

## Required Equipment

- Ion meter or pH/mV meter.
- Wash bottle with distilled or deionized water.
- Several clean beakers.
- 1 mL, 10 mL and 100 mL pipettes.

## Required Solutions

- Reference Fill Solution (for both Silver & Sulfide) YSI #400434
- 1000 ppm Silver Standard YSI #400438
- 100 ppm Silver Standard YSI #400437
- Silver Ionic Strength Adjustor (ISA) YSI #400435
- Sulfide Ionic Strength Adjustor (ISA) YSI #400436

NOTE: Sulfide Standards are unstable and must be prepared carefully by the customer

## Overview

The YSI 400433 Silver/Sulfide Ion Selective Electrode is a combination electrode (includes both reference and sensing half cells in one body housing) for measuring silver ion ( $\text{Ag}^+$ ) or sulfide ion ( $\text{S}^{2-}$ ) activity in aqueous samples.

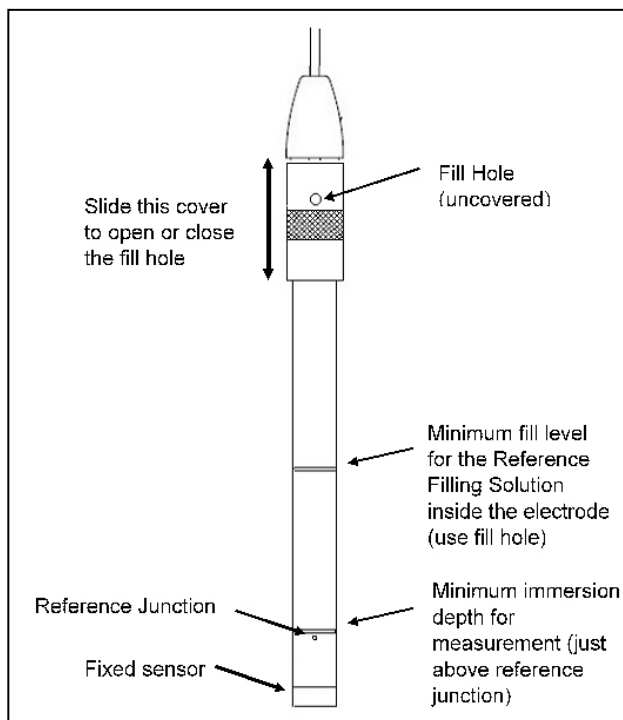
- **Technology:** Fixed position, solid state sensor
- **Size and material:**
  - Body (Epoxy)—12 mm OD x 155mm L
  - Cap (ABS)—16 mm OD x 57mm L
  - Cable (Coax type) – 100cm
  - BNC Connector
- **Reference:** Double-junction, Ag/AgCl, ceramic pin junction, refillable, potassium nitrate electrolyte
- **Features:** long-lasting solid state sensor
- **Range:** 0.01-107,900 mg/L (Silver)  
0.003-32,100 mg/L (Sulfide)
- **Reproducibility:**  $\pm 4\%$
- **Slope:** -26 to -29 mv/decade @ 25°C typical (Sulfide)  
54 to 59 mv/decade @ 25°C typical (Silver)
- **pH range:** 2-12
- **Operating Temperature:** 0 to 80°C
- **Interferences:**  $\text{Hg}^{2+}$
- **Applications/Notes:** Industrial, environmental, food/beverage

## Electrode Preparation

1. This electrode performs better when the reference junction is kept wetted during transit and storage. Unscrew the cap of the storage solution bottle (Soaker Bottle) and remove the electrode. **Caution: Avoid touching the sensor surface with your fingers.**
2. **Filling the electrode with electrolyte** - the reference (outer) chamber must be filled with Reference Fill Solution and remain open during testing:
  - a) Slide the sleeve of the electrode FastFil cap down to uncover the fill hole. (see fig. 1)

- b) Shake the electrode downward like a thermometer to remove any air bubbles trapped inside.
  - c) The surface of the Reference Fill Solution in the reference chamber must be above the inner junction. This is approximately 3" from the electrode tip.
3. Rinse the electrode with DI water, blot dry. Do not rub dry.
  4. Soak the electrode in DI water for 10 minutes, then in a diluted Silver or Sulfide Standard Solution for two hours prior to calibration or use.

Electrode Diagram (fig. 1)



## Checking Electrode Operation (Slope)

1. Connect the electrode to the meter. Place 100 mL DI water into a 150 mL beaker. Add 2 mL Silver/Sulfide ISA to the DI water and stir thoroughly.
2. Set the function switch to the mV mode.
3. Rinse the electrode with DI water, blot dry and place in the solution prepared in step 2.
4. Pipet 1 mL of 1000 ppm Silver or Sulfide Standard into the beaker. Stir thoroughly, then record the potential ( $E_1$ ) in mV when a stable reading is displayed.
5. Pipette 10 mL of the same standard into the same beaker. Stir thoroughly. When a stable reading is displayed, record the potential ( $E_2$ ) in mV.
6. The difference between the first and the second potential readings ( $E_2 - E_1$ ) is defined as the electrode slope. The normal range for the slope is  $27 \pm 2$  mV at 25°C for Sulfide analysis and  $56 \pm 4$  mV at 25°C for Silver analysis.

## Troubleshooting

If the electrode slope is not within the normal range, the following procedure may restore the electrode.

1. Soak the electrode in a diluted standard solution for 2 hours before use.
2. Repeat "Checking Electrode Operation" procedure again. Note: All standard solutions should be prepared fresh. For best performance use ISA in all solutions.

Periodically check the Reference Fill Solution level in the reference chamber of the electrode. The solution level must be higher than the inner junction which is visible as a white ceramic pin on the inner body.

If the electrode slope is still outside the normal range after this procedure, you may need to clean or replace the electrode.

## Reading a Sample with the Electrode

Various procedures may be used to determine the concentration of a sample. The most common is the Direct Calibration method, which is described below. Contact YSI's technical service department for details of other methods.

In Direct Calibration a series of standard solutions of differing concentrations are used to calibrate the electrode. Then each sample requires only a single meter reading, which is compared with the calibration readings to obtain the sample concentration. ISA is added to all solutions to ensure the samples and the standards have the same ionic strength.

### Set up:

1. Prepare the electrode as described in "Electrode Preparation" and "Checking Electrode Operation". Connect the electrode to the meter.
2. Prepare two standard solutions that differ in concentration by a factor of ten and bracket the expected sample concentration range. For example, if your expected sample concentration is 50 mg/L Silver or Sulfide, you should use a 10 mg/L low Standard Solution and a 100 mg/L high

Standard Solution.

NOTE: Temperature compensation is not typical of ISE measurements - for best performance, try to ensure that the standards are within 5 to 10°C of the sample.

#### Measurement:

If using a meter with direct concentration reading capability (see the meter instruction manual for specific information):

1. Place 100 mL of the low standard into a 150 mL beaker. Add 2 mL of ISA. Stir thoroughly.
2. Rinse electrode with DI water, blot dry and place in the beaker. Wait for a stable reading, and then adjust the meter to display the value of the standard. Refer to the meter's instruction manual for the meter adjustment procedure.
3. Measure 100 mL of the high standard into a second 150 mL beaker. Add 2 mL of ISA and stir.
4. Rinse electrode with DI water, blot dry and place in the second beaker. Wait for a stable reading, and then adjust the meter to display the value of the second standard.
5. Pipette 100 mL of sample into a 150 mL beaker. Add 2 mL of ISA. Stir thoroughly.
6. Rinse electrode with DI water, blot dry and place in the sample beaker. Wait for a stable reading and the sample concentration will be displayed on the meter.
7. Determine the sample concentration using the calibration curve prepared in Step 6 above.

#### Electrode Storage

##### Short Term (over night or the weekend):

Rinse the electrode thoroughly with DI water and place the tip in a diluted standard solution between measurements. Slide the FastFil sleeve to close the fill hole.

Refill the reference before putting the electrode back into service.

##### Long Term:

Refill the electrode with Reference Filling Solution and close the fill hole. Put the soaker bottle (storage bottle) on the end of the electrode with a wetted sponge to keep the reference from drying out.

Follow procedures in "Electrode Preparation" and "Checking Electrode Operation" before using the electrode again.

#### Electrode Cleaning

Cleaning should only be attempted if troubleshooting methods fail. The solid state sensor can be buffed with a light cloth or polishing strip if it shows signs of oxidation or precipitate formation. It can also be rinsed vigorously under warm water to remove debris. Soaking for 10-15 minutes in DI water might be useful in extracting other contaminants.

Recondition the electrode by soaking in a low standard solution immediately after any cleaning method.

#### Warranty Statement

The YSI TruLine Silver/Sulfide ISE is warranted for twelve (12) month 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 Silver/Sulfide Ion Selective Electrode

Instruction Manual

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