Temperature - Input Device

## TEMPERATURE

A thermistor is a kind of resistor that depends on temperature.

NTC thermistors are based on granular materials. As temperature increases it makes it easier to hop. NTC are more response because it's an exponential response.

RTD thermistors are based on scattering in metals and as temperature increases there's more scattering and the resistance increases rather than decreases. RTDs are generally more accurate and operate over a wider range.

The changes in resistance can be only very small. Only a few percent. Standard way to read a thermistor is to put it in a bridge.

put voltage across them

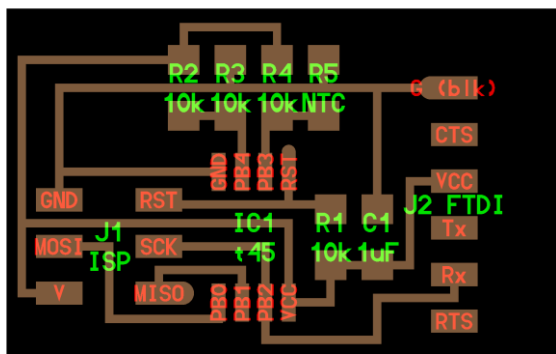bridge of 4 resistors

Differential Amplifier
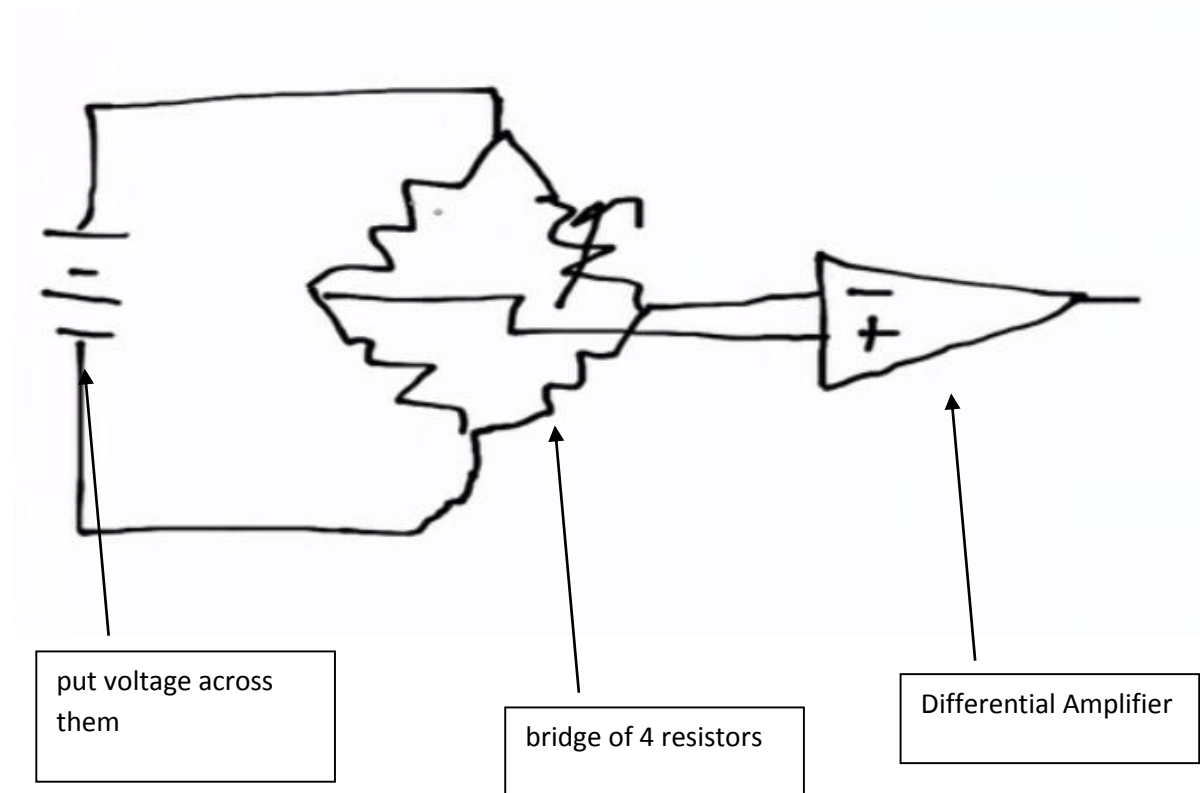
The idea is that normally the resistors are all the same. The same current goes left and goes right and so the voltage in the middle is the same but if this resistor value changes, slightly more current goes left than right and there'll be a difference in these voltages. The reason you do this is you want to measure small changes in a small signal not small changes in a big signal.

So if you had the thermistor and then another resistor in a ladder, where this is variable and you measure that voltage. This voltage would sit in the middle of the range and then change by a little bit. By making it in a bridge the voltage sits in the bottom of the range and changes a little bit and so I can amplify that and look at a big change in a small signal

go back to the board

On this board here are 3 resistors that are the bridge. The left side of the bridge and the right side. One of the resistors is now the thermistor. We're going to use two pins in the A to D
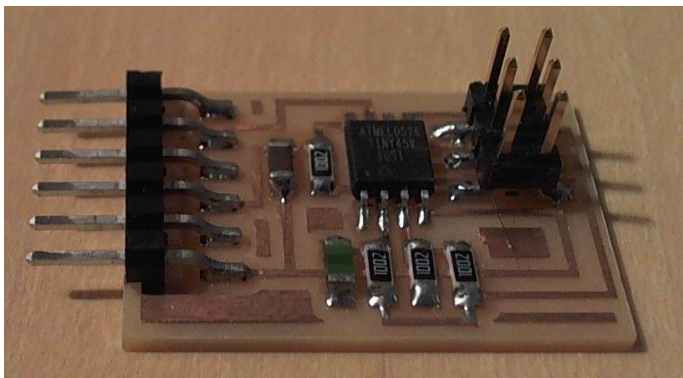
35:40 - C programme code - Will look just like the other one's but here we are using the A D multiplex register. Data sheet - We're picking 20 times PD4 - PD3. We're choosing the multiplexor settings that give us the amplifier 20 times the difference between those 2 pins.

This line says take those 2 pins, take the difference and amplify it by 20, then convert.

```
| (0 << MUX3) | (1 << MUX2) | (1 << MUX1) | (1 << MUX0); // 20(PB4-PB3)
```

That config line makes a differential

Here we're setting a bit to make it bi-polar. Bi-polar means instead of 10 bit, we get a 9 bit conversion and get 1 bit that sign and that lets it go positive or negative. Then send that out

```
ADCSRB = (1 << BIN); // bipolar mode
```

Python programme - in the programme, it reads the conversion, then conversion from the thermistor to temperature is ....this is an approx formula, it's not exact. The formula approx converts it to temperature, that's what we're plotting there.