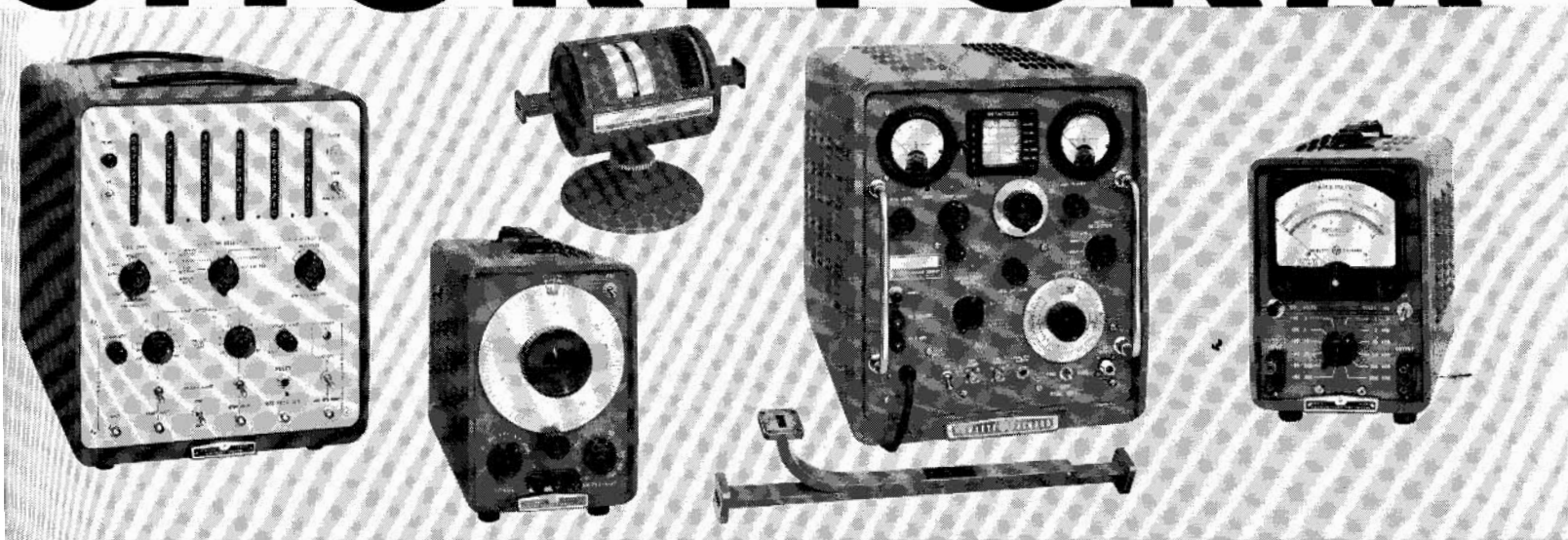


# SHORT FORM



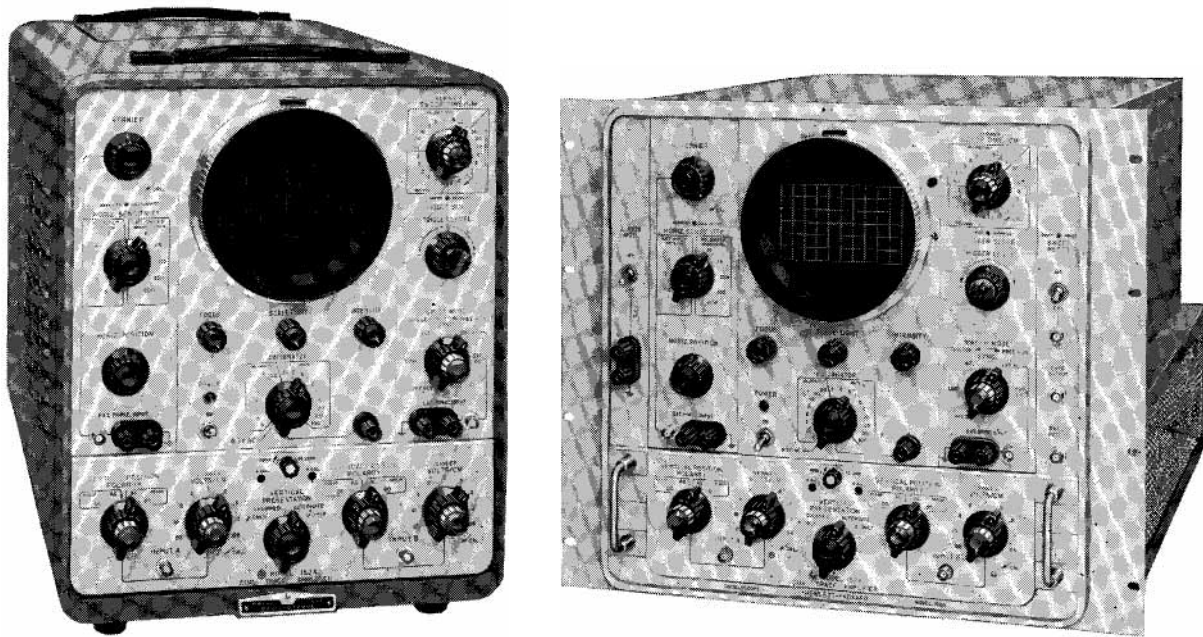
CATALOG

1958



HEWLETT-PACKARD COMPANY • PALO ALTO, CALIFORNIA

# -hp- offers complete coverage in



## -hp- 150A/AR High Frequency Oscilloscopes—DC to 10 MC

Models 150A and 150AR are deliberately designed as the most broadly useful, most convenient high quality 10 MC oscilloscopes ever built. Unique features such as the universal automatic optimum-trace trigger, direct-reading calibrated sweeps, simplified color-coded controls and quick filter or cathode ray tube interchange—all combine to save hours of engineering time.

### Plug-in amplifiers increase versatility

A variety of plug-in units (see below) provide the versatility of dual trace or differential input, or high amplification eliminating pre-amplifiers on input from most transducers. Other important features include brilliant, high resolution trace without halo or bloom, etched circuits with unitized construction, highest quality components and ultra-conservatively rated circuitry.

### Specifications

**Sweep Range:** 0.02  $\mu\text{sec}/\text{cm}$  to 15  $\text{sec}/\text{cm}$ .

**Calibration:** 24 sweeps: 1-2-5-10 sequence, 0.1  $\mu\text{sec}/\text{cm}$  to 5  $\text{sec}/\text{cm}$ , 3% accuracy.

**Triggering:** Internal, line voltage or external 0.5 v or more. Pos. or neg. slope, + 30 to -30 v trigger range.

**Preset Trigger:** Optimum setting for automatic stable triggering.

**Horizontal Amplifier:** Sweep magnification 5, 10, 50, 100 times. Vernier position control selects any 10 cm part of sweep. External input pass band dc to over 500 KC. Sensitivity 200  $\text{mv}/\text{cm}$  to 15  $\text{v}/\text{cm}$ .

**Vertical Amplifier:** Pass band dc to 10 MC. Optimum transient response and rise time less than 0.035  $\mu\text{sec}$ . Signal delay of 0.25  $\mu\text{sec}$  permits leading edge of triggering signal to be viewed.

**Amplitude Calibration:** 18 calib. voltages, 1-2-5-10 sequence, 0.2 mv to 100 v peak-to-peak. Accuracy 3%. Approx. 1 KC square wave, rise and decay approx. 1.0  $\mu\text{sec}$ .

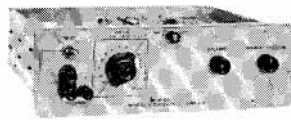
**Prices:** -hp- 150A High Frequency Oscilloscope, \$1,100.00.

-hp- 150AR Rack Mount Oscilloscope, \$1,200.

## New amplifiers and accessories



**-hp- 152B Dual Trace Differential Amplifier.** New plug-in amplifier providing differential input and dual traces electronically switched between A and B channels at either 100 KC or on alternate sweeps. Sensitivity range 0.05  $\text{v}/\text{cm}$  to 50  $\text{v}/\text{cm}$ , input attenuator with 9 calibrated ranges in 1-2-5-10 sequence and vernier. \$250.00.



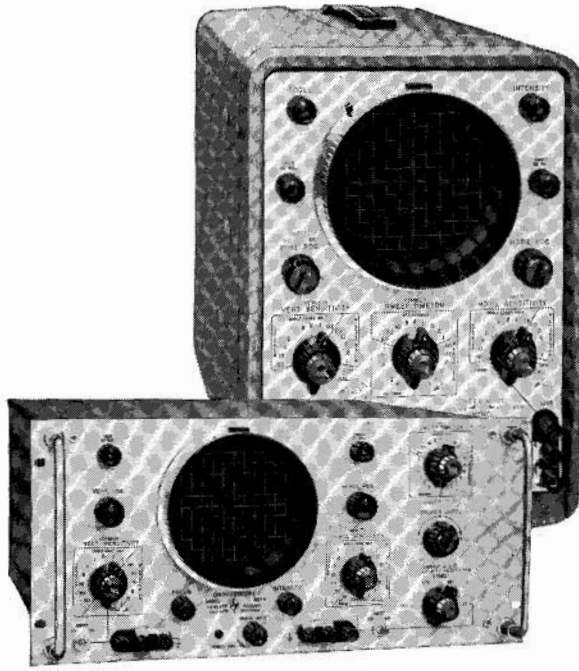
**-hp- 153A Very High Gain Amplifier.** New plug-in permitting -hp- 150A to be used for many direct measurements from transducer without preamplification. Pass band dc to 500 KC, sensitivity 1  $\text{mv}/\text{cm}$  to 125  $\text{v}/\text{cm}$ , balanced input on the 6 most sensitive ranges. 15 calibrated ranges in 1-2-5-10 sequence, 1  $\text{mv}/\text{cm}$  to 50  $\text{v}/\text{cm}$ ; plus vernier. \$125.00.



**-hp- 151A High Gain Amplifier.** For either 150A or 150AR, high gain unit with 5.0  $\text{mv}/\text{cm}$  sensitivity, frequency response dc to 10 MC. 12 calibrated ranges on 1-2-5-10 sequence. 1 megohm input impedance with 27  $\mu\text{mf}$  shunt. Pass band rise time 0.035  $\mu\text{sec}$ . Has 2 BNC terminals. \$200.00.

*Data subject to change without notice. Prices f. o. b. factory.*

## quality oscilloscopes – DC to 10 MC!



### -hp- 130B/BR – DC to 300 KC

Termed the finest low frequency oscilloscope ever offered, -hp- 130B/BR combine big 'scope performance and positive dependability with 1 mv sensitivity and the convenience of direct reading, "universal" automatic trigger, no preamplification from most transducers and simple controls.

#### Similar X and Y amplifiers

Models 130B/BR have similar horizontal and vertical amplifiers with sensitivity 1 mv/cm to 125 v/cm. Input circuits are balanced on the 6 most sensitive ranges; single ended input dc or ac coupled. 21 sweep times may be directly set, instrument sweeps 1  $\mu$ sec/cm to 12.5 sec/cm, triggering is internally, by line power, or externally by 0.5 v or greater. Includes x 5 magnifier for all internal sweeps increasing fastest sweep time to 0.2  $\mu$ sec/cm. -hp- 130B (cabinet) or 130BR (rack) \$650.00.



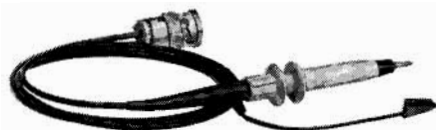
### -hp- 120A/AR – DC to 200 KC

Ideal for industrial or production line work as well as daily lab jobs, Models 120A/AR are outstanding in both value and "big 'scope" performance features. This all-new instrument covers DC to 200 KC, has the -hp- universal trigger circuit which optimizes signals automatically; also offers automatic synchronization on any internal or external voltage including line power.

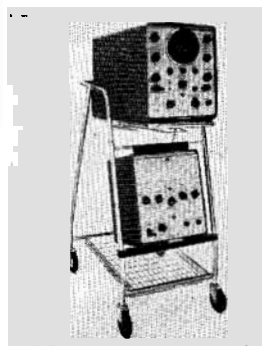
#### Sweeps 1 $\mu$ sec/cm to 0.5 sec/cm

Features include 15 calibrated sweeps in 1-2-5 sequence, sweep speeds range 1  $\mu$ sec/cm to 0.5 sec/cm, "times-5" sweep expansion on all ranges, high sensitivity calibrated vertical amplifiers. All power supplies are regulated for steady, drift-free traces. Automatic trigger and base line can be cut out for bright, clear photography trace. Extra compact Model 120AR is only 7" high. Utmost dependability, rugged construction. -hp- 120A (cabinet) or 120AR (rack) \$435.00.

## increase convenience of your 150A/AR



-hp- AC-21C 50:1 Voltage Divider Probe. A 50:1 divider with high 10 megohm input impedance and low 2.5  $\mu$ mf input capacitance. Convenient "pen" size for maximum handling ease. Probe has durable, attractive nylon barrel, alligator clip contactor. \$25.00.



-hp- AC-115A Oscilloscope Testmobile. Most convenient mobile oscilloscope mounting. For 150A oscilloscopes but usable with other instruments. Rolls easily on large 4" rubber-tired wheels. Extra-sturdy construction of  $\frac{7}{8}$ " tube stock, gleaming chrome throughout. Top shelf tilts 30° in four  $7\frac{1}{2}$ ° increments for better viewing. \$80.00.

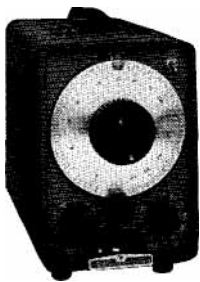
-hp- AC-116A Testmobile Storage Unit. Extra-convenient storage for -hp- 151A, 152A/B, 153A oscilloscope plug-ins. Holds up to three extra plug-ins; guards against dust, mechanical damage. Fits -hp- AC-115A Testmobile (see photo); no installation needed. \$22.50.

-hp- AC-117A Testmobile Accessory Drawer. Fits in -hp- AC-116A Storage Unit; convenient drawer storage for tools, components, solder, etc. Photo shows AC-117A installed in top rack of AC-116A Storage Unit. \$10.00.

## -hp- Oscillators - 0.008 to 10,000,000 cps

Hewlett-Packard now offers 12 high quality, fast and accurate oscillators, each an exceptional value and each engineered to do a specific job best. Each incorporates the famous RC resistance capacity circuit pioneered by *-hp-*. This circuit makes possible instruments that are highly stable, wide range, compact and portable; instruments that are extremely simple to operate and require no tedious re-setting or adjustment during operation.

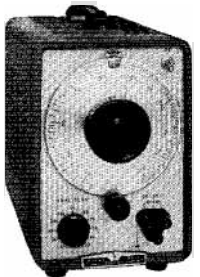
### -hp- 200 Series Audio Oscillators



For audio and ultrasonic measurements, *-hp-* offers popular Models 200AB and 200CD. Both have highest stability and accurate tuning circuits. Low impedance operating levels plus superior insulation guarantee long years of trouble-free dependability. Operation is simple; just three controls; no zero setting necessary. *-hp-*

200AB, 20 cps to 40 KC, \$130.00. *-hp-* 200CD, 5 cps to 600 KC, \$160.00.

### -hp- 207A Sweep Oscillator

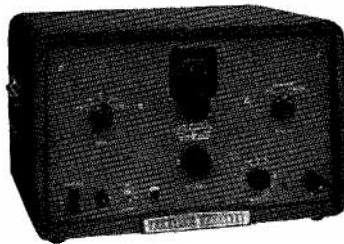


This new audio oscillator provides continuous single-sweep frequency coverage from 20 cps to 20 KC. No band switching is needed; dial accuracy is 4%, and the instrument also provides a flexible 10 v/600 ohm output usable balanced or with one side grounded. Frequency response is  $\pm 1.0$  db full

range, distortion and hum are less than 1%. *-hp-* 207A may be swept by hand, motor driven, tuned remotely or coupled to a recorder. *-hp-* 207A, \$275.00.

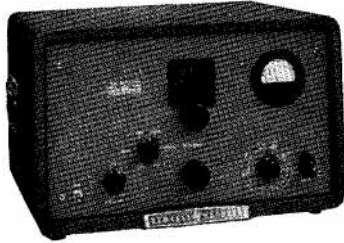
Instrument	Primary Uses	Frequency Range	Output	Price
<i>-hp-</i> 200AB	Audio tests	20 cps to 40 KC	1 watt/24.5 v	130.00
<i>-hp-</i> 200CD	Subsonic through supersonic audio and ultrasonic tests	5 cps to 600 KC	160 mw or 10 v/600 ohms; 20 v open circuit	160.00
<i>-hp-</i> 200J	Interpolation, frequency measurements	6 cps to 6 KC	160 mw/10 v	275.00
<i>-hp-</i> 200T	Telemetry, carrier current tests	250 cps to 100 KC	160 mw or 10 v/600 ohms; 20 v open circuit	350.00
<i>-hp-</i> 201C	High quality audio tests	20 cps to 20 KC	3 w or 42:5 v/600 ohms	225.00
<i>-hp-</i> 202A	Low frequency measurements	0.008 to 1200 cps	28 mw or 30 v p-p/4000 ohms	465.00 $\Delta$
<i>-hp-</i> 202C	Servo equipment tests, measurements	1 cps to 100 KC	160 mw or 10 v/600 ohms	300.00
<i>-hp-</i> 205AG	High power audio tests, gain measurements	20 cps to 20 KC	5 watts	475.00 $\Delta$
<i>-hp-</i> 206A	High quality, high accuracy audio tests	20 cps to 20 KC	+ 15 dbm	615.00 $\Delta$
<i>-hp-</i> 207A	Audio sweep generation	20 cps to 20 KC	160 mw or 10 v/600 ohms	275.00
<i>-hp-</i> 233A	Carrier oscillator—current tests	50 cps to 500 KC	3 w/600 ohms	475.00
<i>-hp-</i> 650A	Wide range video tests	10 cps to 10 MC	15 mw/3 v	490.00 $\Delta$

$\Delta$  Rack mounted instruments available at \$15.00 less.



### -hp- 202A Function Generator

Compact, multi-purpose source of transient-free test voltages from 0.008 cps to 1,200 cps. Continuously variable through 5 bands; offers exceptional stability (within 1%) and distortion less than 1% to 100 cps. Sine, square or triangular waves may be selected by a front panel switch; the 30 volt output peak-to-peak is constant for all wave forms and over full frequency range. *-hp-* 202A, \$465.00 $\Delta$ .

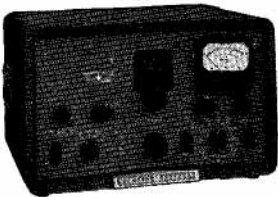


### -hp- 650A Test Oscillator

Covering 10 cps to 10 MC, *-hp-* 650A is a highly stable, wide band instrument for audio, supersonic, video and rf measurements. Output is flat within 1 db full range; voltage range is 0.00003 to 3 v. In addition to 600 ohm impedance, voltage divider provides a 6 ohm impedance. Distortion less than 1% to 100 KC; stability  $\pm 2\%$  to 100 KC. \$490.00 $\Delta$ .

## -hp- Distortion, Wave Form Analyzers - 20 cps to 20 KC

### -hp- 330B Distortion Analyzer



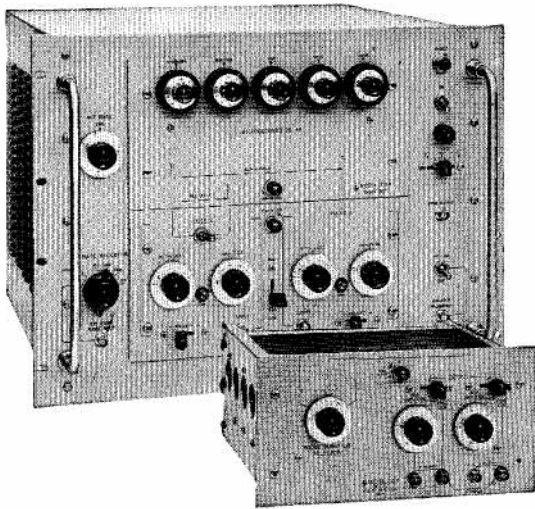
Measures distortion as low as 0.1% from 20 cps to 20 KC; also measures noise voltages down to 100  $\mu$ v. Sensitivity is high; distortions of 0.3% are measured full scale and levels of 0.1% are readable

accurately. Frequency calibration accurate within  $\pm 2\%$  full range. Includes a 20 db amplifier, oscilloscope terminals and precision 10 cps to 100 KC vacuum tube voltmeter usable separately. \$410.00 $\Delta$ .

Instrument	Primary Uses	Frequency Range	Characteristics	Price
<i>-hp-</i> 300A	Wave form analyzer	30 cps to 16 KC	Variable selectivity; measuring range 1 mv to 500 v	\$775.00
<i>-hp-</i> 330B	Measures total audio distortion	20 cps to 20 KC	Includes input amplifier, VTVM	410.00 $\Delta$
<i>-hp-</i> 330C	For FM broadcast measurements	20 cps to 20 KC	Special VU meter to meet F.C.C. requirements	440.00 $\Delta$
<i>-hp-</i> 330D	For AM, FM broadcast measurements	20 cps to 20 KC	AM detector and VU meter to meet F.C.C. requirements	455.00 $\Delta$

$\Delta$  Rack mounted instruments available at \$15.00 less.

# NEW! -hp- 218A Digital Delay Generator



## -hp- 219A Dual Trigger Unit

This plug-in drawer for -hp- 218A supplies trigger pulses of positive polarity, 50 volts, 0.1  $\mu$ sec rise time from a 50 ohm source. Pulse A occurs at  $T_0$  or  $T_1$  as selected by a switch; Pulse B is triggered at  $T_2$ . -hp- 219A, \$100.00.

## -hp- 219B Dual Pulse Unit

This plug-in drawer for -hp- 218A produces two high-power pulses which are continuously adjustable in width, 0.2 to 5  $\mu$ sec and in amplitude from 0 to 50 volts, positive or negative polarity. The leading edge of these pulses can be set to occur at the beginning or end of the selected time interval. Both pulses are brought out to separate front panel jacks but may be switched to a common jack with no change in level or output impedance. -hp- 219B, \$450.00.

## -hp- 219C Digital Pulse Duration Unit

This plug-in drawer for -hp- 218A produces a high power output pulse whose delay and duration are digitally controlled. The pulse is available in both polarities simultaneously, and is continually adjustable in amplitude up to 20 volts from a 90 ohm source. It may also be obtained from a directly coupled 500 ohm source with an amplitude of 100 volts. -hp- 219C, \$350.00.

Independently adjustable time intervals or pulse delays  
 $\pm 0.1 \mu$ sec time interval accuracy  
Crystal oscillator time base  
Regulated power supplies

Model 218A Digital Delay Generator is a totally new instrument applicable to many types of timing measurements including calibrating the range determining circuits of radar receivers, etc. The generator is built to rigid standards and is suitable for military use. It provides two precision time intervals or pulse delays, either of which are independently adjustable from 1 to 10,000 microseconds in 1 microsecond steps. These time intervals are accurate to within 0.1 microsecond  $\pm 0.001\%$  of the selected value, and may be initiated from an internal multi-vibrator, 10 cps to 10 KC, or from an external rate generator, 0 cps to 10 KC. Total jitter does not exceed 0.02 microseconds in either case. The instrument also provides a 50 volt synchronizing output pulse at the beginning or end of a time interval, and a 1 microsecond timing comb output at the front panel.

## No count ambiguity

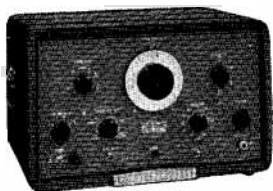
A unique feature of the new -hp- 218A is its time base, a pulsed crystal controlled oscillator. The oscillator starts at  $T_0$  and stops at the last output pulse. This eliminates the "plus-or-minus-1-count" ambiguity of many counter circuits in such application.

Model 218A is a completely self-contained instrument, requiring only one or more -hp- 219 series plug-ins to perform a broad variety of time and delay generation measurements. Simplicity and flexibility are increased by the large variety of input and output connections brought to the front panel. The instrument is particularly compact and well-designed; etched circuits and the use of plug-ins materially increase circuit accessibility.

The instrument's power supplies are fully regulated to avoid effects of line voltage variations. It is available as -hp- 218A, cabinet mount, or 218AR, rack mount. -hp- 218A/AR, \$2,000.00.

# -hp- Square Wave and Pulse Generators

## -hp- 212A Pulse Generator



Provides continuously variable, high power "fast pulses" of superior wave form. Combines broad general usefulness with 0.02  $\mu$ sec rise and decay time to meet requirements of radar, TV and nuclear work. Pulse length variable 0.07 to 10  $\mu$ sec; minimum overshoot; 50 watt peak power (50 v to 50 ohms load). Low impedance means accurate pulses can be delivered at a distance from the instrument. Repetition rate variable 50 to 5,000 pps; controlled internally or externally. Synchronizing pulse available in advance of, or following output pulse. \$565.00 (cabinet), \$550.00 (rack mount).

## -hp- 211A Square Wave Generator



Versatile, wide range instrument for testing oscilloscopes, networks, video and audio amplifier performance, modulating signal generators and measuring time constants. Offers simple control of electronic switches; is also convenient for indicating phase shift, frequency response, transient effects. Two separate outputs (a) 7 volt 75 ohm circuit for TV work; (b) 55 volt 600 ohm output for high level work. Both have full amplitude variation. Instrument operates free-running or externally synchronized with positive going pulse or sine wave of 5 volts minimum amplitude. \$265.00.



# -hp- Vacuum Tube Voltmeters - 10 to 700,000,000 cps

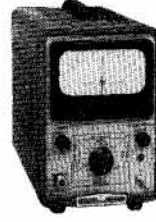
## NEW! -hp- 400L Logarithmic Voltmeter



New -hp- 400L, 10 cps to 4 MC, features a 5" true log voltage scale plus a 12 db linear decibel scale. The log voltage scale plus long scale length provides a voltmeter of maximum readability and an accuracy which is a *constant percentage of the reading*. Accuracy is  $\pm 2\%$  of reading or  $\pm 1\%$  of full scale, whichever is more accurate, to 500 KC;  $\pm 5\%$  full frequency range. Voltage range 0.3 mv to 300 v in 12 steps.

Generous overlap is insured by a 10 db range switch plus a 12 db scale length. High stability, 10 megohm input impedance. Meter is mirror backed for maximum accuracy. Also may be used as a stable amplifier. \$325.00.

## NEW! -hp- 425A Microvolt-Ammeter



New, high sensitivity, high stability microvolt meter reading full scale voltages of 10  $\mu\text{v}$  to 1 v in 11 ranges. Also reads currents of 10  $\mu\text{ma}$  to 3 ma in 18 step, 1-3-10 sequence. Accuracy  $\pm 3\%$  on all ranges. Drift less than 2  $\mu\text{v}$  referred to input terminals. Input impedance 1 megohm  $\pm 3\%$  on all ranges. Instrument can also be used as a 100 db amplifier providing up to 1 v output from signals as small as 10  $\mu\text{v}$ . Amplifier ac rejection is at least 3 db at 0.2 cps and 60 db at 60 cps. In addition to engineering uses ideal for physics, chemistry applications including grid or photomultiplier tube currents, ionization levels, thermocouple potentials and voltaic currents. Also measures v in living cells, nerves, seeds, plants. Includes probe. \$500.00.

## -hp- 400D Vacuum Tube Voltmeter



Best -hp- voltmeter ever built! Covers all frequencies 10 cps to 4 MC. Extremely sensitive, wide range, accurate within 2% to 1 MC, measures 0.1 mv to 300 v. Direct reading in dbm. 10 megohm input impedance insures negligible loading on circuits under test. New amplifier circuit with mid-range feedback assures utmost stability, freedom from change due to external conditions. \$225.00.

## -hp- 410B Vacuum Tube Voltmeter



All-purpose test instrument, range 20 cps to 700 MC. Also serves as dc VTVM with over 100 megohms impedance, or ohmmeter for measurements 0.2 ohms to 500 megohms. Input capacity 1.5  $\mu\text{mf}$ , 10 megohms input impedance; employs radical diode probe

which virtually eliminates circuit loading. Industry's most versatile precision voltmeter. \$245.00.

Instrument	Primary Uses	Frequency Range	Voltage Range	Input Impedance	Price
-hp- 400AB	General purpose ac measurements	10 cps to 600 KC	0.003 to 300 v 11 ranges	10 megohms 25 $\mu\text{mf}$ shunt	\$200.00
-hp- 400D	Wide range ac measurements High sensitivity	10 cps to 4 MC	0.001 to 300 v 12 ranges	10 megohms 15 $\mu\text{mf}$ shunt	225.00
-hp- 400H	High accuracy wide range ac measurements	10 cps to 4 MC	0.001 to 300 v 12 ranges	10 megohms 15 $\mu\text{mf}$ shunt	325.00
-hp- 400L	Log voltages, linear db measurements	10 cps to 4 MC	0.3 mv to 300 v 12 ranges	10 megohms 15 $\mu\text{mf}$ shunt	325.00
-hp- 410B	Audio, rf, VHF measurements; dc voltages; resistances	dc; ac—20 cps to 700 MC	0.1 to 300 v 7 ranges	dc—122 megohms; ac—10 megohms/ 1.5 $\mu\text{mf}$	245.00
-hp- 425A	Read $\mu\text{v}$ , $\mu\text{ma}$ ; 100 db amplifier; medical, biological, physical, chemical	dc voltages as 100 db amplifier	10 $\mu\text{v}$ to 1 v 11 ranges	1 megohm $\pm 3\%$	500.00



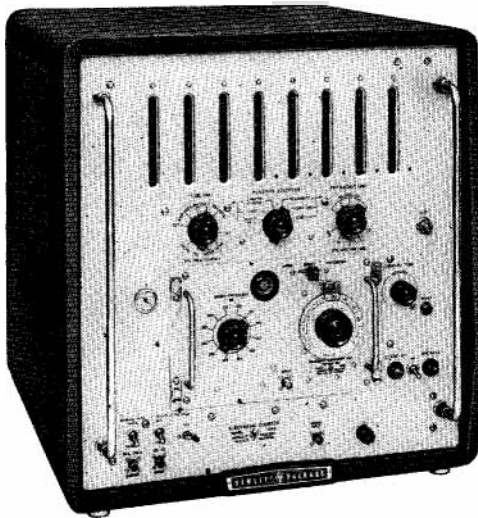
## -hp- 400H Vacuum Tube Voltmeter

Need extreme accuracy of 1%? -hp- 400H covers 10 cps to 4 MC, has 5" meter with mirror scale, measures voltages 0.1 mv to 300 v. 10 megohm resistance minimizes circuit loading, amplifier with 56 db feedback insures lasting stability. Direct reading in db or v. Extremely high quality throughout. \$325.00.

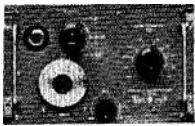
## -hp- accessories increase usefulness of your voltmeters

Instrument	Features	Price
-hp- 452A Capacitive Voltage Divider	For all -hp- ac VTVM. 25 cps to 20 MC. Division 1000:1	\$100.00
-hp- 452-95A Adapter	Connects -hp- 452A to -hp- 410B VTVM probe	10.00
-hp- 453A Capacitive Voltage Divider	For -hp- 410B VTVM only. Division 100:1	25.00
-hp- 454A Capacitive Voltage Divider	For -hp- 400D and 400H only. Division 100:1	30.00
-hp- 455A Probe Coaxial "T" Connector	For -hp- 410B VTVM. Measures voltages between conductor and sheath of 50 ohm transmission line	35.00
-hp- 458A Probe Coaxial "N" Connectors	For -hp- 410B VTVM. Measures volts at open end of 50 ohm transmission line	25.00
-hp- 459A DC Resistive Voltage Multiplier	For -hp- 410B VTVM. For measuring high dc voltages safely. Multiplies 1:100	25.00
-hp- 470A to F Shunt Resistors	For -hp- 400 series VTVM. For measurement of current	470A - 15.00 470B-F - 10.00

# NEW! -hp- 524D Precision Electronic Counter



## 5 PLUG-IN UNITS INCREASE FLEXIBILITY, USEFULNESS FOR MANY MEASUREMENTS



**-hp- 525A Frequency Converter.** Extends 524D's direct reading range to cover 10 cps to 100 MC with no loss in accuracy. Provides additional amplification to

increase video sensitivity to 0.1 v through 524D's basic 10 cps to 10.1 MC range. \$250.00.



**-hp- 525B Frequency Converter.** Converts -hp- 524D for direct readings 100 to 220 MC in decade steps. Maintains same high accuracy throughout range; provides high sensitivity for low level work. \$250.00.

Provides high sensitivity for low level work. \$250.00.



**-hp- 526A Video Amplifier.** Increases 524D sensitivity to 10 mv for low power frequency measurement 10 cps to 10.1 MC. Accuracy same as counter; minimum

input 10 millivolts rms. \$175.00.



**-hp- 526B Time Interval Unit.** Permits 524D to measure interval 1.0  $\mu$ sec to 100 days with accuracy of 0.1  $\mu$ sec  $\pm$  0.0001%. Reads in sec, msec or  $\mu$ sec. Triggering from separate "stop" or "start" on pos. or neg. going waves. Trigger adjustable -192 to +192 volts. \$175.00.

Permits 524D to measure interval 1.0  $\mu$ sec to 100 days with accuracy of 0.1  $\mu$ sec  $\pm$  0.0001%. Reads in sec, msec or  $\mu$ sec. Triggering from separate "stop" or "start" on pos. or neg. going waves. Trigger adjustable -192 to +192 volts. \$175.00.



**-hp- 526C Period Multiplier.** Permits 524D to measure period over 100, 1,000 or 10,000 cycles of unknown, thus providing the greater accuracy of mid-range frequency readings. Front panel switch selects desired period. \$225.00.

Permits 524D to measure period over 100, 1,000 or 10,000 cycles of unknown, thus providing the greater accuracy of mid-range frequency readings. Front panel switch selects desired period. \$225.00.

- New stability—5 parts in  $10^8$  per week
- New convenience—8 vertical readout units
- Direct, instantaneous, automatic readings
- Covers frequencies 10 cps to 220 MC
- Measures time interval 1  $\mu$ sec to 100 days
- Measures period 0 cps to 10 KC
- Resolution 0.1 microseconds
- No calculation or complex setup
- Easily used by non-technical personnel
- High, sensitivity, impedance, reliability

New crystal oscillator stability of 5 parts in  $10^8$  per week plus the added convenience of uniform vertical neon readout units—these are significant advances incorporated into new -hp- 524D Electronic Counter, at no increase in price over -hp- 524B.

The new 524D permits you to buy only the basic counting facilities you need now—later on add inexpensive plug-ins to triple and quadruple the usefulness of your counter.

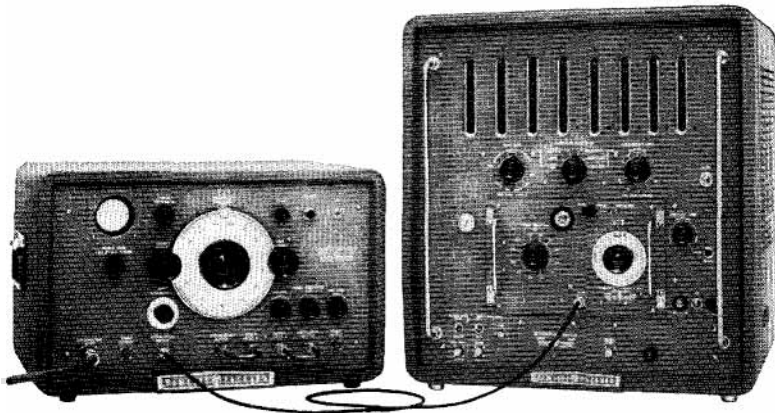
The basic -hp- 524D reads frequency 10 cps to 10 MC over 5 selected periods. Display time is variable, counts are automatically reset, action is repetitive, readings are direct without calculation or interpolation; an automatic illuminated decimal point is included.

The instrument is of highest quality throughout and employs a military design approach. -hp- 524D, less plug-ins, \$2,150.00 (cabinet); \$2,125.00 (rack mount).

Instrument	Primary Uses	Frequency Range	Characteristics	Price
-hp- 524B Frequency Counter	Frequency, period measurements	10 cps to 10 MC (Freq.) 0 cps to 10 KC (Period)	Direct reading, no interpolation, stability about 2/1,000,000/week	\$2,150.00 ■
-hp- 524D Frequency Counter	Frequency, period measurement	10 cps to 10 MC (Freq.) 0 cps to 10 KC (Period)	Direct reading, no interpolation; stability 5/10 <sup>8</sup> per wk	2,150.00 ■
-hp- 525A Frequency Converter	Extends 524 range to 100 MC; increase basic sensitivity	10 cps to 100 MC	Accuracy $\pm$ 1 cps $\pm$ stability; 0.1 v rms min. input	250.00
-hp- 525B Frequency Converter	Extends 524 range from 100 to 220 MC; high sensitivity	100 MC to 220 MC	Accuracy $\pm$ 1 cps $\pm$ stability; 0.2 v rms min. input	250.00
-hp- 526A Video Amplifier	Increases 524 sensitivity to 10 millivolts	10 cps to 10.1 MC	Accuracy same as basic counter; 10 mv rms min. input	175.00
-hp- 526B Time Interval Unit	Measures interval 1 $\mu$ sec to 100 days	1 $\mu$ sec to 10 <sup>7</sup> sec	Accurate 0.1 $\mu$ sec $\pm$ 0.0001%	175.00
-hp- 526C Period Multiplier	Period measurement	Extends range of 524 to measure 10,000 periods	Greater accuracy in period measurement	225.00

■ Rack mounted instrument available for \$25.00 less.

## -hp- 540A Transfer Oscillator



*Just two -hp- instruments*—Model 540A Transfer Oscillator and a 524 series electronic counter, (with plug-ins) are all the equipment you need to measure unknown frequencies up to 12 KMC swiftly and accurately.

This simple, two instrument setup is particularly useful for quick CW and AM frequency measurement, FM center frequency and deviation checks, frequency of high-noise signals and pulsed signals. Overall accuracy is better than 10 times that of the best microwave wavemeters; and on clean CW signals, is about 1/1,000,000.

### Simple operation

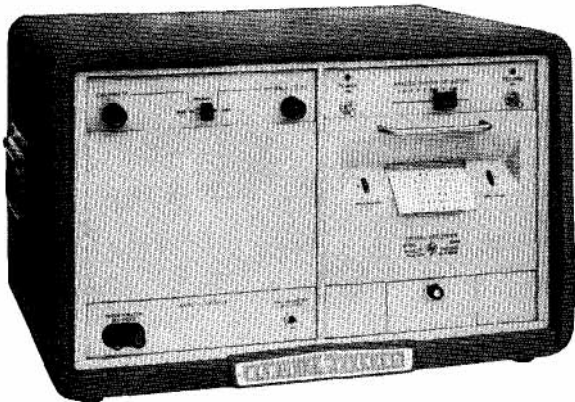
When approximate frequency is known, the 540A is tuned until a harmonic beats with the unknown. The multiplying

factor is noted, and the 540A frequency measured on the 524. The 524 reading, times the multiplying factor, is the unknown.

### Brief Specifications

**Oscillator Freq. Range:** 100 to 220 MC  
**Harmonic Freq. Range:** Up to 12 KMC  
**Stability:** Better than 0.002%/minute  
**Output:** 2 volts into 50 ohms  
**Attenuator Range:** 20 to 80 db into 50 ohms  
SWR 1.5 at 1 KMC  
**Amplifier Gain:** 40 db max, 1 v output  
**Oscilloscope:** 100 cps to 200 KC; vert.  
sens. 5 mv rms/inch  
**Price:** \$615.00

## -hp- 560A Digital Recorder



*No intermediate equipment* is needed between -hp- 560A and its Counter. In direct hookup, completely self-contained -hp- 560A provides a complete record of all types of test data, plus, through an analog output, a convenient graphic record of very small data variations.

The analog output is a voltage or current proportional to the number represented by any 3 consecutive digits of recorded data. The 560A permits expanded strip chart recording and the chart cannot be driven off scale since range variation for the 3-digit scale is 0 to 999. Wider variation merely causes a repetition of the 0 to 999 sequence.

Print capacity is five, 11-digit lines/second; secondary or coding data may be entered simultaneously with primary data.

Continuous digital record for frequency counters

Direct reading, simple hookup

Five 11-digit lines/second

Analog output for recorder

Expanded scale; full scale =  $10^7$

Accuracy identical to counter used

### Brief Specifications

**Accuracy:** Identical to counter used  
**Printing Rate:** 5 lines/sec maximum  
**Digit Capacity:** Up to 11 per line  
**Driving Source:** Parallel entry staircase voltages, descending  
135 to 55 v, 0 to 9  
**Analog Output:** Proportional to any 3 consecutive digits;  
max. amplitude 1 ma or 100 mv  
**Print Command Signal:** 10  $\mu$ sec minimum, pos. or neg.,  
15 v/pulse  
**Price:** (11-digit, cabinet model), \$1,390.00  
(11-digit, rack mount), \$1,375.00



# Other -hp- Frequency Measuring and Monitoring Equipment

## -hp- 500B/C Frequency Meters



Directly measures frequency of voltages 3 cps to 100 KC; expanded scale allows any 10% or 30% of range to be measured full scale. Sensitivity 0.2 v rms (sine waves) 1 v peak for pulses. Input impedance 1 megohm with 40  $\mu$ f shunt; accuracy independent of line voltage changes. Also available as -hp- 500C, calibrated for direct reading in rpm. -hp- 500B/C, \$285.00.

## -hp- 506A Optical Tachometer Pickup



Versatile, flexible light source and pickup for use as a transducer with -hp- 521A/C, 500B/C, etc. Measures 300 to 300,000 rpm (beyond with amplified output); normal output at least 1 v rms into 1 megohm or greater impedance. Light source 21 cp 6 v bulb; Type 1P41 phototube, phototube bias 70 to 90 v dc (supplied from -hp- 500B/C, 521 A/C). -hp- 506A, \$125.00.

## -hp- 508A-D Tachometer Generators



Rotating speed transducers used with electronic counters or frequency meters for simple, accurate measurements from 15 to 40,000 rpm (or beyond with amplifier) -hp- 508A provides 60 output pulses per shaft revolution; -hp- 508B, C, D provide 100, 120 and 360 pulses/rev respectively. Output voltage increases linearly with shaft speed to 5,000 pps. Running torque approx. 0.15 in. oz.; peak starting torque approx. 4 in. oz. -hp- 508A, B, C or D, \$100.00.

## -hp- 521A/C Industrial Counters

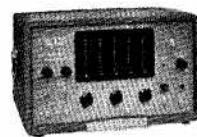


Low cost, simple operation, almost limitless uses characterize -hp- 521A/C Industrial Counters. -hp- 521A measures speed, rpm, rps, frequency, random events per unit of time; with proper transducers also measures weight, pressure, temperature, acceleration, etc. -hp- 521A reads direct in cps, rpm and rps; display is variable 0.1 to 15 seconds or "hold"; 60 cps check circuit confirms accuracy of readings; three accessory power supplies include -150 v dc, +300 v dc and 6.3 v ac. Frequency range 1 cps to 120 KC, accuracy  $\pm 1$  count  $\pm$  accuracy of built-in 60 cps timing frequency (usually  $\pm 0.1\%$ ); input min. 0.2 v rms; input attenuator adjusts sensitivity 0.2 to 100 v rms, input impedance 1 megohm with 50  $\mu$ f shunt, gate time 0.1 and 1 sec, also Manual Gate. -hp- 521C same as 521A except has greater accuracy, crystal controlled time base and 5-place (instead of 4-place) registration with count capacity of 99,999. -hp- 521C, \$650.00. -hp- 521A, \$475.00.

Instrument	Primary Uses	Frequency Range	Characteristics	Price
-hp- 100D Secondary Standard	Frequency, time measurements	100 KC, 10 KC, 1 KC, 100 cps, 10 cps	Stability 1/1,000,000 (short-time). Sine or rectangular output. Marker pips	\$ 615.00 $\Delta$
-hp- 335ER TV Monitor	Aural and visual carrier monitoring; black and white or color	Channels 2 to 83	Aural deviation $\pm 3$ KC; video deviation $\pm 3$ KC; accuracy $\pm 500$ cps approx.	2,050.00
-hp- 500B Electronic Frequency Meter	Rapid frequency measurements	3 cps to 100 KC	9 ranges $\pm 2\%$ accuracy. Input 0.2 to 250 volts	285.00
-hp- 500C Electronic Tachometer Indicator	Rpm measurements	180 to 6,000,000 rpm	Similar to 500B but calibrated in rpm	285.00
-hp- 506A Optical Tachometer Pickup	Rps and rpm measurement	300 to 300,000 rpm	Phototube and light source; output 1 v rms	125.00
-hp- 508A Tachometer Generator	Shaft speed measurement	15 to 40,000 rpm	Output 60 cycles per revolution	100.00
-hp- 508B Tachometer Generator	Shaft speed measurement	15 to 40,000 rpm	Output 100 cycles per revolution	100.00
-hp- 508C Tachometer Generator	Shaft speed measurement	15 to 40,000 rpm	Output 120 cycles per revolution	100.00
-hp- 508D Tachometer Generator	Shaft speed measurement	15 to 40,000 rpm	Output 360 cycles per revolution	100.00
-hp- 520A Nuclear Scaler	For counting high-rate pulses	Capacity 100 counts in 2 decades. 10,000,000 pps counting rate	100:1 divider for operation of low speed scalars	615.00 $\Delta$
-hp- 521A Industrial Electronic Counter	Measure frequency, speed	1 cps to 120 KC	Direct reading, accurate within $\pm 1$ count $\pm 0.1\%$ , 4 place registration	475.00
-hp- 521C Industrial Electronic Counter	Measure frequency, speed	1 cps to 120 KC	Direct reading, accuracy within $\pm 1$ count $\pm 0.01\%$ , 5 place registration	650.00
-hp- 522B Electronic Counter	Frequency, period, time interval measurements	10 cps to 120 KC	Direct reading, accuracy $\pm 1$ count $\pm 0.001\%$	915.00 $\Delta$
-hp- 523B Electronic Counter	Frequency, period, time interval	10 cps to 1.1 MC	Direct reading, accuracy $\pm 1$ count $\pm 2/1,000,000$	1,245.00

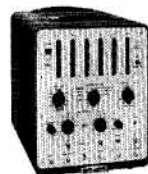
$\Delta$ Rack mounted instrument available for \$15.00 less.

## -hp- 522B Electronic Counter



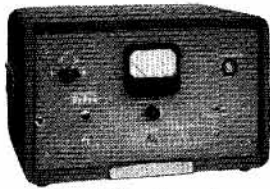
Compact, low cost, versatile instrument for frequency, period or time measurements. Measures frequency 10 cps to 120 KC, time interval 10  $\mu$ sec to 10<sup>9</sup> sec. Reads direct in cps, KC, seconds or milliseconds. Count automatically reset, action repetitive. Stability of time base 5/1,000,000 per week. Easily used by untrained personnel. High quality, completely self-contained, bright, clear numerals; ideal industrial as well as lab instrument. \$915.00 $\Delta$ .

## -hp- 523B Electronic Counter



Revolutionary all-purpose counter measures frequency 10 cps to 1.1 MC, time interval 3  $\mu$ sec to 27.8 hours, period 0.00001 cps to 10 KC. Stability 2/1,000,000 per week. Results displayed in sec, msec,  $\mu$ sec or KC; automatic decimal. Display time variable 0.1 sec to 5 sec or indefinitely. Accuracy  $\pm 1$  count plus crystal stability, 5 gate times. Usable with 100 KC primary standard. High quality, completely self-contained, bright numerals, controls color-coded for simpler use by non-technical personnel. Pulse output for Z-axis oscilloscope modulation. \$1,245.00.

# Microwave Impedance Measuring Equipment



## -hp- 416A Ratio Meter

Automatically combines forward and reverse signals and displays their ratio directly, irrespective of amplitude variations. Contains rf power monitor indicating proper power level. Rear terminal signal available to operate oscilloscope or recorder. Suitable for single and swept frequency operation. \$450.00 $\Delta$ .



## -hp- 415B Standing Wave Indicator

For all waveguide and coaxial slotted sections. Gives readings in SWR or db. Single frequency operation; 315 to 2,000 cps. Low noise level, 0.1  $\mu$ v (full scale) sensitivity, 60 db. calib. attenuator. \$200.00.



## -hp- 803A VHF Bridge

Provides direct impedance measurements in vhf range, 2 to 2,000 ohms,  $-90^\circ$  to  $+90^\circ$  phase angle. Wide frequency range 52 to 500 MC; makes measurements down to 5 MC and up to 1,000 MC. Fast, simple to use. \$600.00.



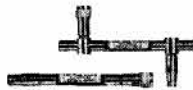
## -hp- 417A VHF Detector

Super-regenerative (AM) receiver covering all frequencies from 10 to 500 MC in 5 bands. Designed for use with -hp- 803A Bridge. 5  $\mu$ v sensitivity full range. Single frequency control, reads direct in MC. \$350.00.

Instrument	Primary Uses	Frequency Range	Characteristics	Price
-hp- 360A-D Low Pass Filters	Eliminates harmonic voltages from uhf systems	Cut-off frequencies A- 700 MC C-2,200 MC B-1,200 MC D-4,100 MC	50 db rejection at 1.25 cutoff freq.	\$ 40.00
-hp- 415B Standing Wave Indicator	SWR indicator or null indicator	315 to 2,000 cps. Normal freq. 1,000 cps	0 to 70 db attn. Max. sensitivity 0.1 $\mu$ v	200.00
-hp- 416A Ratio Meter	Reflection coefficient measurements	1,000 cps $\pm$ 40 cps	Continuous swept frequency presentation; accuracy $\pm$ 3%	450.00 $\Delta$
-hp- 417A vhf Detector	vhf bridge detector (for -hp- 803A)	10 to 500 MC	Approx. 5 $\mu$ v sensitivity	350.00
-hp- 803A vhf Bridge	Measurement of vhf impedance, SWR	52 to 500 MC	2 to 2,000 ohms impedance $-90^\circ$ to $+90^\circ$ phase angle	600.00
-hp- 805A Coaxial Slotted Section	Measurement of SWR	500 to 4,000 MC	For Type N Connectors flexible cables	475.00
-hp- 805B Coaxial Slotted Section	Same as above	Same as above	For rigid $\frac{7}{8}$ " RG44/U line	475.00
-hp- 806B Coaxial Slotted Section	Same as above (mounts in 809B)	3,000 to 12,000 MC	For Type N Connectors flexible cables	200.00
-hp- 809B Universal Probe Carriage	G, J, H, X and P 810 Waveguide Sections Supports 806B section, also		Accepts 442B, 444A probes	160.00
-hp- 814B Universal Probe Carriage	Supports P, K and R 815B Waveguide Slotted Sections		Accepts Untuned Probe 446A	200.00

$\Delta$  Rack mounted instruments \$15.00 less.

## -hp- 360 Low Pass Filters



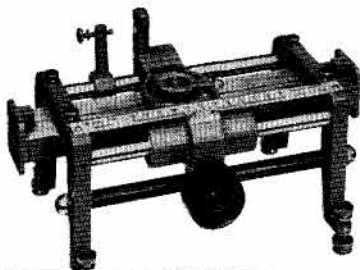
Isolating filters which speed microwave measurements by eliminating harmonics, permitting transmission at single, known frequency only. Particularly necessary in slotted line, filter characteristic, receiver response, similar measurements. Table above gives cut-off frequency; insertion loss not over 3 db; nominal impedance 50 ohms. -hp- 360A, B, C or D, \$40.00.

## -hp- 805A/B Slotted Lines

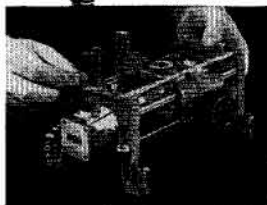


Exclusive -hp- "parallel-plane" design insures utmost mechanical rigidity, less leakage, greater accuracy, low SWR of 1.02 or 1.04 (depending on model). Range 500 MC to 4 KMC, reads in cm and mm to 0.1 mm. -hp- 805A, for 50 ohm Type N use, -hp- 805B, for 46.3 ohm RG 44/U stub supported  $\frac{7}{8}$ " O.D. coax. -hp- 805A/B, \$475.00.

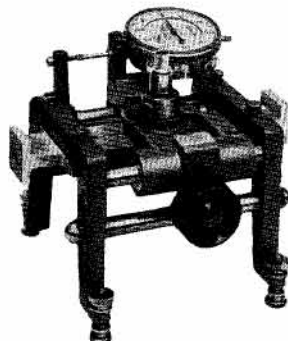
## -hp- 809B/814B Universal Probe Carriages



-hp- 809B



Quick, easy waveguide interchange



-hp- 814B

Models 809B and 814B are precision built mechanical assemblies operating, respectively, with -hp- 810B and 815B series slotted sections.

Combination of the 809B carriage and 810B slotted sections covers 2.6 to 18.0 KMC. Combination of 814B carriage and 815B series sections covers 12.4 to 40.0 KMC.

On either carriage, waveguides can be interchanged in seconds for real savings on engineering time. Only one probe is required for each carriage to cover full frequency range. Manufacture is of highest quality to assure positive mechanical positioning of interchangeable waveguides and precise installation of mating -hp- probes (see page 12). -hp- 809B has a vernier scale reading to 0.1 mm and is equipped for dial gauge mounting. -hp- 814B has a cylindrical dial which may be read directly to 0.1 mm and interpolated at 0.01 mm.

**-hp- 810B Slotted Sections.** -hp- 810B, for mounting in 809B carriage, is a flanged, waveguide section with accurately machined slot. Slot is tapered at ends to minimize reflection. Available in 5 waveguide bands, 3.95 through 18.0 KMC.\*

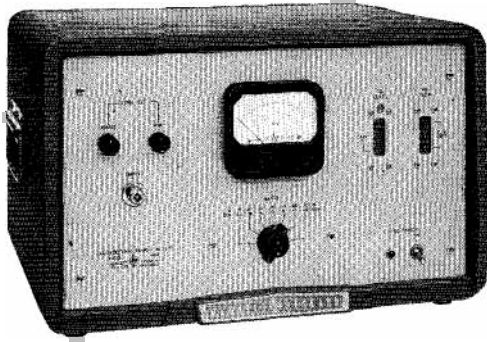
**-hp- 810A.** Complete slotted section assembly including probe carriage. In 2.6 to 3.95 KMC (S-band) size only.\*

**-hp- 815B Slotted Sections.** For mounting in 814B carriage. Available P, K and R bands, 12.4 to 40.0 KMC. To insure positive positioning when mounting in carriage, these sections seat on two eccentric rods. Rods are factory-adjusted so longitudinal plane of guide is always parallel to probe travel.\*

\*For prices, see table page 12.

# NEW! Microwave Power Measuring Equipment

## -hp- 434A Calorimetric Power Meter



Just connect and read powers 10 mw to 10 watts! Covers dc to 10 KMC. No barretter or thermistor needed. No external terminations or plumbing. Measures CW or pulsed power. Two simple controls; no technical skill required.

New -hp- 434A Calorimetric Power Meter is, factually, the fastest, easiest way yet devised to measure powers accurately from 10 milliwatts to 10 watts, dc to 10 kilomegacycles.

With the 434A, measurement is literally as simple as connecting to the 50 ohm, type N front panel terminal and reading power directly. Thus the instrument is particularly suited for use by non-technical people.

### Compact, self-contained

-hp- 434A fills the range between bolometer microwave power meters (such as the popular -hp- 430C, below) and conventional calorimeters for powers above 10 watts. But unlike previous cumbersome equipment suggested for its range, the new -hp- 434A is compact, moderate in cost, completely self-contained, and needs no detectors or external plumbing whatsoever.

### Brief Specifications

**Input Power Range:** 7 ranges; full scale readings 0.01 to 10 watts

**Frequency Range:** dc to 10 KMC

**dc Input Impedance:** 50 ohms  $\pm$  5 ohms at input jack

**Input SWR:** Less than 1.5 full range

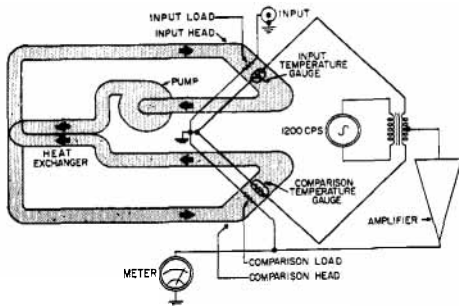
**Meter Response (full scale):** Approx. 10 sec (high range)

Approx. 2 sec (lower ranges)

**Controls:** Zero Set, Meter Range

**Accuracy:** Within 5% of full scale

**Price:** \$1,115.00 (cabinet); \$1,100.00 (rack mount)



Circuitry, -hp- 434A

## -hp- 430C Microwave Power Meter



No computations! Provides instantaneous, automatic power readings *direct* in dbm or mw at all frequencies for which there are suitable bolometer mounts. For CW measurements, uses either 1/100 amp. fuse or Sperry 821 barretter. Also measures CW or pulsed power with negative coefficient thermistor. Provides up to 16 ma bias current. Operates with all mounts in adjacent table. Range 0.02 to 10 mw. \$250.00.

## -hp- 477B Coaxial Thermistor Mount



For frequency range 10 MC to 10 KMC. SWR less than 1.5. Thermistor element is 200 ohm negative. No tuning required; not susceptible to burnout. \$75.00 (including thermistor).

## -hp- 764D-767D Dual Directional Couplers



New high directivity dual coaxial couplers make reflectometer measurements practical in vhf and uhf coax systems. Flat response, high power capacity, low insertion loss. Four models, covering 216 to 4,000 MC collectively. \$125.00.

Instrument	Primary Uses	Frequency Range	Characteristics	Price
-hp- 430C Microwave Power Meter	Measurement of rf power	Depends on Bolometer Mount	0.02 to 10 mw $\pm$ 5% accuracy	\$250.00
-hp- 434A Calorimetric Power Meter	Measurement of rf power	dc to 10 KMC	Direct reading, no barretters, thermistors or terminations; CW, pulsed	1115.00
-hp- 475B Tunable Bolometer Mount	Measurement of rf power (with 430B/C)	1,000 to 4,000 MC	Matches 50 ohm line to 100 or 200 ohms	225.00
-hp- 476A Universal Bolometer Mount	Measurement of rf power (with 430B/C)	10 to 1,000 MC	No tuning required SWR less than 1.25	85.00
-hp- 477B Coaxial Thermistor Mount	Measurement of rf power (with 430C)	10 MC to 10 KMC	No tuning required SWR less than 1.5	75.00
-hp- 485 Waveguide Detector Mount	Measurement of rf power	2,600 to 18,000 MC	Full coverage of waveguide band	See Table page 12
-hp- 487B Waveguide Thermistor Mount	Measurement of rf power	3,950 to 26,500 MC	Full coverage, no tuning, 1.5 SWR except K487B 2.0	See Table page 12
-hp- 764D Dual Directional Coupler	Reflectometer and rf power measurements	216 to 450 MC	Coupling attenuation* 20 db, directivity 30 db	125.00
-hp- 765D Dual Directional Coupler	Reflectometer and rf power measurements	450 to 945 MC	Coupling attenuation* 20 db, directivity 30 db	125.00
-hp- 766D Dual Directional Coupler	Reflectometer and rf power measurements	940 to 1,975 MC	Coupling attenuation* 20 db, directivity 26 db	125.00
-hp- 767D Dual Directional Coupler	Reflectometer and rf power measurements	1,900 to 4,000 MC	Coupling attenuation* 20 db, directivity 26 db	125.00

\*Power handling capacity all 764/767 series couplers 50 watts CW, 10 Kw peak.

# -hp- Waveguide Test Equipment—2.6 to 40.0 KMC

Basic, low-cost elements offer utmost flexibility for assembly of exact instrumentation required. Each unit covers entire range of its waveguide size. Careful engineering, simple, sturdy mechanical design, highest quality manufacture insures accurate, multi-purpose operation.

Instrument	Coaxial Type N Conn.	"S" 3" x 1 1/2" 2.6 - 3.95 KMC	"G" 2" x 1" 3.95 - 5.85 KMC	"J" 1 1/2" x 3/4" 5.2 - 8.2 KMC	"H" 1 1/4" x 5/8" 7.05 - 10.0 KMC	"X" 1" x 1/2" 8.2 - 12.4 KMC	"P" .702" x .391" 12.4 - 18.0 KMC	"K" .500" x .250" 18.0 - 26.5 KMC	"R" .360" x .220" 26.5 - 40.0 KMC	
Adapter, Waveguide to Coax		S281A \$50	G281A \$40	J281A \$35	H281A \$30	X281A \$25				
Cover to Choke Flange		S290A \$65	G290A \$50	J290A \$35	H290A \$25	X290A \$15	P290A \$20			
Attenuators, Fixed 3, 6, 10, 20 db		S370A \$75	G370A \$65	J370A \$65	H370A \$60	X370A \$55	P370A \$60			
Flap, 25 db max.		S375A \$120	G375A \$110	J375A \$100	H375A \$90	X375A \$90	P375A \$100	K375A \$140	R375A \$180	
Calibrated, precision		S380A \$260	G382A \$500	J382A \$350	H382A \$350	X382A \$250	P382A \$275	K382A \$425	R382A \$450	
Detector Mounts	420A \$50 420B \$75 440A† \$85				H421A \$95	X421A \$75	P421A \$95			
		S485D° \$145	G485D \$140	J485D° \$135						
		S485A‡ \$125	G485B† \$95	J485B† \$90	H485B† \$85	X485B† \$75	P485C■ \$110			
Isolators						X365A \$225				
Thermistor Mounts (Fixed tuned) ■	477B \$75		G487B \$95	J487B \$90	H487B \$80	X487B \$75		K487B \$85		
Frequency Meters, Reaction				J530A/B**	H530A \$120	X530A \$120	P530A \$150			
Waveguide						X532A \$150	P532A \$210	K532A \$230	R532A \$250	
Directional Coupler, Cross Guide: 20, 30 db		S750 \$130	G750 \$120	J750 \$70	H750 \$60	X750 \$50				
Directional Couplers, Multi Hole: 3, 10, 20 db		S752 \$375	G752 \$250	J752 \$140	H752 \$120	X752 \$75	P752 \$115	K752 \$175	R752 \$200	
Slotted Sections, Waveguide		S810A* \$450	G810B§ \$110	J810B§ \$110	H810B§ \$110	X810B§ \$90	P815B \$265	K815B \$265	R815B \$265	
Slotted Sections, Waveguide							P870A \$130	K870A \$140	R870A \$140	
Tuners, Slide Screw		S870A \$225	G870A \$185	J870A \$150	H870A \$130	X870A \$125	P880A \$135	K880A \$155	R880A \$170	
E-H				J885A \$400		X885A \$300	P885A \$350			
Waveguide Phase Shifter										
Terminations, Low Power		S910A \$45	G910A \$35	J910A \$30	H910A \$25	X910A \$25	P910A \$25	K910A \$30	R910A \$35	
Terminations, High Power		S912A \$160				X912A \$50				
Moving Load		S914A \$100	G914A \$75	J914A \$70	H914A \$60	X914A \$50	P914A \$55	K914A \$65	R914A \$75	
Standard Reflections						X916A \$100				
Adjustable Shorts		S920A \$100	G920A \$70	J920A \$60	H920A \$50	X920A \$40	P920A \$55	K920A \$140	R920A \$150	
Waveguide Shorting Switch						X930 \$80				
Broad Band Probe	442B§ \$35	All frequencies								
Broad Band Probe, Untuned		444A \$35 2.4 to 18.0 KMC							446A \$145 12.4 to 40 KMC	
Waveguide Clamps, Stands										

†For use with barretter or crystal.  
■ Includes Thermistor, installed.

‡For use with barretter only.  
\*\*J530A, 5.85 to 8.2 KMC, \$120; J530B, 5.20 to 7.05 KMC, \$150.

\*Complete assembly including carriage.

§Mounts in 809B Carriage.

° Includes barretter; checked for square law characteristics.

## NEW! -hp- 382A Precision Attenuators



Previously offered for frequencies 3.95 through 18.0 KMC, popular -hp- 382A series precision attenuators are now available in "K" and "R" bands, 18.0 to 40.0 KMC. "K," "R" band attenuators are of new, space-saving

design (see photo). Direct reading, one-control tuning, high power handling capacity. Attenuation 0 to 50 db full range, independent of frequency. Phase shift constant with attenuation. For prices G, J, H, X and P382A, see table above. -hp- K382A, \$425.00. -hp- R382A, \$450.00

## -hp- 281A Waveguide - Coax Adapters



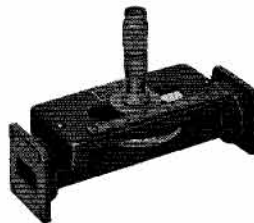
For convenient transition between waveguide and coax systems. Each unit covers a full waveguide range with SWR less than 1.25. Type N coax plug, AN waveguide flange. For S, G, J, H and X bands, 2.6 to 12.4 KMC. \$25.00 to \$50.00.

## -hp-487B Thermistor Mounts

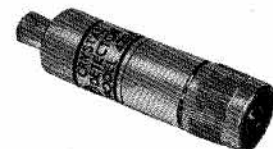


For fast, accurate waveguide power measurements. Each unit covers full range of its waveguide frequency. No tuning needed, SWR 1.5 max., except K487B, SWR 2.0 max. Max. power 10 mw. Rugged construction, high temperature coefficient thermistors virtually eliminate burnout. For G, J, H, X and K bands, 3.95 to 26.5 KMC. \$75.00 to \$95.00.

## -hp- 870A Slide Screw Tuners



For flattening waveguide systems, matching, etc. Probe position and penetration adjusts to set up SWR cancelling existing SWR. Precision lead screw or micrometer varies probe insertion; vernier adjusts probe position. Corrects SWRs of 20 with accuracy of 1.02 SWR. For S, G, J, H, X, P, K, R bands, 2.6 to 40.0 KMC. \$125.00 to \$225.00.



## -hp- 420A/B Crystal Detectors

Employs a silicon crystal to detect rf signals in Type N coaxial lines. Covers frequencies 10 MC to 12.5 KMC, sensitivity approx. 0.01 v/0.1 mw, frequency response ± 3 db full range. Uses modified 1N26 crystal, max. SWR 3. \$50.00 each. Also available in matched pairs as -hp- 420B, \$150.00 pair.

## -hp- 444A/446A Untuned Probes

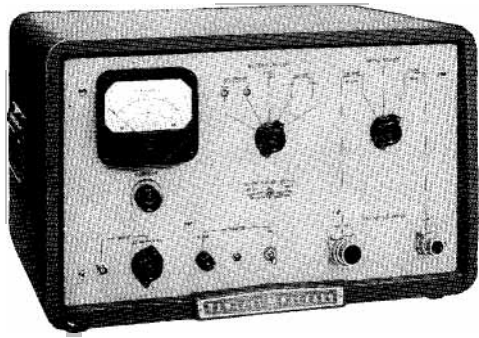


-hp- 444A is modified crystal (1N76 or 1N26) plus small antenna in convenient housing. Probe penetration easily variable; may be locked in position. No tuning needed; sensitivity superior to most elaborate single or double tuned probes. Range 2.4 to 18 KMC; fits 3/4" bore.

New -hp- 446A, for -hp- 814 Probe Carriage, similar but covers P, K and R bands, 12.4 to 40.0 KMC. -hp- 444A, \$35.00. -hp- 446A, \$145.00.



# NEW! -hp- Noise Measuring Equipment



## -hp- 340A Noise Figure Meter

Here is totally new equipment that makes it possible for a semi-skilled worker to do, in 5 minutes, receiver and component alignment jobs that once took skilled engineers a full hour. Receiver performance can often be *improved up to 3 db over the best adjustment previously possible. Improvement in receiver performance frequently equals doubling transmitter output.* Since accurate alignment is now easy, equipment is better maintained and peak performance enjoyed daily.

Model 340A is a revolutionary instrument making it possible, in 5 minutes, to optimize receiver performance and measure noise figure directly. *-hp- 340A* is direct reading in db, simple to use, automatic and needs no periodic calibration, operates over any frequency range for which there are noise sources, and has fast response to instantly track and present noise changes. In addition to usefulness in optimizing receiver and component performance, *-hp- 340A* is particularly helpful in designing circuit components such as IF amplifiers, crystal mixing circuits and traveling-wave tubes.

## -hp- 347A Waveguide Noise Source

These new devices, Argon gas discharge tubes across a waveguide section provide uniform 15.2 (15.25 in S band) db excess noise level full range with maximum SWR of 1.2 even when noise source is cold. No temperature correction required. Available for S through P band, 2.60 to 18.0 KMC, (S, G bands), \$190.00; (J, H, X and P bands), \$180.00.

## -hp- 345A IF Noise Source

Temperature-limited diode noise sources for IF amplifier noise measurement. Matches 50, 100, 200 or 400 ohms impedance. Center frequency either 30 or 60 MC. Noise level depends on cathode current, controlled and metered by *-hp- 340A*. *-hp- 345A*, \$75.00.

## Brief Specifications

**Frequency Range:** Depends on noise source

**Noise Figure Range:** 3 to 30 db to  $\infty$  with waveguide noise source  
0 to 15 db to  $\infty$  with IF noise source

**Accuracy:**  $\pm 0.5$  db, 10 to 25 db;  $\pm 1$  db, 3 to 30 db, waveguide noise source  
 $\pm 0.5$  db, 0 to 15 db, IF noise source

**Required Rcvr or rf Amplifier Gain:** Approx. 40 db (Waveguide Voice Source)  
Approx. 50 db (IF Noise Source)

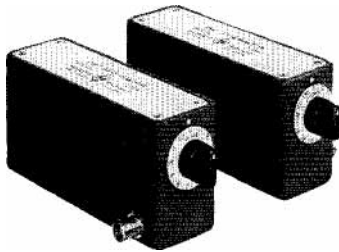
**Input Frequency:** 30 or 60 MC, selected by switch

**Bandwidth:** 1 MC minimum

**Input Impedance:** 50 ohms

**Price:** \$715.00 (cabinet); \$700.00 (rack mount)

# NEW! -hp- 355A/B Attenuators – 0 to 132 db



Here are two completely new design 50 ohm attenuators providing, together, 0 to 132 db attenuation in 1 db steps from dc to 500 MC! *-hp- 355A* provides 0 to 12 db attenuation in 1 db steps; *-hp- 355B* provides 0 to 120 db attenuation in 10 db steps. One simple control for each attenuator; overall full range accuracy is  $\pm 0.25$  db for *-hp- 355A*. For *-hp- 355B*, accu-

racy is  $\pm 1$  db to 250 MC;  $\pm 2$  db to 500 MC. Nominal impedance is 50 ohms, maximum SWR is 1.2 to 250 MC, 1.5 to 500 MC. **Maximum insertion loss** is 0 at dc, 0.4 db at 60 MC, 1 db at 250 MC and 1.5 db at 500 MC. **Power dissipation** is 0.5 watt average, 350 volts peak. The attenuators use BNC connectors. *-hp- 355A* or *355B*, \$125.00.

## More -hp- equipment, available for most waveguide frequencies

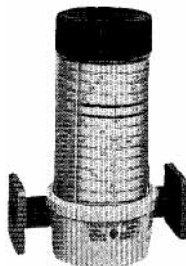
### -hp- 485 Detector Mounts



Three basic series offered; *5485A* for S band (no tuning, 1.35 SWR, 821 element); *485B*, for G, J, H, X bands (tunable, 1.25 SWR full range, 1N23, 1N21 or 821 element); *485D* for S, G, J

bands (factory-installed 821 barretter). Also P485C, like 485B but for P band only, has installed 200 ohm 3 mw thermistor. \$75.00 to \$145.00.

### -hp- 532A Waveguide Frequency Meters



New design for P, K, R bands. Wide band, direct reading, no interpolation or charts. Comprises a high Q resonant cavity tuned by choke plunger; no sliding contacts. Transmits almost full power at resonance; resonance indicated by 1.5 db dip in output. Precision tuning mechanism; no back-lash. Also similar model for X-band. \$150 to \$250.

### -hp- 752 Multi-Hole Couplers

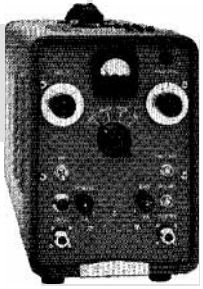


Precision directional couplers available in 3 models with coupling factors of 3, 10 and 20 db. Coupling accuracy  $\pm 0.4$  db except K, R bands which are  $\pm 0.7$  db. Directivity better than 40 db full range, coupling variation not over  $\pm 0.5$  db full range. Primary guide SWR less than 1.05. S, G, J, H, X, P, K, R bands, 2.6 to 40.0 KMC. \$75.00 to \$375.00.



# Wide Band Amplifiers for Fast Circuit Work

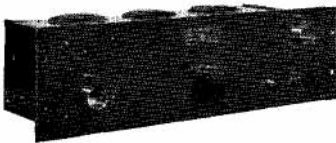
## -hp- Traveling-Wave Tube Amplifiers



*-hp-* offers Traveling-Wave Tube Amplifiers for all frequencies 2 to 12.4 KMC. *-hp-* 490B, 492A and 494A are low level, high gain amplifiers with 30 and 25 db gain; they offer amplitude, pulse, phase or FM modulation. *-hp-* 491A is a high power traveling-wave tube amplifier

having a rated output of 1 watt, 2 to 4 KMC. All amplifiers have exclusive *-hp-* helical coupling system, and employ encapsulated traveling-wave tubes that can be readily replaced. *-hp-* 490B/491A, \$1,400.00. *-hp-* 492A/494A, \$1,500.00.

## -hp- 460A/B Fast Pulse Amplifiers

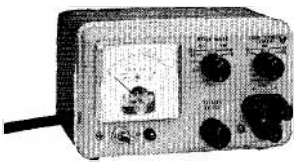


*-hp-* 460A Wide Band Amplifiers, in cascade with *-hp-* 460B Fast Pulse Amplifiers, provide up to 90 db gain, 125 v open circuit. This permits direct connection to oscilloscope deflection plates. Rise time 0.0026  $\mu$ sec. Will amplify millimicrosecond pulses. Over 100 MC band width for 'scopes. *-hp-* 460AR, \$185.00. *-hp-* 460BR, \$225.00.

Instrument	Primary Uses	Frequency Range	Characteristics	Price
<i>-hp-</i> 450A Amplifier, Stabilized	General purpose lab amplifier	10 cps to 1,000,000 cps	20 and 40 db gain, frequency response $\pm 1/2$ db	\$ 140.00
<i>-hp-</i> 460AR Amplifier, Wide Band	Wide band, pulse amplification	100 KC to 140 MC	20 db gain, rise time 0.0026 $\mu$ sec	185.00
<i>-hp-</i> 460BR Amplifier, Fast Pulse	Pulse amplification high output	100 KC to 140 MC	15 db gain, 125 peak volts	225.00
<i>-hp-</i> 490B Traveling-Wave Tube Amplifier	Amplification throughout "S" band	2 to 4 KMC	30 db gain; Millimicrosec rise time; 10 mw output	1,400.00
<i>-hp-</i> 491A Traveling-Wave Tube Amplifier	High power "S" band amplification	2 to 4 KMC	30 db gain; millimicrosec rise time; 1 watt output	1,400.00
<i>-hp-</i> 492A Traveling-Wave Tube Amplifier	Amplification through most of "G" and "J" bands	4 to 8 KMC	30 db gain; millimicrosec rise time; 10 mw output	1,500.00
<i>-hp-</i> 494A Traveling-Wave Tube Amplifier	Amplification throughout "X" band	7 to 12.4 KMC	25 db gain; millimicrosec rise time; 5 mw output	1,500.00

# -hp- Regulated and Klystron Power Supplies

## NEW! -hp- 721A Transistor Power Supply



New, completely transistorized, compact, regulated supply. Output 0 to 30 v, continuously variable. 150 ma maximum output, output impedance less than 0.2 ohms. Regulation,

no load to full load, 0.3% or 30 mv whichever is greater. Line voltage change of  $\pm 10\%$  causes output change of less than 0.3% of  $\pm 15$  mv, whichever is greater. Front panel switch limits maximum output current preventing damage to transistors, etc., from accidental overload. Reads ma, v direct. \$145.00.

## -hp- 712B Power Supply



This *-hp-* instrument features high regulation of 50 mv no load to full load, 0.1 millisecond transient response, internal impedance 0.1 ohms in series with 25  $\mu$ H; full-load maximum

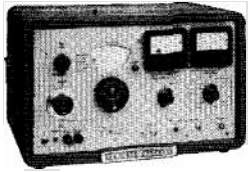
hum less than 500  $\mu$ v, sealed transformers, chokes and condensers. 0 to 500 v, 200 ma supply and fixed -300 v tap providing a 50 ma, 300 to 800 v variable supply for klystron operation. \$365.00 $\Delta$ .

Instrument	Primary Use	Characteristics	Price
<i>-hp-</i> 710B Power Supply	General purpose regulated dc supply for lab and field use	100 to 360 volts @ 75 ma	\$110.00
<i>-hp-</i> 711A Laboratory Power Supply	Same as 710B	0 to 500 volts @ 100 ma	225.00
<i>-hp-</i> 712B Power Supply	Same as 710B	0 to 500 volts @ 200 ma	365.00 $\Delta$
<i>-hp-</i> 715A Klystron Power Supply	Regulated beam, reflector source for low power klystrons	250 to 400 volts @ 50 ma	300.00
<i>-hp-</i> 717A Klystron Power Supply	Powering Type 5721 klystrons	800 to 1,000 volts @ 25 ma	425.00
<i>-hp-</i> 721A Transistor Power Supply	Powering transistors, similar applications	0 to 30 v, 150 ma	145.00

$\Delta$ Rack mounted instrument available for \$15.00 less.

# -hp- Signal Generators - 50 KC to 21 KMC

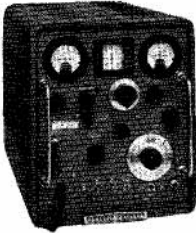
## NEW! -hp- 606A Standard Signal Generator



New, ultra-modern; 50 KC to 65 MC. Output 3 v full range, continuous attenuation to 0.1  $\mu$ v. MO-PA circuit with full feedback loop insures constant out-

put full range. Low distortion, broad modulating capabilities. Typical -hp- speed, ease of operation; occupies 1/4 bench space normally needed for generators of this frequency. \$990.00 $\Delta$ .

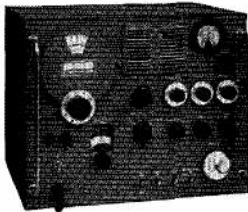
## -hp- 608D vhf Signal Generator



10 to 420 MC. Highest stability. No incidental FM or frequency drift. Calibrated output 0.1  $\mu$ v to 0.5 v throughout range. Built-in crystal calibrator provides frequency check accurate within 0.01% each 1 and 5 MC. Master-oscillator, intermediate and output amplifier circuit design. Premium quality performance, direct calibration, ideal for aircraft communications equipment testing. \$1,050.00.

-hp- 608C vhf Signal Generator. High power (1 v max.) stable, accurate generator for lab or field use. 10 to 480 MC. Ideal for testing receivers, amplifiers, driving bridges, slotted lines, antennas, etc. \$950.00.

## -hp- 626A/628A shf Signal Generators



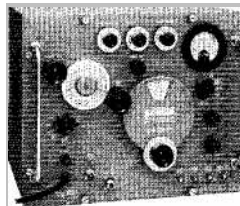
New instruments, bringing high power, wide range, convenience and accuracy to 10 to 21 KMC range. Frequencies, output voltage directly set and read. Output 10 to 20 db better than previous spot-frequency sets

SWR better than 1.2 at 0 dbm and lower. Internal pulse, FM or square wave modulation; also external pulsing or FM'ing. -hp- 626A, 10 to 15.5 KMC, \$3,250.00. -hp- 628A, 15 to 21 KMC, \$3,250.00.

Instrument	Frequency Range	Characteristics	Price
-hp- 606A	50 KC to 65 MC	Output 0.1 $\mu$ v to 3 v. Full feedback loop, low distortion	\$ 990.00 $\Delta$
-hp- 608C	10 to 480 MC	Output 0.1 $\mu$ v to 1 v into 50 ohm load. AM, pulse, or CW modulation. Direct calibration	950.00
-hp- 608D	10 to 420 MC	Output 0.1 $\mu$ v to 0.5 v. Incidental FM 0.001% entire range	1,050.00
-hp- 612A	450 to 1,230 MC	Output 0.1 $\mu$ v to 0.5 v into 50 ohm load. AM, pulse, CW or square wave modulation. Direct calibration	1,200.00
-hp- 614A	800 to 2,100 MC	Output 0.1 $\mu$ v to 0.223 v into 50 ohm load. Pulse, CW or FM modulation. Direct calibration	1,950.00
-hp- 616A	1,800 to 4,000 MC	Output 0.1 $\mu$ v to 0.223 v into 50 ohm load. Pulse, CW or FM modulation. Direct calibration	1,950.00
-hp- 618B	3,800 to 7,600 MC	Output 0.1 $\mu$ v to 0.223 v into 50 ohm load. Pulse, CW, FM or square wave modulation. Direct calibration	2,250.00
-hp- 620A	7,000 to 11,000 MC	Output 0.1 $\mu$ v to 0.223 v into 50 ohm load. Pulse, FM or square wave modulation. Direct calibration	2,250.00
-hp- 623B	5,925 to 7,725 MC	Output 70 $\mu$ v to 0.223 v into 50 ohm load. FM or square wave modulation. Separate power meter and wave meter section	1,900.00
-hp- 624C	8,500 to 10,000 MC	Output 3.0 $\mu$ v to 0.223 v into 50 ohm load. Pulse, FM or square wave modulation. Separate power meter and wave meter section	2,265.00 $\Delta$
-hp- 626A	10 to 15.5 KMC	Output 10 dbm to -90 dbm. Pulse, FM, or square wave modulation. Direct calibration	3,250.00
-hp- 628A	15 to 21 KMC	Output 10 dbm to -90 dbm. Pulse, FM, or square wave modulation. Direct calibration.	3,250.00

$\Delta$  Rack mounted instrument available for \$15.00 less.

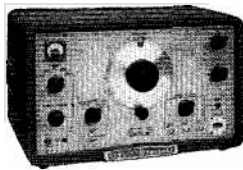
## -hp- 614A/616A UHF Signal Generators



Among most widely used signal generators. -hp- 614A, 800 MC to 2.1 KMC, -hp- 616A, 1.8 to 4.0 KMC. Direct reading, direct frequency set, no calibration charts, wide range. -hp- 614A SWR 1.6, output accuracy  $\pm$  1 db -10 dbm to -127 dbm. -hp- 616A, SWR 1.8, output accuracy  $\pm$  1.5 db, -7 dbm to -127 dbm. Both have constant internal impedance 50 ohms. Modulation is internal or external pulse, or FM. -hp- 614A or -hp- 616A, \$1,950.00.

# -hp- Swept Frequency Oscillators

## -hp- 686A Electronic Sweep Oscillator



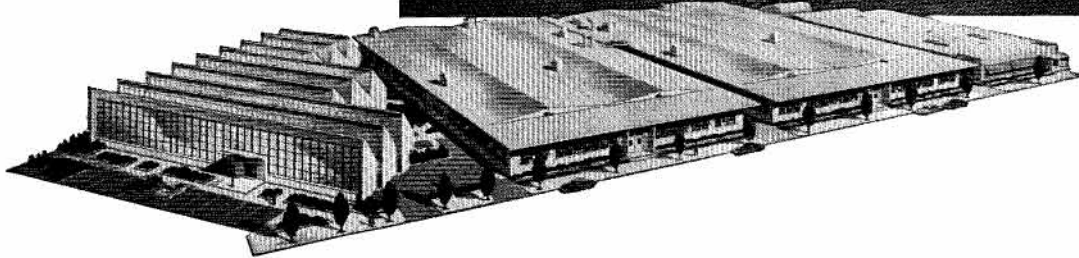
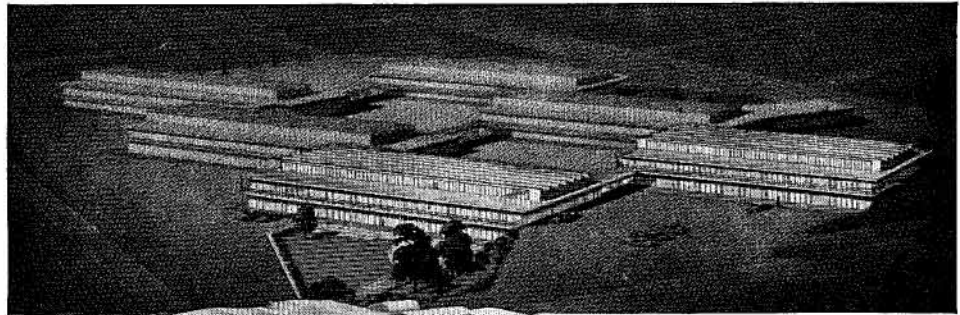
Totally new kind of backward-wave device eliminating sweep motors, tuning plungers, range limitations, etc. Covers all or part of X-band with flexible, quiet electronic sweep.

Simple to operate, direct reading, continuously adjustable sweep width and rate, 10 mw output minimum, frequency sweep linear with time. Has slow sweep for recorders; fast for oscilloscope; single sweep manually started or externally triggered, external FM, AM modulation. Ultimate in X-band sweep oscillators, \$2,615.00 $\Delta$ .

Instrument	Frequency Range	Characteristics	Price
-hp- 670SM	2.6 to 4 KMC		\$1,175.00 with motor
-hp- 670GM	4 to 6 KMC	Automatic adjustable motor-driven sweep, full frequency band coverage, output	1,175.00 with motor
-hp- 670JM	5.85 to 8.2 KMC	10 mw full range, full modulation capabilities, direct-reading frequency dial.	1,175.00 with motor
-hp- 670HM	7 to 10 KMC		1,175.00 with motor
-hp- 684A	3.7 to 5.9 KMC		2,265.00 $\Delta$
-hp- 686A	5.2 to 8.2 KMC	Electronically swept; variable sweep rate, width. Output 10 mw, SWR 2.1 or less.	2,265.00 $\Delta$
-hp- 686A	8.2 to 12.4 KMC	Pulse, square wave, FM, AM modulation	2,615.00 $\Delta$
-hp- 687A	12.4 to 18.0 KMC		3,115.00 $\Delta$

Data subject to change without notice.  
Prices f. o. b. factory.

In 1957, *-hp-* occupied the first two of six 85,000 square-foot buildings forming a complete new laboratory and manufacturing plant. New facility is approximately one mile west of previous plant on a 40-acre site just south of Stanford University. Your visit is invited.



## COMPLETE COVERAGE

Won't you agree it is simple and more time-saving when you can turn to one source for your test equipment needs? *-hp-* engineers are continually working to produce new equipment that anticipates your future needs, yet functions smoothly with your existing *-hp-* instruments. At the 1958 I.R.E. Show 20 new, basic *-hp-* test instruments were introduced. Today, *-hp-* makes over 300 instruments; you can choose from the world's largest and most complete line

just the equipment you need. In making this choice, you are assured of *-hp-* quality; today the standard of the world in electronic test instruments.

To give you personal help with measuring problems, you have available over 150 electronics specialists in every major U. S. metropolitan area, and around the world. These men, trained and annually re-trained by *-hp-*, are experts in applying as well as selling and servicing *-hp-* instruments. Call them when you can use personal, competent help, in your plant, today.

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