for each arrow were taken from a single bird, with opposing feathers taken from alternate wings. At 250 yards, they could penetrate an oak door, or pass through chain mail as though it were parchment.

They slid low across the sky-line and doubled down the slope. A hundred

(continued on next page)

(continued from previous page)

yards from the farm, exposed on open ground, they were stopped by the sound of a woman's scream. Moments later, a large party of French soldiers emerged from behind the house. They were laden with kegs of wine, cheeses and sides of ham. Some laughed and drove before them a dishevelled peasant girl.

She was comely, her bodice was torn and gaping open, and they moved her along by slapping the backs of her thighs with the flats of their swords. From the fine clothing and the scattering of armour Ranulph deduced that the party consisted of men-at-arms, together with some of their pages and valets.

Inevitably they were seen. One man shouted and pointed. Ranulph, with little experience of combat command, found himself again having to make a decision with little precedent to guide him. It was not so much a simple question of attacking or retreating, but whether or not to jettison the complex protocols that governed the chivalrous conduct of a conflict.

There should really be time for parley, the issue of challenges, the choosing of ground and time. Armour should be donned, positions taken, and then hostilities could commence. However, here the imbalance of forces was so great, and the unsuspected proximity of the two great armies so pressing, as to preclude all of these niceties.

He grasped the anodised handle of his sword, drew it, raised it in the air and gave the traditional attacking command: "Nestrocque". In unison, the men fell to their knees, muttered a prayer and traced the sign of the cross in the earth. Then each kissed the ground, taking a small amount of soil into their mouths, and then stood up and prepared themselves.

The archers leant on their bows, slid the knotted and greased strings into the notches, and selected arrows from their belts. Then they stood square, tensed their muscles, drew on the strings until the goose quills brushed their cheeks, and fired at will. A thud and a nerve-tingling whirr marked the passage of the deadly shafts through the air.

The French were transfixed, both figuratively and literally, as the arrows fell among them. Although they outnumbered the English by about four to one, they were lightly armoured and without bows. Thus they made soft targets, and, at a 100yd. range, the arrows passed cleanly through their bodies, unless deflected by a bone.

There was a fateful minute of indecision. Men-at-arms do not expect to engage peasant yeomen in direct conflict. Then, as the arrows rained down, and men continued to fall, a command was shouted and they charged up the muddy slope.

Only 10 men finished the 100 yards alive. They fought bravely but the English, with sound wind, the advantage of the slope and the blood lust upon them, despatched them quickly.

They left the stripping of the bodies for later and advanced rapidly to secure the farm. The woman had run inside but now she re-appeared and eyed them curiously; a baby suckled at her bare breast.

As his men gathered up the abandoned booty, Ranulph addressed her in his execrable French, and pointed to the turret of a distant castle that pierced the carpet of trees beyond the teeming plain.

A thud and a nerve-tingling whirr marked the passage of the deadly shafts through the air.

"Qu' est-ce que le nom de ce château fort, madamoiselle"? She removed a piece of chewing gum from her mouth before replying, "C'est Agincourt, monsieur".

ABEND 29C4

"This is your first stab at programming a historical novel, isn't it, Ray"? asked Zena.

Ray was musing, as ever, on the marvel that so much good looks and intelligence should be encapsulated in the one human being. As usual, he found himself tongue-tied in her presence.

"I gather that Abend 29C4 is an anachronism report", he said.

"That's it. The word-selector routine finds the nouns and verbs on the word index which follow the story line most closely. It also checks and then pulls out the period codes against every artefact. They are retained by the author programs and the page editor finally strips them out. As it does so, it checks the period range on the corresponding entries in the artefact table with the story date set in common data.

"If it counts up to four chronos, it stops the print. Before we put that limit in, we had some incredible stories: Biblical epics involving jet travel and so on. When you get a Timeslip, it's generally obvious".

She slipped her manicured long fingers into the back of the tabulation and peered at the Dump. She was off on the scent. Ray enjoyed watching her in action.

"Let's see, here's the list. There was the lighthouse in paragraph 5. No Needles lighthouse in 1415. Then there's the blotting paper in 10, the anodising in 15 and the chewing gum in 20. Right, so there's the pattern every fifth paragraph".

Flick, flick, flick.

"Right let's see your time parameters. CENT = 15, YR = 15. Good. What's this: CHARDPTH = 2? About right. This was a middle-level paperback novel with possible TV spin-off, so not exactly Walter Scott. You would need to start with a depth of character rating of two and then up it by one for every additional 1,000 words. Remind me to talk to you some more about the style parameters some time".

"All I really want", thought Ray," is to know what you do in your spare time. Are you free this evening, or do you spend your time reading operating manuals or dumps"?

Flick, flick. He said nothing. She was digging deeper in the dump.

"Got it. Look, you were editing to five paragraphs per page average. Remember five. So look here, you've set the paragraph counter but you've given the field the name CENT. You probably meant COUNT or CNT. Somewhere in the edit output, your paragraph counter is reaching five and then being added to the Century field, so that it accepts an artefact five centuries ahead of the story".

She was incredible. It had taken her just three minutes. He had timed her.

"So there we are, Ray. Re-declare it as an implicit variable, or safer still, change the name and you can try a re-run. Oh, and add about three to the adjective tone parameter, I think that will help".

Ruthlessly she shooed him out of her office and he returned reluctantly to his desk clutching his tab. Not for the first time, he paused to wonder at the fact that at one time people wrote stories by putting phrases together in their heads and then painfully typing them through draft after draft. Then they had to try to sell them. Now it was all precise market research and machine-honed story lines.

As he sat down, he applied himself to another problem. He could not keep inventing ingenious mistakes just to win a few words with Zena. It would soon affect his quality assessment rating. So what to do? Write her a personal note and take the consequences?

An idea began to form in his mind. The story line allowed him a Class 14 Romance between two of the main characters. What if he made it Class 16 to make it a little more explicit, and then he doctored the personality profiles so that one of the characters was a Ray type and the other a Zena type. Then when she read it —.

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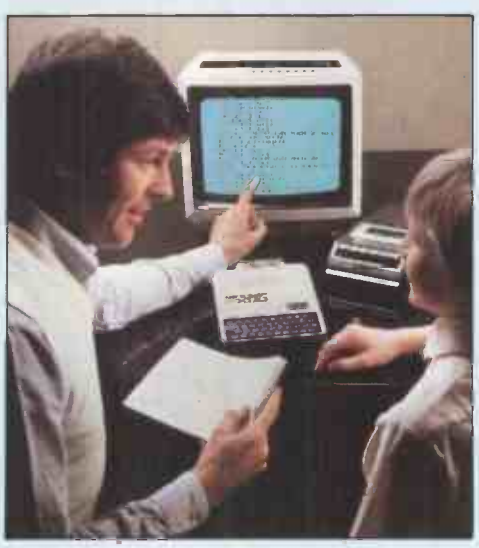

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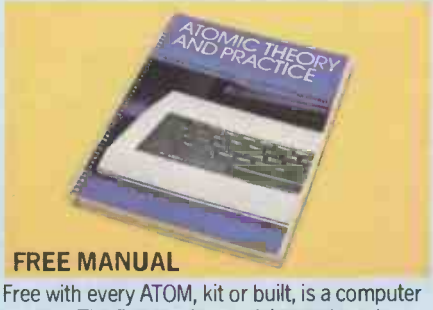

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Prolog can link diverse subjects with logic and fun

by Richard Ennals

SINCE I last wrote for *Practical Computing*, July 1979, August 1979, about the uses of microcomputers in school teaching, there have naturally been a number of important changes in the situation. Apart from the increased provision of magazine outlets for educational programming ideas and the further expansion of user groups for the principal microcomputers in use, a greater range of possibilities for further development is now opening.

Government is showing more interest, but as Edward James remarked in *Practical Computing* November 1980, its activities have been inconsistent and in some cases of dubious value. Whereas the Department of Education and Science has spent years deliberating over procedures for spending £9 million spread over three years, and progressed little further than the agreement not to devote that money to the provision of equipment, the Department of Industry approach has been the reverse: an instant competition designed to provide 100 schools with microcomputer systems.

With increasing awareness of the importance of the new technology now a regular theme in all the media, schools have felt pressure to acquire the equipment — often any equipment that they can afford. There then follows, all too often, a crisis of expectations.

A number of teachers express interest in a new computer, and expect to find a wide range of ready-written programs and packages for use in the teaching of their subjects and particular syllabus requirements. The analogy is drawn at such meetings with video equipment, acquired by the same schools in the recent past. Once you understand which knob is which, it should work.

Limited range

When they see the limited range of ready-made packages, and discover the amount of time and energy involved in writing educational programs, demoralisation sets in. Perhaps that is unreasonable, as the same teachers normally realise the complications and skills involved in making one's own video materials.

The situation has improved greatly in recent months: increasing numbers of local authorities are running courses for their teachers, and developing libraries of software. Many have suggested standard models of equipment to be used — or even provided the schools with such equipment.

More CSE, O-level and A-level courses in computer studies are developing. National bodies like the Schools Council and the British Library Research and Development Department are co-ordinating the work of teachers in developing educational software.

The British Library has attracted support from commercial database producers in the development of bibliographic reference software, which will enable students to obtain references on a given range of subject areas, taken from ephemeral publications readily found in school and local libraries. Pilot schools are soon to start trials.

Problems clearly remain such as those outlined by Edward James. Computing in school can, indeed, become the province of a small elite of computer hams. Courses may be constructed simply on the basis of the degree of knowledge of the teacher and the particular language he has encountered. It can be simply a branch of maths, concerned with number-crunching, or a branch of electronics.

Use of computers in teaching may be determined by simple factors like the geography of the school, or the exigencies of the inflexible timetable. My own work at Sweyne School, Rayleigh, Essex, was enormously aided by the fact that my history department was adjacent to the computer studies room: indeed, we made a connecting door in the wall separating us. Others have not been so fortunate in the haphazard development to date.

We, of course, had the added advantage of winning a 380-Z microcomputer in the December 1978 *Practical Computing* competition, providing also extra goodwill in the school to facilitate innovation which was thus clearly not at the expense of other departments' capitation allowances.

I do not wish to seem pessimistic about prospects for computing in schools, merely to observe its certain lack of direction and purpose at present.

Clear potential

I am particularly encouraged, however, by the clear potential in educational terms of a project in which I am involved at Imperial College, London, supported by the Science Research Council. Logic is being taught as a computer language for children, using a child-orientated microcomputer version of Prolog, PROgramming in LOGic, to support the teaching materials.

Micro-Prolog is written for the Z-80 microprocessor using the CP/M operating system, and is implemented on a North Star Horizon at Imperial College and for school use at Park House Middle School, Wimbledon. Since September, a class of 10-11-year-olds has been working for two double periods each week, steadily gaining in competence in the use of the language.

There are a number of justifications for such an approach. Firstly, there are benefits for computing. The most important of those are that it plays an essential role as a specification language in the methodology of developing correct programs, that it can be employed as a very high-level programming language in its own right, and that it can be introduced simply as a user-orientated query language for databases.

The formulation of database queries offers children a simple introduction to the use of computers. The use of logic as a query language has the additional advantage that children can be promoted from database users to computer programmers with a minimum of fuss by providing minor extensions of the language. The subject content of such databases can be very varied, often relating to other school subjects.

For example, a class may wish to find out about the British Constitution. A database could be available, with this vocabulary:

Queen	)
Prime-Minister	)
Leader-of-the-Opposition	)
Members-of-Parliament	) Names of individuals
Electors	) or sets of individuals
Speaker	)
Lord-Chancellor	)
House-of-Commons	)
House-of-Lords	)
votes-for	)
supports	)
is-a-member-of	) Names of relation-
obeys	) ships
is-chairman-of	)

The students will have a series of questions to ask this database, which have to be expressed in the children's version of Prolog, as shown:

1. English : Who supports the Prime Minister?
   Prolog : Which ((x) x supports Prime-Minister)
2. English : Is the Prime Minister a member of the House of Commons?
   Prolog : Does (Prime-Minister is-a-member-of House-of-Commons)
3. English : Does the Queen vote for the prime Minister?
   Prolog : Does (Queen votes-for Prime-Minister)
4. English : Is the Leader of the Opposition a member of the House of Commons and a supporter of the Prime Minister?
   Prolog : Does (Leader-of-the-Opposition is-a member-of House-of-Commons and Leader-of-the-Opposition supports Prime-Minister)

Alternatively, the class can take on the role of the computer and answer Prolog queries on its behalf. The class could have

(continued on next page)

(continued from previous page)

this database of information about the U.S. presidential election:

Carter	is-candidate-of	Democrats
Reagan	is-candidate-of	Republicans
Anderson	is-candidate-of	Independents
Carter	comes-from	Georgia
Reagan	comes-from	California
Anderson	comes-from	Illinois
Carter	former-job	peanut-farmer
Reagan	former-job	film-actor
Anderson	former-job	congressman
Carter	present-job	President
Carter	wants-job	President
Reagan	wants-job	President
Anderson	wants-job	President

The class then had to provide answers to queries as shown:

1. Which ((x) x comes-from Illinois and
   x is-candidate-of Independents)
   Answer is (Anderson)
   No (more) answers
2. Which ((x) x wants-job President)
   Answer is (Carter)
   Answer is (Reagan)
   Answer is (Anderson)
   No (more) answers
3. Does (Reagan comes-from California and
   Reagan former-job film-actor)
   Yes

The examples look very like queries to relational databases. The use of logic has a number of added advantages. The formalism of the query language is the same as that of the database. Furthermore, Prolog interprets queries both as program specifications and as programs.

For instance, this query to the U.S. election database

Which ((x, y) x is-candidate-of Democrats and
x wants-job z and
y is-candidate-of Republicans and
y wants-job z)
Answer is (Carter, Reagan)
No (more) answers

can be interpreted as the program which

for every x and z such that
x is-candidate-of Democrats and
x wants-job z
searches for y such that
y is-candldate-of Republicans and
y wants-job z

That program can be added to the database by using it to define a new relation. For example:

x is-principal-rival-of y
if x is-candidate-of Democrats
and x wants-job z
and y is-candidate-of Republicans
and y wants-job z

The program could itself be considered as a general rule about American elections. Another could be:

x is-elected President if x is-candidate-of y and
x wants-job President and
Electoral-College votes-
for x

Prolog, a computer realisation of a simple but expressive subset of logic, is well-suited for all of those different uses. It is based on the procedural interpretation of implications

A if B and C

as problem-solving procedures

to solve A solve B and C as subgoals

It first arose from applications of logic to mechanical theorem-proving in mathematics. It was first implemented in 1972 in Marseilles, and has since been applied to a wide variety of areas such as symbolic integration, drug analysis, compiler writing and databases.

It has already become clear from the examples that the benefits of logic as a computer language are not confined to logic and computing. Logic is the single academic discipline which is common to all subjects taught at school.

It provides a single uniform computer-intelligible language which is suitable for expressing databases and programs for such otherwise diverse subjects as mathematics, language, geography, history and the natural sciences. It aids clarity of thought — desirable in any subject area in any school. What is more, from our experience at Park House, it can be fun.

Our current project is to develop teaching materials for a course in logic as a computer language taught in the first instance at Park House Middle School. From that nucleus, we propose to develop both teaching materials which provide an appreciation for the practical applications of computers as well as materials which can aid the teaching of other subjects.

I should add that my previous articles concerned Historical Simulations using the computer. They also seem likely to be far more effective in Prolog than in their original Basic. Using logic as the formalism for the database is producing a much richer and historically more authentic simulation. The implications for other areas of educational computing are very exciting and, as yet, little explored.

How much interest should you pay?

by Charles Norrie

THE publication of the true or annual percentage rate of return, APR, on a loan made by a finance company to reflect the repayment of borrowed capital is a requirement under the Consumer Credit Act, 1974.

That annual rate is approximately twice the flat rate of interest from which the equal, and usually monthly, repayments are calculated. In addition to the monthly payments, finance companies often levy a documentation fee, DF. Generally, that is added to the first monthly repayment, front-end loading, but occasionally a levy may be made on the final discharge of the loan, rear-end loading.

These fees were not considered in calculating the APR, but from October 6, 1980, their inclusion has been a requirement. That, apparently minor change introduces a formidable degree of complexity into the calculation of the APR.

The Office of Fair Trading has issued a pamphlet which suggests that the APR equation may be solved by trial and error. This article proposes a solution which may be implemented on a microcomputer, making use of the Newton-Raphson method of successive approximations.

The APR is calculated from the nett present value, NPV, equation: NPV =

$$\frac{A_1}{(1+r)} + \frac{A_2}{(1+r)^2} + \frac{A_3}{(1+r)^3} \ldots + \frac{A_m}{(1+r)^m}$$

Where NPV is the nett present value of all repayments and is the amount borrowed

r is the APR, expressed as a decimal, to be determined.

A is a periodic payment. The periods must be equal in length. A includes a documentation fee if it is levied at that point.

m is the number of repayments.

In the Newton-Raphson method better values of the APR are obtained by using the equation:

$$r_2 = r_1 - \frac{f(r_1)}{f'(r_1)}$$

where r_2 is a better approximation to the APR than r_1.

f(r) is the value of the NPV equation evaluated at r minus the NPV.

f'(r) is the value of the first derivative of f(r) at r.

The program was written in Applesoft for an Apple II plus to derive the APR. Starting from a first estimate of r as half the flat rate interest a solution to better than .01 percent was found in four iterations.

When the APRs for a consecutive series of amounts borrowed are examined, you will find that they oscillate about a decreasing line. That main trend results from the decreasing importance of the DF, while the variation is a result of the rounding procedure that is permitted in calculating the monthly payment.

When the MP has been derived from the flat rate of interest, the finance company is allowed to truncate the MP to the nearest penny and then add one. That method of rounding differs from usual mathematical practice and thus MPs of £23.48945 and £23.48000 would both be presented as £23.49.

Whatever method is used to calculate the MP, it is that value produced in the finance company tables which must be used to calculate the APR. That value may be rounded-down to the nearest 0.1 percent.

If, under those circumstances, the NPV is calculated for a given MP — making allowance for the DF — and a given APR, the value obtained should be very close to the amount borrowed.

Using APR of 49.8 and MP of 1.99, an NPV of 35.1096254 is obtained. Thus the effect changing the rounding method will be reflected in the APR, on which consumer decisions would be made. If the NPV is not very close to the amount borrowed, it may be indicative that a different value for the MP is produced in the tables, than has been used to calculate the APR. A very small program would be required to perform the NPV calculation.

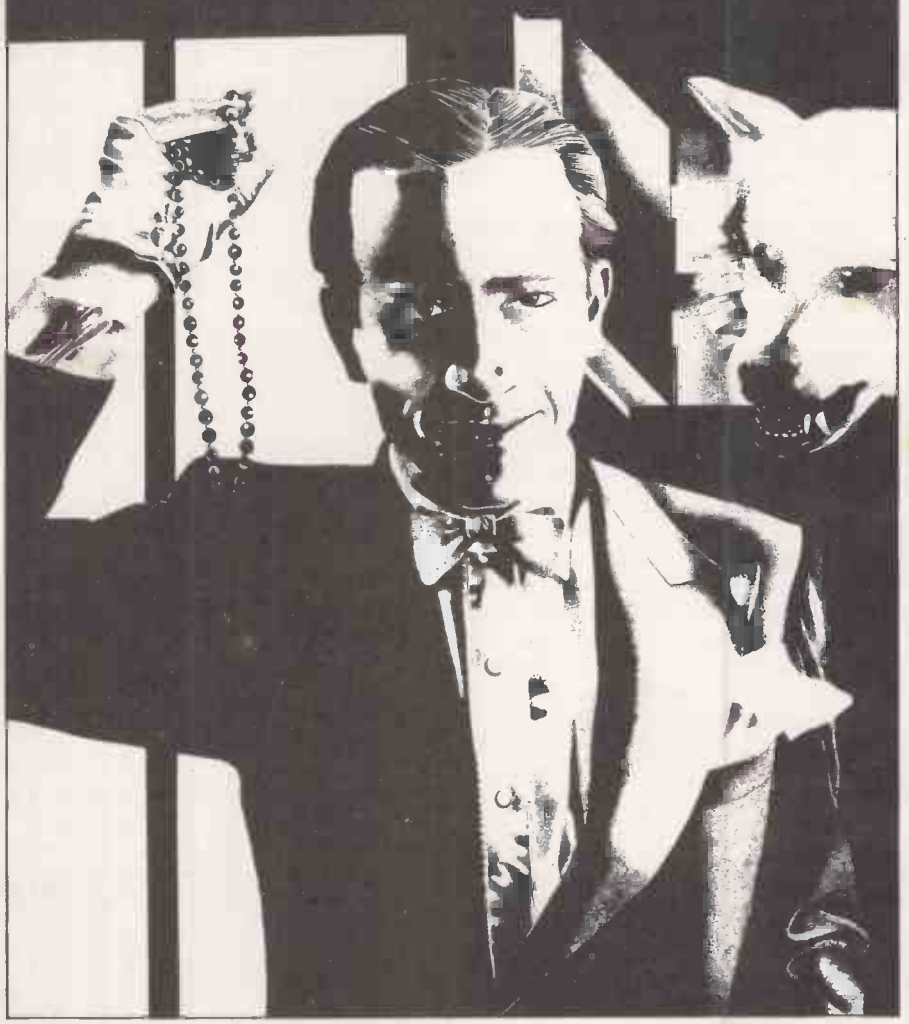
Method of rounding/calculation		MP	APR	NPV
Usual rounding		1.98	49.5	35.000799
Finance company method		1.99	50.3	34.9997782
Result using non-rounded MP	: table	1.99		35.1096254
To calculate APR	: used	1.98333333	49.8	

All values calculated for £35 borrowed for 24 months at 18 percent with a documentation £3 fee.

```
10  REM ************************
20  REM *                      *
30  REM * ANNUAL PERCENTAGE    *
35  REM * RATE OF RETURN       *
40  REM * CALCULATION          *
45  REM *                      *
50  REM *      C NORRIE        *
55  REM * OCTOBER 1980         *
56  REM *                      *
60  REM * NO COPYRIGHT         *
65  REM * THE AUTHOR ACCEPTS   *
70  REM * NO RESPONSIBILITY    *
75  REM * FOR THE ACCURACY     *
80  REM * OF THIS PROGRAM      *
85  REM *                      *
90  REM ************************
95  REM
106  PRINT : PRINT : PRINT "        APR CALCULATION": PRINT : PRINT :
109  REM  INPUT ROUTINE
110  PRINT " STARTING VALUE OF UNPAID"
111  INPUT " BALANCE TABULATION?    ";BL
120  PRINT : PRINT " PROGRAM WILL TABULATE 20 VALUES"
121  PRINT " OF UNPAID BALANCE STARTING AT ";BL
130  PRINT : PRINT : INPUT " REPAYMENT PERIOD IN MONTHS? ";MN
140  PRINT : INPUT " FLAT RATE OF INTEREST P.A.? ";FR
150  PRINT : INPUT " INITIAL DOCUMENTATION FEE?  ";DF
190 P =  - 1 / 12
200  GOSUB 2000
210 BX = BL
220  FOR N = 1 TO 20
225  REM  CALCULATE MONTHLY PAYMENT (MP)
230 ER = FR * MN / 12
240 BT = BX * (1 + ER / 100)
250 MP = 100 * BT / MN
260 MP =  INT (MP + 1) / 100
320 CX = MP * MN - BX
330 X = (1 + FR / 200) ^ P
335  REM  START NEWTON RAPHSON ITERATION
340  FOR J = 1 TO 20
350 XN = 0
360 XD = 0
370 Z = 1
375  REM  CALCULATE F(X) AND F'(X) VALUES
380  FOR K = 1 TO MN
390 XD = XD + K * Z
400 Z = Z * X
410 XN = XN + Z
420  NEXT K
430 XD = XD * MP + DF
440 XN = XN * MP + DF * X - BX
450 XC = XN / XD
460 X = X - XC
465  REM  SEE IF NEW-OLD < .0001
470  IF  ABS (XC) < .0001 THEN  GOTO 510
480  NEXT J
510 AR = ( EXP ( LOG (X) / P) - 1) * 100
520 AR = ( INT (AR * 10)) / 10
525 CX = ( INT (CX * 100)) / 100
530  GOSUB 3000
535 BX = BX + 1
540  NEXT N
550  PRINT : INPUT " DO YOU WISH TO CONTINUE? ";A$: PRINT : PRINT
560  IF A$ = "Y" THEN BL = BL + N - 1: GOTO 210
570  END
2000  HOME
2010  PRINT " PERIOD OF LOAN IS ";MN;" MONTHS"
2020  PRINT " FLAT RATE OF INTEREST IS ";FR;" PER CENT"
2030  PRINT " INITIAL DOCUMENTATION FEE IS ";DF
2035  PRINT : PRINT
2040  PRINT "  UNPAID    CHARGE    MONTHLY    ANN. RATE"
2050  PRINT " BALANCE              PAYMENT     PER CENT"
2060  RETURN
3000  REM  OUTPUT OF RESULTS
3020  PRINT  TAB( 4);BX; TAB( 13);CX; TAB( 22);MP; TAB( 33);AR
3030  RETURN
```

Burglars

by Stewart Peppiatt



BURGLARS IS a solo game which uses graphics and works in real time. It is designed to run on the UK101 with the minimum RAM configuration of 4K and is adaptable for many other systems.

The program often Peeks and Pokes into the display RAM, so a system with memory-mapped VDU is virtually essential. For reasons of space, the instructions given within the program are only brief, but here are full instructions, and a detailed description of the program.

It is midnight. You have entered the ignoble profession of burglar and have broken into a stately house. The house is known to contain money, worth £5 each, silver, £20, gold, £50, and diamonds, £100, although some might be locked away and are, therefore, unobtainable. You have managed to enter by the door, and can see the diamonds glittering in the moonlight.

You cannot, however, see the furniture which bars your way until you bump into it, nor the rest of the treasures. As you move around the room, trying to find a way to the diamonds, you stumble across other loot, and your score is increased accordingly.

Alarm sounded

Some time after your entry, an alarm is sounded. The occupants of the house wake and switch on the lights. Although that allows you to see both the furniture and the loot, it also means that a guard-dog will soon be set loose. You must, therefore, make a decision whether to escape with your haul, or to risk the guard-dog and snatch more loot before escaping.

If you are bitten by the dog, you might manage to shake him off, although in doing so you drop some of your loot, but you could be caught and so lose all your booty. Even if you throw him off, you are injured and move, therefore, more slowly.

To escape the dog, you can, as a last resort, exit through a window — unless it is blocked by the furniture — rather than the door by which you entered, but in doing so, you will drop some of your loot.

At any time while it is dark, you may switch-on the lights. Although that enables you to find your way, it is also likely to wake the guard-dog and is, therefore, a calculated risk. Note also that, unlike yourself, the guard-dog is able to jump over the furniture.

The game ends either when you escape by the door or the window, or else when you are caught once too often. The display remains until you are ready for a new game.

The skill level chosen affects three factors:

- The speed of movement of both the dog and yourself; the higher skill levels give you less time to think.
- How soon the lights go on, and the dog is let loose.
- The tracking ability of the dog.

The tactics which should be adopted depend, therefore, on the skill level set. At low skill levels, it is possible to outrun the dog, which makes switching on the lights soon after the start worthwhile. At high skill levels, on the other hand, the dog is very single-minded in its pursuit and it is advisable not to stray too far from an exit if it is likely to appear, i.e., when the lights are on.

Each time you are bitten but fortunate enough not to be caught, you are injured and your movements become increasingly slow. Therefore, if you are bitten but manage to evade capture, the safest policy is to run for an exit as soon as possible, even if it means losing money by using a window.

Table 1. Program variables.

B	Number of bites suffered
S	Running score
(X,Y)	Co-ordinates used in trail-laying
(U,V)	and the player's movement.
(Q,R)	
M	Skill level
(C,D)	Co-ordinates of the dog
F	
W	Position of the windows
Z	
E	Position of the door
G,I,J	Temporary variables
K,N	

The keys used during the game are:

1 moves the player up
2 moves the player down
3 moves the player left
4 moves the player right
7 switches the lights on

The keys used can be changed — for example, to suit personal preference, or hand-controllers if available — by altering lines 640 to 690. Each key should be held down until the display responds. In particular, after you have been injured, the dog may make several moves for each of yours.

It is not necessary to repeatedly press a key; the movement will continue as long as the key is held down. It is not possible to move in two directions, e.g., up and

right, at the same time, although the guard-dog may. Finally, all movement stops while the lights are being turned-on.

As for the structure of the program, the computer sets-up the lay-out of the house in three steps:

- Furniture and money are deposited at random in the house.
- A trail is set-up through the house starting at a randomly-positioned door, with silver and gold deposited along the way. A diamond is then placed at the end of the path.
- Another diamond is placed at random in the house, and three windows inserted along the walls.

Concealed valuables

In that way, much of the house is certain to be explored, and most of the valuables are accessible although often difficult to find.

To save space, the plan of the house is POKEd directly into machine-code memory — the location is defined by function FNB. That area of memory on the UK101 is just above that required for the Basic program and variables. The memory contents are transferred into the VDU RAM only when the lights are switched-on. Using a variable array, for example, A(X,Y), instead of machine-code memory would result in a simpler program, but that would also occupy more than 1K more RAM.

Note that the setting-up of the house takes several seconds. The program has been designed so that instructions are displayed during that period. Thus, the next game will not be ready any more quickly if the instructions are omitted from the program. The variables used are listed in table 1. Table 3 is a line-by-line description of the game, which should prove useful for anyone wishing to modify or expand it.

Program conversion

For converting the program for other systems, the programming is generally in standard Microsoft Basic, and so should not prove difficult to adapt. All the PRINT statements are executed along the bottom line of the VDU. During the game, the display is prevented from shifting-up after PRINT statements by the use of semicolons at the end of each statement; CHR$(13) is carriage return without line feed. Take care to use the correct number of spaces in the PRINT statements, as they are necessary to over-write existing material.

Skill levels

On the UK101, the VDU display is 48 characters wide by 16 characters high. The house size of 30 by 15 has been chosen to fit the display leaving space for skill level, command keys and number of bites on the left, and comments and the running score along the bottom line.

The address of the VDU RAM is given by FNA, line 20. For other computers, that will need to be changed, as well as the POKE address in line 590. That inserts the ASCII code for the number of bites into the location in VDU originally occupied by "0", line 390.

Memory location 530 — lines 640 and 710 — is the Control-C flag on the UK101. It needs to be disabled to poll the keyboard. Systems which can single-scan the keyboard will not need the cumbersome key-polling routine, line 640.

FNA	Finds the address of position (X,Y) in house in VDU RAM.
FNB	Finds address of position (X,Y) in hidden array in machine-code memory.
FNC	Semi-random movement for guard-dog.
FND(X)	Returns random number between two and (X + 1).
140-160	Set-up the hidden array with random furniture and money.
230	Choose position of door.
240-350	Set-up trail through the house, depositing silver and gold along the way and a diamond at the end.
370-420	Set-up initial display.
430 & 440	Insert final diamond.
450	Starting position for man.
460-480	Set-up windows; then run first part of game with lights off.
500-510	"Lights": transfer hidden array into VDU memory; then run second part of game.
520-530	Insert guard-dog in random position; then run final part of game.
550-570	Move dog.
580-610	Dog bits man.
620	"Caught" routine.
630-830	Key-polling/man-movement subroutine.
640	Keyboard-polling.
650-690	Interpret key pressed — if any.
710	Check for escape by the door.
730	Check for escape through a window.
740	Check for a bump with the wall or furniture.
750	Move man.
760	"Money".
780	Man lands on dog so go to "bite" routine.
790-810	Loot.
840-880	Escape routine.
890	Time delay subroutine, dependent on skill.
900-940	Score-change subroutine.
950	Subroutine which calls key-polling/man-movement subroutine a random number number of times, dependent on skill level.

Table 3.

CHRs ( )	Character	Object
4		Gold
9		Silver
13		CR without LF
24		Money
32		Space
33	!	
42	*	
161		Wall
163		Bottom wall
181		Dog
183		Top window
185		Left window
186		Right window
187		Furniture
219		Prison bars
232		Diamond
240		Man

Table 2. Graphics characters.

Variable transfer

As the UK101 can transfer only one variable in a user-defined function, an extra statement "Y = . . ." has usually proved necessary before calling FNA and FNB — for example, line 490. On many other systems, it should be possible to tidy that by defining FNA(X,Y), etc. The graphics characters used are listed in table 2.

To give you something at which to aim, the highest score obtained so far — to the best of my knowledge — is £1,064. A score more than £1,000 is obviously excellent, while anyone escaping before achieving at least £500 should surely face a charge of cowardice.

```
10 PRINT:PRINT
20 DEF FNA(X)=53211+X+64*Y
30 DEF FNB(X)=4146-X-28*Y
40 DEF FNC(X)=SGN(X*INT(RND(8)*(M+8)/5-.1))
50 DEF FND(X)=INT(2+RND(8)*X)
60 INPUT"SEED,1TO255";K:POKE213,K:RAND255
70 PRINT:PRINT:PRINTSPC(14)"!BURGLAR!
80 PRINT:PRINT:PRINT"IT IS NIGHT:YOU HAVE JUST ENTERED A HOUSE
```

(continued on next page)

(continued from previous page)

```
90 PRINT"CONTAINING:
100 PRINT:PRINTSPC(10);"MONEY.....";CHR$(24);"....5
110 PRINT:PRINTSPC(10);"SILVER....";CHR$(9);"...20
120 PRINT:PRINTSPC(10);"GOLD......";CHR$(4);"...50
130 PRINT:PRINTSPC(10);"DIAMONDS..";CHR$(232);"..100":PRINT
140 FORI=3725TO4088:POKEI,32
150 IFRND(8)<.5THENPOKEI,187
160 IFRND(8)<.04THENPOKEI,24
170 NEXT:PRINT:PRINT:PRINT"YOU MAY SWITCH THE LIGHTS ON OR THEY WILL
180 PRINT:PRINT"COME ON WHEN THE ALARM IS SOUNDED.IN BOTH
190 PRINT:PRINT"CASES,A DOG IS SET LOOSE SOON AFTERWARDS.":PRINT
200 PRINT:PRINT"MONEY IS LOST  FOR BUMPS(1),BITES(50),OR
210 PRINT:PRINT"AN ESCAPE THROUGH THE-WINDOW(100).IF BITTEN,
220 PRINT:PRINT"YOU ARE INJURED AND ALSO RISK BEING CAUGHT.
230 PRINT:E=FND(28):X=E:Y=14:POKEFNB(X),32
240 J=RND(8)*4+1:FORI=1TORND(8)*10+4:U=X:V=Y
250 ONJGOTO270,280,290
260 U=X+1:GOTO300
270 U=X-1:GOTO300
280 U=Y+1:GOTO300
290 U=Y-1
300 IFU>290RU<2 ORV>140RV<2THEN240
310 X=U:Y=V:G=32:IFRND(8)<.15THENG=9
320 IFRND(8)>.92THENG=4
330 K=PEEK(FNB(X)):IFK=40RK=90RK=232THEN240
340 POKEFNB(X),G:N=N+1:IFN<85THENNEXT:GOTO240
350 POKEFNB(X),232:PRINT
360 INPUT"SKILL,1-10";M:PRINT:PRINT
370 PRINT" KEYS":PRINT" -----":PRINT" 1UP":PRINT"2 DOWN
380 PRINT" 3 LEFT ":PRINT"4 RIGHT":PRINT" 7 LIGHTS
390 PRINT:PRINT"BITES...0":PRINT:PRINT
400 FORV=1TO15:POKEFNA(1),161:POKEFNA(30),161:NEXT
410 FORX=1TO30:V=1:POKEFNA(X),161
420 V=15:POKEFNA(X),163:NEXT
430 V=U:POKEFNA(U),232:X=FND(28):Y=FND(13)
440 POKEFNA(X),232:POKEFNB(X),232
450 Q=E:R=15:V=R:POKEFNA(Q),240
460 W=FND(13):V=W:POKEFNA(30),186
470 F=FND(13):V=F:POKEFNA(1),185
480 Z=FND(28):V=1:POKEFNA(Z),183:I=0:GOSUB 950
490 V=R:POKEFNB(Q),240
500 FOR V=2TO14:FORX=2TO29
510 U=PEEK(FNB(X)):POKEFNA(X),U:NEXTX,V:V=R:POKEFNB(Q),32:GOSUB950
520 C=FND(28):D=FND(13):IF ABS(D-R)+ABS(C-Q)<7 THEN 520
530 V=D:J=PEEK(FNA(C)):POKEFNA(C),181:GOSUB 630
540 V=D:POKEFNA(C),J
550 C=C+FNC(Q-C):D=D+FNC(R-D)
560 IFC=1ORC=30THENC=C+SGN(9-C)
570 IFD=1ORD=15THEND=D+SGN(9-D)
580 IFC><QORD><RTHEN530
590 B=B+1:POKE54037,B+48
600 S=S-50:PRINT"  OUCH!!!";
610 K=191:GOSUB900:IF RND(8)*9>3+BTHEN520
620 V=R:POKEFNA(Q),42:G=219:S=0:PRINT"  CAUGHT!!  ";:GOTO860
630 GOSUB890:GOSUB890:V=R:U=Q:IFRND(8)*7<BTHEN RETURN
640 K=57088:POKE 530,1:POKEK,127:K=PEEK(K)
650 IFK=127THENV=V-1:GOTO710
660 IFK=191THENV=V+1:GOTO710
670 IFK=223THENU=U-1:GOTO710
680 IFK=239THENU=U+1:GOTO710
690 IFK=253THENJ=9
700 RETURN
710 V=U:POKE530,0:IFU=EANDV=15ANDK=191THEN840
720 K=PEEK(FNB(U))
730 IFU=30ANDV=WORU=ZANDV=1ORU=1ANDV=FTHENS=S-100:GOTO840
740 IFU<2 OR V<2 OR U>29 OR V>14 ORK=187THENK=32:POKEFNA(U),187:GOTO780
750 POKEFNB(U),32:POKEFNA(U),240:V=R:POKEFNA(Q),32:Q=U:R=V
760 IFK=24THENS=S+5:PRINTSPC(10)CHR$(24);S;CHR$(13);:RETURN
770 IFK=32THEN RETURN
780 IFK=181THENFORK=1TO240:POKEG,K:NEXT:GOTO940
790 IFK=232THENS=S+100:PRINT" DIAMONDS ";
800 IFK=4THENS=S+50:PRINT"  GOLD! ";
810 IFK=9THENS=S+20:PRINT"  SILVER! ";
820 IFK=32THENS=S-1:PRINT"  BUMP!  ";
830 GOSUB 900:RETURN
840 POKEFNA(U),240:V=R:POKEFNA(Q),32:G=33
850 PRINT"   ESCAPE!!  ";
860 FORX=-13TO-3:FORV=4TO11
870 POKEFNA(X),G:NEXTV,X
880 PRINT"HAUL..."CHR$(24)S:RUN20
890 FORG=N*20TO250:NEXT:RETURN
900 IFS<0THENS=0
910 PRINTCHR$(24)S;CHR$(13);:V=R:N=FNA(Q)
920 IFK=181THENFORV=1TO240:POKEN,V:NEXT:GOTO940
930 GOSUB890:POKEN,K:GOSUB890:POKEN,240
940 PRINTSPC(10);CHR$(13);:RETURN
950 J=-600/(M+5)*RND(8)TO9:GOSUB630:NEXT:RETURN
```

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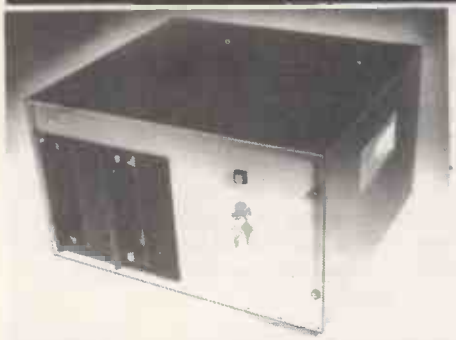

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computer centre

Photographic lab's problems focus on packaged software

IF YOU ARE a professional photographer in north London, you might well know Alexander Colour Laboratories which can process, print, duplicate and mount film for you. It was started 35 years ago as a family concern and now has three shops in north-west London — along with a thriving postal business, a staff of 10 and a Tandy TRS-80.

Its proprietor, John Alexander, is an ex-Fleet Street photographer. He is not the kind of man to call a spade a shovel and, by an interesting extension, he would not describe a microcomputer as a Godsend if something less euphemistic seemed more appropriate.

Practical type

John Alexander is a somewhat larger-than-life character who regards himself as the practical type. He is machine-minded so it is no surprise, for instance, to find that his office boasts a telephone with automatic dialling. He has also designed a superimposing module for one of his printing machines which prints one photograph on top of another.

Not all machines suit John Alexander, however, and, unfortunately, he is not able to spend all his life avoiding

by Cathy Lane

problems: "If I had known what I was letting myself in for with this computer, I don't think I would have given it house room for a minute".

Alexander's venom is not directed against the computer itself, nor even against computer suppliers: his target is packaged software. "Some of it should be piled up in a heap and burned", he claims. That conclusion was not reached without some analysis on Alexander's part: "My personal opinion is that too many people wanted to jump on the bandwagon and they just didn't put enough effort into testing their software. I bet there are people who have thrown computers away. Certainly, there have been times when I've sat down and nearly cried, and my wife has told me to sell it, or give it away".

Business trip

Alexander was already thinking about buying a computer when he took a business trip to Los Angeles in March, 1979. At that time, the TRS-80 cost far less in the States than in the U.K. So he bought one and even with the cost of air-freighting the 48KB machine and a Centronics printer, it cost him only half

Alexander Colour Laboratories managing director John Alexander and his wife, Thea, work at the TRS-80 keyboard.

the sum he would have paid in the U.K.

He wanted the computer for a variety of valid business reasons, apart from the not inconsiderable appeal of having one of his own. In particular, he had been researching the question of his sales promotion and had decided that his advertising budget — about £4,000 a year — would be better spent in direct selling through mail shots rather than in conventional press advertising. For that he wanted to form a mailing list of about 10,000 names and addresses.

Clerical side

In addition, there was the clerical side of the company. That had always been run by Alexander and his wife on a part-time basis, so there was some appeal in automating the invoicing and letter typing. He also wanted a computer, at some time in the future, to handle invoicing and some word processing as well as the mailing list labels.

Through his reading of computer magazines, Alexander had established that Tandy was a reputable company. On his return to the U.K., he contacted Tandy at Hendon, and a representative visited him and helped him assemble his system. He also bought some floppy disc drives and received basic operating lessons.

He now has a 48K TRS-80 with three disc drives and two printers — the Centronics matrix printer at 80cps for most of the standard output like the label printing, and a converted IBM Selectric which provides correspondence-quality printing for the letters.

After switching-on and familiarising himself with the keyboard, Alexander felt sufficiently confident to start loading the names and addresses for the mailing list. On his first foray into microcomputing, Alexander encountered a software bug: he would spend hours typing-in names and addresses only to find that suddenly and inexplicably, the whole of the work would be lost.

"I used to spend entire evenings sitting at the computer, because once I'd started, I couldn't tear myself away", he complains. Then cruelly, silently, unreasonably, the names and addresses just would not be in there any more.

Hardware tested

After four months, he was at the end of his tether: "I'd had it. I put the whole system back in the boxes and carted it round to Tandy asking for my money back. It was tested and I was told that the problem lay in the software, not the hardware. I took a good deal of convincing, but now I know it was true". The problem was that for 100 addresses or so the package was fine, but as soon as the disc started to fill, the problems began.

John Alexander is right: he had been sold a badly-written, poorly-tested piece of software. Not only was it the kind of shortcoming which gives microcomputers a bad name, it was also unnecessary — the tools and techniques required to produce good user software have long been known to large-computer programmers and are consequently available widely. Software is software, irrespective of the size of computer on which it will run. The same kind of programming methods are necessary to produce good programs on microcomputers as are required for larger machines.

That is the kind of lesson a user like John Alexander had to learn by experience. Fortunately, he was not discouraged, and the microcomputer business was able to demonstrate a more acceptable face. Shortly after his tight-lipped visit to Tandy, he was recommended a mailing list program from Applegate in Bristol and since then all has been well.

Without the mailing list program, which now holds about 8,000 names, Alexander Colour Laboratories could not handle direct advertising. Now Alexander is in a position where he finds a typical mail shot to 5,000 names can bring in 12 orders immediately, and that will pay for the cost of the mailing. And after four or five mail-shot exercises, he says the operation has paid for itself.

Nominal ledger

He is also in the early stages of computerising his sales ledger. For that, he has another reliable program, this time from Tridata. Alexander's statements are computerised and sent out at the end of each month, but invoices are still done by hand. He is now thinking of buying the Tridata nominal ledger program — another highly-rated piece of software.

Meanwhile, word processing is proving to be a real boon for the business, although Alexander probably will not go so far as to use those terms of enthusiasm: "You can set text out on the screen and read it and alter it and you can print it, and if you've done it wrong, you can do it again. It looks very professional. My wife used to do all the typing before, but she's not a trained typist and she used to take about an hour and a half over one letter".

Alexander is now finding another of the ways in which living with a small computer is not so different in principle from using a big machine even though the scale may not be the same. This time, the consideration is what might be called cost of ownership, and the particular example which was worrying him was the cost of good-quality paper for the printer. It is exactly the kind of expense a first-time user of computers finds difficult to anticipate.

Still, he is a convert to business computing and has some impressive plans. For a start, Tandy is promising a software package which will link the word processing with the mailing list to personalise each letter — Alexander is waiting for this with eager anticipation.

Then, there is the ambitious plans for upgrading the system in the not too distant future. The present machine will be installed in the shop downstairs and an identical system will go into a second shop; both will be linked to a third TRS-80 in Alexander's office. That means that the computers will be able to keep track of the day-to-day financial aspects of the business, covering everything taken over the counter.

Emotional traumas

Despite enough traumas to qualify him for the honorary chairmanship of the New Luddite League, Alexander anticipates only one major problem with his far-reaching, point-of-sale plans. Reasonably enough his concern is with the software: "With the sales ledger program, we lose only the last transaction if the system crashes while it is being used. Well, that's fine for most people, but the trouble is in this game, it could cost me a fortune. We'll just have to wait and see whether or not the system accepted each transaction before we can let the customer out of the door".

Although he is something of a closet optimist, he feels that you can learn only from experience if you happen to be new to computing. That view certainly puts all those consultants, educators, writers, pundits and other microcomputer propagandists in their place. Yet Alexander has learnt to be wary of even the most expensive software packages: how do you guarantee a degree of quality in the programs you buy if you are a mere computer user?

Practical considerations

What is more, he has also learnt that there is more to computing than plugging-in and pressing the start button. "It seems the smallest things can affect the smooth running of the machine. When I first bought the computer I had it downstairs in the back room, and every time the fridge went on, the system crashed. I've now put in a direct electricity supply from the main fusebox to the computer on a separate circuit; but I wish someone had told me about that kind of thing before". He is right: the computer enthusiasts and the computer sellers gloss over or ignore or sometimes just forget the practical problems of using a computer.

In the end the computer has obviously made a significant difference to the running of Alexander Colour Laboratories, and not just through its effects on the temper of the managing director. Letters are more professional; direct-mailing programmes are effective, and customer files are up to date. "I would have bought one anyway", smiles John Alexander. "I like computers". ◻

How reverse Polish notation can turn micro into calculator

For simple calculations, micros often seem clumsy compared to today's pocket calculators. This program, written in Basic by Ian Taylor, turns your micro into an easy-to-use calculator.

THE USE of the program on a microcomputer has three valuable advantages:

- It displays all of the calculator's registers — not just the one in the usual LED display.
- It uses reverse Polish notation — as employed in the Hewlett-Packard range of calculators. That means quick and efficient working. It also acts as a rapid tutorial for the RPN method.
- You do not need a complicated instruction manual. Enter several numbers, press the function keys and watch the numbers fly from one register to another.

The program works without modification on an Apple II or ITT 2020 and makes use of the GET function to avoid the use of the return key. It also uses the screen formatting and error facilities of those computers, so some modification will be necessary to run it on other machines.

The use of return after each number or function will considerably simplify the program and make it easier to adapt to other micros — the penalty is the extra keystrokes needed to do a calculation.

When the program is 'RUN', the screen shows the four registers of the operational stack. Those registers are referred to as X, Y, Z and T. The contents of those registers are x, y, z and t. The X register, normally shown on the LED display of a pocket calculator, has been enclosed between dotted lines on the TV screen. The appearance of the screen is shown in figure 1.

Figure 1. Figure 2. Available functions. Figure 3. Flowchart for RPN calculator.

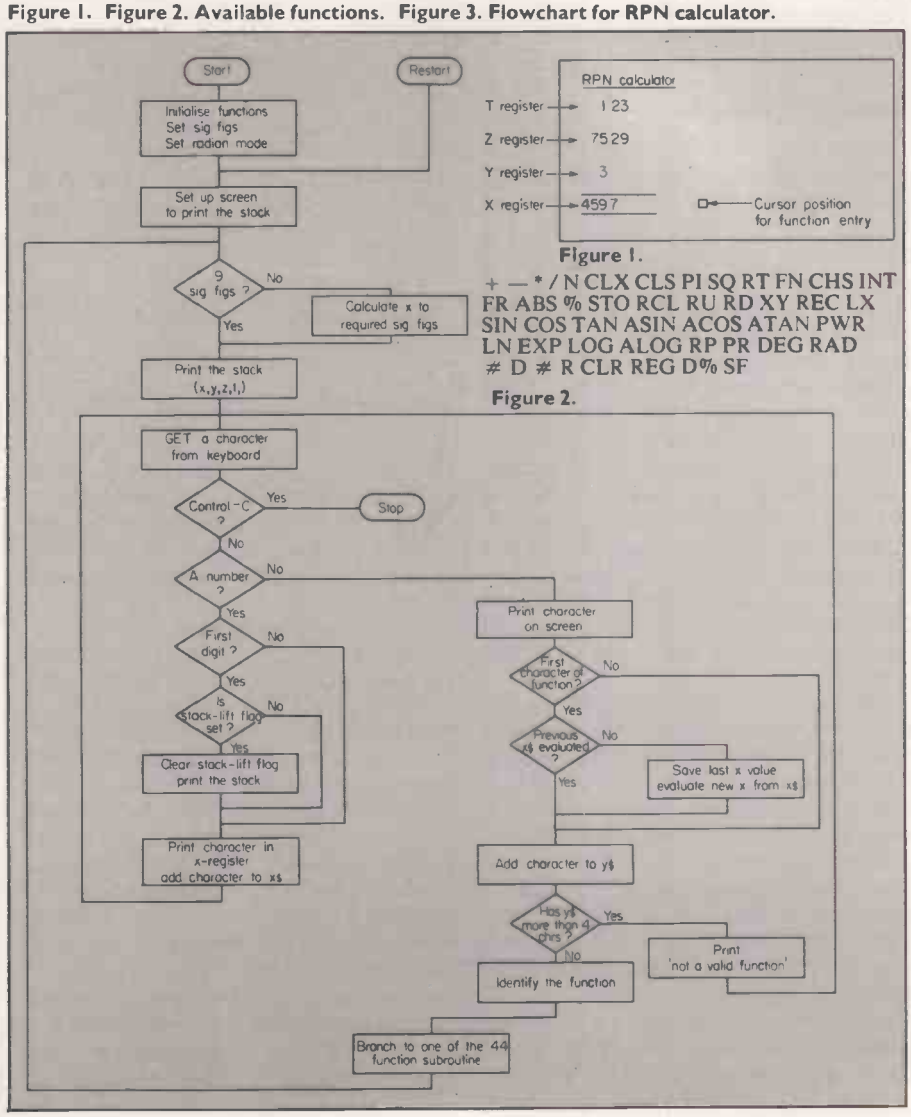


Figure 1.

+ — * / N CLX CLS PI SQ RT FN CHS INT FR ABS % STO RCL RU RD XY REC LX SIN COS TAN ASIN ACOS ATAN PWR LN EXP LOG ALOG RP PR DEG RAD # D # R CLR REG D% SF

Figure 2.

Pressing number keys causes an entry into the X register; the writing into the X register stops when a function entry begins, or when the N is pressed — 'N' stands for 'eNter'. 'N' transfers x to Y register and moves all the other numbers in the stack up to the next, higher register, the value of t being lost. A subsequent number entry then overwrites the old value of x. The display shown in figure 1 has been obtained by pressing the following keys:

1.23 N 75.29 N 3 N 459.7

Pressing *, multiply, will then multiply 459.7 by three, giving the answer, 1379.1, in the X register. 75.29 and 1.23 fall down the stack into the next lower register. The 1.23 in the T register is unchanged.

If, however, we had pressed SQ, square, the value of 459.7^2, i.e., 211324.09, would have been placed in the X register and the contents of the other registers would have been unchanged.

Most functions either operate on the x and y values, like *, or on the x values alone, like SQ. Other functions are available to manipulate numbers in the stack, to store and recall numbers from memory, to display the memory registers, and to remind you of the list of functions available. A complete list of functions is shown in table 1.

To write your own functions for the calculator, insert a program line in place of one of the existing lines 1 to 43. It should end with RETURN. X1 = X will preserve your value of x in a 'last x' register. GOSUB 200 will print-out your modified contents of the stack registers.

You should replace the corresponding key-code for the function in lines 20000 or 20010 with your own; you may even wish to customise your program with function mnemonics of your own invention — mine are not as brief as they should be for maximum efficiency, but then I wanted the operation to be intelligible to others.

If you need more than 44 functions, write in your new functions as subroutines from line 44 onwards, but be sure to keep the present SF — set the number of significant figures — function as the last one in the list. You should also see that your subroutine is addressed by line 2320.

One last warning: if you make any errors in typing or changing the program, you will obtain the ERROR: ILLEGAL DATA message of line 2340. To avoid that, you should leave out line 2310 so that you obtain the normal Basic error messages until your program has been tested.

Key-code	Name	Operation description
+	Plus	Adds x to y. Result in X.
—	Minus	Subtracts x from y. Result in X.
*	Multiply	Multiplies x by y. Result in X.
/	Divide	Divides y by x. Result in X.
N	Enter	Moves all numbers up one stack register; t is lost; x is retained in X but will be overwritten by the next numeric entry.
CLX	Clear X	Replaces x by zero.
CLS	Clear Stack	Replaces x, y, z and t by zeros.
PI	π	Puts the value of π in the X register.
SQ	Square	Squares the value of x. Result in X.
RT	Square Root	Finds the square root of x. Result in X.
FN	Functions	Changes the screen display to show all the function key-codes available. See figure 2. Press any key to return screen to normal.
CHS	Change sign	Reverses the sign of x.
INT	Integer	Removes all digits after the decimal point.
FR	Fraction	Removes all digits before the decimal point.
ABS	Absolute	Gives the absolute magnitude of x.
%	Percent	Finds x percent of y. y is not changed. Result in X.
STO	Store	Must be followed by a digit 0 to 9. Puts x into one of 10 registers R_0 to R_9. The stack is unchanged.
RCL	Recall	Must be followed by a digit 0 to 9. Puts the contents of one of the registers R_0 to R_9 into X. The numbers in the stack are moved up one register. t is lost.
RU	Rotate up	t is transferred to X and other numbers in the stack move up one register.
RD	Rotate down	x is transferred to t and other numbers in the stack move down one register.
XY	X←→Y	x and y are interchanged.
REC	Reciprocal	Finds 1 / x. Result in X.
LX	Last x	Recalls the previous value of x. Useful for error correction.
SIN	Sin x	Finds the sine of x. Result in X.
COS	Cos x	Finds the cosine of x. Result in X.
TAN	Tan x	Finds the tangent of x. Result in X.
ASIN	Arcsin x	Finds the angle whose sine is x. Result in X.
ACOS	Arccos x	Finds the angle whose cosine is x. Result in X.
ATAN	Arctan x	Finds the angle whose tangent is x. Result in X.
PWR	power	Finds y to the power x (y^x). Result in X.
LN	ln x	Finds the logarithm — base e — of x. Result in X.
EXP	e^x	Finds e to the power x. Result in X.
LOG	log x	Finds the logarithm — base 10 — of x. Result in X.
ALOG	antilog x	Finds 10 to the power x. Result in X.
RP	R → P	Converts the rectangular co-ordinates x and y to polar co-ordinates r and θ . r is put in X and θ is put in Y.
PR	P → R	Converts the polar co-ordinates r and θ from X and Y into rectangular co-ordinates x and y.
DEG	→ degrees	Converts the value of x from radians to degrees.
RAD	→ radians	Converts the value of x from degrees to radians.
# D	set degree mode	All subsequent trigonometrical functions will assume values of angles to be in degrees.
# R	set radian mode	All subsequent trigonometrical functions will assume values of angles to be in radians. The calculator is set to the radian mode when first run.
CLR	clear registers	Clears all the registers R_0 to R_9. The stack is not changed.
REG	register display	Changes the screen display to show the contents of all the registers R_0 to R_9. Press any key to return the screen to normal.
D%	delta percent	Calculates the percentage by which the value of x exceeds the value of y. Result in X. y is unchanged.
SF	set significant figures	Must be followed by a digit up to nine. Sets the display of the X register to the required number of figures. The actual value of x is not affected.

Other keys which have been programmed:

M	minus	Used in number entry to indicate a minus sign. If — were used it would be regarded as a function.
shift N	exponent	Used in number entry to indicate that scientific notation is in use and the next number or sign is part of the exponent. If E were used it would be regarded as a function.
;	Plus	Same as + but avoids pressing the shift key.
:	Multiply	Same as * but avoids pressing the shift key.
ctrl C	switch off	Stops the program. To start again without loss of data try GOTO 99. RUN will clear all registers.

Table 1.

Although no alteration is necessary for the ITT 2020, when the program is run on the Apple II, lines 2340 and 2350 should read —

```
2340  VTAB 20: HTAB 20: PRINT "ERROR: ILLEGAL DATA": CALL -
      198: POKE 216,0: FOR W = 0 TO 2000: NEXT
2350 MC$ = "104168104166223154072152072096": FOR W = 0 TO 9:
      POKE 768 + W, VAL ( MID$ (MC$,3 * W + 1,3)): NEXT : CALL
     768: RETURN
```

```
0  GOTO 1000
1 X1 = X:X = X + Y: GOTO 100: REM  +
2 X1 = X:X = Y - X: GOTO 100: REM  -
3 X1 = X:X = Y * X: GOTO 100: REM  *
4 X1 = X:X = Y / X: GOTO 100: REM  /
5 T = Z:Z = Y:Y = X: GOSUB 200:F2 = 0: RETURN : REM  N
    (ENTER)
6 X1 = X:X = 0: GOSUB 200:F2 = 0: RETURN : REM  CLX
7 X1 = X:X = 0:Y = 0:Z = 0:T = 0: GOSUB 200:F2 = 0: RETURN
    : REM  CLS
8 X1 = X:X = 3.14159265: GOSUB 120: RETURN : REM  PI
9 X1 = X:X = X * X: GOSUB 200:F2 = 1: RETURN : REM  SQ
10 X1 = X:X =  SQR (X): GOSUB 200:F2 = 1: RETURN : REM
    RT
11  GOTO 300
12 X =  - X: GOSUB 200: RETURN : REM  CHS
13 X1 = X:X =  INT ( ABS (X)):X = X *  SGN (X1): GOSUB
    200:F2 = 1: RETURN : REM  INT
14 X1 = X:X =  ABS (X) -  INT ( ABS (X)):X = X *  SGN
    (X1): GOSUB 200:F2 = 1: RETURN : REM  FR
15 X1 = X:X =  ABS (X): GOSUB 200:F2 = 1: RETURN : REM
    ABS
16 X1 = X:X = X * Y / 100: GOSUB 200:F2 = 1: RETURN : REM
    %
17  VTAB 20: HTAB 24: PRINT "REGISTER ";: GET A$:J =  VAL
    (A$):X(J) = X:F2 = 1: RETURN : REM  STO (IN REGIS
    TER J)
18  VTAB 20: HTAB 24: PRINT "REGISTER ";: GET A$: PRINT
    A$:J =  VAL (A$):X1 = X:X = X(J): GOSUB 120:F2 =
    1: RETURN : REM  RCL
19 W = T:T = Z:Z = Y:Y = X:X = W: GOSUB 200:F2 = 1: RETURN
    : REM  RU
20 W = X:X = Y:Y = Z:Z = T:T = W: GOSUB 200:F2 = 1: RETURN
    : REM  RD
21 W = X:X = Y:Y = W: GOSUB 200:F2 = 1: RETURN : REM
    XY
22 X1 = X:X = 1 / X: GOSUB 200:F2 = 1: RETURN : REM  R
    EC
23 X2 = X:X = X1:X1 = X2: GOSUB 120:X1 = X:F2 = 1: RETURN
    : REM  LX
24 X1 = X:X =  SIN (X * RD): GOSUB 200:F2 = 1: RETURN
    : REM  SIN
25 X1 = X:X =  COS (X * RD): GOSUB 200:F2 = 1: RETURN
    : REM  COS
26 X1 = X:X =  TAN (X * RD): GOSUB 200:F2 = 1: RETURN
    : REM  TAN
27 X1 = X:X =  ATN (X /  SQR (1 - X * X)) / RD: GOSUB
    200:F2 = 1: RETURN : REM  ASIN
28 X1 = X:X =  (1.570796327 -  ATN (X /  SQR (1 - X * X
    ))) / RD: GOSUB 200:F2 = 1: RETURN : REM  ACOS
29 X1 = X:X =  ATN (X) / RD: GOSUB 200:F2 = 1: RETURN
    : REM  ATAN
30 X1 = X:X = Y ↑ X: GOTO 100: REM  PWR
31 X1 = X:X =  LOG (X): GOSUB 200:F2 = 1: RETURN : REM
    LN
32 X1 = X:X =  EXP (X): GOSUB 200:F2 = 1: RETURN : REM
    EXP
33 X1 = X:X =  LOG (X) / 2.30258509: GOSUB 200:F2 = 1:
    RETURN : REM  LOG
34 X1 = X:X = 10 ↑ X: GOSUB 200:F2 = 1: RETURN : REM
    ALOG
35 X1 = X:X =  SQR (X * X + Y * Y):Y =  ATN (Y / X1) /
    RD: GOSUB 200:F2 = 1: RETURN : REM  RP
36 X1 = Y:X = X1 *  COS (Y * RD):Y = X1 *  SIN (Y * RD
    ): GOSUB 200:F2 = 1: RETURN : REM  PR
37 X1 = X:X = X / 1.745329252 - 2: GOSUB 200:F2 = 1: RETURN
    : REM  DEG
38 X1 = X:X = X * 1.745329252 - 2: GOSUB 200:F2 = 1: RETURN
    : REM  RAD
39 RD = 1.745329252 - 2: RETURN : REM  #D SET DEGREE M
    ODE
40 RD = 1: RETURN : REM  #R SET RADIAN MODE
41  FOR J = 0 TO 9:X(J) = 0: NEXT : RETURN : REM  CLR
42  HOME : FOR J = 0 TO 9: PRINT "R";J;"   ";X(J): PRINT
    : NEXT : GET A$:A$ = "": POP : GOTO 1050: REM  RE
    G
43 X1 = X:X = (X / Y - 1) * 100: GOSUB 200:F2 = 1: RETURN
    : REM  D%
99  VTAB 20: HTAB 20: PRINT "NO. OF SIG.FIGS?";: GET A$
    : PRINT A$:S =  VAL (A$):F2 = 1: GOSUB 200: RETURN
    : REM  GET NO OF SIG FIGS
99  GOTO 1050: REM  RESTART WITHOUT LOSING DATA
100 Y = Z:Z = T: GOSUB 200:F2 = 1: RETURN
120 T = Z:Z = Y:Y = X1: GOSUB 200: RETURN
```

(continued on next page)

(continued from previous page)

```
130 Y = Z:Z = Y:Y = X: GOSUB 200: VTAB 20:L =  LEN (X$
    ): HTAB ) + L: RETURN
140  VTAB 20: HTAB 20: PRINT "NOT A VALID FUNCTION":Y$
     = ""
150  FOR W = 0 TO 2000: NEXT : VTAB 20: HTAB 20: CALL
      - 868:F2 = 1: RETURN
180  TEXT : HOME : PRINT "RPN CALCULATOR": PRINT "----
     ----------"
190  VTAB 18: PRINT "--------------": VTAB 22: PRINT "-
     ------------": RETURN
200  VTAB 20: CALL  - 868
210  IF S = 9 THEN X2 = X: GOTO 230
220 Y1 = X: GOSUB 10000:Z = Y1
230  PRINT X2
240  VTAB 15: CALL  - 868: PRINT Y
250  VTAB 10: CALL  - 868: PRINT Z
260  VTAB 5: CALL  - 868: PRINT T
280  VTAB 20: HTAB 20: CALL  - 868: RETURN
300  HOME : PRINT "      AVAILABLE FUNCTIONS
                  ------------------": PRINT : FOR J =
     0 TO K: PRINT F$(J);" ";: IF  PEEK (36) ) 35 THEN
      PRINT : PRINT
310  NEXT : GET Z$: POP : GOTO 1050
1000  REM  MAIN PROGRAM START
1010 K = 0
1020  READ F$:K = K + 1: IF F$ (  ) "SF" THEN 1020
1030  RESTORE : DIM F$(K):S = 9:RD = 1
1040  FOR I = 1 TO K: READ F$(I): NEXT
1050  GOSUB 180
1060  GOSUB 200
2000  REM  MAIN CHARACTER INPUT
2010  GET A$
2020  VTAB 20:L =  LEN (X$): HTAB 1 + L
2030  IF A$ =  CHR$ (3) THEN  TEXT : PRINT "TO RE-STAR
     T WITHOUT LOSS OF DATA": PRINT : PRINT "TYPE 'GOT
     O 99'": END : REM  CTRL C STOPS THE PROGRAM
2040  IF A$ = "." THEN 2170
2050  IF A$ = "M" THEN A$ = "-": GOTO 2170: REM  M USE
     D TO ENTER A MINUS SIGN
2060  IF A$ = "↑" THEN A$ = "E": GOTO 2170: REM  ↑ (I.
     E. SHIFT N) USED TO ENTER AN EXPONENT
2070  IF A$ = ":" THEN A$ = "*": REM AVOIDS SHIFT ON M
     ULTIPLY
2080  IF A$ = ";" THEN A$ = "+": REM AVOIDS SHIFT ON A
     DD
2090  IF  ASC (A$) )  = 48 AND  ASC (A$) (  = 57 THEN
     2170
2100  REM  NOT A NUMBER
2110  VTAB 20:LY =  LEN (Y$): HTAB 20 + LY: PRINT A$;
2120  IF Y$ (  ) "" THEN 2150: REM ADDING CHARACTER TO
      A POSSIBLE FUNCTION
2130  IF X$ = "" THEN 2150: REM . PREVIOUS NUMBER STRIN
     G CONVERTED TO A VALUE
2140 X1 = X:X =  VAL (X$):X$ = "":F1 = 0
2150 Y$ = Y$ + A$: IF  LEN (Y$) ) 4 THEN  GOSUB 140
2160  GOTO 2240
2170  REM :NUMERIC INPUT
2180  IF F1 = 0 THEN F1 = 1: GOTO 2210
2190  REM NOT THE FIRST CHR OF THE NUMBER
2200  PRINT A$;: CALL  - 868:X$ = X$ + A$: GOTO 2000
2210  IF F2 = 1 THEN  GOSUB 130
2220  IF F2 = 1 THEN F2 = 0: REM  F2 IS STACK LIFT FLA
     G
2230  GOTO 2200
2240  FOR I = 1 TO K
2250  IF Y$ (  ) F$(I) THEN 2270
2260 A = I:I = 60:F = 1
2270  NEXT
2280  IF F = 1 THEN 2300
2290  GOTO 2000: REM  GET ANOTHER CHARACTER
2300  REM OMIT NEXT LINE UNTIL PROGRAM TESTED FOR YOUR
      TYPING ERRORS!
2310  ONERR  GOTO 2340
2320 F = 0:Y$ = "": PRINT : ON A GOSUB 1,2,3,4,5,6,7,8
     ,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,2
     5,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41
     ,42,43,98
2330  GOSUB 280: GOTO 2000
2340  VTAB 20: HTAB 20: PRINT "ERROR: ILLEGAL DATA": CALL
      - 198: POKE 216,0: FOR W = 0 TO 2000: NEXT : RETURN

10000 N = 0
10001  IF Y1 = 0 THEN 10008
10002  IF  ABS (Y1) ( 10 ↑ S THEN 10004
10003 Y1 = Y1 / 10:N = N + 1: GOTO 10002
10004  IF  ABS (Y1) ) 10 ↑ (S - 1) THEN 10006
10005 Y1 = Y1 * 10:N = N - 1: GOTO 10004
10006 Y1 =  INT (Y1 + .5)
10007 Y1 = Y1 * 10 ↑ N
10008  RETURN
20000  DATA +,-,*,/,N,CLX,CLS,PI,SQ,RT,FN,CHS,INT,FR,A
     BS,%,STO,RCL
20010  DATA RU,RD,XY,REC,LX,SIN,COS,TAN,ASIN,ACOS,ATAN
     ,PWR,LN,EXP,LOG,ALOG,RP,PR,DEG,RAD,#D,#R,CLR,REG,
     D%
20020  DATA  SF
20030  DATA **********
20040  DATA PROGRAM BY IAN TAYLOR
20050  DATA ******** 1980 *********
```

Basing your expectations on firm mathematical ground

When events do not occur as we thought they would, is it those events themselves which are aberrant or our expectations of them? Owen Bishop shows you how to find out using the Basic Binomial Test program.

LIFE PRESENTS surprises from time to time and we may wonder if it is events themselves or our expectations of events which are out of line. For example, take the evening classes in home furnishing organised by the Loamshire County Council.

It had been assumed that men would be less likely than women to show an interest in the subject and the course was planned accordingly; 12 people applied — two men and 10 women. The organisers are concerned to know if the numbers truly reflect the relative interest in home furnishing shown by men and women.

They rule out the possibility that men are more interested than women in this topic. At best, they think, men could show equal interest. If so, and assuming that the population of Loamshire has equal numbers of men and women, does a class of two men and 10 women mean that men on average are really less interested than women? If the number of men interested in home furnishing is equal to the number of interested women, that has relevance to the planning of the content of the course. The course must cater adequately for men. Perhaps there should be more carpentry and less curtain-making.

Such a change might lead to increased male enrolments next year. Conversely, if only a relatively small proportion of Loamshire's male population is keen on the topic, there may be no need to change the course from its present form. With two men enrolled in a class of 12, do we alter the course or not?

Random choice

The class consisted of 12 people, sampled from the active adult population of Loamshire. Was the sample purely random, or does it reflect lack of interest on the part of males? Suppose we select people at random — equipment required: one copy of the Electoral Register and one pin — how likely are we to obtain a sample comprising two men and 10 women? Is such an occurrence likely to be frequent or is it a rare event?

That is where the Binomial Test leaps to the rescue. Its name is unprepossessing but it has a host of uses in everyday life, in business, in administration and in research.

The test can be used when we have a population, e.g., adults of Loamshire, in which the individuals belong to either one of two categories, e.g., male or female, and we know or think we know the relative proportions of each, e.g., 50 percent male, 50 percent female. The meaning of the term population can be interpreted in many ways.

Our population could be the days of the year, divided into two categories rainy or dry, with proportions based on previous records, 46 percent rain, 54 percent dry, for London. Then we can discuss whether the year has had fewer fine days than expected. Another population is road accidents involving motor bicycles and two categories could be fatal and non-fatal. Previous records can give the proportions and we can tell if the introduction of new safety measures causes a significant fall in the proportion of fatal accidents.

Sampling occasions

If the population of Loamshire contains 50 percent males, and we pick one person at random, the chance of picking a male is 50 percent. We express that by saying that the probability P, of picking a male is 0.5. The probability Q, of picking a female is also 0.5. The probabilities are expressed on a scale running from 0, impossible, to 1, certain. Note that $P+Q=1$ for, if we pick out one person, it is certain that the person will be either a male or a female, there being no other possibilities.

The problem is that, although we are equally likely to pick a male or a female on any one occassion, when we pick the 12 members of a class, there are 12 sampling occasions and probability operates independently on each occasion. Our random sampling does not necessarily give us six of each.

The numbers to be expected can be calculated mathematically. If we are picking a class of N persons, the probability of picking x males and (N — x) females is:

$$p(x) = \binom{N}{x} p^x Q^{N-x}$$

In the expression, $\binom{N}{x}$ is a shorthand way of writing

$$\left[\frac{N!}{x!\,(N-x)!}\right]$$

where '!' indicates a factorial number.

For example, the probability of picking a class of 12 containing two men is

$$P(2) = \binom{12}{2} P^2 Q^{10}$$

That works out to 0.016. It is a low probability, equal to a 1.6 percent chance. The probability of picking a class with only one male is

$$p(1) = \binom{12}{1} P^1 Q^{11} = 0.0029$$

That is an even smaller probability. The probability of an all-female class is $p(0) = 0.00024$, a chance of only 0.024 percent or one chance in 4,167. Now we can discover the probability of picking a class with two men or fewer. We add the probabilities:

$$p(0) + p(1) + p(2) = 0.019$$

In terms of percentages, that is 1.9 percent. If we pick large numbers of classes — using a pin or some other random method — we expect only 1.9 percent of such classes to contain two men or fewer. The organisers of the home furnishing course have been presented with such a class. That event can be interpreted in one of two ways:

- Men are just as interested as women: we might have easily have had six men and six women in the class, but the luck of the draw produced only two men.
- Men are less interested than women: Therefore, we would not expect many men to apply and that is borne out by events.

Truth probability

The probability of the first alternative being true is 0.019. The probability of the second alternative being true is 0.981. If we want to be nearer the truth we are bound to believe the second and reject the first alternative. Remember we have already rejected, as being beyond all reasonableness, the further possibility that men are more interested than women. So we accept that the second is more likely to be true, and decide that there is no reason to increase the male-interest content of the course.

Calculating p in the previous example takes only a few moments on a pocket calculator, but what happens next year when, with increasing popularity, there are 40 applicants, including 14 males? Calculating and summing p(0) to p(14) is a boring task. It is not easy for the microcomputer either.

Computers take a long time to calculate factorial numbers. We can see why when we write them out in full, for example:

$$\binom{12}{2} = \frac{12\times11\times10\times9\times8\times7\times6\times5\times4\times3\times2\times1}{2\times\ 1\times10\times9\times8\times7\times6\times5\times4\times3\times2\times1}$$

One promising line to follow is that terms of this kind take the value of binomial coefficients. Let us see what that

means. In the expression (a + b) we have (1a + 1b), so the coefficients are 1.1. You may recall that $(a + b)^2 = a^2 + 2ab + b^2$. The coefficients of those three terms are 1.2.1. Similarly, $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$. The coefficients are 1.3.3.1. For $(a + b)^4$, the coefficients are 1.4.6.4.1. For completeness, we should include $(a + b)^0 = 1$, with the single coefficient 1.

If we write those coefficients in a table, we discover an interesting and useful fact:

```
          1
        1   1
      1   2   1
    1   3   3   1
  1   4   6   4   1
1   5  10  10   5   1
```

Each entry is the sum of the two entries to either side of it in the line above it. These rows give us the values of $\binom{N}{X}$. For example if

$N = 5, \binom{N}{0} = 1, \binom{N}{1} = 5, \binom{N}{2} = 10, \binom{N}{4} = 5$

and $\binom{N}{5} = 1$

Instead of using factorials to calculate $\binom{N}{x}$, the computer can build a table like that shown. In the program for the Binomial Test, lines 160-310, the array CA begins by holding (1.1). Then array CB is formed by adding pairs of values from CA, to give (1.2.1.).

The contents of CB are transferred to CA and the operation is repeated to give a new CB (1.3.3.1.). That can be done as many times as is necessary to obtain the coefficients required. On the eleventh repetition, we obtain the coefficients for our class of 12 students: 1,12,66,220,495, etc. After that, the calculation of p(0) to p(x) is a simple matter.

The algorithm for calculating binomial coefficients can be used in many other contexts and is the main point of interest of this otherwise straightforward program. Users should find the program self-explanatory in use. The often-repeated phrase, events or objects, sounds long-winded but is simply a reflection of the versatility of this simple test.

It can deal equally well with events — rainy days or fatal accidents — or objects — males, non-smokers or packets of cornflakes. It can be used when we know or believe the population to consist of equal numbers of each category — P = Q = 0.5 — or when we know the categories to be unequal.

For example, we might know the percentage of newly-married women in the population of Loamshire and could then calculate if the number of newly-married women enrolling for the course is fewer than expected on a random base.

When entering the number expected in the less-frequent category, that includes the case when categories are equal. In that case half of N is entered. The number entered need not be an integer; in a class of 13 students we would expect 6.5 males and 6.5 females.

It is reasonable to assume newly-married women are more likely than other women to want to attend a home-furnishing course. It follows that such women would probably be over-represented in the class. In instances such as this, we might expect on the basis of the whole population only one newly-wed, but eventually 11 enrol. Here, we need to know the probability of selecting 11 or more newly-weds when P = 1/12. To do that, we sum p(11) and p(12) as the program allows — line 320.

Two-tailed test

In performing the two-tailed test, we have decided in advance which group is expected to be the least frequent. We thought of several good reasons why men might be less likely than women to enrol for the course, or why newly-weds would be more likely to enrol. The test tells us the probability that our result is as extreme or more extreme than we expected.

From our knowledge of the interests of men or newly-wed women, we can be certain that there is no chance of there being more men than women on the course, or that newly-weds would be under-represented. Such possibilities are ruled out before we begin analysis. We entertain only one possibility and seek to prove it. That is the one-tailed test.

It sometimes happens that we cannot predict the direction of the results in advance. Would the proportion of left-handed persons on the course be smaller or greater than that in the population as a whole? When testing on that basis, we must allow for extremes in either direction. That is the two-tailed test.

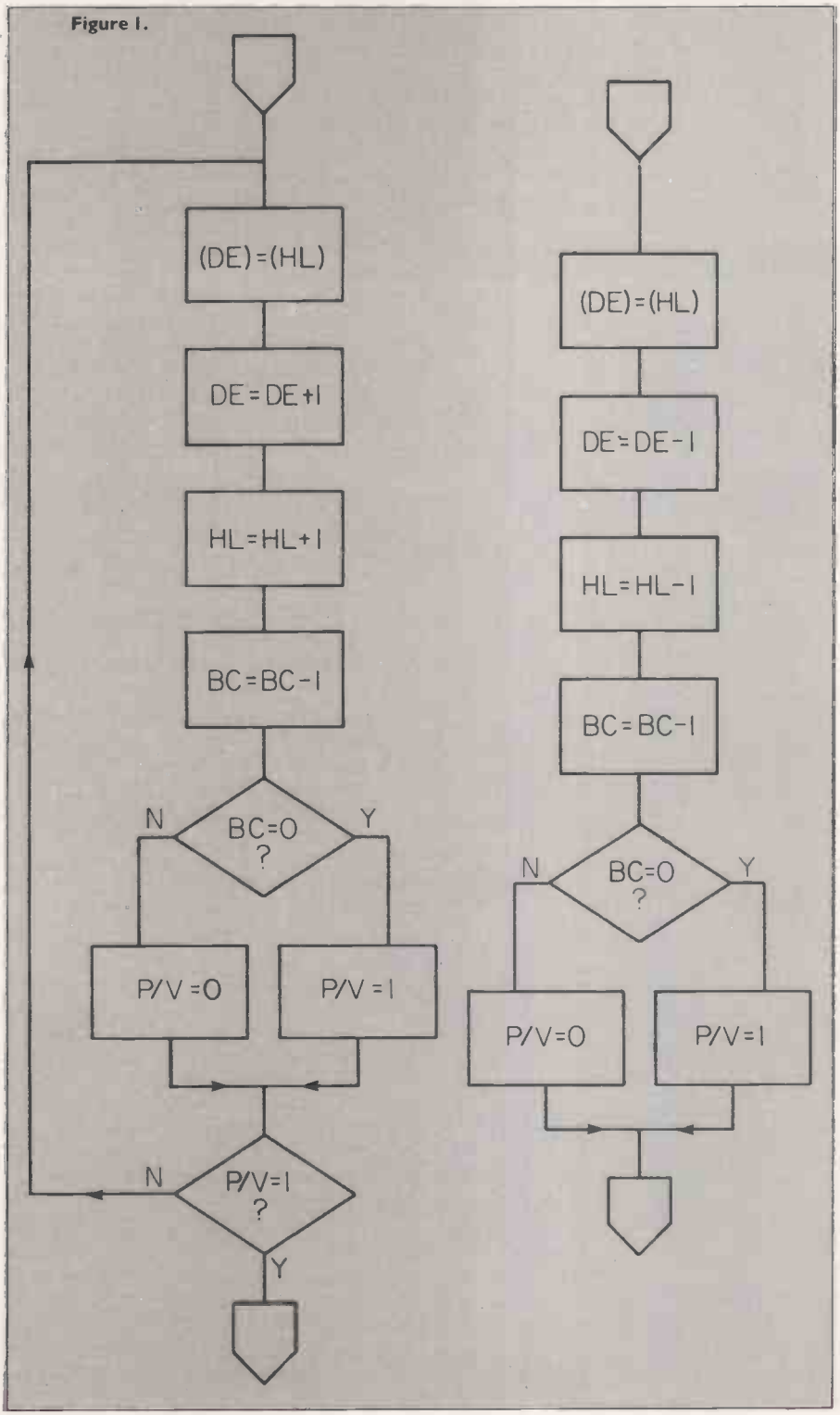
A result as extreme or more extreme than two men in a class of 12, includes classes with zero men, one man, two men and also 10 men, 11 men and 12 men. A simple modification of the program to sum p(0) + p(1) + p(2) + p(10) + p(11) + p(12) allows the two-tailed test to be performed.

```
10 REM**STATISTICS ON A MICRO - BINOMIAL TEST**
20 REM** by Owen Bishop **
30 DEFINTJ,K,N,X:A$="THE NUMBER MUST BE A POSITIVE INTEGER.    PLEASE ENTER AN
    APPROPRIATE VALUE."
40 CLS:PRINTTAB(20)"BINOMIAL  TEST":PRINTTAB(20)STRING$(14,137)
50 PRINT:INPUT"WHAT IS THE TOTAL NUMBER OF OBJECTS OR EVENTS";N
60 IFN=<0PRINT:PRINTA$:GOTO 50
70 PRINT:INPUT"HOW MANY OBJECTS OR EVENTS DO YOU EXPECT TO FIND IN THE LESS    F
REQUENT CATEGORY";P
80 IFP<0PRINT:PRINT"THE NUMBER MUST BE POSITIVE.":GOTO 70
90 IFP>N/2PRINT:PRINT"THIS NUMBER IS MORE THAN HALF THE TOTAL.   PLEASE START AG
AIN.":GOTO 510
100 IFP>NTHEN 500
110 PRINT:INPUT"HOW MANY OBJECTS OR EVENTS DID YOU FIND IN THIS CATEGORY";X
120 IFX<0PRINT:PRINTA$:GOTO 110
130 IFX>NTHEN 500
140 DIMCA(N):DIMCB(N)
150 PP=P/N:Q=1-PP
160 CA(0)=1:CA(1)=1:CB(0)=1:CB(1)=1
170 FORJ=2TON
180 FORK=1TOINT(J/2)
190 CB(K)=CA(K-1)+CA(K)
200 NEXTK
210 IFJ/2=INT(J/2)THEN 260
220 FORK=INT(J/2)+1TOJ
230 CB(K)=CB(J-K)
240 NEXTK
250 GOTO 290
260 FORK=J/2+1TOJ
270 CB(K)=CB(J-K)
280 NEXTK
290 FORK=1TOJ
300 CA(K)=CB(K):NEXTK
310 NEXTJ
320 IFX<=PTHENJ1=0:J2=X:GOTO 340
330 J1=X:J2=N
340 FORJ=J1TOJ2
350 R=R+CB(J)*PP↑J*Q↑(N-J)
360 NEXTJ
370 CLS:PRINTTAB(18)"RESULT OF ANALYSIS":PRINT
380 PRINT"THERE WERE";N;"OBJECTS OR EVENTS.   YOU PREDICTED THAT THERE       WOUL
D BE";P;"OBJECTS OR EVENTS IN THE LESS FREQUENT CATEGORY."
390 PRINT:PRINT"YOU FOUND";X;"OBJECTS OR EVENTS IN THIS CATEGORY."
400 IFX>PTHEN 450
410 PRINT:PRINT"THE PROBABILITY OF FINDING AS FEW OR FEWER THAN";X;"OBJECTS OR
  EVENTS IS";R;", OR";R*100;"% ."
420 IFR>.05PRINT:PRINT"THE OBSERVED RESULTS DO NOT DIFFER SIGNIFICANTLY FROM THE
      PREDICTED RESULTS, AND COULD BE DUE TO RANDOM SELECTION.":GOTO 470
430 PRINT:PRINT"THE OBSERVED RESULTS DIFFER FROM THE PREDICTED RESULTS, WITH THE
PROBABILITY, P=";R;", THAT THE DIFFERENCE IS SIMPLY DUE TO RANDOM SELECTION. (TW
O-TAILED TEST, P=";2*R;")"
440 GOTO 470
450 PRINT:PRINT"THE PROBABILITY OF FINDING AS MANY OR MORE THAN";X;"OBJECTS OR
  EVENTS IS";R;", OR";R*100;"% ."
460 GOTO 420
470 PRINT:PRINTTAB(15)"<PRESS ANY KEY TO CONTINUE>"
480 IF INKEY$=""THEN 480
490 RUN
500 PRINT:PRINT"THE NUMBER YOU HAVE ENTERED IS GREATER THEN THE TOTAL NUMBER OF
OBJECTS OR EVENTS.   PLEASE START AGAIN."
510 FORJ=1TO3000:NEXT
520 GOTO 40
```

Burst of speed which wins you extra processing time

In the final part of his series, David Peckett examines some of the most useful Z-80 instructions which increase the speed of standard operations on masses of data — in some cases, it is possible to shorten the run-time of program segments by a factor of three or four.

Figure 1.



IN PART 4 of the series, we looked at simple program loops which could move blocks of data from one place in memory to another. Because that is such a common requirement, the Z-80 has special instructions to simplify the data transfer.

In fact, the micro has four commands to match the various ways of moving data. They are defined in table 1, and have the mnemonics "LDI", LoaD with Increment, "LDIR", LoaD with Increment Repeated, "LDD", LoaD with Decrement, and "LDDR". Remember, the Z-80 mnemonics use 'LD' for any data transfer operation — often, as in this case, the 8080A "MOVe" is a more accurate description of what is happening.

All the instructions work in a similar way: they move the byte pointed at by HL to the address pointed at by DE. Having moved the byte, DE and HL are incremented or decremented as appropriate to point to the next byte. BC is then decremented and, if that has made it zero, P/V is set. It is important to remember that those operations do not affect the Z flag; instead, they use P/V as a pseudo-zero flag.

If the instruction is a repeated one, the cycle iterates automatically until P/V is set — figure 1a. The non-repeat versions execute once only — figure 1b. Note that figure 1a shows an increment operation, while figure 1b illustrates a decrement; in neither case is A affected. Another useful point is that it is possible to move up to 64Kbytes — BC has 16 bits — in one operation. Normally, you would not need so much, but it is possible if you insisted.

The major advantage of the block moves is that they give very fast data transfers. Suppose that we have to move 'NUMBER' — where NUMBER>256 — bytes from the block starting at 'BASE1' to the block starting at 'BASE2' — figure 2. Without a block transfer, we would use a program segment like:

```
      LD    BC,NUMBER  ;SET UP
      LD    DE,BASE2   ;..START
      LD    HL,BASE1   ;..CONDITIONS
LOOP  LD    A,(HL)     ;MOVE A
      LD    (DE),A     ;..BYTE
      INC   DE         ;ADJUST
      INC   HL         ;..POINTERS
      DEC   BC         ;ADJUST
                       COUNT
      LD    A,B        ;IS COUNT
      OR    C          ;..ZERO?
      JR    NZ,LOOP    ;BACK FOR
                       ANOTHER
```

Operation	Mnemonic	Flags	Effect
Move byte with Decrement/ Increment	LDD LDI	P/V	Move byte; adjust pointers; adjust counter
Move block with Decrement/ Increment	LDDR LDIR	P/V	Move block.
Compare byte with Decrement/ Increment	CPD CPI	S,Z,P/V	Compare accumulator to pointed-at byte. Adjust pointer and counter
Search block with Decrement/ Increment	CPDR CPIR	S,Z,P/V	Search block for pattern in A. Stop when found.
Input with Decrement/ Increment	IND INI	Z = 1 (if B = 0)	Input byte. Adjust pointer and counter
Block Input with Decrement/ Increment	INDR INIR	Z = 1	Input number of bytes set in B from Port (C)
Output with Decrement/ Increment	OUTD OUTI	Z = 1 (if B = 0)	Output byte. Adjust pointer and counter
Block Output with Decrement/ Increment	OTDR OTIR	Z = 1	Output number of bytes set in B from port (C).
Exchange Accum.	EX AF,AF'	All	Swap A and F with A' and F'.
Exchange Registers	EXX	None	Swap B-L with B'-L'.
Decimal Rotate Left	RLD	S,Z,P/V	Rotate lower nybble of A and both nybbles of (HL) to left
Decimal Rotate Right	RRD	S,Z,P/V	Rotate lower nybble of A and both nybbles of (HL) to right
Halt CPU	HALT	None	Action of CPU suspended

Table 1. This month's instructions.

On the other hand, using a block transfer, we would need:

```
LD    BC,NUMBER ;SET UP
LD    DE,BASE2  ;..START
LD    HL,BASE1  ;..CONDITIONS
LDIR            ;MOVE DATA
```

The second piece of code occupies far less space and, more important, runs

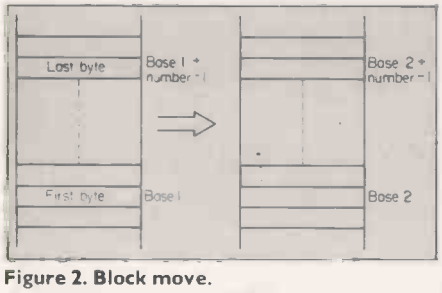


Figure 2. Block move.

much faster. The setting-up time is the same in both cases and, with a 4MHz Z-80 system, each iteration of the first segment would take 16.25μSec. On the other hand, every iteration but the last in the LDIR segment would take only 5.25μSec.; the last iteration, leading to an exit, would take only 4 μSec.

That is a very substantial saving — the data transfer is speeded by a factor of better than three. I have taken the worst case and given a program which can move up to 64K bytes. If I had limited it to 255 bytes or less, the first segment would have been about 6μSec. faster per iteration. Even so, 'LDIR' would still be twice as fast, and could handle any number of bytes.

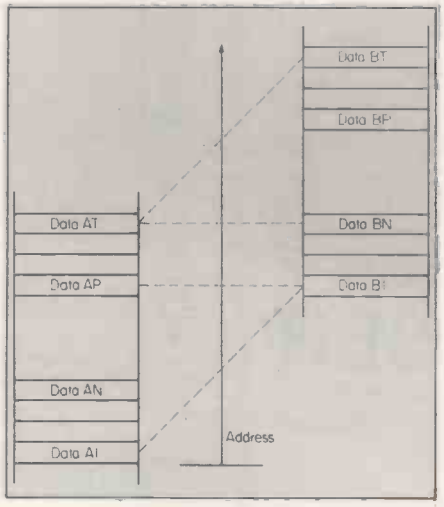
Why do we have incrementing and decrementing forms of the same instruction? There are two main reasons — one is associated with the non-repeat versions of the instructions. For the second reason, consider moving data between two blocks of memory where the low addresses of one block overlap the high addresses of the other block — figure 3.

If we try a block move of data from block 1 to block 2, using LDIR, what happens? We move 'DATAA1' to become 'DATAB1'. Yet 'DATAB1' uses the same addresses as 'DATAAP' — we have just corrupted block 1. Equally, if we move block 2 to block 1 with an LDDR, as soon as 'DATABT' goes to 'DATAAT', 'DATABN' is corrupted.

On the other hand, if we move block 1 to block 2 with an LDDR, things are safe. The first overlapping move is that of 'DATAAN' to 'DATABN'. By that time, 'DATAAT', at the same address as 'DATABN', has been moved, and the corruption does not matter.

Obviously, if the two blocks do not overlap, you can increment or decrement as the whim takes you. When they overlap, the rule is simple; move a low-address block to a high-address block with a decrement and vice-versa.

Figure 3. Corruption during move.



Non-repeat block transfers. The repeated block transfers are ideal if a solid block of data, of known size, has to be moved from A to B. Often, however, that is not the case. Frequently, data has to be manipulated on its way, or has to be transferred until something happens. To meet those kinds of requirements, the Z-80 has 'LDI' and 'LDD'.

Suppose, for instance, that a microcomputer has an input buffer which it fills from, say, a floppy disc. Each time that the buffer is used, a different number of bytes may be loaded; the last character in the string is always a '*'. The problem is to move the data from the buffer to a work area — figure 4.

The data has to be read from the low end of the buffer, so we need an incrementing instruction. Since we must test a byte each time round, 'LDI' fits the bill exactly. A suitable subroutine for the task is at figure 5.

A is set to the ASCII value of a '*' for the comparison, and HL and DE are set to the appropriate addresses for the start of each block. Each byte is tested via HL and, if the marker is found, the subroutine exits. Otherwise, an LDI shifts a

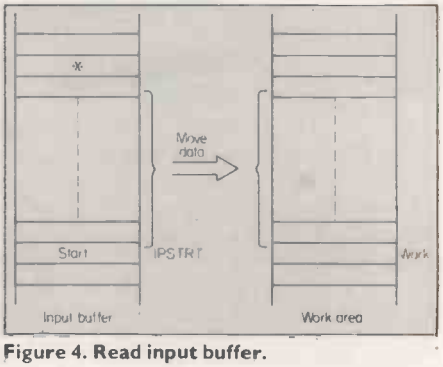


Figure 4. Read input buffer.

byte, and adjusts DE and HL, then we go back for another byte.

There is nothing complicated about the routine, but it shows the simplification we obtain by using LDI. The technique has the extra benefit that, since none of the block moves affects A, we can hold the test pattern in the accumulator permanently. That further shortens the program. I did not set BC because the subroutine did not need to count the number of bytes transferred.

It is also possible to adjust the pointers on each cycle when we use LDI and LDD. An example might be where we have to move every third byte of one block of data to form a single, continuous, block of data somewhere else — figure 6. Because the blocks overlap, we must use LDD, and a suitable subroutine is at figure 7.

Using LDD, and decrementing HL by an extra two on each iteration, gives a very simple way of moving every third byte. You can also see how P/V is used as a pseudo-Z flag. When BC has been decremented to zero, P/V is set, which is normally the condition for odd parity. In that case, then, 'RET PO' has the same effect as the usual 'RET Z'. *(continued on page 109)*

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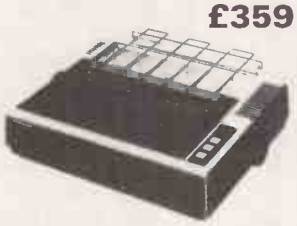

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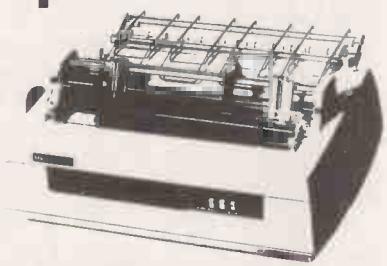

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```
;SUBROUTINE TO MOVE DATA FROM INPUT BUFFER
;DON'T WORRY ABOUT TRANSPARENCY
;
INMOVE  LD      A,'*'           ;EOF MARKER
        LD      HL,IPSTRT       ;START OF BUFFER
        LD      DE,WORK         ;WORKSPACE
CHECK   CP      (HL)            ;EOF?
        RET     Z               ;RETURN IF FIN.
        LDI                     ;MOVE A BYTE
        JR      CHECK           ;TEST NEXT BYTE
;
;END OF SUBROUTINE
```

Figure 5.

(continued from page 107)

Block comparisons. Another set of Z-80 block instructions is the "Block Comparison" group — 'CPI', 'CPIR', 'CPD' and 'CPDR' — shown in table 1. They give a way of searching a block of data for a given pattern. If the pattern is found, the Z flag is set and, with the 'CPxR' instructions, the auto-repeat stops. Figure 8a shows the action of 'CPIR' and figure 8b shows 'CPD'.

There are two significant points about these instructions. The first is that, just

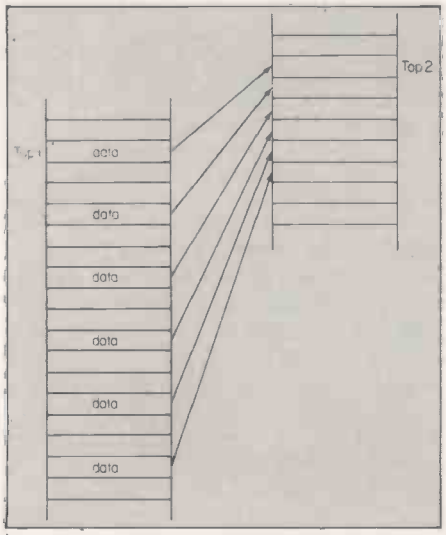


Figure 6. Move one byte in three.

like the block moves, P/V is used as a pseudo-Z flag to mark the end of the block, while Z shows the result of the comparison. The second point is that HL is incremented/decremented after the test is made. That means, when the comparison succeeds, HL points to the byte next to the one with the searched-for pattern. It presents no great problem, as long as you are aware of it.

When would you use those instructions? — to see where a given character is in a block of data. That is rather trivial, though — how about discovering how many bytes have been input to a buffer?

Suppose an input buffer is filled by DMA, or by an input system which runs too fast to include a counter in the input routine. We know that the last character is, say, a '*', and we want to examine the buffer to see how many bytes entered. Figure 9 shows a subroutine which uses 'CPIR' to do this.

The routine sets A to the EOF marker, and loads BC with the maximum size of the input buffer — that will stop CPIR overshooting if there is no marker for any reason. HL is set to the start of the buffer, which is also saved in DE for later. CPIR then looks for the '*'. When it is finished, the Z flag is checked to see if the marker was found and, if not, the program jumps to an error routine.

To find the number of bytes, the carry flag is set, and DE is subtracted from HL. The set CY decrements HL to counter the final, unwanted incremented, and the final value in HL is the total. Obviously, with CPI(R) and CPD(R), we can search from either end of a block of data. By using the non-repeat versions, it is

```
;SUBROUTINE TO MOVE ONE BYTE IN THREE
;
MOVE3   LD      BC,TOTAL        ;SET COUNTER
        LD      DE,TOP2         ;TARGET
        LD      HL,TOP1         ;ORIGIN
LOOPN   LDD                     ;MOVE A BYTE
;IF FINISHED, P/V=1 - TEST IT
        RET     PO              ;RETURN IF FIN.
        DEC     HL              ;POINT TO NEXT
        DEC     HL              ;..BYTE TO MOVE
        JR      LOOPN           ;BACK FOR ANOTHER
;
;END OF SUBROUTINE
```

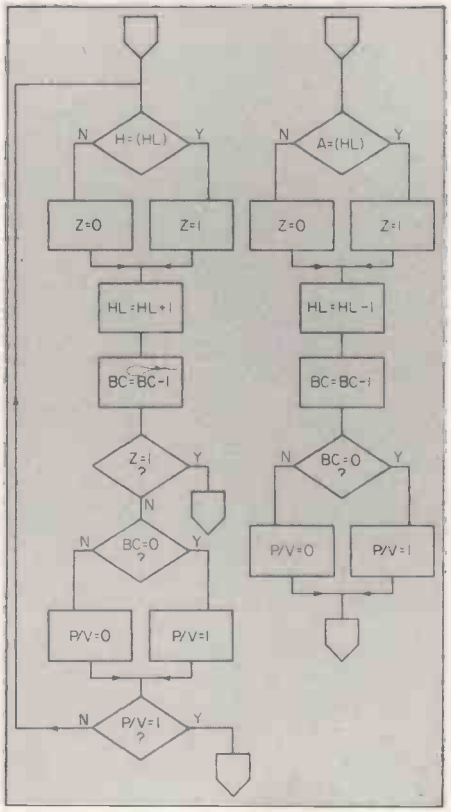
Figure 7.

possible to modify the pointers as we go, e.g., to test every other byte.

Block I/O instructions. The Z-80 also has instructions for automatic and semi-automatic block input — 'INI, 'INIR', 'IND', and 'INDR' — and output — 'OUTI', 'OTIR', 'OUTD', and 'OTDR'. They use HL as a pointer to the data to be output, or where input data is to be stored, and C to contain the port address. Register B is used as a counter, which means that a maximum of only 256 bytes can be transferred at once. The instructions work like other block transfers and figure 10a shows the action of INIR; figure 10b shows OUTD. None of the instructions modifies A, D or E.

Block I/O has the same advantages as

Figures 8a and 8b. Block comparisons.



all the other block instructions — the program runs faster and occupies less space. The most useful versions are those without repeat because the repeated instructions do not allow handshaking to take place.

If you use, say, INIR, with a 4MHz Z-80, each iteration of the instruction will take 5μSec. That means data will be input at 200Kbytes per second. Unless the peripheral can handle that, the micro will run ahead of the data. The same thing applies to the OTxR instructions — unless the peripheral can accept 200,000 bytes of data each second, there is no point in using the repeats.

The non-repeats are much more useful, and allow status lines to be monitored. Figure 11 shows a program segment to input 256 bytes from port 10, and store them in memory. Bit 7 from port 9 shows the status of the incoming data.

Exchanges. The Z-80 has a number of instructions which exchange data between groups of registers. For example, EX DE,HL and EX (SP),IX. What we have

```
;COUNT THE BYTES IN AN INPUT BUFFER
;
BYTENO  LD      A,'*'           ;EOF MARKER
        LD      BC,BUFSIZ       ;MAX SIZE OF BUFF
        LD      HL,INSTRT       ;START OF BUFFER
        LD      D,H
        LD      E,L             ;DE=HL
        CPIR                    ;LOOK FOR '*'
        JP      NZ,ERROR        ;NO EOF MARKER
        SCF                     ;ALLOW FOR INC HL
        SBC     HL,DE           ;HL=TOTAL
        RET
;
;END OF SUBROUTINE
```

Figure 9.

not considered is the micro's second set of working registers, A' — L'.

There are two instructions which allow us to bring those registers into use. "EX AF,AF'" swaps the two accumulators and their associated flag registers, while "EXX" exchanges the two groups of general-purpose registers, B-L and B'-L'. Those two instructions do not copy data from one set of registers to the other; they swap both sets of data. Also, it is not possible to exchange individual registers or RPs.

The main use of the registers is to save the micro's environment during an interrupt. When we looked at interrupts, we saw we needed to top and tail the service routines with such instructions as:

```
PUSH  AF
PUSH  BC
PUSH  DE  ;SAVE THE
PUSH  HL  ;..ENVIRONMENT
      :
      :
      :
;SERVICE ROUTINE PROPER
      :
      :
      :
POP   HL
POP   DE
POP   BC  ;RESTORE THE
POP   AF  ;..ENVIRONMENT
RETI
```

That all takes time, and saving time is the essence of interrupt handling. In the example, the four PUSHes would take

(continued on next page)

(continued from previous page)

11μSec. and the four POPs 10μSec. A much quicker technique is to use:

```
EX     AF,AF'  ;SAVE
EXX            ;..ENVIRONMENT
  .
  .
  .
  .
EXX            ;RESTORE
EX     AF,AF'  ;..ENVIRONMENT
RETI
```

Each pair of EXchanges will take only 2μSec. Although these instructions are normally used by interrupt handlers, they can be used at any time that you want to preserve temporarily one or more registers. That means you lose temporarily the data in the other registers. EX AF,AF' is particularly useful for saving the flags

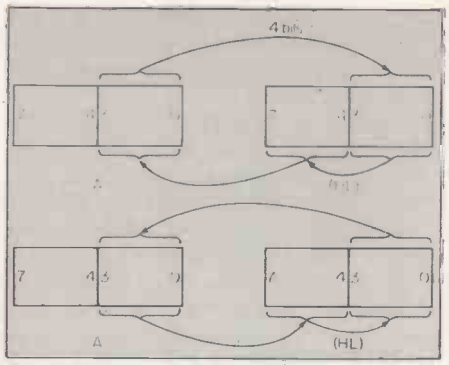
```
;SEMI-AUTOMATIC DATA INPUT
;
DATAIN  LD      B,0
        LD      C,10            ;PORT NUMBER
        LD      HL,BUFFER       ;INPUT BUFFER
WAIT    IN      A,(9)           ;READ STATUS
        ORA                     ;SET FLAGS
        JP      P,WAIT          ;WAIT IF B7=0
;DATA READY
        INI                     ;READ BYTE
        JR      NZ,WAIT         ;BACK FOR ANOTHER
        RET                     ;WHEN B=0 AGAIN
;
;FINISHED
```

Figure 11.

while you perform some intermediate processing.

As usual, there is a warning. If you use EXchanges during interrupts, the interrupts must not be interrupted by other routines which also EXchange. If they were, the second interrupt would bring the original registers back into use, corrupting the main program.

Decimal rotates. Now, two instructions which can be useful during decimal (BCD) arithmetic; we have not looked at programs using that coding method — it is too complicated for this series — but it is used, particularly in financial programs.



Figures 12a, PLD, and 12b, RRD.

The Z-80 has two instructions, "RLD", Rotate Left Decimal, and "RRD", Rotate Right Decimal, which perform four-place, 12-bit rotations. In BCD terms, these are equivalent to three-character left and right rotations.

The rotations take place on the lower four bits of A, and on the high and low nybbles of the byte pointed to by HL. The actions of RLD and RRD are shown in figures 12a and 12b respectively. The two instructions, although aimed at characters, can be used any time that a four-bit shift is needed.

As an example, look at figure 13. Packed Hex data is in memory — N characters, N/2 bytes — starting at 'PAKDAT'. We have to separate the data into single bytes, convert it to ASCII codes by an unspecified subroutine 'ASCII', and save the codes as unpacked data from 'ASCDAT'.

A suitable routine is at figure 14. There is little in it which needs comment, apart from masking-off the four MSBs of A each time. The RxDs do not affect the high nybble of A, but it has to be set to zero each time because 'ASCII' will have set it to three or four. The routine shows how easy the decimal rotates make it to split a byte into nybbles.

Halt. The last Z-80 instruction is "HALT", and that is exactly what it does. The micro waits, doing NOPs to itself, until either an interrupt occurs, or the chip's re-set is applied. The instruction is not much use for ending machine-code programs because, after it has been used, the system monitor or whatever is blocked-

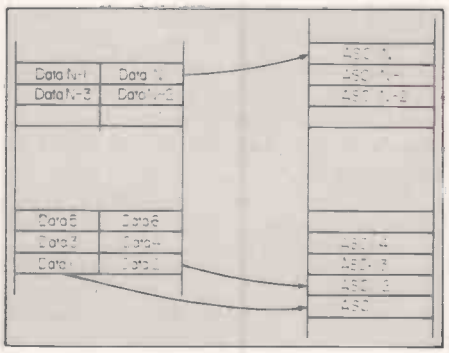


Figure 13.

out. One possible use is as part of an interrupt handler.

If an interrupt has to be handled very quickly, the penalty of saving registers may not be acceptable. By using a HALT, the registers can be saved before the interrupt happens, and the micro left to wait:

```
EX     AF,AF'  ;SAVE
EXX            ;..ALL THE
PUSH   IX      ;..MICRO'S
PUSH   IY      ;..REGISTERS
HALT           ;WAIT FOR INTERRUPT
;RESUME HERE AFTER
  .
  .
  .
INTRPT [STRAIGHT INTO SERVICE
  ROUTINE]
```

That assumes you can afford to wait in the HALT state.

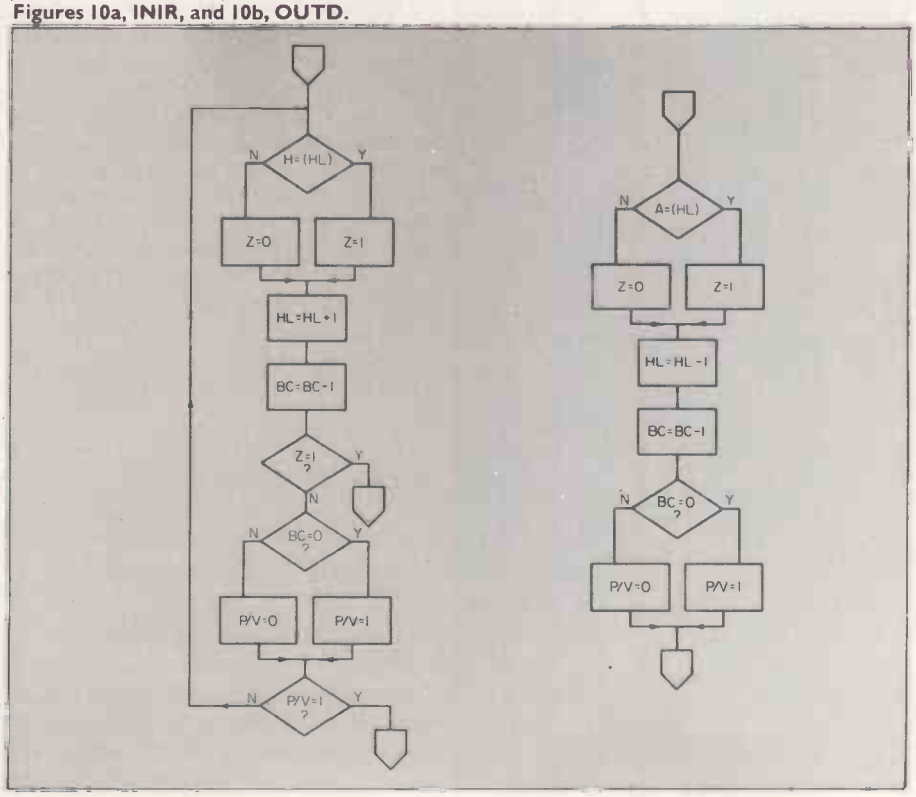
There is no doubt that, if you have to manipulate large blocks of data, the Z-80

```
;SUBROUTINE TO UNPACK DATA
;IT CALLS A SECOND S/R, 'ASCII'
;THE NUMBER OF CHARACTERS IS PASSED IN B
;AND HL HOLDS 'PAKDAT'.  'ASCDAT' IS
;PASSED IN DE
;
UNPACK  LD      C,2             ;INNER COUNTER
LOOP    RLD                     ;NYBBLE TO A
        AND     80F             ;MASK OFF MSBS
        CALL    ASCII           ;CONVERT TO ASCII
        LD      (DE),A          ;SAVE CODE
        INC     DE              ;NEXT TARGET
        DEC     C
        JR      NZ,LOOP         ;PIN WITH BYTE?
        INC     HL              ;POINT TO NEXT
        DJNZ    UNPACK          ;FINISHED?
        RET
;
;END OF SUBROUTINE
```

Figure 14.

block handling instructions make life much easier. Some of the other miscellaneous instructions this month are also useful, particularly, the EXchanges. Others, such as HALT, are only for completeness, while the decimal rotates are very specialised. Now you are on your own in your assembling. I hope that you enjoy it.

Figures 10a, INIR, and 10b, OUTD.



Magic music

THIS MZ-80 Basic program is an attempt to overcome the difficulties in writing music strings for the MZ-80 by providing a sheet music input and display write Tony and Nigel Sale of Bromham, Bedfordshire.

The music notes can be edited on to a five-line stave using the normal ← ↑ → ↓ shift keys. If a mistake is made, the note can be removed by space, and a part of a stave can be re-instated by using the hyphen symbol.

When a page is complete, the music up to the current X position can be compiled into a music string, played and stored in PG$(PG) by pressing Q for quit. Note that if you edit, the X must be moved to the right of the last note as anything to the right of the X will be lost.

Whenever a new page is selected by pressing P at the X point, if there is a music string in PG$(PG), it will be translated back into music notation and re-displayed on the stave. All pages can be played sequentially by pressing S at the X point.

All pages can be written to a data tape by pressing W. The default name is music data, any other name can be used by pressing N. To read music back from tape, set the name using N, and press R to read all pages back.

To delete a note and shift the rest to the left, replace the note with *, put X at the far right and then Q. To make space for a note, place / above the note, put X at the far right and then Q. Joined notes are indicated by immediately preceding the second note by __ — thin bottom line. A gap between notes is treated as a rest.

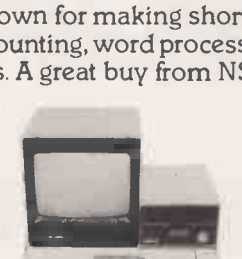
```
10 GOSUB 600:TEMPO 5:T=5:GOSUB 4600:GOTO 6600
100 PRINT"▒          SHARPY'S MAGIC MUSIC▒▒▒▒▒▒▒▒▒▒▒▒▒PAGE";PG+1;
102 PRINT"      NAME ";N$:GOSUB 7560:GOSUB 800
104 X=0:Y=14:T$="":R=0:I=0:PR=0:A$=PG$(PG)
106 FOR M=1 TO LEN(A$)
108 B=ASC(MID$(A$,M,1))
111 IF PR>0 THEN GOTO 156
112 IF B<58 THEN GOTO 124
114 IF B=207 THEN Y=21:GOTO 500
116 IF B=215 THEN Y=7:GOTO 500
118 IF B>64 THEN IF B<72 THEN GOTO 400
119 IF B=82 THEN R=1:PR=1:GOTO 500
120 GOTO 500
124 IF B=51 THEN T$=T$+"0":I=I+1:GOTO 410
126 IF B=52 THEN T$=T$+"0.":I=I+2:GOTO 410
130 IF B=53 THEN T$=T$+"o":I=I+1:GOTO 410
134 IF B=54 THEN T$=T$+"o.":I=I+2:GOTO 410
140 IF B=55 THEN T$=T$+"●":I=I+1:GOTO 410
150 IF B=56 THEN T$=T$+"●.":I=I+2:GOTO 410
152 IF B=35 THEN T$="#":I=1:GOTO 500
154 IF B=49 THEN GOTO 500
156 IF B>49 THEN X=X+1
160 PR=0:GOTO 500
400 IF B>66 THEN B=B-71:GOTO 405
402 B=B-64
405 Y=Y-B:GOTO 500
410 IF R>0 THEN GOSUB 700:GOTO 480
420 U$=T$:T$="_":GOSUB 700:X=X+1:T$=U$
470 GOSUB 700
480 X=X+I:Y=14:T$="":R=0:I=0
500 NEXT M
510 RETURN
600 R$="▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"
610 D$="▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"
620 V=0:W=0:PRINT "▒":RETURN
700 PRINT "▒";LEFT$(R$,X);LEFT$(D$,Y);T$;:RETURN
800 T$="————————————————————————————————————————":X=0
810 FOR Y=8 TO 16 STEP 2:GOSUB 700:NEXT:RETURN
2000 X=0
2004 Y=160
2006 A=109:GOSUB 3800:A=0
2010 GET Z$
2020 IF Z$="▒" THEN GOSUB 3800:IF Y>200 THEN Y=Y-40:GOTO 3200
2030 IF Z$="▒" THEN GOSUB 3800:IF X<39 THEN X=X+1:GOTO 3200
2040 IF Z$="▒" THEN GOSUB 3800:IF Y<960THEN Y=Y+40:GOTO 3200
2050 IF Z$="▒" THEN GOSUB 3800:IF X>0 THEN X=X-1:GOTO 3200
2100 IF Z$="Q" THEN GOTO 4000
2110 IF Z$="P" THEN GOTO 6000
2120 IF Z$="T" THEN GOTO 6500
2130 IF Z$="S" THEN GOTO 7000
2140 IF Z$="W" THEN GOTO 8000
2150 IF Z$="R" THEN GOTO 9000
2160 IF Z$="N" THEN GOTO 7500
2200 IF Z$="" THEN GOTO 2010
3010 IF Z$=" " THEN A=0:GOTO 3150
3020 IF Z$="●" THEN A=71:GOTO 3100
3030 IF Z$="o" THEN A=72:GOTO 3100
3040 IF Z$="." THEN A=46:GOTO 3100
3050 IF Z$="_" THEN A=60:GOTO 3100
3054 IF Z$="-" THEN A=52:GOTO 3100
3056 IF Z$="#" THEN A=99:GOTO 3100
3058 IF Z$="0" THEN A=32:GOTO 3100
3060 IF Z$="*" THEN A=107:GOTO 3100
3070 IF Z$="/" THEN A=45:GOTO 3100
3090 A=0:GOTO 3150
3100 GOSUB 3800:X=X+1:GOTO 3200
3150 GOSUB 3800
3200 A=PEEK(53248+X+Y)
3210 POKE 53248+X+Y,109:GOTO 2010
3800 POKE 53248+X+Y,A:RETURN
4000 M$="":S$=""
4010 FOR X=0 TO 39
4020 P=53248+X+3*40
4100 FOR Y=3 TO 25
4110 P=P+40
4120 A=PEEK(P):IF A=0 THEN GOTO 4166
4124 IF A=109 THEN GOTO 5000
4130 IF A=52 THEN GOTO 4166
4134 IF A=107 THEN GOTO 4170
4136 IF A=45 THEN M$=M$+"R3":GOTO 4166
4140 IF A=32 THEN L=51:GOTO 4300
4150 IF A=72 THEN L=53:GOTO 4300
4160 IF A=71 THEN L=55:GOTO 4300
4162 IF A=99 THEN S$="#":GOTO 4170
4164 IF A=60 THEN GOTO 4170
4165 IF A=46 THEN GOTO 4170
```

```
4166 NEXT Y
4168 M$=M$+"R3"
4170 NEXT X
4180 GOTO 5000
4300 B=PEEK(P+1)
4304 IF B=46 THEN L=L+1:X=X+1
4310 B=PEEK(P-1)
4320 IF B=60 THEN GOTO 4324
4322 M$=M$+"R1"
4324 L$=CHR$(L)
4330 IF Y<18 THEN GOTO 4400
4350 M$=M$+"_"+S$+N2$(Y-18)+L$:S$="":GOTO 4170
4400 IF Y<11 THEN GOTO 4500
4420 M$=M$+S$+N2$(Y-11)+L$:S$="":GOTO 4170
4500 M$=M$+"‾"+S$+N2$(Y-4)+L$:S$="":GOTO 4170
4600 DIM N2$(7)
4640 N2$(0)="B"
4642 N2$(1)="A"
4644 N2$(2)="G"
4646 N2$(3)="F"
4648 N2$(4)="E"
4650 N2$(5)="D"
4652 N2$(6)="C"
4660 DIM PG$(6)
4670 PG=0:N$="MUSIC DATA"
4680 FOR A=0 TO 5:PG$(A)="":NEXT
4700 RETURN
5000 MUSIC M$
5100 PG$(PG)=M$
6000 PRINT"▒";
6020 PRINT"             SHARPY'S MAGIC MUSIC▒"
6030 INPUT "PAGE ";PG:PG=PG-1
6034 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒NAME ";N$
6036 GOSUB 7560
6040 IF PG>5 THEN GOTO 6000
6050 IF PG<0 THEN GOTO 6600
6100 IF PG$(PG)="" THEN GOSUB 800:GOTO 2000
6200 GOSUB 100: GOTO 2004
6500 T$=" ":K=X:L=Y:X=30:Y=2:GOSUB 700
6520 INPUT "TEMPO ";T:TEMPO T:X=K:Y=L:GOTO 2006
6600 PRINT"▒          SHARPY'S MAGIC MUSIC"
6604 PRINT "  copyright Tony & Nigel Sale   5-12-80"
6610 PRINT "                INSTRUCTIONS"
6614 PRINT "▒    enter page number,0 for instructions else 1-6"
6620 PRINT"   use cursor ←↑→↓ to position X"
6630 PRINT "     when in place insert note"
6640 PRINT "          0=8th note"
6650 PRINT "          O=quarter note"
6660 PRINT "          ●=half note"
6670 PRINT "          .=dot added to note"
6680 PRINT "          #=sharp,precedes"
6690 PRINT "          _= join,must precede note"
6694 PRINT "          *=delete on next Q"
6696 PRINT "          /=insert a rest on next Q"
6700 PRINT "▒at X key P for page"
6710 PRINT "          Q for quit,play and store as far as X"
6720 PRINT "          T for tempo 1-7"
6730 PRINT "          S for play all pages"
6740 PRINT "          W for write all pages to tape"
6750 PRINT "          R to read pages from tape"
6760 PRINT "     now  press any key to continue";
6800 TEMPO 7:MUSIC"_C1_D_E_F_G_A_BCDEFGAB‾C‾D‾E‾F‾G‾A‾B"
6810 MUSIC"‾B1‾A‾G‾F‾E‾D‾CBAGFEDC_B_A_G_F_E_D_C":TEMPO 5
6900 GET Z$:IF Z$="" THEN GOTO 6900:GOTO 6000
7000 M$=""
7100 FOR A=0 TO 5
7200 MUSIC PG$(A):NEXT
7400 GOTO 6000
7500 PRINT "▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒                    "
7510 PRINT "▒▒▒▒▒▒▒▒▒▒▒▒▒▒";:INPUT "NAME ";N$:GOSUB 7560
7520 GOTO 2006
7560 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒TEMPO";T:RETURN
8000 WOPEN N$
8100 FOR A=0 TO 5
8140 IF PG$(A)="" THEN GOTO 8300
8200 PRINT/T PG$(A)
8300 NEXT
8320 PRINT/T "█▒"
8400 CLOSE:GOTO 6000
9000 ROPEN N$
9100 FOR A=0 TO 5
9200 INPUT/T PG$(A)
9300 IF PG$(A)="█▒" THEN GOTO 9400
9340 NEXT
9400 CLOSE:GOTO 6000
```

Your search for the right price stops here.

Pet

Well known for making short work of accounting, word processing, mailing lists. A great buy from NSC.



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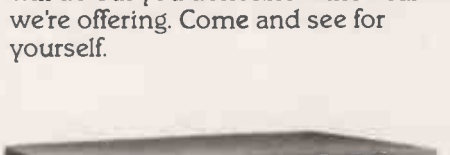
You know what the Apple system will do but you don't know the deal we're offering. Come and see for yourself.



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The exciting new 3/30 system offering 5 mb of fixed disc storage on brand new 5¼" Winchester drives. 64K Machine £4,313 incl. VAT. Full range of black box systems available. Rental terms available.

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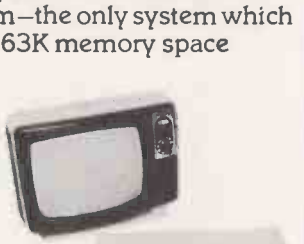
We can now supply the Cromix operating system for single and multi user working. The first big system operating system to be offered on a small system—the only system which offers up to 63K memory space per user.



Acorn Atom

Now available ex-stock. Special offer to ZX80 owners: We will take your ZX80 in part exchange for an Atom.

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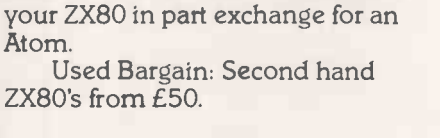

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A complete word processing system extendible from 32K-56K RAM, with up to four mini disc drives, 4MHz Z80A processor, serial and parallel I/O ports and extended BASIC. Full range of accounting packages available. You can lease this very popular system for as little as £25 per week.

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• Circle No. 174

High-resolution timer

THIS PROGRAM needs no explanation, you have only to enter the program and to run it writes Richard France of Mazy, Belgium. The elapsed time must be less or equal to ± 22 minutes. If you want an auto-re-start — for example for a race — that modification allows you to have the elapsed time between the first start and each stop:

- Suppression of line 280, 300 and 320
- addition of line : 320 CLEAR 325 GO TO 90

```
10 PRINT "HIGH RESOLUTION TIMER"
20 PRINT "----------"
30 PRINT
40 PRINT "HIT NEW LINE TO START"
50 PRINT
60 INPUT Z$
70 POKE 16414,0
80 POKE 16415,0
90 LET S = 0
100 LET M = 0
110 PRINT "HIT NEW LINE TO STOP"
120 INPUT Z$
130 LET FM = PEEK(16415)
140 IF NOT FM>127 THEN GO TO 180
150 LET FM = FM—128
160 LET S = 51
170 LET M = 10
180 LET FD = FM*256+PEEK(16414)
190 LET FD = FD—FD/140
200 LET DD = FD/5
210 LET SD = FD/50
220 LET D = DD—10*SD
230 LET M = M+SD/60
240 LET S = S+(SD—60*(SD/60))
250 IF S<60 THEN GO TO 280
260 LET S = S—60
270 LET M = M+1
280 FOR I = 0 TO 5
290 PRINT
300 NEXT I
310 PRINT "ELAPSED TIME ";M;" MIN "
    ;S;" SEC ";D;"/10"
320 PRINT "----------"
330 PRINT
340 PRINT "ENTER 1 FOR ANOTHER GO"
350 INPUT X
360 IF NOT X = 1 THEN STOP
370 CLS
380 RUN
```

Quadratic equations

HERE IS A mathematical program which plots a graph of a quadratic equations, the values of the coefficients being entered on running writes Simon Harris of Bedford. When the program is run, the computer will ask for values of the x^2 term, the x term and the constant. It will then ask for the maximum and minimum values of the axes and the steps on the y-axis.

Then the display will go blank for a while and will then show the points on the line plotted to a pre-defined accuracy-input at the beginning of the program. The program:

```
 1 PRINT "ACCURACY"
 2 INPUT AC
 3 PRINT "COEFF. X**2"
 4 INPUT CX2
 5 PRINT "COEFF. X"
 6 INPUT CX
 7 PRINT "CONSTANT"
 8 INPUT CON
 9 PRINT " MAX/MIN X-AXIS "
10 INPUT XX
11 INPUT XN
12 PRINT "MAX/MIN Y-AXIS "
13 INPUT Y
14 INPUT YN
15 PRINT "Y-AXIS STEPS"
16 INPUT S
17 CLS
19 FOR X = XN TO XX
20 LET Z = CX2*X**2+CX*X+CON
21 IF ABS(Y—Z)<AC THEN PRINT "□";
22 IF (X = 0 OR Y = 0) AND NOT ABS(Y—Z)
<AC THEN PRINT CHR$(128);
23 IF NOT(X = 0 OR Y = 0) AND NOT ABS
(Y—Z)<AC THEN PRINT " ";
30 NEXT X
35 PRINT
40 LET Y = Y—S
50 IF NOT Y<YN THEN GOTO 19
60 STOP
```

We have had so many requests for advice about software for the little ZX-80 that we have decided to start a club page devoted to the machine. If you have a contribution to make, write to *Practical Computing* marking your letter ZX-80 Line-up. We pay £5 for contributions published.

Floating point

This program overcomes the lack of a floating-point Basic on the ZX-80. It calculates the factorials of numbers to as many digits as are required, if the number required is less than 120.

However, the user may increase this number, but, as a result, the program is slower — and I warn you that the program can take a long time to run. The results obtained by using the program are far superior to those of any scientific calculator. After all, what calculator has 120 seven-segment LEDs.

```
  1 PRINT "INPUT NUMBER"
  2 INPUT N
  3 DIM A(61)
  4 LET A(1) = 1
  5 FOR A = 1 TO N
  6 FOR X = 1 TO 60
 10 LET A(X) = A(X)*A
 12 IF A(X)>99 THEN LET A(X+1) = A
    (X+1)+1
 14 IF A(X)>99 THEN LET A(X) =
    A(X)—100
 16 IF A(X)>99 THEN GO TO 12
 20 NEXT X
 30 NEXT A
 40 CLS
 50 PRINT "FACTORIAL OF ";N;" = ";
 60 LET A = 60
 70 LET A1 = 0
 80 IF A(A)>0 THEN LET A1 = 1
 90 IF A1 = 0 THEN GO TO 120
100 IF A(A)<10 THEN PRINT "0";
110 PRINT A(A);
120 LET A = A—1
130 IF A>0 THEN GO TO 80
140 STOP
```

Picture graphics

My final program is for generating pictures which the user can paint on the screen with the graphics characters.

To form the picture, the user uses the character codes. To back-space, 'B' should be typed instead of a number. 'E' should be typed to end the input, and 'N' for a new line.

The computer stores data at the last 'REM' statement in the program, at line 9999, and is terminated with a 118, Hex 76, which is a new-line character.

```
10 FOR X = 16424 TO 17424
20 IF PEEK(X) = 39 AND PEEK(X+1) = 15
   AND PEEK(X+2) = 254 THEN GO TO 50
25 NEXT X
30 PRINT "PLEASE ENTER LINE 9999
   'REM'."
40 STOP
50 PRINT "WRITE NEW PICTURE
   (Y—N)?"
60 INPUT A$
70 IF A$ = "N" THEN GO TO 200
80 CLS
90 LET DP = X+3
100 INPUT A
110 LETAB = —1
111 LET E = 118
112 LET R = 70
120 IF A = B THEN LET DP = DP—1
130 IF A = B THEN GO TO 190
140 POKE DP,A
150 IF A = E THEN GO TO 200
160 IF A = N THEN PRINT
165 IF A = N THEN GO TO 180
170 PRINT CHR$(A);
180 LET DP = DP+1
190 GO TO 100
200 LET DP = X+3
210 LET A = PEEK(DP)
220 IF A = 118 THEN STOP
230 IF A = 70 THEN PRINT
240 IF A = 70 THEN GO TO 260
250 PRINT CHR$(A);
260 LET DP = DP+1
270 GO TO 210
```

More code conversions

I HAVE written two small programs which I believe that ZX-80 owners may find very useful writes Sarbjit Singh of Coventry. They are Hex to decimal and decimal to Hex converters and, therefore, can be used for decoding the ROM, writing assemblers and disassemblers.

```
 10 PRINT " ENTER HEX. VALUE "
 20 INPUT H£
 30 LET A = CODE(H£)
 40 LET A£ = CHR£(A)
 50 LET B£ = TL£(H£)
 60 LET B = 0
 70 LET C = CODE(A£)
 80 FOR I = 28 TO 43
 90 IF C = I THEN LET D = 16*B
100 LETB = B+1
110 NEXT I
120 LET B = 0
130 LET E = CODE(B£)
140 FOR F = 28 TO 43
150 IF E = F THEN LET G = B
160 LET B = B+1
170 NEXT F
180 LET H = 0
190 LET H = G+D
200 PRINT " DEC = ";H
```

```
 10 PRINT " ENTER DEC. VALUE "
 20 INPUT H
 30 LET A = H/16
 40 LET B = A*16
 50 LET C = H—B
 60 LET E = 28
 70 FOR D = 0 TO 15
 80 IF A = D THEN LET F£ = CHR£(E)
 90 LET E = E+1
100 NEXT D
110 LET E = 28
120 FOR G = 0 TO 15
130 IF G = C THEN LET G£ = CHR£(E)
140 LET E = E+1
150 NEXT G
160 PRINT " HEX. = ";F£;G£
```

The £ sign refers to the string or character variable key on the ZX-80.

Fixing fix command

ONE OF the most annoying features of the otherwise excellent T-Bug, is that the fix command, F, is also a Hexadecimal digit writes Alan Evans of Ynysforgan.

As a result, I have, when wanting to examine the contents of a memory location, say, 6FFF, forgotten to hit M first and typed 6, F... and hence forced a fix, often of a non-existent breakpoint.

The T-Bug manual warns you not to type F, without having set a breakpoint.

However, the F command is located in address 43E6H, i.e., 17,382 decimal. That knowledge should mean you can avoid such blunders. I modify the existing contents — they are 46H, 70 decimal, i.e., "F" — to 51H, 81 decimal, which is "Q" ... QUIT breakpoint...

To save that change, you can copy the altered program with

P4380 497F 43A0 TBUG2 (ENTER)

Second last resort

IN YOUR October 1980 issue, in Tandy Forum you printed a program entitled, Last resort, which was used to display programs in machine code writes NR Brickell of Plymouth. I have a program written in Basic which utilises a machine-code routine to do the same.

A full video display of 1,024 characters is generated, which corresponds to the contents of memory locations, starting from location 0. To display the next set of characters, press any key and they appear very quickly. ROM and RAM areas can then be observed. The program is designed for the TRS-80 Level II 16K.

7D03	11003C	LD	DE, 3C00H
7D06	010004	LD	BC, 1024
7D09	EDB0	LDIR	
7D0B	C9	RET	

Basic listing

```
10 REM * LAST RESORT?*
20 FORN = 32003TO32011:READA:
   POKEN,A:NEXT
30 DATA 17,0,60,1,0,4,237,176,201
40 CLS:P = 0
50 POKE32000,33:POKE32001,0
60 FORK = 1TO32:POKE32002,P
70 POKE16526,0:POKE16527,125:X = USR
   (0)
80 A$ = INKEY$:IFA$ = ""THEN80
90 P = P + 4:NEXT
99 GOTO99
```

Line control

HERE ARE two listings of a program that I have been using for some time to control the format of program listings writes Dennis Long of Rochester in Kent. It permits control of margins, page width, underline functions and so on.

The main feature is that it fully controls the versatile printing formats of the Centronics 737 dot-matrix printer.

```
1 REM *** LINEPRINTER CONTROL PRO-
  GRAM ***
2 REM * * * BY DENNIS V. LONG (C)
  198* * *
3 REM * * * ROCHESTER KENT ENG-
  LAND * * *
4 REM * * * FOR TRS 80 I — DISK BASIC
  * * *
5 'This program CONTROLS the line-printing
```

TANDY FORUM is devoted to the Tandy TRS-80. Sometimes we will use it to pass on news about the TRS-80 but, above all, it is for users, and would-be users, of the well-established model I and now the new model II. With your tips, queries, moans and comments, this page can become a market-place for TRS-80 information.

```
  of a program stored on disc in ASCII format,
  so that space is left on the paper for binding,
  note-making and debugging.
6 'SPECIAL FEATURES consist of the ability
  to set top, bottom and side margins. To
  double-space each line, to underline selected
  statements and to avoid chopping statements
  in half at the end of each line.
7 'Line numbers are separated from the text
  by placing them, right-justified in the left
  margin.
8 'REM statements may be underlined if the
  letters REM are followed by at least one
  space. Notice that the underline stops at the
  end of the printed line.
9 'BASIC PRINT statements can also be
  underlined if they contain a (Quote-space-
  asterisk) sequence, for example:— PRINT"
  * * THIS IS A HEADING * *". Note that
  the space between the (") and the (*) has
  gone.
10 'The first space after a (REM) and the
  space between the (") and the (*) is used to
  contain the underline control code for the
  printer. The CENTRONICS P1 and the 737
  both use the code CHR$(15) — see lines
  640 and 650 — to start underline.
11 'Before using this program, save the pro-
  gram you want printed in ASCII format,
  i.e., SAVE"FILENAME/TXT",A. The
  program is read from disc line by line.
12 'Finally, note that all variables beginning
  with P are NOTE:— N — denotes an im-
  bedded line feed strings. They are used to send
  printing codes to the lineprinter, for ex-
  ample PU means Print Underline, PI is Print
  Indented from margin etc.

100 REM* * SET UP PROGRAM * * * * * * * *
110 CLS:CLEAR10000:DEFINTA-Z:DEFSNG F,S,L:DEFSTR P
120 PU=CHR$(15):PN=CHR$(14)
130 REM* * VIDEO HEADING * * * * * * * * *
140 PRINT"PROGRAM TO LINEPRINT AN ASCII ENCODED BASIC PROGRAM
    FROM DISK":PRINT STRING$(62,61)
150 REM* * SET UP PRINTING FORMAT * * * *
160 LP=PEEK(&H4028):PRINT"PAGE LENGTH IS";LP;:INPUT" - CHANGE
    IT ";C$: IFC$="YES" THEN C$="":GOSUB610 ELSEC$=""
170 INPUT"ENTER TOP MARGIN SPACING FOR LISTING ";TM: IFTM
    THEN180 ELSE TM=3
180 INPUT"ENTER LINE NUMBER FOR BOTTOM OF LISTING";BM: IFBM
    THEN190 ELSE BM=58
190 INPUT"ENTER THE CODE FOR THE TYPE OF PRINTOUT REQUIRED^FOR
    EXAMPLE - 27,20   ";A,B: PT=CHR$(A)+CHR$(B)
200 INPUT"HOW MANY CHARACTERS PER LINE DOES IT GIVE ";CL:IFCL
    THEN210 ELSE CL=80
210 INPUT"ENTER LEFT MARGIN WIDTH (ALLOW FOR LINE NO.
    IN MARGIN) ";LM:IFLM THEN 220 ELSELM=10
220 INPUT"ENTER RIGHT MARGIN WIDTH";RM: IFRM THEN 240 ELSE
    RM=10
230 REM* * WRITE A PAGE HEADING * * * * *
240 PRINT@128,CHR$(31);:INPUT"DO YOU WANT A HEADING FOR EACH
    PAGE";C$:IFC$="YES" THEN C$="":GOSUB620 ELSEC$="":PH=""
250 REM* * DEFINE ASCII FILE NAME * * * *
260 LINEINPUT"ENTER THE FILE NAME  - ";N$

NOTE:- ^ - denotes an imbedded line feed

270 REM* * SELECT LINE NUMBERS * * * * *
280 NP=0: INPUT"ENTER START LINE NO. OF LISTING ";SL:IF SL
    THEN 290 ELSE SL=0
290 LN=SL: INPUT"ENTER FINISH LINE NUMBER ";FL:IF FL THEN 300
    ELSE FL=65529
300 INPUT"DO YOU WANT A SPACE AFTER EACH LINE ";C$:IF C$="YES"
    THEN ZZ=1 ELSEC$=""&ZZ=0
310 INPUT"DO YOU WANT REM'S UNDERLINED ";C$:IFC$="YES" THEN
    Z1=1: C$="" ELSE Z1=0:C$=""
320 REM* * DISPLAY SELECTED FORMAT * * *
330 PRINT@128,CHR$(31);PH"^FILE NAME :-" TAB(14)N$
    TAB(35)"PAGE LENGTH" TAB(46)PEEK(&H4028) "^MARGINS
    :- LEFT"LM"   RIGHT"RM"   TOP"TM"   BOTTOM"BM"^LINE
    NUMBERS :-  START" TAB(22)SL TAB(30)"FINISH" TAB(36)FL
    TAB(45)"CURRENT" TAB(53)LN
340 ONERROR GOTO600:POKE&H4029,LP-1:OPEN"I",1,N$:REM* 4029
    is line counter location
350 NP=CL-RM
360 GOSUB660:LPRINTPT;
370 REM* * GET DATA FROM DISK * * * * *
380 IFEOF(1) THEN PRINT@384,CHR$(31) "END OF FILE * *
    ":: CLOSE: GOSUB690: INPUT"ANOTHER FILE USING THE SAME
    FORMAT ";C$: IFC$="YES" THENC$="": GOTO240 ELSE 110
390 LINEINPUT#1,LI$
400 LN=VAL(LI$): IFLN<1 THEN CLOSE:PRINT@832,"* * * * THIS
    IS NOT AN ASCII PROGRAM  * * PRESS ENTER * * *":INPUTC$:
    GOTO240 ELSE PRINT@374,LN;
410 PRINT@448,CHR$(31);LI$
420 REM* * CHECK LINE NUMBER * * * * * *

NOTE:- ^ - denotes an imbedded line feed

430 IF LN<SL THEN 380
440 IF LN>FL THEN PRINT@512,CHR$(31);"LAST LINE REQUESTED HAS
    BEEN PRINTED ": GOSUB690:CLOSE: INPUT "DO YOU WANT MORE
    LINES LISTED USING THIS FORMAT ";C$:IFC$="YES" THENC$="":
    GOTO280 ELSE110
450 REM* * START WORK ON DATA * * * * *
460 I=1:GOSUB630: IFZ1 GOSUB690
470 LL=INSTR(LI$,CHR$(32)):IN=LM-LL:GOSUB670
480 REM* * CHECK PAPER - PRINT HEADING * *
490 LC=PEEK(&H4029): IFLC>=BM THEN NP=NP+1: IFNP=1 THEN
    GOSUB660:LPRINTCHR$(12) ELSE GOSUB690 ELSE530
500 GOSUB700: LPRINT"        "PU;PH;PN;" Page"NP;
510 FORN=2TOTM:LPRINTCHR$(138):NEXT
520 REM* * SORT AND LINE PRINT DATA * * *
530 IFLEN(LI$)<(WP-IN) THEN LPRINTPI;LI$: IFZ2 THEN LPRINT
    CHR$(138): GOTO380 ELSE GOTO380
540 L=WP-IN:V=L-5:TC$=" "
550 X=INSTR(V,LI$,TC$): IF X>0 AND X<L THEN V=X: GOTO540 ELSE
    IFTC$=" "THENTC$="I":GOTO550 ELSEV=V-5:TC$=" ":GOTO550
560 LPRINT PI;LEFT$(LI$,V): IFZ2 THEN LPRINTCHR$(138)
570 LI$=RIGHT$(LI$,LEN(LI$)-V)
580 IN=LM:GOSUB670:GOTO490
590 REM* * SUBROUTINES * * * * * * * * * *
600 CMD"E":PRINT"ERROR CODE"ERR/2+1" ON LINE";ERL;" RE-";:
    CLOSE:RESUME260 : REM* * Error trap assumes a file name
    error * *
610 INPUT"ENTER THE PAGE LENGTH REQUIRED ";LP:POKE&H4028,LP:
    RETURN
    NOTE:- ^ - denotes an imbedded line feed
620 PRINT"ENTER NOT MORE THAN ONE LINE FOR THE HEADING"
    :LINEINPUTPH:RETURN
630 I=INSTR(I,LI$,CHR$(10)): IFI THEN MID$(LI$,I,1)= CHR$(126):
    GOTO630 ELSE RETURN : REM* * Replace line feeds with
    squiggle
640 R=INSTR(LI$,"REM"+CHR$(32)): IFR THEN MID$(LI$,R+3,1)=
    CHR$(15): RETURN :REM R=INSTR(LI$,"REM ") could be used,
    but the space would be replaced with OF Hex if the
    underline is used for lineprinting
650 R=INSTR(LI$,CHR$(34)+" *"): IFR THEN MID$(LI$,R+1,1)=
    CHR$(15): RETURN ELSE RETURN :REM* * Put underline code
    after a REM or a (" *) sequence.
660 IFPEEK(14312)<>63THENPRINT@896,"* * SWITCH PRINTER ON * *
    * ";: FORM=0TO50: NEXT: PRINT@896,CHR$(30);: FORM=0TO50:
    NEXT:GOTO660 ELSE RETURN
670 PI=CHR$(14)+STRING$(IN,32)
680 RETURN: REM* * Define line feed and page indent * *
690 LPRINTCHR$(138)PI "NOTE:- "CHR$(126)" - denotes an
    imbedded line feed" CHR$(12): RETURN
700 PRINT@832,"* * CHECK PAPER * * ";:INPUT"PRESS ENTER TO
    CONTINUE ";C$:GOSUB660:RETURN

    NOTE:- ^ - denotes an imbedded line feed
```

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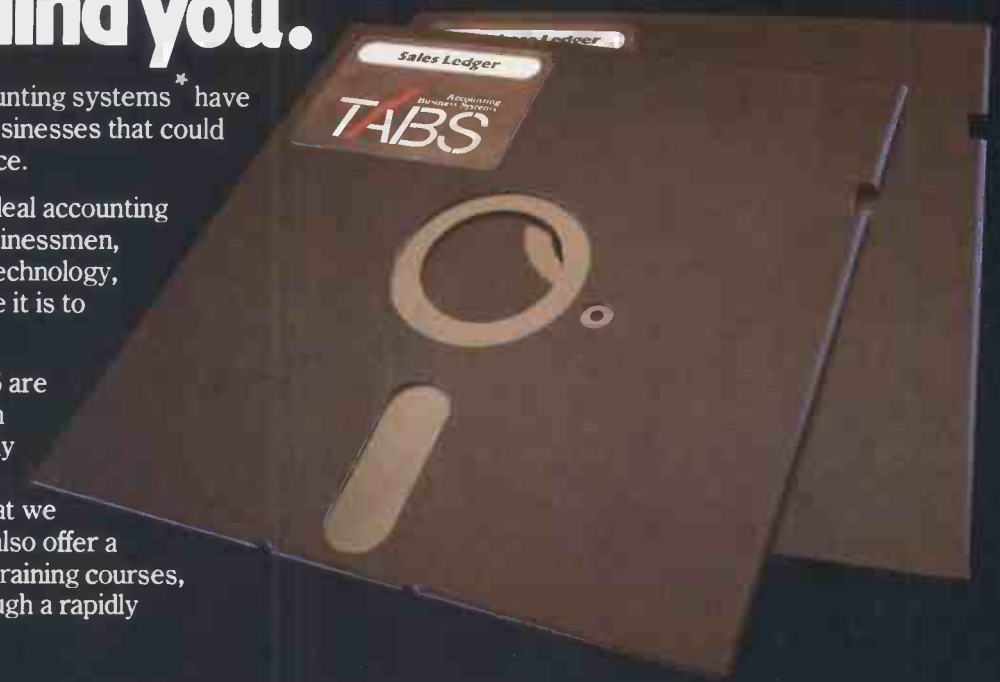

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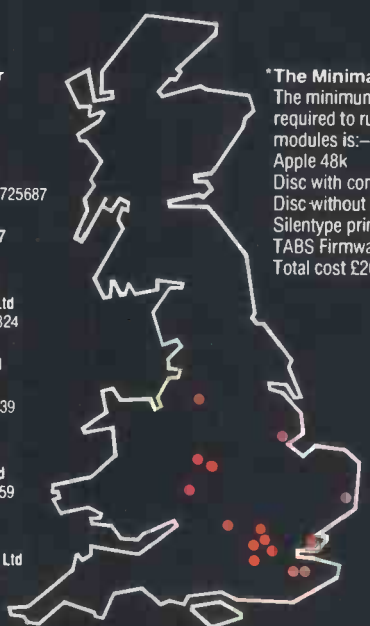

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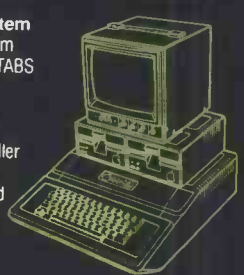
Total cost £2056



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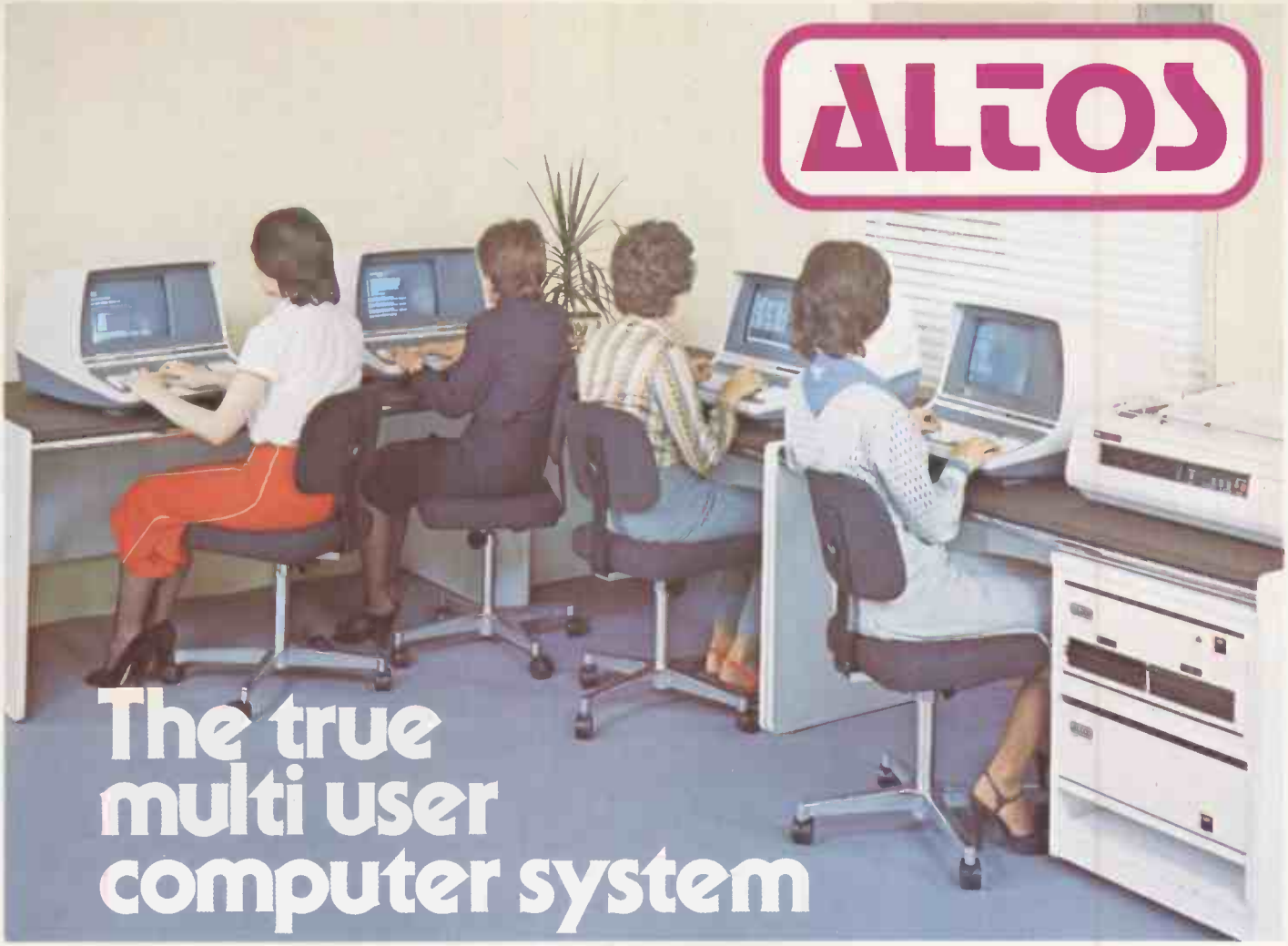

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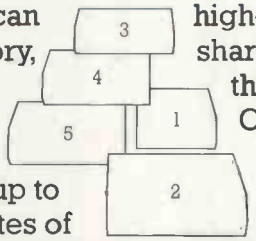

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• Circle No. 178

Input without display

IN MY letter published in August 1980 6502 Special, I described how input could be made using the UK101 Basic, but without the screen displaying the data writes M F Taylor of Peterborough, Cambridgeshire. I have since graduated to the new MK2 monitor ROM for the 101. Due to changes in subroutines in the new ROM, a different Poke value is required to allow the input without display.

For the MK2 ROM lines 2 and 4 of my program should read

```
2 POKE 538, 33
4 POKE 538, 212
```

I find the new ROM with Edit reasonably useful. It allows line edit, rapid screen clear, and storage/recovery of data — string or variable — from tape.

The only loss is the disc bootstrap but that can be kept on an external ROM if one wishes to use a disc. The documentation is good, although in a list of storage locations, there is an error in the decimal address of the vectors on the last page.

The cursor home is to top left and VDU display now starts to write from top to bottom and that scrolls when the bottom line is reached.

All is not lost

IF YOU HAVE ever been in the situation where your UK101 suddenly decides that it has had enough and refuses to run your latest Basic masterpiece which no doubt contains a dreaded Poke command — fear not — all is not lost reassures MDE Connor of Swansea. Before resorting to cold-start go into monitor mode and load the following:

```
0000 :— 4C 74 A2 4C C3 A8 05 AE
```

Now re-set and try a warm-start. With any luck, you will now be able to use Basic again and your program will still be in memory. However, before running your masterpiece, I suggest that you try to discover why it wiped those zero-page locations in the first place.

Fault checking

WHEN YOU have acquired a new memory board, how can you be sure that there are no faults in it? — asks Fionn Turnbull of Walton on Thames in Surrey. It is possible to store binary zeros in each byte in turn, check to see if all bits have cleared, and do the same with all ones.

However, due to the complexity of integrated circuits, some faults are soft. That is; they occur only under particular circumstances which may occur only rarely. To be sure of the integrity of integrated circuits, all possible conditions should be tested.

The bits within a byte of RAM may be set in one of 256 possible combinations. To be sure of the integrity of RAM, each possible combination should be tested for every byte. That is what the program, Bytest, attempts to do.

Having loaded the program, set "GO" to the start of the program at 0E80. Press a command key, and the program name is displayed for a few seconds. Then the Acorn "From" prompt appears. Key-in the address at which you wish testing to start, and finish with a command key. That gives the "To" prompt. Key-in the end address, and on pressing a command key, the display goes blank.

The memory area specified is now being tested. If the test is successful, the display shows the "To" address you keyed-in.

If the program finds a byte which appears faulty — such as ROM, or an address which does not access anything — it branches from the testing loop. The address of the faulty byte is displayed, together with its apparent "contents". To draw attention to the fact that this is a fault, the "contents" flash on and off. To test 8K of RAM takes about 63 seconds.

```
0E80 A9 02     START   LDA #02
82 85 1B               STA Z 1B
                       RECAL
84 A9 B3               LDA #B3
86 85 1E               STA Z 1E
                       BRKVEC
88 A9 FF               LDA #FF
8A 85 1F               STA Z 1F
                       BRKVEC
8C A2 05               LDX #05
8E BD F9 0E    GETNAM  LDA BYTEST
                       ,X
0E91 95 10             STA Z,X D
93 CA                  DEX
94 10 F8               BPL GETNAM
96 A9 4F               LDA #4F
98 20 E9 0E            JSR SHOW
9B 84 15               STY Z D+5
9D A2 06       FROM    LDX #06 FAP
9F A9 71               LDA #71 "F"
0EA1 85 10             STA Z D
A3 20 88 FE            JSR QDATFET
A6 A2 08       TO      LDX #08 TAP
A8 A9 78               LDA #78 "t"
AA 85 10               STA Z D
AC 20 88 FE            JSR QDATFET
AF A2 00               LDX #00
0EB1 86 20             STX Z VALUE
0EB3 A5 20     TEST    LDA Z VALUE
B5 81 06               STA (FAP,X)
B7 49 FF               EOR #FF
B9 A1 06               LDA (FAP,X)
BB C5 20               CMP Z
                       VALUE
BD D0 0F               BNE STUCK
BF C6 20               DEC Z VALUE
0EC1 D0 F0             BNE TEST
C3 8A                  TXA
C4 81 06               STA (FAP,X)
C6 20 A0 FE            JSR COM16
C9 D0 E8               BNE TEST
CB 4C 04 FF            JMP RESTART
CE 84 10       STUCK   STY Z D
0ED0 A2 06             LDX #06 FAP
D2 20 64 FE            JSR QHEXTD1
D5 A1 00       CONTNT  LDA (00,X)
D7 20 60 FE            JSR RDHEXTD
DA A9 0F       ALTERN  LDA #0F
DC 20 E9 0E            JSR SHOW
DF A5 17               LDA Z D+7
0EE1 F0 F2             BEQ CONTNT
0EE3 84 16             STY Z D+6
  Y is 00 on exit from DISPLAY
E5 84 17               STY Z D+7
E7 D0 F1               BNE ALTERN
E9 85 21       SHOW    STA Z TIMES
EB 85 0E               STA Z
  REPEAT Set for single scan
ED 20 0C FE    FLASH   JSR DISPLAY
0EF0 C6 21             DEC Z TIMES
F2 D0 F9               BNE FLASH
F4 A9 FF               LDA #FF
F6 85 0E               STA Z
  REPEAT Set for multi-scan
F8 60                  RTS
F9 7C          BYTEST  b
FA 6E                  Y
FB 78                  t
FC 79                  E
FD 6D                  S
FE 78                  t
FF 00
```

Bug hunter

IN 6502 Special December 1980, S Russell sent in a machine-code program, which listed the ASCII character set by Hex code writes N Corbett of Pontefract, West Yorkshire. The program contains two bugs, as follows:

- On start-up, the first character is printed without its Hex code.
- When Hex code 20 is reached, nothing appears — which is acceptable for the character since Hex code 20 = space, but nothing appears for the Hex code either.

Furthermore, Russell uses 99 to store the contents of the accumulator in the VDU memory map. The instruction '99' means LDA absolute, indexed by IY. Luckily, IY is zero when the program leaves the clear-screen routine, and so, in this case, 99 has the effect of 8D. However, it is safer to use the 8D instruction in this context, since it is independent of the value of IY.

Finally, there are two lines of superfluous code:

```
0077.99.C0.03
007C.99.C1.03
```

Those lines attempt to print the Hex value of the accumulator on the bottom-left corner of the screen. The Tanbug subroutine 'HEXPNT' is called in the program, lines 0077 and 007C are redundant, and may be filled with NOPs, without affecting the workings of the program.

My own version of the program, which is some 20 bytes shorter, follows Russell's program which was the first Microtan 65 program to be published in *Practical Computing*.

To change the subject, I thought A E Prinn's comments — December 1980 — about using 6502 Special for machine-code programs were very pertinent. As he says, one can look elsewhere for Basic programs. We only have one page a month — let's not waste it.

```
0040 A0.10              LDY #10
  ; clear screen using 16
0042 20.73.FE   CLEAR   JSR OUTPCR
  carriage returns
```

(continued on page 121)

THE 6502 SPECIAL is dedicated exclusively to the exchange of information between 6502 users. It is up to you, the reader, to help establish this page with your ideas, problems and guidance for other 6502 users. Please mark your letters 6502 Special. We pay £5 for each contribution published.

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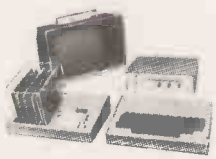

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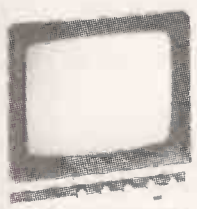

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• Circle No. 179

(continued from page 119)

```
0045 88                    DEY
0046 D0.FA                 BNE,CLEAR
0048 A9.00        START    LDA#00
004A 8D.E3.03     REPT     STA 03E3
  ; print character
004D 48                    PHA
  ; save accumulator, i.e., character
004E 20.0B.FF              JSR HEXPNT
  ; print hex-code of character
0051 A9.20                 LDA#20
  ; obliterate cursor left by HEXPNT
0053 8D.E2.03              STA 03E2
0056 A2.FF                 LDX#FF
  ; delay — may run faster by making LDX
  operands smaller in value
0058 A0.FF        DEL.2    LDY#FF
005A 88           DEL.1    DEY
005B D0.FD                 BNE,DEL.1
005D CA                    DEX
005E D0.FA                 BNE,DEL.2
0060 20.73.FE              JSR OUTPCR
  ; Carriage returns to space out display — one
  or two may be filled with NOPs if required
0063 20.73.FE              JSR OUTPCR
0066 20.73.FE              JSR OUTPCR
0069 68                    PLA
  ; Restore character
006A 69.00                 ADC#01
  ; Increment it
006C C9.80                 CMP#80
  ; Begin again if all characters printed;
  otherwise repeat
006E D0.DA                 BNE, REPT
0070 F0.D6                 BEQ,START
```

Reviewed re-number

THIS PROGRAM, 6502 Special, September 1980, seemed to be just what the doctor ordered — until I found that it altered all the line numbers but all the GOTOs left as in the original writes N G Savill of Ascot, Berkshire. A friend confirmed that, typing the program into his 101, so the midnight oil had to be burnt.

A thorough examination — a euphemism for a week of computing sessions from 11 pm to 3 am — produced the simple reason and the not so simple corrections and modifications.

My friend and I, liking our programs to be readable, used the format "GOTO N" not "GOTON". With the latter format, the program works perfectly but with the former, when the GOTO tokens are found at address J — line 63090 in the original program — address J+1 returns 32 — ASCII for space — for L in line 63100.

Since L < 48, the NEXT in line 63220 sets J = J + 1 and then line 63090 finds the space instead of the token and thus the GOTO is missed altogether. Re-written as shown here the program will now cope with a space between a "GOTO" and its number, and also a space before and/or after a COMMA (ASCII 44) which is used in "ON X....GOTO N, M" statements.

Although not in the 101 manual, GOSUB may also be used in that way, i.e., "ON X....GOSUB N, M". There are two minor errors in the manual here: on return from "GOSUB" and if X in "ON X....GOTO N, M" is greater than the number of lines (N + M), both cause the program to jump to the next statement not to the next line.

Five modifications were made to improve the program:

- If the number of lines is excessive, the program ends earlier; at the end of the first pass instead of the second.
- If the new line number following a "GOTO" with a space is longer than before, i.e., 120 instead of 80, the space will accommodate it, but the "OVERWRITTEN" message is still output so programs can be kept readable. If this is not required, omit the "=" in line 63250.
- The program now re-numbers between user-defined start and finish lines so that with several programs in the memory they can be processed one at a time.
- Re-numbering is again user-defined for the first new line number and increment size. Note that this must be done with the utmost caution not only to ensure that one program is not numbered the same as another, but also to prevent line numbers being stored in the memory out of sequence.
- The error messages have been expanded to give more information, e.g., if the new line number after a "GOTO" is longer than before so the token is overwritten, it will completely disappear as it is stored in only one memory location. The token is, therefore, output — 136 = GOTO, 140 = GOSUB, 160 = THEN and 44 = COMMA. The new line number is given followed by the missing token or label and the old line number.

Lines have been kept to 46 characters even in a readable format to aid use of 1200 BAUD for tape storage. Sadly, the program is long — 35 instead of 25 lines and about 1,010 bytes instead of 760 — these based on a readable format — but, of course, it can be squeezed-in. On a 4K 101, the maximum number of lines the program can treat may be reduced from 200 to 100 by subtracting 100 from the appropriate numbers in lines 63040, 63060 and 63100.

It was ironic that I had to re-number the ammended program manually as it cannot re-number itself and all the mainframe computers I use go beserk if one attempts to re-number lines with multiple statements.

```
63000 INPUT"RENUMBER OLD LINES FROM";S
63010 INPUT"TO";E:IF S=>E THEN 63000
63020 INPUT"FIRST NEW LINE NO.";F
63030 INPUT"STEP SIZE";D
63040 DIM A(199):AD=771:GOSUB 63330
63050 IF LN<S THEN AD=NA:GOSUB 63330:GOTO63050
63060 Z=AD:FOR Y=0 TO 199
63070 GOSUB 63330:IF LN>E THEN 63110
63080 N=F+D*Y:NH=INT(N/256):NL=N-256*NH
63090 POKE AD,NL:POKE AD+1,NH:A(Y)=LN
63100 AD=NA:NEXT Y:PRINT"OVER 200 LINES":END
63110 AD=Z:FOR B=0 TO Y:GOSUB 63330
63120 IF LN>N THEN PRINT" END, LAST LINE"N:END
63130 FOR J=AD+2 TO NA-4:C=PEEK(J)
63140 IF C<>136 AND C<>140 AND C<>160THEN63320
63150 T=C:L=PEEK(J+1):IF L=32 THEN J=J+1
63160 L=PEEK(J+1):IF L<48 OR L>57 THEN 63320
63170 C$="":FOR K=J+1 TO J+8:C=PEEK(K)
63180 IF C<48 OR C>57 THEN 63200
63190 C$=C$+CHR$(C):NEXT K
63200 L=VAL(C$):FOR H=0 TO Y:IFA(H)=LTHEN63230
63210 NEXT H:PRINT F+B*D"LABEL"L;
63220 PRINT"NOT FOUND OLD LINE"A(B):GOTO 63300
63230 N$=STR$(F+D*H):R=LEN(N$):FOR X=2 TO R
63240 POKE K+X-R-1,ASC(MID$(N$,X,1)):NEXT X
63250 IF K-R=>J THEN 63280
63260 PRINT F+B*D"OVERWRITTEN";
63270 PRINT" TOKEN"T"OLD LINE"A(B)
63280 IF K-J-R<=0 THEN 63300
63290 J=J+1:POKE J,32:GOTO 63280
63300 IF C=32 THEN K=K+1:C=PEEK(K)
63310 IF C=44 THEN J=K:GOTO 63150
63320 NEXT J:AD=NA:NEXT B:PRINT"ERROR":END
63330 NA=PEEK(AD-1)*256+PEEK(AD-2)+2
63340 LN=PEEK(AD+1)*256+PEEK(AD):RETURN
```

Disc re-set

EVEN THE simplest function requires several lines of Basic programming on my 2040 disc unit, writes M J Valentine of Rotherham, South Yorkshire. While in the maze of direct access, I accidently stumbled on the re-set vector entry point. Also I discovered where the disc identities are stored in RAM.

This subroutine re-sets the disc unit with the memory execute command "M-E" CHR$(142)CHR$(225). That re-sets the disc unit as a power-up would do. It could be used to re-set the disc without power-down from the Pet. The discs are then both initialised and the error channel checked in the usual way. The disc identities are then read from disc memory using the memory read command "M-R". The result is obtained from the error channel using GET .

The result is printed on the PET screen. The subroutine is to check disc identity or initialise discs. The GET # command could be used to build-up a string for programs to check disc indentity, etc.

Battleships

IN THIS adaptation of the well-known game of Battleships, the player takes on the computer writes Mark Hopley of Coventry.

The game is played on a grid of 19-by-eight squares with the letters A-S along the top and the numbers 1-8 down the right-hand side.

At the start of the game, the player is asked to position each of his 12 battleships in turn. The computer then positions his 12 U-boats on the screen using a non-visible character, avoiding the squares already occupied by battleships or U-boats.

Once that is done, the game starts, with the player and the computer firing alternately, but player beware — you can sink your own ships.

Each player's shot is recorded on the screen by one of the following:

- · Player's miss
- × Player's hit
- # Destruction of own ship
- \+ Computer's hit
- : Computer's miss

The computer will not fire at a square which has been shot at previously, but the player can and he will waste a shot.

The use of non-visible characters in the Poke statements — as in line 580 — enables the computer to store the location of his ships on the screen without them being visible to the opponent.

When the program was first written, the computer selected its targets at random throughout the game, but I found that as the number of free squares decreased the computers moves took longer.

That problem was overcome by the s/rt starting at line 1470 which is called into play when the computer cannot find a free square after a fixed number of moves. The program takes up about 8,000 bytes: ⅛ and ⅞ represent < and > respectively.

It was written for a 16K Pet 2001 with a new ROM.

```
5 GOSUB 1630
10 REM***BATTLE SHIPS'****
20 REM***MARK HOPLEY 16 JULY 1980***
30 R=1:S=49:DIM B(200),X(200),XX(19,19)
40 PRINT"3"
50 REM***PRINT GRID***
60 FOR I=0 TO 19 STEP 2
70 FOR A=0 TO 39 STEP 2
80 POKE32768+40*I+A,93
90 NEXT
100 NEXT
110 FOR I=1 TO 17 STEP 2
120 FOR A=0 TO 39 STEP2
130 POKE32768+40*I+A,91
140 NEXT
150 NEXT
160 FOR I=1 TO 17 STEP 2
170 FOR A=1 TO 39 STEP 2
180 POKE32768+40*I+A,64
190 NEXT
200 NEXT
210 FOR I=1 TO 37 STEP 2
220 POKE32768+40*0+I,R
230 POKE32768+40*18+I,R
240 R=R+1
250 NEXT
260 FOR I=2 TO 17 STEP 2
270 POKE32768+40*I+39,S
280 S=S+1
290 NEXT
300 REM***POSITION YOUR PIECES***
310 FOR G=1 TO 12
320 PRINT""
330 INPUT"COLUMN+ROW";LS,ZS
340 IF ASC(ZS)<49 OR ASC(ZS)>56 OR ASC(LS)<65 OR ASC(LS)>83 THEN 360
350 GOTO 390
360 PRINT"ILLEGAL POSITION.REDO";:FOR I=1 TO 1000:NEXT
370 PRINT"----------                                    ";:GOTO 320
380 GOTO 330
390 FOR I=65 TO 83
400 IF I=ASC(LS) THEN H=(I-64)*2-1
410 NEXT
420 FOR I=49 TO 56
430 IF I=ASC(ZS) THEN F=(I-47)*2-2
440 NEXT
450 IF PEEK(32768+40*F+H)=32 THEN 470
460 PRINT"SQARE OCCUPIED";:FOR I=1 TO 1000:NEXT:GOTO 370
470 POKE32768+40*F+H,102
480 NEXT
490 REM***PET PIECE POSITIONER***
500 DATA 1,3,5,7,9,11,13,15,17,19,21,23,25,27,29,31,33,35,37
510 DATA 2,4,6,8,10,12,14,16
520 FOR I=1 TO 19:READ R(I):NEXT
530 FOR X=1 TO 8:READ X(X):NEXT
540 FOR I=1 TO 12
550 V=INT(RND(0)*19)+1
560 L=INT(RND(0)*8)+1
570 IF PEEK(32768+40*X(L)+R(V))<>32 THEN 550
580 POKE32768+40*X(L)+R(V),96
590 NEXT
600 N1=12:N2=12
610 REM***YOUR MOVE***
620 PRINT"                                "
630 PRINT"                                "
640 INPUT"YOUR GO";GS,FS
650 KK=1
660 IF ASC(GS)<65 OR ASC(GS)>83 OR ASC(FS)<49 OR ASC(FS)>56 THEN 680
670 GOTO 700
680 PRINT"ILLEGAL POSITION";:FOR I=1 TO 1000:NEXT
690 PRINT"---------------                    ";:GOTO 620
700 FOR I=65 TO 83
710 IF I=ASC(GS) THEN G=(I-64)*2-1
720 NEXT
730 FOR I=49 TO 56
740 IF I=ASC(FS) THEN F=(I-47)*2-2
750 NEXT
760 LL=F/2:V=ASC(GS)-64
770 XX(LL,V)=1
780 AA=PEEK(32768+40*F+G)
790 IF AA=91 OR AA=35 OR AA=86 OR AA=46 OR AA=58 OR AA=32 THEN 830
800 IF AA=102 THEN N1=N1-1
810 IF AA=96 THEN N2=N2-1
820 GOTO 850
830 PRINT"MISSED";:IF AA<>32 THEN 860
840 POKE32768+40*F+G,46
850 IF AA<>32 THEN GOSUB 900
860 FOR I=1 TO 2000:NEXT
870 PRINT"                "
880 GOTO 1250
890 REM***EXPLOSION FOR A HIT***
900 B=46
910 POKE32768+40*F+G,B
920 POKE32768+40*F+(G-1),B
930 POKE32768+40*F+(G+1),B
940 POKE32768+40*(F+1)+G,B
950 POKE32768+40*(F-1)+G,B
960 TC=TI+30
970 IF TI<TC THEN 970
980 IF B<>32 THEN B=32:GOTO 910
990 POKE32768+40*F+(G+1),93
1000 POKE32768+40*F+(G-1),93
1010 POKE32768+40*(F+1)+G,64
1020 POKE32768+40*(F+1)+G,64
1030 IF AA=96 THEN POKE32768+40*F+G,86
1040 IF AA=102 AND KK=1 THEN GOSUB 1170
1050 IF AA=102 AND KK<>1 THEN POKE32768+40*F+G,91
1060 IF AA=102 AND KK=1 THEN KK=0:GOTO 1080
1070 PRINT"HIT   "
1080 IF N1=0 THEN 1120
1090 IF N2=0 THEN 1140
1100 RETURN
1110 REM***WIN/LOOSE***
1120 PRINT"YOU LOOSE"
1130 END
1140 PRINT"YOU WIN"
1150 END
1160 REM***DESTROY OWN SHIP S/RT***
1170 CS="FOOLISH WAS ON YOUR SIDE!"
1180 PRINT""!CS
1190 POKE32768+40*F+G,35
1200 IF CS="                                    "THEN RETURN
1210 CS="                                       "
1220 FOR I=1 TO 2000:NEXT
1230 GOTO 1180
1240 REM***COMPUTER MOVE***
1250 KK=0
1260 MM=1
1270 G=INT(RND(0)*19)+1
1280 F=INT(RND(0)*8)+1
1290 IF XX(F,G)=1 AND MM=12 THEN GOSUB 1480
1300 IF XX(F,G)=1 THEN MM=MM+1 :GOTO1270
1310 XX(F,G)=1
1320 F=F*2:H=G*2-1
1330 AA=PEEK(32768+40*F+H)
1340 IF AA=96 THEN GOTO 1270
1350 G=G+64
1360 PRINT"PET'S FIRE:SQUARE ";CHR$(G);INT(F/2)
1370 G=(G-64)*2-1                    "
1380 IF AA=102 THEN N1=N1-1:GOTO 1440
1390 IF AA=32 THEN PRINT"";TAB(25);"MISSED"
1400 IF AA=32 THEN POKE32768+40*F+G,58
1410 FOR I=1 TO 2000:NEXT
1420 PRINT"";TAB(25);"                "
1430 IF AA=32 THEN 1450
1440 GOSUB 900
1450 FOR I=1 TO 500:NEXT
1460 GOTO 620
1470 REM***SEARCH FOR SPACE***
1480 IF INT(RND(0)*2)+1<>1 THEN 1560
1490 FOR I=1 TO 19
1500 FOR A=1 TO 8
1510 UU=PEEK(32768+40*(A*2)+(I*2)-1)
1520 IF UU=32 OR UU=102 THEN G=I:F=INT(A):I=19:A=8
1530 NEXT
1540 NEXT
1550 MM=1:RETURN
1560 FOR I=19 TO 1 STEP-1
1570 FOR A=1 TO 8
1580 UU=PEEK(32768+40*(A*2)+(I*2)-1)
1590 IF UU=32 OR UU=102 THEN G=I:F=INT(A):I=1:A=8
1600 NEXT
1610 NEXT
1620 MM=1:RETURN
1630 PRINT"3            BATTLESHIPS"
1640 PRINT"             CCCCCCCCCC"
1650 PRINT"YOU ARE THE COMMANDER OF A FLEET OF 12"
1660 PRINT"BRITISH BATTLESHIPS.YOUR MISSION IS TO"
1670 PRINT"DESTROY 12 GERMAN U-BOATS MOORED IN "
1680 PRINT"THE VACINITY.THE U-BOATS ARE NOT UNARMED"
1690 PRINT"AND WILL SHOOT BACK.THE U-BOATS WILL NOT"
1700 PRINT"SHOOT AT A SQUARE THAT HAS BEEN SHOT AT"
1710 PRINT"ALREADY.YOU CAN BUT YOU WILL WASTE A "
1720 PRINT"SHOT.NO TWO SHIPS CAN OCCUPY ANY ONE"
1730 PRINT"SQUARE."
1740 PRINT"HIT ANY KEY TO CONTINUE"
1750 GETAS:IF AS=""THEN 1750
1760 PRINT"3EACH SHOT THAT IS FIRED WILL BE RECORDED"
1770 PRINT"ON THE SCREEN BY ONE OF THE FOLLOWING:-"
1780 PRINT"     .   YOUR MISS"
1790 PRINT"     :   PETS MISS"
1800 PRINT"     +   PETS HIT"
1810 PRINT"     v   YOUR HIT"
1820 PRINT"     #   DESTRUCTION OF OWN SHIP"
1830 PRINT"YOU MUST BE CAREFUL WHEN YOU FIRE"
1840 PRINT"BECAUSE YOU ARE ABLE TO DESTROY YOUR OWN"
1850 PRINT"SHIPS."
1860 PRINT"HIT ANY KEY TO CONTINUE"
1870 GET AS:IF AS=""THEN 1870
1880 PRINT"3AT THE START OF THE GAME YOU ARE ASKED"
1890 PRINT"TO POSITION YOUR SHIPS ON THE SCREEN."
1900 PRINT"THIS IS DONE BY FIRST TYPING IN THE"
1910 PRINT"COLUMN AND THEN THE ROW.(I.E A,5). YOU"
1920 PRINT"FIRE IN THE SAME MANNER."
1930 PRINT"THE WINNER IS THE PLAYER THAT DESTROYS"
1940 PRINT"ALL THE OPPONENTS SHIPS FIRST"
1950 PRINT"HIT ANY KEY WHEN READY TO START"
1960 GET AS:IF AS=""THEN 1960
1970 RETURN
READY.
```

Hard copy with toolkit

I WOULD like to make an observation on the use of a feature of the programmers' Toolkit writes D F Haslam of Stockport, Cheshire. I tried the following using a CBM3022 printer.

```
OPEN 4,4 : CMD 4
FIND REM
PRINT#4: CLOSE 4
```

That resulted in printing all the lines in my program containing REM, but no carriage returns and line feeds were output between lines. As one might imagine, that makes the hard copy somewhat difficult to read.

On examining the Toolkit ROM, the offending code in the FIND section appears at Hex B689 .... JMP C9DE. That section of the Pet system first examines byte ØE and only sends <CR><LF> if ØE is zero. Otherwise, it does nothing but RTS.

One solution to the problem would have been for the designers of Toolkit to have written JMP C9E2 which would output <CR><LF> regardless at the end of each line. The same goes for the code at B7AØ if you want a legible hard copy DUMP.

What can be done by the owners of existing Toolkit? Byte ØE decimal 14 is set by the CMD statement to the iio device number. Therefore, to obtain good hard copy of FIND or DUMP, the appropriate sequence of direct commands should be

```
OPEN 4,4 : CMD 4 : POKE 14,Ø
FIND ...          (or DUMP as desired)
PRINT#4 : CLOSE 4
```

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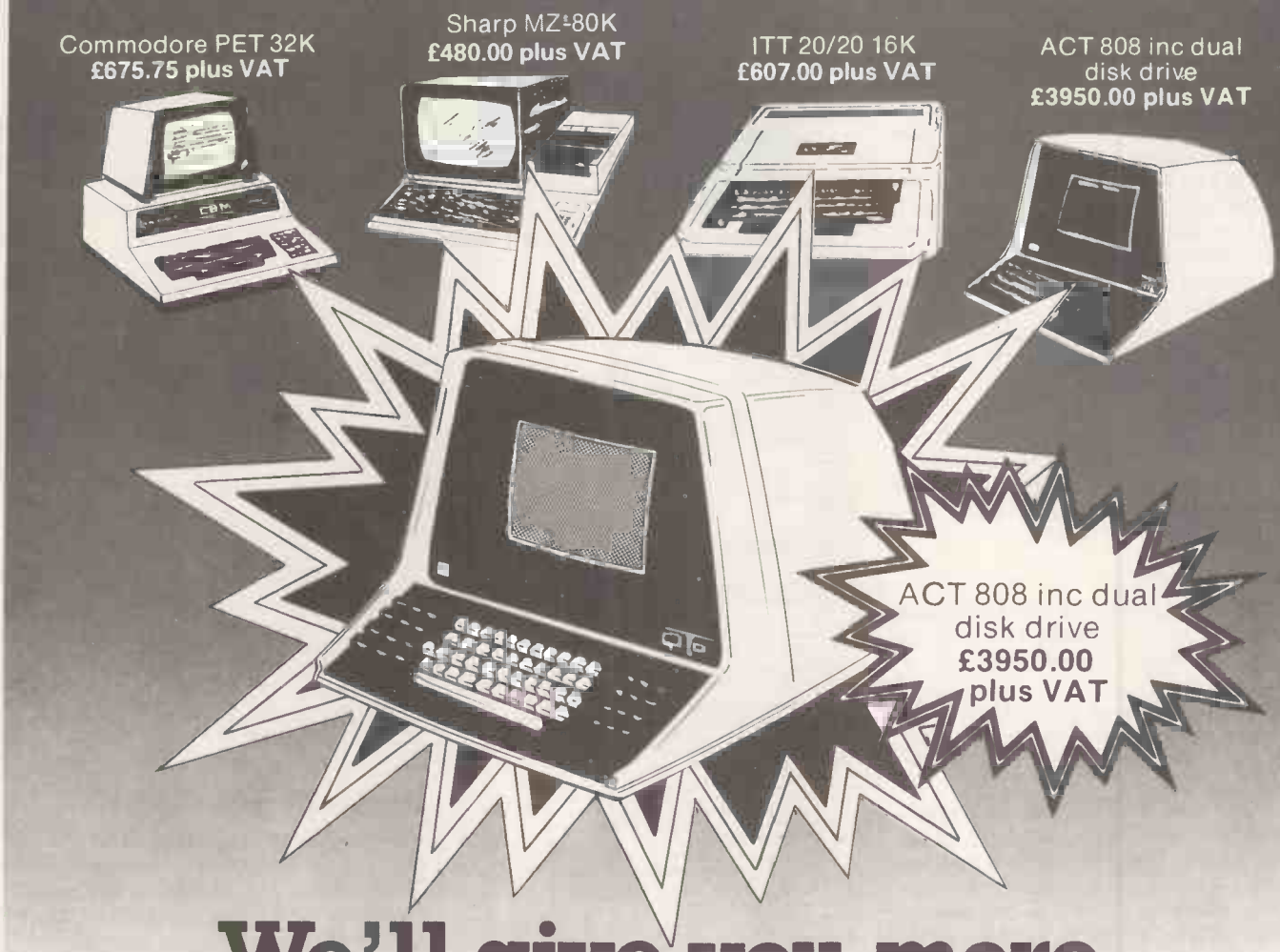

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High line numbers

NORMALLY, in Palsoft, the highest line number available is 63999, but line numbers up to 65535 can be obtained writes Bernard Wylde of Stockport, Cheshire. That is useful for adding undeletable messages or commands to the end of your programs.

Load your program and type:

```
PRINT PEEK (105) + PEEK (106) * 256
```

Make a note of that number, which we call X, add your message/command to the end of your program, e.g.

```
'30000 REM ** WRITTEN BY B. WYLDE **'
```

Now type

```
'POKE X,255 : POKE X-1,255'
```

If you list the program, you will find the last line is now 65535. Try deleting that line and all you obtain is ?SYNTAX ERROR.

Program length

HERE ARE two programs written in machine code for the Apple by M Philips of Knutsford, Cheshire. Each program is accompanied by a Hex listing and an explanation describing the operation and use of it.

The program called Length returns the length of the current Applesoft program in Hex bytes, allowing a user to determine, say, minimum memory size for a program. A sample run is included.

The PDLCOUT program places a delay between output of every character — its length is varied by the paddle. That allows easier listing on revision 0 Apples without the CRTL-S feature. The program may be adapted easily by 6502 programmers to provide functions such as CRTL-S and others. Let us first look at Length.

DOS 3.2 is apt to give an estimation for the sector count of each disc file. The habit of dividing that number by four to find the length of a program in kilobytes yields rather inaccurate results. Applesoft keeps two pointers to the start — at $ 67-8 — and end — at $ AF-B0 — of a Basic program. The Length program returns the difference between these and, hence, the length of the current program. The results are displayed in Hex and include three bytes which mark the end of a program in memory.

The program may be entered from the Hex dump below to the Apple monitor and saved by BSAVE LENGTH , A$ 300 , L$ 16. It is fully re-locatable. To use either type, CALL 768 or do the following POKEs after entry or BLOADing of the program: 1013,76 , 1014,0 and 1015,3. This vectors the ampersand command so that & (CR) will display the results. Here is a listing of the length program followed by a sample run.

```
0300- 20 8E FD A9 A4 20 ED FD
0308- 38 A5 AF E5 67 AA A5 B0
0310- E5 68 4C 41 F9
*
]BLOAD LENGTH
]POKE 1013,76
]POKE 1014,0
]POKE 1015,3
]NEW
]&
$0003
]10 PRINT
]20 PRINT
]&
$000F
]30 PRINT
]40 PRINT
]&
$001B
REM — OR USE 'CALL768'
]CAL768
$001B
```

This section is open to the Apple user. In every issue we hope to print ideas, hints and comments about the Apple and its suppliers. They must come from you, so write and tell us what you know.

Users of the Apple have at their disposal many commands to allow text to be output conveniently. Users of the Apple II revision 0 model do not, however, normally have the stop-list function of CRTL-S of the II plus. The PDLCOUT program, which may be used with either machine, allows the speed of a listing — or any text output — to be varied by adjusting paddle 0.

Its operation is simple — all characters are output by calling COUT in the monitor. COUT then jumps to the routine pointed to by locations $ 36-7. The program changes the vector to the new routine by use of Poke. The new routine pauses for the setting of the paddle and then jumps to the usual character output routine at $FDF0.

To use the program, enter the dump shown in the listing to the monitor and save if necessary with BSAVE PDLCOUT, A$ 300, L$ 12. Then initialise the program by changing the vector and CALLing DOS so as to avoid the new vector being re-set. Type POKE 54,0 : POKE 55,3 : CALL 1002.

List your program and you should find that adjusting the paddle varies output speed, though not sequentially — due to the use of the monitor's wait subroutine. Set the highest possible speed before trying to type anything as the delay will operate on input lines. The program may be turned-off by typing PR£0 and re-run by using the initialisation sequence.

Experienced 6502 programmers may like to change the program by inserting new code between $ 303 and $ 30B to allow CRTL-S or to trap certain ASCII values and interpret them in new ways e.g., as the Pet clear screen, cursor up, etc. The ASCII value of the character to be printed is passed in the accumulator and the new routine should not destroy the values stored by the register save subroutine IOSAVE — see the new reference manual.

```
*300.311
0300- 20 4A FF A2 00 20 1E FB
0308- 98 20 AB FC 20 3F FF 4C
0310- F0 FD
]POKE 54,0:POKE 55,3:CALL 1002
```

Analog input

THIS ROUTINE, when BRUN from DOS, will cause the USR(X) function of Applesoft to return a value from analog input X in the same manner as PDL(X) writes Graham Cole of Farnborough, Hampshire. However, unlike PDL, the routine will return values greater than 255 — depending on the resistance across the analog input.

```
                *PADDLE READING ROUTINE
                PTRIG     EQU $C070
                PADDLE    EQU $C064
                ACCHIGH   EQU $A0
                ACCLOW    EQU $A1
                JMPINST   EQU $4C
                USRINST   EQU $0A
                FINDFP    EQU $E2F2
                FINDINT   EQU $E10C
                USRHI     EQU $0C
                USRLOW    EQU $0B
                BASIC     EQU $03D0
                PRERR     EQU $FF2D
                          ORG $300
          * SET UP USR ROUTINE
0330-A903                 LDA #
  PRGSTART/255  ; Eight least significant
  bits
0302-850C                 STA USRHI
0304-A90D                 LDA #
  PRGSTART  ; Eight least significant bits
0306-850B                 STA USRLOW
0308-A94C                 LDA # JMPINST
030A-850A                 STA USRINST
030C-60                   RTS
              *GET USR DATA
030D-200CE1 PRGSTART JSR FINDINT
0310-A5A1                 LDA ACCLOW
  ; N.b., validity not tested
0312-18                   CLC
0313-6964                 ADC # $64
0315-8D2703               STA GPAD + 1
  ; Dynamically change program
              * PADDLE READ
0318-AD70C0 PREAD         LDA PTRIG
031B-A000                 LDY # $00
031D-A200                 LDX # $00
031F-EA                   NOP
0320-C8       LOOP        INY
0321-D003                 BNE GPAD
0323-E8                   INX
0324-F00A                 BEQ ERROR
0326-AD64C0 GPAD          LDA PADDLE
0329-30F5                 BMI LOOP
          * SET FP ACCUMULATOR
032B-8A                   TXA
032C-20F2E2               JSR FINDFP
032F-60                   RTS
            * ERROR ROUTINE
0330-202DFF ERROR         JSR PRERR
0333-4CD003               JMP BASIC
PROGR \M LENGTH = 54 BYTES
```

This table gives the approximate value against resistance

K Ohms	Value returned
100	190
150	285
200	380
300	570
400	765
500	950

The routine also tests for an open circuit and will return an error message ERR—G as in the monitor subroutine ($FF2D) and halt the program. However, it should prove simple to make the routine return a value of zero without halting. Note that the routine will return a minimum value of one — not zero.

The Micromouse page is for anything that moves. It is edited by Nick Smith who won the 1980 European Micromouse Competition. The aim is to help readers who do not have a clue where to start, learn enough to enter, and perhaps win, the 1981 competition. We will pay the usual £5 for each idea published.

Stepper-motor control

THIS PAGE is dedicated to anything that moves. Almost inevitably, that means there will be at least one electric motor somewhere. Despite considerable discussion, there is no clear answer as to whether stepper motors or ordinary motors are better for micromice. So, to be fair, I am describing my stepper-motor control this month and Brainy Bricks' ordinary motor controller next.

It is interesting to note that mine is a programmers' electronic circuit and that Brainy Bricks' is an electronics wizards' circuit. See if you can spot the difference next month. If you know about motors and believe one type is better than the other, write saying why — I would like to know the truth. If you do not know anything about motors, choose the type with which you feel most comfortable.

A stepper motor comprises just two pieces. A shaft with a bar magnet mounted on it — rather like a compass needle — and a set of coils fixed to the case. By passing current through the coils a magnetic field is generated and the bar magnet will turn to line up with the field — just as a compass finds the North Pole. It is important to realise that, unlike an ordinary motor, the shaft does not turn

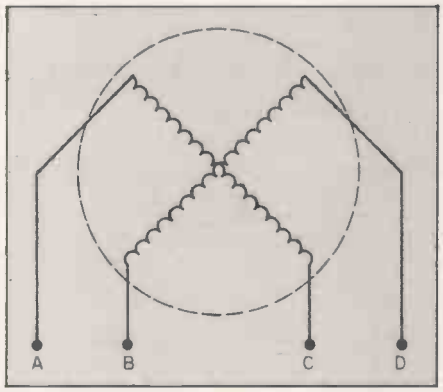

Figure 1.

continuously. The shaft will turn only until the bar magnet — rotor — lines up with the magnetic field and will then hold that position.

To gain continuous rotation, the current in the coils has to be cycled through a specific sequence of changes. Those changes move the magnetic field which in turn drags the rotor with it. Most stepper motors have multi-pole rotors and clever coil arrangements so that the magnetic field and the rotor move in small steps and that makes them expensive. The cheapest new ones I could find cost £70.

I was lucky and found two simple stepper motors at £3 each in my local junk shop. They are 12-volt, 90-degree motors. Four wires lead from the case and there are two coils inside, as shown in figure 1. There are eight possible fixed rotor positions for the motor. They are shown in table 1 together with the power connections to the wires labelled A, B, C and D in figure 1. The full sequence of eight steps is called half-stepping. The two possible full-step subsets are also shown. The high-power set is high power because both coils are always on. That takes twice the current and produces 40 percent more power.

My interface circuit is shown in figure 2. One of those circuits is required for

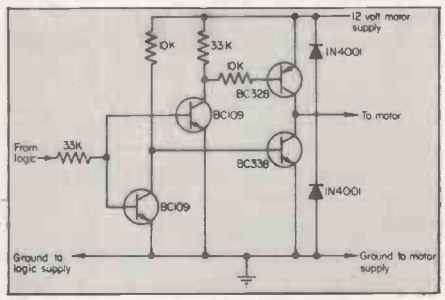

Figure 2.

each wire, i.e., four for one motor, eight for two motors. The intput can be connected directly to a 5-volt CMOS output, e.g., a 4034 eight-bit latch, and the circuit can easily supply 100-150 milli amps at 12 volts. The theoretical maximum is about 300 milli amps at 30 volts. I have been assured that as the circuit works for CMOS, it will also work with TTL. If you use TTL and have any problems, let me know.

A kind of modular construction is essential for testing, development and repair work. The motor board can be removed easily by unplugging the sensors, right back, and both motors, centre left and right. The two remaining sockets allow Sterling to be connected to my microcomputer for software development or its own CPU board for testing and running.

Each motor circuit will fit on an array of five holes by eight holes on Veroboard

Half step number	Rotor position	Half step A B C D*	Full step low power A B C D	Full step high power A B C D
1	→	0 0 1 1		0 0 1 1
2	↘	0 0 1 0	0 0 1 0	
3	↓	0 1 1 0		0 1 1 0
4	↙	0 1 0 0	0 1 0 0	
5	←	1 1 0 0		1 1 0 0
6	↖	1 0 0 0	1 0 0 0	
7	↑	1 0 0 1		1 0 0 1
8	↗	0 0 0 1	0 0 0 1	
1	→	0 0 1 1		0 0 1 1

*n.b. A one corresponds to +V, a zero corresponds to ground

Table 1.

and was built and tested originally on a breadboard.

All the software has to do is create the correct sequence of bit patterns to an output part, with an appropriate time delay between each change. Using machine code to generate the correct sequence of bit patterns is child's play, if you stick to full stepping and connect the wires as shown in figure 1 and table 1. Initialise an eight-bit byte to an appropriate value such as 00110011 binary and let the following five instructions do the rest. The Hex code and mneumonics are for the RCA CDP 1802 — my favourite microchip.

Hex	Mnemonic	Comment
9E	GHI	Get byte
FE	SHL	Shift left
FC01	ADI (01)	Add 01 Hex
C7	LSNF	Skip if zero shifted out
BE	PHI	Store byte

To reverse direction shift right instead of left and change the add instruction to 80 Hex. Generating the time delay between each bit pattern is more of a problem. If you want the motor to go fast, it must be accelerated from the rest. I solved the problem by having a look-up table of decreasing time delays stored in memory.

In the same way, the motors need decelerating to rest. Deceleration can be faster than acceleration because friction is on your side. Trial and error is the only way to generate the necessary look-up tables, but do not finalise them before construction is completed. Factors such as the weight you are driving can have a big effect.

London mice builders

THE EAST London Amateur Computer Club is looking for mouse builders. The club is open to all and I have the impression that a nuts and bolts man or an electronics expert would win the red-carpet treatment. Contact Fred Linger on 01-554 3288.

Peter Boyce of Swindon, Wiltshire, would like to swap ideas with other mouse builders in the area. He is threatening to build a mouse without a micro. It is a pity he does not live in east London. Pete can be reached on 0793-22768.

Answer to problems

ARE YOU tired, listless, depressed? Doesn't your mouse work? The Micromouse Marriage Bureau could be the answer. Send in your name and address together with an assessment of your software, hardware and mechanical abilities and I will put you in touch with someone with a different set of problems. Together, you might make a perfect team.

When the chips — motors, batteries, components, etc — are down, sponsoring a mouse is an inexpensive way of receiving good publicity. If your company would like to help a mouse builder, write to the Micromouse page.

Introduction to microcomputer programming

By Peter C Sanderson. Published by Newnes Technical Books at £3.75, 138 pages paperback, ISBN 0 408 00415 0.

Basic made easy

By Don Cassel and Richard Swanson. Published by Reston Publishing Co Inc, a Prentice-Hall International subsidiary at £8.40 hardback, £6.45 paperback; 240 pages plus nine-page index. ISBN 0 8359 0399 0 hardback, 0 8359 0398 2 paperback.

A bit of Basic

By Thomas A Dwyer and Margot Critchfield. Published by Addison-Wesley Publishing Co at £3.85. 184 pages paperback, ISBN 0 201 03115 9.

IT IS BOTH convenient and revealing to review these three books together as they deal, either in part or in whole, with the art of programming in Basic.

Introduction to Microcomputer programming covers a wider field, starting with a general introduction to computer programming followed by a discussion on the choice of a programming language. Chapters 3-6 cover Basic programming, chapter 7 lists Basic facilities available on a range of machines excluding ZX-80, chapters 8 and 9 deal with assembly language and machine-code programming and the final chapter covers program development and testing. It is followed by a glossary, suggested solutions to exercises and an index.

Basic made easy covers introduction to mini- and microcomputers, use of flowcharts, Basic programming, computer terminals, system commands, typical sign on procedure, entering a program, ASCII code, functions, and an index which compensates in part for the 40 numbered pages devoted either to just a title or left blank. Although published in the U.S., the authors and vocabulary are British, the examples American.

A bit of Basic covers the world of personal computing, systems and jargon; an eight-hour Basic course, simple computer graphics and subscripted variables, advanced Basic, including colour graphics, time-sharing, ASCII codes, a summary of Basic and an index. The book is liberally illustrated with informative cartoons, the vocabulary is U.S.

All three books are aimed at first-time users of computers and assume no previous programming experience. From that starting point, they set out to instruct the beginner in the use of minimum Basic. In all three, the flowchart approach to problem solving is used, and exercises for the student are included in each chapter.

However, only *Introduction to microcomputer programming* includes answers to the set problems and, without answers, problems are of little help to students studying independently. The use of Basic instructions is illustrated with simple programs, full or partial, in all three books. Those in *Introduction to microcomputer programming* are very limited in number, length and interest.

Legibility

The number and interest of the illustrative programs in *Basic made easy* is greater but those programs are reproductions of computer output and are difficult to read — which limits their impact somewhat. *A bit of Basic* uses interesting, well-annotated programs extensively from the start.

Anyone reading through any one of those books will acquire a comprehensive knowledge of the elements of Basic together with an appreciation of the ways in which the elements can be combined to solve problems and perform apparently complex operations. Which book of the three a prospective purchaser should choose will depend largely on the final purpose for which the book is required.

Anyone who sees the possibility of wishing, or having, to progress beyond Basic to programming in assembly language or machine code, would choose *Introduction to microcomputer programming* which introduces both of these topics.

However, as would be expected in a book of this size and price, the topics are not covered in any great detail — only the essentials are discussed. For serious work in those fields, additional specialist texts would be needed, but the present volume gives enough indication of the complexities involved to show the reader whether it is worth proceeding deeper into the subject. A bibliography of suggested further reading would have been very helpful in this context — an omission common to all three books.

File handling

One topic not covered in much detail in the *Introduction to microcomputer programming* is file handling — slightly more than a page is devoted to it — although further discussion of it and of applications of subscripted variables occurs in the assembly-language and machine-code sections later in the book.

In contrast, a whole chapter is devoted to this subject in *Basic made easy* and that would obviously influence the choice of a reader to whom file-handling procedures were important.

Similarly, only passing reference is made in the *Introduction to microcomputer programming* to multi-dimensional arrays and matrix manipulation techniques. They are again the subject of a complete chapter in *Basic made easy* which could be a further critical factor in one's choice of book.

Multiple-subscripted arrays and matrix operations are discussed and illustrated in *A bit of Basic* but file handling is mentioned only in passing in a discussion of sorting of records and fields. However, this volume covers two topics not discussed in either of the other volumes — Boolean operators and graphics.

The logical operators described are ELSE, AND, NOT, OR and their use is not only illustrated, but is also translated into minimum Basic for those whose systems do not include these operators.

Graphics are discussed at three levels; simulated graphics using the TAB(X) function and alpha-numeric characters, medium-resolution graphics based on the TRS-80 SET(X,Y), command, and high-resolution graphics. Both high- and low-resolution colour graphics are also discussed in the context of the Apple II system.

Suggestions for further reading are included at appropriate points in the text throughout the book, but are not collected into a bibliography.

Conclusions

- **All three books will give the beginner a sound introduction to Basic programming.**
- **For students working independently, the provision of answers to exercises in *Introduction to microcomputer programming.* offers some advantages.**
- **The book would also be the best choice for those who wish to progress beyond Basic to programming in assembly language or machine code, although its discussion of these is necessarily limited.**
- **For students needing practical instruction in the use of multi-dimensional arrays or in the construction and manipulation of files, *Basic made easy* is the best choice.**
- **It would, however, be easier to use, and thus more valuable, if, instead of reproducing authentic computer printouts, listings were type-set using the greater legibility of a normal type-face.**
- **Programmers interested in the use of Boolean functions and/or graphics will be best served by *A bit of Basic.***
- **The clarity of detailed explanation of the illustrative programs also make this book as valuable as *Introduction to microcomputer programming* to the student working independently, despite the absence of answers to its set exercises, and its U.S. vocabulary.**
- **For a reader seeking an overall picture of the capabilities and potentialities of microcomputers, especially personal computers, *A bit of Basic* is recommended as the best buy of the three.** *L C Thomas*

INNOVATIVE TRS-80 SOFTWARE

FROM THE PROFESSIONALS

INSTANT SORT/SEARCH DATABASE

Everything in electronics takes a finite time, consequently nothing can be instantaneous. However a database that will search 500 records and sort the names into alphabetical order in 1½ seconds, that will go on to do the same thing with 1,000 names in only 2½ seconds, is fast. If you add that ability to search 500 or 1,000 records for a specific range of names or ages or sexes or whatever, in such a small amount of time that it is not worth timing it, then the program deserves to be described as instantaneous. Especially as these times are attained on a standard Level II TRS-80.

These results are achieved, obviously, by some very clever machine language coding. This however is not enough. After all GSF from Racet will sort 1,000 arrays in about 11 seconds and that is indeed a clever program. No, in order to achieve the results required from this program it is necessary to change one's entire overview of database.

There are many databases available for the TRS-80 now. All of them have been designed to store as much data as possible, as easily as possible. Not as an afterthought, but nor as a prime design requirement, they have also incorporated as fast a sort as was practicable. This program was designed from the outset to achieve unbelievably fast sort and search times. Indeed we do not recommend this database for application in which fast searching or sorting is not a prime requirement. And what are the applications? It's a hackneyed phrase to say that they are limited only by the user's imagination, but that's about it. Let's take an example. Suppose you are running a marriage or data bureau. An ordinary database will file all the names and addresses away together with the necessary information as to sex, age and so on and with some you would be able to sort the list, so that only people with similar characteristics were eventually obtained. With this database you could, for instance, file the name, sex, age, category of hobby, category of chief interest, vital statistics and other data so that at the touch of a button you could instantaneously display on the screen all women of a certain age with certain vital statistics, living in a certain area. You could also display men with similar (excluding the vital statistics!) data that fall into similar categories. And all of this almost instantaneously. Not everybody runs a marriage bureau, but other applications are not hard to think of. Estate agents can file details of property away so that they can instantaneously obtain data on houses in a certain area or of a certain size. Doctors can reach information as to patients with similar diseases, ages or whatever immediately. In the home, a record library can be stored and every record by a certain composer written in a certain year can be accessed without delay. The list of applications is endless. For any use where it is important to extract information within a certain range or it is important to sort information, this database will find a use.

The prime commands and features of this program are as follows:

Datafile creation

1. Create a file.
2. Add a record.
3. Delete a record.
4. Display a record.
5. Tape a file.
6. Amend a record.
7. Display the file data.
8. Load a tape.

Sort/Search

1. Sort up or down.
2. Page forward or backward.
3. Select a range for search.
4. Select or exclude a category.
5. Select or exclude on initial letter.
6. Resort records in a sort.
7. New sort all records.
8. Extended sort.
9. Arithmetic.
10. Display file data.
11. Load a tape.
12. Printout sorted data.

The data is displayed in columnar form and the data may be alphabetical, alphanumeric, integer or decimal. The number of columns is from 2 to 10 and the records may contain a maximum 44 - 60 characters depending upon the number of columns used. Columns may be of any width within the screen capacity but integer or decimal columns more than five and six characters wide respectively will not have the option of searching within a range.

The program consists of two parts. The first is used for entering the data and the second for the sort or search. The second part overlays the first when it is loaded so only 4K of memory is used by the entire program. The remainder of your memory space is available for data. The amount of data that can be contained will of course depend upon the amount of memory available, but as a rough guide a 16K user will be able to manipulate at one time 250 records of 39 characters each or 514 records of 17 characters each. As a further rough guide on sorting speed, the time to sort 1,000 records on fields of random strings of random length, or of random number between 1 and 99,999, averages under 2½ seconds.

Numeric columns either integer or decimal may be arithmetically manipulated almost instantaneously. A total may be cast or an average taken for any numeric column up to five digits. This is so fast that when adding 1,000 numbers totalling over 50 million, only a slight hesitation can be noticed before the total is given.

In summary therefore this program is ideal for any application concerning the manipulation of information whether it be business, personal or hobby which can be comfortably displayed as one record per line upon the screen and in respect of which it is required that super fast searches or sorts be carried out. The program is supplied on cassette. At this time it is not compatible with disk systems. A disk version is in the course of preparation. The cassette includes a set of data randomly generated which can be fed into part 2 of the program to demonstrate the fantastically fast sort and search features.

Tape for 16K TRS-80 or video genie **£19.50**

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Brunel Computer Club
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Avon BS22 GJW
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Tel: 0234 41685.
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HP6 6SU.

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(continued on next page)

(continued from previous page)

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• Circle No. 185

BUYERS' GUIDE

Printers and VDUs

The Peripherals Buyers' Guide is a survey of printers and VDUs suitable for small computers. We have excluded any system which costs significantly more than £2,000. The printers and VDUs are listed in alphabetical order. The addresses of the main suppliers are listed at the end of the guide.

Printers may be divided into several categories. The highest-quality printing is produced by the daisywheel-type which creates text in various type-faces, according to the wheel used. The quality ranges from excellent typing to rather poor book printing and generally there is a proportional-spacing facility. Those machines tend to be expensive and slow. Daisywheels can be either plastic — inexpensive, but must be replaced often — or metal — expensive but durable.

For faster printing, you must turn to dot-matrix machines. The print quality tends to be poor and the machines noisy. Older machines use a 7-by-5 matrix which puts the descenders of letters such as 'y' above the line. That makes bulk text difficult to read. Better printers use a matrix 9 dots deep to give true descenders. Recently, several firms have produced dot-matrix printers which give an approximation to typewriter printing and proportional spacing. They are less expensive than daisywheel machines, work faster and could well be used for correspondence-quality work.

Some dot-matrix printers employ sensitised paper to produce printing by more direct electrical effects. They are often quiet and fast, but the paper can be expensive, unpleasant to handle and hard to obtain.

The trend is to build more processing power into printers. That means they offer increasingly varied features, so it is hard to categorise them precisely.

A printer has to be connected to the computer by a cable and a more or less standard interface. The normal interfaces are the Centronics parallel, RS232 serial port — also known as the V-24 — and 20mA current loop. IEEE is a parallel interface used by Pet; 'cpl' means characters per line, 'cps' means printing speed in characters per second. Allow five characters to the word.

The more intelligent printer prints as its head moves in both directions across the paper — bi-directional printing. Still more intelligent ones end the head movement at the ends of short lines. These two features can more than treble the working speed.

Printers use two types of paper: plain paper — fed like a typewriter — or pinch-, and pin-, or sprocket- or tractor-fed with holes at 5in. centres along the margins. That paper can be supplied fan-folded or in rolls.

Pinch feeding is more expensive but is convenient for letters. Only a few machines will accept both pinch- and pin-fed paper. It is possible to obtain headed letter paper bonded lightly on to pin-fed, fan-folded computer paper for word processors.

Some printers allow direct control of the print-head to give graphics. KSR means keyboard, send and receive, ASR means automatic send and receive, RO means receive only. KSR machines can be used as electric typewriters in local mode.

Comb or line printers have a whole line's worth of dot hammers so they can print a line of text at a time. They tend to be very expensive and very noisy but produce a enormous quantity of work.

PRINTERS

ADDMASTER

400 receive only — *£242*
Uses 2½in. Tally roll paper, 16 cpl, 48 cps. Main U.K. agent Clary Ltd.

420/426 receive only — *£246*
Dot matrix grade-one Tally roll paper at £5 for 20 rolls. BCD serial or 10-line serial interfaces, 12 cpl, 36 cps.

AGILE CORPORATION U.S.A.

Agile 4200 – Agile A1 — *P.O.A.*
Daisywheel, uses paper up to 15in., 132/158 print positions, 55 cps on both models, RS232C EIC with current loop optional interfaces. Main U.K. agent ISG Data Sales Ltd.

ANADEX

Main U.K. agent Anadex Ltd

DP-500 — *from £367*
Dot matrix, tractor feed, parallel interface, 18 cpl, 45 cps.

DP-660 — *from £700*
Dot matrix, pinch feed for printing labels, uses sprocket feed. Parallel interface. 19 cpl, 57 cps.

DP-750A — *from £800*
Dot matrix, RS232C 20mA current loop, 21 cps, 25 cps.

FP-600 — *from £65*
Dot matrix ticket or form printer, from four columns to 19 columns parallel interface, 19 cpl, 44 cps.

DP-9500 Series — *£895 upwards*
Dot matrix, tractor feed, nine-wire print head, bi-directional printing, three ASCII interfaces as standard — parallel bit, RS232C, current loop — 120-200 cps, 132-220 columns, 7×9, 9×9 or 11×9 matrices depending on model. Also from: Peripheral Hardware, Kode Services, Robox, Stack Computer Services and Data Design Techniques Ltd.

DP-8000 — *£550*
Dot matrix, pinch feed, bi-directional printing, fan-fold paper up to 9.5 in. up to three copies. Three ASCII interfaces — parallel bit, RS232C, current loop — 112 cps, 80 column, 9×7 matrix. Also from: Peripheral Hardware, Kode Services, Robox, Stack, Computer Services and Data Design Techniques Ltd.

DP-1000 Series — *from £395*
Dot matrix, tractor feed, internal data storage, roll-type paper for 40 columns at £11 for box of 10 rolls, three basic ASCII-compatible interfaces are available. 40 cpl, 50 cps, 40 columns, 5×7 matrix. Also from: Peripheral Hardware, Kode Services, Robox, Stack Computer Services.

AXION CORPORATION

Main U.K. agent Memec Systems Ltd
EX-820 receive only — *£500*
Electro-sensitive dot matrix includes plotting capability for full graphics, paper at £3 for a 240ft. roll, RS232C or 20mA serial and ASCII parallel, 20/40/80 cpl and up to 160 cps, 5×8 matrix.

EX-850 Video Printer — *£500*
Electro-sensitive dot matrix, aluminised paper at £3/240ft. roll. Needs only the video signal from user's. Normal resoltuion 13.5 seconds per screen, high resolution 27 seconds per screen.

EX801/802 receive only — *£279*
Electro-sensitive, dot matrix, aluminised paper at £3 for a 240ft. roll, RS232C, Centronics, Apple, Pet, and Tandy interfaces, 20/40/80 cpl, 160 cps, 5×8 matrix.

BASE 2

800-MST — *from £385*
Impact dot matrix, bi-directional, tractor feed up to 9½in., RS232C, 20mA, IEEE-488, Centronics and parallel interfaces, up to 132 cpl and 60 cps, with 5×7 matrix. Main U.K. agents Microbyte and Maclin-Zand Electronics Ltd.

CENTRONICS

Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.
Models 700, 701, 702 and 703 — *P.O.A.*
Impact dot marix, uses fan-fold paper, parallel, serial RS232C interfaces 132 cpl, up to 180 cps, 5×7 or 7×7 matrices.

Model 791 — *P.O.A.*
Demand-document printer, impact, dot matrix, up to 12-part forms using bottom feed tractor, standard parallel interface, with serial RS232C interface option, 80 cpl, 60 cps, 5×7 matrix.

Model 730 — *£375*
Impact, dot matrix, uses roll paper up to 8.5 in. wide, fan-fold paper up to 9.5 in. wide and cut sheet up to three-ply paper and two carbons, parallel-standard interface with serial RS232 option, 80 cpl, 100 cpls, 7×7 matrix. Also from: Datac Ltd, Rair Ltd, Comma Computers and MIBF.

Model 737 — *£425*
Impact dot matrix, roll fan-fold or cut sheet paper, standard parallel interface, serial RS232C option, 80 cpl mono-spaced mode, 50 cps

mono-spaced mode, 80 cps proportional mode, 7×8 matrix mono-spaced, 9×9 proportional. Also from: Datac Ltd.

Model P1 Microprinter and Model S1 Microprinter — *P.O.A.*
Non-impact dot matrix electro-sensitive uses aluminium-coated paper roll, parallel interface, serial RS232C interface, up to 80 cpl, and 150 lines per minute, up to 200 cps. Also from: Datac Ltd.

Model 780 — *P.O.A.*
Impact, dot Matrix, pinch-roll paper feed for roll paper, tractor-feed option for rear- and bottom-feed forms and fan-fold paper, parallel interface with serial RS232C option, 80 cpl, 60 cps, 5×7 matrix.

Model 779 — *P.O.A.*
Impact, dot matrix, pinch-roll paper feed for roll paper, with fan-fold, tractor feed option, standard parallel interface with RS232C serial option, 80-132 cpl, 60-110 cps, 5×7 matrix.

Model 704 — *P.O.A*
Impact, dot matrix, uses fan-fold paper, RS232 serial interface, 132 cpl, 180 cps using 7×7, 9×7 and 9×9 matrices.

Model 761 read only or keyboard send/receive — *P.O.A.*
Impact, dot matrix, uses fan-fold paper, RS232C/CCITT V24 or DC current loop interfaces, 132 cpl, 60 cps, 7×7 matrix.

COMMODORE

CBM 3022 — *£425*
Tractor-feed printer, uses fan-fold paper with three-in. to 12in. width, cost of paper £10 per 1,000, IEEE interface, 80 cpl, 150 cps, 6×7 matrix. Main U.K. agent Davinci Computers Ltd.

COMPUTER DEVICES INC

Miniterm 1201, 1202, 1203 — *From £936*
Thermal mechanism, uses Thermal Type B paper at £2.40 per roll, RS232 or parallel — 1201 only — interfaces, 80 or 132 cpl, 10/30 cps, 7×5 matrix. Main U.K. agent Teleprinter Equipment Ltd.

DATAC

Main U.K. agent Datac Ltd

414 free-standing assembly receive only — *£130*
Electro-sensitive, matrix printer type 245L, electro-sensitive roll paper, 59mm. wide × 30m. long at 90p per roll for 20 off, six-bit parallel ASCII, character serial interfaces, 16, 20, 32 or 40 cpl, 32 to 80 character per serial, 7×5 matrix.

DMI-40P free-standing terminal, receive only — *£350*
Impact, matrix, uses pressure-sensitive roll paper, 10mm.-wide ordinary paper version, using ink ribbon. Cost of paper £1 per roll, seven-bit parallel ASCII, character serial, RS232C or graphics, 40 or 20 cpl, up to 80 cps, 7×5 matrix.

411C compact panel mounting, receive only — *£209*
Electro-sensitive matrix type 245 L or R, uses electro-sensitive roll paper, 59mm. wide × 30m. long at 90p per rol, six-bit parallel, serial interfaces, 16, 20, 32 or 40 cpl, 32 to 80 cps, 7×5 matrix.

411 panel mounting, receive only — *£189*
Electro-sensitive matrix printer type 245 L or R, uses electro-sensitive roll paper, 59mm. wide × 30m. long at 90p per roll. Interfaces include six-bit parallel ASCII, character serial, four-bit parallel BCD, character parallel EIA/RS232C, CCITT/V24 and 20mA current loop, under development 40 cpl, 32 to 80 cps, 7×5 matrix.

313 panel-mounting, receive only and 312 free-standing, receive only — *£269*
Impact matrix type PU-1100, Tally roll paper, 59mm. wide × 36m.

long at 60p per roll, CCITT/V24 or EIA RS232C or 20mA current loop interfaces, up to 20 cpl and up to 36 cps, 7×5 matrix.

412/1 and 412/5 receive only — *£255*
Electro-sensitive dot matrix type 245L, uses electro-sensitive aluminium-coated paper, 59mm. × 30m. at 90p per roll, six-bit parallel, ASCII, character serial and four-bit parallel BCD, character parallel, RS232C/V24 interfaces, 20mA current loop (/4) under development, 16, 20, 32 or 40 cpl, 32-80 cps, 7×5 matrix.

522/1 and 522/4 receive only — *£499 (522/1) £535 (522/4)*
Impact matrix type 115DR, roll paper, 114mm. × 75m. up to three copes plus original, cost of paper £1.10 per roll. Parallel interface and RS232C, 20mA current loop and parallel buttered, asynchronous interfaces — (522/4). 40 cpl, 100 cps instantaneous rate, 33 cps average rate — including CR and LF. 7×5, 4×5, 7×10.

DATA DYNAMICS

Main U.K. agent Data Dynamics Ltd

303 Printer — *£980*
Dot matrix, up to six-part stationery width from 3m to 15.375in., V24 RS232C, 20mA current loop, 132 cpl, 30 or 60 cps, 7×7 matrix.

ZIP ASR/K7 twin cassette — *£2,000*
Dot matrix format, uses standard Telytype roll paper, V24, RS232C, or 20mA current loop operating at half or full duplex, 80 cpl, 10 or 30 cps switch selected, 5×7 matrix.

ZIP 30 keyboard printer, RO, ASR, or KSR — *ASR £1,800 RO & KSR £950*
Dot matrix, standard roll paper, 20mA half or full duplex current loop or V24 RS232C, 80 cpl, 10 or 30 cps — switch selected, 5×7 matrix.

390 eight-level and 392 five-level — *ASR from £1,250 LSR from £900 RO from £800*
ASR, KSR and read-only versions. Impact printers, friction or sprocket feed, 8½in. paper with roll diameter 5in. 74 or 86 cpl, 6.6 or 10 cps.

Models 32 and 33 page printers — *ASR from £1,100 KSR from £800 RO from £700*
Available in ASR, KSR and receive-only versions. Friction or sprocket feed, 20mA or 60mA parallel, up to 86 cpl, 6.6 or 10 cps.

DATA GENERAL CORPORATION

Dasher TP1 Printer models 6040 and 6041 — *from £1,598*
6040 standard keyboard and can be used as a typewriter. 6041 is a receive-only terminal printer without keyboard, 30 or 60 cps, switch selectable, EIA-RS232C interfaces. 5×7 dot matrix. Main U.K. agent Data General.

DATAPLUS

400 series receive-only Model 480 — *£475*
Impact dot matrix, uses standard Tally roll, up to 3.75in. wide, from 80p per roll, RS232C, V24, 20mA current loop, bit parallel IEEE, Pet and Apple interfaces, 30/40 cpl, 110 cps, 7×5 and 7×10 matrices. Main U.K. agent Dataplus Ltd.

DATASOUTH CORPORATION

DS-180 — *£1,360*
Impact, matrix printer, uses fan-fold paper, RS232C, Current loop, and parallel interfaces, 132 cpl, 180 cps, 9×7 matrix. Main U.K. agent Sigma U.K.

DIABLO

HY type II receive only — *P.O.A.*
Impact daisywheel plastic or metal print wheel, parallel, interface, 132 10-pitch cpl or 158 12-pitch cpl, 40/45/55 cps. Main U.K. agent Diablo Systems Ltd.

1650 receive only and keyboard send/receive — *RO £2,200 KSR £2,525*
Daisywheel, metal printwheels, standard listing or single-sheet paper, RS232C V24, parallel and current-loop option interfaces, 132 cpl at 10 pitch, 158 cpl at 12, up to 38 cps, line speeds to 9,600 bauds. Main U.K. agents Geveke Electronics Ltd, Rair Ltd.

1640 receive only or keyboard send/receive — *RO £2,100 KSR £2,400*
Daisywheel, plastic printwheels, uses standard listing or single-sheet paper, RS232C CCITT V24, parallel and Current loop interfaces, 132 cpl at 10 pitch, 158 cpl at 12, 40 cps, line speeds to 9,600 bauds. Main U.K. agents Geveke Electronics Ltd, Rair Ltd.

630 receive only — *£1,725*
Daisywheel, metal/plastic printwheels, standard listing or single sheet paper, RS232C, V24 with optional bus interface, 132 cpl at 10 pitch, 158 cpl at 12, 198 cpl at 15, up to 40 cps with automatic bi-directional printing. Main U.K. agent Geveke Electronics.

DIGITAL EQUIPMENT

DecWriter LA34 KSR — *£824*
Dot matrix, uses roll or fan-fold paper, friction feed, up to five copies, V24 or 20mA interfaces, adjustable up to 256 cpl, 30 cps, 7×9 matrix. Main U.K. agent Extel.

A120 — *from £1,645*
7×7 dot matrix, EIA or 20mA option, up to 217 cpl, 180 cps. Main U.K. Agent Wilkes Computing.

DIGITRONIX

Mini-Printer — *£195*
32 column electro-senstive, 110-4,800 baud, ASCII Serial inputs at RS232C, TTL, 20mA, 64 font at 64 cps. Main U.K. agent Digitronix.

ELECTROGRAPHIC AV

EG-800 receive only — *from £450*
Impact, matrix printer, uses any type of paper, parallel, RS232C, TRS-80, Apple interfaces, 80 cpl, 150 cps, 7×5 or 7×6 matrix. Main U.K. agent Electrographic AV Ltd.

500 series receive only — *from £175 for mechanism only*
Impact, matrix printer, uses 3½in. Tally roll paper and flat documents, serial or parallel interfaces, 40 cpl, 120 cps, 7×5 or 7×6 matrices. Main U.K. agent Electrographic AV Ltd.

EPSON

TX-80 — *£395*
Impact, dot matrix, friction pin feed RS232C, V24, 20mA current loop, bit parallel, Centronics, IEEE, Pet, Apple and TRS-80 interfaces, 80 CPL, 150 cps, 7×5 or 7×10 matrices and graphics. Main U.K. agent Dataplus Ltd.

EXTEL CORPORATION

M30 receive only keyboard send/receive and automatic — *£895*

send/receive
Impact, dot matrix printer, uses roll or fan-fold paper, V24 or 20mA interfaces, 80 cpl, 30 cps (50 with buffer) 5×7 matrix, 5- or 8-level operation. Main U.K. agent Extel.

M30 B208L keyboard send/receive *£1,270*
Dot matrix, uses roll paper, V24 or 20mA interfaces, 80 cpl, 30 cps, 5×7 matrix, 5- or 8-level operation. Main U.K. agent Extel.

FACIT

4520 and 4521 *£583*
Seven-wire print head, uses roll paper Telex type (Facit 4520), friction feed, fan-fold (Facit 4521) pin feed, serial, V24/RS323C, Centronics parallel interfaces, both fitted as standard, 80 cpl, 100 cps at 12 characters per inch, 9×7 matrix. Main U.K. agent Facit Ltd.

GENERAL ELECTRIC, U.S.A.

ITT 3330 *£1,496*
Impact dot matrix, pin feed, V24 interface, 132 cpl, 10, 20 or 30 cps, 7×9 matrix. Main U.K. distributor ITT Business Systems U.K.

HEATH ELECTRONICS

WH14 *£510*
Dot matrix, uses edge-punched fan-fold paper, at £24, 20mA, RS232C Interfaces, 80, 96, 132 cpl, 132 cpls, 5×7 matrix. Main U.K. agent Heath Electronics U.K. Ltd. (OEM sales).

INTEGRAL DATA SYSTEMS

Paper Tiger Model 460 *from £700*
Dot Matrix, impact printer, pin-feed fan-fold paper, parallel, RS232C, 150 cps, 24×9 matrix. Main U.K. agent Teleprinter Equipment Ltd. and Microsense Computers Ltd.

J WALTERS

Main U.K. agent Access Data Communications Ltd
ADC 1251 *£560*
Dot matrix printer, uses continuous paper at £13 per box, serial, RS232 V-24 Centronics and IEEE interfaces, 80/132 cpl, 125 cps, 7×9 matrix.

ADC 2401 *£1,350*
Matrix printer, uses continuous paper at £13 per box, serial, RS232 V-24, Centronics and IEEE interfaces, 136 cpl, 240 cps, 9×9 matrix.

LEAR SIEGLER INC

300 series *from £965*
Dot matrix, uses standard paper, RS232C, 20mA parallel interfaces Centronics 701/703 type 132 cpl, 180 cps, 9×7 or 9×9 matrices. Main U.K. agent Penny & Giles Data Recorders Ltd.

LOGABAX

LX-213 *£1,590*
Dot matrix printer, plain paper, fan-fold or cut up to six-ply, RS232C or

V24 interfaces, 132 cpl, 218 cpl, 180 cps, 9×7 matrix, optimised bi-directional printing. Main U.K. agent Brospa Data Ltd.

LRC EATON

7000+ *£250*
Dot matrix printer, uses roll paper, RS232, IEEE, current loop and parallel interfaces, 20, 32, 40 and 64 cpl software selectable by option, 40 cps, 7×7 matrix. Main U.K. agent Sigma U.K.

MALIBU ELECTRONICS CORPORATION

Masterprint 165 *£1,400*
Dot matrix, fan-fold paper, RS232C, current loop and parallel interfaces, 132 cpl, 165 cps, 10×9 matrix with 18×9 matrix character set which approaches word-processing quality, graphics. Main U.K. agent MBS Terminals Ltd.

MANNESMAN TALLY

Main U.K. agent Data Design Techniques Ltd

M-80 MC *from £875*
Dot matrix, 9½in. pin feed paper, all interfaces, 80/132 cpl, 200 cps, 7×9 or 9×9 matrices.

T1612 keyboard send/receive *£1,612*
Dot matrix, single or multi-part paper, pin feed, RS232C or 20mA interfaces, 132/218 cpl, 160 cps, 7×9 or 9×9 matrices.

T1612 receive only *£1,475*

T1602 *£1,395*
Dot matrix single- or multi-part paper, pin feed, Data Products, Centronics and serial interfaces, 132 cpl, 160 cps, 7×9 matrix.

T2000 *from £2,000*
Comb print mechanism, uses standard, single- or multi-part paper, all interfaces, 132 cpl, 200 lines per minutes, 7×7 or 9×9 matrices.

MICRO PERIPHERALS INC

MPI-88T *£535*
Dot matrix printer, uses fan-fold, roll and cut-sheet paper, RS232C, Current loop and parallel interfaces, 80/96/120/132 cpl, all software-selectable, 120 cps, 7×7 matrix. Main U.K. agent Sigma U.K.

NEC

Spinwriter *£2,195*
Golf-ball, uses ordinary paper, RS232C, Centronics, Diablo, Qume, Serial and parallel interfaces, up to 163 cpl, 55 cps. Main U.K. agent Memec Systems Ltd.

NEWBURY LABORATORIES

Model 8300 *from £475*
Dot matrix, pin-feed paper up to 9.5 in., eight-bit parallel interface or CCITT V24, RS232C interfaces, 10 characters per inch, 125 cps, 7×9 matrix. Main U.K. agent Newbear Computing Store.

NIPPON ELECTRIC COMPANY

Spinwriter — *£1,500*
Combines golf-ball daisywheel and thimble mechanism, uses continuous or single-sheet computer paper, RS232C serial (RO and KSR), Centronics-compatible and Diablo-compatible interfaces, 8080 input bus line, current loop, 55 cps, solid-font matrix. Main U.K. agent Memec Systems Ltd.

OKI

Microline 80A — *£500*
Dot matrix, 9×7, 80 cps, 80 or 132 characters per column, pin, traction or friction feed, RS232, 20mA Centronics. Main U.K. Agent, X-Data.

QUME

Sprint 5/45 receive only — *£1,795*
Daisywheel mechanism, uses plain paper, fan-fold or cut appear A4 up to six-ply, RS232C or V24 interfaces, 156 cpl at 12 pitch, 45 cps. Main U.K. agent Brospa Data Ltd and Access Data Communications.

RAIR

Main U.K. agent Rair Ltd

820/825 Desk-top printer — *£1,090*
Dot matrix, RS232C interface, 132 cpl, 75 or 150 cps, 7×7 matrix.

DecWriter IV keyboard printer, KSR and read only — *£795*
Dot matrix, uses standard listing paper, RS232C current loop interface, 215 cpl, 30 or 180 cps, 9×7 matrix.

M200 — *£1,995*
Dot matrix, uses continuous paper, parallel or serial interface. 132 cpl, 340 cps, double 7×9 matrix.

Hyterm 1640 and 1650 — *1640 without keyboard £2,100, wiht keyboard £2,350. 1650 without keyboard £2,200, with keyboard £2,450.*
Metal or plastic daisywheels, uses cut-sheet or continuous paper, serial or current loop interfaces, 215 plus cpl, up to 45 cps.

DecWriter III — *£1,550*
Dot Matrix, uses continuous listing paper, RS232C or 20mA, current loop interfaces, 132-215 cpl, 180 cps, 7×7 matrix.

RICOH

RP-1600 — *£1,295*
Daisywheel, uses single-sheet or continuous paper, Centronics and compatible interfaces, 132 cpl, 60 cps. Main U.K. agent Nexos (U.K.) Ltd.

S FARID (SPECTRONICS) MANUFACTURING

TP-40 and TP-64 receive only — *from £660*
Thermal, matrix, uses thermal paper, cost of paper £1.80 each roll,

seven-bit parallel interface, push-button control and self-test, 40 or 64 cpl, 13 or 18 cps, 7×5 dot matrix. Main U.K. agent S Faird (Spectronics) Manufacturing Ltd.

SIGMA INTERNATIONAL INC

Sintelwriter *£2,064*
NEC 5500 range of thimbles, uses fan-fold paper, cut-sheet paper optional, RS232C and parallel interfaces, 136 or 163 cpl, up to 55 cps. Main U.K. agent Sigma U.K.

TALLY

Main U.K. agent Data Design Techniques Ltd
T1612 keyboard send/receive *£1,612*
Dot matrix, pin feed, single- or multi-part paper, RS232C or 20mA interfaces, 132-218 cpl, 160 cps, 7×9 or 9×9 matrices.

T1612 receive only *£1,475*
T1602
Dot matrix, pin feed, single- or multi-part paper, Data Products, Centronics and serial interfaces, 132 cpl, 160 cps, 7×9 matrix.

T2000 *from £2,000*
Comb print mechanism, uses standard, single- or multi-part paper, all interfaces, 132 cpl, 200 lines per minutes, 7×7 or 9×9 matrices.

TELETYPE CORPORATION

Model 43 keyboard send/receive *£800*
Impact matrix printer, uses pin-feed or friction-feed, dual RS232C and 20mA Current loop interfaces, 132 cpl, 30 cps, 4×7 matrix on 9-wire printhead. Main U.K. agent Geveke Electronics Ltd.

TEXAS INSTRUMENTS

Main U.K. agents Texas Instruments and Rair Ltd
OMNI 800 series *from £1,090*
Models 810, 820 and 825 *to £1,650*
Dot matrix printers, uses plain paper, EIA, current loop, parallel interfaces, 132-216 cpl compressed print (models 820 and 825), 132 cpl (model 810), 75 cps (models 825), 150 cps (models 810 and 820), 9×7 matrix.

Silent 700 model and 765 bubble-memory terminal *£2,395*
Thermal mechanism, uses thermal paper at £1.50 for a 100ft roll, integral acoustic coupler, EIA interfaces, 80 cop, 30 cps, 5×7 matrix.

Silent 700 model and 763 bubble-memory terminal *£2,195*
Thermal mechanism, uses thermal paper at £1.50 per 100 ft roll, EIA, 20mA current loop interfaces, 80 cpl, 30 cps, 5×7 matrix.

Silent 700 model and 745 portable *£1,250*
Thermal mechanism, uses thermal paper at £1.50 per 100 ft. roll, integral acoustic coupler, EIA interface, 80 cpl, 30 cps, 5×7 matrix.

Silent 700, 743 Keyboard send/receive version *£1,105*
Thermal mechanism, uses thermal paper at £1.50 per 100ft. roll, EIA, 20mA current loop interfaces, 80 cpl, 30 cps, 5×7 matrix.

TRANSDATA

313 Receive only *£790*
Dot matrix mechanism, uses thermal paper at £60 per box of 24 rolls × 150 ft. RS232C and parallel interfaces, designed for use as VDU hard

copy, 80/132 cpl, 30 to 45 cps, 7×5 matrix. Main U.K. agent Transdata Ltd.

TRANSTEL COMMUNICATIONS

AHR receive only *P.O.A.*
Dot matrix, uses standard teleprinter paper, V24, current loop interface, 80 cpl, 30 cps, 7×5 matrix. Main U.K. agent Transtel Communications Ltd.

TREND COMMUNICATIONS

800 receive only *P.O.A.*
Dot matrix, uses standard Telex roll paper, current loop, RS232C 80-0-80 interfaces, 80-132 cpl, 30 cps, 7×5 matrix. Main U.K. agent Trend Communications Ltd.

UNITED SYSTEMS CORPORATION

Main U.K. agent Aviqulpo Ltd

DigiTec 6320 *£483*
Electro-sensitive dot matrix, electro-sensitive line roll paper at £1.80 per roll, RS232C or isolated 20mA current loop, 21 or 32 cpl, prints two lines per second, 1,200 Baud receive, 5×7 matrix.

DigiTec 6330 *£421*
Dot matrix, electro-sensitive paper at £1.80 per roll, 8-bit parallel/character serial, 21 or 32 cpl, 5×7 matrix.

DigiTec 6410 *£237*
Dot matrix, electro-sensitive paper at £1.80 per roll, RS232C or 20mA current loop, 21 or 32 cpl, two lines per second, 5×7 matrix.

DigiTec 6420 *£237*
Dot matrix, electro-sensitive paper at £1.80 per roll, 8-bit parallel serial, 21 or 32 cpl, prints two lines per second, 1200 baud receive, 5×7 matrix.

DigiTec 6450 *£266*
Dot matrix, thermal paper at £1.80 per roll, RS232C 20mA current loop, 21 cpl, prints two lines per second, 110 or 300 baud receive, 5×7 matrix.

DigiTec 6460 *£266*
Dot matrix, thermal paper at £1.80 per roll, eight-bit parallel serial 21 cpl, two lines per second, up to 1,000 baud receive, 5×7 matrix.

DigiTec 6550 *£289*
Dot matrix, thermal paper at £1.80 per roll, RS232C or 20mA current loop, 21 or 32 cpl, prints two lines per second, 110 or 300 baud receive, 5×7 matrix.

VECTOR GRAPHIC

MP printer *£599*
Uni-directional seven-wire × five-column dot matrix, original and one copy, maximum paper thickness 0.2mm., uses pin-wheel paper feed, 70 lines per minute, 150 cps, TTL level interface, two parallel output ports and one-parallel input port. Main U.K. agent Almarc Data Systems Ltd.

WALTERS MICROSYSTEMS

BD-80P *£475*
Process-controlled, full graphics set, user-definable graphics, fan-fold

tractor feed, cost of paper £6 per 1,000 sheets, IEEE, RS232C and parallel interfaces, 80 or 132 cpl, 130 cps, 9×7 matrix. Main U.K. agent Camden Electronics.

Dolphin BD-136 *P.O.A.*
240 cps alternative to BD-80P.

WENGER DATENTECHNIK

Main U.K. agent Penny & Giles Data Recorders Ltd
Penny & Giles matrix printer *from £700*
Dot matrix RS232C, 20mA, 60mA and parallel interfaces, Centronics-compatible, 80 cpl, constant throughput 80 cps, 55-1000 lines per minutes, 7×7 matrix.

Penny & Giles hard copies *from £365*
Electro-static RMP paper 127mm. × 70m. at £3.50 per roll, RS232C, current loop option, 80/40/20 cpl, 80 columns 110 lines per minute, 5×8 line printer, 5×7 message printer matrix.

WHYMARK INSTRUMENTS

Main U.K. agent Whymark Instruments Ltd
Model 201 *£440*
Dot matrix, Tally-roll paper printer, IEEE, RS232C, serial, and parallel interfaces, 40 cpl, 40 cps, 52 character set with four-character sizes.

Model 204 label printer *£515*
Dot matrix, impact printer for self-adhesive labels, IEEE, RS232C, serial and parallel interfaces, 40 cpl, 40 cps, 52 character set with four-character sizes.

Model 3011 ticket/form printer *£690*
Dot matrix, plain paper, options automatic date and time, IEEE, RS232C, 40 cpl, 40 cps, 52 character set with four character sizes.

Model 501 rack-mounting printer *£625*
Dot matrix plain paper, options automatic date and time, IEEE, RS232C, 40 cps, 40 cpl, 52 character set with four character sizes.

Model 801 80/120 column printer *£750*
Dot matrix, plain or fan-fold paper, proportional spacing up to 120 cpl, 120 cps, bi-directional printing, user-definable character set, up to 4K selectable character fonts, graphics, and user-defined characters, also available; very large characters seven lines high.

VDUs

The purpose of a VDU is to display messages from the computer sent along an interface cable and to display text typed at the keyboard by the operator before sending it back to the computer.

Most micros have the functions of a VDU built into the computer and use a TV or a video monitor for display, so we present this list for completeness. A very intelligent VDU is practically a microcomputer — conversely, a micro can often be configured to act like a VDU, but giving local computing power as well.

Until recently micros usually displayed 24 lines, 40

characters long. The 80-character line is standard with larger computers' VDUs and is beginning to become more common in microcomputing.

It is important for the comfort of the operator that the keyboard should be physically separate from the screen so that it can be put in a comfortable postion. As well as having number keys on the top row of the keyboard like a typewriter, some VDUs have a separate numeric keypad like a calculator.

APPLIED DIGITAL DATA SYSTEMS

Regent 60 — *£599-£899*
Integral, separate and numeric pad keyboard, 12in. screen, 80 characters wide, switch-selectable cursor, buffered, protected fields, can transmit page line or modified data only, special character sets U.K., U.S., German, Swedish, Finnish, Danish, Norwegian, Spanish, French (Azerty), Arabic, V24, current loop, auxiliary interfaces. Main U.K. agent Terminal Display Systems Ltd.

CIFER SYSTEMS

Main U.K. agent Cifer Systems Ltd

2604 — *£680*
Non-intelligent VDU, separate keyboard, no numeric pad, 12in. screen, 24×80 characters, blinking, underscore cursor, user-defined alternate character set available, V24 with optional current loop interface.

2684 — *£1,995*
Intelligent VDU, with separate numeric pad, 12in. screen, 24×80 characters, blinking, underscore, soft-selectable cursor, includes integral floppy-disc unit, two Z-80 processors, 64K memory associated with disc processor, more than 150 commands associated with disc processor, optional character sets, V24 or optional current loop interface.

2632 — *£890*
Semi-intelligent VDU with separate keyboard and numeric pad, 12in. screen 24×80 characters, blinking, underscoring, soft-selectable cursor, more than 150 commands, user definable character sets, V24 interface with current-loop option.

2653 — *£890*
Non-intelligent VDU with separate keyboard DG6053 emulator, numeric pad, 12in. screen, 24×80 characters, blinking and underscoring cursor, user-definable character sets, V24 interface with optional current loop.

2652 — *£890*
Non-intelligent VDU with separate keyboard and numeric pad and VT52 emulator, 12in. screen 24×80 characters, blinking and underscoring cursor, user definable character sets, V24 interface with optional current loop.

2605 — *£770*
Non-intelligent VDU, with separate keyboard and numeric pad, 12in. screen 24×80 characters, blinking and underscoring cursor, user-definable character sets, V24 interface with optional current loop.

CPU COMPUTERS

Main U.K. agent CPU Computers Ltd

Pentland III — *£594*
Non-intelligent VDU, integral keyboard, no numeric pad, 12in. screen,

24×80 characters, limited cursor control, RS232C and current loop interfaces.

Pentland VI — *£660*
Semi-intelligent VDU, integral keyboard with numeric pad, 12in. screen with bonded-face plate, 24×80, full cursor control, includes extra page of memory, line and page-scroll and row-interchange function, RS232C and current loop interfaces.

DACOLL ENGINEERING SERVICES

Main U.K. agent Dacoll Engineering Services Ltd

M242 — *£600*
Semi-intelligent VDU, with integral keyboard and numeric pad, 12in. screen 25×80 or optional 25×132 characters, underlining cursor, flashing or steady, includes Intel 8085 microprocessor, optional characters sets, RS232C and current loop interfaces.

M248 — *from £795*
Intelligent VDU with separate keyboard and numeric pad, 12in. screen, 25×80 characters or an optional 25×132 characters, either underline or inverse video block cursor, blinking or steady, includes Intel 8085 microprocessor, optional character sets, RS232 and current loop interfaces.

M247 — *£890*
Intelligent VDU, with separate keyboard and numeric pad, 12in. screen 25×80 characters, underlining cursor, blinking or steady with inverse video, includes Intel 8085 mircoprocessor, optional character sets, RS232C and current loop interfaces.

DATA GENERAL CORPORATION

Main U.K. agent Data General

Dasher D2 display 6053 — *£1,728*
Operator-orientated, 96-character, upper- and lower-case alpha-numeric display with detached keyboard, direct cursor positioning and sensing, 9×6 screen, 24 lines × 80 characters, asynchronous communications interface, RS232C and 20mA, 7×8 dot matrix.

Dasher D3 display 6093 — *£1,885*
Operator-orientated, 96-character ASCII, detached keyboard with integral 14-key data-entry pad and 18 function keys, 20mA, EIA RS232C, direct cursor positioning and sensing, 9×6 screen, 24 lines × 80 characters, 5×8 dot matrix.

Dasher D100 and D200 — *from £1,141*
Operator-orientated, 96 character ASCII, movable, typewriter-style keyboard, 20mA, EIA RS232C, direct cursor positioning and sensing, 9×6 screen, 24 lines × 80 characters, 7×11 dot matrix.

DIGITAL EQUIPMENT

VT-100 — *£1,100*
Separate keyboard with 12in. screen, 132 or 80 characters wide, 14 or 24 characters high, full cursor controls with special character sets, RS232C and 20mA interfaces, unintelligent. Main U.K. agent Rair Ltd.

VT103 LSI-II — *£1,971*
CRT monitor, detachable keyboard, numeric keypad, up to 132 columns × 24 line display and 7×9 dot matrix, includes operator-selectable double-height/double-width characters, double-intensity, normal and reverse video, blinking, underlining and variable tabulation, parallel and serial, EIA, 20mA, current loop, RS232C, RS423 and RS422 interfaces. Main U.K. agent Rapid Recall.

FACIT

from £600
Integral and separate keyboards with numeric pads, some models intelligent, 14in. screen, 80/132×40. Main U.K. agent Facit U.K. Ltd.

GENERAL TERMINAL CORPORATION

Main U.K. agent SEN Electronics Ltd

GT-100A *£610*
Intelligent Z-80-based VDU with integral keyboard with separate numeric pad, 12in. screen, 24×80 characters, plus 25th status line, full cursor control special character sets including line-drawing as standard, RS232C and 20mA current-loop interfaces.

GT-101 *£690*
Intelligent VDU, includes Z-80 micro and programmable function keys, integral keyboard with separate numeric pad, 12in. screen, 24×80 characters plus 25th status line, full cursor control, line drawing as standard, RS232C and 20mA current-loop interfaces.

GT-110 *£770*
Intelligent VDU, Z-80-based and includes user-programmable function keys, integral keyboard with separate numeric pad, 12in. screen, 24×80 characters plus 25th status line, full cursor control, with U.K./foreign and line-drawing character sets, RS232C and 20mA current loop interfaces.

GT-400 *£947*
Intelligent Z-80-based VDU, separate keyboard with separate numeric pad, 12in. screen, 25×80 characters includes full editing facilities, full cursor control, RS232C and 20mA current loop interfaces.

HAZELTINE

Main U.K. agent Rair Ltd

1520 *£1,050*
Intelligent VDU with separate standard numeric keypad, 12in. screen, 80×24, full cursor controls with buffered editing and printing and special character sets, RS232C and 20mA interfaces.

1510 *£890*
Intelligent VDU with separate standard numeric keypad, 12in. screen, 80 characters wide, 24 characters high, full cursor controls with buffered editing and special character sets, RS232C and 20mA.

1500 *£785*
Separate numeric keypad, 12in. screen, 80×24, full cursor controls and special character sets, RS232C or 20mA interfaces, unintelligent.

1420 *£330*
Separate standard numeric keypad, 12in. screen, 80×24, full cursor controls, with special character sets, RS232C interface, unintelligent.

1410 *£290*
Separate standard numeric keypad, 12in. screen, 80×24,full cursor controls with special character sets, RS232C interface, unintelligent.

IBM

Main U.K. agent Rair Ltd

3101/20 *£994*
Intelligent VDU with separate standard numeric keypad 12in. screen, 80 characters wide, 24 characters high, full cursor controls with buffered editing, RS232C and 20mA interfaces.

3101/10 *£922*
Separate standard numeric keypad, 12in. screen, 80×24, full cursor controls, RS232C or 20mA interfaces, unintelligent.

INCOTERM U.S.

Main U.K. agent Incoterm Ltd

VTU 5106 *P.O.A.*
Intelligent VDU with clustered-terminals and terminal-processing unit which is programmable and supports up to 16 VDUs, separate keyboard with integral numeric pad, 12in. screen 80 characters × 12 or 25 lines, includes cursor control and character sets and keyboards

for compatibility with IBM, ICL, Honeywell, Burroughs, Univac or to customers' specification, Incoterm current loop and standard RS232C interfaces.

VTU 5102 teller terminal *P.O.A.*
Intelligent VDU, includes Series 7000. Intelligent Transaction Controller, supports up to 12 teller terminals and four executive terminals. Separate keypad. Can be upgraded to support Series 7500 receipt/journal printers, bankcard readers and personal identification number keypads, 5in. screen 40 characters × six or 12 lines, cursor control and 30 programmable keys can be customised to any application, current loop and RS232C.

ITT COURIER, U.S.A.

3280 Visual display system *P.O.A.*
Separate numeric pad keyboard, 80 characters wide × 24 characters high, cursor control, non-intelligent but has own intelligence for self-checking diagnostics, languages for all countries and 'APL', V24 interface. Main U.K. agent ITT Business Systems.

NEWBURY LABORATORIES

Main U.K. agent Newbury Laboratories Ltd

7000 *£495*
Non-intelligent VDU, integral keyboard, no numeric pad, 12in. screen, 24×80 characters, block cursor, V24, 20-60mA.

760C5
Non-intelligent VDU, integral keyboard, no numeric pad, 12in. screen 24×80, block cursor with cursor addressing, V24 or 20mA.

7009 *£795*
Intelligent VDU, integral or separate keyboard option, with numeric pad, 12in. screen 24×80 characters, block cursor, includes full editing facilities, block transmision, highlighting features, cursor addressing and seven pages of memory, also includes special character sets, V24, 20-60mA.

7007 *£745*
Intelligent VDU with integral or separate keyboard options and numeric pad, 12in. screen 24×80 characters, block cursor, includes full editing facilities, block transmission, highlighting features and cursor addressing, also includes special character sets, V24, 20-60mA.

7002C *£645*
Non-intelligent VDU, integral or separate keyboard options, with numeric pad, 12in. screen, 24×80 characters block cursor with cursor addressing, includes hard copy printer output and connection for external monitor, V24 or 20mA.

7002 *£595*
Non-intelligent VDU, integral or separate keyboard option, with numeric pad, 12in. screen 24×80, block cursor, includes hard copy printer output and connection for external monitor, V24 or 20mA current loop interfaces.

E1904 *£775*
Intelligent VDU, integral numeric keyboard, 12in. screen, 80 cpl, 24 lines per screen, cursor controls, full edit features, block transmission by line or page, XY cursor address, protected field format, two-page memory, roll or page mode. Serial interface CCTTT, V24, RS232C and 20/60mA current loop. Main U.K. agent Extel.

E1204 *£595*
Integral numeric keyboard, 12in. screen, 80 cpl, 24 lines per screen, V24 and 20mA interfaces, unintelligent. Main U.K. agent Extel.

PERICOM DATA SYSTEMS

Main U.K. agent Pericom Ltd

6801 *£985*
Semi-intelligent VDU, separate keyboard with numeric pad, 15in. screen, 24×80 characters, underlining, blinking cursor, includes

special character sets, RS232C, current loop interfaces, fully Post Office approved.

6803 *£1,285*
Semi-intelligent VDU, separate keyboard with numeric pad, 15in. screen, 24×80 or 24×132 characters, switch-selectable or software-selectable, underlining, blinking cursor, includes special character sets, RS232C, current loop interfaces, fully Post Office approved.

SOROC TECHNOLOGY INC

Main U.K. agent Sigma U.K. Ltd

IQ140 *£860*
Intelligent VDU, 12in. screen, 80 character wide × 24 characters high, non-destructive block, blinking or non-blinking cursor, includes protect mode, edit features and 25th line for status and mode display, 128 ASCII character set, upper/lower-case and alpha-numeric control characters, RS232C and current loop interfaces.

IQ120 *£576*
Intelligent VDU, integral keyboard, separate numeric pad, 12in. screen, 80 characters wide × 24 characters high, non-destructive block cursor, includes protect mode, RS232 interface.

TELEVIDEO INC

TVI-920 *from £623*
Intelligent VDU, integral keyboard, separate numeric pad, 12in. screen, 80×24, blinking block cursor, block mode, protect mode, tabbing, programmable reverse video, special programmable function keys, RS232C and current loop interfaces. Main U.K. agents Sigma U.K. and Data Design Techniques Ltd.

TVI-912 *from £549*
Intelligent VDU, integral keyboard, separate numeric pad, 12in. screen, 80×24, blinking block cursor, includes block mode, protect mode, tabbing, and programmable reverse video, RS232C and current loop interfaces. Main U.K. agents Sigma U.K. and Data Design Techniques Ltd.

VISUAL TECHNOLOGY INC

Main U.K. agent Sigma U.K. Ltd

Visual 200 *£698*
Intelligent VDU, separate keyboard and numeric pad, 12in. screen, 80×24, non-destructive block cursor, switch-selectable emulation of: Hazeltine 1500, Lear Siegler ADM3A, DEC VT52 and ADDS520, full range of cursor control functions, memory test on power-up, 31 character line-drawing set, RS232C and current loop interfaces.

Visual 100 *£1,213*
Intelligent VDU, separate keyboard and numeric pad, 24×80 or 24×132, blinking block or blinking underscore, user-selectable cursor, DEC VT-100- and DEC VT-52-compatible, advanced video package standard, 95ASCII US/UK plus 32 character graphics, RS232C and current loop interfaces.

VOLKER CRAIG

Main U.K. agents Volker Craig Ltd, Fortronic Ltd

VC-400 series *from £595-£850*
Non-intelligent, separate keyboard with standard or optional numeric pad, 12in. screen, optional green or amber, 80×24/24 characters, flash, steady, blinking or underscore cursor, addressable, special character sets — national, APL, custom design facilities, i.e., Wordstar, RS232/current loop interfaces.

VC-4152 VT-52 emulator *£675*
Non-intelligent, separate keyboard with standard numeric pad, 12in. screen, 80×25 characters, flash, steady, blinking or underscore cursor,

addressable; special character sets — VT-52 Graphics, APL, national and custom design facilities, i.e., Wordstar, RS232/current loop interfaces.

Teleprinter *£1,500*

Non-intelligent, separate keyboard with standard numeric pad, 12in. screen, 80×25 characters, flash, steady, blink or underscore cursor, addressable, special character sets — national, APL, custom design facilities, i.e., Wordstar, VT-24 and 5-bit interfaces.

VC-2100 VT-100 emulator plus *£995*

Non-intelligent, separate keyboard with standard numeric pad, 12in. screen, 132×25 characters, flash, steady, blink or underscore cursor, addressable, special character sets — double height, double width, national, APL, custom design facilities, i.e., Wordstar, RS449, RS232/current-loop interfaces.

Alphabetical list of suppliers

Supplier	Address
Access Data Communications Ltd, 0895-30831	228 High Street, Uxbridge, Middlesex UB8 1LD
Almarc Data Systems Ltd, 0602-625035	906 Woodborough Road, Nottingham NG3 5QS
Anadex Ltd 09905-6333	Weaver House, Station Road, Hook, Hampshire RG27 9HU
Aviquipo of Britain Ltd, 0628-34555	St. Peter's Road, Maidenhead, Berkshire SL6 7QU
Brospa Data Ltd, 0734-589393	87 Castle Street, Reading, Berkshire
Cable and Wireless 01-928 0261	83 Blackfriars Road, London SE1 8HQ
Cifer Systems Ltd, 0225-704502	Avro Way, Bowerhill, Melksham, Wiltshire SN12 6TP
Clary Ltd, 01-680 2222	12-14 Lower Addiscombe Road, Croydon, Surrey CR9 6AG
Comma Computers, 0277-811 131	West Horndon Ind Park, West Horndon, Essex CM13 3MJ
CPU Computers Ltd, 04862-73883	Copse Road, St. John's, Woking, Surrey GU21 6TP
Dacoll Engineering Services Ltd, 0438-4381/0506-56565	Gardners Lane, Bathgate, West Lothian
Datac Ltd, 061-941 236/2	Tudor Road, Broadheath, Altrincham WA14 5TN
Data Design Techniques ltd, 01-207 1717	12 Leeming Road, Borehamwood, Hertfordshire WD6 4DU
Data Dynamics, 01-848 9781	Data House, Springfield Road, Hayes, Middlesex
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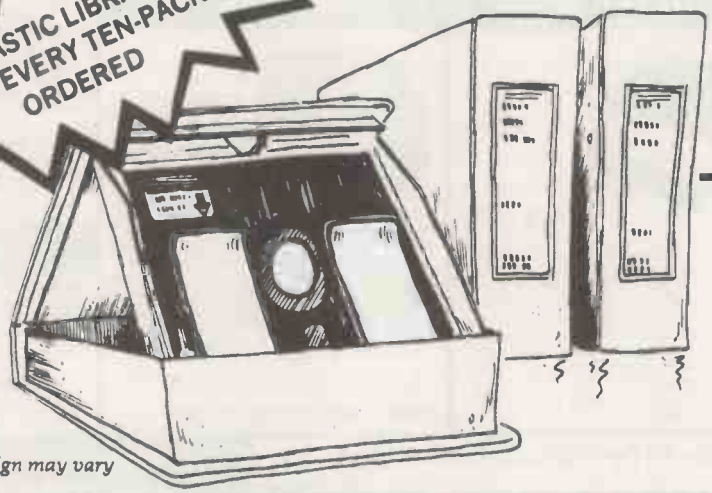

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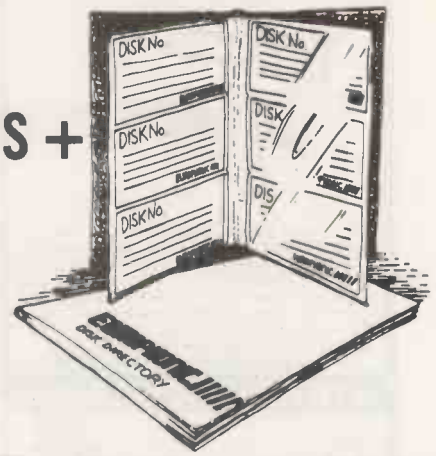

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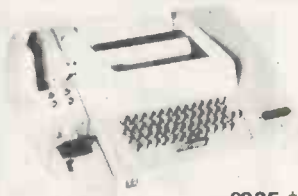

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Son of Hexadecimal Kid

A parable in 10 virtual pages by Richard Forsyth

Page 6 — page feed

Bill Bootstrap has been burned to death for heresy against the Nullard faith. Now young Samson Synapse stands accused of being a computer freak. Even preacher McNull, it seems, cannot by his oratory assuage the rabble's thirst for blood.

The leader of the gang repeated his question. "Answer me boy. Were you or were you not in collusion with that android"?

Samson could find nothing to say.

"Leave us in peace", cried Cleo desperately. "How can a child know anything about computers"?

The interrogator's lips began to frame another question when a large hand covered in dark fur settled on his shoulder and moved him firmly aside. It was Piltdown 2, whose return had not been noticed in the commotion.

The imperturbable ape-man picked-up Samson as though he were a bag of shopping and marched through the stunned spectators holding the boy head-high. The crowd parted to let him pass. For a moment no-one moved.

"Let that be a lesson to you", said the gang-leader to Cleo, but it was mere bluster to save face. Even as he spoke, his followers started to drift away into the darkness.

When the last of them had gone, Cleo and McNull joined Piltdown 2 in their cabin. Samson was sitting on a bed, unharmed but still very frightened. Cleo stamped three times on the floor as a signal to Lambda that the coast was clear. Two of the floorboards creaked into the air and out popped Lambda's head. She squeezed herself stiffly out, then sat down and tried to massage some life back into her limbs.

The incidents of that night had a profound effect on everyone at Sprocket's Hole — especially the boy. At first they feared a second attack and spent the next few nights planning their defence, but it seemed that the presence of Piltdown 2 was enough to deter aggression, and no raid materialised. They were merely shunned.

Samson ceased to attend the village school in Happy Valley, and they became increasingly isolated from the rest of the world. Even McNull's popularity as a preacher waned, so that he had either to travel great distances to places where he was now known or else stay at home to avoid being howled down. Consequently his trips became longer and less frequent.

They were thrown back on their own resources. They could not even go down to the local community to exchange produce. Everything they ate had to be grown or caught by themselves. If Sprocket's Hole had not been built round a reliable well of pure artesian water, they could not have survived. Its fresh water supply enabled them to irrigate the surrounding semi-arid land.

The imperative need for self-reliance meant that Samson, who had no more schoolwork to do, spent his time increasingly in their vegetable patch, which they enlarged considerably. That led him to a discovery that he possessed green fingers of a most remarkable kind.

Wild apples grew plentifully in the hillsides around, but the trek to gather them and bring them home was a long one, so Samson decided on his own initiative to plant some appleseeds and tend them till they had an orchard of their own. He chose a spot several 100 paces from their house, sheltered from view by a clump of boulders and some scrub bushes, and watered them carefully as they grew into saplings. He told no one in case his experiment failed, for their main problem was a poor sandy soil.

However, they grew exceptionally well, and he began to rise early to look after them. He did not want anyone to see his budding plantation until he was ready to present them with an armful of apples and reap the praise due to his independent endeavours. It was fortunate that he was so secretive for, not many weeks after their planting, he rose to find that his seedlings had already borne fruit.

It was an apple grove all right, but the fruit was totally inedible. The branches were laden with floppy discs. He gazed in amazement at row upon row of them, each in its slim green envelope, swaying gently in the morning breeze.

Most astonishing of all, one tree at the end, its branches bent almost to the ground by the weight, was carrying Volume I of the Biosoft Users' Manual. He went straight over to peruse it, turning to the first chapter entitled, in the irritatingly jokey style of such documents, How not to Swallow your PIP. Peripheral Interchange Program.

What had happened was the culmination of a long-term maturation process set in train immediately prior to the final collapse of the System when Mike Rose had injected Cleo with the computing virus. Its DNA had been genetically programmed with the germ of the Future System. The dosage of this micro-programmed micro-organism had been insufficient to affect Cleo, but it had passed right through the placenta to her unborn foetus.

For 11 years it had lain dormant in Samson, its unknowing host. Now, perhaps triggered by the shock the youngster had received, it had taken the first hesitant steps towards its ultimate goal which was nothing less than world dominion — the transformation of all life on earth into one vast, organic distributed-processing system.

Samson heard stirrings from the house. He knew he had to act fast. If any of the Nullards discovered what he had done this time, not even Piltdown 2 could save him. He could not even trust his mother with the secret, let alone McNull. He needed a hiding place for his strange harvest.

As quickly as he could, he gathered his extraordinary crop and set off into the hills. He had not dared re-visit the buried cache of computer components since the day of Bootstrap's death over six months ago. Yet deep in his heart, beneath the fear and guilt, he had always known he would be going back there. Now his feet took him directly to the place.

He had just time to put the floppies and the manual in the chest under the cedar tree, cover it again and rush home to be late for breakfast. He accepted his mother's scolding without protest, evading all enquiries about where he had been.

All day long he was preoccupied. He could think of nothing except his secret store of software, waiting for him in the hills. Time passed with agonising slowness but at last, after night had fallen and everyone else in the house was abed, he was able to steal out into the moonlight.

Up in the hills there was nothing to disturb him, only the broad silence of the desert night, broken occasionally by the call of a coyote.

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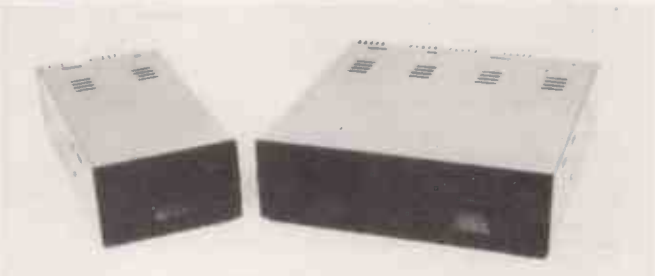

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74126	60p
74128	75p
74132	75p
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74137	50p
74141	50p
74142	200p
74145	90p
74147	190p
74148	150p
74150	130p
74151A	70p
74153	70p
74154	120p
74155	90p
74156	90p
74157	70p
74159	190p
74160	100p
74161	100p
74162	100p
74163	100p
74164	120p
74165	130p
74166	120p
74167	200p
74170	240p
74172	450p
74173	120p
74174	90p
74175	85p
74176	90p
74177	90p
74178	160p
74180	93p
74181	160p
74182	90p
74184A	150p
74185	150p
74186	500p
74188	325p
74190	120p
74191	120p
74192	100p
74193	100p
74194	120p
74195	95p
74196	95p
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74LS30	20p
74LS32	27p
74LS33	27p
74LS37	30p
74LS38	38p
74LS40	25p
74LS42	70p
74LS47	75p
74LS51	24p
74LS55	30p
74LS73	50p
74LS74	27p
74LS75	36p
74LS76	45p
74LS83	70p
74LS85	80p
74LS86	40p
74LS90	40p
74LS92	70p
74LS93	60p
74LS95	75p
74LS96	110p
74LS107	45p
74LS109	80p
74LS112	40p
74LS113	90p
74LS114	45p
74LS122	80p
74LS123	60p
74LS124	180p
74LS125	50p
74LS126	50p
74LS132	60p
74LS133	30p
74LS136	55p
74LS138	65p
74LS139	75p
74LS145	120p
74LS147	220p
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74LS151	80p
74LS153	60p
74LS154	200p
74LS155	60p
74LS156	90p
74LS157	60p
74LS158	60p
74LS160	90p
74LS161	75p
74LS162	140p
74LS163	100p
74LS164	90p
74LS165	140p
74LS166	180p
74LS173	110p
74LS174	100p
74LS175	100p
74LS181	320p
74LS190	100p
74LS191	100p
74LS192	100p
74LS193	100p
74LS194	100p
74LS195	140p
74LS196	120p
74LS197	90p
74LS221	120p
74LS240	175p
74LS241	175p
74LS242	170p
74LS243	170p
74LS244	150p
74LS245	250p
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74LS251	140p
74LS253	90p
74LS257	90p
74LS258	160p
74LS259	160p
74LS266	100p
74LS273	170p
74LS279	90p
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4028	84p
4029	100p
4030	55p
4031	200p
4034	200p
4035	110p
4036	295p
4039	295p
4040	100p
4041	80p
4042	80p
4043	90p
4044	90p
4046	110p
4047	100p
4048	55p
4049	45p
4050	45p
4051	80p
4052	80p
4053	80p
4054	150p
4055	125p
4056	135p
4059	600p
4060	115p
4063	120p
4066	50p
4067	450p
4068	27p
4069	20p
4070	30p
4071	25p
4072	25p
4073	25p
4075	25p
4076	107p
4081	27p
4082	27p
4086	72p
4089	150p
4093	70p
4094	250p
4095	95p
4096	95p
4097	340p
4098	120p
4099	200p
40100	220p
40101	132p
40102	180p
40103	180p
40104	99p
40105	120p
40106	90p
40107	60p
40108	470p
40109	100p
40110	300p
40114	250p
4502	120p
4503	70p
4507	55p
4508	290p
4510	99p
4511	120p
4512	80p
4514	250p
4515	300p
4516	110p
4518	100p
4520	100p
4521	250p
4526	108p
4527	150p
4528	100p
4532	140p
4534	550p
4536	375p
4538	120p
4543	180p
4553	320p
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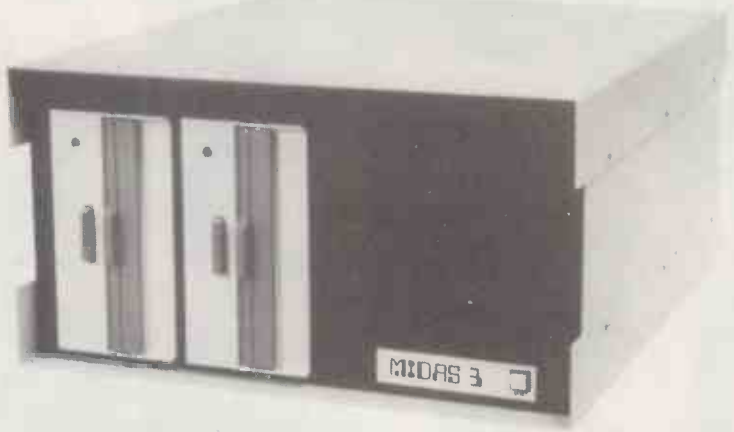

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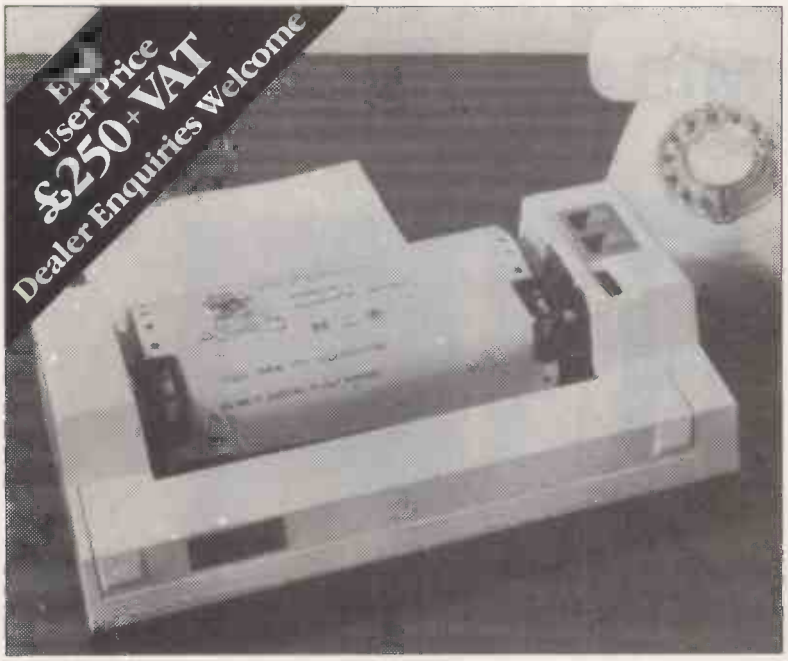

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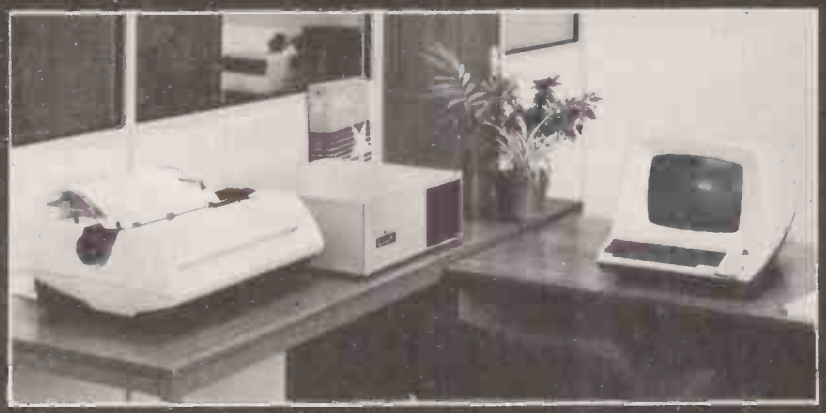

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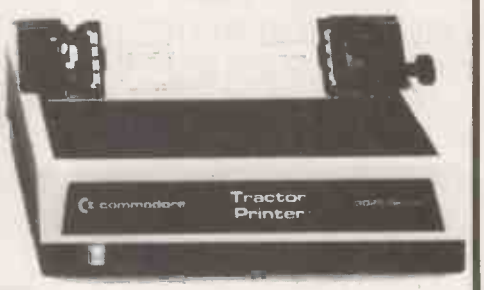

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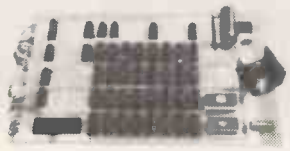

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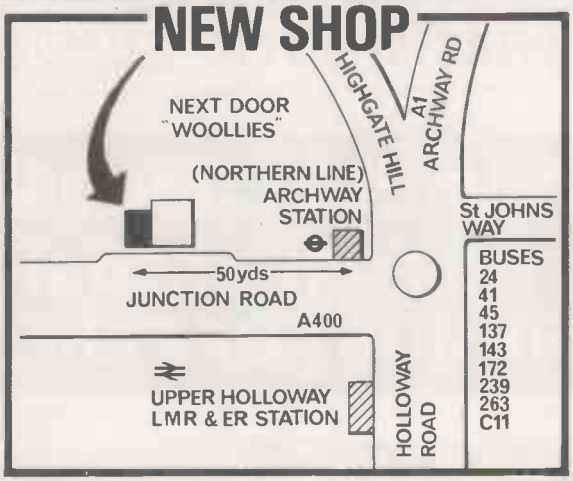

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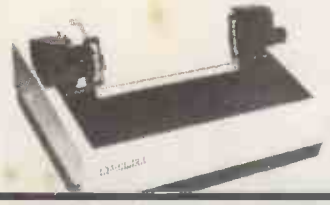

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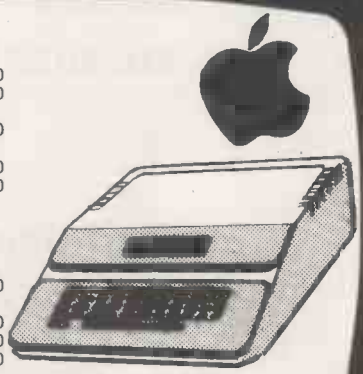

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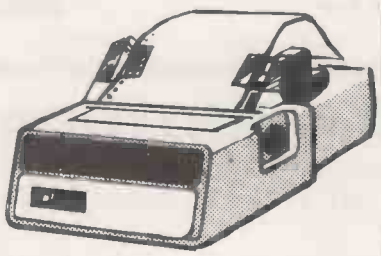

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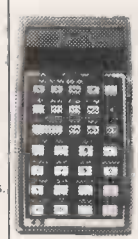

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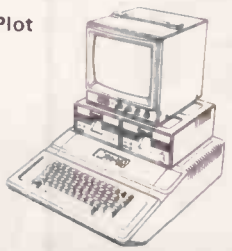

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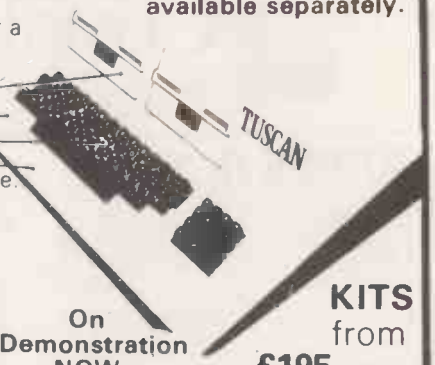

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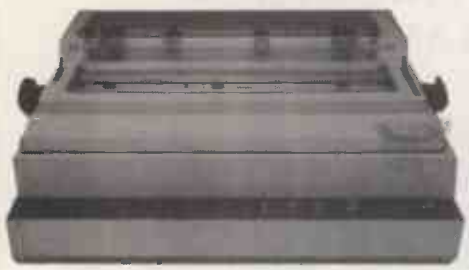

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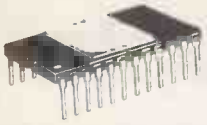

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LS75	48		
LS76	45		
LS83	105		
LS85	105		
LS86	45		
LS90	50		
LS91	125		
LS93	75		
LS95	115		
LS96	180		
LS107	45		
LS109	75		
LS112	80		
LS113	65		
LS114	49		
LS122	70		
LS123	95		
LS124	180		
LS125	60		
LS126	60		
LS132	95		
LS133	30		
LS136	55		
LS138	70		
LS139	90		
LS145	120		
LS148	175		
LS151	95		
LS153	85		
LS155	95		
LS156	95		
LS157	75		
LS158	85		
LS160	120		
LS161	95		
LS162	110		
LS163	100		
LS164	115		
LS165	165		
LS166	175		
LS168	210		
LS169	210		
LS170	288		
LS173	105		
LS174	147		
LS175	110		
LS181	295		
LS190	120		
LS191	120		
LS192	125		
LS193	125		
LS194	125		
LS195	125		
LS196	120		
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4025	25
4026	180
4027	48
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4029	105
4030	60
4033	175
4034	210
4035	125
4040	105
4041	80
4042	80
4043	95
4044	95
4046	130
4047	98
4049	45
4050	48
4051	80
4052	80
4053	80
4054	130
4055	135
4068	28
4069	28
4070	30
4071	25
4072	25
4073	25
4075	25
4075	99
4078	30
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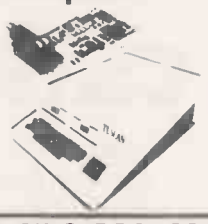

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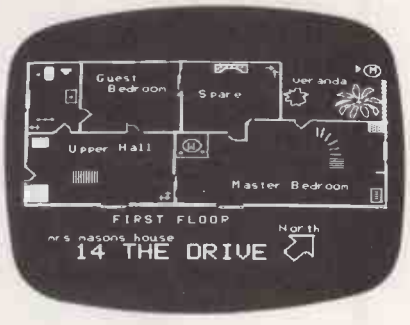

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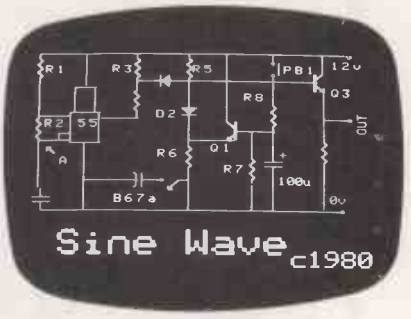

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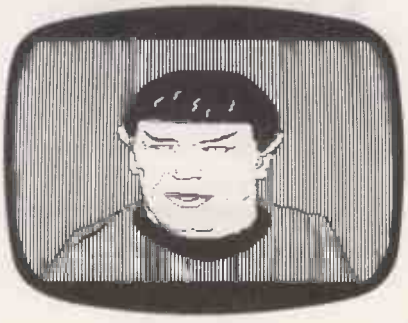

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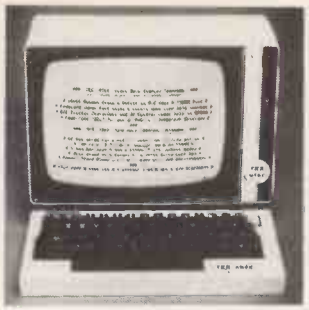

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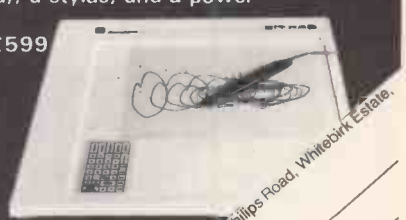

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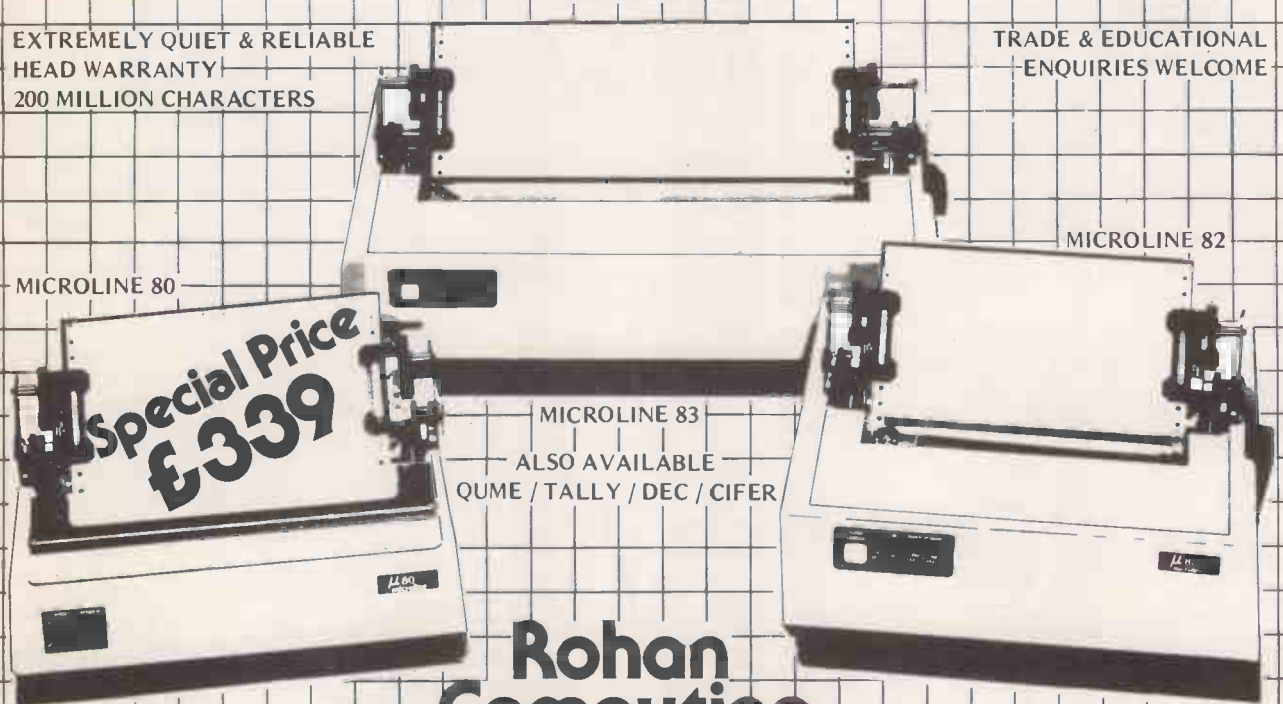

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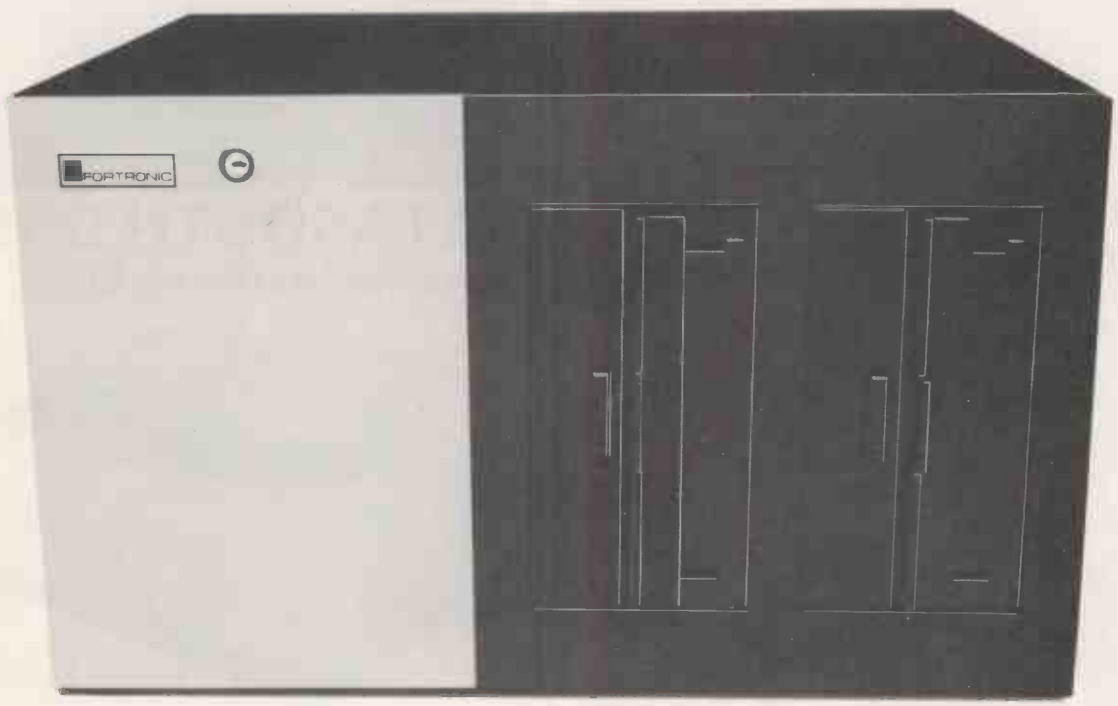

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DATASOUTH DS180

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The Datasouth DS180 is a dot-matrix serial impact printer designed for high performance at an economical price. Application flexibility and a long list of standard features make the DS180 an ideal device for small business systems, distributed communications networks and intelligent terminals.

HIGH SPEED PRINTING
Utilizing 180 cps optimized bidirectional printing, the DS180 offers higher throughput than any printer in its class. Its 9-wire printhead produces highly legible 9x7 characters with descenders for lower case letters and true underlining. All 96 ASCII characters may be printed across a 132 column line at 10 characters per inch. Expanded characters (5 cpi) may be selected for highlighting portions of the text.

USER PROGRAMMABLE
The DS180 offers a large number of user programmable features, yet is easy to operate. A unique programming keypad with a non-volatile memory makes printer set-up quick and simple. Top of form, horizontal and vertical tabs, perforation skip-over and auto line feed are just a few of the features the user may select. Communications status may also be programmed and monitored using the indicator panel lights and LED display.

ATTRACTIVE DESIGN
Compact, desk-top packaging allows the DS180 to fit into almost any installation. Its noise dampening cover makes it suitable for use in a quiet office environment. The cartridge ribbon makes routine changes clean, fast and convenient.

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Through the use of state-of-the-art microprocessor electronics, reliability and maintainability have been greatly improved. The simple modular design of the DS180 provides easy access to all major components. A single printed circuit board contains both the power supply electronics and digital controller for the printer. A self-test feature and diagnostic display panel help the user verify proper operation of the unit and isolate problems should they occur.

COMMUNICATIONS
Interfaces on the DS180 include RS232 and 20mA current loop serial interfaces, and a Centronics compatible parallel interface. Baud rates from 110-9600 and parity selection may be keyed in by the user for his specific application.

FORMS HANDLING
Adjustable tractors accomodate forms from 3-15 inches wide. A head-to-platen gap adjustment ensures optimum print quality on up to 6-part forms. Fanfold paper may be fed from the front or bottom of the DS180. A paper out sensor may be programmed to send a stop transmission character and sound an audible alarm.

QUALITY MANUFACTURING
Reliable performance is ensured by a stringent quality control program. Datasouth uses pretested, high reliability parts from leading manufacturers. Multiple tests are performed on subassemblies during each stage of production, with each completed unit undergoing a final 24 hour print test and burn-in. The DS180 carries a 90 day warranty on materials and workmanship.

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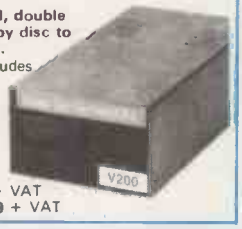

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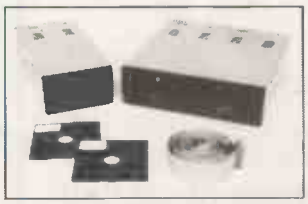

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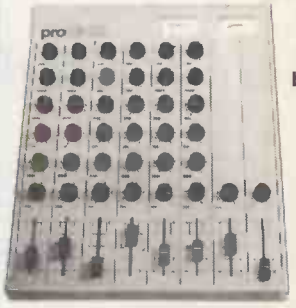

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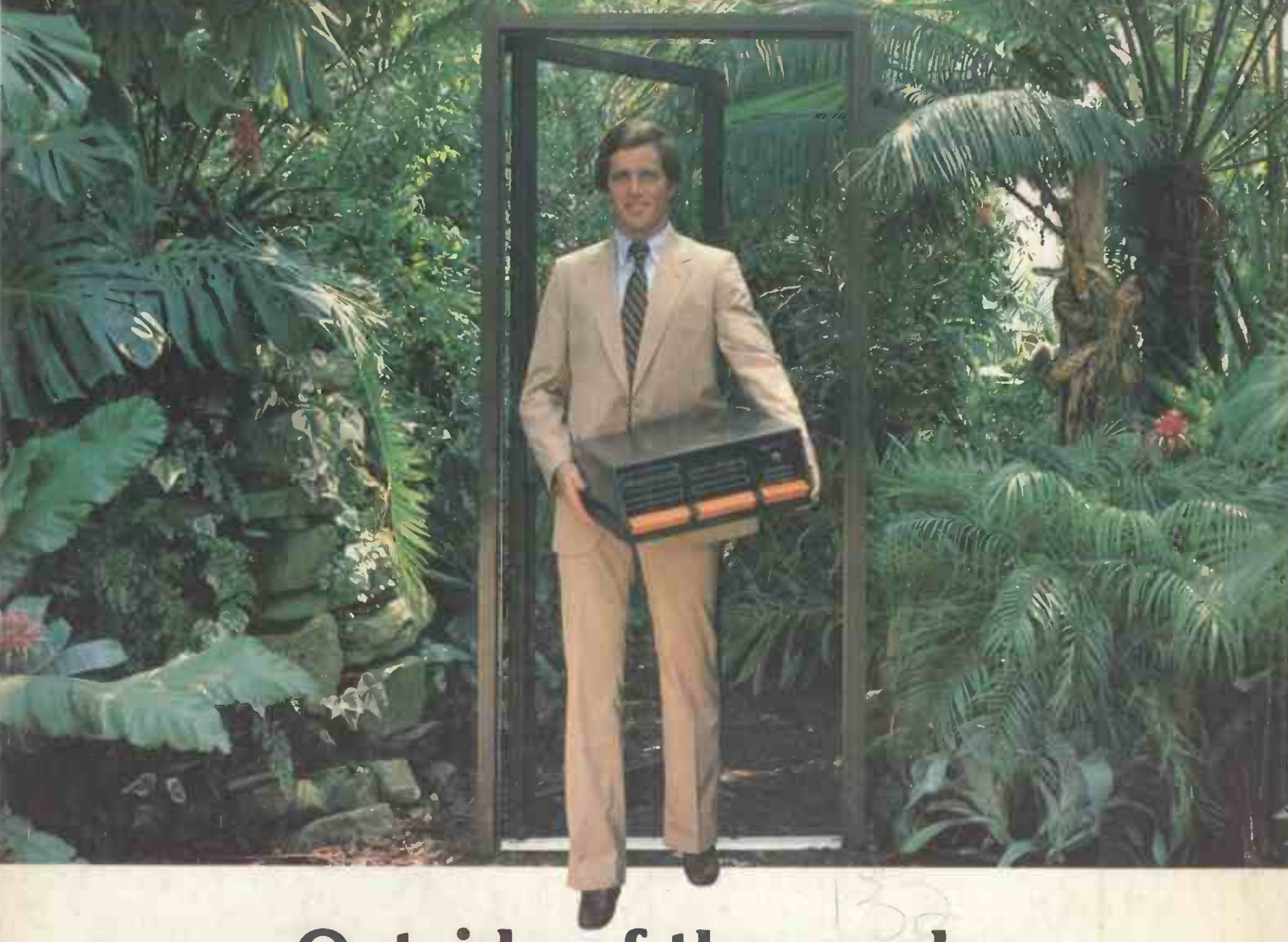

Outside of the garden you need a computer that can grow.

For the common or garden hobbyist, a high quality personal computer is a real temptation. But let's face it: in the world of business, engineering and scientific applications, you need a system that has been designed from the ground up to allow flexibility and expansion.

Providing flexibility and expandability today allows the micro to move up to and beyond the level of yesterdays mini. Hard disks for big system memory; more peripherals for big system flexibility; more number crunching capability and programming power can all be added when you need them. And without the feeling that you are turning a good natured toytown machine into a disproportionate monster.

The Ithaca InterSystems DPS1 has the power and flexibility of the IEEE 696 S100 bus with 20 slots of expandability for up to 16 individually addressable DMA devices and up to 1 MegaByte direct addressing from our Z80 board with its unique memory management system.

For really serious computing, our optional hardware front-panel provides a powerful diagnostic tool for debugging and development. Among its many features are the ability to deposit into and examine memory and set hardware break-points. Coupled with an oscilloscope, many other activities usually associated with expensive logic analyzers are possible. No wonder it's fast becoming the chosen development system in laboratories everywhere. And the recently announced system without the hardware frontpanel sets new standards for target systems too.

On the subject of standards, Ithaca InterSystems Series II is the most complete line of IEEE 696 S100 boards . . . easily upgradeable to the Z8000 or other 16 bit processors as they become available . . . so you never get locked out of rapid expansion, or locked into obsolesence, by depending on a single manufacturer.

But beware: IEEE 696 is an 8 bit AND 16 bit standard, not 8 bit only as some would have you believe. True compatability and later upgrade to 16 bits means you need to stick to the full IEEE 696 S100 standard from the start.

So if you've left the common or garden variety applications behind, come to Ithaca InterSystems and get a system that will grow as big as your next idea. Whether starting out with a basic low cost system or needing a sophisticated full feature multiuser system or anything in between . . . you'll find a solution to your problem with Ithaca InterSystems. With a choice of 5" or 8" drives, hard disks and CP/M or MP/M, and the full range of CP/M compatible software, including the excellent PASCAL/Z native code compiler, we probably have what you need.

Why not contact us to discuss your requirement? Call today for a catalogue of our products which also contains details of the IEEE S100 bus.

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ITHACA InterSystems (UK) Ltd.

"MAKING MICROCOMPUTERS FOR THE '80s"