

## THE MODEL 210A SQUARE WAVE GENERATOR

### Technical Information

The model 210 square wave generator is a new instrument which is extremely useful in both production testing and development work. It provides a new approach to the problem of measuring the characteristics of audio frequency equipment. This generator will save valuable time in production testing because one or two observations will check the frequency response of apparatus where heretofore a large number of observations were necessary. This new instrument is an important tool for development work because it will show up phase shift and transient effects, both of which are rather difficult to study by other methods.

USES: - When a square wave is applied to an amplifier the top of the wave will show distortion if the frequency response of the amplifier does not extend to at least one tenth of the applied frequency. Likewise the sides of the wave will be distorted if the response of the amplifier does not extend to at least ten times the frequency of the square wave applied. Thus one observation with a square wave applied to an amplifier will check a wide frequency range, a range of 100 to 1 or even more. This is extremely important because once the proper criterion has been established a production test can be set up with one or at the most two observations with a square wave.

A square wave may also be used to study phase shift effects in an amplifier. An amplifier will not reproduce a square wave faithfully unless both the amplitude and phase shift characteristics are correct. Thus if the amplitude response is known to be good, phase shift effects can be determined by a square wave observation.

Peaks or deficiencies in amplification of an amplifier can be readily detected with a square wave generator. Amplification peaks appear as damped oscillations on top of the amplified square wave and these peaks can be measured in both frequency and amplitude with a given observation. Deficiencies in amplification at some part of the amplification band have the same appearance except for phase displacements in the damped oscillations.

A square wave is also very useful in determining the transient response of networks. Time constants of R-C circuits can be easily observed, damped oscillations of resonant circuits can be checked, and the transient behavior of complicated networks can be studied by the application of a square wave to the networks and observing the voltage or current with an oscilloscope.

MODEL 210A Continued

SPECIFICATIONS

FREQUENCY RANGE: The output of the generator is square within 1% over the frequency range from 20 cycles to 10,000 cycles. The time for the voltage to rise to 90% of maximum is approximately 1 microsecond, thus a reasonably square wave can be obtained even at 100 kilocycles.

OUTPUT VOLTAGE: The output voltage is 50 volts peak to peak open circuit. The output impedance is 1000 ohms balanced to ground.

OUTPUT ATTENUATOR: A 75 db. attenuator is provided in the output with 5 db. steps. The frequency response of the attenuator is sufficiently wide so that the output wave shape is not affected even at the highest frequencies.

INPUT VOLTAGE: The generator may be driven from any convenient source of alternating voltage or it may be internally synchronized to the power line frequency. A driving voltage of two volts is required and the input impedance is 25,000 ohms.

MOUNTING: The Model 210A is mounted in an attractive steel cabinet 15" long, 8" high, and 9" deep finished in wrinkle grey. The panel is grey baked enamel with machine engraved designations. The model 210AR is mounted in a relay rack assembly with a 19" by 7" panel and is 8" deep. The dust cover is removable from the rear and the binding posts may be supplied either on the panel or at the rear of the assembly.

POWER SUPPLY: The generator is provided with a built-in power supply to operate from 110 volts 50 or 60 cycles. It requires approximately 50 watts.

PRICES: Model 210A.....\$125.00  
Model 210AR.....\$130.00

Prices are net, complete with tubes, f.o.b. Palo Alto, California  
Prices and data subject to change without notice.

HEWLETT-PACKARD CO,  
481 PAGE MILL ROAD  
PALO ALTO, CALIFORNIA

September 19, 1941