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 PACKARD

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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, $10^{-8}$ to $10^8$. 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.


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 12 ⅛-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, ½ 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 holdown, 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).

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, magnetic 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.

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.
Compact, economical 10 MHz counters

Save space and money with either of two new precision HP counters. Now available in a desirable 3-inch height and 7 3/4-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 521A 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

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 x 10^{-7}/day, and there's <±2.5 x 10^{-6} change from 0° to 50° C. Frequency range is DC-12.5 MHz and time interval range is 0.1 µsec-10 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. Fade-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

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

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 unstacking 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.

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

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 1/4 dB with DC inputs, 1/2 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.

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

8787A 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 impedance on lowest ranges to 50 mV/div.

7729A Thermal Recording systems with 8821A from $7205; 7787A 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

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 5 3/4”-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 3 1/2 Rack width (5 3/4”) 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

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 pV-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 1408 ($725) with normal persistence, or Model 1418 ($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).
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% over-ranging 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 on 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 500Ω 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-changing 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 230V, 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).
Auto μ-wave network analyzer for production, engineering and standards lab applications

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

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.

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 theed 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

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 bipolar 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.
command of clock pulses, and read out "pdf" (probability density function—a statistical indication of the proportion of time the input signal spends at 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 (3½" high, 5½" 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 amplifiers 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 502 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-photocative-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 photocative cell >10⁶Ω, 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.

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>40 dB</th>
<th>80 dB</th>
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<tbody>
<tr>
<td>0.8-4 GHz</td>
<td>30000A</td>
<td>$350</td>
</tr>
<tr>
<td>3.7-8.3 GHz</td>
<td>30008A</td>
<td>$375</td>
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<tr>
<td>8-18 GHz</td>
<td>30001A</td>
<td>$395</td>
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All unit prices for 1-9 quantities
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
- 3300A, etc. PIN Absorptive Modulators
- 33002A, etc. Step Recovery Diode Modules
- 33006A, 33007A SPDT Switches
- 3500A 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

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p.o. box or street

city

province
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<th>Address Details</th>
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</thead>
<tbody>
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<tr>
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<td>(Tel: (801) 486-8166, TWX: 910-925-5681)</td>
</tr>
<tr>
<td>UTAH</td>
<td>P.O. Box 6514 2111 Spencer Road Richmond 23220</td>
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