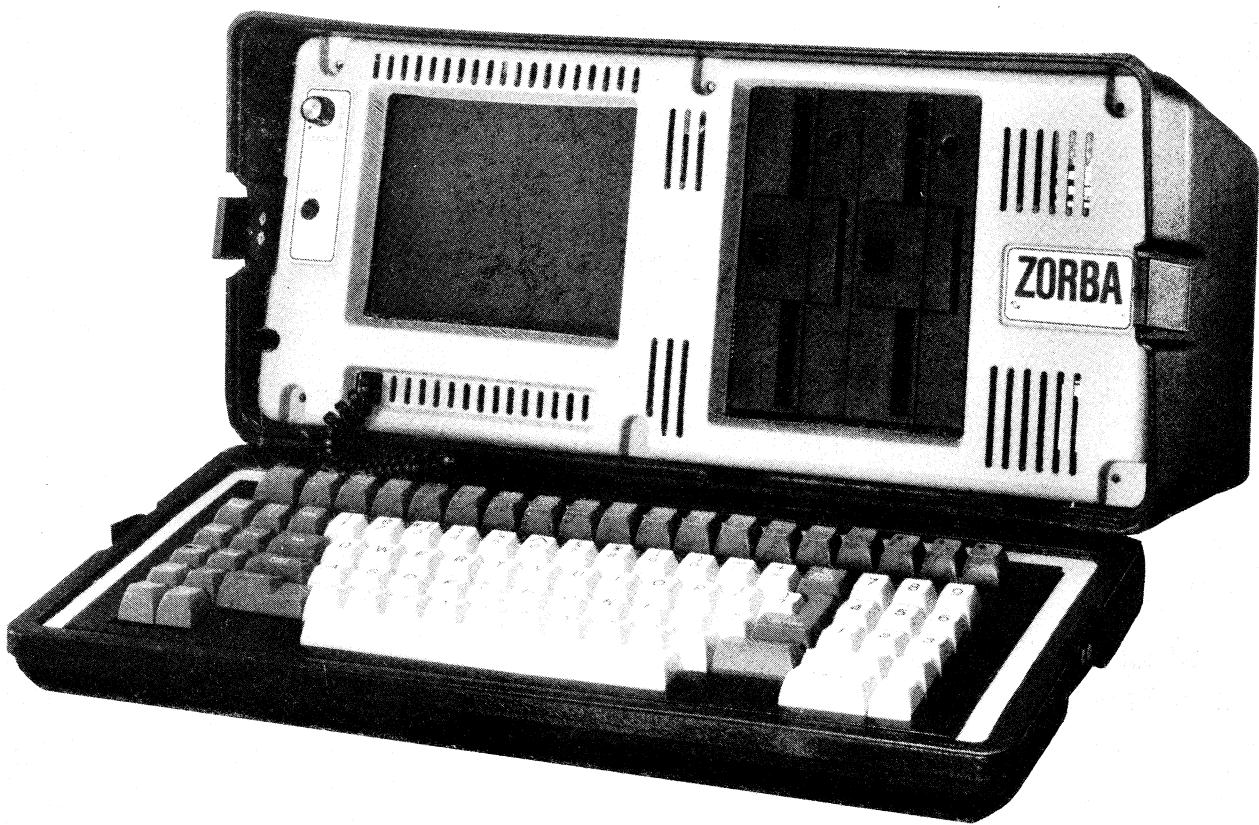


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The Cromemco C-10SP computer system

"Value for money" is the phrase which perhaps best sums up the Cromemco C-10 computer. The compact, up-to-date design of the system, the range of software provided and Cromemco's reputation for reliable, expandable products make the C-10 an excellent choice as a first computer for a small business or self-employed professional.

by PETER VERNON

Physically the C-10 is eye-catching, with a robust beige cabinet and brown trim, and closer inspection reveals some interesting features. In keeping with current thinking on user comfort the keyboard is separate from the computer, attached by an extensible cord similar to that used on telephones. However rather than providing a separate "logic unit" and a video monitor, Cromemco have chosen to mount the electronics of the system inside the cabinet of the display unit on a slide-out circuit board. Printers, disk drives and other peripherals are attached to ports at the rear of the monitor cabinet.

Our review unit was supplied with a stand for the video display unit which

allows the screen display to be tilted and swivelled to suit the operator while raising it to convenient eye height. This stand is optional and may not be required by all users. In fact separately adjustable rubber feet on the monitor unit allow the viewing angle to be adjusted over a more limited range without the additional expense of the stand.

The keyboard is diminutive, although with 60 full-size keys. It weighs less than 2kg and measures 330 x 180 x 55mm (width by depth by height at rear) sloping to a height of around 20mm at the front. There are no excess keys, just the standard typewriter complement with Control, Escape, Alpha Lock and a cluster of cursor controls, with the number

keys along the top row used in conjunction with the Shift and Control keys to provide 30 user-definable function keys. A double row of labels above these keys indicate the functions they perform when running "WriteMaster", Cromemco's word processing program.

A separate software utility is provided to allow a segment of the keyboard to be redefined as a numeric keypad to assist the entry of numeric data.

Other features of the keyboard are a wrist rest, automatic key repeat and optional audible feedback. An operating system utility allows the repetition rate of the keyboard to be varied and enables the audible response. There is no provision for varying the duration or tone of this response, and we found it to be both piercing and too long. The keys have a slightly heavy action, with no sign of contact bounce, and the keyboard is light and compact enough to be positioned to suit the user.

The video display

Our review system was provided with the "CST" tilt and swivel stand, which is an optional extra. Without the stand the video monitor/computer unit measures 300 x 405 x 280mm (W x D x H), while the stand raises the height to 420mm as well as allowing the display to be tilted and swivelled (with a locking knob).

The 30cm (diagonal) green phosphor video screen is capable of displaying 25 lines each of 80 characters, with the 25th line most often used in the half-intensity mode for displaying instructions to the user. Characters are steady and easily readable, on a true non-glare background, with special features including half-intensity, reverse video and on-screen boldfacing and underlining.

Four character sets are available, including standard ASCII and the same set in boldface, scientific symbols and graphics characters. Careful use of the graphics character set allows displays with a resolution of 160 x 72 (horizontal x vertical) but the Basic interpreter provided with the C-10SP has no specialised graphics statements.



The compact detachable keyboard of the C10 is clearly laid out and easy to use. The labels at the top refer to functions provided by the number keys in Shift and Control combinations.



The Cromemco C10SP is a complete, ready-to-run computer system, which comes with software and extensive user manuals. Shown here is the optional CST display stand and (on screen) the four available character sets.

Cromemco supplies disk drives in its own packaging to match the main processing unit. The standard drives are 13cm 80-track double-sided units, using a double-density recording format to provide 390Kbytes of storage per disk. The drives connect to a single port at the rear of the cabinet and the connector provided is designed for piggy-back connection of multiple disk drive units on the one port.

Power for the disk drives is provided from the computer unit, so there is only one power cord and one on/off switch for the system — a convenient feature. In two respects however the design of the C-10 falls short of optimum; the power switch is in an awkward position at the rear of the monitor cabinet, where it is obstructed by the piggy-backed connections of the disk drives, and there are no brightness or contrast controls for the video display.

A utility program on the system disk allows these display parameters to be adjusted from the keyboard, but using the program (called "Bright") requires saving the work in progress, calling in a new program and adjusting the brightness of characters and background using the cursor control keys and then

restoring whatever file you were working with.

This arrangement is far more inconvenient than twiddling a couple of knobs.

Diagnostics and a power-on self-test are incorporated in ROM on the C-10 circuit board, and are carried out each time the system is switched on, creating a noticeable delay (around 30 seconds) before the system is ready for use, but

ensuring that any problems are identified immediately.

System configurations

Like most Cromemco products the C-10 is based on the Z80A microprocessor, running at a clock rate of 4MHz. 64K bytes of RAM is provided as standard, with 24K of ROM containing a resident operating system and machine

Cromemco C-10SP specifications

Processor:	Z80A at 4MHz
RAM:	64K
ROM:	24K
Keyboard:	Detachable, full-size 60-keys
Display:	Green phosphor, 80 x 25 lines
Interfaces:	Programmable printer port, RS232C communications port, Disk drive connection.
Disk drives:	13cm 80 track, double-sided, double-density, 390K storage per disk
Peripherals:	Parallel or serial printer, modem
Documentation:	Five comprehensive manuals, on-screen Help displays. Service and technical manuals are available separately.

The Cromemco C-10SP computer

language monitor. There is no provision to extend the amount of memory in the system.

At the rear of the monitor cabinet are the connections for the disk drives (already mentioned), a keyboard connector and ports labelled "accessory" and "computer". The accessory port can be configured in software either as a parallel or serial printer interface, and a utility program allows the selection of one of nine types of printer. The Cromemco CLQ daisywheel printer is the default, but dot matrix types including the Epson MX80 are also supported.

The "computer" port is an RS232C serial interface which is used to connect the C-10 as a terminal, either via a modem or a hard-wired connection to another system. When the C-10 is switched on without a disk drive attached it will automatically enter a communications mode, sending a series of carriage return characters to establish the baud rate and format of the serial transmission protocol in use by the host system.

A major feature of the C-10 is its menu-oriented operating system. When first switched on with a system disk in the attached drive the computer comes up with a menu of nine functions, including word processing, spreadsheet calculation, or the "MoneyMaster" financial analysis program. From this main menu the user can select an "Advanced Functions" menu or a "Help" file which explains each of the options available.

The advanced functions menu offers options for copying files and entire disks, checking disk space allocation and printing files and a further display of Help screens. One of the options available is to leave the menu system and work directly with CDOS, the Cromemco Disk Operating System.

These two menus present some 20 options and function as the controlling "shell" of the operating system. CDOS commands and utilities which do not appear in the menus can be called up by typing the appropriate command name rather than a menu selection. Commands entered in this way return control to the menu when completed.

CDOS is said to be compatible with CP/M 2.2 in that the 27 system calls supported by this version of CP/M are also implemented in CDOS in the same way, so that most programs working under CP/M will also run under CDOS. Cromemco has added several refinements of its own however, including the menu system, and has renamed some of the other CP/M utilities. PIP, for example is gone, replaced by the XFER (Transfer) utility which

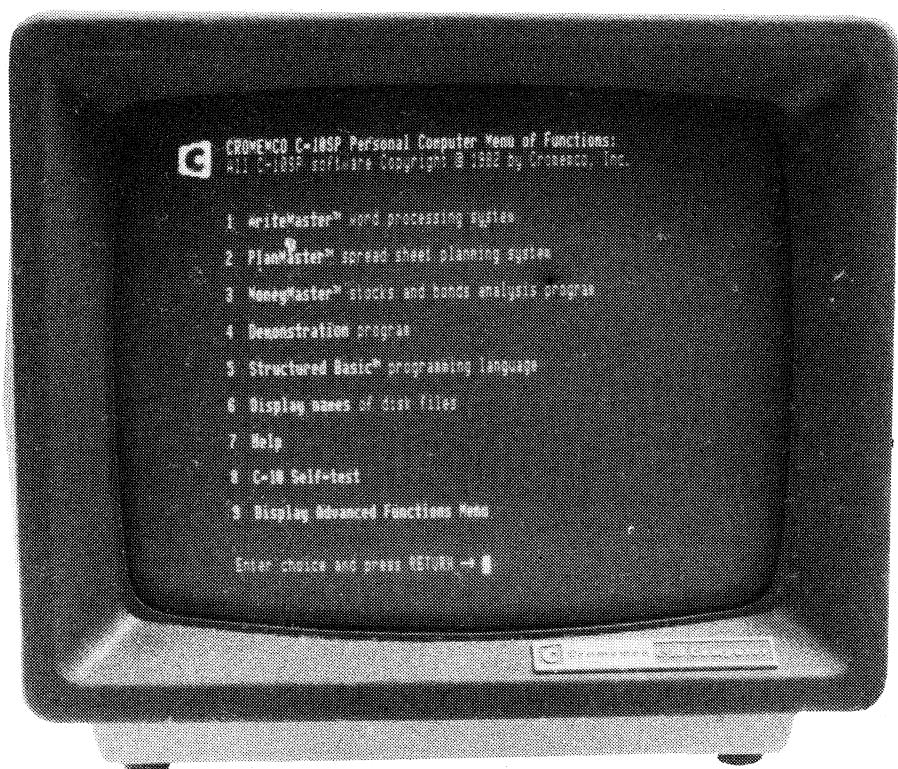
allows files to be transferred between disks or between disk and printer or display console. An extensive manual is provided, with full details, including source listings of I/O drivers.

CDOS is entirely written in Z80 machine code by Cromemco for its own range of computer systems. While many programs written under CP/M will function under CDOS, the reverse is not true. The enhancements added by Cromemco will be primarily evident to the programmer wishing to work directly with the operating system and mainly provide new system calls to allow more flexible allocation of input and output to peripherals and disks. The built-in ter-

Structured Basic

Cromemco's SBasic should not be confused with the compiler of the same name running under CP/M, or Sanyo's version of Microsoft Basic, also called SBasic. The Cromemco version is an advanced interpreted Basic with features intended to overcome the deficiencies of more conventional implementations of the language.

Many criticisms have been made of the unsuitability of Basic for complex programs. The fact that all variables are "global" (can be referenced and reassigned from any part of a program) and the lack of control structures are



Shown here is the menu activated when the C10 is switched on. Main options are word processing, spreadsheet calculations, financial analysis, "Help" and "Advanced Functions".

minal driver and support for a hard disk are two examples of this approach.

Underlying CDOS is CROS, the Cromemco Resident Operating System. "Resident" in this case means that the operating system is contained in ROM. It is a machine language monitor which allows examination and alteration of memory, memory move and compare and execution of machine language programs. Low level disk operations and use of the C-10 as a terminal are also supported and the system self-test routines can be accessed. Two puzzling omissions however are the ability of CROS to set breakpoints or dump the registers of the Z80, both essential for debugging machine language programs.

two of the main criticisms. The lack of procedures which can be called from a library as required also prevents the use of modular programming techniques, essential to the creation of straightforward, understandable code.

SBasic overcomes these problems. Features include variable names up to 31 characters long, substitution of statement labels for line numbers (eg, Gosub Timeroutine is a valid instruction) and Repeat, While, If-then-else and Procedure statements in addition to Gosub and Goto.

The Procedure statement can be used to create a library of independent sub-programs which can be called from a file on disk. Each procedure can have its

The Cromemco C-10SP computer

own local variables which will not be affected by assignment statements outside the procedure, and will not affect variables of the same name in the main program or another procedure unless explicitly passed back or forward. Memory can be divided into eight partitions, each of which can contain independent procedures with variables local to that partition — a positive encouragement to modular programming styles.

SBasic also provides a line oriented editor to facilitate changes to programs and a cross-reference generator which will print out the names and values of all variables used in a program. Program listings are also automatically indented by the interpreter to indicate loops and other control structures in a clear and readable way.

Strings are handled as one-dimensional arrays, referenced by variable names of up to 31 characters. Before a string can be used it must be dimensioned, in the same way as any other array. The default length (without dimensioning) is 10 characters.

The use of arrays to store strings allows consistent, unambiguous references to any part of the string, and substitution of new characters for all or part of an existing string. Absent are statements such as LEFT\$, MID\$ and RIGHT\$, replaced by a single array-oriented string specifier. An example of this approach would be:

Answer\$=Response\$(1,-5) (the first five characters of a string variable called Response\$ becomes the variable Answer\$) or;

Any\$=Response\$(1,10) (Any\$ is assigned the characters from positions 1 to 10 of Response\$).

New substrings can also be inserted into existing strings, as in:

New\$string\$(4,8)="abcde" (the string literal "abcde" is inserted into positions 4 to 8 of New\$string\$).

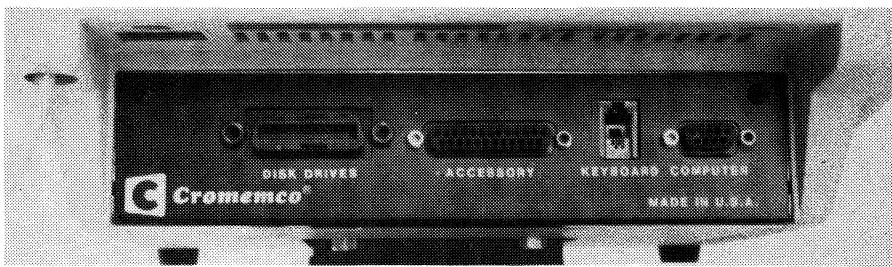
Although it takes a little time to become accustomed to this approach if you are used to Microsoft-style Basic ultimately the array storage of strings is more flexible, with the added advantage that all references to strings take a consistent form.

Other features of SBasic include an extensive range of output formatting instructions, easy access to both sequential and random access disk files (random disk I/O is greatly simplified by the fact that disk files can use exactly the same string format as Basic programs). The language also lends itself well to "number-crunching", with three numeric types; integer, short floating point and long floating point. Data values are automatically converted to the most appropriate format, with 14 digit precision

for long floating point variables, allowing arithmetic in the range 9.99E+62 to 9.99E-65.

Matrix manipulation is also supported directly with the MAT statement and the interpreter will work either with radians or directly in degrees, selected by a MODE statement. To top it all off, the "semi-compiled" design and the 4MHz clock rate of the processor make the language very fast.

SBasic appears to answer many of the criticisms levelled against more conventional interpreters. It combines the clarity made possible by structured program design with the ease of use of a Basic interpreter, and is supported by one of the best manuals we have seen, a comprehensive 312-page spiral-bound book



The rear of the C10 cabinet has connections for disk drives, printer, communication options, and of course, the keyboard.

including examples of every statement and function of the language.

The Cromemco C-10 can be supplied in a "Superpack" configuration, the C-10SP, which includes software. On the system disk with the review unit were "WriteMaster", Cromemco's word processing package, "PlanMaster", a spreadsheet calculator, and "MoneyMaster", a program for analysing the economics of sharemarket transactions, real estate and capital equipment purchases. Also supplied was Screen, a text editor, a chess-playing program, and various demonstration programs.

Word processing

"WriteMaster" is an excellent program, a full-featured word processor which is easy to use and to learn thanks to the extensive "Help" summaries and descriptions which can be called onto the screen from any point in the program. An array of 24 labelled function keys (the number keys, used with Shift and Control) contribute greatly to this ease of use.

A command menu is also a major feature of WriteMaster. On entering the program the available options are listed as Create (a new file), Edit (a previously created file from disk), Type (view the contents of a file), Print (for hard copy), Directory (to view the contents of the disk directory of word processor files)

and Quit (leave the program without saving a copy of the text in memory).

After selecting an option text can be entered in the Edit mode or the Command mode selected with a press of the Escape key. A wide range of commands is available to select text for moving or copying, print the screen contents, a page of text, or a complete file, and to set margins and align text. Automatic pagination "find" and find and replace and mark text for inclusion in an index are also supported.

Many of the commands are quite long, such as "Boldface-selected-text", but on-

Cromemco Structured Basic statements

ABS, ADR, ASC, ATN, AUTOL, BINADD, BINAND, BINOR, BINSUB, BINXOR (16 bit binary operations), BYE, CALL, CHAIN, CHR\$, CLEAR, CLOSE, COMMON, CON, COS, CREATE, DATA, DDLIST, DEF FNS, DEG, DEL, DELREM, DIM, DIR, DO, DSK, ECHO, EDIT, ESC, END, END COMMON, ENDPROC, ENDWHILE, ENTER, ERASE, ERRPROC, EXP, FIND, FOR...NEXT, FRA, FRE, GET, GOSUB, GOTO, HEX\$, IF...THEN...ELSE, IMODE, INP, INPUT, INT, IOSTAT, IRN, LEN, LET, LFMODE, LIBRARY, LIST, LIST VARIABLES, LOAD, LOCAL, LOCK, LOG, LONG, LVAR, MAT, MAX, MIN, NOECHO, NOESC, NOT, NTRACE, ON ERROR, ON ESC, ON GOSUB, ON GOTO, OPEN, OR, OUT, PARTITION, PEEK, POKE, POSE, PRINT, PRINT USING, PROCEDURE, PROTECT, PUT, RAD, READ, REM, REN, RENUMBER, REPEAT UNTIL, RESTORE, RETRY, RND, RUN, SAVE, SCR, SET, SFMODE, SGN, SIN, SPC, SQR, STOP, STR\$, SYS, TAB, TAN, TRACE, TYPE, UNLOCK, USE PARTITION, USR, VAL, VALC, WHILE-ENDWHILE, XOR.

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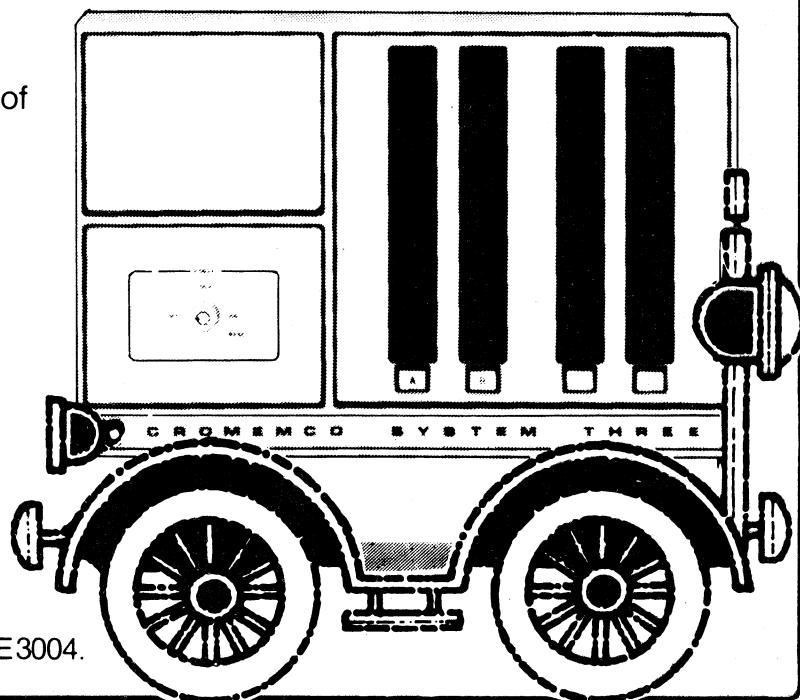
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The Cromemco C-10SP computer

ly enough of the command need be entered to distinguish it from other commands. For example, typing SA will result in WriteMaster displaying "SAVE" and "Is this what you mean?". An answer of "yes" or "y" will lead WriteMaster to prompt for the file name under which text will be saved to disk.

Single key commands can also be activated within the Edit mode by using one of the 24 dedicated function keys supported by WriteMaster. The numeric keys in conjunction with the Control and Shift keys provide access to editing functions such as boldface, underline, delete character, insert character, end paragraph etc. A cluster of cursor control keys on the right side of the keyboard allow movement within the text, although long movements are also supported by the commands "Next Screen" and "Back Screen" — again with dedicated function keys.

A feature of WriteMaster is a "merge" function which enables portions of text to be saved in a temporary file and called in from disk to be inserted in existing text. In addition to allowing large portions of "boilerplate" text to be incorporated in documents this option can be used for printing form letters or other documents.

At any time a summary or a full description of the functions available can be called up by typing HELP in the command mode or pressing the HELP key. These on-screen instructions are in addition to a comprehensive 306-page manual which includes a tutorial on using the word processor.

WriteMaster is a "what-you-see-is-what-you-get" style word processor. In addition to easy, full-screen editing and on-screen boldfacing and underlining, format commands work directly on the screen. Text can be aligned and justified, double-spaced or arranged in tabular columns in a fraction of a second, without the use of complex commands embedded in the text and with the assurance that it will be reproduced on paper exactly as it appears on the screen.

The only exception is "incremental" printing, Cromemco's term for proportional spacing. On the screen lines are justified right and left by inserting spaces between words. Cromemco's CLQ daisywheel printer can justify text more evenly by adjusting the spaces between individual letters in increments of 1/120th of an inch. (The printer is made in the United States, and like all printers and computer equipment is most easily specified in the old imperial system of measurement.)

With its extensive capabilities and features, WriteMaster is equally useful

for the preparation of individual letters and reports, personalised form letters or long documents. It is an excellent complement to the power and flexibility of the C-10 computer system.

Spreadsheet calculations

"PlanMaster", Cromemco's spreadsheet program is just as flexible and convenient to use. Data values and formulas can be entered in any of 10 "pages" each of 12 columns and 30 lines (not including additional "columns total" and "lines total" areas). A command line, entered by pressing the Escape key allows entry of data, formulas, screen formats and line and column labels, printing spreadsheets and saving and loading files from disk.

The ubiquitous HELP file is available at any time from the command mode, in addition to an extensive 212-page manual incorporating a tutorial and full descriptions and examples of each command.

Options include recalculation on command or automatically when the spreadsheet is updated, selection of round-off or "dollar" format, exponential, decimal or hexadecimal notation. A range of control structures is available for complex calculations, including Repeat, If/Else and changing the page or the window

displayed on the screen.

A range of other languages and applications are available to run under CDOS, including Fortran, Ratfor, Cobol and "C".

As we said at the outset, value for money is the key-note of the C-10. Cromemco has created a solid, reliable single-user computer system with software available for most of the tasks required by a small business, software developer or writer. Considering the features provided by the C-10 the pricing is attractive too.

By itself, the C-10 video monitor and processor unit costs \$1710 including sales tax. A keyboard adds \$277 to this price, providing a full-featured terminal for under \$2000. The system reviewed here included two disk drives, but the single-drive C-10SP, including screen, keyboard, disk drive and the software discussed here is priced at \$3059 (including sales tax). The tilt and swivel stand is an additional \$269, and add-on disk drives are priced at \$898 each.

For further information on the Cromemco C-10 contact Minicomp, 378 Forest Rd, Hurstville, NSW, 2220. Phone (02) 570 7233. In Melbourne: Adaptive Electronics, 418 St Kilda Rd, Melbourne 3000, Phone (03) 267 6800, and Informative Systems, 337 Moray St, (03) 690 2284, also distribute Cromemco products.