

Standard Operating Procedure (SOP) 3.1.2.2

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Measuring Temperature with a Thermistor Thermometer

A thermometer is any device used to measure temperature, consisting of a temperature sensor and some type of calibrated scale or readout device. Liquid-in-glass thermometers and thermistor thermometers are most commonly used to measure air and water temperature.

A thermistor thermometer is an electrical device used to measure temperature. It is made of a solid semiconductor with a large temperature coefficient of resistivity. An electrical signal processor (meter) converts changes in resistance to a readout calibrated in temperature units. Thermistors commonly are incorporated in instruments used for surface water and ground water measurements such as a dissolved oxygen meter. A benefit of using a thermistor thermometer is the flexibility of where the probe can be placed within a waterbody in respect to the operators location. For a cross sectional temperature profile to determine temperature variability a thermistor thermometer would be the first choice.

MAINTENANCE, CLEANING, AND STORAGE

Thermometers can easily become damaged or out of calibration. Take care to: Keep thermometers clean (follow manufacturer's recommendations). Carry thermometers in protective cases; thermometers and cases must be free of sand and debris. As an additional precaution on field trips, carry extra calibrated thermometers as spares, and a supply of batteries for instrument systems.

CALIBRATION

To calibrate a thermometer, instrument readings are checked across a range of temperatures against those of a thermometer of certified accuracy. It is recommended that for thermistor thermometers you should check the calibration every 3 to 4 months by using a 5-point calibration. Follow the same calibration procedures you would use for a liquid filled bulb thermometer. Thermometers being calibrated must meet NIST specifications to a minimum of three temperatures at approximately 0, 25, and 40°C. Thermistors must be calibrated at 5 points within this range. If environmental water or air temperatures will fall below 0°C or rise above 40°C, add additional calibration points to bracket the temperatures to be measured. Field checking thermometer calibration by comparing readings with another field thermometer does not substitute for required laboratory calibration procedures. Some thermistor thermometers use electronic calibration clips and most all manufactures can calibrate your thermometer (usually for a fee).

For additional quality control measures check the meter batteries periodically for proper voltage and record the calibration data in the instrument log book for each thermistor thermometer, noting if a sensor has been replaced.

Measuring Temperature

Air temp: Place the thermometer about 5 ft above the ground in a shaded area protected from strong winds but open to air circulation. Avoid areas of possible radiant heat effects, such as metal walls, rock exposures, or sides of vehicles. Allow 3 to 5 minutes for the thermometer to equilibrate, and then record the temperature and time of day. Be sure to measure the air temperature as close as possible to the time when the water temperature is measured

When using a thermistor thermometer, wait until the readings stabilize to within 0.2°C, then record the median of approximately the last 5 values. Remove the temperature sensor from the water, rinse it thoroughly with deionized water, and store it.

To measure the temperature of surface water:

Determine from the cross-sectional profile and from study objectives which sampling method to use. Measure temperature in those sections of the stream that represent most of the water flowing in a reach. Do not make temperature measurements in or directly below stream sections with turbulent flow or from the stream bank (unless this represents the condition to be monitored).

Immerse the sensor in the water to the correct depth and hold it there for no less than 60 seconds until the sensor equilibrates thermally. The sensor must be immersed properly while reading the temperature; this might require attaching the thermistor to a weighted cable. Wait until the readings stabilize to within 0.2°C, then record the median of approximately the last 5 values.

Tip: Erratic thermistor thermometer readings often result from a bad or dirty connection at meter or sensor. Tightening or cleaning the connections can correct this. If a break in the cables is found, replace the cables. If the thermistor thermometer is slow to stabilize the sensor is probably dirty or covered with oil film.

Tip: Before going into the field check the voltage of the batteries. It is best to use good batteries in instruments and carry spares.

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