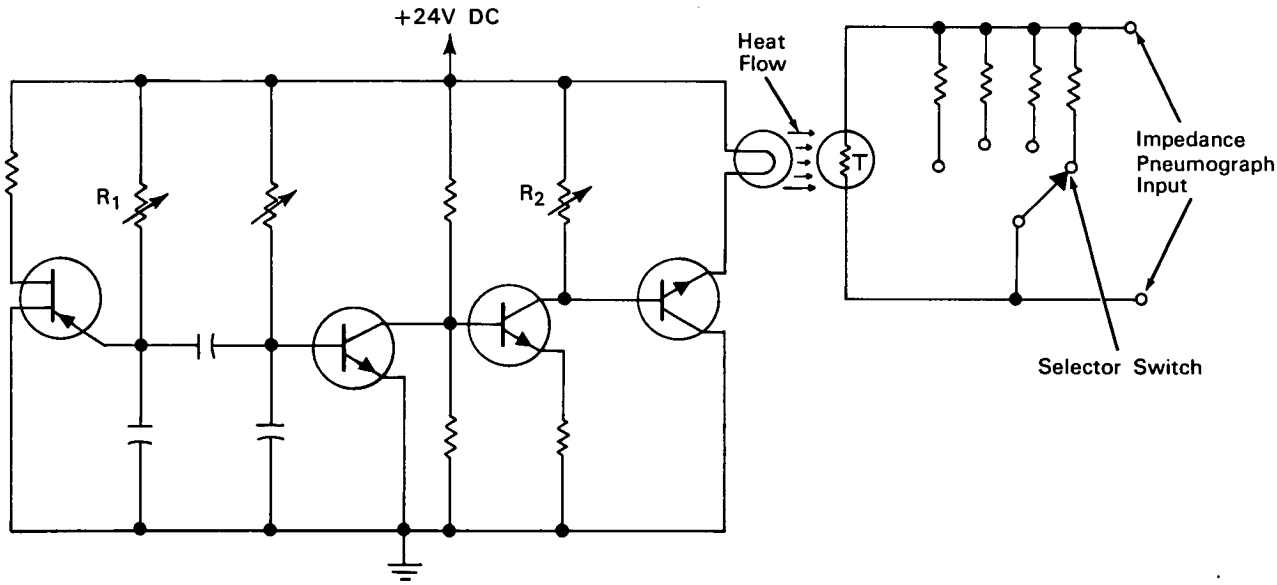
November 1964 Brief 64-10255

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 space program.

Electronic Device Simulates Respiration Rate and Depth



The problem: Instrumentation used on a space vehicle for measuring an astronaut's physiological functions includes an impedance pneumograph for measuring both his rate of respiration and the cyclic change in depth of his chest (thorax) accompanying respiration. The output signal from this instrument, which is a function of the changing dc impedance (resistance) across electrodes on the subject's chest, is telemetered to monitoring equipment on the earth.

In order to permit checkout tests on pneumographs without the use of human subjects, it was necessary to design a simulator that would provide a cyclically varying resistance corresponding to the varying resistance across the electrodes on a subject's chest.

The solution: An oscillator circuit and a thermistor that is in close proximity to a 24-volt light bulb in the oscillator circuit, but not physically connected to it. The periodically varying thermal output of the light bulb correspondingly varies the resistance of the thermistor.

How it's done: The simulator employs a circuit consisting of a unijunction relaxation oscillator, an amplifier stage, a driver stage, a 24-volt dc power supply, and a small 24-volt light bulb. A thermistor connected in parallel with a switching circuit containing a number of resistors is placed in close proximity to the light bulb.

In operation, the oscillator circuit periodically varies the heat output of the light bulb by varying the voltage across its filament. The frequency of the thermal variation is adjusted by means of potentiometer R_1. Potentiometer R_2 can be adjusted to change

(continued overleaf)

the amplitude (maximum temperature range) of the light bulb's output. The heat flux intercepted by the thermistor causes its resistance to vary in conformance with the variation of the thermal output from the bulb. As a consequence, the resistance at the output terminals of the parallel thermistor-resistor network will vary in the same way. The selector switch in this network can be adjusted to compensate for environmental temperature changes, so that the resultant resistance to the pneumograph input will remain effectively dependent only on the cyclic variations of the thermistor resistance.

Notes:

1. This simulator can be used for laboratory testing of electronic equipment other than pneumographs where a cyclic resistance variation is required.
2. The manual resistance-switching circuit can be replaced with a circuit that provides automatic temperature compensation.
3. A related innovation is described in NASA Tech Brief B64-10259, November 1964. Inquiries may also be directed to:

   Technology Utilization Officer
   Manned Spacecraft Center
   P.O. Box 1537
   Houston, Texas, 77001
   Reference: B64-10255

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

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