2B – Thermodynamic Measurements | Suggested Methods for Evaluating and Controlling SPRT and PRT Drift
Michael Coleman, Corporate Temperature Metrologist, Fluke Calibration

Abstract:
The Fluke Primary Temperature Calibration Laboratory often provides help for customers in managing their PRT and SPRT measurement programs. One of the most common questions from customers is – How much can PRT or SPRT RTPW (resistance at the triple-point of water) change before recalibration is required? To help answer this question, as well as provide additional recommendations for SPRT and PRT management based on techniques and research developed by the Fluke temperature metrology department, this paper has been written to bring the information into one source. As an SPRT is used for disseminating temperature traceability, it must be maintained correctly to ensure W(T90) values measured during calibration will be consistent over time to provide reliable SPRT measurements. Our investigations into SPRT resistance drift and W(T90) drift indicate that the majority of SPRTs retain W(T90) very reliably as they are used in industry but there are some that don’t. The research also indicates that resistance drift maintenance alone does not ensure W(T90) reliability.

To provide a complete report, we review how ITS-90 equations are used in modern thermometer readouts and suggest a method for properly accounting for changes in RTPW as the readout measures the SPRT to indicate temperature. This includes a suggested mathematical model for propagating resistance drift, measured as the change in RTPW, to any temperature in the range of the SPRT. The results of our SPRT resistance and W(T90) drift studies help the reader evaluate SPRTs of varying construction to see how reliably they retain W(T90) values measured during calibration and to see how W(T90) drift is correlated with resistance drift. The study uses calibration data from working SPRTs randomly chosen from among the calibration customers of the Fluke Calibration Primary Temperature Laboratory. A mathematical model is suggested for calculating change in W(T90) characterization from one calibration to the next at any temperature of interest. Suggestions are made to help SPRT users reduce risk of an out-of-limit situation occurring with either resistance drift or W(T90) drift.
Learning Objectives:
1. Learn how ITS-90 equations work in thermometer readouts.
2. Provide SPRT and PRT drift study results for W(T90) and RTPW.
3. Provide a method for evaluating change in W(T90) characterization.

Instructor Curriculum Vitae (CV):
Michael Coleman is the corporate temperature metrologist for Fluke Calibration. He has worked in test and calibration for 23 years starting at Intel and 20 years at Hart Scientific and Fluke Calibration. His areas of expertise in contact thermometry are calibration of SPRTs, PRTs, Thermocouples, Thermistors, Digital Thermometer Systems, Humidity Sensors, and Humidity Chambers. Michael works in the technical manager of the primary temperature calibration laboratory in American Fork, Utah supervising calibration processes and working with Fluke design engineering in development of new Fluke temperature calibration products. He has presented papers at NCSLI, TEMPMEKO, METROLOGIA (Brazil), CENAM (Mexico), and MSC. And Michael has provided temperature tutorial workshops at NCSLI for several years. He also provides webinar-based training and classroom training at Fluke Calibration. He graduated from Brigham Young University with a BS in Electronics Engineering Technology.