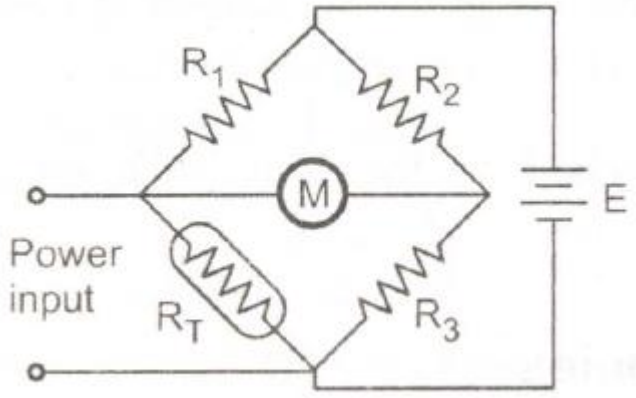
INTRODUCTION TO BOLOMETER POWER METER



The Bolometer power meter basically consists of a bridge called Bolometer bridge. One of the arms of this bridge consists of a temperature sensitive resistor. The basic bridge used in Bolometer power meter is shown in the Fig.The high frequency power input is applied to the

temperature sensitive resistor RT. The power is absorbed by the resistor and gets heated due to the high frequency power input signal.

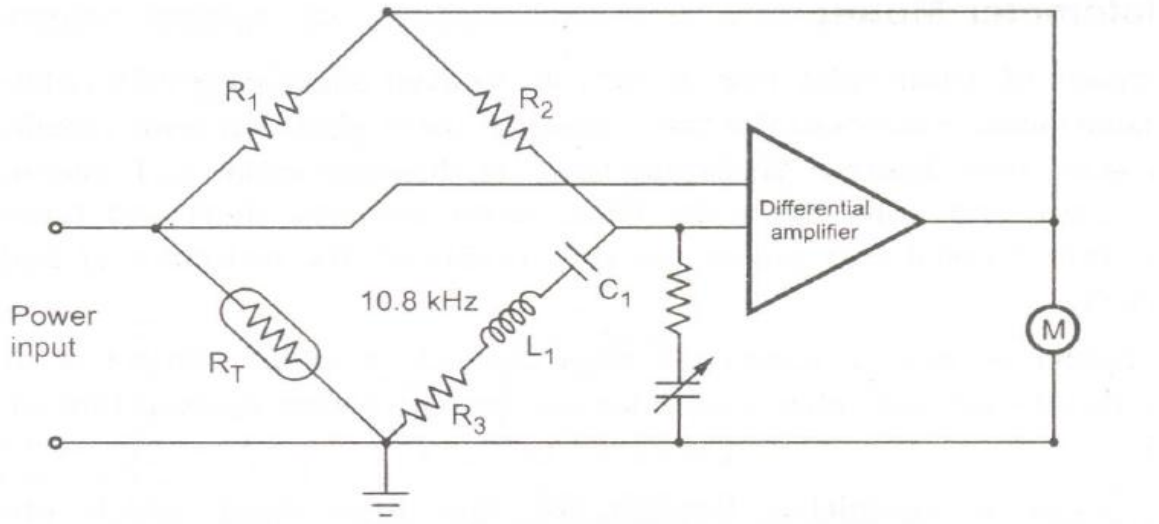
This heat generated causes change in the resistance RT. This change in resistance is measured with the help of bridge circuit which is proportional to the power to be measured.

The most common type of temperature sensitive resistors are the thermistor and barretter. The thermistor is a resistor that has large but negative temperature coefficient. It is made up of a semiconductor material. Thus its resistance decreases as the temperature increases. The barretter consists of short length of fine wire or thin film having positive temperature coefficient. Thus its resistance increases as the temperature increases. The barretters are very deli<::ate while thermistors are rugged. The bolometer power meters are llsed to measure radio frequency power in the range 0.1 to 10 mW.

In modern bolometer power meter set up uses the differential amplifier und bridge [orl11 an oscillator which oscillates at a particular amplitude when bridge is unbalanced. The modern bolometer power meter circuit is shown in the Fig.

Initially when temperature sensitive resistor is cold, bridge is almost balance. With d.c. bias, exact balance is achieved. When power input at high frequency is applied to RT, it absorbs power and gets heated. Due to this its resistance changes causing bridge unbalance. This unbalance is in the direction opposite to that of initial cold resistance. Due to this, output from the oscillator decreases to achieve bridge balance.

The electronic voltmeter measures the power decrease from oscillator. It indicates this as an increase in power due to high frequency power input.



Bolometer Elements

Basically a bolometer is very short thin wire. A wire with positive temperature coefficient of resistance is called Baretter. Similarly a wire with negative temperature coefficient of resistance is called thermistor. Both are able to measure small power of the order of microwatts.

A metal wire bolometer i.e. barreter has a positive temperature coefficient of resistance (PTC). It is operated at powers which heat wire upto 100 - 200°C. The metal wire bolometer consists a short length of Wollaston wire. Its external sheath is etched away so that its thin metal core consisting platinum alloy is exposed. The length of such wires IS extremely small (typically 2.5 mm). The diameter of such wires range from 1 to 3 micron.For perfect match with the R.F. line, resistance of the depleted region is adjusted suitably for bias with low powers. This value is generally equal to the characteristic impedance.

For R.F. measurements, the minute beads of ceramic such as semiconductor mixtures of metal oxides with large negative temperature coefficient of resistance (NTC) are used as thermistors. Such beads consists two platinum alloy wires. Then the bead is sintered and coated with glass film. The beads are capsuled in glass envelope.

To achieve perfect impedance matching between the bolometer element and the R.E line, the bolometer element is made of very small size. Such element responses equally well to low frequency and R.F. power.

In most of the elements, the diameter of wire is selected equal to the skin depth of R.F.current at highest frequency of operation. Typically d.c. and R.F. resistivities of the element are same. The reactive component *is* made negligible for such elements. As the maximumcross-section area of the bolometer wire is inversely proportional to the highest frequency of 0rerahon and conductivity of the bolometer material, the wires of the bolometer are ultra 'hin at microwave frequency.

Source : http://elearningatria.files.wordpress.com/2013/10/ece-iii-electronic-instrumentation-10it35-notes.pdf