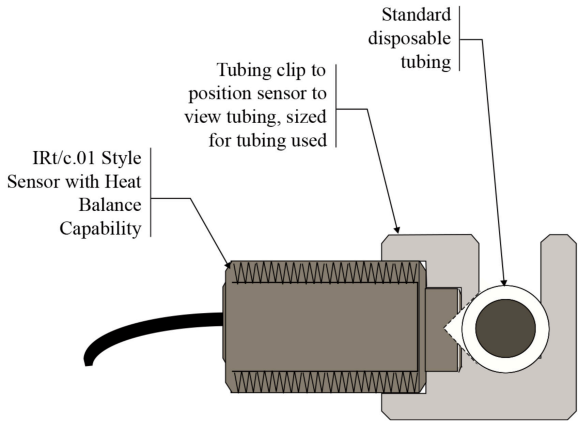
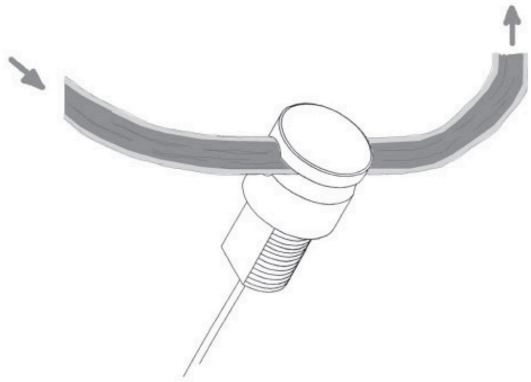
#99: IRT/C HEAT BALANCE SERIES FOR MEDICAL APPLICATIONS

The Heat Balance (HB) Series of IRt/c infrared thermocouples have the ability to measure the internal temperature of the target material, non-invasively, by employing a patented heat balance technique. A typical application in medical equipment is monitoring or controlling the temperature of fluid transported through disposable tubing when warming or cooling:

- Transfusion systems
- IV warming systems
- Dialysis systems
- Cardio-pulmonary bypass systems
- ECMO systems
- Blood analyzers

The IRt/c.01HB model pictured, actually measures the internal fluid temperature by measuring both tubing surface and ambient temperatures then calculating the internal temperature necessary to maintain the heat balance. A convenient clip head provides a reproducible mounting location for the sensor and can be quickly attached to new tubing and removed from used tubing.





Principles of Operation

Fluid at temperature Tf flowing in tubing transfers heat via convection through thermal resistance Rf to the tubing inside surface, which in turn conducts heat to the tubing external surface through thermal resistance Rt, which then transfers to the environment via radiation and convection thermal resistance Ro. The temperatures of the wetted surface of the tubing, outside surface of the tubing, and the local ambient are given by Tw, Ts, and Ta, respectively.

Employing the method of thermal analysis with electrical analogs: current = heat flow, and voltage = temperature, the heat transfer equation may be written as follows:

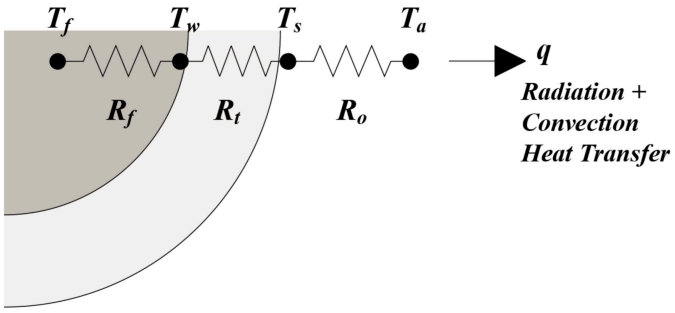
$$q = \frac{1}{R_f + R_t + R_o}\left(T_f - T_a\right)$$

and via heat balance:

$$= \frac{1}{R_o}\left(T_s - T_a\right)$$

Accordingly,

$$T_f = \frac{R_f + R_t + R_o}{R_o}\left(T_s - T_a\right) + T_a$$



The IRt/c-HB Series measures both Ts and Ta, and solves this equation automatically for fluid temperature Tf, providing a highly accurate method of monitoring or controlling the temperature of interest.

The configuration shown above is the model IRt/c.01HB-J-37C with its convenient tubing clip. Any of the IRt/c models can be configured for the HB calculation. Contact the factory for further details.