Construction of the TK-334 temperature probe, 1 µamp per Kelvin.

Photo 1. Materials required are
- 1* LM334 current source temperature sensor, TO92
- 1* 226 ohm 1% film resistor, 1/8 watt (small)
- 2* Raychem solder sleeves
- 1* 1/4" length of 3/32" heat shrink tubing
- 1* red & black cable (Belden 8442 or equiv.)
- 1* 1 inch length of dual wall heat shrink (Raychem ES1)

Be sure to use a 1% resistor for stability and accuracy, the 1/8 watt size to minimize the bulk of the construction. The cable can be as long as necessary, as this is a current loop device. Voltage drops along the cable do not cause errors. For very long runs in noisy environments, shielded, twisted pair cable is preferable. Feel free to make substitutions and adaptations to use available materials.

Pictorial. The LM334 is connected with the 226 ohm resistor in series with the middle leg, to set the current. The formula for current in relation to Kelvin temperature is:

$I \text{ (microamps)} = 227 \, / \, R \text{ ohms}$

so a resistance of 227 ohm will set the output to 1 microamp per K. 226 ohms is the closest standard 1% resistor value. The accuracy of the LM334 itself is not great, ±6% worst case, which amounts to ±24 Kelvin at room temperature (300 K). However, the accuracy is typically much better than that. Calibration can remove much of the error. The AD590 and the TMP17 are better that the LM334, with respect to initial accuracy, and their calibration is set to 1 µamp per K without the use of any resistor.

Lm334

V+

226

R

V-

I=1µamp/K
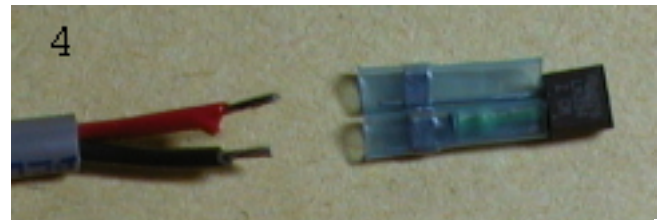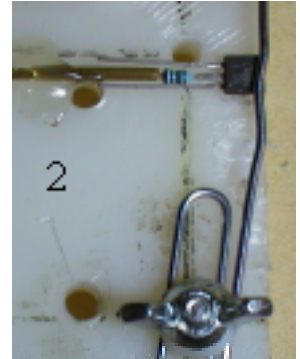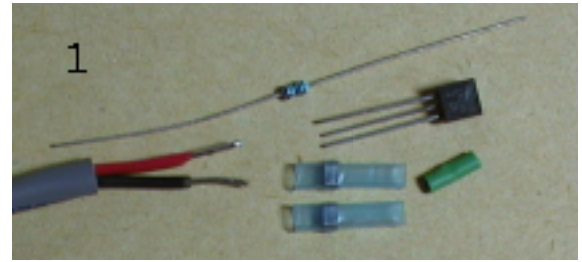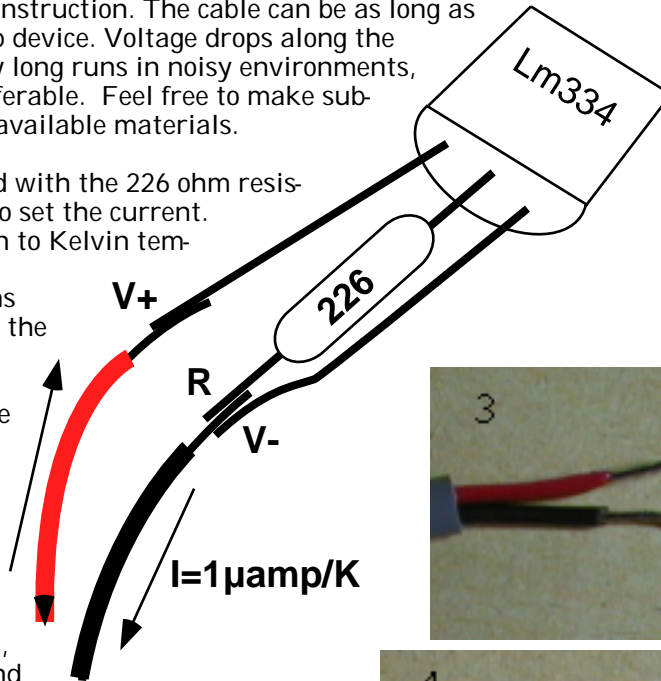
Photos 2 & 3. The center leg of the LM334 and one lead of the resistor are trimmed to 1/8" long. The resistor is soldered to the center leg and covered with the short length of shrink tubing. The simple jig in photo 2 helps to align the parts for soldering.

Photos 4 & 5. The cable ends are stripped, tinned and trimmed to 1/8" long. The sleeves with the solder preforms are slipped over the the single (+) lead, and over the center lead with resistor and the (-) lead taken together. The solder sleeve and solder preform are shrunk over the cable leads as shown in photo 5. Inspect the joint to be sure the solder preform has melted.

Photos 6 & 7. The cable sheath can be pushed up over the leads. And then a sleeve of dual wall waterproofing shrink tubing is applied over the whole assembly.

  -- Tracy Allen