

Measure Resistances Easily, without Reference Resistor or Current Source

by Glen Brisebois

Measuring the resistance of a device, for example a thermistor, usually requires biasing it with a precision current source or combining it with several other precision resistors in a bridge. The circuit of Figure 1 shows how to use the new LT1168 instrumentation amplifier to achieve a precision resistance-to-voltage conversion as simply as possible. Normally, the resistor across pins 1 and 8 is the gain-set resistor and the voltage across pins 3 and 2 is the variable to be measured. In this case,

however, the 1.25V reference establishes a fixed input voltage so that the variable to be measured is now the resistance. The equation for V_{OUT} vs R_T is $V_{OUT} = 1.25V \cdot 49.4k\Omega/R_T$. Given the limitation on output swing (with the supply voltages shown), the smallest measurable resistance is about 4.5k. The highest resolvable resistance is limited to about 200M by the 300 μ V output offset voltage of the LT1168. The 0.05% accuracy of the LT1634 is not an issue here, because it is subtracted at the Ref pin of the

LT1168 and only contributes to gain error. Figure 2 shows output voltage vs temperature for 10k and 100k (at 25°C) thermistors from two manufacturers. Thermistors are difficult to linearize, so although the output is still not linear with temperature, it can, at least, be read directly by an ADC and compared against a lookup table. The circuit has good noise immunity but does not tolerate capacitance at pin 1 or 8 and so is not ideal for resistive devices placed remotely from the LT1168. 

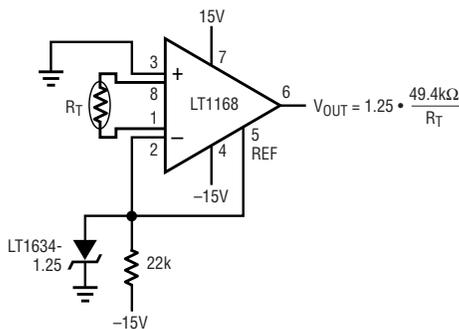


Figure 1. Simple resistance-to-voltage converter

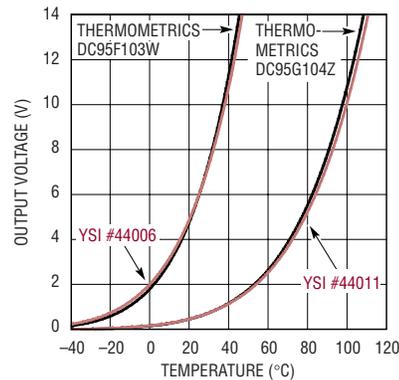


Figure 2. Output voltage vs temperature for thermistors from two manufacturers. Curves are approximations to aid design—contact manufacturers for exact lookup tables: YSI (800) 765-4974; Thermometrics (732) 287-2870.



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