

It's here!

**...at \$995,
the complete
personal
computer**



Dimensions: 16½" wide by 18½" deep. 14" overall height. Weight: 44 lbs.

commodore PET 2001

MEMORY

Random Access Memory (user Memory): 8K included. Expandable to 32K bytes externally.

Read Only Memory (operating system resident in the computer): 13K bytes
8K BASIC interpreter
4K — Operating system
1K — Diagnostic routine

VIDEO DISPLAY UNIT

9" enclosed, black and white, high-resolution CRT
1000 character display, arranged 40 columns by 25 lines
8 x 8 dot matrix for characters and continuous graphics
Automatic scrolling from bottom of screen

Winking cursor with full motion control

Reverse field on all characters (White on black or black on white)

64 standard ASCII characters; 64 graphic characters

KEYBOARD

9½" wide x 3" deep; 73 keys
All 64 ASCII characters available without shift. Calculator style numeric key pad

All 64 graphic and reverse field characters accessible from keyboard (with shift)

Screen Control: Clear and erase
Editing: Character insertion and deletion

CASSETTE STORAGE

Fast Commodore designed redundant-recording scheme, assuring reliable data recovery
Cassette drive modified by

Commodore for much higher reliability of recording and record retention
High noise immunity, error detection, and correction
Uses standard audio cassette tapes

Tape files, named

OPERATING SYSTEM

Machine language accessibility
File management in operating system

Cursor control, reverse field, and graphics under simple BASIC control

Cassette file management from BASIC

Pseudo random number Generator

INPUT/OUTPUT

All other I/O supported through IEEE-488 instrument interface which allows for multiple intelligent peripherals

All I/O automatically managed by operating system software
Single character I/O with GET command

Easy screen line-edit capability
Flexible I/O structure allows for BASIC expansion with intelligent peripherals

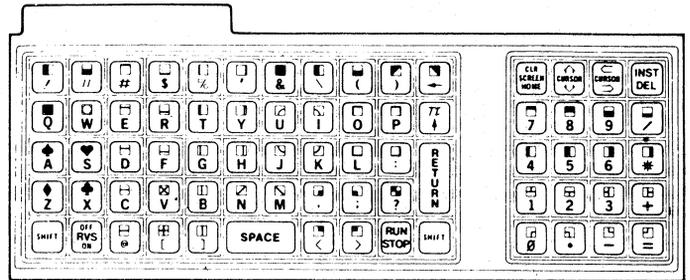
BASIC INTERPRETER

Expanded 8K BASIC; 20% faster than most other 8K BASICS

Upward expansion from current popular BASIC language
Strings, integers and multiple dimension arrays

10 significant digits; floating point numbers

Direct memory access through PEEK and POKE commands



the PET keyboard

The PET keyboard consists of 73 keys. There are the usual alphanumeric (A-Z and 0-9) found on typewriters and calculators and some computers. But the PET has something more: 64 graphic characters. The graphics can be used for plots, for fun and games or for artwork. There are also special screen and keyboard control keys which allow the moving of the cursor in four directions, the reversing of characters and background, the inserting and deleting of characters. Shift keys and a run/stop key are also provided to facilitate keyboard operations. By the use of a POKE command, lower case letters are obtained instead of the graphic symbols above the capital letter keys.

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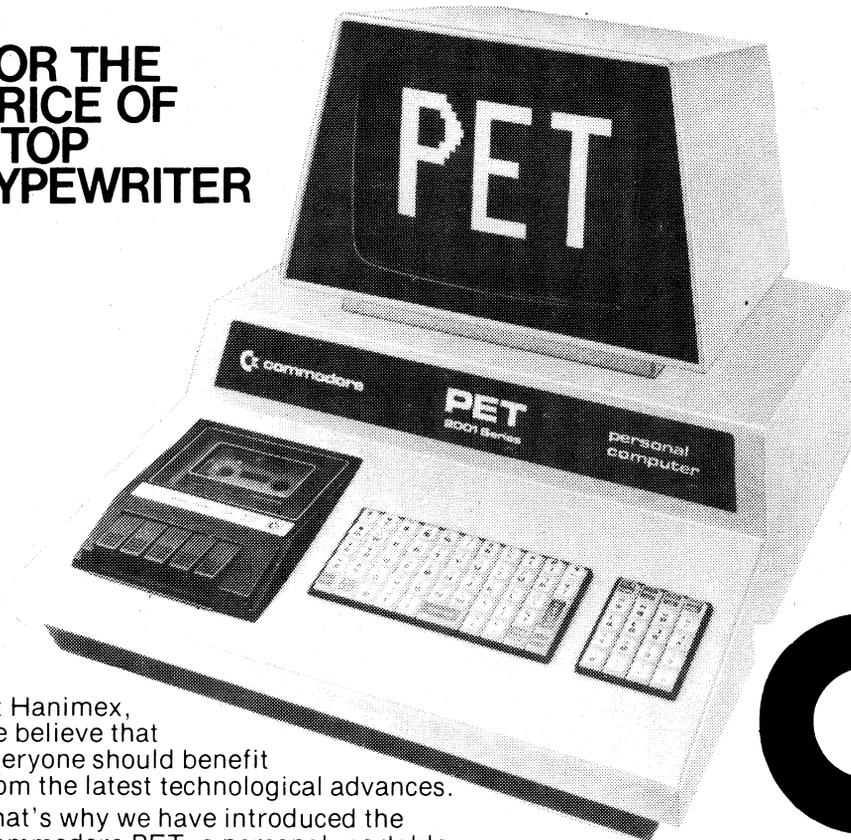
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PET PLUS...

PROFESSIONAL PERIPHERALS: 360K dual drive floppy disk storage system. Tractor feed printer.
TRADE ENQUIRIES WELCOME

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**FOR THE
PRICE OF
A TOP
TYPEWRITER**



At Hanimex, we believe that everyone should benefit from the latest technological advances. That's why we have introduced the Commodore PET, a personal, portable computer that's surprisingly inexpensive.

The PET has been specially designed for people who want all the advantages of computer processing without the cost and complexity of most mini-computer systems.

It consists of a TV screen, keyboard and built-in cassette deck. So you don't need an additional TV monitor, just plug it into mains power.

Because the PET is a personal computer, it uses BASIC language. The easiest to learn and the simplest to programme. And over 200 standard programmes in business, science, education and entertainment are already available.

Storekeepers need PET for inventory control. Engineers use it for complex calculations. Professional men can maintain their records. Graziers can control stock and feed statistics. Real estate agents can catalogue property profiles, and in the home, PET can help you relax with entertainment programmes including chess, backgammon and space games. It also incorporates teach-yourself programmes for subjects such as mathematics and languages. Whatever the job, you will have a need for PET at work and at home.

Dealer enquiries invited

For further information or a demonstration call the Business Equipment Division.



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Commodore CBM computer system

The Commodore CBM 3032 is a computer system designed particularly for use in small businesses. It is supplied complete with dual floppy drive system and an 80-column tractor feed printer. It is backed by a large number of software packages which make it applicable to most business and professional fields.

by PETER VERNON

The system we reviewed was the CBM Professional Business System, comprising the CBM 3032, the 2040 Dual Drive Floppy Disk and the 2022 Tractor Feed Printer. Commodore are marketing this system as an integrated package for business use, although their earlier machine, the PET, was aimed more at the "home computer" market.

Because of this the CBM 3032 has many features that make it attractive to the hobbyist as well as to the business user. The special graphics characters can be used for games and video art as well as for the generation of graphs and visual presentations of business data, and many games programs are available, in addition to a

comprehensive range of commercial applications software.

The most immediately striking thing about the Commodore CBM 3032 is the built-in 22cm video monitor, enclosed in a stylish fairing above the keyboard. Most small microcomputer systems require connection to an external video monitor, which is often a hidden component of the overall cost.

The keyboard itself is a conventional 73 key stepped keyboard, with a separate numeric keypad and 64 special graphics characters. Unshifted, the keyboard gives upper case characters: press the shift key and the special graphics characters are instantly available.

Lower case characters are available by using a Basic instruction to poke a data byte to a location in RAM. In this mode the shift key gives lower case. Because of this arrangement, the graphics characters and lower case letters are mutually exclusive. Both cannot be displayed at the same time, although, as we will see, both can be printed on the same line by an attached printer.

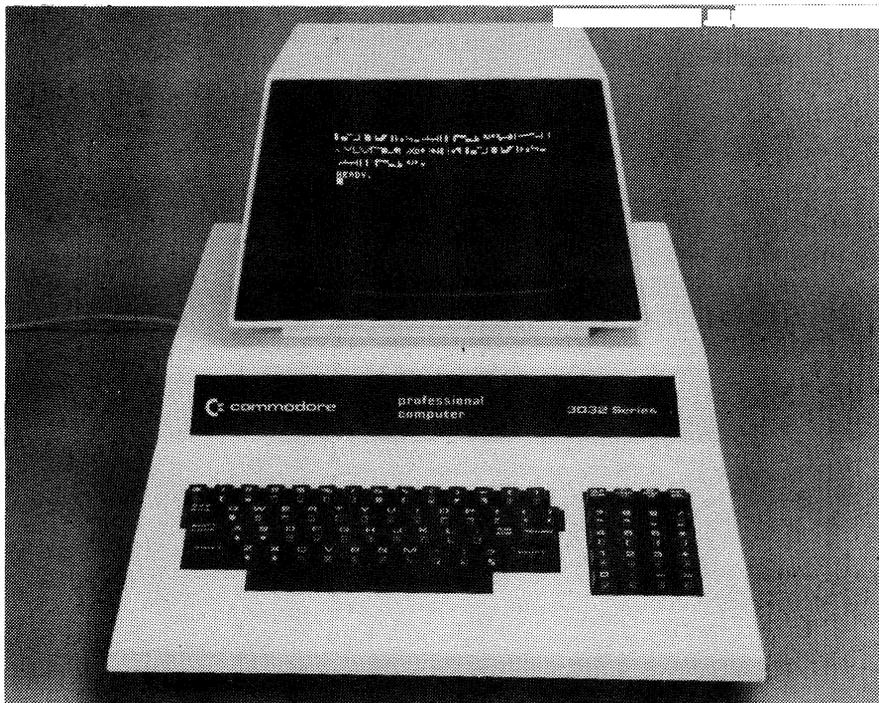
When the machine is turned on the value of the built-in monitor becomes apparent. The green phosphor display presents bright, clearly readable 8 x 8 dot matrix characters with excellent definition, in 25 lines of 40 columns. Using the CBM 3032 is very easy on the eyes.

For many business applications a 40 column line is not long enough, however. Realising this, Commodore have provided the CBM with the capability of defining more than 40 characters as a line. When the cursor reaches the end of the first line it automatically jumps to the next line, and the display continues without a space. The end of the line is marked by the closing quotes. In this way two lines of 40 characters on the screen can be printed as a single 80 character line.

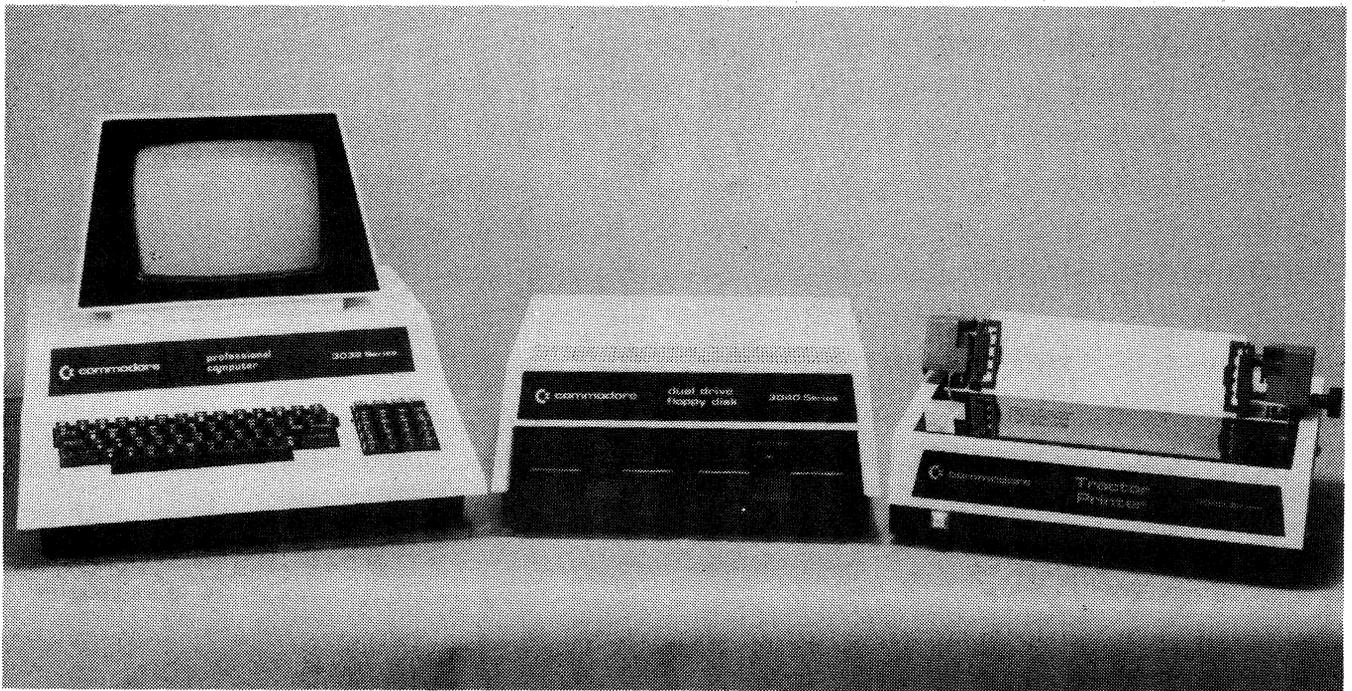
While this capability overcomes the limitations of small screen size, it is a little confusing to use. It is easy to forget, for example, that moving the cursor down one line does not automatically create a space. It is also easy to forget that the extended line feature only operates for two lines. Attempting to continue onto a third line results in a syntax error.

The keyboard of the CBM is not exactly comparable to a typewriter keyboard. For example, there are no numbers on the upper keys, these being confined to the numeric keypad. The upper keys contain the punctuation normally used in Basic programming, such as "" and (), which are available without using the shift key. This allows some time saving in entering programs, but is likely to confuse a user already accustomed to a conventional typewriter keyboard.

The keyboard has a couple of annoying features. There is no Reset key, so if the user is "locked out" by a misbehaving program, the only solution is to turn the machine off and then on again. This is annoying when developing programs in Basic, and even more disadvantageous when working with the Machine Language



This photograph shows the special graphics character set of the CBM 3032. The characters correspond to the legends on the front of the key tops.



The CBM 3032 Professional Computer with the 2040 Dual Drive Floppy Disc and the 2022 Tractor Feed Printer.

monitor developing machine language programs.

Looking at some of the physical specifications, the CBM 3032 is 415mm wide by 460mm deep, with an overall height of 350mm (including the video monitor), and weighs 20kg. Unlike many other small systems, the CBM 3032 is packaged in a sheet steel case, giving it a very solid "feel" and engendering confidence in the system.

The CBM series is based on the MOS Technology 6502 microprocessor and has a Basic interpreter and operating system in 12K of ROM. In addition there is the 1K machine language monitor, TIM (for Terminal Interface Monitor). An 8MHz crystal oscillator is divided down to drive the processor at 1MHz.

The 3032 system, as the designation suggests, has 32K of available RAM. There is also a 3016 system which has 16K of RAM. Prospective purchasers should be aware that these amounts of RAM are fixed. If you buy a 16K system there is no provision for later on-board expansion. A memory expansion interface connector is available on the back panel but the memory boards which use a proprietary RAM chip, are not yet in production.

One of the best features of the CBM 3032 is the screen editing facility. A group of cursor control keys allows the user to move the cursor about on the screen and to insert and delete characters at will. While this is not unique, the Commodore has further refinements. When the cursor movement control character is included within quotation marks as part of a Print statement in a program, the cursor movement becomes part of the program, so that the cursor can be positioned on the screen in order to print in a specific position under program control.

By using various combinations of cursor

movement control characters it is easy to program animated displays or to exactly specify a printing format. Each cursor movement character moves the cursor one space, however, the lack of a repeat key is a disadvantage here. There is no way to speed up the process by using Repeat to give multiple key operations. For example, to print a character in the 35th column, 34 Cursor right characters must be included in the Print statement, or a program loop used.

Another feature is the reverse video display, controlled by a single key. By using the Reverse key any of the standard character set or the special graphics may be displayed in reverse (ie black on white). Like the cursor controls, Reverse may be contained within quotes in a Print statement, so that the reverse video display can be turned on and off under program control. The Reverse command really doubles the size of the CBM character set, allowing, for example, 64 graphics characters in reverse video, as well as the same 64 characters printed white on black.

The ROM-resident Basic of the CBM is the standard Microsoft language with a few special additions. The CBM contains an on-board clock, which is reset when the machine is switched on, and is interrupt-driven by the processor. By entering PRINT TIME\$ the current value of this clock can be displayed. This value can be set to current time, which will be accurately maintained for as long as the machine is on.

One trivial use for this feature is the World Clock program distributed by Commodore, which when run displays a map of the world showing the current time of day in a number of major cities. Other uses include games, logging computer time, and real-time control applications.

The Basic of the CBM 3032 includes all

the usual scientific functions, and also has a nine digit value for pi built in. Calculations can be made in floating point form or scientific notation, with exponent values between ± 38 and up to 10 significant digits in the mantissa.

CBM Basic also includes a useful statement, GETA\$, which will input a single character from the keyboard. It can be used like this:

```

-
70 PRINT "HIT ANY KEY TO CONTINUE"
80 GET A$: IF A$="" THEN GOTO 80
Line 80 will fetch a single character from the keyboard. If no key is pressed, (A$="") then the program will remain in a loop until a key is pressed. The GET statement is not limited to keyboard input. GET will also fetch a single character from a peripheral device.

```

The CBM Machine Language Monitor is more extensive than most. The usual Enter and Display routines are available but in addition, TIM includes subroutines for reading and writing characters on the video display, entering hexadecimal data, and software interrupt and breakpoint functions. Further, on entering the monitor via the Basic command SYS 1024, the monitor will display the contents of the registers of the 6502, the program counter, status register X and Y index registers and stack pointer. Programs written in machine language can be entered from Basic programs using the standard USR(O) command as well as SYS. Thus the monitor of the CBM seems well adapted for developing machine language programs for the 6502. It is a pity about that absent Reset switch though.

The CBM 3032, in common with all Commodore products, uses the IEEE-488 interface standard for input and output. The use of such an interface on a hobbyist machine

Commodore CBM business computer system

is questionable, for while it is the standard interface for scientific instrumentation, very few peripherals available to the hobbyist use the IEEE-488 standard. In particular, S-100 boards cannot be used with the CBM, and Commodore has no plans to introduce an IEEE-488 to S-100 interface.

For a business user this is less significant. Commodore produce their own floppy disk system and printers designed to connect to the IEEE-488 interface, and also have available an IEEE-488 to RS232C adapter. As well as the 2022/23 series of dot-matrix printers, Commodore market a Diablo daisy-wheel printer with a built in conversion to the IEEE-488 interface, for applications where the superior print quality is important.

In addition over 200 peripherals which use the IEEE-488 interface, including x-y plotters and data logging instruments, are available from other manufacturers. The price of these instruments may well place them out of reach of the hobbyist, however.

The CBM integrated system is quite impressive with the dual disk drives and printer. Commodore advertises these as "intelligent peripherals" and they are that. The dual floppy disk unit, for example, contains two microprocessors, an operating system in ROM, and RAM buffer memory. One microprocessor is a dedicated controller for the disk drives, and the second interfaces the disks to the CBM.

This gives the disk system great versatility and provides significant time savings, as the disk unit uses none of the main processor time or RAM memory. It is possible, for example, to copy one disk to another while the main processor runs a different program. A DOS Support program included on the demonstration disk that comes with the system takes all the work out of managing the disks. This program, once loaded from the disk using standard DOS (disk operating system) commands, allows the user to load programs with a single key-stroke.

Two standard 133mm disks provide a total of 340K of storage, without the use of double density techniques. In practical terms, this means that the utility disk provided with the CBM contains 20 programs, with 474 blocks of 256 bytes each left free. Few floppy disk systems can match this capacity. As well as the DOS Support program, this disk included a very well conceived disk maintenance program which allowed us to verify the validity of the programs on the disk, check their history and various other operating parameters.

My one reservation about the disk drives concerns the question of reliability. Whether it is the Commodore modifications to the Shugart 390 disk drives, the sample disks we received from the distributors, or my own unfamiliarity with

the system, I seemed to spend as much time studying the comprehensive list of error messages provided in the operating manual as I did actually reading and writing programs.

The other component of Commodore's professional system is the 2022 Tractor feed printer, a dot matrix (6x7) impact printer capable of reproducing both upper and lower case ASCII characters and the special graphics characters of the CBM 3032. Unless otherwise programmed it prints lines of 80 characters on standard 24cm fan-fold paper. Up to three copies of the original may be made simultaneously.

The printer is "intelligent," containing a microprocessor which allows programmable control of printing format, line width, decimal point position, line justification, and leading and trailing zeros. Control characters inserted in the program driving the printer allow enhanced (double-width) and reverse field characters to be printed.

The CBM 3032/Printer combination has some unusual features. The 40 column format of the CBM monitor does not directly translate to the 80 column format of the printer. As already mentioned, on the video screen there is an automatic carry over of lines which exceed 40 characters, so that 80 characters can be printed on two lines. When this double line output is fed to the printer it will be printed as one line of 80 characters.

The method of printing lower case is not immediately obvious. It requires that each line to be printed is preceded by a cursor down control character, which, when enclosed in quotes instructs the printer to shift to the lower case character set. Shifting back to upper case is done by using a cursor up character in the same way. It should be noted that the data which is entered will appear on the video monitor in upper case, but will be printed in lower case. It takes some time to become accustomed to the procedure.

Another characteristic that takes time to

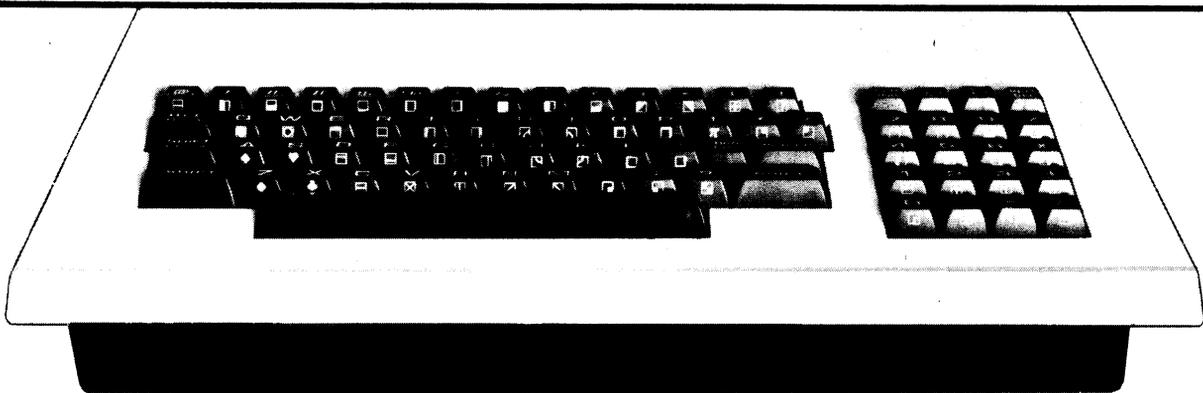
become accustomed to is the nasty grinding sound of the printer in operation. It sounds like it needs a drop of oil, but I was assured that the sound was normal. Many business users cover the printer with a transparent plastic top, partially muffling the sound.

The CBM 3032 is designed for easy expansion. In addition to the IEEE-488 interface connector, there is an eight-bit bidirectional I/O port, a cassette interface, and a memory expansion connector which provides access to the buffered input and output lines of the 6502 processor. In addition a video output and vertical and horizontal synchronisation signals are available to drive an external monitor, or for diagnostic purposes.

The cassette port, I/O port and IEEE-488 connector are well supported by a number of extended Basic statements allowing the user to read and write data to peripheral devices connected to the ports. A Verify command allows the user to check a newly made cassette tape against the program remaining in memory and reports any error in the recording process.

Overall the CBM 3032 professional system is well suited to business applications, once the user adapts to its special features. The dual disk drive provides fast, economical mass storage, and the user can write his own Basic programs or call on a library of programs from Commodore or other suppliers. Some of the programs available include General Ledger, Creditors Ledger, Stock Control, and the Commodore Business Information system program. A complete word processing program is also available.

The total price for the CBM 3032, the dual disk drive, and the 2022 printer is \$6377. This compares quite favourably with the cost of similar small systems including disks and printer. The CBM 3032 computer alone costs \$2249. Further information can be obtained from the distributors, Hanimex Pty Ltd, Old Pittwater Road, Brookvale, NSW, 2100. ☉



Get your hands on our big new PET 3008 keyboard for only \$999*

At last it's here: the Commodore PET you've been demanding! It's called the PET 3008. It boasts all the many features of our PET 2001, plus something you've been itching to get your hands on. A new, big, typewriter-style keyboard!

To celebrate its arrival, Commodore offers you a great deal. To begin, the price is slashed to \$999*. So straight away you save \$196 on the Normal price of \$1195.

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FREE, C2N CASSETTE UNIT WITH EVERY PET 3008 SOLD

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| COMMODORE PET 2001, normally..... | \$1195 |
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Add 'joystick' controls here for even more games fun.



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look what it can do!

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- ★ Memory expandable up to 32K with plug-in modules.
- ★ Typewriter-style keyboard, with programmable function keys: you're really in control!
- ★ An inbuilt tone generator for music and sound effects!
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PET 4016

FEATURES

The PET 4016 offers an IEEE parallel port and an IEEE-488 bus for disk and printer communications. Also included is an eight bit parallel user port with "handshake" lines. The PET supports two Commodore C2N cassette ports for external cassette input and output. Each PET 4016 includes 18K of ROM containing BASIC and a machine-language monitor. The BASIC interpreter is activated when you turn on your PET 4016 - no loading is necessary.

12" SCREEN

40 characters wide by 25 lines long.
128 ASCII plus 128 graphic characters
8x8 dot matrix characters
Green phosphor screen.
Brightness control.

KEYBOARDS

74-key professional keyboard.
Separate calculator/numeric pad.
Upper-case alphabetic characters.
Shift key gives 64 graphic characters.

MEMORY

PET 4016: 16K (15359 net) random access memory (RAM).

POWER REQUIREMENTS

Volts: 240v
Cycles: 50HZ
Watts: 100

SCREEN EDITING CAPABILITIES

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

INPUT/OUTPUT

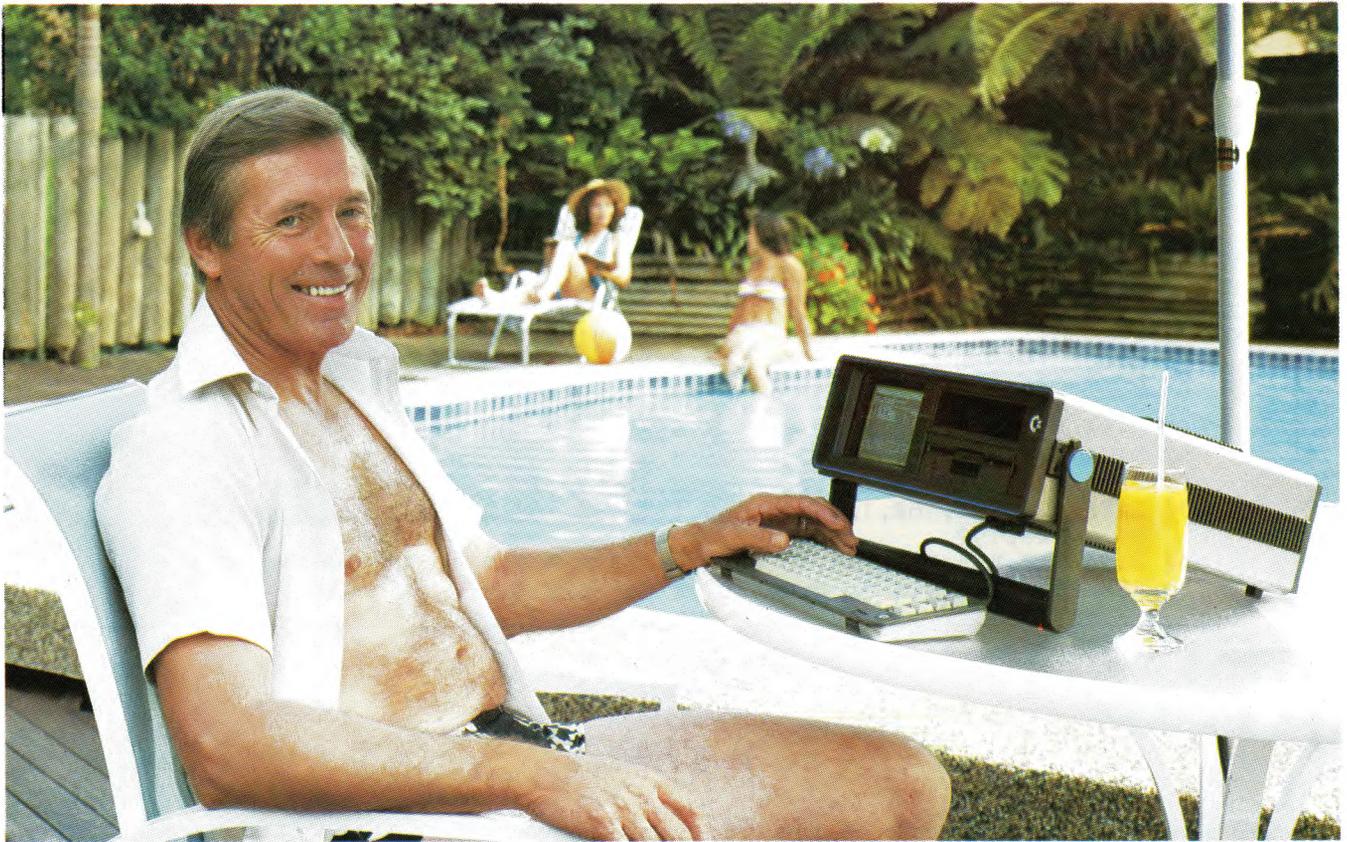
Parallel port
IEEE-488 bus
2 cassette ports
Memory and I/O expansion connectors

FIRMWARE

18K of ROM contains:
BASIC (version 4.0) with 9-digit floating binary arithmetic
Tape and disk file handling
Machine language monitor

PHYSICAL SIZE

Height: 14"
Width: 16.5"
Depth: 18.5"
Shipping Weight: 46lbs



Who's keeping up with Commodore?

The Commodore EXECUTIVE 64.
A personal, portable computer with outstanding graphics, colour, music and astonishing computing capability, all in an easy-to-carry case.

The Commodore EXECUTIVE



64 is designed for the movers of this world. Designed to give you the power. Power at your fingertips. The power of 64K memory. The power to keep up. In the office. At home. Or in your home away from home.

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A computer like this would have been science fiction a few years ago. Now it's a reality. It's the Commodore VIC-20, a full-fledged, expandable colour computer that costs little more than video games.

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- 66 graphic characters
- 25K total memory
- 4 sound generators
- 16 colours



The computer for everyone.

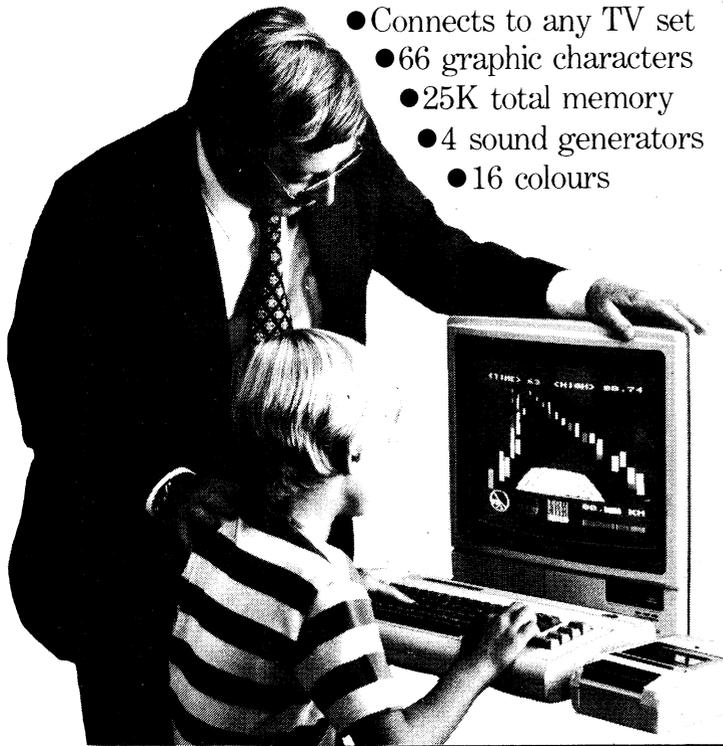
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Why get just another game that could end up in the closet? Get an honest-to-goodness computer for just \$399. Get the Commodore VIC-20.

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LISMORE: Parry's Office Supplies, 25 Molesworth St. (066) 21 7331

CAMDEN: Seahorse Computer Services, 33 Mitchell St. (046) 66 6406

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KINGSFORD: Micro Visions, 472 Anzac Pde. (02) 662 4063

BALGOWLAH: Trevor Burton Pty. Ltd., 93 Beatrice St. (02) 290 1233

SYDNEY: City Personal Computers, 75 Castlereagh St. (02) 233 8992

LIVERPOOL: Computer Focus, Shop 4, 224 George St. (02) 600 8222

KILLARA: Nauta and Associates, 28 Blaxland Rd. (02) 498 2858

PARRAMATTA: Trinity Computing, Shop 5, 1-9 Palmer St. (02) 683 4349

ACT

FYSHWICK: Steve's Comm. Centre, 57 Wollongong St. (062) 80 4339

PHILLIP ACT: Computerland, 22-24 Colbee Court (062) 82 2342

YARRALUMLA: Yarralumla Software, 41 Bailey Place (062) 82 1379

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N. ROCKHAMPTON: Rockhampton Sound Centre, 69 High St. (079) 28 6628

MAROOCHYDORE: Computer Business Aids, 33 Sixth Ave (071) 43 5551

STONES CNR: CW Electronics, 416 Logan Rd. (07) 397 0888

WEST END: Johns Perry Pty. Ltd., 268 Montague Rd. (07) 44 7504

TOOWOOMBA: Downs Office Equipment, 203 James St. (076) 32 4733

CAIRNS: Onro Industries, 136 Sheridan St. (070) 51 6111

SOUTHPORT: TRS Office Equipment, 115 Ferry Rd. (075) 32 3200

VICTORIA

MELBOURNE: B. S. Microcomp P/L, 4th Floor, 561 Bourke St. (03) 614 1433

ABBOTSFORD: Maxwells Office Equipment, 162 Nicholson St. (03) 419 6811

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LUCKNOW: Gippsland Computers, 167 Princes Highway (051) 52 5939

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