Standard Operating Procedure

Temperature using Multi-Parameter Water Quality Meters: Measurement, Meter Calibration, and Meter Maintenance

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1.0 INTRODUCTION

1.1 Purpose

To provide standardized procedures for the use and maintenance of *in situ* Temperature sensors housed within multi-parameter water quality meters.

1.2 Scope of Work

These procedures are applicable for ambient surface water samples from lakes, streams, and tidal waters, and for wastewater samples.

2.0 MATERIALS

2.1 Equipment

The procedures described herein are applicable for use with the following multi-parameter water quality meters:

DRBC Name	Meter Make & Model	Cond. Probe
1. Coastal YSI	YSI 650 MDS + 6920 sonde	YSI 6560
2. Tristate #1	YSI 556 MPS	YSI 5560
3. Tristate #2	YSI 556 MPS	YSI 5560
4. EPA YSI	YSI 556 MPS	YSI 5560
5. Quanta	HydroLab Quanta	Quanta Conductivity
6. YSI 30 - #1	YSI 30	YSI 30
7. YSI 30 - #2	YSI 30	YSI 30

In addition, an NIST certified thermometer with an operational range extending from 0°C to 40°C, at a minimum, will be needed for temperature sensor validation and for compliance with N.J.A.C. requirements for certified laboratories.

2.2 Reagents & Chemicals

[no prepared reagents are needed for temperature calibration and measurement]

3.0 PROCEDURES

3.1 Cleaning & Maintenance

The temperature sensors on the DRBC multi-parameter meters require little or no cleaning or maintenance. Obvious fouling of the temperature sensor should be corrected with gentle cleaning. However, no additional maintenance is needed for the temperature sensors themselves.

3.2 Calibration & Correction Factors

The temperature sensors cannot be calibrated like the other sensors on the multi-parameter meters, in part because the temperature sensors' response is generally stable through time and needs no calibration. Instead of temperature calibrations, the temperature sensors are evaluated against an NIST certified thermometer once per quarter during the periods they are in use. Any discrepancies between the electrical sensor and the NIST certified thermometer across the normal range of use are then recorded, with correction factors attached to each water quality meter to allow for direct adjustment of temperature measurements during data collection.

To conduct the temperature validations, circulating water baths are prepared at three (3) different temperature ranges within the lab (0-5°C, 15-20°C, and 30-35°C). The NIST certified thermometer and the electrical temperature sensor are then mounted adjacent to one another within the circulating temperature bath and allowed to equilibrate for a minimum of 2 minutes. Once the temperature readings are stable, paired readings from the NIST certified thermometer and the temperature sensor are made and recorded on a stand-alone Temperature Calibration Log, along with the date and time of measurements, the serial number for the NIST certified thermometer, and the name of the analyst. From these paired readings, correction factors (if any) are calculated for each temperature range and the correction factors are attached to each water quality meter.

3.3 Measurement Procedures

3.3.1 Streams & Rivers

Attach the probe guard and deploy the sonde within a representative area of appreciable flow to provide adequate mixing around the probes. Turn the meter on, record the time on the data sheet, and wait an initial 60 seconds before checking temperature readings. From 60 seconds onward, observe the temperature readings

and record an initial temperature reading (***based on any correction factor needed in that temperature range***) and the time of measurement when temperature values stabilize (e.g., less than 0.05°C change in temperature within 10 seconds). Record a duplicate reading and the time of the measurement at least 60 seconds following the initial reading and up to 10 minutes following that reading. Retrieve the sonde, retain a small volume of either tap water or surface water within the travel cup, and finish packing the meter for travel.

3.3.2 Tidal Waters

Attach the probe guard and deploy the sonde within the water column and a minimum of 10 cm above the bottom. Turn the meter on, record the time on the data sheet, and wait an initial 60 seconds before checking temperature readings. If the probes are situated in adequate flow, no special care is needed. However, if the measurements are taken at slack tide or from a quiescent location, ensure adequate flow around the probes by either gentle movement of the sonde or by utilizing a flow inducing device (e.g., stirrer, pump). Starting 60 seconds following deployment / turning on the electronics, observe the temperature readings and record an initial temperature reading (***based on any correction factor needed in that temperature range***) and the time of measurement at the point when temperature values stabilize (e.g., less than 0.05°C change in temperature within 10 seconds). Record a duplicate reading and the time of the measurement at least 60 seconds following the initial reading and up to 5 minutes following that reading. Retrieve the sonde, retain a small volume of either tap water or surface water within the travel cup, and finish packing the meter for travel [*note: if brackish or saline waters are used for storage in the travel cup, flush the probes and replace with tap water upon return to the lab, office, or motel; see 3.4 below*].

3.3.3 Lakes & Ponds

Attach the probe guard and deploy the sonde within the water column and a minimum of 10 cm above the bottom. Turn the meter on, record the time on the data sheet, and wait an initial 60 seconds before checking temperature readings. Ensure adequate flow around the probes by either gentle movement of the sonde or by utilizing a flow inducing device (e.g., stirrer, pump). Starting 60 seconds following deployment / turning on the electronics, observe the temperature readings and record an initial temperature reading (***based on any correction factor needed in that temperature range***) and the time of measurement at the point when temperature values stabilize

(e.g., less than 0.05°C change in temperature within 10 seconds). Record a duplicate reading and the time of the measurement at least 60 seconds following the initial reading and up to 5 minutes following that reading. Retrieve the sonde, retain a small volume of either tap water or surface water within the travel cup, and finish packing the meter for travel.

3.3.4 Wastewater

Attach the probe guard and deploy the sonde within the water column and a minimum of 10 cm above the bottom of any structure. Turn the meter on, record the time, and wait an initial 60 seconds before checking temperature readings. If the probes are situated in adequate flow, no special care is needed. However, if the measurements are taken from a quiescent location, ensure adequate flow around the probes by either gentle movement of the sonde or by utilizing a flow inducing device (e.g., stirrer, pump). Starting 60 seconds following deployment / turning on the electronics, observe the temperature readings and record an initial temperature reading (***based on any correction factor needed in that temperature range***) and the time of measurement at the point when temperature values stabilize (e.g., less than 0.05°C change in temperature within 10 seconds). Record a duplicate reading and the time of the measurement at least 60 seconds following the initial reading and up to 5 minutes following that reading. Retrieve the sonde, place a small volume of either tap water or pH buffer within the travel cup (*no not use wastewater!*), and finish packing the meter for travel.

3.4 Storage

The temperature sensors themselves require no special storage. However, for all meters except the two YSI 30 units, the other sensors on the sonde require a humid storage environment. For the two YSI 30 units, therefore, simply shake any excess water from the sensor and re-insert the sensor within the storage compartment.

For all other meters, store the temperature sensor and all remaining probes using a small volume of water within the storage cup, as follows. Except when no other sanitary water is available, distilled or deionized water should ***not*** be used for storage of the water quality probes due to its low ionic strength. Instead, tap water, clean surface fresh water, or pH 4.0 buffer should be used for storage. For short-term storage (a day or less), tap water or clean surface water is preferred [*note: brackish or saline water can be used for short term storage of a day or less, but the probes must be rinsed thoroughly and the*

storage cup water replaced upon return to the lab, office, or motel]. For moderate lengths of storage (up to 2 weeks), tap water should be used for storage in the travel cup. For long-term storage (a month or longer), pH 4.0 buffer solution must be used to prevent damage to the probes (pH 4.0 buffer can also be used for shorter-term storage, but greater care with calibration and verifications must be used in such cases). It is important to note that maintaining some fluid in the cup is more important than the source of water. As a result, if the preferred water source is not immediately available, use a small volume of the available water source (e.g., water bottle) for short-term storage but immediately and thoroughly rinse the sensors at the earliest opportunity, and replace the fluid within the travel cup with the recommended water source.

In both short-term and moderate-term storage, fill the travel cup with approximately ½ inch (1 cm) of water and secure the travel cup to prevent evaporation. A small volume of water is necessary to simultaneously maintain a moist, humid environment within the storage cup while preventing immersion of any probe in the storage fluid. Long-term immersion within any storage fluid can result in sensor drift and/or shorten the sensor lifetime.

Exceptions: The two YSI 30 temperature/conductivity meters provide for dry storage rather than a storage cup. For these two YSI 30 meters, no storage solution is necessary.

3.5 Probe Replacement

Temperature sensors are rugged and long-lasting, with little expectation that the temperature sensor itself will need to be replaced on any water quality meter during its useful lifetime. However, all of the current YSI units combine the conductivity sensor and the temperature sensor into a single unit. Therefore, any serious problems with the conductivity sensors for these YSI units will typically result in the replacement of the temperature sensor, as well.

3.6 Quality Control

Original calibration records will be retained within the lab for a period no less than 5 years. These calibration records will clearly indicate the meter and/or probe being calibrated, the date and time of calibration, and the analyst conducting the calibration. Any calibration checks or validations will also be recorded and transferred to the calibration bench sheet.