Three-Wire Levelling: Mean Readings and Sight Lengths

Mean backsight and foresight from upper, middle and lower cross-hair readings, the elevation difference, stadia sight lengths and their balance, with reading checks.

Method: Three-wire levelling

Input parameters

Unit system: SI

Parameter	Value	Unit
Backsight upper wire	1.9460	m
Backsight middle wire	1.7760	m
Backsight lower wire	1.6070	m
Foresight upper wire	1.2140	m
Foresight middle wire	1.0380	m
Foresight lower wire	0.86300	m
Stadia constant	100.00	

Calculated results

Parameter	Value	Unit
Mean backsight	1.7763	m
Mean foresight	1.0383	m
Rise (+) or fall (–)	0.73800	m
Backsight length	33.900	m
Foresight length	35.100	m
Sight length imbalance	-1.2000	m
Largest middle-wire check difference	0.50000	mm

Notes for this case

• Each rod is read at all three cross-hairs and the mean used, reducing reading error. The upper-minus-lower interval × stadia constant (usually 100) gives the sight length, so backsights and foresights can be balanced to cancel collimation and curvature errors. The middle reading should equal the average of upper and lower within a millimetre or two; a larger difference indicates a misread.

Formula and method

$$\overline{BS} = \frac{B_U + B_M + B_L}{3}, \quad D_B = K(B_U - B_L), \quad \Delta h = \overline{BS} - \overline{FS}$$

Variables

B_U	Backsight upper wire	m
B_M	Backsight middle wire	m
B_L	Backsight lower wire	m
F_U	Foresight upper wire	m
F_M	Foresight middle wire	m
F_L	Foresight lower wire	m
K	Stadia constant	-
$\overline{BS}$	Mean backsight	m
$\overline{FS}$	Mean foresight	m

Δh	Rise (+) or fall (−)	m
D_B	Backsight length	m
D_F	Foresight length	m
$D_B - D_F$	Sight length imbalance	m
$\max$	M - (U + L)/2	$

Method and standards

Three-wire levelling.

Assumptions and limits

- Stadia constant 100 and additive constant zero (internal-focusing level).

References

Three-wire levelling

Report details

Report reference	FCC-8M9S-RJHS (the same inputs always give the same reference)
Generated	23 November 2026, 18:08 UTC
Calculator	Three-Wire Levelling: Mean Readings and Sight Lengths
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/three-wire-levelling

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.