# F1616-BA: Measuring Temperature with Thermistors

A thermistor is a kind of resistor whose resistance decreases when its surrounding temperature increases. It is a very low cost and stable device that can be used to measure a wide range of ambient temperatures from freezers to hot water boilers, which are commonly used in HVAC applications.

In order to convert the resistance changes into voltage readings to be read by the PLC's analog input, you can use it to form an arm of a voltage divider circuit that provides a variable voltage to the analog input when the temperature changes. A type of thermistor that measures 10.0K ohm at 25 degree C (simply called 10K thermistor) is especially suitable for use with the F1616-BA PLC, as illustrated below:

The design of the F1616-BA analog circuitry makes it extremely simple to interface to the 10K thermistor: You simply connect the 10K thermistor directly to the analog input since there is already an internal resistance of 40.00K ohm (0.1% accuracy).
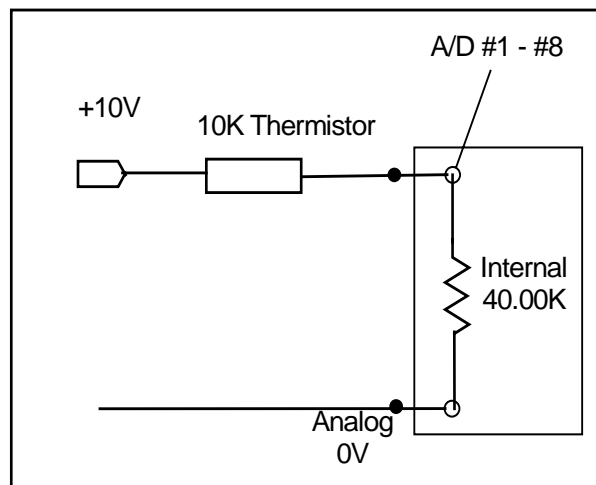
Connecting 10K Thermistor to ADC 5-8

Figure 5.6

Note that since the thermistor resistance value vs. temperature change is a non-linear function, you cannot simply use a formula to calculate the temperature from the voltage value. For better accuracy you need to use a look up table plus a linear interpolation technique to determine the temperature based on the ADC readings. The look up table and interpolation method can be implemented using TBASIC. For your convenience, we have provided sample TBASIC programs that you can download from the following web page:

  http://www.tri-plc.com/appnotes/F-series/ThermistorSensorFPLC.zip

This example uses the R-T (Resistance-Temperature) graph of the Precon Type III thermistor to implement the temperature look up. We have provided an Excel file that computes the ADC reading vs ambient temperature for this thermistor type. The TBASIC program uses these ADC readings to determine the temperature.

The sample program is structured such that the lookup table values are stored in the FRAM and you can readily adapt it to other types of thermistors with a different R-T graph. The program only implements lookup for a temperature range of $-10^{o}F$ to $100^{o}F$, but you can also easily change the temperature range of interest.