Star-Delta (Y-Δ) Resistance Conversion

Converts three resistances (or impedances of equal phase angle) between delta (Δ) and star (Y, wye) connection, both ways, by the Kennelly transformation.

Method: A.E. Kennelly (1899); star–delta transformation

Input parameters

Unit system: SI

Parameter	Value	Unit
Conversion	Delta to star (R_ab, R_bc, R_ca → R_a, R_b, R_c)	
First resistance: R_ab (delta) or R_a (star)	30.000	Ω
Second resistance: R_bc (delta) or R_b (star)	60.000	Ω
Third resistance: R_ca (delta) or R_c (star)	90.000	Ω

Calculated results

Parameter	Value	Unit
First result: R_a (star) or R_ab (delta)	15.000	Ω
Second result: R_b (star) or R_bc (delta)	10.000	Ω
Third result: R_c (star) or R_ca (delta)	30.000	Ω

Formula and method

$$R_a = \frac{R_{ab}R_{ca}}{R_{ab}+R_{bc}+R_{ca}}, \quad R_b = \frac{R_{ab}R_{bc}}{\Sigma}, \quad R_c = \frac{R_{bc}R_{ca}}{\Sigma}$$

$$R_{ab} = \frac{R_aR_b + R_bR_c + R_cR_a}{R_c}, \quad R_{bc} = \frac{\cdots}{R_a}, \quad R_{ca} = \frac{\cdots}{R_b}$$

Variables

$\mathrm{direction}$	Conversion	-
R_1	First resistance: R_ab (delta) or R_a (star)	Ω
R_2	Second resistance: R_bc (delta) or R_b (star)	Ω
R_3	Third resistance: R_ca (delta) or R_c (star)	Ω
R'_1	First result: R_a (star) or R_ab (delta)	Ω
R'_2	Second result: R_b (star) or R_bc (delta)	Ω
R'_3	Third result: R_c (star) or R_ca (delta)	Ω
R_{ab}, R_{bc}, R_{ca}	Delta resistances between terminals	Ω
R_a, R_b, R_c	Star resistances from each terminal to the star point	Ω
Σ	Sum of the delta resistances	Ω

Method and standards

Kennelly's transformation makes a delta and a star of resistances look the same between each pair of terminals. Here R_1, R_2, R_3 are R_ab, R_bc, R_ca for a delta or R_a, R_b, R_c for a star, and the results follow the same order.

Assumptions and limits

- Linear passive elements.
- Magnitudes only: exact for resistances, and for impedances only when all three have the same phase angle. Mixed R, L and C elements need the complex form.

References

• A.E. Kennelly (1899)

- star–delta transformation

Report details

Report reference	FCC-VMWW-QP0V (the same inputs always give the same reference)
Generated	17 November 2026, 19:48 UTC
Calculator	Star-Delta (Y-Δ) Resistance Conversion
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 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/circuits/star-delta-impedance-conversion

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.