

Measuring Ammonia in 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, high performance ammonia, ion selective electrode (ISE), ammonia, wastewater, water.

Goal

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



Introduction

Ammonia can have negative effects on the environment and is an important aspect of wastewater management. High levels of ammonia result in visible contamination in wastewater ponds and reservoirs. The potential ecological impacts include excessive algae growth, and excessive sludge generation, which can cause poor water quality for the support of aquatic life. Algae and sludge can also harbor organisms that contribute to disease.

Required Equipment

- Orion Dual Star pH/ISE meter with electrode stand (Cat. No. 2115000)
- High performance ammonia electrode (Cat. No. 9512HPBNWP)
- Automatic Temperature Compensation (ATC) probe (Cat. No. 927007MD)
- Stirrer probe (Cat. No. 096019) or magnetic stir plate and bar
- 100 ppm ammonia as nitrogen (N) standard (Cat. No. 951207)
- Ammonia Ionic Strength Adjustor (ISA) solution (Cat. No. 951211) or ammonia low-level ISA solution (Cat. No. 951210)
- Ammonia electrode storage solution (Cat. No. 951213)
- High performance ammonia electrode filling solution (Cat. No. 951209)
- Deionized water
- 100 mL volumetric flasks
- 100 mL beakers
- 50 mL pipette or 50 mL graduated cylinders
- 10 mL and 2 mL pipettes

Ammonia Electrode Setup

A new electrode is shipped dry. You must soak the inner body of the electrode in the electrode filling solution for at least two hours before using the electrode. For best results, soak the inner body overnight in filling solution.

Electrode Preparation with Loose Membranes

1. Hold the electrode vertically and unscrew the electrode cap from the electrode body. See *Figure A*. Carefully remove the inner body from the outer body assembly. See *Figure B*. Dispose of any electrode filling solution in the outer body. Unscrew the membrane cap from the outer body. See *Figure C*. Remove the membrane from the membrane cap if one was previously installed.

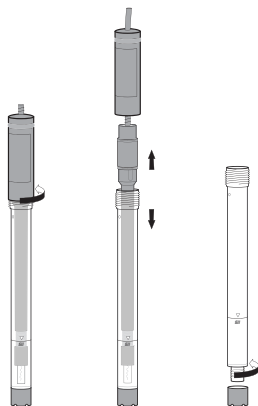


Figure A Figure B Figure C

2. Wear gloves and use tweezers to carefully grasp the corner of a white membrane from between wax papers. Do not touch the center of the membrane. See *Figure D*. Hold the outer body with the smaller diameter threads at the top. Align the serrated edge of the membrane on the threaded shoulder and hold the membrane with your thumb. See *Figure E*. Gently place the membrane across the opening. See *Figure F*.

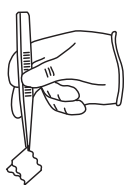


Figure D

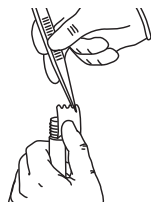


Figure E



Figure F

3. Place the membrane down to align the other edge with the opposite shoulder. See *Figure G*. While holding each edge on both sides, gently place each smooth side of the membrane down over the threads and ensure that the membrane surface is smooth and without wrinkles. See *Figure H*. Smooth any loose material, taking care not to touch center of membrane. See *Figure I*. Do not stretch the membrane.



Figure G

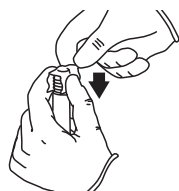


Figure H

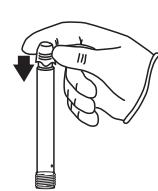


Figure I

4. Screw the membrane cap onto the outer body, being careful not to touch membrane. See *Figure J*. Screw the membrane cap on half way and wrap any loose membrane material onto the threads and under the cap. Make sure the cap is fully screwed on.
5. Fill the outer body to the fill line with electrode filling solution. See *Figure K*. Insert the inner body into the outer body. When the inner body is fully inserted in the top of the outer body, screw on the electrode cap. See *Figure L*. Tap the side of the electrode to remove any air bubbles.

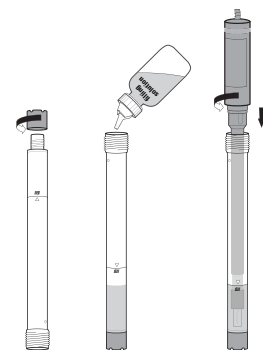


Figure J Figure K Figure L

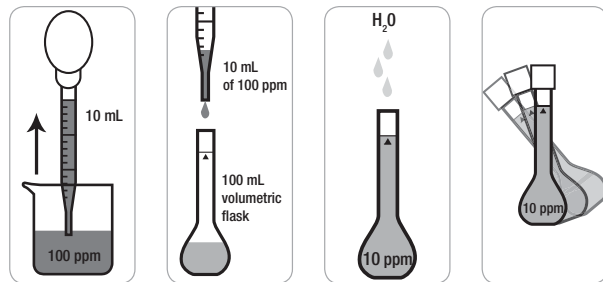
6. Soak the electrode in the ammonia electrode storage solution for at least 15 minutes before use. Prepare the storage solution by combining 100 mL of a 1 ppm ammonia standard with 1 mL of the alkaline reagent (Cat. No. 951011).

Calibration Standard Preparation

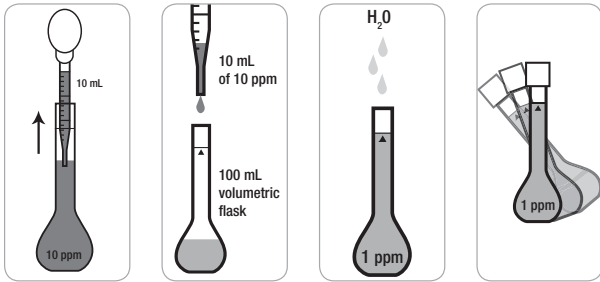
Select the ammonia ISA solution (Cat. No. 951211) or ammonia low-level ISA solution (Cat. No. 951210) based on your sample requirements and use the selected ISA solution for all ammonia standards and samples.

Both ISA solutions adjust the pH and ionic strength of ammonia standards and samples and contain a pH-indicating blue dye. The ammonia ISA solution (Cat. No. 951211) removes metal interferences common in wastewater samples. The ammonia low-level ISA solution (Cat. No. 951210) is ideal for ammonia samples below 1 ppm that do not contain metal interferences.

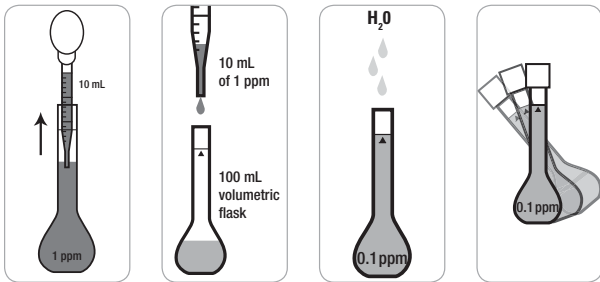
1. Prepare a 10 ppm ammonia standard by pipetting 10 mL of the 100 ppm ammonia standard into a 100 mL volumetric flask. Dilute to the mark with deionized water. Mix the solution well.



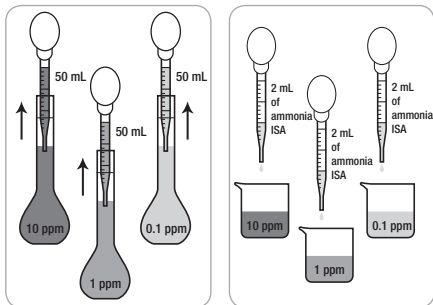
- Prepare a 1 ppm ammonia standard by pipetting 10 mL of the 10 ppm ammonia standard into a 100 mL volumetric flask. Dilute to the mark with deionized water. Mix the solution well.



- Prepare a 0.1 ppm ammonia standard by pipetting 10 mL of the 1 ppm ammonia standard into a 100 mL volumetric flask. Dilute to the mark with deionized water. Mix the solution well.

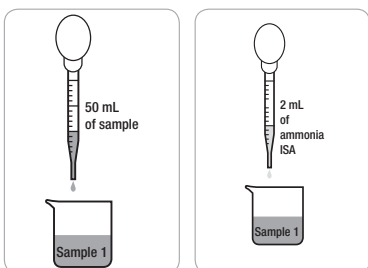


- Pipette 50 mL each of the 10 ppm, 1 ppm and 0.1 ppm standards into separate 100 mL beakers and label the beakers. Just prior to performing the calibration, add 2 mL of the ammonia ISA solution to each beaker. It must be added just prior to calibration to avoid ammonia loss from the standard.



Sample Preparation

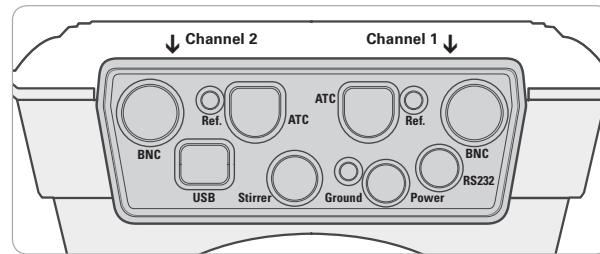
- Using a graduated cylinder or automatic pipette, measure and add 50 mL of the sample into a 100 mL beaker and label the beaker. Just prior to measurement, add 2 mL of the ammonia ISA solution to the beaker. It must be added just prior to measurement to avoid ammonia loss from the sample.



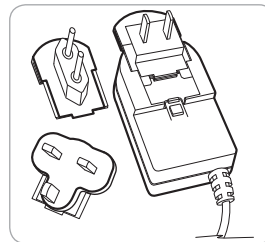
- Repeat step 1 for additional samples.

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.



- 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.



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

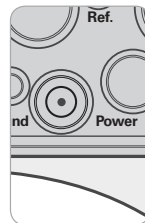


Figure 1



Figure 2

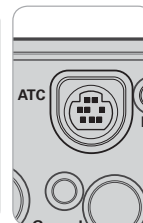


Figure 3

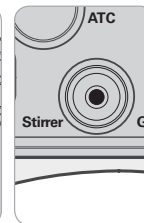


Figure 4

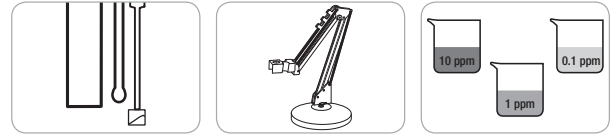
Meter Setup

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.

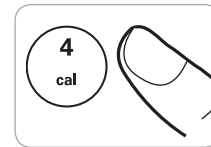
- In the measurement mode, press the *setup* key.
- Press the $\blacktriangle/\blacktriangledown$ keys to highlight Channel 1 or Channel 2, depending on which BNC input the ammonia electrode was connected to, and press the *f2 (select)* key.
- Press the $\blacktriangle/\blacktriangledown$ keys to highlight Measure Mode and press the *f2 (select)* key. Press the $\blacktriangle/\blacktriangledown$ keys to highlight ISE and press the *f2 (accept)* key. Press the $\blacktriangle/\blacktriangledown$ keys to highlight ppm (or mg/L, depending on your preference or method) and press the *f2 (accept)* key.
- Press the $\blacktriangle/\blacktriangledown$ keys to highlight Electrode ID and press the *f2 (select)* key. Press the $\blacktriangle/\blacktriangledown$ keys to highlight NH₃ and press the *f2 (accept)* key.
- Press the $\blacktriangle/\blacktriangledown$ keys to highlight Resolution and press the *f2 (select)* key. Press the $\blacktriangle/\blacktriangledown$ keys to highlight 3 Significant Figures (1.00) and press the *f2 (accept)* key.
- 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.
- Press the $\blacktriangle/\blacktriangledown$ keys to highlight Calibration Setup and press the *f2 (select)* key. Press the $\blacktriangle/\blacktriangledown$ keys to highlight Autoblack and press the *f2 (select)* key. Press the $\blacktriangle/\blacktriangledown$ keys to highlight On and press the *f2 (accept)* key. Verify that the Low Level Stability and Isopotential options are set to Off. Press the *f1 (back)* key.
- 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.
- Press the *f1 (back)* key.
- Press the $\blacktriangle/\blacktriangledown$ keys to highlight Instrument Parameters and press the *f2 (select)* key.
- 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 ammonia 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.
- Press the *f1 (back)* key twice.
- Press the $\blacktriangle/\blacktriangledown$ keys to highlight Stirrer Speed and press the *f2 (select)* key. Press the $\blacktriangle/\blacktriangledown$ 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

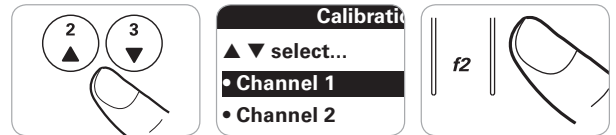
- Prepare and condition the ammonia electrode. Connect the ammonia electrode, ATC probe and stirrer probe to the meter (note which channel the ammonia electrode is connected to) and place the electrode and probes in the electrode stand. Prepare the 10 ppm, 1 ppm and 0.1 ppm standards.



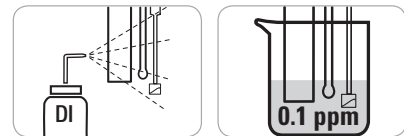
- In the measurement mode, press the *cal* key.



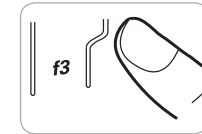
- Dual channel display only: Press the $\blacktriangle/\blacktriangledown$ keys to highlight Channel 1 or Channel 2 as the channel to calibrate and press the *f2 (accept)* key.



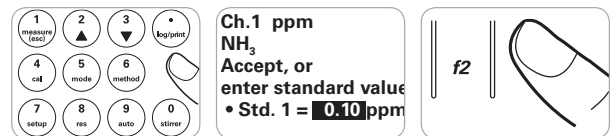
- Rinse the ammonia electrode, ATC probe and stirrer probe with deionized water, blot dry and place into the 0.1 ppm calibration standard.



- When the electrode and standard are ready, press the *f3 (start)* key to begin the calibration.



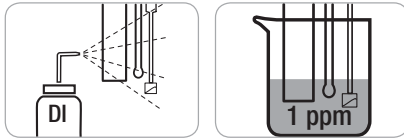
- Wait for the concentration value to stop flashing and then use the numeric keypad and the *decimal* key to enter the concentration of the first standard as 0.10 and press the *f2 (accept)* key.



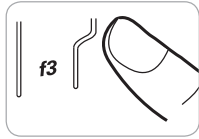
- Press the *f2 (next)* key to proceed to the next calibration standard.



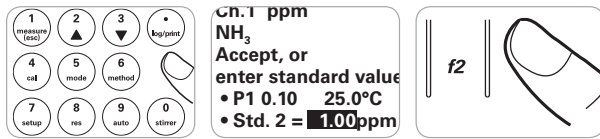
8. Rinse the ammonia electrode, ATC probe and stirrer probe with deionized water, blot dry and place into the 1 ppm calibration standard.



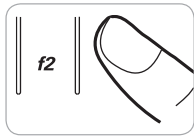
9. When the electrode and standard are ready, press the *f3 (start)* key.



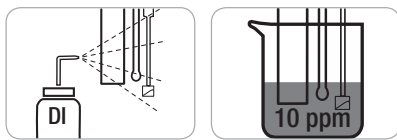
10. Wait for the concentration value to stop flashing and then use the numeric keypad and the *decimal* key to enter the concentration of the second standard as 1.00 and press the *f2 (accept)* key.



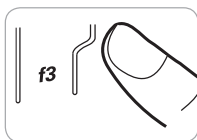
11. Press the *f2 (next)* key to proceed to the next calibration standard.



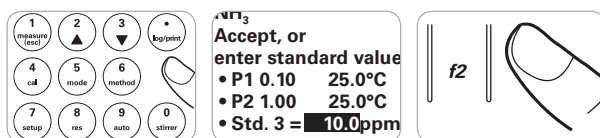
12. Rinse the electrode, ATC probe and stirrer probe with deionized water, blot dry and place into the 10 ppm calibration standard.



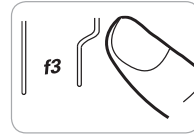
13. When the electrode and standard are ready, press the *f3 (start)* key.



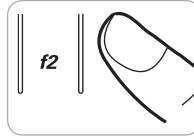
14. Wait for the concentration value to stop flashing and then use the numeric keypad and the *decimal* key to enter the concentration of the third standard as 10.0 and press the *f2 (accept)* key.



15. Press the *f3 (cal done)* key. A summary of the calibration will be displayed. The slope should be -54 mV per decade to -65 mV per decade.

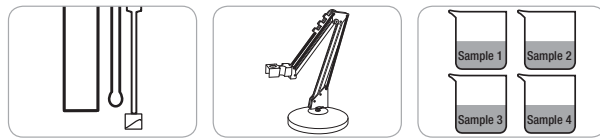


16. Press the *f2 (log/print)* key to save and end the calibration and export the calibration data to the calibration log.

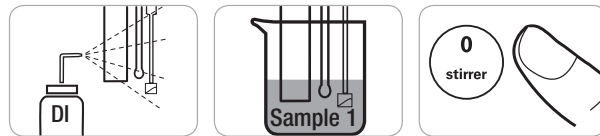


Sample Measurement Procedure

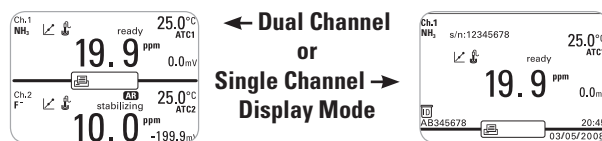
1. Calibrate the ammonia electrode and meter (note which channel the ammonia electrode is connected to). Prepare the ammonia samples and add the ammonia ISA to the samples just prior to taking the measurement to avoid ammonia loss from the samples.



2. Rinse the ammonia 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.



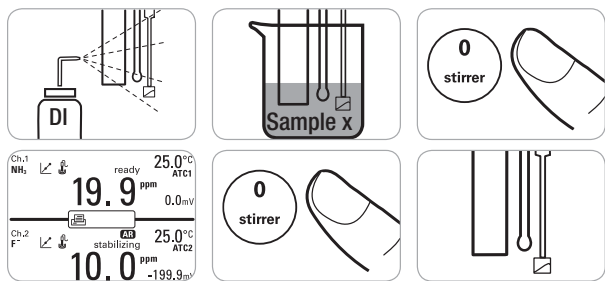
3. The meter display will flash stabilizing and then show ready once the measurement is stable. Record the concentration and temperature of the sample when the meter display shows ready. When ready is shown on the display, the meter will export the measurement to the data log.



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



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, store the ammonia electrode in the 0.1 ppm ammonia standard or pH 4 buffer. Overnight, store the ammonia electrode in the ammonia electrode storage solution. Store the ATC probe and stirrer probe dry.

Visit www.thermoscientific.com/water to view the full line of Thermo Scientific Orion products and download product literature, user guides and manuals and software updates. For any questions or technical support, contact your local Technical Sales Representative or our Technical Support Specialists by phone at 1-978-232-6000 or 1-800-225-1480 (US toll-free), or by email at wai.techservbev@thermofisher.com.

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 Meter	2115000
Electrodes	Orion High Performance Ammonia Electrode	9512HPBNWP
	Orion Stainless Steel ATC Temperature Probe	927007MD
Solutions	Orion 100 ppm Ammonia As Nitrogen (N) Standard, 475 mL	951207
	Orion Ammonia ISA Solution, 475 mL	951211
	Orion Ammonia Low-Level ISA Solution, 475 mL	951210
	Orion Ammonia Electrode Storage Solution, 475 mL	951213
	Orion High Performance Ammonia Electrode Filling Solution, 60 mL	951209
Accessories	Orion Stirrer Probe	096019
	Swing Arm Electrode Stand	090043

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