555 timer

$f = \frac{1}{\ln(2) \cdot C_1 \cdot (2R_1 + R_2)}$

C_1 is the capacitor of 4.7 µF, R_1 is the thermistor and R_2 is the resistor (measured to 2.14 kohm) between the discharge pin and VDD.

Beta equation

$R = R_0 \cdot e^{-\beta(\frac{1}{T_0} - \frac{1}{T})}$

T_0 is the specified temperature at which $R = R_0$ (25°C in this case). R_0 is the specified resistance (10 kohm in this case).

β is 3470 for the thermistor in question. (Cantherm MF52A2103J3470)

Steinhart-Hart

This is supposedly a more accurate approximation of NTC thermistors than the beta equation.

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

A, B and C are the constants that define the curve.

Calibration

The `relog` daemon uses the Steinhart-Hart equation. This requires running the calibration tool to retrieve the A, B and C constants for the thermistor and also C_1 if you don't happen to have a capacitance meter.

The constants are retrieved using a least-squares regression on actual measurements. It's a nasty equation to do it with algebra, a simpler solution is to do it numerically by constantly making small adjustments on all the parameters.

The numerical method requires initial values:

- The initial value of C_1 should be the specified capacitance.
- $A = \frac{1}{T_0} - \frac{1}{\beta}\ln(R_0)$ and $B = \frac{1}{\beta}$ where T_0, R_0 and β are specified in the datasheet for the thermistor. (25°C, 10 kohm and 3470)
- C is very small compared to A and B, but for the calibration script to work, it must have a positive value. I selected it by trial and error.