



## Parameter and Sample Type

pH of Yogurt (at room and at refrigeration temperatures)

## Introduction

Measuring the pH value of yogurt is important for the efficient manufacturing and quality control of the product. The main challenge with this application is contamination of the junction and sensing bulb that can cause poor accuracy and slow response. The 8172BNWP Orion ROSS® pH electrode with a Sure-Flow® junction prevents clogging. The ROSS® reference system provides fast response and accurate readings when testing samples that vary in temperatures.

## Recommended Equipment

Orion Star A Series Benchtop Meter, or Orion Dual Star Meter, or Orion Versa Star; ROSS Sure-Flow pH Electrode (Orion 8172BNWP); ATC probe (Orion 927007MD).  
Optional: RS232 computer interface cable (1010053).

## Required Solutions

pH 4.01 and 7.00 buffers (Orion 910104, 910107); Filling Solution (Orion 810007); ROSS storage solution (810001) or pH electrode storage solution (Orion 910001); deionized water (DI); 1 N Hydrochloric Acid; 1 N Sodium Hydroxide.

## Solutions Preparation

Prepare 1 N Hydrochloric acid by dissolving 42 mL of concentrated HCl in 500 mL volumetric flask with DI water or purchase from a commercial source. Prepare 1 N sodium hydroxide by dissolving 20 g NaOH in 500 mL volumetric flask with DI water or purchase from a commercial source.

## Meter Setup

Connect the pH electrode and the ATC sensor to the Meter. Connect stirrer to the Meter. Set measurement mode to pH. In Setup mode, set resolution to 0.01, buffer set to USA and read type to continuous. If the ATC is connected properly, the true temperature (not the reference 25.0) will be displayed on the screen.

## Electrode Setup

See the electrode user guide for preparation of the electrode.

## Electrode Performance Check

Check slope (see Calibration section) and drift. Drift may be checked by comparing a 1-minute to 2-minute reading. Results should agree with desired criteria. See troubleshooting section of user guide if slope and/or drift are not acceptable. Be sure electrode is working properly before making measurements.

## Sample Preparation

Before removing any portion of sample for analysis, mix it with spatula until homogeneous. Repeat mixing before each subsequent portion is removed for analysis. Place about 50 mL of sample into a 100-mL beaker.

## Calibration –pH and Temperature

See meter user guide for calibration procedure directions. Calibrate the ATC against a NIST calibrated thermometer, if needed. Perform a two point pH calibration using pH 4.01 and 7.00 buffers at room temperature. Stir the buffer during calibration. The electrode slope should be between 92 and 102%. If the slope is not within that range, perform electrode maintenance and/or use fresh buffer solution. Repeat the calibration until satisfactory results. Check calibration by reading pH 4 buffer. Value should be within 0.03 pH units of the tabulated value for that temperature (see the table on page 2).

## Analysis

Place pH and ATC probes in sample, gently agitating for about 15 seconds to remove air bubbles, equilibrate the sensor to sample temperatures, and speed the electrode response. The pH value and temperature will be displayed. Continue measurement for 1 minute for yogurt samples at room temperature and for 2-3 minutes for samples at refrigeration temperature or until pH readings are stable (for example stable to +/- 0.01 pH/min). Record the result. Rinse the pH and ATC probes with DI water to remove any sample left on the sensor and junction.

## Electrode Cleaning

If the electrode becomes slow to respond and drifts, clean it as follows:

1. Rinse the electrode with DI water to remove the contamination, drain and refill with fresh filling solution.
2. If problem still exists, clean the electrode by alternately soaking in 1 N HCL, 1 N NaOH, and 1 N HCL for 30 seconds in each; then soak in pH electrode storage solution for 5 min. Between each solution, rinse the electrode with DI water.
3. If the electrode is still slow or drifts, use Orion pH electrode cleaning solutions: for removal of protein deposits - Orion 900021 pH electrode cleaning solution A; for removal of oil and grease - Orion 900024 pH electrode cleaning solution D; for removing bacterial contaminants - Orion 900022 pH electrode cleaning solution.

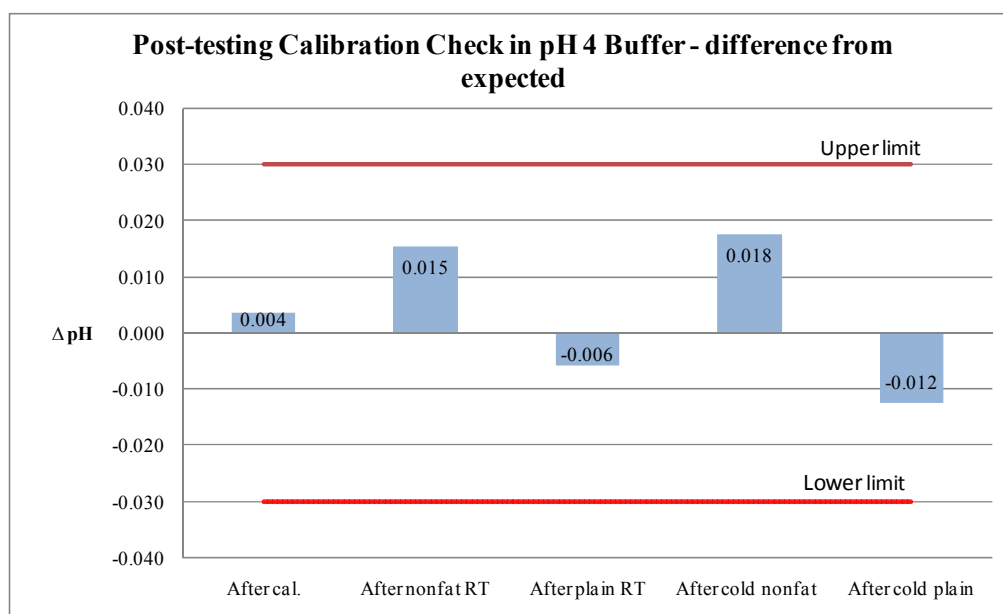
## Quality Control (QC)

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

**Results for pH of nonfat vanilla yogurt w/sugar and plain full-fat yogurt at room and at refrigeration temperatures measured with the Orion ROSS 8172BNWP Sure Flow Electrode**

Sample	Time, min.	Avg pH (n=5)	STDEV
Nonfat vanilla yogurt w/ sugar at room temperature	1	4.38	0.05
Plain yogurt full-fat at room temperature	1	4.34	0.03
Nonfat vanilla yogurt w/ sugar at cold temperature	2	4.39	0.09
Plain yogurt full-fat at cold temperature	2	4.37	0.08

- The pH measurement results of twenty yogurt samples (five replicates of each, the nonfat vanilla yogurt and the plain full-fat yogurt, at room and at refrigeration temperatures) demonstrated good agreement between multiple replicates of the same yogurt sample (STDEV < 0.1 in pH units) within the expected pH range for yogurt of pH 4.25 to 4.5.
- As shown in the above table, it takes only one minute to obtain accurate and repeatable readings in both yogurts at room temperature. Electrode response is two to three minutes in yogurts at cold temperature.



- The above chart demonstrates that after testing twenty yogurt samples at room and at refrigeration temperatures, the Orion 8172BNWP ROSS Sure-Flow pH electrode perform well. It reads the pH 4 buffer within +/- 0.03 pH of expected buffer pH.

**Temperature Corrected Values for pH 4.00 buffer**

°C	0	10	20	30	40	50	60	70	80	90
pH	4.00	4.00	4.00	4.02	4.03	4.06	4.09	4.12	4.16	4.21

For a more detailed table (including buffers 7.00 and 10.01), see <http://www.thermoscientific.com/ecom/servlet/techresource?resourceId=91831&storeId=11152&from=search#>