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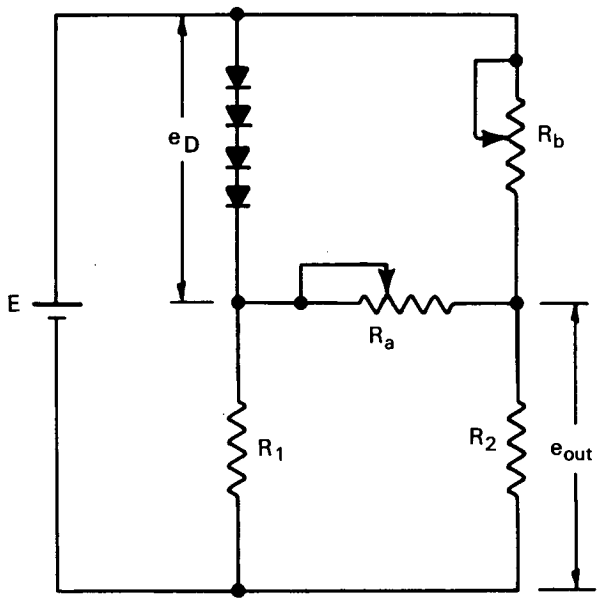
NASA TECH BRIEF

This NASA Tech Brief is issued by the Technology Utilization Division to acquaint industry with the technical content of an innovation derived from the NASA space program.

Simple Circuit Provides Adjustable Voltage with Linear Temperature Variation



The problem: To design a simple circuit giving an adjustable output voltage that varies linearly with temperature.

The solution: A bridge circuit with temperature-compensating diodes in one leg and an adjustable voltage divider across the bridge.

How it's done: A bridge circuit is formed, as represented in the diagram, with diodes in one leg. The voltage drop, e_D, across the diodes decreases linearly with temperature over a limited range. Resistor R_b is adjusted for bridge balance at room temperature (25°C). Under balance conditions, the resistor R_a, of course, has no effect on the output voltage e_{out}. At all other temperatures within a prescribed range the bridge will be unbalanced as a consequence of the fact that e_D decreases linearly as the temperature increases above the balance condition (or conversely, e_D increases linearly as the temperature decreases). The voltage output, e_{out}, will then be a linear function of temperature provided that R_b and R_2 are of sufficiently high resistance to cause the current in the diodes to change negligibly over the operating temperature range. Under these conditions, R_a serves as a voltage divider between R_b and R_2. If the value of R_a is changed from its initial setting, the output voltage will change correspondingly. This voltage can be varied from zero to up to the full voltage

(continued overleaf)

drop across the diodes by adjusting R_a to vary from infinity to zero.

Notes:

1. Diodes were selected as the temperature variable device because of their small size and the fact that their forward voltage drop decreases linearly with temperature over the range of interest. Four diodes were used to provide the required temperature compensation under extreme conditions.
2. The circuit was found to be satisfactory over the temperature range of −20°C to +80°C.

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated.

Source: Larry W. Moede, Datametrics Corp. under contract to Jet Propulsion Laboratory (JPL-WOO-029)