

Popular Electronics Tests



Hewlett-Packard HP-85 Computer

HEWLETT-PACKARD calls the HP-85 the "personal computer for the professional." Judging by its base price (\$3,250), the cost of peripherals, and the titles of the available software, the HP-85 is intended for accountants, engineers, and scientists—and fairly well-heeled ones at that.

Inside the HP-85's 17.8"D x 16.5"W x 6.3"H, 20-lb package is a fully integrated computing system consisting of: a 5-in. CRT that can display 32 x 16 alphanumeric or 256-by-192-dot graphics; 32-column thermal printer; tape-cartridge storage system; HP's own CPU; 16K bytes of RAM (expandable to 32K bytes maximum); and BASIC in ROM. Additionally, the computer has rear-panel slots for plugging in a comprehensive range of optional items via an HP-IB interface module (\$395), which handles up to 14 peripherals.

Among the options available from HP are: a 16K byte memory module (\$395); 7225A graphics plotter (\$2,050 plus \$750 for required personality module); 2631B dot-matrix impact printer

(\$3,650 plus \$150 for high-density print option); and an assortment of 5 1/4" and 8" double-sided, double-density flexible-disk drives (\$1,500 to \$6,500). Software is available in cartridge-tape Application Pacs for \$95 each and includes such titles as BASIC Training, Circuit Analysis, Financial Decisions, and Waveform Analysis.

For those who wish to configure their own systems, HP has the HP-83, which is identical to the HP-85 but lacks the on-board printer and cartridge-tape system. Price is \$2,250. Hewlett-Packard also has, in the works, a less expensive printer that will interface serially with the HP-83 and HP-85; cost of the printer will be about \$1,000.

System Hardware. The HP-85 is built around a custom-designed proprietary microprocessor and a powerful BASIC language that integrate the various elements into a unitary computing system. All additions to the system (RAM expansion, ROMs, and peripherals) are accomplished externally,

through four plug-in "module ports." Even the roll paper for the printer is loaded into an isolated well in the top of the cabinet.

There's not much to tell about the NMOS microprocessor, except that it is designed to access up to 112K bytes of mixed ROM and RAM. Resident in the HP-85 are 16K bytes of RAM and 32K bytes of ROM. To these can be added an optional 16K byte RAM module and up to six 8K byte ROM modules.

On power-up, the HP-85 goes directly into BASIC, and since there's no way of exiting BASIC, there's no means for entering machine-language routines. However, in the BASIC mode, you have access to all of the system's elements, including peripherals.

The cartridge-tape system is used to load programs and data from the Application Pacs and for storing user written data and programs on blank tapes. This system is completely under program control, using such keys as REW (rewind) and LOAD, which can also be invoked by calls in a BASIC program.

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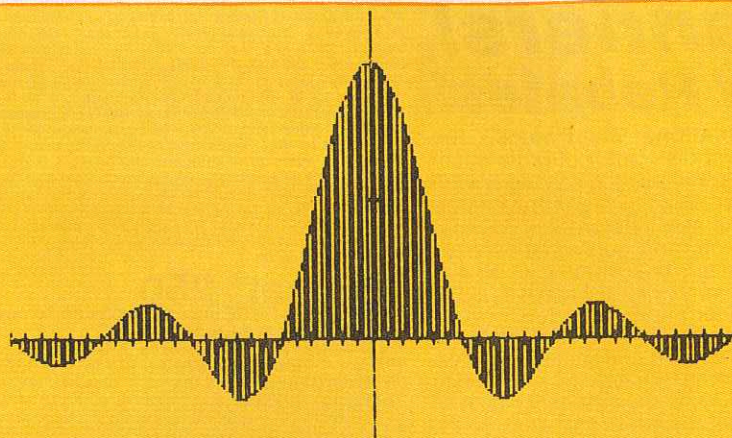
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TEST ROUTINE

```

10 REM *FILL SIN (X)/X
20 GCLEAR
30 RAD
40 SCALE -4*PI, 4*PI, -5, 1.5
50 YAXIS 0, .5
60 XAXIS 0, PI/6
70 FOR X = -4*PI TO 4*PI STEP PI/20
80 IF X = -4*PI THEN MOVE X, SIN(X)/X
90 IF X = 0 THEN 130
100 DRAW X, SIN(X)/X
110 MOVE X, 0
120 DRAW X, SIN(X)/X
130 NEXT X
140 END

```



The tape system can store up to 210K bytes of data or 195K bytes of program on a standard 140-foot tape, with up to 42 named files per tape cartridge. This file-naming feature allows you to load either specific programs or to access various types of data in a simple, straightforward manner. Transfer rate is 650 bytes per second, average access time is 9.3 seconds, search speed is 7.8K bytes (60 in.) per second, and read/write speed is 10 in. per second. The system is equipped with a mechanical security system and has provisions for extra security via program control.

The HP-85's keyboard is an impressive, attention-getting feature. This is one of the few microcomputers with a typewriter-style keyboard on which each key is designed to perform a specific function. Virtually every function you can think of is implemented with a specific key. For example, pressing the LIST key causes a program in memory to be listed on the CRT screen. Tap LIST and SHIFT simultaneously, and the listing goes to the printer for hard-copy read-out. Touch the COPY key, and all on-screen graphics go to the printer, point by point. All of these functions are called by separate keys, without the need for user-written drivers.

The 92-key board is divided into four major parts: standard alphanumeric/punctuation typewriter board; numeric keypad with arithmetic functions (+, -, *, /, etc.); user-definable special-function keys; and display/system-control keys. Using the keyboard, you can directly access 128 of the HP-85's 256-character set. The remaining 128 characters, which are the same as the first 128 but underscored, are accessed via the CHR\$ function.

Hewlett-Packard has reversed standard keyboard convention with the CAPS LOCK key on the HP-85. Normally, pressing down CAPS LOCK locks in the upper-case print mode. On the HP-85, it locks in the lower-case mode. The company reasons that the computer will be used more for entry of specialized data and programs than for text editing, in which case, the upper-case mode would be used more often. (Remember, too, that BASIC converts all lower-case

characters, except those in strings enclosed in quotes, to upper case. Since upper-case is the "normal" mode for BASIC, this implementation of the CAPS LOCK key is logical, even though it takes some getting used to.)

The HP-85's built-in thermal printer is designed to print 32 alphanumeric (and graphics) characters per second. Much of this speed comes from the fact that printing is bidirectional. While text is printed exactly as shown on the CRT screen, graphics are rotated by 90° to permit creation of long graphs that wouldn't otherwise fit across the 4" width of the roll paper. Since this is a thermal printer, it requires special paper, which sells for about \$15 per roll.

The Software. HP-85 extended BASIC is often called an enhanced version of the original Dartmouth BASIC. "Enhanced" here simply means that the language has been designed to take advantage of the power of the integrated HP-85 computing system. Containing more than 150 commands and statements, HP-85 BASIC gives you full control over the CRT screen, on-board printer and cartridge-tape system, and all optional HP peripherals.

HP-85 BASIC enhancements allow you to perform a number of things other BASICs usually don't. For example, a unique software security system that operates on four levels, allows you to protect specified data and program files from being listed, edited, duplicated, written over, and even appearing in the catalog. With the CHAIN and COMMON commands, you can write a very long program and break it into small parts that can be called and executed automatically. The only limitation on program length would be the amount of data that can be stored on tape cartridge or optional disk.

Two levels of data precision are available with HP-85 BASIC. With "full" precision, you get a 12-digit mantissa and three-digit (± 499) exponent. Using "short" precision, five digits of mantissa and a two-digit (± 99) exponent are available. Integer range is ± 99999 .

HP-85 BASIC also allows user definition of the eight special-function keys to

interrupt program execution and direct program flow. Also, you can program a built-in beeper to sound, defining when and how long it will sound and its frequency. This useful feature can be used to signal completion of a desired subroutine, prompt for input, or highlight output. Frequency range of the beeper is approximately 0 to 4,575 Hz.

Another feature of this BASIC is its clock and timer functions. Time is maintained as seconds since midnight, referenced to the year and day of the year. Three timers can be independently programmed to generate periodic interrupts at intervals ranging from 0.5 to 99,999,999 ms (up to 1.16 days).

This isn't just another BASIC interpreter. It's actually an incremental compiler BASIC that checks each line on input for proper syntax. A syntactically correct line of data is interpreted directly to a run-time module and becomes a part of the program being written. If syntax is incorrect, however, an error message is generated on-screen and no entry is made to the program until the error is corrected.

Perhaps more important than input error checking is the method HP-85 BASIC uses for handling data structures, such as arrays. In this BASIC, data is initialized in much the same manner as it is in Pascal and ADA. This means that you can point to any given byte in an array or data set, regardless of where it may reside, even if it's on tape.

Lacking PEEK and POKE statements (they are absent from HP-85 BASIC), the user is barred from access to the processor and, hence, from entry of machine-language routines during programming. Access to the processor really wouldn't help—Hewlett-Packard doesn't provide the instruction set. While omission of PEEK and POKE may represent a major obstacle for the hobbyist, it is consistent with the business applications foreseen by the machine's designers. Professionals who use the HP-85 for business and design applications will rarely if ever need access to the processor. Moreover, just about any task you wish to perform on the HP-85 can be accomplished through BASIC.

For those determined to work in ma-

chine language, Hewlett-Packard has a Series 80 assembler ROM (\$295) that provides limited access to the processor. Plugged into a slot on the rear of the computer, the ROM provides access to many of the entry points used in HP-85 BASIC, including all math routines, high- and low-level CRT control, general I/O routines, etc. Also contained in the Series 80 ROM is an editor that checks for syntax. A comprehensive 400-page manual supplied with the ROM gives full documentation.

Evaluation. It would be unfair—and foolish—to evaluate the HP-85 in direct comparison with such general-purpose computers as the Heath H89, Apple II, or Radio Shack TRS-80. The HP-85 wasn't designed to facilitate machine-language programming, word processing, games playing, etc. In essence, it is dedicated to professional applications where BASIC will suffice. Viewed in this light, the HP-85 is nicely appointed, well integrated, and easy to operate.

We were impressed by the HP-85 BASIC for its power and its relatively high speed. One test of a BASIC is to write the statement 10 GOSUB 10 and observe what happens when it's executed. Most BASICs search through memory for the subroutine and then return an error message like OUT OF MEMORY AT 10 or GOSUB WITHOUT RETURN. HP-85 BASIC, however, returns an immediate error message. The manual gives a good method of checking out HP-85 BASIC. The test routine, shown with its output in the accompanying box, computes and plots a graph. It took 129 seconds to execute, which is acceptable but not particularly fast, since each plot is calculated as it's being drawn.

The system is capable of sharp high-resolution graphics, allowing you to put up to almost 50,000 (256 x 192) dots on-screen, each individually plotted. This being the case, you can design and display any graphics you might need—even create your own character sets. To simplify graphics operations, HP provides special commands that allow you to draw, erase, position labels on axes of graphs, define the limits of the axes, etc. Time, in HP-85 is kept and displayed in an unconventional way. According to the manual, you set time by typing SET-TIME 28800,81076, which represents 8 a.m., March 17, 1981. When displayed, the 28800 refers to the number of seconds since midnight, while 8107 is interpreted in two parts, the first two digits representing the year and the remaining digits the number of days into the year. It would be much better if the date and time could be presented in the format 03/17/81 and 08:00, instead of requiring extra interpretation.

At the present time, the only vendor of software for the HP-85 is Hewlett-Packard itself, which means that the range of available programs is seriously restricted.

However, now that the Series 80 as-

sembly ROM and manual are available to prospective software markets, this situation can be expected to get better.

While Hewlett-Packard offers a Text Editing Pac for the HP-85, it is suitable for occasional or light-duty use. If text editing is something that you need often or for very long, you'll probably be happier with a different computer.

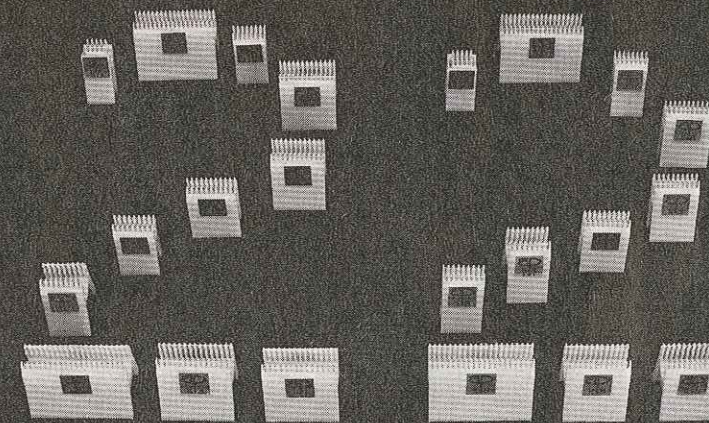
The Bottom Line. With all of its attributes, the HP-85 is a limited computer. If you're in the market for a personal computer for the home, the HP-85 prob-

ably won't be your best choice. To begin with, it's considerably more expensive than typical home computers, and every option added boosts the system price even more. But price aside, the HP-85 would be a poor choice for software development or learning advanced programming skills. On the other hand, for the professional who wants basic number crunching, and doesn't much care how the computer goes about providing it, the HP-85 could be excellent.

—Carl Warren

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