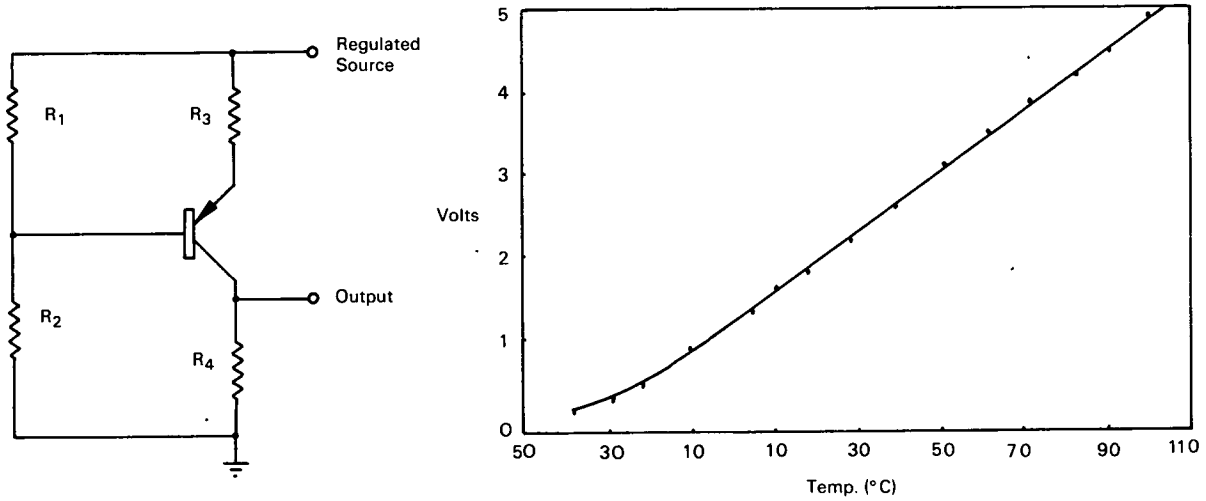
NASA TECH BRIEF

Temperature Transducer Has High Output, Is Time Stable



The problem: To design a small, lightweight, temperature transducer with relatively linear output that requires no amplification of its output signal. Previous devices have used a semiconductor element in conjunction with a thermistor; but the thermistor is not time stable. The output signal, after required amplification, was not linearly proportional to the temperature being measured.

The solution: A compact, lightweight transducer that uses the temperature-dependent characteristics of a planar silicon transistor to provide a zero-to-five-volt signal proportional to temperature.

How it's done: The major element of the transducer is the transistor whose base is held at a constant voltage by a regulated source operating through a voltage divider R_1, R_2. The regulated source is also connected through the emitter resistor R_3. Output of the transducer is developed across the collector resistor R_4 to register the voltage change with temperature on an appropriate instrument. Principle of operation is the characteristic change of base-emitter voltage with changing temperature of a planar silicon transistor. The graph shows the relatively linear rise in output voltage with increase in temperature acting on the transducer.

Notes:

1. Transducer output is sufficient for telemetry purposes to the extent that no preamplification is required.
2. The transducer is disk-shaped and is approximately ½ inch in diameter by ⅓ inch thick. Weight, with 36-inch leads, is approximately 6 grams.

(continued overleaf)

3. Twelve of these transducers are presently providing temperature data on various experiments and components now flying aboard the Orbiting Solar Observatory (OSO-B2).

Patent status: Title to this invention has been waived under the provisions of the National Aeronautics and Space Act (42 U.S.C. 2457 (f)), to Ball Brothers Research Corporation, Boulder Industrial Park, Boulder, Colorado.

Source: William H. Follett of Ball Brothers Research Corporation under contract to Goddard Space Flight Center (GFSC-446)