

## Required Equipment

- Ion meter (preferred) or pH/mV meter.
- Wash bottle with distilled or deionized water.
- Several clean beakers (glass, 150 mL preferred).
- Pipette for measuring 10 mL or less.
- Graduated cylinder (100 mL)
- Fill Solution YSI #400367\*
- 1000 mg/L (ppm) Ammonia Standard YSI #400370\*
- 100 mg/L (ppm) Ammonia Standard YSI #400369
- Ionic Strength Adjustor (ISA) YSI #400368\*
- Replacement Membrane Modules (pk/4) YSI #400366\*\*

\*Small bottles included with ammonia ISE kit (YSI #400365)

\*\*Two Membrane modules included with ammonia ISE kit.

## Overview

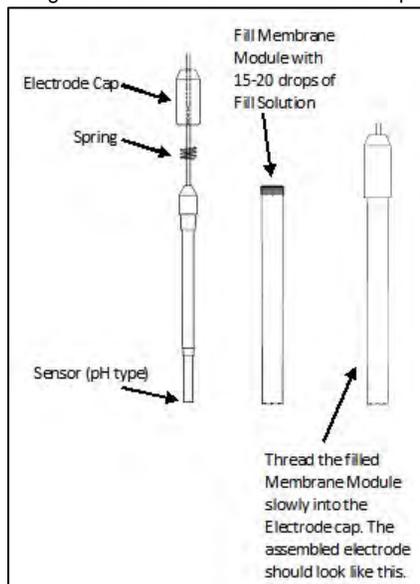
The YSI 400365 Ammonia Ion Selective Electrode is a gas-sensing electrode for measuring ammonia ( $\text{NH}_3$ ) in aqueous samples. It must be used with an ISA that buffers the sample >pH 11 to cause the ammonia in the sample to become gaseous. The Ammonia ISE is a pH Electrode behind an ammonia gas permeable membrane – the ammonia gas causes a pH shift in the Fill Solution that is correlated to ammonia concentration based on the results of calibration.

- **Technology:** Gas sensing technology
- **Size and material:**
  - Membrane Body (ABS)—12 mm OD x 158 mm L
  - Cap (ABS) —16 mm OD x 37 mm L
  - Cable (Coax type) – 100cm; BNC Connector
- **Reference:** The pH electrode inside has a single-junction, Ag/AgCl, annular ceramic junction.
- **Features:** Replaceable, pre-formed membrane module.
  - The ISA has a pH indicator that indicates the pH is in range (>11) by the presence of a blue coloration.
- **Range:** 0.02-17,000 mg/L
- **Reproducibility:**  $\pm 2\%$
- **Slope:** 54 to 59 mv/decade @ 25°C typical
- **pH range:** >11
- **Operating Temperature:** 0 to 50°C
- **Interferences:** Volatile amines
- **Applications/Notes:** Popular for wastewater, aquaculture, agriculture, and industrial applications.

## Electrode Preparation

1. The glass pH sensor and reference junction of the pH electrode should be kept conditioned during transit and storage. Unscrew the cap of the storage solution bottle (Soaker Bottle) and remove the pH electrode.
2. Fill a Membrane Module with Fill Solution
  - a) Add 15-20 drops of Fill Solution to the Membrane Module
  - b) Tap the Membrane Module to ensure no bubbles are present in the fill solution.
  - c) Thread the Membrane Module slowly into the Electrode Cap. If the Module was overfilled, the excess Fill Solution will leak out. Avoid rupturing the Membrane Module with too much Fill Solution.
3. Preferably, allow the pH electrode to condition within the filled Membrane Module for 2 hours prior to use. The

Membrane Module can be conditioned by placing in a low to mid-range standard for at least 15 minutes prior to use.



## Calibration

1. Connect the assembled ammonia electrode to a meter with BNC input. Meters with an ISE mode can directly display ion concentration (e.g. display in mg/L). Ensure the meter is setup for ammonia and be sure to follow the calibration procedure in the meter user manual.

Alternatively, a meter with a mV mode can be used, although the instrument will not display the result of calibration (i.e. calibration curve will need to be created by the user).
2. For highest accuracy, use a meter with automatic temperature compensation (ATC) and connect a temperature sensor.
3. Prepare Standards:
  - a) At least 2 standards that bracket the expected sample range must be used. As an example, prepare 1 mg/L and 10 mg/L standards if the expected sample is ~5 mg/L. Some meters allow up to a 7 point calibration.
  - b) There must be at least one order of magnitude difference between high and low standards (e.g. 10 mg/L and 100 mg/L).
  - c) If standards span more than one order of magnitude (e.g. 1 mg/L and 100 mg/L), it is best to prepare at least one mid-range standard (e.g. 10 mg/L).
  - d) Each standard should have a volume of 100 mL and should be placed in a 150 mL glass beaker.
  - e) Standards should be fresh and carefully prepared. It is best to use a pipette when measuring small volumes (10 mL or less) of a more concentrated standard.
  - f) Use the equation  $C1 \cdot V1 = C2 \cdot V2$  when preparing diluted standards from a more concentrated standard solution.

As an example, if using the YSI 100 mg/L standard as a stock solution (YSI #400369) to make 100 mL of a 10

mg/L standard:  $C1=100 \text{ mg/L}$ ,  $V1=?$ ,  $C2=10 \text{ mg/L}$ , and  $V2=100 \text{ mL}$ .  $V1=(C2 \cdot V2)/C1 = 10 \text{ mL}$ .

Therefore, 10 mL of the 100 mg/L stock standard should be added to 90 mL of DI water (i.e. solution should be 100 mL) to make a 10 mg/L standard.

**Note:** It is not recommended to use a very concentrated standard (e.g. 1000 mg/L) to make a very dilute standard (e.g. 0.1 mg/L).

4. Place the electrode in the lowest concentration standard and stir at a constant rate using a stir bar and stir plate, although the stirring speed should be limited to minimize loss of ammonia gas. Use the same stirring rate throughout calibration.

If you do not have a stir plate, it is best to swirl the solution or use a stir rod once ISA is added.
  5. Add 2 mL of ammonia ISA to the first standard:
    - a) Using a pipette is recommended. The standard solution should have a pale blue color that persists after ISA is added.
    - b) Allow the solution to stir for 1 minute and begin calibration. Calibration is time sensitive, as ammonia diffuses from the sample ~4 minutes after ISA is added. Therefore, ensure calibration with the standard is complete 1 to 4 minutes after ISA is added. This timing is critical! If calibration using the standard is unsuccessful within this time limit, a fresh standard will need to be prepared.
  6. After calibrating with the first point, finish calibrating using steps #4 and #5 for the remaining calibration points. Calibrate in order of increasing concentration.
  7. Evaluate electrode slope:
    - a) View the calibration record on the ISE meter, or create a curve if using a meter with only a mV mode.
    - b) For highest accuracy, the ammonia electrode slope should be between -52 mV/decade and -60 mV/decade.
  8. Recalibrate often:
    - a) The ammonia electrode should be calibrated at the beginning of each day.
    - b) For best accuracy, it is best to calibrate the ammonia electrode every 10 samples. If this calibration interval is too frequent, at least verify your calibration result every 2 hours by preparing a fresh low to mid-range standard, adding ISA, and verifying the reading. If the mV reading has changed ~3 mV compared to the reading in that standard during calibration, you will need to recalibrate the electrode.
- Measurement**
- Samples must be prepared like standards. Follow steps #3-5 of the calibration procedure when preparing samples and taking a measurement.
- In summary, 100 mL of sample should be collected and 2 mL of ISA added. The sample should be fresh and the same stirring rate using during calibration should be utilized. A measurement can be taken 1 to 4 minutes after ISA is added.
- The temperature of measurement solutions should be as close as possible to solution temperatures during calibration.

## Troubleshooting & Maintenance

If the electrode slope is not between -52 mV/decade and -60 mV/decade, or the electrode mV reading drifts, the electrode Fill Solution may need refreshing. Hold the electrode body with one hand, and then gently pull the cable. Release the cable. Fresh Fill Solution will now occupy the space between the inner glass electrode and the membrane.

If refreshing the internal fill solution does not work, remove the pH electrode from the membrane module and use the following procedure to verify the pH electrode slope:

1. Remove the internal glass pH electrode from the Membrane Module
2. Connect the internal glass electrode to a pH/mV meter. Switch to mV mode.
3. Put the internal glass electrode in pH 7.00 buffer. The annular ceramic junction should be immersed in the buffer. Record the stable reading in mV, which should be  $0 \pm 25$  mV.
4. Remove the internal glass electrode from the pH 7.00 buffer. Rinse with DI water, blot dry.
5. Put the internal glass electrode in pH 4.01 buffer. Record the stable reading in mV.
6. The millivolt difference in the two readings should be between 160 and 180 mV.

The Membrane Module will likely need to be changed if the pH electrode passes the test above. Replacement of the Membrane Module is needed more often in dirty samples like wastewater. The membrane will eventually develop pinholes or tears, get stretched, or the membrane will become fouled (surface coating).

You may attempt to clean a Membrane Module that has surface contamination by soaking it in DI water for 1 hour or more, then soak in a low or mid-range standard for at least 15 minutes prior to use.

The pH sensor can be cleaned like other pH electrodes. Avoid rubbing or scratching the glass pH sensor. Placing the pH electrode in pH 4 buffer with some KCl added is recommended after any pH electrode cleaning procedure, but ensure the reference junction (i.e. the white layer where the glass changes in dimension) is completely immersed. Soaking in pH 4 buffer with KCl overnight can also restore the electrode.

Contact YSI Technical Support if electrode slope and/or response continue to be poor.

## Electrode Storage

### **Short Term (overnight or the weekend):**

Between measurements, the ammonia ISE should be stored in a low concentration standard with ISA added. For overnight or weekend storage, place the assembled electrode in 1000 mg/L standard and do not add any ISA. Avoid removing the Membrane Module and reinstalling – this could stretch the membrane causing it to be less responsive.

### **Long Term:**

It is important to keep the pH sensor conditioned through long term storage situations. Completely disassemble the electrode. Rinse the internal glass electrode and Membrane Module

with DI water. Dry all of the parts. Ensure the internal glass electrode is stored inside the included soaker bottle with some storage solution (pH 4 buffer with KCl added).

Use a new Membrane Module, or make sure the old one is not damaged or overly stretched. Follow procedures in "Electrode Preparation" and "Calibration" before using the electrode again.

## Warranty Statement

The YSI TruLine Ammonia ISE is warranted for twelve (12) months from date of purchase by the end user against defects in materials and workmanship. Within the warranty period, YSI will repair or replace, at its sole discretion, free of charge, any product that YSI determines to be covered by this warranty.

To exercise this warranty, call your local YSI representative, or contact YSI Customer Service in Yellow Springs, Ohio at +1 937 767-7241, 800-897-4151, [info@ysi.com](mailto:info@ysi.com) or visit [ysi.com](http://ysi.com) (Support tab). Send the product and proof of purchase, transportation prepaid, to the Authorized Service Center selected by YSI. Repair or replacement will be made and the product returned, transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days from date of repair or replacement.

## Limitation of Warranty

This Warranty does not apply to any YSI product damage or failure caused by:

- 1) Failure to install, operate or use the product in accordance with YSI's written instructions;
- 2) Abuse or misuse of the product;
- 3) Failure to maintain the product in accordance with YSI's written instructions or standard industry procedure;
- 4) Any improper repairs to the product;
- 5) Use by you of defective or improper components or parts in servicing or repairing the product;
- 6) Modification of the product in any way not expressly authorized by YSI.

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TruLine Ammonia Ion Selective Electrode  
Instruction Manual

