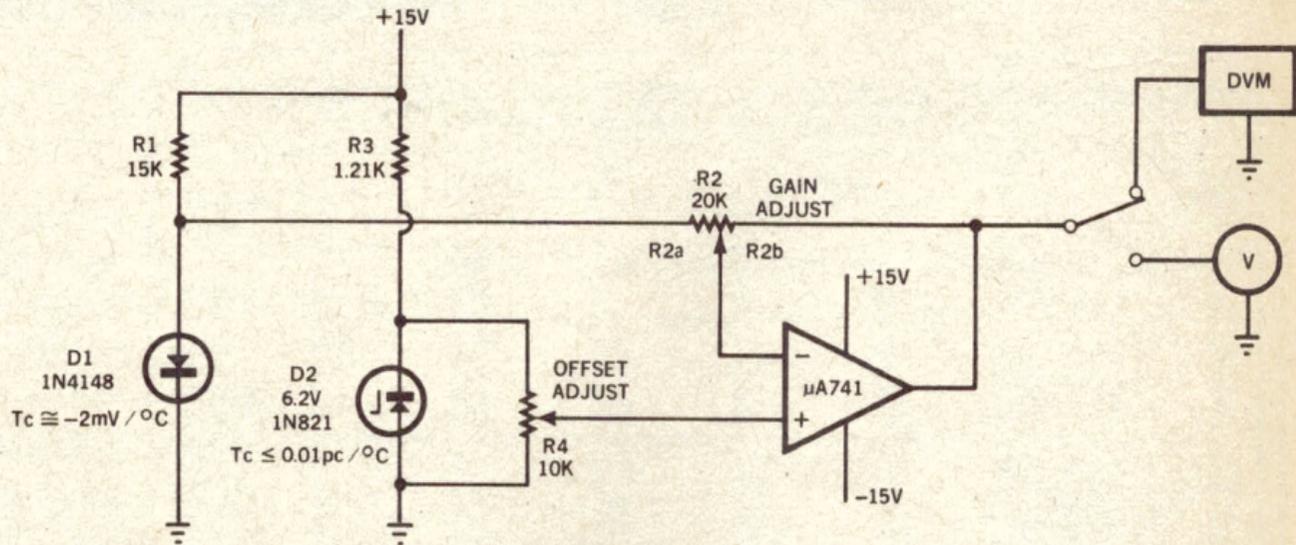


Diode Probe Electronic Thermometer

A silicon diode probe and an operational amplifier with an unusual gain adjustment are the key elements in an electronic thermometer that gives a readout, in degrees, on an ordinary voltmeter. The sensing circuit's voltage variations can be adjusted to align with a temperature scale. For instance, a 10- or 100- millivolt reading can represent 1°C at one setting or 1°F at another setting of the amplifier.

The operational amplifier is connected as a differential amplifier. An input that varies with the temperature of probe D1 is obtained through resistor R1 and part of R2. Zener diode D2 and R3 provide a reference voltage; offset is adjusted by R4. R2 is the gain adjustment, but it is not entirely within the feedback path as shown on the diagram of the conventional differential amplifier. In the location used, R2 helps to make the output both linear and scalable.

After potentiometer R2 in the actual circuit is adjusted to bring the output within a suitable range on the voltmeter, potentiometer R4 is used to adjust offset. This aligns V out with the desired temperature



scale so that the reading corresponds to degrees without further conversion. The instrument is calibrated by setting R4 with the probe at a known temperature.

Metal film resistors, wire wound potentiometers, and the small temperature coefficient of the temperature compensated zener diode give the circuit excellent

temperature stability. Minor variations in supply voltage do not significantly affect accuracy. Since the dynamic impedances of the two silicon diodes are matched closely, supply voltage changes result in a common-mode input signal that is greatly attenuated by the amplifier.

(By Robert J. Battes, in "Electronics".)