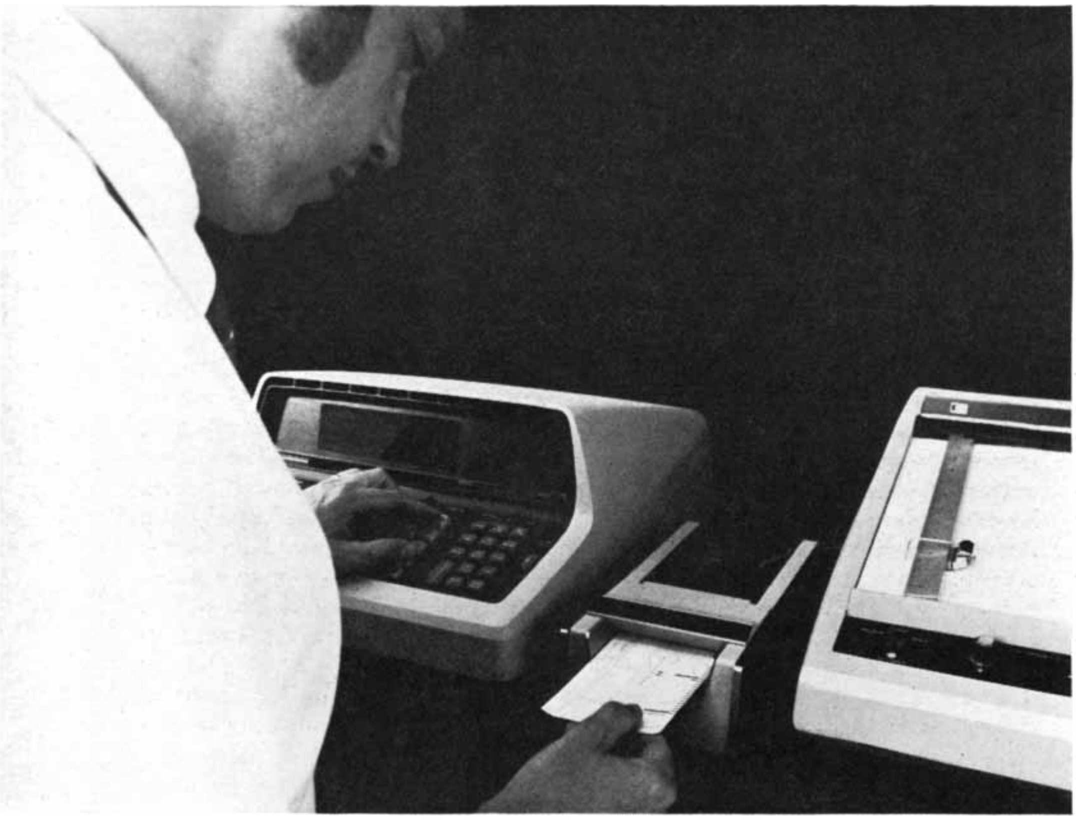
Some things are changing for the better.



Turn your desk calculator into an on-line data handling system

Let's assume that you now perform scientific and engineering computations on the HP 9100 Calculator, entering data off-line on its keyboard.

But now you'd like to get the answers automatically, on-line, by letting your data-gathering instruments communicate directly with your data processing system. You might think the time has come for a large investment in a computer.

Not so. With the new HP 2570 Coupler/Controller, you can now tie many of your HP measuring instruments (more than 40 models including voltmeters, counters, GC integrators, quartz thermometers) to the 9100 and get reduced data directly. By simple cable connections.

You can even tie a teletype to the 2570 and get complete reports of your experiment, formatted as you like them and prepared automatically during the experiment, on a typewritten sheet or punched paper tape. Or on the calculator X-Y Plotter.

We'd be happy to send you a 24-page Bulletin that explains how the 2570 can expand the capabilities of your 9100 for on-line data handling and even for automatic test systems. Write for "Calculator-Based Instrumentation Systems." Price of the Coupler is only $1625. Interfaces cost $450 – $1500 per device.

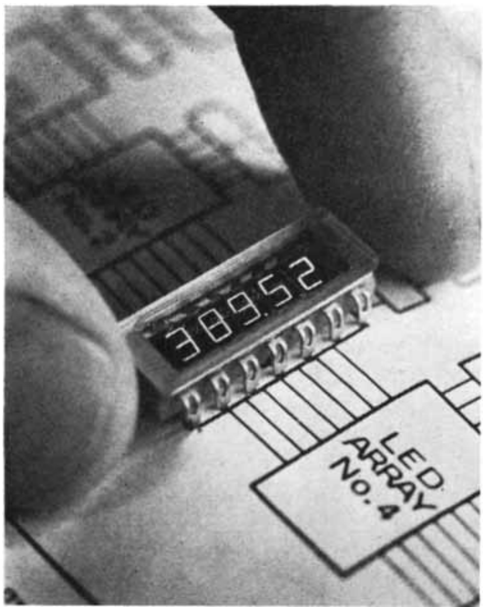
Keep an eye on solid-state displays: they're moving fast

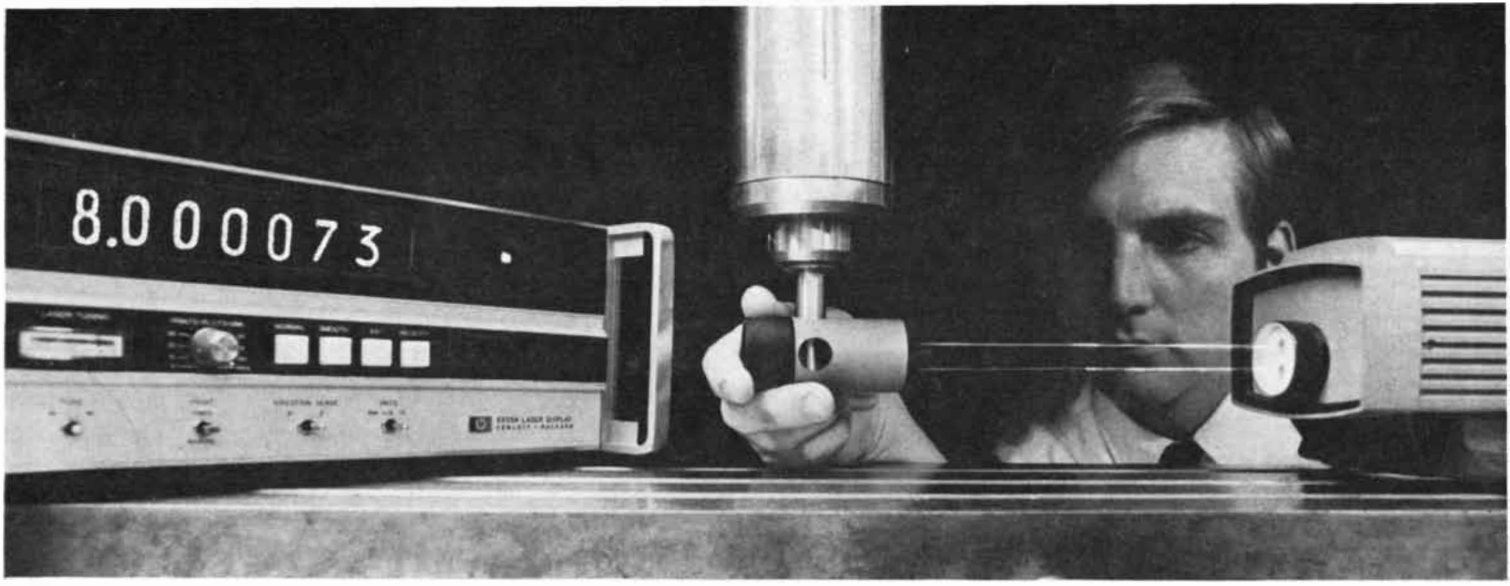
If you haven't been paying very close attention in the last several months, some fast-moving developments in solid-state displays based on GaAsP light-emitting diodes (LED's) have undoubtedly escaped your attention.

Earlier this year, HP introduced an alphanumeric display that incorporates 35 LED's per character, arranged in a 5 x 7 dot pattern. There are two outstanding advantages to this design: it can display highly readable letters and symbols as well as numbers, and it is suitable for dynamic as well as static operation. In static operation, all of the diodes that are needed to form a character are *on* continuously; in a dynamic display, the LED's are scanned one row or column at a time, at high speed. If the scanning rate approaches 100 times per second, the eye sees only the complete character and there is no flicker. The scanning technique not only permits sharing the same character generator and scanning circuits by several displays but also greatly reduces the number of interconnections.

HP scientists have just announced the development of a monolithic display which is fabricated from a single GaAsP chip into which seven LED's are diffused. Its seven-segment character (contrasted to the previous 35 dot matrix) is suitable only for number generation. Counter-balancing this, its fabrication from a single chip is fully automated, a fact that has already reduced its price to $7 per character (compared to $30 for the alphanumeric) and promises a further reduction to $2 in large quantities.

All HP solid-state displays are hermetically sealed, IC-compatible and have a life expectancy of at least 100,000 hours. We'll be glad to send you technical data on any of them.





For interferometers, two frequencies are better than one

All interferometers built since Michelson's original experiments in the 1890's use two light beams of the same frequency. They measure distance by counting the cycles of beam intensity in the reflected light caused by alternate constructive and destructive interference of the two beams, as the reflector is moved. Direction is measured by detecting the phase difference between two portions of the measuring beam. These two signals are used to drive a counter one way or the other, after dc amplification.

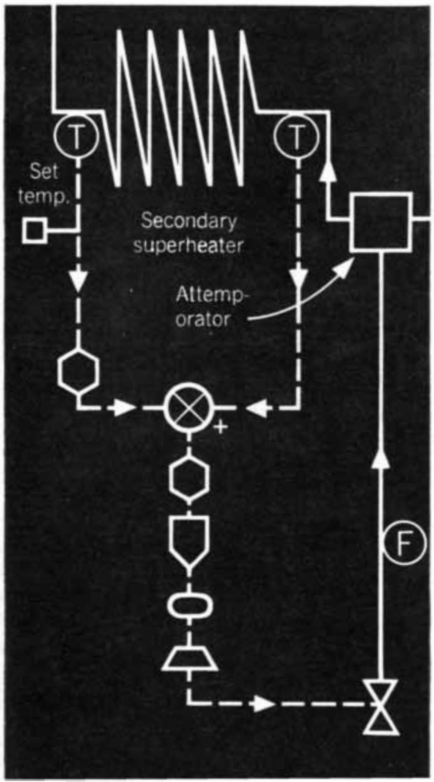
And there's the rub. Any variation in the intensity of the light source due to atmospheric disturbances or normal dc amplifier drift, can cause erroneous readings or put the system out of commission.

A new interferometer completely avoids this problem by the simple expedient of operating entirely on ac. This was made possible by the development, in the HP Laboratories, of an entirely new laser which oscillates *on two frequencies simultaneously.* An axial magnetic field Zeeman splits its main spectral line into two frequencies, 1.8 MHz apart and of opposite circular polarization (thus easily distinguishable).

One of these frequencies (f_1) is isolated in a reference path. The other (f_2), isolated in a measuring path, is bounced off an external reflector and recombined with f_2 at the interferometer. If the external reflector remains stationary, the difference between the two is exactly 1.8 MHz. But when the reflector is moved, the measuring beam's frequency is Doppler-shifted at a rate of about 1 MHz for a 1 foot-per-second reflector velocity, and the difference between these two frequencies becomes ($f_1 \pm \Delta f - f_2$).

Movement is determined by sensing differences between the Doppler signal and the constant reference signal ($f_1 - f_2$) and counting the cycles on separate registers. A subtractor keeps a running count of the differences in quarter-wavelengths of light, while a built-in IC calculator converts wavelengths to units of length.

Besides a radical decrease in susceptibility to air turbulence, the HP Model 5525A Interferometer ($11,500) measures distance to 1 microinch resolution, requires no warmup and tunes itself automatically. These characteristics suggest great utility in metrology laboratories, for measurements from microinches to 200 feet, as well as machine tool use. The August 1970 issue of the HP Journal tells the whole story: write for your copy.



New tool for on-line system analysis

Very recently at a large power station in England, a system analysis of an attemperator or temperature control loop was completed on-line, without disturbing plant output in any way. As the control characteristic of the loop was displayed on a screen during the experiment, adjustments were made to optimize the control system and the results were displayed immediately.

The job of the control system engineer — to predict how the system will react to a given input pulse — has not always been so easy. If he tests the system with an impulse that is large enough to produce a measurable response, plant output is changed in a way that cannot be tolerated.

Some progress was made when control system analysts discovered the power of cross-correlation. With this mathematical technique, a test noise signal is applied to system input at such low levels that system output is not changed beyond normal background disturbances. Yet by cross-correlating the test noise with the system output over a relatively short period, the engineer is able to extract the impulse response of the system; background disturbances do not interfere because they are uncorrelated with the test noise.

At first, cross-correlation did not help because it could only be accomplished after the fact, through off-line digital computation. What made the difference in the English experiment was the availability of two new HP instruments: a Model 3721A on-line correlator that's about as easy to use as an oscilloscope, and a Model 3722A precision noise generator that synthesizes repeatable pseudo-random noise, ideally suited to system analysis. The correlator costs $8325 and the noise generator $2650. On request, we'll be glad to send you a packet of information on these two instruments, correlation and the on-line experiment.

If you're involved in the techniques of digital analysis or correlation, we can offer a new product-oriented handbook, "Discrete Signal Analysis," which will help. For this 96-page booklet or any of the other material mentioned, write to: Hewlett-Packard, 1508 Page Mill Road, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

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