# Accurate for Life

The same innovative technology we developed for our popular thermocouple instruments - used by some of the most sophisticated chains in the world - is now available in selected digital thermometers. With settings stored in a non-volatile memory chip, field calibration has become a thing of the past. No "field" adjusting of calibration settings required. And no risk of introducing error into the instrument. We are so committed to ensuring the accuracy of our products that we guarantee it.

DPP400W

DFP450W

TTM59

TTM41

## Specifications

- Waterproof
- Anti-microbial Additive
- Accurate for Life
- Lifetime Warranty

### DPP400W Pen Style Digital Pocket Test

- -40° to 392°F / -40° to 200°C
- 2.75" / 7cm Stainless Steel Stem with a reduced tip for <6 second response time
- Max / Min / Hold modes

### DFP450W Digital Pocket Test with Temperature Alarm

- -40° to 450°F / -40° to 232°C
- 5" / 12.7cm Stainless Steel Stem with a reduced tip for <6 second response time
- Max / Min / Hold modes

### TTM59 Pocket Test Plus™

- -4° to 350°F / -20° to 177°C
- Clock and calendar
- 3 preset timer alarms, for 5, 15 and 30 minutes
- 4.68" / 11.9cm Stainless Steel Stemwith a reduced tip for <6 second response time
- Max / Min Memory modes

### TTM41 Coolit-Rite™ Cooling Validator

- -4° to 302°F / -20° to 150°C
- Timer Range: 6 Hours : 59 Minutes
- 15" / 38.1cm Stainless Steel Stem with adjustable vessel clip
- Max / Min / Hold modes

Bold **NEW** POS Packaging for Ⓐ Products

**Eliminate Error - Remove Risk**

Cooper-Atkins Corporation • 800-835-5011 • 860-347-2256 • www.cooper-atkins.com

# Setting the record straight on field-calibration of digital pocket test thermometers

Temperature measurement using modern thermistors is one of the most accurate, reliable, and inexpensive methods currently available. These characteristics, when married with today's powerful yet low-cost microcontrollers, produce a new generation of digital pocket test thermometers that far exceed the capabilities of their liquid or bi-metal ancestors.

A thermistor is a resistor that is made to have a high temperature coefficient, which means that the resistance of the thermistor changes as the temperature of the thermistor changes. By producing it to an exact formula, the thermistor's behavior can be accurately predicted and represented in a resistance versus temperature table (R/T) which lists the known resistance value of the thermistor at a given temperature.

The repeatability or drift of the thermistor's behavior over time varies from one thermistor manufacturer to another, but is typically in the order of < 0.05°F per year. In fact, thermistors become more stable over time, so most of the drift occurs within the first six months of use.

In a digital thermometer, the microcontroller is programmed with the thermistor's R/T characteristics in a look-up table. The resistance of the thermistor is measured using precision timing circuitry, and is then "looked-up" in the table to determine the measured temperature. Any difference between the measured temperature and actual temperature, known as calibration offset, is programmed into the microcontroller memory during the manufacturing process.

Periodic checking of the thermometer accuracy is recommended as standard practice to satisfy certain governmental regulations and for HACCP programs. Over its lifetime, the digital thermometer may exhibit some minor accuracy shift, due in part to environmental variations, and in part to normal aging of the components used. However, any such shift will be far smaller than the tolerance allowed on the accuracy specification, and as such, it will not be necessary to make adjustments to calibration once the thermometer is in service.

**Thoughts on field calibratable thermometers...**

"Field calibration" is a feature found in a number of digital thermometers marketed today. This feature allows the user to reset or adjust out the expected error / drift the thermometer may have over time. While this may sound like a useful feature it could actually introduce more error at critical test temperatures!

**Here's why…**

Digital thermometers calibrated in the field by the user are done so using a single test point, usually 32°F (0°C). This temperature is used because an ice bath is usually the easiest, if not the only, way to obtain a known, stable temperature in the field without investing in laboratory calibration equipment. When adjustment is performed on a "field calibratable" thermometer, the resistance versus temperature table (R/T) is adjusted up or down automatically when the user resets their thermometer and removes any error at the 32°F calibration point. By design, this shift in the table or resistance / temperature curve is applied across the entire temperature / resistance curve and therefore is applied to all measured temperatures.

The first potential for introducing error during field calibration has to do with shifting the curve within the thermometer's microprocessor and the fact that any "drift" a thermistor exhibits is not necessarily equal at all temperatures.

For example, a thermometer utilizing an inferior sensor may drift by +2°F at 32°F (reads 34°F in a 32°F bath) but may not have drifted at all at a higher temperature test point. It could read 138°F at a critical test temperature of 140°F for instance, while being off by +2°F at 32°F. During "field calibration" this thermometer will be reset so that instead of reading 34°F, it will read 32°F in the ice bath. The user is satisfied that their thermometer is now "dead-on" at 32°F. Unfortunately this same thermometer will now read 136°F at 140°F, a more critical temperature for food safety! Calibrating at a single point shifts the entire resistance versus temperature relationship by the same two degrees across all temperatures. The user would have no way of realizing this unless they were able to test at other critical temperatures.

A second potential for introducing error during "field calibration" is from an improperly constructed ice bath. The improperly made ice bath (bath made with too much water and not enough ice) will contribute to error as the test temperature, assumed to be 32°F, is actually a few degrees warmer. In this case it is possible for a thermometer without any error (at any temperature) to be reset so that it reads 32°F when the actual test temperature is say 33°F or 34°F. This introduced error would also now affect all other measured temperatures.

Periodic checking of the thermometer accuracy is recommended as standard practice to satisfy certain governmental regulations and for HACCP programs. Over its lifetime, a digital thermometer may exhibit an accuracy shift, due in part to environmental variations, normal aging and the quality of the components used. However, products designed with higher technology components will experience accuracy shifts far smaller than the tolerance allowed on the accuracy specification. As such, it will not be necessary to make "adjustments to calibration" once the thermometer is in service.

While accuracy checks using a properly constructed ice bath remain the recommended in field method, users need to recognize the limitations of single temperature point calibration. Instrument accuracy, stability and guarantees over time can only be achieved through superior design and use of high quality and robust components and sensors.

**U.S. Food and Drug Administration**
**Center for Food Safety & Applied Nutrition**
**Food Code**
**Chapter 4 Equipment, Utensils and Linens**

**4-502.11 Good Repair and Calibration.**

**(A) UTENSILS** shall be maintained in a state of repair or condition that complies with the requirements specified under Parts 4-1 and 4-2 or shall be discarded.

**(B) FOOD TEMPERATURE MEASURING DEVICES** shall be calibrated in accordance with manufacturer's specifications as necessary to ensure their accuracy.

**(C)** Ambient air temperature, water pressure, and water **TEMPERATURE MEASURING DEVICES** shall be maintained in good repair and be accurate within the intended range of use.