

COMBINATION OF LEVELS IN dB

1. NOTATION

L_1	higher level	dB
L_2	lower level	dB
L	level due to combination of L_1 and L_2 , $L_1 + \Delta L_1$	dB
ΔL_1	increase in level above L_1 due to L_2	dB

2. NOTES

A method of determining the combined sound level resulting from two or more sources of known levels is presented in this Data Item.

In the Figure, ΔL_1 is plotted against $L_1 - L_2$. Clearly the combined level from any number of sources may be obtained by repeated combination of pairs of levels.

The method may be used to obtain the overall level for a single source by combination of the levels in particular frequency bands. The method applies strictly to statistically independent sources however.

The figure shows that ΔL_1 is negligible when $L_1 - L_2$ is large, rising to a maximum of 3 dB when the levels are the same.

3. DERIVATION

$$\Delta L_1 = 10 \log_{10} \left\{ 1 + \text{antilog}_{10} \frac{(L_2 - L_1)}{10} \right\}$$

1. HARRIS, C.M. (Editor) *Handbook of noise control*. McGraw-Hill, New York, 1957.

4. EXAMPLE

It is required to determine the overall sound pressure level resulting from three sources with individual levels of 110, 121 and 123 dB with respect to a common reference pressure.

To combine the first pair of levels, choose

$$L_1 = 121 \text{ dB}, \quad L_2 = 110 \text{ dB},$$

$$L_1 - L_2 = 11 \text{ dB}.$$

From the Figure,

$$\Delta L_1 = 0.33 \text{ dB}.$$

Therefore

$$L = 121 + 0.33 = 121.33 \text{ dB}.$$

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Now combining this with the remaining original level, choose

$$L_1 = 123 \text{ dB}, \quad L_2 = 121.33 \text{ dB},$$

$$L_1 - L_2 = 1.67 \text{ dB}.$$

From the Figure,

$$\Delta L_1 = 2.26 \text{ dB}.$$

Therefore

$$L = 123 + 2.26 = 125.26 \text{ dB}.$$

which is the overall level for the original three sources.