# Sound Level at a Distance (Point and Line Sources)

Sound pressure level at a new distance from a point or line source by the inverse-square law, and the level from a sound power level in a free field.

**Method:** Geometric spreading: point source 20 log; line source 10 log; L_p = L_W + 10 log(Q / 4πr²)

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Sound pressure level at the first distance (dB) | 90.000 | |
| First distance | 1.0000 | m |
| New distance | 10.000 | m |
| Source | Point source (−6 dB per doubling) | |
| Sound power level of a point source (dB) | 100.00 | |
| Directivity factor (1 free field, 2 on a floor, 4 at a wall edge) | 2.0000 | |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Level at the new distance (dB) | 70.000 | |
| Change in level (dB) | -20.000 | |
| Level at $r_2$ from the sound power L_W (dB; independent of $L_1$ and $r_1$) | 72.018 | |

**Notes for this case**

- Free-field spreading only; air absorption, barriers and room reflections are not included. L_p uses only L_W, Q and $r_2$; it is independent of $L_1$ and $r_1$. A line source of finite length l behaves as a point source beyond about l/π.

## Formula and method

$$L_2 = L_1 - 20\log_{10}\frac{r_2}{r_1}\ \text{(point)}, \quad L_2 = L_1 - 10\log_{10}\frac{r_2}{r_1}\ \text{(line)}$$

$$L_p = L_W + 10\log_{10}\frac{Q}{4\pi r^2}$$

### Variables

| | | |
|---|---|---|
| $L_1$ | Sound pressure level at the first distance (dB) | - |
| $r_1$ | First distance | m |
| $r_2$ | New distance | m |
| $\mathrm{source}$ | Source | - |
| $L_W$ | Sound power level of a point source (dB) | - |
| $Q$ | Directivity factor (1 free field, 2 on a floor, 4 at a wall edge) | - |
| $L_2$ | Level at the new distance (dB) | - |
| $\Delta L$ | Change in level (dB) | - |
| $L_p$ | Level at $r_2$ from the sound power L_W (dB; independent of $L_1$ and $r_1$) | - |
| $r$ | Distance used for L_p, equal to $r_2$ | m |

### Method and standards

Spherical and cylindrical spreading.

### Assumptions and limits

- Free field.
- The two results are independent: $L_2$ comes from $L_1$ at $r_1$; L_p comes from the sound power L_W and directivity Q at $r_2$.
- The line rule (10 log) holds for a long line close to it. A pipe or road of finite length l behaves as a point source (20 log) beyond about $l/\pi$; the page does not check distance against source length.

### References

- Geometric spreading: point source 20 log
- line source 10 log; $L_p = L_W + 10 \log(Q / 4\pi r^2)$

## Report details

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|---|---|
| Report reference | FCC-FC10-BFWT (the same inputs always give the same reference) |
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| Calculator | Sound Level at a Distance (Point and Line Sources) |
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| Software release | FireCAD Calc, release of 17 November 2026 |
| Release checks | 3 reference cases of this calculator, computed independently, are checked on every release |

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

### This calculator online

https://calc.firecad.com/instrumentation/vibration-noise/sound-level-distance

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.