Measuring High Currents & Voltages, SAFELY

Application Note #82, 8/2/2002

Measuring High Voltages

If one wants to measure the voltage of a 0 to 100V line, we recommend a 100 to 1 voltage divider that drops the 100V to 1V, and puts 0V and 1V across the instruNet Vin +/- screw terminals. This voltage divider is in parallel with the voltage source and in parallel with the load. This means that the 1V shunt resistor must be next to the GND node an not the 100V node, in order to keep the voltage at instruNet at 1V instead of 99V. If the 100V accidently became 1000V in a overvoltage scenario, then 10V would go into the instruNet, and the instruNet is protected at this level indefinitely, and protected for higher voltages for shorter durations. The resistors must be able to handle the power:

resistor power disipation (Watts) = volts * volts / resistance

For example, a 100 ohm and 10K ohm resistor for 100V would mean the 100 ohm resistor power disipation would be: 10V * 10V / 100 = 1Watt. And the 90V drop across the 10K would be: ~100V * ~100V / 10K = 1Watt. These are fairly high, since most resistor are .25 Watts or so; therefore, 100K and 1K would be better, and would yield power disipations of .1Watts for each resistor.

Also, it would be best if the voltage into the instruNet was about 0V to .6V for the expected current range, to allow for plenty of overvoltage (to make the system super safe) and to use the entire instruNet .6V range. 0.1% resistors cost about $1 in quantity 1 and $.25 in quantity 100. These would make the measurement accurate to .2% for 2 resistors. More precise resistors are available for more accuracy, yet cost more. It is best to place both resistors as close to the instruNet box as possible. If they are far away, a capactor across the instruNet Vin+/- screw terminals will help to reduce noise, since it becomes a 1pole low pass filter with the high value resistor, and FrequencyCutoff (Hz) = 1/(6.28 * R * C); where R is the high value resistor in ohms and C is in Farads. For safety, one might want to place the two resistors at the high voltage line, and then run the low voltage signals (e.g. 0 to .6V) to the instruNet box, further away.

Measuring High Currents

This is similar to measuring high Voltages, except 1 current shunt resistor in series with the load is used instead of a voltage divider in parallel with it. This resistor is placed next to the GND node (not the high Voltage node) and is attached to the instruNet Vin+/- screw terminals. instruNet is placed in Current Measurement mode. The resistor is often of a small value. For example, if one wants to measure 0 to 10 Amps, a .02 ohm resistor will yield a 0.2V drop across the resistor, and disipate I * I * R = 2Watts. Caddock Electronics sells such resistors (www.caddock.com).