Orion pH, ORP and ISE Applications

Extreme pH or High Salt Content
Recommended Electrodes
Separate pH and Reference Electrodes Orion 91-01 and 90-02 or 81-01 and 80-03 or 80-05U
Sure-Flow® Combination Electrodes Orion 82-72, 81-72, 81-65, 81-75, 91-72, 91-65
Acid Fluoride (HF) Resistant pH Electrode Orion 93-01 and 90-02
AquaPro Orion 91-04AP

Viscous Samples
Recommended Electrodes
Sure-Flow Epoxy Bodied Combination Electrodes Orion 81-65, 81-75, 91-65
Sure-Flow Glass Bodied Combination Electrodes Orion 82-72, 81-72, 91-72
Rugged Bulb Combination Electrodes Orion 91-61 and 90-01, 91-01 and 90-01
pHuture™ Sure-Flow FET Probes Orion 61-57, 61-58, 61-78, 61-75, 61-65, 61-66, 61-79
AquaPro Orion 91-02AP, 91-03AP, 91-04AP, 91-15AP, 91-35AP, 91-56AP

Non-Aqueous Solutions
Recommended Electrodes
ROSS Sure-Flow Combination Electrodes Orion 82-72, 81-72
Low Resistance Electrodes Orion 91-61 and 90-02, 91-62
AquaPro Orion 91-02AP, 91-03AP, 91-04AP, 91-15AP, 91-35AP, 91-56AP

pH Applications

Choosing the right electrode for a particular application may be as simple as choosing an epoxy bodied electrode for field work or a semi-micro electrode for small samples. However certain samples require specific electrode types to avoid errors due to drift or clogged junctions. The most common difficult samples, observed problems and recommended electrodes are listed below.

Extreme pH or High Salt Content

- Common Problems: Slow Response, Drift.

Samples of extreme pH or high salt content pose special problems for the reference portion of the electrode. Orion filling solutions are formulated for best performance within a pH range of 2 to 12, and when the ionic strength of the sample is less than 1.0 M. Outside of those conditions, a liquid junction potential forms due to incompatibility of the sample and internal filling solution causing drift and slow response. Using a reference or combination electrode with a double junction should alleviate any problems because the flow rate is more uniform. Alternate techniques are available for extreme pH and brine solutions; contact our Technical Service Chemists for more information. The new Orion AquaPro electrodes with their isolated reference system and non-clogging junction are also recommended for these samples.

Viscous Samples

- Common Problems: Difficulty Stirring, Sample Carryover, Electrode Breakage.

Difficulty stirring is a problem that cannot be avoided. If at all possible, stirring is recommended. However, if stirring is abandoned altogether, the pH buffers used for calibration should not be stirred. Note that the electrode response will be slower if the samples are not stirred. Glass electrodes break easier in viscous samples. Using an epoxy bodied or rugged bulb electrode may lessen the occurrence of breakage. Viscous samples “cling” to the electrode surface. Thorough rinsing with Orion cleaning kits or distilled water is recommended. Using a sleeve or Sure-Flow junction simplifies electrode cleaning and rinsing. The new Orion AquaPro electrodes with their isolated reference system and non-clogging junction are also recommended for these samples.

Non-Aqueous Solutions

- Common Problems: Unstable Readings and Drift, Long Response Times, Measurement Errors.

Unstable readings and drift are commonly observed in non-aqueous solutions because of the high resistance (low conductivity) of the sample solution. A pH electrode membrane constructed from low resistance glass alleviates the problems. Orion ROSS Ultra™ and Orion ROSS™ electrodes use a sensing bulb with lower resistance than most electrodes. If problems persist, a small amount of inert salt (e.g. a quaternary ammonium salt, may be added to increase the sample solution’s ionic strength). Addition of a salt will affect the hydrogen ion activity, causing a shift in the pH. However, the error will be small versus a drifting pH reading. (The salt should be relatively pure and free of contamination). Slow response and drift are also attributed to dehydration of the sensing glass. Effectively there is not enough hydrogen ion to cover the sensing surface and create a stable potential. Frequent soaking in storage solution, Orion 910001, or a pH buffer will rehydrate the sensing bulb for improved performance and stability. Errors in pH measurement occur if the non-aqueous sample adheres to the glass surface and carries over to other samples. Rinsing the electrode with a solvent that dissolves the sample material, like acetone, followed by resoaking in storage solution will prevent sample contamination. (Epoxy body electrodes should not be used in highly polar organic solvents because the solvent breaks down the electrode construction). Large liquid junction potentials can occur because the sample and internal filling solution are not similar in composition and diffusion rates. This may result in continuous drift. An electrode with a uniform flow rate, such as a double junction or Sure-Flow design, should be used. Commonly used buffers are based on an aqueous system. Calibrating with aqueous buffers and measuring a non-aqueous sample is similar to comparing apples and oranges. It is essential that the solvent backgrounds of the buffers and samples are similar for a more effective measurement. The development of a pH scale for a particular non-aqueous solution is recommended, but the development is a formidable task. Alternate pH scales for non-aqueous solutions are cited in literature, such as pH standard values for methanol and water buffers. Measurement in non-aqueous solutions such as benzene, heptane and other similar solvents are extremely difficult due to severe liquid junction potentials, drift and noise. Alternate techniques are available; contact our Technical Service Chemists for more information. The new Orion AquaPro electrodes with their isolated reference system and non-clogging junction are also recommended for these samples.