

Installation Instructions

Silicon Diode Temperature Sensor

DT-470/471/670 CY Package

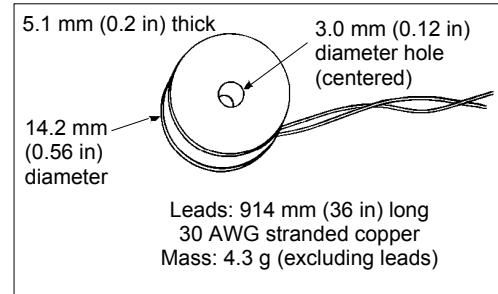


There are three aspects of using a cryogenic temperature sensor which are critical to its optimum performance. The first involves the proper mounting of the sensor package; the second relates the proper joining of sensor lead wires and connecting wires. The final concern is the thermal anchoring of the 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 DT-470/471/670 CY package combines a standard SD sensor with a gold-plated copper mounting bobbin to form the CY package. The mounting bobbin of these packages contains a 3.0 mm (0.12 in) diameter centered hole designed for mounting with a #4-40 screw.

1. A threaded hole in your mounting surface is necessary for mounting the sensor package. The hole in the sensor package will accommodate a #4-40 screw. A brass screw is recommended due to the thermal contractions/expansions of the final assembly.
2. The threaded hole and surrounding surface should be cleaned with a solvent such as acetone followed by 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 screw. To ensure good thermal contact between the sensor and mounting surface use an indium washer/preform or a thin layer of Apiezon[®] N grease between the mounting surface and the sensor package. **NOTE:** An overabundance of grease will increase the thermal barrier. Keep the thickness to 0.05 mm or less.
4. Insert screw through sensor mounting bobbin and tighten screw firmly enough to hold sensor in place. Avoid over tightening (torque of 3–5 in-oz [0.02–0.035 N-M] should be sufficient).



NOTE: This package is designed for use up to 400 K (127 °C); subjecting sensor to temperatures in excess of this will cause a shift in the sensor values.

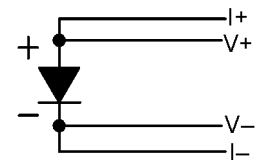
LEAD ATTACHMENT

The SD sensor has been attached to the mounting bobbin and encapsulated in Stycast[®] epoxy. The 914 mm (36 in) sensor leads are 30 AWG, Teflon[®] coated wire which are thermally anchored to the bobbin. Standard lead configuration for the CY is a 2-lead device [Green = Cathode (-), Yellow = Anode (+)].

914 mm (36 in) lead wire is attached during the production process. If additional connection wire is required, use the following instructions.

1. Prepare the sensor leads with a RMA (rosin mildly active) soldering flux. Use a low wattage soldering iron and tin leads with a minimal amount of 60% Pb 40% Sn solder. Clean off residual flux with a rosin residue remover.
2. Strip the insulation from the connecting wires by delicately scraping with a razor blade, fine sand paper, or steel wool. Follow the same procedure in step 1 for preparing connecting wires.

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Four-Lead
Measurement Scheme

HEAT SINKING/THERMAL ANCHORING

Thermal anchoring of the leads is an important factor in cryogenic measurements. As part of the design of the CY packaging, the leads are already heat sunk around the copper bobbin. Depending on the system design, additional heat sinking between room temperature and sensor temperature may be necessary.

For additional heat sinking/thermal anchoring:

1. 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.
2. 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 sufficient thermal anchoring. 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. If used, the wires cannot be disturbed until the varnish is cured and all solvents have evaporated (typically 12–24 hours).

CRYOGENIC ACCESSORIES — Recommended for proper installation and use of DT-470/471/670 CY sensor:

Apiezon® Type N and H Grease: P/N GAN-25 and GAH-25—25 g tube. Low viscosity, easy to use, solidifies at cryogenic temperatures, excellent lubricant. Difference is melting point: Type N is 316 K, Type H is 523 K.

Heat Sink Bobbins: P/N HSB-40 large, HSB-8 small. Large gold-plated copper bobbin holds up to 40 wires, small gold-plated copper bobbin holds up to 8 wires, depending on wire gauge and number of turns.

High-Temperature Solder: P/N SLT-10—3 m (10 ft). Greater lead content (90% Pb 10% Sn) for soldering in applications up to 500 K.

Indium Foil/Solder: P/N IF-5 for 5 foil sheets (51 mm [2 in] square × 0.13 mm [0.005 in] thick), ID-10-31/ID-10-56 for 10 disks, 7.9 mm (0.31 in) or 14.2 mm (0.56 in) diameter × 0.13 mm [0.005 in] thick, respectively. Indium is 99.99% pure, an exceptional pressure seal, and extremely malleable.

Ostalloy® 158 Solder: P/N SOSY-16—16 oz reusable eutectic alloy with sharply defined melting point of 343.16 K (70 °C).

Stycast® Epoxy 2850FT, Catalyst 9: P/N ES-2-20—20 packets, 2 g each. Provides permanent attachment, has excellent low temperature properties, is a poor electrical conductor, and exhibits low cure shrinkage. [Requires Hazardous shipping.]

VGE-7031 Varnish: P/N VGE-7031—0.5 L (1 pt) can. Provides nonpermanent attachment, is an excellent thermal conductor, and is easy to apply and remove. [Requires Hazardous shipping.]

Instruments: Lake Shore sells a complete line of instrumentation used with your sensor, such as: current sources, temperature controllers, monitors and thermometers, temperature scanners and transmitters.

Wire: Lake Shore offers numerous types of wires for various applications, including phosphor-bronze wires: single strand, Duo-Twist™, Quad-Twist™, Quad-Lead™, Nichrome heater wire, non-magnetic Manganin wire, and more.

Cable: Lake Shore offers ultra-miniature coaxial cable (type C, SC, and SS), semi-rigid coaxial cable (type SR), and a robust 4-wire CryoCable™ (type CYRC).

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