



## Thermocouple Best Practices

For years, thermocouples have been an integral part of any validation project. They provide an inexpensive, accurate means of obtaining valuable temperature measurement data for a multitude of validation studies and projects. The key to their success is their simplicity. Dissimilar metals, when put into contact with each other, provide a predictable voltage output that is directly related to a temperature. There are many methods for creating this contact, including twisting the two conductors, argon welding, spot-welding, arc welding, crimping, soldering, etc.

Twisting is prone to inconsistency and measurement uncertainty; thermocouples will always produce an output at the first point of contact. For example, if you are trying to obtain a reading at the base of a temperature well with a thermocouple that has ½" of twisted conductor, you will actually be reading the temperature ½" higher than you think. Twisted conductors can become separated due to their different expansion rates, causing erratic or open readings. Also, over time, corrosion between the dissimilar metals can lead to further degradation of contact. While acceptable in the field as a quick fix should a thermocouple become damaged, the technician needs to be aware of the drawbacks.

For accuracy and consistency, we strongly recommend Argon welding for forming this critical contact between conductors. Argon welding produces a connection free from impurities, providing you with an accurate and reliable thermocouple sensing junction.

We also recommend sealing the welded tip with a dual-wall shrink tubing to extend the life of your thermocouples. This sealing protects the sensor-end of the thermocouple from physical stresses and prevents grounding errors, which can occur should the bare tip contact a conductive surface. In addition, sealing the tip minimizes the amount of moisture being pushed through the wire, reducing oxidation and extending the life of your thermocouples.

When using thermocouples in a steam environment, Masy also recommends steam-slicing your thermocouples. Placing a 1/4" cut in the jacket of each thermocouple (be *extremely careful not to nick the inner conductors*) approximately 18" away from your datalogger will allow any moisture that does get through to drip harmlessly onto the floor and not penetrate your validation equipment.