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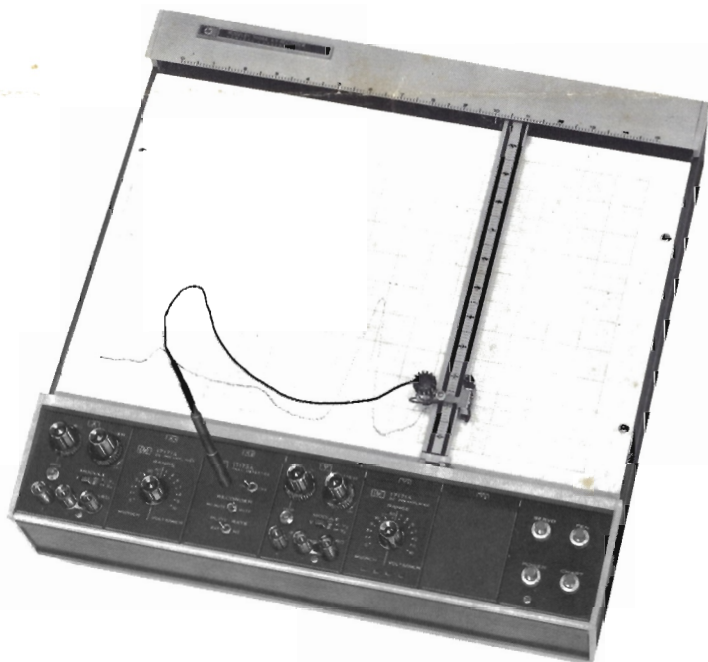
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## X-Y RECORDER ACCESSORY PLOTS 50 PTS/SEC



Model 7004A X-Y Recorder equipped with new point-plotting accessory; plots up to 50 points/sec.

Imprinting up to 50 points/second with an accuracy of 0.25% of FS, a new accessory for the 7004A is ten times faster than other point plotters. High plotting rate is important when many individual points are to be plotted, as in the recording of data accumulated by multichannel analyzers, signal averagers, and other instruments with digital data storage. High slewing speed (30 inches/sec) of the 7004A (\$1395) contributes to plotting speed.

The new accessory consists of the 17012B Point Plotter (\$95) and the 17173A Null Detector (\$200). The Plotter fits in place of the 7004A's pen, and prints a dot whenever the Null Detector senses the 7004A has moved the Plotter to the

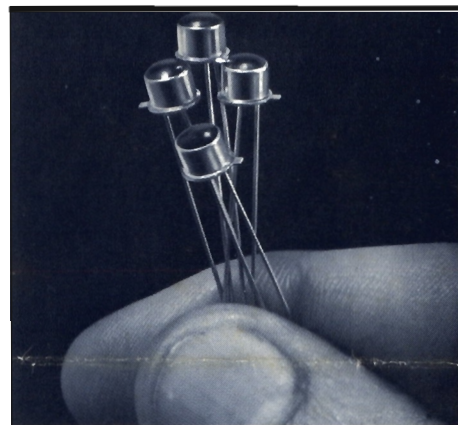
next coordinate position specified by external equipment. The new Plotter prints with fine dots, making high-resolution plots possible. The non-cloggable fiber-tip pen, which evidences wear simply as a broadening of the dot (after many hours of use), is disposable, easily replaced.

The Null Detector controls point plotting. Actuated by a pulse from the external equipment, the Null Detector monitors the 7004A's servo signals. When these indicate a new data point is reached, the Null Detector activates the Plotter. If the point is off scale, the Detector waits 1 second, then plots a point at paper's edge. This "forced" plot prevents the system from stalling on off-scale data.

**A COUNTER  
THAT  
CAN COMPUTE**

See page 2

## LOW PWR LIGHTS SS DIODE



5082-4400 Solid State Visible Emitters

For indicator applications where a primary consideration is visibility, low drive power, or high reliability under adverse conditions, get HP's 5082-4400 Solid State Visible Emitter (\$2.90 in quantities of 1000). It is a diode that emits a bright red light and typically achieves a brightness of 120fL with only 15mW drive power (10mA at 1.5V), more than enough for good visibility at room brightness.

Packaged in a modified TO-46 hermetically-sealed can, the diode is

Continued on page 4, Column 3



# COMPUTING ABILITY GIVES COUNTER UNPRECEDENTED USEFULNESS



5360A Computing Counter with an accessory keyboard that permits solving equations whose variables are the Counter's measurements. Answer is displayed on Counter readout.

With HP designing a new type of electronic counter with interpolating and computing circuits, state of the measurement art has been significantly advanced — like being able to speed up measurements 1000 times or increase accuracy to 100 times, like period time interval measurements with nanosecond accuracy and 100-picosecond resolution, PLUS versatile real-time computational capability. The 5360A Computing Counter, with wide frequency range (0.01Hz–320MHz direct, to 18GHz with the same plug-ins usable in HP 5245-series Counters) and 11-digit readout, brings you these advances. For the systems designer, the 5360A, with its options and accessories, offers instant solutions to many measurement and computation problems

that otherwise would require exorbitant design time and cost.

Despite its tremendous versatility, the 5360A Computing Counter is simpler to operate in many respects than a conventional counter. Its computing capability simplifies the “man-machine interface” by eliminating the need to manipulate some front panel controls, by displaying only as many digits as are within accuracy capability, and by simplifying the readout decimal-point and units interpretation (thus reducing both the time spent in reading and the possibility of error).

Its computing capability makes the 5360A into a new kind of measuring device. Its speed enables it to sample frequency or accurately measure even a single short burst of

carrier, reading out frequency directly (no transfer oscillator needed); its resolution and ability to measure time through zero, plus computational capability, enables it to display the phase difference between two signals by measuring signal frequency and the time between input waveform zero crossings; its computing ability, together with that of its optional keyboard, enable it to display values such as the average frequency over a chosen time period, differential frequency or fractional frequency deviation ( $\Delta f/f$ ), convert to other units, take square roots, compute standard deviations. Flexible computation is afforded via the accessory keyboard while fixed programs can be handled with a lower-priced accessory fixed-program matrix that plugs into the Counter's rear panel.

Packaging of the 5360A allows very flexible future expansion. There are two compartments. The smaller accommodates the plug-in 5365A Frequency-Period Input Module, the larger accommodates the 5379A Time Interval plug-in or, with the 10536A Adapter, one of the 5245 Counter series frequency converters for measurements up to 18GHz.

Price of the 5360A equipped with the 5365A Frequency-Period Input Module is \$6500. The 5379A Time Interval plug-in and keyboard will be available later.

A long-time extender of the electronic counter capability horizon, HP considers the 5360A the most significant counter advance in recent years. Space limitations prevent an adequate description. For information, check the Reply Card.

## CKT DESIGN WITH DUAL PHOTOCELLS COVERED IN APPLICATION NOTE

In analog multipliers and low-noise choppers, the dual photocell has several advantages. Among these are close resistance balance and tracking characteristics.

Circuit design with dual photocells is covered in some depth by a new Application Note, AN 924, “The

Dual Photocell”

The 9-page Application Note gives circuits, design equations, and trade-off possibilities in detail for choppers and multipliers. Among the circuits discussed are synchronous modulator-demodulator choppers, light-beam position sensors, voltage-tun-

able resistors, dual-function controls in analog and switching circuits and in stereo volume controls, bridge-balancing circuits, and remote dual-channel gain controls.

There is no charge for Application Notes. For a copy of AN 924, just check the Reply Card.



# LOWER-COST STORAGE OSCILLOSCOPE W/VARIABLE PERSISTENCE

Continuously variable persistence and storage can now be had in two all-solid-state high-performance 500kHz Oscilloscopes, the 1201A/B and the 1207A/B, and at prices lower than ever before. Trace persistence can be varied from 0.2sec to  $>1$ min, an important feature in low-frequency work as it makes possible adjustment of persistence to sweep speed, thereby eliminating flicker. Low-frequency waveforms, simply a moving dot on a conventional 'scope, are clearly displayed when persistence is adjusted to match slow sweep speeds.

The 1207A/B (only \$1475) is single-channel, with 5mV/div max sensitivity. The versatile dual-channel 1201A/B (\$1800) has max sensitivity of  $100\mu\text{V}/\text{div}$ , common-mode rejection ratio of 100,000:1 (100dB), low noise ( $<50\mu\text{V}$  p-p), high stability (drift typically  $<50\mu\text{V}/\text{hr}$ ). Both have features of the more expensive lab instruments, the low price and ease of operation typical of industrial 'scopes. Latest in HP's line of storage 'scopes, both offer the many advantages of the others of the 1200 series: differential as well as single-ended inputs, high trigger sensitivity (0.2V min), ac or dc trigger coupling, single-sweep capability, Z-axis input, plus other features not usually found in lower-priced 'scopes. All versions are cabinet-enclosed, "B's" are  $5\frac{1}{4}$ "-high rack-mounts.



Models 1201A and 1201B Oscilloscopes

Newest feature is *variable storage* — the control can subdue trace brightness to prolong storage up to 8 hours, brighten the trace up to 100ft-lamberts at any time, making it possible to see the trace outdoors. Storage writing rate is fast ( $0.5\text{cm}/\mu\text{s}$ ), and two or more traces can be stored at different times for side-by-side comparison. Also, repetitive waveforms can be superimposed for several cycles, making it possible to store and view fast-changing phe-

nomena.

Human-engineered pushbutton controls simplify use in any of three modes: persistence, storage, conventional 'scope. The fast single-shot photographic writing rate, burn resistance, and brightness of the aluminumized P31 phosphor combine to give the most functional display available. And the technique used to obtain variable storage yields 8 times more storage time than that obtained with other tube types.

## 1kHz TO 110MHz SPECTRUM ANALYZER FOR 75-OHM SYSTEMS

HP's 8553L/8552A Spectrum Analyzer is now available for use with 75-ohm (single-ended) systems. Featuring the same wide frequency range (1kHz to 110MHz), flat frequency response and wide dynamic range, the 75-ohm Spectrum Analyzer is a general purpose yet accurate instrument for many telephone and 75-ohm communication systems measurements, particularly for frequency domain multiplexing (FDM) baseband measurements.

The Analyzer provides absolute amplitude calibration in both linear (voltage) and log (dBm) modes

referenced to 75-ohm systems. It measures signals accurately from  $-120\text{dBm}$  ( $0.22\mu\text{V}$ ) to  $+20\text{dBm}$  (1.6V) with 70dB distortion-free dynamic range and with bandwidth selectable (50Hz to 300kHz). Automatic frequency stabilization makes high resolution measurements easy and meaningful.

Flat frequency response ( $\pm 0.5\text{dB}$ ) coupled with broad sweeps lets you monitor the entire baseband to detect channel dropout or any unbalance in carrier level. Low distortion allows two- and three-tone intermodulation tests. External preselect-

tion filters can extend the dynamic range for noise loading tests.

The Spectrum Analyzer consists of an RF Section, IF Section and Display Section (mainframe with CRT).

Prices: HO1-8553L RF Section (with WE-560 connectors), \$2050; HO1-8552A IF Section, \$2050. HO2-8553L (with BNC connectors), \$2000; HO2-8552A, \$2025. Display Sections: 140S with Normal Persistence CRT, \$725; 141S with Variable Persistence CRT, \$1525; 143S with Large Screen CRT (8 inch x 10 inch), \$1500.



# DO-EVERYTHING IC COUNTER EXTENDS RANGE

# MICROWAVE TRANSISTORS



Model 5325B Universal Counter

Measuring capabilities offered by the Universal Counter are now available to 20MHz, and with time interval measurements to 0.1  $\mu$ sec. The 5325B (\$1300), latest of the Universal Counters, is ideal for systems (fully programmable) or bench use.

A unique design advance gives the input trigger circuits <1mV threshold within which counting could be uncertain. Essentially, the 5325B either counts accurately or not at all, so trigger-level adjustment is more rapid, certain, and stable.

Similar to the 5325A (July/August Meas News), the 5325B has the same accuracy, convenience (push-button function selection, suppression of unwanted zeroes, two types of oscilloscope markers, indication that range has been exceeded), and broad capability:

- Full remote program capability.

Control (0Vdc) can be contact closure to ground, electronic, or TTL drive for all but input trigger adjustments. Option 01 makes attenuators and ac-dc input coupling selection programmable, too.

- **Digital output with buffer storage.** Storage feature enables Counter to make new measurements while external equipment examines the previous count. This increases the overall speed of a measuring-recording system.

- **Sample rate control**, variable down to as short as 100 $\mu$ sec to increase overall speed in automatic systems.

- **Scales input frequency** in decade steps up to 10<sup>8</sup>. (The 10MHz time base, for example, can be divided down to 0.1Hz and made available at a rear-panel connector.)

- **Frequency, time-interval, period, period-average, ratio measurements.**

## RECORD MEAS'MENTS FOR COMPUTER ANALYSIS

How to record instrument data for computer analysis is discussed in a new Application Note, AN 113, "Recording Digital Measurements with the HP 2547A Coupler." This 24-page Note describes techniques for recording measurements from digital voltmeters, counters, nuclear scalars, etc. on computer-compatible input media. Record formatting for both batch processing and time-sharing is discussed as are techniques for easy entry of data through local time-sharing terminals that use BASIC language.

AN 113 presents 15 applications of the Model 2547A Coupler with single instruments, multiple instru-

ments, and data acquisition systems. The Coupler operates with digital recorders to translate the BCD output of standard instruments into serially-coded records on punched tape, magnetic tape, punched cards, or typed log. Numerous examples illustrate how the Coupler simplifies instrument systems by serving as a three-source digital scanner. Useful applications of the digital clock and manual data options are also discussed.

This Application Note will interest both instrument users and suppliers of digital systems. It is available without charge—just check the Reply Card.

Want to

- Eliminate an amplifier stage?
- Improve linearity?
- Increase oscillator efficiency?
- Decrease distortion?

Four new transistors from HP provide the active devices to do this.

Hermetically-sealed in a strip-line package, they feature high-frequency characteristics and a high-temperature moly-gold contact system for reliability.

The B versions are for common-base applications and the E versions for common-emitter usage.

All devices have microwave performance guaranteed by *s* parameter measurement controls, thus insuring microwave performance for your circuit applications.

For your initial circuit designs, each device can be supplied with *s* parameter data under your usage conditions. Now you can design knowing the microwave performance of the active devices as well as the passive components in your circuits.

### PERFORMANCE:

Model	Typical Output		Output Pwr*	Typ NF(1GHz)
	Osc	Ampl (M.A.G.)		
35803B/E	40mW@4GHz	8dB@2GHz	+33dBm@2GHz	4.5dB
35804B/E	100mW@3GHz	13dB@1GHz	+20dBm@1GHz	6.0dB
35805B/E	250mW@1GHz	7.5dB@1GHz	+22dBm@1GHz	—
35806B/E	20mW@4GHz	10dB@2GHz	+10dBm@2GHz	3.8dB

\* 1dB Gain Compression

## LOW PWR LIGHTS SS DIODE

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resistant to shock and vibration. Life is expected to exceed 100,000 hours to half-brightness, with the further advantage that failure from aging is not catastrophic but is a gradual degradation of light output.

The Diode package is  $\frac{3}{16}$ " in diameter, with a window on the top. A dark background in the TO-46 can and red lens on the window enhance the visibility.

The diode is a gallium-arsenide-phosphide light-emitting device. Maximum steady-state brightness is 200fL, but it can be pulsed to much higher peak levels. Limit is determined by the allowable power dissipation (85mW continuous).

Quantity discounts are available.



# NEW OPTIONS FOR 110MHz SWEEPER

# FOR COINCIDENCE COUNTING

The usefulness of HP's accurate, highly linear RF Generator/Sweeper (Model 8601A, 100kHz–110MHz) is now further enhanced by the availability of several optional features.

- **Variable AM/FM, Meter Monitor**

For increased modulation flexibility, the 8601A can be optionally supplied with continuously adjustable AM (0–30%) and FM (either 0–100kHz or 0–30kHz peak deviation) control. The modulation level is readily monitored, for the output level meter serves as the modulation meter when a front panel pushbutton (MOD) is pressed. Price of this option is \$300.

- **Tracking Generator**

This version of the Generator/Sweeper serves as a tracking generator for the HP 8553L/8552A 110MHz Spectrum Analyzer to provide spurious- and harmonic-free displays for sweep widths from 500kHz to 100 MHz. Logarithmic displays of amplitude versus frequency with greater than 70dB dynamic range are achieved. Both the 8601A and the Spectrum Analyzer have absolute level calibration, assuring known and accurate measurement conditions. Sweep functions are controlled by the Spectrum An-

alyzer, and the 8601A output control determines the signal level applied to the device under test. Total system flatness is typically better than  $\pm 0.5\text{dB}$  over a 100MHz range.

A jumper cable supplied with the 8601A also lets the modified instrument be fully used for regular sweeper/signal generator applications. The tracking generator option price is \$150.

- **75-ohm Calibrated Output**

For use with 75 $\Omega$  systems, the 8601A is optionally available with 75 $\Omega$  source impedance and with the output level calibrated in terms of power delivered to a 75 $\Omega$  load. For added convenience, the output connector can be Type BNC, Type TNC, or Western Electric type. Add-on prices for 75 $\Omega$  output are \$30 for BNC, \$35 for TNC and \$70 for WECO.

The basic 8601A Generator/Sweeper is priced at \$1975. Frequency coverage is 0.1–110MHz with 1% (of frequency) accuracy, and linearity of 0.5% of sweep width. Output level is calibrated from +20dBm to –110dBm, with  $\pm 1\text{dB}$  accuracy. Full range flatness is better than  $\pm 0.25\text{dB}$ .



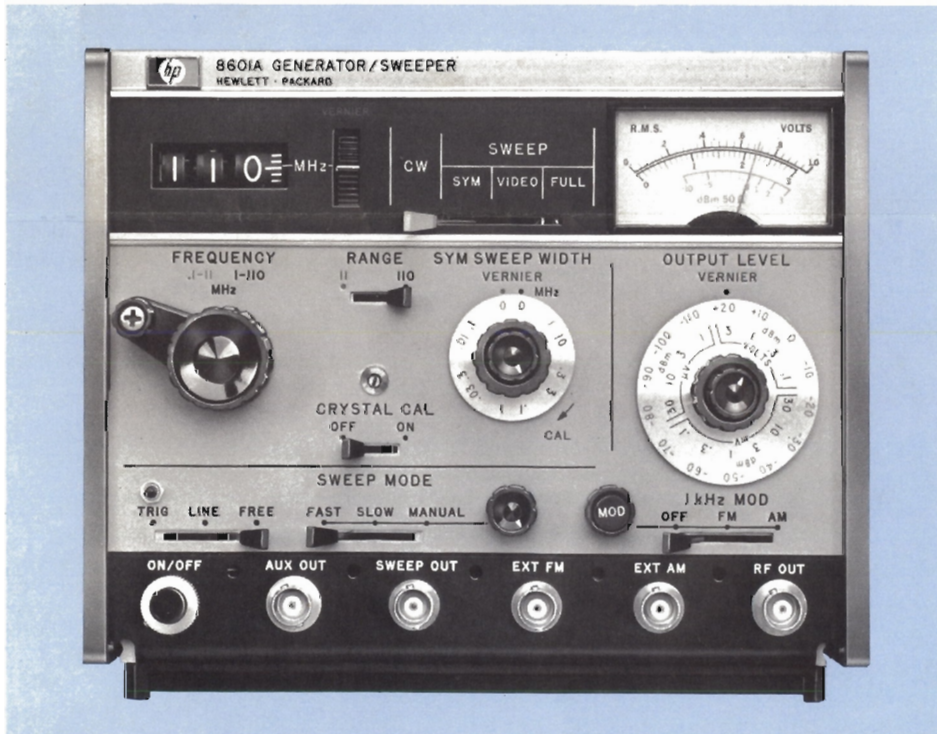
Models 5584A Dual Timing Pickoff and 5585A Fast Coincidence Detector

Coincidence detection systems, required in many nuclear experiments, separate for counting only those events which meet selected timing criteria. Anticoincidence detection suppresses the counting of events, such as cosmic rays, that generate pulses coincidentally in a guard detector and the primary detector. Two new NIM nuclear modules provide improved performance and more versatility for coincidence/anticoincidence detection systems.

The 5584A Dual Timing Pickoff (\$900) generates fast pulses in response to nuclear detector outputs while providing appropriate delay for operation of a coincidence/anticoincidence system. Resolution is high: it's ready for the new input only 100nsec after generating an output. Each channel responds to pulses of either polarity and generates both AEC fast logic (neg) and slow logic (pos) pulses. A new feature, you can select either leading-edge detection or detection of bipolar pulse zero-crossing. Sensitivity is adjustable: for leading-edge detection, 2mV–450mV; for zero-crossing, 50mV–750mV.

The 5585A Fast Coincidence Detector (\$900) has three switch-selectable inputs for coincidence detection, one switch-selectable input for anticoincidence detection. Selected resolving time for coincidence can be as short as 1nsec, three times shorter than that of any other coincidence detector.

For more data on these versatile modules, check the Reply Card.



Model 8601A Generator/Sweeper equipped with Option 001, Variable AM/FM-Meter Monitor



## HP COUNTER GETS BAKED

What happened when an HP 5325A Universal Counter was operated at 95°C (203°F)?

- The readout's plastic window melted and shriveled.
- Some knobs and pushbuttons cracked.
- The OVERFLOW lamp popped out.



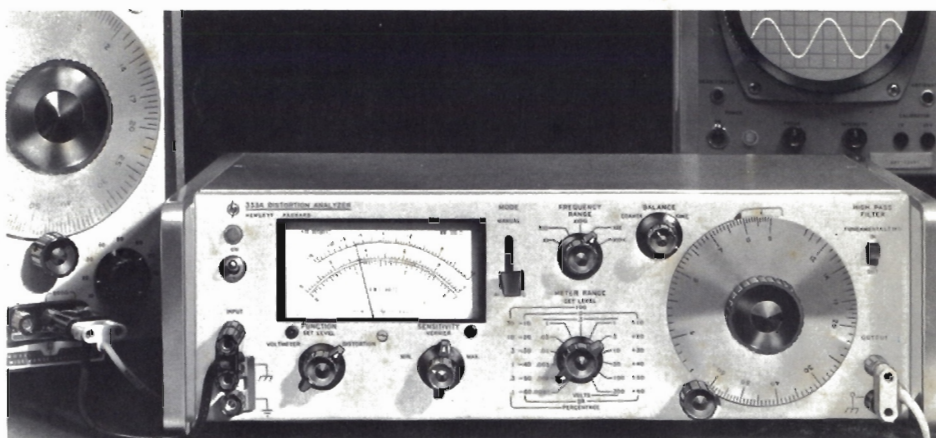
Model 5325A Electronic Counter  
— well done

- When cooled to room temperature again, this integrated-circuit Electronic Counter still met its extensive performance specs in measuring frequency, time interval, period, and frequency ratio.

A test chamber temperature regulator failure caused this accidental environmental test. You'll probably never want to operate precision electronic instruments at such high temperatures, but it's a comfort to know of this extra margin of safety that your HP Counter has. Ability of this and other HP commercially-priced instruments to pass grueling, military-type environmental tests is one reason why so many of them have been selected for service where the environmental chips are down.

## FAST DISTORTION ANALYSIS WITH AUTO-NULL

analyzer's automatic nulling ends tedious tuning



Model 333A Distortion Analyzer in measurement setup with Model 140A Oscilloscope and Model 200CD Wide Range Oscillator

Automatic fundamental nulling (available in the 333A and 334A Distortion Analyzers) speeds the time-consuming portion of harmonic distortion measurements.

The Distortion Analyzer removes the signal to which it is tuned, measures whatever remains. In practice, the Analyzer generally is tuned to the fundamental, and thus by measuring the amplitude of what remains, there's an indication of the percent of harmonic distortion.

The goal of audio and communications equipment design is a faithful reproduction of the input signal. System nonlinearity distorts the wave-shape, and this distortion appears to the user of audio equipment as a change in quality or as noise, to the user of communications gear it appears as channel cross-talk. This distortion is the presence of components not contained in the input signal, components generally generated by nonlinear circuits.

Analyzers such as HP's 330 series are indispensable tools in the measurement of distortion. These tools have gone solid-state, and offer extended tuning range, greater set-level sensitivity, improved selectivity, greater overall accuracy. The 331A, 332A, 333A, 334A measure total distortion down to 0.1% full scale at any frequency, 5Hz-600kHz, with harmonics indicated up to 3MHz. They measure noise to 50 $\mu$ V and voltages over a wide range of level and frequency. In fact all four can be used as sensitive wide-range voltmeters.

The 332A and 334A have an amplitude modulation detector with a range from 550kHz to greater than 65MHz. The HO5-332A and -334A meet FCC requirements on broadcast distortion levels. Prices: \$865 for the 333A and \$895 for the 334A Automatic Nulling Analyzers; \$650 for the 331A and \$680 for the 332A manually-tuned Analyzers.

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