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THE SOUND-LEVEL METER IN THE MOTION PICTURE INDUSTRY

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Although sound-level meters have been commercially available for some time, it is only within the past year that they have attained their present high degree of popularity. One of the main reasons for this sudden acceptance by industry is, doubtless, the availability of new and improved models combining convenience of operation, low weight, and, in some cases, low price.

Probably few industries have as many important uses for a sound-level meter as the motion picture industry. Noise meters, as they were formerly called, have long been used for measuring the noise-levels in studios and theaters, the sounds made by various mechanical and electrical devices such as ventilators, cameras, projectors, arc lights, *etc.*, and for checking the volume of reproduction and the background noise-level from reproducing systems. Recent improvements in microphones, however, have made possible sound-level meters having reasonably smooth frequency characteristics, so that such instruments, unlike the earlier noise meters, are suitable not only for measuring complex noises, but are also quite satisfactory for many kinds of single-frequency measurements. Naturally, this has expanded the usefulness of the sound-level meter to include measurements of the overall frequency response of reproducing systems and variations in frequency response throughout a theater or auditorium.[1]

One of the newest sound-level meters is the General Radio Type *759-A*, which incorporates many features hitherto unavailable in even the most expensive instruments (Fig. 1). Aside from meeting the tentative specifications of the American Standards Association, the design of this new instrument stresses portability and convenience of operation, which characteristics are of utmost importance to the user. Among its many features are a non-directional sound-cell microphone, a high-gain stabilized amplifier, the absence of all battery adjustments, a practically linear decibel meter, and a simple system for resetting the calibration.

To mention the features in more detail, the sound-cell microphone provides a rugged and sensitive sound pick-up device with a smooth, nearly flat frequency response over the important frequency range, practically free from directional effects. Such a device is unaffected by ordinary changes of temperature and humidity, and even unusually low temperatures produce only a small change of sensitivity, for which correction can easily be made, if desirable.

In the interests of convenience the microphone is mounted upon a folding bracket on the top of the sound-level meter, and turns down into a compartment

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Frequency characteristics were taken at various positions in the theater in order to determine the changes in frequency response with location. Some of these data are shown in Fig. 2, which indicates clearly how the frequency response changes in the center of the theater between the front seats and the rear seats. The effect of the balcony upon the high frequencies is particularly noticeable and readily accounts for the decrease in articulation under the balcony.

Data such as these are invaluable to the theater owner or operator, since they show readily how well the various portions of the audience are actually hearing the reproduced sounds. As a result of such measurements it is frequently possible, by proper acoustical treatment or by changes or additions in the speakers or tweeters, to improve noticeably the quality of reproduction throughout the theater.

The data shown here were obtained by merely connecting a beat-frequency oscillator to the input of the amplifying equipment. Obviously, similar runs may be made when using a constant-frequency film in the projectors, thus obtaining an overall measure of the reproduction, including the optical equipment. No particular difficulties were encountered due to standing waves when making measurements at the higher frequencies, but there was some trouble from this source at the lower frequencies. Accordingly, it would be desirable, where extreme accuracy was warranted, to use a warble tone to minimize the effects of standing waves.

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[1] "The Technique of Noise Measurement," Bulletin 20, *General Radio Co.*, Cambridge, Mass.

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WOLF, S. K., AND SETTE, W. J.: "Progress in the Acoustics of Sound Recording and Reproduction for Motion Pictures," *Rev. Sci. Instr.*, **VII** (Sept., 1936), No. 9, p. 323. Note that the decibel ratings mentioned in these papers are referred to the threshold of audibility. The new sound-level meters use 10^{-16} watts per sq. cm. as reference level. Accordingly, for any given sound a new standard sound-level meter will read approximately 7 db. higher than if the measurement were referred to the threshold of audibility.