**Definitions**

**Thermistor**: A thermistor is a type of resistor whose resistance varies significantly with temperature, more so than in standard resistors. The word is a portmanteau of thermal and resistor. Thermistors are widely used as inrush current limiters, temperature sensors, self-resetting overcurrent protectors, and self-regulating heating elements.

**PTC Thermistor**: Positive temperature coefficient thermistor. The resistance increases with the increasing temperature.

**NTC Thermistor**: Negative temperature coefficient thermistor. The resistance decreases with the increasing temperature.

**Potential Divider:** Also known as Voltage Divider. A series of resistors or capacitors that can be tapped at any intermediate point to produce a specific fraction of the voltage applied between its ends. In practical terms: “Tapped or series resistance or impedance across a source voltage to produce multiple voltage”.

**Steinhart-Hart equation:** A third order approximation to calculate temperature from resistance without the use of lookup tables or curves.

Using Beta values (from reference table) we can rearrange the equation to solve using a known reference temperature and resistance (usually 25C).

 B = Beta value

 T1 = reference temp

 R1 = reference resistance

 R2 = measured resistance

 T2 = Calculated Temperature

Simplifying using interim var X

X = B / log (R1/R2);

T2 = X \* T1 / (X – T1)

Note that the Steinhart-Hart equation uses Kelvin in temperature calculations. To convert from C to K add 273.15 and from K to C subtract 273.15.

**Worked Example:**

**Circuit**



**Step 1**  - Calculate resistance of thermistor

1. Measure **Vt**: \_\_\_\_\_\_\_\_\_\_\_\_
2. Measure **V2**: \_\_\_\_\_\_\_\_\_\_\_\_
3. Calculate **I** at **V2**using known resistance of **R2** (I = V/R): \_\_\_\_\_\_\_\_\_\_\_\_
4. Now that we have **I**, calculate R for entire circuit (R = V/I): \_\_\_\_\_\_\_\_\_\_\_\_
5. Using Potential Divider principle calculate **R1** (R = R1 + R2): \_\_\_\_\_\_\_\_\_\_\_\_

**Step 2:**  Use Steinhart-Hart formula to calculate Temperature:

From Reference Sheet Beta = 4100 at 25C.

1. Calculate Interim X variable (X = B / log (R1/R2) ): \_\_\_\_\_\_\_\_\_\_\_\_
2. Convert reference temperature T1 to Kelvin (T1 + 273.15): \_\_\_\_\_\_\_\_\_\_\_\_
3. Calculate T2 (T2 = X \* T1 / (X – T1)): \_\_\_\_\_\_\_\_\_\_\_\_
4. Convert T2 back to Celsius: (T2 – 273.15): \_\_\_\_\_\_\_\_\_\_\_\_