FLUKE®

3-wire RTD measurement

with 2680 Series, NetDAQ® Networked Data Acquisition Units or Hydra data loggers

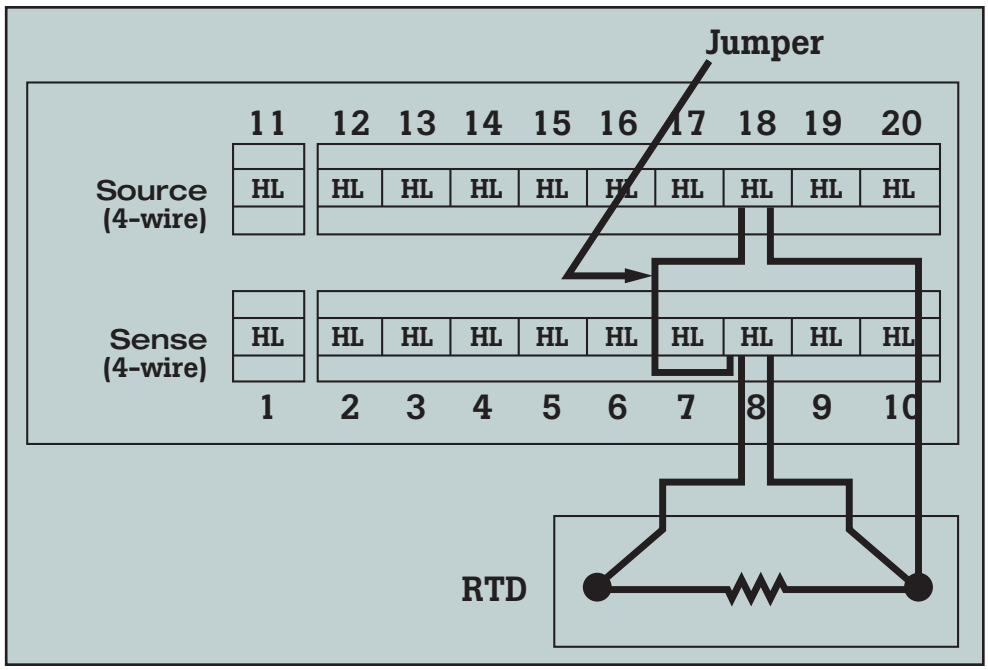
Application Note

Fluke data acquisition models are designed to measure RTD inputs (Resistance Temperature Detector) or PRT probes with a 4-wire connection. A 4-wire connection allows the modern high-resolution resistance measurement capability of the 2680 Series, NetDAQ or Hydra models to measure the RTD element directly without any error from lead resistance.

Many newer style RTD probes are 4-wire, intended for this kind of measurement. However, older style RTD probes often have 3-wire leads. These 3-wire connections are intended to be used for bridge circuits, which in the past was the most practical way to measure the precise resistance of RTD probes. 3-wire measurement with a bridge generally is not as accurate or stable as direct 4-wire measurement, however.

Although Fluke data acquisition models are designed for 4-wire RTD measurements, they also can measure 3-wire RTD probes. This is done by setting up the 3-wire RTD for 4-wire measurement, with a jumper in place of the missing wire. It is necessary to correct the temperature readings as well, for an offset due to one uncompensated lead's resistance; this is done using Mx+B scaling.

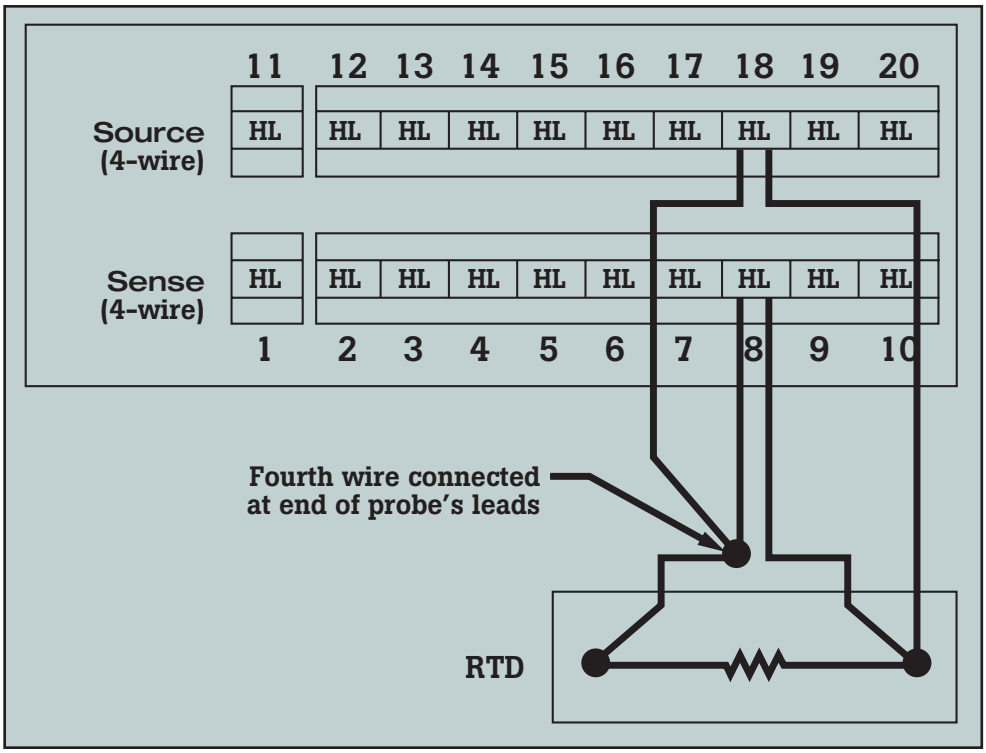
Method A



Configuring 3-wire measurements

There are two methods of connecting a 3-wire device for a 4-wire measurement. Method A above is the simplest method, using a jumper in place of the fourth wire. While this is simple, it is only suitable when the RTD probe's leads are connected directly to the inputs of the data acquisition system. If there is extension or station wiring between the inputs and probe leads, Method B below should be used instead.

Method B



In cases where the connection to the 3-wire RTD is extended with wiring between the inputs and the probe leads, Method B should be used. This prevents the resistance or temperature changes of the added wiring from causing additional errors in the temperature measurement.

Description of 3-wire RTD connections

Use H and L terminals for two channels on rear panel input module. Configure the input channel as 4-wire. The diagrams above show connections for channel 8, with channel 18 providing the additional two connections. Since the measurement is actually taken as a 4-wire connection, one Sense Channel (1 through 10) and one Source Channel (the Sense Channel number +10, i.e. 11 through 20) are used.

The fourth wire is connected either as a jumper on the input module or at the end of the probe's leads, as shown above.

Correcting the 3-wire RTD measurement

With 3-wire RTD measurements, there will be an offset in the temperature reading. This is due to the resistance of the one uncompensated lead wire, which will cause the temperature to read high by some amount. You can correct for this offset by using the built-in Mx+B scaling to enter an offset for each 3-wire RTD channel.

For example, if the RTD temperature reading is 0.20° high on a channel, enter a B value of -0.20 for that channel (leave the M value set to 1.0000 by default).

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