Instructions, Cernox™ Resistance Temperature Sensor, Model CX-10XX-ET and CX-10XX-MT Packages

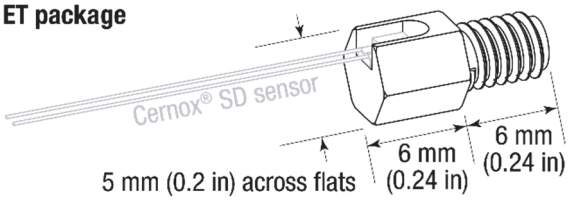
Across flats

There are three aspects of using a temperature sensor which are critical to its optimum performance. The first involves the proper mounting of the sensor package, the second relates the proper joining of sensor lead wires and connecting wires. The final concern is the thermal anchoring of the lead wires. Although the sequence in which these areas should be addressed is not set in stone, all elements covered under each aspect should be adhered to for maximum operating capabilities of the sensor.

SENSOR MOUNTING

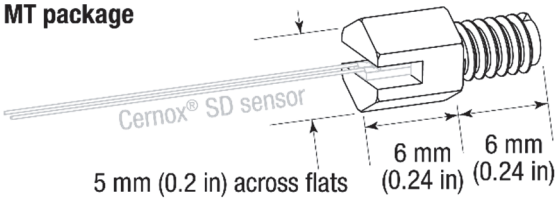
The CX-10XX-ET and CX-10XX-MT packages combine a standard SD sensor with a threaded copper stud to form the ET and MT packages.

ET package



M3 × 0.5 pitch threaded stud
Leads: ~914 mm (36 in) long, 32 AWG
Mass: 1.4 g (without sensor)

MT package



#6-32 threaded stud
Leads: ~914 mm (36 in) long, 32 AWG
Mass: 1.4 g (without sensor)

1. A threaded hole must be tapped into the mounting surface. ET package requires a 6.35 mm (0.25 in) deep, 6-32 threaded hole while the MT adapter screws into a 6 mm (0.24 in) deep, M 3 × 0.5 pitch hole.

2. Mounting hole and surrounding surface should be cleaned with a solvent such as acetone and an isopropyl alcohol rinse. Allow time for the solvents to evaporate before sensor mounting.

3. Apply a small amount of Apiezon® N grease to the threads of the stud.

4. Insert stud into threaded hole and tighten. Do not over tighten since the threads are copper and can be easily sheared. Finger tight should be sufficient.

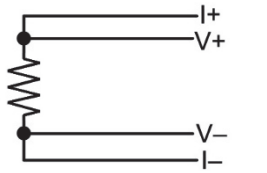
   NOTE: Ensure that no electrically conductive particles lodge between the adapter and SD sensor. There is a thin braze joint around the sides of the SD sensor and is electrically connected to the sensing element. Contact to the sides with any electrically conductive material will cause a short. It is also important that the sensor leads do not touch any part of the hex head.

   NOTE: This package is designed for use up to 325 K (52 °C), subjecting sensor to temperatures in excess of this will cause a shift in the sensor values.

LEAD ATTACHMENT

1. It is recommended that a 4-lead measurement scheme is used with this sensor by attaching four connecting wires to the two sensor leads. See figure to determine sensor lead polarity.

2. Strip connecting wires insulation by delicately scraping with a razor blade, fine sand paper or steel wool. Phosphor-bronze or Manganin wire, in sizes 32 or 36 AWG, is commonly used as the connecting lead wire. These wires have low thermal conductivity which help minimize the heat flow through the leads. Typical wire insulation is Polyvinal Formal (Formvar™) or Polyimide (ML). Formvar™ insulation has better mechanical properties such as abrasion resistance and flexibility. Polyimide insulation has better resistance to chemical solvents and burnout.



Recommended Wire Hook Up

3. Prepare the connecting wire ends with a RMA (rosin mildly active) soldering flux, tin them with a minimal amount of 60% Sn 40% Pb solder. Use a low wattage soldering iron that will not exceed 200 °C. Clean off residual flux with a rosin residue remover.

4. The sensor leads can be prepared in an similar manner. **NOTE:** Since package temperature cannot exceed 325 K (52 °C), thermal protection of the sensor package will be required. A heat sink clip should be applied between the adapter and the end of the sensor leads.

5. Attach one sensor lead with two of the connector wires and apply the soldering iron above the joint area until the solders melt, then remove the iron immediately. Repeat for the other set of connector wires and the other sensor lead.

6. Avoid putting stress on the device leads and leave enough slack to allow for the thermal contractions that occur during cooling which could fracture a solder joint or lead. This can be achieved with heat shrink tubing.

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HEAT SINKING/THERMAL ANCHORING

1. Since the area being measured is read through the base of the sensor, heat flow through the connecting leads can create an offset between the sensor chip and the true sample temperature. Thermal anchoring of the connecting wires is necessary to assure that the sensor and the leads are at the same temperature as the sample.

2. Connecting wires should be thermally anchored at several temperatures between room temperature and cryogenic temperatures to guarantee that heat is not being conducted through the leads to the sensing element.

3. If the connecting leads have a thin insulation such as Formvar™ or Polyimide, a simple thermal anchor can be made by winding the wires around a copper post, bobbin or other thermal mass. A minimum of five wraps around the thermal mass should provide enough of an anchor. However, if space permits, additional wraps are recommended for good measure. To maintain good electrical isolation over many thermal cycles, it is good practice to first varnish a single layer of cigarette paper to the anchored area then wrap the wire around the paper and bond in place with a thin layer of IMI 7031 Varnish. Formvar wiring insulation has a tendency to craze with the application of IMI varnish. Once IMI varnish is applied, the wires cannot be disturbed until all solvents have evaporated and the varnish has fully cured (typically 12 to 24 h).

4. A final thermal anchor at the sample itself is a good practice to ensure thermal equilibrium between the sample and temperature sensor.

CRYOGENIC ACCESSORIES - Recommended for installation and use of CX-10XX-ET and CX-10XX-MT sensors:

Stycast® Epoxy 2850FT (P/N 9003-020, 9003-021): Permanent attachment, excellent low temperature properties, poor electrical conductor, low cure shrinkage.

Apiezon® N Grease (P/N 9004-020): Low viscosity, easy to use, solidifies at cryogenic temperatures, excellent lubricant.

IMI 7031 Varnish (P/N 9009-002): Nonpermanent attachment, excellent thermal conductor, easy to apply and remove.

Indium Solder (P/N 9007-002-05): 99.99% pure, excellent electroplating material, foil form.

90% Pb 10% Sn Solder (P/N 9008-001): Greater lead content, for higher temperature applications no greater than 200°C.

RMA Soldering Flux (P/N 9008): Variety of types, refer to Lake Shore Product Catalog for details.

Phosphor-bronze Wire (P/N 9001-00X): Available in single, duo, and quad strands, no magnetic attraction, low thermal conduction.

Manganin Wire (P/N 9001-00X): Low thermal conductivity, high resistivity, no magnetic attraction.

Heat Sink Bobbin (P/N 9007-900 Large, 9007-901 Small): Gold plated oxygen-free high-conductivity (OFHC) copper bobbins.

Instruments: Lake Shore sells a complete line of instrumentation used with the CX-10XX-ET and CX-10XX-MT sensors, such as: current sources, cryopump monitors, temperature controllers, monitors and thermometers, temperature scanners and transmitters.

For complete product description and detailed specifications on the above accessories and instruments, consult the Lake Shore Temperature Measurement and Control Catalog, call (614) 891-2243, e-mail sales@lakeshore.com, or visit our website at www.lakeshore.com.