

Electronics Australia reviews the . . .

OKI Electric if800 'all-in'

The Sigma Data Oki Model 30 is a recently released upgrade of the Oki Electric Company's if800 series. Features of the system include integrated "all-in-one" packaging, the CP/M 2.2 operating system and high resolution colour graphics.

The first impression of the Oki if800 Model 30 is the sheer size of the machine.

Dimensions of the complete system are 55 × 71.5 × 51cm (W × D × H) and mass is a hefty 53kg. Sigma Data, who distribute the machine in Australia, claim that the space occupied by the if800 is comparable with other computer systems once the space saved by the built-in printer is taken into account, but the impression of bulk remains.

While big, the system is complete. The keyboard, colour video monitor, dual 20cm disk drives and full-size dot matrix printer are all combined in one large package.

As delivered the if800 is in two parts, one containing the keyboard and printer and the other holding the power supply and processor board, with a 30cm colour monitor mounted on pillars above the rearmost unit. Next to the CRT screen are dual 20cm disk drives.

To install the Oki, first clear your desk. The two units are connected with three multi-way cables and the keyboard section fitted into the open front of the rear part. Two screws through small metal

brackets lock the two sections together into one unit.

The integrated configuration has one immediately obvious advantage — there is only one power cord and a single power switch for the system, conveniently located on the left side of the console.

Forward of the power switch and also on the side are two small pushbuttons, one labelled "IPL" and the other NMI. Preparing the if800 for use is a matter of loading a disk into drive A and pressing IPL. Within seconds the disk will load (indicated by colour cycling of the screen border and various clunks and whirring noises from the disk drive). Brief messages on the screen report the status of program initialisation before the screen clears and the CP/M operating system is activated.

Specifications

The Oki if800 Model 30 is based on a Z80B microprocessor running at a clock rate of 4.9152MHz. Programmable memory is provided in the form of 64K × 1-bit dynamic RAM chips, with 128K bytes provided with the standard

machine and an additional 128K provided by an optional memory expansion board.

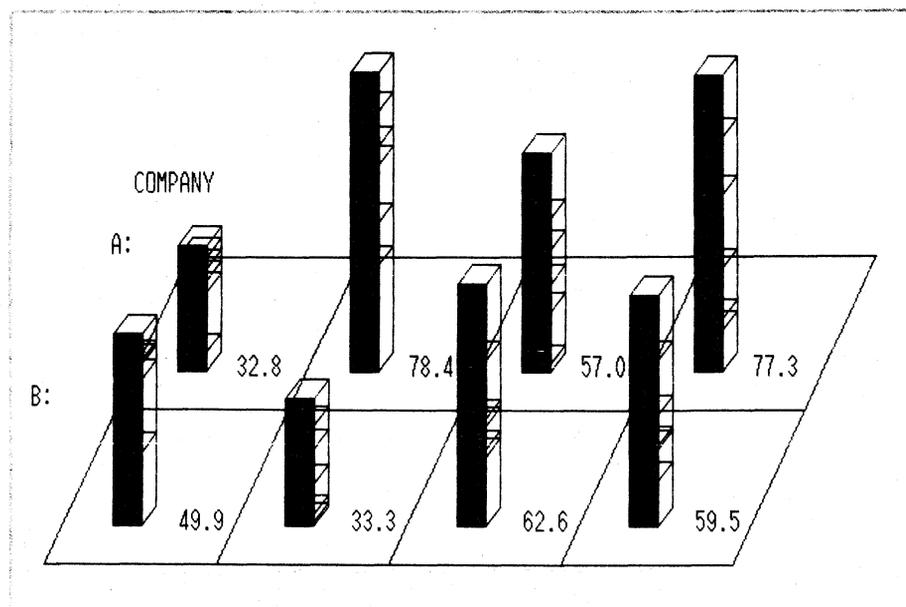
Two configurations of the system are available. One, the IF80150 (reviewed here) has a colour display while the IF80160 has a monochrome display. In the colour version video memory consists of three 64K planes (one each for red, green and blue) for a total of 192K bytes.

The standard machine includes an on-board clock/calendar with internal Nicad battery backup so that the time and date are maintained whether or not the machine is switched on. A sound generator is also provided, generating 64 tones over a range of 65Hz to 1976Hz through an internal speaker.

An RS232C serial port is built into the standard machine and a Centronics parallel port is available as an option. With a full-size 80cps dot matrix printer built in to the keyboard console, the lack of a Centronics port on the standard unit is probably not important. If correspondence quality printing is required any of the available daisywheel printers can be connected to the serial port.

The built-in printer is a fast impact printer, able to produce multiple copies on either single-sheet or tractor feed paper. Lines of 80 or 132 characters can be specified and graphics, including a printed copy of the screen display, are also available. Individual characters are formed on a 5 × 13 dot grid in a 16 × 16 dot matrix, allowing full descenders on lower case letters and the production of user-defined graphics symbols. Double-size, enhanced and boldface type can also be produced, and in fact the version of WordStar available for the if800 supports all the features of the printer.

The if800 is well-equipped with peripheral interfaces and expansion slots. Built into the standard machine are interfaces for a light pen, communications port, and a ROM cartridge. Five expansion slots are provided in the processor unit, with two already occupied by controller boards for the colour graphics display and the disk drives. The three vacant slots can be used with



This 3D bargraph was dumped from the screen to the in-built printer.

'one' computer



The if800 comes complete with printer, colour monitor and dual disk drives.

parallel and serial add-on boards, D/A and A/D converter boards or an IEEE 488 communications bus adaptor board.

Currently available optional extras also include a light pen which is connected by a socket on the right side of the machine. In conjunction with a Basic program the pen can be used to indicate a specific 40×200 pixel area on the screen or to select items from a menu by touching a point adjacent to the written description of the menu entry.

The ROM slot on the left side of the console can be used for cartridges which contain programs or data, although as yet no program cartridges have been released. The information stored in a ROM cartridge does not appear in the memory space of the if800 but can be copied into RAM for use. Up to 20K bytes of information can be stored and accessed in this way.

A "Kanji" cartridge is available for use as an add-on character generator. This ROM pack contains patterns for 2965 Japanese kanji characters, alphanumeric characters, and Greek and other special symbols.

The keyboard

The keyboard of the if800 is extensive. In addition to the standard alphanumeric keys in a typewriter-style layout and a numeric pad, the 104 keys include cursor control, special function keys for the screen and printer and a set of 10 user definable keys. All keys have an automatic repeat feature and an internal speaker provides audible feedback for every keystroke.

Of course not everyone likes audible feedback from a keyboard. Unfortunately, with the if800 it is not an option — there is no way to disable the feature (or

if there is we couldn't find it in any of the system manuals). With a noisy cooling fan, noise from the disk drives and compulsory audio from the keyboard the if800 is obtrusive — a point which must be considered in an office or home environment.

Other features of the keyboard include completely redefinable keys, a Japanese character mode, access to special graphics characters and single key entry of common Basic statements.

The user-definable keys above the alphanumeric keyboard can each be assigned a string of up to 15 characters. Pressing the function key then has the same effect as typing this string.

As initialised, the keys perform various functions under CP/M and a different set of operations under Basic. Under Basic, for example, pressing F1 will print the statement LOAD on the screen, ready for the user to type in a program name to be fetched from disk.

Under CP/M, pressing F1 will print "dir", the instruction to list the directory of a disk drive on the screen. Pressing F6 will call up DDT, the "Designers' Debugging Tool" of CP/M, while F10 will load Basic.

From Basic the statements KEY, ON KEY () GOSUB ... and KEY LIST will respectively assign functions to the programmable keys, call subroutines according to the key pressed and list the current definitions of the keys.

A row of touch switches directly below the video monitor duplicates the operation of the function keys. It would be possible to write software which required no use of the standard keyboard at all, by presenting a series of menu-driven operations with options called up by the function keys. A list of key definitions can also be displayed on the bottom line of the screen conveniently above the key that the label refers to.

To the right of the alphanumeric keyboard are two clusters of four cursor control keys (marked with arrows) and the editing function keys INS, DEL, CLS and HOME. The 20-key numeric keypad is further to the right and includes its own separate keys for arithmetic operators and a separate RETURN key for easy entry of numeric data and calculations.

Above the numerical keypad are three keys for control of the in-built printer. From left to right they are "Hard Copy", "Form Feed" and "Print" (a latching key with a LED indicator). "Hard Copy" will produce a printed copy of the current contents of the screen, using double-width characters and reproducing all graphics (but not colour). Shift-Hard

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Copy will provide a reduced copy of the screen image.

The "Print" key, when locked down, will send all text information to the printer as well as to the screen, using normal size characters. It does not reproduce graphics, but is handy for generating program listings and permanent copies of program output in conjunction with the LIST statement of Basic. LLIST from Basic will also activate the printer, and the LFILES statement will produce a printed list of the contents of a disk directory.

Horizontal tab and tab setting keys complete the complement of special functions in the upper area of the keyboard.

At both sides of the space bar are other special function keys which are more of a nuisance than an asset in English-speaking countries. The first, labelled CHR MODE, is a locking key with a LED indicator. It operates to replace all characters with boxes on the screen, and is presumably designed to work with a Japanese character generator which is

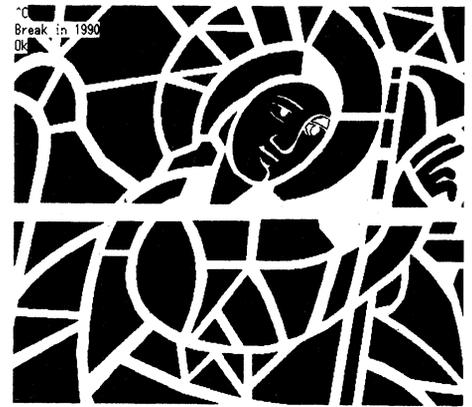
not installed in the standard machine.

Accidentally pressing this key makes it appear that the if800 has developed a strange fault, but there is no information in the manuals on this aspect of the system.

To the right of the space bar are three unmarked keys, one of which is locking and sports a LED indicator. Locking this key down causes the standard keys to be displayed as further Japanese characters, a function of dubious value if you can't read Japanese.

Single key entry of Basic statements is supported by the if800. Pressing the COMD key (on the left side of the keyboard) in conjunction with an alphabetic key will print the Basic keyword associated with that key. COMD-G, for instance, prints GOTO, COMD-E prints ELSE and COMD-F prints FOR and so on.

A GRAPH key to the left of the spacebar allows various graphics characters to be displayed on the screen from the keyboard. Each key alphanumeric key has a pre-defined graphics symbol associated with it, but the Basic statement DEF CHR\$ allows the



Colours on the video monitor are reproduced black by the printer.

programmer to redefine these symbols to create customised characters on an 8 × 16 dot matrix grid. The standard graphics set includes line segments, boxes, card suites and some specialised symbols for cross-hatching and area fill.

While the keyboard of the if800 has many features, user comfort is not one of them. Apart from the compulsory audible feedback, the lowest part of the keyboard is around 8cm from the desktop and there is no room for a "wrist rest" as found on some of the more popular low-profile keyboards. Using the if800 for prolonged periods could be very fatiguing for this reason.

Screen display and graphics

High resolution colour graphics is the best feature of the if800. The colour version of the Model 30 comes with a high bandwidth RGB monitor, capable of displaying up to 25 lines of 80 characters each and graphics in eight colours with a resolution of 640 (horizontal) × 400 (vertical) pixels.

This exceptionally high resolution means that further colours can be created on the screen. Using a technique which Oki call "dithering", shades of various colours can be built up by juxtaposing the available colours. For example, a line made up of alternate red and green points will be perceived as a solid line of some shade between red and green because of the fine detail of the display. Using red for 70% of the pixels and green for the remainder will produce yet another shade. According to the distributors up to 120 distinct shades of colour can be created in this way.

Four options are available for text displays, allowing either 20 or 25 lines of either 40 or 80 characters each. Both graphics and text displays are clear and sharp, and the colours are fully saturated, not the more common "washed out" tones more usually seen.

The display capabilities of the if800 are fully supported by the Basic interpreter



Eleven keys below the screen are paralleled to keys F1-F10 on the keyboard.

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provided with the system. Size of the text display format is selected with the WIDTH command while the CONSOLE command allows other display attributes to be modified, including the scrolling area of the screen, the function key label display and the scrolling speed of the display.

Rather than scrolling over the full height of the screen the if800 can be instructed to scroll only part of the screen by specifying the top line of the scroll window and the number of lines to be included in the window. Lines are numbered from 0 to 24 in the 25 line mode and from 0 to 19 in the 20 line mode.

The fourth parameter of CONSOLE controls the speed of scrolling. When "0", scrolling will be performed on a line by line basis, called "jump scroll" by Oki because of the jerkiness of the resulting movement. Specifying a value from 1 to 255 will select smooth scrolling (pixel by pixel movement). The lower the number the faster the scrolling speed.

Further basic statements allow cursor positioning on the screen and the display of text in any position and in a variety of sizes and orientations. The SYMBOL statement of Basic, for instance, displays a specified character string at a specified position on the screen, and allows the selection of a variety of type sizes. Character strings can also be rotated in increments of 90 degrees for labelling graphs etc.

The display screen of colour versions of the if800 is "bit-mapped" in three planes, one each for the red, green and blue components of a screen image. Each bit plane can be displayed and erased separately, allowing a multitude of special effects. Different colours can be selected for the characters displayed, the screen background and the border of the screen with the Basic COLOR statement (the English spelling "COLOUR" will generate a syntax error).

Further Basic statements support graphics, with statements to set and reset individual pixels to any colour, draw lines using either relative or absolute co-ordinates and fill areas of the screen with colour until a boundary of a specified colour is encountered. A "graphics sub-language" accessed by the DRAW statement allows specification of connected lines, angles of rotation and various scaling factors using strings of parameters, and the statements GET and

PUT will respectively store a graphics image in a data array and re-display it.

There is also the CIRCLE statement, which will give draw circles, as the name implies. Given various parameters the statement will also draw arcs and ellipses and optionally fill the shape with any of the available colours.

To make best use of graphics displays usually requires some adjustment of the screen for the best picture, and the if800 has a conveniently placed brightness control tucked into a recess beneath the left side of the screen. Controls for contrast and vertical and horizontal adjustments are at the rear of the monitor and would require use of a screwdriver. No adjustments were necessary on the review machine.

A knurled knob on the leftmost supporting pillar of the display allows the tilt angle of the screen to be adjusted, but of course the design of the if800 does not allow the screen to be swivelled. The RGB monitor is always directly in front of the user, at a distance of perhaps 45cm, since the keyboard is not detachable. Tilting the display screen should eliminate most problems with glare, but attention would have to be given to lighting of the environment, since the physical configuration of the if800 is not as flexible as that of modular systems.

Disk storage and software

Next to the CRT screen are two vertically mounted 20cm disk drives, each providing 968K bytes of useable storage for programs and data. Several other disk formats are supported, including the IBM 3740 single density single-sided standard. Using this format disk, capacity is reduced to 239K bytes but disks are compatible with the standard CP/M 20cm disk format, allowing the if800

user to take immediate advantage of the thousands of programs available in this format under CP/M 2.2.

Supplied with the review system was a disk containing the CP/M 2.2. disk operating system and "OBasic", Oki's extended version of Microsoft Basic80. Features of this interpreter include variable names up to 40 characters long, the CHAIN and COMMON statements which allow one program to call up another while preserving a common set of data between the two, and extensive support for the graphics, sound, I/O and extended memory facilities of the if800.

Statements and functions of OBasic are listed in Table 2, but some of the more unusual features may require explanation.

AUTO, as might be guessed, enables the automatic generation of line numbers, a great convenience for programmers. Parameters to the command allow the specification of the starting line number and the increment between lines. The RENUM command is also available to change line numbers of a program or part of a program.

BEEP will sound a tone from the internal speaker, while the PLAY statement provides control of the five-octave sound generator by use of a parameter string specifying the octaves, notes and rests to be played.

The statement BLOAD will load a machine language program from disk to a specified area of memory, and the CALL statement is available to activate the routine. The USR statement is also supported, but unlike CALL it does not allow parameters to be passed to the machine language program.

While the EDIT command allows editing of lines using the cursor control keys and INS and DEL, "full screen" editing is also available. In this mode the user moves the cursor over the characters to be changed and inserts,

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The if800 has a comprehensive keyboard with dedicated function keys and LED indicators on the locking keys.

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deletes or types over existing text to make the changes. On pressing RETURN these alterations will be incorporated into the program on display. When line numbers are changed in this way the result is a new line, while the existing line also remains in memory with the previous line number.

The SELECT statement allows the programmer to specify one of a number of

banks of memory, each of 32K. When a memory expansion board is installed in the if800 up to four such banks are available and can be used as the Basic program area, or for storage of "extended arrays" (indicated by the use of the DIM@ statement). The extended array declared by this statement is stored in the memory bank specified by the number used with SELECT.

CHAIN@ also uses the extended

memory capabilities of the if800. A number of programs may be loaded from disk at the start of a session and called up by the CHAIN@ statement. Since the programs are already in memory access is much faster than if a program is loaded from disk each time it is required.

The real-time clock of the if800 is supported with the statements TIME, TIME\$, DATE and DATE\$. PRINT TIME will display the current count of the clock while PRINT TIME\$ will display the time (to the second) in 24-hour format PRINT DATE\$ will display the date, month and year. When using Basic, pressing Function key six will have the same effect as PRINT DATE\$, TIME\$.

Extensive support is also provided for the communications functions of the if800. Peripheral devices can interrupt the execution of a Basic program when enabled by the COM ON statement. Once enabled, subsequent use of ON COM GOSUB xxxx lets the program incorporate routines which will only be entered on receipt of data through the RS232C communications port.

The ON PEN and ON KEY statements function in the same way to allow light pen or function key inputs to be handled from within a Basic program.

For additional versatility there is the OBasic TERM command which allows the if800 to operate as a terminal using the RS232C interface. Either full or half duplex communication formats can be used and an extensive range of control codes and ESC sequences allows control of screen formats, communications protocol and the internal printer. Most Basic statements can be executed in a "remote" mode, which carries out the operation specified and outputs the result to either the terminal or the host computer.

OKI if800 Model 30 Specifications

Processor:	Z80B at 4.9152MHZ
RAM:	128K bytes, expandable to 256K
ROM:	2K bytes for Initial Program Loader
Keyboard:	104 typewriter style keys, numeric pad, definable keys and special functions keys
Display:	RGB monitor, 80 characters X 25 lines, 640 X 400 pixel graphics in eight colours (see text)
Interfaces:	RS232C serial port (110-9600 baud) light pen socket. Three expansion slots for optional devices.
Disk drives:	Two 20cm double-sided double density each providing 968K storage.
Peripherals:	Built-in 80cps full-size dot matrix printer.
Documentation:	Separate manuals on hardware, Basic and CP/M. Manuals well organised but lack detail.

OKI if800 Basic statements

ABS, ASC, ATN, ATTR\$(disk), AUTO, BEEP, BLOAD, CALL, CDBL, CHAIN, CHR\$, CINT, CIRCLE, CLEAR, CLOSE, CLS, COLOR, COM OFF, COM ON, COM STOP, COMMON, CONSOLE, CONT, COPY, COS, CSNG, CSRLIN, CVI, CVS, CVD, DATA, DATE, DATE\$, DAY, DAY\$, DEF CHR\$, DEF FN, DEF USR, DEFINT/SNG/DBL/STR, DELETE, DIM, DIM@, DRAW, DUMP, EDIT, END, EOF(disk), ERASE, ERL, ERR, ERROR, EXP, FIELD(disk), GET@, GOSUB . . . RETURN, GOTO, HEX\$, IF . . . THEN . . . ELSE, INKEY\$, INP, INPUT, INPUT (disk), INST, INT, KEY, KEY LIST, KEY OFF, KEY ON, KEY STOP, KILL(disk), LEFT\$, LEN, LET, LFILES(disk), LINE, LINE INPUT, LINE INPUT (disk), LIST, LLIST, LOAD(disk), LOC(disk), LOCATE, LOF(disk), LOG, LPOS, LPRINT, LPRINT USING, LSET(disk), MDI\$(disk) MERGE(disk), MID\$, MKD\$(disk), MKS\$(disk), NAME(disk), NEW, OCT\$, ON . . . COM GOSUB, ON ERROR GOTO, ON KEY GOSUB, ON PEN GOSUB, ON . . . GOSUB, ON . . . GOTO, OPEN(disk), OPEN(port), OPTION BASE, OUT, PAINT, PAUSE, PEEK, PEN(n), PEN OFF, PEN ON, PEN STOP, PLAY, POINT, POKE, POS, PRINT, PRINT USING, PRINT (disk), PRINT USING(disk), PSET, PRESET, PUT(disk), PUT@, RANDOMIZE, READ, REM, RENUM, RESET, RESTORE, RESUME, RIGHT!, RND, RSET(disk), RUN, SAVE(disk), SCALE, SCREEN, SELECT, SET, SET(disk), SGN, SIN, SPACE\$, SPC, SQR, STOP, STR\$, STRING\$, SWAP, SYMBOL, SYSTEM, TAB, TAN, TERM, TIME, TIME\$, TRON/TROFF, USR, VAL, VAPRTR, WAIT, WHILE/WEND, WIDTH, WIDTH LPRINT, WRITE.

Enhanced CP/M

CP/M (Control Program for Microcomputers) is an operating system written by Digital Research to run on the 8080 microprocessor. It is organised in such a way that only a small section of the program (the BIOS, or Basic Input/Output System) is dependent on the configuration of any one machine. All other functions are implemented with calls to this system, allowing CP/M programs to be used by a large number of machines.

Many thousands of applications programs are available from commercial and private suppliers which will, in theory, run on any system using CP/M.

In practice a major obstacle to the interchange of CP/M programs between different computers is the variation in disk formats used to store data on disks. Although a standard format exists for 20cm disks (the IBM 3740 format), each manufacturer of systems using 13cm disk

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drives tends to use a different data storage format, so that disks written on one system cannot be read by a system with a different brand name.

The if800's 20cm disk drives can be configured to be fully compatible with the 3740 format, so that these problems do not arise.

Oki supplies an extended version of CP/M with the if800 Model 30. While compatible with CP/M 2.2 this version of the operating system incorporates other functions to take advantage of the special features of the if800 system. What this means is that standard CP/M programs will run on the if800, but programs written using the special features of Oki's CP/M cannot be run on systems which lack these features.

The extended features of IF-CP/M allow the programmer to access graphics, the in-built printer, screen format routines, RS232C port and optional Centronics port, ROM cartridge and light pen directly from CP/M or any other program running under CP/M. Function keys and the extended "bank select" memory arrangement of the if800 can also be fully utilised and a number of disk utility programs provide further capabilities.

Access to the graphics features of the if800 is an exceptional feature of IF-CP/M. Many other systems provide graphics capabilities which can only be accessed through Basic, making them unusable by other programming languages and applications programs.

Two methods are available to allow the user to add graphics to programs running under CP/M on the if800. The first method uses Escape key sequences to indicate that graphics commands and parameters follow. To draw a circle under CP/M, for example, the command is ESC G C, Colour, Centre X, Centre Y, Radius, where the four parameters are expressed as decimal numbers. Ellipses, arcs, line and boxes can be drawn and coloured with variations on this technique.

The second method of accessing graphics is faster but less general-purpose. Direct calls to the BIOS routines of Oki's extended CP/M are permitted, allowing graphics to be added to any program. This method requires some experience of assembly language programming but allows fast, versatile access to all graphics functions.

A number of utility functions of the on the Oki system disk further expand the usefulness of the if800. IFCONFIG allows the selection of parameters for the RS232C port and an external printer which may be connected to either the



This view shows the if800 with an on-screen self-portrait.

serial port or via the optional Centronics interface. Another utility, 20T030, allows programs stored on the 13cm disks used with the Oki Model 20 to be transferred to the 20cm disks of the Model 30.

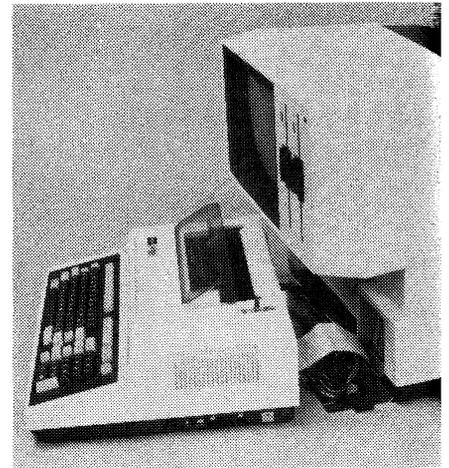
A utility called MDDUTY can be used to create a "memory disk" using the colour graphics memory or the extended memory provided by a memory expansion board. Using this utility a section of memory of up to 192K bytes can be configured so that it appears to the system as a very fast disk drive.

The advantage of this approach is that programs which require frequent disk accesses can operate on the "memory disk", considerably increasing the speed of execution. Compilers, database programs and word processing programs in particular can make good use of this feature. While most other S100 CP/M systems can be fitted with a "memory disk" it is usually a costly optional feature.

Applications

Given the standard CP/M format of the if800 disk drives, applications programs for the system should be readily available, although some customisation would be required to take full advantage of the if800 features. WordStar and Spellbinder word processing programs are available, as is the spreadsheet calculator SuperCalc and a host of other programs from dealers and organisations such as the CP/M Users Group.

We ran Spellbinder, a full-featured easy-to-use word processor. Using this program shows up a possible disadvantage of the if800. The bit-mapped colour display and long persistence phosphor means that screen updates take an appreciable amount of time. Since



The two parts are joined by three cable connectors and bolted together.

Spellbinder (and to a lesser extent, WordStar) reformat the screen as new characters are entered or inserted, for a great deal of the time what's on the screen has no relationship to what is being typed — an annoying peculiarity.

To some extent the problem is inherent in the design of the if800, in that colour graphics and text processing make different demands on a system. While the colour version of the if800 is excellent for graphics it is not ideal for processing large amounts of text. Those considering such applications would perhaps be better advised to look at the monochrome version of the if800.

Conclusions

We have some reservations about the if800. With its expanded memory and fast Z80B microprocessor, plus colour graphics, the machine is an excellent implementation of a CP/M system. In these days of 16-bit microprocessors however, CP/M, while maintaining a large and loyal following, can hardly be described as "state of the art".

Other reservations arise from the "all in one" configuration. Perhaps the if800 does take up no more space than an equivalent modular system with separate printer and disk drives, and the lack of cabling is a definite advantage, however the if800 presents itself as a big, bulky and noisy system. The height of the keyboard and the fixed position of the display are also incompatible with current thinking on ergonomic design standards.

Cost of the system reviewed here is \$5650 plus sales tax. Included in the price is the CP/M operating system, OBasic interpreter, WordStar word processing program, SpellStar, Mailmerge and the CalcStar electronic spreadsheet program.

For further information contact Sigma Data Corporation Pty Ltd, 157 Walker St, North Sydney, NSW, 2060, phone (02) 436 3777.