Air/gas flow measurement using NTC thermistors

Measurement of air or gas flow with NTC thermistors can be implemented relatively easily using the following approach. This method utilizes a self heated thermistor to monitor the heat dissipation capacity of a gas in a manner similar to a hot wire anemometer, and a second thermistor is employed to compensate for any variation in temperature of the gas stream.

Background

A thermistors dissipation constant is measured in mW/°C, i.e. the amount of power the thermistor can dissipate which will raise the temperature of the device 1°C. This will change depending on the thermistors environment (still air, moving air, liquid, heat-sink, etc.) If a thermistor under constant power (self heated) is placed in different environments, the resistance of the thermistor will change as the amount of heat withdrawn from the device changes. This property is utilized to measure the flow of a gas over the thermistor. In this embodiment, a second, unheated thermistor is placed in the gas stream to compensate for changes in the gas temperature and thus the dissipation capacity of the medium.

Considerations

- The heated thermistor should be hotter than the gas
- The compensation thermistor should be in close proximity to the heated thermistor without being affected by the heat from the thermistor
- Larger (higher dissipation constant) thermistors are more robust
- Smaller (lower dissipation constant) thermistors have faster time response

Example Circuit

Fig. 1 shows a simple implementation of this circuit to measure air-flow of a room temperature gas. The transistor/zener/resistor Ri form a simple current source. Ri is selected to produce a current sufficient to self heat thermistor Th to the desired temperature. Resistor Rh is a voltage dropping resistor of a value small enough to minimize heating in the fixed resistor. Resistor Rc is a value large enough to minimize self heating of thermistor Tc. The voltage difference Vc-Vf is proportional to the gas flow.

Flow Meter Schematic
Dual Thermistor

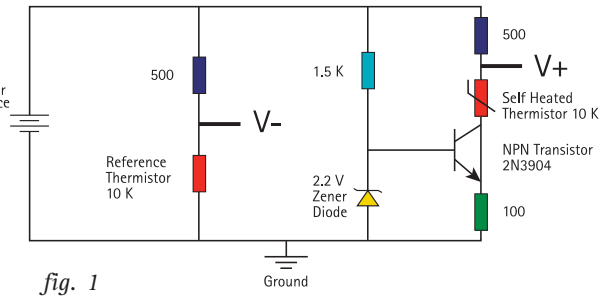

fig. 1

Assumptions

DC of thermistor Th=.25mW/°C
Power needed to raise thermistor Th from 25°C to 50°C=6.25mW
R of thermistor Th at 50°C=1.8kΩ
I thermistor Th=1.8mA
Ri=720Ω
I thermistor Tc=.23mA
Power dissipation Tc=.54mW

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