

# Measuring pH of Water and Wastewater using the Thermo Scientific Orion Dual Star pH/ISE Meter

Water and Lab Products, Thermo Fisher Scientific

## Key Words

Thermo Scientific Orion Dual Star pH/ISE meter, Thermo Scientific Orion ROSS Ultra pH electrode, pH, wastewater, water

## Goal

This technical note explains how to accurately measure the pH level in general water and wastewater samples using the Thermo Scientific™ Orion™ Dual Star™ pH/ISE dual channel benchtop meter.



## Introduction

Proper wastewater treatment can be a serious environmental concern. Extreme pH levels, particulates, toxic contaminants, and high levels of alkalinity are common problems in wastewater. The use of pH in the treatment of wastewater requires quick, accurate and robust measurement. The following technical note describes how the Orion Dual Star pH/ISE meter paired with an Orion combination pH electrode can help measure the pH levels in water and wastewater.

## Required Equipment

- Orion Dual Star pH/ISE meter with electrode stand (Cat. No. 2115000)
- Thermo Scientific™ Orion™ ROSS Ultra™ glass-body pH electrode (Cat. No. 8102BNUWP)
- Automatic Temperature Compensation (ATC) probe (Cat. No. 927007MD)

- Stirrer probe (Cat. No. 096019) or magnetic stir plate and bar
- Orion pH 4.01 buffer (Cat. No. 910104)
- Orion pH 7.00 buffer (Cat. No. 910107)
- Thermo Scientific™ Orion™ ROSS™ pH electrode storage solution (Cat. No. 810001)
- ROSS electrode filling solution (Cat. No. 810007)
- Deionized water
- 50 mL beakers

## pH Electrode Setup

**Note:** Add filling solution each day before using the electrode. The filling solution level must be above the reference junction and at least one inch above the level of the sample to ensure a proper flow rate. The fill hole should always be open when taking measurements.

See *Figure 1* for labeled electrode components.

1. Remove the protective shipping cap from the pH sensing bulb and save the cap for long-term electrode storage.
2. Rinse the electrode with deionized water to remove any salt deposits from the electrode exterior.
3. Uncover the fill hole by removing the tape.
4. Insert the spout of the ROSS electrode filling solution bottle into the electrode fill hole and add filling solution to the electrode up to the bottom of the fill hole. See *Figure 2*.
5. Place the electrode in the electrode stand and suspend the electrode in air for about five minutes to thoroughly wet the reference junction.
6. Shake the electrode downward (similar to a clinical thermometer) to remove any air bubbles.
7. Soak electrode in ROSS pH electrode storage solution for at least 30 minutes prior to use. The sensing bulb and reference junction should be immersed in solution at all times.

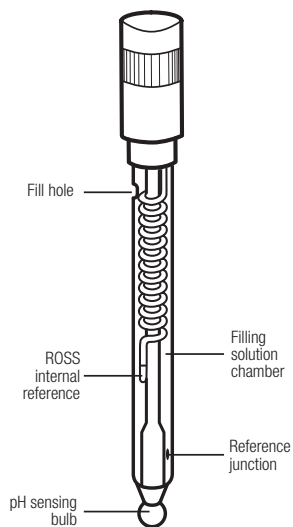


Figure 1 : pH Electrode Components

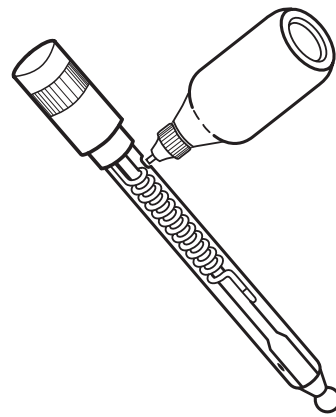
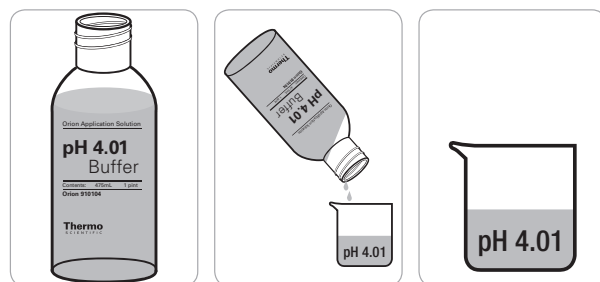


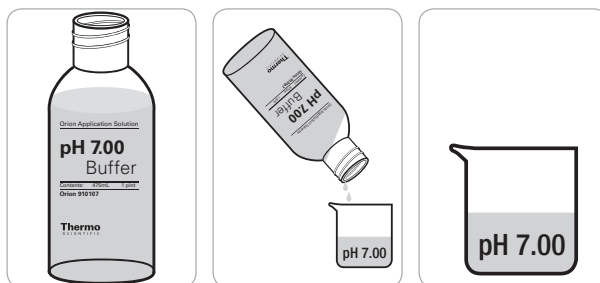
Figure 2 : Filling the pH Electrode

## Calibration Standard Preparation

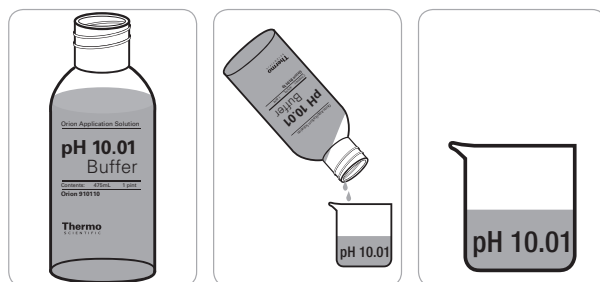
1. Add about 30 mL of the pH 4.01 buffer to a 50 mL beaker and label the beaker.



2. Add about 30 mL of the pH 7.00 buffer to a 50 mL beaker and label the beaker.

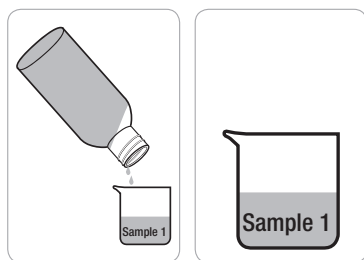


3. Add about 30 mL of the pH 10.01 buffer to a 50 mL beaker and label the beaker.



## Sample Preparation

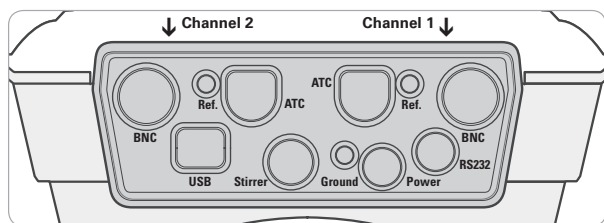
1. Add about 30 mL of the sample to a 50 mL beaker and label the beaker.



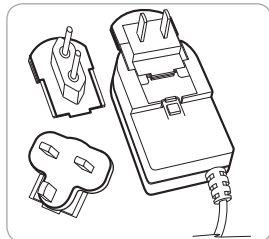
2. Repeat step 1 for additional samples.

## Meter Preparation

The Orion Dual Star meter has two BNC, reference and ATC connections. These connections are labeled as Channel 1 or Channel 2 on the ridge above the connections.



1. Prepare the power adapter by selecting the appropriate wall outlet plug and sliding the plug plate into the groove on the back of the adapter.



2. Connect the power adapter to the meter and then to the wall outlet. See *Figure 3*. Connect the pH electrode to one of the BNC inputs on the meter and note which channel (channel 1 or channel 2) was selected. See *Figure 4*. Connect the ATC probe to the 8 pin MiniDIN input on the meter and note which channel was selected. See *Figure 5*. Connect the stirrer probe to the stir jack input on the meter. See *Figure 6*.

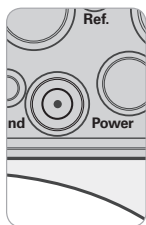


Figure 3



Figure 4

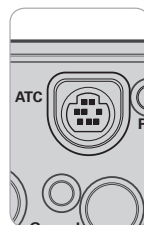


Figure 5

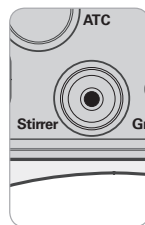


Figure 6

## Meter Setup

**Note:** It is highly recommended that the EZ Startup menu be completed the first time that the meter is used. The EZ Startup menu sets important meter parameters, such as the displayed language, date and time, measurement mode and read type for each channel, and data output settings. To access the EZ Startup menu from the measurement mode, press the *setup* key, press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight EZ Startup and press the *f2 (select)* key.

1. In the measurement mode, press the *setup* key.
2. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight Channel 1 or Channel 2, depending on which BNC input the pH electrode was connected to, and press the *f2 (select)* key.
3. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight Measure Mode and press the *f2 (select)* key. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight pH and press the *f2 (accept)* key.
4. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight Electrode ID and press the *f2 (select)* key. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight pH and press the *f2 (accept)* key.
5. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight Resolution and press the *f2 (select)* key. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight 2 Decimal Places (10.01pH) and press the *f2 (accept)* key.
6. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight Temperature Input and press the *f2 (select)* key. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight ATC1 or ATC2, depending on which 8 pin MiniDIN input the ATC probe was connected to, and press the *f2 (accept)* key.
7. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight Calibration Setup and press the *f2 (select)* key. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight Buffer Set and press the *f2 (select)* key. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight US: 1.68, 4.01, 7.00, 10.01, 12.46 and press the *f2 (accept)* key. Press the *f1 (back)* key.
8. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight Read Type and press the *f2 (select)* key. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight On Ready and press the *f2 (select)* key.
9. Press the *f1 (back)* key.
10. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight Instrument Parameters and press the *f2 (select)* key.
11. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight Export Data (PC/Printer/Log) and press the *f2 (select)* key. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight Export Trigger and press the *f2 (select)* key. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight Channel 1 or Channel 2, depending on which BNC input the pH electrode was connected to, and press the *f2 (accept)* key. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight Data Log and press the *f2 (select)* key. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight Data Log On/Off and press the *f2 (select)* key. Press the  $\blacktriangle$  /  $\blacktriangledown$  keys to highlight On and press the *f2 (accept)* key.
12. Press the *f1 (back)* key twice.

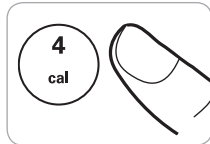
- Press the ▲/▼ keys to highlight **Stirrer Speed** and press the *f2* (*select*) key. Press the ▲/▼ keys to highlight **1** and press the *f2* (*accept*) key. Press the *f1* (*back*) key.
- Press the *f1* (*back*) key. The meter will return to the measurement mode.

### Calibration Procedure

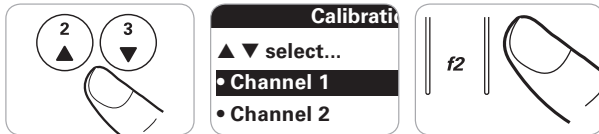
- Prepare and condition the pH electrode. Connect the pH electrode, ATC probe and stirrer probe to the meter (note which channel the pH electrode is connected to) and place the electrode and probes in the electrode stand. Prepare the pH 4.01, 7.00 and 10.01 buffers.



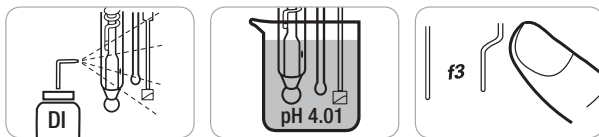
- In the measurement mode, press the *cal* key.



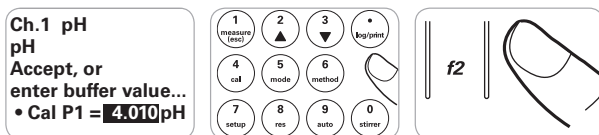
- Dual channel display only: Press the ▲/▼ keys to highlight Channel 1 or Channel 2 as the channel to calibrate and press the *f2* (*accept*) key.



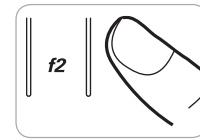
- Rinse the pH electrode, ATC probe and stirrer probe with deionized water, blot dry and place into the pH 4.01 buffer. When the electrode and buffer are ready, press the *f3* (*start*) key to begin the calibration.



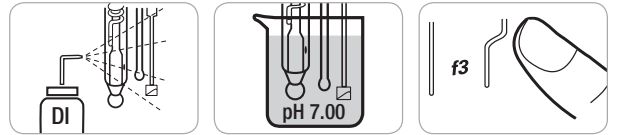
- Wait for the pH value to stop flashing. The meter should automatically recognize the buffer and display the pH value of the buffer at the measured temperature. If the meter does not automatically recognize the buffer, use the numeric keypad and the *decimal* key to enter the value of the pH buffer at the measured temperature. Press the *f2* (*accept*) key.



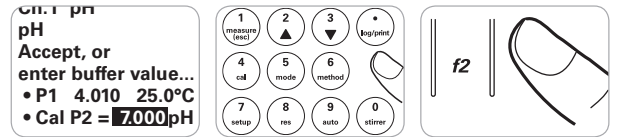
- Press the *f2* (*next*) key to proceed to the next pH buffer.



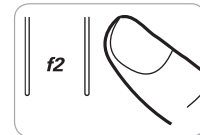
- Rinse the pH electrode, ATC probe and stirrer probe with deionized water, blot dry and place into the pH 7.00 buffer. When the electrode and buffer are ready, press the *f3* (*start*) key.



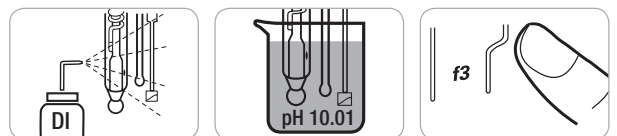
- Wait for the pH value to stop flashing. The meter should automatically recognize the buffer and display the pH value of the buffer at the measured temperature. If the meter does not automatically recognize the buffer, use the numeric keypad and the *decimal* key to enter the value of the pH buffer at the measured temperature. Press the *f2* (*accept*) key.



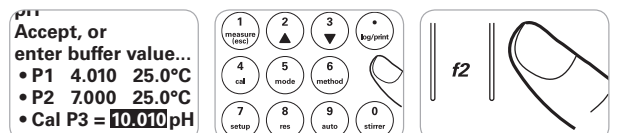
- Press the *f2* (*next*) key to proceed to the next pH buffer.



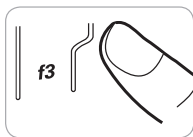
- Rinse the pH electrode, ATC probe and stirrer probe with deionized water, blot dry and place into the pH 10.01 buffer. When the electrode and buffer are ready, press the *f3* (*start*) key.



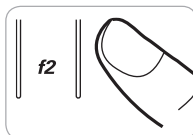
- Wait for the pH value to stop flashing. The meter should automatically recognize the buffer and display the pH value of the buffer at the measured temperature. If the meter does not automatically recognize the buffer, use the numeric keypad and the *decimal* key to enter the value of the pH buffer at the measured temperature. Press the *f2* (*accept*) key.



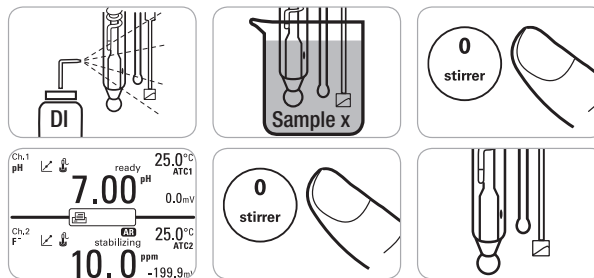
12. Press the *f3 (cal done)* key. A summary of the calibration will be displayed. The slope should be 92% to 102%.



13. Press the *f2 (log/print)* key to save and end the calibration and export the calibration data to the calibration log.



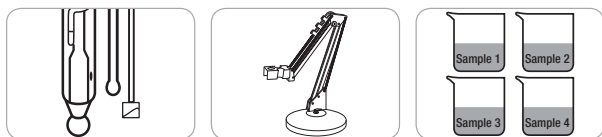
5. Repeat steps 2 through 4 for all of the samples.



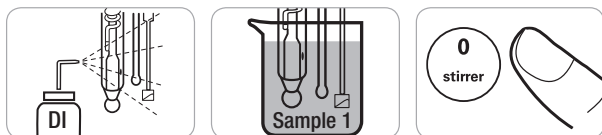
6. When all of the samples have been measured, store the equipment. Between samples and overnight, store the pH electrode in the ROSS pH electrode storage solution. Store the ATC probe and stirrer probe dry.

### Sample Measurement Procedure

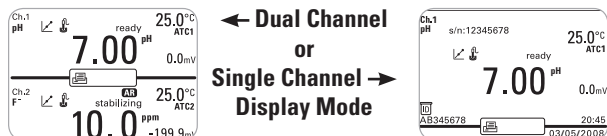
1. Calibrate the pH electrode and meter (note which channel the pH electrode is connected to) and make sure that the electrode and probes are in the electrode stand. Prepare the pH samples.



2. Rinse the pH electrode, ATC probe and stirrer probe with deionized water, blot dry and place into the sample. Press the *stirrer* key to turn on the stirrer probe.



3. The meter display will flash stabilizing and then show ready once the measurement is stable. Record the pH and temperature of the sample when the meter display shows ready. When ready is shown on the display, the meter will export the measurement to the data log.



4. Press the *stirrer* key to turn off the stirrer probe. Remove the pH electrode, ATC probe and stirrer probe from the sample.



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### Ordering Information

To purchase an Orion Dual Star meter, electrodes and other related products, please contact your local equipment distributor and reference the part numbers listed below.

Product	Description	Part Number
Meter	Orion Dual Star pH/ISE Dual Channel Benchtop Meter	2115000
Electrodes	Orion ROSS Ultra Glass-body pH Electrode	8102BNUWP
	Orion Stainless Steel ATC Temperature Probe	927007MD
Solutions	Orion pH 4.01 Buffer, 475 mL	910104
	Orion pH 7.00 Buffer, 475 mL	910107
	Orion pH 10.01 Buffer, 475 mL	910110
	ROSS pH Electrode Storage Solution, 475 mL	810001
	ROSS Electrode Filling Solution, 5 x 60 mL	810007
Accessories	Orion Stirrer Probe	096019
	Swing Arm Electrode Stand	090043

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