Steinhart–Hart Coefficients from Three Points

Steinhart–Hart coefficients A, B and C of a thermistor from three resistance–temperature points, and the temperature at a measured resistance.

Method: J.S. Steinhart and S.R. Hart; Deep-Sea Research 15 (1968) 497

Input parameters

Unit system: SI

Parameter	Value	Unit
Temperature 1	0	°C
Resistance at T_1	32,650	Ω
Temperature 2	25.000	°C
Resistance at T_2	10,000	Ω
Temperature 3	50.000	°C
Resistance at T_3	3,603.0	Ω
Measured resistance	5,000.0	Ω

Calculated results

Parameter	Value	Unit
Coefficient A	0.001125	
Coefficient B	2.3472e-04	
Coefficient C	8.5631e-08	
Temperature at the measured resistance	41.580	°C

Notes for this case

- Pick points spread over the range of use; the fit is exact at the three points.

Formula and method

$$\frac{1}{T} = A + B\ln R + C(\ln R)^3$$

$$C = \frac{\gamma_3 - \gamma_2}{(L_3 - L_2)(L_1 + L_2 + L_3)}, \quad B = \gamma_2 - C\left(L_1^2 + L_1 L_2 + L_2^2\right), \quad A = Y_1 - \left(B + C L_1^2\right) L_1$$

Variables

T_1	Temperature 1	K
R_1	Resistance at T_1	Ω
T_2	Temperature 2	K
R_2	Resistance at T_2	Ω
T_3	Temperature 3	K
R_3	Resistance at T_3	Ω
R_m	Measured resistance	Ω
A	Coefficient A	-
B	Coefficient B	-
C	Coefficient C	-
T	Temperature at the measured resistance	K
R	Resistance in the equation	Ω
L_i, Y_i	ln R_i (R in Ω) and 1/T_i	-, 1/K

γ_2, γ_3	Slopes between points 1–2 and 1–3	K^{-1}

Method and standards

Three linear equations in A, B and C.

Assumptions and limits

- NTC thermistor; resistances in ohms inside the logarithms.
- No unique fit exists when $R_1R_2R_3 = 1\ \Omega^3$ ($\ln R_1 + \ln R_2 + \ln R_3 = 0$); the page then asks for other points. Real thermistor points in the kΩ range are far from this.

References

• J.S. Steinhart and S.R. Hart
• Deep-Sea Research 15 (1968) 497

Report details

Report reference	FCC-49TY-M042 (the same inputs always give the same reference)
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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/instrumentation/temperature/steinhart-hart-coefficients

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.