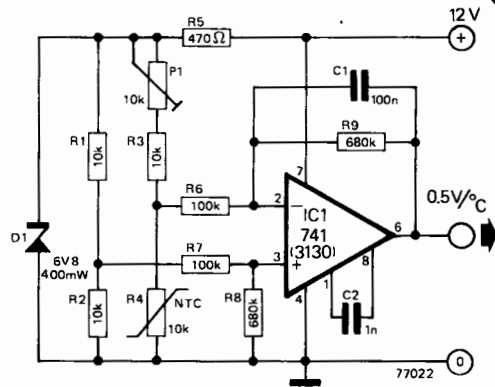




temperature-to-voltage converter

This circuit provides a simple means of constructing an electronic thermometer that will operate over the range 0 to 24°C (32 to 75°F). The circuit produces an output of approximately 500 mV/°C, which can be read off on a voltmeter suitably calibrated in degrees.

In order that the circuit should be kept simple the temperature sensing element is a negative temperature coefficient thermistor (NTC). This has the advantage that the temperature coefficient of resistance is fairly large, but unfortunately it has the disadvantage that the temperature coefficient is not constant and the temperature-voltage output of the circuit is thus non-linear. However, over the range 0 to 24°C the linearity is sufficiently good for a simple thermometer. Op-amp IC1 is connected as a differential amplifier whose inputs are fed from a bridge circuit consisting of R1 to R4. R1, R2, R3 and P1 form the fixed arms of the bridge, while R4 forms the variable arm. The voltage at the junction of R1 and R2 is about 3.4 volts. With the NTC at 0°C P1 is adjusted so that the output from the op-amp is zero, when the voltage at the junction of R3 and R4 will also be 3.4 V. With increasing temperature the resistance of the NTC decreases and the voltage across it falls, so the output of the op-amp increases. If the output is not exactly 0.5 V/°C then the values of R8 and R9 may be increased or



decreased accordingly, but they should both be the same value.

The IC can be a general purpose op-amp such as a 741, 3130 or 3140. The compensation capacitor C2 is not required if a 741 is used since this IC is internally compensated. Almost any 10 k NTC thermistor may be used for R4, but the smaller types will obviously give a faster response since they have a lower thermal inertia. 5 k or 15 k types could also be used, but the values of P1 and R3 would have to be altered in proportion.