Measuring The Accuracy of the i100 Box itself

Application Note #65, 12/28/2002

Below are several notes on how to measure the accuracy of an instruNet device using a calibrator or precision external voltage source device.

Software Setup
* Run instruNet World and press the Network tab to see your input channels.
* Set integration to .1 seconds (or 0.01666) to reduce the fluctuation of the measured voltage.
* Press the Record tab, press the Setup button, press the Calibration button, and set the Auto Cal Rate field to 3. This will instruct instruNet to autocalibrate every 3 minutes.
* Set the 40Hz/4KHz instruNet internal analog filter to the OFF position (which is the default).
* Apply your voltage source and measure several voltages on several ranges. The maximum voltage ranges are +-4.95V, +-.6V, +-78mV, +-8mV. Please do not test voltages outside these ranges. To measure the maximum voltage range of a unit, input 20% higher than the typical voltage range and then observed the measured bound. For example, enter 12mV on the +-10mV range and the maximum reading will between 8mV and 12mV (10mV is typical). These limitations are caused by internal op amp offset voltages.

Hardware Setup
* If doing differential measurements (i.e. "Vin+ - Vin-"), attach Vin- to GND with a small wire to minimize the affects of an RFI signal between the signal source and instruNet GND (which could add a +-30uV error).
* Do not apply or measure signals with BNC cables, since the center pin is often gold plated and the outter shield is not, a thermocouple measurement error is induced (e.g. +-100uV).
* When using Banana jacks and cables, make sure you use the same style; otherwise, dissimilar metals can induce thermocouple errors. Imagine you have a 10.000mV battery with two banana connectors attached to each end, one gold plated, the other not. Now, place this into DVM #1 with internal temperature 30C. When two metals of different type touch, a small voltage, referred to as the "thermocouple voltage", which is a function of temperature, is induced. Lets imagine the gold banana at 30C induces a 100uV drop and the other banana induces a 150uV drop at 30C. DVM #1 will then measure 10.050mV. Now, insert the bananas into DVM #2 at 35C. Let's assume the thermocouple errors here, at 35C, are 110uV and 180uV. DVM #2 would show 10.070mV, a 20uV difference from the first DVM. The solution is banana connectors of the same type, so that their thermocouple errors cancel to 0. In that case, both DVM's would correctly read 10.000mV.
* If you input 0.000mV on the +-10mV range, and instruNet World does not show +-1uV, then you are probably picking up an RFI signal in your test wires. To debug this, attach a wire from GND to Vin- to Vin+, detach all your voltage source/DVM wires, see +-1uV on the instruNet screen (you should see this, especially after pressing the Calibrate button in the Network page), and then add back your diagnostic set up in stages. If the voltage changes at the DVM or instruNet World, while moving your test leads to different positions, an RFI signal is probably interacting with that loop of wire.
* If two wires are placed into one screw terminal, make sure they are both making contact.
* The instruNet 100 Rev 3 units are more accurate then Rev 2 units that were manufactured pre 1999.

Thermocouple Measurements
* When doing thermocouple measurements, the temperature of the instruNet screw terminals are measured by instruNet and used in the temperature calculation. If you attach a room temperature wire to instruNet, it might take 60 minutes or so for the screw terminal temperature to reach an equilibrium; therefore, one might see a 2C error for several minutes after first attaching the wires.
* See Application Note #71, Troubleshooting Thermocouples, for more informaiton.

Connecting a Thermocouple/RTD/Voltage Calibrator
* If measuring thermocouple accuracy, make sure you have your calibrator set to the same thermocouple