Level Vial Sensitivity and Radius of Curvature

Angular value of one division of a level vial from the change in rod reading as the bubble moves, and the vial's radius of curvature.

Method: Level vial sensitivity

Input parameters

Unit system: SI

Parameter	Value	Unit
Rod reading, bubble at one end	1.4820	m
Rod reading after moving the bubble	1.4950	m
Divisions the bubble moved	5.0000	
Distance to the rod	60.000	m
Length of one division	2.0000	mm

Calculated results

Parameter	Value	Unit
Sensitivity (arc seconds per division)	8.9381	
Vial radius of curvature	46.154	m
Reading change per division	2.6000	mm

Notes for this case

• Tilting the telescope until the bubble moves n divisions changes the rod reading by Δr at distance D, so one division is α = (Δr/n)/D radians (× 206,265 for arc seconds). The vial radius is the division length divided by that angle. Engineering levels have about 20″ per 2 mm division (radius about 20 m); precise levels use compensators or 10″ vials.

Formula and method

$$\alpha = \frac{\Delta r}{nD}\ \text{rad}, \quad R = \frac{s}{\alpha}$$

Variables

r_1	Rod reading, bubble at one end	m
r_2	Rod reading after moving the bubble	m
n	Divisions the bubble moved	-
D	Distance to the rod	m
s	Length of one division	m
α	Sensitivity (arc seconds per division)	-
R	Vial radius of curvature	m
Δr	Reading change per division	m

Method and standards

Vial sensitivity.

Assumptions and limits

- Small angles; rod vertical.

References

Level vial sensitivity

Report details

Report reference	FCC-8VQR-Y6P3 (the same inputs always give the same reference)
Generated	23 November 2026, 18:08 UTC
Calculator	Level Vial Sensitivity and Radius of Curvature
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 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/civil/surveying/level-vial-sensitivity

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.