ADVANCED INDUSTRIAL SYSTEMS, INC.

Applications Note 711
RTD Hook-ups

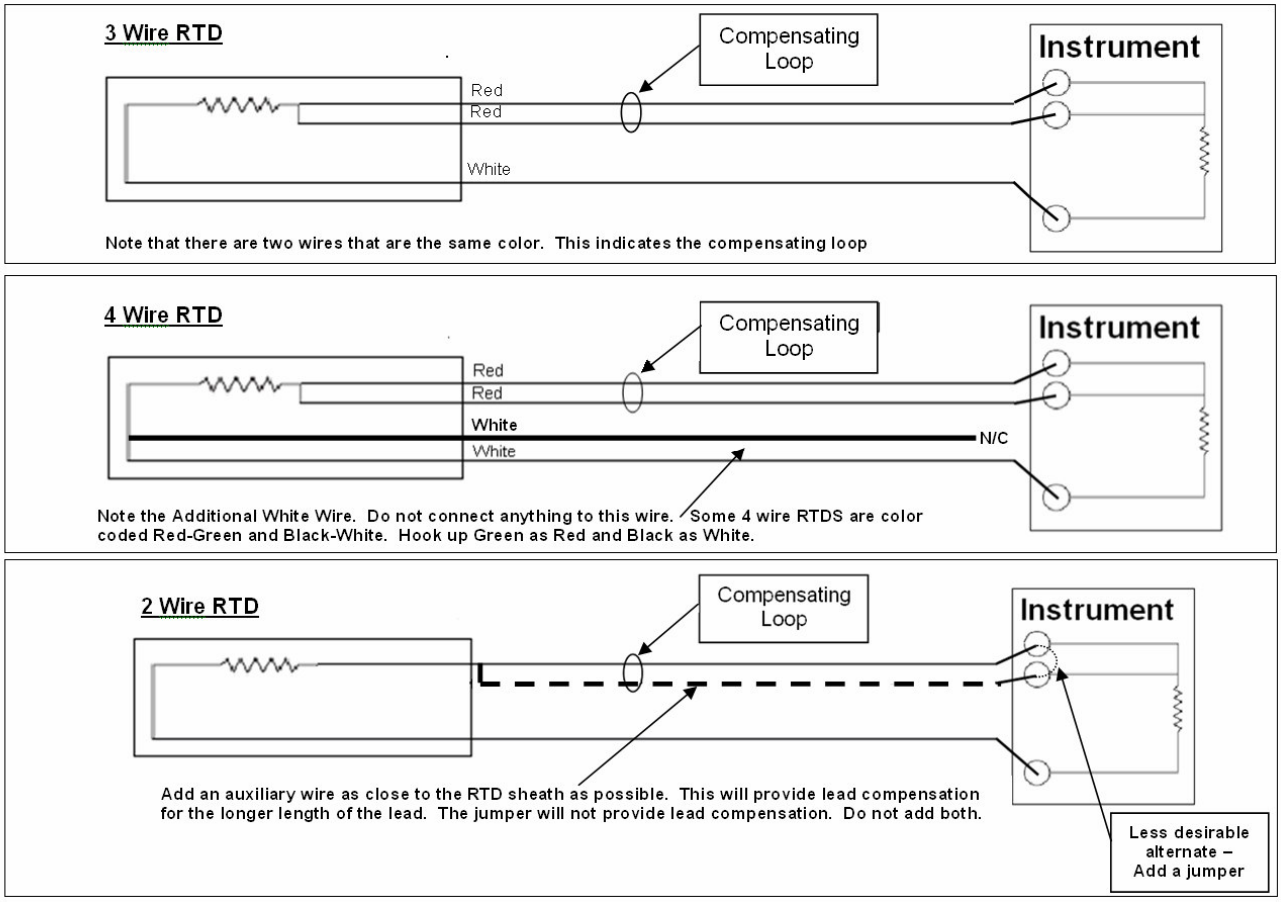
Q: How do you hook up the various kinds of RTD's?

Answer: The most popular RTD's come in 2 wire, 3 wire and 4 wire. Dual Element RTD's have more wires but are generally a variation of the above. In general 3 wire RTD's and 4 wire RTD's are the most common.

RTD's have very small resistance changes per degree (approx 0.4%). Even a small change in lead resistance can lead to a significant error. Lead configurations of 3 and 4 wires are often used to compensate for the effect of lead resistance on the measurement. Two wire configurations do not compensate. They are shown below only for completeness. Try to avoid them when possible, as the lead resistance can lead to significant errors.

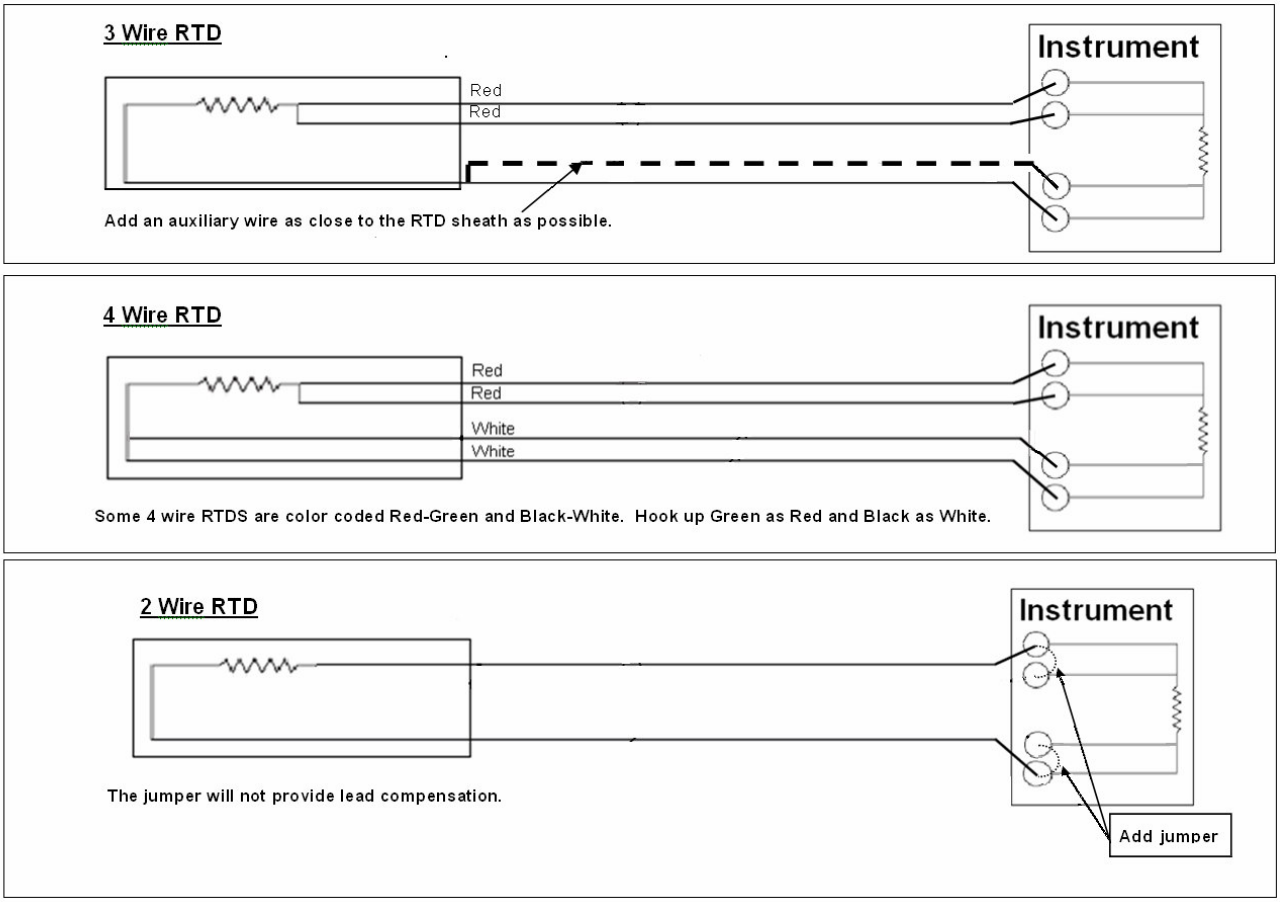
Three Wire Instrument Hook-Ups:

A three wire RTD uses a compensation loop to measure the drop in the leads and subtract it back out. It depends on all of the leads being the same resistance so that the lead wire voltage drop can be accurately measured and removed. A three wire RTD depends on all of the leads having the same resistance therefore any auxiliary wires should be of the same size and type as the RTD leads.



Four Wire Instrument Hook-Ups:

A four wire RTD sends current down the outer two leads and measures the voltage across the inner two leads. In this way we measure the resistance at the RTD, avoiding the voltage drop in the leads.



Two wire RTD instruments may also be found. With a two wire instrument, hook up the common wires to the terminals (i.e. the 2 red common wires to one terminal and the white (or 2 white) common wires to the other terminal).

If you can compensate for the lead error in the instrument, it may be determined in one of three ways.

1. Immerse the RTD in a known temperature solution. The difference between the known temperature and the indicated temperature is the error. Adjust for minimum error.
2. Determine the lead resistance from wire tables. Remember there are two wires. Multiply by the lead length to find total resistance. Multiply by 0.4 to find the error in degrees C or 0.7 to find the error in degrees F. Your RTD will read this much too high. Subtract the value from your reading.
3. Use a resistor of approximately 100 ohms. Connect it to the instrument (without the RTD connected). Note the temperature. Now connect it to the other end of the lead wire (again no RTD). The difference is the error in measurement caused by the lead resistance. Subtract this difference from your reading.

Additional information on RTD's may be found on our web site at www.AdvIndSys.com/RTD.htm. Additional Applications Notes, Tables and Links to Engineering Publications and Organizations may be found at www.advindsys.com/ApplicationsNotes.htm .

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