INSTRUCTIONS

MODEL 200I

SPREAD SCALE
AUDIO OSCILLATOR

HEWLETT-PACKARD COMPANY

Laboratory Instruments for Speed and Accuracy

395 PAGE MILL ROAD • PALO ALTO • CALIFORNIA

INSTRUCTIONS

AUDIO OSCILLATOR

Model 200I

ELECTRICAL SPECIFICATIONS

Frequency..... 6 to 6,000 cps.

Calibration - main dial, two bands (A - 6-20; B - 20-60)

Frequency Range	Multiplying Factor	Frequency
A-X1	1	6 - 20 cps
B-X1	1	20 - 60 cps
A-X10	10	60 - 200 cps
B-X10	10	200 - 600 cps
A-X100	100	600 - 2000 cps
B-X100	100	2000 - 6000 cps

Power Output..... 10 volts into 1000 ohm load.

Load Impedance..... 1000 ohms (grounded).

Frequency Response (Ref. 400 cps, 10 volts into 1000 ohms load)..... ±1 db from 6 cps to 6,000 cps.

Stability (Frequency)..... Within ±2% under normal temperature conditions. By standardizing the ranges against a suitable frequency standard from time to time, an accuracy of better than 1% can be maintained.

Distortion (Rated Output)..... Less than 1% above 10 cps.

Hum..... Less than 0.1% of maximum output voltage.

Power Supply ..... 115 volts, 60 cycles, 50 watts.

Fuse Rating..... 1 ampere.

I. GENERAL

The Hewlett-Packard Model 200I is a resistance-tuned oscillator covering the range from 6 cps to 6000 cps, and is designed for application in interpolation work. The main frequency control dial is 6 inches in diameter, with calibrations covering approximately 300 degrees. There are more than 750 calibrated points for the toal total frequency range of the instrument.

II. CIRCUIT DESCRIPTION.

The Oscillator Section of the Model 200I is a two-stage resistance-coupled amplifier over which both positive and negative feedback are applied. The positive feedback network is a frequency-selective resistance-capacitance combination which is used to control the frequency of oscillation. Negative feedback is used to stabilize the operation of the circuit. The amount of negative feedback is determined by a resistance network which contains a non-linear element in the form of a 6 watt incandescent lamp. This element controls the amount of feedback in accordance with the amplitude of oscillation and consequently maintains the proper operating point in the system.

The Amplifier Section is a two-stage resistance-coupled output amplifier. Feedback is used in this circuit to eliminate distortion and to provide a good frequency response over the entire range of the instrument.

This amplifier is designed to deliver 10 volts into a 1000 ohm load over the entire frequency range. The internal impedance of the output system is low enough so that the output voltage is not critical with load. However, load resistance less than 1000 ohms will tend to increase the distortion when the volume control is set for full output and will also decrease the maximum output voltage obtainable.

III. OPERATION.

Ordinarily, a warm-up period is not required. However, when the unit is first put into operation, or when it has been standing idle for a long time, the instrument should be allowed to run for ten or fifteen minutes before it is used.

The Output Frequency is selected by the main dial. This dial is located behind the front panel, so that only part of it is visible through the window. The frequency control knob is directly below this window, and under the frequency control know is a vernier for fine tuning. The dial has two sets of calibrations, both of which read directly in cycles per second for the lowest frequency ranges.

The Frequency Range Switch on the lower left side of the panel indicates the particular dial calibration and multiplying factor to use.

The Output Voltage is controlled by the volume control at the right side of the panel. This control is situated in the circuit between the oscillator and the output amplifier. When very small audio voltages are desired, it is good practice to use an attenuator between the oscillator and the equipment being driven. This will aid in keeping the hum level far below the audio signal.

The Model 200I is designed to operate on 115 volts at 50 to 60 cycles per second. However, changes in line voltage of ±10 volts will have very little effect on the instrument because of the voltage-regulator circuit incorporated.

Before leaving the factory, the instrument has been adjusted to deliver more than rated power into the rated load. Because of this feature, the output wave may show some distortion when the volume control is adjusted to give maximum output. This condition is normal, and when low distortion is required, the oscillator should be operated at rated output or slightly below.

IV. MAINTENANCE.

The total Harmonic Distortion is less than 1% if the instrument is operating properly. When tubes are changed, the distortion should be measured, because a poor tube will increase the distortion without otherwise affecting the operation of the instrument.

The Fuse is a 1 ampere cartridge located on the under side of the chassis close to the power cord. If the fuse fails, the instrument should be carefully checked to ascertain the cause of overload. Do not replace with a fuse of higher amperage. Never short the clips on the fuse block.

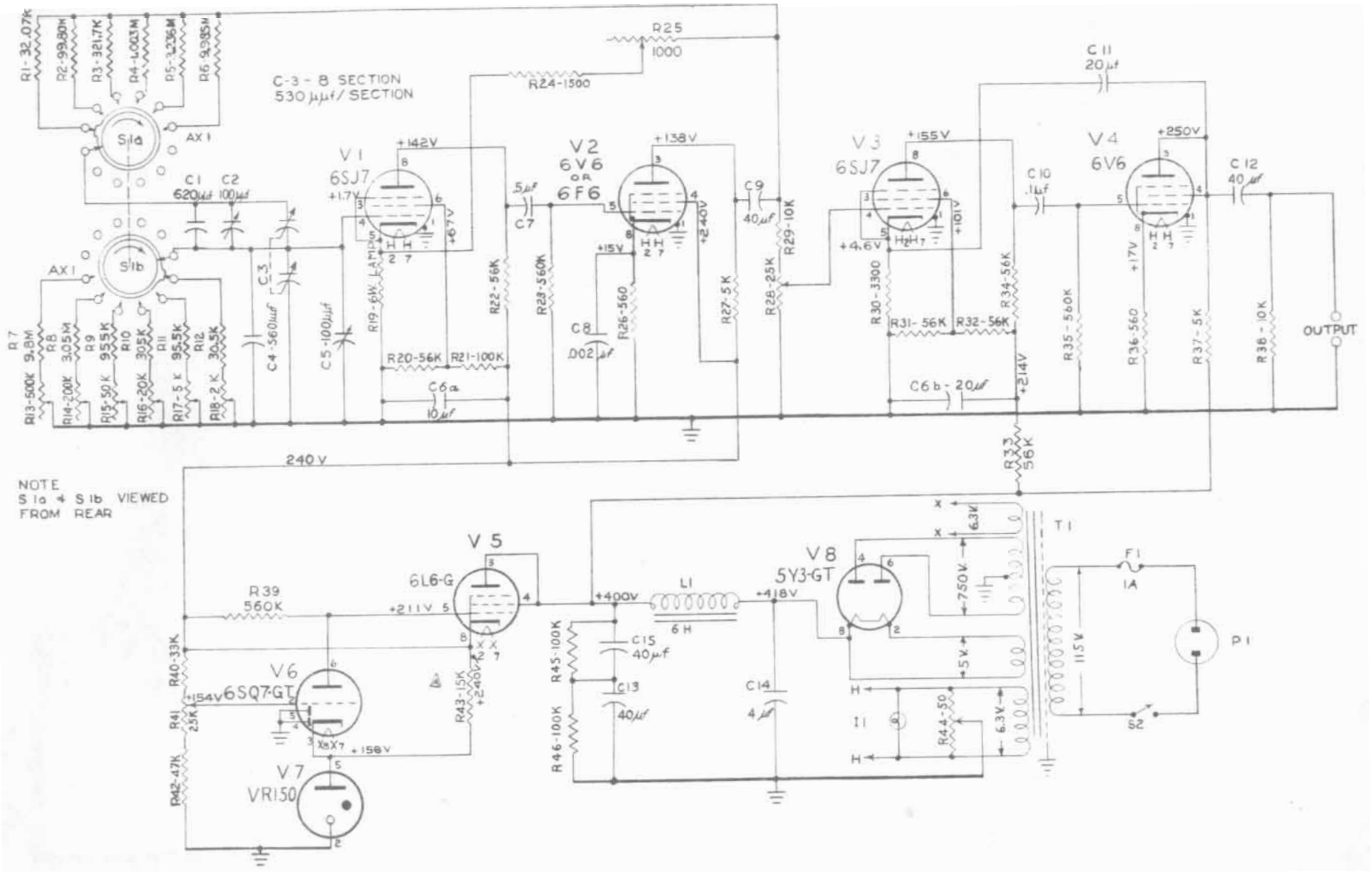
Instability of the output voltage is sometimes caused by a defective tube in the oscillator section. Therefore, if such a condition arises, it will often save time to check these components. first.

The Frequency Calibration will ordinarily remain constant without adjustment. If necessary, however, the calibration of the various bands may be shifted slightly be adjusting the potentiometers R13 to R18, in the following manner:

The A-X1 band is adjusted by R13,
the B-X1 band is adjusted by R14,
the A-X10 band is adjusted by R15,
the B-X10 bans is adjusted by R16,
the A-X100 band is adjusted by R17,
and the B-X100 band is adjusted by R18.

If the calibration cannot be lined up by the use of these potentiometers, the circuit components have probably changed value. The instrument should then be returned to the factory for recalibration.

In General, the frequency calibration and the distortion level in the output should be checked periodically. Clean the unit thoroughly, and apply a drop of light oil to the drive bearing on the main dial shaft every six months.



SCHEMATIC DIAGRAM OF-HP-MODEL 200I SPREAD-SCALE OSCILLATOR

CIRCUIT CONSTANTS

R1	31.6 K	1 W precision composition
R2	97.5 K	1 W precision composition
R3	316 K	1 W precision composition
R4	975 K	1 W precision composition
R5	3.16 M	1 W precision composition
R6	9.75 M	1 W precision composition
R7	9.51 M	1 W precision composition
R8	3.07 M	1 W precision composition
R9	951 K	1 W precision composition
R10	307 K	1 W precision composition
R11	95.1 K	1 W precision composition
R12	30.7 K	1 W precision composition
R13	500 K	variable resistor
R14	200 K	variable resistor
R15	50 K	variable resistor
R16	20 K	variable resistor
R17	5 K	variable resistor
R18	2 K	variable resistor
R19	Lamp	6 W incandescent
R20	56 K	1 W composition
R21	100 K	2 W composition
R22	56 K	1 W composition
R23	560 K	1 W composition
R24	1500 ohms	1 W wirewound
R25	1000 ohms	variable resistor
R26	560 ohms	1 W composition
R27	5 K	10 W wirewound
R28	25 K	variable resistor
R29	10 K	1 W composition
R30	3300 ohms	1 W composition
R31	56 K	1 W composition
R32	56 K	1 W composition
R33	56 K	1 W composition
R34	56 K	1 W composition
R35	560 K	1 W composition
R36	560 ohms	1 W composition
R37	5 K	10 W wirewound
R38	10 K	1 W composition
R39	560 K	1 W composition
R40	33 K	1 W composition
R41	25 K	variable resistor
R42	47 K	1 W composition
R43	15 K	2 W composition
R44	50 ohms	variable resistor
R45	100 K	1 W composition
R46	100 K	1 W composition

C1	620 mmf	silver mica
C2	0-100 mmf	air, adjusted at factory
C3	...	main tuning capacitor
C4	560 mmf	silver mica
C5	100 mmf	air, adjusted at factory
C6a	10 mf)	3 x 10, 450 V electrolytic
C6b	20 mf)	
C7	0.5 mf	600 V paper
C8	0.002 mf	600 V mica
C9	40 mf	450 V electrolytic
C10	0.1 mf	600 V paper
C11	20 mf	450 V electrolytic
C12	40 mf	450 V electrolytic
C13	40 mf	450 V electrolytic
C14	4 mf	800 V paper
C15	40 mf	450 V electrolytic

S1a,b	Range Switch
S2	Power Switch
F1	1 ampere fuse
T1	Power Transformer

V1	6SJ7
V2	6V6 or 6F6
V3	6SJ7
V4	6V6
V5	6L6G
V6	6SQ7
V7	VR150
V8	5Y3GT

CLAIM FOR DAMAGE IN SHIPMENT

The instrument should be tested as soon as it is received. If it fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to us. We will then advise you of the disposition to be made of the equipment and arrange for repair or replacement. Include model number, type number and serial number when referring to this instrument for any reason.

WARRANTY

Hewlett-Packard Company warrants each instrument manufactured by them to be free from defects in material and workmanship. Our liability under this warranty is limited to servicing or adjusting any instrument returned to the factory for that purpose and to replace any defective parts thereof (except tubes, fuses and batteries). This warranty is effective for one year after delivery to the original purchaser when the instrument is returned, transportation charges prepaid by the original purchaser, and which upon our examination is disclosed to our satisfaction to be defective. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at cost. In this case, an estimate will be submitted before the work is started.

If any fault develops, the following steps should be taken:

1. Notify us, giving full details of the difficulty, and include the model number, type number and serial number. On receipt of this information, we will give you service instructions or shipping data.

2. On receipt of shipping instructions, forward the instrument prepaid, and repairs will be made at the factory. If requested, an estimate of the charges will be made before the work begins provided the instrument is not covered by the warranty.

SHIPPING

All shipments of Hewlett-Packard instruments should be made via Railway Express. The instruments should be packed in a wooden box and surrounded by two to three inches of excelsior or similar shock-absorbing material.

DO NOT HESITATE TO CALL ON US

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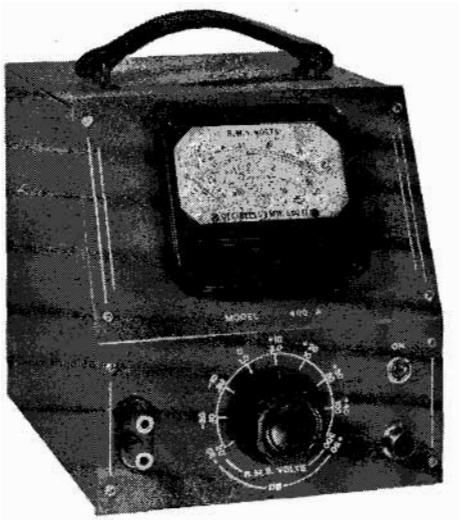
LABORATORY INSTRUMENTS OF SPEED AND ACCURACY

Standard -hp- instruments shown here are adaptable for making nearly every electronic measurement in the electronic field. Following is a brief description of a few of these instruments. Complete technical information will be sent—without obligation—on request. In addition, -hp- engineers are at your service to help solve special problems.

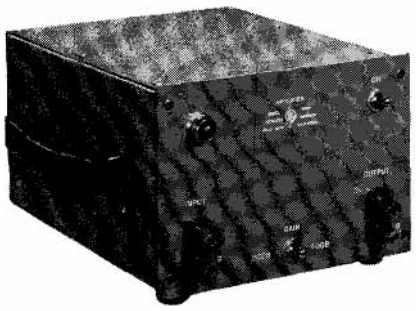


VACUUM TUBE VOLTMETER

-hp- Model 400A Vacuum Tube Voltmeter sets a new standard of performance for voltage measurements in the audio, supersonic, and lower radio frequency region. Measurements up to 1 megacycle with this instrument are as simple as measurements with the usual multi-range meter at d-c. Nine ranges give full-scale sensitivities from .030 to 300 volts. Ordinarily no precautions whatsoever are required: turn-over effect and waveform errors are minimized; there are no adjustments to make during operation; a large overload will not damage the instrument. The input impedance is 1 megohm so that most circuits will not be disturbed when their voltage is measured.

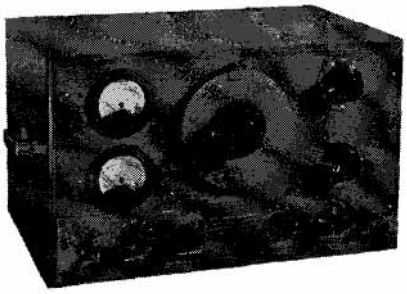
H-F VACUUM TUBE VOLTMETER

-hp- 410A High Frequency Vacuum Tube Voltmeter combines in one instrument an ac voltmeter covering frequencies from 20 cps to 700 mc, a dc voltmeter with 100 megohms input impedance, and an ohmeter capable of measuring resistances from .2 ohms to 500 megohms. The special probe places a capacity of 1.3 uufd across the circuit under test. Input resistance for ac measurements is 6 megohms. Six voltage ranges provide full-scale sensitivities from 1 to 300 volts.



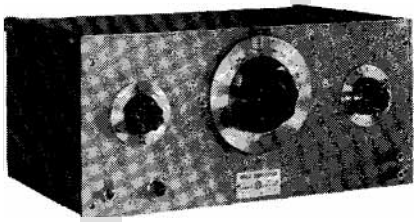
WIDE-BAND AMPLIFIER

-hp- 450A Amplifier is a new, versatile, wide-band amplifier designed for general laboratory or production use. It provides exceptional stability at 40 or 20 db gain, and gives new freedom from spurious responses. **Low phase shift is assured by a straight-forward, resistance-coupled amplifier design,** together with inverse feed back. Frequency response is flat within ½ db between 10 and 1,000,000 cps. Varying tube voltages or aging tubes have no appreciable effect on the gain or other characteristics. When used in conjunction with *-hp-* 400A Vacuum Tube Voltmeter, it increases voltmeter sensitivity 100 times.



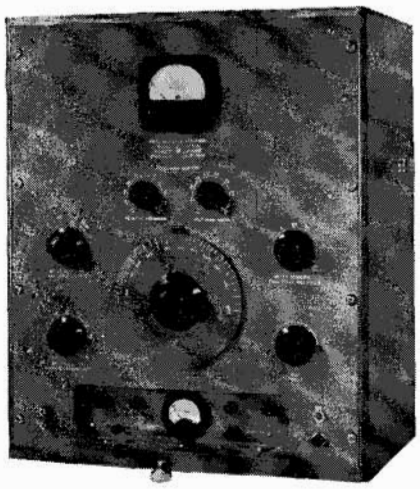
AUDIO SIGNAL GENERATORS

-hp- Audio Signal Generators are designed for time-saving performance. They are excellent for **general** laboratory applications because they supply a **known** voltage as well as a known frequency at the commonly used impedance levels. They are particularly suitable for gain measurements because no auxiliary apparatus is required. They provide an excellent source of voltage for distortion measurements because their waveform distortion is very small.



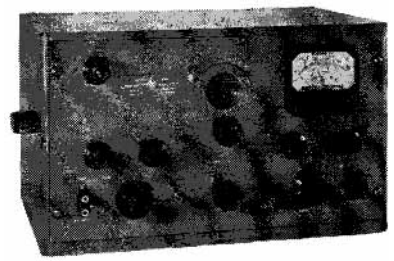
RESISTANCE-TUNED AUDIO OSCILLATORS

-hp- Resistance-Tuned Oscillators are suitable for almost every type of work. Their low distortion makes them particularly valuable in making distortion measurements on audio amplifiers, broadcast transmitters and other equipment. They provide an excellent source of voltage for accurate bridge measurements. The output is sufficient to drive signal generators and other equipment requiring considerable power. Their wide frequency range also makes them suitable for work in the supersonic region.



HARMONIC WAVE ANALYZER

-hp- Model 300A Harmonic Wave Analyzer is an excellent instrument for both laboratory and production work where accurate and rapid measurement of individual components of a complex wave is required. The maximum selectivity is sufficient for measurement of harmonics of frequencies as low as 30 cycles and it can be varied over a wide range. With this variable selectivity feature, measurements at higher frequencies can be made more rapidly, yet with no sacrifice in accuracy.

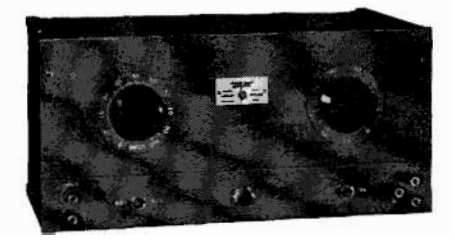


DISTORTION ANALYZER

This Model 330B Distortion Analyzer is *-hp-*'s newest, finest distortion measuring instrument. It is capable of measuring distortion at any frequency between 20 cps and 20,000 cps. It will make noise measurements of voltages as small as 100 microvolts. A linear r-f detector makes it possible to measure these characteristics directly from a modulated r-f carrier. The high sensitivity, stable accuracy and compactness of the 330B make it extremely valuable for broadcast, laboratory and production measurements.

ADDITIONAL INSTRUMENTS ON REVERSE SIDE OF PAGE

LABORATORY INSTRUMENTS OF SPEED AND ACCURACY

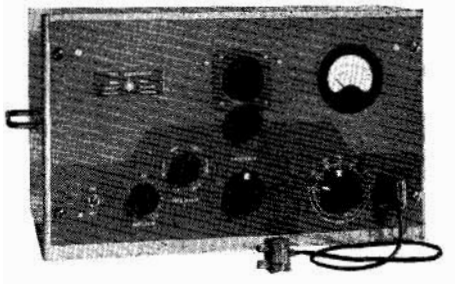


SQUARE WAVE GENERATOR

-*hp*- Model 210 Square Wave Generator provides a new approach to the problem of measuring the characteristics of audio-frequency equipment. One or two observations with this generator will check the frequency response of apparatus where heretofore a large number of observations were necessary. It will show up phase shift and transient effects, both of which are rather difficult to study by other methods.

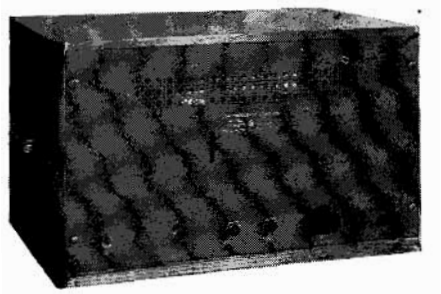
ATTENUATORS AND VOLTAGE DIVIDERS

-*hp*- Model 350 is a bridged-T attenuator consisting of one 100 db attenuator with 10 db steps and a 10 db attenuator having 1 db steps. Special construction is used to assure high frequency response. Inquiries pertaining to your particular attenuator or voltage divider problems will be given careful attention. The Model 350A operates on a 500-ohm impedance level while the 350B operates at a 600-ohm impedance level.



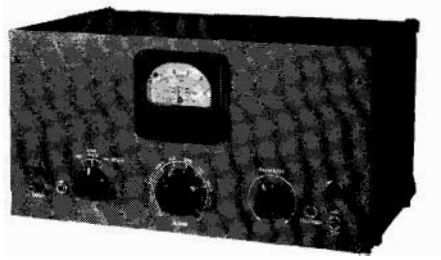
WIDE-BAND OSCILLATOR

-*hp*- Model 650A Resistance-tuned Oscillator is the first instrument of its kind that not only covers a frequency range of 10 cps to 10 mc, but brings to the r-f and video fields all the speed, ease and accuracy traditional in -*hp*- audio oscillators. This highly-stable, precision instrument provides output flat within ±1 db from 10 cps to 10 mc, and a voltage range of .00003 to 3 volts. Output impedance is 600 ohms, or 6 ohms with 100 to 1 output voltage divider. Instrument includes built-in vacuum tube voltmeter and 50 db output attenuator.



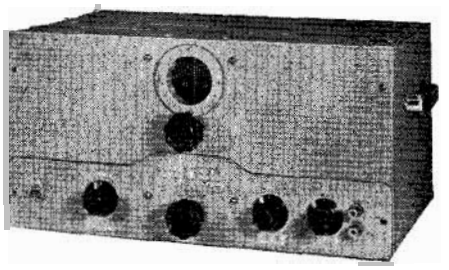
SECONDARY FREQUENCY STANDARD

-*hp*- Model 100 Low Frequency Standard provides a convenient and extremely useful source of four standard frequencies (100 cps, 1 kc, 10 kc, 100 kc) for accurate measurement purposes, for calibrating audio equipment and for various other work where great accuracy is required. It is useful in making accurate interpolation measurements at higher frequencies.



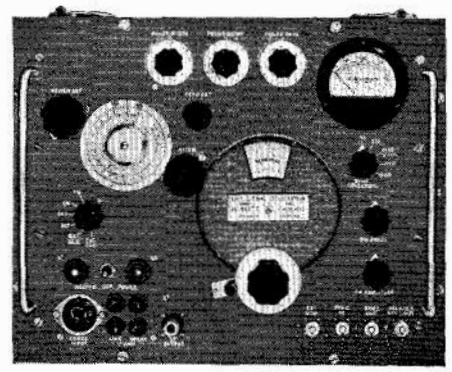
ELECTRONIC FREQUENCY METER

-*hp*- Model 500A Frequency Meter is designed to measure the frequency of an alternating voltage from 5 cps to 50 kc. It can be used to measure difference between two h-f signals. It is particularly suited to crystal grinding work where it can be used to measure the frequency deviation from the standard, quickly and accurately.



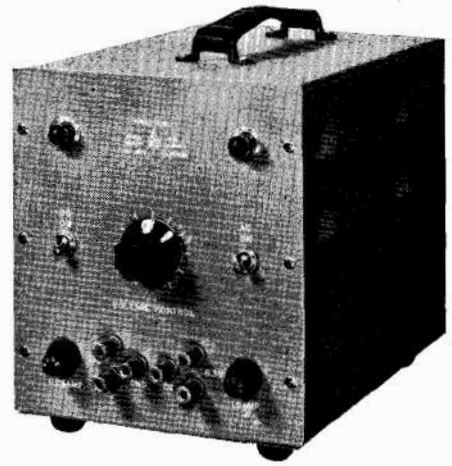
PRECISION OSCILLATORS

-*hp*- Model 201B and -*hp*- Model 200I are precision measuring instruments of utmost accuracy and latest design. The 201B spans a range from 20 cps to 20 kc in three bands; the 200I, a spread-scale oscillator, covers frequencies from 6 to 6000 cps in six bands. Both include a 6" main frequency tuning dial calibrated over 300 degrees, controlled directly or by 6-1 micro-drive. Both meet all requirements for measurement speed, accuracy, and purity of wave form. And both instruments incorporate -*hp*- family characteristics of no zero set, constant output, and great stability.



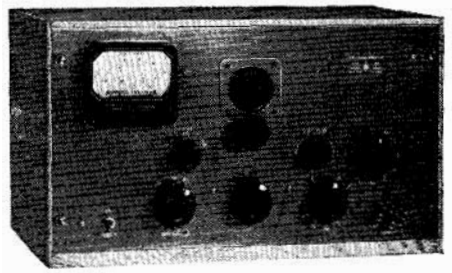
UHF SIGNAL GENERATOR

-*hp*- Model 616A UHF Signal Generator is the first instrument developed commercially which combines great operational speed, accuracy and ease of operation with a frequency range of 1800 mc to 4000 mc. R-f power is generated by a reflex klystron oscillator, and voltage adjustments during operation are eliminated by special -*hp*- automatic coupling device which causes oscillator repeller voltage to track frequency changes. The -*hp*- 616A features direct frequency and voltage control; c-w, f-m or pulsed output; plus wide variety of input and output delay and synchronization features.



POWER SUPPLY UNIT

-*hp*- Model 710A Power Supply is an excellent source of d-c power for every laboratory and production department use. The power pack is designed for the utmost in flexibility, compactness, portability and economy. Output is continuously variable between 180 and 360 volts. The output voltage varies approximately 1 per cent with changes in load current up to 75 ma and with normal line variations. Noise and hum level is exceptionally low, and output unusually stable over a long period of time. Also contains auxiliary center-tapped 6.3 volt source providing 5 amperes of a-c.



AUDIO SIGNAL GENERATOR

-*hp*- Model 206A Audio Signal Generator provides a highly-stable source of continuously variable a-f having a total distortion of less than 0.1% between 50 cps and 20 kc. Output meter monitors output voltage signal with accuracy of at least 0.2 db. Precision attenuators vary output signal level in 0.1 db steps over 111 db range. Flat frequency response and great accuracy of output voltage make this instrument ideal for FM transmitter and station maintenance work.

hp laboratory instruments
FOR SPEED AND ACCURACY

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