



QUALIFYING A SOUND DATA ACQUISITION SYSTEM—SAE J184

Report of Vehicle Sound Level Committee approved September 1970. Editorial change July 1972.

1. Purpose—Various SAE vehicle noise standards require use of a sound level meter which meets the Type 1 requirements of American National Standard S1.4-1971, Specification for Sound Level Meters. The purpose of this recommended practice is to provide a procedure for determining if an acoustical data acquisition system has performance equivalent to such a meter.

2. Scope—The scope includes determination of frequency response characteristics for the entire measurement system except the microphone. However, the procedure described herein prescribes inclusion of the manufacturer's frequency response calibration data for the microphone in order to determine if the overall system is within required tolerances. The scope also includes determination of certain dynamic performance characteristics of the sound level indication devices.

The scope of this document does not encompass qualifying components for harmonic distortion, signal-to-noise ratio, tape recorder flutter and wow, etc. The references listed in section 6 should be consulted for general performance requirements and precautions regarding instrumentation for acoustical measurements.

3. Performance Requirements

3.1 System Frequency Response—It is required that the overall steady-state frequency response of the data acquisition system shall be within the tolerances prescribed in Table 1 when measured in accordance with section 4. The tolerances in Table 1 are applicable to either flat or A-weighted response (see paragraph 5.4).

3.2 Detector Response—To ensure that a (true) rms indication is provided, the difference between the level indicated for a 1000 Hz sinusoidal signal equivalent to a sound level of 86 dB (rms) and the level indicated for an octave band of random noise of equal energy as the sinusoidal signal centered at 1000 Hz shall be no greater than 0.5 dB. A true rms voltmeter shall be used to determine equivalence of the two input signals.

3.3 Indicating Meter—If an indicating meter is used to obtain sound levels or band pressure levels, it must meet the requirements of paragraphs 3.2 and 3.6.2, and the following:

3.3.1 The scale shall be graduated in 1 dB steps. No scale indication shall be more than 0.2 dB different from the true value of the signal when an input signal equivalent to 86 dB sound level indicates correctly.

3.3.2 Maximum indication for an input signal of 1000 Hz tone burst of 0.2 s duration shall be within the range of -2 to 0 dB with respect to the steady-state indication for a 1000 Hz tone equivalent to 86 dB sound level.

3.4 Microphone—If a microphone is used which has not been provided as a component of a Type 1 sound level meter, it must be determined to meet the microphone characteristics described in ANSI S1.4-1971.

3.5 Magnetic Tape Recorders—No requirements are described in this document pertaining to tape recorders, except for frequency response. Generally, recorders of adequate quality to provide the frequency response performance required will also meet other minimum requirements for distortion, signal-to-noise ratio, etc.

3.6 Graphic Level Recorder Dynamic Response—When using a graphic level recorder, it is necessary to select pen response settings such that the readings obtained are statistically equivalent to those obtained by directly reading a meter which meets the "fast" dynamic requirement of a precision sound level meter indicating meter system for the range of vehicles to be tested. To ensure statistical equivalence, at least 30 comparative observations of real test data shall be made and the average of the absolute value of the differences observed shall be less than 0.5 dB. The settings described in paragraphs 3.6.1 and 3.6.2 will likely assure appropriate dynamic response; however, different settings may be selected on the basis of the above requirement.

3.6.1 Use a pen writing speed of nominally 60-100 dB/s. If adjustable, low frequency response should be limited to about 20 Hz.

3.6.2 Indicated overshoot for a suddenly applied 1000 Hz sinusoidal signal equivalent to 86 dB sound level shall be no more than 1.1 dB and no less than 0.1 dB.

SAE Recommended Practice

4. Frequency Response Qualification Procedure

4.1 Typical noise measurement and analysis configurations are shown in Figs. 1-3. The qualification procedure described herein duplicates these configurations, but with the microphone replaced by an electronic sine-wave oscillator. Caution should be exercised when connecting an oscillator to the input of a sound level meter to ensure, perhaps by using a resistive voltage divider network, that the input is not overloaded. (Refer to paragraph 5.3.)

4.2 Calibrate the oscillator to be used by measuring its output relative to the voltage which is equivalent to 86 dB sound level at each of the 27 frequencies listed in Table 1, using an electronic voltmeter of known calibration. Record the result in voltage level in dB re voltage corresponding to 86 dB sound level at 1000 Hz. This will describe the frequency response characteristic of the oscillator.

4.3 If a graphic level recorder is to be used, connect it to the oscillator output. If the oscillator and graphic level recorder can be synchronized, slowly sweep the frequency over the range of 31.5-12,500 Hz, recording the oscillator output. If they cannot be synchronized, record oscillator output for signals at the 27 frequencies given in Table 1. The differences between the combined response thus obtained and the oscillator response obtained previously will describe the frequency response of the graphic level recorder.

4.4 If visual observation of an indicating meter is to be used for obtaining data, the oscillator should be connected to the indicating meter input (such as the microphone input of a sound level meter) and the meter reading observed for a fixed oscillator output voltage setting for signals at the 27 frequencies given in Table 1.

4.5 To check a tape recorder, connect the instruments as shown in Fig. 3. Using a 1000 Hz tone, adjust the oscillator output level to obtain a reading 15 dB below maximum record level. If the synchronized oscillator/graphic level recorder system is to be used for analysis, record

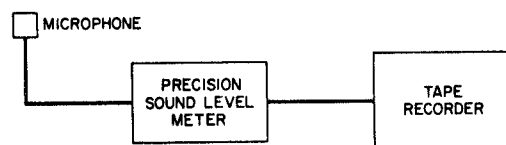


FIG. 1—DATA RECORDING

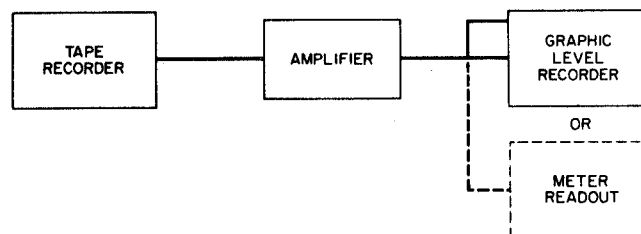


FIG. 2—DATA ANALYSIS AND TEST ANALYSIS

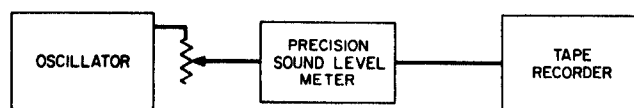


FIG. 3—TEST RECORDING