



## Measuring pH of water and wastewater using the Thermo Scientific Orion Dual Star pH/ISE meter

### Keywords

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

### 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 Thermo Scientific™ Orion™ Dual Star™ pH/ISE Bench Meter paired with an Orion combination pH electrode can help measure the pH levels in water and wastewater.

### Required equipment

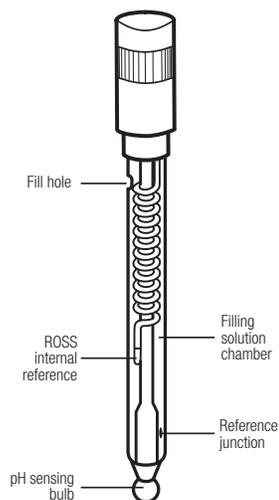
- Orion Dual Star pH/ISE dual channel benchtop meter kit with ROSS Ultra glass-body pH electrode, ATC probe, solutions and stand (Cat. No. 2115001)
- Orion Automatic Stirrer Probe (Cat. No. 096019) or magnetic stir plate and bar
- Orion pH 4.01 buffer (Cat. No. 910104)
- Orion pH 7.00 buffer (Cat. No. 910107)
- Orion ROSS™ pH electrode storage solution (Cat. No. 810001)
- Orion pH Electrode Filling Solution for ROSS electrodes (Cat. No. 810007)
- Deionized water (DI) or Reagent grade water (RGW)
- 50 mL beakers

## pH electrode setup

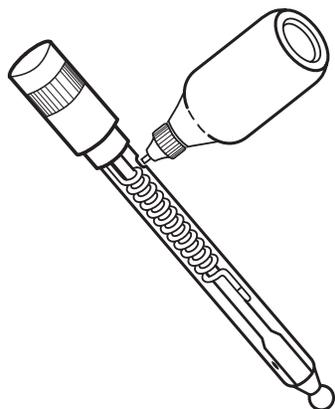
**Note:** Add filling solution each day before using the electrode. The filling solution level must be above the ROSS internal reference and at least one inch above the level of the sample to ensure a proper flow rate. The fill hole should always be open when taking measurements.

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 DI or RGW 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. Do not leave dry any longer.
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.



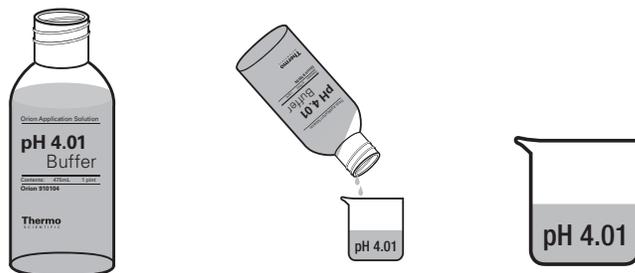
**Figure 1. pH Electrode Components**



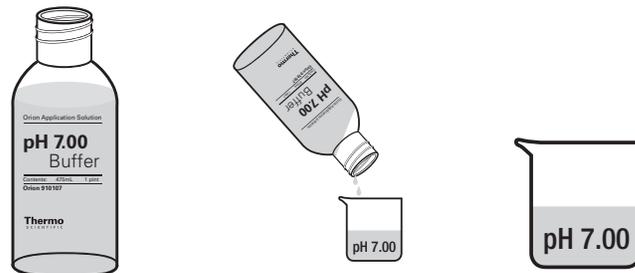
**Figure 2. Filling the pH Electrode**

## 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.

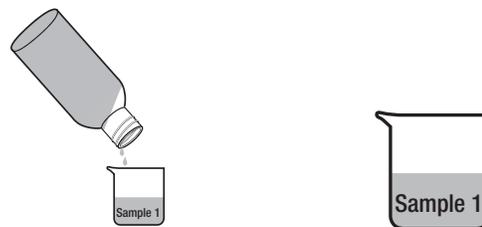


3. Add about 30 mL of the pH 10.01 buffer to a 50 mL beaker and label the beaker.



## Sample preparation

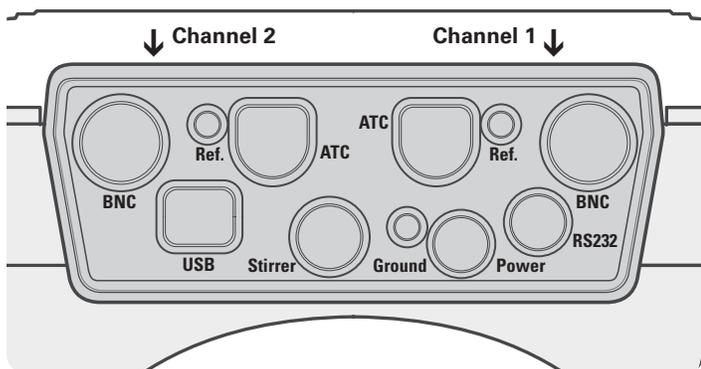
1. Add about 30 mL of the sample to a 50 mL beaker and label the beaker.



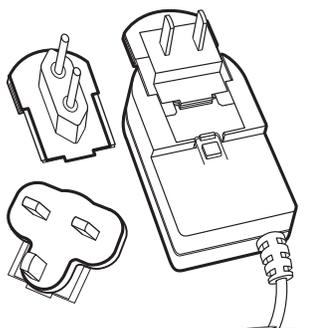
2. Repeat step 1 for additional samples.

## 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.

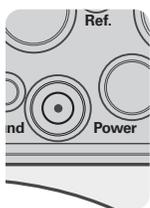


Figure 3.



Figure 4.

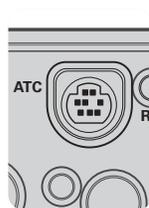


Figure 5.

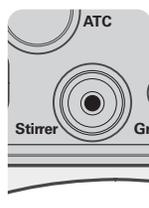


Figure 6.

## 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 ▲/▼ keys to highlight EZ Startup and press the *f2 (select)* key.

1. In the measurement mode, press the *setup* key.
2. Press the ▲/▼ 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 ▲/▼ keys to highlight Measure Mode and press the *f2 (select)* key. Press the ▲/▼ keys to highlight pH and press the *f2 (accept)* key.
4. Press the ▲/▼ keys to highlight Electrode ID and press the *f2 (select)* key. Press the ▲/▼ keys to highlight pH and press the *f2 (accept)* key.
5. Press the ▲/▼ keys to highlight Resolution and press the *f2 (select)* key. Press the ▲/▼ keys to highlight 2 Decimal Places (10.01pH) and press the *f2 (accept)* key.
6. Press the ▲/▼ keys to highlight Temperature Input and press the *f2 (select)* key. Press the ▲/▼ 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 ▲/▼ keys to highlight Calibration Setup and press the *f2 (select)* key. Press the ▲/▼ keys to highlight Buffer Set and press the *f2 (select)* key. Press the ▲/▼ 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 ▲/▼ keys to highlight Read Type and press the *f2 (select)* key. Press the ▲/▼ keys to highlight On Ready and press the *f2 (select)* key.
9. Press the *f1 (back)* key.
10. Press the ▲/▼ keys to highlight Instrument Parameters and press the *f2 (select)* key.
11. Press the ▲/▼ keys to highlight Export Data (PC/ Printer/Log) and press the *f2 (select)* key. Press the ▲/▼ keys to highlight Export Trigger and press the *f2 (select)* key. Press the ▲/▼ 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 ▲/▼ keys to highlight Data Log and press the *f2 (select)* key. Press the ▲/▼ keys to highlight Data Log On/Off and press the *f2 (select)* key. Press the ▲/▼ keys to highlight On and press the *f2 (accept)* key.

- 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

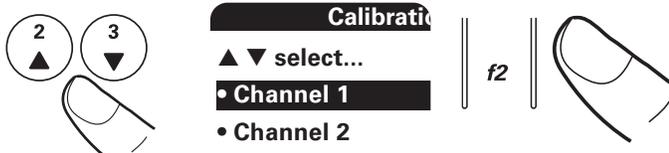
- Prepare and condition the pH electrode. Connect the pH electrode, ATC probe and stirrer probe to the meter (note which channel the pH electrode is connected to) and place the electrode and probes in the electrode stand. Prepare the pH 4.01, 7.00 and 10.01 buffers.



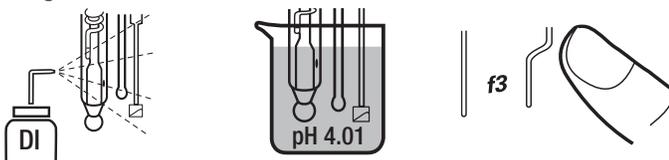
- In the measurement mode, press the *cal* key.



- 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.

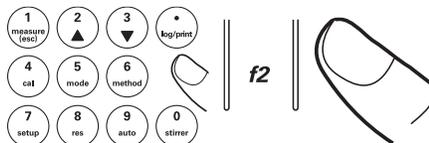


- Rinse the pH electrode, ATC probe and stirrer probe with DI or RGW and place into the pH 4.01 buffer. When the electrode and buffer are ready, press the *f3* (*start*) key to begin the calibration.



- 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.

Ch.1 pH  
pH  
Accept, or  
enter buffer value...  
• Cal P1 = **4.010**pH



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

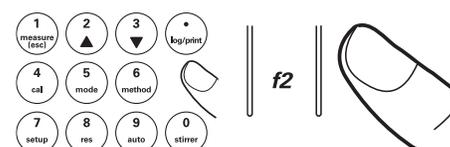


- Rinse the pH electrode, ATC probe and stirrer probe with DI or RGW and place into the pH 7.00 buffer. When the electrode and buffer are ready, press the *f3* (*start*) key.



- 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.

Ch.1 pH  
pH  
Accept, or  
enter buffer value...  
• P1 4.010 25.0°C  
• Cal P2 = **7.000**pH



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

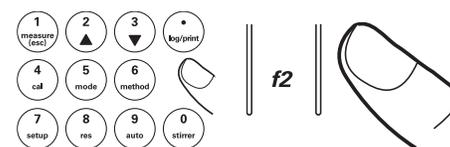


- Rinse the pH electrode, ATC probe and stirrer probe with DI or RGW and place into the pH 10.01 buffer. When the electrode and buffer are ready, press the *f3* (*start*) key.

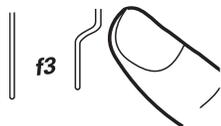


- Wait for the pH value to stop flashing. The meter should automatically recognize the buffer and display the pH value of the buffer at the measured temperature. If the meter does not automatically recognize the buffer, use the numeric keypad and the decimal key to enter the value of the pH buffer at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

Ch.1 pH  
pH  
Accept, or  
enter buffer value...  
• P1 4.010 25.0°C  
• P2 7.000 25.0°C  
• Cal P3 = **10.010**pH



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

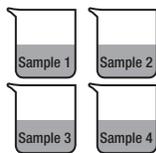
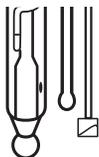


- Press the *f2* (*log/print*) key to save and end the calibration and export the calibration data to the calibration log.

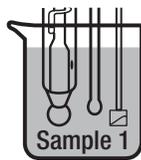
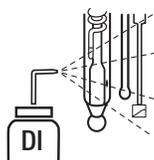


### Sample measurement procedure

- 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.



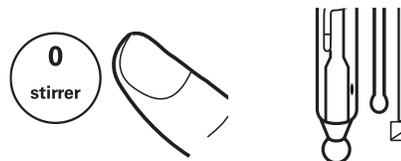
- Rinse the pH electrode, ATC probe and stirrer probe with DI or RGW and place into the sample. Press the stirrer key to turn on the stirrer probe.



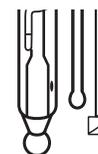
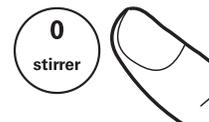
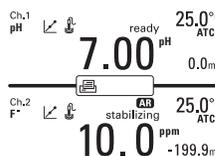
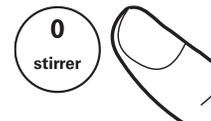
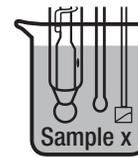
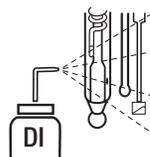
- The meter display will flash stabilizing and then show ready once the measurement is stable. Record the pH and temperature of the sample when the meter display shows ready. When ready is shown on the display, the meter will export the measurement to the data log.



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



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



- 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.

**Ordering information**

Product	Description	Part Number
Meter Kit	Orion Dual Star pH/ISE Dual Channel Benchtop Meter Kit	21150001
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
	Orion ROSS pH Electrode Storage Solution, 475 mL	810001
	Orion pH Electrode Storage Solution for ROSS Electrodes, 5 x 60 mL	810007
Accessories	Orion Stirrer Probe	096019
	Swing Arm Electrode Stand	090043
	Orion Storage Sleeve and Base	810017

This product is intended for General Laboratory Use. It is the customer's responsibility to ensure that the performance of the product is suitable for customers' specific use or application.

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