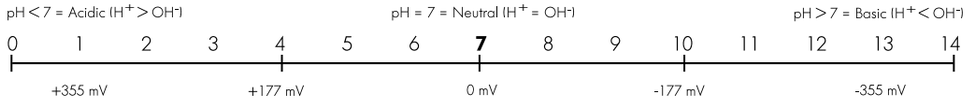
Technical Reference Section: pH/ORP

Information in this section addresses frequently asked questions regarding pH & ORP and is provided as REFERENCE ONLY to supplement procedures and recommendations specifically outlined in individual product instruction manuals. All manuals, data sheets, and additional helpful information are available at **www.gfsignet.com.**

Definition of pH

pH is defined as the negative logarithm of the Hydrogen ion concentration in aqueous solutions. The common pH scale ranges from 0 to 14, with 7 being neutral water (H_2O). At pH 7, Hydrogen ions (H^+) exist in equal concentration to Hydroxyl ions (OH^-). A solution is considered to be acidic if the concentration of H^+ exceeds that of OH^-, and is indicated by pH values below 7. Conversely, a solution is considered to be basic if the concentration of H^+ is less than that of OH^-, and is indicated by pH values above 7.

pH Scale



(Theoretical: 59.16 mV/pH @ 25°C)

Common Acids

1M HCl: 0.0 pH
Sulfuric Acid: 0.3 pH
Lemon Juice: 2.0 pH
Vinegar: 3.0 pH
Wine: 3.5 pH
Beer: 4.5 pH
Milk: 6.0 pH

Common Bases

Egg Whites: 7.5 pH
Seawater: 8.0 pH
Sodium Bicarbonate: 8.4 pH
Ammonia: 11.6 pH
Photo Developer: 12.0 pH
0.1M NaOH: 13.0 pH
Lye: 14.0 pH

Definition of ORP

ORP is an abbreviation for **O**xidation-**R**eduction **P**otential. Oxidation is a term used to denote the occurrence of a molecule losing an electron. Reduction occurs as a molecule gains an electron. The "potential" is simply an indication of a solution's propensity to contribute or accept electrons. ORP reactions (sometimes referred to as REDOX) always take place simultaneously. There is never oxidation without reduction, and ORP electrodes are used to detect electrons exchanged by molecules as these reactions occur.

Both pH and ORP electrodes produce voltages that depend on the solutions in contact with their sensing ends. Most pH electrodes, including the +GF+ SIGNET brand, are designed to produce 0 mV at pH 7, positive mV below pH 7 (associated with the charge of the Hydrogen ion, H^+) and negative mV above pH 7 (associated with the charge of the Hydroxyl ion, OH^-). According to the Nernst Equation, the interval between each pH unit is approximately 59.16 mV at 25°C. This "raw" output is converted to a pH value by the display instrument. The ORP scale is typically -1000 mV to +1000 mV, and the electrodes produce these values directly.

Whereas pH is a specific measure of the Hydrogen ion concentration in solution, ORP only provides relative measures of chemicals and cannot discriminate one from another. Although non-specific, it is a very useful and inexpensive method of monitoring and controlling the activity of such compounds as chlorine, ozone, bromine, cyanide, chromate, and many other chemical reactions.

It is worth noting that Temperature Compensation, very important for accurate pH measurement, is NOT used in ORP measurements. Temperature does indeed affect the reactionary potential of all chemicals, some to a greater extent than others. But even if the affects of temperature could be precisely known in all of the many different REDOX reactions, it would not be desirable to remove them from the measurement. True ORP is the direct measurement of electrons in transit during Oxidation-Reduction reactions, regardless of temperature.