NEW ELECTRONIC INSTRUMENTATION

SPRING 1968

HEWLETT hp PACKARD

For your catalog file

Here is a digest of new Hewlett-Packard electronic instrumentation, components and data products being introduced this spring—with many of them to be seen first-hand at trade shows and on HP demonstration vans.

Since the majority of these new products are not covered in the 1968 HP Catalog, *please keep this booklet for future reference.*

HEWLETT hp PACKARD

Desk-top calculator
. . . outperforms some computers

Spend your time on engineering – let the 9100A do the calculating!

Here's a new stand-alone problem-solver that is easily accessible for solving intricate scientific and engineering equations. Or, team it with your large computer or time-share facility—doing many jobs faster and easier than either—for less money.

Log functions, trig and hyperbolic functions—all available in milliseconds at a key-depression with the Hewlett-Packard **9100A** Calculator. Forward and inverse polar/rectangular coordinate transformation in all four quadrants. Floating decimal point calculations for 10 significant digits of accuracy over the range, 10^{-98} to 10^{99}. Fastest cycle times in the calculator field, with 10-place trig operations under 300 milliseconds. There are 23 magnetic core registers, with 19 available for display and storage.

Program up to 196 steps with the keyboard or handy magnetic cards. And, all keys are in algebraic or English notation; no language to learn! Use conditional qualifiers to program looping and branching decisions. Couple the Calculator to other peripherals, including optional silent printer. Model 9100A is priced at $4900.

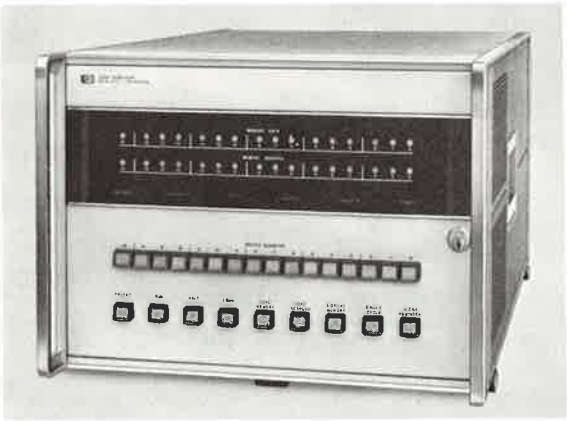
NEW HP INSTRUMENTATION

Time sharing with a small computer system . . . save up to 90%

You can save up to 90% of your present time-sharing costs with Hewlett-Packard's new 16-terminal computer system. Utilizing the Model 2116 computer with disc memory, the HP Time-Sharing System **2000A** is within economic reach of many users who cannot afford conventional time-sharing systems. Terminal cost of less than $10 per day is typical.

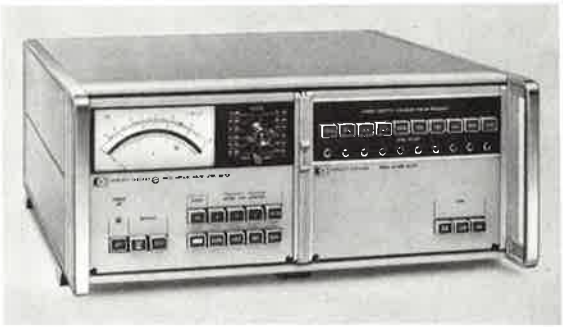
The system uses Conversational HP BASIC language for easiest user/computer interaction. Operator terminals can be connected through telephone lines or direct-wired to the computer. Full duplex inputting eliminates telephone line noise errors by confirming each character. Each input statement is checked by the compiler for format and syntax as it is entered. 2000A: about $75,000; or, lease for about $2500/month.

Low-priced 16-bit computer



$9950 now buys a computer with all the family characteristics of the Hewlett-Packard 2115 and 2116 Digital Computers, in terms of input/output flexibility and extensive software capability. Model **2114A** Computer has the highest ratio of performance-to-price of any computer available today. It is designed for the user whose needs for later optional expansion are less demanding. Either 4K or 8K memory size, with 2 μsec cycle time. The processor and self-contained power supply are all contained in a compact 12¼-inch high package, suitable for bench or rack use.

Measure sound level accurately with this precision portable meter



Obtain accurate RMS, Peak or Impulse measurements from this precision 5 Hz-20 kHz sound level meter. It is portable, adhering to tighter specifications than standard sound level meters, providing you with measurements of short sound bursts which closely approximate the response of the human ear. Peak sound pressure is measured accurately—even single pulses as short as 100 msec. And it measures accurately, independent of environmental temperatures from −10° to +45°C or relative humidity up to 95% at 40°C.

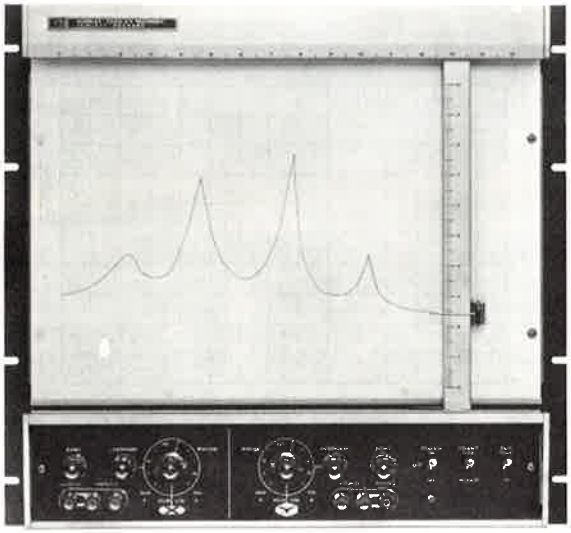
For recording, there's a DC output proportional to meter deflection; no longer must you provide an appropriate detector (peak or RMS) for the type recording you desire. And, a positive indication of overload is provided for all types of signals. Line-operated (110 or 220V) Model **8052A**, $670; battery operated Model **8062A**, $720; ANC weighting network option, add $25. Available accessories include: octave filter, ⅓ octave filter, condenser microphone, and preamplifier.

Digital magnetic tape units have extended read/read capability

With a single HP digital tape unit, you can now read *both* of the industry 7- and 9-track digital tape recording formats—a task that previously required two separate units.

This extended "read/read" capability means considerable savings in design and production of your own digital systems. And, for the first time, operators can conveniently change tape format with a flip of a switch; a single reel transport is used. This new dual-format capability is available for either the **3030**-series Tape Units (tape speeds to 75-ips) or **2020**-series Tape Units (speeds below 45-ips).

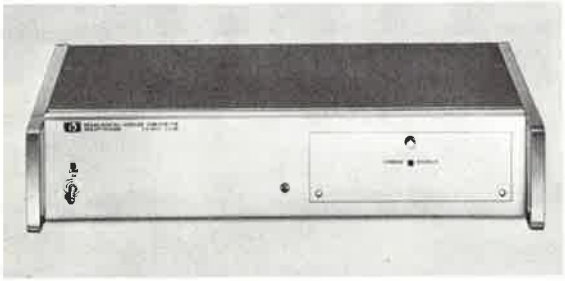
Low-cost 11″ x 17″ X-Y recorder with improved dynamic response



Twenty inches/sec slewing speed and increased acceleration means improved dynamic performance in this new X-Y recorder. Common-mode rejection is improved too, now enabling 100 dB rejection of 60 Hz common-mode interference.

At no increase in price over earlier "A" model, new Model **7005B** also has lockable zero and vernier controls, and a rear input connector. Worthwhile features of earlier model are retained: guarded, floating inputs, electric pen lift, Autogrip silent electric paper holddown, easy convertibility from bench to rack mounting. And performance remains high: 1 mV/inch max. sensitivity, ±0.2% position accuracy, ±0.1% linearity. Model 7005B: $1195 (no additional charge for metric calibration).

Fast digital-to-analog converter with isolated bipolar output

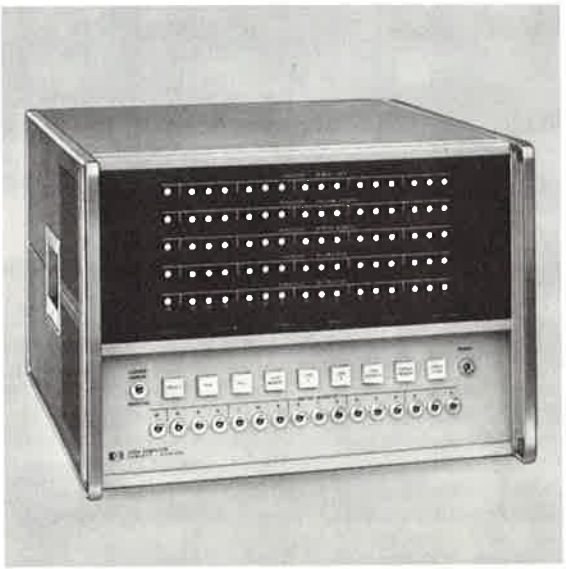


Model **6933A** Digital-to-Analog Converter changes digital information into a DC voltage for operating programmable instruments. It responds quickly, stepping across its output range from −10 V to +10 V or vice versa <20 μsec. Use it to program power supplies in automatic testing systems, or to generate special waveforms by programming a computer or digital programmer to step the Converter through voltages rapidly.

Output voltage can be programmed with 1 mV resolution. Transfer storage retains voltage while your computer is occupied with other tasks. All-solid-state for speed, with excellent electrical isolation between input and output—eliminating grounding problems between your computer and systems driven by the new Converter.

The 6933A drives any power supply capable of external voltage control, including almost all HP supplies. It supplies up to 10 mA itself, and you can use it to drive light loads directly. It behaves as any well-regulated power supply should: short-circuit proof, no overshoot on turn on/turn off/power removal, line and load regulation within 0.2 mV, ripple and noise <1 mV p-p, transient recovery <10 μsec. And it's flexible: plug-in board construction accommodates codes and logic levels of most computers. 6933A: $1200.

High performance digital computer at an economical price



New, economical member of the HP computer family—the 16-bit bench top Model **2115A**. Fully software and interface compatible with other HP computers, it has 2 μsec cycle time and either 4K or 8K memory. Like all HP computers, the 2115A interfaces easily and economically with many HP measuring and recording instruments; plus usual peripherals such as card and tape readers, tape punches, line printers, plotters, mag tape decks.

In addition to I/O circuit cards, other standard plug-in options include direct memory access for disc and high speed applications, and hardware multiply and divide for increased processor power. Eight I/O channels with multilevel priority interrupt included in main frame; externally expandable.

Software and hardware are modular, fully designed, documented, and deliverable—bringing you immediate system start-up without further hardware or software design effort on your part. Complete software includes FORTRAN, ALGOL, and Conversational BASIC compilers; Assembler, Real Time Monitor, utility routines, diagnostics, etc. A modular Basic Control System lets you easily adapt the 2115A to your specific application. Price of 2115A with 4K memory: $14,500.

NEW HP INSTRUMENTATION

Compact, economical 10 MHz counters

Six-digit version Model 5321B Counter, only 3 inches high.

Save space and money with either of two new precision HP counters. Now available in a desirable 3-inch height and 7¾-inch width, they are among the lowest cost 5 Hz-10 MHz counters available today. Both types have readout storage for a non-changing display during each gate interval, plus a simple time interval measuring capability.

Standard 4-digit Model **5321A** has a power-line-controlled time base, 0.1 and 1 sec gate times, 100 mV maximum input sensitivity, is priced at $350. Also 5-digit version ($425) and 6-digit version ($475) available.

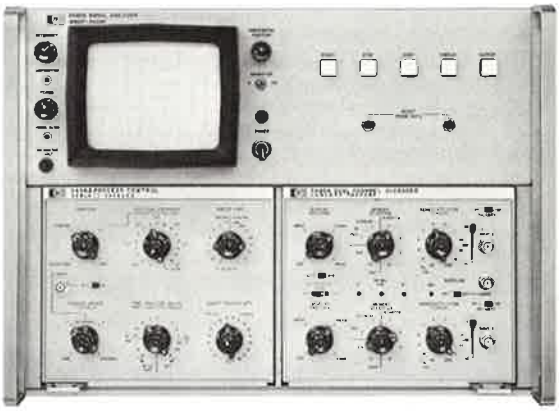
More accurate 5-digit Model **5321B** has a crystal oscillator time base, gate times from 0.01 to 10 sec, BCD output. Also a front panel stepped attenuator for counting higher input voltages. Price is $700, with 6-digit version ($775) also available.

Low-cost atomic frequency/time standard

Here's a compact and lightweight atomic frequency/time standard for applications requiring more accuracy, ruggedness and faster warm-up than quartz oscillators—yet at half the price of the even more precise HP Cesium Beam Standard!

Model **5065A** Rubidium Frequency Standard ($7000) has long-term variations $<2 \times 10^{-11}$/month; short-term stability $<1 \times 10^{-11}$ rms for 1 sec averaging ($<5 \times 10^{-12}$ rms, 100 sec); warm-up time 45 minutes, max.; weight 37 lbs; 5¼ x 16¾ x 16⅜ inches. Unique features include built-in adjustable synthesizer for changing time scales by thumbwheel switches (atomic to UTC, etc.) and a fine frequency adjustment for changes to $<2 \times 10^{-12}$. Options include a built-in clock movement and divider with very high quality 1 ppsec output (add $1500), and a built-in battery standby power supply (add $300).

Recover signals that are buried in 1000-times-greater noise



Also known as a signal averager or enhancer, the **5480A** Signal Analyzer recovers repetitive signals buried in noise by averaging out that noise. It's ideally suited for applications in medicine, biology, spectroscopy, physics and vibration analysis, as well as electronics.

The flicker-free display is continuously calibrated and stationary—it does not crawl or go off screen as signal-to-noise ratio is being enhanced. And, current results are furnished while averaging is still in process. The 5480A processes slowly-varying signals as well as stationary ones by using an exponential weighing technique; memory is large—1024 words, 24 bits each. A 100 kHz sampling rate gives an input bandwidth of 50 kHz. Flexible interface with digital and analog devices. Future developments are accommodated by analyzer plug-in design. Signal analyzer price (including dual-channel amplifier and process control plug-ins) is $9500.

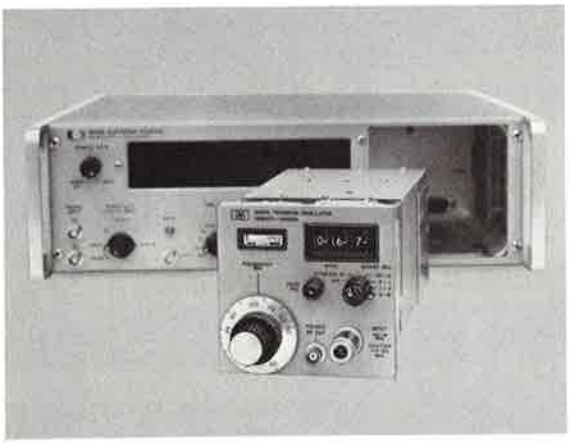
Versatile and economical 12.4 MHz universal counter

Model **5325A** Universal Counter is the most versatile of all HP counters without plug-ins. It measures frequency, time interval, period, ratio, multiple periods and multiple ratios—over a wide range.

The stable time base has an aging rate $<1 \times 10^{-8}$/day, and there's $<\pm 2.5 \times 10^{-6}$ change from 0° to 50° C. Frequency range is DC-12.5 MHz and time interval range is 0.1 μsec-10^8 sec. A unique readout method blanks insignificant zeros to the left of the most significant digit in the 7-digit display, for ease and accuracy of observation. Fail-safe time interval measurements prevent a period measurement from being made if the "stop" input channel drops out, or if trigger level controls are improperly set. BCD output included; buffer storage permits printout while next measurement is in progress.

Input impedance is 1 MΩ/30 pF. Input sensitivity is 100 mV, and a fast display time setting readies the counter for new reading in 100 μsec. Remote programming included. Extensive use of IC's contribute to the 5325A's compact size and economical price of $1200.

Easy-to-use transfer oscillator with wide phase-lock range, direct readout to 18 GHz



Plug this transfer oscillator into any of your HP high-frequency counters (5245/5246/5247-series) to extend their ranges up to 18 GHz for CW, FM or pulsed signals.

It uses a broadband sampler in a phase-locked loop; provides outstanding input sensitivity, typically −23 dBm at 50 MHz and −8 dBm at 18 GHz (−7 to −4 dBm guaranteed worst case); eliminates bothersome manual tuning of input mixers. Readout given directly in frequency; no offset to add. Unique features include simple one-dial tuning, wide phase-lock range (±0.2% of input frequency) for measuring noisy signals, automatic inhibit to prevent readout until fully tuned. CW and pulsed-measurement zero beat easily detected with meter, instead of complex oscilloscope patterns necessary with conventional transfer oscillators. A pulsed RF output permits use of **5257A** Transfer Oscillator ($1850) as a down-converter.

IC counters for preset limit control and measurement

5332B Dual Preset Controller/Counter

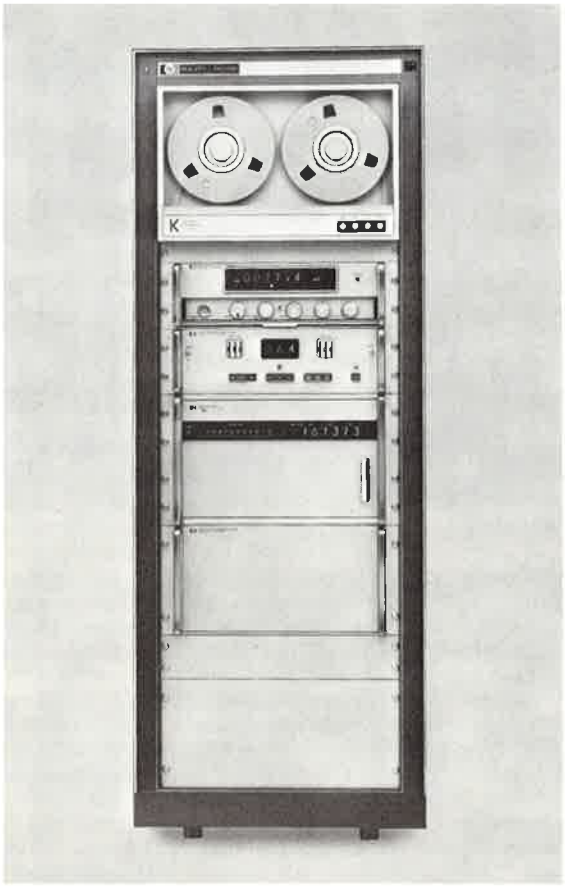
All the features and characteristics needed in preset limit control and measurement applications are built into four new integrated circuit counters, which issue signals when an input count reaches the value preset into thumbwheel limit switches.

Models **5331A** ($850) and **5332A** ($1000) have a single set of limit switches, while Models **5331B** ($950) and **5332B** ($1100) have dual sets of switches for both high and low limits. Crystal time bases in Models 5332A and 5332B permit measuring frequency or rate, frequency ratio, time interval; use as delay or pulse generators (Models 5331A and 5331B are strictly totalizers). All units: 2 MHz count rate; 100 mV input sensitivity; 1 MΩ/30 pF input impedance; BCD output standard.

Higher system speed with new digital recorder storage options

Increase your data system's speed by using a **5050A** Digital Recorder equipped with new storage options —which now lower data transfer time from 50 msec to 0.1 msec. Easily compatible with integrated circuits, the storage options require <1.3 V input. Print speed of 20 lines/sec; 18 column capacity; fast economical code and format changes; and reliable, quiet operation. Standard 5050A, $1750 plus $35 for each column to be printed; storage for 10 columns, add $200; storage for all 20 columns, add $400.

Digital data acquired faster with greater resolution, noise immunity



2012B Data Acquisition System

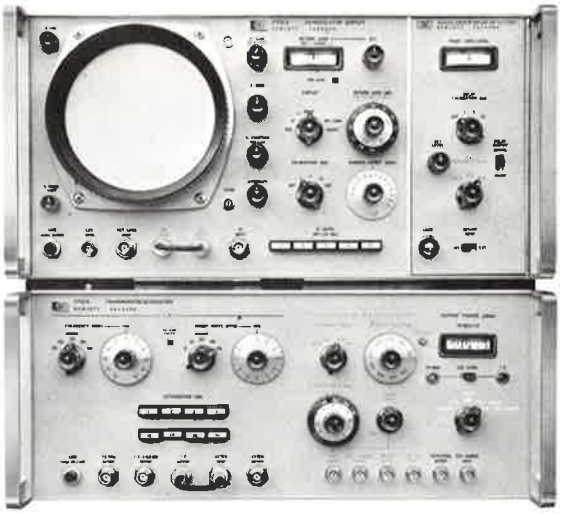
New 2012-series Data Acquisition Systems scan, measure and record results with 5-digit resolution at up to 14 channels/sec. They achieve a combination of speed and resolution without sacrificing noise immunity—measurement rates are combined with 152 dB suppression of 60 Hz common-mode interference. All the usual types of digital recorders are offered: magnetic tape, punched tape, punched cards, printed output.

Systems use the 2402A Digital Voltmeter, a systems-oriented, lab-quality voltmeter capable of 0.01% accuracy. Most sensitive range is 100 mV DC full scale providing a 1 μV resolution without preamplification, and enabling measurement of millivolt signals at fast reading rates. Maximum voltage range is 1000 V.

The 2012 systems can be tailored to fit a wide range of measurement applications. Add AC voltage, resistance, and frequency measuring capabilities to the basic DC simply by inserting appropriate printed circuit cards.

Model **2012A,** which can scan 200 3-wire inputs, and records on printed tape: $12,240. Model **2012B** also scans 200 3-wire inputs; uses new Model 2547A Coupler (see adjacent column) to interface with a wide variety of recording devices; 2012B prices begin at $13,825.

Make group delay and linearity measurements on microwave links . . . up to 1800 channels

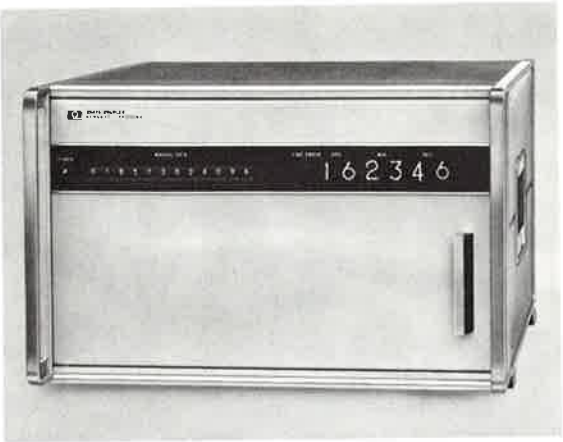


The new HP Microwave Link Analyzer Test Set is a compact system for measuring group delay to 100 psec resolution, and for displaying linearity. It also permits measurement of band flatness and power gain or attenuation.

For the first time, communications systems can be easily analyzed *at* IF (fundamental or swept), as opposed to cumbersome baseband-to-baseband techniques. Simultaneous group delay and linearity display; and a spectrum display is provided at 70 MHz. Also, it has a 50 MHz sweep width capability.

Total **Test Set** system is $7200, complete with accessories: 3-port hybrid, two 75Ω terminations, standard mismatch, two 75Ω U-couplers, three 75Ω cables. (Or, purchase the major Test Set elements separately: **3701A** Transmission Generator, $2700; **3702A** Demodulator Display, $3750; **3703A** Group Delay Detector, $750.)

Coupler converts BCD data for recording via tape, cards or printer

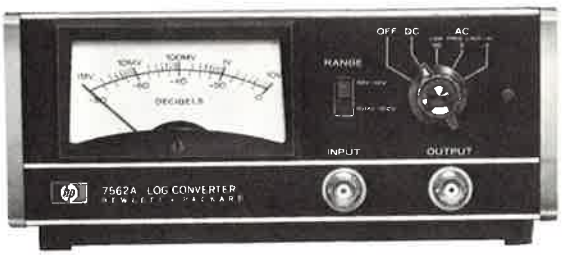


Data from up to 6 digital sources (DVM's, scalers, etc.) can be stored, translated from parallel entry code to serial form, and transferred to a recording device with the new **2547A** Coupler. By simply changing plug-in cards, you can adapt it to a variety of recording media: magnetic tape, punched tape, punched cards, typewritten log, as well as teleprinter. Coupler also retransmits BCD input for simultaneous operation of digital printer.

Input is equally flexible. Coupler handles 60 characters simultaneously, 10/plug-in card; works with either 8-4-2-1 or 4-2-2-1 BCD format over a wide range of logic levels.

Both input and output cards can be changed anytime after installation by swinging out front panel, making it easy for you to modify a system without unracking the coupler. Optional plug-in clock for adding time-of-day to your records, supplying timed start-stop intervals for system control. Also, optional manual data entry adds 20 characters for run identification, date, or other numerical information. Model 2547A (including output device), from $3600 to $8275.

Logarithmic converter with true RMS response, exceptional low-frequency range

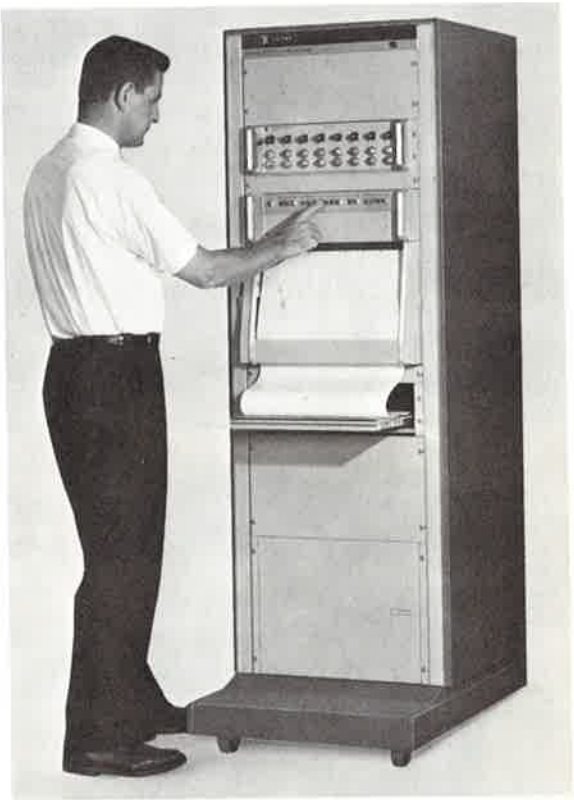


Model **7562A** Logarithmic Converter has a frequency response from 100 kHz all the way down to 0.5 Hz, and it functions over a wide, *wide* 80 dB input dynamic range. Use it as an AC detector when using an X-Y recorder to plot frequency response curves of filters, transformers, amplifiers, and the like—or wherever you need a DC output proportional to the logarithm of AC or DC inputs.

Conversion accuracy is ¼ dB with DC inputs, ½ dB with AC inputs between 2 and 50 kHz, and 1 dB over remainder of frequency range. It responds to the *true* RMS value of input waveform, regardless of waveform shape (it uses a thermocouple as the sensing element in a constant-level, null-seeking servo circuit).

Two input ranges: 1 mV-10 V, and 10 mV-100 V. Output is 0-800 mV DC full scale with conversion factor of 10 mV/dB. Front panel meter shows signal level over an 80 dB range on one scale. Price: $995.

Fluid/thermal-writing recording systems now with economical 8-channel medium-gain amplifier



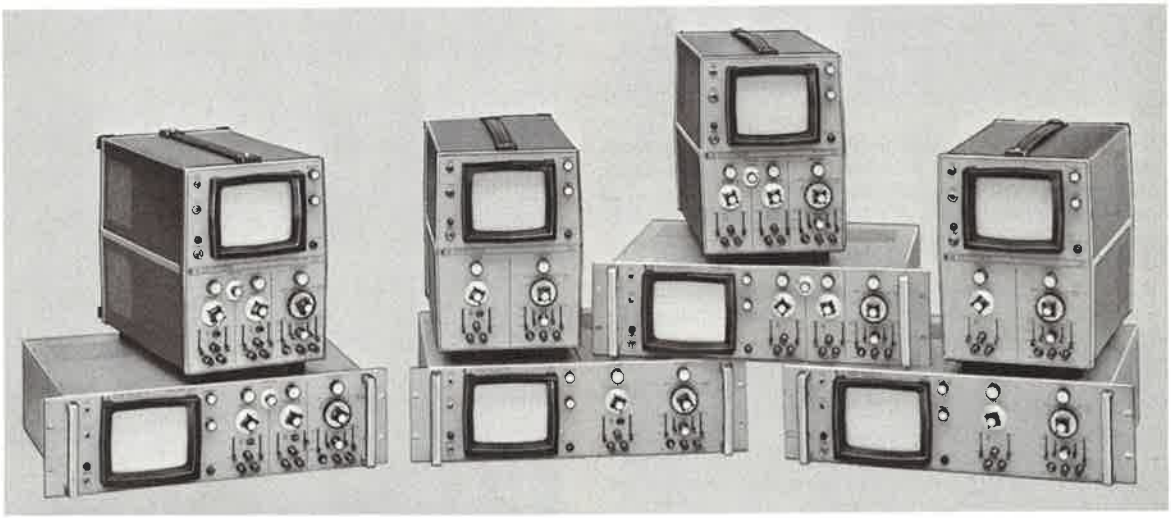
7878A Fluid-Writing System with 8821A Amplifier

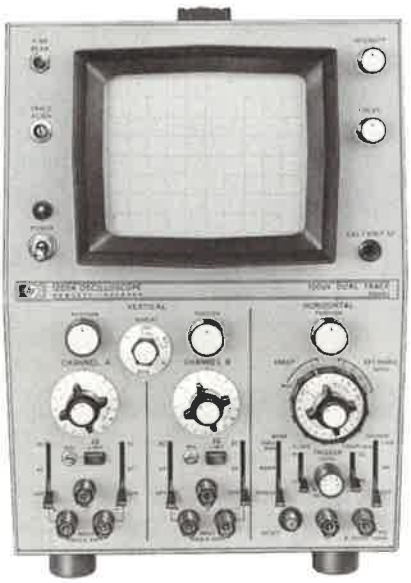
Eight independent channels of identical amplification are economically provided by new **8821A** Medium Gain DC Amplifier—ideally suited for signal conditioning duty in HP fluid-writing and thermal-writing recording systems.

Maximum calibrated sensitivity of 0.5 mV/div, with gain ranges conveniently varied from 1 mV/div to 5 V/div with each channel's front panel control. Also smooth gain, position and calibration front panel controls. Input floating and guarded with CMR up to 100 dB at 1 mV/div. Constant 9 MΩ input Ƶ on lowest ranges to 50 mV/div.

7729A Thermal Recording systems with 8821A from $7205; **7878A** Fluid Recording systems with 8821A from $11,200; 8821A alone, $2500.

New DC-500 kHz oscilloscopes . . . capabilities formerly found only on high-frequency lab scopes





1200A Dual-Trace 100 μV Oscilloscope

New generation of general-purpose low-frequency scopes: high stability, low noise, good common-mode rejection, greater triggering flexibility, simplified controls, direct-coupled Z-axis, rectangular CRT, compact size, and light weight. Eight models give you a choice of single or dual channels, 5 mV or 100 μV sensitivity, compact cabinet or 5¼″-high rack-mounting versions.

All-solid-state circuitry gives you a trace that stays put; drift <50 μV/hr. Noise below 50 μV; CMR >100 dB at 100 μV/division with input signal up to ±10 V, DC to 10 kHz. Connect it directly across a strain-gage bridge loaded with DC, and measure AC components on the screen. In automatic trigger mode, change frequency, DC level or trigger amplitude at will—without a tremor on the trace. And keep a visible baseline even with *no* signal.

Cabinet model prices (same for rack-mounting models): Single-channel Models **1206A** (5 mV/div) $715, or **1202A** (100 μV/div) $790; dual-channel Models **1205A** (5 mV/div) $875, or **1200A** (100 μV/div) $990.

Splash-proof carrying cases hold modular instruments

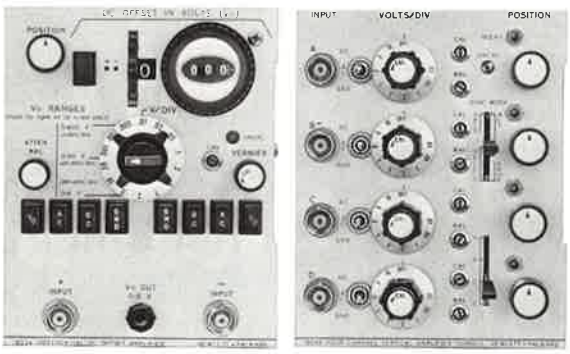
Rugged carrying/storage cases fit HP instruments having ⅓-rack width (5⅛″) cabinets—including voltmeters, oscillators, counters, and many others. Instruments slide in, are held by catches. Smartly styled cases, made of acid and heat resistant high-impact ABS plastic, in two sizes: Model **11075A** holds 8″ deep instruments, Model **11076A** takes 11″ deep instruments; $45 each.

Compact oscilloscope has variable persistence plus storage

181A Oscilloscope—cabinet and rack-mount versions

This general-purpose 50 MHz scope gives you the versatility of plug-ins—including delayed sweep and 4-channel display—while applications are greatly increased by variable persistence and storage. Model **181A** Oscilloscope's storage capability allows you to store different traces for side-by-side comparison, for over an hour. Maintenance-free, solid-state design brings you reliability and low (31-lb) weight in a compact, bench-top package. All this, plus a large 8 x 10 cm viewing area for $1850; rack-mount version for $1925 (plus plug-ins: Dual-Channel Amplifier, $650; Time Base, $475; Time Base/Delay Generator, $800—plus two new units described below).

Two new plug-ins for 180/181-series oscilloscopes



Using the slide-back technique for greater accuracy, Model **1803A** Differential/DC Offset Amplifier plug-in generates a very stable, precise DC voltage which may be read to 4-digit resolution. Foolproof, interlocked controls prevent unwanted offset changes as sensitivity is changed. Used as a differential amplifier, it has high common-mode rejection and will withstand a 10 V common-mode signal on the most sensitive range of 1 mV/div. 1803A: $950.

For direct comparison of four signals simultaneously, use the Model **1804A** 4-Channel Amplifier plug-in (especially useful with the 181A Oscilloscope). It features 50 MHz bandwidth and 20 mV/div sensitivity for each channel. Ideal for logic circuit testing or time correlation measurements. Unused channels may be turned off for uncluttered displays of three channels or less. 1804A: $975.

For design engineers: RF spectrum analyzer with absolute vertical calibration

Visual display of absolute signal levels vs. frequency over the 1 kHz-110 MHz spectrum means you can now evaluate circuit performance in a more practical, meaningful way—in the frequency domain!

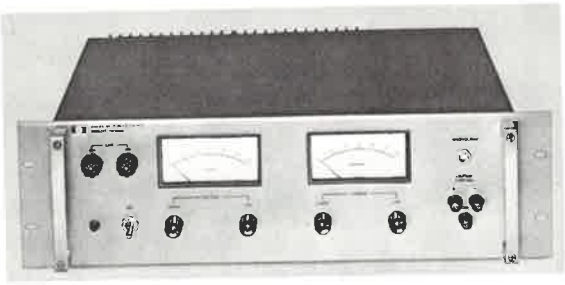
The 8552A/8553L RF Spectrum Analyzer (which can also well be called a frequency domain oscilloscope) quickly and accurately measures signal levels, frequency response, harmonic and intermodulation distortion, spurious oscillations, frequency stability and spectral purity, modulation index, gain and attenuation. You'll use it as an essential design tool on circuits such as oscillators, amplifiers, mixers, modulators and filters.

Both display axes are calibrated in absolute units: amplitude −130 dBm to +10 dBm (0.7 μV-0.7 V), frequency scan widths 2 kHz-100 MHz. Distortion-free dynamic display range >70 dB. Resolution so high you can measure a signal spaced only 200 Hz away from another signal 40 dB stronger. On narrow scan widths, automatic frequency stabilization keeps residual FM as low as 10 Hz p-p, making it easy to evaluate parameters such as spectral purity, residual FM, and frequency drift.

The **8552A** IF Section ($1900) and **8553L** 110 MHz RF Section ($1800) plug-ins fit either of two internal graticule CRT Display Sections: Model **140S** ($725) with normal persistence, or Model **141S** ($1525) with storage and variable persistence (especially desirable for full spectrum, flicker-free displays when slow sweeps are used for highest resolution, or when low repetition rate or transient phenomena are being analyzed).

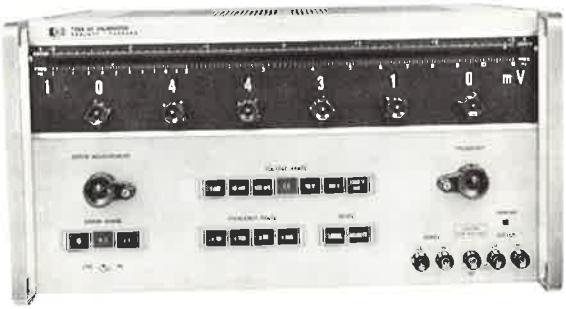
NEW hp INSTRUMENTATION

Lo-V, Hi-A DC power supplies with built-in circuit protection



New all-silicon "B" versions of Models 6264 and 6267 DC Power Supplies have built-in crowbar circuit that reacts within 10 μsec to protect supply and load in event of accidental overvoltage. These are low voltage, high current, rack-mounting supplies with lab-quality performance: 0.01% line and load regulation, <500 μV rms ripple, Constant Voltage/Constant Current operation, remote programming capability; auto-series, auto-parallel, and auto-tracking operation, and fast recovery (<50 μsec). Model **6264B** (0-20 A/0-20 V) and Model **6267B** (0-10 A/0-40 V): $525 each.

AC calibrator . . . ±0.02% amplitude accuracy, 10 Hz-110 kHz continuous range

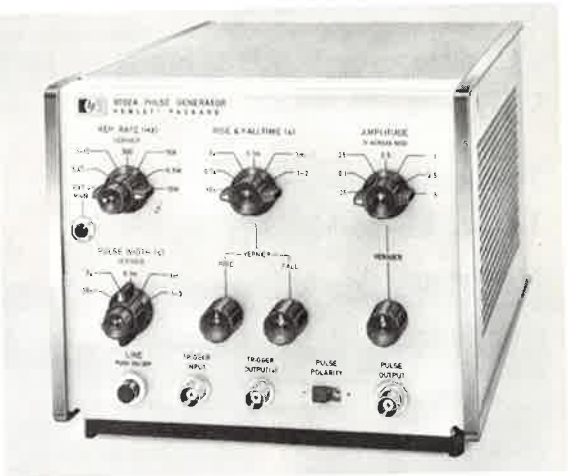


AC voltages—at levels accurately known within ±0.02% from 50 Hz to 20 kHz, and within ±0.05% all the way up to 110 kHz—are generated by the new **745A** AC Calibrator. Its high accuracy holds for at least 90 days following calibration, in 20-30°C ambient temperatures. You can use it on production lines, engineering labs, and other unprotected areas as well as in the standards lab for calibrating voltmeters, amplifiers, and other AC instruments.

Output frequency is continuously adjustable in four overlapping bands, 10 Hz-110 kHz; output amplitude is selectable with 6-digit resolution from 0.100000 mV to 109.9999 V in six decade ranges (1 mV fs-100 V fs with 10% overranging permitted). Built-in measurement error system gives direct reading of % error in tested device.

It's programmable: frequency range and voltage range are selected by electrical closures to ground, frequency on any range is set by externally supplied analog voltage. Only three adjustments are needed to calibrate the new Calibrator with respect to an external DC standard. Magnetic voltage dividers and continuous thermocouple transfer standard comparison to internal reference insure long-term accuracy. Model 745A: $4500.

Fast, accurately controllable pulse waveshapes . . . at low cost



Model **8002A** Pulse Generator offers fast, accurately controllable waveshapes at a very reasonable price. Rise and fall times are variable in 6 steps from 10 nsec to 2 sec, with individual verniers for precise independent control of each—providing the flexibility of a more costly function generator.

The 8002A's fast rise time, plus the versatility of 0.3 Hz-10 MHz rep rates and 30 nsec-3 sec pulse widths, allow circuits to be tested in real time, under actual operating conditions. Positive or negative pulses, constant 50Ω source impedance. Sophisticated performance at the competitive price of $700.

Plug-in function generator sweeps four decades logarithmically

Model **3305A** Sweep Plug-In for the Model 3300A Function Generator sweeps over four decades in 3 ranges, (0.1 Hz-1 kHz, 1 Hz-10 kHz, and 10 Hz-100 kHz) with continuous start-stop control. Now you can explore the frequency response of broadband, low-frequency devices in one continuous sweep. You can also use the Sweep Plug-In/Function Generator as a programmable frequency source by supplying an external voltage to set the frequency anywhere within the selected four-decade range.

It's easy to operate: Select start and stop frequencies with independent calibrated controls. Frequency increases exponentially as sweep progresses; but sawtooth voltage provided for driving external recorder or oscilloscope is linear and, for your convenience, sawtooth amplitude remains constant regardless of how you set start and stop controls.

Sweeps can be triggered one at a time or they can be repetitive. You can select fast sweeps for flicker-free scope presentation or slow sweeps for graphic recorders. You can also manually set frequency with a front panel knob; one complete turn sweeps the output from selected start frequency to stop frequency. Model 3305A Sweep Plug-In ($975) works with any Model 3300A Function Generator ($625).

1 Hz-10 MHz square waves from low-cost mini-generator

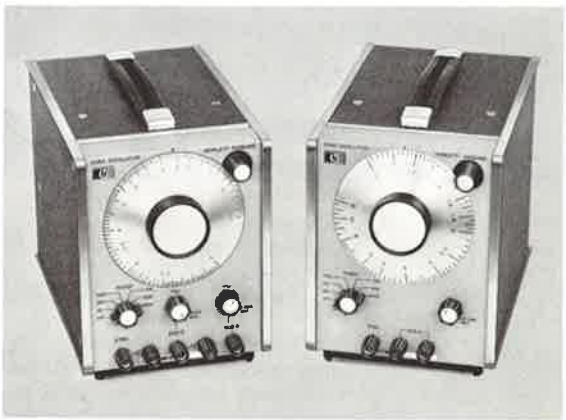
Costing only $195, the **220A** Square Wave Generator is a laboratory-grade instrument which produces square waves at 1 Hz-10 MHz repetition frequencies.

Square-wave output rise and fall times <15 nsec; source impedance of 50Ω preserves clean wave shape by absorbing reflections from impedance mismatches; negative-going amplitude controllable 0 to −5 V peak into 50Ω load. Frequency is selected by vernier control within any of 7 decade ranges; can also be controlled throughout any range by external −1 to −13 V. External voltages between 0 and −1 V suppress square wave generation, so you can also use a VCO input to gate generator's output. Compact, weighs only 3½ lb.

4 Hz-2 MHz sine and square waves simultaneously . . . flat and clean, in one low-cost, compact package

With two separate outputs Model **209A** simultaneously delivers sine waves flat to ±0.5% with <0.1% distortion, and transient-free square waves with rise and fall times <50 nsec. Output is at least 10 V RMS open-circuit for sine waves, 20 V p-p (symmetrical around 0) for square waves. The no-parallax recessed dial is calibrated to better than ±3%. Long-term stability is typically a startling ±0.01% of selected frequency and ±0.05% of amplitude! Feed a voltage-varying wave of any shape into the SYNC input, and produce simultaneous sine and square waves, leveled in amplitude, and clean in waveform. SYNC output for scopes, counters, etc. Convenient HP modular cabinet, under 7″ high; weighs less than 7 lbs. AC-powered (115 or 230 V, 50-400 Hz), only $320.

Super-flat frequency response and clean sine waves . . . new low-cost 5 Hz-1.2 MHz oscillator



Model 209A (left) and Model 204C Oscillators

Newest in the traditional HP family of RC Wien bridge oscillators, Model **204C** has a flatness of ±0.5% (±0.05 dB), a distortion below 0.1%, and long-term frequency stability of 0.01%. Adding the sync input will provide a clean sine wave out for most repetitive signals. Separate sync output for scopes, counters, etc. Max. output 5 V open circuit, 2.5 V into 600Ω. AC-powered 204C, $250 (Optionally, with plug-in, field-interchangeable battery power supplies equipped with mercury batteries for $265—or with rechargeable batteries for $285).

NEW INSTRUMENTATION

Auto μ-wave network analyzer for production, engineering and standards lab applications

Completely characterize microwave devices and networks quickly, automatically, and at standards lab accuracies with the **8541**-series Automatic Network Analyzers—covering as wide as 0.11-12.4 GHz in a single system.

Basic measurements of complex reflection and transmission coefficients made with the 8410A Network Analyzer at frequencies supplied by an 8690-series Sweep Oscillator achieve real power with the addition of an HP 2115A stored-program computer. Now the system becomes fully automatic: test frequencies and measurement functions are programmed, and the resulting data may be transformed and manipulated (as directed by the program) to present information in its most usable form.

Overall accuracy is far greater than individual instrument accuracies because system measures and stores its own residual vector errors, as determined through comparison with *physically derived* reference standards. By subtracting system errors from measured data for the device under test, extreme accuracies are achieved, with direct traceability.

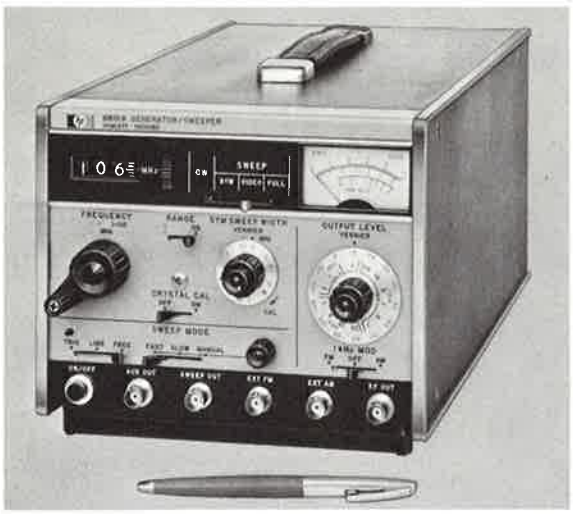
Non-technical personnel, using a simple programmed text of instructions, can make rapid measurements (30/sec) easily, with extreme accuracy. Ideal for production testing, the system's overall versatility commends it for design engineering and standards lab applications as well.

HP automatic network analyzers have a broad range of options for tailoring them to your specific requirements. Systems are easily expanded at any time by adding new test units or software; wide array of computer peripherals available. Basic single-band 0.11-2 GHz system (including programmable signal source and network analyzer with two-port measuring unit, 2115A Computer, oscilloscope displays and general-purpose software): $81,030. Similar system for multi-band 0.11-12.4 GHz coverage: $97,230.

IRIG-specified FM-recording center-frequencies from handy, portable source

Get stable and accurate CW frequencies conveniently for aligning FM reproduce electronics without having to permanently tie the source to your recording system. Completely portable, Model **3605A** Frequency Source provides all the IRIG-specified crystal-controlled frequencies needed, with push-button ease! In addition, it offers absolute frequency accuracy of ±0.05% for all frequencies, and excellent stability—making it extremely useful for flutter-testing in low and intermediate bands. Compact, light-weight (6 lbs.), $495.

High performance AM/FM/CW 0.1-110 MHz sweeping signal generator



It's only 6″ x 7½″ x 16″ in size and weighs just 21 lbs.—yet the Model **8601A** Sweeper/Signal Generator offers performance exceeding most laboratory and production line requirements. Two-band frequency coverage (0.1-11 MHz and 1-110 MHz) embraces important activities such as: broadcast, communications, FM bands; IF's of all sorts; active and passive networks like amplifiers, filters, attenuators.

Signal generator characteristics include ±1% frequency accuracy (±0.01% at 5 MHz marker intervals), <500 Hz residual FM, calibrated output from +20 dBm to −110 dBm with ±1 dB accuracy, and extremely low leakage. Internal 1 kHz modulation provides precise 30% AM and 75 kHz deviation FM. And you can externally modulate (AM and FM) at rates to 10 kHz with very low distortion.

As a swept signal generator, 8601A provides unprecedented sweep function flexibility while maintaining ±0.5% sweep linearity and ±0.25 dB full-range flatness. There are calibrated sweep widths to 10 MHz symmetrical about dialed center frequency, a separate "video sweep" starting at bottom of the selected frequency band and stopping at dialed frequency, and a "full-band" sweep. The 1% center frequency accuracy and ½% sweep linearity obviates a need for frequency markers in most swept-measurement setups. All-solid-state 8601A is priced at $1975.

Scattering parameter test set for convenient, comprehensive network analysis 0.1-2 GHz

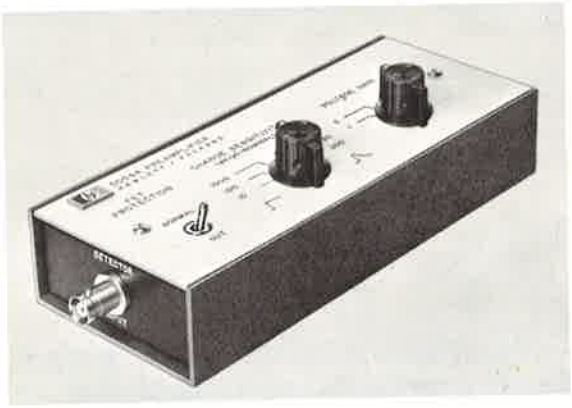
S-Parameter Test Set with device holding accessories

Measure all four scattering parameters of two-port networks, 0.1-2 GHz, with the **8745A** S-Parameter Test Set. Use it with 8410A Network Analyzer or 8405A Vector Voltmeter to characterize active and passive networks—transistors, negative-resistance devices, amplifiers, filters, switches, etc.—either via swept-frequency or CW.

With test device in place, each s-parameter is measured with simple front-panel pushbutton selection; no need to re-connect or manipulate the unknown. Parameter selection can be remotely programmed, making this Test Set especially useful for automatic systems. Each parameter's magnitude and phase are highly accurate because measurement ports are well matched with high directivity. Built-in calibrated line stretcher permits adjustment and precise location of measurement plane.

Accessory device holders include **11604A** Universal Extension ($600) with movable precision air-line arms to accommodate almost any coaxial component. Also, **11600A** and **11602A** Transistor Fixtures ($425 each) accept TO-5/TO-12 and TO-18/TO-72 packages for bipolar and field-effect transistors; selectable circuit configuration: common-emitter/-base/-collector for bipolars and common-source/-gate/-drain for FET's; transistor biasing via external power supply connection to Test Set bias input connector. Model **11599A** Quick-Connect Adapter ($75) facilitates simple change of device holders. 8745A S-Parameter Test Set, $3000.

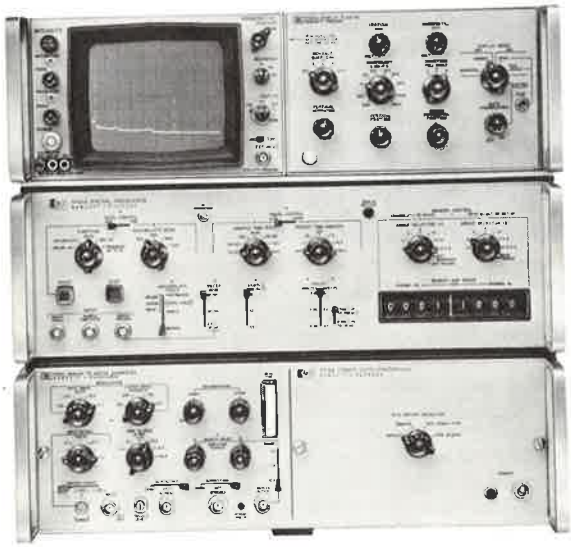
General-purpose preamplifier



Stable, low-noise general-purpose nuclear preamp you can use with a variety of detectors—semiconductor, scintillation, gas proportional or geiger. When changing detectors, simply snap the appropriate bias resistor into a clip!

Model **5554A** doubles as a preamp or a combination preamp-amplifier. Front panel switches vary the charge sensitivity and voltage gain, and select the pulse shape. It has its own pulse-shaping capability, and can output directly to almost any pulse analysis equipment. Diode-protection guards the FET against damage from high voltage transients. 5554A: $300.

100 MHz ADC multichannel analyzer



You get reliable data quickly, in any of 3 operating modes—pulse height, sampled voltage or multichannel scaling—with the **5400A** Multichannel Analyzer. It has an exceptionally fast analog-to-digital converter (ADC) with a clock rate of 100 MHz, and it processes pulses in 13 μsec when the full 1024 channels are being used!

The 5400A is useful in applications outside the nuclear measurement field. In sampled voltage analysis mode, monitor an input waveform, sample it on command of clock pulses, and read out "pdf" (probability density function—a statistical indication of the proportion of time the input signal spends at its various amplitudes). These pdf's are useful for characterizing system response to non-periodic signals when evaluating communication channels; or for showing the character of noise or other spurious signals, to help determine their origin.

Linearity over entire range is within 0.1% integral, 1% differential. Remarkable stability; drift is no problem. Unique "card cage" lets you add peripherals whenever you want, for easy I/O expandability. Quick-change interface cards for switching rapidly to punched tape, digital readout, or typewritten copy. 8 x 10 cm display is standard, plus analog output for X-Y plotter, strip chart recorder, or remote oscilloscope.

Easy to use: annunciator lights indicate pertinent controls for each mode; thumbwheel switches for instant channel selection. 5400A: $9500 for 1024-word memory, $8750 for 512-word memory.

Bantam 1A/10V supplies . . . high performance, low cost

Compact Model 6214A Power Supply

Two new 0-1 A/0-10 V additions have joined HP's low-cost, compact BENCH power supply series. The new units have: 4mV load and line regulation, ripple <200 μV RMS (1 mV p-p, DC to 20 MHz) on constant voltage; for constant current, specifications are: 500 μA load regulation, 750 μA line regulation, ripple 150 μA RMS, 500 μA p-p, DC to 20 MHz.

Front panel meter monitors either voltage or current. Constant Voltage Model **6213A** is Current Limited—a short across the output causes no harm. Model **6214A** has Constant Voltage/Constant Current operation—you can set both voltage and current limits, output will switch to one or the other depending on load.

Diminutive size (3¼" high, 5¼" wide, 7" deep) allows three BENCH supplies to be mounted side by side in a standard relay rack. Molded, impact-resistant cases interlock when stacked on your bench. Model 6213A, $90; Model 6214A, $115.

Low-priced hot carrier diode offers sub-nanosecond turn-on/off times

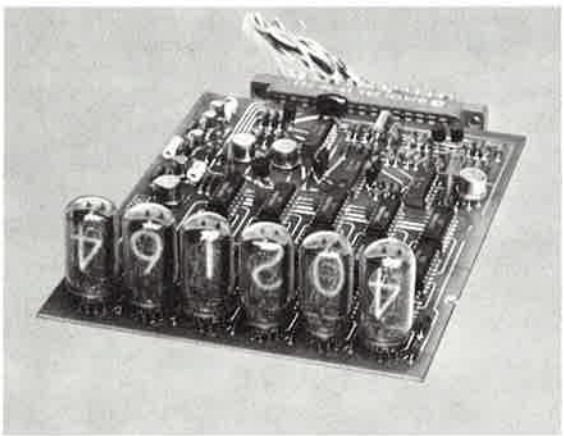
HP's new **5082-2800**-series hybrid diode combines conventional PN junction and Schottky barrier construction techniques. This results in a device with the high breakdown and temperature characteristics of silicon, the turn-on voltage of germanium, and the speed of a Schottky barrier, majority carrier diode.

Economically priced to replace conventional PN junctions in digital applications, it is also an efficient and reliable UHF mixer or detector. (1-99, $0.99.)

Ministrip diodes for use in thick and thin film applications

For thick and thin film applications, Hewlett-Packard now offers standard HP step recovery, hot carrier, PIN and high conductance diode chips in a configuration suitable for hybrid integration. These ministrip packages eliminate problems associated with handling and processing bare semiconductor chips, and they can be mounted using conventional solder reflow methods. Transient and RF parameters for these devices are similar to those of conventionally packaged devices.

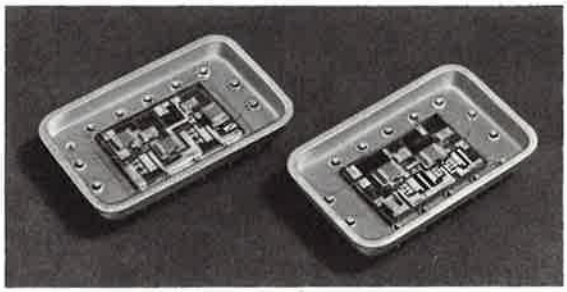
Low-cost counting digital readouts



Add compact, reliable, low-cost digital readout to your own devices or systems with new HP integrated circuit modules. They count 4 Hz-10 MHz inputs, can totalize, and measure frequency or time interval.

Standard module gate times of 0.1 and 1 sec are internally derived from 60 Hz line, but external gate signal (contact closure or saturated transistor to ground) can be used. Remotely programmable gate time, sample rate, display time. Input required: +3 to +5 V pulse (for 100 mV sensitivity and 1 MΩ/30 pF input impedance, add $30). Module prices: 4-digit **KO1-5221A**, $300; 5-digit **KO2-5221A**, $350; 6-digit **KO3-5221A**, $400.

Wideband microcircuit amplifiers for RF and microwave systems applications



100 MHz Preamplifier 100 MHz Power Amplifier

HP thin-film hybrid microcircuit amplifier modules offer the systems designer superior performance over broad bandwidths, in dramatically small packages.

The Model **35000A**-series includes preamps and power ampliers with 0.1-100 MHz and 0.1-300 MHz bandwidths, plus high frequency power amplifiers covering 10-1300 MHz and 0.1-2 GHz. Amplifier gains are in 20-30 dB region, and output powers of +10 dBm and higher (harmonics >30 dB down) are available.

Comprised of reliable thin film passive components for long-term stability, miniature chip capacitors, and high performance planar semiconductor devices—the modules are hermetically sealed for stable performance and high reliability. Prices on small quantities start at $250 each.

Solid-state SPDT switches cover microwave spectrum to 18 GHz

HP **33006A** Coaxial and **33007A** Stripline single-pole-double-throw switches cover the frequency range 400 MHz to 18 GHz. They offer improved performance for ECM, radar, and lab checkout, etc. Their small size and high reliability make them excellent replacements for electro-mechanical switches. And, they meet MIL specs. (1-9: 33006A, $395; 33007A, $250).

C-band step recovery diode for harmonic generation

Intended for use in high- or low-order, single-stage harmonic generation, the HP **5082-0310** operates with output frequencies in C-band. Offering low thermal resistance and minimum package inductance, it meets the general requirements of MIL-S-19500, and also qualifies for use in man-rated space systems. (1-9, $55.)

DC-18 GHz coaxial SPDT switch

You can perform low loss, high isolation switching in coax systems with the Model **8761A** broadband electro-mechanical SPDT switch. Exceptionally good match (SWR <1.2) maintained over full DC 18 GHz range. Connector geometry invites cascading of switches where higher isolation or more elaborate switching patterns are required. Connector options include Type N, precision 7mm or miniature 3mm connectors. Control is DC or latching from either 12 or 28 V. Small quantity prices start at $150 each.

New step recovery diode modules . . . complete shunt mode impulse circuits

New HP Step Recovery Diode Modules are hybrid integrated, hermetically sealed, and contain all necessary matching elements, driving inductance—and a step recovery diode chip—to make a complete shunt mode impulse circuit.

They have a 3mm coaxial connector for convenient mounting in 50Ω miniature coaxial transmission line, and a DC return for the step recovery diode bias circuit. Driven at an input frequency of 25, 100, 500 or 1,000 MHz (depending on model), they produce an output spectrum with frequency line at integral multiples of the input frequency. Relatively high power levels (>−30 dBm) are available simultaneously from any line in the 100-12,500 MHz range. Comb output is particularly useful in measuring spectral behavior of components, antennas, receivers, filters and slow-wave structures; also provides a means for frequency identification in swept systems. Models **33002A, 33003A, 33004A, 33005A:** (1-9, $125.)

Dual-cell photo-controlled resistor

The **5082-4509** Dual Photo Controlled Resistor combines in a single package a 12 V incandescent lamp and a hermetically-sealed dual-photoconductive-cell manufactured by HP. It is designed for use in control circuits and very low frequency (<10 Hz) switching applications. The voltage controlled resistance has a dynamic range >5 decades. Electrical isolation between lamp and photoconductive cell $>10^{12}\Omega$, with coupling capacitance <0.05 pF. (1-9, $11; 10-99, $9.50.)

Stripline PIN diode features small size, light weight, low cost

Designed to provide optimum characteristics for stripline signal conditioning and control applications, HP **5082-3040** is an optimally integrated shunt diode intended for use from HF through 18 GHz without the limitations of matching structures. (1-9, $25.)

Hybrid integrated PIN absorptive modulators

HP 33000-series PIN Absorptive Modulators combine broad bandwidth, wide dynamic range, low VSWR, and hybrid integration. They also meet MIL spec environmental ratings. These coaxial devices have 40 and 80 dB attenuation, maintain constant impedance and have low-VSWR 50Ω loads. They may be used as modulators, switches or attenuators in such applications as sweep generator leveling, receiver AGC, distance measuring systems and phase array radar systems.

Frequency Range	Attenuation 40 dB	80 dB
0.8-4 GHz	**30000A** $350	**30000B** $500
3.7-8.3 GHz	**30008A** $375	**30008B** $525
8-18 GHz	**30001A** $395	**30001B** $550

All unit prices for 1-9 quantities

INFORMATION REQUEST
SPRING 1968

Contact me immediately to discuss:_____

_____My phone:_____

Send technical data on items checked below:

____ 181A Variable Persistence Oscilloscope
____ 204C Oscillator
____ 209A Oscillator (sine/square wave)
____ 220A Square Wave Generator
____ 745A AC Calibrator
____ 1200-Series 500 kHz Oscilloscopes
____ 1803A Differential/DC Offset Amplifier Plug-In
____ 1804A 4-Channel Amplifier Plug-In
____ 2000A Time Sharing System
____ 2012A, 2012B Data Acquisition Systems
____ 2114A Low-priced Computer
____ 2115A High-performance Computer
____ 2547A Data Coupler
____ 3305A Sweep Plug-In for 3300A
____ 3605A Frequency Source
____ 3701, etc. Microwave Link Analyzer
____ 5050A Digital Recorder with Storage
____ 5065A Rubidium Frequency Standard
____ 5257A Transfer Oscillator plug-in
____ 5321A, 5321B Compact 10 MHz Counters
____ 5325A Universal Counter
____ 5331, 5332 Preset Controllers/Counters
____ 5400A Multichannel Analyzer
____ 5480A Signal Analyzer
____ 5554A Preamplifier
____ 6213, 6214A Compact Power Supplies
____ 6264B, 6267B DC Power Supplies
____ 6933A Digital-to-Analog Converter
____ 7005B X-Y Recorder
____ 7562A Logarithmic Converter
____ 7729A Thermal Recording System
____ 7878A Fluid Recording System
____ 8002A Pulse Generator
____ 8052A, 8062A Sound Level Meters
____ 8541-series Automatic Network Analyzers
____ 8552A, 8553A RF Spectrum Analyzer
____ 8601A Sweeper/Signal Generator
____ 8745A S-Parameter Test Set and Accessories
____ 8761A Coaxial SPDT Switch
____ 9100A Desk Top Calculator
____ 11075A, 11076A Carrying/Storage Cases
____ 33000A, etc. PIN Absorptive Modulators
____ 33002A, etc. Step Recovery Diode Modules
____ 33006A, 33007A SPDT Switches
____ 35000A Microcircuit Amplifier Modules
____ K01-5221A, etc. Digital Readouts
____ 5082-0310 Step Recovery Diode
____ 5082-2800 Hot Carrier Diode
____ 5082-3040 Stripline PIN Diode
____ 5082-4509 Dual Photo Controlled Resistor
____ Ministrip Diodes

Please PRINT your complete mailing address:

name _____ title _____

dept., bldg., mail station, etc. _____

company _____

p.o. box or street _____

city _____ province _____

1B1

Place
5¢ Postage
Here

To: **HEWLETT-PACKARD (CANADA) LTD.**

275 Hymus Boulevard

Pointe Claire, Quebec

SALES AND SERVICE IN THE UNITED STATES

ALABAMA
P.O. Box 4207
2003 Byrd Spring Road S.W.
Huntsville 35802
Tel: (205) 881-4591
TWX: 810-726-2204

ARIZONA
3009 North Scottsdale Road
Scottsdale 85251
Tel: (602) 945-7601
TWX: 910-950-1282

5737 East Broadway
Tucson 85716
Tel: (602) 298-2313
TWX: 910-952-1162

CALIFORNIA
3939 Lankershim Boulevard
North Hollywood 91604
Tel: (213) 877-1282
TWX: 910-499-2170

1101 Embarcadero Road
Palo Alto 94303
Tel: (415) 327-6500
TWX: 910-373-1280

2591 Carlsbad Avenue
Sacramento 95821
Tel: (916) 482-1463
TWX: 910-367-2092

1055 Shafter Street
San Diego 92106
Tel: (714) 223-8103
TWX: 910-335-2000

COLORADO
7965 East Prentice
Englewood 80110
Tel: (303) 771-3455
TWX: 910-935-0705

CONNECTICUT
508 Tolland Street
East Hartford 06108
Tel: (203) 289-9394
TWX: 710-425-3416

111 East Avenue
Norwalk 06851
Tel: (203) 853-1251
TWX: 710-468-3750

DELAWARE
3941 Kennett Pike
Wilmington 19807
Tel: (302) 655-6161
TWX: 510-666-2214

FLORIDA
P.O. Box 545
Suite 106
9999 N.E. 2nd Avenue
Miami Shores 33153
Tel: (305) 758-3626
TWX: 810-848-7262

P.O. Box 20007
Herndon Station 32814
621 Commonwealth Avenue
Orlando
Tel: (305) 841-3970
TWX: 810-850-0113

P.O. Box 8128
Madeira Beach 33708
410 150th Avenue
St. Petersburg
Tel: (813) 391-0211
TWX: 810-863-0366

GEORGIA
P.O. Box 28234
2340 Interstate Parkway
Atlanta 30328
Tel: (404) 436-6181
TWX: 810-766-4890

ILLINOIS
5500 Howard Street
Skokie 60076
Tel: (312) 677-0400
TWX: 910-223-3613

INDIANA
4002 Meadows Drive
Indianapolis 46205
Tel: (317) 546-4891
TWX: 810-341-3263

LOUISIANA
P.O. Box 856
1942 Williams Boulevard
Kenner 70062
Tel: (504) 721-6201
TWX: 810-955-5524

MARYLAND
6707 Whitestone Road
Baltimore 21207
Tel: (301) 944-5400
TWX: 710-862-0850

2 Choke Cherry Road
Rockville 20850
Tel: (301) 948-6370
TWX: 710-828-9684

MASSACHUSETTS
32 Hartwell Road
Lexington 02173
Tel: (617) 861-8960
TWX: 710-332-0382

MICHIGAN
24315 Northwestern Highway
Southfield 48075
Tel: (313) 353-9100
TWX: 810-232-1532

MINNESOTA
2459 University Avenue
St. Paul 55114
Tel: (612) 645-9461
TWX: 910-563-3734

MISSOURI
9208 Wyoming Place
Kansas City 64114
Tel: (816) 333-2445
TWX: 910-771-2087

2812 South Brentwood Blvd.
St. Louis 63144
Tel: (314) 644-0220
TWX: 910-760-1670

NEW JERSEY
Office A-1
1050B North King Highway
Cherry Hill 08034
Tel: (609) 667-4000
TWX: 710-892-4945

W. 120 Century Road
Paramus 07652
Tel: (201) 265-5000
TWX: 710-990-4951

NEW MEXICO
P.O. Box 8366
Station C
6501 Lomas Boulevard N.E.
Albuquerque 87108
Tel: (505) 255-5586
TWX: 910-989-1665

156 Wyatt Drive
Las Cruces 88001
Tel: (505) 526-2485
TWX: 910-983-0550

NEW YORK
1702 Central Avenue
Albany 12205
Tel: (518) 869-8462
TWX: 710-441-8270

1219 Campville Road
Endicott 13764
Tel: (607) 754-0050
TWX: 510-252-0890

82 Washington Street
Poughkeepsie 12601
Tel: (914) 454-7330
TWX: 510-248-0012

39 Saginaw Drive
Rochester 14623
Tel: (716) 473-9500
TWX: 510-253-5981

1025 Northern Boulevard
Roslyn, Long Island 11576
Tel: (516) 869-8400
TWX: 510-223-0811

5858 East Molloy Road
Syracuse 13211
Tel: (315) 454-2486
TWX: 710-541-0482

NORTH CAROLINA
P.O. Box 5188
1923 North Main Street
High Point 27262
Tel: (919) 882-6873
TWX: 510-926-1516

OHIO
5579 Pearl Road
Cleveland 44129
Tel: (216) 884-9209
TWX: 810-421-8500

3460 South Dixie Drive
Dayton 45439
Tel: (513) 298-0351
TWX: 810-459-1925

OKLAHOMA
2919 United Founders Boulevard
Oklahoma City 73112
Tel: (405) 848-2801
TWX: 910-830-6862

OREGON
Westhills Mall, Suite 158
4475 S.W. Scholls Ferry Road
Portland 97225
Tel: (503) 292-9171
TWX: 910-464-6103

PENNSYLVANIA
2500 Moss Side Boulevard
Monroeville 15146
Tel: (412) 271-0724
TWX: 710-797-3650

144 Elizabeth Street
West Conshohocken 19428
Tel: (215) 248-1600, 828-6200
TWX: 510-660-8715

TEXAS
P.O. Box 22813
4242 Richmond Avenue
Houston 77027
Tel: (713) 667-2407
TWX: 910-881-2645

P.O. Box 1270
201 East Arapahoe Road
Richardson 75080
Tel: (214) 231-6101
TWX: 910-867-4723

GOVERNMENT CONTRACT OFFICE
225 Billy Mitchell Road
San Antonio 78226
Tel: (512) 434-4171
TWX: 910-871-1170

UTAH
2890 South Main Street
Salt Lake City 84115
Tel: (801) 486-8166
TWX: 910-925-5681

VIRGINIA
P.O. Box 6514
2111 Spencer Road
Richmond 23230
Tel: (703) 282-5451
TWX: 710-956-0157

WASHINGTON
433-108th N.E.
Bellevue 98004
Tel: (206) 454-3971
TWX: 910-443-2303

FOR U.S. AREAS NOT LISTED:
Contact the regional office nearest you: Atlanta, Georgia . . . North Hollywood, California . . . Paramus, New Jersey . . . Skokie, Illinois. Their complete addresses are listed above.

SALES AND SERVICE IN CANADA

ALBERTA
Hewlett-Packard (Canada) Ltd.
11745 Jasper Avenue
Edmonton
Tel: (403) 482-5561
TWX: 610-831-2431

BRITISH COLUMBIA
Hewlett-Packard (Canada) Ltd.
304-1037 West Broadway
Vancouver 9
Tel: (604) 731-5301
TWX: 610-922-5059

NOVA SCOTIA
Hewlett-Packard (Canada) Ltd.
7001 Mumford Road
Suite 356
Halifax
Tel: (902) 455-0511
TWX: 610-271-4482

ONTARIO
Hewlett-Packard (Canada) Ltd.
880 Lady Ellen Place
Ottawa 3
Tel: (613) 722-4223
TWX: 610-562-1952

Hewlett-Packard (Canada) Ltd.
1415 Lawrence Avenue West
Toronto
Tel: (416) 249-9196
TWX: 610-492-2382

QUEBEC
Hewlett-Packard (Canada) Ltd.
275 Hymus Boulevard
Pointe Claire
Tel: (514) 697-4232
TWX: 610-422-3022
Telex: 01-20607

FOR CANADIAN AREAS NOT LISTED:
Contact Hewlett-Packard (Canada) Ltd. in Pointe Claire, at the complete address listed above.

MEASURING INSTRUMENTS
FOR SCIENCE AND INDUSTRY

HEWLETT hp *PACKARD*

PRINTED IN U.S.A.