Current-Sense Shunt Resistor and Amplifier Gain

Shunt resistance, power and voltage drop for measuring a current, and the amplifier gain to scale the shunt voltage to an ADC full scale.

Method: Shunt current measurement and ADC scaling

Input parameters

Unit system: SI

Parameter	Value	Unit
Maximum current to measure	20.000	A
Shunt voltage at full scale	50.000	mV
ADC full-scale input	3.3000	V
ADC resolution (bits)	12.000	
Present current	7.5000	A

Calculated results

Parameter	Value	Unit
Shunt resistance	2.5000	mΩ
Shunt power at full current	1.0000	W
Amplifier gain to reach ADC full scale	66.000	
Current per ADC count	4.8828	mA
ADC input at the present current	1.2375	V
ADC counts at the present current	1,535.0	

Notes for this case

• R = V_sh/I_max. 50–100 mV full scale balances accuracy against loss; choose a shunt rated for at least twice the power and use a Kelvin (four-terminal) connection. Low-side shunts are simpler; high-side needs a current-sense amplifier.

Formula and method

$$R_{sh} = \frac{V_{sh,max}}{I_{max}}, \quad P = I_{max}^2 R_{sh}, \quad G = \frac{V_{FS}}{V_{sh,max}}, \quad I_{LSB} = \frac{I_{max}}{2^n}$$

Variables

I_{max}	Maximum current to measure	A
$V_{sh,max}$	Shunt voltage at full scale	V
V_{FS}	ADC full-scale input	V
n	ADC resolution (bits)	-
I	Present current	A
R_{sh}	Shunt resistance	Ω
P_{max}	Shunt power at full current	W
G	Amplifier gain to reach ADC full scale	-
I_{LSB}	Current per ADC count	A
V_{ADC}	ADC input at the present current	V
N	ADC counts at the present current	-

Method and standards

Shunt measurement scaling.

Assumptions and limits

- Ideal amplifier; linear ADC.

References

Shunt current measurement and ADC scaling

Report details

Report reference	FCC-S83Z-X7XT (the same inputs always give the same reference)
Generated	23 November 2026, 17:34 UTC
Calculator	Current-Sense Shunt Resistor and Amplifier Gain
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/current-sense-shunt

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.