

 **commodore**

# COMPUTING

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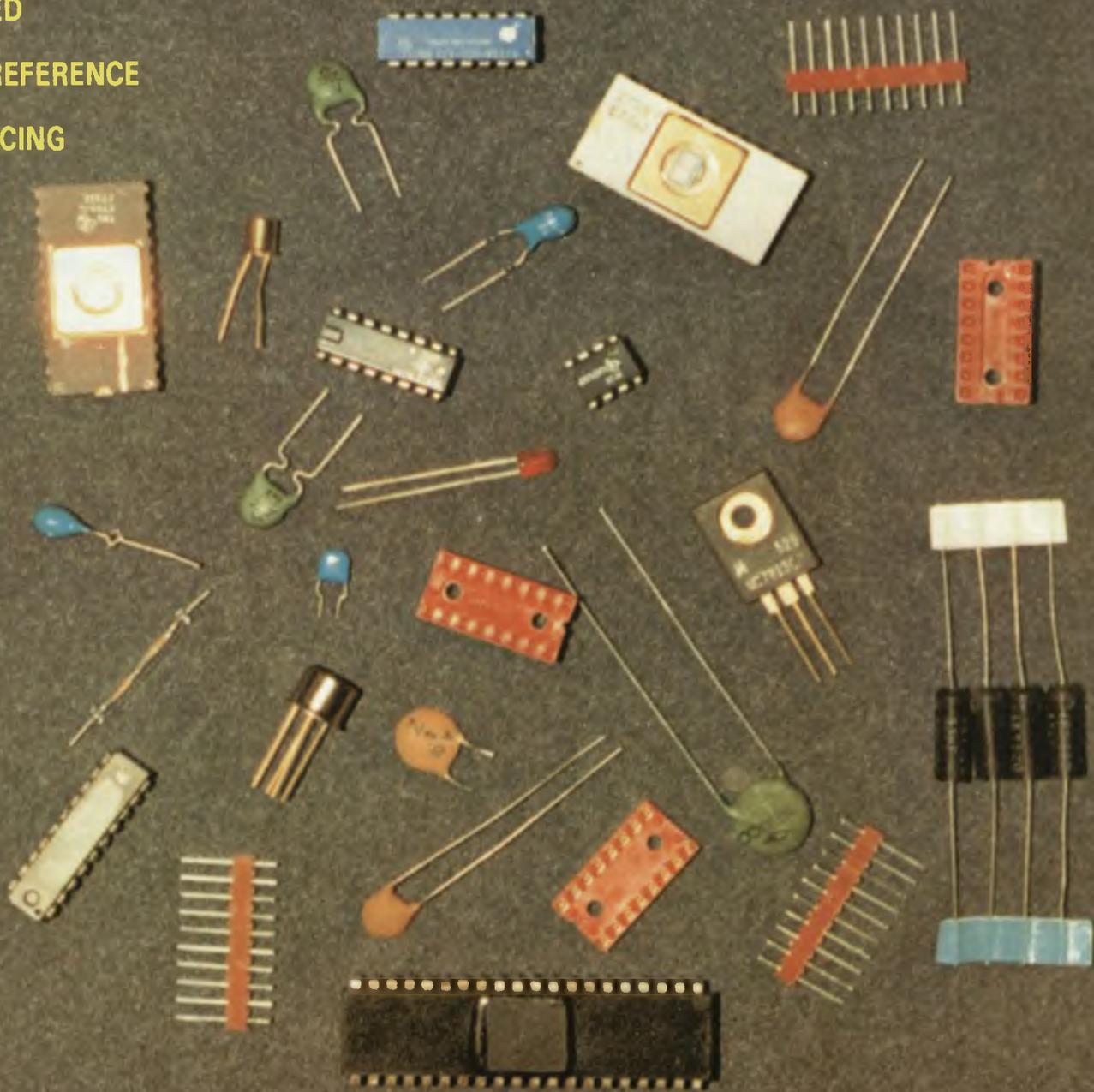
**international**

**BUSINESS TRAINING  
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**MICRO-SIMPLEX  
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**CROSS REFERENCE**

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**The independent magazine for Commodore computer users**



# COMPUTING

January 1983

international

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## EDITORIAL

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London W1. Tel: 01-636 6354.

It can be confidently expected that 1983 will see a considerable increase in the world-wide market for micro-computer systems. With the expansion of the family of micro-computer systems offered by Commodore from three to eight in the near future, the company is poised to increase its current 12 per cent of the world market.

Before Christmas Commodore announced the sale of the millionth Vic 20 colour computer. Since the American company launched the machine last year, US sales have reached an estimated 800,000. The sales figure for Europe is close on 200,000, with the United Kingdom accounting for half the total. The development of a wide range of software, including games and educational programmes, is certainly paying dividends.

With Commodore expanding we are looking forward to increasing the readership of this magazine. The February issue of Commodore Computing will therefore be on sale at newsagents across the country. To assist this expansion there have been some changes in the magazine's staff. The editor is now Nick Hampshire and Pete Gerrard is technical editor. In addition there are three new members of staff — Ron Scott is production editor, Richard Franklin is staff programmer and Martin Bush staff writer. We hope that all our readers will approve of the improvements we will be making to the magazine in the coming months.

# COMMODORE COMPUTING BACK NUMBERS



April/May : Forth for the Pet and Vic : The Manager reviewed : Butterfield : Additional I/O Interface : Search Procedures : Alpha Sorts.



July : Comal : Petspeed reviewed : Butterfield : More on modems and stepper motors : Pet Talker : Another Vic voice : Quarter square plotting : Fourier Analysis part two : machine language auto location.



September : Microcomputers in Business : Microfacts 82 reviewed : Cursor Handling Routines : Instrument Synthesis : 8032 control characters : Linking Pets up to a teletype : Getting to grips with Machine Code.



November : An interview with Jim Butterfield : More music : high resolution plotting : writing user friendly programs : security chip storage : Getting neater printouts : Animation on the Pet, plus a couple of hints from Butterfield.



June : Connecting a disk drive to an Old Rom Pet : The 8010 modem revealed : programmable characters on the Vic : High Speed stepper motor for the Pet : Load and Save explored : Fourier Analysis : Tinymon, a machine code monitor for the Vic.



August : Vic educational software : Butterfield on compilers : Glass Teletype machine code listing : Dump Mate, a multi linking Pet and/or Vic system : CB2 interface : graphics drawing : Sound Synthesis Input and Output from the User Port : How to use a SYS call with parameters.



October : DMS for the Pet : old Rom DOS Support program : Upgrade roms for old 8K Pets : More on Instrument Synthesis : Sorting dates : Cursor positioning : True assignments for Vic function keys : An adaptation of Superman, a powerful extension to the monitor, for the Vic.



December : Three word processors compared : computers in the optical industry : a first look at machine code : graphics and plotting routines : full Commodore 64 memory maps : auto-loading of programs : packed with program listings.

Every issue has much more than what we've detailed above. In each issue you'll find plenty of program listings, in Basic and machine code, for all the Commodore family of machines, as well as in-depth articles, news and reviews. Why not buy now and see what you've been missing?

Each back issue costs £1.00, including post and packing. Just send your cheque or postal order to:—

Back Issues, Commodore Computing International, 167-169 Great Portland Street, London W1 or telephone 01-636 6354

### Micro vision system

This is one of those ideas that makes you wonder why no-one has ever done it before. Technical problems perhaps, but Digithurst in Royston have solved them all and now present a vision system for the Pet (amongst other micros).

Coming in two versions (Microsight 1 and 2: the first one's cheap and the second one is very fast), the system uses a standard CCTV camera to capture images and an interface to process this and send it back to the micro as 8 bit digitised video.

The software package handles data transfer from the 'Micro Eye' interface to the Pet, and controls the camera. It also looks after disk storage and retrieval, as well as the display of images on a high resolution screen.

High resolution screen? Well, Digithurst have taken care of that by making available a high resolution board for £150, which gives you an image resolution of 128 x 128. No doubt someone will produce a higher resolution to take advantage of the technology available.

I think you can see the potential of the system. Given a really high resolution, text recognition becomes possible, and if linked to a word processor we'll be able to transcribe War and Peace to disk within seconds!

Prices are not cheap: system 1 is £495, and system 2 is £1,900, but the advantages are enormous.

*Area: Micro Computer Vision System*  
*Company: Digithurst Ltd.*  
*Address: Leaden Hill, Orwell, Royston, Herts. SG8 5QH*  
*Tel. No. 0223 208926*  
*Contact: Peter Kruger*

### Getting serious

There is money to be made in accountancy after all. Pegasus, who've been selling their accounts and stock control packages since the beginning of the year, recently announced impressive sales figures for the first seven months of the year, with a projected profit for the year of almost a quarter of a million. On top of this, they've just brought out a payroll package as well, so perhaps we'll see an even bigger profit.

*Area: Business Packages*  
*Company: Pegasus Software Ltd.*  
*Address: Station Road, Kettering, Northants*  
*Tel. No. 0536 522822*  
*Contact: Johnnie Johnson*

### Star gazing

The Constellation is the latest in the growing battle for control of the local area network (LAN) market, this one being from Keen Computers.

Claiming to have already sold over 1,000 systems, the Constellation allows up to 64 micros of varying pedigrees to share data and programs, printers and up to 72 megabyte of hard disk.

A considerable saving in an always cost-conscious market.

*Area: Local Area Networks*  
*Company: Keen Computers*  
*Tel. No. 01-236 0026/7*  
*Contact: Max Hotopf*

### More Super soft and hardware

One of, if not the, first add-on chip for the Pet was the Toolkit, often impersonated in recent years. This added a number of commands to the existing Pet Basic, and became very successful in terms of sales.

Supersoft have long had a reputation for being suppliers of chips for one purpose or another, and they have just taken over from Zynar Limited as UK distributors of the original Toolkit.

Versions of the Toolkit are available for all the Pet range of micros, and costs start at just 29.00 pounds plus VAT. Just by lifting up the lid of your Pet and plugging in this one chip, you'll find your programming abilities significantly enhanced.

*Area: Enhancing Basic*  
*Company: Supersoft*  
*Address: Winchester House, Canning Road, Harrow, Middlesex*  
*Tel. No. 01-861 1166*

### Processing package

Just a quick mention for another Supersoft product, their well known Microscript word processing package. A couple of bits of news: one is that it now makes full use of the 96K available on the 8096, allowing you to hold three work spaces of about 15 pages of A4 text in each.

Secondly, the latest version has implemented proportional spacing for those printers that can accommodate it.

And finally, their expansion module for Microscript, Maths Pack, is reportedly doing well. Described as 'the first in a range of Microscript add-ons designed to meet the needs of particular users', it enables you to produce invoices, statements, quotations and anything else of that nature from within Microscript.

### Trashman on the Vic

Jeremy Biggs continues on his merry way by supplying me (and no doubt every other magazine editor in the world) with the latest wodge of wallpaper describing new game releases for the Vic from Audiogenic.

In light of snooker's dominance of our TV screens lately, it is surprising that no-one has yet come up with a version for the Vic. Can you imagine an alcohol swigging Alex Higgins, or Terry Griffiths chain-smoking in front of your very eyes in high resolution graphics? Perhaps not.

One of our other popular games has however been given the Vic treatment. Golf, my knowledge of which is limited to the 19th hole, weighs in at 7.99 pounds plus a 3K ram expansion pack.

Suitable for one or two players, it throws all the usual hazards at you like water, bunkers, rough, and tries to ensure that each club approximately performs as in real life. Not a bad implementation, nice colour, but I can't see many business deals being concluded over it.

Describing their next one as featuring 'Bigger and Meaner monsters', Bonzo puts the player in the role of a workman whose job it is to collect boxes from different levels of the screen. These levels are connected up by ladders. But, you are not the only one who can climb up ladders. The 'Bigger and Meaner' monsters can also climb, and displaying a rare intelligence, actually try and trap you on a particular level.

All good clean fun, it gets progressively difficult as you clear more and more levels.

However, the press release to end all press releases must be their description of Trashman, a games cartridge for £19.95. And I quote ....

The garbage problem in the city has reached a crisis point. The streets are full of litter and there are lots of trash cans waiting to be emptied. Worst of all, the flies are thriving in these conditions and have grown to vast, man-eating proportions! Of course, no sane trashman will work under these dangerous conditions, so the city council has invested in a fleet of remote controlled robot trash trucks, in the hope that if they can get rid of the garbage, then the mutant flies will starve, and the citizens will be able to walk the streets again without fear.

Good stuff, eh?

You are in charge of steering the remote controlled trash trucks round the city streets. The screen display will give you a street map showing the position of your truck and the location of the six green trash cans. The litter appears as dots in the street, and you can also see the flies as they chase

your truck. If the flies catch your truck they will devour it. Your duty is to clear the streets of litter and trash cans. The flies will be after your truck, but if you pick up a trash can they will be temporarily weakened by this loss of sustenance and will turn blue. During this time you can hit them with your truck, and they will limp harmlessly back to their hideout in the city centre.

Almost there .....

The council cannot afford to lose too many trucks, so you are restricted to three. If you lose them then it's the end of your shift. During each shift a bit of bonus rubbish will appear for a while near the centre of the screen. If you manage to pick it up you will get bonus points depending on what shift level you are on. If you manage to clear all the litter and trashcans, you will be allowed to start another shift, and you can carry on until you run out of trucks.

Remember: the hygiene of the city is in your hands!

So now you know what I have to put up with: truth, justice, and the American way of hygiene.

Area: *Vic Games*  
 Company: *Audiogenic Ltd.*  
 Address: *PO Box 80, Reading, Berks.*  
 Tel. No. *01-468 7045*  
 Contact: *Jeremy Biggs*

### Educational releases

Chalksoft are a new company in the educational software market. Formed by a group of teachers and programmers (which makes a pleasant change from teachers attempting to be programmers or programmers attempting to be teachers) their software is aimed principally at the 5-11 primary school and 9-13 middle school range.

Various programs have come out to coincide with the launch of the company, with the promise of at least one or two new ones each month. All the Vic ones require the 3K memory expansion pack, but this is reasonable enough judging by the use of sound and colour in each 'game'.

Suitable for use in the classroom or the home, with prices ranging from £5.95 to £9.95 Chalksoft could find themselves doing quite well.

If all else fails, they must be remembered as the company who coined the most ridiculous name for a game so far: Punc-Man.

Area: *Vic Educational Programs*  
 Company: *Chalksoft*  
 Address: *Lowmoor Cottage, Tonedale, Wellington,*

*Somerset*  
Tel. No. 082 347 7177  
Contact: Brian Kerslake

### Program networks

More news has been filtering through on networking again. We gave a brief mention last month for Hydra, the LAN system being marketed by Dataview. The latest information to come in describes a system called Hydra being marketed by a company called IJJ Ltd. Are they the same? Who knows?

This one comes in a small board which plugs into the memory expansion port of each Pet (must be at least 32K on board, which I would have thought cuts out a fair chunk of the available market), and then the Pets are just daisy chained together by link cable. They can be connected up in whatever configuration you like, because as far as the whole system is concerned it doesn't matter whether any particular Pet is active, switched on or even connected.

A multi user disk operating system (MUD) is provided on disk, which allows any computer on the network to use disk drives and printers connected to any other computer on the network without affecting that computer's operation. Messages can also be passed from machine to machine without destroying programs in either of them.

A number of commands are added to Basic, special LAN ones being prefixed by 'N' to distinguish them from ordinary commands. Thus we have NLIST, NOPEN and so on. Executive sites, which are specified at switch-on by a security code, have a number of additional commands of their own.

Price of one to five units is £175 each, and for more than five, £169 each. One board is needed for each computer connected on the network.

Area: *Local Area Networks*  
Company: *IJJ Ltd.*  
Address: *1 Cardigan Road, Marlborough, Wiltshire*  
Tel. No. *0672 54487*

### More communications

Oxford Computer Systems, those well-known producers of PetSpeed, have combined forces with

the respected talents of Mark Clarke to produce a device called Interpod.

Interpod is a small box that essentially takes a computer (e.g. the 64) in at one end, and at the other allows it to speak to any IEEE instrument (e.g. 10 megabyte disk drive), or even any RS232 instrument, thus doing away with IEEE to RS2232 interfaces.

All you have to do is plug Interpod in at the serial port of your Vic or 64, and you are ready to communicate with any number of IEEE or RS232 devices. No extra software is needed, and at just £95.95 Oxford could well have another winner on their hands.

Area: *Communications*  
Company: *Oxford Computer Systems*  
Address: *The Old Signal Box, Hensington Road, Woddstock, Oxford*  
Tel. No. *0993 812700*

### Easy to assemble

More software aimed at improving the existing Pet comes from Comsoft in Birmingham. Called X3 (eXtensions to eXisting eXecutive: good grief!) it is a package of Assembler modules providing 'users and programmers with a string of important benefits on floppy and hard disk systems'.

Many features are detailed: an Indexed Sequential Access Method, restructured and enhanced Input/Output, more comprehensive and easily maintained overlays, and much more.

Area: *Disk Software*  
Company: *Comsoft Associates*  
Address: *2c-2d Wake Green Road, Mosely, Birmingham*  
Tel. No. *021 449 9151*  
Contact: *Phil Nutt*

### Programming aids

Yet another Eprom Programmer has appeared, this one at £79, from MED Ltd. Also from them we have the Meddev-P Development Package, at £19.75, all to do with storing sequential ASCII records on disk or tape. We hope to bring you more on these two in future months.

Area: *Programming Aids*  
Company: *MED Ltd.*  
Address: *640 Melton Road, Thurmaston, Leicester LE4 8BB*  
Tel. No. *0533 704492*

### I'm forever blowing bubbles

Computer Applied Technology Ltd. have just announced a 128K Bubble Memory for the Apple II, with promise of a similar goody for the Pet by the end of December. Why mention the Apple one? Because we have no other source of information as yet. Why anyone should want 128K for £465, even if it is three times faster than the standard Apple disk drive is beyond me, but at least you know the thing exists, and is very reliable.

*Area:* Bubble Memory  
*Company:* Computer Applied Technology Ltd  
*Address:* Scarborough House, Scarborough Road,  
 Bridlington, East Yorkshire YO16 5NS  
*Tel. No.* 0262 73036

### Training courses

I thought we'd seen the end of training courses for a while, but now the Polytechnic of North London has got in on the act, and is promoting training courses for computer sales staff.

Claiming, quite rightly, that selling micro computers is far more difficult than selling other electronic equipment, the Poly boasts an impeccable pedigree for putting on this kind of course.

Names like Barry Miles, Robin Bradbeer, Adrian Woods et al. are all fairly well known in the micro world (you may remember the series of articles we featured by Barry in the old Commodore Club News days) and all are more than capable of giving you a good insight into the uses (and abuses!) of micro salesmanship.

Ideally you should already have some industrial or commercial experience, but you do not have to be in employment to qualify for the course. Being connected with the Manpower Services Commission, all their usual rules apply, and they'll give you a weekly training allowance and some contribution towards expenses.

The pilot course, with places for up to 20 students, starts on February 7 and runs for 21 weeks. It will include three weeks of instruction on the premises of a micro-computer manufacturer on the Continent.

*Area:* Computer Sales Training  
*Company:* Polytechnic of North London  
*Address:* Micro Sales Course, c/o The Community  
 Computer Centre, Polytechnic of N. London,  
 Holloway Road, London N7 8DB  
*Tel. No.* 01-607 8349  
*Contact:* Peter Hofer, Course Tutor

### A thumping good read

Prentice Hall International send out almost as many catalogues as they produce books, but all contain something of interest to the Commodore reader.

Their winter catalogue features many interesting Pet and Vic books, and also one for the machine that arguably started it all, the Kim-1. This is by one of their regular contributors, Lance A. Leventhal, and is called Microcomputer Experimentation with the Kim-1. It emphasises the practical side of things, including a look at communications, peripherals, and more.

On the Pet front we have quite a few publications, mainly aimed at teaching you the art of programming in Basic on your Pet (or Vic and Commodore 64 for that matter). One that deserves mention is Pet Games and Recreations, by Len Lindsay and half the population of the western world, which covers games from the simple to the extremely complex.

*Area:* Books  
*Company:* Prentice Hall International  
*Address:* 66 Wood Lane End, Hemel Hempstead,  
 Hertfordshire HP2 4RG  
*Tel. No.* 0442 58531/212771

### The video age

For those of you who don't know anything about the micro world but would dearly like to, System-Two are producing a series of educational documentary television programmes, available on cassette, featuring micros.

Not specifically Pet, but of interest to educationalists generally, the programs aim to be unbiased, and present the practical and theoretical facts about microcomputers, which should enable you to understand the theory and principles involved.

Each film lasts an hour, but for some obscure reason (could be money!) each film will also contain some advertising. The press release doesn't make it quite clear whether it is the films or the advertisements that 'will not only appeal to students ... but also those people who enjoy computers as a hobby', but rest assured that one or the other of them will!

*Area:* Understanding Microcomputers  
*Company:* System-Two Limited  
*Address:* No. 3 Woking Business Park, Albert Drive,  
 Woking, Surrey GU21 5JY  
*Tel. No.* 04862 27676  
*Contact:* Luke Thornton

# Now the VIC 20 and 64 can communicate with PET peripherals



## VIC and 64 users

Would you like to be able to access **any** of these peripherals from your computer?

- 1/3 megabyte disks (Commodore 4040 drive)
- 1 megabyte disks (Commodore 8050 drive)
- 10 megabyte disks (Commodore 9090 hard disk)
- Printers including a wide range of inexpensive IEEE and RS232 matrix and quality printers
- IEEE instruments such as volt meters, plotters etc.

Now you are no longer limited by the VIC or the 64's serial bus. Simply by attaching INTERPOD you can vastly increase the power of your VIC 20 and when used with the new 64, INTERPOD turns the computer into a really powerful system.

With INTERPOD the VIC and 64 become capable of running really professional quality software such as Word-processing, Accounting, Instrument control and many more.

INTERPOD will work with any software. No extra commands are required and INTERPOD does not affect your computer in any way.

### Using INTERPOD is as easy as this:

Simply plug INTERPOD into the serial port of your computer, power-up and you are ready to communicate with any number of parallel and serial IEEE devices and any RS232 printer.

INTERPOD costs £95.95 + VAT

# INTERPOD

# APL and the SuperPet

Eike Kaiser  
Toronto, Ont.

After working with computers for only four years, the real surprise in this relationship is probably the infrequency rather than the frequency with which major problems arise. I won't claim that this is because almost all my work is in APL, but it probably does contribute. One such problem that I've finally cleared up involved the use of the serial port (RS-232C) on my Super Pet. It took a lot of help from a lot of people, but my special thanks go to Peter Velocci of Commodore Canada. He took the time and showed the interest to set up the contacts that finally shed light on one more hidden secret of the SuperPet.

Documentation of the SuperPet's serial port has only been released in bits and pieces. At this point I'm still not convinced that enough pieces have come out to let the average user pull them all together, even if he happens to have access to all the available literature. I'll try to correct this here, at least for any APL users in the audience. Don't stop though, if you are not an APL freak like me. Much of this is not tied to any one language, other parts may at least be a guiding milestone!

The first problem in using the serial port is to get some information about its "pinouts": the location and operation of each of the 25 electrical connections that make up this communications channel. Some of this has recently become available, but none that I found was either explicit or complete. Here is how the standard information goes.

RS-232C has the following 25 pins, in two columns

|                        |       |                              |
|------------------------|-------|------------------------------|
| 1 earth ground         |       | 14 sec. transmitted data     |
| 2 transmitted data     | (TXD) | 15 transmit clock            |
| 3 received data        | (RXD) | 16 secondary received data   |
| 4 request to send      | (RTS) | 17 receiver clock            |
| 5 clear to send        | (CTS) | 18 ... unassigned ...        |
| 6 data set ready       | (DSR) | 19 sec. request to send      |
| 7 logic ground         |       | 20 data terminal ready (DTR) |
| 8 carrier detect       | (DCD) | 21 signal quality detect     |
| 9 ... reserved ...     |       | 22 ring detect               |
| 10 ... reserved ...    |       | 23 data rate select          |
| 11 ... unassigned ...  |       | 24 transmit clock            |
| 12 sec. carrier detect |       | 25 ... unassigned ...        |
| 13 sec. clear to send  |       |                              |

Normally, only pins 1-8 and pin 20 are used. Diablo and SuperPet use only these pins but may have conflict on pins 2 & 3, or pins 4 & 5.

REF: Byte, May 1982, p.212 et al.  
Commodore Mag, Feb 82, p.58,  
Apr/May 82 p.87  
Diablo documentation, p.2-10  
Torpet, April 1982, p.23  
Computers and Programming, Jul/Aug  
1981, p.32

The Transactor, Volume 3, Issue # 6,  
p.6

The pin allocations shown above reflect the industry standard which, so far as I have seen, Commodore have adhered to. As noted, only pins 1-8 and pin 20 are used by the SuperPET. Among other things, this limits users to only one serial device at a time being attached to the machine. If you dreamed of a plotter and printer, one of them better be on the IEEE port.

The note on a possible conflict on pins 2 and 3 turned out to be a fact. I doubted this for a long time. The connection inside the SuperPET is the female side of the RS-232 plug. Without wishing to be sexist, I reasoned that the "transmitted" line on a male plug really ought to be the "received" line on a female plug. After all, none of the documentation referenced above said "transmitted to" or "transmitted from". My guess seemed a logical compromise, right???

Not so. It turns out that male or female doesn't matter (at least not in computers). Pin 2 sends data from whatever device that pin is attached to, regardless of its sex! Count one more for equality.

The moral of all this is that pins 2 and 3 MUST be reversed in any connection between a SuperPET and a serial device that adheres to the industry standard for the RS-232C ports. That is a generalization gleaned from experience, but it seems even more sensible than my male/female theory.

The possible conflict on pins 4 and 5 relates to a "handshake" procedure, where the SuperPET confirms that the printer is ready for input. Pins 6 and 8 are used to test that the printer is in fact there. If your printer doesn't actually use these pins then it's time to play electrician. Without removing any existing connections, somewhere in either machine, or in the cable joining them, you must make a connection between pins 4 and 5, and/or pins 6,8, and 20. These fool the SuperPET into thinking that the printer is sending all the right acknowledgements of its existence. For details, Waterloo has a technical letter with a bit more information.

So much for the hardware. Now just plug it all up and watch APL fly back and forth between machines — right? Wrong!

The SuperPET has its own special ASCII representations, which differ from the standard that most manufacturers adhere to. This is more of a nuisance than a problem, since Waterloo

have provided some facility, however meagre, for converting this "internal representation" into an "external representation" that devices like ASCII printers can use. Conveniently, these are provided as the system functions "`⎕XR`" and "`⎕IR`". The former converts SuperPET jargon into something that the rest of the world can understand while the latter turns incoming code into the SuperPET's talk.

This difference doesn't seem to affect other Waterloo languages, perhaps because they use the standard typewriter character set, unlike the special characters used by APL. Waterloo may also have found a less cumbersome way of handling the conversion in the other languages, and are moving slowly in this direction in release 1.1 of APL. Note though, that in release 1.0 these conversions do not work on matrices. This is the improvement that release 1.1 will bring. For now we must convert our text line by line.

Note that I said "text". Waterloo didn't provide for sending anything other than characters out the serial port, at least in APL. Numbers and function listings don't qualify. Both must first be converted to character representations of themselves. This again is quite contrary to the basic philosophy of APL, which was to let users be users, and oblivious of computer technicalities.

Fortunately these are no difficult task. "`⌘`" (Φ) is the APL operator that converts numbers into their character representation. "`⌘5 5pi25`" gives a printable 5 by 5 matrix of all the numbers from 1 through 25. Functions, the APL equivalent of user defined programs, are converted by the statement "`⎕CR'FN'`", where FN represents the function's name, which must be enclosed in single quotes. This has a hidden problem though. `⎕CR` strips the function of its line numbers, making the printed listing very different from what users, especially new users, come to expect from their experience with listing functions on the screen. Thus, yet another step is forced on us by Waterloo — re-inserting line numbers in a way that mirrors what APL would normally give us. The program "NUMBER" is included below to meet this need.

Here then are our three functions "PRINT" is the main routine, and fairly thorough notes on its operation follow the listings. "ASK" is a utility function that is called by PRINT, its purpose being to modify the way that user input is handled at the screen and to interrupt program execution until that input is received. This is used to permit changing paper if you are not using continuous forms. An alternative statement allowing for automatic advance of continuous forms is provided

in the discussion below. "NUMBER", finally, provides for function line numbering as described above.

Do note that the problems we are fixing here are not APL problems. They are little inconsistencies that Waterloo gave us in an otherwise very acceptable APL implementation. Hopefully future releases, beyond 1.1, will continue to work towards the APL goal of encouraging a very casual user relationship with the computer.

### Discussion of Function "PRINT"

Note: See next month for program listings.

APL programs always start with line zero, which defines the syntax of the function, along with any local variables that it will create. Their names, separated by semi-colons, list the temporary work variables that will no longer be needed when execution terminates. Having them here tells APL to throw them out for you. Any variables created by the executing function but not listed in this way remain available for possible later use.

"PRINT" expects a right argument of X, which is the data we want printed "X" can be a variable name, it can be "`⌘DATA`" (the character representation of numbers) or it can be "`⎕CR'FN'`", as discussed above. In fact, APL even lets us string together more complicated arguments to functions. Remember the problem of line numbers not appearing in the `⎕CR` of a function? To fix this, the "NUMBER" function above can be used as in this statement:

```
PRINT NUMBER ⎕CR'FN'
```

In this case "NUMBER" is just another function which does its job before PRINT. The right argument in the header permits this type of syntax.

Line one of an APL function is often reserved for a brief statement of what the function does or how. This is strictly a matter of style. I suggest you get into the habit, and a future article will show how you can take great advantage of this feature. Unlike BASIC, APL lets you have numerous programs and sets of data available simultaneously, mixing and matching them as in our "PRINT NUMBER" example. This saves a great deal of code, because you can re-use utilities rather than re-coding them into every application that needs them.

With such a mixture of functions, that one line of documentation can protect against confusion over similar names, and help you or others find their way around.

*Continued next month*

# Are Small Micros of Any Use To the Businessman?

This is not just the superficial question it might at first sight appear to be. No doubt many pundits would dismiss this with a derogatory NO, but that is far from being the case. The use of a small microcomputer, such as the Vic, the Spectrum or whatever, could indeed enhance many businesses, but the question goes deeper than that.

Consider the businessman who wants to learn about computing, but cannot justify the cost of buying (say) a complete 8000 series system out of his own budget, with the possibility of it being of no use to him or his business in the long run. Obviously he would have to aim his sights a little lower, but at the same time remain aware of the fact that at some day in the future the system will have to be expanded up from its original humble beginnings.

## Use in the Home

I think, if the system is to be expanded up into a fully fledged office one, we will have to discount the Vic from our reckoning. Although it has long been promoted as a possible business machine, I cannot see how Commodore justify that. With only 3.5K on board, and a terribly limited screen, an awful lot of money has to be spent before it can be brought up to the basic requirements of at least a 40 column screen, preferably 80, and a lot more memory.

By the time you've added on disk drives, printers and so on, the final cost has soared far beyond the original outlay. Of course, items like Interpod could be used here, but before he's bought anything our businessman will have to have designed out his whole office structure. This is not what we're here to consider.

Interpod is a good and useful product, don't get me wrong, but I feel it will be bought by existing users who wish to save on the price of a few disk drives, or who want an inexpensive IEEE to RS232 convertor, or any of the other uses of it, rather than the first time buyer.

If we're going to seriously consider any of the Commodore machines, it will have to be the Commodore 64. This certainly has enough memory, has a 40 column screen (and no doubt some enterprising company will bring out an 80 column convertor before long), and already has an astonishing array of software to back it up. Not

least of this of course is all the original Basic 40 column Pet software: much of this, given the Pet emulator program, will run quite happily on the new machine.

## Commodore 64

Enough has been written about the 64 already without me giving you a mini-review of it again, so I'll assume from now on that you know more or less what the machine is all about.

At three hundred pounds some users may consider it to be too expensive for a first buy, but considering the fact that it will almost certainly be an invaluable asset to any business, the idea of getting one initially for home use is perhaps not so outlandish after all.

Already, we have an extremely good and sophisticated word processing package available, and if the 64 ends up being used for nothing more than this, the original outlay will have been justified. Equally, you can be assured that many more business packages will be appearing on the market, and with the very impressive specifications of the 64 that software looks like being of a very high quality.

So we know it will be all right for later use: what about the present?

## Getting Started

Having taken the plunge and brought the new machine home, once you've removed everyone else from watching yet another re-run of Star Wars on the video you're about to launch yourself into the world of home computing.

Obviously you have to start somewhere, and possibly the best place would be with Commodore's Introduction to Basic Part 1, which has been specially re-written for the 64, although personally I think the original Strathclyde Basic is good enough. This won't teach you all about the features specific to the 64, such as colour, sound and high resolution graphics, but it will teach you all about Basic Programming.

However, sooner or later you're going to want to know all about the tricks possible with this 'wonder-toy', so perhaps a machine specific book is desirable.

I have yet to see such a book, other than the manual that comes with it and the aforementioned Introduction to Basic, but I wouldn't be surpris-

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ed to see a number of such on the market before long. As far as the manual itself is concerned, tread warily, as it has a number of significant errors in it. Still, it's probably all you'll have to go on to begin with, so you'll have to make the most of it.

Nonetheless, by skirting around the errors and reading whatever else comes along you will no doubt progress a fair way to being computer literate with the machine before too long. It's round about this time, having achieved a degree of literacy on the 64, that you'll want to consider taking your new found skills into the office and seeing more precisely what the machine is capable of.

### **First Steps in Business**

By virtue of having used the machine at home, you'll be in a far better position than most businessmen who come into the world of computing. Generally, most newcomers tend to buy off the shelf packages, with the result that they run them and nothing else, and never really get to grips with the computer proper.

This could be the mistake of many a business. It is true, in all walks of our increasingly commercial and material world, that if you don't know your subject matter sooner rather than later you are going to come unstuck.

This truism can have no greater weight anywhere than in the computer industry. You've got to know how the machine operates, how it functions, if you're going to get the best out of it. By that, I don't mean that you're a machine language programmer capable of interfacing it to the coffee machine, but you do at least have a fairly good idea of how it works, and what its strengths and limitations are.

By being familiar with the machine at home, you'll be able to take this one stage further into the office.

### **Initial Ideas**

At first you'll probably want to try and computerise everything, with the result that everything becomes that little bit more inefficient. Bearing in mind that the 64 is not a multi-megabyte machine, but is instead a humble (humble? Remember the original 8K Pets ?!) 64K, and that you will probably only have a cassette deck to begin with, it would be best at first to concentrate on some simple administrative task that is perhaps taking a little bit longer to sort out than it should.

Using your new found programming skills, it should be possible to take a simple operation like this, work out a flow chart showing how you

would tackle the problem, and then go about writing the program.

It doesn't matter if, at first, your coding looks inefficient and the program runs a little slowly. The important factor is that it works, and does the job required of it. Your first program is not going to be a machine code tour de force, but thirty or forty lines of Basic solving a particular problem will do just as well to begin with.

Then, having got one problem solved, you're then in a position to branch further out, and perhaps feeling a little pleased with yourself as well!

### **Backup**

All the time though it is important to remember that you bought this originally as a home computer, and although it may be doing sterling work in the office, it's vital that you keep up the training at home.

This is one of the beauties of a computer like the 64. It can do very important tasks at work, either with programs like the ones we mentioned above that you've written yourself, or perhaps an off-the-shelf package for something that is originally a bit beyond your own programming talents, but at the same time it is equally at home in your front room connected up to the television set.

The more you use the machine, the more familiar you get with it, the better it will be all round. Your programming ability develops, and better programs result from this.

### **Conclusion**

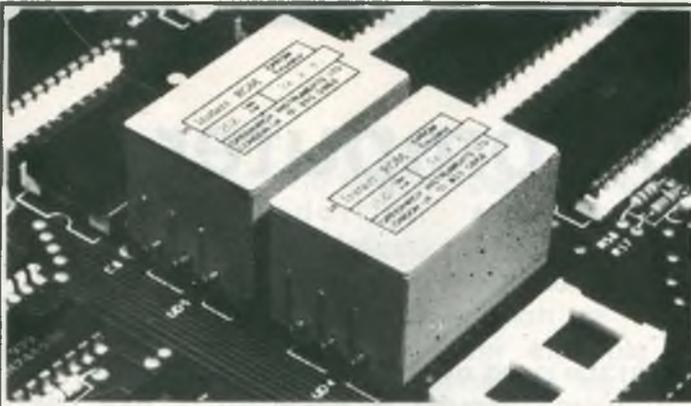
The point to always bear in mind is that the Commodore 64 (or indeed whatever small micro you eventually end up acquiring) is not the Cray-1. It is a small computer that can be made fairly large with the aid of disk drives and printers. I don't think we really need worry about memory expansion with the 64! 64K should keep us happy for a while.

It is a machine that is going to teach you a lot about programming, and as we get ever more technically oriented this is going to be of great use.

It is a machine that is capable of doing many time consuming tasks in the office. One that can function as a word processor, a stock control machine, and one that in addition will probably have a lot of control applications developed for it.

In short, the 64 will find a use in the office and the home, and a very valuable use at that.

By picking up on the micro revolution at home, you'll be keeping ahead of the revolution in the office.



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*Superscript*

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# What is a micro-computer?

*Robert Moscrop*

This series of six articles is intended as a guided tour through 'Microland' for the business user and assumes no previous knowledge of micro-computer technology. Each article will explore the ground of the various aspects of the problem which he will encounter on the way from his first thoughts of putting a micro computer to work in a business situation, to the hopefully successful implementation of his system. It is hoped to take away the mystique by explaining the terminology and signpost a few of the check points along the way. But first a word of caution, moving into micro computing (like mini and mainframe before it) is like moving into the world of motor transport. Who in his right mind would buy a car without learning to drive it properly and safely? Business data processing is just the same, whilst you can't actually kill or maim yourself, lack of some basic knowledge of hardware systems technology can lead you to do damage to your business.

This series of articles is only intended to create an awareness, the reader is advised first to have proper training in the techniques of defining and communicating his needs, evaluating alternative proposals and changing over to a new computer based system. Learning to program a micro in the hope that this will enable the first time user to design effective systems is a misconception. It is like learning to maintain a car in the hope that you will then drive it properly. The market is flooded with equipment and software for sale; it is, regrettably only too short of skilled people, — 'CAVEAT EMPTOR'.

## Smaller and cheaper

It would be impossible to define with any precision what is or is not a micro computer. Let us therefore consider it as a piece of electro/mechanical equipment capable of undertaking the processing of a conventional business routine, accounting, stock control, costing, etc, and capable of expanding into more sophisticated techniques, simulation, modelling, etc, and talk to each other.

In point of fact the basic characteristics — 'the architecture' as we call it, has not changed since the first days of the computer in the mid 1950's. What has happened is that the technology 'the hardware' has become smaller and cheaper hence

within the need of most people.

A micro-computer is made up of four basic Elements:

1. An Input Facility : Whereby processing instructions, 'the program' and current business transactions 'the data' can be fed in.
2. The Processing Unit : Where the programs and data are held during the actual processing operation, together with the associated control mechanisms.
3. Backing Memory (or Backing Files) : These are the disks (floppy, Winchester and hard disks) and cassette tapes which hold the files of data, eg. Names and Addresses, Accounts, Stock Records, etc, which are the basis of the system.
4. An Output Facility : Where the results of computation are fed back to the user.

Let us now consider each of these components in turn in greater detail.

## 1. Input Facilities

This is a keyboard similar to a conventional typewriter in its layout having provision for the letters A-Z, the numerals 0-9 and function keys.

In practice, more function keys are required than in the case of a typewriter and a duplicate set of numeric keys, in a cluster or 'key-pad' is often provided to speed up the input of numeric data.

It is by the depression of these data and function keys that the operator communicates with the processing unit.

## 2. The Central Processing Unit (CPU)

This is the nerve centre of the computer which has three functions:

- (i) The Memory : This is the part of the CPU which holds software and data to be processed. (often called Main or internal Memory)

- (ii) **Arithmetic and Logic Unit** : This is where the calculations, addition, subtraction, multiplication and division are performed. In addition, it contains the decision or logic mechanism, for example to compare items for equality, greater or less than.
- (iii) **Control Unit** : This is where the operating system maintains control of the location of data during processing.

The CPU is made up of a number of electronic devices, in early days these were valves which in the course of time were replaced by transistors, printed circuits and latterly silicon technology. Whatever the form, the device is capable of holding a pulse of energy, ie. being 'on' 'off'. This means that we must use a form of notation to the base '2' or binary to hold information, to replace the deanery or decimal notation which uses a base of '10'. The binary scale can therefore be represented thus:-

|               |      |      |     |     |     |    |    |    |   |   |   |   |
|---------------|------|------|-----|-----|-----|----|----|----|---|---|---|---|
| Positions     | 12   | 11   | 10  | 9   | 8   | 7  | 6  | 5  | 4 | 3 | 2 | 1 |
| Binary Values | 2048 | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |

The decimal values we wish to represent can be expressed in an 'off' or 'on' condition using the symbols 0 and 1 thus:-

| Decimal Values | Binary Values |
|----------------|---------------|
| 1              | 1             |
| 2              | 10            |
| 3              | 11            |
| 4              | 100           |
| 5              | 101           |
| 6              | 110           |
| 7              | 111           |
| 8              | 1000          |

and so on.

Each of the positions in the binary scale is known as a Binary Digit or BIT. It is therefore possible to represent any decimal values in this way, and perform arithmetic operations on them.

In practice, however, we want to hold various elements of data in memory, thus these devices are linked together in a number of bits, usually 8 or 16, hence 8 bit or 16 bit machines. In earlier days the combination of bit arrangements was much more varied than this, although the principle remains the same. Each of the groups of bits referred to as a 'location' in memory, the size of memory — hence the power of the computer be-

ing measured in 1000's of K locations, hence 32K, 64K, 128K, etc. memory is measured in set units of 'modules' as quoted above.

Thus far, only numeric information has been considered. Where alphabetic data is to be catered for, this is achieved by the machine having its own code of binary equivalents for the letters of the alphabet, special symbols, £, &, =, >, <, etc, and for the function keys of the input device.

The final point to note is that the control must be maintained of the data in memory. This is accomplished by each location being identified by an 'address' in the same way as we have our home address or telephone number — a mechanism by which we can be located.

What then are the contents of Memory during processing?

- (i) **Data** : This is either —
  - (a) Current transaction information received via the keyboard, eg. an order item from a customer, a payment to a supplier, an item of stock received or issued, or an instruction to the computer.
  - or (b) A record from the backing file which is to be processed, eg. Customer Name and Address, his record in the sales ledger, the stock balance record for the item of stock etc.

The data area of memory is often considered as three functional divisions —

**INPUT BUFFER.** Where data is read from the input device or backing file.

**WORK AREA.** Where it is located during the actual processing, together with intermediate results.

**OUTPUT BUFFER.** Where the results are put prior to being written to an output device. During execution of the program, data is constantly moving between these three areas.

Backing Store

Keyboard

Input Buffer

Work Area  
 Output Buffer  
 Printer VDU

This whole matter of data movement is known as Input/Output. (I/O). The solid lines above denote Physical I/O, under the control of the Operating System, logical I/O is movement in memory by the user program.

- (ii) A Program (The User Program) : This is a list of instructions which is in a language the computer understands and which will perform the required operations on the data.
- (iii) Operating System : This is a program just like the one above, but its purpose is to do the housekeeping required for smooth operation. For example, it maintains control of data location, interfaces between the operator and the user program, gets data from or puts data to the backing files and many other jobs.

In practice, various types of memory devices are available to-day, the most significant being:-

1. ROM Read only memory.
2. RAM Read and Amendable Memory.  
 Is used for the data which are being processed ie. transaction and balance records and can be used as ROM.
3. PROM Programmable ROM.
4. EPROM Erasible Programmable ROM.

The addresses of locations of memory are often held in a shorthand version of binary called Hexadecimal (HEX) using the base '16'. This requires four binary bits per decimal digit using the letters A-F to cover values 10-15 thus:-

|              |      |      |      |      |
|--------------|------|------|------|------|
| Binary Value | 1111 | 0011 | 1001 | 0101 |
| HEX Value    | F    | 3    | 9    | 5    |

### 3. Backing Memory

These are the files and programs on which the computer will operate. As with earlier Mini or Mainframe computers two devices are available:-

#### (i) TAPES

These are simple cassettes identical to the ones used for music on radios and music centres.

By their very nature, these are 'serial devices' in that the information is recorded over the length of the tape and must be processed in the same way. The entire tape must pass the read/write mechanism, every record must be read whether or not it is needed for processing, it is not possible to 'access' data randomly or quickly.

In practice, they are very useful for holding programs and duplicates or 'back-up' copies of data files.

#### (ii) DISKS

Using the analogy a gramophone record, data is recorded not in one continuous groove, but in discrete 'tracks' from the outermost to the innermost and within each track, blocks of records.

It is possible therefore by numbering the tracks and the blocks, to have an addressing system as with the locations in main memory and to know where each record is, say the stock record of a given number, the name and address of a particular customer etc. As with main memory, control over a file is maintained by a series of indexes in conjunction with the operating system.

It is this flexibility of what are called 'indexed files' that enable data to be processed or retrieved 'sequentially' or randomly'.

As with a gramophone record, it is possible to position the read/write head at any point in the file without scanning the remainder.

A range of disks is available from small pliable 'floppy' to large capacity 'Winchesters' to 'hard disks' approaching the capacity of larger machines.

This facility to store data on cassettes and tapes enables the user to have an infinite backing store for the various applications.

A word of caution at this point. Processing on a computer is essentially one of updating files, stock, accounting, payroll, etc, on an 'ad hoc' or regular cyclic basis; by current transaction data. In planning a system, always make sure to have 'back-up' of your important data files. Things can go wrong. As a general rule, three generations of balance information should be retained to enable a 'reconstruction' to take place.

#### 4. Output Facilities

- (i) **The Visual Display (VDU)** : This is a television screen on which results can be displayed.

It is also a mechanism by which the operating system or the user program can communicate with the user to ask for more data, tell him he has made an illegal entry or given him some other instructions.

By its very nature, the VDU is limited in the amount of data it can display and the time for which it can hold it. It does, however, have the benefit of the capability both tabular and moving/graphic display.

The use of the input keyboard coupled with the almost instant response of results on the VDU is referred to as 'interactive mode' whether writing a program or processing data.

- (ii) **Printers** : By this means, printed or 'hard copy' results can be obtained. These vary in type and hence quality of the final product, dot matrix printers producing graphics and draft quality text, whilst daisy wheel or thermal printers enable high resolution letter quality printing in a variety of type faces or 'fonts' to be produced.

Types of report are:

- (a) Internal — usually produced on plain 'listing' paper.
- (b) External — letters or the normal business forms.

In either case, care should be taken in the layout of



*Commodore CBM 8096 micro-computer.*

reports, in many cases these are the main ambassadors of your system.

To review the scope of this article, a Micro Computer is an electronic device comprising:-

1. **Input** — Via a keyboard.
2. **Main Memory** — Which holds user programs/operating systems and data which is being processed.
3. **Backing Files** — The ledgers, names and addresses, stock balances which are held on tapes and disks externally to the computer. When processing takes place, the file media is placed in the reading/writing mechanism to be called into memory as required.
4. **Output** — To the screen (or the printer) of the results of processing.

#### ● Next month

*What is a system?*

*All businessmen and their staff use them daily without thinking about them. This article is intended to direct their thinking about systems and their implications in a micro-computer environment.*

*Robert Moscrop, Director of Computotech Ltd, is a widely experienced systems analyst and designer. Since 1978 he has been developing training systems for the Manpower Services Commission and working as a consultant.*

# Micro-Simplex

The traditional image of accountants poring over ancient manuscripts in lofty garrets, aided only by a quill and the light from a flickering candle, is already far removed from reality. Their image takes a further step into the future with the advent of Micro-Simplex, a total accountancy package linked up to a cash register.

The idea behind the package came from the Simplex D book, much used (and much hated) by over 200,000 retailers. The book has been in existence for some 50 years now, and is a total record of all sale transactions, accounts and so on. It is also extremely difficult to keep up to date and, moreover, keep accurate as well.

It is a complex book and its life was made even more complex by the 'invention' of Value Added Tax. A book that, by sheer tradition, could not possibly change, even for the vagaries of a government that wanted to introduce something like VAT. Consequently everything became considerably more complex with the addition of a new book to keep VAT records.

With nine different VAT schemes to keep track of, with balance sheets to fill in at the end of every period, and with much duplication of material between the books (necessary but unfortunate), the whole system had become just a little unwieldy and cried out to be 'computerised'.

Since just about every retailer uses a cash register of some kind, and it is that cash register which should be providing all the information for the Simplex book, it was logical to produce a link from a cash register to a Pet, as part of our computerised system. As one of the most popular, and indeed most intelligent, of cash registers is the Nortron System 81, this was the model chosen by the company who now go under the name of Catlands Information Services, although their package will work with a whole herd of different models.

## The Story Begins

The road to success started with just one sale, albeit of a fairly large system: word processing, accountancy and so on. The program which is now (suitably amended) the heart of Micro-Simplex cost about £1,000 to install then.

Four months later, in October 1981, Vynes, the publishers of the Simplex book, were contacted, and gave total support to the idea of pro-

ducing a complete package bearing the Simplex logo. Obviously as the name was so well known using it would give the system a very good market entry point, and Vyners were more than happy to do this.

With Commodore recognising the significance of a previously untapped, but potentially enormous, market, Micro Simplex was launched with an initial publicity brochure run of around 100,000.

With a complete backup of personnel training, sales aids, and more, Micro Simplex is proving to be a success. Is the package worthy of this?

## The Package Itself

For a total cost of 4,950 pounds, you will get an 8032, 8050 and 4022 printer, the aforementioned Nortron cash register, a communications package (of which more later), the actual Micro Simplex suite of programs, and the Anagram Stock Control package, which links into the whole thing.

Since most of you will know what 8032s, 8050s and 4022s are, let's move straight onto the cash register.

The Nortron Cash Register, as we've said, is an extremely intelligent register. With spare ROM sockets on board (and communications specialists Cortex are considering, and may already have done so, putting a comms package onto the spare ROM), a programmable till, and its own data storage (with data checking) it is a powerful beast.

Every transaction is recorded on cassette, using mini cassettes with about 26K of storage. This records stock numbers, account numbers and so on, and can be used for links with Silicon Office, or whatever. It can also be used for goods inwards, and at a transfer rate of 9600 baud can rapidly transport all of this information to the Pet at the heart of it all.

This information is also used in the link to the Anagram Stock Control package. This has been reviewed in enough other places for it not to warrant an independent review of its own here, but suffice it to say that it's an extremely robust stock control program, or rather suite of programs, and makes an admirable link for any program requiring stock recordings.

## Communications

All the communications used throughout the system have been developed by Cortex, long regarded as experts in the field. This is principally used when communicating from the register to the Pet, but equipment other than a register can also be used with the software.

For instance, various remote data entry terminals can be used. the RDC MSI/55 for example is the latest wonder device that can be held in the hand and trundled around the store for entry of data. With 4K of RAM on board, this 300.00 pound unit can hold a fair amount of information, which can be subsequently transferred to the Pet and handled from there.

Whether you use a hand held terminal, or the tape storage of the Nortrond, sooner or later you're going to have to get all that information into the Pet, and the Micro Simplex system allows this to be done overnight thus no time is lost during the day, it can be simply left alone all night to totally update everything, and be ready for another days service the next morning.

Nor are you limited to just one register. Larger stores, with a number of different ones about the place, would also be able to use the system, as up to 20 cash registers can be linked up at the same time to the one Pet, and all their information pooled at the end of the day, or whenever is convenient.

## The Heart of the System

Rather like Manchester United depending on Bryan Robson, so all of this depends on the program running on your Pet.

What they've tried to do with this software is duplicate the Simplex D book as much as possible. Screen layouts try, wherever possible, to appear the same as the written layout in the book. Thus, by running a simple demonstration program that comes with the package, the retailer can see a) that he's dealing with something very familiar, and b) it's an awful lot easier than the system he's used to.

The system, like the book, runs on a 13 week history schedule: thus everything is COMPLETELY updated after every 3rd month, just as it has to be with the book. Fortunately the program does this for you, rather than have you poring over 'the books' into the small hours for day after day.

In order to perhaps convince the retailer that this microcomputer lark isn't really as complicated as he first thought, the program is truly user friendly. Very easy to use, single key entry



*The CBM 8032 can be linked up to the Micro-Simplex package.*

wherever possible, and very visual.

Plenty of screen prompts exist to guide you through, but unlike other packages where screen prompts, after you've got used to everything, become a hindrance, these merely serve to make life easier throughout the lifetime of the package.

To complete the introduction the program uses terms that the retailer will know and be familiar with in his everyday work: unpaid bills are referred to as unpaid bills, for example, and this principle applies throughout the running of the program.

All transactions are instantly updated on entry, so that at no time do you have to worry about having missed an entry, or incorrect entry of some data. You can see immediately whether or not you've made a mistake.

## Conclusion

From the first pressing of shift and run/stop the package is robust and easy to use. The initial menu, which decides whether you're going into Micro Simplex itself, the communications side, entering data processing or running the Anagram Stock control, sets the package up, and from then on in it is very difficult (if not impossible) to make any mistakes on data entry or processing.

The whole system, as we've said earlier, can be left on overnight to completely read in all the data stored on cassette from the cash register. Thus you can arrive bright and fresh the next day to find all the arithmetical work done for you. A far cry from earlier days.

|                 |                                                                      |
|-----------------|----------------------------------------------------------------------|
| <i>Area:</i>    | <i>Retail Accountancy</i>                                            |
| <i>Company:</i> | <i>Catlands Information Service</i>                                  |
| <i>Address:</i> | <i>8 Charlotte Street West, Macclesfield,<br/>Cheshire, SK11 6EF</i> |
| <i>Tel. No.</i> | <i>0625 615375</i>                                                   |
| <i>Contact:</i> | <i>Mike Dawson, Lee McGaw</i>                                        |

# Petween

As Information Technology Year draws to a close (and aren't you sorry you missed it) one of the better things to come out of it was an increasing awareness of communications as a tool for the future.

Many packages exist for the Pet, whether operating as a remote terminal, chatting away to a giant mainframe, talking to a number of other Pets via some local area network system, or whatever.

What no one has done, and this is quite surprising as it would seem to be a fairly common requirement, is a simple package to allow a couple of Pets to talk to each other. For instance, while one controls some complex laboratory equipment, the other can be garnering the information from that Pet while it is fully occupied, and get on with the job of processing it all.

Although many LAN packages exist, these are all aimed at rather large numbers of Pets, in a large university, laboratory or some other such place. We're not decrying LANs here, but most people seem to have ignored the somewhat smaller establishments who can only afford two Pets at the most.

These two Pets usually tend to be pretty hard pushed to do everything that's required of them, so a package to let them share the load would be a welcome development.

Such a package now exists, and has been produced by a company that is an offshoot of 3D Digital Design and Development, long regarded as authorities in the interfacing world.

This new company is called D.M.A., based in Nottingham, and their product is called Petween.

## Ease of installation

Petween is a combination of a machine code program sitting in EPROM in the spare 9 socket, a replacement ROM for the F socket, and a simple cable that connects the two Pets together. As the cable connects up the Pets via the User Port we still have control of the IEEE port.

Unfortunately this does not mean that both Pets can still access one disk drive: only one Pet at a time can use either this, or a printer. So the procedure would be to load a program on Pet1 transfer it to Pet2 and let that one get on with its job, and then load another program onto Pet1.

The package, being simple and straightforward, is also easy to install. Just remove the F ROM, replace it with the new one, put the 9 EPROM into place and plug the cable into the back of the two

Pets. Everything is then ready to go.

There are seven new commands available on both Pets. All of these special commands are preceded by the ! symbol, and consist of two commands to enable and disable the Pet as a listener, one to kill Petween completely, one to send a program from one Pet to the other, one controlling passing of variables, one to subsequently evaluate the variables, and the seventh sets the top of the memory pointer in the Pet to give us an input buffer for the variables.

One would, as usual, like to see more commands available. DMA are currently working on some, including a screen dump from one Pet to another, a networking system, sending text from one to another ready for printing, and so on.

## In operation

All of these commands can be used in either direct or program mode, and in addition to these we have five error condition detectors, which between them manage three printed error messages and a break in whatever is happening at the time.

Only one incompatibility with existing Pet Basic. If one of these new commands is to follow an IF ... THEN statement, the command must be preceded by a colon. E.G. IF ST = - 1 THEN : ITEST.

A full handshaking sequence is employed on data transfer, and the error risk is exceedingly small.

The manual takes you through everything in sufficient detail for you to understand quite easily what's happening, and it is soon apparent that Petween is rather more powerful than you might at first have thought. Timing sequences are explored, so that data can be sent when you want it to (and more importantly when the Pets want it to!) rather than just being passed as and when it comes in, for instance.

## Conclusion

An easy to use system that should find a home in many small establishments and laboratories, where one Pet is virtually devoted to one task, but the data gathered from that task needs to be processed at the same time.

Area: *Pet to Pet Communications*  
 Company: *D.M.A.*  
 Address: *3 Sandfield Road, Arnold, Nottingham, NGS 6QA*  
 Tel. No. *0602 267007*  
 Contact: *Alan Mills*

# Programs for learning

Ivan Berg Associates have released details of their new educational software produced in conjunction with Commodore Computers and Hodder and Stoughton:

## *Revision Aids*

Geography

History

*Test Your Child's*

Reading

Arithmetic

General knowledge

This series is based on Hodder and Stoughton's *Test Your Child's* series.

*Teach and Test* (5 - 8 year-olds)

Alphabet skills

Vocabulary skills

Arithmetic I

Arithmetic II. (Rules of hundreds, tens and units, multiplication and division).

Ivan Berg's exam revision programs for secondary school students are already well established.

In all cases, says Ivan Berg, the data is prepared by teachers and textbook authors who specialise in the subjects covered. Students completing the tests will have a clear indication of any weak areas which require further revision.

The software comes with extensive student notes prepared by the authors and designed for use alongside each program.

Other programs available are:

## *English language*

Material is supplied by International Correspondence School tutors. The program follows the GCE/CSE syllabus and covers composition, comprehension, spelling and grammar.

## *Biology*

Covers the nature and variety of living organisms, functions of living organisms and the biology of the environment.

## *Mathematics 1*

This begins with a general section covering different parts of the syllabus. The student's knowledge of arithmetic, algebra, geometry and trigonometry is then tested and the program ends with two tests of short questions and longer problems.

## *Mathematics 2*

Similar to Mathematics 1, with ICS data and more concerned with traditional mathematics, this program covers arithmetic, equations, progressions, functions, calculus and trigonometry.

## *Physics*

Prepared in collaboration with Hodder and Stoughton. The program covers charges and circuits, electricity and magnetism, electronics and nucleonics, waves and sound, light, matter, forces and motion.

## *Chemistry*

This program covers basic techniques, the periodic table, structure, binding and energy, Redox reactions, acids, bases and salts, reactions and their rates, analysis and organic chemistry.

With the exception of biology, for which many of the

questions are in a sequential order, all the programs have an automatic randomising feature; the questions are never presented to the student in the same order, thus discouraging students from learning parrot fashion.

The student can choose three kinds of tests. He can work against the clock, setting his own time limit, he can work through the test with the answers checked and the correct answers given to every question; or he can work through the test with all his results presented at the end of the test.

At the end of each test the screen displays the full results of each test and the bar chart displayed at the end of the program shows areas in need of further revision.

## Brains of the year

For his proposal to make micro-computers more widely available to the mentally and physically handicapped, 14-year-old Derek Reynolds from Newcastle-upon-Tyne has won the accolade of 1982 Young Computer Brain of the Year.

At a ceremony at the headquarters of The British Computer Society in London, he received Commodore computer equipment valued at £2,000 and a special trophy from The Sunday Times Magazine, presented by Peter Hall, Chairman of the Council of The British Computer Society.

Derek wrote a program to enable handicapped people to teach themselves with a micro-computer. "I noticed that some children had difficulty recognising the 'odd-man-out' in a group of shapes or letters. This gave me two ideas which I combined. The first was an educational computer program. The second, a keyboard with only two large keys, so the program could be used easily, even by the handicapped."

The Young Computer Brain of the Year competition is an annual event run by The Sunday Times Magazine and Commodore Computers. From this year's 328 entries, 19 were chosen to share £12,000 of computer prizes.

The competition is aimed at encouraging young people to think of original ways of using a computer to benefit society.

Derek Reynolds was the winner in the 13-15 age group. Twelve-year-old Rachael Goberman from Oldham won first prize in the under-13 category for her entry on how computer aided design could be used to improve police Identikit methods. Lionel Tun, in the 16-18 age group won first prize for suggesting ways of using computers to treat depression.

## Vic 20 makes it to a million

Commodore Business Machines (UK) Ltd. have announced the millionth Vic 20 colour computer sale.

Since Commodore launched the machine in America last year, sales have topped 800,000 over there — half that number selling in the last quarter of 1982 alone.

Sales in Europe, by Christmas, were expected to exceed 200,000, with the United Kingdom accounting for over half this total.

# CBM Professional Computer Guide

Every publication of this nature which now comes out has got to compete with Ray West's *Programming the PET/CBM* to some extent. What West's book didn't cover, and the only way that others will succeed, is the beginner's aspect: that is, I've got the machine, what do I do with it now. Everything else he touched on was more or less 100% correct.

Consequently, Osborne's book is now bedecked with memory maps, explanations of Basic keywords and so on, in an attempt to cover all the hard-core material that he previously didn't go into in such great detail.

However, it is as a learning, instruction book that it is of most value.

## An Overview

We start off with an introduction to CBM computers and their peripherals, all good stuff, designed to give you a thorough grounding in the basics of the machines. How you connect them all up, simple things like operation of the cursor control keys, tours of the keyboard and so on.

Simple that is if you know it all already, but as Jim Butterfield has said, what you think everyone else already knows doesn't always turn out to be what they do know!

Having found out where everything is, and how to use it, chapter two goes onto the actual operation of the computer, starting off with program statements in immediate mode, and then onto simple programs, file handling etc.

A short section on screen editing leads us into programming the beast: variables, arrays, boolean operators and much more are all given a thorough (if at times brief) going over. This section could really be applied to any computer being programmed: not a criticism of the book, but an introduction to the next, and perhaps most important chapter, Making the Most of CBM Features.

One of the longest chapters in the book this tells us all about the peculiarities and idiosyncrasies of the Commodore family, and is probably also one of the most useful chapters in the book as far as the novice is concerned.

## Business Use

Since this particular version of the book is aimed more at businessmen than home hobbyists, we must therefore believe that the content follows this dictum. To be fair, it does, and in this chapter

in particular we have more business utilities explored than anything else: sorts, that kind of thing.

All these listings incidentally are reproduced direct from a CBM printer, which does encourage confidence in their ability to work.

The longest chapter in the book is devoted to CBM peripherals, starting off with the cassette deck: not of much use to the average businessman I would have thought, but nonetheless valuable information if you want to start using CBM kit in a humble way.

Disk drives, and their uses, get the most extensive coverage, with many programs covering file handling (sequential, random), storing string and numeric data.

Printers round off this section, before moving onto a short look at other peripherals, including modems and voice response units.

The chapter called Inside and Beyond Basic tends to refer you to other publications rather than try and do everything itself: no bad thing really I suppose, if you acknowledge your peers in this way. Still, it is a reasonable and concise introduction to how basic does what it does.

After that, the book is rounded off by a summary of all the basic keywords and error messages you're ever likely to encounter, followed by the fairly detailed memory maps, and finally a list of other information resources.

## Summary

A most useful and accurate guide to the use of Commodore equipment. At 512 pages it is pretty good value for its cover price of £10.95 and for the businessman wanting to know more than how to press shift and run/stop it is probably the best buy around at the moment.

It will not take you into the murky depths of machine code programming in any great detail, but I would assume that the authors know where their readers' interests lie.

|            |                                               |
|------------|-----------------------------------------------|
| Area       | : Guide to Commodore Equipment                |
| Title      | : CBM Professional Computer Guide             |
| Authors    | : Adam Osborne, Jim Strasma and Ellen Strasma |
| Publishers | : McGraw-Hill Book Company (UK) Ltd.          |
| Address    | : Shoppenhangers Lane, Maidenhead, Berkshire  |
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# Universal String Thing

*Jim Butterfield*

This is not a complete String Thing\*, just the INPUT# section. Quite simply, the program is an INPUT# utility that lifts some of the restraints imposed by the BASIC INPUT# command. It works on all versions of BASIC (except 1.0) for PETs and CBMs. If there's enough demand, a VIC String Thing will be released that will probably work on the Commodore 64 when it arrives.

Logical file number 1 must be used in the DOPEN or OPEN statement. Using the routine with any other file number will result in ?FILE NOT OPEN ERROR after the SYS call.

No buffer if required for the incoming data. The characters are built directly into the space allocated for the string variable. If the string resides in high RAM, they will be delivered there. If the string is declared in the program, the characters will land right in text space.

The string used for input must be the first variable seen by BASIC. Location 189 decimal is used to store the length of the input string. Input stops only on Carriage Return and EO1 which occurs at the end of a file or relative records not terminated by a CR. Leading spaces, commas, colons and quotation marks are all accepted. The size of the string can be used to govern the amount of input. For example, removing lines 110 and 120 from the program below leaves a\$ = " abcdefghijklmnopq", with a length of 17.

## Subsequent calls

Now, strings longer than 17 can not be retrieved in whole. Instead, the first 17 characters are brought in and the remainder is received in subsequent calls. If the string is exactly 17 long followed by a Carriage Return, a subsequent input would be met by the CR and PEEK (189) would equal zero. Be careful though. In this case A\$ will contain the previous input, not null string.

Using this routine as opposed to INPUT# can be especially helpful when disk space is at a premium. It can handle strings up to 255 characters long and there's no need for Carriage Returns.

\* — The String Thing was originally a utility written by Bill MacLean of BMB Compuscience. It in-

cluded string search, string overlay, and string input functions. For details on this program, see The Transactor, Volume 3, Issue 1. Copies are available from the Toronto PET Users Group.

```

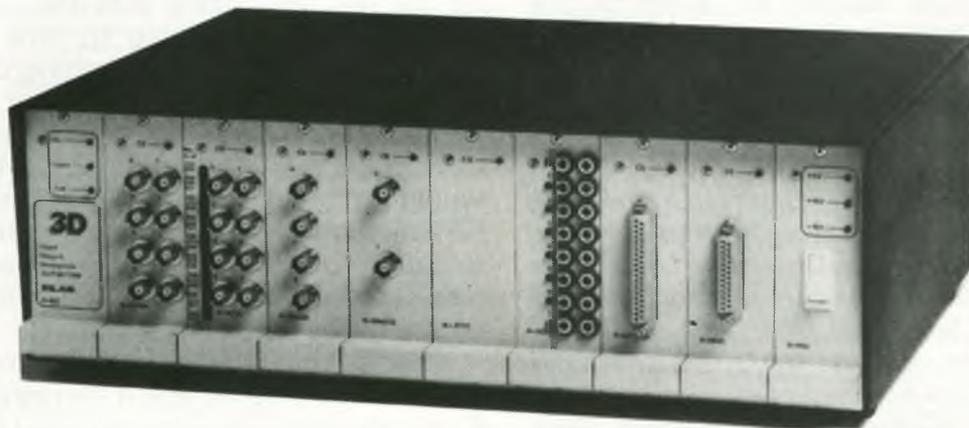
40 rem *****
50 rem **      string thing (universal)  **
60 rem **      jim butterfield         **
70 rem **      string used for input   **
80 rem **      must be first variable  **
90 rem *****
100 a$="abcdefghijklmnopq"
110 a$=a$+a$+a$+a$+a$
120 a$=a$+a$+a$
130 rem above sets string for maximum (ie. 255)
200 data 160, 2, 177, 42, 153, 184, 0, 200, 192, 6
210 data 208, 246, 162, 1, 32, 198, 255
220 data 32, 228, 255, 201, 13, 240, 11, 164, 189, 145
230 data 187, 200, 132, 189, 196, 186, 208, 238, 76, 204,
    255
250 for j=896 to 933 : read x : poke j, x : t=t+x : nextj
260 if t<>5767 then stop
400 dopen#1, "some SEQ file" ,d0
410 rem : next sys same as 'input#1,a$'
420 sys 896
425 rem : l = size of input (could be 0)
430 l=peek(189)
440 print left$(a$,l)
450 if st=0 goto 420
460 dclose
    
```

## Filing It

Once you have learned how to input from the keyboard and output to the screen, it's easy to take the next step, and input or output using other devices.

The printer is handy, of course. But the super power comes from devices you can both read and write. That way, information can be stored now and brought back in later. You can store names, addresses, phone numbers ... and read them when you need them. This gives you two advantages: first, the information isn't lost when you turn the power off; and second, you have lots of storage space even if your computer memory is small.

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### The Golden Rule

You'll find it easy to remember the golden rule of input and output; the information going out is almost exactly as you would see it on the screen. So if you asked to print out a value of 167, the following characters would be sent to the cassette, printer or disk: Space. 1;6;7;Return. That's almost exactly the same as would go to the screen; we wouldn't see the Return on the screen, but we'd see its effect since a new line would be started.

The opposite side of the golden rule concerns input. If the above value was written to a device, and later we rewind and ask to INPUT from that device, the program will receive exactly the same information as if we typed on the keys: Space, 1,6,7, and Return. On the keyboard, RETURN signals that we are finished; and it means the same when the information comes from some other device.

Two special situations should be mentioned. You might have noticed that if we say PRINT 167 an extra character is delivered to the screen: behind the last digit, 7, there's a cursor-right. You may not notice it, since it doesn't print, but it's there. This extra character will not be sent to other devices. That's good because we don't need it; we save the space and no harm is done.

The other situation is another invisible character. Many versions of Basic send one more character after RETURN. Basic 4.0 does not normally send it, but most other Basics send a special character called a Linefeed. The Linefeed is a nice character for certain types of printers: it may be needed to move the paper up ready for printing the next line. But it's wasted in data storage, and might even give us a little trouble. More on this later.

### Writing a File

It's easy to write a file. All we need to do is: Open it, which tells the computer to get everything ready to go; Print the stuff; and then Close it, which tells the computer to wrap everything up.

Let's do it. If you have cassette tape, type:

```
OPEN 6,1,1,"DATAFILE"
```

or if you have disk, type:

```
OPEN 6,8,2,"O:DATAFILE,S,W"
```

... and in either case, your file number 6 is ready to go.

Now we can write a few things. Let's try some numbers:

```
PRINT # 6,3
```

```
PRINT # 6,123
```

```
PRINT # 6,3*45*6
```

And a few names:

```
PRINT # 6,"HELLO"
```

```
PRINT # 6,"MY NAME IS FRED"
```

Finally, we wrap up the file with:

```
CLOSE 6
```

A few notes. Did you notice that after we opened the file, the coding was the same no matter whether we were going to tape or disk? The OPEN statement sets everything up for us. This can make things very easy.

Note that we use one print statement for one item. Don't try punctuation' PRINT #6,3,123 would not work right — we will need that extra RETURN when we read back the data. It's also interesting to see that expressions are worked out before being printed, so that 3\*45\*6 will placed on the file as value 810.

Now for that sneaky Linefeed. You don't really need to worry about this if you have 4.0 Basic or if you are using cassette tape, but it's good practice. Those PRINT # statements wrote the information we asked; then a Return, which we wanted; then a Linefeed, which we didn't want. We can get rid of the unwanted Linefeed by writing the Return ourselves — it codes at CHR\$(13). So we might more correctly write:

```
PRINT # 6,"HELLO";CHR$(13);
```

... and don't forget both semicolons.

### Reading it Back

This is just as easy, except that we need to write these statements as a program. INPUT and INPUT # won't work as direct statements typed on the screen. So we code:

```
100 OPEN 4,0,0,"DATAFILE"
```

or, for disk:

```
100 OPEN 4,8,3,"DATAFILE"
```

And continue with:

```
110 INPUT # 4,A$
```

```
120 PRINT A$
```

```
130 IF ST=0 GOTO 110
```

```
140 CLOSE 4
```

What's ST doing? That's the Status word. If it's zero, we are reading our file normally. If it's non-zero there is something going on — usually we are at the end of the file (ST will equal 64 in this case).

Your data should come back very nicely just as you wrote it.

### Conclusion

It's not hard to write and read files. We'll pick up a few fine points next time around.

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| APPROXIMATE MEMORY USAGE |     |                                                                                                                 |         |     |                                                                |
|--------------------------|-----|-----------------------------------------------------------------------------------------------------------------|---------|-----|----------------------------------------------------------------|
| AUTO                     | 40  | Provides automatic line numbering.                                                                              | MON     | 10  | Enters the CBM machine-code monitor.                           |
| BEEP                     | 60  | Plays music of given duration and pitch.                                                                        | MOVE    | 130 | Moves a block of memory to another position in RAM.            |
| BLOAD                    | 40  | Loads in a block of memory without affecting BASIC execution.                                                   | NUMIN   | 740 | Foolproof input routine for amounts of money.                  |
| BSAVE                    | 120 | Saves the memory area between two given addresses.                                                              | PCTRL   | 100 | Set the device number and characteristics of the printer.      |
| CALL                     | 80  | Enter a machine-code subroutine with given Acc,X- & Y-reg.                                                      | PLOT    | 170 | Plots a double-density point on the screen.                    |
| CIF,CEND                 | 220 | Four commands which provide facilities for structured BASIC, largely eliminating the need for the GOTO command. | POP     | 30  | Removes the last subroutine return address from the stack.     |
| ELIF,ELSE                |     |                                                                                                                 | PRINT   | 130 | Adds routine to automatically right-justify amounts of money.  |
| CURSOR                   | 30  | Places the cursor at position x,y on the screen.                                                                | PRINT   | 280 | Modifies all printer-output as needed and adds TAB function.   |
| DATIN                    | 690 | Foolproof input routine for dates with full error detection.                                                    | PUSH    | 60  | Pushes a return address onto the stack.                        |
| DELETE                   | 70  | Deletes a given range of program lines.                                                                         | RENU    | 930 | Renumbers a program, altering all GOTO's, THEN's, etc.         |
| DISABLE                  | 50  | Disables the run/stop key without affecting the internal clock.                                                 | REPEAT  | 50  | Adds repeat key function.                                      |
| DISP                     | 140 | Displays a prompting or warning message on a given line.                                                        | REPLACE | 490 | Replace all occurrences of one character string with another.  |
| DREAD                    | 100 | Reads data from disk without input restrictions.                                                                | RESCUE  | 40  | Recovers a program accidentally 'NEW'ed.                       |
| DSEARCH                  | 330 | Searches a disk relative-file for a given string or pattern.                                                    | RESET   | 170 | Resets a double-density point on the screen.                   |
| DUMP                     | 170 | Outputs the names and values of all current scalar variables.                                                   | RESTORE | 20  | Restores DATA back to a given line number.                     |
| EDIT                     | 70  | Adds 'delete-forwards' function.                                                                                | REVERSE | 50  | Reverses the field of the screen.                              |
| EXEC                     | 140 | Executes a string as a BASIC command.                                                                           | SCAN    | 190 | Scans a string for the next occurrence of a given character.   |
| FIND                     | 200 | Lists all lines in which a given character string appears.                                                      | SCOPY   | 340 | Copies the screen to the printer.                              |
| GENIN                    | 700 | General foolproof input routine with selected key disablement.                                                  | SCROLL  | 230 | Scrolls screen contents up,down, left or right.                |
| GSUB                     | 110 | Performs a GOSUB to a given labelled line.                                                                      | SEARCH  | 270 | Searches an array for a given string or pattern.               |
| GTO                      | 90  | Performs a GOTO as above.                                                                                       | SHRINK  | 180 | Removes all unnecessary spaces and 'REM's from a program.      |
| INPUT                    | 40  | Allows a program to continue despite a null entry being input.                                                  | SORT    | 760 | Sorts any one-dimensional array (and tags another array along) |
| INVERT                   | 160 | Turns a string back to front.                                                                                   | SWAP    | 440 | Loads in another program, retaining all variables.             |
| IRO                      | 80  | Restores normal system use of interrupts.                                                                       | SWIND   | 150 | Saves the contents of the screen in a compressed format.       |
| KILL                     | 20  | Takes out SOFTCHIP commands.                                                                                    | TRACE   | 110 | Displays the last six line numbers at the top-right screen.    |
| LINES                    | 50  | Calculates the number of lines in a program.                                                                    | VAR     | 390 | Outputs the names of all variables referred to in a program.   |
| LWIND                    | 170 | Loads a screen display from a compressed format file.                                                           | WINDOW  | 30  | Sets top, bottom, left, right for an 8032 screen window.       |
| MERGE                    | 360 | Merges a program from tape or disk into the current program.                                                    | WPOKE   | 50  | Pokes two memory locations in hi-lo 6502 order.                |

## ★ ★ NEW COMMANDS NOW AVAILABLE

|         |     |                                                           |
|---------|-----|-----------------------------------------------------------|
| BORDER  | 100 | Draws a border around the edge of the screen              |
| CLOCK   | 250 | Continually displays the time at a given screen position. |
| GRAPH   | 120 | Gives access to the box-drawing characters on an 8032     |
| ON      | 50  | Branches to program line corresponding to key pressed.    |
| PROTECT | 90  | Allows regain of control after system crash.              |
| STATS   | 120 | Outputs the number of statements in the current program.  |

## ★ ★ NEW FUNCTIONS which may be used in any expression

|         |     |                                                            |
|---------|-----|------------------------------------------------------------|
| AVG     | 140 | Calculates the average of the elements in a numeric array. |
| BLANK   | 40  | Tests a string : returns true if the string is blank.      |
| DEC     | 80  | Gives the decimal equivalent of a hexadecimal number.      |
| FACT    | 60  | Provides the factorial function.                           |
| GAMMA   | 90  | Provides the gamma function.                               |
| HEX\$   | 90  | Gives the hexadecimal equivalent of a decimal number.      |
| MAX     | 120 | Returns the maximal element of an array.                   |
| MIN     | 120 | Returns the minimal element of an array.                   |
| NORM    | 160 | Provides the normal distribution area function.            |
| PAD\$   | 90  | Pads a string with spaces.                                 |
| QUMES\$ | 70  | Assists high-resolution plotting on QUME Sprint 5 printer. |
| SHR\$   | 260 | Gives the compressed form of a number for compact storage. |
| SPC\$   | 30  | Gives a string of spaces of given length.                  |
| SUM     | 130 | Returns the sum of elements of an array.                   |
| WPEEK   | 40  | Peeks a two-byte address.                                  |
| XPD     | 220 | Decompresses a number.                                     |

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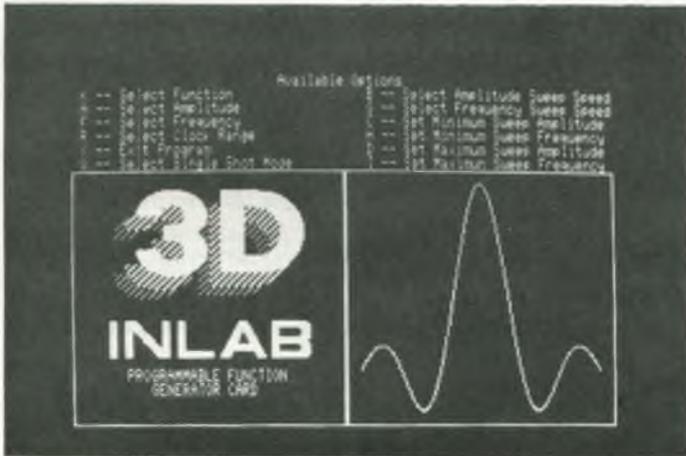
(2) Write your selections in order of preference - this is important as our numbers of bytes are only approximate.

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# The Role of the Micro-computer as an Intelligent Controller



This article will show how a Commodore PET microcomputer can drive a very sophisticated waveform generator, with wide applications in such fields as the mechanical testing of various components for the automobile industry, and the medical investigation of the effects of drugs on muscle tissue.

## Oscillators and Function Generators

The classical approach for generating various waveforms is based on a controlled amount of positive feedback signal. Normally tuned circuits are used to select specific frequencies. Figs. 1 & 2 show simple oscillators with tuned circuits and R-C feedback networks. Most active devices can be made to oscillate by the correct choice of feedback components.

Operational amplifiers lend themselves as the ideal devices to obtain oscillation at low frequency since they have both a positive input and a

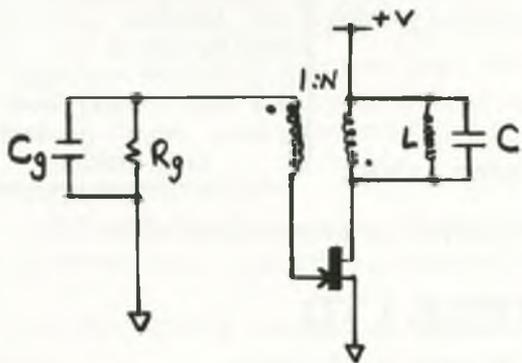


Fig 1: TUNED DRAIN TRANSISTOR OSCILLATOR.

negative input i.e. the non-inverting and inverting inputs. Fig. 3 shows an operational amplifier configured as an oscillator. As in the case of transistor oscillators the feedback network characteristics will determine the frequency of oscillation. The maximum frequency obtainable with an operation amplifier will depend on its slew rate (normally quoted in Volts/microsecond).

## Pulse outputs

Non-linear integrated circuits such as digital gates, whether TTL or MOS, may be configured as oscillators to produce pulse outputs (see Fig. 4). The frequency can either be determined using an R-C network or by a crystal. Crystal oscillators (see Fig. 5) are more stable than R-C oscillators since both resistors and capacitors vary with temperature quite significantly whereas crystals typically vary by a few parts per million per °C.

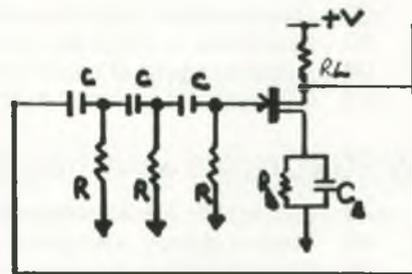


Fig 2: R-C PHASE SHIFT OSCILLATOR USING FET TRANSISTOR.

Crystal-controlled oscillators are used in most computer systems, including the Commodore range of machines, to provide the microprocessor master clock. Most processor clocks are in the range 1MHz to 8MHz. The usual practice is to use a high frequency crystal oscillator followed by dividers to provide clock signals for use in different parts of the system, sometimes with unequal mark-space ratios.

Digital-to-analogue converters may also be used to generate output waveforms. Here the data is provided in digital form from a microprocessor, and consequently both the output waveform and the output frequency is determined by the soft-

ware. To provide sufficient flexibility and speed means that a sophisticated machine code program must be designed, and furthermore the microprocessor ends up as dedicated to the task of waveform generation.

Specially microprogrammed single-chip microcomputers are available for such tasks, and voice-synthesis chips and intelligent stepper-motor controllers fall into this general category.

An approach similar to the D-to-A convertor technique has been employed by 3D Digital Design & Development Ltd. Their technique is based on stored waveforms in a read-only-memory (ROM). Since the price of memory chips is coming down all the time, and their capacity is rapidly increasing, this is a cheap yet powerful route to follow. A 2716 EPROM can be used to store eight waveforms with eight bit resolution in both amplitude and time (equivalent to drawing the waveform on a high resolution grid of 256 x 256 pixels). If higher resolution is needed a combination of two or more 2716s may be used to provide up to 16-bit resolution.

The data output from the ROM(s) is applied to a digital-to-analog convertor, and the ROM address lines are driven from the outputs of a digital counter chain. The frequency of the counter clock determines the rate at which the stored waveform is sent out.

By appropriate circuitry the counter may stop after one complete cycle, or it may be made to keep counting repetitively over and over, so the output waveform may be one-shot or continuous.

Additionally, it is possible to arrange for the counter clock frequency to be chosen as an integral sub-multiple of a very high crystal-controlled frequency, thereby giving flexibility in output frequency as well as accuracy. With this clever piece of circuitry interfaced to the PET the above mentioned options can be brought under software control. Further, the output level may be additionally varied using transconductance amplifiers or electronic attenuators.

The approach employed by the 3D waveform generator offers the following facilities under program control:-

1. Selection of waveforms which are stored in EPROM
2. Coarse frequency selection i.e. high range or low range
3. Fine frequency control with 12-bit resolution i.e. there are 4096 frequencies which the operator may select under program control
4. Amplitude control with 8-bit resolution, allowing 256 amplitude levels to be selected from the micro-computer.

5. Frequency modulation may be achieved by sweeping the fine frequency control
  6. Amplitude modulation may be achieved by sweeping the amplitude control under software
- In addition, the following signals are available at the front panel:

1. High frequency square wave
2. Low frequency square wave
3. Amplitude control signal
4. External control for synchronisation with an external signal source or to trigger one-shot operation.
5. X-axis sweep-signal: a synchronised ramp output which can act as a timebase for oscilloscope displays or chart recorders.

It is apparent from the discussion above that the combination of the stored waveform principle together with the Commodore PET provides a remarkably flexible and convenient way of generating a variety of waveforms. These waveforms may be generated mathematically or derived from graphical templates. The computer is the ideal tool for generating, or reading the waveforms from a digitising tablet. A simple EPROM programmer can then be used to store these waveforms in an EPROM. Using this approach a library of various waveforms may be built up and then used at some stage to provide the test signals for whatever application is required.

### More easily controlled

One possible improvement on the design presently being considered is the possibility of using off-board RAM instead of EPROM, together with means of down loading the waveform data from the PET, via the IEEE-488 bus, thus making the generator even more easily controlled.

Fig 6. shows a sample of waveforms generated using the combination of Commodore PET microcomputer and 3D stored-waveform generator.

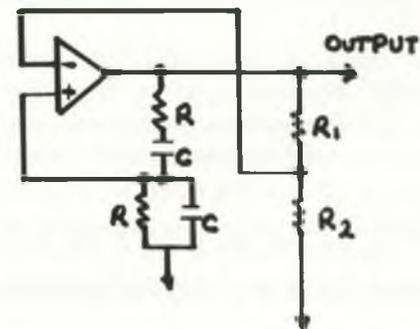


Fig. 3: AMPLIFIER CONFIGURED AS A WIEN-BRIDGE OSCILLATOR.

**Application Areas**

Waveform or pulse generators are used in the testing and calibration of most electronic circuits, be they digital or analogue. Typical of such pieces of hardware are audio-amplifiers, servo-amplifiers, and medical recorders for electro-cardiography and electro-encephalography: these all require input test signals of particular characteristics. Modern fatigue-testing machines, which determine the lifetime-to-failure on critical aerospace or automobile mechanical components, may have a range of standard

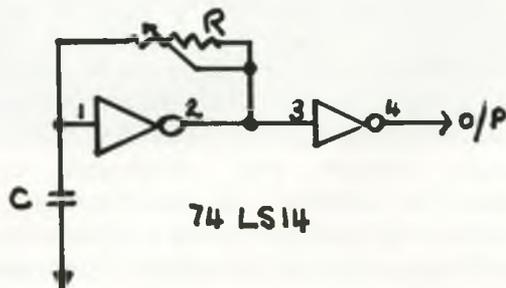


Fig. 4: TTL SCHMITT TRIGGER CONFIGURED AS AN OSCILLATOR.

waveforms which can be applied to the test specimen. Wave tanks or moving vibratory test tables similarly impose a pre-selected pattern of acceleration, force, or stress.

Before implantation medical pacemakers must undergo a particularly rigorous and precise testing procedure involving the superimposition of sine, square, and sine pulses on their output electrode to simulate real physiological impulses.

The amplitude and pulse repetition rate of the impressed waveform together with its synchronisation (or phase delay) from the inherent internal signals of the device under test can be crucial to the significance of the test procedure as a whole.

We will discuss two specific areas where a 'closed loop' control system may be employed using the 3D waveform generator and a number of analogue-to digital convertor channels to provide feedback about the system's response to the applied waveform.

**A. Computer Control of Audio Amplifier Test Bed**

Most audio-amplifier manufacturers carry out a well-defined set of routine tests in order to

measure the amplifier's main characteristics. e.g.

1. Frequency Response
2. Power Efficiency
3. Harmonic Distortion
4. Protection circuitry & overload shutdown

A microcomputer test bed may be based on the waveform generator to provide the test signal and an analog-to-digital convertor with multi-channel multiplexer to provide signals back to the computer about the response of the various components of the system. The analog-to-digital convertor could have a 12-bit resolution and a short conversion time. The test set-up would be as in Fig. 7. Since the waveform generator and the analog-to-digital convertor are part of the same interface system (INLAB) which is IEEE-488 compatible, programming in Commodore BASIC is straightforward, making much use of PRINT # and GET #.

**Digital representation**

The program will select the appropriate waveform and set the frequency and output level of the waveform generator; the multiplexer will then be addressed to select the channel of interest and the A/D convertor will supply the PET with a digital representation of the selected analog signal, such as current, voltage, power, etc. The program may then plot the resultant response curve on the PET screen (perhaps fitted with a HIRES board), and if a permanent record is required the information may be sent to a digital plotter and/or dot matrix printer. The test data may be stored on diskettes for statistical analysis or quality control checks. Since the PET can perform these operations at a fairly high speed it may prove desirable to have a single PET controlling several such test rigs, especially if the device under test is slow in responding. On the other hand, some applications demand that the speed of the whole process is increased. In such circumstances, the limitation to speed is usual in the

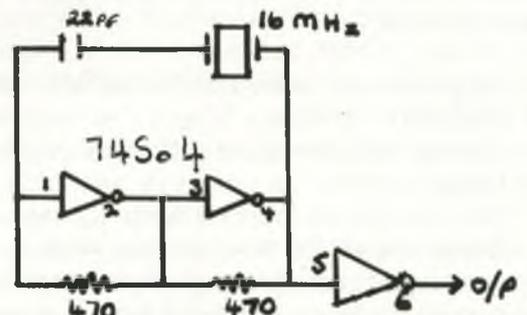


Fig. 5: 8032/4032 MASTER CRYSTAL OSCILLATOR.

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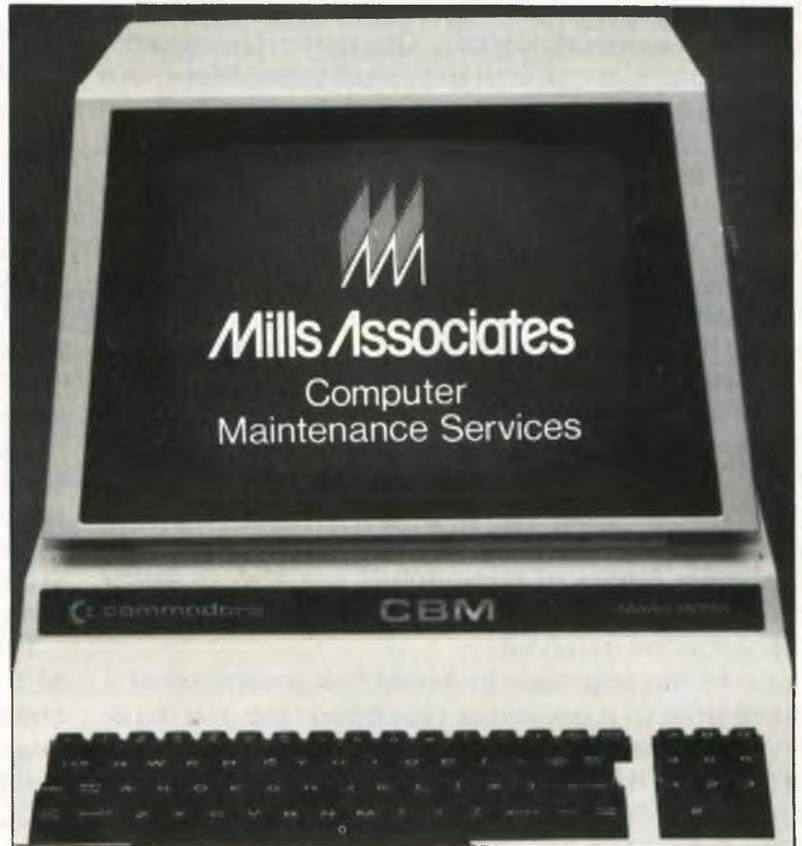
If break-neck speed is not essential then Mills' low-cost fault repair service is the answer. This provides for call-outs on a 72 hour response basis and as with the full maintenance contract, all costs are included in the annual charge. Similarly, replacement loan equipment is available at no extra cost.

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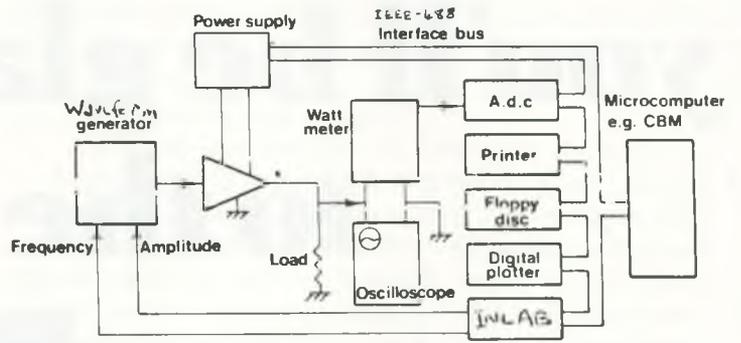
execution time of the interpretive BASIC, and it thus becomes necessary to move to machine code to obtain the true speed advantage of the microprocessor. If you are not familiar with machine code programming it is probably advisable to use a compiler in order to increase execution speed.

In the above illustration the PET may finally be programmed to grade the amplifier and produce a label via the printer indicating passed, rejected or necessary rework details. Obviously this type of test system is not limited to audio amplifiers, but can easily be extended to telecomms equipment, white goods, or electrical/electronic equipment of all sorts.

**B. Bio-Medical Application**

One interesting area of physiological research concerns the investigation of the response of muscle tissue to applied electrical stimuli, and more particularly the way in which the pattern of such response is altered when that tissue is suffused with low concentrations of different chemical compounds or drugs. In this way it is possible not only to study the effectiveness of a particular family of compounds but also to study the underlying physiological and biochemical mechanisms involved.

An earlier approach involved the generation of a pulse train of a particular repetition rate and duration by running a machine code program on a microprocessor system, and 'quasi-simultaneously' monitoring signals coming back from the tissue by sampling a fast A/D with the



*The complete circuit*

as keeping within the time constraints during running meant that it was necessary to use a fast processor (i.e. 4MHz Z80A or 2 MHz 68B09).

Now, with the 3D waveform generator and the ubiquitous PET we have the prospect of storing several of the pre-designed stimulus pulse trains in EPROM, and applying them to the muscle sample as we choose, at any desired repetition rate (or one-shot) and amplitude, whilst having the whole of the PET processor free to run a machine-code (or compiled BASIC) fast-data acquisition monitoring program. With A/D convertors mapped onto the PET's memory-bus, sampling rates of tens of kilohertz are possible, whilst outputting stimulus waveforms at frequencies up to several tens of kilohertz.

It is hoped that this article gives an impression of the power and scope of relatively simple and cheap microcomputers like the CBM PET when coupled with intelligently designed interface equipment.

**Users welcome the 500**

"I hear that the first Commodore 500 has arrived in the UK," says Stephen Rabagliati in the latest newsletter from the Independent Commodore Products User Group.

"My spies tell me that 'ti' is no longer a reserved word and that 'ti\$' now returns the lapsed time in tenths of seconds.

"Another feature of both the 500 and the sole 700 in the UK is that they both have only 24 display lines on their screens as opposed to the familiar 25. It makes you wonder what else CMB (USA) have seen fit to alter on the new range.

"The 720BX (the super twin processor version) will not be working until next March at the earliest, while the MAX (Vic 10) has not had its design finalised.

"On the other hand, the UK version of the CBM 64 is available. I expect to receive the machine soon. If anybody wants a 64 I might be able to arrange more if given early warning."



*Micro-computer with oscillator*

same microprocessor and same machine code program.

The machine code development for such a combined task is time-consuming, and the result is inflexible. To enable the processor to keep up with all the necessary inputs and outputs as well

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## AND INTRODUCING PETWEEN . .

PETWEEN is ROM based PET link-up system. PETWEEN was designed for data transfer between one PET and another. Whole programmes or a string of variables can be sent in either direction. Ideal for scientific use where one PET is busy collecting data for the other one to process and deal with printer and disk drives.

**PRICE:** Manual by itself £1.00 + VAT. PETWEEN ROMset (BASIC 4), cable and manual £95.00 + VAT.

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# A Simple Light Pen

Although written for the Commodore PET, the method used here will work for any computer which has a memory-mapped screen and a parallel port.

## General Principle

Our method is simplicity itself, works in BASIC; requires only one external IC and needs no additional power supply. It can be easily adjusted to suit ambient light conditions. The plug into the computer costs more than the pen! As you might expect with a simple arrangement, there are limitations. Most commercial pens will pick up the position of the light pen anywhere on the screen by timing how long it takes the scanning dot of the CRT to reach it. 'Drawing' on the screen is possible. The pen described here will not do this but it will work in that most common situation where the user is asked to select from a number of choices printed on the screen. Other uses will no doubt occur to readers.

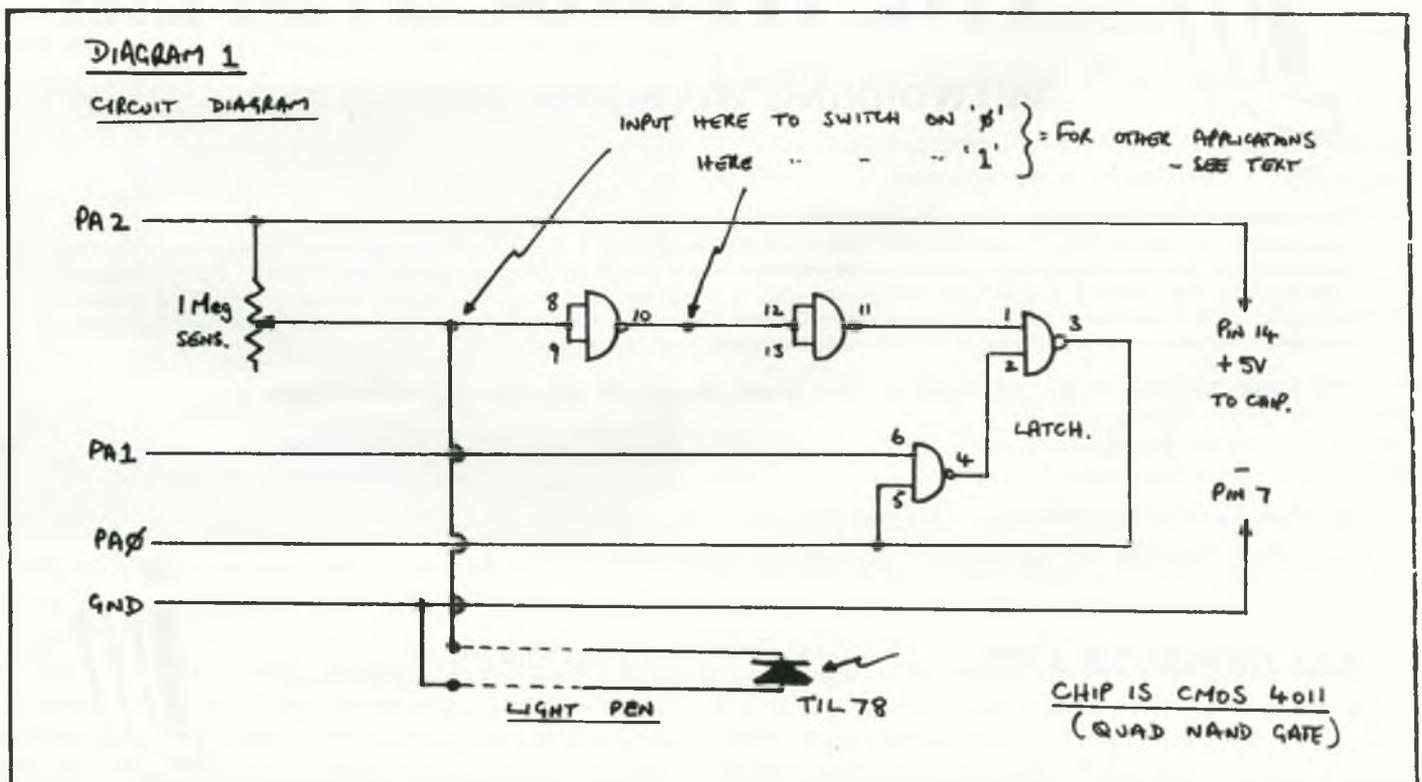
The pen works as follows. Reversed squares, or graphic blobs of light, are allocated on the screen which correspond to the replies from a menu of possibilities. The pen is 'peeked' to ascertain if it

is 'seeing' a light. If it is, the first square on the menu is blanked and reprinted rapidly four times. The input from the pen is monitored. If the pen stays on constantly, it cannot be over this square and the next one is flashed. If, however, the pen also turns on and off four times as a particular menu square flashes, then it is over this square and this is the selected choice.

## Circuit

The circuit is shown in diag. 1. It is intended that the pen be operated via a PIA or VIA port such as that on the 6522. One data line (PA0) is configured as an input and reads the output from the pen circuit. Two other lines (PA1 and PA2) are used as outputs to run the pen chip. +5V is maintained on PA2 to supply the chip itself. The current used is minute and the port is quite capable of supplying it direct. PA1 is used to reset the latch circuit. It works in the following way. The chip is turned on by poking the port with a 4. PA2 becomes +5V. Next, the chip latch is set by poking the port address with 6. PA1 also becomes +5V.

Now, if the pen detects light, the latch will flip



and PA0 will become a '1'. The latch will stay in this position until the port is poked with '4', when PA1 will become '0' and reset the latch. The latching mechanism is required to prevent the indefinite movements of the pen from retriggering the circuit. Sensitivity can be adjusted by means of the preset control.

### Mechanical

The pen proper is an old opaque ball-point. It must have an internal diameter which will allow the light detector transistor to slide right to its end. The photo-transistor looks like a transparent LED and is the same size as the larger variety — 0.2". The lead can be held with a small grommet or Araldite. I mount my 1C and pot. on a small piece of Vero, in the line itself.

### Program

The flow chart of the program is shown in diag. 2. This should be easy to follow when read in conjunction with the above description. Note that a delay has to be introduced, even in the BASIC program, to allow the screen persistence to fade. There is, therefore, no point in trying to convert it to machine code as the time taken for the screen to fade out will be the same and the program will run no faster. Anyway, the time taken to scan 6 possible answers is quite short and acceptable.

Variables used are:

- UP — User port address.
- OP — Option number being tested (max 6 on our menu)
- PN — Position on screen of first option blob — see below.
- DL — Delay loop.
- DT — Number of times the pen has followed correctly.
- L1 — 1 if light is detected by pen, 0 otherwise.

For those not familiar with the PET, the following notes should aid adaptation to your machine.

1. Memory location 59471 is the PET User Port 8-bit data bus.
2. Location 59459 is the data direction register. Poked with 254, it sets all bits to outputs except the first, PA0, which we are using as the input from the pen.
3. Locations 32768-33767 are the screen memory map (40x24 — 1000 squares on PET 40 column). 33123 is the first of our menu

'blobs'. Each succeeding option blob in the menu is directly below the one above and 2 lines down, hence the + 80 in line 40140 (this can be changed as required.).

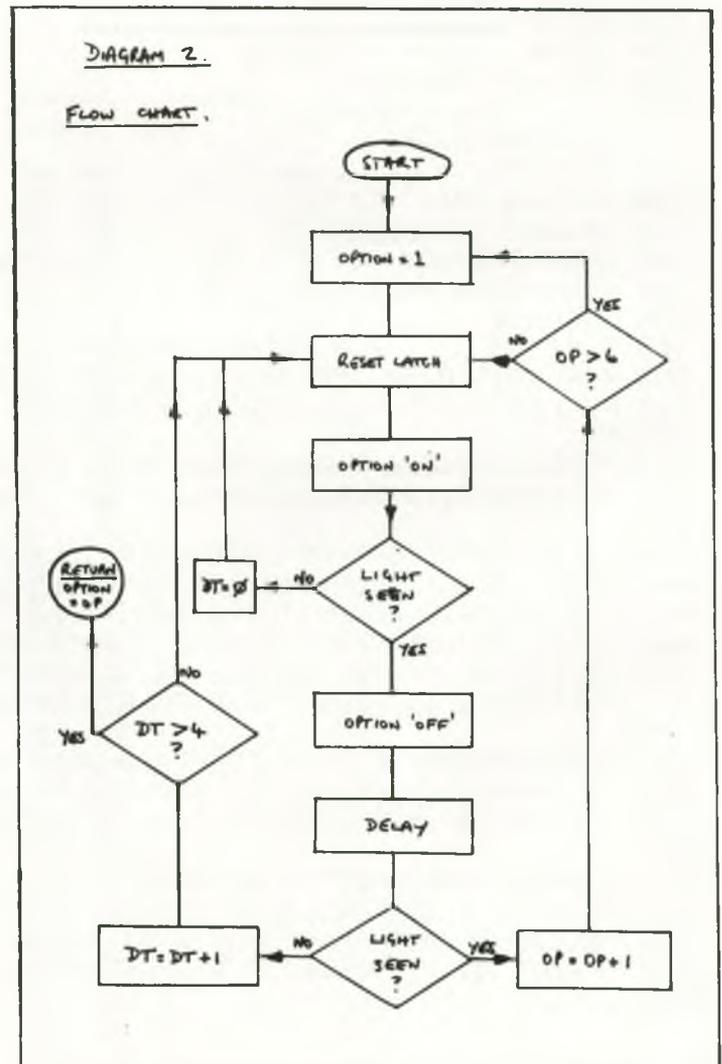
### Other points

The pen will work well on any monitor or external TV attached to the computer operating it.

The circuit shown is easily adapted to other inputs and, with appropriate detectors, can be made to switch on a sound input, temperature change etc. Inputs are shown which switch either on a '0' or '1'.

The author is prepared to copy a demonstration program, which includes full setting-up method, flow charts and instructions for those less understanding of computers, onto your disk (3040) or cassette (PET format) or alternatively a full printer listing, any for 50p ( funds to ACC). Please enclose return postage.

David Annal, 142 Windermere Road, London SW16 5HE.



## Musical Vics

Whilst browsing around through a number of programs we came across this simple demonstration of the musical abilities of the Vic, and thought you might be interested. It will work on any Vic, just type it in and run it, and follow the instructions as they appear on the screen.

```

100 REM PET BENELUX
110 REM EXCHANGE
120 REM NETHERLANDS
130 POKE36879,26
140 POKE36869,242
150 PRINT"■■■■■ SOUND EFFECTS ■■■■";
160 PRINT"_____";
170 PRINT"■ 0 MYSTERY NOISE!
180 PRINT"■ 1 COMPUTER MANIA
190 PRINT"■ 2 EXPLOSION
200 PRINT"■ 3 BOMBARDMENT
210 PRINT"■ 4 ALARM
220 PRINT"■ 5 LASER FIRE
230 PRINT"■ 6 SIREN
240 PRINT"■ 7 SILLY TUNE
250 PRINT"■ 8 TELEPHONE
260 PRINT"■ 9 RANDOM NOISES
270 PRINT"_____ WHICH ONE ? ■■■■ Q=1
280 GETA$:IFA#<>" THEN330
290 FORI=1TO500:NEXT
300 Q=Q+1:IFQ=8THENQ=2
310 POKE36879,Q+24
320 GOTO280
330 A=1+VAL(A#)
340 IFA#=" THEN550
350 ONAQSUB380,400,410,420,440,460,480,500,510,530
360 FORG=0TO4:POKE36874+G,0:NEXT
370 GOTO280
380 POKE36878,15:FORL=250TO200STEP-2:POKE36876,L:FORM=1TO100:NEXT:NEXT
390 FORL=205TO250STEP2:POKE36876,L:FORM=1TO100:NEXT:NEXT:RETURN
400 POKE36878,15:FORL=1TO100:POKE36876,INT(RND(1)*128)+128:FORM=1TO10:NEXT:NEXT
:RETURN
410 POKE36877,220:FORL=15TO0STEP-1:POKE36878,L:FORM=1TO300:NEXT:NEXT:RETURN
420 POKE36878,10:FORL=230TO128STEP-1:POKE36876,L:FORM=1TO20:NEXT:NEXT:POKE36876
,0
430 POKE36878,200:FORL=15TO0STEP-.5:POKE36878,L:NEXT:RETURN
440 POKE36878,15:FORL=1TO10:FORM=180TO235STEP2:POKE36876,M:FORN=1TO10:NEXT:NEXT
450 POKE36876,0:FORM=1TO100:NEXT:NEXT:RETURN
460 POKE36878,15:FORL=1TO30:FORM=250TO240STEP-1:POKE36876,M:NEXT:FORM=240TO250
470 POKE36876,M:NEXT:POKE36876,0:NEXT:RETURN
480 POKE36878,15:FORL=1TO10:POKE36875,200:FORM=1TO500:NEXT:POKE36875,0:POKE3687
6,200
490 FORM=1TO500:NEXT:POKE36876,0:NEXT:RETURN
500 POKE36878,15:FORL=1TO15:POKE36876,160:FORM=1TO400:NEXT:NEXT:RETURN
510 POKE36878,15:FORL=1TO5:FORK=1TO50:POKE36876,220:FORN=1TO5:NEXT:POKE36876,0
NEXT
520 FORM=1TO3000:NEXT:NEXT:RETURN
530 POKE36878,25:FORL=1TO20:FORM=254TO240+INT(RND(1)*10)STEP-1:POKE36876,M:NEXT
540 POKE36876,0:FORM=0TOINT(RND(1)*100)+120:NEXT:NEXT:RETURN
550 :PRINT"■■":POKE36879,27:POKE36869,240
READY.
```

# Graphical Pets

Four short Basic programs for use in your own business and utility programs, all to do with screen appearance. As they are written in Basic they'll work on any machine.

```

100 SP$=""
1000 REM *****
1001 REM *EXAMPLE OF SUBROUTINE CALL
1002 REM *TO DISPLAY WARNING MESSAGE
1003 REM *THIS SUBROUTINE ALSO CALLS
1004 REM *THE CURSOR CONTROL SUBROUTINE
1005 REM *CURSORCONT AT 29800.
1009 REM *****
1010 PRINT " "
1020 ME$="EXAMPLE OF WARNING MESSAGE"
1030 GOTO 30100
1040 PRINT " "
1050 END
2000 REM
3000 REM
4000 REM
5000 REM
6000 REM
29800 REM *****
29802 REM *CURSOR CONTROL SUBROUTINE
29804 REM *****
29806 COL$="*****"
29808 LNE$="*****"
29812 PRINT " "
29814 IF COL<1 THEN PRINT LEFT$(COL$,COL-1)
29816 IF LNE<1 THEN PRINT LEFT$(LNE$,LNE-1)
29822 RETURN
29900 REM
29910 REM
29920 REM
29930 REM
30100 REM *****
30102 REM *WARNING MESSAGE
30104 REM *****
30106 COL=1 LNE=24 GOSUB 29800
30108 AS$="*****"
30110 FOR A=1 TO 30
30112 AW=LOG(A) PRINT "WARNING" AS$
30114 AW=LOG(A) PRINT "WARNING" AS$
30116 NEXT PRINT "WARNING -" LEFT$(ME$+SP$,31) " "
30118 GET A$ IF A$="" THEN 30118
30120 COL=1 LNE=24 GOSUB 29800
30122 PRINT SP$
30124 RETURN
READY.

```

```

29900 REM *****
29902 REM *SUBROUTINE TO DRAW A BORDER
29904 REM *AROUND THE SCREEN.
29906 REM *****
29908 PRINT " " AS$=" " FOR I=1 TO 25 AS=AS$+" " NEXT
29910 BS$=" " FOR I=1 TO 40 BS=BS$+" " NEXT
29912 FOR I=1 TO 20 PRINT " " TAB(20-I) LEFT$(BS$,2) I NEXT
29914 PRINT " " FOR I=1 TO 21 PRINT " " SPC(38) " " NEXT PRINT
29916 PRINT " " SPC(38) " "
29918 FOR I=0 TO 19 PRINT " " SPC(I) " " SPC(38-I*2) " " NEXT
29920 RETURN
READY.

```

```

100 SP$=""
1000 REM *****
1001 REM *EXAMPLE OF SUBROUTINE CALL
1002 REM *TO DRAW BORDER WITH SCREEN
1003 REM *HEADING.
1009 REM *****
1010 PRINT " "
1020 P$="EXAMPLE" REM ***HEADING**
1030 GOSUB 29900
1040 PRINT "*****TEXT *****"
1050 END
2000 REM
3000 REM
4000 REM
5000 REM
6000 REM
29900 REM *****
29902 REM *SUBROUTINE TO DRAW BORDER
29904 REM *AROUND THE SCREEN WITH A
29906 REM *REVERSE FIELD PAGE HEADING
29908 REM *TRANSFERRED AS P$
29910 REM *****
29912 A=LEN(P$) A1=(40-A)/2
29914 A1$=LEFT$(SP$,A1)
29916 PRINT " "
29918 PRINT A1$; PRINT " " P$ " "
29920 PRINT " "
29922 FOR X=32850 TO 33610 STEP 40 POKEX,101 NEXT X
29924 FOR X=32886 TO 33686 STEP 40 POKEX,101 NEXT X
29926 PRINT " "
29928 PRINT " "; RETURN
READY.

```

```

100 SP$=""
1000 REM *****
1001 REM *EXAMPLE OF SUBROUTINE CALL
1002 REM *TO DISPLAY FORMATTED NUMBERS
1009 REM *****
1010 INPUT "INPUT 5 NUMBERS - " A$(1),A$(2),A$(3),A$(4),A$(5)
1020 PRINT PRINT
1030 P=12
1040 FOR Q=1 TO 5
1050 P*=A$(Q)
1060 GOSUB 27000
1070 PRINT P$
1080 NEXT Q
1090 END
2000 REM
3000 REM
4000 REM
5000 REM
6000 REM
27000 REM *****
27002 REM *SUBROUTINE TO ROUND NUMBERS
27004 REM *TO TWO DECIMAL PLACES AND
27006 REM *PAD WITH SPACES TO RIGHT
27008 REM *JUSTIFY COLUMNS. NUMBER INPUT
27010 REM *AND OUTPUT AS P$. OUTPUT
27012 REM *LENGTH P CHARACTERS.
27014 REM *****
27016 A$="" A1$="" A2$=""
27018 AN=VAL(P$)
27020 REM
27022 REM ***ROUND TO 2 PLACES***
27024 REM
27026 A1=-INT(AN)-AN
27028 A1=SGN(A1)*INT(ABS(A1*100)+.5)/100
27030 REM
27032 REM ***FORMAT NUMBER***
27034 REM
27036 A$=STR$(A1)
27038 IF A1<.01 THEN A$="0.00"
27040 IF LEN(A$)=4 THEN A2$=27052
27042 IF LEN(A$)>4 THEN A$=LEFT$(A$,4)
27044 IF LEN(A$)<4 THEN A$=A$+"0"
27046 REM
27048 REM ***JUSTIFY***
27050 REM
27052 A$=RIGHT$(A$,3)
27054 A$=STR$(INT(AN))+A$
27056 P$=RIGHT$(SP$+A$,P)
27058 RETURN
READY.

```

DISPLAYSRC.....PAGE 0001

| LINE# | LOC           | CODE           | LINE                        |
|-------|---------------|----------------|-----------------------------|
| 0001  | 0000          |                | *****                       |
| 0002  | 0000          |                | *SCREEN DISPLAY             |
| 0003  | 0000          |                | *SUBROUTINES                |
| 0004  | 0000          |                | *5/4/80                     |
| 0005  | 0000          |                | *****                       |
| 0006  | 0000          |                |                             |
| 0007  | 0000          |                |                             |
| 0008  | 0000          |                |                             |
| 0009  | 0000          |                | STARTL=\$54                 |
| 0010  | 0000          |                | STARTR=\$55                 |
| 0011  | 0000          |                | TEMP1=\$56                  |
| 0012  | 0000          |                | TEMP2=\$57                  |
| 0013  | 0000          |                | TEMP3=\$58                  |
| 0014  | 0000          |                |                             |
| 0015  | 0000          |                |                             |
| 0016  | 0000          |                | BEGIN=\$7A00                |
| 0017  | 0000          |                | *=BEGIN                     |
| 0018  | 7A00          |                |                             |
| 0019  | 7A00          |                | ,HORIZONTAL LINE DRAW S/R   |
| 0020  | 7A00          |                |                             |
| 0021  | 7A00          |                | ,DRAW HORIZONTAL LINE       |
| 0022  | 7A00          |                | ,LENGTH TEMP2 USING         |
| 0023  | 7A00          |                | ,CHARACTER WITH ASCII       |
| 0024  | 7A00          |                | ,NUMERIC VALUE IN TEMP3     |
| 0025  | 7A00          |                |                             |
| 0026  | 7A00 98       | HORIZ TYA      |                             |
| 0027  | 7A01 48       | PHA            |                             |
| 0028  | 7A02 A4 57    | LDY TEMP2      |                             |
| 0029  | 7A04 A5 58    | LDX #500       |                             |
| 0030  | 7A06 91 54    | STA (STARTL),Y |                             |
| 0031  | 7A08 88       | DEY            |                             |
| 0032  | 7A09 D0 F9    | BNE NEXT       |                             |
| 0033  | 7A0B 68       | PLA            |                             |
| 0034  | 7A0C A8       | TAY            |                             |
| 0035  | 7A0D 60       | RTS            |                             |
| 0036  | 7A0E          |                |                             |
| 0037  | 7A0E          |                | ,VERTICAL LINE DRAWING S/R  |
| 0038  | 7A0E          |                |                             |
| 0039  | 7A0E          |                | ,VERTICAL LINE LENGTH TEMP2 |
| 0040  | 7A0E          |                | ,CHARACTER ASCII NUMERIC    |
| 0041  | 7A0E          |                | ,VALUE IN TEMP3             |
| 0042  | 7A0E          |                |                             |
| 0043  | 7A0E 98       | VERT TYA       |                             |
| 0044  | 7A0F 48       | PHA            |                             |
| 0045  | 7A10 A4 57    | LDY TEMP2      |                             |
| 0046  | 7A12 A2 00    | LDX #500       |                             |
| 0047  | 7A14 A5 58    | LDY TEMP3      |                             |
| 0048  | 7A16 81 54    | STA (STARTL),X |                             |
| 0049  | 7A18 20 21 7A | JSR NEXTL      |                             |
| 0050  | 7A1B 88       | DEY            |                             |
| 0051  | 7A1C 10 F6    | BPL NEXTV      |                             |
| 0052  | 7A1E 68       | PLA            |                             |
| 0053  | 7A1F A8       | TAY            |                             |
| 0054  | 7A20 60       | RTS            |                             |
| 0055  | 7A21          |                |                             |

# Tiny-Aid For VIC-20

David A Hook  
Barrie, Ont

## Introduction

Since the early days of the PET, various enhancements for BASIC have been available — Toolkit and Power are two commercial examples. Bill Seiler, then of Commodore, produced the first public-domain version, called BASIC-Aid.

Many updates, corrections and improvements have been made over the past couple of years. The PET/CBM program has ballooned to a 4K package for almost every flavour of equipment configuration.

As has been customary in the Commodore community, Mr. Jim Butterfield developed a version of the BASIC-Aid. He called this TINY-Aid2 (or TINY-Aid4, For Basic 4.0). This offered the six most useful commands from the full-fledged program.

Following is my modification of that work, designed to provide VIC users with the same benefits. After using this for a while, I think you will find the added commands nearly indispensable.

## Features

VIC Tiny-Aid is a machine language program which consumes about 1200 bytes of your RAM memory. After you have loaded the program, type 'RUN' and hit 'RETURN'. The program repacks itself into high memory. The appropriate pointers are set so that BASIC will not clobber it. VIC Tiny Aid is now alive.

Once activated, five commands become attached to BASIC. They will function only in "direct" mode, i.e. don't include them in a program.

(1) NUMBER 1000,5 'RETURN'  
NUMBER 100,10

Renumbers a BASIC program with a given starting line number and given increment between line numbers. The maximum increment is 255.

All references after GOTO, THEN, GOSUB and RUN are automatically corrected. A display of these lines is presented on the screen as it works. If a GOTO refers to a non-existent line number, then it is changed to 65535. This is an illegal line number, and must be corrected before the BASIC program is used.

(2) DELETE 100-200 'RETURN'  
DELETE — 1500  
DELETE 5199 —

Deletes a range of lines from a BASIC program. Uses the same syntax as the LIST command, so any line-range may be specified for removal. DELETE with no range will perform like a NEW command, so be careful.

(3) FIND/PRINT/ 'RETURN'  
FIND/A\$/ , 150-670  
FIND "PRINT" , 2000 —

Will locate any occurrences of the characters between the "/" marks. Almost any character may mark the start/end of the string to be found, so long as both are the same. The first example will find all the PRINT instructions in the program.

If you are looking for a string of text which contains a BASIC keyword, you must use the quote characters as markers. This will prevent the search string from being "tokenized".

If a limited line-range is desired, use the same syntax as for LIST. Note that a comma (",") must separate the line-range from the end marker.

All lines containing the string are printed to the screen. If a line has more than one of them, each occurrence will cause a repetition of that line.

(4) CHANGE — PRINT — PRINT # 4, — 'RETURN'  
CHANGE/ABC/XYZ/,6000  
CHANGE/DS\$/D1\$/ , — 5000

Using the same syntax as FIND, you may change any string to any other string in a BASIC program. This command is very powerful, and was not part of the early versions of Basic-Aid or Toolkit.

As before, you may indicate a line-range. As the changes are made, the revised lines are displayed on the screen.

Watch out for the difference between BASIC keywords and strings of text within quotes. You may use the quote characters to differentiate, as with FIND.

(5) KILL 'RETURN'  
This command disables VIC Tiny-Aid and its associated commands. A syntax error will be the result if any of the above commands are now tried.

Since the routine is safe from interference from BASIC, you may leave it active for as long as your machine stays on. It is possible that VIC Tiny-Aid

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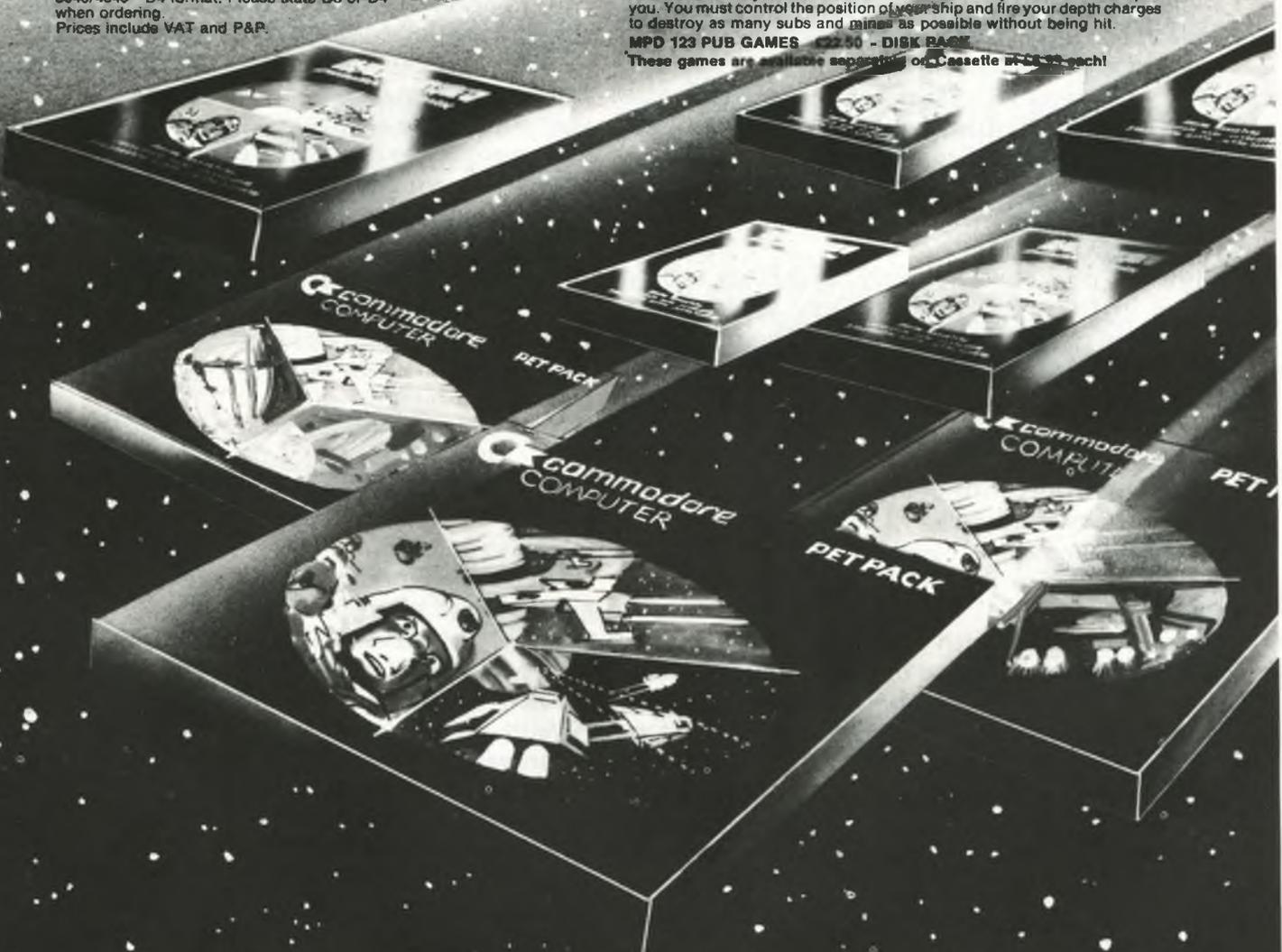
**WARI** - You are the captain of the British torpedo boat. You must steer your ship through the minefield to destroy the four shore bases. Unfortunately, you only have two torpedos at a time, so you must get through the minefield again to rearm. Prove that we still rule the waves!

**STAR FIGHT** - The Alien Invaders are coming again! Control your laser cannon to blast their ships out of the sky and destroy their missiles and bombs. Accuracy and quick reflexes are essential.

**DEPTH CHARGE** - Your mission - seek out and destroy the enemy submarines. They are armed with mines which they release to float up at you. You must control the position of your ship and fire your depth charges to destroy as many subs and mines as possible without being hit.

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may interfere with other programs that modify BASIC's internal 'CHRGOT' routine. The KILL command allows you to avoid this conflict.

## Procedure

The VIC contains no internal machine language monitor, which is really the only practical way to enter this program. So follow one of the three methods below to perform the task.

- (1) Borrow an Upgrade (2.0) or Basic 4.0 PET/CBM, with its internal ML monitor. This will be the easiest method to work with the program included.
- (2) Use your VIC-20, but you must have a machine language monitor.  
— Jim Butterfield's TINYMON FOR VIC — my adaption of SUPERMON FOR VIC — VICMON cartridge from Commodore.
- (3) The easy way (?). Send \$3, a blank cassette or 1540/2031/4040 diskette in a stamped, self-addressed mailer to me at:  
558 Steel Street  
BARRIE, Ontario, CANADA  
L4M 2E9

Be sure it's packaged securely. Diskettes will be returned in DOS 2.0 format. Only 2040 (DOS 1.0) owners need take extra care. (The programs need to be copied to a DOS 1.0 formatted disk. Don't SAVE or otherwise WRITE to the disk you get).

If you are using a VIC, and have a 3K RAM or SUPEREXPANDER cartridge, plug this in. It will be somewhat easier to follow, since programs are then "PET-compatible" without further juggling. However don't use the 8K or 16K expansion for this job.

If you are familiar with the operation of the ML monitor, please skip ahead to the specifics below.

You are about to type in about 2500 characters worth of "hexadecimal" numbers. In addition to the digits from zero to nine, the alphabetic characters from A-F represent numbers from ten to fifteen. These characters, and three instructions, will be all that are used to enter our program. You don't have to understand the process — just type in the characters exactly. It's not very exciting, but don't be too intimidated by the "funny" display.

Enter the machine language monitor program: TINYMON/SUPERMON FOR VIC — LOAD and RUN the program.

PET/CBM — Type "SYS1024" and hit "RETURN".

VICMON Cartridge — "SYS 6\*4096" or "SYS

10\*4096" (depending on the version you have), then type "RETURN".

NOTE: If you are working on the unexpanded VIC you will need to follow the alternate instructions in parentheses.

The cursor will be flashing next to a period character ("."). Type the entry starting at the current cursor position:

```
.M 0580 05C0 "RETURN" (.M 1180 11C0)
Several lines should appear on the screen, much like the "memory-dump" which accompanies this article. A four-"digit" quantity called an "address" leads off a line, and either eight or five columns of two-"digit" values appear alongside.
```

Look at the tables of values in the article. They show eight rows of these addresses. Note that the first "block" has the address "0580", which matches the first address just above. The first row of the next table shows "05C0", which is the second (or ending) address just above.

Your mission is to type in the matching values from the article, in place of the two-"digit" values you see on the screen.

Remember to hit "RETURN" at the end of each screen line, or the changes won't be made.

Double-check the values you've typed. It's not easy to find an error later on.

Look at the next block of values. Type in the start/end addresses to display:

```
.M 05C0 0600 "RETURN" (.M 11C0 1200)
Type in the values required and go on with the rest of the blocks.
```

You will use addresses ranging from:

05xx-06xx-07xx-08xx-09xx-0Axx

as shown in the tables. The "x" characters stand for the other two "digits" of the address in the leftmost column.

If you are working on the unexpanded VIC, the sequence of addresses is:

11xx-12xx-13xx-14xx-15xx-16xx

You will have to type these pairs of characters in place of the leading two shown just above.

With that task complete, we are ready to preserve this work on tape. So type:

```
.S"VICAID.ML",
01,0580,0AB6 "RETURN"
( ' o r . S ' ' V I C
AID.ML',01,1180,16B6 "RETURN")
```

Mount a blank tape, and follow the instructions. Save a second copy, for safety.

Exit the ML monitor, with:

.X "RETURN"

VERIFY the program normally before going any further.

Now comes the easy part. Type "NEW", then the BASIC listing. Enter this exactly, without including any extra text. Save this as "VIC

AID.BAS" and VERIFY it.

Finally, LOAD "VIC AID.ML" and SAVE "VIC AID.REL" on another blank tape. Both the BASIC part and the machine language part have been SAVED together.

### Check-Out

We are going to check out the machine language using a "checksum" method. Type in "NEW" before proceeding. Now enter the following program:

```
10 i=0 : rem(i=3072 for unexpanded VIC)
20 t=0 : for j=1048+i to 2741+i
30 t=t+peek(j)
40 next j
50 print t
```

After a few seconds, if the value 161705 appears, you've likely got it perfect. Go to the next section.

If not, there's at least one incorrect entry. Change the two values in Line 20, using the table below. Re-RUN the program and compare against the value in the third column.

Repeat the process for each row, noting any that don't match. Each row corresponds to two "blocks" from the last section. You will have to re-enter the ML monitor to re-check those sections that differ. Re-SAVE the ML part!!!

| Block # | Value 1 | Value 2 | Checksum |
|---------|---------|---------|----------|
| 1- 2    | 1408    | 1535    | 15201    |
| 3- 4    | 1536    | 1663    | 17221    |
| 5- 6    | 1664    | 1791    | 15925    |
| 7- 8    | 1792    | 1919    | 15117    |
| 9-10    | 1920    | 2047    | 15565    |
| 11-12   | 2048    | 2175    | 14141    |
| 13-14   | 2176    | 2303    | 15840    |
| 15-16   | 2304    | 2431    | 16276    |
| 17-18   | 2432    | 2559    | 15152    |
| 19-20   | 2560    | 2687    | 15194    |
| 21      | 2688    | 2741    | 6073     |

### Operation

The final acid test. ReLOAD the program from tape and RUN it. The screen will clear and a brief summary of the added commands will be displayed. The cursor should return almost instantly, under the "READY." message.

If the cursor does not come back, there is something still amiss. All the values appearing in the article were produced from a working copy of the program (Honest!). You still have option (3) from the Procedure section available. If you do send a tape/disk now, include your non-functioning version. I can then do a compare, to see where the error(s) were.

This has been a massive exercise, and mistakes can easily creep in. Your comments are welcome.

```
1 print "S r vic tiny aid"
2 print "q adapted for vic by:"
3 print "david a. hook"
4 print "q from 'tiny aid' by:"
5 print "jim butterfield"
6 print "q and 'basic aid' by:"
7 print "bill seiler"
8 print "or sample commands:"
9 print "c change/?/print # 4./"
10 print "find .gosub.,200—"
11 print "delete 130-625"
12 print "number 100,5"
13 print "kill (vic aid)"
14 sys (peek(43) + peek(44) * 256 + 383)
```

```

.: 0580 a5 2d 85 22 a5 2e 85 23
.: 0588 a5 37 85 24 a5 38 85 25
.: 0590 a0 00 a5 22 d0 02 c6 23
.: 0598 c6 22 b1 22 d0 3c a5 22
.: 05a0 d0 02 c6 23 c6 22 b1 22
.: 05a8 f0 21 85 26 a5 22 d0 02
.: 05b0 c6 23 c6 22 b1 22 18 65
.: 05b8 24 aa a5 26 65 25 48 a5

.: 05c0 37 d0 02 c6 38 c6 37 68
.: 05c8 91 37 8a 48 a5 37 d0 02
.: 05d0 c6 38 c6 37 68 91 37 18
.: 05d8 90 b6 c9 df d0 ed a5 37
.: 05e0 85 33 a5 38 85 34 6c 37
.: 05e8 00 aa aa aa aa aa aa aa
.: 05f0 aa aa aa aa aa aa aa aa
.: 05f8 aa aa aa aa aa aa aa aa

.: 0600 df ad fe ff 00 85 37 ad
.: 0608 ff ff 00 85 38 a9 4c 85
.: 0610 7c ad d9 fb 00 85 7d ad
.: 0618 da fb 00 85 7e 4c 8f fc
.: 0620 00 f0 03 4c 08 cf a9 c9
.: 0628 85 7c a9 3a 85 7d a9 b0
.: 0630 85 7e 60 db fb 00 85 8b
.: 0638 86 97 ba bd 01 01 c9 8c

.: 0640 f0 10 d0 02 a4 8c a6 97
.: 0648 a5 8b c9 3a b0 03 4c 80
.: 0650 00 00 60 bd 02 01 c9 c4
.: 0658 d0 ed a5 8b 10 02 e6 7a
.: 0660 84 8c a2 00 00 86 a5 ca
.: 0668 e8 a4 7a b9 00 00 02 38
.: 0670 fd d9 ff 00 f0 13 c9 80
.: 0678 f0 13 e6 a5 e8 bd d8 ff

.: 0680 00 10 fa bd d9 ff 00 d0
.: 0688 e4 f0 bf e8 c8 d0 e0 84
.: 0690 7a a5 a5 0a aa bd f5 ff
.: 0698 00 48 bd f4 ff 00 48 20
.: 06a0 e9 fb 00 4c 73 00 00 20
.: 06a8 b2 fd 00 a5 5f a6 60 85
.: 06b0 24 86 25 20 13 c6 a5 5f
.: 06b8 a6 60 90 0a a0 01 b1 5f

.: 06c0 f0 04 aa 88 b1 5f 85 7a
.: 06c8 86 7b a5 24 38 e5 7a aa
.: 06d0 a5 25 e5 7b a8 b0 1e 8a
.: 06d8 18 65 2d 85 2d 98 65 2e
.: 06e0 85 2e a0 00 00 b1 7a 91
.: 06e8 24 c8 d0 f9 e6 7b e6 25
.: 06f0 a5 2e c5 25 b0 ef 20 33
.: 06f8 c5 a5 22 a6 23 18 69 02

.: 0700 85 2d 90 01 e8 86 2e 20
.: 0708 59 c6 4c 67 e4 20 7c c5
.: 0710 20 73 00 00 85 8b a2 00
.: 0718 00 86 49 20 8c fd 00 a5
.: 0720 a5 c9 00 00 d0 07 a2 02
.: 0728 86 49 20 8c fd 00 20 73
.: 0730 00 00 f0 03 20 fd ce 20
.: 0738 b2 fd 00 a5 5f a6 60 85

.: 0740 7a 86 7b 20 d7 ca d0 0b
.: 0748 c8 98 18 65 7a 85 7a 90
.: 0750 02 e6 7b 20 ca ff 00 f0
.: 0758 05 20 dc fd 00 b0 03 4c
.: 0760 8f fc 00 84 55 e6 55 a4
.: 0768 55 a6 31 a5 32 85 8b b1
.: 0770 7a f0 d8 dd 00 00 02 d0
.: 0778 ed e8 c8 c6 8b d0 f1 88

.: 0780 84 0b 84 97 a5 49 f0 5b
.: 0788 20 f0 fd 00 a5 34 38 e5
.: 0790 32 85 a7 f0 28 c8 f0 ca
.: 0798 b1 7a d0 f9 18 98 65 a7
.: 07a0 c9 02 90 40 c9 4b b0 3c
.: 07a8 a5 a7 10 02 c6 8b 18 65
.: 07b0 0b 85 97 b0 05 20 24 fe
.: 07b8 00 f0 03 20 0c fe 00 a5

.: 07c0 97 38 e5 34 a8 c8 a5 34
.: 07c8 f0 0f 85 8c a6 33 bd 00
.: 07d0 00 02 91 7a e8 c8 c6 8c
.: 07d8 d0 f5 18 a5 2d 65 a7 85
.: 07e0 2d a5 2e 65 8b 85 2e a5
.: 07e8 7a a6 7b 85 5f 86 60 a6
.: 07f0 43 a5 44 20 3d fe 00 20
.: 07f8 e1 ff a9 00 00 85 c6 a4

.: 0800 97 4c f2 fc 00 a4 7a c8
.: 0808 94 31 a9 00 00 95 32 b9
.: 0810 00 00 02 f0 15 c5 8b f0
.: 0818 05 f6 32 c8 d0 f2 84 7a
.: 0820 60 c9 ab f0 04 c9 2d d0
.: 0828 01 60 4c 08 cf 90 05 f0
.: 0830 03 20 a6 fd 00 20 6b c9
.: 0838 20 13 c6 20 79 00 00 f0

.: 0840 0b 20 a6 fd 00 20 73 00
.: 0848 00 20 6b c9 d0 e0 a5 14
.: 0850 05 15 d0 06 a9 ff 85 14
.: 0858 85 15 60 20 ca ff 00 85
.: 0860 43 20 ca ff 00 85 44 38
.: 0868 a5 14 e5 43 a5 15 e5 44
.: 0870 60 a5 7a 85 22 a5 7b 85
.: 0878 23 a5 2d 85 24 a5 2e 85

.: 0880 25 60 a5 22 c5 24 d0 04
.: 0888 a5 23 c5 25 60 a4 0b c8
.: 0890 b1 22 a4 97 c8 91 22 20
.: 0898 01 fe 00 d0 01 60 e6 22
.: 08a0 d0 ec e6 23 d0 e8 a4 0b
.: 08a8 b1 24 a4 97 91 24 20 01
.: 08b0 fe 00 d0 01 60 a5 24 d0
.: 08b8 02 c6 25 c6 24 4c 24 fe

.: 08c0 00 a0 00 00 84 a5 84 0f
.: 08c8 20 cd dd a9 20 a4 a5 29
.: 08d0 7f 20 d2 ff c9 22 d0 06
.: 08d8 a5 0f 49 ff 85 0f c8 b1
.: 08e0 5f f0 19 10 ec c9 ff f0
.: 08e8 e8 24 0f 30 e4 84 a5 20
.: 08f0 7c fe 00 c8 b1 ae 30 d6
.: 08f8 20 d2 ff d0 f6 20 d7 ca

.: 0900 38 60 a0 9d 84 ae a0 c0
.: 0908 84 af 38 e9 7f aa a0 00
.: 0910 00 ca f0 ee e6 ae d0 02
.: 0918 e6 af b1 ae 10 f6 30 f1
.: 0920 20 6b c9 a5 14 85 35 a5
.: 0928 15 85 36 20 fd ce 20 6b
.: 0930 c9 a5 14 85 33 a5 15 85
.: 0938 34 20 8e c6 20 ca ff 00

.: 0940 20 ca ff 00 d0 21 20 ac
.: 0948 ff 00 20 ca ff 00 20 ca
.: 0950 ff 00 d0 03 4c 8f fc 00
.: 0958 20 ca ff 00 a5 63 91 7a
.: 0960 20 ca ff 00 a5 62 91 7a
.: 0968 20 b7 ff 00 f0 e2 20 ca
.: 0970 ff 00 20 ca ff 00 20 ca
.: 0978 ff 00 c9 22 d0 0b 20 ca

.: 0980 ff 00 f0 c5 c9 22 d0 f7
.: 0988 f0 ee aa f0 bc 10 e9 a2
.: 0990 04 dd d4 ff 00 f0 05 ca
.: 0998 d0 f8 f0 dd a5 7a 85 3b
.: 09a0 a5 7b 85 3c 20 73 00 00
.: 09a8 b0 d3 20 6b c9 20 51 ff
.: 09b0 00 a5 3c 85 7b a5 3b 85
.: 09b8 7a a0 00 00 a2 00 00 bd

.: 09c0 00 00 01 c9 30 90 11 48
.: 09c8 20 73 00 00 90 03 20 82
.: 09d0 ff 00 68 a0 00 00 91 7a
.: 09d8 e8 d0 e8 20 73 00 00 b0
.: 09e0 08 20 91 ff 00 20 79 00
.: 09e8 00 90 f8 c9 2c f0 b8 d0
.: 09f0 96 20 ac ff 00 20 ca ff
.: 09f8 00 20 ca ff 00 d0 08 a9

.: 0a00 ff 85 63 85 62 30 0e 20
.: 0a08 ca ff 00 c5 14 d0 0f 20
.: 0a10 ca ff 00 c5 15 d0 0b 20
.: 0a18 d1 dd a9 20 4c d2 ff 20
.: 0a20 ca ff 00 20 b7 ff 00 f0
.: 0a28 d2 20 a2 ff 00 e6 97 20
.: 0a30 24 fe 00 e6 2d d0 02 e6
.: 0a38 2e 60 20 a2 ff 00 c6 97

.: 0a40 20 0c fe 00 a5 2d d0 02
.: 0a48 c6 2e c6 2d 60 20 f0 fd
.: 0a50 00 a0 00 00 84 0b 84 97
.: 0a58 60 a5 35 85 63 a5 36 85
.: 0a60 62 4c 8e c6 a5 63 18 65
.: 0a68 33 85 63 a5 62 65 34 85
.: 0a70 62 20 ca ff 00 d0 fb 60
.: 0a78 a0 00 00 e6 7a d0 02 e6

.: 0a80 7b b1 7a 60 89 8a 8d a7
.: 0a88 43 48 41 4e 47 c5 44 45
.: 0a90 4c 45 54 c5 46 49 4e c4
.: 0a98 4b 49 4c cc 4e 55 4d 42
.: 0aa0 45 d2 00 00 a5 fc 00 41
.: 0aa8 fc 00 a5 fc 00 c6 fb 00
.: 0ab0 98 fe 00 ac fb 00 aa aa
.: 0ab8 aa aa aa aa aa aa aa aa

```

# Disk utilities

The two programs in this section are designed to give users of the PET information about how data is being stored on disk; they are of most use when using direct access files.

BLOCKMAP prints a table of all the blocks on a disk, track by track, showing which blocks have been allocated for data storage by the system and which are free. Free blocks can then be used for direct access (modifying the subroutine

TRACK/SECTOR one can block off allocated sectors). Alternatively one may simply wish to find out how much free space is left on a disk.

SECTORPRINT is the second of the two programs and is designed to print a table of data stored in a specified block. The data is displayed both in ASCII and hexadecimal form. Using this program one can see how data is stored on disk and also discover the source of disk errors.

```

100 REM *****
110 REM *THIS DISK UTILITY PROGRAM
120 REM *ALLOWS ONE TO LOOK AT WHICH
130 REM *BLOCKS ON THE DISK ARE
140 REM *ALLOCATED TO DATA OR PROGRAMS.
150 REM *USEFUL IN CHECKING WHERE DATA
160 REM *HAS BEEN STORED WHEN USING
170 REM *RANDOM FILES.
180 REM *****
1900 POKE144,49: REM *DISABLE STOP KEY*
1910 OPEN15,8,15
1920 PRINT"*****"
1930 PRINT"HARDCOPY Y OR N ":P=0
1940 GETA$:IFA$=""THEN1040
1950 IFA$="Y"THENP=1
1960 PRINT"DRIVE# "
1970 GETD$:IFD$=""THEN1070
1980 D=VAL(D$)
1990 IFTHENOPEN1,4:PRINT#1:PRINT#1
1100 PRINT"D"
1110 P1$="          1          2"
1120 P2$="TRACK 012345678901234567890 USED FREE"
1130 PRINTP1$:PRINTP2$
1140 IFTHENPRINT#1,P1$:PRINT#1,P2$
1150 FORDT=1TO35
1160 DT#=RIGHT$(STR$(100+DT),2)+" "
1170 ADS=21
1180 IFDT>17THENADS=20
1190 IFDT>24THENADS=18
1200 IFDT>30THENADS=17
1210 PRINTDT$: IFTHENPRINT#1,DT$;
1220 AU=0:AF=0
1230 FORDS=0TO20
1240 A$="."
1250 IFDS>=ADSTHENA$=" ":GOTO1320
1260 PRINT#15,"B-A";D;DT;DS
1270 INPUT#15,EN,E1$,E2$,E3$
1280 IFEN<>0THENA$="*":AU=AU+1:GOTO1320
1290 AF=AF+1:PRINT#15,"B-F";D;DT;DS
1300 GOSUB1440:IFEN=0THEN1320
1310 PRINT:PRINT:PRINT"DISK ERROR"EN,E1$,E2$,E3$:STOP
1320 PRINTA$: IFTHENPRINT#1,A$;
1330 NEXTDS
1340 AU#=RIGHT$(STR$(AU+100),2)+" "
1350 AF#=AF#+RIGHT$(STR$(AF+100),2)
1360 PRINT"      ";AU$: IFTHENPRINT#1,"      ";AF#
1370 BU=BU+AU:BF=BF+AF
1380 NEXTDT
1390 PRINT:PRINT:PRINT
1400 P3$="BLOCKS USED "+STR$(BU)+" FREE "+STR$(BF)
1410 PRINTP3$: IFTHENPRINT#1,P3$
1420 CLOSE1:CLOSE15
1430 POKE144,46:END
1440 INPUT#15,EN,E1$,E2$,E3$
1450 RETURN
READY.

```

BLOCKMAP



## SECTORPRINT

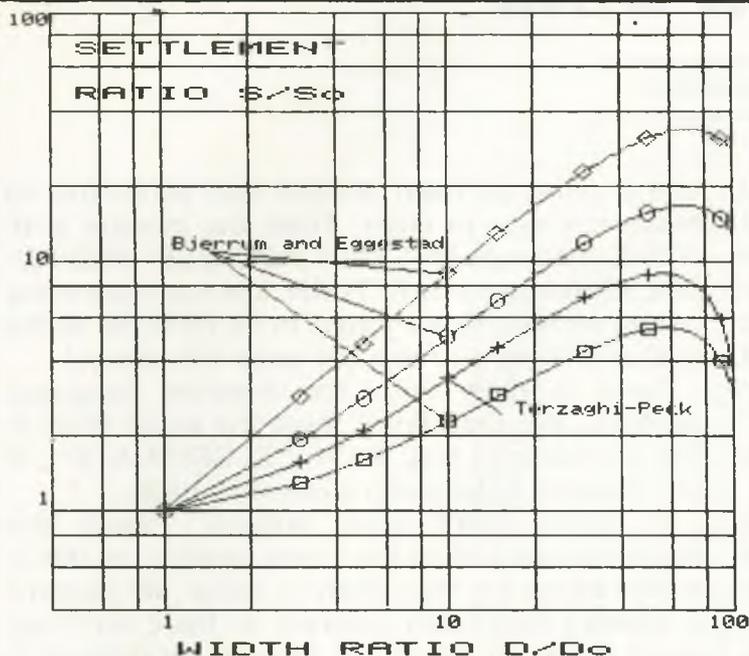
```
100 REM *****
110 REM *DISK UTILITY PROGRAM TO PRINT
120 REM *CONTENTS OF A DISK SECTOR IN
130 REM *HEX AND ASCII. USEFUL IN CHECKING
140 REM *DATA STORED CORRECTLY.
150 REM *****
1000 DIMA(264)
1010 Z1%=CHR$(0)
1015 PRINT"J"
1020 PRINT"HARDCOPY Y OR N ";:P=0
1025 GETA%:IFA%=""THEN1025
1030 IFA%="Y"THENP=1
1040 OPEN4,8,4,"#":CH=4
1050 OPEN15,8,15
1060 IFPTHENOPEN1,4:PRINT#1,CHR$(147);
1070 PRINT"J"
1080 INPUT"DRIVE ";:D
1090 INPUT"TRACK ";:T
1100 INPUT"SECTOR ";:S
1110 PRINT"0000"
1120 PRINT#15,"U1"CH;D;T;S:GOSUB1490
1130 PRINT#15,"B-P"CH;1
1140 FORI=1TO250STEP5:GET#4,C1%,C2%,C3%,C4%,C5%
1150 A(I)=ASC(C1#+Z1%)
1160 A(I+1)=ASC(C2#+Z1%)
1170 A(I+2)=ASC(C3#+Z1%)
1180 A(I+3)=ASC(C4#+Z1%)
1190 A(I+4)=ASC(C5#+Z1%)
1200 NEXTI
1210 FORI=1TO250STEP8
1220 IFI=121THENGOSUB1460
1230 A%=RIGHT$(STR$(1000+I),3)+" ";
1240 PRINTA%:IFPTHENPRINT#1,A%
1250 FORQ=0TO7
1260 IFA(I+Q)=13THENA%="+":GOTO1300
1270 IFA(I+Q)=10THENA%="<":GOTO1300
1280 IFA(I+Q)>127ORAI+Q<32THENA%="." :GOTO1300
1290 A%=CHR$(A(I+Q))
1300 PRINTA%:IFPTHENPRINT#1,A%
1310 NEXTQ
1320 PRINT" ";:IFPTHENPRINT#1," ";
1330 FORQ=0TO7
1340 A=A(I+Q)
1350 A1=AND15:A0=(AND240)/16
1360 A1=A1+48:IFA1>57THENA1=A1+7
1370 A0=A0+48:IFA0>57THENA0=A0+7
1380 PRINT" ";CHR$(A0);CHR$(A1);
1390 IFPTHENPRINT#1," ";CHR$(A0);CHR$(A1);
1400 NEXTQ:PRINT" ";:IFPTHENPRINT#1," ";
1410 NEXTI
1420 PRINT"000":IFPTHENPRINT#1
1430 PRINT"ANOTHER -YES OR NO-";
1435 GETA%:IFA%=""THEN1435
1440 IFA%="Y"THEN1070
1450 CLOSE4:CLOSE15:END
1460 GETA%:IFA%=""THEN1460
1470 PRINT"J"
1480 RETURN
1490 INPUT#15,EN,E1%,E2%,E3%
1495 IFEN>0THENSTOP
1500 RETURN
READY.
```

Sample printout from SECTORPRINT

```

001:.....BLOC      04  82  11  00  42  4C  4F  43
009:KMAP.....      4E  4D  41  50  A0  A0  A0  A0
017:.....          A0  A0  A0  A0  00  00  00  00
025:.....          00  00  00  00  00  04  00  00
033:.....SECT     00  82  11  01  53  45  43  54
041:ORPRINT.      4F  52  50  52  49  4E  54  A0
049:.....          A0  A0  A0  A0  00  00  00  00
057:.....          00  00  00  00  00  05  00  00
065:.....DIGI     00  82  11  04  44  49  47  49
073:T.....        54  A0  A0  A0  A0  A0  A0  A0
081:.....          A0  A0  A0  A0  00  00  00  00
089:.....          00  00  00  00  00  02  00  00
097:.....RAND     00  82  11  05  52  41  4E  44
105:OM.....       4F  4D  A0  A0  A0  A0  A0  A0
113:.....          A0  A0  A0  A0  00  00  00  00
121:.....          00  00  00  00  00  05  00  00
129:.....INIT     00  82  11  09  43  4E  43  54
137:RAND.....     52  41  4E  44  A0  A0  A0  A0
145:.....          A0  A0  A0  A0  00  00  00  00
153:.....          00  00  00  00  00  06  00  00
161:.....BDIS     00  82  13  00  42  44  49  53
169:F.....        50  A0  A0  A0  A0  A0  A0  A0
177:.....          A0  A0  A0  A0  00  00  00  00
185:.....          00  00  00  13  00  04  00  00
193:.....DDPL     00  82  13  05  44  44  50  4C
201:OT.....       4F  54  A0  A0  A0  A0  A0  A0
209:.....          A0  A0  A0  A0  00  00  00  00
217:.....          00  00  00  13  05  06  00  00
225:.....RAND     00  82  13  02  52  41  4E  44
233:DEMO.....     44  45  4D  4F  A0  A0  A0  A0
241:.....          A0  A0  A0  A0  00  00  00  00
249:.....          00  00  00  00  00  00  00  00
    
```

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Middlesex, HA3 7SJ, England  
Telephone: 01-861 1166



# Screen Data

*Peter Gabor*

The following program will work on any Basic 4.0 machine, and its function is to convert the entire screen contents into data statements. Although the Basic demonstration program is essentially the same for both 40 and 80 column machines (change line 180 in the 40 column version to read 180 SYS3200), the machine code parts are different.

Enter the Basic program first (don't forget line 180!), and if you like change the REM and instructions in lines 40 and 105 if you have a 40 column machine. The values become OBB8 and ODF0 respectively. Save that normally, and then go onto the machine code part.

The first two blocks are for 80 column machines, and the second four are for 40 col-

umns. They've been divided into screenfuls to make it easier to enter. Enter the monitor with SYS4, then type M 'START ADDRESS' 'END ADDRESS' followed by RETURN, and just type in the values shown. Don't forget to hit RETURN at the end of each line to actually enter the values!

Save it then with the machine language monitor, and then finally save the entire thing in the normal way e.g. SAVE "SCREENDATA", if you happen to be using a cassette deck.

If things don't work properly, check the machine code part of the listing carefully, as this is where errors are most likely to occur. We haven't included a checksum program, as there isn't that much code, so you'll just have to go through it carefully, byte by byte!

```

10 REM *****
15 REM * DEMO PROGRAM FOR SCREEN TO *
20 REM * DATA TRANSFORMATION. *
25 REM * SAVE MACHINE CODE PROGRAM *
30 REM * WITH MLM: - *
35 REM * *
40 REM * .S"0:SCRNDATA",08,1388,1500 *
45 REM * *
50 REM * AFTER COMPLETING TRANSFER, *
55 REM * ENTER 'CLR' AND PRESS RETURN*
60 REM * IF NO EDITING IS NECESSARY. *
65 REM * *
70 REM * P.GABOR 16/2/82 *
75 REM *****
80 :
90 PRINT" "TAB(7)" "TAB(38)" ";
95 PRINT" "TAB(47)" SCREEN TO DATA DEMO * "TAB(79)"
100 PRINT"SAVE THE MC PROGRAM WITH THE MLM
105 PRINT"FROM LOC $1388 TO $1500.
110 PRINT"TO ACTIVATE THE PROGRAM, ENTER 'SYS5000'
115 PRINT"(NOT NECESSARY FOR DEMO PROGRAM)
120 PRINT"PERFORM THE TRANSFER BY HITTING ^V.
125 PRINT" AFTER THAT, ENTER FOLLOWING PROGRAM
130 PRINT"BY PASSING THE CURSOR OVER EACH LINE:
135 PRINT" 100 PRINT CHR$(147);
140 PRINT" 110 FOR K=1 TO 24
145 PRINT" 120 READ A$: PRINT A$: NEXT
150 PRINT" 130 READ A$: PRINT A$;
155 PRINT" 140 GET A$: IF A$=CHR$(67) THEN 140
160 PRINT" 150 PRINT CHR$(19): END
165 PRINT" "TAB(39)" ";
170 PRINT" # PRESS 'C' TO CONTINUE # ";
175 PRINT"IT*****";
180 SYS5000
READY.

```

```

.
. : 1388 20 CC FF A4 C6 B1 C4 8D
. : 1390 EB 14 49 80 91 C4 A5 9B
. : 1398 C9 EF D0 03 4C FF B3 20
. : 13A0 E4 FF F0 F2 48 AD EB 14
. : 13A8 A4 C6 91 C4 68 C9 5C F0
. : 13B0 05 20 D2 FF D0 D5 A9 FF
. : 13B8 85 88 A9 03 85 89 A9 00
. : 13C0 85 8A A9 80 85 8B A9 19
. : 13C8 85 8C A0 08 88 08 B9 E0
. : 13D0 14 91 88 28 D0 F6 EE E4
. : 13D8 14 EE E4 14 D0 03 EE E5
. : 13E0 14 18 A5 88 69 08 85 88
. : 13E8 90 02 E6 89 8C EB 14 B1
. : 13F0 8A C0 4F 90 04 C9 20 F0
. : 13F8 41 29 7F C9 22 D0 02 09
. : 1400 05 AA B1 8A 4D EB 14 10
. : 1408 0C B1 8A 8D EB 14 29 80
. : 1410 49 92 20 87 14 8A C9 20
. : 1418 B0 04 09 40 D0 0E C9 40
. : 1420 90 0A C9 60 B0 04 09 80
. : 1428 D0 02 49 C0 C0 4F 90 03
. : 1430 20 91 14 91 88 C8 C0 50
. : 1438 90 B5 88 F0 06 B1 88 C9
. : 1440 20 F0 F7 C8 18 A5 8A 69
.
. : 1448 50 85 8A 90 02 E6 8B 18
. : 1450 98 65 88 85 88 90 02 E6
. : 1458 89 C6 8C F0 03 4C CA 13
. : 1460 A0 00 A9 22 20 87 14 A9
. : 1468 00 20 87 14 20 87 14 20
. : 1470 87 14 A5 88 85 2A 85 2C
. : 1478 A5 89 85 2B 85 2D 20 B6
. : 1480 B4 20 EC B5 4C FF B3 91
. : 1488 88 18 E6 88 90 02 E6 89
. : 1490 60 8D EB 14 88 B1 88 C9
. : 1498 12 F0 0A C9 92 F0 06 48
. : 14A0 20 CF 14 68 60 8D EA 14
. : 14A8 88 B1 88 48 AD EA 14 20
. : 14B0 87 14 20 CF 14 A9 20 20
. : 14B8 87 14 A9 9D 20 87 14 AD
. : 14C0 EA 14 49 80 91 88 C8 68
. : 14C8 C9 20 D0 02 09 80 60 AD
. : 14D0 EB 14 91 88 C8 A9 9D 20
. : 14D8 87 14 A9 94 20 87 14 60
. : 14E0 22 00 FF FF 94 EA 83 22
. : 14E8 00 00 00 00 00 00 00 00
. : 14F0 00 00 00 00 00 00 00 00
. : 14F8 00 00 00 00 00 00 00 00
. : 1500 AA AA AA AA AA AA AA AA
.

```

READY.

```

..: 0BB8 78 A5 90 C9 E1 F0 07 8D
..: 0BC0 DD 0B A9 E1 85 90 A5 91
..: 0BC8 C9 0B F0 07 8D DE 0B A9
..: 0BD0 0B 85 91 58 60 22 00 FF
..: 0BD8 FF 62 EA 83 22 00 00 00
..: 0BE0 00 A5 97 C9 45 F0 03 6C
..: 0BE8 DD 0B 79 A9 FF 85 01 A9
..: 0BF0 03 85 02 A9 00 85 8A A9
..: 0BF8 80 85 8B A9 19 85 8C A0
..: 0C00 08 88 08 B9 D5 0B 91 01
..: 0C08 28 D0 F6 EE D9 0B EE D9
..: 0C10 0B D0 03 EE DA 0B 18 A5
..: 0C18 01 69 08 85 01 90 02 E6
..: 0C20 02 8C E0 0B B1 8A C0 27
..: 0C28 90 04 C9 20 F0 48 29 7F
..: 0C30 AA B1 8A 4D E0 0B 10 0C
..: 0C38 B1 8A 8D E0 0B 29 80 49
..: 0C40 92 20 CE 0C 8A C9 20 B0
..: 0C48 04 09 40 D0 1B C9 22 D0
..: 0C50 09 20 CE 0C A9 14 20 CE
..: 0C58 0C 8A C9 40 90 0A C9 60
..: 0C60 B0 04 09 80 D0 02 49 C0
..: 0C68 C0 27 90 03 20 D8 0C 91
..:
..: 0C70 01 C8 C0 28 90 AE 88 F0
..: 0C78 06 B1 01 C9 20 F0 F7 C8
..: 0C80 78 A5 90 C9 A9 F0 07 8D
..: 0C88 A5 0C A9 A9 85 90 A5 91
..: 0C90 C9 0C F0 07 8D A6 0C A9
..: 0C98 0C 85 91 58 60 22 00 FF
..: 0CA0 FF 94 EA 83 22 55 E4 00
..: 0CA8 00 A5 97 C9 45 F0 03 6C
..: 0CB0 A5 0C 78 A9 FF 85 01 A9
..: 0CB8 03 85 02 A9 00 85 8A A9
..: 0CC0 80 85 8B A9 19 85 8C A0
..: 0CC8 08 88 08 B9 9D 0C 91 01
..: 0CD0 28 D0 F6 EE A1 0C EE A1
..: 0CD8 0C D0 03 EE A2 0C 18 A5
..: 0CE0 01 69 08 85 01 90 02 E6
..: 0CE8 02 8C A8 0C B1 8A C0 27
..: 0CF0 90 04 C9 20 F0 41 29 7F
..: 0CF8 C9 22 D0 02 09 05 AA B1
..: 0D00 8A 4D A8 0C 10 0C B1 8A
..: 0D08 8D A8 0C 29 80 49 92 20
..: 0D10 8F 0D 8A C9 20 B0 04 09
..: 0D18 40 D0 0E C9 40 90 0A C9
..: 0D20 60 B0 04 09 80 D0 02 49
..:
..: 0D28 C0 C0 27 90 03 20 99 0D
..: 0D30 91 01 C8 C0 28 90 B5 88
..: 0D38 F0 06 B1 01 C9 20 F0 F7
..: 0D40 C8 18 A5 8A 69 28 85 8A
..: 0D48 90 02 E6 8B 18 98 65 01
..: 0D50 85 01 90 02 E6 02 C6 8C
..: 0D58 F0 03 4C C7 0C A0 00 A9
..: 0D60 22 20 8F 0D A9 00 20 8F
..: 0D68 0D 20 8F 0D 20 8F 0D A5
..: 0D70 01 85 2A 85 2C A5 02 85
..: 0D78 2B 85 2D AD A5 0C 85 90
..: 0D80 AD A6 0C 85 91 20 B6 B4
..: 0D88 58 20 EC B5 4C FF B3 91
..: 0D90 01 18 E6 01 90 02 E6 02
..: 0D98 60 8D A8 0C 88 B1 01 C9
..: 0DA0 12 F0 0A C9 92 F0 06 48
..: 0DA8 20 D7 0D 68 60 8D A7 0C
..: 0DB0 88 B1 01 48 AD A7 0C 20
..: 0DB8 8F 0D 20 D7 0D A9 20 20
..: 0DC0 8F 0D A9 9D 20 8F 0D AD
..: 0DC8 A7 0C 49 80 91 01 C8 68
..: 0DD0 C9 20 D0 02 09 80 60 AD
..: 0DD8 A8 0C 91 01 C8 A9 9D 20
..:
..: 0DE0 8F 0D A9 94 20 8F 0D 60
..: 0DE8 0D 41 41 80 01 FD 7F 00
..: 0DF0 00 AA AA AA AA AA AA

```

READY.



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  - (b) Lists of unpaid bills
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# Cross Reference

*Jim Butterfield*

Have you ever wanted a cross reference of a listing? In other words, you're happily debugging a program and want to know every occurrence of J\$, but without a Basic Aid-type program all you have is a listing covered in scrawl and ink?

Well, this month we bring you the answer in this tidy bit of code from Jim Butterfield. Don't worry about the 1980 date in line 110 of the basic listing: it's as valid today as it's ever been.

The old CPUCN published a similar listing purely in Basic once, but that program was dreadfully slow, and Jim invited people to produce a machine code version. Since no-one did he's done it himself, and now you can share the benefits. To

prove the increase in speed we decided to do a cross reference of the basic listing for Adventure, an incredibly convoluted 12K (or thereabouts) of program. Just to prove it, that is reproduced at the end of the article, in case you've ever wanted to cheat at Adventure but didn't know where to begin.

That process took less than a minute, and indeed took much longer to print out than it did to produce the results.

Let's take a look at the program itself, starting with the Basic part, followed by a cross reference of itself.

```

100 PRINT "CROSS REFERENCE"
110 PRINT "          (C) 1980 JIM BUTTERFIELD"
115 N=6 IFPEEK(32800)=32THENW=11
120 CLOSE1 INPUT "NAME OF PROGRAM FILE"/N#
130 OPEN1:8:3:N#+"J.P.R" GET#1:Y#Y#
140 IFY#<>CHR$(4)GOTO120
150 IFX#<>"ANDX#<>CHR$(1)GOTO120
160 IFX#="" THENGET#1:N#
170 SYS 1924
180 CLOSE1
190 INPUT"PRINTER":Z#:P=3:IFASC(Z#)=89THENP=4:W=1
200 OPEN4:P PRINT#4,"CROSS-REF "/N#:"POKE206,W:SYS2335
240 PRINT#4 CLOSE4
READY.
    
```

CROSS-REF: CROSS-REF(C)

|      |     |     |     |
|------|-----|-----|-----|
| 120: | 140 | 150 |     |
| N#   | 120 | 130 | 200 |
| P    | 190 | 200 |     |
| W    | 115 | 190 | 200 |
| X#   | 130 | 150 | 160 |
| Y#   | 130 | 140 |     |
| Z#   | 190 |     |     |

CROSS-REF: ADVENTURE

|       |      |      |      |      |      |      |      |      |      |
|-------|------|------|------|------|------|------|------|------|------|
| 290:  | 320  |      |      |      |      |      |      |      |      |
| 330:  | 290  | 310  | 1080 | 1130 | 1190 | 2200 | 4640 |      |      |
| 340:  | 4570 |      |      |      |      |      |      |      |      |
| 360:  | 340  | 4580 |      |      |      |      |      |      |      |
| 380:  | 360  |      |      |      |      |      |      |      |      |
| 390:  | 370  |      |      |      |      |      |      |      |      |
| 400:  | 380  |      |      |      |      |      |      |      |      |
| 420:  | 450  | 600  | 620  | 630  | 640  | 680  | 760  | 790  | 850  |
|       | 900  | 1650 | 1680 | 1760 | 1820 | 2110 | 2120 | 2130 | 2180 |
|       | 2310 | 2330 | 2370 | 2450 | 2490 | 2730 | 2930 | 3380 | 3540 |
|       | 3560 |      |      |      |      |      |      |      |      |
| 430:  | 4450 |      |      |      |      |      |      |      |      |
| 440:  | 2770 |      |      |      |      |      |      |      |      |
| 510:  | 480  |      |      |      |      |      |      |      |      |
| 550:  | 530  |      |      |      |      |      |      |      |      |
| 560:  | 540  |      |      |      |      |      |      |      |      |
| 620:  | 2970 | 3425 |      |      |      |      |      |      |      |
| 650:  | 590  |      |      |      |      |      |      |      |      |
| 680:  | 700  | 720  |      |      |      |      |      |      |      |
| 690:  | 660  | 670  |      |      |      |      |      |      |      |
| 720:  | 690  |      |      |      |      |      |      |      |      |
| 730:  | 610  | 650  |      |      |      |      |      |      |      |
| 750:  | 560  |      |      |      |      |      |      |      |      |
| 770:  | 3310 |      |      |      |      |      |      |      |      |
| 840:  | 770  |      |      |      |      |      |      |      |      |
| 860:  | 750  |      |      |      |      |      |      |      |      |
| 890:  | 870  | 1200 | 1880 | 2000 | 2010 | 2270 | 2275 | 2290 |      |
| 900:  | 840  |      |      |      |      |      |      |      |      |
| 920:  | 2020 |      |      |      |      |      |      |      |      |
| 980:  | 950  | 960  |      |      |      |      |      |      |      |
| 1000: | 1250 |      |      |      |      |      |      |      |      |
| 1010: | 920  |      |      |      |      |      |      |      |      |
| 1040: | 1010 |      |      |      |      |      |      |      |      |
| 1050: | 1670 | 1700 | 1730 | 1910 | 1930 | 1950 | 1970 |      |      |
| 1080: | 1060 |      |      |      |      |      |      |      |      |
| 1090: | 1050 |      |      |      |      |      |      |      |      |

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# MACHINE CODE PROGRAMMING

|      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|
| 1110 | 1090 |      |      |      |      |      |      |      |      |      |
| 1170 | 1150 |      |      |      |      |      |      |      |      |      |
| 1180 | 1140 |      |      |      |      |      |      |      |      |      |
| 1200 | 980  |      |      |      |      |      |      |      |      |      |
| 1260 | 1040 |      |      |      |      |      |      |      |      |      |
| 1290 | 1260 |      |      |      |      |      |      |      |      |      |
| 1350 | 1270 | 1290 |      |      |      |      |      |      |      |      |
| 1370 | 1280 | 1300 | 1310 | 1320 | 1330 | 1340 |      |      |      |      |
| 1380 | 1650 | 4670 |      |      |      |      |      |      |      |      |
| 1450 | 1430 |      |      |      |      |      |      |      |      |      |
| 1460 | 1420 |      |      |      |      |      |      |      |      |      |
| 1560 | 1510 | 1520 | 1530 | 1540 |      |      |      |      |      |      |
| 1620 | 1590 |      |      |      |      |      |      |      |      |      |
| 1640 | 1610 |      |      |      |      |      |      |      |      |      |
| 1650 | 790  |      |      |      |      |      |      |      |      |      |
| 1660 | 770  |      |      |      |      |      |      |      |      |      |
| 1680 | 1660 | 1690 | 1710 | 1890 | 1900 | 1940 | 1960 | 1990 | 2030 | 2280 |
|      | 2300 | 2990 | 3040 | 3220 | 3230 | 3320 | 3400 | 3430 | 3510 |      |
| 1690 | 770  |      |      |      |      |      |      |      |      |      |
| 1710 | 770  |      |      |      |      |      |      |      |      |      |
| 1740 | 820  |      |      |      |      |      |      |      |      |      |
| 1770 | 820  |      |      |      |      |      |      |      |      |      |
| 1810 | 3390 |      |      |      |      |      |      |      |      |      |
| 1820 | 740  | 1790 |      |      |      |      |      |      |      |      |
| 1830 | 780  |      |      |      |      |      |      |      |      |      |
| 1900 | 770  |      |      |      |      |      |      |      |      |      |
| 1920 | 770  |      |      |      |      |      |      |      |      |      |
| 1940 | 1920 |      |      |      |      |      |      |      |      |      |
| 1960 | 770  |      |      |      |      |      |      |      |      |      |
| 1980 | 810  |      |      |      |      |      |      |      |      |      |
| 2000 | 790  |      |      |      |      |      |      |      |      |      |
| 2030 | 790  |      |      |      |      |      |      |      |      |      |
| 2040 | 880  |      |      |      |      |      |      |      |      |      |
| 2050 | 2340 |      |      |      |      |      |      |      |      |      |
| 2060 | 810  | 2140 |      |      |      |      |      |      |      |      |
| 2110 | 2060 | 2950 | 2980 | 3050 | 3440 |      |      |      |      |      |
| 2120 | 2100 |      |      |      |      |      |      |      |      |      |
| 2130 | 2080 | 2090 |      |      |      |      |      |      |      |      |
| 2140 | 780  | 2500 |      |      |      |      |      |      |      |      |
| 2190 | 810  |      |      |      |      |      |      |      |      |      |
| 2220 | 2190 | 2230 | 2505 | 2870 | 2880 | 3180 | 3210 |      |      |      |
| 2230 | 810  |      |      |      |      |      |      |      |      |      |
| 2250 | 780  |      |      |      |      |      |      |      |      |      |
| 2260 | 1830 |      |      |      |      |      |      |      |      |      |
| 2270 | 2250 |      |      |      |      |      |      |      |      |      |
| 2290 | 780  |      |      |      |      |      |      |      |      |      |
| 2310 | 780  |      |      |      |      |      |      |      |      |      |
| 2340 | 810  |      |      |      |      |      |      |      |      |      |
| 2380 | 2360 |      |      |      |      |      |      |      |      |      |
| 2450 | 2430 |      |      |      |      |      |      |      |      |      |
| 2490 | 2050 | 2210 | 2240 | 2590 | 3080 | 3140 |      |      |      |      |
| 2500 | 810  | 2640 | 2670 | 3190 |      |      |      |      |      |      |
| 2560 | 2560 |      |      |      |      |      |      |      |      |      |
| 2610 | 810  |      |      |      |      |      |      |      |      |      |
| 2630 | 2610 |      |      |      |      |      |      |      |      |      |
| 2710 | 2690 |      |      |      |      |      |      |      |      |      |
| 2720 | 2680 |      |      |      |      |      |      |      |      |      |
| 2730 | 2550 |      |      |      |      |      |      |      |      |      |
| 2740 | 810  |      |      |      |      |      |      |      |      |      |
| 2790 | 2740 |      |      |      |      |      |      |      |      |      |
| 2850 | 810  |      |      |      |      |      |      |      |      |      |
| 2890 | 2870 |      |      |      |      |      |      |      |      |      |
| 2900 | 2870 |      |      |      |      |      |      |      |      |      |
| 2910 | 2870 |      |      |      |      |      |      |      |      |      |
| 2920 | 2870 |      |      |      |      |      |      |      |      |      |
| 2930 | 350  | 730  | 765  | 910  | 930  | 940  | 970  | 990  | 1000 | 1030 |
|      | 1210 | 1230 | 1740 | 1750 | 1770 | 1780 | 1990 | 2070 | 2260 | 2380 |
|      | 2390 | 2400 | 2410 | 2420 | 2440 | 2480 | 2600 | 2620 | 2650 | 2660 |
|      | 2760 | 2780 | 2790 | 2800 | 2810 | 2820 | 2840 | 2850 | 2870 | 2890 |
|      | 2900 | 2910 | 2940 | 2960 | 3000 | 3010 | 3020 | 3090 | 3110 | 3160 |
|      | 3170 | 3240 | 3270 | 3280 | 3290 | 3300 | 3330 | 3410 | 3420 | 3450 |
|      | 3460 | 3470 | 3480 | 3490 | 3500 | 3520 | 3530 |      |      |      |
| 2940 | 2920 |      |      |      |      |      |      |      |      |      |
| 2950 | 2860 |      |      |      |      |      |      |      |      |      |
| 2960 | 2630 |      |      |      |      |      |      |      |      |      |
| 2970 | 780  |      |      |      |      |      |      |      |      |      |
| 2990 | 2150 |      |      |      |      |      |      |      |      |      |
| 3030 | 780  | 3200 | 3260 |      |      |      |      |      |      |      |
| 3050 | 3030 |      |      |      |      |      |      |      |      |      |
| 3090 | 3060 |      |      |      |      |      |      |      |      |      |
| 3120 | 810  | 2580 |      |      |      |      |      |      |      |      |
| 3150 | 3130 |      |      |      |      |      |      |      |      |      |
| 3170 | 3150 |      |      |      |      |      |      |      |      |      |
| 3180 | 3120 |      |      |      |      |      |      |      |      |      |
| 3220 | 820  |      |      |      |      |      |      |      |      |      |
| 3260 | 790  |      |      |      |      |      |      |      |      |      |
| 3310 | 790  |      |      |      |      |      |      |      |      |      |
| 3330 | 790  |      |      |      |      |      |      |      |      |      |
| 3370 | 3340 | 3350 |      |      |      |      |      |      |      |      |
| 3380 | 800  |      |      |      |      |      |      |      |      |      |
| 3390 | 800  |      |      |      |      |      |      |      |      |      |
| 3410 | 770  |      |      |      |      |      |      |      |      |      |
| 3420 | 780  |      |      |      |      |      |      |      |      |      |
| 3460 | 820  |      |      |      |      |      |      |      |      |      |
| 3480 | 820  |      |      |      |      |      |      |      |      |      |
| 3510 | 770  |      |      |      |      |      |      |      |      |      |
| 3540 | 780  |      |      |      |      |      |      |      |      |      |
| 3550 | 790  |      |      |      |      |      |      |      |      |      |
| 3560 | 790  |      |      |      |      |      |      |      |      |      |
| 3570 | 430  |      |      |      |      |      |      |      |      |      |
| 3670 | 3590 | 3600 | 3610 | 3620 | 3630 | 3640 | 3650 |      |      |      |
| 3710 | 1760 |      |      |      |      |      |      |      |      |      |
| 3730 | 3570 | 3660 | 3670 | 3710 |      |      |      |      |      |      |
| 3740 | 400  |      |      |      |      |      |      |      |      |      |
| 3790 | 3780 |      |      |      |      |      |      |      |      |      |
| 3810 | 3790 |      |      |      |      |      |      |      |      |      |
| 3860 | 3750 | 3820 | 3830 |      |      |      |      |      |      |      |
| 3890 | 2730 | 3860 |      |      |      |      |      |      |      |      |



|                |      |      |      |      |      |      |      |      |      |      |
|----------------|------|------|------|------|------|------|------|------|------|------|
| K9             | 340  | 450  | 540  | 550  | 560  | 600  | 630  | 650  | 700  | 710  |
|                | 720  | 730  | 740  | 765  | 880  | 1740 | 1750 | 1770 | 1830 | 1930 |
|                | 2050 | 2070 | 2190 | 2230 | 2250 | 2340 | 2360 | 2380 | 2390 | 2400 |
|                | 2410 | 2420 | 2430 | 2450 | 2460 | 2470 | 2490 | 2500 | 2505 | 2510 |
|                | 2520 | 2530 | 2540 | 2550 | 2560 | 2570 | 2580 | 2590 | 2610 | 2620 |
|                | 2630 | 2640 | 2740 | 2790 | 2800 | 2810 | 2820 | 2830 | 2850 | 2860 |
|                | 2870 | 3120 | 3140 | 3160 | 3170 | 3180 | 3190 | 3220 | 3270 | 3290 |
|                | 3460 | 3470 | 3490 | 3500 | 4260 | 4270 | 4290 | 4300 | 4320 | 4350 |
|                | 4370 |      |      |      |      |      |      |      |      |      |
| L              | 340  | 870  | 1090 | 2200 | 2240 | 3310 | 4640 |      |      |      |
| L#             | 510  | 520  | 540  | 630  | 1820 | 3310 |      |      |      |      |
| L1             | 260  | 340  | 360  | 370  | 380  | 390  | 400  | 590  | 765  | 840  |
|                | 880  | 890  | 900  | 910  | 920  | 930  | 940  | 950  | 980  | 990  |
|                | 1000 | 1010 | 1050 | 1080 | 1130 | 1140 | 1150 | 1210 | 1260 | 1350 |
|                | 1500 | 1660 | 1670 | 1690 | 1700 | 1710 | 1730 | 1750 | 1780 | 1790 |
|                | 1830 | 1840 | 1850 | 1860 | 1870 | 1900 | 1920 | 1940 | 1960 | 2000 |
|                | 2030 | 2050 | 2080 | 2090 | 2150 | 2200 | 2250 | 2270 | 2275 | 2290 |
|                | 2390 | 2410 | 2430 | 2510 | 2520 | 2540 | 2550 | 2570 | 2590 | 2610 |
|                | 2620 | 2630 | 2650 | 2660 | 2670 | 2720 | 2780 | 2970 | 3030 | 3040 |
|                | 3060 | 3130 | 3140 | 3160 | 3230 | 3260 | 3300 | 3330 | 3340 | 3350 |
|                | 3390 | 3420 | 3425 | 3480 | 3510 | 3520 | 3530 | 3570 | 3590 | 3600 |
|                | 3610 | 3620 | 3630 | 3640 | 3650 | 3740 | 3750 | 3770 | 3780 | 3790 |
|                | 3810 | 3820 | 3880 | 3890 | 4020 | 4050 | 4060 | 4080 | 4110 | 4170 |
|                | 4280 | 4290 | 4300 | 4310 | 4340 | 4390 | 4570 | 4590 | 4640 |      |
| L2             | 840  | 900  | 910  | 1050 | 1150 | 3790 | 3820 | 4080 |      |      |
| L4             | 3570 | 3580 | 3590 | 3600 | 3610 | 3620 | 3630 | 3640 | 3650 | 3670 |
|                | 3710 |      |      |      |      |      |      |      |      |      |
| L5             | 260  | 760  | 1060 | 1090 | 3980 | 4010 | 4600 |      |      |      |
| L6             | 260  | 1090 | 1100 | 1110 | 1120 | 4600 |      |      |      |      |
| L9             | 840  | 890  | 900  | 910  | 920  | 930  | 940  | 950  | 980  | 990  |
|                | 1010 | 1040 | 1050 | 1280 | 1300 | 1310 | 1320 | 1330 | 1340 | 1350 |
|                | 1670 | 1700 | 1730 | 1910 | 1930 | 1950 | 1970 | 2020 |      |      |
| M%<br>M0       | 140  | 210  | 840  | 890  |      |      |      |      |      |      |
|                | 420  | 750  | 860  |      |      |      |      |      |      |      |
| F1             | 2010 | 2390 | 3000 | 3010 | 4070 | 4090 |      |      |      |      |
| R0             | 1500 | 4610 | 4630 |      |      |      |      |      |      |      |
| S#<br>S%<br>S1 | 140  | 190  | 390  |      |      |      |      |      |      |      |
|                | 140  | 260  | 360  | 370  | 380  | 400  | 1240 | 1450 | 2810 | 3610 |
|                | 3980 | 4000 | 4570 |      |      |      |      |      |      |      |
| ST             | 140  | 190  | 210  |      |      |      |      |      |      |      |
|                | 4520 |      |      |      |      |      |      |      |      |      |
| T              | 1210 | 1230 | 2590 | 2600 | 2620 | 3530 | 3650 | 3920 |      |      |
| T%<br>V        | 140  | 190  | 340  | 380  | 880  | 1130 | 1830 | 2030 | 2080 | 2200 |
|                | 2250 | 3480 | 3570 | 3750 | 4290 |      |      |      |      |      |
| X              | 1410 | 1420 | 1430 | 1440 | 1460 |      |      |      |      |      |
| Z              | 4500 | 4510 |      |      |      |      |      |      |      |      |
| Z#             | 270  | 290  | 320  | 3670 | 3710 | 4500 | 4540 | 4550 | 4560 | 4610 |
|                | 4620 |      |      |      |      |      |      |      |      |      |
| Z8             | 2350 | 2360 |      |      |      |      |      |      |      |      |

Type this in exactly as shown, being very careful about the number of spaces (especially line 110): mixtures of Basic and Machine Code have a habit of going wrong if you interfere with them. You'll note from line 130 that a disk drive is vital for this program! A printer isn't, although you can select printer output if required, in line 190.

The two machine code routines (lines 170 and 200) respectively control the cross referencing part of the program and the output part.

Save the Basic program under the name Cross Ref. B, and then onto the machine code.

Enter the monitor with SYS 1024, type in M 0553 0603 (RETURN), and then type in the values shown in the first block of numbers. When you've finished with that, type M 060B 06BB (RETURN), and again type in the values in the second block of numbers.

This is bringing up one screenful at a time, to make it easier to enter all the machine code part. Continue type in M 'START ADDRESS' 'END ADDRESS' as shown in the first and last row of each block, until we get to the final one, which is M 09A3 0A13.

```

0553 32 35 36 AC C2 28 4A AA
055B 35 29 3A 98 34 2C 4C 3B
0563 00 71 05 F0 00 82 4A 3A
056B 98 34 3A A0 34 00 00 00
0573 35 29 3A 98 34 2C 4C 3B
057B 00 89 05 F0 00 82 4A 3A
0583 98 34 3A A0 34 00 00 00
058B 00 00 00 00 00 00 00 00
0593 00 00 00 00 00 00 00 00
059B 00 00 00 00 00 00 00 00
05A3 00 00 00 00 00 00 00 00
05AB 00 00 00 00 00 00 00 00
05B3 00 00 00 00 00 00 00 00
05BB 00 00 00 00 00 00 00 00
05C3 00 00 00 00 00 00 00 00
05CB 00 00 00 00 00 00 00 00
05D3 00 00 00 00 00 00 00 00
05DB 00 00 00 00 00 00 00 00
05E3 00 00 00 00 00 00 00 00
05EB 00 00 00 00 00 00 00 00
05F3 00 00 00 00 00 00 00 00
05FB 00 00 00 00 00 00 00 00
0603 0E 0E 0E 0E 0E 0E 0E 0E

```

```

060B 0E 0E 0E 0E 0E 0E 0E 0E
0613 0E 0E 0E 0E 0E 0E 0E 0E
061B 0E 0E 0E 0E 0E 0E 0E 0E
0623 0E 03 03 03 0E 04 0E 0E
062B 0E 09 0E 0E 0E 0E 02 02 02
0633 02 02 02 02 02 02 02 0E
063B 0E 0E 0E 0E 0E 0E 0E 01 01
0643 01 01 01 01 01 01 01 01
064B 01 01 01 01 01 01 01 01
0653 01 01 01 01 01 01 01 01
065B 0E 0E 0E 0E 0E 0E 0E 0E
0663 0E 0E 0E 0E 0E 0E 0E 0E
066B 0E 0E 0E 0E 0E 0E 0E 0E
0673 0E 0E 0E 0E 0E 0E 0E 0E
067B 0E 0E 0E 0E 0E 0E 0E 0E
0683 07 0E 0E 0E 0E 0E 0A 0A
068B 0E 0E 0A 0E 0E 0E 0E 0E
0693 0E 0E 0E 0E 0E 0E 0E 0E
069B 0E 0E 0E 0E 0E 0E 0E 0E
06A3 0E 0E 0E 0E 0A 0E 0E 0E
06AB 0E 0E 0E 0E 0E 0E 0E 0E
06B3 0E 0E 0E 0E 0E 0E 0E 0E
06BB 0E 0E 0E 0E 0E 0E 0E 0E

```



```

06C3 0E 0E 0E 0E 0E 0E 0E 0E
06C4 0E 0E 0E 0E 0E 0E 0E 0E
06D3 0E 0E 0E 0E 0E 0E 0E 0E
06DE 0E 0E 0E 0E 0E 0E 0E 0E
06E3 0E 0E 0E 0E 0E 0E 0E 0E
06E8 0E 0E 0E 0E 0E 0E 0E 0E
06F3 0E 0E 0E 0E 0E 0E 0E 0E
06FB 0E 0E 0E 0E 0E 00 00 00
0703 00 00 00 00 00 00 00 00
070E 00 00 00 48 00 00 18 24
0713 30 00 00 30 00 00 18 18
071E 18 18 00 18 18 18 18 18
0723 18 00 24 24 24 24 24 24
072E 24 24 24 24 24 00 30 30
0733 30 30 30 30 30 00 30 30
073E 30 00 00 04 00 00 18 24
0743 30 00 30 30 00 00 48 48
074E 00 00 18 24 30 00 00 30
0753 00 00 00 04 00 00 18 24
075E 30 00 30 30 00 00 00 00
0763 F8 00 18 24 30 00 00 30
076E 00 30 60 60 00 00 18 24
0773 30 00 00 30 00 00 00 00
    
```

```

077E 00 00 18 24 30 00 00 30
0783 00 A2 01 20 C6 FF 20 1F
078E 08 A9 00 85 3E A9 00 85
0793 BF A9 07 85 B9 A2 00 ED
079E 06 0A 9D F9 0B CA 10 77
07A3 30 07 20 C0 FF 60 20 9C
07A8 08 20 E4 FF 20 E4 FF F0
07B3 F1 A9 00 35 50 A9 08 35
07BE C1 20 E4 FF 85 5A 20 E4
07C3 FF 35 59 A2 00 86 B8 20
07CE E4 FF C9 20 F0 F9 AA ED
07D3 00 06 A8 B1 B8 10 03 20
07DE F4 07 29 7F A4 B8 85 B8
07E3 C9 54 B0 07 C0 54 9C 03
07EE 20 29 08 C9 00 F0 B7 D0
07F3 D6 29 7F 48 C9 54 F0 14
07FE 8A A2 00 B4 54 C0 20 F0
0803 07 E8 E0 85 D0 F5 F0 12
080E 95 54 F0 0E 8A A2 00 B4
0813 55 94 54 E8 E0 04 D0 F7
081E 85 58 66 60 A2 04 A9 20
0823 95 54 CA 10 FB 60 48 A5
082E C0 A4 C1 38 E9 07 85 BA
    
```

```

0833 E0 01 88 84 BE C9 00 98
083E E9 0B 90 14 A0 04 B9 54
0843 00 D1 BA D0 05 88 10 F6
084E 30 49 A5 BA A4 BE D0 DB
0853 A5 C0 A4 C1 85 BC 84 ED
085E 38 E9 07 B0 01 88 85 BA
0863 84 BE C9 00 98 E9 0E 98
086E 15 A0 06 38 B1 BA 91 EC
0873 F9 54 00 88 10 F6 90 06
087E A5 BA A4 BE D0 D6 A0 06
0883 E9 54 00 91 BC 88 10 F8
088E 18 A5 C0 69 07 85 C0 90
0893 02 E6 C1 20 1F 08 66 60
089E 60 A5 BE A4 BF 85 BA 84
08A3 BE 38 A5 C0 E9 00 8D 7A
08AE 02 A5 C1 E9 0B 3D 7B 02
08B3 0D 7A 02 F0 E3 18 AD 7A
08BE 02 65 BA 85 BE 85 BC AD
08C3 7E 02 65 BE 85 BF 85 ED
08CE 20 10 09 A5 C0 38 E9 07
08D3 A4 C1 B0 01 88 85 C0 84
08DE C1 C9 00 98 E9 0E 90 B8
08E3 A5 BC A4 ED 38 E9 07 B0
    
```

```

08EE 01 88 85 BC 84 ED A0 06
08F3 38 B1 BA 91 BC F1 C0 88
08FE 10 F7 90 06 20 10 09 4C
0903 E3 08 A0 06 B1 C0 91 BC
090E 88 10 F9 30 BE A5 BA A4
0913 BE 38 E9 07 B0 01 88 85
091E BA 84 BE 60 A2 04 86 54
0923 20 C9 FF A9 00 A0 00 85
092E BA 84 BE A0 04 B9 54 00
0933 D1 BA D0 05 88 10 F6 30
093E 22 A9 0D 20 D2 FF A9 0A
0943 20 D2 FF A0 00 B1 BA 99
094E 54 00 20 D2 FF C8 C0 05
0953 90 F3 A9 3A 20 D2 FF A9
095E 00 85 BC E6 BC A5 BC C5
0963 D0 90 16 A9 0D 20 D2 FF
096E A9 0A 20 D2 FF A0 05 A9
0973 20 20 D2 FF 88 10 F8 30
097E DE A0 05 B1 BA 85 5A C8
0983 B1 BA 85 59 20 E1 FF A4
098E 97 C8 D0 F8 20 A9 09 18
0993 A5 BA A4 BE 69 07 90 01
099E C8 35 BA 84 BE C5 BE A5
    
```

```

09A3 BF E5 BF 90 86 60 A9 00
09AB A2 02 9D 7A 02 CA 10 FA
09B3 78 F8 A0 0F 06 59 26 5A
09BB A2 02 ED 7A 02 7D 7A 02
09C3 9D 7A 02 CA 10 F4 88 10
09CE EE D8 58 A2 00 A9 30 85
09D3 ED 86 C0 ED 7A 02 48 4A
09DE 4A 4A 4A 09 30 20 F9 09
09E3 62 29 0F 85 30 E0 02 D0
09EE 82 06 ED 20 F9 09 A6 C0
09F3 23 E0 03 90 DC 60 05 2D
09FE D0 84 A9 20 D0 02 0E ED
0A03 4C D2 FF 00 00 00 00 00
0A0E 00 00 4E 4F 4E 45 20 00
0A13 00 AA AA AA AA AA AA AA
    
```

Save all this under the name Cross Ref.M (for machine code), and then finally SAVE the whole masterpiece in the normal way. In other words, type SAVE"O:CROSS REF",8 if you happen to be using drive zero on a disk drive whose device number is 8.

When this is completed, type in the following short piece of code in direct mode, and hit RETURN:-

```
A = 0:FOR I = 1363 TO 2579:A = A + PEEK(I):NEXT:PRINTA
```

If the value you see on your screen is 94336 all is well and good, and the program will work correctly.

If the value is anything other than 94336, there are two possibilities. If the program jumps into the monitor, type X to exit and check very carefully the Basic part of the program. If the machine hangs up totally, we have problems, and we'll have to check the machine code.

To make life easier for you, the machine code was earlier divided up into seven blocks. We'll make use of this, to try and pin down our error in typing it in.

Take our little program mentioned above:-

```
A = 0:FOR I = X to Y:
```

```
A = A + PEEK(I):NEXT:PRINTA
```

where X and Y are the start and end addresses. The following table shows the values of X and Y for each of the seven blocks, and also the value of A that should appear. If your total is different, we've found the block with the mistake. Enter the monitor, re-check your code, re-save the machine code part and we should now have a working copy of Cross Ref.

| Block <sup>0</sup> | X    | Y    | A     |
|--------------------|------|------|-------|
| 1                  | 1363 | 1546 | 4199  |
| 2                  | 1547 | 1730 | 1619  |
| 3                  | 1731 | 1914 | 5935  |
| 4                  | 1915 | 2098 | 22606 |
| 5                  | 2099 | 2282 | 23640 |
| 6                  | 2283 | 2466 | 24413 |
| 7                  | 2467 | 2579 | 11924 |

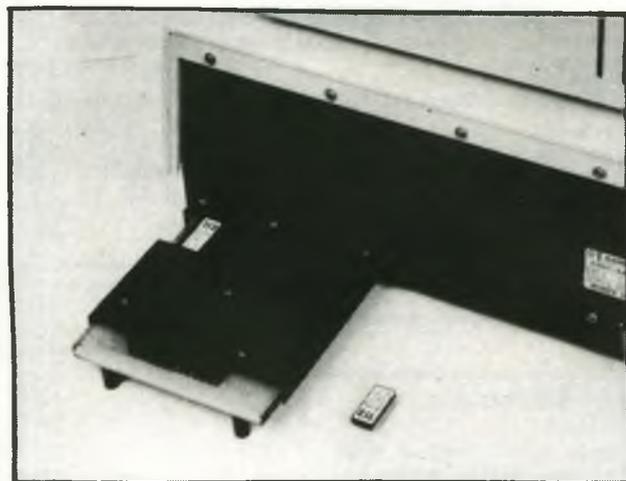
We think you'll find that the speed and usefulness of this program far outweighs the effort involved in typing it in. As ever, we are indebted to Jim Butterfield!

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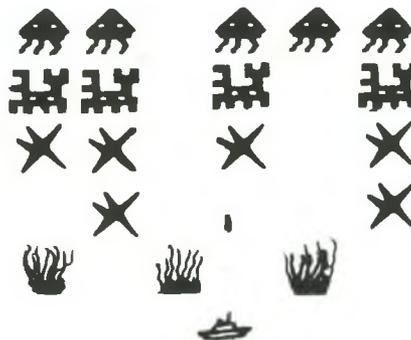


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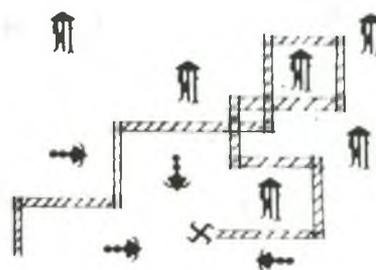
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