

Orion pH, ORP and ISE Theory

Sensing Electrode

Several types of sensing electrodes are commercially available. They are classified by the nature of the membrane material used to construct the electrode. It is the difference in membrane construction that makes an electrode selective for a particular ion.

Glass Electrode

The most familiar type of sensing electrode, a glass membrane is routinely used for measuring pH and some ions, such as sodium.

ROSS Ultra™ and ROSS™ Electrodes

The Orion ROSS Ultra pH, ROSS pH and ROSS Sodium Electrodes are glass electrodes with a patented internal system that eliminates electrode drift due to temperature variations. ROSS electrodes are available in both half-cell and combination system designs. These electrodes are very stable and have fast response.

AquaPro Professional Electrodes

The Orion AquaPro Professional series offers performance a cut above standard Ag/AgCl pH electrodes, because of its patented reference system and double junction design. The double junction design isolates the silver from the sample and allows the electrode to be used in samples typically not recommended for standard pH electrodes. The AquaPro electrodes are the choice of anyone who is looking for stability and minimal maintenance in challenging samples.

ORP Electrodes

ORP (Oxidation / Reduction Potential) measures the oxidizing or reducing nature of a sample. This gives an overall indication of how "reactive" the sample is. ORP measurements are becoming more common in water, wastewater, process water and plating baths as well as other applications.

Thermo Electron offers several types of Orion ORP electrodes, from standard platinum electrodes to ORP Triodes™, which measure both ORP and temperature together, to multi-parameter probes, which measure pH, ORP and temperature or pH, ORP, conductivity and temperature. Accurate ORP measurements are temperature dependent, therefore the Triodes and the multi-parameter probes are ideal. Thermo also offers a ready-to-use ORP standard, which is both convenient and safe.

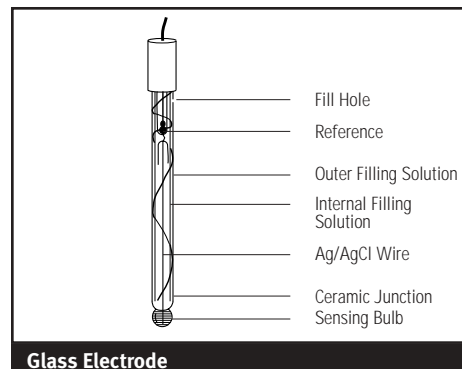
pHuture™ Ion Selective Field Effect Transistor (ISFET)

This type of electrode contains a transistor coated with a chemically sensitive material to measure pH in solution and moist surfaces. As the potential at the chemically active surface changes with the pH, the current induced through the transistor varies. A temperature diode simultaneously monitors the temperature at the sensing surface. The change in current and temperature are correlated by the pH meter to a temperature compensated pH reading. Orion pHuture probes utilize ISFET for fast response and durability.

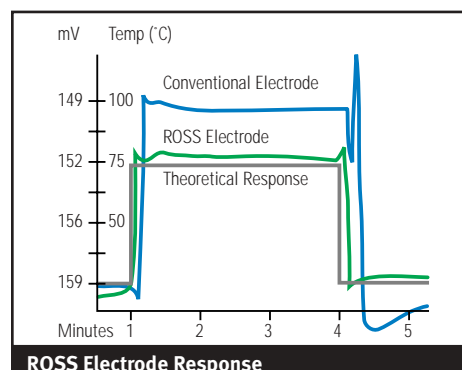
The Orion pHuture Pentrode™, the world's first pH, ORP, Conductivity, Temperature probe in a standard electrode body, was selected as a Year 2000 R&D Top 100 award winner. This exciting product features two way communication between the sensor and the pHuture MMS™ meter and allows two parameters plus temperature to be viewed and all data to be logged simultaneously from the same sample! The planar conductivity 4-electrode cell technology offers fast response and accurate measurement. Other pHuture probes offer Sure-Flow® non-clogging junctions to keep the sensor clean in dirty, viscous samples.

Solid State Electrode

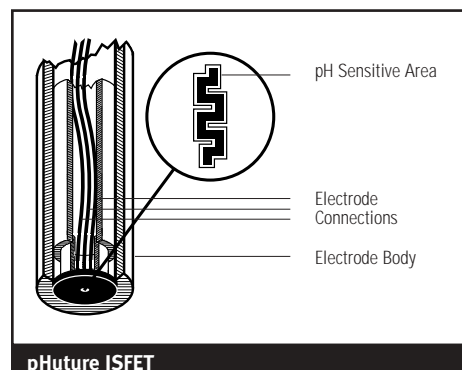
This sensing membrane is made of a uniform or homogeneous solid substance. The Orion 94 Series half-cell and Orion 96 Series ionplus® combination electrodes allow for many measurements such as chloride, bromide, iodide, and fluoride. The 96 Series ionplus electrodes also incorporate the Sure-Flow® reference system which provides fast response in an easy to clean design.



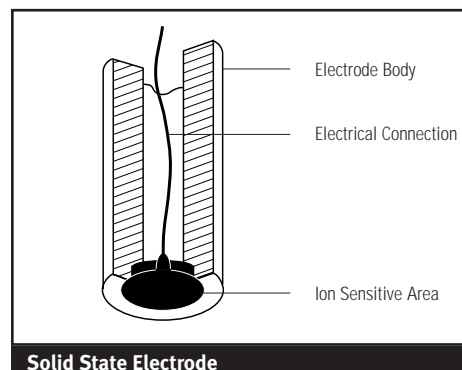
Glass Electrode



ROSS Electrode Response

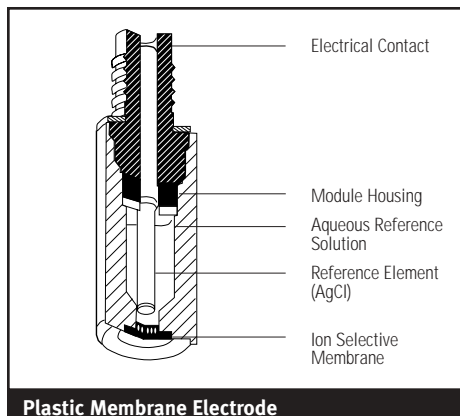


pHuture ISFET



Solid State Electrode

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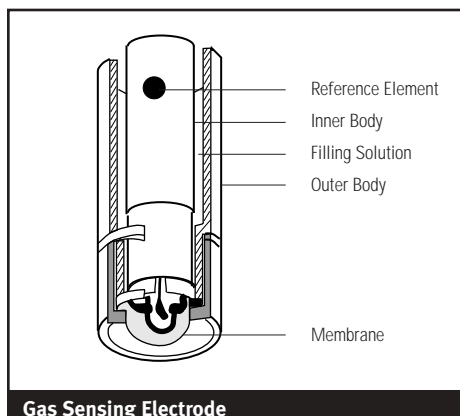


Plastic Membrane Electrode

This type of electrode has an ion exchange material contained in a solid plastic membrane. The sensed ion is exchanged across the membrane, creating the potential. Both the Orion 93 Series half-cell and Orion 97 Series ionplus® combination electrode systems measure calcium, potassium, nitrite, nitrate, as well as other species. These electrodes feature a replaceable sensing membrane module, allowing the user to easily rejuvenate the electrode. The Orion 97 Series ionplus combination electrode use this module as part of the exclusive patented Sure-Flow® reference system.

Gas Sensing Electrode

This electrode responds to dissolved gases in solution. The dissolved gas diffuses across the membrane into a small volume of buffer, specific for each electrode. Reaction of the gas with the buffer causes a pH change sensed by an internal glass pH electrode. Because the reference element is built-in, a separate reference electrode is not necessary. Carbon dioxide and ammonia are among the species measured by this type of electrode.



Sure-Flow Combination Electrode

The ionplus Series of combination electrodes illustrates how the use of combination electrodes provides an easy-to-use and maintain measurement system with superior performance abilities. Both the Solid State 96 Series and Plastic Membrane 97 Series ionplus electrodes employ the Sure-Flow junction, which provides the most stable and reproducible reference potentials in an easy-to-clean design. In the 97 Series ionplus electrodes, the replacement module acts as part of the reference system design unique to Orion electrodes. Easily rejuvenate the sensing membrane and reference junction by simply replacing the module. The ionplus flat surface design allows measurement of small sample volumes as little as 5 mL. Reducing the solution volume saves precious sample, plus lowers chemical usage and waste. The Orion Optimum Results™ series of filling solutions used with ionplus electrodes contain little or none of the ion of interest to prevent contamination of the sample, which is especially important in low-level analyses. Optimum Results filling solutions also minimize reference junction potentials, producing a faster and more stable electrode response. Effects on measurement accuracy from sample ionic strength, temperature and background matrix are reduced when using Optimum Results filling solutions. Having small temperature coefficients, these solutions prevent electrode potential shifts due to changing sample temperatures. With other electrode systems, a 1 °C change in sample temperature can lead to measurement errors greater than 4%. Using Optimum Results, the same change in temperature produces less than 2% error with ionplus electrodes. By formulating the solutions to meet specific application conditions, Optimum Results solutions improve the ionplus electrodes' response time and accuracy.

