

Calculating Sound Measurement Units

Purpose

This technical bulletin provides several sound measurement formulas.

Explanation

Sound is reported in two distinct units of measure, pressure or decibel. Pressure is measured directly from the microphone while decibels is the conversion of these direct measurements from an arithmetic to a logarithmic scale.

Formulas

Decibels are calculated from pressure by the following equation:

$$dB = 20 \times \log_{10} (P/P_0)$$

Where P is the sound pressure and P₀ is the reference pressure.
The same measurement units must be used for P and P₀.

$$P_0 = 2 \times 10^{-5} \text{ N/m}^2, \text{ or} \\ 2 \times 10^{-5} \text{ Pascals, or} \\ 2.900755 \times 10^{-9} \text{ psi.}$$

Differently stated, the relationship can read:

$$dB = 20(\log_{10} P) + 93.98 \quad \text{or} \quad dB = 20(\log_{10} (5 \times P)) + 80$$

Where P is the pressure reading in Pascals, or

$$dB = 20 \times \log_{10} \left(\frac{P}{2.90076 \times 10^{-9}} \right)$$

Where P is the pressure reading in psi.

Additional noteworthy conversions:

$$1 \text{ N/m}^2 = 1 \text{ Pascal}$$

$$1 \text{ Pascal} = 1.450377 \times 10^{-4} \text{ psi}$$

$$6.894757 \times 10^3 \text{ Pascal} = 1 \text{ psi}$$

$$Vel = \frac{ACC}{2\pi f}$$

$$Acc = Vel \ 2\pi f$$

Where *f* is the Frequency of the sine wav.



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