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David Hebditch's On The Line will be continued in the next issue.

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Manufacturers, suppliers and dealers are welcome to contribute technical articles, and send product information, but we are pledged to an independent viewpoint and will publish evaluations and reasoned criticism or praise, space permitting. Naturally there will be right of reply. Views expressed in articles are not necessarily those of Personal Computer World.

We may make arrangements to offer our readers products at special prices, for a limited period, in line with the policy outlined above.

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Editorial

Changing of the guard

This is the last issue under my editorship. Saying good-bye and expressing sentiment without appearing sentimental is a tricky process, but I am compelled to say that you, readers, are exceptional people. Your curiosity and intelligence is matched by your warmth and good humour, and I shall miss you all.

For myself, one of my favourite sayings over the past eighteen months has been, "I'm under great stress . . . and enjoying every second of it". I'm only too aware that, more often than was comfortable, I fell short of my ideal of what an editor should be: the representative of the magazine's readers, and guardian of their interests. But I have done my best.

Publisher's Letter

The market for micros, and magazines dealing with them, continues to expand, and a publication such as PCW has to keep pace. This means a need for better packaging, better marketing and tighter organisation; greater resources must be called upon. So PCW has been taken over by H. Bunch Limited, an organisation with the necessary know-how and an outlook in keeping with the spirit of PCW. The magazine is now in very, very good hands.

SUBSCRIPTIONS

When PCW started publication, we had a special six-issue offer. When these subscriptions expired, we sent out reminders.
The renewal rate was 70%!
PCW reader loyalty is becoming a byword in publishing. If you're having difficulty in obtaining PCW at your newsagent, take our subscription. You can find the details at the foot of P.3.

STOP PRESS! £1,500 CASH – FIRST PRIZE

Second PCW Microprocessor Chess Tournament

Following the success of the first **PCW Chess Tournament** last year, we are pleased to announce that our second tournament will take place at the PCW show in London, November 1st – 3rd, 1979.
It is hoped that some financial support may be available for private entrants from outside the U.K., to defray travelling expenses, and there will be at least one cash prize. The highest placed programs will be eligible to compete in the first **World Microprocessor Championships** which will be held at the 1980 PCW Show.

Detailed rules and entry forms will be available in due course.
Prospective entrants are requested to write to David Levy (c/o Personal Computer World, 62a, Westbourne Grove, London W2) who will be acting as commentator and tournament manager.

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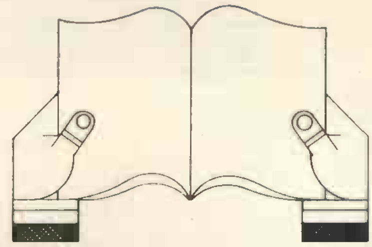

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CHANGE OF MANAGEMENT AND ADDRESS

PERSONAL COMPUTER WORLD

As from the September issue, Personal Computer World will be managed and published through the Bunch Books organisation.

The new address for all correspondence, both editorial and advertising, will be: Personal Computer World, 14 Rathbone Place, London W1P 1DE.

New Editors will be Bruce Sawford and Dave Tebbutt. Stephen England, previously PCW's advertising consultant, has been appointed Advertising Manager.

A. Zgorelec, the founder of PCW, will continue to liase closely with the magazine on a consultancy basis.

There will undoubtedly be changes made, mostly in the way the magazine is presented. We are out to make PCW the best Personal Computer magazine in the world. Readership participation has always been an essential facet of PCW and we intend to keep it that way.Watch out for the 'new look' front cover on the September issue.

See you next month.

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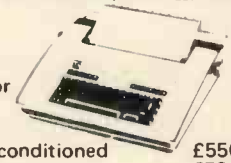

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Letters

Fuzz Buzz (cont'd.)
Please note the following errata in the 'Buzzwords' section of February:

EPROM:— Erasable Programmable Read Only Memories. The program can be erased, usually with U.V. light. See for example the Intel memory design handbook page 8—1.

Electrode The point at which the form of conduction changes e.g. from electron flow in a metal to ionic as in batteries, or from electron flow in a metal to free electronics as in a valve. Your definition of electrodes would include, for example the terminals of a transformer, but no-one would call these electrodes.

Editor An editor is not necessarily Interactive as you state
K (capital) = 1024
k (lower case) = 1000

Please don't write 4k8 for 4K x 8 bit as in electronics 4k8 means 4.8k.

May I also point out an error in the article 'Concepts of programming' in January's issue.

In that article Barry Woollard states that there are two kinds of High Level Language, interpretive and compiled. In fact these are 2 ways of *implementing* a language and there are cases of both kinds of implementation being available for the same language at the same installation.

J.S. Linfoot,
Flat 10, Pembroke Court, Rectory Road, Oxford OX4 1BY.

PCW *But see the "8080A Bugbook", by Rony, Larsen & Titus, pg. 67, where EPROM means "electrically programmable".* PCW

Relocating your (Grosser) Pet
Having changed from an 8K to 32K Pet, I found that the Maze programme (Page 45 May 1979 PCW) would not run. In order to get it to run, it is necessary to change the Peek + Poke numbers as follows:

Original 8K machine	New 32K machine
80	582
84	586
85	587
86	588
89	591

J. Bloore
8 Woodlawn Grove, Kingswinford, Brierley Hill, West Midlands DY6 9QE.

His Pet needs a Vet
I have just upgraded my Pet system by selling my 8K and buying the new 16K version with a "real" keyboard. To anyone contemplating a similar change, may I issue a word or two of warning.
1) There have been a number of changes in the memory map, and a number of programs using PEEK + POKE will no longer work.
2) The lower case/graphics POKE has been changed so that POKE S9468, 14 gives lower case/upper case, but they are reversed and now work like a typewriter — so programmes with lots of instructions in UC/LC will have to be changed round.
3) There is now a complete Hex monitor — residing between FDII & FPB0 which will load and save Hex programmes on tape, although the new Manual says it is available on tape.
4) This new Manual is full of: errors of fact, of grammar; and misprints.
5) Commodore seem uninterested in explaining & listing the differences. They said that there might one day be a conversion programme to change all programmes. Well, we know what their delivery promises are like, don't we! When did they first promise the printer for?

So now I am left with a number of programmes I have bought that don't work, Commodore say in effect "Hard Luck". Perhaps someone who knows will help.

Even the programmes published by Commodore in the Pet Users Club newsletter don't all work now.

P.S. Are there any clubs in Portsmouth, Winchester, Chichester, Guildford, Haslemere or at any rate within 20 miles of Petersfield? If not, I will be happy to meet any readers in this area to discuss probabilities.

Peter R.A. Dolphin
27 Kimbers, Petersfield, Hampshire GU32 2JL

Clothing the Dandy
I would like to start a TRS-80 software exchange for users of this machine.

The sort of thing I hope to start would be a central point for users and producers of original TRS-80 programs. I have the facilities and the spare time to sort and test any programs etc. I feel that this would be useful, as I have noticed a shortage of software for the TRS-80 at low prices and feel sure that many of the purchasers of this machine feel the same. I can run and copy programs in any TRS-80 format (LEV 1, LEV 2, DISK, and SYSTEM TAPES).

So if you can say a bit about it all and ask anyone interested in either helping to run or using such a service to write to me I would be very grateful. It would help if you do give me a word to say that S.A.E's would be appreciated.

Chris Cain,
ENG WING, R.A.F. West Drayton, Middlesex.

PCW *There is no lack of professional software for the TRS-80, as is evidenced by advertisers in the magazine. Nevertheless, Chris Cain has a point worth putting* PCW

In Extremis?
I do not, as Mr. Price suggested, miss the point of medical confidentiality, but disagree with the extremes to which it is taken. (See PCW Letters, March '79).

I see no valid reason for failing to provide all *medical* data to a large data-base, keeping out of the data base only patient identity (name and address etc.) but including a reference number so that if the central computer reports to the Doctor his reference number 14256 shows symptoms that in 9 cases out of 10 resulted in death within 1 month, the doctor can then determine whom to urgently call into hospital.

It may be beneficial for each Doctor to have his own personal micro-computer. It would not be inconsistent to feed a large main-frame with "statistics" collected on the small computers. Please give us the best of both worlds!

A.J. Borer D.Eng.M.I.E.E., B.Sc.
22 Deerfold, Astley Park, Chorley, Lancs.

Flattery will get you most places
Many thanks for a really good magazine, which I find most useful on the software side for technique and handy routines. As an engineer/programmer only recently moved in to the micro field from a mini-mainframe environment, I find the enthusiasm and open-mindedness of your (and similar) publications most refreshing!

One note of dissatisfaction has crept in today, however, when I received two binders for PCW that I recently ordered. Firstly, they were sent in separate packages (surely un-economic for you!) and secondly, I was charged 4p extra postage on both parcels! (A little un-economic for me!) Nevertheless, I can now stack all my copies of PCW proudly on the bookshelf!

A footnote for your south coast readers — my employers' company, Amplicon Electronics Ltd., long into LSI-11 systems, has now formed Amplicon Micro Systems Ltd. We are opening a new showroom in Ditchling Road, Brighton, and will be selling Commodore PETs, discs and printers, together with a wide selection of tape and disc based software.

One new product probably of interest is a complete stock control system for the PET, disc and printer, written almost entirely in machine-code by a friendly local software house, Anagram Systems. We shall be marketing this system in September at around £3000.

Once again thanks for a terrific mag. — keep up the good work.

Peter Wood,
11 Burrell Close, Partridge Green, Horsham, Sussex RH13 8BH

PCW *Hope you got our 8p refund!* PCW

Occam's Razor
There has been considerable discussion about both 'aligning the decimal point' and 'right-hand justification' of numbers in versions of BASIC that do not have the PRINT USING or other formatting control.

This would appear to be the simplest way:

Alignment of Point
```
DEF FNA(X) = -LEN (STR$(INT(X))) - (ABS(X) < 1)
```
Right Hand Justification
```
DEF FNA(X) = 1-LEN(STR$(X))
```
To use either of the above functions simply write:—
```
PRINT TAB(Y+FNA(X)); X
```
which will either align the point or righthand justify the number in the Yth position.

NOTE some BASICs may require the following function in place of the first one above:—
```
DEF FNA(X) = -LEN(STR$(INT(X))) + (ABS(X) < 1)
```

Sheridan Williams, PCW Consultant,
114, Beech Road, St. Albans, Herts. AL3 5AU.

PCW *William of Occam was a medieval philosopher who put forward the principle (Occam's Razor) that entities should not be multiplied unnecessarily* PCW

Personalising DOS
This program allows the user to change the names of the Apple II DOS commands to suit his or her own taste. For example, one might wish to abbreviate CATALOG to CAT. The program is

based on information contained in an article by Andy Hertzfeld, published in the February 1979 issue of MICRO.

In a 48K system the command names are held in a table between SA7E0 and SA863, the last character of each string is denoted by setting the most significant bit. Note 10 explains how to modify the program for smaller systems. The program works by overwriting this area of memory with a new table in the correct format.

After running the program and testing the new command names, use BSAVE or its replacement to save the table on disk (it is $ 83 bytes long), then add a line to your 'HELLO' program to BLOAD it each time the disk is booted.

Program Listing

```
10  LOC = 42976
20  FOR I = 1 TO 28
30  READ CO$
35  IF LEN(CO$) = 1 THEN 80
40  FOR J = 1 TO LEN (CO$) –1
50  POKE LOC, ASC (MID$ (CO$ , J, 1))
60  LOC = LOC +1
70  NEXT J
80  POKE LOC, ASC (RIGHT $(CO$ , 1)) + 128
90  LOC = LOC +1
100 NEXT I
110 END
120 DATA INIT, LOAD, SAVE, RUN, CHAIN, DELETE, LOCK
130 DATA UNLOCK, CLOSE, READ, EXEC, WRITE,POSITION
140 DATA OPEN, APPEND, TITLE, CATALOG, MON, NOMON
150 DATA PR #, IN #, MAXFILES, FP, INT, BSAVE, BLOAD
160 DATA BRUN, VERIFY
```

Notes

10 LOC is used as a pointer to the current location in the table. SA7E0 - 42976(10). For a system with nK of RAM (where n < 48) subtract (48-n)*1024 from this value.

30 CO$ contains the current command from the data list.

35 This test is necessary as Applesoft executes a FOR ... NEXT loop at least once.

80 Bit 7 of the final character is set before the POKE.

120-160 These are the standard DOS command names – replace them as desired, but do not increase the total number of characters.

S.J. Withers,
43 Watercall Avenue, Stivichall, Coventry CV3 5AW.

Computer Club

We would like to start a school's computing magazine as forum for software, games exchange, utility programs, tutorial programs exchange for the ILEA RSTS computer and the 380Z microcomputer, having recently acquired the latter; and intend using it with the Text Editor to produce the magazine.

Having once operated the RSTS without the Polytechnics' permission we probably know more about it than any other school (all strictly legal please!) Any charge will be minimal covering the cost of producing it. We would like any contributions: articles, programs, ideas, and we would like to get in touch with other 380Z users.

Our main purpose would be to exchange programs, ideas, and provide a medium for the solution of problems.

We implore PCW to start a school's computer users page!

Burlington Danes School Computer Group
Dane Building, Du Cane Road, Hammersmith W6 0TY

PCW *Young people, your wish is our command* PCW

A marked improvement

I read with interest Mr Clark's program (On Your Mark, Get Set; May 1979), and whilst it is a good idea as far as it goes, could be very much improved by a little extra work.

```
0F12   C4 0D   LDI X'0D
0F14   35      XPAH 1
0F15   C4 00   LDI X'00
0F17   31      XPAL 1
0F18   C4 00   LDI X'00
0F1A   01      XAE
0F1B   C1 80   LD 1+E
0F1D   E4 FF   XORI X'FF
0F1F   C9 80   LD 1+E
0F21   01      XAE
0F22   F4 01   ADDI X'01
0F24   D4 07   ANDI X'07
0F26   01      XAE
0F27   8F 01   DLY 1
0F29   90 F0   JMP –16
```

In Mr. Clark's program, the byte is loaded from the keyboard, and then displayed. This means that the user is looking for a light switching off. It is many times easier to look for a light switching on, so in the above program, locations 0F1D/E complement the byte before it is displayed.

Also in Mr. Clark's program, only one set of keys could be tested at once. To be used properly the program had to be stopped, have location 0F19 changed, then restarted again. The program above does this for you. The byte is loaded from the keyboard, displayed, and then instead of restarting the program, the value of E is taken out, has 1 added to it (locations 0F22/3), then lines 0F24/5 ensure that it is always between 0 and 7. The value produced is now put back into E.

The resulting display is blank, until any key is pressed, when a segment lights up corresponding to the key pressed.

Because this program does increment the keyboard scan itself, and does not have to be altered, this means that the program may be burnt into PROM as part of an overall diagnostic routine.

J.C. May
3 Chiltern Drive, Waltham, S. Humberside, DN37 0DY.

Results of Puzzle Dazzle No.3

David C. Broughton

This problem asked for a method of comparing two signed 8-bit numbers in registers A and B of an 8080 or Z80 microprocessor, without disturbing the contents of any register. The following solution for a Z80 was submitted by four readers. It makes use of the parity flag which, in a Z80, is also used as an overflow flag.

```
        CP   B          ; Set flags to result of A-B
        JP   PO,NOVER   ; Skip next instruction if no overflow
        OR   A          ; else set flags to content of A
NOVER: . . .
```

At label NOVER the result of the comparison is in the sign flag, allowing the programmer to write JP M,ALTB for example. The zero flag is also set if A=B.

I am grateful for this solution, for it is new to me and has immediate practical application in my chess program. Thank you PCW readers.

The solution is of 5 bytes. Mike Blandford points out that, as a subroutine, it is only 4 bytes:

```
CP   B
RET  PO
OR   A
RET
```

No one sent a correct solution in 8080 code so I give my own 9-byte version:

```
CMP  B        : Result in carry flag if signs same
PUSH PSW      ; Save A and flags on stack
XRA  B        : Bit 7 set if signs different
RLC           ; Rotate bit 7 into bit 0
XTHL          ; Original carry now bit 0 of L. H=old A.
XRA  L        ; Bit 0 of A now required test
RRC           ; Put it in Carry. Carry set if A < B.
MOV  A, H     ; Restore A
POP  H        ; Restore HL
```

The first three correct solutions received were from Mike Blandford, Terry Bronilaw and M.R. Edwards who each receive £5.

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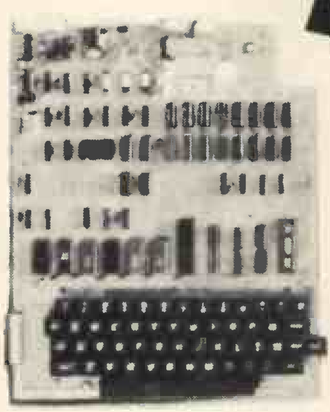

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Tid Bits PRODUCTS . . . . COMPANY NEWS . .

Pet for Beginners
A short introductory text on using and getting the best out of the Commodore Pet has been written by two lecturers at the new University of Ulster. The booklet does not make any attempt to teach programming, except incidentally, but concentrates on techniques and routines that have proved useful in exploiting Pet's many facilities.

Send £1.00 per copy or write for further details to:
Seamus Dunn and Valerie Morgan, The Education Centre, The New University of Ulster, Coleraine, N. Ireland.

New from Cromemco

Featuring:
Fast Z80A 4MHz processor; 11-megabyte hard disk drive; Two floppy disk drives; 64K RAM memory; RS-232 special interface; Printer interface; Extensive software available. (See Tidbits, PCW, July)

A New Company
Pitech & Co. Ltd., of 19 Market Place, Durham, DH1 3NL has been newly formed to market Microcomputer Equipment Software etc.

The new Company specialises in marketing the ITT 2020 together with the necessary software aimed at the small business market.

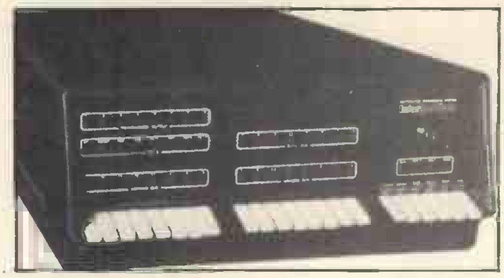
They are also able to supply PET, North Star Horizon, Cromemco, Nascom etc. in Co. Durham and the surrounding area.

EXIDY INTRODUCES
Word Processing ROM PAC™ Software
Exidy Incorporated, manufacturers of the Sorcerer computer product line, has introduced its word processing computer system at the National Computer Conference and Summer Consumer Electronics Show.

The heart of the system is the Word Processing ROM PAC™ cartridge, which transforms the company's Sorcerer computer into a dedicated word processing system.

The software will support an inexpensive modified Selectric typewriter or the high performance Diablo/Qume proportional spaced output printers.

New from Ithaca Intersystems Inc.
Ithaca Systems Inc. has introduced the following new products:
a) DPS1 Mainframe incorporating an S100 bus with front panel and power supply.
b) PASCAL/Z true compiler.
c) More S100 boards: high density graphics board, analogue I/O, etc.



Ithaca Systems Inc., is, also, setting up a European subsidiary, based in London, to support growing OEM and dealer networks providing full local technical and marketing support. Jim Wood has joined as European Marketing Manager.

Another appointment is that of Kells Elmquist, principal author of the new IEEE S100 standards spec as Senior Design Engineer.
Further information is available from:
Jim Wood, 58 Crouch Hall Road, Crouch End, N8 8MG
Tel: (01) 341 2447

Eprom Eraser Costs Less
A compact low-cost UV irradiator unit operating at 2357Å, erasing up to 32 devices at a time in typically 30 mins, yet runs cool with low ozone emissions.

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Newbear Cut SYM-1 Prices!
The SYM-1 is a fully assembled, single board microcomputer based on the 6502 "chip" (as used in the PET and KIM from Commodore) and is produced by Synertek Systems Corp. in the USA.

The price including full documentation is now down to £160 plus VAT and 8K Basic in ROM is down to £75 plus VAT.
For further details contact:
Jon Day, Newbear Computing Store
40 Bartholomew Street, Newbury RG11 5LL
Telephone: (0635) 30505
(SYM-1 was reviewed in the March 1979 issue of PCW)

Algol 60 for Z80 Microcomputers
Research Machines Limited announce the RML Algol compiler for Z80 microcomputers which support CP/M, such as the Research Machines 380Z. The Algol is fully operational on a system with as little as 21k of memory and one minifloppy disk drive. The compiler implements most of the features of the Algol 60 report.
For further information:
Research Machines, P.O. Box 75, Oxford. Tel: 0865 49792

Family Affair
Computerland, Nottingham, is leading the way toward a better understanding of micros. It is holding a "Computers for Pleasure Weekend" for the family on 14 - 16 September, at the Victoria Hotel, Nottingham.
Enquiries to:
The Manager, Victoria Hotel, Milton Street, Nottingham.
***PCW* recommended**

New German Designed Micro
Powerhouse Microprocessors Ltd., of Hemel Hempstead has been formed as a new company to manufacture a West German designed microcomputer, called the Powerhouse 2. The company has sales rights throughout the world, with the exception of certain European countries.

The Z80 based Powerhouse 2 packs 48k byte of memory, a 5 inch VDU and a 53 key keyboard into a good looking and compact (11 x 17 x 7 in., 14 lb; 280 x 431 x 178 mm, 6.4 kg) housing. Facilities include BOS, DOS, serial interfaces, flexible screen logic (6—96 characters, 1—27 lines) and compatability with all standard computers and terminals.

The Powerhouse 2 is capable of controlling three Powerhouse mini floppy discs with a total capacity of 1M byte.

Options include: 14k of Basic in EPROM, IEEE 488 interface, true XY graphics and integral mini cassette drive (40k byte).

Two hundred original Powerhouse units have been sold so far, mainly to OEM's and expert users. Applications include: real time process control, desk top computer for scientific and engineering calculations, commercial systems, automation of

programmable laboratory instruments including calculations performed on data received and stored.
Further details from:
H.G. King,
Powerhouse Microprocessors Ltd., 5 - 7 Alexandra Road, Hemel Hempstead, Herts, HP2 5BS. Tel: (0442) 48422

Micros in Elections Canvassing
The European elections may not have inspired much interest in the voters but it has produced a novel application of microcomputers. In Welwyn Garden City the job of recording and analysing canvass returns and polling day information has been handled by a VECTOR MZ (48k twin mini floppy disk drives). The Election day picture shows a party worker typing the election numbers collected outside polling stations. The program produces summary figures of the relative positions of the parties at any instant. Print outs of those supporters who need to be "knocked up" in each road can be given to the "workers".

It is claimed that bottle necks in committee rooms are eliminated and there is also no need for laborious manual records to be kept. The company which provided the equipment (Research Resources Ltd., Welwyn Garden City 26633) normally specialise in statistical and scientific applications of micros. They are considering converting the software to run on cheaper machines for future elections.

Abacus Computers introduce the "Stuntbox"
Until recently, equipment users wanting to link differing protocol systems had only two real alternatives: either to employ their own hardware engineers or to have an interface custom-built — both expensive exercises.

Now, Abacus Computers have introduced a new choice, the GENERAL PURPOSE INTELLIGENT INTERFACE — called the "STUNT BOX" because it can "connect nearly everything to anything".

This new interface, based around the Intel 8085 microprocessor uses Programmable Read Only Memories to store control routines. The unit can have 32 BITs Parallel I/O and up to 2 Synchronous and 3 Asynchronous ports.

Software is already available to cover:

- IEEE 488 to Serial Bi-directional
- IBM 3270 to RS232 Asynchronous
- A variety of Parallel to Parallel protocols.

For further information contact:
Robin Bailey, the Managing Director of ABACUS COMPUTERS on 01-637 0777

One-day Seminars
L & J COMPUTERS, who are specialising in 'PETS' (including packages with floppies, printers and software), are running a series of one-day practical tutorial courses, which will also include wide ranging discussions on systems and applications.

They are starting this autumn, the first one being scheduled for 16th October in Wembley.
For further information contact:
Jack Goodman, L & J Computers,
3 Crundale Avenue, Kingsbury, London, NW9 01-204 7525

The Microstar system with the staff of Microsense Computers (off shoot of Data Efficiency). The Microstar is supplied by Micro V Corporation of Irvine, California, and is claimed to be a "dream answer" for British businessmen, educationalists, and administrators and Scientists disposing of £5000 to £7000. Delivery is said to be immediate, and Microsense staff are said to be "jubilant" about the supply situation and the market for the Micro V. Dealer enquiries are invited.

Microsense is now also distributor for Apple in the UK.
Contact:
Bill Mercer, Microsense Computers,
Finway Road, Hemel Hempstead, Herts, HP2 7PS.
Tel: 0442 48152

LK3000 — The Pocket Size Translator
Designed like a miniature computer, the LK3000 is a highly sophisticated terminal, its programmes contained in different language modules which simply slot into the back. French, German, Italian, Spanish, Portuguese, Swedish, etc.

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What's more the LK3000 not only translates English into different languages, it also works in reverse to enable a foreign language to be translated into English.

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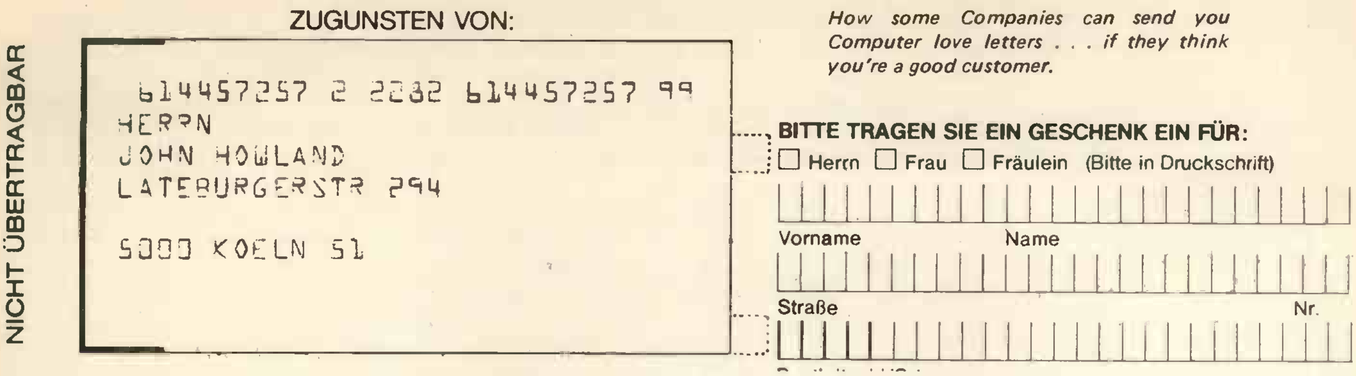
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How some Companies can send you Computer love letters . . . if they think you're a good customer.

I LOVE COMPUTERS, BUT...

The not So private Computer

Chris Howland

The other day I received an unusual letter.

"Dear Mr. Howland", it read. "We have computerised information concerning your financial situation and find it satisfactory. Therefore, should you at any time wish to take out a mortgage or other form of loan, we will be glad to co-operate with you or even act as your guarantors should you so require. Yours faithfully, etc. etc. etc."

I literally flew into the car and drove to my bank. The manager happens to be a friend of mine (yes, I know I'm lucky!) and he sat watching me quietly as I did my little bit.

"There must be a leak — there's a spy out there," I said pointing to the door, "and it's up to you to find out who it is or I'm going to take my money somewhere else!"

At this point we both had to laugh, but that's another story. In any case, I came away entirely satisfied that the system used in the bank makes it almost impossible for any one employee to obtain a complete picture of a client's financial situation.

Back home, I decided to consult my computer. No, not my friend in the office but the one I always carry around with me between my ears. I read the letter again. It looked like a computer job alright — you know what I mean — too well-typed to be true, and with hints of perforations above and below.

Then something else struck me. At the top, I read *John* Howland instead of *Chris*. This isn't really a mistake because my first name *is* John and I've no idea why my parents decided to do it all the wrong way around. Obviously, the computer didn't either. Then I read the address and suddenly there were little lights flashing all over the place. You see, I live in Alteburger Strasse but the address on this letter said Lateburger Strasse. I remembered that I'd once received a letter with a similar mistake and that various postmen had written remarks such as 'not known here' or 'return to sender' on the envelope, so that, by the time it finally reached me, it was going grey with age.

I don't know how a hound feels when it gets it's first sniff of a fox's trail, but I experienced a sort of tingling all over.

"The car!" I shouted and bounded towards my filing cabinet.

You see, many months ago, I had received another astonishing letter. This one had contained the log book of an exclusive car all neatly made out in my name. This was a bombshell. Never in my life had I ever won anything for free, either in a raffle or a casino, yet here I was with a brand new car right out of the blue.

Until I opened the 'log book' and read: "This car could be yours if you take out a subscription to xxxxxxx xxxxxxx magazine!" Talk about a let-down! Nevertheless I took out a subscription just for a giggle, which is about all it was worth!

But I'd kept that 'log book', which was why I was frantically searching through my files. Finally, I had it. John Howland, Lateburger Strasse.

Then the detective in me got going. My grandmother once told me never to throw a piece of paper away because it might someday come in useful. I took her unusual advice with the result that I now have quite a selection of useless printed matter collected in a series of files all marked 13. I began to go through these and the hound in me began to tingle again. There were pages and pages of advertising matter all addressed to John Howland in Lateburger Strasse. Obviously the Post Office had twigged this one long ago. And Granny had been right!

Finally I caught my fox — or at least part of it. Some years ago, I had joined a Continental Motoring Association and it was *their* wrongly addressed letter which had originally confused my postman. This association prints a monthly magazine and the publishing firm *just happens* to be the same one which issues the other periodical which nearly gave me a free car. Do you begin to get the message?

Where is the connection, however, between an incorrect name, a misspelled address and my finances?

From here on I can only conjecture. I've narrowed it down to above five sources of information, but there could easily be dozens, if not hundreds more.

Firstly, I buy my food in a fully computerised wholesalers. They are so computerised, in fact, that they itemise every article and, at the hit of a button, can tell whether I have bought Danish or Russian caviar and when. I use caviar purely as an example. If I buy Danish I'm just using it to garnish hard-boiled eggs, but if I invest in Russian, I'm either celebrating a birthday, or a good contract or I'm trying to impress someone who might *give* me a good contract.

An obvious question: do these wholesalers have my date of birth? Answer: yes. So if I buy Russian caviar shortly before my birthday this has little significance except that it implies that I still have enough cash for the splash. But if I buy it at any other time (apart from my wife's birthday which is also on the list) it could mean good news or probable goods news. On the other hand, if I don't buy any form of caviar on either date I might be in a worse shape than I was at the same times last year.

Second, petrol. I buy most of mine at a local station and receive a computerised bill once a month. Here we could have another indication of my finances because when I'm on the road, I'm earning money; and when I'm not, I'm not!

Third, the doctor. If you're a private patient in Germany, you receive your bill from a central organisation and not from the Doc himself. Sure, he wants the money alright (and he gets it too!) but he doesn't want to be bothered with paperwork.

Fourth, the faulty address. Here, unlike in England, you always put your address on the back of the envelope and your letter will eventually be returned unopened if the recipient has moved. However, as the law requires him to register his new address within two weeks you can easily trace him if you care to go to the trouble; but, as long as your letter isn't returned, you can reasonably assume that he has received it.

Fifth, the date of birth. This, combined with your various names, helps to pinpoint you. In former years an adult could simply write "over 21" when a form asked him for his age but this practice is unfortunately dying out. Now they even want to know *where* you were born!

When they called me up in 1946 they paid me four shillings a day, which meant that I was completely broke every Wednesday. Later, on being promoted, I received more than double and it was like being in Heaven, until I realised that I was getting broke every Wednesday just as before. Perhaps I was taking buses instead of walking, or eating steaks instead of hamburgers. In any case, more money was going out than before and I hadn't noticed it. But a computer would have!

Now back to those points I mentioned earlier.

He's eating well, he's doing a lot of travelling, he hasn't been to the doctor nor has he moved house. Then compare these figures every month. The slightest variation will give a clue to his general condition and each clue will help to form a pattern. The rest I'll leave to your imagination.

Recently a law was passed in Germany controlling the swopping of computerised data. But for one person at least, this law has come too late. His name is JOHN CHRISTOPHER HOWLAND and his address is either LATEBURGER or ALTEBURGER STRASSE number . . . . come to think of it. I'll stop there. If you want any further information, plug into your nearest data bank.

Perhaps you might even like to send me a birthday card!

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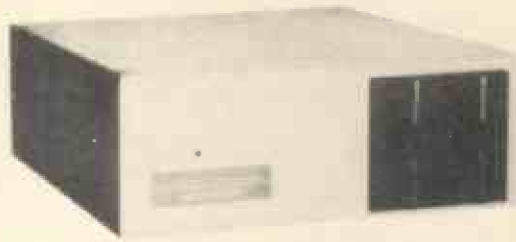

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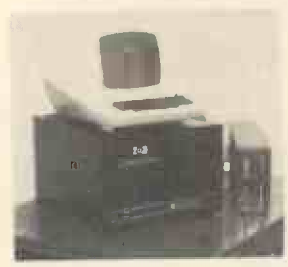

System E
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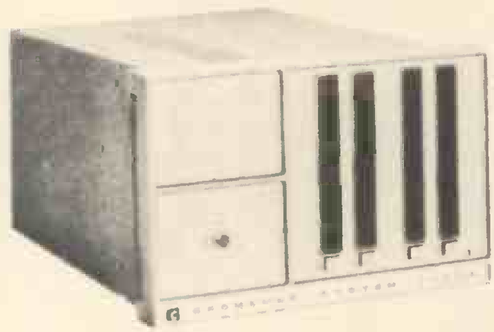

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PCW CASE STUDY

Apple Medical Application

PCW *This Case Study is in the words of a Harley Street Obstetrician and gynaecologist who remains anonymous for reasons of professional ethics relating to publicity* PCW

A system based on the Apple II computer, complete with two minifloppy disc drives, Axiom thermal printer, and software was installed at a cost of just over £3,500.

The doctor began in the National Health Service and has been in private practice for the last six years in Harley Street. Two years ago he moved into improved offices.

He reflects here on his experiences.

I had no experience of computers at all prior to purchasing the Apple computer. My secretary and I were operating a manual billing system which entailed a lot of double-checking and was generally a time-consuming job. Realising that I had a sizeable administrative problem the larger my practice grew, I spoke to some friends in the business world who suggested I should look for a cheap minicomputer which I could use to store information on tape and call up as required.

I then saw an article in a local newspaper about Apple, so I called up Mike Sterland of Personal Computers Ltd, the UK distributors of the Apple II computer, and explained my problem to him. As I did not know how to program the machine myself I needed to find a software house to write the applications software for me.

Fortunately Mike Sterland had a list of software houses specialising in Apple II, and he put me in touch with Stanton Smith of Microsolve Computer Services of Edgware. Microsolve had a range of standard application packages for payroll, ledgers and invoicing but I needed something quite specifically geared to my requirements, so I sat down with Stanton Smith and spent three hours or so discussing exactly what I wanted with him. He then went away and returned a few days later with a complete systems design.

The next step was to order the equipment while Stanton went back to write the actual software programs on his own machine.

The applications software comprises three main modules: patient records, a billing system and a monthly and annual expenses system. At the time I decided against buying a large printer because I felt that, professionally, it was more presentable to type out bills from a printout.

In the patient records module, each patient is given a particular number which is entered in a manual master index file, a book which sits on my desk, with patient name kept in alphabetical order. The search for a patient's records is made alphabetically from the book in order to find the appropriate number which is then entered through the Apple Keyboard to get the details stored on the disc.

The disc is updated from a daily record of the practice's activity which has been written onto a sheet. These activities are coded into salient points, for example, CO for consultation, OP for operation, AN for anaesthetic, PA for pathology, and so on.

The main reason this type of record is required is that where one is dealing with 800 to 1000 patients a year, as I am, it is impossible to keep all the details in one's head, specially if a patient has been absent for any length of time. This can give rise to an embarassing situation as records can be difficult to find or go missing altogether.

The billing system comprises a master disc with the names and addresses of up to 900 patients, and an accounts file disc. The following menu of options appear on the television screen:

1. Update patient name/address
2. Update bills and payments
3. Report printout of outstanding bills
4. Update case history
5. Exit from system

Each option in turn triggers in a submenu as follows:

An Apple a day keeps the doctor in play. Supplied by Personal Computers Ltd. *of Bishopsgate, the Apple II sits unobtrusively on a desk top in a corner of the practice. The software was written by* Microsolve Computer Services *of Edgware and is now marketed on a 'packaged' basis.*

The Apple II computer system plugs into a standard domestic television set through the use of a PAL card. The use of a colour television set allows one to generate colour graphics patterns if required.

1. Update patient name and address
   1. Input/amend patient name and address
   2. Exit from program

2. Update bills and payments
   1. Input new patient bill
   2. Input new payment on consultation
   3. Display/amend patient bill
   4. Display/amend payment on consultation
   5. Exit

I am currently discussing modifications with Microsolve, to provide a printout of all money paid as well as owing in order to help my accountant in preparing my financial accounts.

3. Printout report of outstanding bills
   1. Print o/s bills not written off
   2. Print o/s bills with reminders
   3. Print bills written off
   4. Print all bills
   5. Exit

4. Update case history
   1. Input/amend initial case details
   2. Input new further visit details
   3. Display/amend further visit details
   4. Print full patient history
   5. Exit

The practice's expenses system comprises the following menu:

1. Initialise file(s)
2. Input/amend month of year
3. Input/amend expense description
4. List/amend expense(s) for month
5. List/amend expense(s) for year
6. End

In selecting the system, I looked at other systems on the market available for around £600 but none seemed adequate for what I wanted. The speed of access for information is a very important factor and a system based on cassette tape storage is not fast enough. I find the pressure to enter information to the system every night enough as it is, and cassette tape would make nonsense of any speed benefits, quite apart from problems of tape distortion. Used as a toy, it is another matter, but this is a serious application.

To be sure there have been problems with disc drive and printer interface cards, but their speed and ease of use more than balance this out. Anyway the system is only as good as the people using it.

From the time it was ordered, the system took 12 weeks to be shipped from the United States. One of the beauties about it is that software could be developed on another machine while I was awaiting delivery.

The machine arrived end December 1978 and I started using it in January. I mastered most of the beginners' faults within a week. The only problem is the location of the reset button so close to the carriage return key. This can be most irritating if the wrong key is depressed but fortunately the software allows for quick recovery. Apple should set the reset button somewhere out of the way.

Apart from that the system tells you when you've done anything wrong without destroying everything: it is designed for a relatively unsophisticated user. My advice to those contemplating the purchase of a similar computer system is a)spend a long time on the systems design as this will save many headaches later, b) try to build in expansion to the system right at the start if possible, and c) use an expert to help you unless you are yourself an expert on computer systems.

Overall I feel I have what I wanted. Eventually I plan to employ someone part-time to take over the accounts from my secretary and feed in the information to the system. For the small businessman who can afford it, it provides enormous benefits. The market is still in its infancy but I can see the medical profession using this type of system in a big way given the way prices have been dropping. In another 15 to 20 years many more doctors will be using computers.

PCW *We hope to have case studies on the uses of other machines as well.* PCW

THE NORTH STAR HORIZON

A Review

Martin Healey, Paul Woodward and Mike Rees

Introduction

North Star are one of the many American companies that came into the computer business on the back of the ALTAIR systems. They saw the market for S100 bus "plug-ins". In particular, North Star were about the first company to pick up the new Shugart mini floppy diskettes. Most microcomputers were cassette based and, while standard 8" floppies were soon introduced, the mini-floppy offered an attractive in-between. Thus around 1975 they designed an S100 bus controller for mini-floppies. Undoubtedly North Star's continued success is founded on the fact that this was a very sound and well made card, giving the company credibility. We have in fact used a North Star mini-floppy disc controller on an ALTAIR for some years now and it in fact forms the basis of our standard Word Processing system. The disc system came with a BASIC interpreter and very rudimentary Disc Operating System. Within its scope this software was sound, but very limited; there was for instance no Assembler/Editor and the file structure was trivial at best.

The company produced other add-on S100 bus products such as an interesting Maths board, but they have really come to the fore now with a complete computer system, the HORIZON. This system integrates the disc hardware and computer, but not the VDU, into one chassis. This is one of the first systems to adopt this obvious approach, along with Cromemco, VECTOR GRAPHIC, RAIR, etc. The concept is sound since it reduces the nett cost of boxes, power supplies, etc., provided one is aiming for a disc based system. The physical size of the mini floppy is also more suited to integrated packaging, although there are examples using 8" diskettes; eg. Cromemco System 3. Most full sized diskette systems are still separately boxed, since the integrated systems can be bulky. Obviously, with double-sided, double-density and even quad-density diskettes maturing, the concept will be even more pertinent.

The Horizon does not include a terminal, utilising a serial I/O port to a conventional VDU; similarly for a printer.

North Star do not have exclusive dealerships in the UK, so that the system can be purchased from a number of sources. I (Martin Healey) have had previous dealings with COMART, and EQUINOX kindly lent me a system to conduct this review. Both companies have been most helpful and knowledgeable about their product.

Like most American microcomputer companies, North Star announced the HORIZON long before it was ready for marketing. This caused quite considerable frustration, but the machines are now generally available. They are available with none, one or two diskettes. The overheads of packaging make it an expensive *diskless* system, not competitive with, say, the APPLE. Single disk systems should never be seriously considered and can only serve as a stop-gap for the amateur enthusiast while he saves up for the second drive. Originally introduced as a single density (90KB per drive) diskette system, a double-density version is now available. This will clearly totally replace the single density machines. There could be some cheap single density controllers going on the second hand market soon!

With the HORIZON have come upgrades to the North Star software which, however, is still BASIC oriented. Needless to say most alternative software packages have been adapted and can be separately purchased.

Hardware

The first impression is a very good one. It seems that North Star's original high quality manufacture has been retained. The box is most attractive physically with the disk drives mounted vertically, side by side to the right. The power-on and reset switches are as for convention on the rear, and my only compalint is quite trivial and is that power-on lead is stuck slap-bang in the middle of the front panel. The system tested had an outside cover made of wood, with a veneer finish, quite an interesting and attractive variant. COMART apparently prefer an optional blue metal case, but I liked the wood one better.

Inside, the good impression continues. The chassis is strong and well finished. The mother board runs front to back in the bottom of the chassis alongside the diskettes. The power supply is mounted behind the disk drives. The S100 motherboard provides slots for 12 cards, stretching from the front about 2/3 depth of the chassis. The number of S100 connectors and card guides actually fitted depends upon your order. The last 1/3 of the motherboard contains the control circuits and I/O ports. This is a most interesting variant on the standard S100 systems in which all circuiting is mounted on cards. The North Star approach clearly reduces basic production costs, although it is possibly more difficult to add the optional parts if these are not ordered from the outset.

The power supply is rather robust, providing the normal +16V, — 16v and 8 volt smoothed but unregulated D.C. lines. The mains input is fused and includes an A.C. line filter. Unfortunately, I could find no data on the current rating of the power supply. All I can report is that the transformer stayed cool when feeding the 6 cards in the system I tested. I have, however, doubts about a chassis of this sort supporting any old combination of boards. I suggest anyone contemplating using a high number of cards should first check with the dealer. Thus, for instance, the heat generated from the 4 x 8KB static RAM cards I tested must be 4 or 5 times as high as from 2 x 16KB North Star dynamic RAM cards. I have faith that the power

The *Horizon* is sold by Interam, Equinox and Comart

supplies and the good sized fan will cope with most situations. I must also add that the fan runs very quietly, an essential requirement in an office environment, e.g. word processing. There are an ample number of holes in the back panel to mount input/output sockets.

The motherboard circuitry is quite extensive, including features often needing 1 or 2 cards in other S100 systems. The circuitry is of course directly interfaced to the S100 bus. It also carries voltage regulators to provide +12v and +5volt for its own circuits and the V24 serial post. Separate voltage regulators are also provided for the disc drive logic, since the drives are integral with the chassis.

The motherboard includes 2 serial I/O ports, 2 parallel I/O ports (1 input, 1 output), Interrupt control circuits and a real-time clock. One of the serial ports and the parallel port pair are options. All the selectable features in the I/O system, e.g. baud rates, are determined by a number of jumper connections soldered onto the "headers" — plugs which fit into sockets on the board. There is a very wide range of options available, all well described in the detailed literature. When a completed system is supplied, these are pre-set, but a kit builder or anyone adding the options will need quite a bit of studying to get this right.

The serial ports are configured to full V24 (RS232) standard, including modern control. They employ the INTEL 8251 USART chip, so a most interesting variant is that the system can be used for synchronous as well as the normal asynchronous transmission. Very few users will have any opportunity to use anything other than asynchronous mode, but the variant may appeal for such advanced communications concepts as, say, IBM 3780 emulation. In asynchronous mode the Baud rate can be selected from the on-card baud rate generator (using the normal 16 x baud rate clock) for speed, between 75 and 9600 bits/second. In synchronous mode clocking would normally be provided by the Modem. The older 20mA current-loop mode is available by replacing the TTL to V24 driver chip by a special "header" containing the current loop driver . . good luck! If full V24 mode is used then MODEM control signals must be answered. This required interconnection of certain pins in the 25 pin D-type plug if a conventional VDU is employed. This can be avoided by an alternative setting of one of the control "headers" on the motherboard, abandoning the modem control at the plug level. This should be the normal setting for most users, but North Star must be complimented on the advanced thinking which has provided such a versatile interface.

The parallel input and output ports are latched and could be used to interface a single printer. A more complex printer would require more ports, however. For example, we use 3 out and 2 in for a parallel Diablo Daisywheel printer interface. Only TTL signal levels are catered for, so that any device connected to these ports should use flat strip cable of length below 6 feet or so.

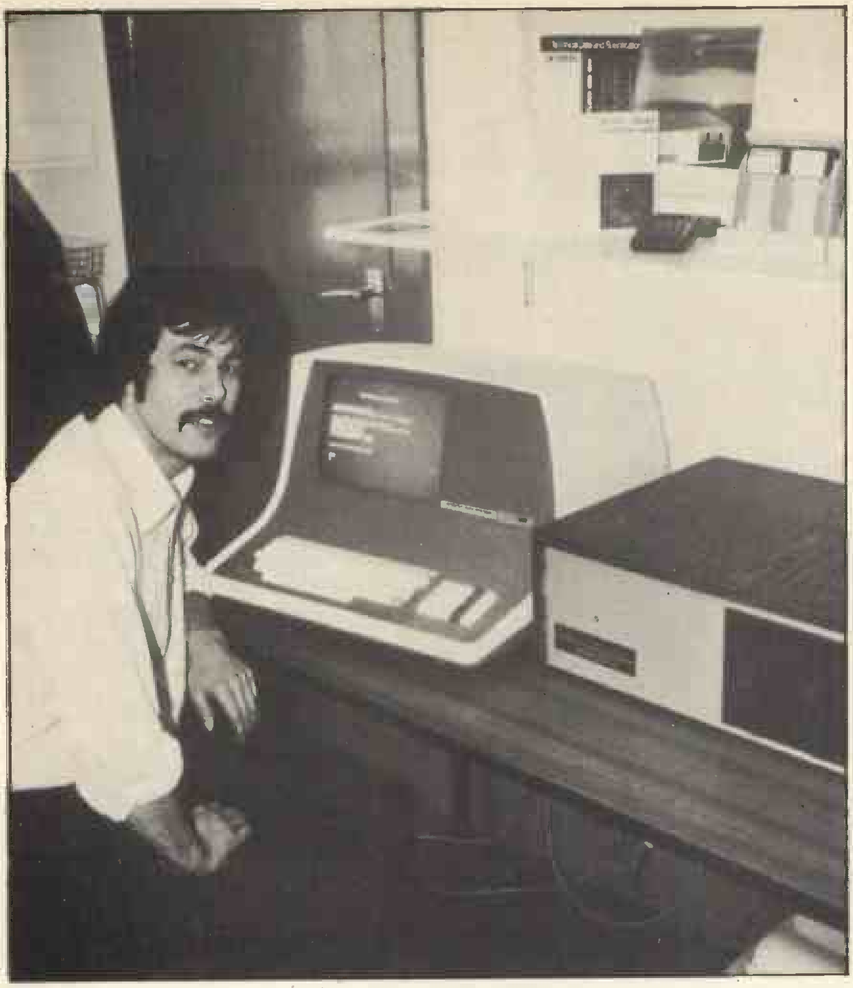
A feature of the original S100 bus specification was the allocation of 8 pins to interrupt requests: V10 to V17. These were extended to a total of 10 possible interrupt requesting lines by the direct Z80 related signals PINT and NMI (non-maskable interrupt). Logic on the Horizon motherboard allows certain events to be jumper-selected to pull any of these lines low (active), so as to request an interrupt. On the motherboard, four interrupting devices are configured; serial ports 1 and 2, the parallel port and the real-time clock. Individual features of a port are grouped to one interrupt, i.e. receiver-ready, transmitter-ready, sync-detect and transmitter-empty for a serial port all raise the same interrupt request. Note, however, that the vectored interrupt lines on the S100 bus are only interrupt *requests;* another card must supply the corresponding RST instruction insertions; in this case, the CPU card (see later). Interrupt diven I/O is *essential* for multiple terminal work.

One of the above mentioned interrupts can be generated by a real-time clock on the motherboard. The clock flag can optionally be read under program control. The clock rate must be set by jumper connections on the board (not by programmed instructions). The clock pulse time intervals range from 3.3280 millisec to 27.263 sec in intervals of powers of 2. Like the pulses for the USART's, the timer is derived from the 2 MHz S100 bus clock, and so is mains frequency independent.

There are two direclty addressable ports allocated to the motherboard itself. One is used to report the current status of the devices on the board; the other is a CPU output port so that various functions on the motherboard can be software controlled, in particular enabling and inhibiting the interrupt request logic.

The North Star CPU card *continues the high standard of innovation.* It features a ZILOG Z80A processor running at the full 4 MHz clock, although a 2MHz option is provided. Even at 4MHz the S100 bus 2MHz clock is maintained. Obviously designed for use in the Horizon, the card supports jumper-selectable options to allow operation with most other S100 bus mainframes, including those with front panels. (These require slightly different S100 bus control signals — so much for a "standard"). On a card using the Z80, much of the logic is dedicated to expanding the processor control signals to suit an older design. With such a radical new design as the Horizon, North Star must have been tempted, following RAIR, to abandon the S100 bus and use a simpler, cheaper construct. In the end, moving much of the standard I/O circuitry to the motherboard, and retaining the S100 bus for other cards, has achieved a compromise.

As well as the CPU, the processor board supports an on-board ROM option, auto-start circuitry and vector interrupt handling. The ROM



Horizon System at Interam

option uses a 2708 EPROM (1KB) with jumpers to select the address anywhere in the 64KB address space, but on a 1KB boundary; e.g. 53KB but not 53.5 KB. This does not appear to be used on the HORIZON, since the Bootstrap loader is in ROM on the disc controller card. It's obvious use is for interrupt routines.

The auto-jump circuitry is *superb*. Activated either by power-on or by the reset button, the circuit causes a full 3-byte Jump instruction to be executed. This allows the start address to be located at *any* address in the 64KB range. It doesn't use an RST instruction (as do most systems) which then requires 3 bytes of ROM to store a Jump instruction for full range of start address. The actual start address is jumper selected on one of the "headers" plugged into the card, E900H for the standard North Star Bootstrap.

"Vectored interrupt" is a slight misnomer. Remember that the V10 to V17 lines previously discussed only *request* interrupts. This CPU board provides corresponding action. Whenever the CPU issues an Interrupt Acknowledge signal, the logic on this board detects the highest priority interrupt request line which is active and uses this to "jam" an equivalent one byte RSTn instruction (RST 0 — V10, etc), causing a branch to location 8 x n. The Z80 is capable, by setting an internal register, of providing full vectored interrupt, responding with unique branch addresses to 256 interrupts by "jamming" a 1 byte vector address, rather than the simpler single byte RSTn instruction. This is not used, obviously to retain 8080 compatability.

The CPU board provides a facility for inserting wait states to enable the 4MHz Z80 to be used with slower memories. The EPROM on the CPU card automatically uses Wait states, if used.

The system I tested was supplied with two 16KB Industrial Microsystems static RAM boards — real industry standard workhorses. I have also used a system with North Star's own boards. These boards have had a chequered history and early delivery problems of the Horizon were largely related to these boards; now I hear all problems are resolved.

The North Star RAM boards I checked were more interesting. They used 16KB dynamic, 200 nanosecond access time RAM's using a 4 x 8 array of 4KB chips with on board refresh so as to work with Z80 or 8080 CPU's at full speed. There were also spare sockets for further chips to extend the word length from 8 to 9 bits. This card then provided parity check logic so that error checking at run time could be implemented as a further option. The card also supported bank switching logic. For those readers who have not met this technique, *bank switching* is a crude form of memory management. A card is made inactive unless selected. In this way multiple cards can share the same addresses, so that on one program can run in one physical memory, while a separate program, using the same address, can run in another physical memory. This will greatly accelerate the availability of multi-programming software. The multi-programming executive controls which bank in associated with which program. The selection mechanism is controlled by allocating an output post, appropriate bits of which select one of eight possible cards. This I/O port detect logic is built onto the North Star boards. In principle, such a computer could now support 8 x 64KB memory, although the CPU can still only use one 64KB space at a time. The boards also supports an optional "phantom" control so that ROM addresses can be overlapped with RAM addresses, e.g. Bootstrap. I have reliable information that a 32KB board is due for release.

There are two disc controllers available for the Horizon, a single-density and a double density. Both use the same Shugart SA400 drive. An existing single density system can be field upgraded by replacing the controller card. I was warned that there may be some selectivity in drives supplied, but this sounds a little far-fetched. Possibly newer drives are upgraded on the originals. However, we transferred the double-density controller to our old ALTAIR system with no problems.

The single density controller is the old-established product on which North Star made their name. The new one is also a single card, still constructed from MSI chips rather than a LSI controller, but a totally new design. With this new card the software can set the drive up to handle *both* double and single density recording. Thus a utility is available to read a file or a complete disc recorded on an old single density diskette and write it double density. Double-density is achieved by doubling the recording density on the diskette. The diskettes are still hard-sectored with 10 sectors per track, 35 tracks; each sector now stores 512 rather 256 bytes. Since the recording density is doubled, the bit transfer rate is also doubled. This will however only give a marginal improvement in response times, since head positioning times and rotational latencies are still the same. The new controller supports four drives, compared to three on the older systems.

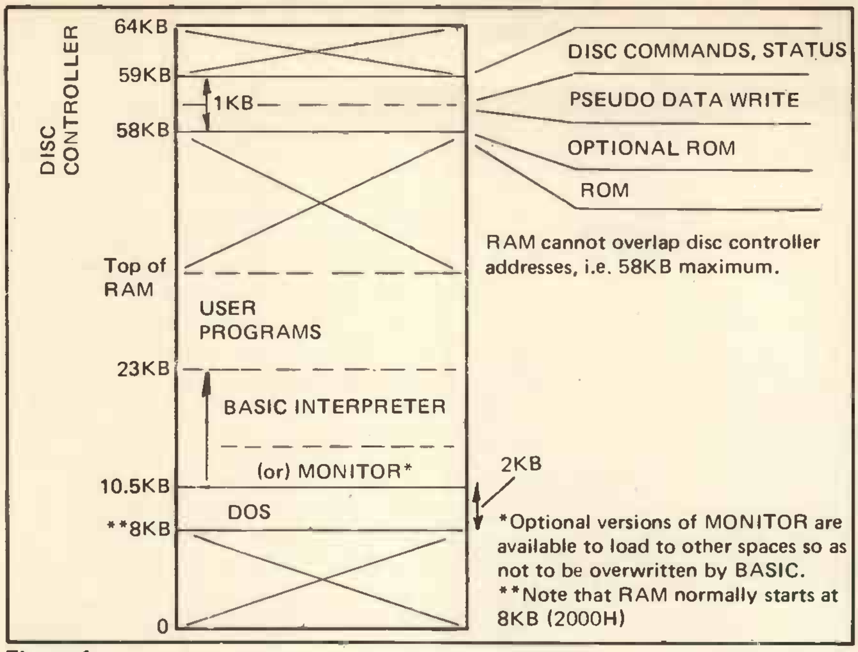


Figure 1.

Both controllers have the Bootstrap program and basic disc drive function software fitted into ROM's (not EPROMS) on the card.

System Software

The North Star software is best described as adequate. As far as I am aware it is reliable, but is nothing like so refined as the de-facto industry standard, CP/M.

As previously mentioned, the disc handling "primitives", e.g. load head, move to specific track, etc, and the bootstrap loader, are permanently stored in ROM's on the disc controller card, as indicated in Figure 1. The disc controller uses memory mapping techniques, effectively occupying 1KB of address space starting from location E800 H (58K); this start address is determined by a ROM on the controller card, not jumpers; and is fixed in all North Star software. The controller software however is most intriguing. The older controller supported a 256 byte ROM program at E900H; the new one is for some reason moved down to E800H. Writing a data byte to the controller is achieved by issuing a pseudo-read operation with address EAxxH; when the EA position of the address is detected, the other 8 bits of the address, xx, are copied into a shift-register and the controller disc write operation initiated. Similarly, reads to locations EByyH cause the byte yy to be interpreted as one of a set of commands to control the diskettes. This simple technique means that software need only set the EA or EB in CPU register D and the data byte into register E, and execute a memory read instruction (LDAX D) ignoring the data returned to the accumulator by the instruction.

Status words in the controller are also treated as memory addressed locations, as is the data read port.

The standard system diskette contains a disk-operating system (DOS), which is loaded into memory by the bootstrap operation. DOS utilises the controller primitives to provide a user-orientated interface to the system by interpreting commands issued at a console terminal. DOS also supports a simple file structure so that units of software can be stored and retrieved by name (files) rather than physical track and sector addressing. DOS only supports allocation of consecutive sectors to a file, the size of which is therefore fixed when created, as opposed to the sophisticated sector allocation algorithms used by CP/M. DOS does however have a function for compressing files, rewriting them to reclaim spare sectors created by deletions. DOS is designed as standard to load into RAM starting at location 2000H (8K) to 29FFH; i.e. DOS occupies 2½KB. With normal systems the first RAM card can be set to start at 8KB. Lower address space would be used by any systems using RST instructions.

DOS can be used to load a MONITOR program to give enhanced terminal features such as direct display and changing of memory locations. The Monitor program is 2KB big. The standard version loads from 2A00H, immediately above DOS. Alternative versions are available to load into other locations so that, say, the Monitor and BASIC could both be resident in RAM.

BASIC is the other main North Star software product. This also loads above DOS from 2A00H and is about 12.5 KB big. Any RAM above address 23KB is used for BASIC programs. (N.B. Don't waste 8K of your RAM by starting it at location 0 unless you need the bottom 8K for some specific reason.)

North Star BASIC is of a reasonable standard, but no better. What is implemented appears to be well done, but compared to say MITS BASIC it has a low level specification. In earlier versions, to save a BASIC program a file had to be previously created. If you had forgotten to do so, you had to exit BASIC and return to DOS, create a file and then use a DOS Command to restart BASIC. This has now been incorporated into the new version of BASIC.

The weakness of the BASIC lies in two areas, string handling and file handling. The file handling is related to the simplicity of the DOS file structure. Random files for instance have to be accessed by computing the position of the first byte in the record. Although there have been improvements in the latest version it leaves a lot to be desired for, say, commercial applications. String handling barely exists. String lengths are determined the first time they are involved in an executed statement and cannot be changed later. Different versions of BASIC are available with other than the standard 8 digit accuracy arithmetic on special order. Both integer and floating point variables are not supported. North Star BASIC also uses a variant of the FORTRAN style print formatting rather than the more common "PRINT USING" technique.

On the plus side North Star BASIC supports calls to machine code routines and multi-dimensional arrays. The best feature, however, is a multi-line function, allowing input variables to be changed with each call to the function as in a proper FORTRAN subroutine; BASIC subroutines use the same variables as the main program. By use of a PRINT # n type of statement one program can read and write to multiple terminals, but not multi-user BASIC.

DOS is quite modular in construction so that special user I/O routines for individual terminals can easily be incorporated. We were able, for instance, to add a line printer driver which supported a Diablo daisy-wheel printer, through our own S100 bus parallel interface card. Thus, since BASIC (for instance) uses DOS I/O facilities, the Diablo could be used as a line printer by Basic programmes.

There are two quite different versions of DOS for the single and double density systems. We are very conversant with the single density version since the drivers for the North Star controller are an integral part of our word processing system.

Imagine our surprise (and chagrin) when we found that the controller was completely different and our software had to be upgraded on the new system. Some routines which were in ROM on the controller card are now embedded in DOS. Obviously, if one buys a new controller, the new version of DOS comes with it. All interfaces into DOS (BASIC for instance) are still compatible. One feature of the new DOS is the ability to run single or double density, including a utility to read old DOS diskettes to new double-density versions. Single density diskettes created by the new DOS will run under the older single density system.

Anyone who used the older North Star software will be aware that documentation was not their strong point! All is now changed with the Horizon. *The documentation is as good as any available on a microcomputer system* and is a major plus-factor for potential North Star users. The importance of good documentation cannot be overstressed.

The Horizon system has attracted numerous independent soft-ware vendors. A quick read through adverts in an American personal computer journal will reveal multi-user upgrade to DOS, Assemblers, Editors, etc. Far more interesting however is the implementation of CP/M, which leaves the way free for access to a variety of Assemblers, Compilers and other goodies. Lifeboat Associates have been offering CP/M for older single density North Star systems for about $ 150 for some time. I have just however obtained a version to run on the double density diskettes. A 90 KB diskette is rather limiting for real program development; but 180 KB, with a real file structure like CP/M, is *very healthy indeed.*

With the full MACRO assembler facilities, the Horizon and CP/M can make a good program development system. Note however that it will still not fully compete with the INTEL and ZILOG MDS products which, in addition to Assemblers, support high-level languages (PL/M, PL/Z, CORAL) and In-Circuit Emulation (ICE) hardware and software. An engineering department with a full MDS, however, can look to machines like the HORIZON with CP/M to expand their facilities.

North Star have announced that they will shortly be releasing their own implementation of PASCAL.

Conclusion

The product is well produced, well priced and above all well placed in the market. It does not attempt to compete with COMMODORE in the simple system market. Conversely anyone seriously considering diskette systems will find that this product is probably cheaper, and certainly better packaged than, say, a PET with add-ons. The main competition comes from established market leader, PERTEC (formerly MITS) although they tend to be further upmarket still at the moment, and possibly also from VECTOR GRAPHIC, using the intriguing Quad density MICROPOLIS diskettes. In the UK, RAIR with the BLACKBOX, and RESEARCH MACHINES with their new BASF diskette system, are both more expensive, but include more extensive software (CP/M for instance is the standard RAIR Operating system).

I am still to be convinced that minifloppies are man enough for commercial applications, in which area I prefer the potential increased reliability of 8″ diskettes. The 5″ system, particularly since the disc drive can be integrated like in the HORIZON, are however much cheaper. We shall see.

With specific reference to the Horizon, the software supply, particularly because of the high quality documentation, is excellent for general purpose use. For commercial applications, however, an upgrade to CP/M and BASIC-M is needed to get the superior file and string handling.

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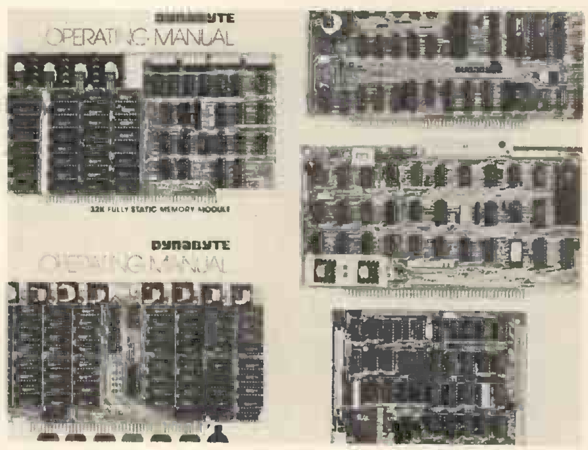

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SO, I GOT A WORDPROCESSOR

Edward P. Hawthorne

My computer and I are in a state of armistice. We have stopped fighting each other but are not yet at peace.

It all started just about a year ago. I felt that wordprocessors had reached a stage of development when it would be worthwhile investigating whether they could help me to do some of my work more effectively.

Much of my work results in reports, occasional articles and, even more occasionally, books. Hitherto, these have been dictated although I prefer to write direct so that I get immediate visual feed-back of previous sections. The original manuscript then goes through two or even three stages of correction and retyping. Initially, the alterations are extensive but the penultimate version needs only minor correction and, of course, even the final version often has some typing errors.

All this results in a great deal of unnecessary typing and delay — quite apart from cost.

As a first step, I taught myself to type using all my fingers in the conventional method. As yet, I do not touch type too accurately, and even my present efforts are shot through with errors. However, my secretary could read the corrected first draft more readily than when it had been handwritten, and much time was saved.

The next step was to produce the finished report using my input corrections only, so saving someone else the trouble of retyping perfectly good sections and paragraphs. This can often be done with scissors and a good copying machine but it is still a time consuming business. Could a wordprocessor speed up the whole process and even enable me to produce the final version?

Ideally, what I wanted was to be able to think straight onto a keyboard, make substantial alterations to the text, correct the spelling and other minor mistakes easily, store the text for subsequent alteration and then produce a good quality print-out. In other words, be able to interact directly with the machine.

Specification

At this stage I began to prepare a specification. It was clear that my basic requirements centred around two types of product:

REPORTS, running to upwards of 3 or 4 pages of A4 size; both single and double-spaced; having very heavy rewriting during the initial preparation; going through two or three phases of alteration; and needing good quality typeface for the final version. This would cover the requirements for other types of general script, for example for publications, although the printing quality could be lower.

LETTERS, usually not exceeding a single A4 size page; having some rewording but mainly requiring correction of typing errors and lay-out to produce accurate finish in good quality print. Letters were most unlikely to be repetitive, although there would be some standard phrases, and a hard copy would always be needed for filing.

I then expanded this into a more detailed list split into four phases:

1. **Necessary straightaway, such as:** i. Upper and lower case. ii. Alter characters. iii. Insert and delete. iv. See as much of an A4 page as possible and be able to recall up to three previous pages without delay. v. Underline.
2. **Desirable but not immediate, such as:** i. Store deleted paragraphs temporarily. ii. Number pages.
3. **Expansion of system into other uses, such as:** for accounting records, address filing, calculations and graph plotting, etc.
4. **Long-term, such as:** linking to Prestel.

In all, there were twenty-five items in the list but these were modified as I went along. Even now, I still come across items that should have been included — not that I would necessarily have finished up with a different system!

Working out this initial specification is a vital exercise for any prospective user. It not only prevents one being bemused by all the goodies on offer but focuses attention on the most important element in a wordprocessor — *namely, that it is a man-machine system.* Both you and the machine should be able to change your respective ways of working. If you won't adapt, you will not get the best out of the machine. If its facilities cannot be altered you will most certainly work inefficiently, and probably get very frustrated.

The Hardware

With this specification in my hand, I started to look around the market. The microprocessor exhibitions were of great value in giving me an overview of the current equipment, although I rapidly reached a state of mental indigestion and confusion.

One thing was immediately obvious. I couldn't afford even the simplest standard office model which all secretaries will shortly be clamouring for.

I then decided that the only thing to do was to try and cobble a system together. In this, I have been encouraged and enormously helped by an enthusiastic band of experts. Just as well! Apart from attending a course on Algol fifteen years ago, I knew nothing about programming and not much more about microprocessors.

An important factor in reaching this decision was the cost of a printer. Many people, starting on a new project, tend to concentrate on the innovative part of the system and forget about the apparently conventional items which must be included. Despite the obvious attractions and apparent cheapness of the computers, I started from the *other* end of the system, arguing that if I could not get the right kind of print-out at the right price, I might as well forget the whole exercise.

Matrix printers were ruled out because they did not give the full depth of print I required. This appeared to be obtainable only with the golfball or the new daisy wheel types of printer. The new price of these printers was equal to or more than 75 per cent of the whole of the rest of the system. However, IBM golfball computer typewriters have been coming on the secondhand market steadily for some years and are available at, by comparison, a ridiculously cheap price — provided you are prepared to take the risk inherent in mechanical wear and tear. Most of these machines have been used in accounting computer systems and have usually been worked pretty hard.

I decided to take the gamble. Here again, I was greatly helped by the genuine interest of two or three people. My machine appears mechanically to be in good condition; it was well overhauled; the solenoids and wiring were good and it proved to be a straightforward job to add the interface circuitry.

Having settled on the printer, my next step was to look at the computers. Finding my way through this jungle was quite an experience. M6800, Z80, SCAMP; MSI, SWTP; S-50 or S-100 bus; cassette or disc; ROM, RAM, EPROM. Signs of the zodiac — full of mystery and all pointing in different directions! Of one thing, no-one was in doubt. There is a much better chip, board, system 'round the corner'. Bound to be cheaper too.

To some extent the jungle dissolved of its own accord. I needed a fair amount of software in order to meet my specification. In the end, I discovered that there was no option but to go for a system capable of using the TSC software. At that time, this was the only wordprocessing programme sufficiently developed to meet my needs.

This committed me to the M6800 standard. My experiences are therefore coloured by the limitations imposed by this system and, no doubt, some of the problems which I encountered would not be present in other systems now coming on the market.

Cassette or disc? This was a difficult decision. I plumped for cassette mainly because I really had no clear idea of what I would need in the way of 'off computer' memory and storage. Cassette was cheaper, and I thought that it would give me time to learn how to use the system as a whole and gamble on discs coming down in price. But it did lead me into some irritating trouble and still unsolved handling problems.

The complete system comprises a MSI 6800 computer with 24K RAM, a Newbury VDU with integral 96 ASCII character set keyboard giving 24 lines of 80 characters, an IBM 735 typewriter and a cassette tape recorder. The software is based on the combination of the TSC Text Editor and Word Processor programmes. The purchase and setting up of the system was organised by Tim Moore of NewBear. Throughout, he and his colleagues have provided marvellous service and responded cheerfully to my plaintive cries for help. I trust that others who may be tempted to fall for wordprocessors get as good service from their suppliers.

Came the great day. Although I had tried the system out before installation in my office and I had some notes on what to do to make it go, I immediately fell into the first of a series of traps set for the micro-beginner . . .

Everything was powered up; I typed the start instruction — and nothing happened. Suddenly, I realised that I hadn't set the recorder to play. Press the switch — still nothing happened. I began the routine all over again — and again. And then I pressed the wrong switches and wiped out part of the programme on the cassette.

Since then, I have written out a set of checklists and follow them through carefully each time. Well, more or less, and when I don't check I frequently make a mistake!

This, of course, is all part of the learning curve. I had not expected to learn quickly but, equally, I had not anticipated that it would be so difficult to comprehend the manuals. Despite my attending a microcomputer familiarisation course at my local technical college, I quickly found that the manuals were written by experts for experts.

I also suffered my fair share of hardware problems. Computer failures consisted of: a fault which developed in the cassette interface circuit, the complete failure of the processor voltage regulator and a failure of one chip in the 16K RAM board. The latter was more nuisance than disaster because I could still use nearly half of the memory until I got a new chip.

Initially, mains interference frequently corrupted the main processor programme. Worst was caused by the typewriter, especially when switching off. But a more difficult interference to trace was that coming through the mains circuit. These interferences have been overcome by fitting separate filters to both the typewriter and processor.

The Cassette tape recorder caused the most irritating problem of all. This was a £30 new machine, with remote control and counter — apparently perfectly good. First, its mains transformer failed and had to be replaced. Then some other untraceable fault appeared, together with a loose screw! But even when it was working it would neither record perfectly nor play back without corrupting the data. For a long time we suspected the interface and spent many hours checking it out, trying spare interfaces. We also tested different types of tape.

The recorder problem became even worse after we raised the data rate to 600 baud (see below). It was then I discovered that the frequency response of this recorder was limited to 6000Hz. Changing to a recorder with a response up to 13000Hz has

```
.NR A Ø                          Consecutively numbered sub-sections.
.NR B Ø
.AU +1
.DM IA                           .IA  Arabic numerals starting at 1.
.SP                                         Left margin at column 8.
.LM 8
.LN 47
.AR
.IF !#+A-9 .SA
.IF #A-9 .SB
..
.DM SA
:SI -5
 #A.
..
.DM SB
:SI -6
 #A.
..
.DM IB                           .IB  Roman numerals starting at i.
.SP                                        Left margin at column 15.
.LM 15
.LN 40
.SR
:SI -7
 #+B.
..
.DM EI                            .EI  ALWAYS TYPE TO END INDENTS
.AR                                    Puts line length back to 55,
.SP                                    left margin and indents to 0.
.LN 55
.LM O
.IN O
..
```

Fig. 1. Sample of Macro Sub-Routine for numbering Sub-Sections.

```
I then expanded this into a more detailed list
split into four phases:
.IA
Necessary straightaway, such as
.IB
Upper and lower case.
.IB
Alter characters.
.IB
Insert and delete.
.IB
See as much of an A4 page as possible and be able to recall
up to three previous pages without delay.
.IB
Underline.
.IA
Desirable but not immediate, such as
.NR B 0
.IB
Store deleted paragraphs temporarily.
.IB
Number pages.
.IA
Expansion of system into other uses,
such as for
accounting records,
address filing,
calculations and
graph plotting,
etc.
.IA
Long-term, such as linking to Prestel.
.EI
```

Fig. 2. Section of Text as actually Typed In

cured the problem. It is often said that cheap tape recorders are good enough for computer use. This may be true if you don't mind some errors, but when you want accurate data handling day-in and day-out, my experience suggests it pays to use a recorder having a high-grade circuit.

The typewriter has functioned well so far, except for one occasion, when it seemed unable to respond smoothly to the input signals. Consequently, it overprinted and sometimes refused to change to upper case. This was solved with a touch of oil applied to the right linkage. Hence the warning above to be careful that the moving parts are not badly worn.

Software

The wordprocessing software programme consists of four parts:

- The Text Editing System developed by Technical Systems Consultants and marketed by South West Technical Products whose UK distributor is Computer Workshop in London.
- The Text Processor also developed and marketed in the same way as the Editing System.
- Software for linking the above two programmes, developed by Ed.Smith's Software Works in California.
- A set of sub-routines written specially for my system to organise the peripherals and link all the software together.

The general arrangement and capabilities of the TSC Editor and Processor programmes have been well described by Charles Sweeten (PCW Feb. 1979 Vol. 1, No. 10, p34-37).

The Text Editor is essentially a line processor. That is, it deals with the text line by line. Hence, one can insert and delete lines; move, copy, replace one or a block of specified lines; find, change or delete characters or strings of words; use tab settings; and so on.

After all is written and corrected, the typewriter will print out an exact copy of what is on the VDU screen. Thus, a text which has been subjected to extensive alterations will probably require considerable retyping if the print-out is not to look very scrappy.

The Text Processor does all the cleaning up for you. It takes your scrappy lines and fits them neatly into lines of specified length with left and right justified margins; automatically spaces out your lines and paragraphs; types only your specified number of lines per page; places your titles on the right, centre or left — e.g. addresses to the left and the date on the right; and so on.

It is perfectly possible to use the Editor programme alone for a large range of work, such as audio or copy typing, in which only minor corrections to the text are required and one can accept the appearance of the output as from a normal typewriter.

The advantage of the full processor programme is the capability which it provides to make major changes in the text, and to produce a pre-determined lay-out on the page.

The real power of this software, however, lies in the scope that it gives the user to devise his own set of programmes which can then be defined by a single command. These are called 'macros' and are typed in as, for example, ".DM IA" which in my system will call up automatic indentation and indexing in arabic numerals of sub-sections of the text. An example of such a sub-routine is shown in Fig. 1.

Fig. 2. shows how the numbered sub-sections of 'Specification' above were actually typed in. Note that it was only necessary to type the commands ".IA" and ".IB" to produce the correct numbering in arabic and roman numerals, the indexing and the line spacings. (Perceptive readers will notice that this sub-routine does not produce the most desirable lay-out; it is good enough for my purposes).

Fig. 2. also illustrates the point referred to above concerning the tidying up of scrappy lines. The subsection "Expansion of system . . . graph plotting, etc." is shown as it might appear on the screen following very heavy correction and alteration, using the Text Editor programme only — several lines of short and erratic length. The great advantage of using the Wordprocessor programme as well, is that it sorts all this mess out automatically into the correct line and page lay-out.

Even this simple macro took me some time to work out correctly and I have a long way to go before I have fully mastered all the possible functions offered by these programmes. The command routine which I have compiled to process letters and reports, such as this article, uses 17 macro sub-routines and contains a total of 121 commands. From experience, I can echo Sweeten's comment that "if you intend to do something else which is not very simple indeed, then you would be wise to obtain help, or expect to take some time in mastering the difficulties".

The length of the learning curve should not be underestimated although, in my case, some of the difficulties which I encountered were partly of my own making. My computer is a system for work and I used it as such from the very first day. Consequently, I spent too little time in mastering the subtleties of the software. For a long time, my failure to devise an efficient method of operating caused me considerable frustration but, gradually, the machine and I reached a compromise. Provided I use my checklists, it will get on with its bit of the work without interfering with mine!

No wordprocessor programme will cover everybody's requirements. As yet, I have not got a fully satisfactory method of underlining. This involves backspacing the typewriter and problems arise in organising this move properly under certain conditions. Nor does there seem to be a satisfactory way of breaking a line into two separate lines without retyping one part of it. No doubt these deficiencies will be overcome in due course; but their presence emphasises the importance of drawing up as full a specification as possible before commitment to either hardware or software.

Using the System

My wordprocessor is used virtually daily although the number of hours per day varies widely. The computer itself is rarely switched off. It is worth drawing attention to four of the lessons learned from the experience so far.

Checklists

It may be particular to my set-up that I have found that it is essential to use a checklist for getting the system going, feeding in the programmes and, especially, for finding what to do when I have made an error. When the typewriter is busily banging its head against the end of the carriage and refusing to stop or the cursor won't to back to reset, it is a great temptation to panic and press all the buttons and switches in sight.

Gradually, I have evolved a checking method using lists of actions and flowcharts. The former make sure that I follow through the correct sequence. I find the flowcharts of most use in tracing through what action to take when the machine has apparently decided to do its own thing.

Productivity

Having got over the settling-in period of the learning curve, I have started to think about productivity improvement. There are three aspects: the machine, the human and the man-machine combination. So far, I have really only tackled two issues: one for the machine and the other for me.

The computer interface rates were originally set at 300 baud for transmission between computer and tape recorder and between computer and VDU screen. This rate corresponds to about 30 characters per second. Although it took 25 minutes to play in the main processor programme, this was only necessary every few days. The rate at which the display appeared on the screen was well over my typing rate and I was not unduly concerned at the leisurely way the lines scrolled up the screen on a print-out; I could read them as they appeared.

The rot set in when an expert pointed out how slow it all was and that both computer and VDU were equipped with a set of switches to speed things up. The result is that now the computer-tape recorder rate is 600 baud and the computer-VDU works at 9600 baud.

The latter change has really paid off. The display appears virtually as a line at a time and is up the screen too fast to read. The snag is that an extra action has been introduced — the comptuer has to be switched from the one speed to the other and, of course, I sometimes forget to do so prior to recording my work on cassette! Nevertheless, my advice to would-be users is to go for the highest transmission rates you can get with accuracy.

The second aspect of productivity which I am beginning to tackle is my own efficiency — first of all, by standardising lay-outs so as to make maximum use of the macro facilities and, secondly, by evolving a filing system.

In filing, one problem is to locate a section of the text which I have already typed into the computer memory without having to go through the whole input. The "Find" instruction works splendidly but I cannot always remember the right keyword so I usually make a note also of the main line numbers for different sections in the text.

A more serious problem is to locate a file on the tape. At present I do this by using the counter on the cassette recorder. This is satisfactory when there are only a few files on each tape but I realise that the time is coming when a piece of software will be useful in reducing the time spent in finding and playing back a specified recording. Perhaps by then, I will have my disc.

Ergonomics

This is a man-machine issue and is one which I have not yet tackled in detail, partly because there are some aspects about which I can do little anyway at this stage.

My screen and keyboard are in one unit. I am coming to the conclusion that it would be better if I could angle and locate them separately. I use bifocals and actually find it easier to read the text on the VDU without my glasses. Others might not be able to do this and would find that the bifocal division tends to come in the middle of the screen.

This, of course, is partly related to posture and the type of chair used. These are very much personal factors but should not be overlooked when considering the physical layout of the system.

Another aspect of the lay-out is the availability of the switches, typewriter, cassette file and recorder. It is essential to have some of these within easy reach but I have found it beneficial to have to get up every now and then and move around.

Other Applications

Obviously, my system is capable of greater things than mere wordprocessing. It could handle many of the chores in a business or home. It could do accounts, do calculations and, no doubt, be linked to other computers. It could eventually receive information from Prestel or other databanks. Maybe, I will use it for games; and my wife for planning her shopping.

So far, however, I have done none of these things except to find out how to input a character onto the screen and add simple numbers in hex! Getting software adapted and working is time-consuming and I have serious doubts as to whether I will ever master the technique of writing my own programmes. My next step, therefore, is to investigate the "Basic" software and see what that can do for me.

In due course, we may be able to buy programmes from bookshops or borrow them from libraries. Meanwhile, it is worth joining the network of enthusiasts, such as the ACC, who are always willing to take an interest in one's problems and to whom, in turn, one can often contribute ideas and experiences.

Conclusions

The user has a great deal to learn about wordprocessors. It is therefore very important before purchase to draw up as detailed a specification of one's requirements as possible. After purchase, one should be prepared for a long learning curve and adaptation of one's method of working.

As a result of my own experiences, I am undertaking a survey of users' requirements. The intention is to assist potential users to prepare their specifications and I hope that readers who already possess or operate wordprocessors will send me details of their own needs and experiences.

It is some measure of my own satisfaction with wordprocessing that I resent my system being out of action. I find it extremely frustrating to have to go back to working with a perfectly good spare electric typewriter. It is noisy and I am much more jittery about making typing mistakes. It is so much easier to correct them on the wordprocessor.

For potential users, I would briefly summarise my conclusions on this project as follows:

Make sure you have some good friends who can help you to get sorted out on software and who will be able to maintain both it and your equipment. User groups can be very helpful.

Work out what you want your system to do but don't be afraid to change your ideas as you learn more about it all.

Be prepared for a long learning curve. If you have never been near a computer, attend a course on the fundamentals of the hardware and programming. This at least will give you the jargon and probably help you to get more out of your system.

Make sure the operating instructions are well written and easily used. Computers can be like aircraft. They both crash if their operators don't follow the book.

PCW *Edward Hawthorne is the author of "The Management of Technology", published by McGraw-Hill Book Company (UK) Ltd. Good as general background reading for engineers, scientists and technologists, it has some genuinely original insights.* PCW

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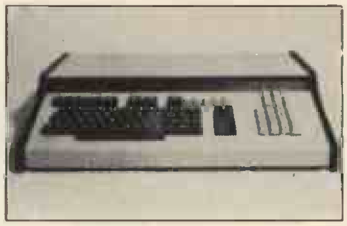

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MK14. PSEUDO RANDOM NUMBER GENERATOR

On your mark, get set

Clifford Clark

This article brings into use the control features demonstrated in the previous MK14 experimental and diagnostic programs (PCW May '79). Part of the read only memory (ROM) is brought into use and incorporated in the program. Other useful information about the MK14 microcomputer circuitry (hardware) and its relationship to the program instructions (software) is demonstrated and explained.

The program is purposely written in the sledge-hammer style, i.e. short cuts such as auto-indexing and like memory space saving features are not used. This enables new-comers to visualise clearly the various sequences separately.

The MK14 Manual contains a listing of the monitor program. This is resident in the fixed part of memory and is essential for loading and running programs. Because it is fixed or permanent memory it cannot be changed or written into but only read from therefore it is designated 'read only memory, (ROM). To beginners, this fixed region of memory might appear to be forbidden territory, but this is not the case. Any part suitable for a user program can be read and used as required. Take for example the section of ROM which indicates "Error" in the display. On page 43 of the Monitor listing the starting address for this routine is location 0083. This could be read into any user program to show a wrong procedure.

Digital computers only process ones (1) and noughts (0) so it is necessary that some arrangement be made to convert these ones and noughts into decimal and hexadecimal notations.

The CROM routine listed on page 44 of the MK14 Manual is available for this task. In the Pseudo Random Number Generator program which is developed in this article, use is made of the part of the CROM 'Hexadecimal Number to Seven Segment Table' which deals with the decimal numbers (0-9). This table converts 4-bit Binary Coded Decimal (BCD) numbers into the appropriate 8-bit code to be able to display the number in a seven segment LED unit. This conversion is explained in detail in the program commentary.

Getting the Program Essentials Together

At the start the specifications are listed. This is done by first stating the objective of the program. When this is stated other questions will then arise and further requirements will become obvious. For example: 'Has the program to be started from a particular address each time a result has been obtained?' or 'Is it to be a looping program with key or external interrupt control?' etc. The general outline of action is then sketched out as a block diagram (algorithm). This is an essential step

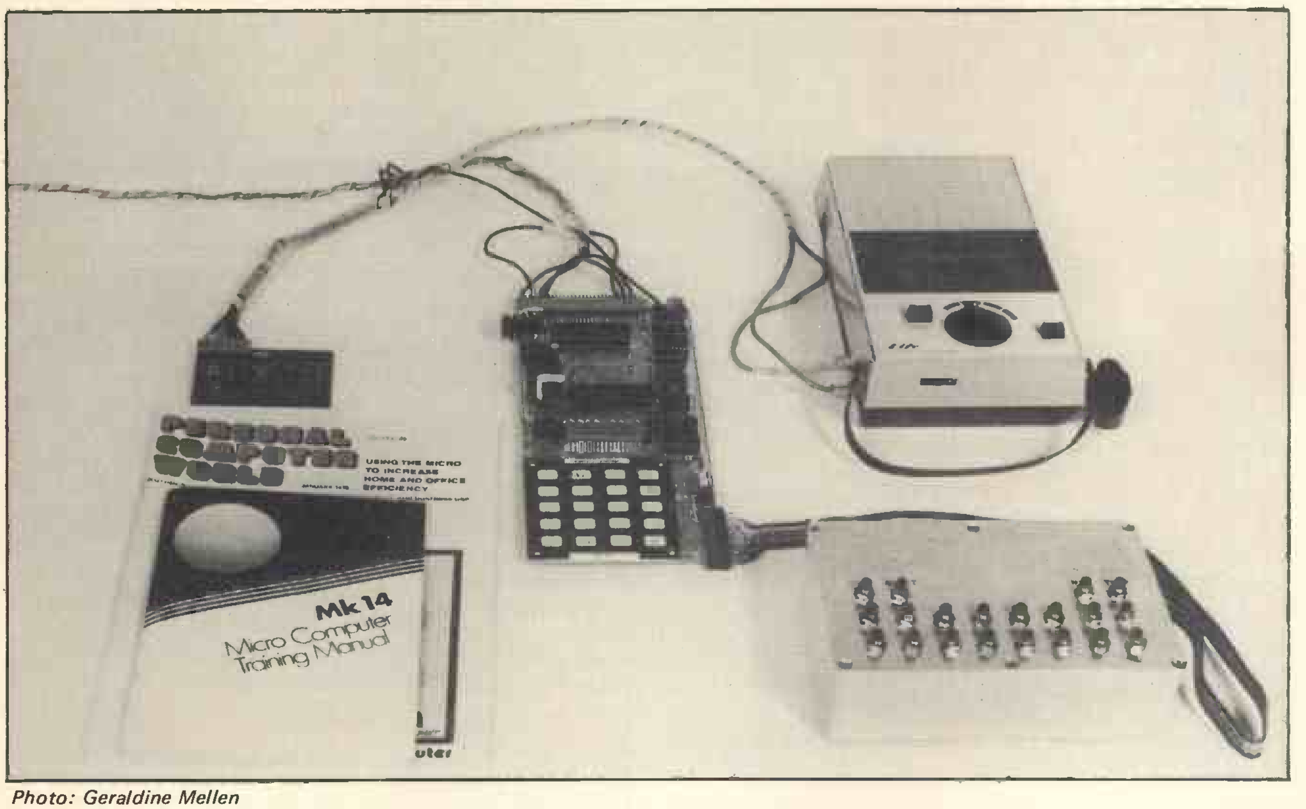

Photo: Geraldine Mellen

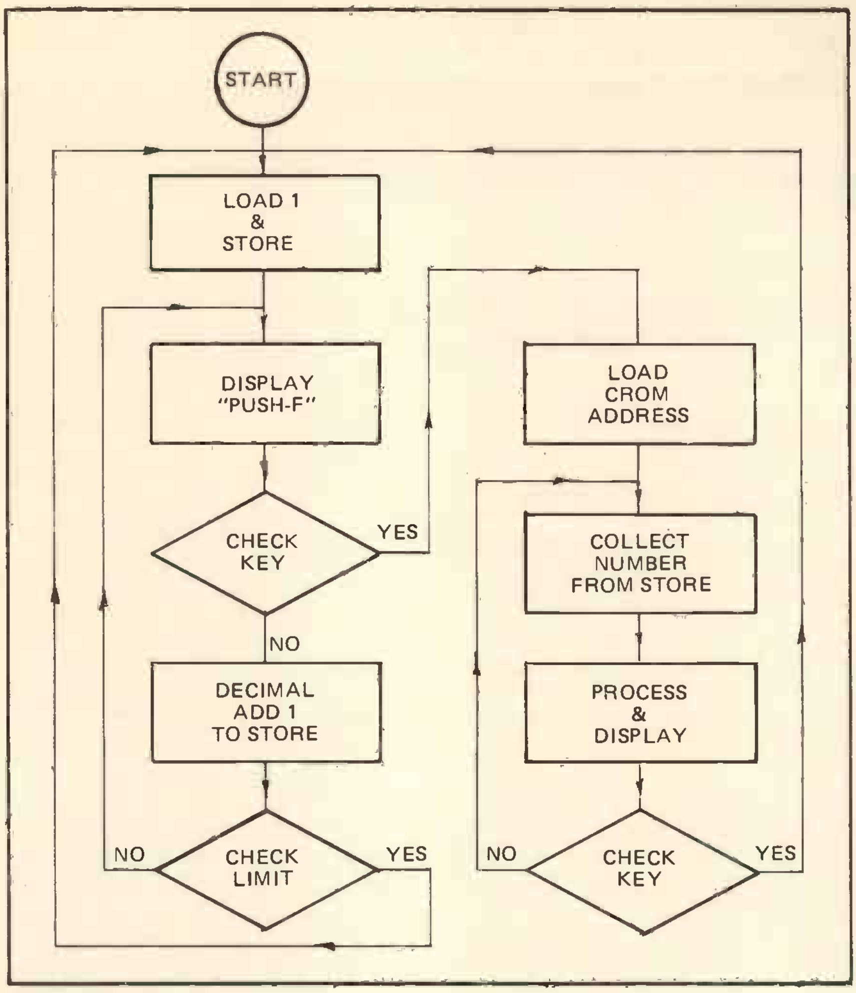

Figure 1.

which saves time because it enables one to get the program steps in the correct sequence.

The PRNG program ideas were listed this way:—

Basic objective . . . produce random number of two decimals.

Output . . . number displayed in LED units.

Number Generator action . . . simple count up to maximum set.

Additional requirements . . . display legend in counting loop.

. . . stopped by one designated key.

. . . restarted another designated key.

A block diagram was then drawn and altered until it became obvious which sections preceded and which followed. The final result was the algorithm shown at Figure 1.

With the algorithm finalised it was then a matter of deciding on the location in memory and the starting address. The MK14 basic kit was being used, so location OF2O was chosen to allow a few vacant memory spaces in front for possible future modifications. This is always good practice even though the end of the program might not be in sight!

PRNG Program Commentary

The starting address is location OF2O and the first four bytes load number one into the accumulator to start the count up and then store it in location OF58.

The next six bytes put the display address into pointer register No. 3 so that it is available for displaying and also the key sensing actions. Reference to the algorithm indicates that the display legend instructions are next and this requires twenty four bytes to display "PUSH-F". Each seven segment byte code appropriate to the required letter is loaded and then 'sent to' or stored at the display address ranging from ODOO to ODO7 (if all locations are used). A full table for the alphanumeric codes was shown in the MK14 article PCW May. The bytes OF42-OF45 seem to be of no apparent use and a waste of memory space but they are essential in this program to prevent a spurious display. If key sensing instructions immediately follow a display instruction in the MK14 microcomputer it is necessary to make sure that the display latching circuitry has returned to zero state. To appreciate this particular effect, when the program has been loaded and running correctly, omit the latch zero instructions by substituting O8 (no operation) in locations OF42-45. There are other ways around this 'ghosting' effect but the main aim of this program is to keep it simple so that each separate action can be easily visualised.

OF46-OF4B are six bytes used to check for key F action. This is carried out by loading the contents of the key address into the accumulator and then the contents are exclusive OR'd with the code EF.

So the initial program listing started off:—

OF2O	C4	Load immediately into AC
OF21	O1	Decimal number 1.
OF22	C8	Store number in AC at
OF23	??	(displacement calculated later)
OF24	C4	Load
OF24	C4	Display address
OF24	C4	into
OF24	C4	Pointer register
OF29	33	number 3.
OF29	33	number 3. etc.

Where displacements are needed, leave blank until the full program is laid out and then remember that all calculations are from the memory address containing the displacement number to the referred address WITH THE EXCEPTION OF TRANSFER INSTRUCTIONS (JUMPS). Transfer is always to the address MINUS ONE of the location to be next activated. The overlooking of the minus one in transfer address calculations probably accounts for the most commonly occurring mistake (bug) in programming the MK14.

Key Control

The keys to be used in controlling the program have to be fitted into the instruction sequences. The choice of the designated keys is arbitrary and is the legend to be displayed. The key "GO" was chosen because it seemed the most appropriate to re-run a program. The key "F" for function seemed to suggest itself as well as being at the bottom right hand corner of the author's keyboard. Decisions like these are for the programmer to decide unless one is compiling to required specifications. MK14 users will gain good experience by altering the key control locations and forming their own display legend. The key location addresses and hexadecimal identifications for all keys were illustrated in PCW May. The necessary information for the PRNG is given in the program commentary.

(All key address contents are FF with no key action. F key down results in the change to EF) The result of the exclusive OR action is:—

Contents Loc.	No Key	Key F
ODO7	11111111	11101111
EF	11101111	11101111
Ex. OR AC	00010000	00000000

Therefore Zero AC signals Key F.

So the AC is tested for zero and if zero the program transfers to the display digits routine. If AC is not zero the program counter carries on to the next sequential instruction (OF4C).

These next six bytes instruct the processor to load another number one into the AC and DECIMAL ADD this to the number in the store (OF58). Note that the result of this addition is produced in the AC and therefore for this program the result must be re-stored. In other words, the current stored number is updated in the AC and re-stored back into its memory location. After this action the updated number is still left in the AC. So to check for the limit the AC can now be exclusive OR'd with the required number up to the set limit of 99. Note that if number 12 maximum is required (for double dice games) 13 will be the contents of OF53. That is the required maximum plus one. The result of the exclusive OR action is checked by testing the AC for zero. Zero means limit reached so jump back to start count at number one again. Not zero AC indicates carry on count up and so the last instruction in this routine is an unconditional jump to OF29 to take the next instruction from OF2A which results in continuing the count up.

Displaying AC Contents

In writing the routine to display the contents of the AC as two digits the requirements are that each digit (4-bits in AC) will require a display byte (8-bits) to switch on the appropriate segments of the LED unit. So each digit will have to be processed separately. The digits can be any in the range 0 to 9 so arrangements have to be made within the program to deal with all ten different display patterns. A table for conversion of the 4-bit binary coded decimal (BCD) number to its 8-bit display signal could be written into the program, but as this table is permanently resident in ROM it can be read and used as required. On page 44 of the MK14 Manual, locations O1OB to O114 contain segment bits for numbers 0 to 9. It is only necessary to load a pointer register with the starting address of this table and the required displacement number added to the pointer will load the AC with the required signal bits for the display.

The second routine starts at OF59 and the first six bytes load the starting address of the Character Table (Crom) O1OB into pointer register No. 1. The following two bytes (OF5F-OF60) load the BCD number stored at OF58 into the AC ready for processing. As stated previously, this will have to be done in two separate steps. When dealing with more than one binary bit it is necessary to be able to label them without causing confusion. The accepted form is to refer to them as 'most significant bits' (MSB) down to 'least significant bits' (LSB) reading from left to right (MSB11111111-LSB). The stored number now brought into the AC is ANDed with OF (OF61-OF62). This action cancels out the first four bits (4-MSB) and leaves only the last four bits (4-LSB). This number is then put in the extension register (E) ready for adding to the address stored in pointer register No. 1 as the displacement, thus selecting the 8-bit code from the Crom table. This is carried out by the instruction C180 which loads into the AC the contents of the address given by O1OB plus contents E. The store instruction CBO3 at locations OF66 & 67 displays the digit at address Ptr. 3 plus 3 which gives ODO3.

The Second Part

The second part of the BCD number processing deals with the other digit to be displayed. This is contained in the 4-MSB of the byte. The operation requires the reloading of the stored number into the AC and then shift the 4-MSB from left to right into the position previously occupied by the 4-LSB. (OF6A-OF6D shift right four times). As this is done zero's are automatically put into the 4-MSB positions; therefore there is no need for a repeat of the AND operation as in the first instance. Otherwise the reference to the Crom Table and the displaying instructions are repeated except that ODO4 LED is now used to show the second digit one display unit to the left of the first. Locations ODO3 and ODO4 were chosen to centralise the display.

The next step in the program starting with OF73 to OF76 is to zero the display latching circuits before testing for the GO key. The sequence for key checking is a repeat of the previous procedure except that the key address is different. The GO key down will switch the program to the counting routine address at OF2O. If no GO key sensed then the digit display loops continuously.

After working through this and the previous MK14 articles the beginner should now be conversant with display and key control actions and be able to write original software for the S of C Microcomputer.

```
MK14.PSEUDO RANDOM NUMBER GENERATOR PROGRAM.
CLIFFORD CLARK. JANUARY 1979.
STARTING ADDRESS 0F20. RANDOM NUMBER RUNS UP TO SET LIMIT AT 0F53.
MAXIMUM SETTING #99.  DISPLAYS "PUSH-F".
ON PUSHING KEY F NUMBER IN STORE AT 0F58 DISPLAYED AS DECIMAL NUMBER.
ON PUSHING KEY GO RANDOM NUMBER PROGRAM RUNS AGAIN.

0F20   C4
0F21   01     LOAD #1
0F22   C8
0F23   35     STORE #1 AT 0F58
0F24   C4
0F25   0D
0F26   37
0F27   C4
0F28   00
0F29   33     LOAD 0D00 PTR.#3
0F2A   C4
0F2B   71     LOAD "F"
0F2C   CB
0F2D   01     DISPLAY "F" 0D01
0F2E   C4
0F2F   40     LOAD "-"
0F30   CB
0F31   02     DISPLAY "-" 0D02
0F32   C4
0F33   76     LOAD "H"
0F34   CB
0F35   03     DISPLAY "H" 0D03
0F36   C4
0F37   6D     LOAD "S"
0F38   CB
0F39   04     DISPLAY "S" 0D04
0F3A   C4
0F3B   3E     LOAD "U"
0F3C   CB
0F3D   05     DISPLAY "U" 0D05
0F3E   C4
0F3F   73     LOAD "P"
0F40   CB
0F41   06     DISPLAY "P" 0D06
0F42   C4
0F43   00     LOAD 00 (ZERO AC)
0F44   CB
0F45   07     ZERO DISPLAY LATCHES TO PREVENT SPURIOUS DISPLAY 0D07
0F46   C3
0F47   07     LOAD 0D07 KEY F CONTENTS INTO AC
0F48   E4
0F49   EF     CHECK FOR KEY F
0F4A   98
0F4B   0D     JUMP IF AC ZERO(KEY F) TO 0F58(START DECIMAL DISPLAY)
0F4C   C4
0F4D   01     LOAD ANOTHER #1
0F4E   E8
0F4F   09     DECIMAL ADD 1 TO NUMBER IN STORE(0F58) RESULT IN AC
0F50   C8
0F51   07     RESULT INTO STORE(RESULT STILL IN AC)
0F52   E4
0F53   99     CHECK FOR LIMIT
0F54   98
0F55   CA     JUMP IF ZERO(LIMIT) TO 0F1F TO RESTART COUNT
0F56   93
0F57   D2     NOT LIMIT SO JUMP TO 0F29 & CONTINUE ADDING
0F58   ZZ     STORE
0F59   C4
0F5A   01
0F5B   35
0F5C   C4
0F5D   0B
0F5E   31     LOAD 010B PTR.#1. C-ROM ADDRESS IN MONITOR
0F5F   C0
0F60   F8     LOAD STORE INTO AC FROM 0F58
0F61   D4
0F62   0F     "AND" LEAVES ONLY 4 LSB IN AC
0F63   01     PUT IN EXTENSION REGISTER
0F64   C1
0F65   80     LOAD CONTENTS PTR.#1+ER(DISPLAY SEGMENTS CROM TABLE)
0F66   CB
0F67   03     DISPLAY LSB DIGIT 0D03
0F68   C0
0F69   FF     RELOAD STORE TO PROCESS MSB
0F6A   1C
0F6B   1C
0F6C   1C
0F6D   1C     SHIFT RIGHT 4 TIMES. 4 MSB TO 4 LSB
0F6E   01     PUT IN EXTENSION REGISTER
0F6F   C1
0F70   80     LOAD CONTENTS PTR.#1+ER(DISPLAY SEGMENTS CROM TABLE)
0F71   CB
0F72   04     DISPLAY MSB DIGIT 0D04
0F73   C4
0F74   00     LOAD 00 (ZERO AC)
0F75   CB
0F76   02     ZERO DISPLAY LATCHES TO PREVENT SPURIOUS DISPLAY 0D02
0F77   C3
0F78   02     LOAD 0D02 KEY GO CONTENTS INTO AC
0F79   E4
0F7A   DF     CHECK FOR KEY GO
0F7B   98
0F7C   A3     JUMP IF AC ZERO(GO KEY) TO 0F1F AND RESTART COUNT
0F7D   90
0F7E   E0     NO KEY GO.CONTINUE DIGIT DISPLAY  AT 0F5E
```

HIGH-SPEED SOFTWARE CASSETTE INTERFACE FOR THE SWTP 6800 SYSTEM

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This article describes a software approach to the problem of interfacing a microprocessor system (in this case the SWTP 6800 system) to an audio cassette used for data storage. This alternative to the more conventional hardware methods offers several distinct advantages. Since the system is software based (the only hardware requirements being the cassette player and two ports of a PIA), its most obvious attraction is low cost. Unlike dedicated hardware cassette interfaces, total control over speed is available and the system is capable of data transfer rates up to about 2000 baud. With the parameters given in the listings, a rate of 1600 baud is obtainable.

Figure 1 illustrates the hardware configuration. A PIA is plugged into row 4 in the motherboard and output to the mic. socket of the cassette recorder is taken directly via a screened lead from the most significant bit of the 'A' side of the PIA. Incoming data from the cassette player is received via another screened lead connected from the extension speaker socket to the most significant bit of the 'B' side. Good results were obtained using medium quality audio cassettes and with the volume and tone controls on the cassette player both set to maximum.

Data is stored on the cassette as a frequency shift keyed signal. Logic levels 'Ø' and '1' are stored as single cycles of 2800 and 1400 Hz respectively which represents an average bit rate of 1600 baud. Data is sent as a MIKBUG formatted tape headed by a string of 200 ASCII nulls and terminated with an ASCII 'S9' end of file pattern. The 'save' and 'read' programs are shown in Figures 2 and 3 respectively, and have been given arbitrary origins, although both programs are fully relocatable. By storing the programs in PROM, the risk of overwriting them is eliminated.

To save an area of data on cassette tape, first enter the beginning address of the area in locations AØØ2 and AØØ3 and the final address in locations AØØ4 and AØØ5. Set locations AØ48 and AØ49 to the start address of the SAVE program, switch the cassette player on to record and enter G. When the transfer of data is complete, the system automatically returns to MIKBUG.

To read data from the cassette, first set locations AØ48 and AØ49 to the start address of the READ program, start the cassette rolling a little before the data begins (to allow it to pick up speed) then enter G. When the end of file pattern is read from the tape the system returns to MIKBUG. Should an error be encountered during playback, an 'E' will be printed on the teletype; the tape should be stopped, rewound slightly and a G should again be entered. Note that there is no need to reset the program counter before doing this.

This cassette system has been used for several months and has been found to be very reliable. The data transfer rate is more than five times that of Kansas City standard system which results in a considerable time saving for long programs. A change of speed can be effected by changing the frequencies of the two FSK tones. This is done by altering the timing loop parameter at location 5ØDØ in the SAVE program, and the mean number of samples per half-cycle at location 6ØØB in the READ program.

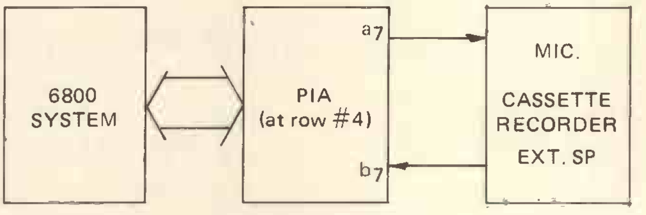

Figure 1. Hardware Configuration

```
TITLE:  SAVE

LOC   OBJECT CODE      SOURCE STATEMENTS

                        NAM    SAVE
        *
        *
        *               TRANSMIT ROUTINES
        *
        *    This program sends mikbug formatted data as
        *    an FSK signal through one port of A Pia.
        *    A logic '1' is sent as one cycle of 1400 Hz;
        *    A logic '0' is sent as one cycle of 2800 Hz.
        *    Bega, Bega + 1 and Enda, Enda + 1 Contain the
        *    first and last addresses respectively of the
        *    data area to be saved.
        *
        *
      8010       PIAAD   EQU   $8010    PIA ADDRESS
                 * MIKBUG RAM ADDRESSES:
      A002       BEGA    EQU   $A002    DATA START ADDRESS
      A004       ENDA    EQU   $A004    DATA END   ADDRESS
      A00E       TEMP    EQU   $A00E
      A00F       TW      EQU   $A00F
      A011       MCONT   EQU   $A011
      A012       XTEMP   EQU   $A012
                 * END-OF-FILE PATTERN:
A020                     ORG   $A020
A020  0D         MTAPE2  FCB   $D,$A,0,0,0,0,$53,$39,4
A021  0A
A022  00
A023  00
A024  00
A025  00
A026  53
A027  39
A028  04
                 * MIKBUG ROM ADDRESSES
      E0E3       CONTRL  EQU   $E0E3
      E134       MTAPE1  EQU   $E134
5000                     ORG   $5000    PROGRAM ORIGIN
5000  CE FF04    START   LDX   #$FF04   INITIALISE PIA
5003  FF 8010            STX   PIAAD
                 *  SEND 200 NULLS
5006  C6 C8              LDA B #200
5008  4F         NULLS   CLR A          NULL
5009  8D 67              BSR   SEND
500B  5A                 DEC B
500C  26 FA              BNE   NULLS
                 * MIKBUG "PUNCH" ROUTINE:
500E  FE A002    PUNCH   LDX   BEGA     START ADDRESS
5011  FF A00F            STX   TW       SAVE IT
5014  B6 A005    SEN11   LDA A ENDA+ 1
5017  B0 A010            SUB A TW+1
501A  F6 A004            LDAB  ENDA
501D  F2 A00F            SBCB  TW
5020  26 04              BNE   SEN22
5022  81 10              CMP A #16
5024  25 02              BCS   SEN23
5026  86 0F      SEN22   LDA A #15
5028  8B 04      SEN23   ADD A #4
502A  B7 A011            STA A MCONT  FRAME COUNT THIS RECORD
502D  80 03              SUB A # 3
502F  B7 A00E            STA A TEMP   BYTE COUNT THIS RECORD
                 * SEND  C/R, L/F, NULLS, S, 1 (START OF RECORD):
5032  CE E134            LDX   #MTAPE1
5035  8D 34              BSR   PDATA1
5037  5F                 CLR B        ZERO CHECKSUM
                 * SEND  FRAME COUNT
5038  CE A011            LDX   #MCONT
503B  8D 38              BSR   SEND2
                 * SEND  ADDRESS
503D  CE A00F            LDX   #TW
5040  8D 33              BSR   SEND2
5042  8D 31              BSR   SEND2
                 * SEND  DATA
5044  FE A00F            LDX   TW
5047  8D 2C      SEN32   BSR   SEND2  SEND ONE BYTE (2 FRAMES)
5049  7A A00E            DEC   TEMP   DEC BYTE COUNT
504C  26 F9              BNE   SEN32
504E  FF A00F            STX   TW
5051  53                 COM B
5052  37                 PSH B
5053  30                 TSX
                 * SEND  CHECKSUM
5054  8D 1F              BSR   SEND2
5056  33                 PUL B RESTORE STACK
5057  FE A00F            LDX   TW
505A  09                 DEX
505B  BC A004            CPX   ENDA
505E  26 B4              BNE   SEN11
                 * IF FINISHED, SEND END-OF-FILE
5060  CE A020            LDX   #MTAPE2
5063  8D 06              BSR   PDATA1
5065  7E E0E3            JMP   CONTRL  RETURN TO MIKBUG
5068  8D 24      PDATA2  BSR   SENDIT
506A  08                 INX
506B  A6 00      PDATA1  LDA A X
506D  81 04              CMP A #4
506F  26 F7              BNE   PDATA2
5071  39                 RTS
5072  8D 1A      SEND    BSR   SENDIT
5074  39                 RTS
                 * SEND  2 HEX CHARS: UPDATE CHECKSUM
```

Continued on page 42

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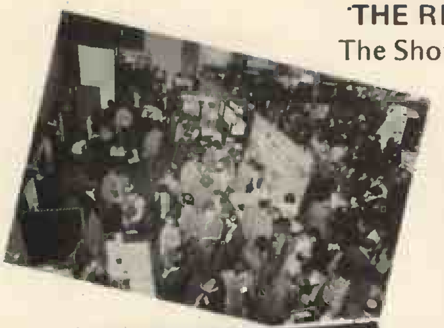

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```
5075 EB 00     SEND2   ADD 3  0,X     UPDATE CHECKSUM
5077 A6 00     OUT2H   LDA A  0,X     SEND 2 HEX CHARS
5079 8D 05     OUT2HA  BSR    OUTHL   OUT LEFT CHAR
507B A6 00             LDA A  0,X
507D 08                INX
507E 20 04             BRA    OUTHR   OUT RIGHT CHAR & RETURN
5080 44        OUTHL   LSR A
5081 44                LSR A
5082 44                LSR A
5083 44                LSR A
5084 84 0F     OUTHR   AND A  #$F     OUT RIGHT BCD DIGIT
5086 8B 30             ADD A  #$30
5088 81 39             CMP A  #$39
508A 23 02             BLS    SENDIT
508C 8B 07             ADD A  #$7
               *
               * GENERATE FSK SIGNAL AND SEND THROUGH PIA
               *
508E 37        SENDIT  PSH B
508F FF A012           STX    XTEMP   SAVE XREG
5092 C6 08             LDA B  #8      BIT COUNT
5094 8D 29             BSR    ZERO    SEND START BIT
5096 0D                SEC
5097 49        NEXBIT  ROL A          GET NEXT BIT
5098 24 04             BCC    SKIP    JUMP IF ZERO
509A 8D 14             BSR    ONE     SEND A '1'
509C 20 02             BRA    OVER
509E 8D 1F     SKIP    BSR    ZERO    SEND A '0'
50A0 0D        OVER    SEC
50A1 5A                DEC B
50A2 26 F3             BNE    NEXBIT  NEXT BIT
50A4 8D 0A             BSR    ONE     SEND STOP BIT
50A6 86 00             LDA A  #0      PIA---> LOW
50A8 B7 8010           STA A  PIAAD
50AB FE A012           LDX    XTEMP   RESTORE XREG
50AE 32                PUL A          AND STACK
50AF 39                RTS
               * BIT=1; TRANSMIT CYCLE OF LOW FREQUENCY
50B0 36        ONE     PSH A          SAVE ACCA
50B1 86 00     AGAIN   LDA A  # 0     PIA---> LOW
50B3 8D 15             BSR    DELAY   TIMER
50B5 8D 13             BSR    DELAY   AND AGAIN
50B7 86 FF             LDA A  #$FF    PIA--> HIGH
50B9 8D 0F             BSR    DELAY
50BB 8D 0D             BSR    DELAY   WAIT AGAIN
50BD 32                PUL A          RESTORE STACK
50BE 39                RTS
               * BIT=0; TRANSMIT CYCLE OF HIGH FREQUENCY
50BF 36        ZERO    PSH A          SAVE ACCA
50C0 86 00     BACK    LDA A  #0      PIA--> LOW
50C2 8D 06             BSR    DELAY   TIMER
50C4 86 FF             LDA A  #$FF    PIA--> HIGH
50C6 8D 02             BSR    DELAY
50C8 32                PUL A          RESTORE STACK
50C9 39                RTS
               * FREQUENCY CONTROL DELAY LOOP
50CA 37        DELAY   PSH B          SAVE ACCB
50CB C6 08             LDA B  #8      DELAY COUNTER
50CD B7 8010   LOOP1   STA A  PIAAD   OUTPUT TO PIA
50D0 5A                DEC B          DEC LOOP COUNT
50D1 26 FA             BNE    LOOP1   LOOP AGAIN
50D3 33                PUL B          RESTORE STACK
50D4 39                RTS            RETURN
                       END
```

SYMBOL	VALUE		
		OVER	50A0
AGAIN	50B1	PDATA1	506B
BACK	50C0	PDATA2	5068
BEGA	A002	PIAAD	8010
CONTRL	E0E3	PUNCH	500E
DELAY	50CA	SEND	5072
ENDA	A004	SENDIT	508E
LOOP1	50CD	SEND2	5075
MCONT	A011	SEN11	5014
MTAPE1	E134	SEN22	5026
MTAPE2	A020	SEN23	5028
NEXBIT	5097	SEN32	5047
NULLS	5008	SKIP	509E
ONE	50B0	START	5000
OUTHL	5080	TEMP	A00E
OUTHR	5084	TW	A00F
OUT2H	5077	XTEMP	A012
OUT2HA	5079	ZERO	50BF

```
TITLE:  READ

LOC  OBJECT CODE        SOURCE STATEMENTS

                          NAM      READ
        *
        *
        *               RECEIVE ROUTINES
        *
        *    This program demodulates the fsk signal from
        *    the cassette player by comparing the number
        *    of samples per 1/2 cycle with a threshold (mean)
        *    value.  The received data is stored directly
        *    into ram.  If a non-hex char is received or
        *    a checksum error is detected, an 'E' is typed
        *    on the terminal before returning to mikbug.
        *    A return to mikbug without the 'E' indicates
        *    that all data has been successfully transferred.
        *
        *
     8012        PIAAD   EQU   $8012      PIA ADDRESS
                 * MIKBUG RAM ADDRESSES:
     A00A        CKSM    EQU   $A00A
     A00B        BYTECT  EQU   $A00B
     A00C        XHI     EQU   $A00C
     A00D        XLOW    EQU   $A00D
     A012        XTEMP   EQU   $A012
     A020        CNTR    EQU   $A020
     A021        MEAN    EQU   $A021
                 * MIKBUG ROM ADDRESSES
     E0E3        CONTRL  EQU   $E0E3
     E1D1        OUTCH   EQU   $E1D1
6000                     ORG   $6000      PROGRAM ORIGIN
6000 CE 0004             LDX   #$0004     INITIALISE PIA
6003 FF 8012             STX   PIAAD
                 * SET MEAN NO. OF SAMPLES PER 1/2 CYCLE:
6006 86 0B               LDA A #$0B
6008 B7 A021             STA A MEAN
                 * BEGIN SEARCHING FOR DATA:
600B 8D 68       LOAD3   BSR   READ1      FETCH A CHAR
600D 81 53               CMP A #'S        IS IT AN S ?
600F 26 FA               BNE   LOAD3      NO;LOOK AGAIN
6011 8D 62               BSR   READ1      YES; GET NEXT CHAR
6013 81 39               CMP A #'9        END-OF-FILE ?
6015 27 26               BEQ   LOAD21     YES; READING COMPLETE
6017 81 31               CMP A #'1        START OF RECORD ?
6019 26 F0               BNE   LOAD3      NO; LOOK AGAIN
601B 7F A00A             CLR   CKSM       ZERO CHECKSUM
601E 8D 2E               BSR   BYTE       READ 1 BYTE
6020 80 02               SUB A #2
6022 B7 A00B             STA A BYTECT
                 * BUILD ADDRESS:
6025 8D 19               BSR   BADDR
                 * STORE DATA:
6027 8D 25       LOAD11  BSR   BYTE
6029 7A A00B             DEC   BYTECT
602C 27 05               BEQ      LOAD15
602E A7 00               STA A    X        STORE DATA
6030 08                  INX
6031 20 F4               BRA      LOAD11   GET NEXT BYTE
6033 7C A00A     LOAD15  INC      CKSM
6036 27 D3               BEQ      LOAD3
                 * ERROR DETECTED:
6038 86 45       LOAD19  LDA A    #'E      PRINT ERROR MESSAGE
603A BD E1D1             JSR      OUTCH
603D 7E E0E3     LOAD21  JMP      CONTRL   RETURN TO MIKBUG
                 * BUILD ADDRESS:
6040 8D 0C       BADDR   BSR      BYTE     GET A BYTE
6042 B7 A00C             STA A    XHI      MSBYTE
6045 8D 07               BSR      BYTE     GET A BYTE
6047 B7 A00D             STA A    XLOW     LSBYTE
604A FE A00C             LDX      XHI      ADDRESS WE BUILT
604D 39                  RTS
                 * INPUT 1 BYTE (2 FRAMES):
604E 8D 10       BYTE    BSR      INHEX    READ HEX CHAR
6050 48                  ASL A
6051 48                  ASL A
6052 48                  ASL A
6053 48                  ASL A
6054 16                  TAB
6055 8D 09               BSR      INHEX    READ HEX CHAR
6057 1B                  ABA
6058 16                  TAB
6059 FB A00A             ADD B    CKSM
605C F7 A00A             STA B    CKSM
605F 39                  RTS
                 * INPUT HEX CHAR:
6060 8D 13       INHEX   BSR      READ1
6062 80 30               SUB A    #$30
6064 2B D2               BMI      LOAD19   NOT HEX; ERROR ?
6066 81 09               CMP A    #$09
6068 2F 0A               BLE      IN1HG
606A 81 11               CMP A    #$11
606C 2B CA               BMI      LOAD19   NOT HEX; ERROR ?
606E 81 16               CMP A    #$16
6070 2E C6               BGT      LOAD19   NOT HEX; ERROR ?
6072 80 07               SUB A    #7
6074 39          IN1HG   RTS
                 * SAMPLING AND TIMING ROUTINES:
6075 37          READ1   PSH B             SAVE ACCB
6076 FF A012             STX      XTEMP    AND XREG
6079 4F          START   CLR A
607A 5F                  CLR B
607B 0D                  SEC
607C 8D 13       SBIT    BSR      LOOK     LOOK FOR START BIT
607E 25 FC               BCS      SBIT     NOT FOUND; LOOK AGAIN
6080 36                  NEXBIT   PSH A             SAVE ACCS
6081 37                           PSH B
6082 8D 0D                        BSR      LOOK
6084 33                           PUL B             RESTORE ACCS
6085 32                           PUL A
6086 49                           ROL A             GET RECEIVED BIT
6087 5C                           INC B             8 BITS FOUND ?
6088 C1 08                        CMP B    #8
608A 26 F4                        BNE      NEXBIT   NO; FETCH NEXT BIT
608C FE A012                      LDX      XTEMP    RESTORE INDEX REG
608F 33                           PUL B
6090 39                           RTS
                          * FETCH A BIT:
6091 7F A020              LOOK    CLR      CNTR     SAMPLE COUNT
6094 86 80                        LDA A    #$80     SELECT INPUT LINE
6096 B1 8012              LOOP1   CMP A    PIAAD    START OF CYCLE ?
6099 26 FB                        BNE      LOOP1    NO; LOOK AGAIN
609B 7C A020              LOOP2   INC      CNTR     YES; INC SAMPLE COUNT
609E 01                           NOP
609F B1 8012                      CMP A    PIAAD    INPUT STILL HIGH ?
60A2 27 F7                        BEQ      LOOP2    YES; KEEP LOOPING.
60A4 B6 A020                      LDA A    CNTR     TOTAL SAMPLE COUNT
60A7 B1 A021                      CMP A    MEAN     COMPARE WITH MEAN
```

Pg. 43

```
60AA  2D 02                BLT     HF       IF LESS THEN HI FREQUENCY
60AC  0D           LF      SEC              RETURN '1' IN CARRY
60AD  39                   RTS
60AE  0C           HF      CLC              RETURN '0' IN CARRY       IN1HG      6074   MEAN      A021
60AF  39                   RTS                                        LF         60AC   NEXBIT    6080
                           END                                        LOAD11     6027   OUTCH     E1D1
                                                                      LOAD15     6033   PIAAD     8012
                                                                      LOAD19     6038   READ1     6075
          SYMBOL                 VALUE  CKSM              A00A        LOAD21     603D   SBIT      607C
                                        CNTR              A020        LOAD3      600B   START     6079
          BADDR                  6040   CONTRL            E0E3        LOOK       6091   XHI       A00C
          BYTE                   604E   HF                60AE        LOOP1      6096   XLOW      A00D
          BYTECT                 A00B   INHEX             6060        LOOP2      609B   XTEMP     A012
```


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STATPACK

Colin Chatfield

```
LIST   STAT 9    PART OF STATPACK  WRITTEN BY COLIN CHATFIELD

                 MICRO-AID,  LLOYDS BANK CHAMBERS, CAMBORNE, CORNWALL.

0005 REM STAT9 - RELATIONAL STATISTICS
0020 Z9=1: REM OUTPORT PORT #
0080 LINE= 132: DIGITS=0: GOSUB9380
0100 ? TAB(22);"RELATIONAL STATISTICS"
1000 GOSUB 9600
1010 ? "YOUR ARRAY IS ";A;"X ";B;:?CHR$(8);:?". ";A*B;"ITEMS."
1110 INPUT "     CARRIAGE RETURN WHEN READY",A$
1120 GOSUB 6000
1200 GOSUB 9360
1210 IF LEFT$(A$,1)="N"THEN1240
1220 IF LEFT$(A$,1)<>"Y"THEN1200
1230 INPUT "     IF RELATIONAL STATISTICS ENTER `Y' ",A$
1232 IF A$="Y"THEN1120
1234 CHAIN STAT1
1240 GOSUB 9300: ?TAB(20);"STATPACK END": END
6000 REM RELATIONAL STATISTICS
6010 GOSUB 9380
6020 ? "     ENTER COLUMN #'s TO BE CONSIDERED - MAJOR ONES FIRST,";
6030 INPUT " FOLLOWED BY OTHERS UP TO THREE IN ALL ",C1,C2,C3
6100 INPUT "   ENTER LOWEST & HIGHEST VALUES FOR 1ST COL # ",L1,L4
6110 INPUT "   ENTER LOWEST & HIGHEST VALUES FOR 2ND COL # ",L2,L5
6120 INPUT "   ENTER LOWEST & HIGHEST VALUES FOR 3RD COL # ",L3,L6
6130 GOSUB 9300
6140 ? #(Z9),"COL #","VALUE","OCCURENCES","%":?#(Z9)
6150 FOR V1=L1TOL4: FORV2=L2TOL5: FORV3=L3TOL6
6200 FOR I=1TOA: IFC(I,C1)=V1THEN T1=T1+1: GOTO6220
6210 GOTO 6260
6220 IF C(I,C2)=V2THENT2=T2+1:GOTO6250
6230 GOTO 6260
6240 IF C3=0 THEN6260
6250 IF C(I,C3)=V3THENT3=T3+1
6260 NEXT I: IFA8=1 THEN6340
6300 ? #(Z9),C1,V1,T1,T1/A*100
6310 IF T2=0 THEN?#(Z9),"COL # ";C2;", VALUE # ";V2;"= ZERO":A7=1:GOTO6360
6320 ? #(Z9),C2,V2,T2,T2/T1*100
6330 IF C3=0 THEN6360
6340 ? #(Z9),C3,V3,T3,T3/A*100
6360 T1=0:T2=0:T3=0:IFA7=1 THENGOSUB9310:GOTO6380
6370 A8=1:NEXTV3:GOSUB9310:A8=0
6380 A7=0:NEXTV2:GOSUB9310:NEXTV1
6390 GOSUB 9310: GOSUB9300: RETURN
9000 REM SUB PROGRAMS
9300 FOR K=1TO5:?#(Z9):NEXTK:RETURN
9310 FOR K=1TO56:?#(Z9),"-";:NEXTK:?#(Z9):RETURN
9360 INPUT "     ENTER `Y' FOR MORE, `N' FOR NONE ",A$: RETURN
9380 ? CHR$(25);:?CHR$(25);:?CHR$(22);:?CHR$(12);:RETURN
9400 B2=0:IFB=1THENB2=1:GOTO9430
9600 OPEN #10, STATFL1 FOR INPUT: FIELD #10,F=6
9610 OPEN #20, STATFL2 FOR INPUT: FIELD #20,A=6,B=6
9640 SET #10=1:SET#20=1:GET#20
9650 DIM C(A,B),B3(A)
9660 FOR I=1TOA:FORJ=1TOB:GET#10:C(I,J)=F:NEXTJ:NEXTI
9683 INPUT "     ENTER `Y' FOR VISUAL OF DATA",A$:IFA$<>"Y"THEN9690
9685 ? :FORI=1TOA:FORJ=1TOB:?C(I,J);:NEXTJ:?:NEXTI:?
9690 CLOSE #10:CLOSE#20:RETURN

THE GHOST
#
```

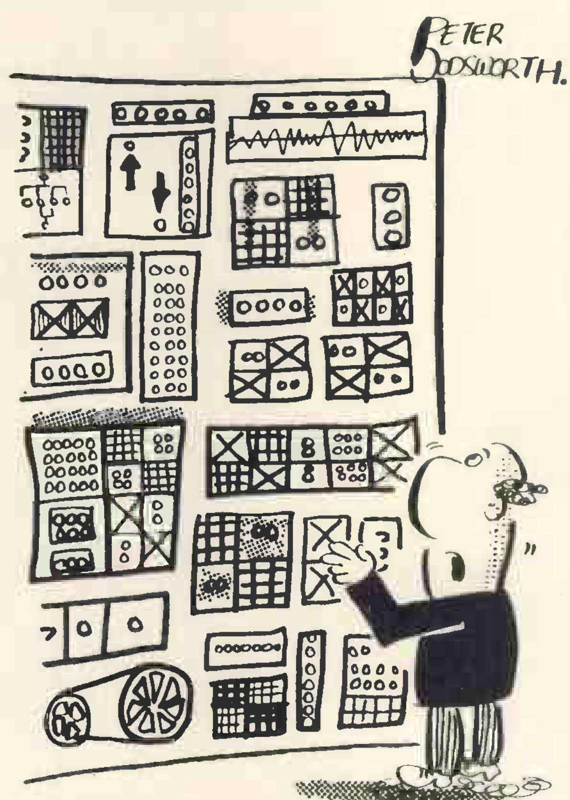
```
                        RELATIONAL STATISTICS
      ENTER `Y' FOR VISUAL OF DATA? Y

 3 2 0 0 2 3 1 1 50 5 0 0 0 1 0 0 0 0 0
 3 1 0 0 2 4 1 1 100 2 0 2 0 0 0 0 0 1 0
 3 1 0 1 0 1 1 1 100 3 3 2 0 1 0 1 0 1 1
 3 1 0 1 0 2 1 1 2 1 0 2 0 0 0 1 0 1 0
 3 1 0 0 2 3 1 3 2 1 0 0 0 0 1 1 0 0 0
 3 1 1 0 0 2 1 1 50 2 0 0 0 0 1 1 0 1 0

 YOUR ARRAY IS 6 X 19. 114 ITEMS.
      CARRIAGE RETURN WHEN READY?
      ENTER COLUMN #'s TO BE CONSIDERED - MAJOR ONES FIRST,
      FOLLOWED BY OTHERS UP TO THREE IN ALL ? 2,6,10
  ENTER LOWEST & HIGHEST VALUES FOR 1ST COL # ? 1,2
  ENTER LOWEST & HIGHEST VALUES FOR 2ND COL # ? 1,4
  ENTER LOWEST & HIGHEST VALUES FOR 3RD COL # ? 0,5
```

```
COL #        VALUE        OCCURENCES        %

2            1            5                 83.3333333
6            1            1                 20
10           0            0                 0
10           1            0                 0
10           2            0                 0
10           3            1                 16.6666666
10           4            0                 0
10           5            0                 0
--------------------------------------------------------
2            1            5                 83.3333333
6            2            2                 40
10           0            0                 0
10           1            1                 16.6666666
10           2            1                 16.6666666
10           3            0                 0
10           4            0                 0
10           5            0                 0
--------------------------------------------------------
2            1            5                 83.3333333
6            3            1                 20
10           0            0                 0
10           1            1                 16.6666666
10           2            0                 0
10           3            0                 0
10           4            0                 0
10           5            0                 0
--------------------------------------------------------
2            1            5                 83.3333333
6            4            1                 20
10           0            0                 0
10           1            0                 0
10           2            1                 16.6666666
10           3            0                 0
10           4            0                 0
10           5            0                 0
--------------------------------------------------------
--------------------------------------------------------
2            2            1                 16.6666666
COL # 6 , VALUE # 1 = ZERO
--------------------------------------------------------
2            2            1                 16.6666666
COL # 6 , VALUE # 2 = ZERO
--------------------------------------------------------
2            2            1                 16.6666666
6            3            1                 100
10           0            0                 0
10           1            0                 0
10           2            0                 0
10           3            0                 0
10           4            0                 0
10           5            1                 16.6666666
--------------------------------------------------------
2            2            1                 16.6666666
COL # 6 , VALUE # 4 = ZERO
--------------------------------------------------------
--------------------------------------------------------
```



"I've got some bad news for you. Tomorrow you're being replaced by a micro-chip!"

SCALE

A GENERAL PURPOSE GRAPH SCALING AND PLOTTING PROGRAM

Gillian Richmond
L VI, Norwich High School for Girls.

At our school we have found a need for a general purpose program which will accept, as input, any two quantities (variables) to be plotted whose maximum values are requested, followed by the co-ordinates of the points to be plotted on the graph. Typically, these points might have come from a science experiment e.g. the relationship between length and time period for a pendulum, where the data is available as pairs of co-ordinates. We have used this program to see whether data generated in an experiment is following an expected trend, before committing the points formally to paper. This program can easily be incorporated as a subroutine within larger programs, and we hope that it will prove useful in other schools.

The main problem in plotting the points manually is in deciding a suitable scale for the graph along both axes. The program does this automatically by deciding that there shall be between 5 and 10 lines or columns (depending on which axis) between tick marks, and then labelling the axes accordingly.

The program was originally written for the Research Machines 380Z using PLOT commands to display to a VDU; but it has been changed to give an output on a printer, and it uses commands which should be standard in all versions of BASIC. It was written for a 40 column printer but it can easily be modified for wider carriages, if required. (e.g. lines 530, 540, 700, 710, 770). So as not to elongate the resulting graph it was decided that no more than 50 lines of printer output should be used. This can also easily be modified (e.g. lines 290, 300, 460, 900) to match alterations of the number of columns used for a wider carriage.

Program Details

Input

Line numbers 150-190 request initial information, i.e. units to be plotted on each axis, maximum values on each axis and the number of co-ordinates to be plotted. In line 200 an array is dimensioned to store the co-ordinates which must be entered in ascending order for the X co-ordinate. This is the co-ordinate which will correspond to lines rather than columns on the printer output. Data input can be in decimal or standard form within the limits 10^{-10} to 10^{+10} (as explained in the scaling details).

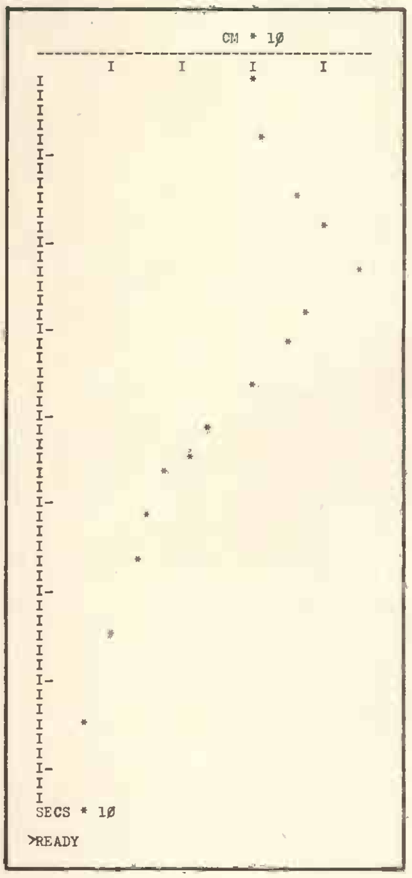
Scaling

The axes are scaled separately, horizontally (X) axis first (lines 260-490) and the vertical (Y) axis (lines 500-740). The methods used are in principle the same for both axes.

In line 280, H represents the maximum value to be plotted, lines 280-290 check whether H is between 1 and 50. If H is not between these limits, the subroutine between lines 430-470 is entered, where H is multiplied by powers of 10 between 10^{-10} and 10^{+10} (C in line 430). The value of C which makes H come between 1 and 50 is noted. This is the first of our scaling factors.

On return from line 460, line 300 is entered where a certain number of lines are apportioned to each integer value on the axis. Lines 310-320 check whether the number of lines of printer output to each integer value, i.e. to each tick mark, is between 5 and 10, meeting the previous requirement of 5-10 lines to each tick mark.

N.B. It is because of this limitation chosen on the values of C that the program can only accept data whose values lie between 10^{-10} and 10^{+10}, but for most applications this is perfectly adequate. If wider limits are required lines 430 and 670 should be changed.



This gives between 10 and 5 tick marks on 50 lines of printer output. If this condition is not met further scaling is done between lines 350-420, until it is met. All scaling factors are combined in line 480.

The vertical (Y) axis is then treated in a similar way in lines 500-740.

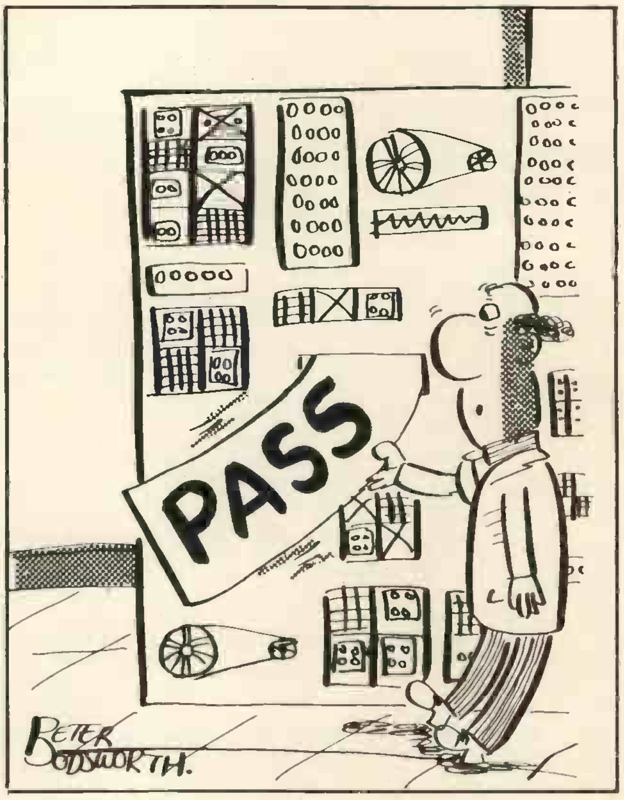
Output

Final output starts at line 750 and continues to the end of the program. Plotting of data points is done conventionally using TAB statements in the subroutine lines 990-1040; but, obviously, this results in small rounding errors.

```
100 REM SCALE - GILLIAN RICHMOND
110 PRINT TAB(17)"SCALE"
120 PRINT TAB(17)"====="
130 PRINT:PRINT
140 CLEAR 100
150 INPUT "UNITS ON HORIZONTAL AXIS";H$
160 INPUT "UNITS ON VERTICAL AXIS";V$
170 INPUT "MAX VALUE ON HORIZONTAL AXIS"
;H
180 INPUT "MAX VALUE ON VERTICAL AXIS";V
190 INPUT "HOW MANY CO-ORDINATES";N
200 DIM A(N,1)
210 PRINT "CO-ORDS IN ASCENDING ORDER OF
 X PLEASE"
220 FOR I=1 TO N
230 INPUT A(I,0),A(I,1)
240 NEXT I
250 PRINT:PRINT
260 REM SCALING HORIZONTAL AXIS
270 A=1:B=1:C1=1
280 IF H<1 THEN GOSUB 430
290 IF H>50 THEN GOSUB 430
300 H1=INT(50/H)
310 IF H1<5 THEN GOTO 350
320 IF H1>10 THEN GOTO 390
330 H2=H1
340 GOTO 480
350 FOR A=1 TO 6
360 H2=H1*A
370 IF H2>=5 AND H2<=10 THEN GOTO 480
380 NEXT A
390 FOR B=1 TO 10
400 H2=H1/B
410 IF H2>=5 AND H2<=10 THEN GOTO 480
420 NEXT B
430 FOR C=-10 TO 10
440 C1=10↑C
450 C2=H*C1
460 IF C2>=1 AND C2<=50 THEN H=C2:RETURN
470 NEXT C
480 H3=A/B/C1
490 H2=INT(H2)
500 REM SCALING VERTICAL AXIS
510 D=1:E=1:F1=1
520 IF V<1 THEN GOSUB 670
530 IF V>40 THEN GOSUB 670
540 V1=INT(40/V)
550 IF V1<5 THEN GOTO 590
560 IF V1>10 THEN GOTO 630
570 V2=V1
580 GOTO 730
590 FOR D=1 TO 6
600 V2=V1*D
610 IF V2>=5 AND V2<=10 THEN GOTO 730
620 NEXT D
630 FOR E=2 TO 10 STEP 2
640 V2=V1/E
650 IF V2>=5 AND V2<=10 THEN GOTO 730
660 NEXT E
670 FOR F=-10 TO 10
680 F1=10↑F
690 F2=V*F1
700 IF F2>=1 AND F2<=40 THEN V=F2
710 IF F2>=1 AND F2<=40 THEN RETURN
720 NEXT F
730 V3=D/E/F1
740 V2=INT(V2)
750 REM LABEL VERT AXIS
760 PRINT TAB(20) V$;"*";V3
770 FOR I=1 TO 38
780 PRINT "-";
790 NEXT I
800 PRINT
810 U=0
820 U=U+V2
830 IF U>=40 THEN GOTO 860
840 PRINT TAB(U)"I";
850 GOTO 820
860 PRINT
870 REM MARKING HORIZONTAL AXIS AND
880 REM PLOTTING DATA
890 J=1
900 FOR I=1 TO 50
910 PRINT "I";
920 IF I/H2=INT(I/H2) THEN PRINT "-";
930 IF J>N THEN GOTO 950
940 IF INT(A(J,0)*H2/H3)=I THEN GOSUB 990
950 PRINT
960 NEXT I
970 PRINT H$;"*";H3
980 END
990 REM SUBROUTINE TO PLOT DATA
1000 T=A(J,1)*V2/V3
1010 IF T>=40 THEN GOTO 1040
1020 PRINT TAB(T)"*";
1030 J=J+1
1040 RETURN

RUN
                                 SCALE
                                 =====


UNITS ON HORIZONTAL AXIS? SECS
UNITS ON VERTICAL AXIS? CM
MAX VALUE ON HORIZONTAL AXIS? 80
MAX VALUE ON VERTICAL AXIS? 50
HOW MANY CO-ORDINATES? 15
CO-ORDS IN ASCENDING ORDER OF X PLEASE
? 3,30
? 8,33
? 15,37
? 19,40
? 24,46
? 28,40
? 33,35
? 37,30
? 42,26
? 44,22
? 48,18
? 53,16
? 57,14
? 65,11
? 75,8
```



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WHAT SORT OF SORT?

Dr. William B. Samson

Department of Mathematics and Computer Studies, Dundee College of Technology

Microcomputers being used for Business applications present special problems which are not so apparent when large scale computers are used:

1. They are slow.

2. The main memory (RAM) is small.

This means that it is important to try to strike the right balance between program size and speed when designing a business system.

Most business systems require sorting at some stage and in many cases this will prove to be the most time consuming part of the process. The aim of this article is to compare some of the commoner internal sorting algorithms. It should be noted that these algorithms are *not* suitable for sorting files which are *larger than the available* RAM. The sorting of large files will be the subject of a future article.

The sorting algorithms below are written in BASIC. They use only statements which are common to all the full BASIC interpreters with which the author is familiar. They will not necessarily be suitable for integer BASICs.

For a full, theoretical account of sorting, the reader should refer to Knuth's 'The Art of Computer Programming', Volume 3.

The algorithms below were developed on an SWTPC 6800 with 16K bytes of RAM. They can be made more efficient for particular machines by using non-standard features such as multiple statement lines, machine code subroutines and so on.

Four algorithms are described below:

(a) The Bubble Sort
(b) The Straight Selection Sort
(c) The Straight Insertion Sort
(d) The Quicksort

Each algorithm is designed to sort an array of *N* numbers and includes a routine for inputting the numbers and one for printing them out, so that you can test them for speed and accuracy on your own machine.

It is not a difficult matter to rewrite these algorithms as subroutines. The reader should ensure, however, that his array of numbers is called *A* and that it is dimensioned appropriately. This is of particular importance for the Quicksort, as we shall see below. In addition, if these numbers are keys of records and the associated records are to be sorted too, then the records must be held in a separate array (or arrays) with the same dimension as *A*. Every time the elements of array *A* are moved, the corresponding elements of the record array(s) must be moved in the same way.

The Bubble Sort

Neighbouring elements of *A* are compared and switched if they are in the wrong order. A number of passes is made in this way until the elements are arranged in ascending order.

```
0010 DIM A(255)
0020 PRINT "HOW MANY NUMBERS";
0030 INPUT N
0050 PRINT "ENTER THE NUMBERS"
0060 FOR I=1 TO N
0070 INPUT A(I)
0080 NEXT I
0090 LET B=N
0100 LET T=0
0110 FOR J=1 TO B-1
0120 IF A(J)<=A(J+1) THEN 170
0130 D=A(J)
0140 A(J)=A(J+1)
0150 A(J+1)=D
0160 T=J
0170 NEXT J
0180 IF T=0 THEN 210
0190 B=T
0200 GOTO 100
0210 FOR I=1 TO N
0220 PRINT A(I)
0230 NEXT I
0240 END
```

Fig. 1. Bubble Sort

The Straight Selection Sort

The array, *A*, is searched for its highest element and this is switched with the last element of the array. The next stage switches the second highest element and the second last array element and so on.

```
0010 DIM A(255)
0020 PRINT 'HOW MANY NUMBERS';
0030 INPUT N
0050 PRINT 'ENTER THE NUMBERS'
0055 FOR I=1 TO N
0060 INPUT A(I)
0065 NEXT I
0070 FOR J=N TO 2 STEP -1
0075 B=A(J)
0076 X=J
0080 FOR R=J TO 1 STEP -1
0090 IF A(R)<=B THEN 110
0100 X=R
0105 B=A(R)
0110 NEXT R
0120 D=A(J)
0130 A(J)=A(X)
0140 A(X)=D
0150 NEXT J
0160 FOR I=1 TO N
0170 PRINT A(I)
0180 NEXT I
0190 END
```

Fig. 2. Straight Selection Sort

The Straight Insertion Sort

The elements of the array are considered in turn (starting with the last one) and each is placed in its correct position relative to the elements which have already been considered. The other elements of the array are shuffled around to make room for the one being dealt with.

```
0010 DIM A(255)
0020 PRINT 'HOW MANY NUMBERS';
0030 INPUT N
0050 PRINT 'ENTER THE NUMBERS'
0055 FOR I=1 TO N
0060 INPUT A(I)
0065 NEXT I
0080 FOR J=2 TO N
0090 I=J-1
0100 A=A(J)
0110 IF A>=A(I) THEN 140
0115 A(I+1)=A(I)
0120 I=I-1
0130 IF I>0 THEN 110
0140 A(I+1)=A
0150 NEXT J
0160 FOR I=1 TO N
0170 PRINT A(I)
0180 NEXT I
0190 END
```

Fig. 3. Straight Insertion Sort

The Quicksort

This is by far the fastest sort when large number of random elements are to be sorted. The first element is considered and by a series of comparisons and switches, it ends up in its final position. All values to the left are less than or equal, and all values to the right are greater than or equal to the element under consideration. The array is therefore partitioned into two parts, the left and the right. The process is repeated for one of these parts and the subscripts of the first and last elements of the other part are stored away in a stack (S) for future consideration. When the number of elements to be sorted becomes less than a certain value (M) then straight insertion sorting is used because it is faster for small numbers of elements. The value of *M* can vary from machine to machine, depending on the speeds of execution of various instructions, but is usually about 9 or 10.

```
0010 DIM A(202),S(10)
0020 REM S IS STACK
0030 REM INITIALISE STACK,
                    P IS POINTER
0040 FOR I=1 TO 10
0050  S(I)=0
0060 NEXT I
0070  P=1
0075  M=10
0077  A(1)=-1E99
0080 PRINT 'HOW MANY NUMBERS';
0090 INPUT N
0100 PRINT 'ENTER THE NUMBERS'
0110 FOR I=1 TO N
0120 INPUT A(I+1)
0130 NEXT I
0135  A(N+2)=1E99
0140 REM SET UPPER AND LOWER
                     BOUNDS
0150  L=2
0160  R=N+1
0170 REM M IS THE LIMIT FOR
           STRAIGHT INSERTION
0175 REM STEP Q2
0180 IF R-L<M THEN 590
0190  I=L
0200  J=R
0210  K=A(L)
0220 REM STEP Q3
0230 IF K>=A(J) THEN 260
0240  J=J-1
0250 GOTO 230
0260 REM Q4
0270 IF J>I THEN 300
0280  A(I)=K
0290 GOTO 450
0300  A(I)=A(J)
0310  I=I+1
0320 REM Q5
0330 IF A(I)>=K THEN 360
0340  I=I+1
0350 GOTO 330
0360 REM Q6
0370 IF J>I THEN 410
0380  A(J)=K
0390  I=J
0400 GOTO 450
0410  A(J)=A(I)
0420  J=J-1
0430 GOTO 230
0440 REM Q7
0450 IF R-I<I-L THEN 520
0460  S(P)=R
0470  P=P+1
0480  S(P)=I+1
0490  P=P+1
0500  R=I-1
0510 GOTO 180
0520  S(P)=I-1
0530  P=P+1
0540  S(P)=L
0550  P=P+1
0560  L=I+1
0570 GOTO 180
0580 REM Q8 STRAIGHT INSERTION
0590  J=L
0600  J=J+1
0610 IF J>R THEN 700
0620  K=A(J)
0630  I=J-1
0640 IF A(I)<=K THEN 680
0650  A(I+1)=A(I)
0660  I=I-1
0670 GOTO 640
0680  A(I+1)=K
0685 GOTO 600
0690 REM Q9
0700 IF P=1 THEN 770
0710  P=P-1
0720  L=S(P)
0730  P=P-1
0740  R=S(P)
0750 GOTO 180
0760 REM PRINTOUT
0770 FOR I=2 TO N+1
0780 PRINT A(I)
0790 NEXT I
0800 END
```

Fig. 4. Quicksort

Although the quicksort is very fast the algorithm carries a number of disadvantages:

(a) It is much longer than the others considered (63 lines of sorting) and so uses up valuable RAM.
(b) The algorithm, as written, requires that the first element of the array (A(1)) be smaller than any of the elements being sorted (−1E99) and the final element (A(N+2)) be larger than any of the elements being sorted (1E99).

This means that the *N* elements under consideration are in A(2) to A(N+1) which means a little extra fiddling for the user.

The stack array *S* is used to store the start and end subscripts of the sections of the array *A* which are still to be sorted. The number of elements in *S* must be greater than or equal to the log (base 2) of *N*. The stack dimensioned in the program, S(10), will be sufficient for up to 1024 elements. It must be increased if more elements are to be sorted.

Comparison of Algorithms

The four algorithms have been compared on the SWTPC 6800 and Figure 5 shows their relative speeds for various numbers of random elements (generated using RND). It is clear that the time taken to sort the *N* elements is roughly proportional to N^2 in the case of bubble, straight selection and straight insertion while it is roughly proportional to *N* in the case of the quicksort.

If the quicksort is ruled out on the grounds of size or complexity, then of the other sorts, straight insertion appears to be the most generally useful, being the shortest algorithm and faster than the other simple algorithms for most purposes.

REFERENCE
KNUTH, D.E.
The Art of Computer Programming, Vol.3, (Sorting and Searching), Addison-Wesley, 1973

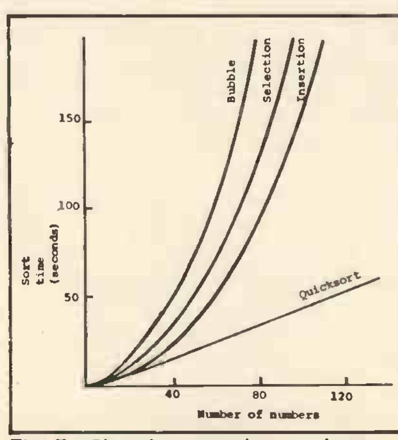

Fig. 5. Showing sort time against number of records for the SWTPC 6800

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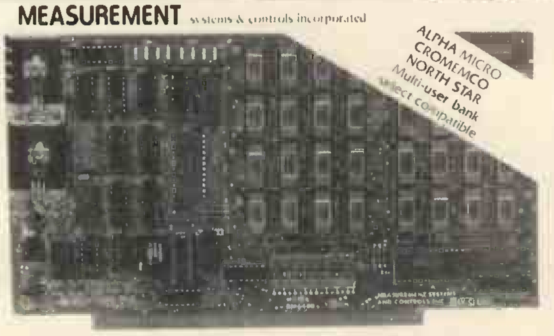

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TRS-80 LEVEL II DISK BASIC W.H. Davies

Introduction

This program is written in TRSDOS DISK BASIC and is intended for those readers who possess a TRS-80 Microcomputer System and have added either one, or two, Floppy Disk Drives to their system. It does not take account of the availability of a Line Printer, as such peripherals often cost more than many amateurs, or even small traders, can afford. However, for those who require a print-out, relevant PRINT statements should be changed to LPRINT.

Although it is written with the TRS-80 in mind the program may be altered quite easily to suit other Disk Basics. It occupies just under 2K bytes, but the amount of RAM required when the program is operational will depend upon the number of data records inputted when it is running. Hence the CLEAR 8000 statement in Line 100 at the beginning of the program; this statement should be changed to suit individual needs, or when the VDU displays 'OUT OF STRING SPACE'.

Operation

The Random Access Technique is used because the RANDOM FILE offers distinct advantages over those Files which use sequential access. The latter Files store data in ASCII format whereas Random Files provide the facility for immediate retrieval of the desired data and can be written to, or read from, whenever required. Data can also be modified to change existing information and then written back to disk.

Sample procedures for writing and reading data are given below. It should be noted that pressing the (BREAK) key when the prompt 'TYPE 1 TO WRITE, 2 TO READ' appears will STOP the program and all data entered up to that point will then be stored on disk to be retrieved as and when required. It is also possible to change a sub-record within a Physical Record at any time without any effect on the data contained in the other sub-records.

Sample Run No. 1

```
> RUN
Type 1 to Write, 2 to Read? 1
Enter the Logical Record Number? 1
Sub-Record Number 0
Physical Record Number 1

Name              ? F.H. Winterbottom
Account Number    ? 112113
Phone (Home)      ? 0242 54321
Phone (Office)    ? 0242 12345
Date In           ? 05/27/79
Vehicle           ? Cortina  Mk.2.  1600
                    Red (1970) LLZ 123J
Job Number        ? 1234
Hours Worked      ? 4.5
Hourly Rate       ? 9.323
Cost of Parts     ? 12.95

Enter Logical Record Number? (Break)
```

Sample Run No. 2.

```
> RUN
Type 1 to Write, 2 to Read? 2
Enter Logical Record Number? 1
Enter VAT Rate. eg. 8, 10, 12.5 15 etc?
              12.5
Sub-Record Number 0
Physical Record Number 1

Name              F.H. Winterbottom
Account Number    112113
Phone (Home)      0242 54321
Phone (Office)    0242 12345
Date In           05/27/79
Vehicle           Cortina  Mk.2.  1600
                  Red (1970) LLZ 123J
Job Number        1234
Hours Worked      4.5
Hourly Rate       9.323
Labour Charges    41.95
Cost of Parts     12.95
VAT Due at 12.5%   6.86
ACC Rendered      61.76

Enter Logical Record Number? (Break)
```

The two examples show the Write and Read sequences; in practice of course several entries of data would be written — or read — at one time. It could be that an intended user of this program may wish to have a different order of data, but this should present no problem.

In conclusion I would recommend TRS-80 owners to peruse or obtain TANDY's latest Manual on TRSDOS & DISK BASIC (Cat. 26-2104), this gives detailed information on the use of Random Files and is much more helpful then their previous preliminary manual on this subject.

```
GARAGE ACCOUNTING PROGRAM

1ØØ  PRINT:CLEAR 8ØØØ:CLS:PRINT
11Ø  PRINT:INPUT"TYPE 1 TO WRITE, 2 TO READ";N
12Ø  OPEN "R",1,"GARAGE"
13Ø  ON N GOTO 2ØØ,4ØØ
2ØØ  PRINT:INPUT"ENTER LOGICAL RECORD NUMBER ";LR:PRINT
21Ø  IF LR = Ø THEN 1ØØ
22Ø  GOSUB 6ØØ:PR = INT((LR-1)/2)+1
23Ø  GET 1,PR:PRINT"PHYSICAL RECORD NUMBER ";PR:PRINT
24Ø  PRINT"NAME";TAB(2Ø);:INPUT N$:LSET NM$ = N$
25Ø  PRINT"ACCOUNT No.";TAB(2Ø);:INPUT A$:LSET AC$ = A$
26Ø  PRINT"PHONE (HOME)";TAB(2Ø);:INPUT H$:LSET PH$ = H$
27Ø  PRINT"PHONE (OFFICE)";TAB(2Ø);:INPUT F$:LSET PF$ = F$
28Ø  PRINT"DATE IN";TAB(2Ø);:INPUT D$:LSET DT$ = D$
29Ø  PRINT"VEHICLE";TAB(2Ø);:INPUT V$:LSET VL$ = V$
3ØØ  PRINT"JOB NUMBER";TAB(2Ø);:INPUT J$;LSET JB$ = J$
31Ø  PRINT"HOURS WORKED";TAB(2Ø);:INPUT W:LSET HW$ = MKS$(W!)
32Ø  PRINT"HOURLY RATE";TAB(2Ø);:INPUT R:LSET HR$ = MKS$(R!)
33Ø  PRINT"COST OF PARTS";TAB(2Ø);:INPUT P:LSET CP$ = MKS$(P!)
34Ø  PUT 1,PR:GOTO 2ØØ
4ØØ  PRINT:INPUT"ENTER THE LOGICAL RECORD NUMBER ";LR
41Ø  IF LR = Ø THEN 1ØØ
42Ø  PRINT:INPUT"ENTER VAT RATE.  EG. 8, 1Ø, 12.5, 14 ETC";T
43Ø  GOSUB 6ØØ:PR = INT((LR-1)/2)+1
44Ø  GET 1,PR:PRINT"PHYSICAL RECORD NUMBER ";PR:PRINT
45Ø  PRINT"NAME";TAB(2Ø);NM$
46Ø  PRINT"ACC.No";TAB(2Ø);AC$
47Ø  PRINT"PHONE (HOME)";TAB(2Ø);PH$
48Ø  PRINT"PHONE (OFFICE)";TAB(2Ø);PF$
49Ø  PRINT"VEHICLE";TAB(2Ø);VL$
5ØØ  PRINT"DATE IN";TAB(2Ø);DT$
51Ø  PRINT"JOB No.";TAB(2Ø);JB$
52Ø  PRINT"HOURS WORKED";TAB(2Ø);CVS(HW$)
53Ø  PRINT"HOURLY RATE";TAB(2Ø);CVS(HR$)
54Ø  PRINT"LAB CHARGES";TAB(2Ø)USING"######.##";CVS(HR$) * CVS(HW$)
55Ø  PRINT"COST OF PARTS";TAB(2Ø)USING"######.##";CVS(CP$)
56Ø  PRINT"VAT DUE AT ";T;"%";TAB(2Ø)USING"######.##";T/1ØØ * (CVS(HR$)
     * CVS(HW$) + CVS(CP$))
57Ø  PRINT"ACC RENDERED";TAB(2Ø)USING"######.##";(T/1ØØ * (CVS(HR$)
     * CVS(HW$) + CVS(CP$))) + CVS(HR$)* CVS(HW$) + CVS(CP$)
58Ø  GOTO 4ØØ
59Ø  END
6ØØ  SR = LR-2 * INT((LR-1)/2) - 1
61Ø  PRINT"SUB-RECORD NUMBER ";SR
62Ø  FIELD 1, SR*115 AS D$,2Ø AS NM$,6 AS AC$,12 AS PH$,12 AS PF$,
     37 AS VL$,1Ø AS DT$,6 AS JB$,4 AS HR$,4 AS HW$, 4 AS CP$
63Ø  RETURN
```

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THE READER'S DILEMMA

PCW *We are well aware that there are very many people who would like to use small computers but cannot get a "handle" on how to go about it. This article is a small contribution to helping towards an understanding. It is by no means comprehensive or complete, for no article or book can ever be. When it comes to the crunch, there is no substitute for application, persistence and practice.* PCW

I'm a reader of your magazine, but a computer novice. My job is selling supplies of inks and papers for photocopiers and duplicators over a wide area.

Regular repeat sales are a mainstay of the business, and contacting customers when they are about to re-order increases our chances of retaining the business.

Maintaining records of one or two hundred customers is difficult, and I've been thinking of the advantages of a micro-computer as a sophisticated filing system.

Ideally, when a customer places an order I would key in a projected date for their next order. (It might also be possible to check on the dates of previous orders as a guide to making the estimate).

With the system running properly, I would be able to key in the date and receive a list of calls to be made. It could also be used as a diary for appointments, errands and deadlines.

Would the use of codings enable the main body of information on customers to be broken down in different ways? For example, to be able to get a list of all copier owners in a certain area, or of the top 20% of our customers, or of all the owners of a certain type of machine, would be invaluable.

I would be very glad to know how much of the above could be done with the popular micro's such as the PET, TRS-80 and Apple II, or how much bigger the machine would have to be.

Would I need to get deeply involved in DIY programming (I don't want to) or buy expensive software to do the job? How much would it cost to send the machine?

If you can advise, or put me in touch with someone who can, I would be very grateful for your help.

Phil Symons

Open Reply to the Reader

Sheridan Williams

Thank you for your interesting letter; it outlines the very common need amongst small businesses for an 'intelligent' filing system. Most of the questions you have asked are fundamental to many data processing programs. Consider that computers are really only used for scientific and business applications. The majority of applications fit the latter category, and your proposed requirement is fairly typical of a general computer based filing system. As you are probably aware computers have many advantages over manual filing systems; these are: reduction in manpower, speed of response, accuracy, up-to-date records and, usually, a saving in cost. Many of the above advantages create customer goodwill, provided nothing goes wrong.

Hardware

You state that you have one or two hundred customers, whose records you wish to keep. The system that you decide on will vary slightly according to your precise requirements, but it appears that you will need not much more than 50K bytes of backing store to hold your customer file. A lot depends on the way that you organise the file and the information on it, so this figure is only a guide.

This minimum requirement puts you in the middle of a very highly competitive market place, and amongst the computers worth considering come the three that you have mentioned — Commodore PET, Tandy TRS-80, Apple (ITT); slightly upmarket are the Vector Graphics MZ, Horizon and many others.

It is essential that you consider purchasing a disc system, and I would not recommend a cassette based system for several reasons. Cassettes are unreliable, even the fastest work at an incredibly slow rate, files must be serially organised, programs take ages to load, expansion later on is essential. There are a number of mini floppy disc drives that allow storage in excess of 300K on a single side of a 5¼ inch floppy disc. This would appear more than adequate for your requirements. However, unless it is vital to save £300 I would suggest that you purchase a dual floppy disc drive for the sake of convenience.

Your complete system requirement will probably be as follows: Central processing unit (CPU) with at least 16K of usable store, this probably means a 32K system if the language compiler/interpreter is not in ROM; a dual floppy disc drive; a reasonably fast printer with a good typeface.

The Commodore PET, Tandy TRS-80 and Apple all have the necessary peripheral devices available. The Horizon and Vector MZ are more sophisticated systems, have the advantage of different language capabilities. Also, they can support several terminals enabling you to have several data entry and data acquisition points throughout your building. A typical large system based on either the Horizon or MZ would offer you computing power well into the future, but of course will be more expensive initially.

There are many still larger systems available and the suppliers could offer you software support. We are then in the £5000 to £10000 bracket and hence talking about facilities way in excess of your present requirements.

Software

The hardware side of your problem is relatively easy. It is the software that could cause you problems. As I see it, you have the following ways of getting a program written:—

1. Write it yourself.
2. Get a friend to write it for next to nothing.
3. Buy a program and tailor it to suit your requirements by either method 1 or method 2.
4. Engage a professional to write the program.
5. Approach your local college or school and get an 'A' level computer science student to write it for you, as his compulsory project.

Each of the above ways has advantages and disadvantages as follows:—

1. It could take you up to one year to learn a suitable language well enough to write your own programs. There are courses available on introductory, intermediate and advance programming in BASIC given by Sumlock Bondain and Computer Workshop in London but these are not very local for you.
2. Friends with sufficient programming experience are few and far between, and considering that it could take over 50 man-hours to program, including debugging, and this would be spread over many weeks — even friends tend to become intolerant if put-upon to this extent.
3. It could be difficult to find a program on which to start the tailoring. It may take a long time to understand the original program and may be quicker to write your own program from scratch. I personally would not choose this option.
4. If money is no object this is the best way. You should have back-up support and a guarantee; and a working system within one month. It is expensive though. I have approached two companies — Sumlock Bondain, 15 Clerkenwell Close, London, EC1R 0AD Telephone 01-253 2447/8; and Almarc Data Systems, 29, Chesterfield Drive, Burton Joyce, Notts. Tel: 0602 248565 both of whom quoted similar rates for the software. Around £500 for the program and £250 per week to tailor the program for your needs.
5. This alternative is very interesting because it is not often considered. 'A' level Computing Science students are required to provide a fully documented project for their final examination. This must be a practical application. I know several students who would jump at the opportunity to write your system for you. Approach your local school or college and ask to speak to the teacher/lecturer in charge, who will advise you. The major disadvantage to this method is that you will have to wait until next June before the project is complete.
(PCW *And what you get is what you'll have to use.* PCW)

If you consider doing it yourself then you will have to study techniques for file manipulation. This is not difficult, but I'm afraid experience cannot be learned over-night. Points worth considering are: The file will contain 200 records (say), these should be given a code number which will allow identification of certain types of record (eg. area codes), they will allow customer records to be broken down in various ways. Another relevant question is whether you store a complete customer record including name and address, together with all the relevant ordering information on the master file; or should you use a reference file for the names and addresses. The program will probably be best written as a 'suite' of programs, and a 'menu' printed first asking which program is required:—

Example:

CUSTOMER FILE

Which of the following do you require?

1. Delete a customer record.
2. Add a customer record to the file.
3. Update or amend a customer record.
4. Change area codes
5. Amend for price increases.
6. List of customers due for visits. etc. etc.

SYSTEM ONE

Based on Commodore PET 2001-16N 16K £730
or PET 2001-32N 32K £860

Dual disk drive £800

Printers: Teletype 43 (inc. keyboard) 132 columns 30 ch/s £1000
or Anadex DP8000 80 column 112 ch/s £575

Total Price £2100 – £2700

SYSTEM TWO

Based on the Horizon 16K plus *dual* disc drive £1800
or 32K plus *dual* disc drive £2200

Elbit VDU £600

Printer: Centronics 779 80 column 60 ch/s £950

Total Price £3300 – £3700

SYSTEM THREE

Based on the Vector Graphics MZ *48K* with dual disc drive £2500

Elbit VDU £600

Printer: Centronics 779 80 column 60ch/s £950

Total Price £3850

All quoted prices are approximate. Because I have only given three suggested systems, it is not that I don't recommend any others but that I found the quoted suppliers readily helpful and willing to demonstrate at a moment's notice.

Yes, you can hire microcomputers but the cost is at least £5 per day. This is only worthwhile to evaluate a particular machine, and not worthwhile in the long term. After 6 months' rental you could have bought a small system.

Good luck with whatever you decide to do and don't forget to let PCW know when the system is operational and we can then come down and visit you. Your experience in setting up such a computer controlled sales network will undoubtedly help others.

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	7440	.20		74166	1.75		74L55	.85		74S03	.35
	7441	1.15		74175	.90		74L72	.65		74S04	.35
	7442	.55		74176	.95		74L73	.70		74S05	.45
	7443	.45		74177	1.10		74L74	.75		74S08	.45
	7444	.45		74180	.95		74L75	1.05		74S10	.45
	7445	.75		74181	2.25		74L85	2.00		74S11	.45
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	4011	.30		4026	1.95		4047	2.50		4522	1.10
	4012	.25		4027	.35		4048	1.25		4526	.95
	4013	.40		4028	.75		4049	.65		4528	1.10
	4014	.75		4029	1.15		4050	.45		4529	.95
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	LM320H6	.79		LM340T18	.95		LM725	2.50
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	LM320H24	.79		LM340K12	1.25		LM741 (8-14)	.45
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	LM320K12	1.65		LM340K18	1.25		LM1307	1.75
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BUYING A COMPUTER FOR A SMALL BUSINESS

M.D. Nott

Writers write. Computer men computate . . . and small business men just (barely) run small businesses.

All the articles I read seem to be based on the assumption that small business men are a breed of person who know where they are going, how and why, and as far as computers are concerned — 'oh, they know what they are as well', and are just waiting till the time is right.

I think it might help if you know something. We are just plain and straightforward play-the-percentage gamblers, and that's all. We just work out the odds.

What does that mean? Well, in any given situation, fast or slow, we try to work out what courses of action are open to us and take the one that appears least wrong. Because if you have been in business more than three years you absolutely know that you can't be right whatever you decide.

So how does that involve computers? Well, to show you, I will have to cite my case and mix in a few of my business associates' cases as well.

I am now the possessor of an 8K PET, indigestion, headache, an engineering business (or I think that's what it is), some started programs, a lot of inventions and a bike (the car broke down).

I had to do a quotation for a large racking installation and another for a shelving installation, and having settled down to do the design work (from 10pm till 2 or 4am, I'm the designer), I found the specification to be a bit tight, so calling for very accurate structural steelwork design. So on my 15th run of the first framework, it seemed the fault lay in my inability to check in detail back through the calculations of 50 or so formulae to find the bit that needed altering; to bring the strength up, or the price down, or both. In addition, on the shelving quote my research had shown that there were no figures available for the strength of the tube I was requested to use, and so I would have to start right at the beginning. What is the beginning? Well, you need size, thickness, mass per metre, area of section, moment of inertia XX & YY, and eight more of 35 different sizes of tubes before you can start to design.

So guess what I went looking for — a good programmable calculator. I ended up with an 8K PET on the assurance of the salesman that it would *come with complete and proper information and instructions* that would enable me to put it straight to work. (Now you know why I am writing this).

So what did I get? One 8K PET (I was lucky, off the shelf!) and one PET user's manual 2001-8 first edition, and that was it. So of course first I sat down to read the manual, then I sat down to read the manual, so then I sat down with the computer to work my way through the manual, then I sat down to read the manual.

The Author's rack for the PET

On the 4th day I was beginning to get somewhere. I had worked out how to get the INPUT working without getting a SYNTAX ERROR. It took 14 days to work out what that meant. I then took another 7 days to write the program, 2 days to test it, and 7 hours running to do my estimates.

So, what am I saying about small businesses and small computers?

1. A small businessman/woman is a very busy person trying to do about 40 jobs, such as planner, designer, buyer, accountant all at once, and never actually completing any to their satisfaction.

2. At their present state these small computers are not, but do, present themselves as toys.

3. All the people involved in selling small computers have to start being honest in their comments as to what is possible to achieve with them.

4. All *necessary* extras *must be* included in the sale price.

5. Dealers and manufacturers should realise that the computer is the perfect aid to teach people about itself.

6. Most important is what the small businessman wants of a small computer, and my conversations show it to be this:—

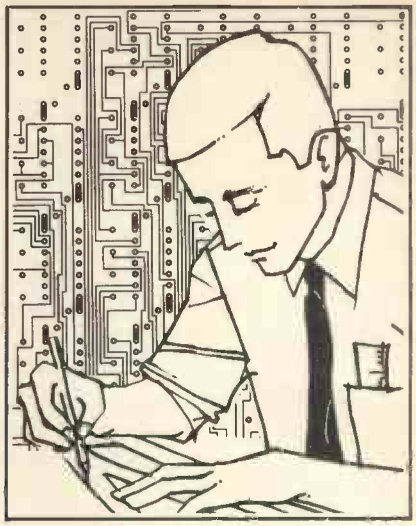
When a man is in the office the phone keeps ringing with customers making sometimes technical, sometimes logistical enquiries, and on each call you have to make a series of quick and sometimes arbitrary decisions, and this is the area into which a small computer fits, with the following organization:—

i) Job number initialisation
ii) Materials order 1, 2, or 3 start sequence
iii) Advice note/packing note — *update* stock
iv) Materials invoice — *update* 1,2,3, verifying against 1,2,3, *check* quantities; *check* pricing *enter* VAT to VAT
v)a) Time sheets — *calculate* wages, tax, etc. *update* 1,2,3, *update* VAT (expenses)
v)b) Materials used — *update* 1,2,3; *decrement* stock
vi) From 1,2,3,4,5, *print* invoices to customers.
vii) From 1,2,3,4,5,6, *print* statements to customers.
viii) *Do all printing at night* so that at the start of the day the boss can check them and alter as necessary.
ix) *Keep up-to-date* turnover, overheads, wages, materials, vehicles, expenses, VAT, bank balance, etc.
x) *Print recommendations* to pay bills.
xi) Have all this information available all day to answer telephone and internal enquiries.
xii) Be available as a super calculator
xiii) Say good morning and good night.

I know the programming is difficult but not impossible. So we want an honestly represented aid, not a new master, to help us, not to invent more time consuming problems.

PCW *The author's electrical & mechanical business goes under the name of D. Franklin, and is at 89 The Plain, Thornbury, Bristol BS12, 2AG.* PCW

Give Us this Day Our Business Processor



Mark Fillingham

Mark Fillingham gained more than 4½ years of data processing experience on ICL and IBM machines in Army installations in the UK and Canada during his career in REME. His insights, gained as Chief Programmer of one of the major systems on the REME computer installation, are now being put to work in his executive appointment in a Christian charity.

PCW *Opinions in this article are not necessarily those of our magazine* PCW

In D.R. Worsley's article "Are Small Businesses Ready to Buy" (PCW April '79) he skilfully analysed some of the psychological and practical reasons why, in general, the answer at present seemed to be 'No'. In this article, written by someone with previous mainframe data processing experience, some further pointers are offered to manufacturers and distributors as to how to bridge the various mental and practical gaps that stand in the way of progress in a potentially enormous market. The background to this article derives from the author's attempts to evaluate what would be the 'best buy' for two small charities in which he is interested.

Small businesses understand office machinery

Whilst some of Mr Worsley's remarks about the inadequacies of the office systems of small businesses may be true, many small businesses are currently small because in the current climate this is the most profitable size to be. By the trimming of staff and the automation of as much routine work as possible a small organisation may achieve a great deal of work from a small number of people.

People are expensive to hire, difficult and expensive to dispose of and, by the nature of the frailties of the human frame, unreliable. Office machinery, power cuts aside, if it is up to its task, suffers none of these faults. Small businesses thrive on the efficient use of good office machinery and many appreciate that an investment in machinery that may cost several thousand pounds will, over a period of years, be a better investment than additional staff.

The micro computer as a piece of office machinery

In many ways the typical micro system is the ultimate piece of office equipment since it is able, through its software, to undertake a whole range of tasks. This has been concealed to some extent by the whole approach of manufacturers and retailers. Some manufacturers such as Hewlett Packard, Wang, and IBM have configured systems simply for word processing and have sold them for this one task. For large businesses they are probably worth it, if there is any truth in the statement that the true cost of a typed business letter produced by a secretary is £5. No-one, as far as I have been able to discover, has offered a complete *integrated* software/hardware package that will handle all the other tasks that a small business could put on such a machine.

Before all the manufacturers and distributors start complaining, there is no doubt that there is on the market most, if not all, of the necessary software and hardware necessary to make up a suitable configuration for almost any business. That is not the same thing at all. The emphasis on the present marketing attitudes seem to be that everyone is keen to sell hardware ("because that's where the mark-up is to be found") and then it is up to the user either to find his own software or to write his own. This again is something of a gross overstatement, but although it is clearly not the policy in the minds of those that sell, it is too often the policy that is perceived by the potential user.

'There's no money in software' may be the entrepreneur's dictum (though having seen the prices asked for some software one is tempted to question this) but hardware without software turns a piece of office machinery into a kind of science-fiction esoteric toy. I have yet to see anything approaching a detailed software specification in all the material I have dredged, with some difficulty, from the various advertisers in PCW. In a proper specification one would expect to see the hardware requirements for a given package (eg. xK bytes of memory for a word processing package, n addresses for a given mini-floppy mailing system, etc.) as well as the more obvious criteria for the specific function. Even the most chaotic small businessman should have a fairly clear idea of the number of people on his mailing list, for example. Ideally, he should thus be able to read straight out of the catalogue what system he needs to buy to fit his requirement. He couldn't care less whether it was a Z80 MPU or had an S100 bus any more than he knows the horsepower rating of the motor in his electric typewriter.

A more commercial approach

To suggest that a more commercial approach is required may offend the average reader of PCW, but the unleashing of a flood of sales by this means would benefit by reducing the cost of his equipment. A more commercial approach would involve, as was picked up by Mr Worsley, a thorough examination of the needs of small businesses. For example, a typical mailing system for a small business with, say, 2000 customers (changing at 50 to 100 a year) and 4 mailings per year would be charged, by a computer bureau producing its address labels, perhaps £50 per year for the service. Similarly a business with perhaps 40 employees would have its payroll calculations run on a bureau at an annual cost of £180. Each of these tasks could be undertaken by an in-house micro and regarded as a brick in constructing the justification for the machine. The more bricks identified the sooner the machine would pay for itself. Each brick would in fact come in a range of sizes, since there are considerable hardware differences between running a payroll package for less than 10 employees and one for 50 employees.

Such 'packaging' of hardware and software could either be done by the manufacturer or by a chain of distributors. We must set our eyes on the target of making the micro computer just another piece of office equipment. An obvious flaw in this approach is the variety of needs in, say, financial packages, but again, the average first time user will be happy to accommodate himself to a different system of accounts and financial reports, rather than have to invest several thousand pounds in tailormade software to meet the requirements of a system which has grown up with the business; and may well have no intrinsic merit of its own apart from familiarity. With modular programming concepts it should eventually be possible to buy your software in modules so that you bought only the bits you wanted and perhaps commissioned the odd bits that no-one else had ever thought of.

The characteristics of a good office machine

Good office machinery is basically robust and simple to operate. Having been involved in using one of the earliest ICL 1900 machines it would have failed on both counts, both on software and hardware (four years of experience wrought an amazing transformation). If this commercial approach is to be followed, effort must be expended in making programmes and operating systems simple enough for the typical secretary to use with the minimum of training. Small businesses have neither the resources to send staff on long courses for the capacity for only one member of staff to be able to touch 'that machine'. The present correspondence columns of PCW seem to be full of cunning dodges which you can use to prevent yourself wiping out disks, programs and odd chunks of memory by accidentally pressing the wrong button. A bad reputation on this score would rapidly put a blight on sales of an otherwise commendable system, just as poor quality control for a month or two has damaged some famous names in the world of motoring.

Almost there

It is possible that much of what has been described is already being done in some areas by the more enlightened distributors and consultants. As a result of writing twenty or more letters to advertisers seeking advice and giving some specific details on system requirements, I did eventually establish personal contact with a couple of firms offering such a service. I am an enthusiast competent to discuss the niceties of both hardware and software, and thus able to detect some of the more obvious cases of attempting to sell over-specified hardware and under-capable software. The average small businessman would rightly duck for cover faced with the trials to which I have been put in my attempts to find suitable software/hardware configurations for two offices.

The one sentence lesson from all this is that if you want the small businesses to buy, someone has got to make it an awful lot easier to do so. The office machinery approach advocated in this article is probably the most rewarding way to go.

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PCW Book Review

Michael James

USING COMPUTERS IN PHYSICS
J.R. Merrill, 1976
258 pages, (Houghton Mifflin Co.
8" x 10" £4.35)

This is a collection of programs to solve various problems in physics. Each program is given in both BASIC and FORTRAN, so there should be few difficulties in getting any of them to work, no matter what computer you have. The range of topics covered is far too large for me to discuss each in turn, but the following list should give some idea of what can be found.

Mechanics	—	Motion, scattering, three body motion, coupled oscillators.
Thermodynamics	—	PVT surfaces, state functions.
Statistical physics	—	Gases, Ising model.
Electric Fields	—	Plotting field lines
Laplace & Poissons Equ.	—	Electrostatics
Magnetic fields	—	Plotting field lines, motion
Relativity	—	Lorentz contraction, electric fields
Circuit theory	—	Resistors, capacitors, inductors
Geometrical Optics	—	Ray tracing
Fourier Analysis	—	Dispersive waves
Wave Addition	—	Standing waves, interference
Quantum Mechanics	—	One dimensional Schrodinger equation
Nuclear Decay	—	Decay chains
Solid State Physics	—	Reciprocal lattice, phonons.

This is an ideal book for physics teaching from 6th form all the way to 1st-2nd year degree level. My only criticisms are the lack of detailed explanation of many of the methods used, the absence of any coherent discussion of the numerical methods, and the odd way the program listings turn up away from the relevant text. Also, the results of the programs are very often presented as graphs and charts. This is slightly misleading as nearly all the programs produce lists of numbers as their answers and the graphs have to be drawn by hand — a task most would agree is best done by computer. Given a little time, the necessary graphical output could be added to any of the programs, so forming a very pleasant teaching aid.

I have tried a selection of these programs on both a SWTPC 6800 and a VECTOR MZ using CBASIC and have had no problems apart from matrix statements (eg. matrix reads and inversion) which the author assumes are available and are not often found on micro systems. It is also obvious that a larger machine than a micro was used to develop the programs, because one or two take rather a long time to run!

Although I have a few criticisms of the book's text, the programs are invaluable to anyone interested in physics or interested in teaching physics. Excellent value!

PARKINSON'S REVAS

D.W. Parkinson

Continued from Vol.2, No. 3.

```
FB24  38 E3               JR     C,NOP      ;JUMP ALSO IF<10.
FB26                ;
FB26                ; JUMP RELATIVE
FB26                ;
FB26  EB            JR:   EX     DE,HL      ;WRITE "JR"
FB27  36 4A               LD     (HL),'J'
FB29  23                  INC    HL
FB2A  36 52               LD     (HL),'R'
FB2C  11 32 10            LD     DE,BUFFER+32;RESET DE
FB2F  FE 18               CP     $18        ;UNCONDITIONAL?
FB31  28 08               JR     Z,UCD      ;YES,JUMP
FB33  E6 18               AND    $18        ;ISOLATE COND. CODES
FB35  CD AB FA            CALL   CCODES     ;WRITE APPROPIATE ONE
FB38  CD 11 F9            CALL   COMMA      ;","
FB3B  CD DB F8      UCD:  CALL   BYTE       ;GET OFFSET
FB3E  4F                  LD     C,A        ;PUT IN C
FB3F  07                  RLCA              ;EXTEND SIGN THRU' A
FB40  9F                  SBC    A
FB41  47                  LD     B,A        ;PUT IN B
FB42  2A 03 10            LD     HL,(ADDR)  ;LOAD CURRENT ADDRESS
FB45  09                  ADD    HL,BC      ;COMPUTE TARGET ADDRESS
FB46  C3 60 F9            JP     LD16B      ;WRITE IT ETC.
FB49                ;
FB49                ; EX AF/AF'/JR/JR Z/JR C
FB49                ;
FB49  F1            EXAETC: POP  AF         ;RECOVER OPCODE
FB4A  FE 08               CP     8          ;JR?
FB4C  20 D8               JR     NZ,JR      ;YES,GO TO THEM
FB4E                ;
FB4E  CD 5D FB            CALL   WREX       ;WRITE "EX"
FB51  21 57 FB            LD     HL,EXAFM   ;WRITE "AF,AF'"
FB54  C3 1D F9            JP     COPY6
FB57  41 46 2C 41   EXAFM: DB    'AF,AF',$27
      46 27
FB5D                ;
FB5D                ; WRITE "EX"
FB5D                ;
FB5D  EB            WREX: EX     DE,HL
FB5E  36 45               LD     (HL),'E'
FB60  23                  INC    HL
FB61  36 58               LD     (HL),'X'
FB63  11 32 10            LD     DE,BUFFER+32;RESET DE
FB66  C9                  RET
FB67                ;
FB67                ; JP/OUT/EX (SP),HL/DI
FB67                ;
FB67  F1            JPETC: POP   AF         ;RECOVER OPCODE
FB68  FE D3               CP     $D3        ;JUMP?
FB6A  DA 7B FA            JP     C,CJR+1    ;JUMP IF "JP"
FB6D  28 36               JR     Z,OUT      ;JUMP IF "OUT"
FB6F  FE F3               CP     $F3        ;"DI"?
FB71  28 13               JR     Z,DI       ;YES,JUMP
FB73                ;
FB73  CD 5D FB            CALL   WREX       ;WRITE "EX"
```

Continued Page 76

PCW OPEN PAGE

THE AMATEUR VIEW

Mike Lord

MORE ON LOW SPEED BUSSES

One of the disadvantages of communicating via a monthly journal such as PCW is the time between writing an article or letter and a reply appearing in print. This can amount to several months, and meanwhile the original author is left wondering if anyone actually read his piece.

So it was nice to see, in April's PCW, the letter from Mr. Siddons responding to the plea for a low speed bus standard which was published in the January issue.

In the meantime, some further thinking had taken place and so, heartened by having caught at least one reader's interest, it may be time to expand on the original article.

First, one should establish whether there is in fact a need for a standard 'low speed bus' in the personal computing world. The argument for this is that it would allow the peripheral manufacturer to produce a standard unit which would work with anyone's processor, relieving him of the necessity to design a range of wierd and peculiar interface boards, and conversely the processor designer wouldn't have to allow for strange boards being inserted in his box. Also, given a standard and clear cut interface, there should be less confusion over the responsibility for a failure in a system made up from units from different suppliers.

The second area to be examined is the actual specification for such a bus. Since writing the original item, the author has become convinced that the best choice must be the IEEE-488 on the grounds that:

- It exists.
- It works.
- It is specified properly.
- It will do the job.

Agreed it is a complicated beast, but then it does provide a comprehensive range of facilities, and it may be that the IEEE specification, in detailing exactly how every feature of the bus shall work, makes it appear to be more complicated than it actually is. And in practice, the dedicated ICs now becoming available mean that an IEEE-488 interface can be implemented with hardly any more difficulty than say a serial RS232C port. Although these controller and interface ICs are relatively expensive at the moment, they have only just been introduced, and one would expect their prices to drop rapidly over the next year or two.

So, in conclusion, a plea to the designers of the next generation of personal computers and peripherals; please include IEEE-488 capability in your next product.

Note; IEEE-488 has been re-published in an expanded form, and copies are available for $10 + $2 shipping and handling charge from IEEE Service Centre, 445 Hoes Lane, Piscataway, NJ 08854 U.S.A.

Pascal from Down Under

'Pipe Dream Software' of 28 Palmerston St., Berwick, Vic 3806, Australia, are advertising a suite of programs which will let you use a sub-set of the Pascal language on a 16k Level II TRS-80. Although some Pascal features have been left out, or are only allowed in a limited form e.g. the only data types are 16 bit integers and integer arrays, program listings are provided so the software enthusiast could add features to match the size of his memory.

And from the Netherlands

A bit closer to home, Lucidata of Oosteinde 223, Voorburg 2271 EG (ZH), Netherlands, have developed a Pascal compiler for 6800 users running FLEX Operating System with at least one mini-floppy and 16k RAM.

Growing Groups

Ian Dunkley has written to tell of a new group forming in the *Sheffield* area to cater for both amateurs and small business users. Anyone interested in joining should ring him on (0742) 363337 or write to 1 Prospect Place, Sheffield S17 4HZ.

A.J. Perks of 99 Hillside Rd., Corfe Mullen, *Wimborne, Dorset* is interested in forming a local computer user group with a bias towards the TRS-80. It is hoped that if sufficient interest can be stimulated, and active support from members can be maintained, a worth-while newsletter may be produced. Those interested are invited to write or ring Broadstone 697888.

On the subject of club newsletters, the North London Hobby Computer Club is now producing one inappropriately named GIGO (Garbage In = Garbage Out). As those in touch will know, the NLHCC is now one of the most active clubs in the UK. Based on the Polytechnic of North London, and so able to use many of the Poly's facilities, it has specialised groups for Homebrew, PET, NASCOM and Business Users, and organises regular courses on subjects such as BASIC and Digital Electronics. All this activity has resulted in an average of six meetings a week, and an attendance of around 150 at the main monthly meetings. For more details write to the Chairman, Robin Bradbeer: NLHCC, c/o The Polytechnic of North London, Holloway, N8 8DB.

Another newsletter received recently was that of the *TRS-80 User Group*. The group is independent of Tandy, and the newsletter carries hardware and software tips and news of TRS-80 related products. The group is also organising a software exchange scheme. Anyone wishing to join is invited to contact: B.C. Pain at 40a High St., Stony Stratford, Milton Keynes, telephone: (0908) 564271.

Like many other groups which are based on colleges or universities, the *Southampton Amateur Computer Club* has closed for the summer months, and will start up again in October with regular monthly meetings. Just before going on holiday, the SACC had been offered an IBM 360/40 and were trying to find a suitable site to house it. If they do take it, they would obviously be interested to hear from anyone living locally who has 360/40 experience. For more details of this and other club activities, send a SAE to SACC c/o Students Union, University Road, Southampton SO9 5NH.

Geoff Phillips of 8 Poolsford Road, London NW9 6HP has started a newsletter for owners of *SC/MP* based machines like the *MK14* to help them get to grips with their processor, and to provide a means of communication between users.

Similarly, Jim Cunningham is setting up a club for users of systems such as *Cosmac* and *ELF* which are based on the *RCA 1802*. Those interested are invited to send a SAE to 7 Harrowden Court, Harrowden Road, Luton LU2 0SR.

And, continuing the theme of clubs devoted to specific types of hardware, the *Sorcerer Program Exchange Club* has been formed to act as a clearing house for program ideas and helpful hints on the use of this micro, and is being run by M.P. Hannaby of 65 Trafalga Road, Birkdale, Southport PR8 2NJ.

The *South Yorkshire Personal Computer Group* is now flourishing and holding meetings on the second Wednesday of each month at the University of Sheffield; details from SYPCG secretary Tony Rycroft, 88 Spinneyfield, Moorgate, Rotherham, S. Yorks.

Finally, those wishing to publicise their group are invited to get in touch with Mike Lord at 7 Dordells, Basildon, Essex; telephone; (0268) 411125.

AMATEUR COMPUTER CLUB ON SHOW

L H Side. *Pete Hesketh, Secretary/Chairman*
R H Side. *Tim Robson; Basic, Karate and Assembler Expert.*

As quite a few of the members of the Gwent Amateur Computer Club are Radio Amateurs it came as no surprise when someone suggested that the Club should get involved with the Mobile Radio Rally at Barry, South Glamorgan, organised by the Barry College of Further Education Amateur Radio Society.

In the past this event has not had any home computer exhibitors, but this did not stop the Club from having a go. In fact as the only Welsh computer club (go on – prove us wrong) they felt duty bound to enlighten the hordes of Hams as to the interest and fun to be had with microcomputers.

Bob Robson (call sign GW8AGI) was volunteered into being the link-man (his son Tim is the one administering a Karate chop to his Triton in the picture) and came to the next meeting to say that he had reserved 50 feet of display space.

When the day arrived the Club managed to install and demonstrate a Triton, a Nascom, an ETI System 68, a North Star Horizon with floppy discs and a couple of PETs, including one with a bright orange case. Needless to say, with all that high technology connected to one 13 amp plug, there was a low technology disaster and the main fuse blew for part of the building.

In spite of all this there were plenty of people interested and the event was pronounced a success – well, at least one new member joined the club.

For a list of future events, contact the Events Secretary, Hugh Harrison-Allen, Newport 50528.

Peter Hesketh, Hon.Sec., Gwent ACC.

AMATEUR COMPUTER CLUB

Membership forms for the current year have now been despatched. The current annual subscription is £3.50 except for members under 16 or over 65 years of age, where it remains £1.

New applications for membership can be sent to Derek Ellis, Membership Secretary of 82 St. Albans Road, Kingston, Surrey. Please do not send money with your letter as the payments are to be made by giro.

We consider applications from all walks of life be you politician or an (unwilling!) guest of Her Majesty.

Derek Ellis,
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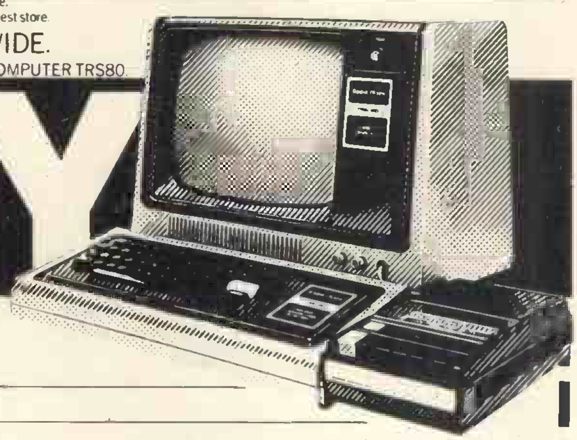

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BUZZWORDS

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Half-Add. A process of combining two sets of binary numbers to produce a third with 1 bits in those positions where the two *operands* differ and 0 bits where the operands coincide. The process is like addition but ignoring all carry figures.

Half-Adder. Logical circuit, with two outputs (S and C) and two inputs (A and B), which achieves the following relationship between input and output:

Input		*Output*	
A	B	S	C
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

S denotes "sum without carry" and C denotes "carry." Two half-adders may be used for performing binary addition.

Half Duplex. A system for inter-connection of data transmission devices, such as teleprinters linked by ordinary telephone wires, so that one can send and the other receive, or vice versa, but they cannot both send at the same time. Whatever one sends from a half duplex keyboard is normally displayed or printed locally as well, whereas with a duplex system only what is sent or echoed from the distant station will be shown. Synonymous with *Simplex.*

Halt Instruction. Synonymous with *stop* in a computer program. The program terminates when it reaches this point.

Handshake. An exchange of signals between a computer and a peripheral device which establishes synchronisation for transmission of data.

Hands-Off. Operating without personal attention. The phrase is used particularly of program testing when the programmer hands his work over to a computer operator and in no way attends the machine during the testing process. A print-out will usually be delivered to show the result of the test in some detail and there may also be a listing of the contents of memory at some crucial stage. The programmer working through these papers afterwards will see if any trouble was encounterer and, if so, may be able to deduce part at least of the cause. Hands-off working makes it easier to estimate the length of program testing sessions on a computer and is of particular value when machine time is in more critically short supply than the time of programmers. It tends to take the search for programming errors and bugs one step at a time and when the first fault or two have been identified and corrected the next hands-off testing session will probably reveal further snags and so on. By contrast, when a skilled programmer is allowed the run of a machine for some hours at a stretch he will usually manage to take his work through several successive stages of redevelopment in the course of a single session.

Hands-on. Under direct personal control; normally used of a machine where this method of working might not be expected, for example, in traditional mainframe work where the programmer operates the computer himself and possibly manipulates the console to correct or circumvent minor errors that come to light.

Hang-Up. An unintended stop in running a program.

Hard Copy. A legible copy in conventional characters. For example, when a typewriter is used to feed *input* into a computer, either by direct connection of electrical impulses or by preparing punched paper tape, a conventional record of what is typed is produced simultaneously on ordinary paper; this is known as the hard copy.

Hard Data. Properly established and quantified or identified facts or statements, for example, the items reflected in an audited profit and loss account or balance sheet. By contract *soft data* is less certain or specific, for example, the chairman's announcement that improved results may be expected in the next year.

Hard Error. A computing fault that occurs predictably and can usually be traced to some physical malfunction of equipment. Contrast with *soft error.*

Hardware. A general term applied to all parts of the computer and its equipment — the central processor, memory units and peripheral devices. To be distinguished from *software.*

Hardware Check. A test of data for completeness or accuracy effected by permanent logical circuits in the machine. Contrast with *programmed* check.

Hardware Lock. An electronic arrangement whereby certain parts of a computer are not accessible to, and cannot be influenced by, other programs or by inadvertent action on the part of the operator.

Hardwired. Descriptive of computer facilities (for instance automatic computation of mathematical functions) when they happen to be provided by permanent circuits (or hardware) rather than by sub-routines or software.

Hash Total. A total (or the least significant part of a total) of the various numbers involved in some piece of data transfer which may be taken without regard to whether or not the values derive from true numbers or alphabetic characters which can have a numerical equivalent. A comparison of hash totals taken before and after processing will usually indicate whether or not any data has been lost or corrupted in the process.

Head. A device to read, write or erase data in a (typically magnetic) storage medium. This is comparable to the heads in a conventional audio recorder.

Header. Information at the start of a set of records to identify those records before they are processed.

Header Label. Header information typically related to a larger collection of records, such as a complete magnetic tape or disk. The machine-readable code in the label may, for instance, identify the tape or disk number, name and date of last updating.

Head Gap 1). The distance between a magnetic read/write head and the surface of the disc (or other device) it serves.

2). The slot in a read/write head which provides the point of focus of the magnetic reading or writing process.

Heat-Sensitive Paper. Paper coated with a substance which darkens locally in response to head. Such paper is used in thermal printers, where the matrix print head floats across the platen (or roller) in light contact with the paper but without any impact.

Head Shunt. A tool, typically embodying a lump of copper or other good conductor of heat, temporarily attached to a transistor or other component while it is soldered in position. The shunt absorbs surplus heat from the molten solder which might otherwise damage the component.

Heat Sink. A metal attachment which increases the surface area of a transistor or electronic switch dissipating a large amount of energy as heat and so helps to keep the device within its designed limits of operating temperature.

Henry. The standard unit of electrical inductance (named after Joseph Henry 1797-1878). In practice the inductance of a coil is typically measured in millihenries (one-thousandth of a henry).

Hertz. A standard unit of frequency or periodicity, being one cycle per second. A pendulum beating twice a second has a frequency of 2 Hertz; the usual electricity supply in the U.K. has a frequency of 50 Hz (in the U.S.A. 60 Hz). The term was generally adopted about 1967 in commemoration of Heinrich Hertz, the German physicist who, in 1888, was the first to demonstrate the electrical production of radio waves.

Hesitation (term now rare). A brief and effectively imperceptible interrupt in the main activity of a processor, during which some other work is momentarily advanced.

Heuristics. Achieving a solution by deliberate trial and error.

Hex. Abbreviation for hexadecimal.

Hexadecimal. A numbering system based on the radix 16 (as the decimal system is based on the radix 10 and the binary system on the radix 2). "Hex" uses A, B, C, D, E and F for the values 10 to 15 respectively and is most often met in machine language programs and memory addresses.

High (state). The output of bistable devices can be either high or low, according to the level of voltage present at that point in the circuit. High is generally identified with a voltage of some 40% or more of the nominal line or supply voltage. Low is ideally zero volts and should certainly not exceed an agreed voltage, say 25% of supply.

High Level (Language). Powerful program coding system generating more than one machine instruction for each instruction written by a programmer, for example, BASIC or FORTRAN. High level languages tend to save programming time at the expense of greater use of hardware and slower processing. Interpreters or compilers, provided by the computer manufacturers, are required to make machine-usable instructions from high level language programs and they usually require to be run on a computer above a certain size. Selections of high level languages are sometimes available for smaller computers for example, TINY BASIC.

High Order (bits). The left hand or most significant group of digits in a number, especially when it is expressed in binary or hexadecimal notation. Beware, however, of identifying high order numbers by where they appear: in hexadecimal memory addressing the low order part is normally entered before the high order part.

High Speed Printer. Peripheral device for computer output which prints a complete line of data at a time, at a speed of usually not less than 300 (sometimes 10,000) lines a minute. A typical line of print accommodates up to 132 (or 156) characters. Synonymous with *line printer.*

Highway. A communication *channel* which may be shared by several devices. Synonymous with *bus.*

Hit. The fault condition in a magnetic disc unit when a moving read/write head comes into actual contact with the rotating surface. This can damage the equipment and lead to loss of data.

Hollerith. System of encoding data on punched cards for subsequent sorting, counting and tabulation by electro-mechanical machines. A direct forerunner of the punched-card family of computers. Named after Dr. Herman Hollerith who applied his invention to the US census in 1890.

Home. Base or starting position for the cursor on a visual display screen, typically in the top left corner.

Homebrew (of a computer system) home-made, implying some originality of design and personal wiring, though standard components and units may be included.

Hot. A terminal at a high voltage and therefore dangerous (or unpleasant) to touch.

Housekeeping. Computer program instructions which are necessary for its processing but which do not form a constructive part of any application program; for example, instructions to pack or rearrange data in some form to suit the peripheral devices which happen to be attached. A feature of sophisticated housekeeping software is that it tends to demand exclusive use of a large area of core which must be disregarded in taking stock of the amount available for normal computing purposes; a multi-programming computer with 64K characters of memory might have more than half this storage committed to housekeeping software.

HT. High Tension, an electrical voltage at say 100 volts or more, possibly much more.

Humidity. The extent of moisture in the atmosphere — normally measured in degrees of relative humidity (RH), since absolute humidity varies with ambient temperature. Material such as punched cards and paper tape can be affected by the humidity in the atmosphere in which it is stored, and it then becomes desirable to transfer it to a humidity-controlled atmosphere to get acclimatised before feeding it into a fast reading or punching machine.

Hunting. The oscillation of some automatically controlled system around a standard value it is seeking to reach without success. A domestic example may be found in central heating radiators which are turned off by an air thermostat only after they have become too hot and are turned on again only after they have become too cold.

Hybrid. A combination of different technologies, for instance the linking of digital and analogue computers for some special purpose, e.g., in industrial process control or an aircraft flight simulator.

Hysterisis. A physical property of delay in completing a change of state. In electronics a notable example is the timing of the build up and subsequent decay of magnetic fields.

Hz. Hertz (abbreviation). A frequency of one cycle per second.

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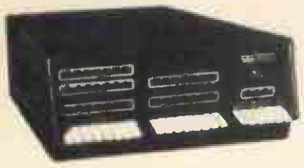


A **MINI COMPUTER** using MICRO technology at a ridiculous MICRO price!! The front panel with a backplane and power supply accepts S100 bus boards from many manufacturers.

Just look at these professional features!

★ FRONT PANEL (we won't ask you to debug our hardware, but we will give you the tools to debug yours!) Has lights and switches to allow inspection and control of addresses and data. Other features include programmed input switches, and output lights, Examine, Examine next, deposit, deposit next, single or slow step (0.1 to 1000 IPS), hardware breakpoint on any data or address byte, repeat instruction and many other hardware diagnostic facilities.

★ 30 Amp, 8V power supply. 5 Amps on ± 16v rails (all rails are seperately fused)

★ 20 slot IEEE S100 Motherboard with active termination and shielding between bus lines

★ Suitable for 6800, 6502, 8080, 8085, Z80, Z80A processors.

★ Guaranteed operation at 4MHz.

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

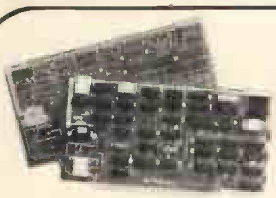
S100 boards from a number of manufacturers will plug into the DPSI IEEE S100 bus.

Just add S100 Memory Boards — S100 disk controller boards — S100 I/O boards — S100 video and/or graphics boards — S100 EPROM boards

All Ithaca Intersystems OEM products including K2 disk operating system and PASCAL/Z on 8" floppy drives will run in the DPS-1.

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

OEM S100 boards from the experts!



	Assembled and tested
8K Static RAM board (45 ons)	£123.75
8K Static RAM board (25 ons)	£146.25
Z80 cpu board (2MHZ)	£131.25
Z80 cpu board (4MHZ)	£153.75
2708/2716 EPROM board	£63.75
Prototype board (bare board)	£18.75
Video display board (64x16, 128U/L Ascii)	£108.75

New products from Ithaca audio!

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

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

Over 15,000 boards delivered worldwide

InterSystems

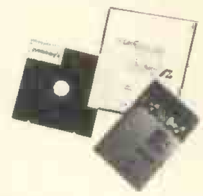
Software for your S100 system

K2 operating system

8" disk based operating system — distributed on Shugat compatible 8" floppy disk ★ TED — 52 command character orientated text editor with Macros. ★ PIP — File and directory handler. ★ ASMBLE — full Z80 2 pass assembler. ★ HDT—Hex debug tool. ★ QCI—Utility overlay/command decoder. ★ SYSGEN—System builder. ★ COPY—disk to disk file copier. ★ DUP—disk duplicator. **£56.25**

PASCAL/Z The new language for Micros £131.25

Runs under K2 operating system.



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

ASMBLE/Z Z80 Macro assembler £37.50

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

UP-GRADE KITS

Trying to add computer memory is not much fun if you dont get everything you need. Receiving unprogrammed jumpers and having to program them yourself is not much better. Most important, that's the place where the problems are introduced.

So Ithaca Audio's better idea is the Simple Up-Grade. Each Simple Up-Grade is specially designed to make adding memory foolproof. We include all the parts you'll need; 8 prime, tested 16K RAMs, along with concise step by step directions and diagrams. And if a personality jumper is required, *it's premade*.

The TRS-80* memory expansion was our first Simple Up-Grade. Now there are two more — for owners of Apple II** and Exidy Sorcerer*** computers. Each kit is 100% guaranteed — if a part ever fails, we replace it FREE. Your Ithaca Audio dealer has them in stock, only £69. Now you can afford to add high quality, high density memory to your system for remarkably little — far less than you would expect to pay from Radio Shack, Apple, or Exidy directly. These Simple Up-Grades are Ithaca Audio's first step in adding more capability and reliability to your computer at lower cost. Other Up-Grades are on the way to your dealer now.

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NEW EUROPEAN SUBSIDIARY
58 Crouch Hall Road, London N8 8HG. UK.
Telephone: 01-341 2447 Telex: 299568

From Page 67.

```
FB76  21 81 FB              LD    HL,BSPBM   ;WRITE "(SP),"
FB79  CD 1F F9              CALL  COPY5
FB7C  3E 20                 LD    A,$20      ;SET FOR HL/IX/IY
FB7E  C3 7E F9              JP    REGPR      ;WRITE APPROPRIATE ONE.
FB81  28 53 50 29   BSPBM:  DB    '(SP),'
      2C
FB86                ;
FB86                ; DI/EI
FB86                ;
FB86  3E 44         DI:     LD    A,'D'      ;WRITE "DI"...
FB88  18 02                 JR    *+2
FB8A  3E 45         EI:     LD    A,'E'      ;..OR "EI"
FB8C  EB                    EX    DE,HL
FB8D  77                    LD    (HL),A
FB8E  23                    INC   HL
FB8F  36 49                 LD    (HL),'I'
FB91  C9                    RET
FB92                ;
FB92                ;  IN A,$XX
FB92                ;
FB92  21 9E FB      IN:     LD    HL,INM     ;WRITE "IN  A,"
FB95  CD 21 F9              CALL  COPY4
FB98  CD 23 F9              CALL  COPY3
FB9B  C3 09 FA              JP    IMM        ;GET & WRITE PORT NO.
FB9E  49 4E 20 20   INM:    DB    'IN   A,'
      20 41 2C
FBA5                ;
FBA5                ;  OUT $XX,A
FBA5                ;
FBA5  21 B8 FB      OUT:    LD    HL,OUTM    ;WRITE 'OUT'
FBA8  CD 23 F9              CALL  COPY3
FBAB  13                    INC   DE         ;SPACE
FBAC  13                    INC   DE
FBAD  13                    INC   DE
FBAE  CD 09 FA              CALL  IMM        ;GET & WRITE PORT NO.
FBB1  CD 11 F9              CALL  COMMA      ;","
FBB4  3E 41                 LD    A,'A'      ;WRITE "A"
FBB6  12                    LD    (DE),A
FBB7  C9                    RET              ;DONE
FBB8  4F 55 54      OUTM:   DB    'OUT'
FBBB                ;
FBBB                ; ROTATE & TEST/IN/EX DE,HL/EI
FBBB                ;
FBBB  F1            CBETC:  POP   AF         ;RECOVER OPCODE
FBBC  FE DB                 CP    $DB        ;IN?
FBBE  28 D2                 JR    Z,IN       ;YES,JUMP
FBC0  DA 4F FC              JP    C,CB       ;JUMP IF "CB"
FBC3  FE FB                 CP    $FB        ;"EI"?
FBC5  28 C3                 JR    Z,EI       ;YES,JUMP
FBC7                ; EX DE,HL
FBC7  CD 5D FB              CALL  WREX       ;WRITE "EX"
FBCA  21 A5 F9              LD    HL,RPRTAB+4;WRITE "DE"
FBCD  CD 25 F9              CALL  COPY2
FBD0  CD 11 F9              CALL  COMMA      ;","
FBD3  C3 25 F9              JP    COPY2      ;WRITE "HL" & RETURN
FBD6                ;
FBD6                ; RET/EXX/JP (HL)/LD SP,HL
FBD6                ;
FBD6  F1            RETETC: POP   AF         ;RECOVER OPCODE
FBD7  FE D9                 CP    $D9        ;"RET" OR "EXX"?
FBD9  DA 7B FA              JP    C,CJR+1    ;"RET",SO JUMP
FBDC  28 21                 JR    Z,EXX      ;"EXX" SO JUMP
FBDE  FE F9                 CP    $F9        ;"LD SP"?
FBE0  28 0C                 JR    Z,LDSP     ;YES,JUMP
FBE2  21 A3 FA              LD    HL,CJRTAB+4;WRITE "JP"
FBE5  CD 25 F9              CALL  COPY2
FBE8  21 32 10              LD    HL,BUFFER+32;RESET HL
FBEB  C3 2E FC              JP    LD1+3      ;WRITE HL,IX OR IY
FBEE                ;
FBEE                ; LOAD SP
FBEE                ;
FBEE  CD 06 F9      LDSP:   CALL  WRLD       ;WRITE "LD"
FBF1  21 FC FB              LD    HL,SPM
FBF4  CD 23 F9              CALL  COPY3      ;WRITE "SP"
FBF7  3E 20                 LD    A,$20      ;MAKE LIKE HL
FBF9  C3 7E F9              JP    REGPR      ;WRITE HL,IX,OR IY
FBFC  53 50 2C      SPM:    DB    'SP,'
FBFF                ;
FBFF                ;  WRITE "EXX"
FBFF                ;
FBFF  CD 5D FB      EXX:    CALL  WREX       ;WRITE "EX"
FC02  23                    INC   HL         ;BUMP ADDRESS
FC03  36 58                 LD    (HL),'X'   ;ADD ANOTHER "X"
FC05  C9                    RET
FC06                ;
FC06                ;  LD (BC),A LD (DE),A LD(NN),HL LD,(NN),A
FC06                ;
FC06  CD 06 F9      STIND:  CALL  WRLD       ;WRITE "LD"
FC09  F1                    POP   AF         ;RECOVER OPCODE
FC0A  F5                    PUSH  AF         ;SAVE IT FOR ST16I
FC0B  FE 22                 CP    $22        ;16 BIT?
FC0D  28 2D                 JR    Z,ST16I    ;YES,JUMP
FC0F  F1                    POP   AF         ;NO,THROW AWAY SAVE
FC10  CD 2B FC              CALL  LD1        ;WRITE INDIRECT PART
FC13  CD 11 F9              CALL  COMMA      ;","
FC16  3E 41         ST1:    LD    A,'A'      ;WRITE "A"
FC18  12                    LD    (DE),A
FC19  13                    INC   DE
FC1A  C9                    RET
FC1B                ;
FC1B                ;  LD A,(BC)  LD A,(DE)  LD HL,(NN)  LD A,(NN)
FC1B                ;
FC1B  CD 06 F9      LDIND:  CALL  WRLD       ;WRITE "LD"
FC1E  F1                    POP   AF         ;RECOVER OPCODE
FC1F  F5                    PUSH  AF         ;SAVE
FC20  FE 2A                 CP    $2A        ;16 BIT?
FC22  28 21                 JR    Z,LD16I    ;YES,JUMP
FC24  CD 16 FC              CALL  ST1        ;"A"
FC27  CD 11 F9              CALL  COMMA      ;","
FC2A  F1                    POP   AF         ;RECOVER OPCODE
FC2B  FE 22         LD1:    CP    $22        ;REGPR OR EXTENDED?
FC2D  EB                    EX    DE,HL      ;WRITE "("
FC2E  36 28                 LD    (HL),'('
FC30  23                    INC   HL
FC31  EB                    EX    DE,HL
FC32  3F                    CCF              ;REVERSE RESULT OF COMPARE
FC33  D4 7E F9              CALL  NC,REGPR   ;(RETURNS WITH NC)
FC36  DC 57 F9              CALL  C,LD16A    ;EXTENDED ADDRESS
FC39  C3 04 FA              JP    NOTIXY     ;CLOSE BRACKETS
FC3C                ;
FC3C                ; 16-BIT INDIRECT STORE  LD (NNNN),PP
FC3C                ;
FC3C  CD 2B FC      ST16I:  CALL  LD1        ;DO INDIRECT BIT
FC3F  CD 11 F9              CALL  COMMA      ;","
FC42  C3 7D F9              JP    REGPR-1    ;GET OP & PR. REG PAIR
FC45                ;
FC45                ; 16-BIT INDIRECT LOAD  LD PP,(NNNN)
FC45                ;
FC45  F1            LD16I:  POP   AF         ;GET OPCODE
FC46  CD 7E F9              CALL  REGPR      ;PRINT REG PR.
FC49  CD 11 F9              CALL  COMMA      ;","
FC4C  A7                    AND   A          ;CLEAR CARRY
FC4D  18 DE                 JR    LD1+2      ;DO INDIRECT BIT
```

TO BE CONTINUED

If you buy the wrong personal computer, you can't re-program your bank account!

Buying a personal computer is not an easy task.
So many people selling them neglect the little things that enable you to get the most from your computer, such as documentation, spares, add-ons and maintenance. We believe that these 'details' are essential. We are the only British company to put all our time and energy into the personal computer market and are in the best position to advise you on your initial purchase and keep you fully informed about all the new developments relevant to your computer.
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