pH/ORP Electrode Care & Maintenance

Your pH or ORP electrode can be the most sensitive component of your pH/ORP measurement system. Correct calibration procedures combined with proper maintenance will provide years of reliable measurement.

Calibration

pH Electrodes - Since glass pH electrodes measure the H^+ (hydrogen ion) concentration (or activity) relative to their reference half-cells, they must be calibrated periodically to ensure accurate, repeatable measurements. It is important to use reliable pH Buffers to calibrate your pH electrode.

Calibration using one pH buffer (one-point calibration) typically involves a pH 7 buffer and only adjusts the offset of the electrode slope – either a default slope, or the previous slope stored in the meter memory. A multi-point calibration (2 buffers or more) ensures more accurate pH measurement since it adjusts the offset and the slope for that electrode. When possible, use pH buffers that bracket the expected pH range of the sample you will be measuring. It is often recommended to record the offset (mV value in a pH 7 buffer) of the pH electrode when it is put into service, then monitor that offset for the life of the electrode. When the offset becomes >±30mV, the electrode may need to be either cleaned, or replaced.

ORP Electrodes - ORP is the raw millivolt (mV) potential of the oxidation-reduction (redox) reaction of a solution. The ORP electrode has an output in millivolts, just like a pH electrode, but instead of being "renamed" as a pH unit (by the meter/controller software), it stays as a mV! You really can't calibrate a mV - it is a 1000th of a volt.

There are commercially available solutions that were designed to deliver a specific mV value (typically ±10mV). For example:

	ORP Check Solution mV Values using 3M KCl Reference (±10 mV)			
Temp (ºC)	**Zobell's Solution**	**Light's Solution**	**Quinhydrone + pH 4**	**Quinhydrone + pH 7**
10	243	447	268	95
15	236	453	268	93
20	228	462	265	87
25	221	469	261	82

NOTE: Using a 4M KCl Reference will cause these values to be 2-7mV higher in most cases.

That said, it is possible to “offset” an ORP Electrode’s reading to read more in line with expectations. This would require software or a program in the meter to allow you to “offset” or “rename” a mV value to a different mV value. This is not a very common feature set or mode, but it does exist. Also, keep in mind that this could be misleading if the solution being used was not prepared accurately, is expired or if the electrode was fouled, defective or past it’s useful life. A good guideline would be to consider this procedure only if the electrode was within ±10% of the typical value as shown in the table above.

Handling

During shipment it is possible for air bubbles to form in the glass pH sensing bulb. The presence of such a bubble can cause a host of problems on the meter display ranging from inaccuracy to instability, to no reading at all. To remove air bubbles, shake the electrode's sensing end down in the same manner as a clinical thermometer until the bubble is dislodged and the glass sensor bulb is filled with solution. This is not an issue for ORP Electrodes.

Rinse electrodes with DI water (distilled or deionized water) before and after measuring a sample. Blot the end of the electrode with lint-free paper to remove excess water. NOTE: Never wipe or rub the electrode to remove excess water - wiping can create static charges that interfere with correct pH measurement.

Conditioning

Upon receipt or before putting an electrode into service, remove and inspect the soaker bottle or protective cap covering the sensing end of the electrode. If you are certain that there was the proper type and volume of soaking solution in that protective covering, you can consider the electrode properly conditioned and ready for use. If you are uncertain of the solution type or there was no solution at all, place the electrode in a clean vessel containing a proper pH/ORP electrode soaking solution. The list below is some suggestions for pH/ORP soaking or storage solution in order of best, to just adequate:

- pH 4 Buffer Solution with Potassium Chloride (KCl) added to saturation
- pH 4 or pH 7 Buffer Solution
- 3M or 4M Potassium Chloride Solution (e.g. pH or ORP Electrode Fill Solution)

Soak the electrode for at least 30 minutes, or preferably longer, if had been dry for an extended period. NOTE: Never condition the electrode in distilled, deionized, or even tap water - long term exposure to pure water will damage the pH electrode's glass sensor, and leach electrolyte from the reference system.

Improper conditioning may involve the glass pH sensor not being properly "hydrated", or the reference junction not fully prepared for ion-sharing. For example, the pores of the reference junction may have dried potassium chloride crystals that need to be wetted to "recharge" the salt bridge function of the reference junction. Signs of improper conditioning may be:

1) Inaccuracy of a pH electrode soon after calibration
2) Unstable, erratic or extremely drifty readings
3) Lack of signal, or over-range situation if the reference junction is not working at all (meter dependent)

If it is likely that the electrode was stored dry for an extended period and the reference junction may be dried or have the crystal formation described above in the pores, soaking the electrode in warm soaking/storage solution (~50°C) may accelerate the reconditioning of the reference junction. However, prolonged drying conditions could severely damage the glass pH sensor.

After conditioning the electrode, rinse with DI water. The electrode is ready for calibration and measurement.

Storage

As mentioned in the conditioning section, the pH or ORP Electrode's sensing end should never be stored dry. Always maintain moisture at the sensor and reference junction. Proper electrode storage maximizes electrode performance and extends electrode life. It is best to store electrodes in clean containers filled with pH/ORP soaking or storage solution, such as a sealing soaker bottle, protective cap, or a beaker. Oftentimes a soaker bottle will have a sponge or cotton ball in the bottom – the purpose of the sponge is to maintain some solution in the event of a spill. However, it is best to store the electrode with solution present. Do not store an electrode in DI water - this will cause ions to leach out of the pH glass sensing bulb and the reference junction, destroying the electrode over time.

Improper storage will cause the same type of issues mentioned in the improper conditioning situations mentioned above.

Cleaning

The solution used to clean pH/ORP electrodes depends on the presence of possible contaminants. pH/ORP electrodes may show slow response due to sensor coatings or reference clogging. Use the guide below to choose the appropriate cleaning solution options:-

- For general cleaning: Soak the pH/ORP electrode in 0.1 M HCl or 0.1 M HNO_3 for 20 minutes. Alternatively, an ORP electrode's platinum or gold sensor plate or band can be swabbed with an isopropyl or ethyl alcohol if convenient. Rinse well in DI or tap water before use.
- For removing stubborn deposits and bacteria: Soak the pH electrode in a 1:10 dilution of household laundry bleach for 10 minutes. Rinse thoroughly with DI or tap water before use.
- For removal of oil and grease: Rinse the pH/ORP electrode in mild detergent or methyl alcohol. Alternatively, an ORP electrode's platinum or gold sensor plate or band can be swabbed with an isopropyl or ethyl alcohol if convenient. Rinse well in DI or tap water before use.
- For removal of protein deposits: Soak the pH electrode in a solution containing 1% pepsin and 0.1M HCl for 15 minutes to 1 hour depending on how dirty it may be. Rinse well in DI or tap water before use. (NOTE: Pepsin is readily available as a powder form a lab supply house).
- Also refer to the warm soaking solution method in the conditioning section to restore a clogged or crystallized reference junction.

CAUTION: Proper eye and skin protection must be used when handling strong chemicals.

After any of the cleaning procedures, it is good practice to thoroughly rinse the electrode with DI water, recondition, and recalibrate the electrode. If the electrode is a refillable type, drain and refill the reference chamber with fresh fill solution prior to use.