
Contribution ID: **362** Type: **Contributed Oral Presentation**

# Mechanical Robustness of Cryogenic Temperature Sensors Packaged in a Flat, Hermetically-Sealed Package

*Wednesday, July 1, 2015 2:00 PM (15 minutes)*

Much of the work to develop internationally recognized temperature scales over the past 50 years was performed with thermometers whose sensing elements were constructed from platinum wire, rhodium-iron wire, or doped germanium elements. For high stability the best results were obtained when the sensing element was strain-free mounted which reduced the effects of temperature-induced mechanical stress and deformation. Unfortunately, the devices were still highly susceptible to mechanical damage, and, barring a catastrophic mechanical shock, damage to the temperature sensors could go unnoticed as it could continue to operate with degraded accuracy. While not at the same level of stability as standards grade thermometers, many of the most commonly used cryogenic thermometers today are far more resistant to mechanical handling. This work examines the calibration offsets on six models of cryogenic temperature sensors resulting from mechanical shock and vibration. The models tested in this work were all obtained from Lake Shore Cryotronics, Inc., and included Cernox™ resistance thermometer models CX-1050-SD and CX-1050-AA, diode temperature sensor model DT-670-SD, platinum resistance thermometer models PT-103 and PT-111, and germanium resistance thermometer model GR-1400-AA. Mechanical treatments were performed via a simple drop test (heights 20 cm, 50 cm, 1 m, and 4 m), random vibration per MIL-STD-202, Method 214, Table 2, Condition H, and mechanical shock per MIL-STD-883, Method 2002, Condition B. Each sensor was calibrated pre- and post-mechanical treatment and the effect of the treatment on each test sensor was quantified in terms of the equivalent temperature calibration shift. This work details the calibration shift of each sensor type following each treatment type over the sensor type's appropriate temperature range. Sensors packaged in the -SD package, a flat, hermetically sealed package, demonstrated the highest robustness.

**Primary author:** COURTS, Scott (Lake Shore Cryotronics, Inc.)

**Presenter:** COURTS, Scott (Lake Shore Cryotronics, Inc.)

**Session Classification:** C3OrG - Cryogenic Instrumentation and Control Systems

**Track Classification:** CEC-15 - Instrumentation and Controls