Instrumentation Amplifier Gain Resistor and Output

Gain-setting resistor for a three-op-amp instrumentation amplifier, its gain for a chosen resistor, and the output for a bridge or sensor differential signal.

Method: Three-op-amp instrumentation amplifier

Input parameters

Unit system: SI

Parameter	Value	Unit
Internal feedback resistor (each of the two input stages)	24.700	kΩ
Required gain	100.00	
Chosen gain resistor (0 to use the ideal value)	499.00	Ω
Differential input signal	12.000	mV
Reference pin voltage	1.6500	V

Calculated results

Parameter	Value	Unit
Gain resistor for the required gain 2R/(G − 1)	498.99	Ω
Gain with the chosen resistor	99.998	
Output voltage G·V_d + V_ref	2.8500	V
Gain error of the chosen resistor	-0.002004	%

Notes for this case

• Three-op-amp instrumentation amplifier with a unity-gain difference stage: G = 1 + 2R/R_G. Integrated parts state R (for example 24.7 kΩ or 25 kΩ) in the datasheet; check the output swing and common-mode range.

Formula and method

$$G = 1 + \frac{2R}{R_G}, \quad R_G = \frac{2R}{G - 1}, \quad V_{out} = G\,V_d + V_{ref}$$

Variables

R	Internal feedback resistor (each of the two input stages)	Ω
G_{target}	Required gain	-
R_G	Chosen gain resistor (0 to use the ideal value)	Ω
V_d	Differential input signal	V
V_{ref}	Reference pin voltage	V
$R_{G,ideal}$	Gain resistor for the required gain 2R/(G − 1)	Ω
G	Gain with the chosen resistor	-
V_{out}	Output voltage G·V_d + V_ref	V
$\Delta G/G$	Gain error of the chosen resistor	-

Method and standards

Instrumentation amplifier relations.

Assumptions and limits

- Ideal matched resistors and op-amps.

References

Three-op-amp instrumentation amplifier

Report details

Report reference	FCC-80AE-0Z07 (the same inputs always give the same reference)
Generated	23 November 2026, 17:34 UTC
Calculator	Instrumentation Amplifier Gain Resistor and Output
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/electrical/electronics/instrumentation-amplifier-gain

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.