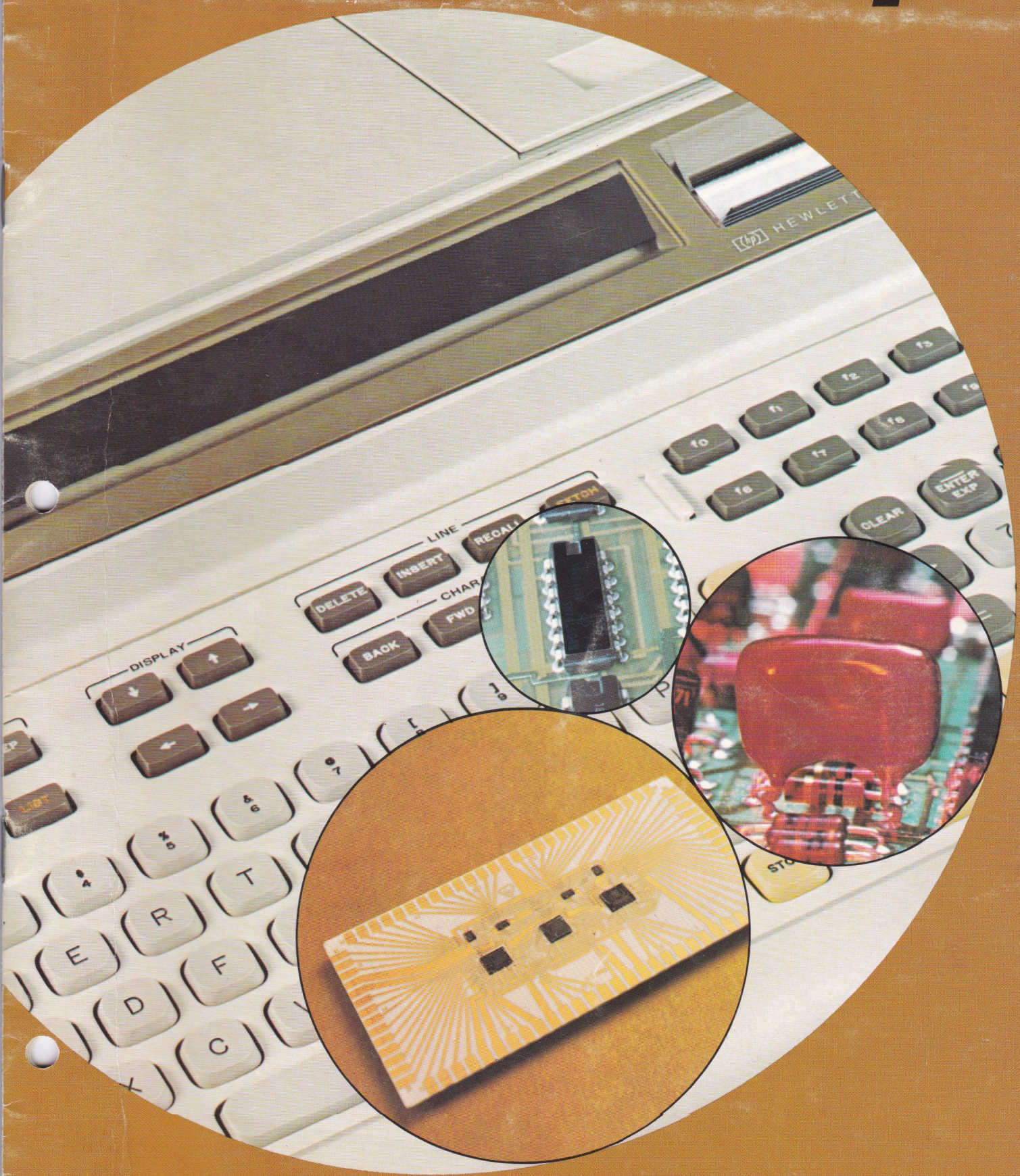
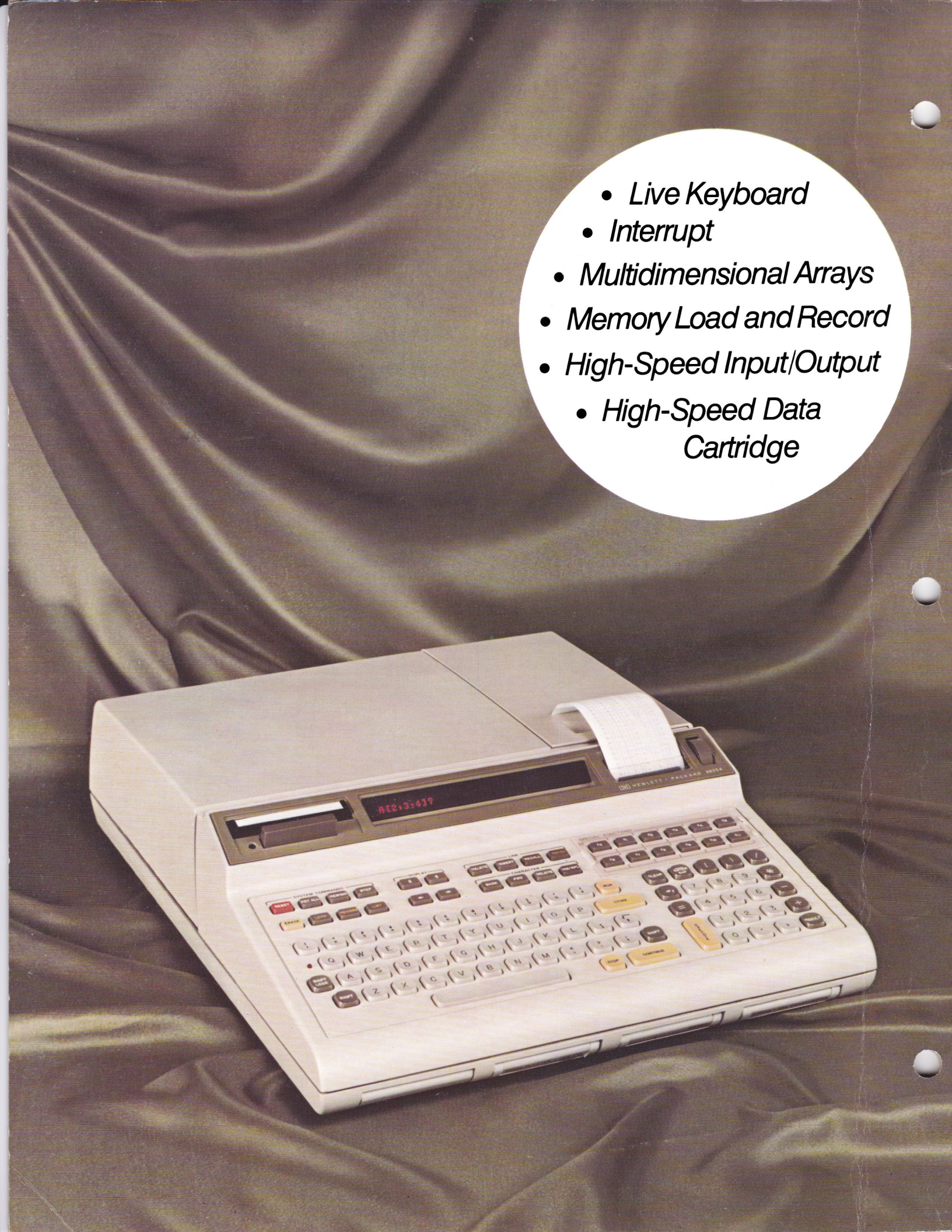
9825: Computing Performance.

HEWLETT hp PACKARD




• Live Keyboard
• Interrupt
• Multidimensional Arrays
• Memory Load and Record
• High-Speed Input/Output
• High-Speed Data Cartridge

The Unexpected in Performance.

Live Keyboard. Here is an exciting new feature: the keyboard is "live" even while a program is running. This means you can do a variety of things, including arithmetic calculations, from the keyboard at the same time a program is running.

Interrupt. This powerful feature adds a new dimension to the 9825's interfacing capability. It permits the 9825 to act as a controller for several independent devices which require attention at unpredictable rates or times.

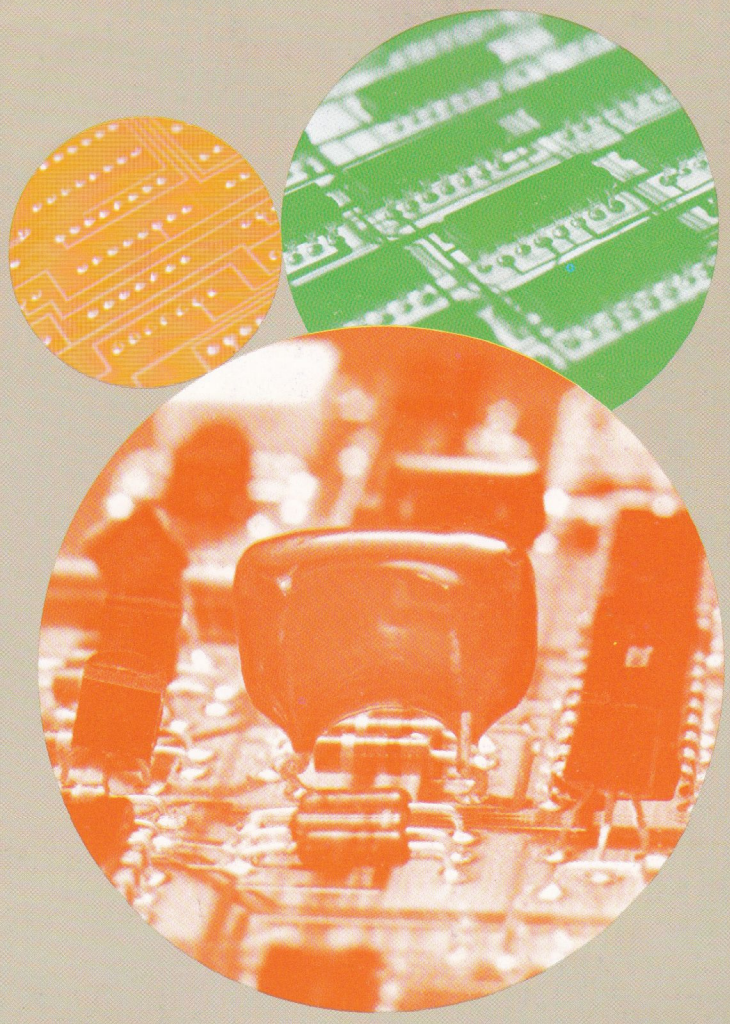
Multidimensional Arrays. By allowing you to organize your data logically, this capability saves program space and execution time. It also facilitates program reading and debugging. The 9825 provides 26 arrays whose sizes are limited only by the available memory.

Memory Load and Record. Another special new feature gives you the capability to transfer the entire contents of read/write memory (program, keys, data, and internal pointers) to and from the data cartridge. Thus, you can preserve the current status of the machine and recreate it at a later time.

High-Speed Input/Output. In addition to interrupt, the I/O capability of the 9825 is further enhanced by a variety of methods and speeds:

- Formatted read/write ..... up to 16K bytes/second
- Burst read/write ..... up to 70K bytes/second
- Direct Memory Access (DMA) ..... up to 400K transfers/second

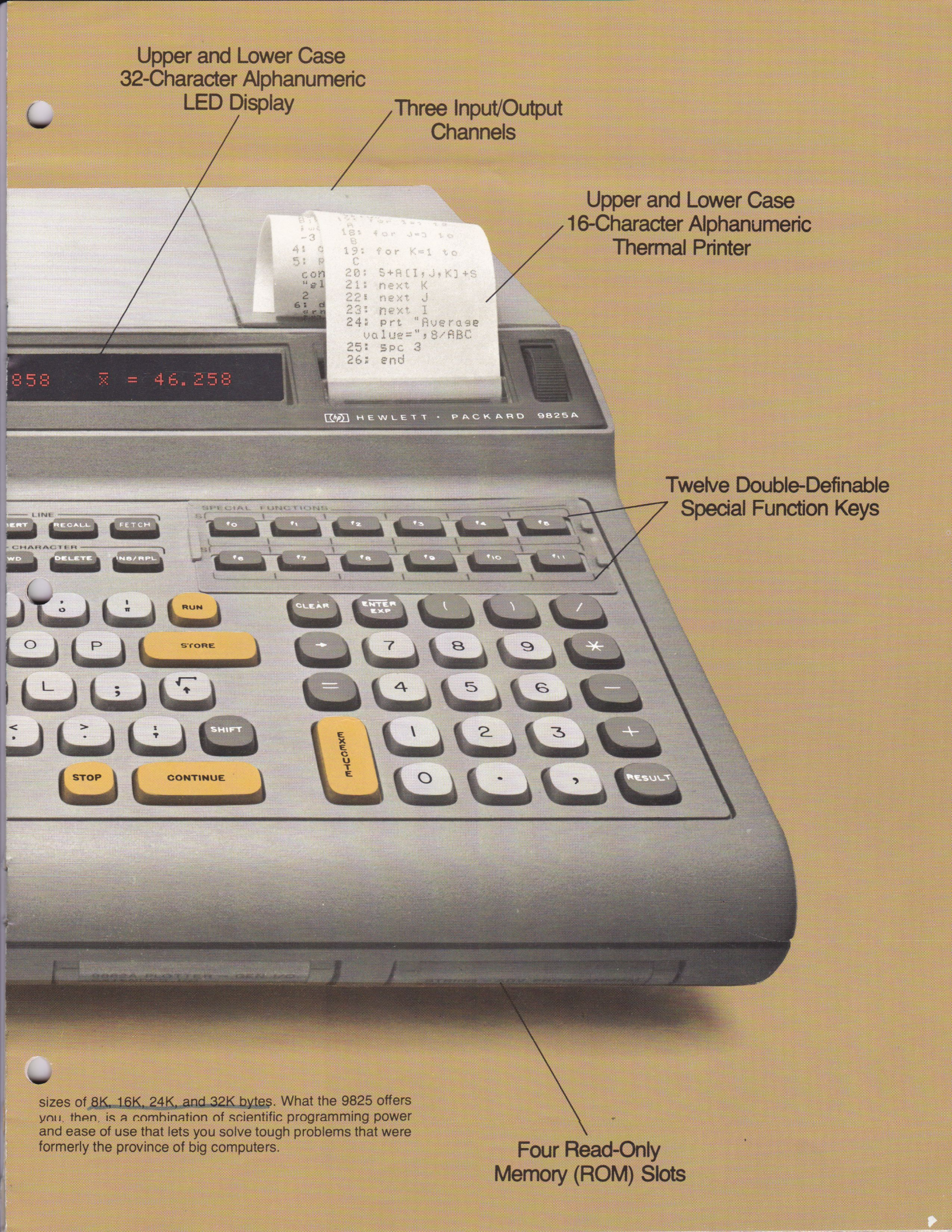
High-Speed Data Cartridge. This new data cartridge is small but it still stores up to 250K bytes of data and programs. With a 90 inch/second search and rewind speed, you have to wait only an average of about 6 seconds to find and load your program from any place on the tape.



9825

Performance at a Glance.

Design efficiency is important to the 9825. Convenience and operational features are stressed even though the 9825 offers you the unexpected in performance. It's easy to communicate with the 9825. HPL, the high level programming language of the 9825, offers you power and efficiency for handling equations, data manipulation, and input/output operations. And you have the ability to add ROM's, interface cards, and peripherals. You may choose read/write memory



sizes of 8K, 16K, 24K, and 32K bytes. What the 9825 offers you, then, is a combination of scientific programming power and ease of use that lets you solve tough problems that were formerly the province of big computers.

SPEED: Performance to Solve Tough

These Computing Capabilities . . . . . .

High-Speed Cartridge. The built-in, two-track tape drive provides rapid access to data and programs. Automatic verification ensures your important information has been stored successfully on tape. The 3K byte/second transfer rate and 90 inch/second search rate means your important programs and data can be quickly found and loaded.

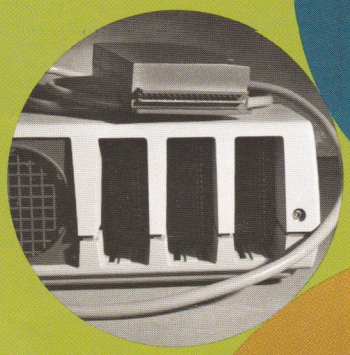
These five methods provide speed and flexibility:

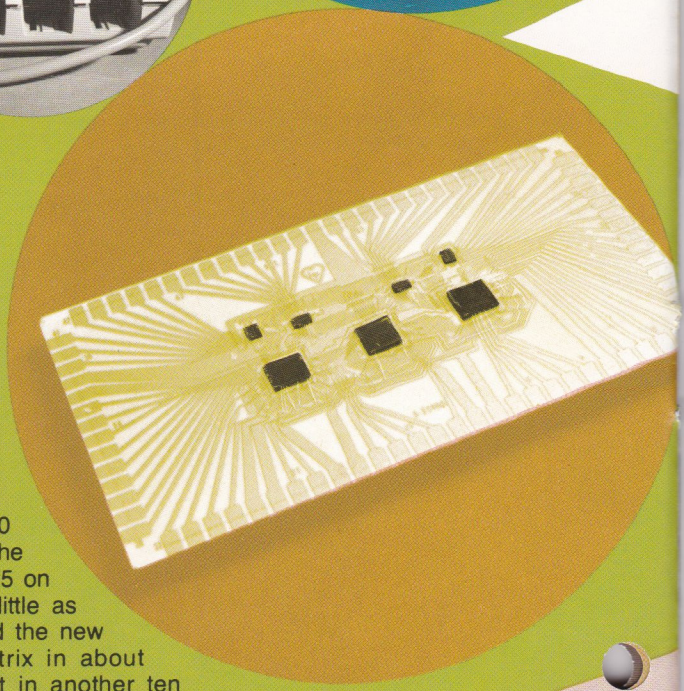
- **Single character read/write** gives you control of your special interface situation at rates of up to 2K bytes/second.
- **Formatted read/write** provides the most flexible method of communicating with both standard peripheral devices and your own peripherals at rates up to 16K bytes/second.
- **Buffered read/write** can be used to overlap computation and data handling with data transfers to external devices, thus increasing your throughput.

Burst read/write lets you capture or send out data at rates up to 70K bytes/second for those cases where high speed and flexibility is required.

- **DMA** provides you with the capability to move data at rates up to 400K transfers/second.

- **Processor.** The high performance coupled with small size is made possible by an LSI processor specifically designed for this calculator. HP not only designed this processor, but developed a state-of-the-art "N-channel MOS" process to build it. As a performance example, consider these execution times for some of the typical built-in math functions: multiply, 0.88 msec; $\sqrt{\ }$, 2.5 msec; sine, 18 msec.



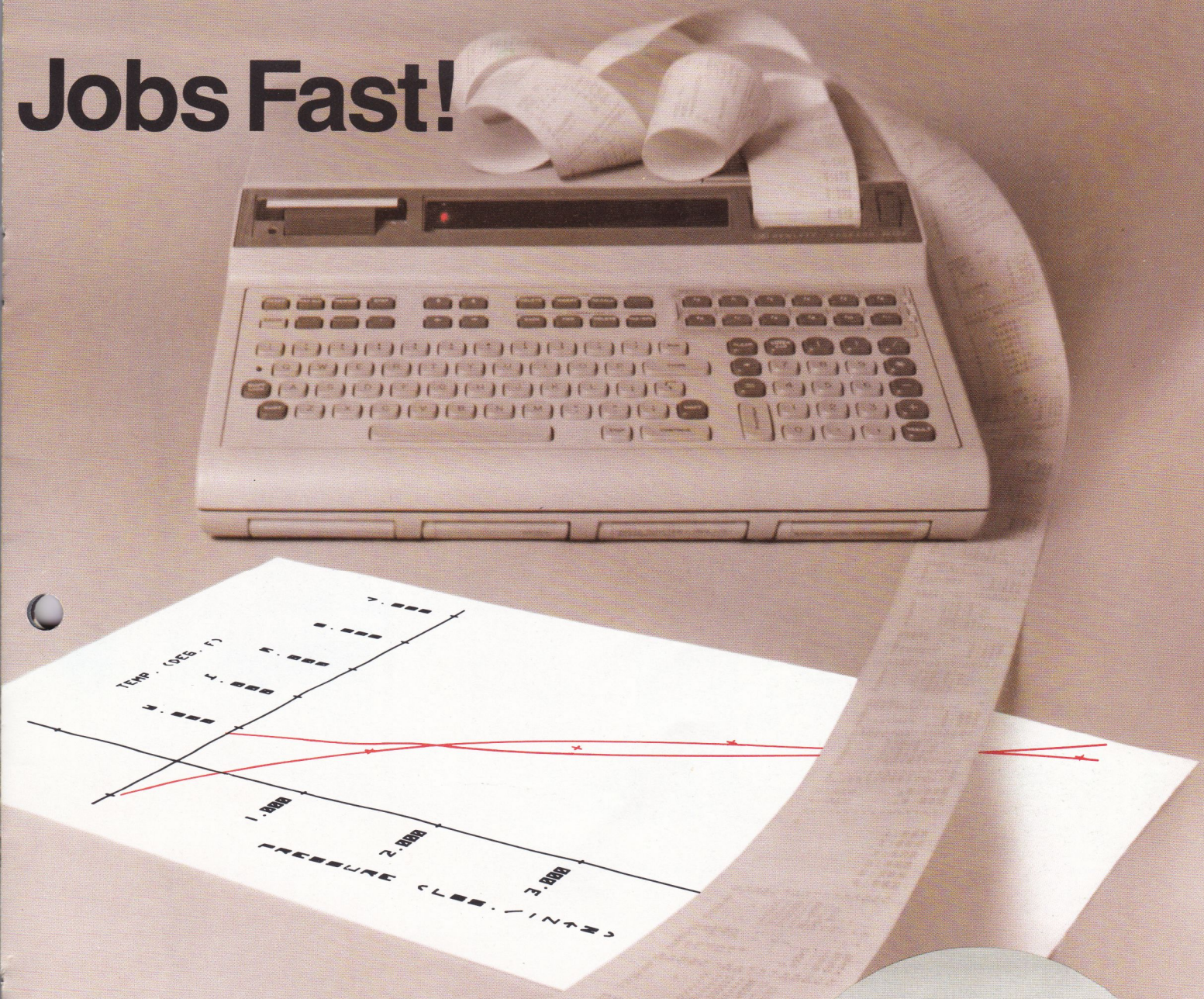


. . . Save You Time Like This.

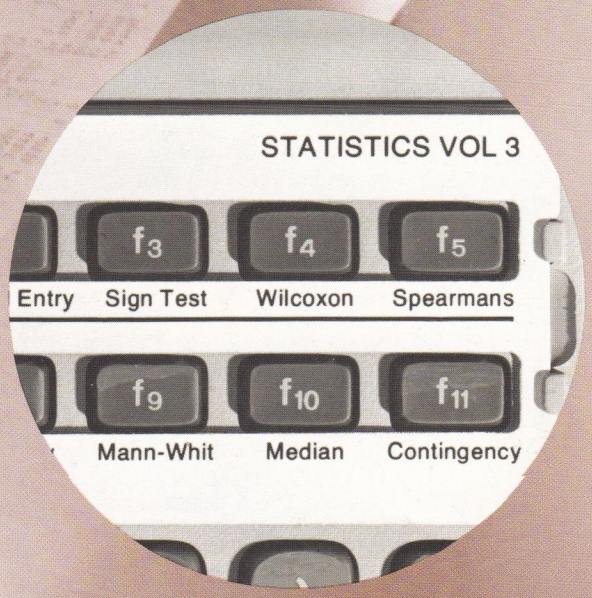
The 9825 can accommodate a variety of tasks simultaneously. As an example, the 9825 can read, analyze, format, and print data from the tape cartridge concurrently with plotting a set of results stored on paper tape. Cartridge data is read, analyzed, formatted by the 9825, and printed on the built-in printer. Paper tape data points are read under interrupt and plotted. You can use live keyboard to turn interrupt off while you change the paper tape and the plotter paper. When you are ready to begin the next plot, you turn on interrupt and the 9825 continues with the next set of data. . . All without disturbing data printout tasks and you can still use live keyboard to do spur-of-the-moment calculations without waiting for the 9825 to finish the other two jobs.

If, at any time in this process, someone else wished to use the 9825 to solve another problem, for example, to invert and print a 20 x 20 matrix, you simply store the entire memory of the 9825 on the data cartridge in as little as three seconds. Then load the new program, invert the matrix in about ten seconds, and print it in another ten seconds. You then reload your original problem, using memory load, and continue your tasks without missing a single step.

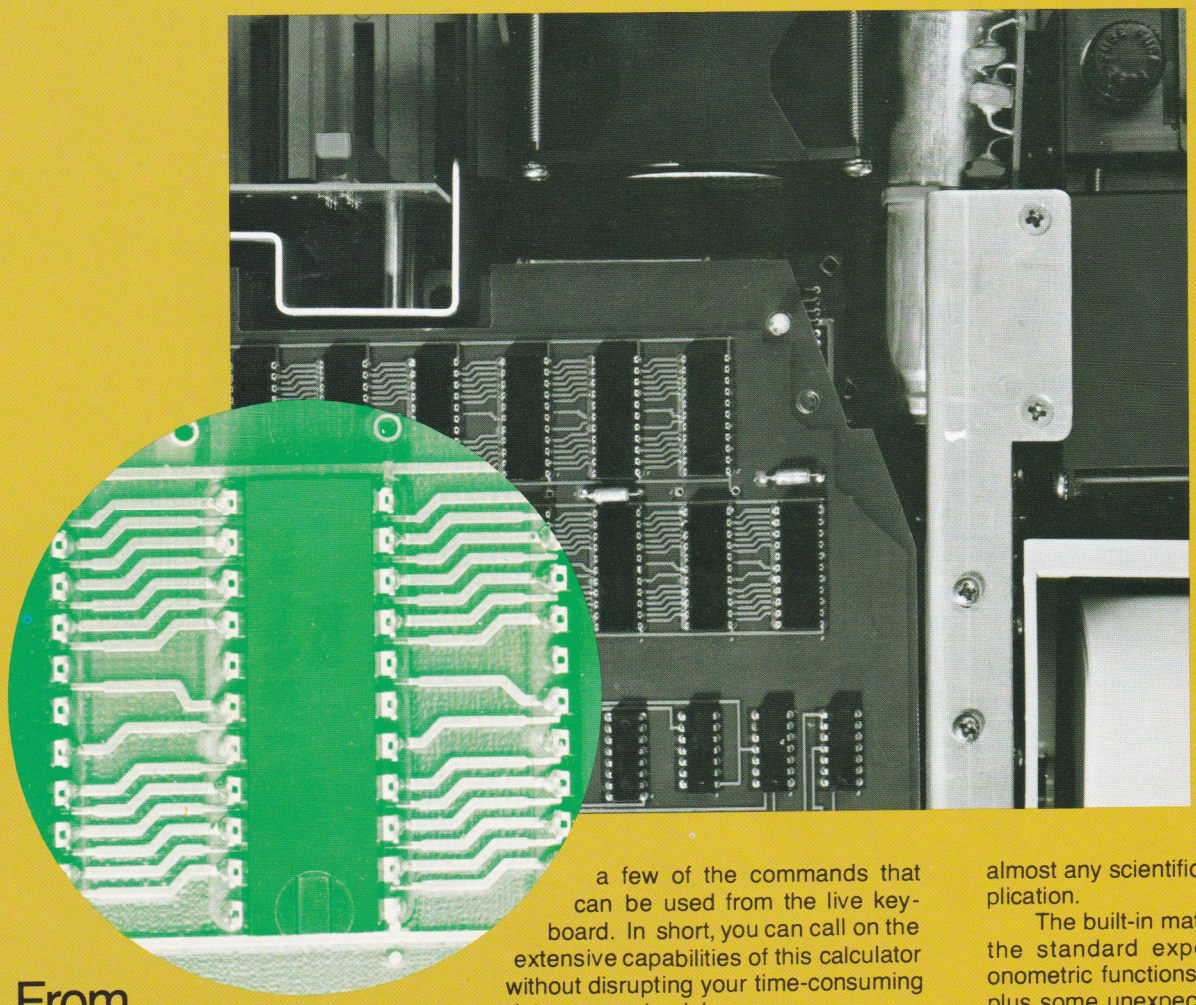
Jobs Fast!



TEMP. (DEG. F)
PRESSURE (LBS./IN**2)


STATISTICS VOL 3
f3
f4
f5
Entry
Sign Test
Wilcoxon
Spearmans
f9
f10
f11
Mann-Whit
Median
Contingency

POWER:
Performance Inside.....



From The Inside Out.

The standard 9825 is a power-packed unit with performance built into each keystroke. The live keyboard, memory load and record, language features, and the built-in math functions bring together convenience and capability.

Look at the versatility that a live keyboard gives you! Not only can you use this feature to perform extensive calculations independently of a running program, but you can debug programs by monitoring and even changing program variables while the program is running. Listing and recording programs and calling subroutines are only a few of the commands that can be used from the live keyboard. In short, you can call on the extensive capabilities of this calculator without disrupting your time-consuming data processing jobs.

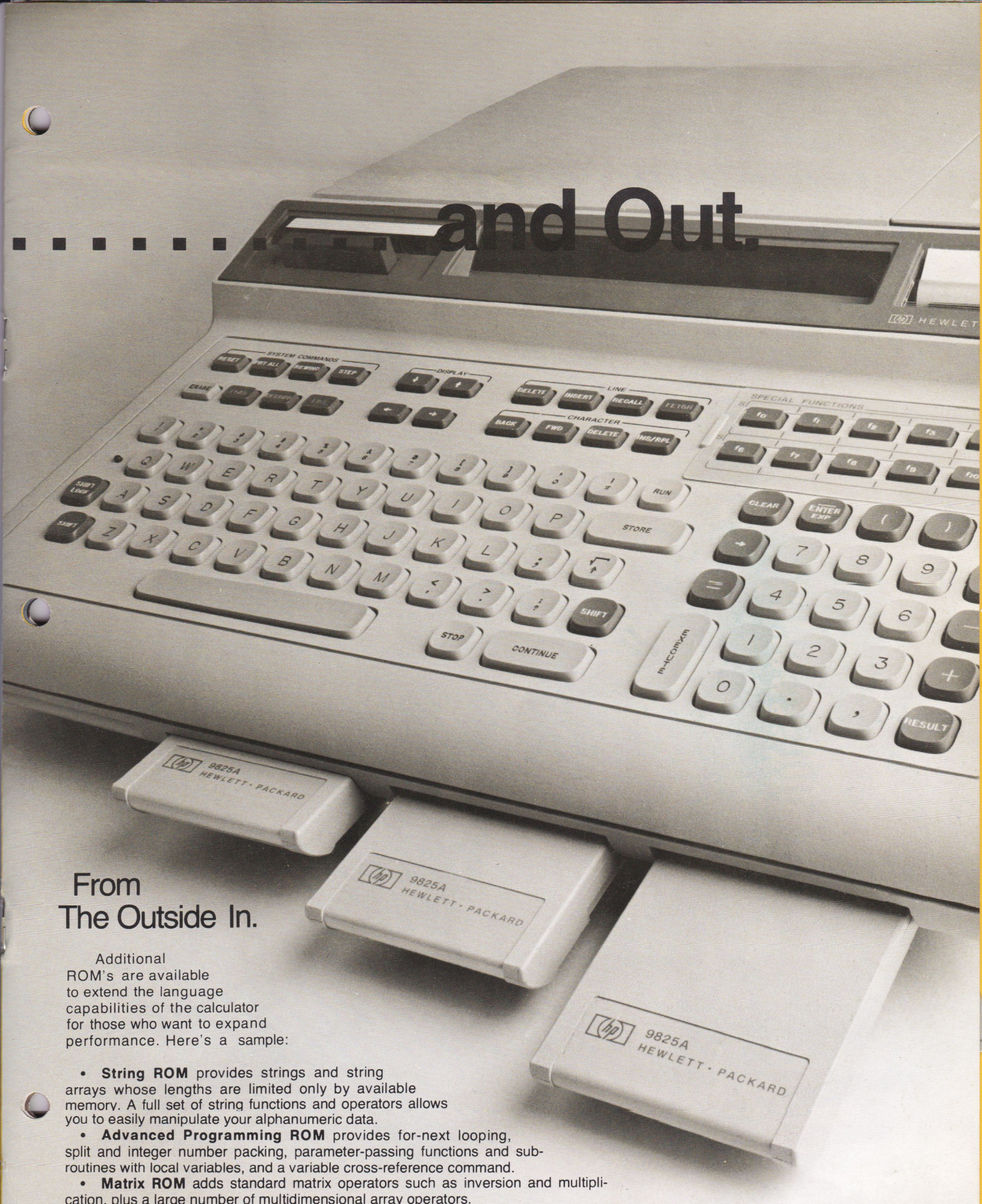
Memory load and record gives you the ability to temporarily suspend one job in order to run a completely unrelated job of higher priority. In an unattended data logging application, you can periodically save the current status of the machine on tape. This eliminates rerunning the entire program or losing logged data in the event of a power failure.

The ability to use up to 26 multi-dimensional arrays, with virtually no limit to their size, permits you to organize data logically. This alone can save a tremendous amount of time and program space. By combining this feature with optional lower bounds and dynamic dimensioning, you have the power to handle unusual problems in almost any scientific or engineering application.

The built-in math functions provide the standard exponential and trigonometric functions you would expect, plus some unexpected additional functions such as min, max, and modulus. A random number generator and two kinds of rounding functions provide additional convenience. Accuracy to 12 digits with a dynamic range of 10^{-99} to 10^{99} and an internal calculation range of 10^{-511} to 10^{511} complete the 9825 math capabilities.

HPL provides such proven features as implied multiply, imbedded assignments, flags, Boolean operations, relational expressions, symbolic and relative addressing, and the ability to enter expressions when the program asks for data.

and Out.



From The Outside In.

Additional ROM's are available to extend the language capabilities of the calculator for those who want to expand performance. Here's a sample:

- **String ROM** provides strings and string arrays whose lengths are limited only by available memory. A full set of string functions and operators allows you to easily manipulate your alphanumeric data.
- **Advanced Programming ROM** provides for-next looping, split and integer number packing, parameter-passing functions and subroutines with local variables, and a variable cross-reference command.
- **Matrix ROM** adds standard matrix operators such as inversion and multiplication, plus a large number of multidimensional array operators.

INPUT/OUTPUT:

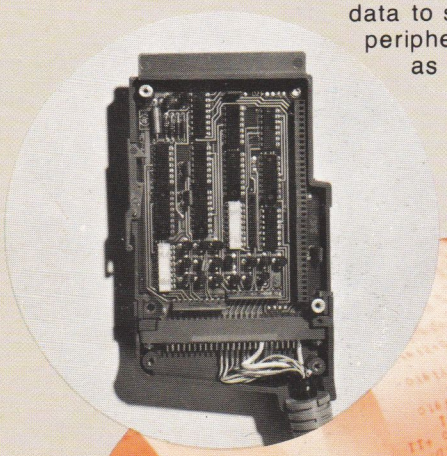
Building From The Basics.

The 9825 is designed to easily connect to peripherals and instruments without extensive hardware setup procedures or complex and time-consuming programming tasks. Three fundamental capabilities within the General I/O ROM allow you to control and communicate with most peripherals.

• **Formatted read/write** capabilities are the heart of the General I/O ROM. You can send completely formatted data to such peripherals as tape punches and printers and receive data from paper tape readers, digitizers, and card readers without any special knowledge of interfacing procedures.

• **Single Character Read/Write** capabilities of the General I/O ROM allow the 9825 to send and receive non-ASCII control characters as well as data words of up to 16 bits in length.

• **Status/Control** capabilities of the ROM let you monitor peripheral devices for error conditions or their operating status.



Extending To Sophisticated Systems.

The Extended I/O ROM gives you sophisticated interfacing capabilities by offering you these features:

• **Interrupt** permits the system to branch to a subroutine from anywhere in the program to service a request from an external device. This is accomplished by four simple statements.

• **Buffered I/O** allows you to increase your program throughput by providing a software storage buffer between the program and the external device. Transfers between the program and the buffer are under program control. Transfers between the buffer and the device are accomplished by an automatic interrupt routine whenever the device is ready for the transfer.

• **Burst Read/Write and DMA** have been developed for those cases where transfer time must be held to an absolute minimum. These allow you to capture real-time data for later processing or to communicate with high-speed synchronous devices.

• **HP-IB (HP-Interface Bus) Control** provides complete control of peripherals on the bus. Most functions are performed by the use of simple instructions. Additionally, the 9825 can function either as the bus controller or as a simple I/O device on the bus with an instrument or another calculator acting as the controller.

• **Bit Manipulation** provides such powerful instructions as AND, inclusive-OR, rotate, shift, addition, and bit testing of 16-bit numbers for structuring I/O data to form required bit patterns.

Performance for Peripherals and Interfacing.

• **Code Conversion** gives you the ability to convert ASCII input or output codes for compatibility with the I/O formats of other computers or instruments.

• **Time Out** allows you to specify alternative actions to be taken when a peripheral does not respond in a specified time. This prevents your program from "hanging up" while waiting for a device that is not operational.

• **Error Trapping** prevents anticipated error conditions from bringing the program to a premature stop by branching to an alternate set of program steps.

• **AUTO START** allows a program to recover from a power failure, even if unattended, by automatically loading and running the first file on the tape cartridge after the power is returned.

Putting It All Together.

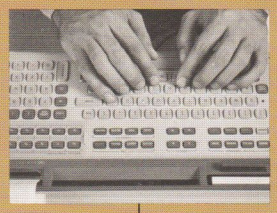
Interfacing to instruments and peripherals requires a variety of methods. Here's a sample of what you can order:

• **16-bit Parallel Interface** provides compatibility with card readers, printers, tape punches, tape readers, and general instruments.

• **BCD Interface** provides input lines for instrumentation having parallel, binary-coded decimal output. Some typical instruments are digital voltmeters and electronic counters.

• **HP-IB** allows you to connect up to 45 HP-IB compatible instruments to the calculator at one time.

FRIENDLINESS...



Write Program

BACK

Edit Program

J

STORE

LIST

LIST

```
0: dim A[20,20]
1: ldf 2,A[*];
 0→S
2: for I=1 to 20
3: for J=1 to 20
4: A[I,J]+S→S
5: next I
6: next I
7: prt "Average=
 ",S/400
8: spc 2
9: end
*11309
```

Program Error

```
0: dim A[20,20]
1: ldf 2,A[*];
 0→S
2: for I=1 to 20
3: for J=1 to 20
4: A[I,J]+S→S
5: next J
6: next I
7: prt "Average=
 ",S/400
8: spc 2
9: end
*10877
```

Corrected Program

RUN

Answer

```
Average=    4.59
```

A Language for Scientists and Engineers.

HPL is designed especially for scientists and engineers. Its power and efficiency provide you with technical problem-solving performance you'll quickly recognize. And HPL is an easy-to-learn, high-level language.

As you become familiar with the capabilities of the 9825, you will appreciate more and more its problem-solving performance. HP programmable calculators are known for their ease of use. The keyboard contains a set of Special Function keys which can be used as typing aids as well as "program selectors". A complete set of editing keys are not only powerful, but easy to use. For example, attempting to store an incorrect program line produces an error message in the display, and a flashing cursor over the error. Correcting the error is a simple matter. Inserting and deleting lines are just as easy. And in doing so adjusts all the branch addresses. Further enhancing this machine is its ability to print and display some Greek characters for typical computation terminology, as well as many European language characters for multilingual prompts and messages.

ROM's extend language capability with string, matrix, advanced programming, and input/output capabilities. These ROM's simplify complex tasks. For example, with the Extended I/O ROM, it takes only four commands to provide interrupt for the 9825.

Versatility At Your Fingertips.

The 9825 offers you versatility in the live keyboard that gives you the ability to solve little problems without interrupting your big jobs. Thus, the 9825 combines power with versatility to let you do more — conveniently.

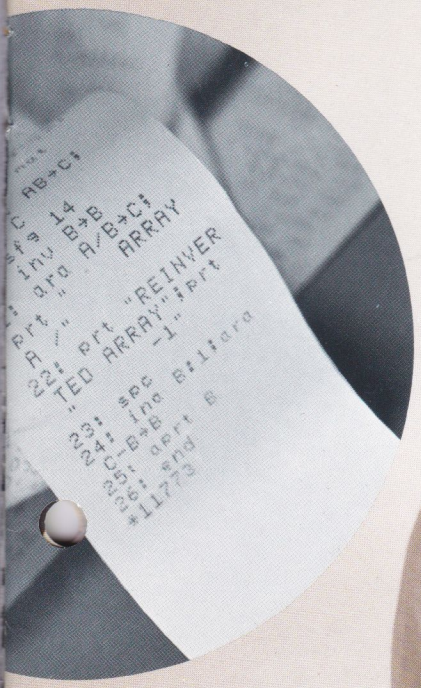
Featuring Convenience.

The cross-reference feature, for example, lets you list all the variables in your program and the lines in which they are used.

Other convenience features add to the language to give you easy operation and control of standard HP peripherals. The plotter ROM enhances the language features so plotting and labeling of charts and graphs is simplified.

Combine the high-speed data cartridge, a prerecorded program, Special Function keys, and AUTO START, and you have a computing package usable by someone who is familiar with the application, not necessarily the programming process.

Performance You Can Use.



run
jump
or
mark
if
you
need
next
bit
for

9825 · HP Technology Delivers Performance.

HP Technology.

HP 9825A performance is based on HP's proven calculator technology. State-of-the-art advances in NMOS and LSI techniques mean more cost-effective design, higher efficiency, and power for you. As a part of our continuing effort to keep you informed, current hardware and software advances are continually being published in KEYBOARD, Application Summaries, and Application Notes.

Peripherals Give You More.

Hewlett-Packard's specially designed input, output, and memory-related peripherals deliver increased data processing performance. Output variety comes in the form of an impact printer/plotter that gives you typewriter-quality output; punched tape; graphic plots; and others. Input can come from instruments, punched tape readers, a digitizer, a card reader, or. . . and you can order more memory. In essence, you pick and choose the options you need to fulfill the requirements of your job.

Service To Keep You Running.

As with all our products, the 9825 went through extensive testing to assure you a product that meets HP's long established reputation for quality. While the 9825 was going through more than 2500 hours of testing, the field offices were preparing to handle any and all problems that might arise. Competent service engineers were trained to repair your calculator quickly, minimizing downtime. Thus, providing you with maximum use of your calculator and its HP peripherals.

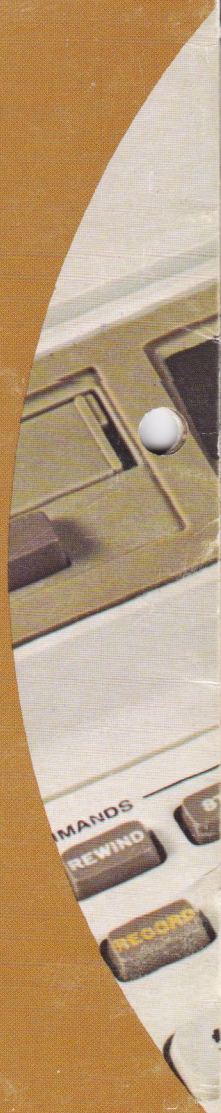
Software From People Like You.

Our international users club is composed of HP 9820A and HP 9821A Calculator owners. Hundreds of contributed programs in a variety of applications have been sent to the central library. Because these calculators use a language similar to the 9825 HPL, you have years of practical problem-solving experience available to you. For more information on what's available to you as a HP calculator owner, contact the nearest HP sales office. Your salesman in any one of 170 locations throughout the world can give you more information on the 9825, as well as fill you in on the entire HP computing calculator product line.


HEWLETT-PACKARD 9825A
SYSTEM COMMANDS
RESET
PRT ALL
SCRNPRT
STEP
ERASE
LOAD
RECORD
LIST
DISPLAY
LINE
DELETE
INSERT
RECALL
STATUS
CHARACTER
BACK
FIND
DELETE
INS/RPL
RUN
STORE
SHIFT
SHIFT LOCK
STOP
CONTINUE
CLEAR
EXEC STEP
RESULT

HEWLETT hp PACKARD

Sales and service from 172 offices in 65 countries.
Loveland, Colorado 80537



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