IonX Low Maintenance Portable Electrodes

Basic Care Items

- This electrode contains a specially formulated filling solution that should not require “topping off”. The “Minimum Solution Lever” mark should be used to indicate the correct fill level if the solution is topped off or replaced.
- Rinse off dirt and mud from the ceramic tip after each use (keep the ceramic tip clean)
- Replace the ceramic tip’s plastic cover after each use (helps maintain the solution level)

For maximum reliability IonX portable electrodes must be returned to M. C. Miller Co. **Annually** for recertification. The certification date is printed on the front box flap.

M. C. MILLER ELECTRODE CALIBRATION TEST

DERIVATION OF CALIBRATED ELECTRODE POTENTIAL VALUE

A particular test procedure is used for each manufactured reference electrode, regardless of the electrode type (Ag/AgCl or Cu/CuSO4).

The test procedure involves measuring the potential difference between a manufactured electrode and a Fisher Scientific Ag/AgCl Standard Electrode. The filling solution in the Fisher Scientific electrode is 4M KCl (saturated with AgCl). The electrolyte that we use for the shop test is our facility's tap water (typical conductivity is 500µS/cm) and we keep the separation between the electrodes in the electrolyte "bath" at 2 inches. Also, the electrolyte temperature is maintained at 22°C, as are the solution temperatures in the manufactured electrodes and the Fisher Scientific reference electrode.

With regard to maintaining consistency of the half-cell potential of our "Standard" reference electrode, we replace the Fisher Scientific electrode every 6 months with a newly-purchased electrode.

Interpretation of Test Data:

Since the reference electrode used in the calibration test (Ag/AgCl electrode having a 4M KCl filling solution) has a half-cell potential of approximately 200mV versus a Standard Hydrogen Electrode (SHE), the half-cell potential of a manufactured electrode versus SHE becomes the test result **plus** 200mV.

For example, if a test result of 115mV is obtained from a copper/copper sulfate reference electrode, the electrode potential will be indicated as, 315mV versus SHE, on the Calibration Certificate.

INSTRUCTIONS & MAINTENANCE

IonX Portable Electrodes are shipped complete and arrive "ready-to-use".

Here are some important Do's and Don'ts

- Do not remove the ceramic tip.
- Do not attempt to remove the (black) PVC component (top piece) from the (orange) Lexan tube. Unlike conventional portable electrodes, the copper rod assembly is not designed to be removed from the Lexan tube, since, the rod assembly in the case of an IonX electrode is an integral part of a sealed unit.
- Store the electrode either right-side up (ceramic plug pointing down) or horizontally. Do not store the electrode upside-down (ceramic plug pointing up) – this prevents the ceramic plug drying out.
- Keep the plastic cover over the ceramic plug when the electrode is not in use (reduces electrolyte (liquid) evaporation rate).
- Do not use a ceramic tip that has been pre-soaked in copper sulfate solution (such as the ceramic tip from a conventional portable electrode) as the Electrode Solution could become contaminated and this would also defeat a major purpose of the IonX electrode which is to eliminate operator (and soil) contact with toxic copper sulfate
- If the electrode has not been in use for some time and prior to embarking on a survey, it is recommended that after removing the plastic cover the ceramic tip be briefly run under tap water (or briefly dipped into a water source).
- If the soil surface is dry, wet the plug/soil contact area with water to provide better electrical contact.

If for any reason the ceramic tip must be replaced, the electrode should be returned to MCM for re-certification. Field replacement could compromise the electrode's calibration value.

Using an IonX electrode to check the calibration of a regular RE Series electrode

M. C. Miller's criterion requiring that the potential difference between two RE Series electrodes be less than ±5mV in order for a service electrode to be declared "calibrated" with respect to a non-service electrode, does not apply in the case of an IonX electrode.

IonX electrodes are pre-constructed and are supplied with a Certificate of Calibration. The electrode potential is quoted on the Certificate versus the Standard Hydrogen Electrode (SHE) potential. The electrode potential of an IonX electrode will be in the range, 316mV ±10mV versus SHE, which is the manufacturer's tolerance range for this type of electrode.

IonX electrodes are designed for field (service) use, however, if an IonX electrode is used to check the calibration of a regular RE Series electrode, an understanding of what a potential difference reading means in such a case, is required.

Example:

Let's say that an IonX electrode has an electrode potential, as indicated on its Certificate of Calibration, of 321mV versus SHE, which is a potential within the manufacturer's specified range. Now, let's say that a potential difference reading of 8mV is recorded in tap water between the IonX electrode and a service RE Series electrode. This means, in this example, that the potential of the service electrode is 313mV (321mV – 8mV) versus SHE, assuming that the IonX electrode was connected to the positive side of the voltmeter and the service electrode was connected to the negative side of the voltmeter.

Since the accepted electrode potential of a copper/saturated copper sulfate electrode is 316mV versus SHE, the service electrode potential in this example is within 3mV of the "Standard" value, which would be very acceptable (313mV compared to 316mV).

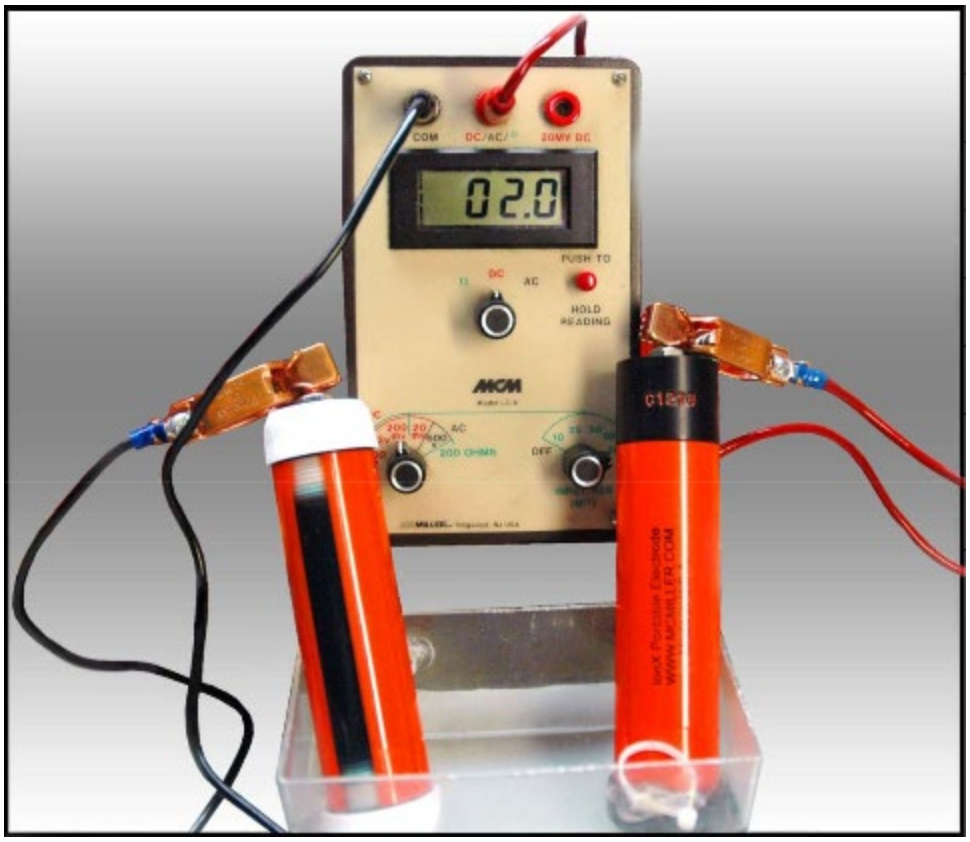
Consequently, the service electrode should be considered to be "calibrated" in this example. However, since the potential difference between the IonX and the service electrode was measured as 8mV, the service electrode would not have been declared calibrated by application of the ±5mV criterion.

So, if an IonX electrode is to be used to check the calibration of a service electrode, the first step is to check the electrode potential value quoted on its Certificate of Calibration, and, based on the potential difference reading, determine the potential of the service electrode and compare that value to the "Standard" 316mV value.

Example Test Set Up

An example calibration test set up is illustrated in the photograph below, which shows an example IonX electrode (Serial # C1218), together with a regular RE-5C electrode, with their ceramic tips immersed in tap water. The IonX electrode is connected to the positive side of the

voltmeter and the regular RE Series electrode is connected to the negative side of the voltmeter. Note: The solutions inside both electrodes should be allowed to stabilize to room temperature.



Since the IonX electrode potential was quoted as -318mV versus SHE on its Calibration Certificate, and, since the voltmeter reading (potential difference reading) was indicated as 2mV (see the LCD in the above photograph), the electrode potential of the RE-5C electrode, in this example, would be inferred to be -316mV versus SHE (-318mV plus 2mV).

However, had the Calibration Certificate for the IonX electrode indicated an electrode potential of, say, -325mV versus SHE, the voltmeter reading would have been 9mV (rather than 2mV), in the case of this specific RE-5C electrode (-325mV plus 9mV = -316mV).