

# Temperature Sensors:

## Thermocouple and Thermocouple Extension Wire Information

**Thermocouple and Thermocouple Extension Wire** is offered with many different options and in numerous style combinations. Selecting from the various wire gauge sizes, insulating materials, conductor styles (solid vs. stranded), and limits of error enable the

user to select the correct material for virtually any industrial process application. CONVECTRONICS offers the most common constructions used by industry, however, special construction wire and cable is available upon request.

### Thermocouple Wire

**Thermocouple Grade Wire** is generally used to make the actual thermocouple element. (Although it can be used as extension wire as well, the outer jacket insulation may have a different color and it may not be as cost effective.) Each of the calibration types has their own insulation standard color code for easy identification. Please refer to the Thermocouple Wire Color Code Table in this section.

- To assist in the installation of the thermocouple, the Red wire is always the Negative leg of the element.
- If the thermocouple wires are installed incorrectly the instrument in the circuit will give backwards readings.
- Available in AWG sizes from 6 AWG (0.1620") to 40 AWG (0.0031")
- Insulation materials are available to cover temperature ranges from -190°F to 2600°F (-123°C to 1430°C)

### Extension Wire

**Extension Grade Wire** is used to complete the thermocouple circuit from the thermocouple element to the instrumentation. Extension grade wire should not be used to make the actual elements. The extension wire and thermocouple wire must both be of the same calibration type to maintain the accuracy of the thermocouple. Also, the polarity of each set of wires must be maintained during installation in order for the thermocouple circuit to function properly. Each of the calibra-

tion types has their own insulation standard color code for easy identification. Please refer to the Thermocouple Extension Wire Color Code Table in this section.

- To assist in the installation of the wire, the Red wire is always the Negative leg of the extension wire.
- For typical, non-flexing, ambient temperature, indoor use, a 20 AWG solid conductor with PVC insulation is an excellent choice.

### Helpful Hints

- Thermocouple and thermocouple extension wire are both available in "standard" and "special limits of error" grade conductor.
- Use a wire gauge size compatible with terminal screw size connections, and of a size that would withstand any physical abuse that may be encountered.
- Choose wire insulation that is compatible with the environment in which it will be used. For applications requiring moisture resistance use Teflon, PVC or Kapton insulations. For applications requiring high temperature insulations use Fiberglass, Ceramic Fiber or Vitreous Silica insulations.
- Use stainless steel overbraid and leads in flexible armor to provide physical abuse protection to wiring.
- Use stranded conductor wire to connect thermocouples where continuous or frequent flexing of the leadwires may occur to prevent conductor fatigue and failure.
- Use leadwire with built-in aluminum mylar shields and drain wires to connect sensors to computers and to provide protection against error producing EMF stray signals. Use multi-pair cables to run large quantities of sensor leads from common point-to-point locations.
- Do not run thermocouple leads in conduits containing power wiring and do not run conduit carrying thermocouple leads parallel to electric buss bars and heavy power carrying conduits. Cross buss bars and power carrying conduits at right angles with thermocouple conduits when necessary.

### Limits of Error for Thermocouple & Extension Wire

The limits of error for the calibration types listed in this section have been extracted from standards set by the American National Standard Institute, Inc. as shown in ASTM Standard E 230.