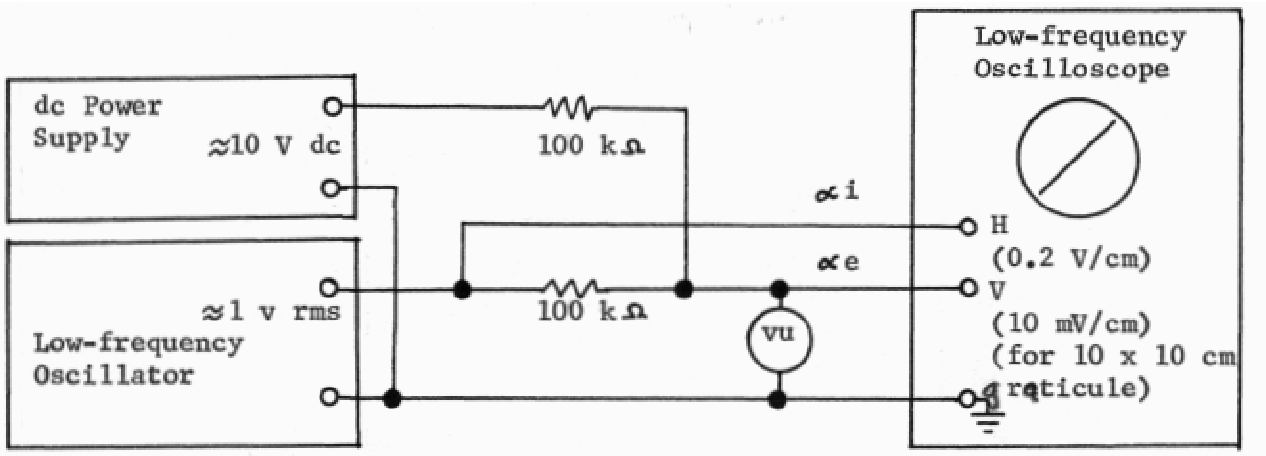
Measuring the Dynamics of a Standard Volume Indicator (SVI)

John G. McKnight
Ampex Corporation
12 Sept. 1967
Minor editing 2000-05-15

TEST SETUP



TEST PROCEDURE

1) Set the dc offset (dc power supply) to make the meter read about mid-scale (-2 dB).

2) Set the oscillator frequency for about 1 Hz, and the output voltage to give a meter swing of about ± 1 dB.

3) Adjust the frequency for zero phase angle between the voltage across the meter (shown on the V plates) and the current through the meter (shown on the H plates). The pattern will be a circle for 90° phase shift (at frequencies well below, and well above, 2.1 Hz), and a straight line at a 45° angle (see drawing above) for zero phase shift. This frequency for zero phase shift is the mechanical natural (resonance) frequency of the meter. For a Standard Volume Indicator, the frequency must be 2.1 Hz ± 10 %, which corresponds to a free period of 0.47 s ± 10 %.

ADDITIONAL REQUIREMENT

1) The overshoot must also be measured. For this measurement, the meter must be operated from the proper impedance (usually 3600 Ω in series with a 300 Ω source resistance, for 3900 Ω total). Visual observation of amount of overshoot is usually satisfactory. Set the meter input voltage so that the meter deflects to exactly 0 dB. Place a card against the meter glass, so that the pointer is covered. Switch the input voltage off, then on again. Move the card so that you can just see the pointer when it just reaches its maximum deflection. (It is much easier to tell whether you are seeing the pointer "pop" out from behind the card, than to tell what the maximum deflection is.) Then read the level for where the card is. The overshoot must be between 1.0 and 1.5 % (0.1 to 0.15 dB) for the meter to meet the SVI specification.

2) Note that *both* the natural (resonance) frequency and the overshoot specifications must be simultaneously met to qualify as a SVI. The natural (resonance) frequency is controlled only by

the inertia of the moving system and the compliance of the restoring spring. The overshoot is controlled by the relationship of damping to inertia-to-compliance ratio, so that a frequency change only may change the amount of overshoot. Therefore, if you could adjust the damping, the frequency should be adjusted first, then the damping.

TEST EQUIPMENT (that was available in 1967)

dc Power Supply: 0... 30 V, e.g. Hewlett-Packard Model 721-A (145 $).

Low-frequency oscillator: For meters to the SVI specification, resonance frequency will be 1.9 to 2.3 Hz. This range is covered by the GR 1310-A (1.9 Hz...2 MHz; 295 $). It is usually preferable to have a wider range, e.g. the HP 202C (1 Hz...l00 kHz; 325 $). The HP 202A (8 mHz...12 kHz; 550 $) includes an adjustable dc-offset thereby eliminating the need for the separate dc power supply. When this oscillator is used, the series resistor should be changed to 47 kilohms, the dc voltage to 5 V, and the ac voltage to 0.5 V.

Oscilloscope: Tektronix 502 or similar. The phase shift of the two scope inputs must be the same for H and V. (Absolute phase shift doesn't matter, as long as both are the same over the 1 to 3 Hz region.) This may be checked *after* a meter is measured, in the following manner:

a) Set the oscillator to the frequency that gives 0° phase shift.

b) Replace the meter with a resistor of equal resistance (about 3 kilohms; or use an "R" box and adjust for same scope pattern). DO NOT change any oscillator or scope setting.

c) If scope phase shifts are identical, the pattern will remain same straight line.

It is necessary to use the "ac" inputs of the scope because of the dc offset necessary for centering the meter and getting rid of the rectifier action. If the scope "ac" inputs don't have the same phase shift, "dc" inputs may be used with a large external blocking capacitor.