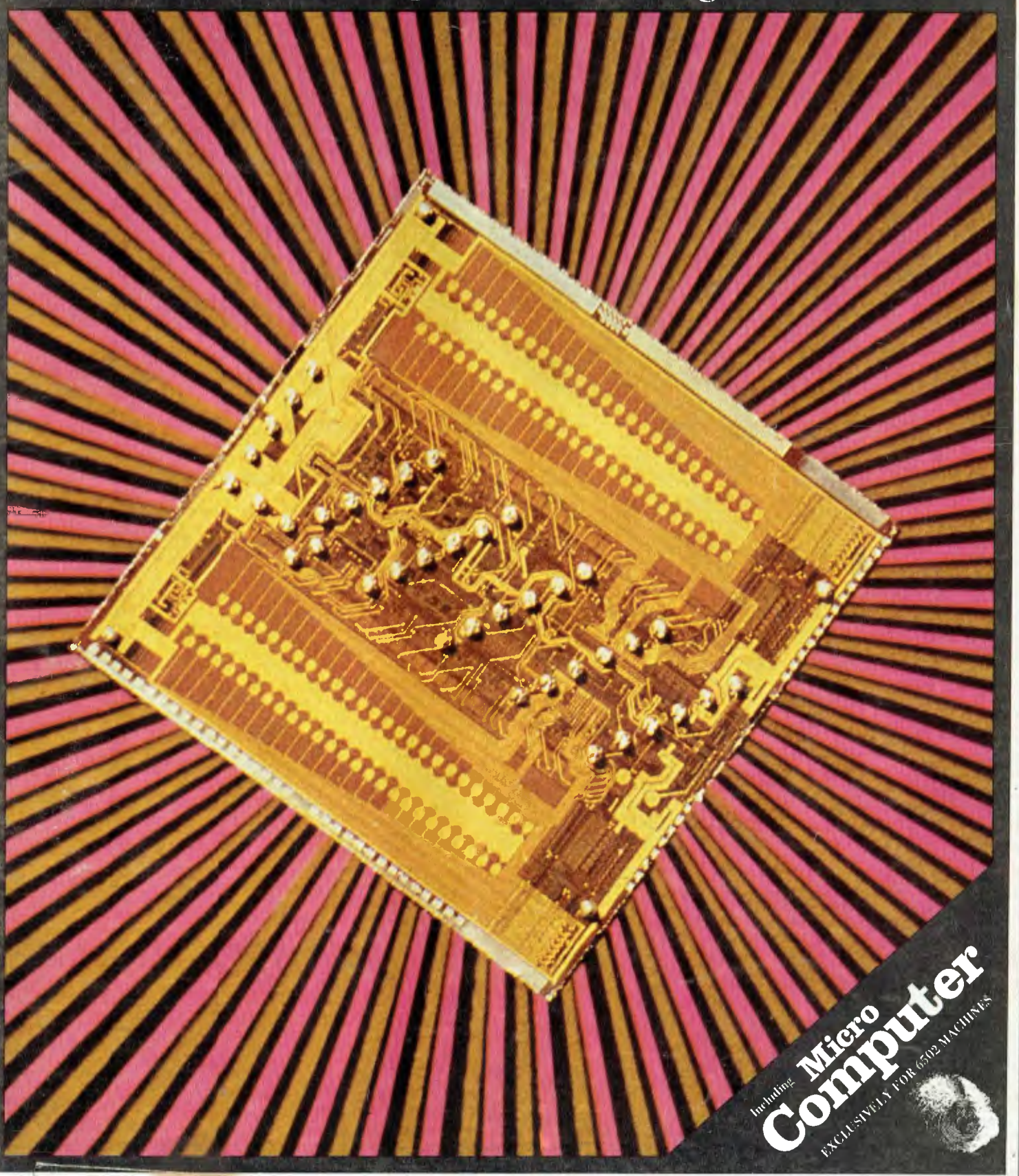
Australian Personal Computer

$2.50* NZ $3.00*
August/September 1981

Australia's leading micro magazine



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Filling this vital role was the concept behind ComputerLand. Our purpose is to provide you with ready access to the entire world of microcomputing. Today we represent over 50 different manufacturers and suppliers. But no matter what brand or type of equipment you purchase or lease from ComputerLand, you get an extra feature no one else can offer — the resources of the world's largest network of computer stores.

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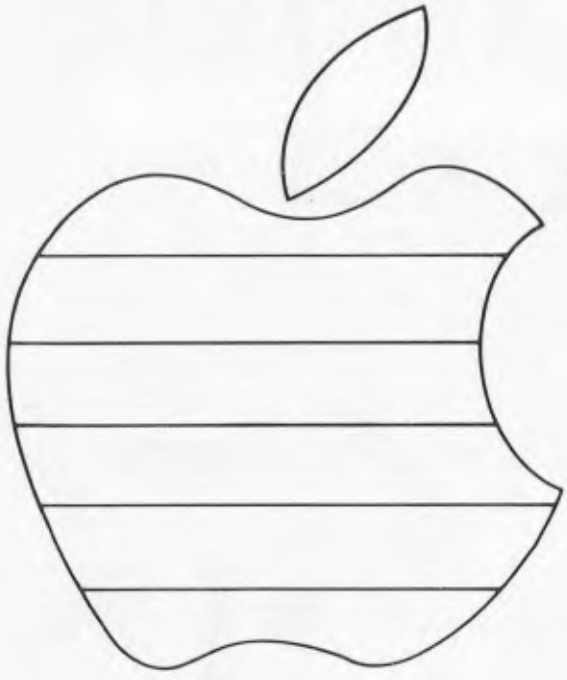

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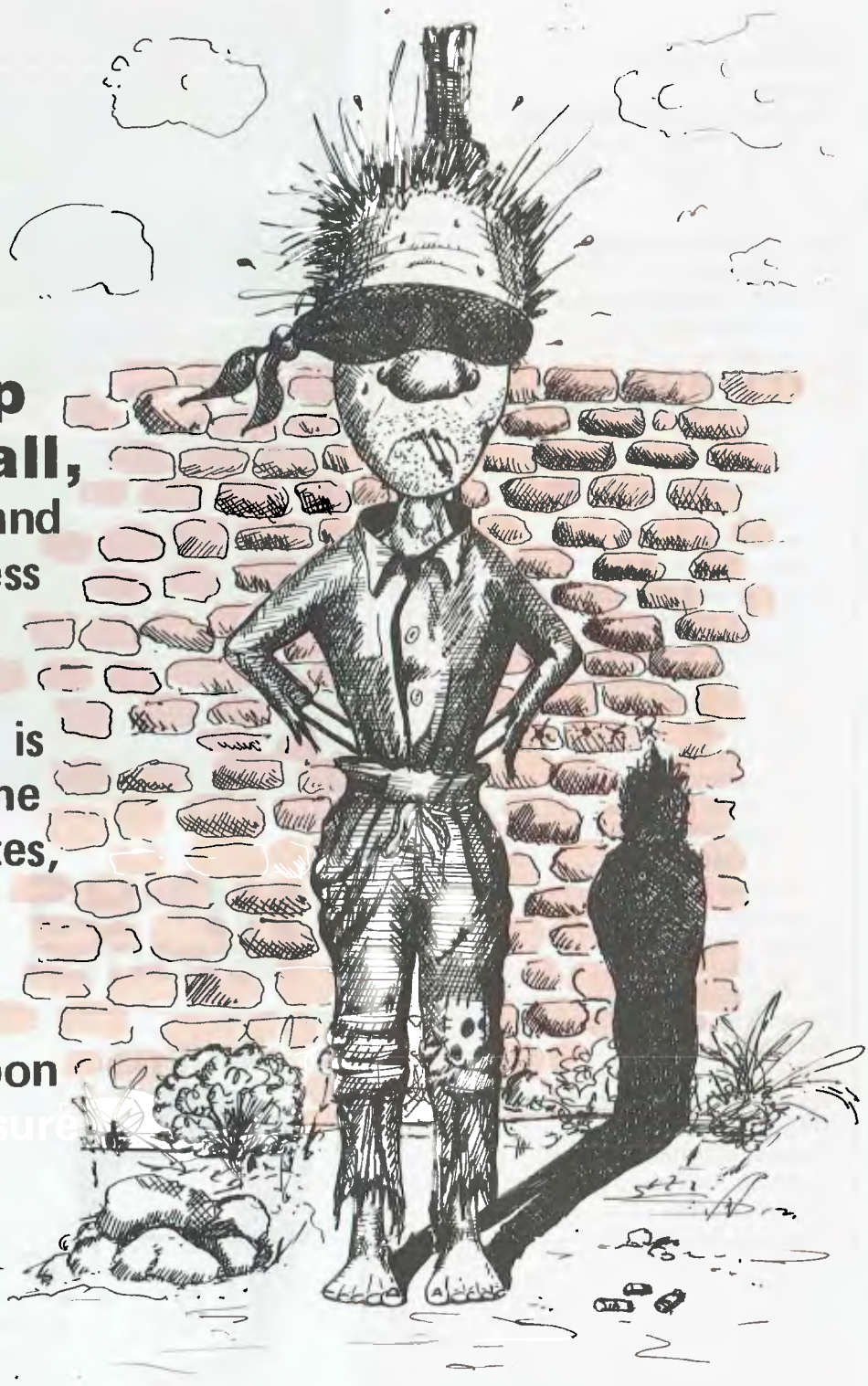

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Fill out the coupon in this issue and ensure your eleventh-hour escape.

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PROFILE

APC

Volume 2 No. 2 August/September 1981

Business Computer

Micro Computer

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OUR COVER:

Photograph courtesy of Comalco Aluminium and IBM Australia

An IBM 64k chip, which measures only a few millimetres each way, and fits easily on the end of a finger. These chips were recently introduced into IBM commercial systems, and it seems only a matter of time before they are used in personal computers. The standard 8k chip in personal systems is now sharing its place with the 16k chip. How long will it be before personal computers join the big chips league? According to some industry sources, it won't be long.

APPLE BUSINESS SYSTEMS

Few computers can match the power and versatility of the APPLE II as a business computer, and nowhere will you see that power better demonstrated than at C.P.C. We have the finest software and equipment, and the experience to make your computer installation a success. As Authorised APPLE Dealers, we offer a complete support to all our customers. In addition we have our own special "same day" backup service which keeps our business users operational and productive. Call in at C.P.C. to get the full story of how our business systems can help you.

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ATARI COMPUTER SYSTEMS

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FEATURES & SPECIFICATIONS — THE ATARI 800

Console: FCC approved, with built in RF modulator. Connects to any TV.
CPU: 6502 Microprocessor. 0.56 microsecond cycle. 1.8 MHz
Colour: 16 colours, each with 8 intensities
Sound: Four independent sound synthesizers (in addition to audio through TV) for musical tones or game sounds. Four octaves. Variable volume and tone. Internal speaker
Memory: 16K bytes of Random Access Memory is included. The ATARI 800* may be expanded to 48K RAM with user-installed 8K or 16K ATARI Memory Modules*. The system includes a 10K ROM Operating System. ROM may be expanded with user installed cartridge programs.
Keyboard: 57 full stroke alphanumeric keys plus 4 function keys. Upper/lower case. Inverse video. Full screen editing.
Display: Highest graphics resolution 320 x 192, 24 lines of 40 characters. Three text modes.

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ATARI 410* PROGRAM RECORDER
ATARI 810* DISK DRIVE1
ATARI 815* DUAL DISK DRIVE
ATARI 820* 40 COLUMN PRINTER
ATARI 822* 40 COLUMN THERMAL PRINTER
ATARI 825* 80 COLUMN PRINTER
ATARI 830* ACOUSTIC MODEM
ATARI 850* INTERFACE MODULE
8K RAM MEMORY MODULE* (CX 852)
16K RAM MEMORY MODULE (CX 853)

* TRADE MARK

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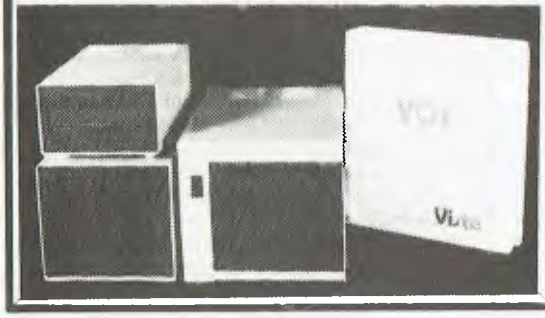
Minifloppy Disk Systems

Description

The V200-E for Exidy Sorcerer* is a dedicated system that a long needed powerful tool to complete the Exidy Computer.

The V200-E for Exidy is a completely tested and assembled modular system that does not require the S100 Expansion interface and plugs directly into the expansion connector.

The fast-access on-line storage of the V200 and V200-E system gives you instantaneous program loading and dumping, sequential and random file access, context editin of programs and text, dynamic debugging of programs, program assembly, batch processing and much more.



Here are three options available:

V200E-10 200K single drive, in a dual drive case to allow for expansion, ready to plug into the Sorcerer with CP/M, BASIC E, full documentation and a box of disks. $990.00

V200E-20 400K dual drive, complete and ready to plug into Sorcerer, with CP/M, BASIC E, documentation and disks. $1450.00

V200E-22 800K dual double sided disks, ready to plug into the Sorcerer, with CP/M, BASIC E, documentation and disks. $1850.00

No other system offers such value for money. Already the major software houses are arranging to supply software on Vista format disks, and the CP/M operating system opens the door to even more.

Write or phone today for our free factsheet and price list on the VISTA V-200 Disk System.

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TRS-80/SYSTEM 80

DATA ENHANCER — Small but very useful device for all System 80/TRS-80's using cassettes. Enhances the signal of program tapes to improve loading reliability. Can be used on input, or between two recorders to create improved copy. Comes complete with leads and all instructions. $49.95

SEIKOSHA PRINTER — 30 cps dot matrix printers with two sizes of print and graphics capability. $495.00

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DRAGON SCHOOL

Professional Australian Systems has been marketing the DYAD RI, designed to meet a single application – computer education in a classroom environment. Over the last three years they've been designing a new modular product to handle all a school's needs.

According to Neil McKellar, the M.D. of the operation, the idea behind most of the competitive imported computers has been to build a general purpose unit which will carry out tasks for commerce, industry, or the hobbyist. In this machine, he hopes to prove that Australia can compete with the rest of the world in technological design, assembly and price, without needing tariff protection.

The Dyad Dragon, as it is called, is based on the 6802 microprocessor and has an inbuilt mark sense card reader. There's a 14k ROM, including 12k of DYAD Basic.

When using the disk, Basic expands to 17k. It comes with 16k of RAM, expandable to 48k and can be purchased with two disk drives giving a total of 630k of storage. Two further drives can be handled under the DOS. The card reader handles up to 60 cards per minute.

Because of its modular design the Dragon can be added to a school's existing hardware without the need for expensive modems, software or interface cards. The basics can be bought initially, then the system built up as the curriculum develops and as funds can be wrenched from the Government.

The basic configuration – CPU, card readers, card hopper feed, 16k RAM, video screen, keyboard and cassette interface – retails for under $2,500. It's distributed by Zephyr Products, 70 Bateford Rd, Chadstone, Vic, 3148.

Bill Penrose, of PAS, watches a student load the DYAD Dragon.

TWO-IN-ONE

Inca Data Systems have added the IRWIN 510 disk/tape drive to their line up of OEM products.

According to Sam Irwin, the man in the driver's seat at Irwin International, the market demands four major features in a small disk drive – greater storage capacity, reliable back-up, faster access time, and low price. He maintains that all this is provided by the new product, which is a 5¼ inch Winchester disk drive system with integrated cartridge tape back-up.

The memory capacity is 12.3 megabytes unformatted, 10.02 formatted. Only one disk platter is used.

Tape backup is a fully integrated cartridge, as opposed to separate minifloppy backup. All 10 megabytes of formatted data can apparently be dumped or restored in less than four minutes. Unlike floppy disk backup, there's no need for sophisticated software to do selective dumping, and no need for the operator to repeatedly stop and change media.

Mr Irwin said the average time of the new gizmo is 25 milliseconds, and the maximum is 45 milliseconds.

Inca Data Systems have a hardware and disk operating system support facility in Sydney to speed implementation of IRWIN technology into existing and future products. Current interfaces include the LSI 11, Multibus and S100.

Pricing in OEM quantities is about $2,215 and Inca can be contacted on (02) 411 7844. Datatel, the Southern distributor, can be reached on (03) 699 7614.

FREE RANGE APPLES

Melbourne has another Apple dealer in Omni Computer Systems. Bob Cruikshank, the G.M., is an Authorised Apple Technician (the St. Rudi standard version), and Richard De Vere, the Software Manager, is an electronics technician with a penchant for Applesoft Basic. They intend to concentrate on marketing the Apple to schools, small business and personal users which sounds pretty typical but also intend to carry "at least one uprange system, one downrange system plus a wide range of software." Presumably the buffalo also roam down at 36 Park St, Sth Melbourne; Tel: (03) 690 4955, where Omni Computer Systems are located.

PSST!

CISA has decided to concentrate solely on the Olympia Whisperdisc computer terminal/typewriter and stop importing other daisy wheel printers.

This unit can act either as a stand alone daisy wheel typewriter or, by using a switch, can be converted into an automatic computer terminal. In the terminal mode, the Whisperdisc will print continuously at over 200 words per minute.

It's price is $2,200 including cables and the necessary software for interfacing to a TRS-80 disk system. A tractor feed attachment should be available soon, enabling the use of fan-fold continuous forms. CISA Microcomputing has left its old Kent St address because it became too small. This time they've covered themselves by finding a place which will handle doubling in the retail area if their future requirements demand it. This sensible showroom can be found at 89 York St, Sydney; Tel: (02) 291599.

LEGAL THOUGHTS

The Victorian Society for Computers and the Law has published a selection of papers delivered in the past fifteen months. The first volume, for $20, contains three papers dealing with software protection. The second, at $15, contains papers

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delivered at Cetia 81, on the legal ramifications of computer abuse. The third volume, also at $15, is a collection of papers given to the Society's general meeting.

They're available from the chairman of the Society, 205 William St, Melbourne, 3000.

COST CUTTING DISK

Microprocessor Applications has a new hard disk configuration which will reduce the cost of its Micromation M/NET systems by $1650. It will allow the system capacity to be expanded while the number of modules is reduced.

The new system uses Fujitsu's M2302 Winchester-type hard disk drive, with 23.4 MB of unformatted data storage capacity. The disk is divided into 512-byte sectors, providing two improvements to M/NET users. Firstly, program execution is faster and overall system performance is improved; and secondly, disk storage capacity is more efficiently used.

The original three cabinet system is reduced to two horizontal units – one containing the computer with a 17-slot mother-board and the other holding both the floppy and the 8" hard disk drive.

The Micromation M/NET was first supplied to the Australian market last September. The problem with single-processor, multi-user systems is that as each user comes on-line, system performance decreases appreciably. The Micromation solves this problem by configuring a master, with a Z80A and 64k of RAM, to execute the operating system while a separate satellite card, also with a Z80A and 64k RAM, is allotted to each user. So the processing is distributed among the satellites rather than channeling through a single CPU.

Using the MP/M operating system, Microprocessor Applications has recently doubled user capacity from a maximum of four to eight. Upgrading is accomplished by inserting a new CPU/RAM card and plugging in a new terminal.

Basic unit prices range from $11,500 to $23,210 for full eight user system with 21.5Mb of storage. An additional disk package can be purchased separately at a basic unit price of $6,150.

Microprocessor Applications are in Maskell's Hill Rd, Selby, Vic, 3160; Tel: (03) 754 5108.

LEISURE FUN

Looky Video is selling Intellivision, the "Intelligent Television". It's a 16-bit micro-computer which provides a full range of sound effects, music, colour and very high resolution to be "the most exciting advance in electronic entertainment".

It's a games unit. Modular design will allow it to grow into a real computer through projected development programmes in the future. A keyboard component is on its way with 60 keys, four track cassette and a microphone for programs such as language learning and something rather pretentiously called "Personal Development".

Right now, there are two hand held controls with special input keys, and four buttons on each to send action commands. Each game comes with the program cartridge, an instruction booklet and two plastic overlays indicating control keys for that particular game.

Programs range from Word Fun and Fun with Maths, the latter automatically adjusting to the child's level of skill, to orthodox adult games such as backgammon and draughts, to the new type of murderous games such as Space Battle, Armour Battle, Sea Battle, etc battle.

The master component costs $359 and cartridges, currently with a choice of twenty, cost $49.98. The keyboard component and peripherals will be coming later. Call Bruce Fisher at Looky Video on (03) 429 5674. Or drop in at 418 Bridge Rd, Richmond, Vic, 3121.

BRINGING HOME THE BACON

Near 10% of Australia's population is classified as disabled in one way or another. Many of these people are highly skilled but can't leave their houses because of illness or accident.

Control Data has developed a program which it hopes will allow such people to re-enter the workforce and become, once again, productive and financially independent. The program is called HOMEWORK and is based on the same company's education system, PLATO.

It was developed three years ago in the US to cater for the needs of Control Data's employees who had become incapacitated. It proved very successful and many of the company's disabled workers with the necessary subject experience are now working from home as programmers. Others have learned to develop courses and lessons on the PLATO system, devising computer-based teaching courses. Six months ago the whole concept was offered to private industry in the States, and now negotiations are beginning with private organizations to introduce HOMEWORK here.

Mr Bob Hogg, manager of Control Data's Plato services, said that the HOMEWORK program "re-establishes communication between a company and its disabled employees and ensures that skills acquired over the years are not lost.

"But, more importantly, it provides the disabled persons with satisfying, stimulating employment." He added that insurance companies could conceivably include training on the HOMEWORK program as part of any compensation settlement following a disability accident. PLATO terminals and connections can be conveniently installed in the home and keyboard modifications are being investigated to accommodate workers with limited hand movements.

The Intellivision master component.

HELP
IS ON THE WAY

People in business face a daunting situation when they plan to introduce a computer. What are the criteria for choosing a system? Are there alternatives to buying a system? Is it possible to separate facts from confusing sales talk? These questions and others plague business people in Australia, and for years most of them have been left alone to face the dangers presented by a complex and highly competitive industry keen to sell its wares.

But the solution is as simple as ABC – in other words, Australian Business Computer. This new monthly magazine, a sister publication to Australian Personal Computer, will help to guide business people through the process of finding the best solution for their organisation.

Australian Business Computer is coming soon – watch for it.

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* optional

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TO SUIT TRS-80S & SYSTEM 80S

PERTEC 40 TRACK		$379.00
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Twin 77 TRACK	(385 bytes)	$1399.00

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ITOH 8300 P	Dot Matrix	$889.00
EPSON MX-80	Dot Matrix	$969.00
ANADEX 9501	High Speed	$2169.00
QUME SPRINT 5	Daisy wheel	$4341.00

HARDWARE

16k R.A.M. (200 ns)	$35.00
GREEN SCREEN (TRS-80 +)	$19.95
HI–RES (by C.I.S.A. for TRS-80 +)	$225.00
DATA SEPARATOR	$29.95

Disk & Printer cables available

*TRS-80 is a registered trademark of Tandy/RadioShack

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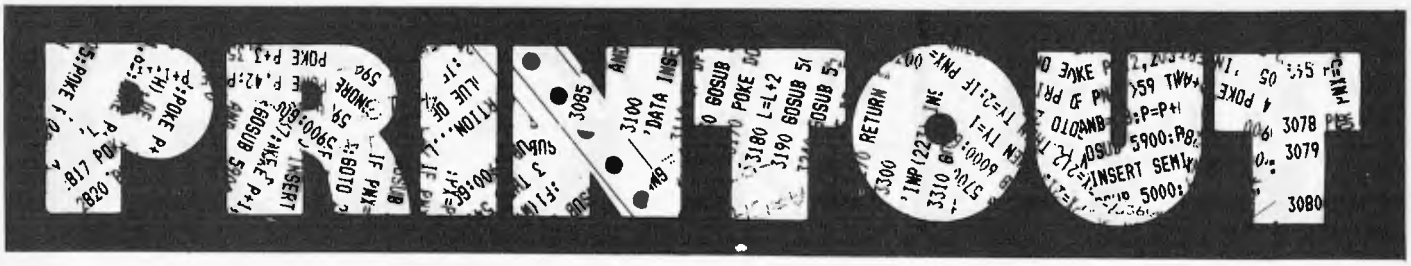


AN EDIBLE CURSOR

Cursor Magazine, for the Commodore, is available from Edible Electronics. The 'Magazine' is actually a cassette which has a cover program plus five other programs. New editions come out on a bi-monthly basis. All twenty-six back issues are available at $10 each.

Each issue comes with an instruction sheet and an interesting editorial extra. For subscription information contact Joel Gotlib at Edible Electronics, 50 Park St, Abbotsford; Tel: (03) 41 5708.

APPLE PACK

The Graphpack I.O allows the user to enhance the current Apple Basic, Applesoft, by the addition of 30 commands. Two major features of Graphpack allow you to intermix graphics and text within the hi-res screen mode and to define "windows" within the screen area with simple commands. Another enhancement allows use of the "Print Using" statement originally implemented for Cobol.

Graphpack can sort alpha-numeric arrays, restore a data pointer to a nominated line number and 16-bit addressing utilises the PEEK and POKE commands. The speed of a number of commands, including GOTO and GOSUB, has been increased up to 40%.

Utility programs included allow re-definition of the character set under software control, definition of screen forms and SAVE to either disk or tape. A reasonably sophisticated function plotter enables you to build your own plotting routines. There's a MUSIC command too.

All these wonderful things and a 32 page manual are available for $95 from Cybernetics Research, 120 Lawson St, Redfern, 2066; Tel: (02) 698 8286; or most Apple dealers.

IBM, FINALLY

After all the "will they, won't they" and predictions and denials of IBM's entry into the personal computer market it was a bit of a yawn when the expected but not expected press release hit the desk. And, of course, by now you'll have read all about it.

The basic system, selling in the U.S. for $1,565, is comprised of a 16-bit processor, 16k of memory and a built-in speaker for audio and music applications. A compact unit the size of a portable typewriter, it interfaces to a domestic TV set and cassette recorder.

Graphics capabilities provide a text system which can display 256 characters in any of 16 foreground and 8 background colours. It can also display graphics in four colours. The 83-key keyboard is adjustable and comes with a six-foot cable so it can be moved around. The Basic is an enhanced version of Microsoft.

Memory is expandable to 260k. A bidirectional printer moves at 80 characters per second. The available VDU has an anti-glare screen, green phosphorus characters and controls for brightness and contrast. Automatic flashing and underlining can be used to call attention to information on the screen.

IBM predicts that a typical home or school system with 64k RAM, a single drive and its own display would cost around $US3,005. An expanded business system with two disk drives, colour graphics and a printer would cost about $US4,500.

In conjunction with Microsoft, IBM has adapted an advanced DOS to support software development. It has also contracted with Digital Research and Softech to adapt the CP/M-86 and UCSD P-System to the computer. So many established programs will be readily available.

It doesn't seem startlingly innovative or price competitive, but IBM's reliability and marketing and support expertise will keep the other personal computer manufacturers on their toes. There are no plans to market in Australia just yet.

METRON MARKER

The Metron Marker is a finger-pressure fluid application for marking PCBs with permanent or removable ink. You work it by squeezing it and the pressure controls the ink flow through a needle-like applicator.

The inks are fluorescent under ultra-violet light. They are electrically non-conductive so can be left on the board.

The markers are available for $5.70 from Royston Electronics, 27 Normanby Rd, Notting Hill, Vic 3168, Tel: (03) 543 5122; or 15/59 Moxon Rd, Punchbowl, NSW 3168, Tel: (02) 709 5293.

ASP's Stringy Floppy for the Sorcerer.

SNAKEY FLOPPY

Stringy Floppy is an 850 character per second digital tape system which stores programs and data on endless loop wafers. It's very small, about the size of a credit card, 5mm thick, and very cheap, as a low cost disk alternative. Now available for the Sorcerer, a compact controller plugs into that machine's expansion connector and accommodates up to two Stringy Floppy drives. Replacement monitor ROMs, operating system in ROM and a supply of wafers are included in the price of $403 for a single drive system, and $580 for dual drives. It was designed by ASP Microcomputers, which also distributes versions for other computers. They can be found at 797 Dandenong Rd, E. Malvern, Vic 3145; Tel: (03) 211 8855.

FAMILY ACCESS

Peter Keubler is promoting his Random Access stores as "family computer centres." Presumably this is the next step after the personal computer and the publicity stresses the consumer appliance side of micros.

He has broken with two practices which, he says, are grounded purely in tradition. Firstly, he's offering a twelve-month warranty on all parts and services. As he points out, this is the sort of warranty people are used to for other household and business equipment and there's no reason for the computer industry not offering it too.

Secondly, Peter sees that buying a home computer is often a family decision. So he's set up the stores so that families can go and try out the machine before buying. Instead of having just one system on the floor, he'll have a situation where people can go in, pick a computer loaded with software they fancy, and use it.

Random Access is selling the 48k Apple II Plus for $1,095. According to Peter, by passing on the dealer discounts their large turnover qualifies them for, they hope to bring computers within the range of everybody who'd like one. Commendable attitude.

They develop their own software, under the name Andromeda, providing everything from General Ledger to Recipe Storage to Dairy Herd Fertility Analysis. (Dairy herd fertility analysis?)

Random Access is at Twin Plaza, 21 Hindmarsh Square, Adelaide, 5000, Tel: (08) 223 2505; Ground Floor, 555 Collins St, Melbourne, 3000, Tel: (03) 62 1339; and on the corner of Pacific Highway and Berry St, Nth Sydney, Tel: (02) 920 337.

ASP AGAIN

ASP has a new PCB module which will allow you to increase the memory on your TRS-80 Model I without using an external interface. Easy to

PRINTOUT

instal, all you need to do is unplug the eight chips which make up the existing dynamic RAM, plug in the special pins on the bottom of the module which are designed to pick up the lines where the original stuff was taken out, and plug the eight chips back in. Four wires with solderless connections hold it in place, and you're off with 48k RAM on board.

Many people would already have an interface, but if you want to go walkabout with your machine this will save you carting it about as well. With disks on the expansion interface, the module can be turned off with a switch. Simple and only $152 with the new sales tax.

SPEED LIMIT

The idea of a microcomputer becoming a mini black hole is a thought-provoking one. According to Nicholas Rothwell, in *The Australian*, a finite limit has been placed on computer operating speeds before gravity creates serious problems.
Dr Jacob Bekenstein, co-discoverer of the black hole concept and recent author of a paper in *The Physical Review* where he explained all this, has proved that preservation of energy in technological improvement can only go so far. Using the theory of relativity as a backup, he has pointed out that as the speed of light is approached, relativistic effects start occurring. If computers are made smaller to make data flow faster, quantum mechanical effects begin to interface with computed results. Dr Bernstein's results suggest that too small a computer will 'implode' under its own gravitational effects to become a "mini black hole".

He has also calculated that the most efficient cooling system will not allow a computer to perform more than ten to the fifteenth operations per second. Any more than that and it may begin to melt.

COMPLIANT SYSTEM

The Law Society of NSW has examined a solicitor's package and issued with a certificate of compliance, meaning that it will enable records to be created and maintained in accordance with the Solicitors' Trust Account Regulations.

Developed by Diehl Data Systems, the computer system, called SOLAR, is based on the powerful 160 bit Alpha Micro with multi-user, multi-tasking facilities to provide a computerised office and trust accounting system. The program suite consists of word processing, trust, office and private ledgers, client, matter and finished matter registers, matter diary system and management reporting.

Contact Diehl Data Systems at 84 Edwin St, Croydon, NSW, 2132; Tel: (02) 799 3000.

The DG280 single board.

APPLIED INSTRUCTOR

At the heart of all Applied Technology's "package deal" systems is the DGZ80 single board S100/Z80 computer. The DGZ80 has 2k ROM and 2k RAM on-board, Zilog P10 and CTC, power-on-jump and is supported by a powerful monitor program, DGOS, in ROM.

The base system is the Super Instructor 80. It includes the microprocessor mentioned above, VDU and keyboard. The VDU is memory mapped, with a 64 character by 16 line format and has upper and lower case. Printer port and I/O facilities are available. 'Free' expansion means that the system is S100 based right from the start. It will set you back $399.

The basic system has been taken a step further with the addition of the 'Basic 80' pack. This includes Microworld Basic (12k) in ROM and 16k of RAM. The two boards are being sold together at an introductory price of $269, which is apparently $90 off their usual price.

Contact Applied Technology Pty Ltd on (02) 487 2711.

NOVELL PRINTER

The TCG Group has a new programmable dot matrix printer, the Novell Image 800, designed specifically for office use.

It features 30 programmable functions including six sizes of condensed and expanded print, variable line spacing, subscripting and superscripting, selection of two character sets and a programmable Vertical Format Unit.

Five operator control switches allow the operator to put the printer in an on-line or off-line mode, set the top of form, advance paper to the next top of form setting and all kinds of other wonderful paper-oriented things.

The operator can set the printer configuration desired and select the baud rate for communication.

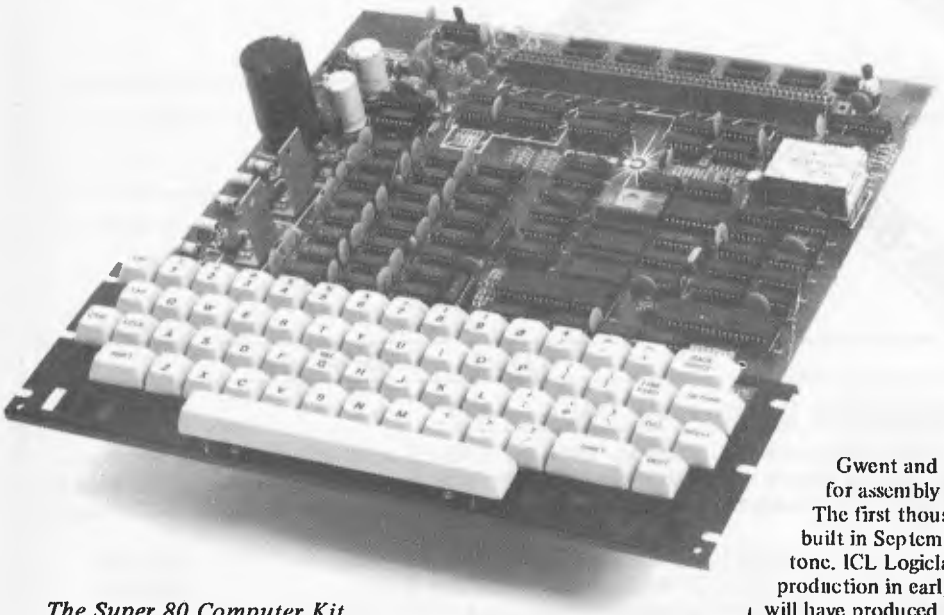
It prints 150 characters per second, bi-directional, with logic seeking intelligence. The printhead is designed for an average of 200,000,000 characters.

It costs less than $1,700 and is available from the TCG Group, 31-33 Hume St, Crows Nest, 2065; Tel: (02) 439 6477.

THIS IS A RECORDING

Computerland has returned to grace the streets of Melbourne with a showroom at 123 Lonsdale St, in the city. The franchisee is Peter Andrews, managing director of Integer Investments. Etc, etc, watch this space for next month's grand opening.

PRINTOUT



The Super 80 Computer Kit.

SUPER KIT

Dick Smith Electronics and "a popular electronics magazine" *(Electronics Australia* – we don't mind mentioning them) have designed the Super 80 Computer Kit. Although not recommended for the raw beginner, apparently, it's straight forward and easy to build and, unlike other kits, has a full-size 60-key keyboard.

It uses a Z80 processor and includes an inbuilt cassette interface and 16k of RAM on board, expandable to 48k. There's an inbuilt power supply and a direct RF output so it can be used with a domestic TV set. It's available for $289 from all DS stores, including the new Victorian shop at 260 Sydney Rd, Coburg.

DEALING DUET

NEC Information Systems Australia is a wholly owned subsidiary of the Nippon Electric Company (NEC), a Japanese computer and communications giant worth billions of dollars. NEC leads the Japanese market in small business and personal computers. They've been active in Australia for the last decade or so, with a telecommunications subsidiary in Victoria and other ventures.

Now they've signed a distributors contract with Hanimex, who will market their Astra range of desk top and small hard disk equipment. Hanimex lost its Commodore PET distributorship last year then a few months ago picked up Zilog Microcomputer Systems.

According to Brain Love of Hanimex, the NEC distributorship will give the corporation the opportunity of gaining a significant share of the rapidly expanding micro market.

The small business computer market, already well established has a growth rate of about 30%. At the moment there are only about 10,000 personal computer installations in Australia, and this largely untapped area has a projected growth rate of 50%. So its not surprising that Hanimex have continued to look for another product.

Brian Love sees the arrangement with NEC allowing Hanimex to exploit the resources they have already built up in the area. And NEC's Robin Firth is pleased that Hanimex will allow NEC to expand its "geographical coverage" very rapidly.

PROTON POWER

Consolidated Marketing have been backpedalling the Acorn Atom recently and warning prospective buyers that they may like to wait for the bigger, better, brighter and beautiful new offering from Acorn.

The Proton is designed and manufactured in the UK under licence from BBC Enterprises Ltd. The British broadcasting crowd contracted for a microcomputer to be part of its programme to teach computing.

Acorn, in turn, have awarded contracts to Cleartone Ltd of Gwent and ICL Kidsgrove for assembly of the units. The first thousand will be built in September by Cleartone. ICL Logiclayer will start production in early October and will have produced two thousand by the end of the month. In November, the combined output from both companies will be 5000.

The specs are impressive. The CPU is a 6502 running at 2 MHz. A second processor, 8 or 16 bit, is optionally available and, when it is attached, the 6502 devotes itself entirely to handling I/O and allows it to carry out very fast language processing. The largest option can be equivalent to a minicomputer and have up to 16Mb of RAM. The basic unit has 16k of dynamic RAM expandable on board to 32k. There are 32k of ROM expandable to 48k. The VDU is memory mapped, transparent access and available with eight formats.

There's an audio cassette interface, an RS232 (V24) serial port with nine selectable baud rates, parallel printer output to Centronics specifications, floppy disk controller for one or two disk drives, sound generator and loudspeaker, light pen input and it goes on and on.

It interfaces to Acorn Econet for local networking of up to 255 stations. The system is

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EXEL Ados command processor	$24.00

HAVE YOU HEARD?

The new COMMODORE VIC 20 will be released in Australia during October/November this year. The VIC connects to any television set or monitor, provides 5K bytes of memory and has the following features :–

DISPLAY:	22 characters by 23 lines, 64 ASCII characters and PET graphics.
COLOUR:	8 charcater colours, 8 border colours, 16 screen colours.
SOUND:	4 internal amplifiers including 3 tone (music) generators, and 1 sound (white noise and sound effects generator). Each amplifier has 3 octaves. The sound is available with the television or separate speaker.
MEMORY:	5K RAM – expandable to 32K RAM.
KEYBOARD:	Full typewriter keyboard with special screen editing and function keys.
GRAPHICS:	Full PET keystroke graphics.
LANGUAGE:	PET BASIC.
FUNCTION KEYS:	4 programmable function keys (8 separate functions).
EXPANSION PORT:	For 3K direct plug-in memory expansion and for program cartridges. To expand memory further a separate "motherboard" with slots for memory expansion and programmed cartridges will be available.
ACCESSORIES:	Will include a Single Disk Drive, Printer, Tape Cassette, Joystick, Paddles and Lightpen.
PROGRAMS:	Will be available on cassette and "VIC ROM Packs".

PLACE YOUR ORDER NOW TO SECURE YOUR VIC – THE PRICE APPROX. $400 – CAN YOU BEAT THAT?

ON SPECIAL

We still have a few of the "Special Offer" Commodore 4016 16Ks at the all low price of $999 including Sales Tax. As an added bonus, we are offering this machine COMPLETE WITH HIGH RESOLUTION GRAPHICS PACKAGE for $1500 including Sales Tax. The normal retail price for this configuration is $1964 – you save OVER $400. Hurry now, stocks are limited.

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Julian Barson, at Consolidated is quietly confident that this machine is going to be very, very successful.

ECLETIC FRUIT

Abacus is distributing the Orange micro in Australia. And a very interesting product it is. The processor is a 6502. RAM is 49k, the extra k being for the PAL D encoder which is included and not an add-on. With an RF modulator, the Orange plugs straight into a colour TV.

It will run all Apple Inc. software and peripherals without special interfacing.

It's available in board, kit or unit form. The first costs $275 plus sales tax, the second $800, and the unit $995. Call Theo Sapountzis at Abacus, 512 Bridge Rd, Richmond, Vic, 3121; Tel: (03) 429 4780.

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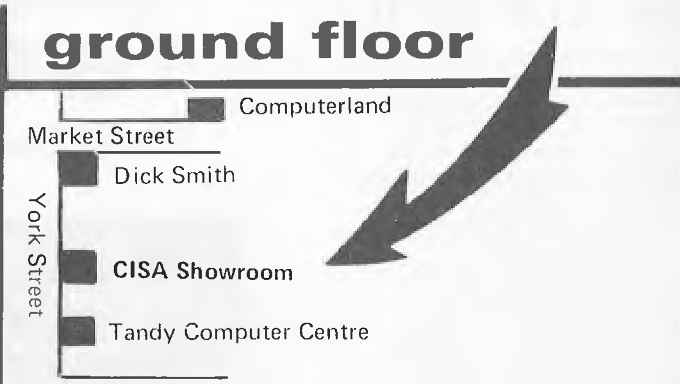

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Business Computer

THE HP-85 REVISITED

Ian Davies takes another look at the HP-85

Small businesses, as well as large companies, have a need for data processing. Before microprocessors, the small business either had to buy time from timesharing bureaus or make do with the inaccuracies and delays of manual systems. Business management technology has reached a point where manual systems are becoming impractical since the success or failure of an enterprise can easily depend on how soon accurate and well-presented information is available – this being the "edge" that many competitors are looking for. It is now feasible for small businesses to possess their own data processing hardware, usually in the form of a hobbyist home computer with a few business software packages. Small businesses, however, have a habit of changing and expanding, and as they change their information needs change with them. It is at this point the owner of an enthusiast's machine will find himself in a bind. Often these home computers lack both software and hardware support for business applications and support should be one of your main criteria in selecting a data-processing system.

HP-85A Personal Computer

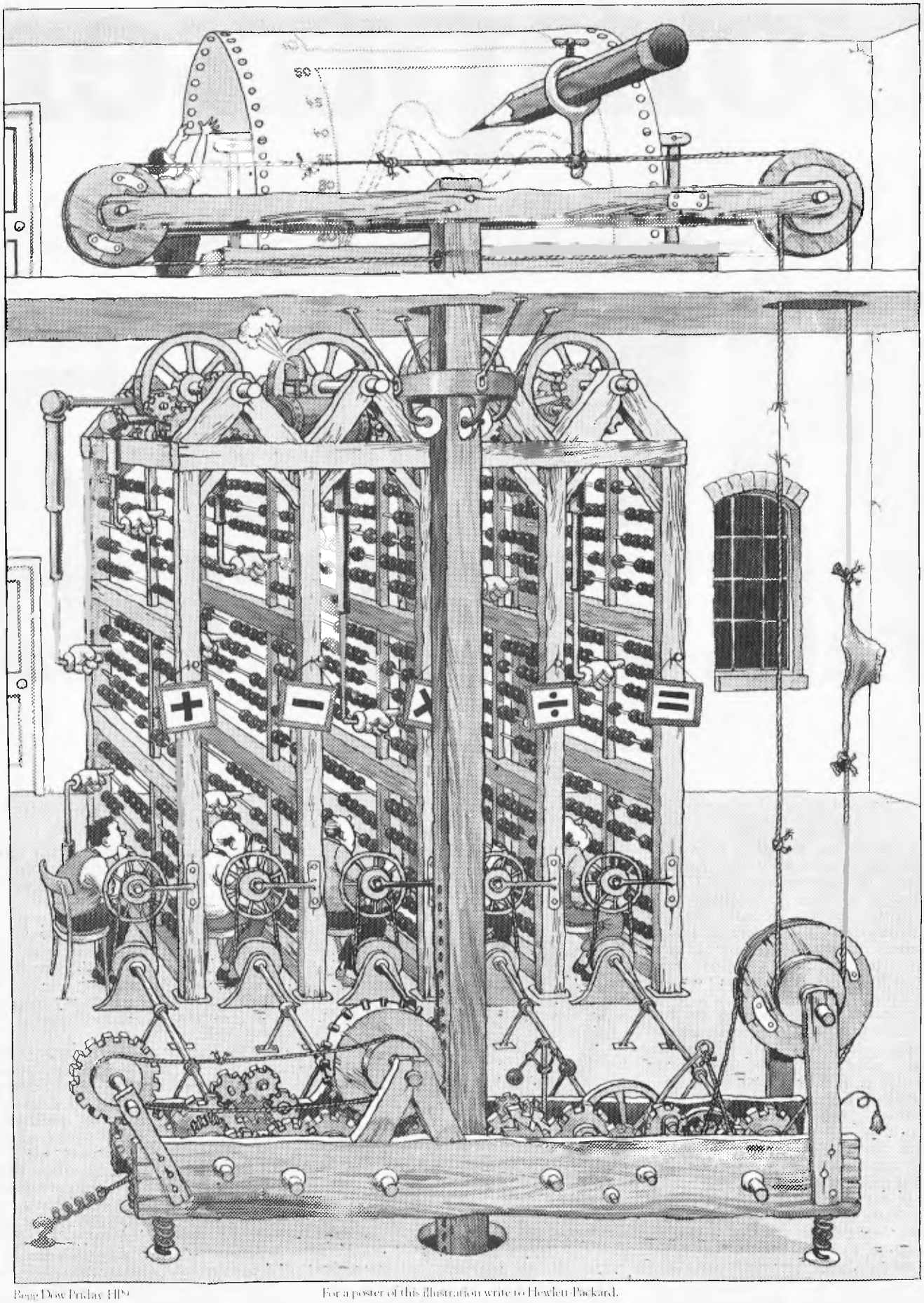
A powerful Basic language computer complete with built-in keyboard, CRT display, printer, tape unit, and graphics system.

There are many excellent machines on the market and the HP-85 is one of them. The distinguishing feature of the HP-85, however, is the support and back-up provided by Hewlett Packard – something which was largely lacking on the micro scene until people with HP's experience and expertise in the established areas of computing decided to diversify into the new technology of micros.

APC first reviewed the HP series 80 in August 1980, and the reader is referred to this article, but since then there have been many additions to the HP line. Before embarking on this new area I will first jump onto my soap-box and give you my impressions of the HP-85 unit.

I am a great believer in really getting to know a machine before casting opinions about it. Courtesy of Hewlett Packard, I had an HP-85 for about 2 weeks and feel adequately qualified to pass judgement. By the end of this time, I was very impressed with the HP series 80 basic configuration and a subsequent demo of the peripherals available for this ravenous beast served to re-affirm my convictions. It is a common practice for micro computer designers to skimp on hardware in an attempt to cut costs – often taking this concept to an extreme with adverse results. One would not expect Hewlett Packard to fall into this trap but, surprisingly, neither did they go to the

A device for the accurate prediction of business trends.



Peugeot Dow Pridaux HP9

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Illustrated, the HP Series 80 system with integrated graphics, high speed flexible disc memory and business management software.

HEWLETT PACKARD Computers at work.

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THE HP-85 REVISITED

other extreme. HP has achieved a superb balance of software, firmware and hardware which is so often lacking in micros and which I believe to be the greatest single factor affecting the versatility and success of any serious micro computer.

HP-83A Personal Computer

Identical to the HP-85, but without the built-in printer and tape unit.

The HP-85/83 series comes with a 32k ROM as standard, explaining the unusual degree of intelligence and sensibility found in its O/S and its Basic. Its general feeling is one of being a professional's machine. Below are listed some of its features which I feel warrant praise.

- Easy to use high resolution graphics
- Extensive character set
- Good screen editing
- Four independant display screens
- Large range of arithmetic functions
- "Intelligent" management of mass storage
- High accuracy
- Automatic removal of redundant brackets in arithmetic expressions (and other sneakies)
- Easy to use program function keys
- Good sound generator
- Extensive programmer debug aids such as selective tracing
- Comprehensive self-test on power-up
- Facility to send all CRT output to the printer/plotter and vice-versa
- Indexed variable access mechanism which provides equal access speed to all variables
- Real time calendar, clocks and timers
- Sensible and efficient string management

A criticism often levelled at this machine is its small screen size, but this can be justified in two ways. The first is one of convenience. The HP-85 provides in one typewriter size package a keyboard, screen display, mass storage, printer and plotter which can easily be moved and need only be plugged in to become fully operational.

The second justification is one of practicality. When you think about it, nothing terribly vital takes place on a screen display except for the necessary interactions with the user. All important output takes place on hard copy devices. And as we are about to see, the Series 80 is second to none in its hard-copy peripherals.

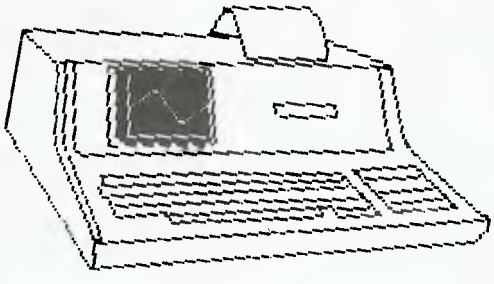
New products

Since our review of the HP-85, Hewlett Packard have been busy developing a wide range of integrated software and hardware packages for their machine. They have also released the HP-83, which is identical to the 85 with the exception that the mainframe does not include the cartridge mass storage system or the thermal printer/plotter. The idea is that the 83 can be used by people who will also be purchasing the peripheral storage and hardcopy devices but who are trying to keep their costs to a minimum. The HP-83 costs about 30% less than the 85. HP suggests that, where possible, the 85 should be selected as the mainframe even when it is to be used with the peripherals as this provides the option of "going mobile" with the self contained unit, rather than carrying around the peripherals as well. This seems like a pretty reasonable idea, but it is nice that they should also provide the HP-83 for those customers who would otherwise baulk at the slightest hint of redundancy by duplication.

Both the HP-85 and the 83 provide a bank of four neat interface sockets on the rear of the unit to add extra memory, ROM or peripherals. The maximum RAM is limited to 32k, but the provision of program chaining and common core for inter-program communication means that 32k is quite sufficient, especially when one considers the power of the Basic statements available. Also, I think you will find that you get more program into 32k than on other machines as the series 80 reduces Basic source to a larger degree.

Hardware

Extra mass storage is provided by a range of expandable 5¼" and 8" floppy disk drives. The units come in both one and two drive per package configurations, allowing up to four drives of either disk size. The master drive automatically tests itself and all its slaves when powered up. The disk units are double head and double density. The 5¼" system offers 270k for one drive up to 1,080k bytes for the maximum of four drives. The 8" system provides sufficient storage for most applications, ranging from 1,180k in one drive up to 4,720k bytes in four drives. One small point I noticed which I think sums up the whole series 80 design philosophy is that the mainframe knows whether or not a disk is mounted in the drive. It doesn't rush off and try to access a non-existant surface as I have seen many other small systems try to do. Six possible configurations are available to suit your storage needs in both disk sizes and can be easily expanded to keep up with changing needs.



The HP-85 as it sees itself.

Hard copy output peripherals are supplied in two parts, the first being the HP2632B printer. This is a professional grade high speed (180 cps) bidirectional dot matrix printer with lower case descenders and eight print modes. It can produce up to 132 characters per line with selectable vertical line spacing on up to 6 part stationery of widths from 3.1 cm to 40 cm. It has tractor feed, programmable left and right margins, programmable page and text length, automatic perforation skip and, of course, a self-test feature. The printer integrates smoothly with the rest of the series 80 system thus providing a facility for industry standard report formats and forms printing.

The second piece of output hardware available is the HP7225 graphics printer. This unit operates in conjunction with the plotter/printer ROM pack (discussed later) and provides a means of reducing large amounts of data to a managable form for recognising trends and cycles. Multi colour plotting is possible although, unfortunately, this plotter cannot change its own pens – you must do that for it. The 7225 is a "bed" type plotter capable of handling A4 size paper. Plot resolution is 0.032 mm with a maximum pen speed of 35 cm/sec. HP developed a special device level graphics communication system called HP-GL (Hewlett Packard Graphics language) which runs through the standard HP-IB interface, meaning that all HP plotters are plug compatible. While out at HP, I had the pleasure of seeing a little HP-85 running a huge $16,000 drum plotter and suffering no trauma from the experience. I suppose that's what HP means when they talk about compatibility. Incidentally, the plotter can also be used for producing overhead projector transparencies.

For graphics input there is a HP9111A graphics tablet, fully compatible with the series 80 mainframes and the series 80 peripherals. The tablet has 16 definable soft keys, audio feedback and a self-test. Exactly how much software is available for the tablet is unclear, but I imagine most applications would be specialized anyway.

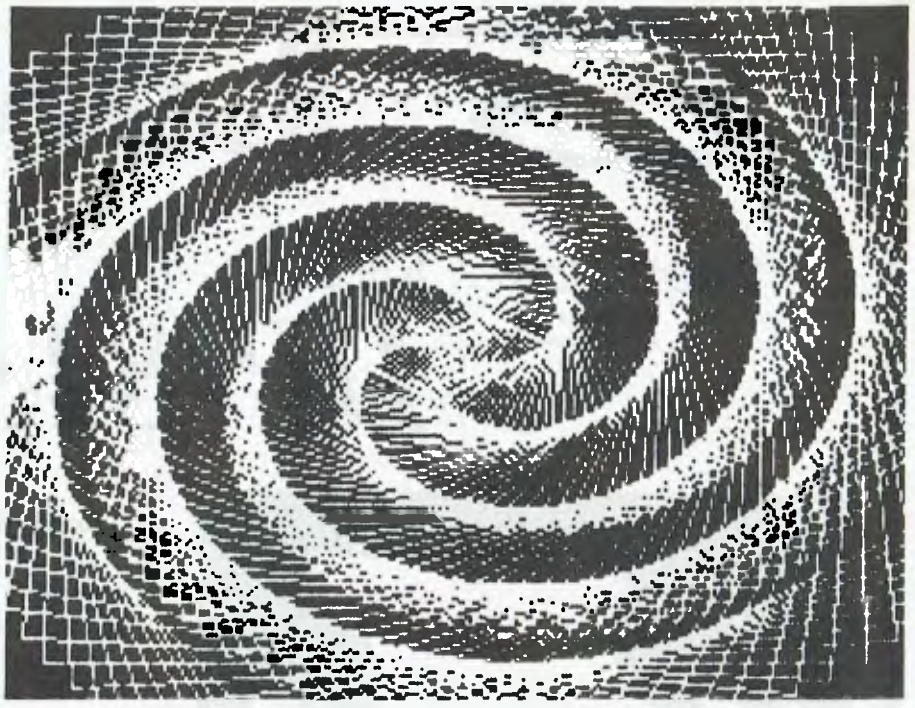
Firmware

A new range of plug-in ROM packs is a new development allowing the series 80 machines to increase their capabilities by adding new statements and allowing them to communicate with peripherals. Up to six ROM packs may be plugged into one ROM drawer, providing a total of more than 112k bytes of firmware. These enhancements are application oriented, and include the following.

ADVANCED PROGRAMMING ROM

This pack provides extra commands, statements and functions to the already full Basic repertoire. It fills a few of the

THE HP-85 REVISITED



Fancy plotting made easy.

"holes" which, strangely enough, are present in the standard language such as string arrays and cursor positioning. It also provides powerful facilities such as cross referencing program variables and statements, program merging and 64 program flags.

MATRIX ROM

Provides more than 40 matrix operations and vector operations, some of which are found on other machines.

I/O ROM

The I/O pack adds over 40 statements and functions for users who need to perform direct device I/O for applications such as process control. Device drivers are included in the package which can perform character conversions. String arrays can be declared as I/O buffers for flexibility. High level constructs are provided for interrupt handling, device timeouts, handshaking and many more, meaning that machine code programming is not necessary for this sort of activity.

MASS STORAGE ROM

This ROM is necessary when using floppy disk mass storage systems providing the disk I/O primitives and 30 commands with which to use them. Normal disk operations are provided, although they appear to be more elegant than on most machines.

PLOTTER/PRINTER ROM

This package is required when interfacing to either the external printer or the external plotter. Access to both these peripherals are provided by about 50 additional facilities such as absolute or relative plotting, line types, automatic axes-labelling, automatic scaling and two clipping modes.

ASSEMBLER ROM

Complete with this ROM pack is all necessary documentation to write your own assembler programs for the series 80 CPU. Additionally, entry points into the standard 32k ROM are specified to allow access to system I/O routines, controllers and arithmetic routines. The assembler pack also describes how to customise your own Basic statements and functions or redefine existing ones. HP can supply a programmable ROM drawer for those who wish to create their own firmware in 2732 or 2764 EPROMS.

The HP 7225A plotter.

Software

Hewlett Packard supplies a large range of applications software available on both cartridge and disk. Additionally there is an HP series 80 software library group in the USA.

All of the HP software is delivered with extensive documentation in the form of a weighty manual designed for the uninitiated. Their packaged software starts at the lowest level with the Basic Training Pack, in which the computer and the manual join forces to teach you how to use the machine and how to program in Basic. The educational material is generally excellent and highly user-friendly. It passed the ultimate test by educating one of my computer-ignornat friends in an admirable fashion. The training pack includes:

- 51 example programs
- 13 tutorial programs
- 67 programming problems
- 110 program listings
- 54 flowcharts

all of which are presented clearly in a step by step fashion using the computer itself to the fullest advantage.

Other software packs include:

INFORMATION MANAGEMENT

A flexible package for data file management and presentation, including a query system, mail label program, sorting capabilities, statistics and a report writer.

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A suite of eight programs concerning loans, cash flow, amortization, depreciation and interest analysis.

LINEAR PROGRAMMING

This package provides for data input, data output and solution output using the modified simplex method.

STAR

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	40, 48 and 66 (in case of enlarged character)
Charcater Size :	2.57mm X 2.0mm (in case of 80 column/line)
Charcater Density :	5 Characters per inch (cpi) for 40 column, 10 cpi for 80 column, 12 cpi for 96 column and 16.7 cpi for 132 column
Line Spacing :	1/6", 1/8" and 1/12"
Printing Speed :	80 characters per second
Paper Advance Speed :	1.25" per second
Number of Copies :	2 (original plus 2 copies in case of N-30)
Paper Width :	8-10 inches in case of friction paper
	3-10 inches in case of sprocket paper (Tractor feed type)
Inked Ribbon :	1/2" (13mm) wide, 11.5 yards (10.5m) long on standard underwood type spools, matrix inking
Dimensions :	387mm(W) X 309mm(D) X 124mm(H)
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Power Consumption :	60 watts maximum during operation
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THE
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MATH

The mathematics package contains programs to perform Fourier transforms, integrations, differential equations, Chebyshev pdynomials and many other equally un-pronounceable functions.

Other software packs include Text editing, General statistics, Regression analysis, AC circuit analysis, Waveform analysis, Surveying.

The package HP seem most excited about is "VISICALC PLUS". The HP visicalc is based on the many other visicalcs floating around at the moment (in fact, it is written by the same people), but it includes a few enhancements. Visicalc — any visicalc — would have to be the most versatile and productive business or planning tool available to the non-computer professional for a minimum of effort.

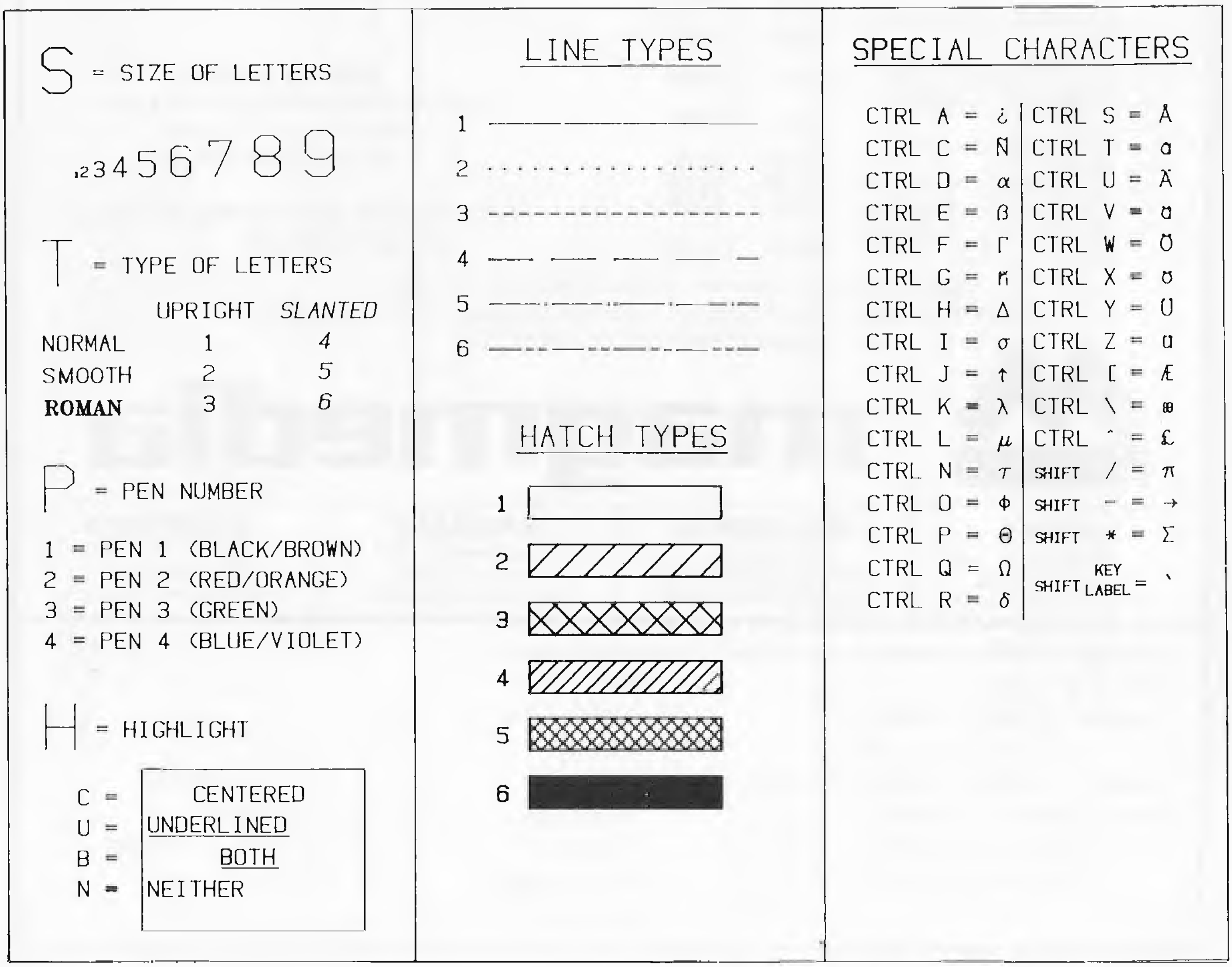
The main advantage of the HP visicalc is its integration to their total system by providing a series of programs which use the visicalc data files to produce pictorial output in the form of graphs, bar charts and pie charts. Also included is a line fitting program which may employ one of four regressions to provide automated forecasting. The HP visicalc, incidentally, will run on their cartridge based system as well as disks.

Conclusion

Hewlett Packard have succeeded in producing a totally integrated system with the flexibility, support and expandability most microcomputer buyers are looking for. The most outstanding feature is that they have also succeeded in two very difficult trade-offs: the correct mix of hardware, software and firmware making up their system and the difficult task of providing equal capability as a peripheral oriented mainframe and also a self-contained portable microcomputer, without compromising in either.

The ROM drawer.

Interchangeable modules for the HP 7225A plotter



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Bill Anderson

On the eighth anniversary of Anderson Digital Electronics, Bill Anderson spoke to Miriam Cosic about himself and his company.

Bill Anderson admits that his first business venture was a failure. A joint venture in growing mushrooms proved disastrous. He was fourteen. So he continued in the mushroom business alone and by his late teens had bought a block of land on which he subsequently built his first house.

Born in Sydney and educated at North Sydney Technical School, Bill's first job was with the railways. He kept up his mushroom business, did a bit of electrical contracting on the side and studied Electronic Engineering part-time at the NSW Institute of Technology.

In the late fifties it was apparent that computers would be the line to steer his studies towards and this Bill did. After the railways, he did a stint with AWV, the semi-conductor division of AWA, where he designed and built test equipment. He was then offered a job with Electronics Associates Inc. The job involved hybrid computers and Bill was sent to U.S., to the parent company in New Jersey, for extra training. At EAI, he was a field service engineer, then field service manager, then project manager.

In 1967, his years of study behind him, he moved to Melbourne to set up an electronics division for D.C. Industries. He subsequently added computers to the company's products and within a year it was a lucrative part of their operation. When Bill left, the computer division was 70% of the business, making several million dollars a year.

With the move to Melbourne came a new attitude to life. He was already married and had two small children. At twenty-seven, he had just finished studying part-time and had kept up his sideline business with his full-time job. Now he decided that working was for work and his private time was for family and its a philosophy he's stuck to ever since.

In 1973, Anderson Digital Equipment opened in Mt Waverley. Bill and his wife, Maureen, were it. As Bill put it, "I was the engineer, salesman and delivery boy." Nonetheless, by the end of the year the company had a turnover of $250,000. Since then it has had an average growth rate of 50%, and last year the turnover had climbed to $14.5 million. There are now 60 employees.

Bill's personal ambition is to see ADE become a truly international company, with branches throughout the world, including the U.S. and Europe. Within four years of starting up, ADE had branches in all the states and, a first for any computer company, had opened in country centres — Albury/Wodonga and Newcastle. Now ADE also has branches in Barnarwartha, Lae in Papua New Guinea, and Auckland, Wellington and Christchurch in N.Z. Plans are well under way to expand into South East Asia. At the beginning of October, ADE will open in Singapore with the current South Australian manager at the helm. A Hong Kong office is projected in roughly six months time.

Part of Anderson's success would have to be attributed to Bill's organizational ideas. It was interesting to note that whenever he talked of decision making he always spoke of "we" not "I". He doesn't believe in democracy in business. As he says, it's his company and he has the final word. But he does believe in delegating responsibility. There are seven senior people, including Bill himself, forming a management committee, and they generally make their own decisions. It's only when a consensus can't be reached among these seven that he steps in with his veto.

The new offices in Clayton are a few miles away from the Victorian branch and this was by design. The Victorian branch is a separate entity to head office and the move, Bill considers, will stop the management feeling that he's breathing down their necks. There was also the worry that other branches might feel that Victoria had preferential treatment.

Each branch, interstate and overseas, has autonomy. The head of each organization is answerable to Bill but, for instance, the accounts departments do not come under head office's accounts department.

Head office provides the central support for engineering departments. Each sales office has engineering facilities attached. Head office gets all the "too hard" baskets and controls the sharing of spares. Millions of dollars worth of spares circulate and the regional offices can't afford this sort of outlay. So the Clayton office acts as a central depot.

There is an open-door management policy and Bill makes himself available to all members of staff, whatever their seniority. Bill Johnston, ADE's publicity manager, told me he's the kind of man the tea lady can go to about the wheel sticking on her trolley. And, indeed, I saw evidence of this walking through the office. Two people stopped him with problems and he stopped by the receptionist's desk to enquire after the arm she was holding in a sling. Her reply showed he wasn't a remote "boss". Maureen Anderson is social secretary for the company and she and Bill believe in developing social activities for the company. They like to see it as a family organisation where everyone gets on well. Friday nights, Bill stops work at five and there are drinks in the office for all the staff. He hopes this relaxed atmosphere makes management more approachable, and provides a definite end to the working week.

Bill himself works a twelve-hour day, Monday through Thursday. On Fridays he stops work with the rest of the staff and has a drink. From then till Monday morning, work is banned — he never works on weekends. They are for his wife and three children — two boys aged nineteen and seventeen, and his twelve-year-old daughter. He's an avid Richmond supporter, and the family often spend weekends at their house-boat in Eildon. He's interested in home renovation and built most of the ground floor section of their Ferntree Gully house.

When I asked what makes a good businessman he replied, "People who succeed entrepreneurally must like their work and

be willing to work sixty hours a week. They must have a desire to see the thing nurtured grow to maturity."

Bill has managed the pressures of business success and family life by dividing them definitely into separate parts of the week.

Another factor which was very important for the success of the company was growing with Teleray as the primary product. He called it the right product for the right time. He retains a special interest in tertiary institutions because his first major deals were putting Telerays into the computer departments of Caulfield, RMIT, Monash and other colleges and universities. The point with Telerays, he says, is that they are very good, reliable and cost $1,500 instead of $3,000

Bill also discussed the problems of growth. A business has to find the middle ground between profit and growth. Over-extension can cut the profit margin below viable levels. Yet, if the market is growing at, say 40% per annum, you have to exceed that 40% basis or someone else is getting your business.

One of the problems with growth is that a company can become insular and very mechanical about things. Bill worries that ADE's success may have removed the company from the suppliers and customers, losing the reality of them as a real people. Consequently and in conjunction with the Caulfield Institute of Technology, ADE is now surveying clients in regard to sales, engineering and administrative matters with a view to gearing up support.

The decision to move into micros with the North Star included software for the first time. The people who buy mainframe computers are professional users who can solve their own problems. People buying micros are not trained computer people, so Bill felt that ADE had to offer solutions. "We have a long term interest in the micro market," Bill said, "we're not just flogging *el cheapo* hardware." Micro dealers are often just in a shop and don't understand the specific application, for instance accounts, of the buyer.

ADE runs seminars on the North Star for dealers, salesmen and users. They also hold seminars on computers in general and encourage people to learn how to ask questions about computers.

Bill gets annoyed with the knockers who say there is no Australian Computer industry, with "the people who think if we're not making boards, there is no industry." There are the salient successes like Webster Electronics and many local companies are producing software and exporting it. ADE, itself an international concern, is selling Australian-made products — Webster's Electro-Med acoustic couplers and North Star software.

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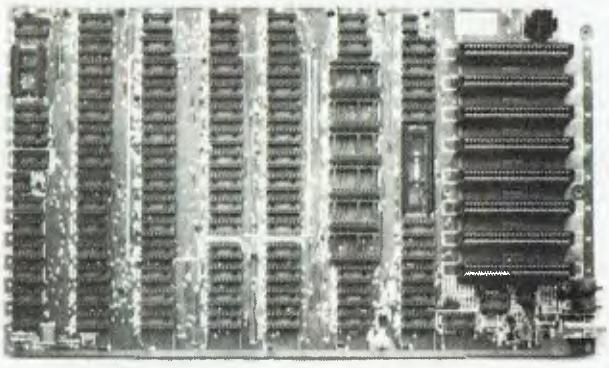

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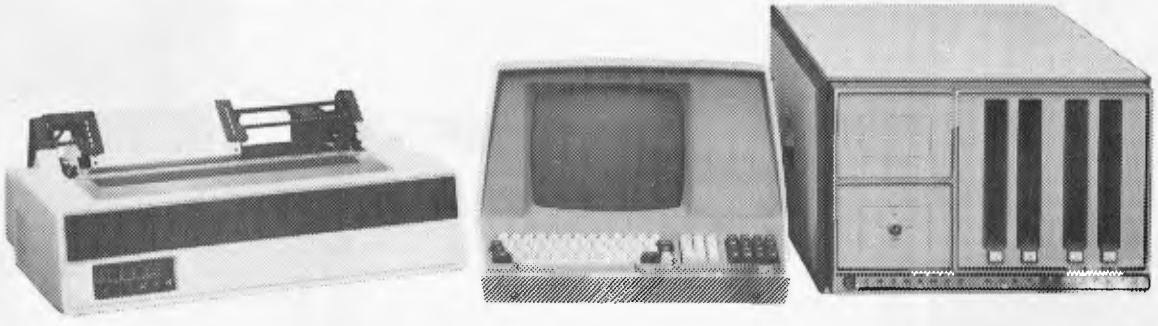

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FACING THE FUTURE

Barry Jones, MHR for Lalor in Victoria and Shadow Minister for Science and Technology in the Federal Government, is well known for his constructive and outspoken criticism of government policy and his concern for the interests of ordinary Australians.

In April of this year he criticized the media for preoccupation with short-run issues, and journalists for turning "positively grey with boredom about the issues behind science and technology although they often exhibit a "gee whiz" enthusiasm about technologic artefacts themselves".

Taking up this gauntlet, APC reprints part of a speech "Australia – Ill-prepared for Technological Change", delivered by Mr Jones to the National Forum in Canberra.

"Australia, the poor little rich country, has fallen almost to the bottom of the list of technologically advanced nations in expenditure on research and development with a mere 0.9% of Budget outlays.

However, not only is the government shirking its responsibility on Research and Development, but Australian industry (both domestic and multi-national) is quite prepared to sit back and import technology and designs from overseas. G.M.H. sees no real need to carry out extensive R&D in Australia when it is able to draw on German or Japanese design and technology which can be applied to Australia.

It is generally accepted that the development phase of any innovation requires 5 – 10 times the initial research cost. Clearly, Australian inventions are not being developed in Australia. Can it be said that $1,000 million is available for development in Australia to apply the results of the $157 million expended by CSIRO in 1977-78?

The ease of penetration by corporate interest into Australia has led to Australia being swamped by imported products and technologies. This has contributed to a sense of complacency and/or pessimism. "Why invent the wheel? If it is any good, the Americans will sell it to us."

Australia spends nearly $14 on imported computer equipment for every $1 spent on local manufacture, the most unbalanced proportion of any advanced country. The ratio of spending on imported vs locally produced computer equipment is as follows:

Australia	13.6:1
Spain	5.9:1
U.S.S.R.	2.7:1
Brazil	2.1:1
Belgium/Canada/Switzerland	1.8:1
France	1.5:1
Netherlands	1.3:1
Italy	1.2:1
U.K.	1.0:1

The parasitic mode of Australian industry (i.e. their dependence on foreign technology) removes more control of Australia's future from Australia's hands than the foreign control of companies, repatriation of profits and foreign ownership of resources does.

American economic history has been strongly, even passionately, shaped by entrepreneurial spirit – a quality conspicuously lacking in Australia's economic history in the 20th Century. In the U.S. of the "Fortune 500" companies, that is, the 500 companies with the highest turnover – about 250 did not exist in 1950. In the U.S., as new technologies have developed, new firms have "hived off" from already existing corporations or universities – and often they have further subdivided into another generation of new firms. Most innovation and employment generation has come from small, new firms.

In Australia, we have a completely different tradition. We tend not to develop our own technology, preferring to buy it off the shelf overseas. Where new industries are based on technological forms, they tend to be owned by already existing companies or taken over by them. This is the exact reverse of the U.S. hiving off process. R. W. Connell has calculated that of Australia's top 50 companies, only 4 have been established since 1936. None of these four are Australian-owned and all are based on some corporate structure which had an Australian presence long before 1936. Collectively, we are not a nation of entrepreneurs, we are a

Photograph courtesy of "The Age".

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Sir Rod Carnegie has argued that contrary to the popular stereotype, Australians are not gamblers, that "they bet only after the horse has passed the finishing post". It is extraordinarily difficult to raise risk capital for new ventures in this country. Australians prefer to lend money on debentures to finance operations of multinational corporations rather than seeking equity participation with its attendant risks. Government support is available to foreign corporations but not to local companies. Banks take the view that if they can make large profits with minimal risk in property investments and mortgages, why enter areas with a high failure rate like scientific R&D?

The fact that Solahart, an innovative solar energy equiment manufacturer, could not raise local capital and was obliged to sell half its interest to Shell is a striking example. Even more recent has been the National Semiconductor Corporation project for a silicon wafer plant in Canberra where the Fraser Government has offered $19 million in assets as an inducement and invited the corporation to carry out its own feasibility study – an interesting precedent which, we hope, will be more honoured in the breach than the observance in future. On the other hand, the Hartley Computer Company of Brisbane, just about to launch its 3900 mainframe computer, has faced extraordinary difficulty in raising capital – bank and government entities have shown little interest, until a small loan from a merchant bank was guaranteed by the Queensland Government. Canberra's technological innovators in computers have also had thin pickings financially.

It is unlikely that we will venture far into Biotechnology unless and until governments take the initiative to generate risk capital and enter into joint ventures.

We face an extraordinarily ambiguous future.

Technology can be used to promote greater economic equity, more freedom of choice, and participatory democracy. Conversely, it can be used to intensify the worst aspects of a competitive society, to widen the gap between rich and poor, to make democratic goals irrelevant, and institute a technocracy.

We must evolve policies in response to the current era of rapid technological change. However, first we must attempt to understand what is going on.

There is nothing inherently alarming about much of the new technology itself (although Artificial Intelligence and Cyberveillance appear to be exceptions).

However, there is much to worry about in human responses to technology (or, even worse, failure to respond at all). Worst of all is a fatalistic, passive acceptance that technological determinism is inevitable, and that nothing can be done to moderate or monitor the social impact of technology.

Will technology be in the hands of business? Government? Community groups? Will political decisions be taken, or will they be resolved by "natural selection" without any political debate?

Australia's tendency to follow historic trends "automatically" – that is, literally, like automata – is a major cause for anxiety. But who among our major political leaders takes the faintest interest in matters described above?

Will Australia have the intelligence, energy or guts to impose democratic and pluralist forms on the new technology, or will its ambiguities all be resolved in favour of the rich, the powerful and the *status quo?*

Our timorous social history, the feeble grasp of complex matters exhibited by too many of our leaders, the low level of intellectual vitality, a lack of national self-confidence, our national tendency towards bureaucracy, conformity, obedience and fatalism, the mediocrity of the business and academic establishment do not give us much ground for optimism. ”

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by Bob Pascoe, Lecturer in Computer Science at the Royal Melbourne Institute of Technology.

I am prompted to write again about software and its costs. Partly because of a court case I attended, partly because of some events around RMIT. During the last week I appeared in court in the capacity of what the legal profession euphemistically refers to as an "expert witness." I found it extraordinarily interesting to watch the interaction between that bastion of professions, represented by the court, and the world's "newest profession", represented by a colleague and myself.

Everyone knows that there is a significant problem with software and its relation to the law. Numerous difficulties arise, principally related to the intangibility of it (you can't kick it.) A piece of software cannot apparently be patented, since it is not a "process." And while it may be copyrighted (as for music and other works of art), does this copyright extend to the object program, which is so dissimilar to the source?

Fortunately, the action I was involved in did not touch on these sensitive issues. While there was still a communications gap between us and the court, a great deal of tolerance was exercised on both sides, and the case proceeded satisfactorily. I believe that the number of "programmer before the law" cases will increase greatly in the future. Overseas, joint computer science/law courses are rapidly gaining popularity in universities, and this area of law could be very lucrative in the future.

The reason for this brings us to the main point which I want to make. A large number of people get their fingers "burned" by software, and it is usually their own fault.

Hobbyists would be amazed at the high costs which the professional side of the industry attaches to software products. Projects which hobbyists might think they can undertake in a few evenings of spare time, and for which they might think a charge of a couple of hundred dollars would give a nice profit, would not be touched by the industry at ten or twenty times the price!

There are two reasons for this disparity. The hobbyist, naturally, does not cost his time and so regards *any* income as a profit. And the hobbyist is usually not aware of the incredible difference between coding a program for his own use (complete with "bugs" everywhere), and distributing a reliable package.

As an example let us say a hobbyist sells the distribution rights of a small games package he has written for himself to distribution company X for $200. A handy bit of money to buy that extra memory board. Yet after our friend has written a manual on the game, changed "a few" of the statements so they will run on other versions of Basic, and responded to the inevitable " a couple of bugs have been reported; would you mind fixing them?" request, the project starts to go sour. It's great for his ego, to have his program distributed, but by this stage his hourly rate on time invested is about 50c/hour — not much to live on for a professional. And the distributed program is still not up to industry standards.

There are many, many entrepreneurs around who see software, with its apparent low investment, and the possibility of "slave" labour, as a licence to print money. They — or their customers — suffer.

I am angry about the naivety of people who, having written a hundred line Basic program, take up a contract for a large software system in the honest belief that they can finish it. Such undertakings abound and are destined for failure. The attitude is particularly true of electronics engineers, who seem to assume that, because they understand well the electronics, they can understand and successfully complete any software project which can run on such electronics.

In contrast, I have *designed* and built a reasonably sophisticated stereo amplifier (which is currently almost working!) But when that is finished, I don't intend to go out and tender for government contracts to design and supply electronics for missile launching systems. The fact that, in the previous case, such instant expertise is assumed shows an extreme arrogance. The fact that such "expertise" is sometimes accepted shows extreme naivety on the part of the employer.

Students doing Computer Science/EDP (at RMIT or elsewhere) will probably have written a program with 100 + lines in the first ten weeks of their course. When they go out into industry, three or four years later, do we assume they have learnt nothing else?

Large programs are the most complex objects man is capable of creating. It is dangerous and stupid to believe that anyone who has sat near a terminal can cope with them.

At the moment I am practicing my French for the next time an *instant expert* comes to me and says "Look — I've created this wonderful program but it doesn't work — can you help me out?" The answer will still be fairly brief, expressive, and will say — more or less — "no."

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PRINTER CONTROL

Jeff Richards has devised this small routine to improve interfacing to the simpler printers. It can be inserted in a CP/M BIOS to handle form feeding; so it's suitable for any machine running under CP/M.

Form feed control in software

Many cheaper serial printers now available, especially those appearing on the second-hand market, lack the ability to feed the paper to the next top-of-form. The system alteration detailed here implements a top-of-form control in the system printer handler. Anyone who has access to the peripheral drivers (e.g. CP/M users) can include this routine in front of the existing printer handling. Note that it is written so that it assumes that the printer is at top-of-form when the system is loaded, so usually no initialization should be necessary. The handler works by counting the number of line feeds sent to the printer, and when the line count gets within a nominated range of the paper length a number of line feeds are sent to skip the paper over the perforation. In the listing the page length is set at 66 (11") and the BOF-TOF skip is set at 8 lines, so positioning the paper four lines down from the top of the page will give a four line margin at the top and bottom of each page.

To initialize the top-of-form position at any time it is only necessary to send a single form feed character to the printer, and a simple utility to do this in a CP/M environment has been included. If the program is SAVEd as FF.COM then in order to set the printer up at top-of-form it is only necessary to type FF and hit return, and then manually move the paper to the desired position.

1

```
                ;
                ; PRINT CHARACTERS ON LIST  DEVICE AND COUNT LINES,
                ; INSERTING FORMS FEEDS AS NEEDED.
                ;
                ;


000C =          FF      EQU     12D     ;FORM FEED CHARACTER
000A =          LF      EQU     10D     ;LINE   "     "
000D =          CR      EQU     13D     ;CARRIAGE RETURN
0042 =          PAGE    EQU     66D     ;PAGE LENGTH (11")
0008 =          BOF     EQU     8D      ;BOF-TOF SKIP LENGTH
0000            CHAR    DS      1       ;TEMP STORE FOR CHARACTER
0001 42         LCOUNT  DB      66      ;LINE COUNT STORE (AND
                                        ;   INITIALIZE AT LINE 0)

                ;
                ;
0002 79         LIST:   MOV     A,C     ;GET CHAR
0003 FE0C               CPI     FF      ;FORM FEED ?
0005 CA1E00             JZ      NLF     ;YES - PRINT LF'S
0008 320000             STA     CHAR    ;SAVE IT
000B CD3900             CALL    LIST1   ;PRINT IT
000E 3A0000             LDA     CHAR    ;RETRIEVE IT
0011 FE0A               CPI     LF      ;LINE FEED ?
0013 C0                 RNZ             ;NO - RETURN
0014 3A0100             LDA     LCOUNT  ;GET LINE COUNT
0017 3D                 DCR     A       ;SUBTRACT 1
0018 320100             STA     LCOUNT  ;PUT IT BACK
001B FE08               CPI     BOF     ;BOTTOM MARGIN ?
001D C0                 RNZ             ;NO - RETURN
001E 3A0100     NLF:    LDA     LCOUNT  ;GET LINE COUNT
0021 FE00               CPI     00H     ;FINISHED ?
0023 CA3200             JZ      ENLF    ;YES - NO MORE LF'S
0026 3D                 DCR     A       ;NO - SUBTRACT 1
0027 320100             STA     LCOUNT  ;AND SAVE IT
002A 0E0A               MVI     C,LF    ;GET LINE FEED CHAR
002C CD3900             CALL    LIST1   ;AND PRINT IT
002F C31E00             JMP     NLF     ;GO BACK FOR MORE
0032 3E42       ENLF:   MVI     A,PAGE  ;GET PAGE LENGTH
0034 320100             STA     LCOUNT  ;SAVE IT AS LINE COUNT
0037 0E0D               MVI     C,CR    ;LOAD C/R AND PRINT IT
                LIST1:                  ;INSERT HERE CODE TO
                                        ;SEND CHAR IN C TO PRINTER
0039            END
```

2

```
                ;
                ; SEND SINGLE FF CHAR TO LIST DEVICE
                ;
000C =          FF      EQU     12D     ;FORM FEED CHARACTER
0005 =          LIST    EQU     05H     ;LIST OUTPUT CALL NUMBER
0005 =          BDOS    EQU     0005H   ;BDOS ENTRY POINT
                ;
0100            ORG     0100H           ;STANDARD CP/M ORIGIN
0100 3E0C               MVI     A,FF    ;LOAD FORM FEED CHARACTER
0102 5F                 MOV     E,A     ;   INTO REGISTER E
0103 0E05               MVI     C,LIST  ;LOAD CALL NUMBER
0105 C30500             JMP     BDOS    ;GOTO CP/M FUNCTION (IT
                                        ;WILL RETURN TO CCP)
0108            END
```

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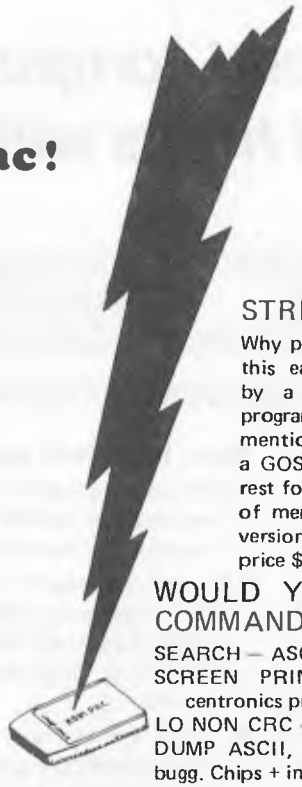

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Every ZX81 comes with a comprehensive, specially written manual — a complete course in BASIC programming, from first principles to complex programs.

APPLES FOR THE HANDICAPPED

Leigh Lockrey operates an Apple II micro SCAT (Scanner Apple Touch Keyboard) system mounted on a trolley to provide a fully mobile base.

As a result of becoming handicapped, many people will lose their jobs or be demoted simply because they look different, are awkward in their movements, have difficulty in speaking, and are generally regarded as 'lesser beings'.

Programs are being conducted by a variety of organisations throughout the country to help these people maintain as normal a life as possible and to continue their educational studies. One organisation vitally involved in both continuing learning programs and rehabilitation work is the Spastic Centre of NSW.

The Centre operates as a treatment and training division, dealing in the main with children. It operates two schools for people affected by cerebral palsy. The schools are staffed by Department of Education personnel and the Spastic Centre provides medical back-up.

The Spastic Centre also operates its own manufacturing company, Centre Industries, employing about 600 people, of whom over half are handicapped. A Rehabilitation Department within Centre Industries provides medical treatment, assessment and training, vocational guidance, occupational therapy, physiotherapy, speech therapy and development and service workshops. Through these sections the department provides full support services for the induction and training of cerebral palsy affected persons.

The development and services workshop is a specialised section of the Rehabilitation Department. Employees design, manufacture and service special tools, jigs, wheelchairs, splints, and surgical boots and shoes for handicapped people. Other departments within Centre Industries are typical of a manufacturing organisation, and include data processing, accounts, personnel, sales, planning and material control, manufacturing, toolmaking, engineering and quality assurance departments.

In both the Spastic Centre and Centre Industries, specialised equipment is essential to the on-going training and education programs and to achieve maximum effective results.

In December 1980 nine 48k, disk operated Apple II micros were installed. The two schools have three each and Centre Industries has three in its adult rehabilitation division attached to the factory. The major areas of application of the Apples are –

- Education
- As a means of simulating the pleasurable experiences of life, such as chess and adventure games, which previously were unattainable to the spastic.
- Conceptual development, enhancing the sensory aspects of learning.
- Providing vocational opportunities such as programming and on-site administration including accountancy, inventory and stock control at Centre Industries.

In each area, the computer provides the facility for a handicapped person to achieve and experience things normally unavailable, and to experience aspects of life which would otherwise be out of reach.

"The computers enable handicapped persons to simulate normal functions," Mr Bob Gilchrist, Psychologist in the Rehabilitation Centre, said. "For education we have found them to be extremely good motivators. They are non-threatening and provide an excellent learning vehicle which both the children and adults thoroughly enjoy using.

"One of the major problems cerebral palsy handicapped people suffer is that

it is difficult for them to participate in a normal classroom environment. They experience frustration from other children; the teacher doesn't have time to devote to one handicapped individual; they are often absent due to physiotherapy requirements; and so on. Their background education is often lacking and school and learning are not recalled with fondness," he said.

"The computer overcomes these negative feelings. It provides a one to one relationship which is friendly and encouraging. It is gentle and patient, teaching in a fashion which points out errors, or problem areas, in a logical unemotional manner. The children can relate to it without fear and it pays very detailed attention to the learning experience which is usually not possible in a normal classroom setting."

Modifications

A series of modifications, including software and input operational methods have been developed to overcome problems experienced by cerebral palsy sufferers. Lack of muscle co-ordination means control of movements is severely affected resulting in unsteady direction of hands to the keyboard, and sometimes an inability to use the hands at all. Special overlay plates have been designed to fit on the keyboards. They isolate the individual keys and remove the chance of two keys being activated simultaneously by the same digit. Accidental double key presses of the same key may be suppressed. The use of a probe attached to the forehead or a keyboard positioned at the feet overcomes the problem of uncontrollable hands.

"The Apple II is a versatile learning aid for anyone capable of operating a typewriter keyboard," according to Mr A.R. Lowe of Centre Industries' Electronics Laboratory. "However, there are some who are unable to exert the pressure required by one finger to operate the conventional keyboard or those who can't use a finger at all and are limited to hand or arm movements only."

To overcome this problem Centre Industries recently developed the SCAT (Scanner Apple Touch Keyboard), a self-contained unit which enables children and adults with a wide variety of severe physical handicaps to directly input to the computer. It is designed to be easily moved to different locations within schools and offices.

"The SCAT interface doesn't remove standard use of the keyboard or allow other input devices to be used, but allows several devices to be used at once," Mr Lowe said. "The input devices handled by the SCAT are the standard keyboard, the touch keyboard known as TASA (Touch Activated Switch Array) and a rotary scanner which doesn't require operation of a keyboard at all.

"The interface receives data from the keyboard, checks it for valid character entry, and transfers the characters to the computer. Information from the TASA keyboard is checked in a similar manner although special operations are performed at the touch of a single key and subsequent entries are processed before the final transfer to the computer." The system incorporates the Apple microcomputer plus disk drive, monitor and high speed printer.

The TASA keyboard has a transparent perspex overlay to guide shakey fingers or the head mounted probes through gaps to the keys. The keyboard may be freed and located in the best position for the user (within the bounds of the connecting cable). All Apple II keyboard operations which normally require the simultaneous use of two fingers (e.g. CTRL/character and SHIFT/character) may be implemented on the TASA keyboard with single key operations.

The rotary scanner is particularly successful with those spastic children who are only able to operate a single input switch. For students of computer studies maths options, the rotary scanner permits the printing and execution of whole Basic commands (e.g. PRINT, LIST, CATALOG), as well as control characters, with single item selections.

The SCAT interface functions independently of the Apple, deriving only its 5V power supply from the main computer. Its electronics are based on the 6802 microprocessor which translates signals from the various input devices into ASCII characters, and multiplexes them. It also allows multiples of input from the same TASA key to be suppressed for a time interval selected by the user and allows CTRL/character and SHIFT/character operations to be implemented by single key operations.

The most complex function of the interface is reception, verification of valid entry and processing of data entered from the rotary scanner. The scanner may be operated by a single pressure switch, air switch, touch switch or by the interruption of a light beam to select a character to function. Data from the scanner is in no way recognisable by the Apple computer and is designed specifically to operate an electric typewriter. The SCAT interface first verifies valid data entry then translates the code into the language used by the computer. There are several complete words used by the computer often enough to make them cumbersome even when the scanner is operating at its quickest rate. The interface assists by transmitting entire words to the Apple on reception of a single character from the scanner.

The system is mounted on a trolley which provides a fully mobile base which will clear all standard doorways. The height of the platform carrying the monitor and the main computer is fully adjustable from 20" (for a child) to 37" (for an adult). All intercomponent leads are covered and concealed, and there is only one power cable to be plugged into a 240V socket. The trolley is designed to give the user good visual access to the keyboard, the monitor, the scanner, the disk drive, the SCAT interface, function lights and the printer. A storage space is provided at the rear.

According to Mr Gilchrist, it is necessary for some of the software to be modified to suit the special requirements of the handicapped and to meet demands not found on a large scale elsewhere. Some program design is done at the Centre. It is also supplied by the Apple Users Group and the Computer Education Group. Commercial software is also used. Any features which may penalise the handicapped must be eliminated from the program.

"Because of problems with vision which are experienced by most cerebral palsy handicapped, we must program to make visual scanning easier."

The TASA (Touch Activated Switch Array) touch keyboard with transparent perspex overlay to guide unsteady hands or head-mounted probes through gaps to the keys.
The keyboard may be freed and located in the best position for the user — within the bounds of the connecting cable.

Mr. Gilchrist explained. "It is necessary to keep read-out lines a reasonable distance apart, increase the size of characters and incorporate similar seemingly simple adjustments which greatly increase effective use of the computer.

"Eye/hand co-ordination and response time is different to that of able-bodied persons. Programs which require real time response and reaction times are therefore not satisfactory," he said. "The handicapped will continually make errors because they cannot keep up physically – although they are coping adequately mentally. Naturally this proves very discouraging and it is necessary for us to adjust the response time realistically."

Vocational applications

Installation of the Apples has provided the handicapped with an opportunity to explore areas of life previously closed to them. New educational, vocational and emotional fulfillment have been introduced. Development and progress in each of these areas is "tremendously rewarding," to quote Mr Gilchrist. The microcomputer area is, however, not the only field in which computers play an important role for the Spastic Centre.

Centre Industries has its own data processing division employing about 20 handicapped persons. The general aims of the installation are to operate as a financially viable unit and to provide training and employment for handicapped people.

The able-bodied people employed in the EDP section overview, tutor and assist the others in the group being trained as key entry operators, computer operators, programmers, and so on. Able-bodied persons are also selected for training, in order to maintain a balance of able-bodied and handicapped employees within the section.

The division began eight years ago when Centre Industries bought a Honeywell G58. In 1976 a second G58 was obtained. The machines have since been field upgraded to level 61. The Honeywell computers were used to implement production and inventory control systems, using the Honeywell AMAP package and Financial Systems supplied by a contractor.

When upgrading was considered necessary a Facom M140F was installed, and the implementation of MAS-I package modules began. All modules of the MAS-I have been purchased including inventory control, order control, manufacturing control, financial control and costing. These are being implemented to replace the systems currently being processed using the Honeywell AMAP System.

Further Systems are being planned to control and report on medical records and the Spastic Centre transport system. It is intended to store the medical records in a highly confidential manner, to provide research statistics and individual case histories for rehabilitation departments and research clinics.

The Transport Section of the Spastic Centre in Sydney maintains a fleet of 38 buses. These provide transport for handicapped persons from home to the Spastic Centre's premises at Mosman and Allambie Heights. They cover the entire metropolitan area of Sydney. The fittings in the buses are in many instances specialised for the individuals carried, and therefore create unique problems in scheduling. These problems are currently being investigated and it is intended to use a computer system in planning bus timetables. The major aim is to minimise the travelling time of passengers carried and maximise the fleet's utilization.

The SCAT (Scanner Apple Touch Keyboard), developed by Centre Industries, the manufacturing division of the NSW Spastic Centre. The SCAT is a self-contained unit incorporating SCAT interface, movable TASA (Touch Activated Switch Array) keyboard and a rotary scanner.

Lazing Around

I didn't think Puzzle 11 would cause too much trouble, but most people missed the catch. *Each*, i.e. every, digit from 0 through 9 had to be used. So although everyone who wrote solved the equation $A^3 = B^2$, few used all ten digits. The correct numbers are 4761 and 328509 and the winning entry, chosen at random, came from J. Cameron in Brisbane. Twenty plugs are on their way, barring fire, flood or industrial action.

Prize puzzle

There is a line of 2000 subscribers' post office boxes and there are 2000 enthusiastic postal employees. The first enthusiastic postal worker places a copy of APC in each subscriber's box. The second post office employee, annoyed because they're supposed to be working to rules, comes along and removes every second magazine, starting with box 2.

The third enthusiastic worker, acting on a misplaced sense of duty, walks along and, starting with box 3, changes the situation in every third box so that if there is a magazine in the box it is removed or a magazine is placed in an empty box. The fourth postal worker, jumping on the bandwagon, changes the situation in every fourth box starting with box 4. And so it goes until every postal worker has done what they thought to be the right thing by APC and its subscribers or their union.

Did the subscribers with Box 1000 and Box 2000 finally receive copies?

Answers on a postcard *please to Puzzle No. 14, APC, P.O. Box 115, Carlton, Vic. 3053.*

Prize of the month

Boring, I'm afraid, but from now on I'm giving away a book token each month.

Quickie

As usual, no answers, no prizes for this: Jack's famous beanstalk doubles its height every day. After 21 days it was as high as the Town Hall; after how many days was it half the height of the Town Hall?

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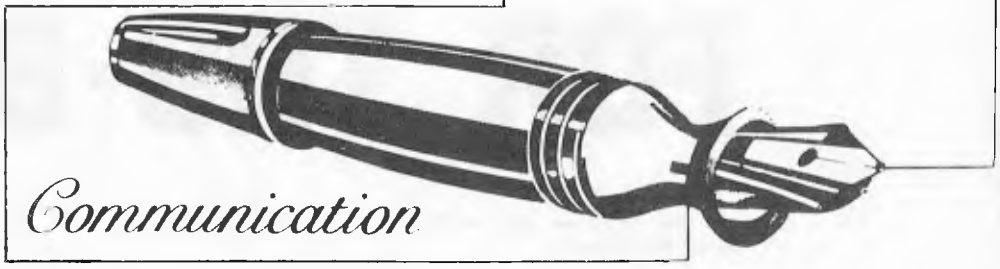
APC welcomes correspondence from its readers but we must warn that it tends to be one way! Please be as brief as possible and add "not for publication" if your letter is to be kept private. Address letters to 'Communications', Australian Personal Computer, P.O. Box 115, Carlton, Vic. 3053.



Communication

I have some information which may be of some interest to your readers. For some time I have been trying to discover how my computer, a 16k L2 TRS-80, can tell if there is a tone present on the input from the cassette–this would be useful for automatic decoding of morse code, etc.

Finally I discovered that the necessary method is to have the cassette player in record mode (with a cassette) so as to act as an amplifier. Then any time you wish to see if any input is being received, do an OUT (255), Ø and *then* an X=INP(255). This will give X the value of 127 if there is no input, and 255 if there is. The OUT statement seems to be necessary to reset a latch which is set when a tone is present, and stays that way till you reset it.

Andrew L. Roberts

Thanks for APC. Please don't let the editorial content be reduced to a jumble of ads with occasional text scattered in between.

One grumble: why the joint months?

J. Carter

These are not actually joint months. We simply fell slightly behind in recent months primarily because of increased numbers of editorial pages and larger print runs and to a lesser extent because of industrial disputes. We shall still be publishing twelve issues per year so you can look forward to APC at 4 week intervals instead of the normal 30/31 day monthly issue frequency.

CISA HIRES-80 BOARD

We have been advised by Customtronics that the article appearing in APC, Issue no. 7, pages 9 and 10, may contain inaccuracies. The comparison chart in the advertisement, Issue no. 8, should be read in the light of the article and of any correction which may need to be made to the information contained in it.

HOTLINE

Last month, Ian Davies initiated a panic line between 4 and 6 pm on Fridays for assistance in constructing the TRS-80 Joystick. He was absolutely swamped with calls – not all about the joystick.

The session was so successful that we have decided to extend the concept to a general computer panic line.

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Provision has even been made for those who normally use an Expansion Interface but may want to expand their keyboard memory for those times it is inconvenient to transport more than the keyboard. A switch may be installed to disable or enable the Internal Memory above 16K.

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Micro market

Name of Machine (Price From)	Main Distributor & Phone No.	Hardware	Software/ Firmware	Miscellaneous (Documentation)
Altos ACS 8000 ($4,314)	The Dindima Group (03) 873 4455	64k RAM; Z80 1k EPROM; dual 8" F/D; 2 x RS232 ports; P/P	CP/M; MP/M; OASIS O/S; Basic; Fortran; Pascal; APL; Algol; Cobol	Expandable to 4-user with 58 Mb H/D.
Alpha Micro ($17,900)	Australian Alpha Micro Systems (02) 438 2855	64k – 1Mb RAM; 16-bit dual 8" F/D (2.4 Mb) 6 x S/P	Multi-user O/S; Basic; M/A; Pascal; Lisp; U	Modular Expands to 1200 Mb; 24 terminals or Multi-processor system
APF Imagination Machine ($995)	Radio Parts (03) 329 7888	8-16k RAM; C; RS-232C port; F/D int.	Level I Basic; disk O/S	
Apple II plus ($1395)		16-48k; 6502; colour VDU int; 8 I/O slots; games paddles; option 5¼" F/D (116k) and 11 MB disk	O/S; Basic; Pascal; games	280x192 high res colour graphics; Applesoft Basic in 12k ROM (E)
Atari 400/800	Futuretronics (03) 555 5536	8-16k RAM; 6502; C int; cartridge slot; 12x20 TV int; RS232 port	OS (10k ROM); Basic (8k ROM)	Hi-res colour graphics; 4-channel sound; 4 games controller/ light pen sockets. Up to 4 disk controllers
Atom ($780*)	Sinclair Equipment Australasia Pty Ltd (03) 861 6224	4-12k RAM; 6502; Full K/B; C int; TV int; 20 I/O lines; 1 P/P	Basic in 8k ROM; A; Cass O/S	High resolution graphics on bigger model; colour monitor O/P. Loudspeaker. Note also, systems based on Acorn SBC (B).
Archives	Computerland (03) 62 5581	64k RAM; Z80; dual 5¼. F/D (744k) 12" 24x80 VDU; S/P; P/P; N/P. Option 1.5 Mb F/D	CP/M	(E)
CBM 8032 $2,760	Commodore Information Centre (02) 437 6296	32k RAM; 6502; C int; 12", 25x80 VDU; IEEE-488 port; Options: dual 5¼" F/D (353k); $2305; same but (950k) $3100	O/S; 18k ROM; Forth; Pilot Pascal	
Century (C100 – $2,950; C200 – $5,400)	Abacus Computer Store (03) 429 5844	C100, 48-64k RAM; Z80; 12" VDU; 2x5¼" F/D (2x143k); 112 cps printer; RS 232 port; S100 bus; C200 includes 2x1 F/D (2x315k); hard disk 4xRS232; 2x P/P	Cobol; Fortran; Basic	Also available: C300 (I)
Challenger IP ($448)	Systems Automation (02) 439 6477	4-32k RAM; 6502; C int; 24x32VDU int; RS232 port; option – dual 5¼" F/D (140k)	O/S Basic; A; games	8k microsoft Basic in ROM; expansion board available (I)
Challenger 4 ($871)	Systems Automation (02) 439 6477	8-48k RAM; 6502; colour 32x64 VDU int; RS232 port; P/P; option – 6502C microprocessor; dual 5¼" F/D (140k)	Basic; Pascal	Basic in 8k ROM (I)
Compucolor II ($2095)	Anderson Digital Equipment (03) 543 2077	8-32k RAM; 8086; 13" 32x64 8 colour VDU; single 5¼" F/D (51k); RS232 port	ExBasic (ROM); A	16k model, $2395; 32k $2695; maintenance manual available (I)
Compucorp 625 ($10,600)	Namrac Business Systems (03) 89 1770	48-60k RAM; dual 5¼" F/D (630k); 9" 16x80 VDU; 40 col printer; RS232 port; P/P	DOS; C Basic; Fortran; Pascal; A	Hi-res graphics
Compucorp 655 ($7,644)	As above	60k RAM; 280; Up to 4x5¼" F/D; 9" 20x80 or 12" 20x80 or 20" 60x80 VDU; 40 col printer; RS232 port	As above	Opt: 10-20 Mb H/D
Cromenco System 2, System Z2H, System 3 ($3990, $9650, $6750)		64-512k RAM; Z80A; System 2, dual 5¼" F/D (346k); System Z2H, also Winchester disk (11MB); System 3, 8" dual 1MB; S/P; P/P	CDOS; Basic; Cobol; Fortran; M/A; ExBasic; Structured Basic	All systems expandable to multi user (2-7 users) $2880 – $8825 (E)
Diablo 3000 ($14,000)	Mitsui Computer Systems (02) 929 9921	32-64k RAM; 8085 dual 8" F/D (1.3 Mb)	DOS; Basic; DACL; ABL; A; U	
Durango ($10,800)	Rockend Pty Ltd (02) 438 1418	64k + 128k RAM, 3MHz + 5MHz microprocessor 16x64 or 24x80 VDU; single or dual mini diskette drive; multi-port serial interface	OS; CP/M or Durango; Basic; Microcobol; U	Basic system includes integral dot matrix printer

Name of Machine (Price From)	Main Distributor & Phone No.	Hardware	Software/ Firmware	Miscellaneous (Documentation)
ECS 4000/4500 ($3,450)	Electronic Control Systems (02) 406 5711	16-256k RAM; Z80A; keyboard int; VDU. 4500: 48k RAM minimum; 2 x F/D; I/O card with dual P/P and 2 x S/P	CP/M; CP/M compatible languages; U	256k RAM by bank switching
ERA-50, ERA-100 ($5,800)	Electronic Research Australia (062) 80 6911	64-256k RAM, 8085; dual F/D; 4 P/P. ERA-100: 16-bit 8086; 128k – 1Mb RAM	CP/M and USCD Pascal O/S; Pascal; Basic-80; Cobol-80; Fortran-80	Optional higher capacity F/D and H/D
Exidy Sorcerer Model II ($1295*)	Dick Smith Electronics (02) 888 3200	8-48k RAM; Z80; 30x64 VDU int; RS232 Port; P/P; S100 bus; extra C int.	O/S; Ex Basic (ROM); M/DOS; CP/M	High res graphics capability; 16k version $1395*; 32k version $1525*; 48k version $1655*; User programmable character set (I)
Findex 100 TD/ 128TD ($7,500)	Keyline Pty Ltd (03) 819 1033	48-200k RAM; Z80; F/D, keyboard; printer 4 RS232 int. Can expand to 2Mb RAM; 32k ROM; 64 P/P; 2 extra RS232 int.	CP/M; Basic; Fortran; Cobol; Macro	128TD has 128k of bubble memory, expandable to 2Mb
HP-85 ($3550)	Hewlett Packard Australia (03) 89 6351	16-32k RAM; N/A; 5", 16 x 32 B/W VDU; C(200K); 64 cps printer; RS232 port; 4xP/P	Basic	Full dot matrix graphics; N/P; compact portable unit (S)
Intecolor 8350/8050 ($4,500)	Anderson Digital Electronics (03) 544 3444	64k; 8080A; colour VDU; mini-F/D and F/D to 591k; H/D to 26Mb 8050; 13" VDU; integrated keyboard. 8350: 19", 25" display; separate keyboard	OS; CP/M; Basic; Fortran	
IPS-100 ($3750)	Microprocessor Applications (03) 754 5108	32-896k RAM; 8085; 2 RS 232 ports; S100 bus; dual 5¼" F/D (630k)	O/S; Ex Basic; Ed; A; CP/M; C Basic; Fortran Cobol	(F)
Industrial Micro Systems ($2747)	S.I. Micro-computer Products P/L (02) 231 4091	32-64k RAM Z80A 5¼" F/D (170k) 2xSP Optional to 100M VDU $1250, P/P 8" F/D ditto but to 2400k	O/S CP/M Basic Cobol; Fortran; Pascal	Multi terminal capability Interrupt driven 80 char x 24 lines Ditto x Hard Disk 24M up option ($4565) (E)
Microengine ($2995)	Daneva Control (03) 598 9207 Abacus Computer Store (03) 429 5844	64k RAM; MCP 1600; 2x RS232 ports; 2xP/P; Options – dual 5¼" F/D (Single or dble density); 8" F/D (single or dble density)	Basic; Pascal; File Manager; U	Also available as board (F)
Micronation ($5,365)	Microprocessor Applications (03) 754 5108	64k RAM; Z80A; dual 8" F/D; S100 bus; 2xS/P; 6xP/P. Optional: 2 extra F/D; H/D	CP/M; MP/M; Fortran; Cobol; Basic; Pascal	Processor/memory card, F/D and H/D systems also offered as add-ons for any S100 bus micro system
Microman I ($13,500)	AWA Data Processing Systems Division (02) 922 3300	64k RAM; 8085A; dual 8" F/D (1.2 Mb) 3xRS232C ports; 1k EPROM.	Stardos; Basic; U.	Models 2 and 3 available
National Panasonic JD840 ($10,725)	The Computer Company (02) 436 1733	64k RAM; 2–4k PROM; 8085A; 3 RS232C ports; 2x5¼" F/D (2.2 Mb) 1920 ch. green phosphor VDU	Panabasic, Interpreter, Microsoft Basic Fortran, Cobol & Assembler	(F)
National Panasonic JD700 ($7,850)	The Computer Company (02) 436 1733	32-64k RAM; 2-4k PROM; 8085A; 3 RS232 ports; 2x5¼" (140k) 1920 ch. green phosphor VDU	Panabasic, Interpreter, Microsoft Basic, Assembler, Fortran & Cobol	(F)
National Panasonic JD740 ($8,550)	The Computer Company (02) 436 1733	64k RAM; 2-4k PROM; 8085A; 3 RS232 ports; 2x5¼" F/D (560k) 1920 ch. green phosphor VDU	Panabasic, Interpreter Microsoft Basic, Fortran, Cobol & Assembler	Price depends on systems configuration (F)
North Star Horizon ($2695)	S. I. Micro-computer Products (02) 231 4091	32-64k RAM; Z80A; 5¼" F/D (170k); 2xSP; 1 P/P; optional – VDU ($1350); Quad density F/D	DOS; Basic; Cobol; Fortran Pascal; CP/M; M/A	(E)

Micro market

Name of Machine (Price From)	Main Distributor & Phone No.	Hardware	Software/ Firmware	Miscellaneous (Documentation)
PET, 16k ($999)	Commodore Information Center (02) 437 6296	8-32k RAM; 6502; C; 9" 25x40 VDU; IEEE-488 port; Options: dual 5¼" F/D (353k) $2305; same but (950k) $3100	O/S. Basic (in 8k ROM); Forth; Pilot; Pascal	Disk controller .$109 (I)
Philips P3000 ($15,500)	Philips Data Systems (02) 922 0181	64-256k RAM; 8085; dual 8" F/D; RS232 port; 12" VDU. Optional: printer; H/D	Basic OS; CP/M.	Expandable to 4 extra displays. Price includes printer
QASAR ($7,476)	Fairlight Instruments (02) 33 5222	64k RAM; dual CPU; dual 8" F/D; VDU; 2xRS232 ports; 2 P/P	QDOS; A: Basic; Fortran; Pascal	CPUs: dual Mb800; dual Mb809; or mixed Mb800 and Mb809
Sinclair ZX80 ($199)	Sinclair Equipment Australasia Pty Ltd (03) 861 6224	1-16k RAM; 780-1; C int; T.V. int; full K/B 44 pin expansion port	4k Basic in ROM	CPU is Nec 3,25 MKz version of Z80A (I)
Sord M100 ACE III ($4500)	Alliance Digital Corporation (02) 436 1600 Abacus Computer Store (03) 429 5844	48k RAM; Z80; 24x64, 12"VDU; RS232 ports; 2x5¼" F/D (2x143k); S100 bus; 2 octave speaker; A/D Conv.; option: 8 colour graphic controller ($1450)	O/S: Ex Basic Fortran	M100 ACE IV – 8 colour graphics controller incL.
Sord M223 ($7500)	Alliance Digital Corporation (02) 436 1600 Abacus Computer Store (03) 439 5844	64k RAM; Z80: 12" 24x80 VDU; 2xRS232 port: S100 bus: 5¼" FD (350k)	O/S: Ex Basic Fortran; Cobol	(I)
Superbrain ($3500)	Informative Systems (03) 690 2284	64k RAM; 2xZ80; dual 5¼" F/D (320k) 12", 25x80 VDU; S100 bus; RS232 port	CP/M; A; Basic, Cobol, Fortran, APL; Pascal	Limited graphics. Main frame int. available. Options: dual 5¼" F/D (320k); dual 8" F/D 2.4 Mb); 8–120 Mb H/D (S&H)
System 80 ($615*)	Dick Smith Electronics (02) 888 3200	16k RAM; Z80; 500 bps C; 32x64 TV int; 1 P/P	Basic: M/A; Fortran	(I)
Tandy TRS-80 Model 2 ($5300*)	Tandy Electronics (02) 638 6633	32-64k RAM; Z80A; single 8" F/D (500k) 12", 24x80 VDU; 2 S/P; 1 P/P; N/P	DOS: Basic	64k version $5999* expandable to four F/D drives, single drive expansion $1999*: three drive $3999
TI 99/4 ($1499*)	Canberra Television	16k RAM; 26k ROM; 9900; 24x32 VDU; 2x C int; TV int; RS232 port	O/S; Basic	Can run 16–colour TV screen (S)
TRS-80 Level I ($499)	Tandy Electronics (02) 638 6633	4-16k RAM; Z80; C; 12", 16x64 optional: B/W VDU	Basic; Games: A	Basic in 4k ROM; upgradeable to Level 2 (I)
TRS-80 Level 2 ($879*)	As above	4-48k RAM; Z80: C; 12" 16x64 B/W VDU; RS232 port; P/P	Basic: M/A; Fortran; Cobol	16k machine incl. N/P; 4-16k upgrade $320*; ($250* without N/P); max config. $1169*; option – single 5¼" F/D (78k); max of 4
Vector Graphics System B ($6350)	A J & J W Dicker (02) 524 5639	64k RAM; Z80: Dual 5¼" F/D (630k); 12" 24x80 B/W VDU; S/P; 2x P/P	DOS: Basic: A; CP/M; Ed	Graphics and numeric pad (E)
Versatile 4 ($5692)	Micro-processor Applications (03) 754 5108	32-56k RAM; 8085: 9", 24x80 B/W VDU; dial 5¼" F/D (630k); S100 bus: 2xRS232	MBasic: MDOS including T/E and A; Version 4 MDOS AND Basic: CP/M	(E)
Zenith Z89 ($3,300)	Warbuton Franki (02) 407 3261	16-48k RAM; Z80; inbuilt 5¼" F/D (100k)	HDOS; CP/M; U	

Name of Machine (Price From)	Main Distributor & Phone No.	Hardware	Software/ Firmware	Miscellaneous (Documentation)
Aim 65 ($525*)	Dwell Pty Ltd (02) 487 3111	1-4k RAM; 6502; 8k ROM; full K/B; 20 character LED display; 20 character thermal printer; Cx2 int; 1 P/P	8k monitor in ROM; A; Basic	Case available * $75* (E)
SBC 100 ($299)	Microtrix (03) 718 2581	1k RAM; Z80; 8k ROM; S100 bus; 1 S/P; 1 P/P	1k monitor; DOS in ROM	Also available assembled $374 (E)
Superboard ($360)	Systems Automation (02) 439 6477	4-32k RAM; 6502; 10k ROM; full K/B; 24x32 VDU Int; C int; options RS232; dual 5¼" F/D (140k)	Basic; games	Basic in 8k ROM (I)

List of Abbreviations

		F/D	Floppy disk	M/A	Macro assembler	S/P	Serial Port
		G/C	Graphics card	N/A	Not available	T/E	Text editor
A	Assembler	H	Hardware	N/P	Numeric pad	TBA	To be announced
B	Basic	H/D	Hard disk	O/S	Operating system	U	Utility
C	Cassette	I	Introductory	P/P	Parallel port		
E	Extensive	Int	Interface	S	Software		

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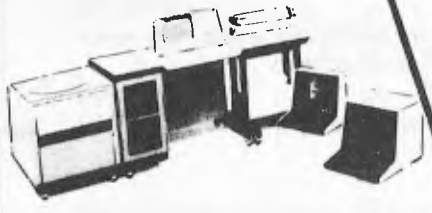

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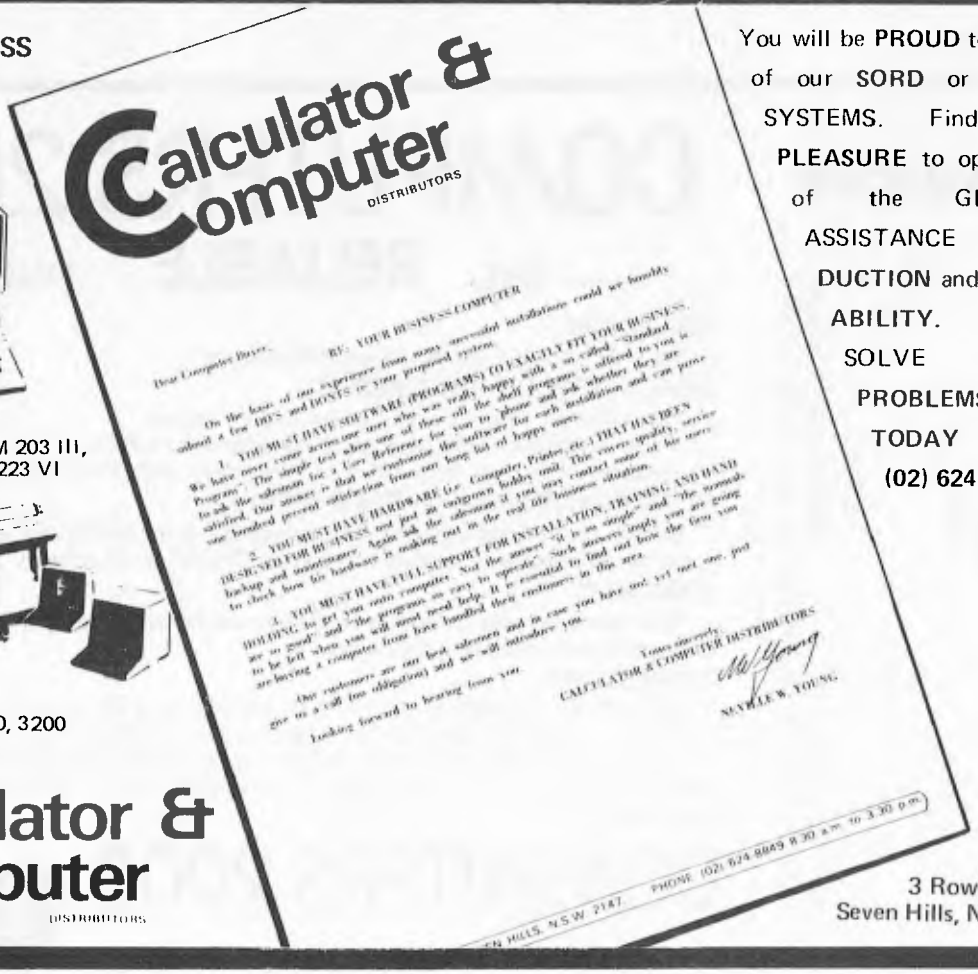

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The Sorcerer's Grimoire

the pages turned by Ian Macmillan, member of SCUA, and editor of its newsletter.

The Sorcerer was ejecting sundry elves and goblins from his workshop. "Dratted folk," he grumbled, "they all want to be in electronics!"

"How can you tell when they're in?" I asked.

"Well . . . " He paused to debug his beard. " . . . It's easy with gremlins, but gnomes are very resistant, and you have to use a gnome meter."

Elves and gnomes may not be very logical, but Sorcerer Basic is well equipped to handle logical expressions. Logical operators compare the bits making up pairs of numbers (bytes) having values in the range +127 to -128.

If you emer

PRINT 5 AND 6 <CR>

you will get 4, because 00000101 and 00000110 coincide as 00000100. Similarly

PRINT 5 OR 6 <CR>

will yield 7, because the bits that are 1 in either number (00000101 & 00000110) are 00000111. Another operator is NOT:

PRINT NOT 5 <CR>

will get you -6, which seems a bit queer. What actually happens is that NOT inverts every bit of the number, so that 00000101 becomes 11111010. Now, you might think that this ought to be printed out as 250, but -6 is correct because the Sorcerer assumes that all arguments (numbers) used with logical operators are one byte Signed Binary Numbers.

Signed Binary Numbers use the high order bit, i.e. the leftmost bit, bit 7, as a flag to show that a number is negative. The whole of a negative number is determined by taking 1 from the value, then inverting all the bits. Thus -6 as a signed binary number is found by taking 6-1 = 5, which is 00000101. Inverting (complementing) gives 11111010 which then represents -6, so you can see why you get this when you enter PRINT NOT 5.

The largest single byte signed positive number is 01111111 = 127, while the largest negative number is 10000000 = -128. If this is not quite clear, experiment at your keyboard until you can predict each result!

There is one more logical operator; Exclusive Or (XOR). This is not available in Sorcerer Basic but can be easily synthesised, or the Z80 XOR instruction could be used through a USR(X) call. XOR gives a result containing the bits that are in one, or the other argument, but not both. Thus 5 XOR 6 would give 3, i.e. 00000101 XOR 00000110 = 00000011.

The XOR statement may be synthesised as shown here:

```
10 INPUT A,B
20 PRINT (A AND NOT B) OR
   (NOT A AND B)
30 GOTO 10
```

A practical use for a logical operator is shown in the following fast keyboard routine which tests for the GRAPHIC, CONTROL, and SHIFT keys. The AND acts as a 'mask' setting the unwanted bits from the keyboard port output to '0'.

```
10 A=INP(254) AND 31: REM 31
   = 00011111
20 IF A=21 THEN PRINT
   "GRAPHIC";
30 IF A=7 THEN PRINT "SHIFT";
40 IF A=31 THEN PRINT
   "CONTROL";
50 IF A=5 THEN PRINT
   "GRAPHIC/SHIFT";
60 IF A=23 THEN PRINT"NO
   KEY";
70 GOTO 10
```

THE ATARI® PERSONAL COMPUTER SYSTEM FROM FUTU

NOTHING SO COMPLEX HAS EVER BEEN SO SIMPLE

The new Atari 400 and Atari 800 personal computers are now on sale in Australia and New Zealand and brought to you by Futuretronics. The new computers are so easy to understand, that people who never dreamed of owning a computer now can. Even those who were really hesitant can have these machines humming in minutes, and will really benefit from owning one!

So easy to hook up*

Just plug your Atari personal computer into your TV set, and it's ready to go – use it at home, or take it to the office (it's no bigger than an electric typewriter).

So easy to change programs*

The Atari computers take special program cassettes. so you can take your pick from an enormous range of computer facilities – for home, business or educational use – or you can play fabulous new games with high resolution graphics! And the 800 PCS can run up to 4 disc drives.

So easy to extend*

The Atari 400 and Atari 800 computers have 16K bytes of RAM memory, but this can be expanded further if required by adding Memory Modules. The machines are capable of full color synthesis, and can run light pen and independent graphics accessories, plus word processors, recorders and printers.

So easy to communicate*

Unlike most other "small computers" the Atari models have their own upper and lower case alphabets – much easier, and quicker, to take in. The computers are programmed in Atari Basic. The Atari 400 has a 57-key monopanel ("touch-type") keyboard, with 4 function keys and 29 graphics keys. The bigger Atari 800 has the same key specification but has a full-stroke keyboard.

So many uses — in the office*

In America, professional men and small businessmen are already learning what an enormous time and energy savings help Atari computers can be. And company men have come to rely on their own personal Atari computer (instead of having to book themselves in to use that unco-operative hulk down in the company basement!). An Atari computer takes the paper out of paperwork! It estimates, deduces, solves problems, increases profitability – at the touch of a key.

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Atari computers work just as hard at home. For instance, they'll help you learn languages, conduct a personal fitness programme, or teach touch typing. They'll entertain you . . . or help you and your family manage your personal finances, keep household records – even recipes, birthday lists or addresses!

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HP INTERFACE

David McFarlane presents a page for HP series 80 users.

Here at last, is a feature page devoted to the Hewlett-Packard Series 80 Users.

Starting this issue we will be publishing programming tips, routines, reader requests, new product release information, etc, as a regular feature of Australian Personal Computer.

The continued success of these columns relies on response from you, the reader and user. If you feel you have any information, tips, routines, or an interesting application that would benefit other Series 80 users then let us hear about it.

Likewise, any local Series 80 User groups are invited to contribute details of their activities and where they may be contacted.

If you have something to contribute, then send it to:—

HP – INTERFACE
Australian Personal Computer,
P.O. Box 115,
Carlton 3053.
Victoria.

Merging Programs

At some time, you may want to make a single program out of two separate programs. The procedure described here allows you to do so by using the CRT RAM as a buffer. Since the CRT memory can hold at most four screens (64 lines) of information, large programs may require the procedure to be repeated.

1. Initially, program A must be on a tape cartridge and program B must be in the system RAM, with A greater than B in length.
2. First, RENumber B so that the first statement number is greater than the last statement number in A. For example, if A is numbered from 10 to 50 and B is numbered from 10 to 50, RENumber B from 60 to 100.
3. Then, LIST B. Press LIST n times, until the entire program is in the CRT RAM or until the CRT RAM is full (n = 4).
4. Now, LOAD A. B is no longer in system RAM but is preserved in the display memory.
5. Press HOME. The cursor is now at the top of screen n.
6. Press END LINE, entering each line on the display into the system RAM as the cursor moves down the screen.
7. When all the program lines on the screen have been entered, SCROLL back to screen n – 1. Press HOME and repeat step 6.
8. When (up to four screens of) the program has been moved from CRT RAM to system RAM, give the new, merged program a new name and STORE it on tape.

It is necessary to work "backwards" from screen n to screen 1 so no program lines will be lost.

COM = ECONOMY

You may be interested to know that there is a way you can squeeze more programs onto a tape cartridge. You can store a program using significantly fewer records, say 15 instead of 20, by using a COM (common) statement in your program.

As you know, one of the first things that happens in your HP-85 when you press RUN is that storage is allocated (set aside) for all variables in the program. Each real variable is given eight bytes, short variables four bytes, and integers three. Dimensioned variables gobble up space according to the size of the array.

By putting variables in common, space is still reserved for them in the system RAM, but no corresponding space is set aside on tape when the program is stored. The variables are stored unallocated.

As an example, type in the following program:

```
10  DIM A(40,40)
20  PRINT "THIS IS A TEST"
30  END
```

Then store it on tape: STORE "DTEST".

Now, change the first line to 10 COM A(40,40) and store it on tape: STORE "CTEST". Type CAT to see the storage requirements – the display looks as follows:

NAME	TYPE	BYTES	RECS	FILE
DTEST	PROG	256	53	1
CTEST	PROG	256	1	2

Here, a storage comprehension of 53.1 was obtained just by putting the variable A in common.

Binary Utilities

Binary programs can reside unobtrusively in memory with Basic programs, adding powerful Basic commands, statements, and functions to the repertoire built into the machine. With the equivalent of the Assembler RAM. HP engineers have developed 23 binary programs. These programs define about 100 Basic key words that add some new capabilities to your machine.

to enter names into a data file – Jones, Harvey P. That comma makes life difficult because the INPUT statement thinks you have entered two names when it has only asked for one. If instead of INPUT, you use LINPUT, you can put any character including commas, quotation marks, and leading blanks – Green, "Mean" Joe. But before the program can execute the LINPUT statement, the binary program "LINKEY" must be in place. LOADBIN "LINKEY" is programmable, so this may be accomplished automatically in the Basic program, unbeknown to the user.

"LINKEY" adds four other Basic key words in addition to LINPUT. The KEY ON statement can be used to define any key on the keyboard as an immediate execute key that will behave just like the soft keys, K1 through K8, built into the system. All or a subset of the keys so defined can be turned off using the KEY OFF statement. "LINKEY" also provides cursor control. MOVE CURSOR lets you move the cursor to any location on the display.

Remember, there can be at most one binary and one Basic program in memory at one time. But the SCRATCHBIN command provided by "LINKEY" lets you erase the binary program without scratching the Basic program. Since SCRATCHBIN is programmable, a Basic program can erase one and load another binary program when necessary. Pretty trickey. And "LINKEY" only uses 889 bytes of memory.

"SOFTKEY" is a binary program that returns up to 96 characters with the touch of one key. A special feature of the SOFT KEY statement is that you can optionally cause the string to be executed as a command immediately upon display, like AUTO, which is built into the system.

"PCOL" is a binary program that assigns the capabilities of the HP-85 graphics screen to the print-head of the built-in printer. "BPLOTB" provides two more extremely helpful graphics functions: a BREAD that reads groups of dots from the graphics screen and generates a corresponding character string; and a BPLOT that performs an OR (rather than an EXOR) with existing dots on the screen.

"GCURS" allows you to place the cursor on the graphics screen at specified coordinates, manoeuvre it around using the edit keys, and read the x-y coordinates of the cursor location.

Normally, a Series 80 machine stores programs in its own unique internal language. DSAVE, provided by "DGTSAV", saves a program as string data, one program line per string. One use for "DGTSAV" that comes quickly to mind is transferring programs over the telephone. DGET loads a program previously saved with the DSRUE command or any string data file consisting of valid Basic statements preceded by line numbers, stored one line per string. The program lines that are read into program memory are merged with any program lines already in memory. A line with the same number would replace the original line.

Here, then, is a way of having a program modify other programs or even itself. Note that DGET is not programmable, so that while a program can rewrite itself, it can't execute the new program. Still, you can do some interesting things, like packing programs using @'s to combine program lines, in order to pinch memory. DGET is also a convenient way to merge two programs.

"STRNGB" enhances the string manipulation capabilities of your machine. With it, you can underline strings, reverse the order of string elements, rotate the elements, and delete leading and trailing blanks. You can even find the number of times a particular string occurs. And SAR$ (string expression, match string, replacement string) allows you to perform a search and replace operation, where the match string will be replaced by the replacement string every time it occurs in the string expression.

In addition to these, there are statistical functions, math functions, and commands to re-dimension arrays and verify tapes. If you have access to a Hewlett-Packard desktop computer like an HP 9845A, there are binary programs that will help you transfer data and programs back and forth between systems.

For further information write to APC.

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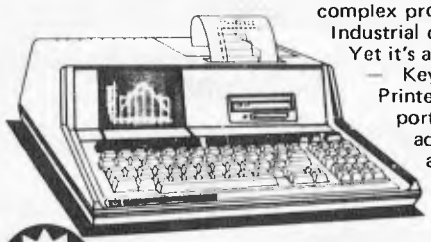

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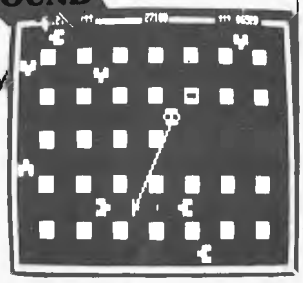

Your screen is transformed into a maze-like playfield. As your ship appears, eight alien ramships also appear; all of them are travelling at flank speed directly at you! Quickly you move towards them and fire missiles to destroy them. But, the more aliens you destroy, the faster the remaining ones become.

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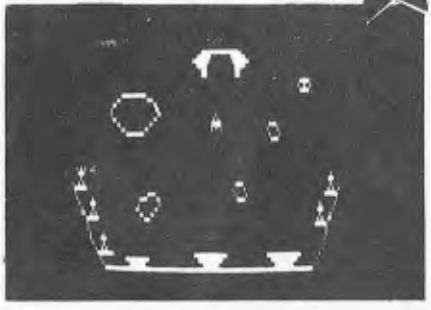

The second **BIG BANG** has occurred and the galaxy is full of stray asteroids and meteors. As you look through your space port you see a belt of asteroids drifting across the screen blocking your path to the safety of the space station above. Be careful because meteor showers and exploding suns and invading aliens may strike your ship and send it hurtling back to ground level. How many times can you and your opponent manoeuvre through these obstacles before time runs out? With sound effects!

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ZX80 CORNER

The material for this page in Australian Personal Computer comes from the National ZX80 Users Club. Details about the Club may be found at the end of this article.

The National ZX80 Users Club welcomes comments and suggestions for their ZX80 page.

More and more people are starting to get the new 8k ROM for their Sinclair ZX80s and we are now beginning to receive programs especially written for the ZX80 with the new ROM.

It may be unfortunate for users with the old ROM but it looks as though the new ROM will become the standard rather than the optional extra.

This month we include two programs. The first one is for the ZX80 with new ROM and illustrates the use of the PAUSE function. The program plays the old game of SIMON using numbers. You have to be pretty fast to be able to get a score of ten out of ten.

The other program included is a marvel of a well designed 1k program by Clifford Ramshaw. Caves and Pitfalls is a mini-adventure and although the language is a little terse, provides for hours of enjoyment. Users with the 8k ROM will find it almost impossible to convert this program without additional memory.

For further information about the Club just write sending a self-addressed, stamped envelope to

NATIONAL ZX80 USERS CLUB
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for a FREE Introductory Newsletter, ZEBRA X-RAY 80. The newsletter provides Sinclair ZX80 Users with programming tips, sample programs, ways of overcoming problems specific to the ZX80 and the new 8k ROM, reviews of currently available software and discussions of developments in the UK and USA. ZEBRA X-RAY 80 will also serve as a forum for ZX80 users who will be able to air their views, questions, complaints and any other comments on the ZX80.

'SIMON'

by J M Revis

```
1     Rem WISP
2     Let C=1
5     Let X=10
10    Let A=INT(RND*X)
20    Print A
30    Pause 50
40    CLS
50    Input B
60    If B=A Then GOTO 90
70    If B< >A Then Print "Wrong,
        the NO. was "; A
75    Print " Your NO. was "; B
76    Print
80    GOTO 110
90    Print " CORRECT "
95    Let X=X*10
96    Let C=C+1
100   GOTO 10
110   110  Print "Your score is";C*10;
      " Percent "
111   Print
115   If C=< 5 Then Print "Idiot"
120   If C=6 Or C=7 Then Print
        " Average "
125   If C=8 Then Print "Good "
130   If C=9 Then Print "Show Off "
140   If C=10 Then Print " You've
        been cheating "
```

CAVES AND PITFALLS

by Clifford Ramshaw

```
1 LET T=0
2 LET K=0
3 LET T1=RND(3)
4 LET S=RND(10)
5 LET H=RND(4)
6 LET W=RND(10)
7LET G=RND(10)
8 LET P=RND(10)
10 PRINT"LEFT,RIGHT?"
11 GOSUB 900
12 INPUT A
13 CLS
14 IF H=1 THEN GO TO 3
15 LET H=H-1
16 GO TO H*100
100 PRINT "YOU SEE A";
101 GOSUB 500+(RND(4)*10)
102 PRINT "IT ADVANCES"
103 GO TO 1000
200 PRINT "YOU HEAR SOMETHING
    BEHIND A". "DOOR"
201 PRINT "IN, OR LEAVE"
202 INPUT A
203 IF A=2 THEN GO TO 3
204 GO TO 100
300 PRINT "WHOOPS .. YOU FELL
    DOWN A PIT"
301 IF P=1 THEN GO TO 3
302 PRINT "AT THE BOTTOM IS
    A";
303 GO TO 300+(P*10)
320 GO TO 101
400 PRINT "SET OF";S;"
    SPIKES"
410 LET T=T-(S/2)
420 GO TO 3
510 PRINT "DRAGON"
511 RETURN
520 PRINT "WRAITH"
521 RETURN
530 PRINT "HYDRA"
531 RETURN
540 PRINT "DEMOGORGON"
541 RETURN
900 PRINT "SCORE:"; T*K
901 RETURN
1000 PRINT
1001 PRINT "COMBAT, OR RETREAT"
1002 INPUT A
1003 CLS
1004 IF A=1 THEN GO TO 1010
1005 PRINT "CHICKEN"
1006 GO TO 3
1010 IF W> 2 THEN GO TO 1020
1011 PRINT "R.I.P."
1012 GOSUB 900
1013 STOP
1020 IF W> 5 THEN TO GO 1030
1021 PRINT "LOST, TREASURE 1/2"
1022 LET T=T/2
1023 GO TO 3
1030 PRINT "THE MONSTER IS DEAD"
1031 PRINT
1032 LET K=K+1
1040 IF T1=1 THEN GO TO 3
1041 PRINT "TREASURE:";G;
1042 IF T1=2 THEN PRINT "SILVER";
1044 IF T1=3 THEN PRINT " GOLD";
1045 PRINT " PIECES"
1046 LET T=T+(G*T1)
1047 GO TO 3
```

APC TINY COMPILER

Peter McDonald concludes his series on the APC Compiler

Firstly, the bad news, Philip Colbourn wrote explaining a peculiar problem regarding the assignment of variables:

I own a SYSTEM 80 and have typed in your APC Tiny Compiler. I have a bug in it somewhere. It won't assign given values to a variable unless it is after an APC-80 command.

EG.

```
2000  MOVE 12288 TO 15360
      FOR 1024
2010  A=10
2020  PRINT A
2030  END
```

This works BUT

```
2000  A=10
2010  PRINT A
2030  END
```

This doesn't.

What can I change to rectify the problem or where do I look for my bug? I think the compiler is great but perhaps a few more commands would make it become a very competitive compiler.

Yours Sincerely,
Philip Colbourn.

The fault lies in line 10 which, among other things assigns the top of memory pointer (variable TM) with a value of 32767. In the first case quoted by Peter, the APC-80 command MOVE is used and the compiler provides two bytes of storage for what it thinks is a variable ie MOVE. While I acknowledge this is slightly inefficient by wasting two bytes, it saves quite a good deal more in not executing a search to compare "variables" found against the possibility they are APC-80 commands.

It does not interfere with the operation of the compiler and can waste a maximum of only eight bytes (two each for INP, BEEP, MOVE and INC).

However, as Peter noted, the problem occurs when the APC-80 command is *not* used. This is because the compiler provides two bytes for the storage of each variable from the top of memory down towards the object code. When the APC-80 command, MOVE, is used first in the program, the "variable" MOVE is given two bytes at 32767 and 32768.

As the last RAM location in a 16k TRS-80 is at 32767, the high order byte will always return a value of 255. This similarly occurs when the variable A is used first in the program and assigned a value of 10 ie the two bytes then hold values of 10 and 255 instead of the correct values of 10 and 0. This returns a value to A of -246 instead of 10.

So, when MOVE is used, it protects the variable A from the bug of trying to use a byte at memory location 32768 for storage. The problem can be fixed using a sledge-hammer technique. Simply give TM a value of 32766 in line 10 (or one byte below the top of memory in whatever larger sized machine you're using).

Several readers have written in saying that typing SYSTEM '/' after compilation of a source code will work the first time but following any modifications etc, retyping SYSTEM '/' will result in the software crashing. This is because the values POKEd into memory locations 16607 and 16608 by line 30, which permit the slash without any following address, can be altered by routines executed in the interpreter. It is a good idea to specify the entry address subsequent to the first execution of object code. The entry point is always 108 bytes above the MEMORY SIZE, so type (for eg.) SYSTEM '/28608' and the object code should be executed correctly again.

LARGER MACHINES

Before explaining how owners of larger memory sized machines can use their extra memory for compiling longer source codes, I shall briefly outline how the compiler uses the available RAM.

Normally, the compiler is loaded into low user RAM and the source code typed in above it. The source is then compiled into RAM, starting about 100 bytes above the MEMORY SIZE and working up towards the top of memory (for a 16k machine this is 32767). Variables and the elements of DATA statements are stored in successive bytes descending from the top of memory down towards the ascending object code. Of course the compiler checks that the two do not overlap. The first 100 bytes above the MEMORY SIZE are used for storage of certain commonly used routines, for example, READ, BEEP, and MOVE. Also stored in that area are pointers used during execution of the object code, for example: a pointer to the next DATA element to be READ and another to restore that pointer to the first DATA element upon execution of a RESTORE statement. Figure 1 shows how the compiler, source and object code normally reside.

In order to produce object code on large memory sized machines which can be saved on tape and used by 16k (or even 4k for smaller programs) machines, the object code must be built into low RAM. Relative and some absolute addresses ensure that the program is non-relocatable. Therefore the arrangement shown in figure 2 must be adopted. The compiler and source reside in high memory (the MEMORY SIZE being set to the top of memory) and the two variables, TM and MS, which define the perimeter of the space to be used for the object code, must now be revalued.

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PARAMETER	SYSTEM-80	TRS-80 (Level II)
1 CPU type	Z-80	Z-80
2 Speed	1.7MHz	1.7MHz
3 S-100 compatible (with expansion unit)	Yes	No
4 Amount of RAM (basic computer)	16K	16K
5 Built-in cassette recorder	Yes	No
6 Built-in video RF modulator (use with any TV)	Yes	No
7 Capacity of BASIC ROM	12K	12K
8 Cassette recorder ports (basic machine)	2	1
9 Motor control for cassette recorders	Yes (2)	Yes (1)
10 Cost of basic unit with 16K RAM including monitor and cassette recorder	**$844.50**	**$1169**

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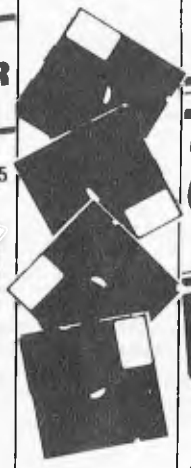

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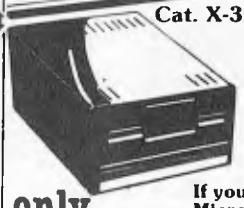

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TM will have to equal the beginning of Basic pointer (ie Peek (16548) + Peek (16549) *256) which itself will have had to be altered to allow object code to be inserted between the compiler and beginning of user RAM. And MS should be set to 17129 – the beginning of user RAM.

Line 10 should therefore read:

```
10 CLEAR 100:P=17129 + 2: MS=P: B=PEEK (16548) + PEEK (16549) *256: TM=B-2: CLS: PRINT@
   74, "APC COMPILER":PRINT: INPUT"COM
PILE FROM LINE NUMBER ";X:INPUT"TO LINE NUMBER "; YE:INPUT"ARE INTERRUPTS
   REQUIRED IN OBJECT CODE (Y/N) ";S$
```

HOW TO USE IT

Owners of large machines will firstly have to estimate how large the source code is expected to be. Increase this by a half to allow for the fact that the object code will require more room than source code and add this value to the beginning of user RAM. For example, if the source code is expected to be 10k, 15k must be added to 17129 (the beginning of user RAM) to give a value of about 32,000.

The Basic pointers must therefore be set to point at 32000 so POKE 16548, 0 and POKE 16549, 125 (as 0+125*256=32,000). Then RAM locations 32000 and 32001 must be zeroed so as to indicate to the interpreter that no programs are resident in RAM:

POKE 32000, 0 and POKE 32001, 0.

From now on, the procedure is fairly normal. CLOAD the (modified) compiler, type in the source code, compile it and save it on tape using Ian Davies' System Tape Generator remembering that the object code now resides between 17129 and 32000. This system tape can also be run on 16k machines.

Figure 1

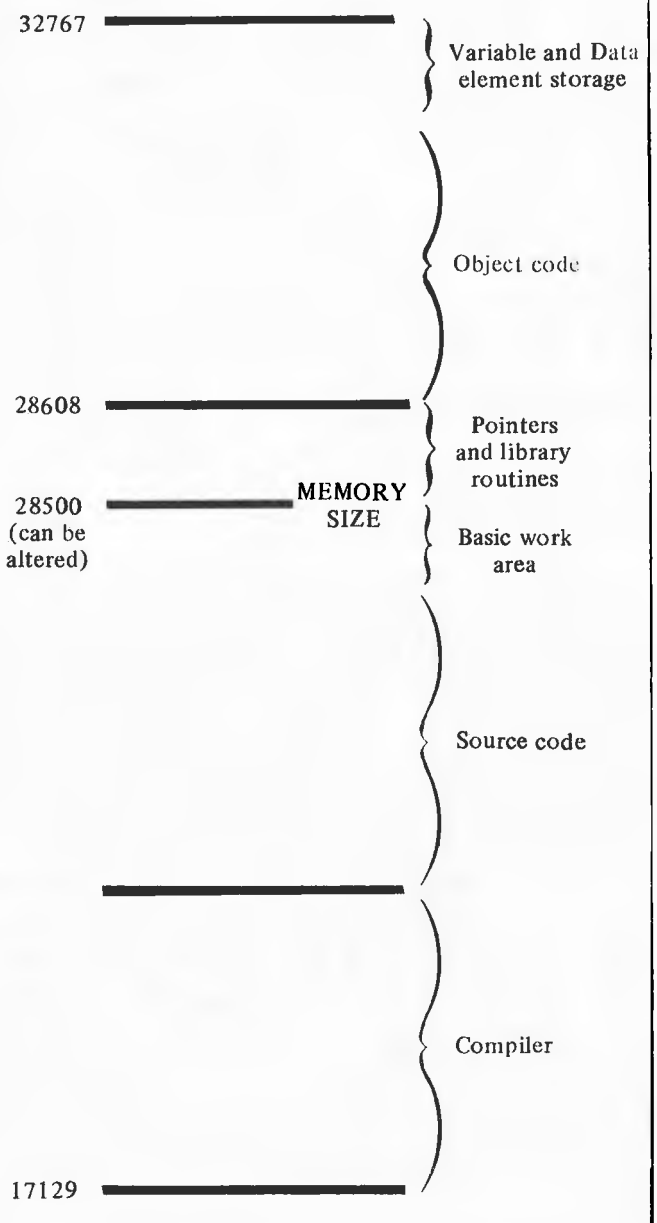
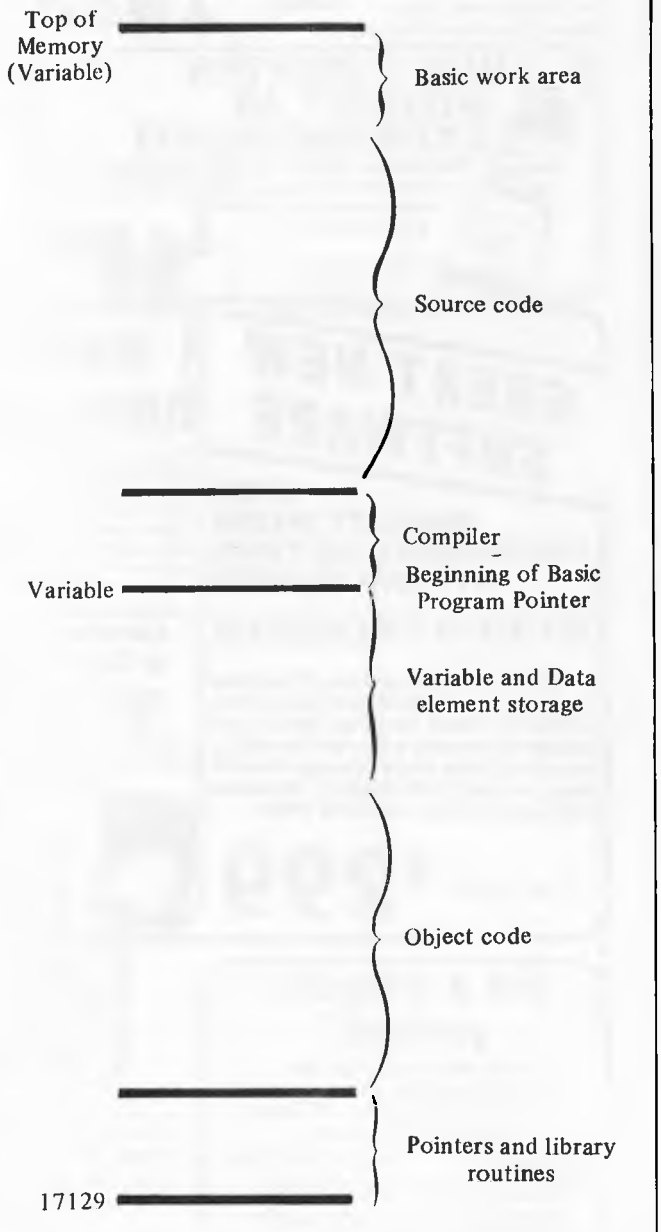


Figure 2



APC-80

Renumber Utility

This month, Ian Davies describes a renumber utility for disk and non-disk based systems.

We are all aware of how often small programs seem to grow into large programs. It's a very common situation, especially among hobbyists, to just get your latest masterpiece working and then go back and put in a few more checks on user responses and generally dress the whole thing up a bit. This usually becomes an iterative process until a point is reached where you have run out of space between line numbers. Often this is handled by putting in a GOSUB instead and placing the actual code elsewhere, resulting in a completely unintelligible "birdsnest". Clearly the optimum solution is to periodically renumber your programs during development.

APC-80 this month is a stand-alone renumber utility for disk and non-disk based systems. "Stand alone" means that it doesn't require any of the previous APC-80 modules in order to run (it actually loads over the usual APC-80 area). The utility is 745 bytes in length and also requires an unknown amount of table space — 4 bytes for each referenced number. In other words, if a program contains 200 line numbers, but only 10 of these are referred to on the right hand side of the program, then a mere 40 bytes of table space is needed. The utility manages the usage of free space itself, and is careful not to destroy the program if it runs out of room. It is highly unlikely space will be a problem for two reasons. Firstly, the number of referenced line numbers is usually quite small and, secondly, large programs usually have a large number of variables and other data items, and it is this space (among others) that the renumber uses for its tables. In the unlikely event that you do run out of memory, simply find a large REMark somewhere and temporarily delete it for the renumber.

The renumber performs three complete passes of the Basic program.

FIRST PASS

- Scans right hand side of the entire program and finds all line numbers, adding them to the table, if not already there, and checking for space.
- Counts the number of lines and statements while performing the above scanning.
- Displays number of lines and statements.
- Calculates and displays total amount of memory taken up by the program.

SECOND PASS

- Goes down the left hand side of the program and changes the line numbers to their new value.
- If the old value appeared in the table then the new value is also placed in the table in the space provided.

THIRD PASS

- Scans right hand side of the program again, finding all the line numbers and looking in the table for the new value and inserting it into the program.

HOUSEKEEPING

- Fixes all line pointers.
- Clears all variables.

The result of the above technique is a very fast renumber with linear execution time characteristics. In other words, it only takes twice as long to renumber a 200 line program as it does a 100 line program. This is a very important factor since some of the less reputable renumbers floating around tend to degrade exponentially for large programs.

How to use it

Since the APC-80 renumber is a utility, it should only be loaded in when needed, rather than taking up memory all the time.

The first step is to power up your machine and set a memory size of 32025, then CLOAD in the Basic version of the renumber (listing 2). Run the Basic program to POKE the machine code into high memory, then type NEW and CLOAD the program you want to renumber. Once this is complete, type SYSTEM and reply with /32025 to execute the renumber, which will then ask for two parameters: the new first line number and the increment for all subsequent line numbers. For obvious reasons negative or zero increments are illegal.

The utility then performs its first pass and prints the statistical information mentioned before. During the third pass the new line numbers are displayed on the screen so you can see where it is up to. Except in very large programs, this figure will usually change so fast that you will not be able to keep up with it. The utility returns to a READY state when finished. Do not load APC-80 in your power-up sequence for a renumber as this utility will destroy it.

Making a system tape of the renumber routine if you don't have an editor/assembler is a simple matter using the system tape generator of the April 1981 instalment of APC-80. The procedure is:—

- Power-up with a memory size of 31500.
- CLOAD and RUN Basic version of the renumber.
- CLOAD and RUN the system tape generator.
- ADDRESS TO PUT ROUTINE = 31500.
- START ADDRESS OF DUMP = 32025.
- NUMBER OF BYTES TO DUMP = 743.
- ENTRY POINT OF DUMP = 32025.
- Prepare blank cassette in record mode and reply 'SYSTEM','/'

By creating a system tape, either with our utility or with the editor/assembler, you can load the renumber much more quickly (12 seconds instead of 90 seconds for a CLOAD and RUN).

We're confident the renumber will behave correctly under all conditions, but just in case you've made an error while typing it in which only shows up in strange circumstances, always keep a copy of your un-renumbered program until you are sure the renumbered version is the same. Incidentally, the renumber should be able to handle anything you care to throw at it, including RESUME, ON . . . GOTO and all the rest.

Next month APC-80 recovers lost programs.

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BRUERPYM 1805

MICRO-80

Listing 1

Editor/assembler output of the renumber utility.

```
                00100 ;    APC-80  RENUMBER UTILITY
                00110
                00120 ; FOR TRS-80 DISC & NON-DISC BASED SYSTEMS.
                00130 ;        (ASSEMBLED FOR 16 K)
                00140
7D19            00150          ORG     32025
                00160
7D19 31157D     00170 RENUM    LD      SP,RENUM-4
7D1C 21D67E     00180          LD      HL,INTRO
7D1F CD9D7E     00190          CALL    PRINT    ; PRINT INTRO
7D22 E5         00200          PUSH    HL       ; SAVE TEXT PTR
7D23 CD6103     00210          CALL    0361H    ; INPUT LINE
7D26 CD5B1E     00220          CALL    1E5BH    ; VALUE IN DE
7D29 E1         00230          POP     HL       ; RECOVER TEXT PTR
7D2A D5         00240          PUSH    DE       ; SAVE FIRST VALUE
7D2B 23         00250          INC     HL       ; SKIP DELIMETER
7D2C CD9D7E     00260          CALL    PRINT    ; CONTINUE MESSAGE
7D2F CD6103     00270          CALL    0361H    ; INPUT SECOND LINE
7D32 CD5B1E     00280          CALL    1E5BH    ; AND FIND VALUE
7D35 C1         00290          POP     BC       ; GET BACK FIRST VALUE
7D36 D5         00300          PUSH    DE       ; SAVE INCREMENT VALUE
7D37 C5         00310          PUSH    BC       ; THEN SAVE FIRST VALUE
7D38 7A         00320          LD      A,D      ; CHECK FOR ZERO
7D39 B3         00330          OR      E
7D3A 200B       00340          JR      NZ,CONTRN
7D3C 21487F     00350          LD      HL,INCZER ; ELSE ERROR
7D3F CD9D7E     00360          CALL    PRINT
7D42 CD4900     00370          CALL    0049H     ; WAIT FOR KEY
7D45 18D2       00380          JR      RENUM     ; START AGAIN
                00390
7D47 210000     00400 CONTRN   LD      HL,0000H
7D4A 54         00410          LD      D,H          ; ZERO COUNTERS
7D4B 5D         00420          LD      E,L
7D4C D9         00430          EXX                  ; SWAP COUNTERS TO OTHER REGS
7D4D 2AF940     00440          LD      HL,(40F9H)   ; END OF PROG PTR
7D50 22D47E     00450          LD      (ENDTAB),HL ; SET TABLE TO EMPTY
7D53 2AA440     00460          LD      HL,(40A4H)   ; SET PTR TO START
7D56 2B         00470          DEC     HL
7D57 23         00480 P1LNLP   INC     HL       ; FETCH NEXT BYTE
7D58 7E         00490          LD      A,(HL)
7D59 23         00500          INC     HL
7D5A B6         00510          OR      (HL)     ; CHECK FOR END OF PROG
7D5B 2845       00520          JR      Z,ENDP1
7D5D 23         00530          INC     HL       ; SKIP LINE NUMBER
7D5E 23         00540          INC     HL
7D5F D7         00550 P1CHLP   RST     10H      ; FETCH NEXT SYMBOL
7D60 200B       00560          JR      NZ,P1CONT ; IF NOT END OF STAT/LINE
7D62 D9         00570          EXX              ; SWAP TO COUNTER SET
7D63 23         00580          INC     HL       ; INCREMENT STATEMENT COUNTER
7D64 D9         00590          EXX              ; AND SWAP BACK
7D65 A7         00600          AND     A        ; CHECK TERMINATOR
7D66 20F7       00610          JR      NZ,P1CHLP ; IF A COLON
7D68 D9         00620          EXX              ; COUNTER SET AGAIN
7D69 13         00630          INC     DE       ; INCREMENT LINE COUNTER
7D6A D9         00640          EXX              ; AND BACK
7D6B 18EA       00650          JR      P1LNLP   ; END OF LINE
                00660
7D6D CDA37E     00670 P1CONT   CALL    TESTCH   ; CHECK FOR KEYWORDS
7D70 20ED       00680          JR      NZ,P1CHLP ; IF NOT FOUND
7D72 D7         00690 P1LIST   RST     10H      ; FETCH NEXT
7D73 CD5A1E     00700          CALL    1E5AH    ; READ LINE NUMBER
7D76 CDB07E     00710          CALL    SEARCH   ; CHECK TABLE
7D79 281E       00720          JR      Z,FOUND  ; IF ALREADY THERE
7D7B 7B         00730          LD      A,E      ; ELSE PUT IT IN TABLE
7D7C 02         00740          LD      (BC),A
7D7D 03         00750          INC     BC
7D7E 7A         00760          LD      A,D      ; AND MSB
7D7F 02         00770          LD      (BC),A
7D80 AF         00780          XOR     A        ; ZERO A
7D81 03         00790          INC     BC
7D82 02         00800          LD      (BC),A   ; ZERO SECOND HALF OF TABLE
7D83 03         00810          INC     BC
7D84 02         00820          LD      (BC),A   ; AND MSB AS WELL
7D85 03         00830          INC     BC       ; LEAVE SPACE FOR SECOND HALF
7D86 ED43D47E   00840          LD      (ENDTAB),BC
7D8A E5         00850          PUSH    HL       ; SAVE PROG PTR
7D8B AF         00860          XOR     A        ; CLEAR CY
7D8C C5         00870          PUSH    BC
7D8D E1         00880          POP     HL
7D8E ED72       00890          SBC     HL,SP    ; CHECK FOR OUT OF MEMORY
7D90 3806       00900          JR      C,MEMOK
7D92 21887F     00910          LD      HL,MEMERR
7D95 C3977E     00920          JP      ABORT
7D98 E1         00930 MEMOK    POP     HL       ; RESTORE PROG PTR
7D99 2B         00940 FOUND    DEC     HL
7D9A D7         00950          RST     10H      ; FETCH NEXT
7D9B FE2C       00960          CP      ','      ; CHECK FOR LISTS
7D9D 28D3       00970          JR      Z,P1LIST
7D9F 2B         00980          DEC     HL
7DA0 18BD       00990          JR      P1CHLP   ; AND CONTINUE
                01000
7DA2 3E0A       01010 ENDP1    LD      A,0AH       ; GIVE LINEFEED
7DA4 CD2A03     01020          CALL    032AH
7DA7 D9         01030          EXX                 ; SWAP TO COUNTER REG SET
7DA8 D5         01040          PUSH    DE          ; SAVE LINE COUNTER
7DA9 CDAF0F     01050          CALL    0FAFH       ; PRINT
7DAC 21AB7F     01060          LD      HL,STAMES   ; MESSAGE PTR
7DAF CD9D7E     01070          CALL    PRINT
7DB2 23         01080          INC     HL          ; SKIP DELIMITER
7DB3 E3         01090          EX      (SP),HL     ; RETREIVE STATEMENT COUNTER
7DB4 CDAF0F     01100          CALL    0FAFH       ; PRINT
7DB7 E1         01110          POP     HL          ; RECOVER MESSAGE PTR
7DB8 CD9D7E     01120          CALL    PRINT
7DBB 2AF940     01130          LD      HL,(40F9H)  ; LAST PROGRAM BYTE
7DBE ED5BA440   01140          LD      DE,(40A4H)  ; FIRST PROGRAM BYTE
7DC2 37         01150          SCF                 ; SET CARRY
7DC3 ED52       01160          SBC     HL,DE
7DC5 2B         01170          DEC     HL
7DC6 CDAF0F     01180          CALL    0FAFH       ; PRINT PROG SIZE
                01190
                01200 ;   START OF PASS TWO
```

```
                01210
7DC9 2AA440     01220           LD      HL,(40A4H) ; SET PTR TO TOP
7DCC 5E         01230 PASS2     LD      E,(HL)  ; FETCH NEXT LINE PTR
7DCD 7B         01240           LD      A,E
7DCE 23         01250           INC     HL      ; SELECT MSB
7DCF 56         01260           LD      D,(HL)
7DD0 B2         01270           OR      D       ; CHECK FOR END OF PROG
7DD1 281F       01280           JR      Z,ENDP2
7DD3 D5         01290           PUSH    DE      ; SAVE NEXT PTR
7DD4 23         01300           INC     HL
7DD5 5E         01310           LD      E,(HL)  ; FETCH LINE NUMBER (LHS)
7DD6 23         01320           INC     HL
7DD7 56         01330           LD      D,(HL)
7DD8 CDB07E     01340           CALL    SEARCH  ; CHECK TABLE
7DDB DDE1       01350           POP     IX      ; SAVE NEXT PTR
7DDD D1         01360           POP     DE      ; NEW NUMBER
7DDE 2005       01370           JR      NZ,NOTIN; IF NOT IN TABLE
7DE0 7B         01380           LD      A,E
7DE1 02         01390           LD      (BC),A  ; PUT NEW NUMBER IN TABLE
7DE2 03         01400           INC     BC
7DE3 7A         01410           LD      A,D
7DE4 02         01420           LD      (BC),A
7DE5 72         01430 NOTIN     LD      (HL),D  ; NEW NUMBER IN PROG (LHS ONLY)
7DE6 2B         01440           DEC     HL
7DE7 73         01450           LD      (HL),E  ; AND MSB
7DE8 EB         01460           EX      DE,HL
7DE9 D1         01470           POP     DE      ; GET INCREMENT
7DEA 19         01480           ADD     HL,DE   ; AND ADD IT
7DEB D5         01490           PUSH    DE      ; SAVE INCREMENT
7DEC E5         01500           PUSH    HL      ; SAVE NEW NUMBER
7DED DDE5       01510           PUSH    IX
7DEF E1         01520           POP     HL      ; NEXT LINE
7DF0 18DA       01530           JR      PASS2
                01540
7DF2 21D07F     01550 ENDP2     LD      HL,END2M
7DF5 CD9D7E     01560           CALL    PRINT
                01570
                01580 ;  START OF PASS 3
                01590
7DF8 2AA440     01600           LD      HL,(40A4H)  ; SET PTR TO TOP
7DFB 2B         01610           DEC     HL
7DFC 23         01620 P3LOOP    INC     HL
7DFD 7E         01630           LD      A,(HL)  ; CHECK FOR END OF PROG
7DFE 23         01640           INC     HL
7DFF B6         01650           OR      (HL)
7E00 CA8E7E     01660           JP      Z,ENDP3
7E03 23         01670           INC     HL
7E04 5E         01680           LD      E,(HL)  ; PICK UP LINE NUMBER
7E05 23         01690           INC     HL
7E06 56         01700           LD      D,(HL)
7E07 E5         01710           PUSH    HL      ; SAVE PROG PTR
7E08 214F3E     01720           LD      HL,15951
7E0B 222040     01730           LD      (4020H),HL ; SET CURSOR POSITION
7E0E EB         01740           EX      DE,HL   ; NUMBER IN HL
7E0F CDAF0F     01750           CALL    0FAFH   ; PRINT LINE NUMBER
7E12 E1         01760           POP     HL      ; RECOVER SOURCE PTR
7E13 D7         01770 P3CHLP    RST     10H     ; GET NEXT
7E14 A7         01780 P3CHL     AND     A       ; SET FLAGS
7E15 28E5       01790           JR      Z,P3LOOP ; IF END OF LINE
7E17 CDA37E     01800           CALL    TESTCH  ; CHECK FOR KEYWORDS
7E1A 20F7       01810           JR      NZ,P3CHLP ; IF NOT FOUND
7E1C D7         01820 P3LIST    RST     10H     ; GET NEXT
7E1D 30F5       01830           JR      NC,P3CHL  ; IF NO LINE NUMBER
7E1F E5         01840           PUSH    HL      ; SAVE START OF NUMBER
7E20 CD5A1E     01850           CALL    1E5AH   ; READ LINE NUMBER
7E23 CDB07E     01860           CALL    SEARCH  ; CHECK TABLE
7E26 0A         01870           LD      A,(BC)  ; GET NEW VALUE FROM TABLE
7E27 5F         01880           LD      E,A
7E28 03         01890           INC     BC
7E29 0A         01900           LD      A,(BC)
7E2A 57         01910           LD      D,A
7E2B D5         01920           PUSH    DE      ; SAVE NEW VALUE
7E2C EB         01930           EX      DE,HL   ; DE IS LAST DIGIT POSITION
7E2D 2AD47E     01940           LD      HL,(ENDTAB)
7E30 E5         01950           PUSH    HL
7E31 AF         01960           XOR     A       ; CLEAR CY
7E32 ED52       01970           SBC     HL,DE   ; FIND LENGTH
7E34 23         01980           INC     HL
7E35 E5         01990           PUSH    HL
7E36 C1         02000           POP     BC      ; BC=LENGTH OF MOVE
7E37 E1         02010           POP     HL      ; RESTORE ENDTAB
7E38 54         02020           LD      D,H
7E39 5D         02030           LD      E,L     ; COPY INTO DE
7E3A 13         02040           INC     DE
7E3B 13         02050           INC     DE
7E3C 13         02060           INC     DE      ; MAKE ROOM
7E3D 13         02070           INC     DE
7E3E C5         02080           PUSH    BC
7E3F DDE1       02090           POP     IX      ; COPY INTO IX FOR LATER
7E41 EDB8       02100           LDDR            ; SHIFT PROG AND TABLE
7E43 E1         02110           POP     HL      ; NEW LINE NUMBER
7E44 D5         02120           PUSH    DE
7E45 CD9A0A     02130           CALL    0A9AH   ; SET UP IN ACC
7E48 AF         02140           XOR     A
7E49 CD3410     02150           CALL    1034H   ; PREP FOR CONVERSION
7E4C B6         02160           DEFB    0B6H    ; SET CONTROL
7E4D CDD90F     02170           CALL    0FD9H   ; WRITE NUMBER IN 4130...
7E50 C1         02180           POP     BC
7E51 D1         02190           POP     DE      ; RESTORE NUMBER START
7E52 23         02200           INC     HL      ; SKIP SPACE
7E53 C5         02210           PUSH    BC      ; LDI CHANGES IT
7E54 EDA0       02220 SHIFLP    LDI             ; COPY NUMBER INTO PROG
7E56 7E         02230           LD      A,(HL)  ; CHECK FOR END
7E57 A7         02240           AND     A
7E58 20FA       02250           JR      NZ,SHIFLP ; LOOP IF NOT DONE
7E5A C1         02260           POP     BC      ; BACK AGAIN
7E5B 1B         02270           DEC     DE      ; ADJUST PTR
7E5C D5         02280           PUSH    DE      ; SAVE NEW SOURCE PTR
7E5D 13         02290           INC     DE
7E5E C5         02300           PUSH    BC
7E5F E1         02310           POP     HL      ; SET 'FROM' PTR
7E60 E5         02320           PUSH    HL      ; SAVE
7E61 D5         02330           PUSH    DE      ; SAVE
7E62 EB         02340           EX      DE,HL   ; SWAP
7E63 AF         02350           XOR     A       ; CLEAR CY
7E64 ED52       02360           SBC     HL,DE   ; FIND DIFFERENCE OF SHIFT
```

```
7E66 23       02370          INC     HL
7E67 23       02380          INC     HL
7E68 23       02390          INC     HL      ; ADJUST FOR PREVIOUS SHIFT
7E69 D1       02400          POP     DE      ; RECOVER
7E6A E3       02410          EX      (SP),HL ; RECOVER & SAVE DIFFERENCE
7E6B 23       02420          INC     HL      ; ADJUST PTR
7E6C DDE5     02430          PUSH    IX
7E6E C1       02440          POP     BC      ; SET LENGTH
7E6F EDB0     02450          LDIR            ; CLOSE RANKS AROUND NEW NUMBER
7E71 D1       02460          POP     DE      ; RECOVER DIFFERENCE OF SHIFT
7E72 2AD47E   02470          LD      HL,(ENDTAB)
7E75 19       02480          ADD     HL,DE   ; FIX ENDTAB POINTER
7E76 22D47E   02490          LD      (ENDTAB),HL
7E79 2AF940   02500          LD      HL,(40F9H)
7E7C 19       02510          ADD     HL,DE   ; FIX END OF PROG POINTER
7E7D 22F940   02520          LD      (40F9H),HL
7E80 E1       02530          POP     HL      ; SOURCE PTR
7E81 E5       02540          PUSH    HL      ; SAVE AGAIN
7E82 D7       02550          RST     10H     ; FETCH NEXT
7E83 FE2C     02560          CP      ','     ; CHECK FOR LISTS
7E85 D1       02570          POP     DE      ; SOURCE PTR MAY BE NEEDED
7E86 CA1C7E   02580          JP      Z,P3LIST
7E89 EB       02590          EX      DE,HL   ; RESTORE PROPER SOURCE PTR
7E8A 2B       02600          DEC     HL      ; ADJUST BACK
7E8B C3137E   02610          JP      P3CHLP  ; LOOP AROUND
              02620
7E8E CDF81A   02630 ENDP3    CALL    1AF8H   ; FIX UP LINE POINTERS
7E91 CD611B   02640          CALL    1B61H   ; DESTROY ALL VARIABLES
7E94 21E87F   02650          LD      HL,ENDMES
7E97 CD9D7E   02660 ABORT    CALL    PRINT
7E9A C3CC06   02670          JP      06CCH   ; BACK TO BASIC
              02680
7E9D 1600     02690 PRINT    LD      D,0
7E9F CD0A2F   02700          CALL    2F0AH   ; PRINT ROUTINE
7EA2 C9       02710          RET
              02720
7EA3 E5       02730 TESTCH   PUSH    HL      ; CHECKS FOR SPECIAL KEYWORDS
7EA4 C5       02740          PUSH    BC
7EA5 21E27F   02750          LD      HL,XLIST
7EA8 010600   02760          LD      BC,0006H
7EAB EDB1     02770          CPIR            ; SEARCH TABLE
7EAD C1       02780          POP     BC
7EAE E1       02790          POP     HL
7EAF C9       02800          RET
              02810
7EB0 E5       02820 SEARCH   PUSH    HL      ; LINE NUMBER TABLE SEARCH.
7EB1 D5       02830          PUSH    DE
7EB2 D5       02840          PUSH    DE
7EB3 C1       02850          POP     BC      ; NUMBER TO SEARCH FOR IN BC
7EB4 2AF940   02860          LD      HL,(40F9H) ; START OF TABLE
7EB7 ED5BD47E 02870          LD      DE,(ENDTAB); END OF TABLE
7EBB DF       02880 SRCHLP   RST     18H     ; CHECK FOR END OF TABLE
7EBC 280E     02890          JR      Z,ENDSCH
7EBE 79       02900          LD      A,C     ; FETCH FIRST BYTE
7EBF BE       02910          CP      (HL)    ; AND COMPARE
7EC0 23       02920          INC     HL
7EC1 2002     02930          JR      NZ,SRCONT  ; IF NOT EQUAL SO FAR
7EC3 78       02940          LD      A,B     ; ELSE TRY SECOND BYTE
7EC4 BE       02950          CP      (HL)    ; ALSO COMPARE
7EC5 23       02960 SRCONT   INC     HL
7EC6 2807     02970          JR      Z,SFOUND   ; IF FOUND
7EC8 23       02980          INC     HL
7EC9 23       02990          INC     HL      ; SKIP RHS OF TABLE
7ECA 18EF     03000          JR      SRCHLP  ; KEEP GOING
7ECC 3EFF     03010 ENDSCH   LD      A,0FFH  ; ENSURE ZERO FLAG IS RESET
7ECE A7       03020          AND     A       ; SET FLAGS
7ECF E5       03030 SFOUND   PUSH    HL
7ED0 C1       03040          POP     BC      ; TABLE INDEX IN BC
7ED1 D1       03050          POP     DE
7ED2 E1       03060          POP     HL      ; RESTORE
7ED3 C9       03070          RET
              03080
              03090
7ED4 0000     03100 ENDTAB   DEFW    0
              03110
7ED6 1C1F     03120 INTRO    DEFW    1F1CH
7ED8 41       03130          DEFM    'A.P.C.  --  PROGRAM RENUMBER UTILITY'
7EFC D0       03140          DEFB    208
7EFD 56       03150          DEFM    'VERSION 3.1'
7F08 0A0A     03160          DEFW    0A0AH
7F0A 45       03170          DEFM    'ENTER NEW FIRST LINE NUMBER : '
7F28 00       03180          DEFB    0
7F29 41       03190          DEFM    'AND RENUMBERING INCREMENT   : '
7F47 00       03200          DEFB    0
              03210
7F48 0A0A     03220 INCZER   DEFW    0A0AH
7F4A 2A       03230          DEFM    '** INCREMENT OF ZERO IS ILLEGAL.'
7F6A 0A       03240          DEFB    0AH
7F6B 2A       03250          DEFM    '** PUSH ANY KEY TO CONTINUE.'
7F87 00       03260          DEFB    0
              03270
7F88 0A0A     03280 MEMERR   DEFW    0A0AH
7F8A 2A       03290          DEFM    '** OUT OF TABLE SPACE - ABORTED.'
7FAA 00       03300          DEFB    0
              03310
7FAB 20       03320 STAMES   DEFM    ' STATEMENTS'
7FB6 0A00     03330          DEFW    000AH
7FB8 20       03340          DEFM    ' LINES'
7FBE 0A       03350          DEFB    0AH
7FBF 50       03360          DEFM    'PROGRAM BYTES = '
7FCF 00       03370          DEFB    0
              03380
7FD0 0A0A     03390 END2M    DEFW    0A0AH
7FD2 52       03400          DEFM    'RENUMBERING AS '
7FE1 00       03410          DEFB    0
              03420
7FE2 8D       03430 XLIST    DEFB    8DH     ; GOTO
7FE3 91       03440          DEFB    91H     ; GOSUB
7FE4 CA       03450          DEFB    0CAH    ; THEN
7FE5 95       03460          DEFB    95H     ; ELSE
7FE6 9F       03470          DEFB    9FH     ; RESUME
7FE7 8E       03480          DEFB    8EH     ; RUN
              03490
7FE8 0A0A     03500 ENDMES   DEFW    0A0AH
7FEA 52       03510          DEFM    'RENUMBERING COMPLETE.'
7FFF 00       03520          DEFB    0
```

```
                03530
0000            03540           END
00000 TOTAL ERRORS


ABORT   7E97 02660   00920
CONTRN  7D47 00400   00340
END2M   7FD0 03390   01550
ENDMES  7FE8 03500   02650
ENDP1   7DA2 01010   00520
ENDP2   7DF2 01550   01280
ENDP3   7E8E 02630   01660
ENDSCH  7ECC 03010   02890
ENDTAB  7ED4 03100   00450 00840 01940 02470 02490 02870
FOUND   7D99 00940   00720
INCZER  7F48 03220   00350
INTRO   7ED6 03120   00180
MEMERR  7F88 03280   00910
MEMOK   7D98 00930   00900
NOTIN   7DE5 01430   01370
P1CHLP  7D5F 00550   00610 00680 00990
P1CONT  7D6D 00670   00560
P1LIST  7D72 00690   00970
P1LNLP  7D57 00480   00650
P3CHL   7E14 01780   01830
P3CHLP  7E13 01770   01810 02610
P3LIST  7E1C 01820   02580
P3LOOP  7DFC 01620   01790
PASS2   7DCC 01230   01530
PRINT   7E9D 02690   00190 00260 00360 01070 01120 01560 02660
RENUM   7D19 00170   00170 00380
SEARCH  7EB0 02820   00710 01340 01860
SFOUND  7ECF 03030   02970
SHIFLP  7E54 02220   02250
SRCHLP  7EBB 02880   03000
SRCONT  7EC5 02960   02930
STAMES  7FAB 03320   01060
TESTCH  7EA3 02730   00670 01800
XLIST   7FE2 03430   02750
```

Listing 2

Basic version of the renumber utility.

```
10 CLS : POKE 16553,255
20 PRINT "LOADING A.P.C. - 8 0 RENUMBER UTILITY"
30 READ H$
40 C%=C%+1 : PRINT @ 56, C%
50 IF LEN(H$)>2 THEN 110
60 H%=ASC(LEFT$(H$,1))-48
70 L%=ASC(RIGHT$(H$,1))-48
80 IF H%>9 THEN H%=H%-7
90 IF L%>9 THEN L%=L%-7
100 POKE B%+O%,H%*16+L%: O%=O%+1:GOTO 30
110 IF H$="ORG" THENREAD B%:O%=0:GOTO 30
120 IF H$<>"END" THEN STOP
130 PRINT
140 PRINT "LOAD COMPLETE"
150 END
160 DATA ORG, 32025
170 DATA 31, 15, 7D, 21, D6, 7E, CD, 9D, 7E
180 DATA E5, CD, 61, 03, CD, 5B, 1E, E1, D5
190 DATA 23, CD, 9D, 7E, CD, 61, 03, CD, 5B
200 DATA 1E, C1, D5, C5, 7A, B3, 20, 0B, 21
210 DATA 48, 7F, CD, 9D, 7E, CD, 49, 00, 18
220 DATA D2, 21, 00, 00, 54, 5D, D9, 2A, F9
230 DATA 40, 22, D4, 7E, 2A, A4, 40, 2B, 23
240 DATA 7E, 23, B6, 28, 45, 23, 23, D7, 20
250 DATA 0B, D9, 23, D9, A7, 20, F7, D9, 13
260 DATA D9, 18, EA, CD, A3, 7E, 20, ED, D7
270 DATA CD, 5A, 1E, CD, B0, 7E, 28, 1E, 7B
280 DATA 02, 03, 7A, 02, AF, 03, 02, 03, 02
290 DATA 03, ED, 43, D4, 7E, E5, AF, C5, E1
300 DATA ED, 72, 38, 06, 21, 88, 7F, C3, 97
310 DATA 7E, E1, 2B, D7, FE, 2C, 28, D3, 2B
320 DATA 18, BD, 3E, 0A, CD, 2A, 03, D9, D5
330 DATA CD, AF, 0F, 21, AB, 7F, CD, 9D, 7E
340 DATA 23, E3, CD, AF, 0F, E1, CD, 9D, 7E
350 DATA 2A, F9, 40, ED, 5B, A4, 40, 37, ED
360 DATA 52, 2B, CD, AF, 0F, 2A, A4, 40, 5E
370 DATA 7B, 23, 56, B2, 28, 1F, D5, 23, 5E
380 DATA 23, 56, CD, B0, 7E, DD, E1, D1, 20
390 DATA 05, 7B, 02, 03, 7A, 02, 72, 2B, 73
400 DATA EB, D1, 19, D5, E5, DD, E5, E1, 18
410 DATA DA, 21, D0, 7F, CD, 9D, 7E, 2A, A4
420 DATA 40, 2B, 23, 7E, 23, B6, CA, 8E, 7E
430 DATA 23, 5E, 23, 56, E5, 21, 4F, 3E, 22
440 DATA 20, 40, EB, CD, AF, 0F, E1, D7, A7
450 DATA 28, E5, CD, A3, 7E, 20, F7, D7, 30
460 DATA F5, E5, CD, 5A, 1E, CD, B0, 7E, 0A
470 DATA 5F, 03, 0A, 57, D5, EB, 2A, D4, 7E
480 DATA E5, AF, ED, 52, 23, E5, C1, E1, 54
490 DATA 5D, 13, 13, 13, 13, C5, DD, E1, ED
```

```
500 DATA B8, E1, D5, CD, 9A, 0A, AF, CD, 34
510 DATA 10, B6, CD, D9, 0F, C1, D1, 23, C5
520 DATA ED, A0, 7E, A7, 20, FA, C1, 1B, D5
530 DATA 13, C5, E1, E5, D5, EB, AF, ED, 52
540 DATA 23, 23, 23, D1, E3, 23, DD, E5, C1
550 DATA ED, B0, D1, 2A, D4, 7E, 19, 22, D4
560 DATA 7E, 2A, F9, 40, 19, 22, F9, 40, E1
570 DATA E5, D7, FE, 2C, D1, CA, 1C, 7E, EB
580 DATA 2B, C3, 13, 7E, CD, F8, 1A, CD, 61
590 DATA 1B, 21, E8, 7F, CD, 9D, 7E, C3, CC
600 DATA 06, 16, 00, CD, 0A, 2F, C9, E5, C5
610 DATA 21, E2, 7F, 01, 06, 00, ED, B1, C1
620 DATA E1, C9, E5, D5, D5, C1, 2A, F9, 40
630 DATA ED, 5B, D4, 7E, DF, 28, 0E, 79, BE
640 DATA 23, 20, 02, 78, BE, 23, 28, 07, 23
650 DATA 23, 18, EF, 3E, FF, A7, E5, C1, D1
660 DATA E1, C9, 00, 00, 1C, 1F, 41, 2E, 50
670 DATA 2E, 43, 2E, 20, 20, 2D, 2D, 20, 20
680 DATA 50, 52, 4F, 47, 52, 41, 4D, 20, 52
690 DATA 45, 4E, 55, 4D, 42, 45, 52, 20, 55
700 DATA 54, 49, 4C, 49, 54, 59, D0, 56, 45
710 DATA 52, 53, 49, 4F, 4E, 20, 33, 2E, 31
720 DATA 0A, 0A, 45, 4E, 54, 45, 52, 20, 4E
730 DATA 45, 57, 20, 46, 49, 52, 53, 54, 20
740 DATA 4C, 49, 4E, 45, 20, 4E, 55, 4D, 42
750 DATA 45, 52, 20, 3A, 20, 00, 41, 4E, 44
760 DATA 20, 52, 45, 4E, 55, 4D, 42, 45, 52
770 DATA 49, 4E, 47, 20, 49, 4E, 43, 52, 45
780 DATA 4D, 45, 4E, 54, 20, 20, 20, 3A, 20
790 DATA 00, 0A, 0A, 2A, 2A, 20, 49, 4E, 43
800 DATA 52, 45, 4D, 45, 4E, 54, 20, 4F, 46
810 DATA 20, 5A, 45, 52, 4F, 20, 49, 53, 20
820 DATA 49, 4C, 4C, 45, 47, 41, 4C, 2E, 0A
830 DATA 2A, 2A, 20, 50, 55, 53, 48, 20, 41
840 DATA 4E, 59, 20, 4B, 45, 59, 20, 54, 4F
850 DATA 20, 43, 4F, 4E, 54, 49, 4E, 55, 45
860 DATA 2E, 00, 0A, 0A, 2A, 2A, 20, 4F, 55
870 DATA 54, 20, 4F, 46, 20, 54, 41, 42, 4C
880 DATA 45, 20, 53, 50, 41, 43, 45, 20, 2D
890 DATA 20, 41, 42, 4F, 52, 54, 45, 44, 2E
900 DATA 00, 20, 53, 54, 41, 54, 45, 4D, 45
910 DATA 4E, 54, 53, 0A, 00, 20, 4C, 49, 4E
920 DATA 45, 53, 0A, 50, 52, 4F, 47, 52, 41
930 DATA 4D, 20, 42, 59, 54, 45, 53, 20, 3D
940 DATA 20, 00, 0A, 0A, 52, 45, 4E, 55, 4D
950 DATA 42, 45, 52, 49, 4E, 47, 20, 41, 53
960 DATA 20, 00, 8D, 91, CA, 95, 9F, 8E, 0A
970 DATA 0A, 52, 45, 4E, 55, 4D, 42, 45, 52
980 DATA 49, 4E, 47, 20, 43, 4F, 4D, 50, 4C
990 DATA 45, 54, 45, 2E, 00
1000 DATA END
```


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by Carl A. Kollar

[Reprint of June 1980 Review, *80 Microcomputing*]

I guess I don't have to tell any TRS-80 owners how frustrating the cassette system that comes with the computer can be. Even with the factory mod that's available, the annoyance of loading and checking programs becomes just barely tolerable.

If you're like me, after you've just plunked down a chunk of money for a Level II 16K machine, "you ain't got nuttin left" for even one disk drive at 500 bucks apiece. So you suffer.

A reasonable alternative is the Ekaton Storage Floppy (ESF). This will cost you about 350 bucks and totally eliminates your loading and saving problems, automatically and fast. I've had one of these for about six months and love it!

But, if the price is still too steep, have I got a device for you!

The Device

The February 1980 issue of *Microcomputing* had an ad that intrigued the hell out of me. It was a high-speed cassette system by JPC Products, acclaimed as a "poor man's floppy." It made all sorts of seemingly ridiculous claims such as "loads five times faster," "stores 50,000 bytes on a 30-minute cassette," "less than one bad load in a million bytes with the volumes on mod anywhere between one and eight."

All this for a measly 120 bucks? How could this be? A call to Albuquerque answered a few questions: Yes, it had its own power supply, and, it stored programs five times faster because it utilized higher density data. The computer outputs the information at a higher rate of the rear keyboard connector.

The ad had even claimed anyone could build it even if you have never soldered before. JPC would make it work, it you couldn't—for free. It was sold. I placed my order, and it arrived about two months later (parts shortage).

I work in electronics, so I found the unit exceptionally easy to build. It took about an hour. The manual is superb. If that's better than a TRS-80 it was clear, concise and exact with no ambiguities. Important parts placements are stressed (polarity markings on electrolytics, bands on diodes, etc.).

JPC was right! With these instructions, you couldn't go wrong. The board quality is excellent. It is double-sided and parts locations are clearly marked on the component side of the board. There are no jumper wires to install. JPC utilizes PC traces and plated-through holes for connections to traces on the other side of the board.

Also, there are absolutely no adjustments or settings to bother with.

The documentation is a shade of 8½ × 11 papers stapled together. It is written in the nicest format I've seen in a while. Each command and or subjects is covered on its own sheet in large type. All explanations are in easy to read English—not computerese.

Commands and Features

SAVE"filename": Saves your BASIC program on cassette.
LOAD: Reads the next BASIC program from the cassette.
LOAD"filename": Searches for and loads the specified file from cassette.
LOAD? and LOAD?"filename": Reads file from cassette, and compares contents to memory.
LOADN: Prints a list of all the programs on a cassette, until interrupted by the "break" key.
LOADN"filename": Same as above except the tape will stop at the end of the program named.
KILL: Removes the file manager program from memory so that the extra memory can be used by large programs.
RSET: Allows the operator to rewind and position the tape on tape recorders that have these functions tied to the motor control jack.
RUN"filename": TC-8 searches for a specified program and runs it immediately.
PUT"filename": Same as SAVE "filename", except it is for use with system tapes.
GET: Same as LOAD, except it is for use with system tapes.
GET"filename": Same as LOAD "filename", except it is for use with system tapes.
GET? and GET?"filename": Same as LOAD? and LOAD?"filename", except it is for use with system tapes.
GETN and GETN"filename": Same as LOADN and LOADN"filename", except it is for use with system tapes.
OPEN: Required before cassette input or output of a data file can be attempted.
CLOSE: Required to end a cassette data file.
PRINT#: Allows numerical or string data to be output to a cassette file.
INPUT#: Allows numerical or string data to be input from a cassette file.

I haven't counted them, so I don't know about the "one load in a million bytes" claim, but my son, Anthony (age 11), loaded about 30 of his programs from his Radio Shack format tape to a new TC-8 format tape. He's run them all and found no bad loads.

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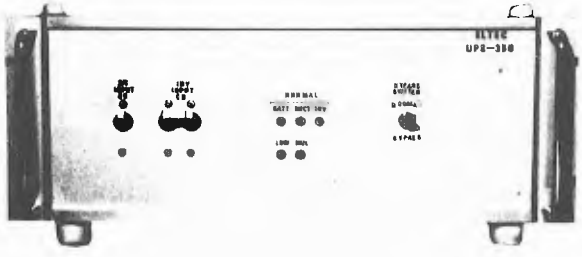

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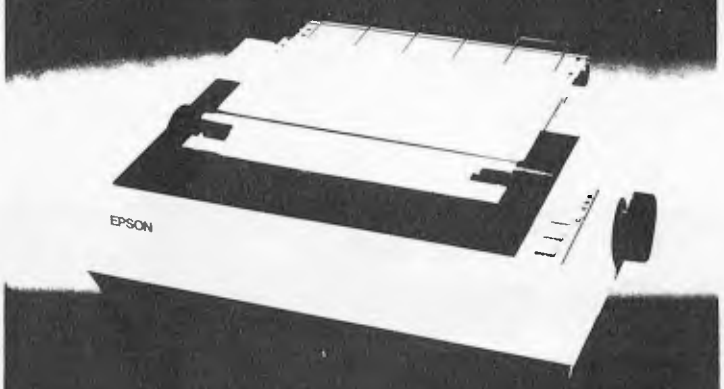

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Fully Interactive Business programmes

Adapter for TRS-80* computer eliminates disk read errors

De Forest Software is marketing a simple plug-in adaptor for TRS-80* computers that corrects a design deficiency in the disk controller circuit.

The problem, which causes disk read errors, has been traced to Tandy's reliance on a circuit internal to the FD1771 controller IC to perform the function of separating clock and data pulses.

As explained in the *Backgrounder*, use of the internal chip circuit for reliable data-clock separation is a design shortcut which the manufacturer of the controller IC warns against.

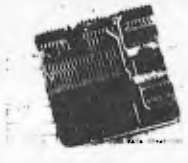
The De Forest solution, a PC card adaptor called the DATA SEPARATOR, eliminates the problem by substituting an explicit data separator circuit – one which has been used reliably in disk controllers since 1977 – for the internal IC separator circuit.

The DATA SEPARATOR is installed without modifying the host system. The user merely removes the FD1771 IC from the host controller, installs the IC in the DIP socket on the SEPARATOR card, and plugs the adaptor into the vacated socket of the host controller and then joins two wires.

We caution that opening the Expansion Interface of the TRS-80* computer which is required to install the SEPARATOR, may void the computer's limited 90 day warranty.

The SEPARATOR which sells for $29.95, may be purchased from De Forest dealers or ordered direct from De Forest Software.

Payment for mail orders may be made by cheque or money order or charged to a BANKCARD account.



Adaptor fixes TRS-80 computer disk controller*

CRC ERROR! TRACK LOCKED OUT!

Technical Staff
Percom Data Company

This problem started while we were studying an annoying problem with the TRS-80* computer. Disk drives sold by Percom are realigned and tested before shipment. We noticed, however, that some disk drives would pass the Percom inspection but just would not work reliably on the inner tracks with a TRS-80* computer. These drives were within the manufacturer's specifications, and would function perfectly on other disk systems. Percom manufactures "perfectly" here meaning more than 50 million bytes read without error!

The disk read data separation arrangement in the TRS-80* computer Expansion Interface uses an internal data separator of the FD1771 disk formatter/ controller IC. Use of the FD1771 internal data separator is not recommended by Western Digital, the IC manufacturer. The following note appears on page 17 of the FD1771 data sheet:

Internal data separation may work for some applications. However for applications requiring high data recovery reliability, WDC recommends external data separation be used.

We suspected the data separator because the problem was most severe on disk inner tracks where storage density is highest and data separation is most critical.

To prove our point, a technician breadboarded a standard Percom data separator circuit, and configured it to plug directly into the FD1771 IC socket of the TRS-80* computer controller.

When connected to the TRS-80* computer, a trouble some drive functioned perfectly! We ran a BACKUP utility many times and never got a track lockout. Before we added the external data separator circuit to the computer, this same drive would always lock out tracks, and would have difficulty reading from the inner (higher number) tracks.

The data separator circuit fixes the mini-disk controller of the TRS-80* computer. The type of drives being used is irrelevant, the circuit eliminates disk read errors resulting from the inability of the Tandy controller design to reliably separate clock and data signals when reading high density inner tracks.

This Australian Unit has been designed and produced for deForest Software ONLY $29.95

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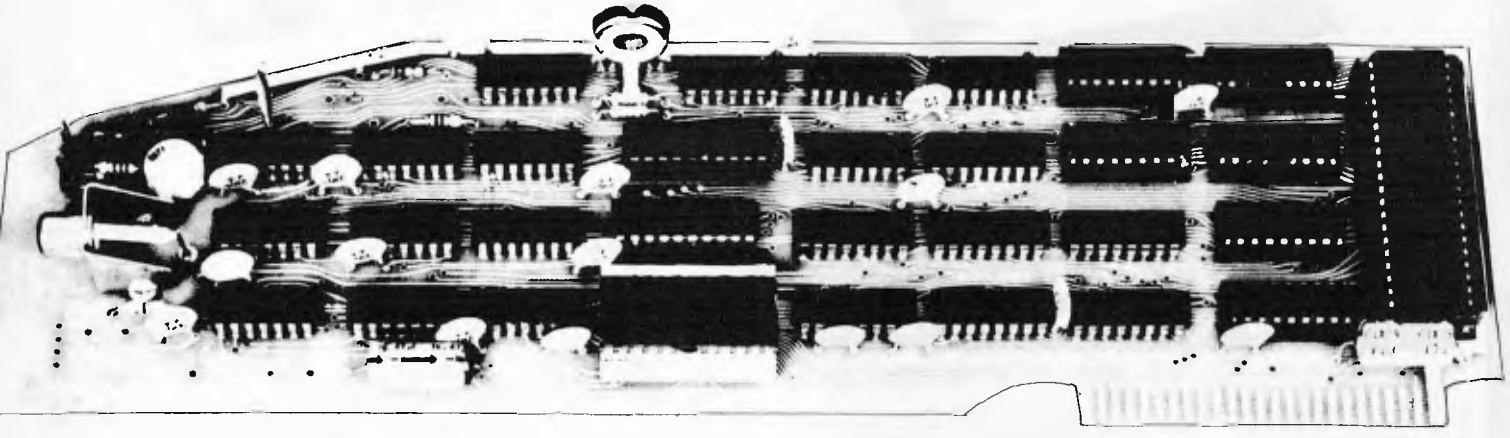

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PRINT USING for Applesoft

One of the minor but annoying problems with Basic is the format of output. The program here permits user-defined formatting of the output for Applesoft, and can be easily modified for other flavors of Basic.

by Gary A. Morris

When I started using my Apple for business programming, my biggest headache was formatting output for reports. I started out using various Basic subroutines that barely performed the needed job and required a lot of overhead. Tired of using MID$, LEFT$, RIGHT$, and STR$, I decided to write a general-purpose print formatter using the USR function in Applesoft.

The routine is written entirely in assembly language, which is ideal for handling this sort of problem. It is used from Basic by assigning the string variable ED$, the edit pattern showing how you want the output formatted. During a print statement when you use the USR function, the argument is evaluated and then printed in the format specified by the current value of ED$.

In the sample Basic program (in figure 1) line 10 loads the machine language program into RAM at $300-$3A9. Then line 20 puts a "JMP $0300" at $000A, which is used by Applesoft to find the routine to be used. Lines 10 and 20 are only needed once at the beginning of a program. Line 30 assigns an edit pattern to the variable ED$. Line 40 is a sample print statement that uses the USR function. Line 50 assigns a value to X (that we want printed) rounded off to two decimal places, and line 60 does this. If you wanted to round to three places, the 100 would be changed to 1000 and the edit pattern would have to be changed to allow three digits after the decimal point. Note that any valid expression could be placed within the parenthesis of the USR function.

The routine works by taking the number that Applesoft would normally print out and filling up the edit pattern with those characters from right to left, skipping over decimal points, commas and special characters.

The output of the routine may be used wherever a Basic PRINT statement can be used, such as printing to a disk file, to a printer, or just to the screen. It is especially desirable for creating fixed length records in files.

The edit pattern can be fairly complex, as in figure 1, or it can be simply blanks. Using a blank pattern will cause the number to be right-justified within the number of blanks in the edit pattern. If the number is too large to fit in the edit pattern, the left-most digits will be truncated. Any special characters ($,." %:*) in the edit pattern will be skipped, and the digits will fill in over blanks or numeric digits in the pattern.

Figure 1: Sample Program

```
]LIST

10 PRINT CHR$(4);"BLOAD EDIT.OBJECT
    CODE,A$300"
20 POKE 10,76:POKE 11,0:POKE 12,3
30 ED$="$   ,   0.00"
40 PRINT "SUB TOTAL...";USR(3495)
50 X=12345.67899
60 PRINT "NET TOTAL...";
    USR(INT(X*100+.5))
70 END
]RUN

SUB TOTAL...$     34.95
NET TOTAL...$12,345.68
```

The zeros are used in the edit pattern so that, if the number is small, there will always be zeros between the decimal point and the right-most column. If the number is too small to fill past the comma(s), then the extra commas will be replaced with blanks. When using an edit pattern with a decimal point, the argument for the function must be a whole number, or two decimal points will result. The edit pattern must be less than or equal to 16 characters in length. If it is greater, it will be cut off at 16.

The machine language program was written so that it can be located anywhere in addressable memory space. It is completely relocatable. That is, no changes are needed to run it at another address. It requires 169 ($A) bytes of RAM. The program uses the same zero page locations that are assigned to Applesoft so that there are no conflicts. It also uses 752-767 ($2F0-$2FF) as a buffer to perform editing. This area is in the input buffer and is not used during printing (except when printing DOS commands).

How it works

For those of you who would like to know how the program works, keep reading. Starting with the PRINT statement, the argument for the USR is evaluated and placed in the floating point accumulator by the Basic interpreter. Then a JSR is made to $000A, where we have a JMP to the start of our subroutine.

At the beginning of the machine language subroutine, the Applesoft floating point accumulator is converted (lines 48-55) into a character string, in the format that Applesoft would normally print it out. This is done by the Applesoft subroutines FPSTR1 and FPSTR2 (my names). These routines leave the resulting string as the bottom of the page used for the stack ($100).

The routine then searches (lines 57-75) the variable table to find ED$. When found, its value is moved (lines 77-83) to the buffer area ($2F0-$2FF).

After the program has all the necessary data, it starts to work. The length of the unformatted number is found (lines 85-90); and this number (an ASCII string right now) is then moved (lines 92-133) into the buffer, one character at a time, from right to left. The current character in the pattern is checked and, if it is a special character, it is skipped. Minus signs are carried over any digits in the pattern so that they will be on the left of the number. This process continues until we run out of characters to put in the pattern (or the printer fills up), at which time any leftover commas are covered up (lines 135-146) with blanks.

Finally the program is ready to print out the result. Lines 147-152 print out all of the number, except the last digit (I'll explain this in a moment), using the output routine in Applesoft. This output routine does all of the necessary checking and conversion so that Applesoft's SPEED, INVERSE, and FLASH functions will work. The routine also sets the most significant bit of all outgoing ASCII characters.

The USR function must return a value to the Basic program, which will be printed out by the Basic interpreter, because we are in a PRINT statement. The last character of the buffer (which must be a digit) is taken and converted to an integer in the Y register and passed to Applesoft's integer to floating conversion routine (lines 154-161). This routine converts the integer (passed in the *A*, *Y* registers) into floating point in the floating point accumulator, which is just where we need it to pass back to Basic.

```
0300- A5 52 48 20 34 ED 20 E7
0308- E3 68 85 52 A9 45 A2 C4
0310- 85 81 86 82 20 53 E0 A0
0318- 04 B1 9B 85 84 88 B1 9B
0320- 85 83 88 B1 9B C9 10 90
0328- 02 A9 10 85 D0 A8 88 B1
0330- 83 99 F0 02 88 10 F8 A0
0338- 00 B9 00 01 F0 03 C8 D0
0340- F8 A6 D0 88 B9 00 01 48
0348- 68 48 C9 2D D0 0E BD EF
0350- 02 C9 2D 90 16 CA D0 F0
0358- 68 18 90 35 BD EF 02 C9
0360- 20 F0 08 C9 3A F0 EE C9
0368- 30 90 EA 68 9D EF 02 CA
0370- F0 1F C0 00 D0 CD E8 18
0378- 90 10 BD EF 02 C9 24 F0
0380- 10 C9 2E B0 05 A9 20 9D
0388- EF 02 CA F0 04 E4 D0 90
0390- E9 A2 01 BD EF 02 20 5C
0398- DB E8 E4 D0 90 F5 BD EF
03A0- 02 49 30 A8 A9 00 4C F2
03A8- E2
```

Figure 2: HEX DUMP

Hardware requirements

This program requires an Apple II +, an Apple II with an Applesoft card, or an Apple II with a language card. It will work in any memory size system. A disk drive is not required.

If the appropriate changes are made to the JSRs and JMP in the machine language routine, the program can be used with RAM Applesoft (which loads in at $0800-2FFF). After keying in the code from figure 2, if you then key in the code from figure 3, it will run with RAM Applesoft instead.

Figure 3: MOD FOR RAM APPLESOFT

```
>BLOAD PRINT USING.OBJECT,A$300
>CALL-151
*304:2B 25 20 DE 1B
*315:4C 18
*397:5F 13
*3A7:EB 1A
*3D0G
>BSAVE PRINT USING.OBJECT,A$300,L$A9
```

```
LINE# LOC CODE   LINE

0002 0000        ;**************************************
0003 0000        ;*                                    *
0004 0000        ;*     PRINT USING for APPLESOFT      *
0005 0000        ;*                                    *
0006 0000        ;*      (C) 1980 by Gary Morris       *
0007 0000        ;*                                    *
0008 0000        ;*                                    *
0009 0000        ;*     Commercial Rights Reserved     *
0010 0000        ;*                                    *
0011 0000        ;*ASM/65                    JAN 5 1980*
0012 0000        ;**************************************

0014 0000        ;The USR  function  requires a JMP  to
0015 0000        ;the start of  the routine. If 'START'
0016 0000        ;equals the address  where the routine
0017 0000        ;is loaded then the following will set
0018 0000        ;up the JMP:
0019 0000        ; 10 POKE 10,76
0020 0000        ; 20 POKE 11,START-INT(START/256)*256
0021 0000        ; 30 POKE 12,INT(START/256)

0023 0000        ;Variables:
0024 0000        AFLAG  =$52          ;flag for Applesoft
0025 0000        NAME   =$81          ;variable name
0026 0000        PNTR   =$83          ;pntr to edit pattern
0027 0000        VARBLE =$9B          ;pointer to variable
0028 0000        LENGTH =$D0          ;pattern length
0029 0000        BUFFER =$02F0        ;edit buffer
0030 0000        STRING =$0100        ;number put here as -
0031 0000                             ;a character string

0032 0000        ;ROM Applesoft subroutine addresses:
0033 0000        FPSTR1 =$ED34        ;floating to string -
0034 0000        FPSTR2 =$E3E7        ;conversion routines
0035 0000        COUT   =$DB5C        ;print an ascii char
0036 0000        INTFP  =$E2F2        ;INT to FP conversion
0037 0000        FIND   =$E053        ;find a variable
```

```
LINE# LOC CODE   LINE

0039 0000        ;RAM Applesoft subroutine addresses:
0040 0000        ;FPSTR1 =$252B       ;floating to string -
0041 0000        ;FPSTR2 =$1BDE       ;conversion routines
0042 0000        ;COUT   =$135F       ;print an ascii char
0043 0000        ;INTFP  =$1AEB       ;INT to FP conversion
0044 0000        ;FIND   =$184C       ;find a variable

0046 0000                *=$0300      ;Organize at $0300
0047 0300                             ;(relocatable)

0048 0300        ;First convert floating point accum to
0049 0300        ;an ASCII string...
0050 0300 A552   START  LDA AFLAG     ;save the flag
0051 0302 48           PHA
0052 0303 2034ED       JSR FPSTR1    ;convert floating
0053 0306 20E7E3       JSR FPSTR2    ;point to string
0054 0309 68           PLA
0055 030A 8552         STA AFLAG     ;restore flag

0057 030C        ;Now find the  variable (ED$) that has
0058 030C        ;the edit pattern.
0059 030C A945   SEARCH LDA #'E'      ;basic variable
0060 030E A2C4         LDX #$C4      ;name is ED$
0061 0310 8581         STA NAME
0062 0312 8682         STX NAME+1
0063 0314 2053E0       JSR FIND
0064 0317 A004         LDY #4
0065 0319 B19B         LDA (VARBLE),Y  ;get addr hi
0066 031B 8584         STA PNTR+1
0067 031D 88           DEY
0068 031E B19B         LDA (VARBLE),Y  ;get addr lo
0069 0320 8583         STA PNTR
0070 0322 88           DEY
0071 0323 B19B         LDA (VARBLE),Y  ;get length
0072 0325 C910         CMP #16
0073 0327 9002         BCC LENOK     ;maximum length
0074 0329 A910         LDA #16       ;allowed is 16!!!
0075 032B 85D0   LENOK STA LENGTH

0077 032D        ;Move the pattern to the buffer
0078 032D A8           TAY
0079 032E 88           DEY
0080 032F B183   LOOP2 LDA (PNTR),Y
0081 0331 99F002       STA BUFFER,Y
0082 0334 88           DEY
0083 0335 10F8         BPL LOOP2

0085 0337        ;Find the string end
0086 0337 A000         LDY #0
0087 0339 B90001 LOOP  LDA STRING,Y  ;get char
0088 033C F003         BEQ NEXT2
0089 033E C8           INY
0090 033F D0F8         BNE LOOP
```

```
LINE# LOC CODE   LINE

 0092 0341        ;Move string to the buffer, from right
 0093 0341        ;to  left,  filling  over  numbers but
 0094 0341        ;skipping comma's and periods.
 0095 0341        ;    If we come  to  a minus sign then
 0096 0341        ;keep going left until the pattern has
 0097 0341        ;a blank or a  comma,  then keep going
 0098 0341        ;left  storing  blanks  in  the buffer
 0099 0341        ;until it ends  or we come to a dollar
 0100 0341        ;sign.

 0102 0341 A6D0   NEXT2  LDX LENGTH   ;field width
 0103 0343 88     EDLOOP DEY
 0104 0344 B90001        LDA STRING,Y  ;get a character
 0105 0347 48            PHA           ;save it
 0106 0348 68     CHECK  PLA
 0107 0349 48            PHA
 0108 034A C92D          CMP #'-'      ;if a minus then
 0109 034C D00E          BNE DIGIT     ;skip to a blank


 0110 034E BDEF02 MINUS  LDA BUFFER-1,X
 0111 0351 C92D          CMP #'-'
 0112 0353 9016          BCC DROPIT
 0113 0355 CA     SKIPIT DEX
 0114 0356 D0F0          BNE CHECK
 0115 0358 68            PLA
 0116 0359 18            CLC
 0117 035A 9035          BCC DONE
 0118 035C BDEF02 DIGIT  LDA BUFFER-1,X
 0119 035F C920          CMP #' '
 0120 0361 F008          BEQ DROPIT
 0121 0363 C93A          CMP #':'
 0122 0365 F0EE          BEQ SKIPIT
 0123 0367 C930          CMP #'0'
 0124 0369 90EA          BCC SKIPIT
 0125 036B 68     DROPIT PLA           ;get it back
 0126 036C 9DEF02        STA BUFFER-1,X
 0127 036F CA            DEX
 0128 0370 F01F          BEQ DONE
 0129 0372 C000          CPY #0       ;end of string?
 0130 0374 D0CD          BNE EDLOOP
 0131 0376 E8            INX
 0132 0377 18            CLC
 0133 0378 9010          BCC NEXT1

 0135 037A BDEF02 BLANK  LDA BUFFER-1,X ;blank from
 0136 037D C924          CMP #'$'       ;here to $
 0137 037F F010          BEQ DONE
 0138 0381 C92E          CMP #'.'
 0139 0383 B005          BCS NEXT1
 0140 0385 A920          LDA #' '
 0141 0387 9DEF02        STA BUFFER-1,X
 0142 038A CA     NEXT1  DEX
 0143 038B F004          BEQ DONE
 0144 038D E4D0          CPX LENGTH
 0145 038F 90E9          BCC BLANK

 0147 0391 A201   DONE   LDX #1
 0148 0393 BDEF02 LOOP4  LDA BUFFER-1,X ;print the
 0149 0396 205CDB        JSR COUT      ;output buffer
 0150 0399 E8            INX           ;except last char
 0151 039A E4D0          CPX LENGTH
 0152 039C 90F5          BCC LOOP4

 0154 039E        ;Take the last  char from  the buffer,
 0155 039E        ;convert it to floating  and return it
 0156 039E        ;to applesoft to be printed.
 0157 039E BDEF02        LDA BUFFER-1,X
 0158 03A1 4930          EOR #'0'
 0159 03A3 A8            TAY           ;lo order byte
 0160 03A4 A900          LDA #0        ;hi order byte
 0161 03A6 4CF2E2        JMP INTFP     ;convert & return
 0163 03A9               .END

ERRORS = 0000 <0000>
```

SYMBOL TABLE

SYMBOL	VALUE				
AFLAG	0052	BLANK	037A	BUFFER	02F0
CHECK	0348	COUT	DB5C	DIGIT	035C
DONE	0391	DROPIT	036B	EDLOOP	0343
FIND	E053	FPSTR1	ED34	FPSTR2	E3E7
INTFP	E2F2	LENGTH	00D0	LENOK	032B
LOOP	0339	LOOP2	032F	LOOP4	0393
MINUS	034E	NAME	0081	NEXT1	038A
NEXT2	0341	PNTR	0083	SEARCH	030C
SKIPIT	0355	START	0300	STRING	0100
VARBLE	009B				

END OF ASSEMBLY

SUPERBOARD II PLUS

by Peter Brooks

There are many hardware modifications available for improving the SUPERBOARD II. Unfortunately these modifications can become rather messy if you wish to reverse the process after finding that the modification is not quite what you hoped for. By delving into the Basic ROM and knowing how it uses the reversed RAM many of these improvements can be obtained by using software — no more screams of frustration if the improvement does not fully meet your aspirations.

This month I present the first instalment of SBII PLUS to improve the already powerful SUPERBOARD II. The top 1k of memory will be reserved to house the machine code routines used by SBII PLUS. No knowledge of machine code is needed, you will only need to type in the new lines in the ever-growing Basic program which stores the machine code into memory. With each instalment, an assembly listing will be presented with full explanation of how it works. This will hopefully keep the machine code enthusiasts interested — I am hoping for reader input with ideas and programs.

New commands

Three new commands this month are #CLS, #SPD and #GOTO. All SBII PLUS commands will have the prefix "#", the reason being that the SBII PLUS routine waits for a "#" to come along when the program is running and then tests for which command the Basic should be directed. If we did not have a "#" in front of the new keywords every character in a line would have to be tested, which would cause the Basic to run much more slowly and would also lengthen the decoder routine within the valuable memory which has been set aside.

In his APC-80 series, Ian Davies has redirected the syntax error vector on the TRS-80 so that only the characters in a line need be tested when a SN ERROR occurs. The Superboard does not have this vector. This is why an APC-80 command does not need a marker like the "#" character as we do with a SBII PLUS command. All SBII PLUS commands have a harmonious union with Basic with two exceptions. Firstly, they will always work in immediate mode except sometimes in multiple statements which use one of the new commands where Basic will reply with a SN error message. Secondly, Basic will be directed to a SBII PLUS command if a REM keyword is *directly* followed by one of the new commands. Otherwise you may use REM statements containing a "#" command.

These two exceptions are the only ones found so far. They could have been corrected but we did not think such trivial problems were worth the extra code needed.

The following is a description of the syntax and function of the new keywords.

#CLS: This command is an essential function which was missed by the original writers of the Basic ROM. Obviously this keyword is extremely useful, especially in graphics based games and is certainly much faster than a PRINT statement in the middle of a FOR loop which is commonly used to clear the screen.

#SPD expression (e.g. # SPD A+B): Controls the speed of PRINT statements, where the variable has a range of 0 to 255. Zero is the normal PRINT speed; 255 which is the slowest and prints at a rate similar to when the SAVE statement is in use.

#GOTO expression (e.g. # GOTO A+B-3): Operates similarly to the normal non-expression GOTO statement except when the expression is equal to a non-existent line. Then the new GOTO statement is directed to the first existing line above the value of the expression. If the expression value is greater than the highest line, we are returned to the immediate mode. This new GOTO statement makes the old one obsolete because a constant can be used just as in the original.

Listed is a Basic program which loads the SBII PLUS program into the reserved 1k of memory. Each month extra lines will be added as the list of SBII PLUS commands and functions grows longer.

The SBII PLUS machine code routine has been written to fit in the top 1k of memory in the standard 8k of RAM. If you have more than 8k of RAM you are best advised to type in the ASSEMBLY listing using the OHIO SCIENTIFIC 6500 ASSEMBLER/EDITOR and change the location origins and the pointers in the DECODER ROUTINE and SYMBOL TABLE. If you have the standard 8k RAM machine, set the MEMORY SIZE to 7192 during the initiating cold start. TYPE the Basic program listed, then enter RUN and wait for the reply of "SBII PLUS LOADED". You have now successfully loaded SBII PLUS. Either save the Basic program in tape or enter NEW so to ensure normal operation of your SUPERBOARD II until one of the new commands is needed. The BREAK key can be pressed if you wish to enter the on-board monitor; when you do return with a warm start SBII PLUS will still be in full operation.

How it works

As you can see in the Basic LISTING, a USR is directed to INITBC (ASSEMBLY LISTING) which loads a JMP command in the middle of the line passer routine to the decoder routine. The decoder routine is the heart of the SBII PLUS routine. It checks and finds the SBII PLUS commands and directs Basic to them.

At BASPAS, each character is tested to see if it is a #. If not, the character is stored in $FA. If it is, the immediate mode flag is checked at TSTIMM and if the answer is correct there are two possibilities. Either we are in immediate mode or the tokenising routine is in operation and this is tested at 340 and 350. If it is only tokenising it is allowed to continue on its merry way. Once everything is correct we drop through to ENDCMD, where the characters after the # mark are each compared with the TABLE. Each word in the TABLE is checked until either we reach the end of the table, which is signified by a NULL, or the keyboard has been found and loads its vector to JMPCMD+1 and 2.

At this point, Basic is directed to one of the extra commands now supplied by SBII PLUS. The # CLS routine works simply by loading each point on the screen with the value #$20. The # SPD routine firstly goes to $B3AE, which is an expression handler used by the POKE routine, and returns with a value which is placed in the PRINT rate location of the Basic scratch pad.

The # GOTO routine operates

similarly to the normal GOTO though the prefixes for the routines are slightly different. One is testing for ASCII characters, while the other is doing full expression handling.

Next month we will have a Basic program demonstrating SBII PLUS commands, plus some extra commands.

```
 10 ;           ************
 20 ;===========SB II PLUS============
 30 ;           ************
 40 ;
 50 ;SUPERBOARD II
 60 ;HIGH MEMORY MACHINE CODE ROUTINES
 70 ;
 80 ;ASSEMBLED FOR 8K RAM MACHINE
 90 ;
100 ;
110 ;          INITIALIZATION
120 ;          **************
130 ;ROUTINE REDIRECTS CHARACTER
140 ;PASSER TO DECODER ROUTINE
150 *=7192
160 INITBC LDY #$03
170 LOOP01 LDA NEWPTR-1,Y
180        STA $CC,Y
190        DEY
200        BNE LOOP01
210        RTS
220 NEWPTR .BYTE $4C,$27,$1C
230 ;
240 ;          DECODER ROUTINE
250 ;          ***************
260 *=7207
270 BASPAS CMP #$23   ;TEST FOR #
280        BEQ TSTIMM ;YES? TSTIMM
290        STA $FA    ;NO.STORE IN $FA
300 BASRET JMP $BCFF  ;RETURN TO BASIC
310 TSTIMM LDA $C4    ;TEST IMM MODE
320        BNE FNDCMD ;NO? FIND COMMND
330        LDA $FA
340        JSR $BCFF
350        BCC HSHRET ;NO?RETURN WITH#
360        LDX $88    ;ENSURE LINE
370        INX
380        BEQ FNDCMD
390 HSHRET LDA #$23
400        BNE BASRET
410 ;
420 ;DROPS THROUGH HERE IF # COMMAND
430 ;
440 FNDCMD LDX #$8A ;TABLE (LO)
450        LDA #$1C ;      (HI)
460 GETLEN STX $FE
470        STA $FF
480        LDY #$00
490        LDA ($FE),Y ;TEST FOR NULL
500        BNE NRDLEN ;NO?CONTINUE ON
510        JMP $AC0C ;YES SN ERROR
520 NRDLEN TAX
530        STX $FB
540 NRDPAS INY         ;NEXT CHAR
550        LDA ($C3),Y
560        CMP ($FE),Y ;TEST WITH TABL
570        BNE NEXTWD ;NO TRY NEW WORD
580        DEX         ;COUNT WORD LEN
590        BEQ GETVEC ;SETUP FOR#COMMD
600        BNE NRDPAS ;CONTINUE
610 NEXTWD LDA $FB
620        CLD
630        CLC         ;CHNGE TAB VECT
640        ADC #$03
650        ADC $FE
660        TAX
670        LDA $FF
680        ADC #$00
690        JMP GETLEN ;NEW NRD..IN TAB
700 GETVEC LDX $FB    ;SET VECTOR
710 GVLOOP JSR $00BC
720        DEX
730        BNE GVLOOP
740        LDX #$02
750 VECPTR INY         ;TIDY UP
760        LDA ($FE),Y
770        STA JMPCMD,X
780        DEX
790        BNE VECPTR
800 JMPCMD JMP $A274  ;JUMP TO #COMMND
810 ;
820 ;
830 ;
840 ;SYMBOL TABLE USED BY THE DECODER
850 ;HAS 3 ELEMENTS FOR EACH SYMBOL
860 ;  :-THE LENGTH
870 ;     THE NAME
880 ;     THE VECTOR (HI,lo)
890 ;
900 ;A NULL ENDS THE TABLE
910 ;
920 ;            TABLE
930 ;           *******
935 *=$1C8A
940 .BYTE 03,$43,$4C,$53,$1C,$DB ;#CLS
950 .BYTE 03,$53,$50,$44,$1D,06 ;#SPD
960 .BYTE 01,$88,$1D,$12 ;#GOTO
965 .BYTE 0 ;NULL ENDING TABLE
970 ;EXTRA FUNCTIONS
980 ;***************
990 ;
1000 ;#CLS ROUTINE-CLEARS SCREEN
1010 *=$1CDB
1020 CLS    JSR NOCIKH
1030        JSR RUNCLS
1040        JMP $00C2
1050 RUNCLS PHA
1060        TYA
1070        PHA
1080        LDY #0
1090        LDA #$20
1100 BLANKS STA $D300,Y
1110        STA $D200,Y
1120        STA $D100,Y
1130        STA $D000,Y
1140        INY
1150        BNE BLANKS
1160        PLA
1170        TAY
1180        PLA
1190 CLSRET RTS
1200 NOCIKH JSR $00BC
1210        BEQ CLSRET
1220        JMP $AC0C
1230 ;#SPD ROUTINE-CONTROLS PRINT RATE
1240 SPD    JSR $00BC
1250        JSR $B3AE ;HANDLE EXPRESS
1260        STX $0206 ;STORE VALUE
1265        JMP $00C2
1270 ;#GOTO expression
1280 GOTO   JSR $AAC9 ;LOAD FLOAT ACCUM
1290        JSR $B408 ;CONVERT TO HEX
1300        JSR $A432 ;FIND LINE
1310        CLC
1320        CLD
1330        JSR $A6D9 ;REDIRECT LINE
1340        JMP $00BC ;GOTO NEW LINE
```

Multiple File Tape Backups

This PET utility takes the drudgery out of making multiple backup copies of cassette files.

G. R. Boynton

Always make a backup copy! That is good advice, and I followed it assiduously for a year. Then it became apparent that something had to give. I had over 100 original programs or data files on separate tapes; which meant that I had over 100 backups. That made me one of the more regular customers of the store from which I buy tapes, and I had a very large sum of money tied up in tapes. In addition, my tapes were running me out of house and home. Something had to be done!

Aside from lethargy, what kept me from doing something about this situation was the recognition of how slowly the PET tape drive operates, and the amount of time I projected it would take to make multiple file backup tapes or to use them once they were constructed. But I remembered a couple of programs that used fast forward to go skittering across the tape until the correct file was found so I dug them out and began to construct multiple file backup tapes. Everything was going fine until I had to save a program that took 2k of memory and one that took 11.3k of memory. Because of the way the program worked, that wasted a lot of space for the first program and was not big enough for the second. The problem: a fixed amount of tape reserved for each program. That seemed a very unhandy way for a program to operate so I wrote this program called TAPE BACKUP.

TAPE BACKUP is designed to facilitate creating multiple file backup tapes. In order to do this effectively you need a long tape: a 46 minute or 60 minute tape will do. The first program saved on the tape is TAPE BACKUP. After TAPE BACKUP is loaded you are asked whether you want to use cassette # 1 or # 2. Then a "table of contents" is displayed, and you are instructed to push F.FWD and then indicate the number of the file you want to access (or the location at which you wish to save a file). Once you indicate the file, the cassette fast forwards to the appropriate place and stops. The operation is very simple, and F.FWD is fast, at least relative to PLAY. In addition, the program gives instruction on what has to be changed in the program when you add a file to the tape to bring it up to date, and it will even compute the number of jiffies required to fast forward over a program of a given size.

Next I would like to describe the program and how it does what it does. Then I will suggest some simple procedures for using the program.

```
10 REM *** TAPE BACKUP PROGRAM
20 REM *** G. R. BOYNTON
90 RM=PEEK(50003)
100 PRINT"[CLR][DN][DN][DN]";TAB(10);"*** TAPE BACKUP ***"
110 PRINT"[DN][DN][DN]THIS PROGRAM IS DESIGNED TO FACILITATE"
120 PRINT"CREATING MULTIPLE FILE TAPE BACKUPS."
130 PRINT"[DN]IT CAN BE USED EITHER TO SAVE A FILE"
140 PRINT"AT A PARTICULAR SPOT ON THE TAPE OR TO"
150 PRINT"ACCESS A PROGRAM OR DATA SET QUICKLY."
160 PRINT"[DN][DN][DN]DO YOU WANT TO USE TAPE #1 OR TAPE #2?"
170 PRINT"[DN][RC][RC][RC](RESPOND '1' OR '2')  ";:INPUT TD
180 IF RM=0 AND TD=1 THEN RO=1
185 IF RM=0 AND TD=2 THEN RO=2
190 IF RM=1 AND TD=1 THEN RO=3
195 IF RM=1 AND TD=2 THEN RO=4
200 PRINT"[CLR][DN][DN][DN]PRESS F.FWD KEY ON CASSETTE TAPE NOW."
210 PRINT"[DN]NEXT ENTER THE DESIGNATION FOR THE FILE"
220 PRINT"TO BE SELECTED."
230 PRINT"[DN][DN]THE FILES ON THIS TAPE ARE:"
240 PRINT"[DN] N   DATA FILES FROM CALENDAR"
250 PRINT"---   ----------"
260 PRINT"[DN]0.  FIRST FILE"
270 PRINT"1.  SECOND FILE"
280 PRINT"2.  THIRD FILE"
290 PRINT"3."
300 PRINT"4."
310 PRINT"5."
320 PRINT"6."
330 PRINT"7."
340 PRINT"8."
350 PRINT"9.  TENTH FILE"
400 N$=""
410 GET N$
420 ON RO GOSUB 1000,1010,1020,1030
430 IF N$="" THEN GOTO 410
440 N=ASC(LEFT$(N$,1))-48
445 IF N=0 THEN 600
450 FOR K=1 TO N
460 READ D(K)
470 LET J=J1+150+D(K)
480 LET J1=J
490 NEXT K
500 RESTORE
510 PRINT"SEARCHING FOR FILE ";N
520 ON RO GOSUB 1100,1110,1120,1130
530 IF TI<TS THEN 530
540 ON RO GOSUB 1200,1210,1220,1230
600 PRINT"[CLR][DN][DN][DN]FILE ";N;" HAS BEEN FOUND."
610 PRINT"[DN]PRESS 'STOP' ON THE CASSETTE."
620 PRINT"[DN]NOW YOU MAY ACCESS THE FILE NORMALLY"
630 PRINT"[DN]OR"
640 PRINT"[DN]SAVE A NEW FILE ON THE TAPE AT"
650 PRINT"[DN]THIS POINT."
660 PRINT"[DN][DN][DN]WOULD YOU LIKE INSTRUCTIONS FOR UPDATING"
670 PRINT"THIS PROGRAM WHEN ADDING A NEW FILE?"
680 PRINT"[DN]";:INPUT A$
690 IF A$="YES" THEN GOSUB 1300
```

In the world of personal computers there is just one that is known as the best: the PET

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The Commodore PET has become the standard for the Personal Computer Industry..

The Pet is completely integrated, with the processor, memory, keyboard and visual display unit contained within a robust housing, allowing easy transportation with no interconnecting cables necessary. In order to retrieve and save your data and programs, a storage device is used which operates like a cassette recorder, with your information recorded reliably on standard cassettes. The PET has 16k bytes of RAM. Optional equipment permits expansion to 32k. Also, it has 14k bytes of ROM.

The Pet communicates in BASIC— the easiest computer language. Easy to learn and easy to use, BASIC has now become the standard for personal computers, with literally thousands of programmes available. The PET is also programmable in machine language, allowing more efficient use of the system.

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The full range of Commodore Disk Drives and Printers are plug-compatible with the PET and a comprehensive range of cassette and disk based programmes are available through the extensive network of Commodore Dealers.

APPLICATIONS

The Commodore PET is a creature of many faces. Its applications are limited only by the user's imagination.

The future of the PET is virtually unlimited; its present capabilities are already many and impressive. As a personal computer, the PET can teach languages and mathematics; play games; create graphic designs; store meal recipes and change number of portions; maintain budgets, personal records and checkbooks; operate appliances and temperature controls.

As a management tool, it delivers the information the executive needs, in the form he can use, and available to him alone. Trend analyses charts and graphs can be almost instantly available.

The professional may use the PET for maintaining appointment schedules, recording income and expenditures and filing all the specialized information and forms he may need to make his work more efficient — from medical records for a doctor to income tax computations for an accountant.

The engineer, mathematician, physicist, has a tool far superior to the very best programmable calculators yet developed... at a cost that is comparable...and with almost infinitely greater versatility.

And the businessman has a computer that can maintain inventories, keep payroll records, operate accounts payable and receivables, issue cheques and handle correspondence.

Commodore PET 4016 Computer Technical Specifications.

Computer/Memory
Read/Write Memory (RAM) 16K bytes available to the user.
Read Only Memory (ROM) 14K bytes in total, divided into:
8K BASIC interpreter available immediately you turn on your PET,
5K Operating System
1K Test Routine
The 6502 micro-processor chip makes the PET one of the fastest and most flexible BASIC systems. Significant features of Commodore BASIC are:

- 960 simple variables
- 960 integers
- 960 string variables
- 960 multi-dimensional array fields for the above 3 types of variables
- Up to 80 characters per program line with several statements per line
- Upper/Lower case characters and graphics capability
- Built in clock
- 9-digit floating point binary arithmetic
- True random number generator
- Supports multiple languages; machine language accessibility

Keyboard
74-Key professional keyboard.
Separate calculator/numeric pad.
Upper-case alphabetical characters with shift key to give 64 graphics characters.
Can be set for lower case and shifted upper case characters.

Screen
40 characters wide by 25 lines (1000 characters in 8 × 8 dot matrix).
23 cm screen phosphor screen.
Brightness control.
64 ASCII plus 64 graphics characters.
Blinking cursor with full cursor control, including programmable control.

Screen editing capabilities
Full cursor control (up, down, left, right).
Character insert and delete.
Reverse character field.
Overstriking.
Return key sends the entire line to the CPU regardless of cursor position.

Input/Output
8 bit parallel input/output port.
IEEE-488 Bus (HP-IB and IEC Bus) allows up to 12 other peripherals to be connected.
Two cassette ports.
Video signals for additional displays.
Serial output port.

Technical Data
Dimensions: Height 355 mm (14"), Width 419 mm (16.5"), Depth 185 mm (18.5"), Shipping Weight 20.9 kg (46 lbs).
Power requirements 240V ± 10%, Frequency 50 Hz, Power 100 Watts.

Commodore BASIC

APPEND	GOSUB..RETURN	STOP	SPC
BACKUP	IF..THEN	SYS	LEFT$
CLOSE	INPUT	VERIFY	RIGHT$
CLR	INPUT #	WAIT	MID$
CMD	LET		CHR$
COLLECT	LIST	SGN	ASC
CONCAT	LOAD	INT	LEN
CONT	NEW	ABS	VAL
COPY	ON..GOSUB	SQR	STR$
DATA	OPEN	SIN	TI
	POKE	COS	TI$
DEF/FN	PRWT	TAN	ST
DIM	READ	ATN	DS
DIRECTORY	RECORD	LOG	DS$
DLOAD	REM	EXP	+
DOPEN	RENAME	AND	-
DSAVE	RESTORE	OR	*
END	RUN	NOT	/
FOR/NEXT	SAVE	TAB	↑
GET	SCRATCH	POS	π

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The program is designed to be quite flexible. It will run on machines with either the new or old PET Basic ROMs, and it will permit using either cassette. The PEEK statement in line 90 determines whether it is the new or old ROM. The next few lines print an introduction to the program and determine which cassette will be used. Lines 180-195 define a variable "RO" which combine those two pieces of information, and this variable is used later in three GOSUB statements.

Lines 200 through 350 put the instructions to push F.FWD and the table of contents on the screen.

Lines 400 through 500 plus three subroutines and a data statement are the heart of the program. There are four tasks to be performed in this segment of the program.

1. Stop the cassette.
2. Ascertain the file to be accessed.
3. Determine the number of jiffies needed to get to that file.
4. Start the cassette; let it run the required length of time; and then stop the cassette.

Lines 400, 410 and 530 obtain the number of the file to be accessed. They constitute a loop which includes the GOSUB statement in 420. Depending on "RO", which specifies the ROM and the cassette being used, statement 420 sends the program to a statement which does two things. It sets the tape drive to an "off" status, and it stops the operation of the appropriate cassette motor. For the old ROM, memory location 519 sets the status of the first tape and 520 sets the status of the second cassette. For the new ROM the comparable memory locations are 249 and 250. If 52 is POKEd to 519 for the old ROM or 1 is POKEd to 249 for the new ROM this sets the status of tape 1 as off. For tape 2 the memory location 520 must be POKEd 1 for the old ROM and 250 must be POKEd 1 for the new ROM. Memory location 59411 is used for the first cassette motor in both old and new ROMs, and 59456 is used for the second cassette motor. By POKEing 61 for the first cassette or 223 for the second cassette, the motor is turned off.

The third task is accomplished by lines 440 through 500. In 440 the file number is changed from a string variable to a number. This allows the FOR/NEXT loop in 450 through 490 to operate the appropriate number of times. Line 460 reads the Kth number on a data statement; the data statement is in line 888. Line 470 adds the past value of J (represented by J1) to 150 (which is the jiffies needed for the leader) to the number of jiffies needed for the file. If one wants the fourth file the loop will operate four times. The first time it will add the past value of J (which is zero) to 150 (for the leader) to the number of jiffies for the first file. And it continues in this way through four iterations. Thus, the loop calculates the number of jiffies needed to reach the file to be accessed.

The final task is fast forwarding to the appropriate place on the tape. This is done in lines 510 through 540 and the associated subroutines. The subroutine in 1110 (or whichever of the four is appropriate) sets a value of TS which is the current value of TI (the PET's clock) plus J. Then it starts the cassette motor. In 530 the value of TI is compared to TS; as long as TI is less than TS the cassette is fast forwarding. When TI is no longer less than TS the subroutine shuttled to by line 540 stops the cassette motor.

```
700 PRINT"[CLR][DN][DN][DN]WOULD YOU LIKE TO COMPUTE THE NUMBER"
710 PRINT"OF JIFFIES REQUIRED FOR THIS FILE?"
720 PRINT"[DN]";:INPUT A$
730 IF A$="YES" THEN GOSUB 1400
740 PRINT"[DN]THAT'S IT."
750 END
888 DATA 325,700,5
1000 IF PEEK(519)=0 THEN POKE 519,52:POKE 59411,61:RETURN
1010 IF PEEK(520)=0 THEN POKE 520,1:POKE 59456,223:RETURN
1020 IF PEEK(249)=0 THEN POKE 249,52:POKE 59411,61:RETURN
1030 IF PEEK(250)=0 THEN POKE 250,1:POKE 59456,223:RETURN
1100 POKE 59411,53:TS=TI+J:RETURN
1110 POKE 59456,207:TS=TI+J:RETURN
1120 POKE 59411,53:TS=TI+J:RETURN
1130 POKE 59456,207:TS=TI+J:RETURN
1200 POKE 59411,61:RETURN
1210 POKE 59456,223:RETURN
1220 POKE 59411,61:RETURN
1230 POKE 59456,223:RETURN
1300 PRINT"[CLR][DN][DN][DN]TWO PARTS OF THE PROGRAM SHOULD BE"
1310 PRINT"UPDATED."
1320 PRINT"[DN]THE TABLE OF CONTENTS IN LINES 230"
1330 PRINT"THROUGH 350 SHOULD BE CHANGED BY ADDING"
1340 PRINT"THE NAME OF THE FILE ADDED."
1350 PRINT"[DN]THE DATA STATEMENT IN LINE 888 SHOULD"
1360 PRINT"HAVE THE NUMBER OF JIFFIES IN THE NEW"
1370 PRINT"FILE ADDED TO IT."
1380 PRINT"[DN]";:FOR K=1 TO 22:PRINT"[DN]";:NEXT K
1385 PRINT"PRESS SPACE BAR TO CONTINUE"
1390 GET A$:IF A$="" THEN 1390
1399 RETURN
1400 PRINT"[CLR][DN][DN][DN]THE NUMBER OF JIFFIES REQUIRED TO"
1410 PRINT"FAST FORWARD OVER A FILE DEPENDS ON THE"
1420 PRINT"SIZE OF THE FILE.  IF THE FILE REQUIRES"
1430 PRINT"2.1K OF MEMORY IT WILL TAKE A SMALL"
1440 PRINT"NUMBER OF JIFFIES. IF THE FILE REQUIRES"
1450 PRINT"11.8K OF MEMORY MORE JIFFIES WILL BE"
1460 PRINT"REQUIRED."
1470 PRINT"[DN][DN]HOW MANY BYTES OF MEMORY ARE REQUIRED"
1480 PRINT"FOR THE FILE?"
1490 PRINT"[RC](PLEASE GIVE A NUMBER LIKE 2.1 OR 11.8)"
1500 PRINT"[DN]";:INPUT N
1510 NN=N*1000
1520 JJ=NN/15
1530 PRINT"[DN]";JJ;" IS THE NUMBER OF JIFFIES"
1540 PRINT"[DN][DN]WOULD YOU LIKE TO COMPUTE THE NUMBER"
1550 PRINT"OF JIFFIES FOR ANOTHER FILE?"
1560 PRINT"[DN]";:INPUT A$
1570 IF A$="YES" THEN GOTO 1470
1580 RETURN
```

[CLR]	CLEAR SCREEN	[LC]	CURSOR LEFT
[DN]	CURSOR DOWN	[RC]	CURSOR RIGHT
[UP]	CURSOR UP	[RV]	REVERSE
[HM]	CURSOR HOME	[RVOFF]	REVERSE OFF

From line 600 on, the program gives instructions. After the cassette stops one can either access the file or save a new file. The program contains two features for assisting in creating a new file. First, it will remind the user about the changes that should be made in TAPE BACKUP when a new file is added. Then it will compute the jiffies needed for a file of a given size. The user has to know how much memory is required for the program or the data set. This can be determined using FRE(0) when the program is loaded or before and after a data file has been read by a program.

Using the program is quite simple. It works particularly smoothly with two cassettes, one for tapes to be copied from and one for the tape to be copied to. However, I will not assume two cassettes are available in these instructions.

First, one needs a long tape with TAPE BACKUP saved as the first file. Load and run the program. DO NOT REWIND THE TAPE. The tape is now ready for saving your backup file '0'. Take the backup tape out of the cassette and put the tape to be copied from in the cassette and load that program. PRINT FRE(0). That will give the amount of RAM left. If that number is subtracted from the RAM available you then know the amount of RAM used by the program. Take the program tape out and insert the backup tape which is still at the position it was after loading TAPE BACKUP. Save the program at this point. Rewind the tape and load TAPE BACKUP again. Add the name of the new file to the table of contents. Then type RUN 1400 to compute the jiffies needed, and add this to the data statement in line 888. To save a second program run TAPE BACKUP again asking for file '1'. The program will fast forward over your '0' file and be in place for saving file '1'. Then repeat the steps outlined above.

To access a file is even simpler. Load TAPE BACKUP. Specify the file you want to access. The program will fast forward to that file, and you load the program.

To save or access a data file (as opposed to a program) you need a program that will read and write the data file. Load TAPE BACKUP. When it has fast forwarded to the appropriate location take the backup tape out and load the program to read and write the data file. Read the data file, and take that tape out. Put the backup tape in the cassette, and write the data file.

Making multiple file backup tapes is always a rather boring task; it is one of the overhead costs of having a tape based system. But this program takes a good deal of the drudgery out of the task.

Applecations

by Ian Webster, Co-editor of the NSW Apple Users' Group Magazines (Applications) and co-ordinator of the Computerworld Project.

Queensland Apple user groups have reappeared after a quiet period. Apple Q is a group of Brisbane enthusiasts who meet on Sundays and publish a newsletter. Contact Rob Neary at the W.H. Hooper Education Center, P.O. Box 150, Chermside, Qld. 4032 (05 350 2320). The Wondai Apple users group is a diverse group of Apple users co-ordinated by Dr P. Lip. Members share a lot of Apple information in their newsletter. Write to WAUG, P.O. Box 19, Wondai, Qld. 4606.

The copyright issue continues to be important within the Apple user community. A committee of the NSWAUG has recommended that the group include a copyright clause into the new Group constitution that supports the copyright of software authors and prohibits the copying of copyright software at group meetings. Many recent software packages have been released with both half-tracking and bit-manipulation protection and a small plastic key that is inserted into the game paddle socket. The key is either a ROM, logic chip or set of pin straps and pull-out resistors. The program reads the key by toggling the game paddle ports. These keys are not sophisticated but there is potential for them to provide secure protection. A lot of CP/M software that is now available for the Apple is sold under licence and it will be interesting to see how this affects sales in the Apple market.

The creation and distribution of public domain Apple software is becoming the main casualty of the copyright controversy. Very little software written under funded projects or in educational institutions is being released into the public domain because it isn't feasible to offer support for software when it will be extensively copied. The attitude of some state education departments towards program copying is especially counterproductive to the development of computer applications in education

The Applesoft compilers have finally arrived with the simultaneous release of compilers by Hayden, Online and Ascomp. They will convert Applesoft to machine code but differ in the techniques used to implement the compilers. An Applesoft program is converted line by line into a series of calls to the Applesoft ROM routines. The size of the program will probably double after compilation and a 4k system module has to be included with the compiled program. The compilers support varying degrees of modularisation with local and global variables and control over string and variable memory use. Speed increase varies considerably depending on program structure, but is generally disappointing. Some programs will have to be modified before compilation, particularly if they use any of the well known Applesoft patches. Ben Herman has been conducting a discussion about the compilers on the SOURCE. The consensus is that they are best used as production tools when a program has been designed and written with the intention of compiling the production version. The compilers have arrived but they may not be the panacea many Applesoft programmers had hoped for. This leaves the frustrated Applesoft programmer with the option of learning Pascal or installing a Z80 Softcard.

There has been a tremendous upsurge in Apple Pascal programming. Now that the 1.1 Pascal update is available, Pascal can be used on any Apple with a 16k Ramcard and the 1.1 Update. Two new Pascal books for Apple beginners have been released. T.C.Lewis *Pascal Programming for the Apple* and *The Pascal Primer* by Michael Fox and David Waite. There is also a steady flow of Pascal articles in the user group newsletters. Apple is licencing a 48k runtime version of Pascal ($100 per annum) that will enable compiled Pascal code to run on a 48k Apple. Contact Apple Technical Support at Cupertino headquarters for details.

The most popular Apple peripheral card is the Z80 softcard. Most of the CP/M software houses have released softcard versions of their software. The Z80 wordprocessors are superior in almost every respect to any Apple word processor. Spellbinder, available from Imagineering, has been well received in Australia by users looking for a powerful and sophisticated word processor. Most of the programming languages not available for the Apple (C, Cobol, APL and PL/1) are available for the Softcard.

Electronic Concepts has the Stellation II 6809 card in stock with the Pascal speed-up kit. Stellation II has good news for programmers who consider CP/M to be a poor implementation of an operating system with an announcement that OS/9 will be available for their 6809 card. OS/9 is a multi-tasking, multi-user operating system modelled on UNIX and supports a range of compilers optimised for the 6809. This system should put some guts into the Apple where it is really needed. Several bank-switching RAM cards have been released recently. I have been using a 32k RAM card containing both DOS and Integer Basic that is switchable in 4k blocks. A 64k RAM card and software to emulate in memory disks will be released soon.

Softalk is an 80 page color magazine distributed free every month to US Apple owners. The magazine features trade talk, software releases, the TOP 30 programs and news about people involved with the Apple world. Softalk is an essential magazine if you want to know what is happening in the Apple world. The magazine always has pre-release notices from software companies and highlights the activities of hardware and software developers. Softalk is available to Australians from BITESOFT, P.O. Box 175, North Hollywood, CA 91603. Subscriptions are US$15.00 (surface) or US$25.00 (airmail) for six issues. If you can arrange a US mailing address you can get a free copy, otherwise write to BITESOFT.

Below is Softalk's August Top 30 based on a sampling of 50 computer stores. The percentages refer to the demand for a particular product. Visicalc had been No. 1 for the past nine months until Bill Budge's Raster Blaster took No. 1 last month.

Month	Last Month	Index	Program
1.	1.	97.53	Raster Blaster
2.	8.	61.48	Pool 1.5
3.	-	50.12	Gorgon
4.	2.	46.66	Visicalc
5.	12.	38.52	Flight Simulator
6.	6.	31.50	DOS 3.3
7.	3.	29.38	Spce Eggs
8.	6.	29.13	Hires Adventure # 2
9.	11.	26.17	Sabotage
10.	9.	24.20	Alien Rain
11.	27.	23.70	Typing Tutor
12.	13.	23.46	Olympic Decatholin
13.	-	22.22	Robot War
14.	14.	21.48	Pulsar II
15.	17.	20.74	Autobahn
16.	5.	19.51	Snoggle
17.	4.	19.26	DB Master
18.	-	17.78	Orbitron
19.	-	17.53	Gobbler
20.	19.	17.53	DOS Toolkit
21.	10.	17.04	Zork
22.	-	16.79	Ultima
23.	23.	16.30	Hires Adventure # 1
24.	-	14.81	Asteriod Field
25.	-	14.81	Apple Writer
26.	-	14.32	Gamma Goblins
27.	15.	13.82	Warp Factor
28.	-	13.83	Visitrend/Visiplot
29.	-	13.09	Visidex
30.	20.	12.84	Missile Defense

Relocating OSI ROM Basic Programs

by William L. Taylor.

This Basic program relocator will help users of Ohio Scientific computers with Basic in ROM to better understand how their Microsoft Basic and monitor are used.

To begin with, since Microsoft wrote the Basic that is used in Ohio Scientific Challengers and Commodore PET computers, it would seem there would be similarities. This is true. Both versions of Basic use low memory in the same manner as a scratch pad. Zero page, for example, is used as a scratch pad to store Basic's parameters. A list or memory map for the Challengers and PET is listed in table 1. From the table it can be seen that both the Challengers and PET use the same pointers. There are differences between the version for the PET and the one for the Challengers and in how they use some locations in zero page; but both versions use identical pointers for memory allocation, for the beginning of Basic work space, etc. One difference between the versions is that Ohio Scientific uses page 3 of the system memory as a part of Basic program memory workspace.

Ohio Scientific computers with Basic in ROM perform the same tests on memory as do PETs. That is, hex 24 is loaded into memory locations from 0301 hex upwards, depending on the memory size. When Ohio Scientific's Basic in ROM machines are brought up under cold start, the user may define memory size or allow Basic to utilize all the available memory in the system from hex 0301 upward.

After Basic tests memory for available space and determines the upward limit, this available size is stored in a zero page location called the memory size pointer. On initialization, there are several other parameters set up in the scratch pad memory in zero page under ROM Basic. These parameters are called pointers. We have already used this term and have defined two of these pointers. Ohio Scientific ROM Basic always sets its pointers to begin at 0301 hex or 769 decimal for a starting point.

There are several pointers in the scratch pad memory that must be changed to initiate a relocation of Basic programs. These pointers are: the beginning of Basic program; the beginning of the single variable; the beginning of array variables; the available space for DIM array variable; and, finally, the top of strings and the bottom of strings. All of these pointers must be changed to point to the location for a Basic program, if a new starting area is to be used. As stated before, the listing in table 1 will show the location in the scratch pad where the pointers are located. In addition, I will describe how to use these pointers to allow you to relocate your Ohio Scientific Basic programs.

The Ohio Scientific Microsoft Basic in ROM uses addresses hex 79 or 7A or decimal 121 and 122 as the Basic start pointer locations. On a Basic cold start, these locations contain a pointer that points to hex 0301 or decimal 769. The data stored in these locations must be in the 6502 format, that is, low byte followed by the high byte (for example, 0079 01 007A 03). All the pointer locations are two bytes wide and must have their data in this format. As an example, if you wished to have your Basic program start at, say, hex 0400, then this address would have to be stored in 0079 and 007A as 00,04. To relocate your programs to start at 0400 hex, you would have to change all the pointers in the same manner. The seven pointers that must be changed are listed in table 1.

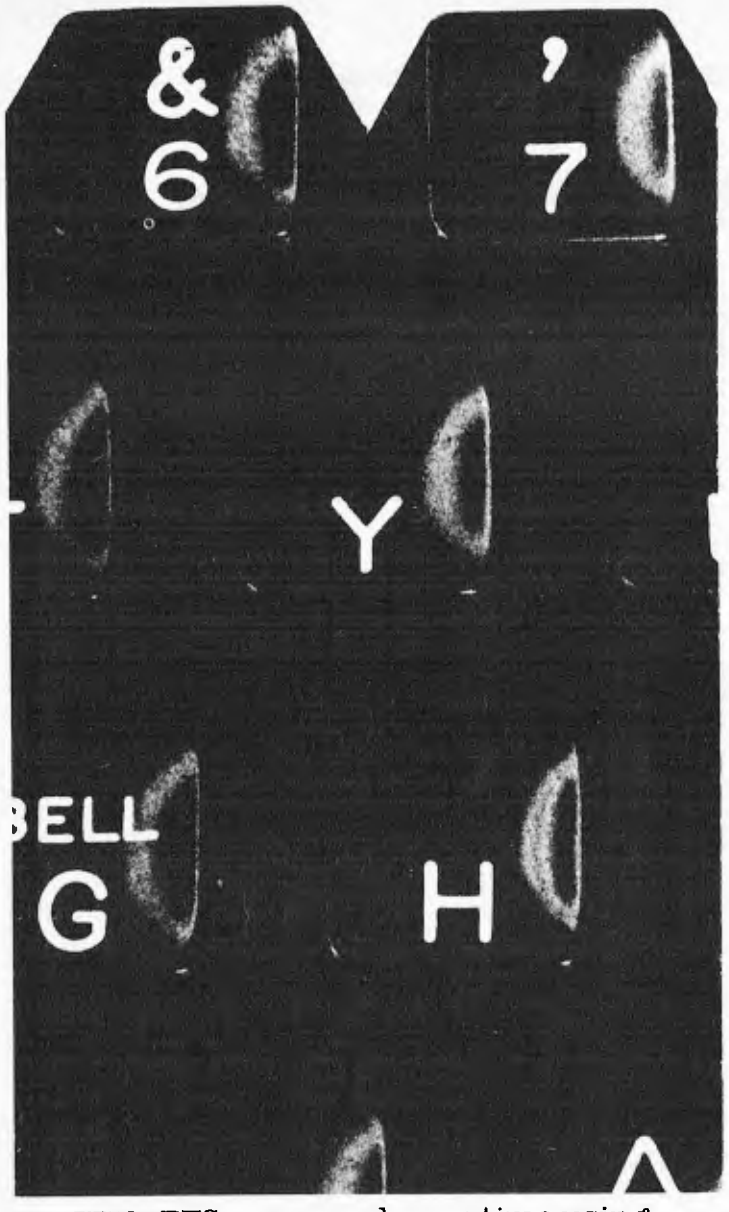
Table 1:
Relocating Ohio Scientific Basic Programs

Similarities in PET and Ohio Scientific Scratch Pad

The Commodore PET has Basic program work space set to begin at 0401. hex. Ohio Scientific has the Basic work space set to begin at 0301 hex.

Scratch Pad Area

	PET		OSI	
Basic START	122 dec.	7A hex	121 dec.	79 hex
	123 "	7B "	122 "	7A "
Single Variable	124 "	7C "	123 "	7B "
	125 "	7D "	124 "	7C "
Array Variable	126 "	7E "	125 "	7D "
	127 "	7F "	126 "	7E "
Array Space Available	128 "	80 "	127 "	7F "
	129 "	81 "	128 "	80 "
String Bottom	130 "	82 "	129 "	81 "
	131 "	83 "	130 "	82 "
String Top	132 "	84 "	131 "	83 "
	133 "	85 "	132 "	84 "
Memory Size	134 "	86 "	133 "	85 "
	135 "	87 "	134 "	86 "
Present Basic Line	136 "	88 "	135 "	87 "
	137 "	89 "	136 "	88 "
Line at BREAK	138 "	8A "	137 "	89 "
	139 "	8B "	138 "	8A "
Pointer for CONT.	140 "	8C "	139 "	8B "
	141 "	8D "	140 "	8C "



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As an example, let's reinitialize the pointers in zero page for a Basic program start address to begin at 0800 hex. To have the program begin at 0800 hex, we will need to change the high byte of the pointers for Basic program start, simple variable start, array variable start, available space, and string top and string bottom. To make this change, bring up Basic in cold start. Reset the computer. Bring up Monitor Mode by typing "M" on the keyboard. Once in Monitor Mode, you can call up the pointer addresses and change the data, to point to the new Basic program starting point. In address mode, call up 007A hex. Enter Data Mode by typing a slash (/) on the keyboard. Now load the required data at this address, in this case hex 08. Enter hex 08 at locations 007C, 007E, and 0080. Return to Address Mode. Call up 0800 hex. Examine the data stored at 0800. If this data is not 00, then change this data to read hex 00. Reset the computer. Call up Basic in warm start with "W" on the keyboard. Now type NEW followed by RETURN. If all went well the computer should respond with OK. Your Basic work space has now been changed to begin at page 8 and your Basic programs will be written upward from this point.

The last example is only one method of re-initializing the pointers. A different approach to this task is demonstrated in program listing 1. This program provides a Basic and machine language program that can be saved on cassette tape and can be loaded into the C1P or other Ohio Scientific system when the need arises. Refer to listing 1 for the following description.

The Basic portion of the program is used as an executive in connection with the machine language routine that actually does the work in initializing the scratch pad area pointers. The machine code program is stored in the memory area between 0200 hex and 0300 hex. This area in memory is little used and rarely mentioned in most articles. The memory area between 0222 and 02FF hex is not used by Basic or the Ohio Scientific monitor and is free for machine language routines or any other machine coded programs that can fit into this area. This is a perfect location for our machine code routine used in this program. Once the machine code routine is stored in this area, it can be called at any time the need arises to re-initialize the Basic start pointers. The Basic program in listing 1 contains the parameters needed to store the machine code in user memory and provides for user input in changing the Basic pointers.

At line 10 through 30, the machine code program is stored in user memory beginning at hex 0222 or decimal 546. The machine code is stored in the Basic program in DATA statements at lines 100 through 130. These data are READ and POKEd into memory with the FOR . . . NEXT loop at lines 10 through 30. The remainder of the Basic program simply obtains the operator's input for a new Basic start address. This start address is obtained at line 50 and stored in the "A" variable. At line 60 and 70, this new address data is stored or POKEd into the machine code areas at 0223 or 547 decimal and 023A or 570 decimal. The USR vector is set at line 80 to point to the machine code routine beginning at 0222 hex or 546 decimal. Line 90 is a statement using the USR vector to 0222 hex and executes the machine code routine.

When the program is run, the pointers will be changed to reflect the new start address. When the machine code program has reset the pointers, it jumps to Basic warm start at hex 0000 or decimal 0. The C1P responds with OK. To set up the new Basic work space, simply type NEW and a carriage return.

Once the Basic program in listing 1 has been keyed into the C1P or other Ohio Scientific computer, you should SAVE the program on cassette tape for later use. This cassette program can be loaded into any relocated Basic program space, as can any SAVED Basic program. The Ohio Scientific SAVE and LOAD cassette commands can be used regardless of where you have relocated your Basic program workspace.

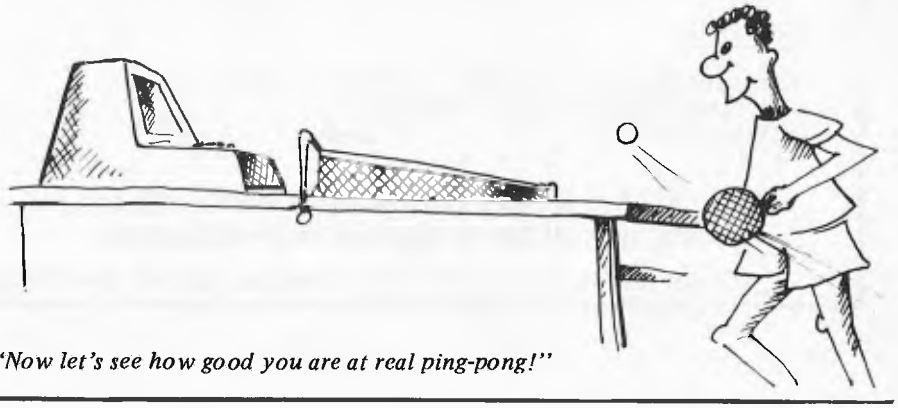
In conclusion, I hope this information will help owners and users of Ohio Scientific with Basic in ROM to better understand how the Ohio Scientific Microsoft Basic and the OSI monitor are used. Good luck.

Listing 1:
Basic Program Relocator

```
5 REM OSI ROM BASIC PROGRAM RELOCATOR
7 PRINT" ROM BASIC PROGRAM RELOCATOR"
10 FOR Q=546 TO 573
20 READ P: POKE Q,P
30 NEXT Q
50 INPUT" START";A
60 POKE 547,A
70 POKE 570,A
80 POKE 11,34:POKE 12,2
90 X=USR(X)
100 DATA 169,0,133,122,133,124,133,126
110 DATA 133,128,133,144,133,173,133,165
120 DATA 133,167,133,196,169,0,141,0,0
130 DATA 76,0,0
```

Disassembled Object Code
Located at 0222 through 023D

```
0222 A9 00      LDA   #$00
0224 85 7A      STA   $007A
0226 85 7C      STA   $007C
0228 85 7E      STA   $007E
022A 85 80      STA   $0080
022C 85 90      STA   $0090
022E 85 AD      STA   $00AD
0230 85 A5      STA   $00A5
0232 85 A7      STA   $00A7
0234 85 C4      STA   $00C4
0236 A9 00      LDA   #$00
0238 8D 00 00   STA   $0000
023B 4C 00 00   JMP   $0000
```



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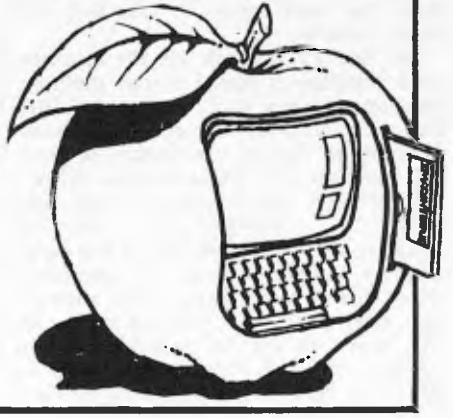

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BIGBOARD REAL TIME CLOCK

by Jeff Richards

These programs relate to the real time clock feature of the Bigboard. Program 2 is a demonstration of what the first program has achieved.

Program 1

```
; THIS PROGRAM RUNS UNDER CP/M AND PFM MONITOR VERSION 3.3
; ON THE FERGUSON BIGBOARD.  IT PERMITS EASY ALTERATION OF
; THE CURSOR CHARACTER AND THE DISK AC SWITCH TIMING, AS
; WELL AS LOADING AND INITIALIZING THE CLOCK.
;
; TO CHANGE THE CURSOR SIMPLY TYPE THE NEW CHARACTER. CONTROL
; CODES ARE PERMITTED. THE CURSOR CAN BE MADE TO FLASH.
;
; THE DISK TIMER IS A NUMBER BETWEEN Ø AND 255 BEING THE
; DELAY IN SECONDS.
;
; THE CLOCK ROUTINE WILL ASK FOR HOURS MINUTES AND SECONDS.
; RESPONSES ARE FULLY VALIDATED.
;
; THE PROGRAM MAKES EXTENSIVE USE OF MONITOR ROUTINES
; SO IT MAY NOT WORK WITH VERSIONS OTHER THAN 3.3
;
; IT IS WRITTEN FOR MICROSOFT'S MACRO-8Ø ASSEMBLER, BUT
; COULD BE EASILY CONVERTED FOR OTHER Z8Ø ASSEMBLERS, OR
; EVEN REWRITTEN FOR THE 8Ø8Ø.
;
START   EQU     ØF3ECH    ;MESSAGE PRINTING ROUTINE
DOIT    EQU     ØF407H    ;GET AND ECHO 1 CHAR
CCJUMP  EQU     ØF18ØH    ;JUMP INTO TABLE VECTOR
COMP    EQU     ØF36ØH    ;TABLE LOOKUP
MOTOR   EQU     ØF7B9H    ;DISK TIMER LOCATION
TIMER   EQU     ØFF6CH    ;TIMER INSTRUCTION LOCATION
CSRCHR  EQU     ØFF76H    ;CURRENT CURSOR CHARACTER
ENT3    EQU     ØFØØ9H    ;CONSOLE INPUT
ENT4    EQU     ØFØØCH    ;CONSOLE OUTPUT
RSTART  EQU     ØF7B8H    ;INITIALIZE DISK TIMER
HOURS   EQU     ØFF62H    ;CLOCK VALUES
MINS    EQU     ØFF63H
SECS    EQU     ØFF64H
JUMP    EQU     ØFF57H    ;INTERRUPT VECTOR
VECT    EQU     ØF48ØH    ;INTERRUPT ROUTINE
DEST    EQU     ØF8ØØH    ;CLOCK ROUTINE ADDRESS
;
BEGIN:  CALL    START     ;SEND MESSAGE
        DEFB    1AH,ØAH,ØAH,ØAH
        DEFB    9,9,9,9,"System Parameter Setup",ØDH,ØAH,ØAH
        DEFB    9,9,9,9,"1.  Cursor Character",ØDH,ØAH,ØAH
        DEFB    9,9,9,9,"2.  Disk AC Control Timing",ØDH,ØAH,ØAH
        DEFB    9,9,9,9,"3.  Clock Initialize",ØDH,ØAH,ØAH
        DEFB    9,9,9,9,"4.  Return to CP/M",ØDH,ØAH,ØAH
        DEFB    ØAH,9,9,9,9,"   Your Choice = ",4
        CALL    DOIT      ;GET 1 CHAR
```

```
        LD      HL,TABLE  ;BASE OF ACCESS TABLE
        LD      BC,4      ;LENGTH OF TABLE
        CALL    COMP      ;DO TABLE SEARCH
        JP      NZ,BEGIN  ;RESTART IF NOT FOUND
        PUSH    BC        ;PUSH VECTOR
        POP     IX        ;RETRIEVE IT
        CALL    CCJUMP    ;AND JUMP TO IT.
        JP      BEGIN
TABLE:  DEFB    "4","3","2","1"
        DEFW    CSRCHG
        DEFW    DISKAC
        DEFW    CLOCK
        DEFW    CPM
CSRCHG: CALL    START     ;SEND MESSAGE
        DEFB    ØDH,ØAH,"Character = ",4
        CALL    ENT3      ;GET INPUT
        PUSH    AF        ;SAVE IT
        CALL    ENT4      ;ECHO IT
        CALL    START     ;ANOTHER MESSAGE
        DEFB:   ØDH,ØAH,"Make it flash ? ",4
        CALL    ENT3      ;GET INPUT
        AND     5FH       ;FORCE UPPER CASE
        PUSH    AF        ;SAVE IT
        CALL    ENT4      ;ECHO IT
        POP     AF        ;RETRIEVE IT
        CP      59H       ;"Y" ?
        POP     BC        ;GET CURSOR CHARACTER
        LD      A,B       ;INTO A
        JR      NZ,NO     ;SKIP IF NO FLASH
        ADD     A,8ØH     ;ELSE SET HI BIT ON
NO:     LD      (CSRCHR),A ;AND PUT IT AWAY.
        RET
DISKAC:
        CALL    START     ;SEND MESSAGE
        DEFB    ØAH,ØDH,"Currently is = ",4
        LD      A,(MOTOR) ;CURRENT VALUE
        CALL    HEXOUT    ;CONVERT & PRINT
DSK2:   CALL    START     ;ANOTHER MESSAGE
        DEFB    ØAH,ØDH,"Make it = ",4
        LD      A,255     ;IE NO LIMIT
        LD      HL,MOTOR
        CALL    GETIT
        JR      C,DSK2    ;AGAIN IF ERROR
        CALL    RSTART    ;SWITCH DISK ON
        RET
HEXOUT: LD      C,1ØØ     ;HUNDREDS
        CALL    DIV
        LD      C,1Ø      ;TENS
        CALL    DIV
        LD      C,1       ;UNITS
DIV:    LD      B,Ø       ;CLEAR COUNTER
DIV1:   SUB     C         ;WILL IT GO ?
        JR      C,OUT     ;NO - FINISH
        INC     B         ;YES - BUMP CNTR
        JR      DIV1      ;AND TRY MORE
OUT:    PUSH    AF        ;SAVE REMAINDER
        LD      A,B       ;GET COUNT
        ADD     A,3ØH     ;MAKE ASCII
        CALL    ENT4      ;PRINT IT
```

```
        POP     AF          ;RETRIEVE REMAINDER
        ADD     A,C         ;ADD 1 BACK
        RET
CLOCK:  CALL    START       ;MESSAGE
        DEFB    ØDH,18H,"Hour = ",4
        LD      A,23        ;MAX FOR HOURS
        LD      HL,HOURS
        CALL    GETIT
        JR      C,CLOCK     ;AGAIN IF ERROR
M:      CALL    START       ;MESSAGE
        DEFB    ØDH,18H,"Minutes = ",4
        LD      A,59        ;MAX FOR MINS
        LD      HL,MINS
        CALL    GETIT
        JR      C,M         ;AGAIN IF ERROR
S:      CALL    START       ;MESSAGE
        DEFB    ØDH,18H,"Seconds = ",4
        LD      A,59        ;MAX FOR SECONDS
        LD      HL,SECS
        CALL    GETIT
        JR      C,S         ;AGAIN IF ERROR
        LD      HL,DATA     ;START OF ROUTINE
        LD      DE,DEST     ;DESTINATION
        LD      BC,DATEND-DATA  ;LENGTH
        LDIR                ;COPY IT
        LD      HL,JUMP     ;REPOINT VECTOR JUMP
        LD      (HL),85H    ;WHILE WE UPDATE
        LD      HL,VECT     ;THE ACTUAL
        LD      (HL),ØCDH   ;INSTRUCTION AT
        INC     HL          ;THE INTERRUPT
        LD      (HL),Ø      ;ROUTINE TO POINT
        INC     HL          ;TO OUR ROUTINE
        LD      (HL),ØF8H   ;AT F8ØØ
        LD      HL,JUMP     ;THEN RESTORE
        LD      (HL),8ØH    ;THE JUMP
        RET
DATA:                       ;THIS WILL BE LOADED
                            ;AND WILL EXECUTE AT F8ØØ
        LD      HL,SECS     ;GET SECONDS COUNT
        INC     (HL)        ;AND BUMP IT
        LD      A,6Ø        ;MAX COUNT
        CP      (HL)        ;COMPARE IT
        JR      NZ,DONE     ;FINISH IF NOT THERE
        LD      (HL),Ø      ;ELSE MAKE Ø
        DEC     HL          ;MOVE ONTO MINUTES
        INC     (HL)        ;AND BUMP IT
        CP      (HL)        ;COMP TO 6Ø
        JR      NZ,DONE     ;FINISH IF NOT THERE
        LD      (HL),Ø      ;ELSE MAKE Ø
        DEC     HL          ;MOVE ONTO HOURS
        INC     (HL)        ;AND BUMP IT
        LD      A,24
        CP      (HL)        ;END OF DAY?
        JR      NZ,DONE     ;FINISH IF NOT
        LD      (HL),Ø      ;ELSE MAKE Ø
DONE:   LD      HL,TIMER    ;REPLACE INSTRUCTION THAT
                            ;THE CALL OVERWROTE
        RET                 ;AND BACK TO REST OF
                            ;INTERRUPT SERVICE ROUTINE
```

```
DATEND  EQU     $
GETIT:  PUSH    AF
        PUSH    HL
        XOR     A           ;CLEAR A
        LD      (CHAR),A    ;CLEAR STORE
GET1:   CALL    ENT3        ;GET A CHAR
        CP      ØDH         ;CARR RET ?
        JR      Z,FINI      ;FINISH IF IS
        CALL    CONVT       ;ELSE UPDATE COUNT
        JR      GET1        ;AND BACK FOR MORE
FINI:   POP     HL          ;RETRIEVE ADDRESS
        LD      A,(CHAR)    ;GET RESULT
        LD      (HL),A      ;AND SAVE IT
        POP     AF          ;RETRIEVE LIMIT
        CP      (HL)        ;DO COMPARE
        RET                 ;C SET IF ERROR
CONVT:  SUB     "Ø"         ;MAKE ØH<=A<=9H
        RET     C           ;ERROR
        CP      1Ø          ;GREATER THEN 9 ?
        RET     NC          ;ERROR
        PUSH    AF          ;SAVE IT
        ADD     A,"Ø"       ;MAKE IT ASCII
        CALL    ENT4        ;ECHO IT
        LD      A,(CHAR)    ;GET PREVIOUS
        ADD     A,A         ;MULTIPLY
        LD      B,A         ;  IT
        ADD     A,A         ;   BY
        ADD     A,A         ;    1Ø
        ADD     A,B
        LD      B,A
        POP     AF          ;RETRIEVE LATEST ONE
        ADD     A,B         ;ADD PREVIOUS*1Ø
        LD      (CHAR),A    ;AND PUT IT AWAY
        OR      A           ;CLEAR CARRY
        RET                 ;PROPER FINISH
CPM:    POP     AF          ;REMOVE RETURN
        RET                 ;AND BACK TO CP/M
CHAR:   DEFS    1           ;TEMP STORE
        END
```

Program 2

```
; THIS PROGRAM RUNS UNDER CP/M AND PFM MONITOR VERSION 3.3
; ON THE FERGUSON BIGBOARD.  IT DEMONSTRATES THE PROCEDURES
; INVOLVED IN ACCESSING AND DISPLAYING THE INBUILT CLOCK.
; IF THE INTERRUPT ROUTINE HAS BEEN INSTALLED AND THE CLOCK
; INITIALIZED THE TIME WILL BE DISPLAYED IN THE TOP RIGHT
; CORNER OF THE SCREEN.
;
; THE PROGRAM IS WRITTEN FOR MICROSOFT'S MACRO-8Ø ASSEMBLER,
; BUT COULD EASILY BE CONVERTED FOR OTHER Z8Ø ASSEMBLERS.
;
HOURS   EQU     ØFF62H
MINS    EQU     HOURS+1
SECS    EQU     HOURS+2
ENT4    EQU     ØF00CH
PROMPT  EQU     ØF415H
CSRADD  EQU     ØFF73H
START   EQU     ØF3ECH
```

```
DONE:   LD      HL,(CSRADD)  ;GET CURSOR POSN
        LD      (STOR),HL    ;AND STORE IT AWAY
        CALL    START        ;POSITION CURSOR
        DEFB    1BH,"=",20H,66H,4
        LD      HL,HOURS     ;GET HOURS
        CALL    DISP         ;DISPLAY IT
        LD      HL,MINS      ;GET MINUTES
        CALL    DISP         ;DISPLAY IT
        LD      HL,SECS      ;GET SECONDS
        CALL    DISP         ;DISPLAY IT
        LD      HL,(STOR)    ;RETRIEVE CURSOR POSN
        LD      (CSRADD),HL  ;AND PUT IT BACK
        JP      DONE         ;REPEAT FOREVER
DISP:   LD      A,(HL)       ;GET DATA
        LD      B,0          ;CLEAR COUNTER
LOOP:   SUB     10           ;WILL IT GO ?
        JR      C,GOTIT      ;EXIT IF NOT
        INC     B            ;ELSE BUMP COUNTER
        JR      LOOP         ;AND TRY AGAIN
GOTIT:  ADD     A,3AH        ;MAKE ASCII
        PUSH    AF           ;SAVE REMAINDER
        LD      A,B          ;GET 10'S COUNT
        ADD     A,30H        ;MAKE ASCII
        CALL    ENT4         ;PRINT IT
        POP     AF           ;RETRIEVE REMAINDER
        CALL    ENT4         ;PRINT IT
        LD      A,20H        ;SPACE
        CALL    PROMPT       ;PRINT IT
        RET
STOR:   DEFS    2
END
```


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APC-80 ALIEN INVASION

by T. Lam and A. Sun

The world is invaded by aliens! Help to save the world by fighting off the invaders. Here are the instructions. Set the memory size to 31569. Load in the object file for APC-80 Version 4. Using CLOAD, load the program as listed (the program is written for 16k). Note that the USR function starts at location 31570. Run the program and save the world!

```
1 REM  ***  ALIEN INVASION  ***
2 REM BY T.LAM AND A.SUM
3 REM APC-80 VERSION 4 REQUIRED
5 CLS:DEFINT A-Z:CLEAR 150
6 RANDOM
7 DR=1:DL=0:'DIRECTIONS RIGHT & LEFT
10 POKE 16526,31570-(INT(31570/256)*256):POKE 16527,INT(31570/256)
11 FORJ=0TO273:READ DA:POKE 31570+J,DA:NEXT
15 DIM RW(4),CL(8)
17 M$=" "+CHR$(174)+CHR$(179)+CHR$(157)+" "
18 KC=200
20 CHAR32:PRINT@264,"ALIEN INVASION";
30 PRINT@335,"PLEASE SAVE THE EARTH";
40 CHAR64:PRINT@528,"HIT ANY KEY TO PROCEED";
50 IF INKEY$="" THEN 50
60 FOR I=1TO30:BEEP RND(120),RND(100):NEXT
70 CLS:E=100:L=4:SC=0:HS=0
80 PRINT@65,"DO YOU WANT INSTRUCTIONS";
90 INPUT Q$:IF Q$<>"Y" THEN 200
100 ' INSTRUCTIONS
101 CLS:
110 PRINT TAB(5);" > MOVE LASER BASE RIGHT"
115 PRINT TAB(5);" < MOVE LASER BASE LEFT"
120 PRINT TAB(5);" Z OR X FIRE LASER "
130 PRINT:PRINT"HIT ANY KEY TO PROCEED"
140 IF INKEY$="" THEN 140
150 CLS
200 CLS:TP=2:DIR=DR:MX=64:GOSUB 2000:' DRAW ALIENS
201 FOR I=1TO4:RW(I)=8:NEXT
202 L1=0:FOR I=1TO8:CL(I)=4:NEXT
210 PRINT@0,"ENERGY ";E;:PRINT@13,"SCORE ";SC;:PRINT@27,
    "HIGH SCORE ";HS;:PRINT@46,"LASER ";L;
220 B$=CHR$(190)+CHR$(189):BX=961
230 PRINT@BX,B$;:PRINT@63,"";
240 GOSUB 3000:GOSUB 4000
242 IFRW(1)<>0 THEN GOSUB 1000 ELSE 260
245 IF MX>64 THEN GOSUB6000 ELSE IF RND(20)>17 AND TP>2
    THEN GOSUB6000
250 IF SC>HS THEN HS=SC:PRINT@39,HS;"";
251 IF SC>KC THEN KC=KC+100:L=L+1:PRINT@53,L;"";
255 GOSUB 3000:GOSUB 4000:GOSUB 3000
256 GOSUB3200
260 IF RW(1)=0 THEN 200 ELSE  240
500 DATA 205,127,10,125,50,95,124,33,128,63,55,63,31,245
502 DATA 48,8,63,62,1,50,96,124,24,4,175,50,96,124,241
504 DATA 133,48,1,36,111,34,98,124,205,139,123,58,97,124
506 DATA 254,1,40,6,33,0,0,195,154,10,43,195,154,10,58
```

```
508 DATA 96,124,254,1,32,58,6,14,205,9,124,58,97,124,254
510 DATA 1,200,42,98,124,75,203,231,203,255,119,205,252
512 DATA 123,175,203,215,203,255,119,205,252,123,175,203
514 DATA 199,203,255,119,205,252,123,175,203,255,119,17,64
516 DATA 0,55,63,237,82,34,98,124,16,201,201,6,14,205,9
518 DATA 124,58,97
520 DATA 124,254,1,200,42,98,124,62,160,119,205,252,123,62
522 DATA 136,119,205,252,123,62,130,119,205,252,123,62,128
524 DATA 119,17,64,0,55,63,237,82,34,98,124,16,211,201
526 DATA 197,245,1,220,0,11,121,176,32,251,241,193,201,17
528 DATA 64,0,42,98,124,55,63,237,82,126,203,127,40,14
530 DATA 230,63,183,40,9,175,60,50,97,124,205,43,124,201
532 DATA 175,50,97,124,201,229,43,205,79,124,205,252,123
534 DATA 225,229,43,205,79,124,205,252,123,225,229,43,205
536 DATA 68,124,225,201,197,6,3,62,32,119,35,16,250,193
538 DATA 201,197,6,3,126,47,203,255,119,35,16,248,193,201
540 DATA 195,102,0,0,0,0,0,0
1000 ' NEW WOBLER
1010 ' BM-BOTTOM MOST,LM-LEFT MOST,RM-RIGHT MOST
1100 FOR BM=4TO1 STEP -1
1110 IF RW(BM)<>0 THEN 1150
1120 NEXT BM
1150 FOR LM=1TO8
1160 IF CL(LM)<>0 THEN 1200
1170 NEXT LM
1200 FOR RM=8TO1 STEP -1
1210 IF CL(RM)<>0 THEN 1250
1220 NEXT RM
1250 B1=(RM-LM+1)*8
1260 FS=(LM-1)*8+L1-1
1300 IF DIR=DL THEN 1400
1310 T1=TP*3
1320 IF POINT(125,T1)<>0 THEN DIR=DL:GOTO 1600
1350 FOR I=TP TO TP+(BM-1)*2 STEP 2
1360 MOVE 15360+I*64+FS TO 15361+I*64+FS FOR B1
1370 NEXT I
1380 L1=L1+1:RETURN
1400 T1=TP*3
1410 IF POINT(2,T1)<>0 THEN DIR=DR:GOTO 1600
1420 FOR I=TP TO TP+(BM-1)*2 STEP 2
1430 MOVE 15361+I*64+FS TO 15360+I*64+FS FOR B1
1440 NEXT I
1450 L1=L1-1:RETURN
1600 ' ALIENS ARE COMING DOWN
1610 IF (TP+BM*2-1)>13 THEN 1650
1620 T1=TP+(BM-1)*2
1630 FOR I=1TOBM*2
1640 MOVE 15360+T1*64+FS TO 15360+(T1+1)*64+FS FOR B1
1645 T1=T1-1:NEXT I:TP=TP+1:RETURN
1650 GOTO5000
2000 ' SET UP ALIENS
2010 A1$=" "+CHR$(153)+CHR$(166)+" "
2020 A2$=" "+CHR$(155)+CHR$(167)+" "
2030 A3$=" "+CHR$(154)+CHR$(165)+" "
2040 PRINT@128,A1$;"";
2050 P=15360+128:DX=7:GOSUB 2500
2060 PRINT@256,A2$;"";:P=15360+256:DX=7:GOSUB 2500
2070 PRINT@384,A3$;"";:P=15360+384:DX=7:GOSUB 2500
2080 A4$=" "+CHR$(182)+CHR$(185)+" "
```

```
2090 PRINT@512,A4$;:P=15360+512:DX=7:GOSUB 2500
2100 FOR I=1TO 160 STEP 3:BEEP I,16:NEXT
2110 RETURN
2500 FOR J=1TO7:MOVE P TO P+DX FOR 4:DX=DX+8:BEEP
     RND(50)+20,RND(9)+5:NEXT J:RETURN
3000 'MOVE LASER BASE
3010 IF PEEK(14368)=0 THEN RETURN ELSE PRINT@63,"";
3020 IF PEEK(14368)=64 THEN 3060
3030 IF PEEK(14368)<>16 THEN RETURN
3040 BX=BX-1:IF BX<961 THEN BX=961:RETURN
3050 MOVE 15361+BX TO 15360+BX FOR 4:RETURN
3060 BX=BX+1:IF BX>1020 THEN BX=1020:RETURN
3070 MOVE 15358+BX TO 15359+BX FOR 4:RETURN
3200 'DROP BOMB
3210 IY=RND(7)+1
3220 IF CL(IY)=0 THEN RETURN
3230 ROW=TP+(CL(IY)-1)*2
3240 COL=(IY-1)*8+L1+1
3250 F2=(ROW+1)*64+15360+COL
3270 POKE F2,130:POKEF2,132:POKEF2,160
3275 GOSUB 3000
3280 POKE F2,32
3290 IF PEEK(F2+64)=189 OR PEEK(F2+64)=190 THEN 3320
3300 F2=F2+64
3310 IF F2>16383 THEN F2=F2-64:POKEF2,32:RETURN
     ELSE GOSUB 3000:GOTO 3270
3320 L=L-1:PRINT@53,L;"";:IFL=0 THEN 5000
3330 POKE BX+15360,32:POKEBX+15361,32:BX=961
3335 BEEP 120,128
3340 E=100:PRINT@7,E;"";
3350 POKE 16320,32:POKE16321,254:POKE16322,253:RETURN
4000 'FIRING LASER
4010 IF PEEK(14344)=0 THEN RETURN
4015 FX=(BX-960)*2+1:IF FX<0 THEN FX=2 ELSE IF FX>124 THEN  FX=124
4017 E=E-1:PRINT@7,E;"";:IF E<=0THEN E=100:L=L-1:BEEP 120,100:
4018 IF L=0  THEN5000
     PRINT@53,L;"";ELSE 4020
4020 Z=USR(FX+1)
4030 IF Z=0 THEN RETURN
4100  FOR K=3TO 60 STEP 5:BEEP K,10:NEXT
4110 T1=INT((Z-15360)/64):IX%=INT((T1-TP)/2)+1
4120 IF IX%>0ANDIX%<5 THEN RW(IX%)=RW(IX%)-1:SC=SC+RND(IX%)+1
:R=Z-15360-T1*64:IY%=INT((R-L1+1)/8)+1:CL(IY%)=CL(IY%)-1:GOTO 4140
4130 SC=SC+RND(10)+1:PRINT@MX,"    ";"";:MX=64
4140 PRINT@19,SC;"";
4150 RETURN
5000 'ALL LASER BASE GONE OR ALIENS LANDED
5005 FOR J=0TO120:BEEP RND(100)+25,RND(10)+9:NEXT
5010 CLS:CHAR32:PRINT@10,"ALIENS HAVE INVADED EARTH";"";
5020 CHAR64:PRINT@128,"ANOTHER GAME";"";:INPUT Q$
5030 IF Q$="Y" THEN 5100 ELSE END
5100 L=4:SC=0:E=100:KC=200:GOTO 200
6000 ' MYSTERY SHIP
6010 MX=MX+1:IFMX>123THEN MX=64:PRINT@123,"      ";"";:RETURN
6020 PRINT@MX,M$;"";
6030 IF RND(20)<17 THEN RETURN
6035 FX=(BX-960)*2+1:M1=(MX-62)*2
6040 REDRAW M1,5TO FX,46
```

```
6045 FOR J=20TO60STEP5:BEEPJ,9:NEXTJ
6050 REDRAW M1,5TOFX,46
6060 E=E-RND(15)+1:PRINT@7,E;"";
6070 IF E<=0THEN L=L-1:PRINT@52,L;"";ELSE RETURN
6080  IF L=0THEN 5000
6090 E=100:PRINT@7,E;"";
6096 BEEP 200,40:BEEP95,40:BEEP220,40:BEEP 90,40
6100 RETURN
```

PET RTC

by Bob Leask

The program covers part of a Radio Technician Course, dealing with L.C. R.L.C. Tuned circuits in both series and parallel. Between lines 100 and 450 is another small program called Starter Tape. The listing between lines 300 and 430 explain the function of each sub routine.

Its value is most realized in conjunction with the PET Toolkit. LOAD the starter; APPEND or write your program into memory. Then RENUMBER to include the starter in your program. Once that's done its a simple matter of placing the various GOSUBs in the appropriate places.

This program also has the advantage of placing ALL the most used subroutines at the 'top' of memory to speed execution. It was written on a PET 2001, 32k with Basic 2.0, and will run on any 16k machine.

```
LISTING: (A) STARTER  (B) CIRCUIT THEORY

 100 REM ** SUBROUTINE STARTER TAPE BOB LEASK 02.0 2.81
 110 POKE59468,12:PP=1:GOTO300
 120 OPEN50,4,0:CMD50:RETURN
 130 OPEN2,4,6:PRINT#2,CHR$(18):CMD50:RETURN
 140 PRINT#2,CHR$(24):PRINT#2:CLOSE2:CMD50:RETURN
 150 PRINT#50:CLOSE50:PP=1:GOSUB170:RETURN
 160 GOSUB270:GOTO 450
 170 IFPP=0 OR PP=1THENGOSUB270:PRINT"□":RETURN
 180 IFPP=2THENRETURN
 190 IFPP=1ORPP=0THENGOTO200
 200 OPEN6,3,0:CMD6:PRINT"SCREEN OR PRINTER NEXT?
     ■ [SC=1 PR=2] ■ ";:INPUT X
 210 IF X=1 THEN PP=1:GOTO 230
 220 IF X=2 THEN PP=2:GOSUB 120
 230 PRINT#6:CLOSE6:RETURN
 240 PRINT"□■■■■■BYTES USED ="31743-FRE(0)
     :PRINT:PRINT"BYTES FREE ="FRE(0)
 250 C=INT(100*((31743-FRE(0))/31743)*100)/100:PRINT
     :PRINT"SPACE USED ="C;"%":PR
INT
 260 PRINTTI$;"  TIME ELAPSED":PRINT"■■■■■■■■■■■■■■■■■■■■■■■■■":GOTO260
 270 PRINT"          PRESS ■ RETURN ■ PLEASE"
 280 GETA$:IF A$=""THEN280
 290 RETURN
 300 PRINT"□  SUBROUTINES TO SPEED UP PROGRAMS"
 310 PRINT"   ________________________________
 320 PRINT"________________________________________"
 330 PRINT" ** USE ■ GOSUB■ XXX TO INITIALISE  ** "
 340 PRINT"________________________________________"
 350 PRINT"120   STARTS PRINTER OPERATION":PRINT
```

```
 360 PRINT"130    PRINTER DRAWS PICTURES (6 LPI)":PRINT
 370 PRINT"140    RETURNS PRINTER TO (8 LPI)":PRINT
 380 PRINT"150    END PRINTER PROGRAM REVERT TO VDU":PRINT
 390 PRINT"160    END EACH PROGRAM. RETURNS TO MENU":PRINT
 400 PRINT"170    PLACE AT END ■EACH■ SCREEN  (RUNS
                  PRINTER CONTINUOUSLY)
":PRINT
 410 PRINT"190    GIVES CHIOCE OF SCREEN OR PRINTER
 420 PRINT"       (■PP=1■ SCREEN) (■PP=2■ PRINTER)":PRINT
 430 PRINT"270    END SCREEN. CLEARS & RETURNS
 440 PRINT:GOSUB270:FORI=1TO500:NEXT:GOTO450
 450 POKE59468,12:PRINT"■■ SUMMARY■ OF TUNED CIRCUITS

 460 PRINT"■ SERIES-TUNED CIRCUIT AT RESONANCE:":PRINT
 470 PRINT"1. CURRENT FROM THE SUPPLY ■ MAXIMUM"
 480 PRINT"2. MIN Z AND EQUALS RESISTANCE"
 490 PRINT"3. VLTGS ACROSS L & C ARE = & AT MAX"
 500 PRINT"4. ■ VLTG MAGNIFICATION■ TAKES PLACE":PRINT
 510 PRINT"RESONANCE IS OBTAINED WHEN XL = XC":PRINT
 520 PRINT"■ PARALLEL-TUNED CIRCUIT AT RESONANCE:":PRINT
 530 PRINT"1. CURRENT FROM SUPPLY ■ MINIMUM"
 540 PRINT"2. CIRCULATING CURRENT IS AT A MAXIMUM"
 550 PRINT"3. IMPEDANCE IS MAXIMUM"
 560 PRINT"4. ■ CURRENT AMPLIFICATION■ TAKES PLACE":PRINT
 570 PRINT"RESONANCE IS OBTAINED WHEN IC = IL":PRINT
 580 PRINT"CONCLUDES SUMMARY...MENU OF EXAMPLES FOLLOW...
     ":PRINT:GOSUB170
 590 POKE59468,14:PRINT"■■\‾/■: ⌐ESONANT, ¬APACITANCE,
     \NDUCTANCE":PRINT
 600 PRINT"1.    GIVEN: R, IN SERIES WITH L, E,F":PRINT
 610 PRINT"2.    GIVEN: R, IN SERIES WITH C, E,F":PRINT
 620 PRINT"FIND: A.  CIRCUIT IMPEDANCE          (Z)"
 630 PRINT"      B.  CURRENT FLOWING            (I)"
 640 PRINT"      C.  VLTG ACROSS RESISTANCE    (ER)"
 650 PRINT"      D.  VLTG ACROSS INDUCTANCE    (EL)"
 660 PRINT"     DA.  VLTG ACROSS CAPACITOR     (EC)"
 670 PRINT"      D1. CHECK ON VLTG              (E)"
 680 PRINT"      E.  POWER FACTOR              (PF)"
 690 PRINT"      F.  POWER                      (P)":PRINT
 700 PRINT"USE: ■⌐ ///●|┌■ THEN ■|┌|┌■ 1130  ":PRINT:GOSUB170
 710 PRINT"■■ \ENU■ CONT.....":PRINT
 720 PRINT"3.    GIVEN: R, H, F, IN SERIES, V,F":PRINT
 730 PRINT"FIND: A. CIRCUIT IMPEDANCE           (Z)"
 740 PRINT"      B. CURRENT FLOW                (I)"
 750 PRINT"      B.(A) RESONANT FREQ           (FO)"
 760 PRINT"      C. VLTG ACROSS EACH    (ER,EL,EC)"
 770 PRINT"      D. POWER FACTOR (& PHASE ANG)(PF)"
 780 PRINT"      E. VOLT-AMPS (WATTS)           (S)"
 790 PRINT"      F. POWER                       (P)":PRINT
 800 PRINT"■ ALSO■: IF NOT GIVEN FREQ ENTER AS ■ 1■"
 810 PRINT"FINDS RESONANT FREQ PLUS THE ABOVE.":PRINT
 820 PRINT"■AND■ IF ONLY GIVEN XC & XL WILL ALSO
     FIND THE ABOVE.":PRINT
 830 PRINT"FINDS RESONANT FREQ PLUS THE ABOVE.":PRINT
 840 PRINT"USE: ■⌐ ///●|┌■ THEN ■|┌|┌■ 1610  ":PRINT:GOSUB170
 850 PRINT"■■ \ENU■ CONT.....":PRINT
 860 PRINT"4. GIVEN:R,COIL 1, R,COIL 2, XC ■SERIES":PRINT
 870 PRINT"FIND: A. TOTAL IMPEDANCE OF2 COILS &CAPACITOR IN SERIES"
 PRINT
 880 PRINT"USE: ■⌐ ///●|┌■ THEN ■|┌|┌■ 2170  ":PRINT
 890 PRINT"■ \ENU■ CONT...":PRINT
```

```
900 PRINT"5. GIVEN: R, H, F, IN ■SERIES■ WITH X VOLT VARIABLE
    FREQ SUPPLY":PRINT
910 PRINT"FIND: A. RESONANT FREQ                (F)"
920 PRINT"      B. CURRENT AT RESONANCE         (I)"
930 PRINT"      C. VLTG DROP ACROSS EACH AT RES "
940 PRINT"                                      (ER,EL,EC)":PRINT
950 PRINT"USE: ■←,//✱!┌■ THEN ■!┌!┌■ 1610  ":PRINT:GOSUB170
960 PRINT"□■ \ENU■ CONT..."
970 PRINT"6. RESISTANCE & INDUCTANCE IN ■┐ARALLEL■"
980 PRINT"GIVEN: R,H,V,X HZ":PRINT
990 PRINT"FIND: A. THE CURRENT"
1000 PRINT"      B. POWER FACTOR
1010 PRINT"      C. POWER    ■ ┐LUS■":PRINT
1020 PRINT"USE: ■←,//✱!┌■ THEN ■!┌!┌■ 2340    ":PRINT
1030 PRINT"■ \ENU■ CONT...";
1040 PRINT"  7.  ─,└,─ IN ■┐ARALLEL"
1050 PRINT"■OR■ ─P,─└,└,─ IN ■✱/┐ARALLEL":PRINT
1060 PRINT"GIVEN: ─,─└,└,─, X, X  !Z":PRINT
1070 PRINT"FIND: A. THE CURRENT
1080 PRINT"      B. POWER FACTOR
1090 PRINT"      C. THE POWER
1100 PRINT"      D. TOTAL IMPEDANCE      ■┐LUS■ ":PRINT
1110 PRINT"USE: ■←,//✱!┌■ THEN ■!┌!┌■ 3020  ":PRINT
1120 GOSUB170:GOTO450
1130 POKE59468,12:PRINT"□1.GIVEN: R, IN ■SERIES■ WITH L, E,F":PRINT
1140 PRINT"2.   GIVEN: R, IN ■SERIES■ WITH C, E,F":PRINT
1150 PRINT"FIND: A.  CIRCUIT IMPEDANCE          (Z)"
1160 PRINT"      B.  CURRENT FLOWING            (I)"
1170 PRINT"      C.  VLTG ACROSS RESISTANCE     (ER)"
1180 PRINT"      D.  VLTG ACROSS INDUCTANCE     (EL)"
1190 PRINT"     DA.  VLTG ACROSS CAPACITOR      (EC)"
1200 PRINT"      D1. CHECK ON VLTG              (E)"
1210 PRINT"      E.  POWER FACTOR               (PF)"
1220 PRINT"      F.  POWER                      (P)":PRINT
1230 PRINT"AS YOU CAN SEE FROM ABOVE THE ONLY DIFF IS EITHER
    L OR C, ENTER L OR  C"
1240 INPUTA$
1250 IFA$="L"THENXX=1
1260 IFA$="C"THENXX=2
1270 IFXX=1THENINPUT"ENTER R,L,E,F";R,L,E,F:GOTO1290
1280 IFXX=2THENINPUT"ENTER R,C,E,F";R,C,E,F:GOTO1300
1290 X1=INT(100*(2*π*F*L)+.5)/100:GOTO1310
1300 X1=INT(100*(1/(2*π*F*C))+.5)/100
1310 Z1=INT(100*(SQR(R↑2+X1↑2))+.5)/100
1320 I=INT(1E6*(E/Z1))/1E6
1330 ER=INT(1E4*(I*R))/1E4:EX=INT(1E4*( I*X1))/1E4
1340 ET=INT(1E4*SQR(ER↑2+EX↑2))/1E4
1350 Q1=INT(100*(Z1/R)+.5)/100:PF=INT(1E4*(R/Z1))/1E4:REM QQ=1/PF
1360 AG=(180/π)*(-ATN(PF/SQR(-PF*PF+1))+π/2):AN=INT(100*AG)/100
1370 PT=INT(1E6*(E*I*PF)+.5)/1E6:PC=INT(1E6*(I↑2*R)+.5)/1E6
1380 PRINT"□■ SOLUTION■:":PRINT
1390 IFXX=1THENPRINT"A. XL=2*π*F*L = 2π*"F;"*"L:GOTO1410
1400 IFXX=2THENPRINT"A. XC=1/2*π*F*L =1/2π*"F;"*"C
1410 PRINT"      = "X1;"■OHMS"
1420 PRINT"    Z=SQR(R↑2+X↑2)="R;"↑2+"X1;"↑2)":PRINT" ="Z1;"■OHMS"
1430 PRINT"B. I=E/Z  ="E;"/"Z1;" ="I;"■AMPS":PRINT
1440 PRINT"C. ER=IR  ="I;"*"R;" ="ER;"■V":PRINT
1450 IFXX=1THENPRINT"D. EL=I*XL ="I;"*"X1;" ="EX;"■V":GOTO1470
1460 IFXX=2THENPRINT"D. EC=I*XC ="I;"*"X1;" ="EX;"■V"
1470 PRINT"    E(CHECK)=SQR(ER↑2+EX↑2)
1480 PRINT"             =SQR("ER;"↑2 +"EX;"↑2)
1490 PRINT"             ="ET;"■V"
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 1500 PRINT"F. POWER FACTOR = COS θ = R/Z
 1510 PRINT"                    ="R;"/"Z1;" ="PF
 1520 PRINT"G. P = EI COS θ ="E;"*"I;"*"PF
 1530 PRINT"      ="PT;" WATTS"
 1540 PRINT"      ="PC;"WATTS (CHECK I↑2R)"
 1550 PRINT" Q FACTOR = XL OR XC / R ="Q1:PRINT
 1560 IFXX=1THENPRINT"CURRENT LAGS VLTG BY
      ":PRINT"PHASOR COS θ ="AN;"DEG":GOT
01580
 1570 IFXX=2THENPRINT"CURRENT LEADS VLTG BY
      ":PRINT"PHASOR COS θ ="AN;"DEG"
 1580 PRINT:INPUT"MORE DATA? (1=Y 2=N)";X
 1590 IFX=1THEN1130
 1600 IFX=2THEN450
 1610 POKE59468,12:PRINT"
 1620 PRINT"3.   GIVEN: R, H, L, IN SERIES, V,F":PRINT
 1630 PRINT"FIND: A. CIRCUIT IMPEDANCE          (Z)"
 1640 PRINT"      B. CURRENT FLOW               (I)"
 1650 PRINT"      C. VLTG ACROSS EACH    (ER,EL,EC)"
 1660 PRINT"      D. POWER FACTOR              (PF)"
 1670 PRINT"      E. VOLT-AMPS (WATTS)         (S)"
 1680 PRINT"      F. POWER                     (P)":PRINT
 1690 PRINT"HAVE YOU BEEN GIVEN H,F OR XC,XL? ":PRINT"H,F = 1
      XC,XL =2";:INP
UT%
 1700 IFX=1THEN1740
 1710 IFX=2THEN 1720
 1720 INPUT"ENTER R,XL,XC,E,F";R,XL,XC,E,F
 1730 C=1/(2*π*F*XC):L=XL/(2*π*F):GOTO1750
 1740 INPUT"ENTER R,L,C,E,F";R,L,C,E,F
 1750 IFC=1THENC=1/(4*π↑2*L*F↑2)
 1760 FO=INT(10*(1/(2*π*SQR(L*C)))+.5)/10:IF F=1 THEN F=FO
 1770 XL=INT(1000*(2*π*F*L)+.5)/1000
 1780 XC=INT(1000*(1/(2*π*F*C))+.5)/1000
 1790 XT=INT(10000*(XL-XC))/10000:XX=5
 1800 IFXL<XCTHENXT=ABS(XL-XC):XX=0
 1810 IF F=1THENTX=1
 1820 Z1=INT(100*(SQR(R↑2+XT↑2))+.5)/100:R1=R↑2:X2=XL↑2:X3=XC↑2
 1830 I=INT(1E6*(E/Z1))/1E6
 1840 EA=INT(1E4*(I*R))/1E4:EB=INT(1E4*(I*XL))/1E4:EC=INT
      (1E4*(I*XC))/1E4
 1850 QQ=INT(100*((1/R)*SQR(L/C))+.5)/100:PZ=R/Z1:H=1/PZ
 1860 Q1=INT(100*((2*π*F*L)/R)+.5)/100:Q2=INT(100*
      (1/(2*π*C*R))+.5)/100
 1870 QA=INT(100*(EB/E)+.5)/100:QB=INT(100*(EC/E)+.5)/100
 1880 PF=INT(10000*(R/Z1))/10000:EX=INT(1E4*(EB-EC))/1E4
 1890 ET=INT(1E4*(SQR(EA↑2+((EB-EC)↑2))))/1E4:IFTX=1THEN1920
 1900 IFZ1=RTHEN1920
 1910 AG=(180/π)*(-ATN(PF/SQR(-PF*PF+1))+π/2):AN=INT(100*(AG)+.5)/100
 1920 PT=INT(1E6*(E*I*PF)+.5)/1E6:PC=INT(100*(I↑2*R)+.5)/100
 1930 PRINT" SOLUTION:":PRINT
 1940 PRINT"A. XL=2*π*F*L = 2π*"F;"*"L:PRINT"      ="XL;" OHMS":PRINT
 1950 PRINT"    XC=1/2*π*F*L = 1/2π*"F;"*"C:PRINT' ="XC;" OHMS":PRINT
 1960 PRINT"    X =XL-XC ="XT;" OHMS    Fo="FO;" HZ":PRINT
 1970 PRINT" Z=SQR(R↑2+X↑2)="R;"↑2+"XT;"↑2)":PRINT"="Z1;" OHMS":PRINT
 1980 PRINT"B. I=E/Z   ="E;"/"Z1;" ="I;" AMPS":PRINT
 1990 PRINT"C. ER=IR   ="I;"*"R;" ="EA;" V"
 2000 PRINT"    EL=IXL ="I;"*"XL;" ="EB;" V"
 2010 PRINT"    EC=IXC ="I;"*"XC;" ="EC;" V":PRINT
 2020 PRINT" PART B OF SOLUTION FOLLOWS":PRINT:GOSUB170
 2030 PRINT"E(CHECK)=SQR(ER↑2+EX↑2)
 2040 PRINT"         =SQR("EA;"↑2+"EX;"↑2)
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2050 PRINT"          ="ET;"■V":PRINT
2060 PRINT"D. POWER FACTOR = COS Ø = R/Z
2070 PRINT"                    ="R;"/"Z1;" ="PF:PRINT
2080 PRINT"E. P = EI COS Ø ="E;"*"I;"*"PF
2090 PRINT"      ="PT;"■WATTS■  CHECK ="PC:PRINT
2100 PRINT"   Q = ■VL="QA;" ■VC="QB;" ■QQ="QQ:PRINT
2110 IFZ1=RTHENPRINT"CURRENT AND VLTG ■IN PHASE■"
     :PRINT"PHASE Ø="AN;"■DEG":GOTO 2140
2120 IFXX=ØTHENPRINT"CURRENT ■LEADS■ VLTG BY COS Ø":PRINT"
     ="AN;"■DEG":GOTO 2140
2130 PRINT"CURRENT ■LAGS■ VLTG BY COS Ø":PRINT"        ="AN;"■DEG"
2140 PRINT:PRINT:INPUT"MORE DATA? (1=Y 2=N)";X
2150 IFX=1THEN1610
2160 IFX=2THEN450
2170 POKE59468,12:PRINT"■4. GIVEN:R,COIL 1, R,COIL 2, XC":PRINT
2180 PRINT"FIND: A. TOTAL IMPEDANCE OF 2 COILS &
      CAPACITOR IN ■SERIES":PRINT
2190 PRINT:INPUT"R1,XL1,R2,XL2,XC [ALL OHMS]";R1,X1,R2,X2,XC:PRINT
2200 R3=R1+R2:XL=X1+X2:XT=ABS(XL-XC):IFXL>=XCTHENX$=
     " INDUCTIVE ":GOTO2220
2210 IFXL<=XCTHENX$=" CAPACITIVE "
2220 Z=INT(1000*SQR(R3↑2+XT↑2))/1000
2230 PRINT"■SOLUTION■:":PRINT
2240 PRINT"TOT RES = R1 + R2   ="R3;"■OHMS":PRINT
2250 PRINT"TOT XL = XL1 + XL2  ="XL;"■OHMS":PRINT
2260 PRINT"NET REACTANCE XL-XC ="XT;"■OHMS":PRINT
2270 PRINT"Z = SQR(RT↑2 + X↑2) ="Z;"■OHMS":PRINT
2280 AN=XL/R3:AG=INT(100*(180/π)*ATN(AN))/100
2290 PRINT"CIRCUIT IS "X$
2300 PRINT"PHASE ANGLE Ø = TAN (XL/RT) ="AG;"■■■DEG"
2310 PRINT:PRINT"MORE DATA? (1=Y 2=N)";:INPUTX
2320 IFX=1THEN2170
2330 IFX=2THEN450
2340 POKE59468,12:PRINT"■5. R,L, ■AND■ C  IN ■PARALLEL■":PRINT
2350 PRINT"GIVEN: R,L,C?,V,X HZ":PRINT
2360 PRINT"FIND: A. THE CURRENT"
2370 PRINT"       B. POWER FACTOR  & PHASE ANGLE Ø
2380 PRINT"       C. POWER":PRINT:PRINT"
2390 PRINT"** FINDS: RES FREQ OR C, SEE BELOW":PRINT
2400 PRINT"**  TO FIND C,  ENTER C AS 1"
2410 PRINT"**  TO FIND Fo, ENTER F AS 1":PRINT
2420 PRINT"** IF GIVEN R,L,F,HZ  ■ENTER C AS■  ■2":PRINT
2430 PRINT"HAVE YOU BEEN GIVEN L,C OR XL,XC? ":PRINT:PRINT"L,
     C = ■1■    XC,XL =  ■";:INPUTX
2440 IFX=1THEN2480
2450 IFX=2THEN2460
2460 PRINT:INPUT"ENTER R,XL,XC,E,F";R,XL,XC,E,F
2470 C=1/(2*π*F*XC):L=XL/(2*π*F):GOTO2510
2480 PRINT:INPUT"ENTER R,L,C,E,F";R,L,C,E,F
2490 IFC=1THENGG=5
2500 IFC=2THENAS=5:C=1
2510 IFC=1THENC=INT(1E13*(1/(4*π↑2*L*F↑2)))/1E13
2520 FO=INT(10*(1/(2*π*SQR(L*C)))+.5)/10:IF F=1 THEN F=FO
2530 XL=INT(1000*(2*π*F*L)+.5)/1000
2540 XC=INT(1000*(1/(2*π*F*C))+.5)/1000
2550 IR=INT(1E6*(E/R))/1E6:IL=INT(1E6*(E/XL))/1E6
2560 IC=INT(1E6*(E/XC))/1E6
2570 IFAS=ØTHEN2600
2580 IFAS=5THENXC=Ø
2590 IFAS=5THENIC=Ø
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2600 IT=ABS(INT(1E6*(IL-IC))/1E6):XX=5
2610 IFIL<ICTHEN XX=0
2620 IFIT=0THENXX=1
2630 IFIT>=1THENIT=INT(100*IT)/100
2640 I=INT(1E6*(SQR(IR↑2+IT↑2)))/1E6
2650 IFI>=1THENI=INT(100*I+.5)/100
2660 ZO=INT(100*(L/(C*R))+.5)/100
2670 Z1=INT(100*(E/I)+.5)/100
2680 PF=INT(1E5*(IR/I))/1E5:IFPF=1THEN2700
2690 AG=(180/π)*(-ATN(PF/SQR(-PF*PF+1))+π/2):AN=INT(100*(AG)+.5)/100
2700 QO=INT(100*((2*π*F*L)/R)+.5)/100
2710 QO=INT(100*((1/R)*SQR(L/C))+.5)/100:PZ=R/Z1:H=1/PZ
2720 V=INT(1000*(I*ZO)+.5)/1000
2730 PT=INT(1E6*(E*I*PF)+.5)/1E6:PC=INT(100*(IR↑2*R)+.5)/100
2740 PRINT"■■SOLUTION■ PART ONE      ■ FO■ ="FO;"■HZ":PRINT
2750 PRINT"A. XL = 2*π*F*L =";XL;"■OHMS■":PRINT
2760 PRINT"   XC = 1/2πFC  =";XC;"■OHMS":PRINT:IFX=1THEN2800
2770 PRINT"** IF ONLY GIVEN XC & XL, THEN:-"
2780 PRINT"    L = XL/2πF  =";L;"■HENRYS"
2790 PRINT"    C = 1/2πFXC =";C;"■FARADS":PRINT
2800 IFGG=5THEN PRINT"    C = 1/2πF*L =";C;"■FARADS":PRINT
2810 PRINT"   IR = E/R     =";IR;"■AMPS":PRINT
2820 PRINT"   IL = E/XL    =";IL;"■AMPS":PRINT
2830 PRINT"   IC = E/XC    =";IC;"■AMPS":PRINT
2840 PRINT"THE TOTAL CURRENT IS THE PHASOR SUM."
2850 PRINT"    I = SQR((IR↑2+(IL-IC)↑2)":PRINT
2860 PRINT"      =";I;"■AMPS■  (IL-IC)=";IT;"■A":PRINT:PRINT"■
     PART B OF SOLUTION NEXT"
2870 PRINT:GOSUB170
2880 PRINT"■■SOLUTION■ PART TWO":PRINT
2890 PRINT"B. POWER FACTOR = COS Ø":PRINT
2900 PRINT"    ■" PF = IR/I =";PF:PRINT
2910 IFIL>ICTHENPRINT"TOTAL CURRENT ■LAGS■ VLTG BY ";AN;"■DEG":PRINT
2920 IFIL<ICTHENPRINT"TOTAL CURRENT ■LEADS■ VLTG BY ";AN;"■DEG":PRINT
2930 IFIL-IC=0THENPRINT"CURRENT & VLTG ARE ■ IN PHASE":PRINT
2940 PRINT"C.  P = EI COS Ø =";PT;"■WATTS■":PRINT
2950 PRINT"(CHECK) P = I↑2R =";PC;"■W":PRINT
2960 PRINT"D.  Z = E/I      =";Z1;"■OHMS":PRINT
2970 PRINT"   Zo = L/C*R    =";ZO;"■OHMS■":PRINT
2980 PRINT"   QO =";QO;"  Q9 =";Q0:PRINT
2990 PRINT:INPUT"MORE DATA? (1=Y 2=N)";X
3000 IFX=1 THEN2340
3010 IFX=2THEN450
3020 POKE59468,12:PRINT"■7. RP OR RS & R(COIL) L, C,
     IN ■PARALLEL":PRINT
3030 PRINT"■FOR■  ■(A)■ (RL,L) C, IN ■PARALLEL":PRINT
3040 PRINT"■(B)■ RP,(RL,L) C, IN ■ PARALLEL":PRINT
3050 PRINT"■(C)■ RS,(RL,L) C, IN ■SERIES/PARALLEL"
3060 PRINT"A. GIVEN: RL,L,C,E, X HZ"
3070 PRINT"B. GIVEN: RP,RL,L,C,E, X HZ"
3080 PRINT"C. GIVEN: RS,RL,L,C,E, X HZ"
3090 PRINT"■FIND■: A. THE CURRENT
3100 PRINT"         B. POWER FACTOR
3110 PRINT"         C. THE POWER
3120 PRINT"         D. TOTAL IMPEDANCE      ■PLUS■ ":PRINT
3130 PRINT"**  ■FINDS■: RES FREQ OR C, SEE BELOW"
3140 PRINT"**  TO FIND C,  ENTER C AS 1"
3150 PRINT"**  TO FIND Fo, ENTER F AS 1":PRINT
3160 PRINT"■ COMPUTER WILL NOW PROMT■.":PRINT
3170 PRINT"■DO YOU REQUIRE■ P OR S/P":PRINT:PRINT"■P■ = 1
     ■S/P■ = 2";:INPUTX
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3180 PRINT
3190 IFX=1 THENGOTO3210
3200 IFX=2 THENGOTO3220
3210 PRINT:INPUT"GIVEN: ■1.■ (RL,L),C ■2.■
     (RL,XL),XC IN ■P■";X:GOTO3230
3220 PRINT:INPUT"GIVEN: RS,(RL,L),C ■OR■ RS,(RL,XL)
     ,XC ■1■ OR ■2";X:GOTO 3250
3230 IFX=1THENPRINT:PRINT"■ENTER■ RL,L,C,E,F
    ":PRINT:INPUT RL,L,C,E,F:GOTO 3270
3240 IFX=2THENPRINT:INPUT"■ENTER■ RL,XL,XC,E,F
    ";RL,XL,XC,E,F:GOTO3310
3250 IFX=1THENPRINT"■ENTER■ RS,RL,L,C,E,F
    ":PRINT:INPUT RS,RL,L,C,E,F:GOTO3820
3260 IFX=2THENPRINT"■ENTER■ RS,RL,XL,XC,E,F
    ":PRINT:INPUT RS,RL,XL,XC,E,F:GOTO38
20
3270 IFC=1THENC=INT(1E13*(1/(4*π↑2*L*F↑2)))/1E13
3280 FO=INT(10*(1/(2*π*SQR(L*C)))+.5)/10:IF F=1 THEN F=FO
3290 XL=INT(10*(2*π*F*L)+.5)/10
3300 XC=INT(10*(1/(2*π*F*C))+.5)/10:GOTO3330
3310 IFX=2THEN C=1/(2*π*F*XC):L=XL/(2*π*F)
3320 IFX=2THENFO=INT(10*(1/(2*π*SQR(L*C)))+.5)/10:IF F=1 THEN F=FO
3330 ZC=INT(1E6*SQR(RL↑2+XL↑2))/1E6
3340 IFZC>1THENZC=INT(100*ZC)/100
3350 CI=INT(1E6*(E/ZC))/1E6
3360 IFCI>1THENCI=INT(100*CI)/100
3370 IL=INT(1000*(XL/RL)+.5)/1000
    :A1=ATN(IL)*180/π:AI=INT(100*A1)/100
3380 IC=INT(1E6*(E/XC))/1E6:IFIC>1THENIC=INT(100*IC)/100
3390 H1=CI*ABS(COS(AI*180/π)):HI=INT(1000*H1+.5)/1000
3400 VI=INT(1000*(CI*ABS(SIN(AI*180/π)))+.5)
     /1000:REM IX SHOULD READ (VI-IC)
3410 IX=INT(100*ABS(VI-IC)+.5)/100
3420 IT=INT(1E6*SQR(HI↑2+IX↑2))/1E6:IFIT>1THENIT=INT(100*IT)/100
3430 Z=INT(100*(E/HI)+.5)/100:Z1=INT(100*(E/IT)+.5)/100
3440 PF=INT(1E4*(HI/IT))/1E4:IFPF>=1THEN3460
3450 AG=(180/π)*(-ATN(PF/SQR(-PF*PF+1))+π/2):AN=INT(100*(AG)+.5)/100
3460 ZO=INT(100*(L/(C*RL))+.5)/100
3470 QC=INT(100*(ZO/XL)+.5)/100
3480 QL=INT(100*(XL/RL)+.5)/100
3490 QO=INT(100*((1/RL)*SQR(L/C))+.5)/100
3500 REM:(COIL) RL=XL/Q:Q=XL/RL:ZT=Q*XL
3510 REM:(@ FIF) Q=ZT/XL:Q=XL/R
3520 BW=INT(100*(FO/QO)+.5)/100
3530 PT=INT(1E6*(E*IT*PF)+.5)/1E6:PC=INT(100*(IT↑2*Z)+.5)/100
3540 PRINT"□■SOLUTION■ FOR RL,L,C,E,F ■SCREEN 1■":PRINT
3550 PRINT" XL = 2πFL  ="XL;"■OHMS■":PRINT
3560 PRINT" XC =1/2πFC ="XC;"■OHMS":PRINT
3570 PRINT"( C ="C;"■FARADS■";"  FO ="FO;"■HZ■)":PRINT
3580 PRINT"Z(COIL)= SQR(RL↑2+XL↑2) ="ZC;"■OHMS":PRINT
3590 PRINT"I(COIL) LAGS V BY SOME ANGLE Θ.":PRINT
3600 PRINT"I(COIL) = E/Z(COIL)      ="CI;"■AMPS":PRINT
3610 PRINT"TAN Θ = XL/RL ="IL
3620 PRINT" ∴  Θ ="AI;"■DEG■ (H.MS H.P19C)":PRINT
3630 PRINT" IC = E/XC ="IC;"■AMPS":PRINT:GOSUB170
3640 PRINT"□■SOLUTION■      ■SCREEN TWO■":PRINT
3650 PRINT" IC(HOR)= I(COIL)*COS Θ ="HI;"■AMPS"
3660 PRINT" IC(VER)= I(COIL)*SIN Θ ="VI;"■AMPS"
3670 PRINT" IX = IC(H) - IC(V)      ="IX;"■AMPS":PRINT
3680 PRINT"  I = SQR(I(H)↑2+IX↑2)  ="IT;"■AMPS":PRINT
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3690 PRINT"  Z = E/IT              ="Z"■OHMS":PRINT
3700 PRINT"  COS Θ = I(H)/IT       ="PF:PRINT
3710 PRINT"■"■    Θ                ="AN;"■DEG":PRINT
3720 PRINT"■EXTRAS■":PRINT
3730 PRINT"Zo = L/C*RL             ="ZO;"■OHMS"
3740 PRINT"Q(COIL) = XL/RL         ="QL
3750 PRINT"Qo = (1/RL)*SQR(L/C)    ="QO
3760 PRINT"BW = FO/Qo              ="BW;"■HZ"
3770 PRINT" P = E*IT*PF            ="PT;"■WATTS"
3780 PRINT" P(CHECK) = IT↑2*Z      ="PC;"■WATTS":PRINT
3790 INPUT"MORE DATA? (1=Y 2=N)";X
3800 IF X=1THEN3020
3810 IF X=2THEN450
3820 IFX=2THEN C=1/(2*π*F*XC):L=XL/(2*π*F)
3830 IFC=1THENC=INT(1E13*(1/(4*π↑2*L*F↑2)))/1E13:ZZ=1
3840 ZO=INT(100*(L/(C*RL))+.5)/100
3850 XC=INT(10*(1/(2*π*F*C))+.5)/10
3860 XL=INT(10*(2*π*F*L)+.5)/10
3870 IFF=1THENFO=INT(10*(1/(2*π*SQR(L*C)))+.5)/10:IF F=1 THEN F=FO
3880 QO=INT(100*(XL/RL)+.5)/100
3890 ZC=INT(1E6*SQR(RL↑2+XL↑2))/1E6
3900 IFZC>1THENZC=INT(100*ZC)/100
3910 CI=INT(1E6*(E/ZC))/1E6
3920 IFCI>1THENCI=INT(100*CI)/100
3930 RT=INT(1000*(RS+ZO)+.5)/1000
3940 IA=INT(1E6*(E/RT)+.5)/1E6
3950 V=INT(100*(IA*ZO)+.5)/100
3960 PRINT"■■OLUTION■ FOR RS,(RL,L,) C,E,F ■S/P■":PRINT
3970 PRINT" XC = 2πFL              = "XL;"■OHMS":PRINT
3980 IFZZ=1THENPRINT"  C = 4*π↑2*L*F↑2 ="C;"■FARADS":PRINT
3990 PRINT" XL = 1/2πFC            = "XC;"■OHMS":PRINT
4000 PRINT" Zo = L/C*RL            = "ZO;"■OHMS":PRINT
4010 PRINT" Qo = XL/RL             = "QO:PRINT
4020 PRINT" RT = RS+Zo             = "RT;"■OHMS":PRINT
4030 PRINT"  I = E/RT              = "IA;"■AMPS":PRINT
4040 PRINT"  V = I*Zo              = "V;"■VOLTS":PRINT
4050 INPUT"MORE DATA? (1=Y 2=N)";X
4060 IFX=1THEN3020
4070 IFX=2THEN450
     READY.
```


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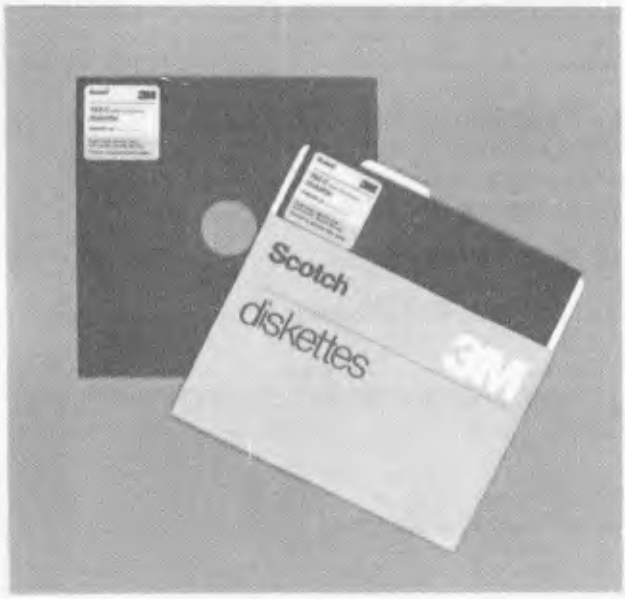

Superior performance & reliability– Scotch brand data recording products

'Scotch' data recording products all perform with a high degree of excellence. Technology assures that excellence. 3M uses the same technical expertise and quality control programmes throughout the entire line of 'Scotch' products. 'Scotch' products for information processing will help you get the best from your system. We give you our best to make sure.

Diskettes 'Scotch' diskettes are available in standard 8-inch and 5¼-inch sizes offering single or double sided. Each 'Scotch' diskette is formatted and verified by 3M for 100% certification of error-free performance. Even storage, mailing and handling is made easier with a variety of packaging configurations available from 3M.

Head Cleaning Diskettes
Do-it-yourself Data protection. Simply saturate the white cleaning fabric, insert into the drive and turn it on. It takes less than 30 seconds to eliminate particles of dirt, dust and oxide that accumulate with normal use.

Personal Computing Cassette The 'Scotch' personal computing cassette is designed for use with microcomputers. Only 'Scotch' personal computing cassettes provide this combination of performance and reliability.

Available from leading computer supply retailers.

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3M

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- archives III — The most revolutionary hard disk computer released in 1981. Provides over 5 Megabytes of inbuilt storage capacity. Incorporates all features of previous Archives models and boards speed exceeding 10 times that of floppy disk systems.
- archives II — Provides twice the storage as the Archives I.
- archives I — Today's most versatile low cost word processing, business computer.

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WORDSTAR — The industry's most highly reputed word processing package is configured to fully utilize the Archive's special function keys and is supplied with a training guide to ensure immediate familiarisation of this powerful system.

MAILMERGE — Integrated mailing data base package for Wordstar.
SPELLSTAR — A 20,000 word dictionary to check for spelling errors in Wordstar files.
DATASTAR — The most innovative information storage and retrieval system available.
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FINANCE COMPANY PACKAGE — Complete system caters for Finance Company record keeping and accounting.

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BSTAM — Communications Software will enable transfer of any CP/M Software to the Archives.
LANGUAGES — Basic 80, Basic 80 Compiler, CBASIC 2, Fortran, Cobol, Pascal Z.

IMS DEBTORS — Integrated accounts receivable will keep track of monies owing to your business.
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Display

Flat gas plasma display panel consisting of 6 rows of 40 or 80 characters each, numeric and upper and lower case alpha; 5 x 7 dot matrix. Micro-programmed cursor and scroll protocols. Character set under software control. Can be interfaced to full-screen CRTs, although most applications do not need a full screen as computer operators answer only one question at a time.

Audio (optional)

I/O in the form of two-tone audio, 100 bytes per second (1100 baud), is built in and available for data transfer to any standard cassette recorder.

Printer

40, 80, 96, 132-columns per line, 25 lines/min. (Numeric, upper and lower case alpha characters, and expanded print) Tractor &/or friction feed. Uses multi-copy plain paper, and 5 x 7 dot matrix impact principle. Character set, forms under software control. Form width: 9 inches.

Mass storage:

Built-in mini-floppy diskette drive

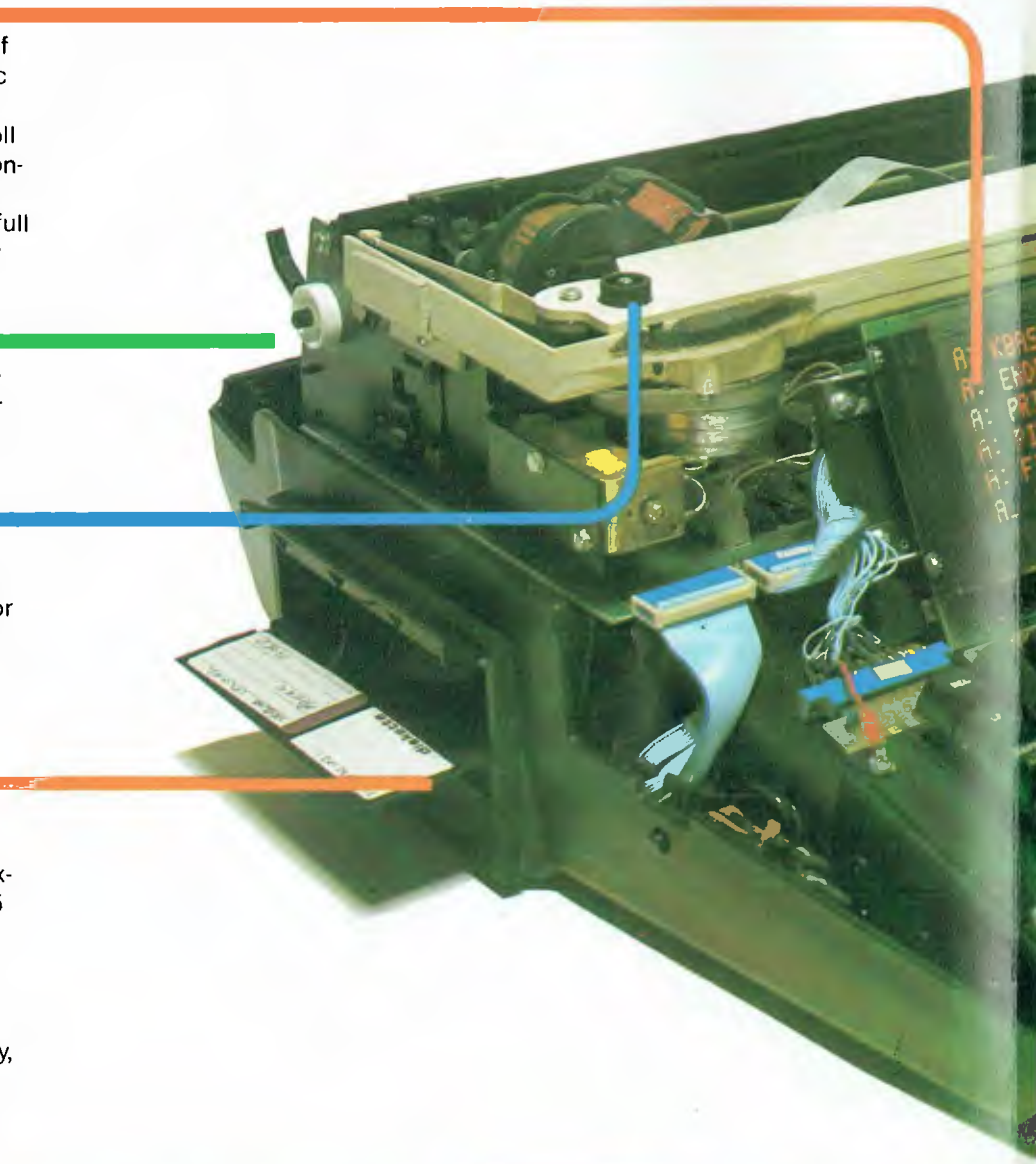
System 100TD includes one built-in mini-floppy diskette drive holding 200k bytes, expandable to 400k bytes. Access time: 40-75 milliseconds. Option available for built-in dual mini-floppy disk drive.

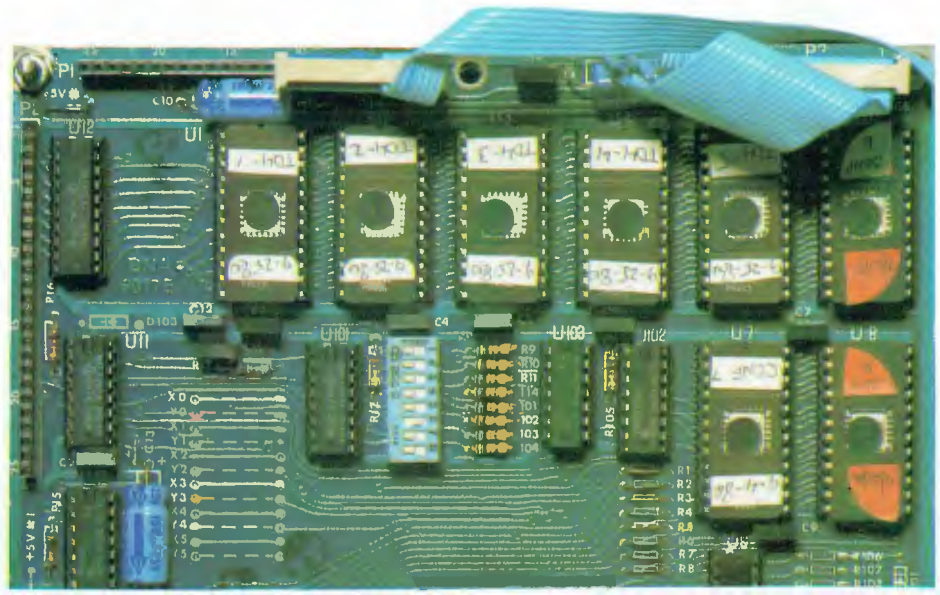
Bubble memory

System 128TD uses 128k of bubble memory, expandable to 2 megabytes on the same controller. (½ million only inside the case) Access time: 8 milliseconds. Memory is retained even during power interruptions. No rotating parts.

Hard Disk

Optionally 10, 39, 90 and 195 Megabyte drives available. Data transfer up to 2 Megabytes/sec.





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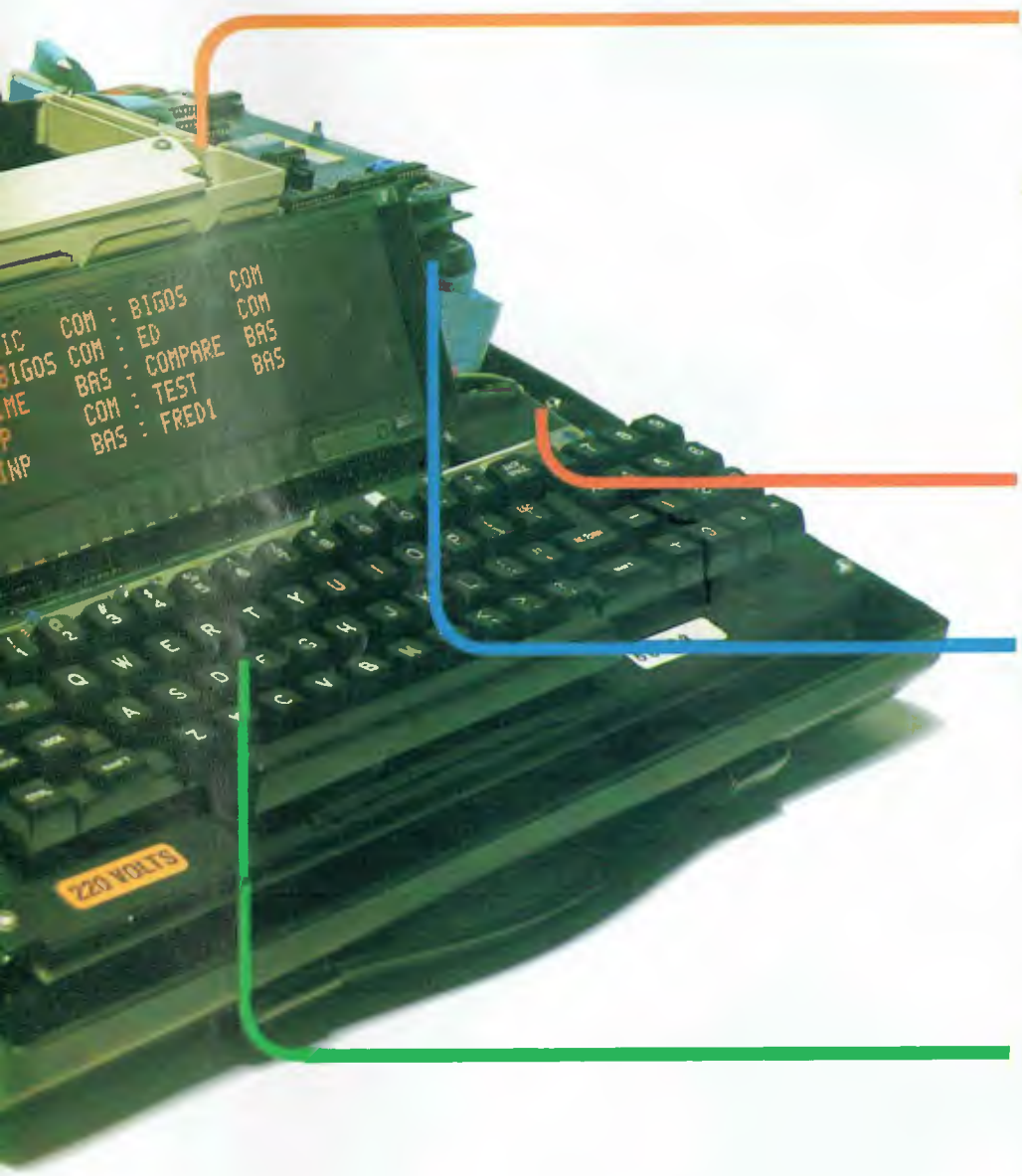
The World's First Portable Computer



Serial I/O
Four RS-232C ports, one of which is also a TTY. 4 DB-25s connectors provided on back panel. Full interrupt capability with priority optional.

Parallel I/O
64 TTL lines, each can be either input or output. Full interrupt capability, with priority optional.

S-100 Bus Adaptor
Allows interfacing to any S-100 bus devices

Acoustic Coupler
Optionally built-in, 300 or higher baud rate.

Battery (optional)
A continuously charged battery pack maintains the information in the RAM memory in the event of a temporary power failure and gives one hour plug-off work capability.

CPU
Zilog Z-80 with 2.5 MHz clock (4 MHz optional), 1.6 microsecond minimum add cycle time.

Real Time Clock
Software interrupt settable and readable.

Random Access Memory
48k bytes of dynamic RAM, expandable to over 2 megabytes. 1k bytes of static RAM.

Read Only Memory
8k bytes of ROM. Expandable to 32k bytes.

Keyboard
72 sculptured keys, alphanumeric, upper and lower case, up to 35 programmable function keys, ten-key numeric pad, electronic shift lock, all-caps lock, LED indicator, N-key rollover, autorepeat.

Physical specifications
Size: 17½ x 21½ x 8½ inches
(44.4 x 54.6 x 21 cm)
Weight: 31 pounds (14 kg)
Case: high impact, molded Kydex
Temperature resistant: 32°-122° F
(0°-50° C)
Humidity resistant: 20-85% relative

Baud Rate
Up to 19,200 entirely under software control.

Peripherals
Standard floppy and large hard disc drives, printers, other computers. Asynchronous, synchronous or bisynchronous communications.

Electrical specifications
Power: 110/220V (optional),
± 15%, 47-440 Hz, 200 W max.

Mechanical specifications
Functions are modularized into separate printed circuit boards connected by STACKBD™, a proprietary interconnection scheme which eliminates the need for a mother board. Board position and relative order in the chain is arbitrary, and expansion is limited only by the physical size of the unit and the electrical load capacity.

How to buy a personal computer.

In California, a store owner charts sales on his Apple Computer. On weekends though, he totes Apple home to help plan family finances with his wife. And for the kids to explore the new world of personal computers.

A hobbyist in Michigan starts a local Apple Computer Club, to challenge other members to computer games of skill and to trade programs.

Innovative folks everywhere have discovered that the era of the personal computer has already begun—with Apple.

Educators and students use Apple in the classroom. Businessmen trust Apple with the books. Parents are making Apple the newest family pastime. And kids of all ages are finding how much fun computers can be, and have no time for TV once they've discovered Apple.

Visit your local computer store

The excitement starts in your local computer store. It's a friendly place, owned by one of your neighbors. He'll show you exactly what you can use a personal computer for.

What to look for

Your local computer store has several different brands to show you. So the salesman can recommend the one that best meets your needs. Chances are, it will be an Apple Computer. Apple is the one you can program yourself. So there's no limit to the things you can do. Most important, Apple's the one with more expansion capability. That means a lot. Because the more you use your Apple, the more uses you'll discover. So your best bet is a personal computer that can grow with you as your skill and involvement grow. Apple's the one.

It's your move

Grab a piece of the future for yourself. Visit your local computer store. We'll give you the address of the Apple dealer nearest you when you call our toll-free number. Then drop by and sink your teeth into an Apple.

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