

Measuring pH in Surface Water

Water Analysis Instruments, Thermo Fisher Scientific

Key Words

pH, triode, electrode, ROSS, Orion, meter, surface water, rivers, streams, public water supply, mill pond, water quality.

Goal

The following application note describes how to reliably measure the pH of surface water using a portable pH meter and pH triode.



Introduction

The pH of surface water is a common field measurement. This measurement can be made using a Thermo Scientific™ Orion™ ROSS Ultra™ Triode™ which will measure both the temperature and pH of the sample with a single probe. The probe provides quick, reproducible results in both fresh and salt water samples.

Reference

USGS National Field Manual: pH Method, Chapter 6.4; Version 1.3, January 2006.

Recommended Equipment

- Thermo Scientific™ Orion™ Portable pH Meter
- Thermo Scientific Orion ROSS Ultra Triode
- NIST calibrated thermometer - optional

Required Solutions

- pH 4.01, 7.00, and 10.01 Buffer Pouches
- Filling Solution
- Thermo Scientific™ Orion™ ROSS™ Storage Solution
- Deionized Water (DI)

Solutions Preparation

Buffers used for field calibration should be equilibrated to the temperature of the sample. This can be done by placing buffer pouches in large beaker of sample for 10 minutes prior to calibration.

Meter Setup

Connect the electrode to the Thermo Scientific™ Orion Star™ Meter. Set measurement mode to pH. In Setup mode of Star meter, set resolution to 0.01, Buffer Set to USA and read type to Auto. If all steps were followed correctly the meter display will show units of pH, a value with two decimal places, and the actual temperature (not 25.0 C).

Electrode Setup

See the electrode manual for preparation of the electrode.

Electrode Performance Check

These checks may be done in the lab. Check slope at least daily according to the electrode manual. Drift may be checked by comparing a 1-minute to 2-minute reading. Results should agree with desired criteria. See troubleshooting section of manual if slope and/or drift are not acceptable. Be sure electrode is working properly before going out into the field to make measurements.

Electrode Storage, Soaking and Rinsing

Store electrode in pH 4.01 or 7.00 buffer in between measurements. A buffer pouch in a beaker of sample is best to keep the electrodes as close to sample temperature as possible. Rinse the electrode with DI water and blot dry with lint free tissue before measuring the next sample. Store electrode in small bottle with electrode storage solution when transporting probe.

Sample Preparation and Preservation

Since the sample is measured in the field, no preparation or preservation is required.

Calibration

Because pH readings are temperature dependent, it is good practice to bring the pH buffers to the same temperature as the sample before calibrating your pH electrode. Place unopened pH buffer pouches in a large beaker containing sample water for at least 10 minutes to allow for temperature of buffer to equilibrate. Perform a three point calibration using pH 4.01, 7.00 and 10.01 buffers. The meter automatically recognizes the buffers and displays the temperature-corrected pH value for each calibration point. The electrode slope should be between 92 and 102%. Read a fresh portion of pH 7.00 buffer to verify calibration. Reading will be temperature-adjusted, see the table for expected values. If readings are not acceptable and/or slope is not within range, see troubleshooting section of your pH triode manual.

Analysis

Rinse electrode with DI water and blot dry. Collect a sample aliquot in a large beaker. Place probe in beaker and measure immediately following collection. The pH value will be displayed. When a stable reading is achieved, the "pH" icon will stop flashing and screen will freeze with stable values displayed. Read additional aliquots until successive sample readings are within 0.1 pH unit of each other. This should happen within one or two sample readings.

Quality Control

Recommended QC procedures include: calibration and calibration verification, sample duplicates, slope, and drift check.



Results

Lake (Public Water Supply)	pH	Temperature (°C)
Sample 1	7.64	26.6
Sample 2	7.56	26.8
Sample 3	7.60	26.8
Mean	7.60	26.7
Standard Deviation	0.04	0.12
Time per Sample	121 seconds	

Mill Pond	pH	Temperature (°C)
Sample 1	7.85	25.2
Sample 2	7.71	25.1
Sample 3	7.78	24.9
Mean	7.78	25.1
Standard Deviation	0.07	0.15
Time per Sample	85 seconds	

Ocean (Harbor)	pH	Temperature (°C)
Sample 1	8.12	20.2
Sample 2	8.15	20.2
Sample 3	8.12	20.0
Mean	8.13	20.1
Standard Deviation	0.02	0.12
Time per Sample	33 seconds	

Table: Temperature Corrected Values for pH 7.00 Buffer

(°C)	0	10	20	30	40	50	60	70	80	90
pH	7.11	7.06	7.01	6.98	6.97	6.97	6.97	6.99	7.03	7.08



To purchase an Orion portable pH meter kit, Orion ROSS Ultra pH Electrode and other related products, please contact your local equipment distributor and reference the part numbers listed below.

Product	Description	Part Number
Meters	Thermo Scientific™ Orion Star™ A321 pH Portable Meter Kit	STARA3215
	Thermo Scientific Orion Star A221 pH Portable Meter Kit	STARA2215
	Thermo Scientific Orion Star A121 pH Portable Meter Kit	STARA1215
Sensors	Thermo Scientific Orion ROSS Ultra Refillable pH/ATC Triode Combination Electrode	8157BNUMD/8157UWMMD
	Thermo Scientific Orion ROSS Ultra pH/ATC Triode with Epoxy Body, Low Maintenance Gel	8107BNUMD/8107UWMMD
Solutions	Orion pH 4.01 Buffer Individual Use Pouch, 25 x 15 mL	910425
	Orion pH 7.00 Buffer Individual Use Pouch, 25 x 15 mL	910725
	Orion pH 10.01 Buffer Individual Use Pouch, 25 x 15 mL	911025-WA
	Orion ROSS Ultra pH Electrode Filling Solution	810007
	Orion ROSS pH Electrode Storage Solution, 475 mL Bottle	810001

Visit www.thermoscientific.com/water for additional information on Thermo Scientific Orion products, including laboratory and field meters, sensors and solutions for pH, ion concentration (ISE), conductivity and dissolved oxygen analysis plus spectrophotometry, colorimetry and turbidity products.

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