

Instrumentation Northwest, Inc. (INW)

APPLICATION NOTE

CALIBRATION AND FILLING SOLUTION RESERVOIR INSTRUCTIONS FOR AQUISTAR® TEMPHION™ SMART SENSOR SEPTEMBER 2007

INTRODUCTION

The TempHion should be calibrated before first use and periodically thereafter. It should also be calibrated if moving to a different sampling environment where readings will be significantly different than the current environment.

Environmental conditions of turbulence and temperature swings, as well as local likelihood for bio-fouling or mineral deposition, can vary considerably from site to site. Therefore, where the sensor is to be used for long-term monitoring, it is recommended that the calibration be initially checked frequently until a performance history is established.

Aqua4Plus provides an easy-to-use calibration calculator for performing one- or two-point in-field calibrations. Two-point calibrations are more accurate and should be used whenever possible. A Calibration Kit is available from INW, which includes a beaker, pipette, measuring beaker, and stand.



- In order for the TempHion Smart Sensor to calibrate and function correctly, the filling solution reservoir must be properly filled with reference solution. For details, refer to “Care of Filling Solution Reservoir” later in this application note.
- The sensor and all calibration buffers and solutions should be at the same temperature before and during calibration.
- Calibration can only be done when there are no sessions stored on the sensor. If there are any sessions stored on the sensor, upload any data you want and then erase the sessions before continuing. (Sessions Menu | Erase All Sessions).

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CALIBRATION INSTRUCTIONS

Field Calibration Window and Calculator

Field calibration is performed on each channel separately. To calibrate a specific channel, select Field Calibration from the Configure Menu, and then click on the channel to be calibrated. Refer to Appendix A in the *TempHion Smart Sensor Instruction Manual* for general use of the field calibration window and the calculator. Follow directions below for each specific channel type.

	First Point	Second Point	Cal Values
Ref ppm	<input type="text"/>	<input type="text"/>	M: <input type="text"/>
mV	<input type="text"/>	<input type="text"/>	I: <input type="text"/>
	<input type="button" value="Measure"/>	<input type="button" value="Measure"/>	<input type="button" value="Apply"/>

Field Calibration Calculator

Temperature Channel

The temperature channel rarely needs calibration. If needed, select Field Calibration from the Configure Menu. Click on Temperature, and then following the instructions on the screen.

pH Channels

Preparing

- INW recommends pH buffers of 4, 7, and 10 for calibration. For a one-point calibration, select the buffer closest to the expected values in your samples. For a two-point calibration, select the two buffers that most closely bracket the expected values in your samples.
- For best results, look up the buffer's actual pH for the temperature closest to the buffer temperature during calibration. This information is available from the buffer manufacturer.

One-Point Calibration

-- First Calibration Point --

- Prepare the buffer.
- Rinse sensor first with distilled water and then with small amount of the buffer.
- Place sensor in buffer. (Buffer must be deep enough to cover the sensing bulb in the slot in the black module on the sensor.)
- Allow time for sensor to stabilize.
- In the **Ref pH** box for the first point, enter the reference pH as noted in the preparation section above.
- Click first **Measure** button.
- When readings have stabilized to your satisfaction, click the **OK** button in the pop-up box.

-- Applying Calibration Values --

- Observe **I** value in the right hand section of the calculator. This should be between 180 and 300.
- Click the **Apply** button to apply calibration values.
- The reference value, the computed I, and the sample temperature will be transferred to the calibration fields.
- Click **OK** to save the values to the sensor.

-- Verifying Calibration Values --

- Using the Real Time Monitor, take a few readings while the sensor is still in the buffer. Be sure units are set to pH. Readings should be very close to your selected buffer.

Two-Point Calibration

-- First Calibration Point --

- Prepare first buffer.
- Rinse sensor first with distilled water and then with small amount of first buffer.
- Place sensor in buffer. (Buffer must be deep enough to cover the sensing bulb in the slot in the black module on the sensor.)
- Allow time for sensor to stabilize.
- In the **Ref pH** box for the first point, enter the reference pH as noted in the preparation section above.
- Click first **Measure** button.
- When readings have stabilized to your satisfaction, click the **OK** button in the pop-up box.

-- Second Calibration Point --

- Prepare the second buffer.
- Rinse sensor first with distilled water and then with small amount of second buffer.
- Place sensor in second buffer. (Buffer must be deep enough to contact stainless steel tube above the sensor section.)
- In the **Ref pH** box for the second point, enter the reference pH as noted in the preparation section above.
- Click second **Measure** button. (Note: measured temperature must be +/- 1 degree of first measured temperature or calibration will not be accurate!)
- When readings have stabilized to your satisfaction, click the **OK** button in the pop-up box.

-- Applying Calibration Values --

- Observe the **M** and **I** values in the right hand section of the calculator. **M** should be between -50 and -60, and **I** should be between 180 and 300.
- Click the **Apply** button to apply calibration values.
- The reference values, the computed M and I, and the sample temperature will be transferred to the calibration fields.
- Click **OK** to save the values to the sensor.

-- Verifying Calibration Values --

- Using the Real Time Monitor, take a few readings while the sensor is still in the buffer. Be sure units are set to pH. Readings should be very close to your selected buffer.

ISE Channels (Bromide, Chloride)

Introduction to ISE Calibration

INW recommends using the “known addition method” for preparing calibration solutions. Using this method, the sensor is placed in 100 mL of distilled or de-ionized water. A small amount of standard is added to create a known concentration. The first point is measured. An additional amount of the same standard is added to create a second known concentration. The second point is measured.

INW recommends the calibration standards listed below. The following instructions are based on using one of these standards. If you use different standards or prefer not to use the known addition method, you must use some other method to determine the concentration used for the first and second point when calibrating.

Recommended Standards

Bromide

- 0.1 Molar NaBr (equates to 7990 ppm)

Chloride

- 0.1 Molar NaCl (equates to 3550 ppm)
- 100 ppm
- 1000 ppm

Preparing

- Select a standard that you will be using for calibration.
- Place 100 mL of distilled water in a beaker.
*Note: Temperature of the water **must remain the same** throughout the calibration. Temperature of the sensor must also be this temperature prior to calibration.*

One-Point Calibration

-- Computing Calibration Value --

- Rinse sensor with distilled water and pat dry.
- Place sensor in beaker of distilled water, as prepared above. (Solution must be deep enough to cover the sensing buttons.)
- Add 1 cc of selected standard to the water. Depending on which solution you are using, this will result in a concentration as shown below:
 - 0.1 Molar NaBr (Bromide) = 79.10 ppm
 - 0.1 Molar NaCl (Chloride) = 35.15 ppm
 - 100 ppm (Chloride) = 0.99 ppm
 - 1000 ppm (Chloride) = 9.90 ppm
- Stir to distribute standard evenly.
- Allow time for sensor to stabilize (15 – 20 minutes).
- In the **Ref ppm** box for the first point, enter the concentration you have chosen.
- Click the first **Measure** button. (Readings will be in mV.)
- When readings have stabilized to your satisfaction, click the **OK** button on the pop-up box.

-- Applying Calibration Values --

- Observe the **I** value in the right hand section of the calculator. For Bromide, **I** should be between 0 and 40. For Chloride, **I** should be between 120 and 160.
- Click the **Apply** button to apply calibration values.
- The reference value, the computed I, and the sample temperature will be transferred to the calibration fields.
- Click **OK** to save the values to the sensor.

-- Verifying Calibration Values --

- Using the Real Time Monitor, take a few readings while the sensor is still in the standard. Be sure units are set to ppm. Readings should be very close to your selected concentration.

Two-Point Calibration

-- First Calibration Point --

- Rinse sensor with distilled water and pat dry.
- Place sensor in beaker of distilled water, as prepared above. (Solution must be deep enough to cover the sensing buttons.)
- Add 1 cc of selected standard to the water. Depending on which solution you are using, this will result in a concentration as shown below:
 - 0.1 Molar NaBr (Bromide) = 79.10 ppm
 - 0.1 Molar NaCl (Chloride) = 35.15 ppm
 - 100 ppm (Chloride) = 0.99 ppm
 - 1000 ppm (Chloride) = 9.90 ppm
- Stir to distribute standard evenly.
- Allow time for sensor to stabilize (15 – 20 minutes).
- In the **Ref ppm** box for the first point, enter the concentration you have chosen.
- Click the first **Measure** button.
- When readings have stabilized to your satisfaction, click the **OK** button on the pop-up box.

-- **Second Calibration Point** --

- Add 10 cc of the **same** standard to the water. Depending on which solution you are using, this will result in a concentration as shown below:
 - 0.1 Molar NaBr (Bromide) = 791.8 ppm
 - 0.1 Molar NaCl (Chloride) = 351.8 ppm
 - 100 ppm (Chloride) = 9.9 ppm
 - 1000 ppm (Chloride) = 99.0 ppm
- Stir to distribute standard evenly.
- Allow time for sensor to stabilize (15 – 20 minutes).
- In the **Ref ppm** box for the second point, enter the concentration you have chosen.
- Click the second **Measure** button.
- When readings have stabilized to your satisfaction, click the **OK** button on the pop-up box.

-- **Applying Calibration Values** --

- Observe the **M** and **I** values in the right hand section of the calculator. **M** should be between –50 and –60. For Bromide, **I** should be between 0 and 40. For Chloride, **I** should be between 120 and 160.
- Click the **Apply** button to apply calibration values.
- The reference values, the computed M and I, and the sample temperature will be transferred to the calibration fields.
- Click **OK** to save the values to the sensor.

-- **Verifying Calibration Values** --

- Using the Real Time Monitor, take a few readings while the sensor is still in the standard. Be sure units are set to ppm. Readings should be very close to your selected concentration.

Redox Channels



- Call INW for instructions the first time you calibrate a TempHion redox channel.
- Do not use an ORP standard for calibrating TempHion redox channels.

Note on units: The unit “Eh” refers to readings in millivolts referenced to a hydrogen electrode. In other words, Eh represents millivolt readings that would have been obtained if using a hydrogen electrode. The units “mV” are direct millivolt readings from the sensor.

-- **For Calibration You Will Need** --

- A beaker or bucket of a sample that is representative of what will be measured with the sensor.
- An alternate redox meter – such as an Orion or YSI meter.
- Distilled or deionized water.
- Paper towels.

-- **Computing Calibration Value** --

Note: When calibrating a redox channel, do not use the built-in calculator in the Field Calibration Window. Instead, follow the instructions below.

1. Rinse sensor with distilled or deionized water, and then pat dry with clean paper towels.
2. Place the sensor in sample. (Solution must be deep enough to cover the sensing bulb.)
3. Using the alternate meter, take a redox measurement of that sample. Use either plain mV or Eh, whichever you normally use.
4. In Aqua4Plus – set display units to either mV or Eh, whichever you used for the above step.
5. Scan for and click on the sensor.
6. Open the field calibration window (**Configure** | **Field Calibration**).

7. Click on the redox channel, and then enter a zero in the offset box.
8. Click **OK**
9. Take two or three single readings using the Real Time monitor and note the redox value.
10. Subtract this value from the value read in the step 3.

-- Applying Calibration Value --

11. Open the field calibration window.
12. Click on the redox channel, and then enter this value in the offset box..
13. Click **OK**.

-- Verifying Calibration Values --

14. Take another couple single Real Time readings. These should be close to the reading taken with the other meter.

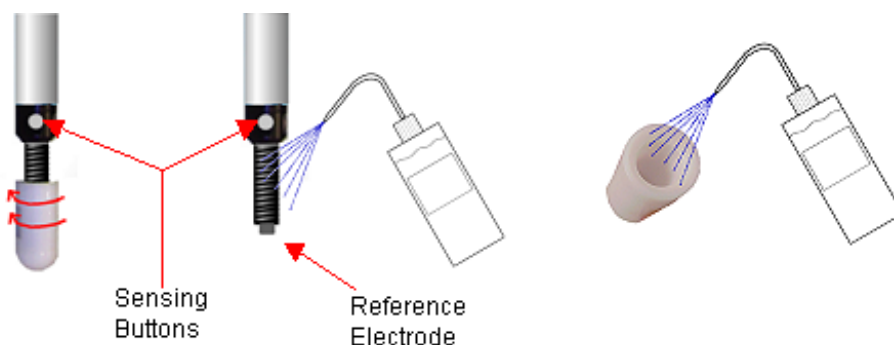
CARE OF FILLING SOLUTION RESERVOIR

The TempHion's patented reference electrode is key to the TempHion's superior performance. The TempHion uses a long capillary pathway, filled with reference solution, to separate the reference electrode from the solution being analyzed. Proper care and filling of this reference solution reservoir is essential to accurate functioning of the sensor.

The TempHion is normally shipped with a bottle of INW Reference Solution. If you will be using a different solution, contact INW for any adjustments that may be needed.

Emptying and Cleaning the Reservoir

The TempHion is shipped fully assembled with the reservoir empty and the reference electrode chemically clean and dry. If you have just received your sensor from INW, you will not need to empty the reservoir. You should still, however, follow the instructions below for cleaning the electrode and reservoir cap.



Rinsing the Electrode and Reservoir Cap

- Unscrew the reservoir cap. **Do not touch or scratch the sensing buttons or the reference electrode!**
- Empty any remaining filling solution from the cap.
- Thoroughly rinse the reference electrode and the inside of the cap with distilled or de-ionized water.

- There may be some crystallized residue inside the cap, on the electrode screw path, or on the electrode itself. If rinsing does not clear this away, then gently use a cotton swab or a soft toothbrush to remove the residue.
- Rinse the electrode assembly and cap thoroughly again after cleaning with the swab or brush.
- Gently, pat dry with a clean paper towel.

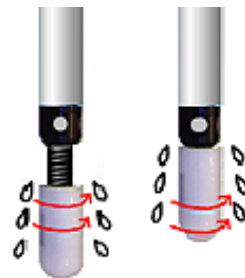
Filling the Reservoir

Once the reservoir has been emptied and cleaned, you are ready to fill the reservoir with reference solution.

- Rinse the reference electrode assembly and the inside of the cap with a small amount of the reference solution.
- Empty any remaining solution from the cap.
- Fill cap about half full with reference solution.
- Holding sensor vertically, replace reservoir cap. Some solution should spill from the top as you screw the cap on. This assures that no air bubbles are trapped inside.

If any air bubbles are trapped, a proper electrical connection cannot be made and the sensor may read erratically!

- Once filled, keep the sensor upright in liquid to prevent the solution from drying out. A 1 to 10 ppm dilute chloride solution is recommended, but tap water will do. If you cannot keep sensor in liquid, see instructions below for storing dry.



Excess filling solution spills over, forcing out any air bubbles.



CAUTION: Filling solutions are not considered hazardous, but they can be irritating to the skin. Protective gloves are advised. Rinse hands or gloves with fresh water.

Storing Sensor

For long-term storage, or when the sensor cannot be left in liquid, the sensor should be stored dry.

- Unscrew and empty the reservoir cap. **Do not touch or scratch the sensing buttons or the reference electrode!**
- Clean the cap and electrode assembly as detailed earlier in this application note.
- Let cap and electrode assembly dry thoroughly.
- Replace cap to protect electrode from scratching.

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