

# Hewlett-Packard advances in measurement and computation



## The HP-01: a new kind of "time machine" you wear on your wrist.

New tools sometimes demonstrate their full significance only after people have invented a new range of uses for them. Their existence precedes their "reason" for existence. The HP-01 may be such a tool. It results from a timely fusion of two Hewlett-Packard technologies—precision time measurement<sup>1</sup> and computation—and *interrelates* timekeeping with a computing element for the first time in a wrist-sized instrument.

Any resemblance between the HP-01 and a watch/calculator stops inside the case. What makes the HP-01 a new kind of "time machine" is that it can compute time data to produce numerical perspectives in time. For example:

It displays hours, minutes, and seconds in 12- or 24-hour formats. Adds and subtracts time intervals from present time, and lets you use time intervals or segments in arithmetic manipulations.

It times by increments of .01 seconds from 00:00.00 to 99:59:59. You can take cumulative splits (freeze an exact time in the display as the stopwatch continues

"It's against reason," said Filby.  
"What reason?" said the Time Traveller.  
—H.G. Wells, *The Time Machine* (1895)

to run) as often as desired. It starts backwards from any nonzero time up to 99:59:59, counts down to zero, sounds an alarm, and counts forward as described above. (A second, separate alarm can be set to sound anytime during a 24-hour day). You can make continuously updated arithmetical calculations using the stopwatch or timer.

It displays the current day, month, year (or month, day, year). Preprogrammed 200-year calendar allows the HP-01 to find the number of days between dates, or any date given any other date and number of days, or the day of the week or year.

It computes. Whether interactively or not, it adds, subtracts, multiplies, divides; performs chain, mixed chain, serial, and mixed serial calculations; finds percentages, changes signs. Computes to 11-digit accuracy and rounds the display to seven digits. Automatically switches to scientific notation when the answer is equal to or greater than  $10^7$  or less than  $10^{-4}$ , with a range of  $1 \times 10^{-99}$  to  $9.999 \times 10^{99}$ .

Lets you store data and recall it for further computation in memory. You can, for instance, keep a numeric quantity in continuous memory.

Admittedly not everyone's cup of tea, the HP-01 offers fascinating ways to compute and keep track of numbers in the time domain. For example, you can compute and then count down the time it takes for a command to reach a spacecraft several hundred million miles away. The HP-01 can alternately show you the time remaining until the message is received, displayed to seconds or hundredths of seconds, and the distance the radio waves have yet to travel, updated each second. When the message arrives (T zero) the HP-01's alarm sounds automatically.

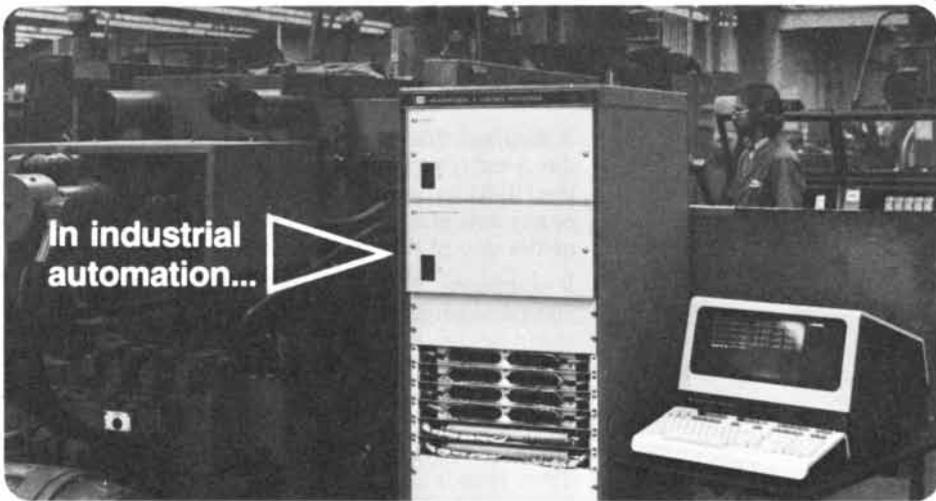
Because only a relatively small number of these instruments will be made, we suggest you start your own discovery process by mailing the coupon now. Call 800-648-4711 in the U.S.A. (in Nevada, call 323-2704 collect) for the name of the HP-01 retailer nearest you.

The HP-01 with accessories costs \$650\* in stainless steel, or \$750\* with gold-filled case and gold-plated band. With its 200-year calendar, it not only bridges the generation gap, but represents a legacy of sorts.

<sup>1</sup>HP cesium beam frequency and time standards keep time with an accuracy equivalent to a 1-second error in 4500 years. They are used for calibration at observatories and at national centers for measurement standards throughout the world. The HP-01 is calibrated against this standard, though obviously it does not possess the same degree of accuracy.

**For more Hewlett-Packard advances, turn the page.**

In laboratory testing... ▷



Racked in the open cabinet below the HP 2240 at left are signal conditioning trays and screw terminations. These optional trays isolate the HP 2240's electronics from the high voltages and electrical noise common to industrial automation applications.

## This little box is a computer conserver.

Incorporating HP's new silicon-on-sapphire LSI technology, this microprocessor-based analog/digital subsystem is designed to simplify product testing and real-time monitoring and control. It performs measurement and control tasks that your computer previously had to handle, freeing the computer for other uses and reducing program timing constraints.

Think of the HP 2240 as your industrial computer's right arm. Too often, automating measurement and control jobs has required complicated computer languages and programming, and expensive interconnection devices. The HP 2240 changes all that. In conjunction with the HP Interface Bus (HP-IB)<sup>2</sup>, it simplifies task communications and programming. It decouples automation tasks from the computer through its microprocessor intelligence: timing, scanning, event synchronizing, formatting, and interrupt tasks can now be delegated to the HP 2240. And an advanced level of self testing allows you to speed your installation and lower your service costs.

The 16-bit silicon-on-sapphire (SOS) microprocessor, tailored for controller applications, operates at the high speed required for real-time applications, and consumes just half the power of comparable systems. This built-in intelligence, and an industry-

standard interface (HP-IB), let you implement measurement and control solutions in three easy steps:

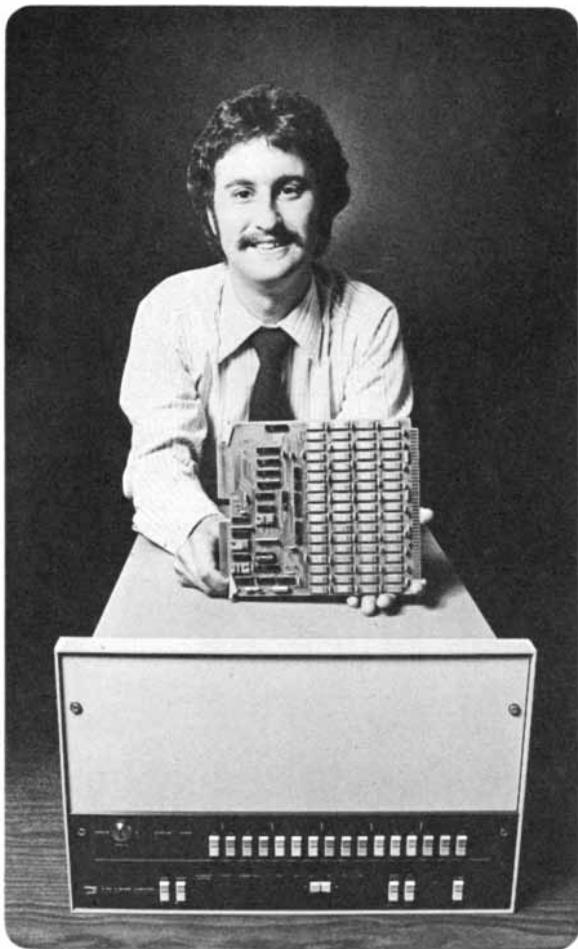
- **Connect to the computer of your choice.** The HP 2240 is designed to operate with any computer that is HP-IB compatible. With the HP 2240, the HP 1000 and 21MX series computers and HP 9800 series desk-top computers become powerful tools for the acquisition of data and the control of physical and electrical processes.

- **Connect to your measurement and control application.** Through common industrial sensors, the HP 2240 accepts both analog and digital inputs and outputs, and several interrupt-driven inputs, to simplify interfacing with real-time processes.

- **Give simplified instructions to the HP 2240.** The powerful command set of the HP 2240 is easy to use. When you delegate real-time tasks from the computer, the HP 2240 holds the task instructions in memory and executes them in sequence without further computer interaction—freeing the computer for other operations.

The HP 2240 measurement and control processor, with a typical mix of analog and digital I/O cards, costs about \$6000\*. Low-cost laboratory data acquisition systems based on the HP 2240 and HP 9825 desk-top computer start at \$15,000\*. High-performance equipment control systems based on the HP 2240 and HP 1000 Model 20 computer system begin at \$27,600\*.

<sup>2</sup>HP's implementation of IEEE Standard 488-1975.



**Small wonder: a breadbox-size computer with up to 1 million bytes of fault-control, semiconductor memory—at 5¢ a byte.**

For technically and/or environmentally demanding applications where processing reliability, or high speed, or both, are essential, HP 21MX and HP 1000 computers can now contain up to 1 megabyte of memory in modules of 128k bytes.

With up to 1 million bytes of fault-control semiconductor memory, HP's small computers can go to

work in demanding applications where large or disc-based systems were previously needed:

- in rugged environments such as ships and airplanes, or in remote, unattended locations such as offshore oilwell platforms—applications where reliability is critical and downtime must be held to a schedule;
- in applications such as physics and electronics labs, where data must be acquired at speeds beyond those possible with a disc.

A new fault-control memory system uses 22-bit Hamming error correction code to ensure high reliability: Because the system automatically corrects all single-bit errors, programs can continue even if a memory chip malfunctions. Additionally, the system reports all double-bit errors and most errors of three bits or more. Fault-indicating LED's pinpoint failures at chip level. Maintenance can be performed on a scheduled rather than emergency basis, and unscheduled downtime is effectively avoided.

Reliability tests indicate that mean time between failures (MTBF) for an HP 21MX computer with 1 megabyte of high-density, fault-control memory is 6000 to 8000 hours—roughly a year without probability of failure.

The 128k byte high-density memory modules that make it all possible cost \$6400\* each, and can be used with 21MX K, M, and E series computers, and HP 1000 computer systems.

Here are prices for typical configured computers:

0.5 megabyte: An 8½-inch-high 21MX E Series computer with 512k bytes of memory, fully capable of running the supporting RTE software: \$35,950\*.

1 megabyte: A 12¼-inch-high E Series computer with 1024k bytes of memory: \$59,800\*.

1.8 megabytes: A 12¼-inch-high E Series computer with an optional memory extender adding 768k bytes, for a total of 1792k bytes of memory: \$108,800\*.



1504 Page Mill Road, Palo Alto, California 94304

For assistance call: Washington (301) 948-6370, Chicago (312) 255-9800, Atlanta (404) 955-1500, Los Angeles (213) 877-1282.

Mail to: Hewlett-Packard, 1504 Page Mill Road, Palo Alto, CA 94304.

Please send me further information on

- HP-01
- HP 2240 measurement and control processor
- HP high-density memory module

Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

\*Domestic U.S. prices only.

00748