Two-Wattmeter Method: Three-Phase Power and Power Factor

Total power, reactive power, apparent power and power factor of a balanced three-phase load from the two wattmeter readings W1 and W2.

Method: Blondel's theorem; two-wattmeter method for balanced loads

Input parameters

Unit system: SI

Parameter	Value	Unit
Reading of wattmeter 1 (the higher)	8.0000	kW
Reading of wattmeter 2 (negative if reversed)	4.0000	kW

Calculated results

Parameter	Value	Unit
Total power $W_1 + W_2$	12.000	kW
Reactive power $\sqrt{3}\,(W_1 - W_2)$	6.9282	kvar
Apparent power	13.856	kVA
Power factor	0.86603	
Phase angle	30.000	°

Notes for this case

- P = $W_1 + W_2$ holds for any three-wire load; Q, S, the power factor and φ assume a balanced load.

Formula and method

$$P = W_1 + W_2, \quad \tan\varphi = \frac{\sqrt{3}\,(W_1 - W_2)}{W_1 + W_2}$$

Variables

W_1	Reading of wattmeter 1 (the higher)	W
W_2	Reading of wattmeter 2 (negative if reversed)	W
P	Total power $W_1 + W_2$	W
Q	Reactive power $\sqrt{3}\,(W_1 - W_2)$	var
S	Apparent power	VA
$\cos\varphi$	Power factor	-
φ	Phase angle	rad

Method and standards

Two-wattmeter relations for a balanced three-wire load.

Assumptions and limits

- Total power is valid for unbalanced three-wire loads too (Blondel); the reactive power and power factor are valid for balanced loads only.
- The sign of Q depends on which meter is W_1 and on the phase sequence; the page warns when W_1 is the lower reading.
- Balanced load and sinusoidal supply for the power factor.

References

- Blondel's theorem; two-wattmeter method for balanced loads

Report details

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

This calculator online

https://calc.firecad.com/electrical/power/two-wattmeter-method

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.