Discrepancies of indicated voltages warrant investigation of the particular circuit involved. Wiring errors or faulty components may be found with inspection or resistance measurements.

Consider the characteristics of the circuit by rereading the circuit description. An understanding of the theory will aid in locating and correcting difficulties.

If intelligent investigation along the lines indicated does not solve your problem, write to the Heath Company describing your difficulty in detail, giving all symptoms, voltages and other data that may aid in correcting your trouble. Be sure to state model and name of instrument, AG-9A Audio Generator. You will receive a prompt reply to guide your further efforts.

APPLICATION

This instrument lends itself to the many applications in audio laboratories where a near-perfect sine wave signal within its amplitude and frequency limits is required. Some of the applications are as follows:

Signal source for bridge measurements.
Signal source for harmonic distortion measurements.
Signal source for external modulation of RF signal generators.
Signal source for testing of audio amplifiers for gain and frequency response.

OPERATION

The instrument produces a low distortion sine wave signal voltage of adjustable amplitude and frequency. To select the desired frequency, adjust the 0-100 knob to the first significant figure, adjust the 0-10 knob to the second significant figure and turn the multiplier to the desired value.

Example: For a frequency of 35 cycles, set the 0-100 knob to 30, the 0-10 knob to 5 and the multiplier to X1.

Example: For a frequency of 72 kc, set the 0-100 knob to 70, the 0-10 knob to 2 and the multiplier to X1000.

To select the desired output amplitude into a high impedance load (10 KΩ or more): Set the LOAD switch to internal, the ATTENUATOR to the nearest full scale value above the desired output; adjust the OUTPUT control to give the desired output on the appropriate meter scale.

Example: Desired voltage 7.3 volts. Set ATTENUATOR to 10 volts full scale. Turn OUTPUT to give a 7.3 volt reading on the 0-10 volt scale.

Example: Desired voltage .025 volts. Set ATTENUATOR to .03 volts full scale. Turn OUTPUT to give a 2.5 volt reading on the 0-3 volt scale.

To select the desired output amplitude into an external 600 Ω load (1 volt maximum): Set the LOAD switch to external and proceed as above.

USING THE DB SCALE

The decibel is a ratio of two power levels and is used in comparative expressions. It may be applied to voltage levels if the impedances are identical. It may be used as a quantitative indication for one power or voltage level if the other level is defined. In this instrument, the db scale is based on a reference or standard level of 0 db = 1 milliwatt in 600 Ω. If used with a 600 Ω external load, the meter reading is expressed in dbm and the reference level is automatically defined.

If the instrument is used with loads differing from 600 Ω but substantially less than 10 KΩ, correction factors for the voltage reduction in the attenuator and for the db level may be calculated.

If the instrument is used with high impedance loads, the relation between two signal levels may be expressed as a number of db difference.

Example: A device requires a signal of .61 volts on one input jack for a certain output. It requires a signal of .012 volts on another input jack for the same output. How many db difference between the two input jacks?

.61 volts is - 2 db (on meter) ±0 db (on attenuator) = -2
.012 volts is -6 db (on meter) -30 db (on attenuator) = -36
level difference is (-2) - (-36) = 34 db.

NOTE: Theoretically the input impedances should be equal in the above example. The method described is generally more useful than calculating the power level at each input (using voltage and input impedance and using the formula:

$$db = 10 \log \frac{P_1}{P_2} = 10 \log \frac{E_1{}^2/R_1}{E_2{}^2/R_2}$$

for equal impedances this reduces to:

$$db = 10 \log \frac{(E_1)^2}{(E_2)} = 20 \log \frac{E_1}{E_2}$$

Although theoretically correct, erroneous impression may be gained by using the above approach:
Changing a 10 KΩ grid resistor to 10 megohm decreases the power level by a factor of 100 or 20 db. Yet the input voltage is unchanged.

For further information see: Langford-Smith; Radiotron Designer's Handbook, 4th Ed. Ch. 19

ACCURACY

As the output of this instrument is a signal voltage of a certain frequency and a certain amplitude a certain amount of accuracy of those two factors may be expected.

Frequency is primarily determined by the "notch" network and thus the precision of the components in this network. Nominal tolerance on the precision resistors is 1%, on the condensers 2%. The influence of the 5% resistors is at most, a tenth of the effect of the precision resistors, so their maximum contribution is not more than 1/2%. Allowing for temperature effects, stray capacities and phase shift of the amplifiers at the frequency limits, the maximum frequency error is expected to fall within 5% of the indicated frequency.

Output voltage depends on a number of factors. Meter calibration is the task of the constructor and it should be borne in mind that many standard meters are subject to frequency errors. Iron vane and dynamometer instruments rarely maintain their rated accuracy above 150 cycles. Rectifier instruments begin to drop at about 5 to 10 kc. The output voltage is further affected by the attenuator. Here 5% resistors are used and the resultant accuracy should fall within 5%. The attenuator accuracy also depends on the load resistance, particularly on the 3 volt range, where a 12 KΩ load makes the output 1/2 db less than indicated and a 2000 Ω load causes a 3 db error.

On the 1 volt range and below, a high impedance load will be subject to twice the indicated voltage (6 db high) if the internal load is not used.

On the 10 volt range however, loading, while lowering the output voltage, will not cause error because the meter indicates the output voltage directly. Loads of less than 10 KΩ may increase the distortion and very low resistance loads effectively short out the 6CL6 output and cause oscillation to cease, when the output control is set at maximum.

The meter and its circuit contribute additional inaccuracies at voltages differing from the calibration voltage. The meter movement may deviate as much as 2% of the full scale value due to the discrepancy between the nominal meter curve on which the scale is based and the characteristics of the particular movement in an instrument. The meter rectifiers are non-linear at low voltages but this deviation is effectively compensated for by the third diode. Considering all the factors affecting the accuracy of the output voltage, it is expected to fall within 5% of indicated value.