TECHNICAL NOTES

Conductivity in Water

Conductivity in Water Defined

Electrical conductivity, or specific conductance, refers to how well a medium conducts electricity. We know that water conducts electricity, which is why we don't go swimming during a thunderstorm or use a hair dryer in the bathtub. However, water is not a good conductor of electricity on its own. In order for water to conduct electricity, there must be ions present. The electrical conductivity of water is often measured in industrial and environmental applications as an easy, inexpensive way to determine the number of ions present.

Electrical Conductivity Units

There are several different conductivity measurement units in use today. When measuring in conductivity units we will often use either siemens or mhos; these units are equivalent, e.g. one microsiemen = one micromho. The term mho is actually derived from the unit of measure for resistivity, the ohm. When working with ultrapure water the measurement is typically referenced in ohms, with ultrapure water often referred to as 18 megohm water.

Conductivity measurements are often converted into TDS units, salinity units, or concentrations. This might be parts per million (ppm), parts per thousand (ppt) or percent i.e a 10 percent hydrochloric acid solution.

How to Measure Salinity and TDS

The conductivity measurement units you use will depend on your location and the conventions of your application. Each industry has a preferred unit of conductance. Note that TDS (expressed in mg/L or ppm) actually refers to the number of ions present, not the electrical conductivity. However, as mentioned previously, electrical conductivity is often used to measure the number of ions present. TDS meters measure electrical conductivity and convert the value to a reading in mg/L or ppm. Electrical conductivity is also an indirect way to measure salinity. When measuring salinity, units are typically expressed in ppt. Some conductivity instrumentation comes pre-configured with the option to measure salinity if desired.

Note that conductivity measurements are dependent on temperature and ionic species present.

How to Convert Conductivity to Concentration

The conversion between conductivity and TDS or salinity depends on the chemical composition of the sample. TDS measurements are typically used for environmental monitoring, where most dissolved solids are ionic. Different ions produce different values of electrical conductivity. Since TDS meters rely on a single conversion factor for different ionic species, measured TDS values will almost always be slightly different from true TDS values. In order to determine concentration from conductivity, the ionic composition of the solution must be known.

- 1 S/m = $s^3 * A^2 / kg * m^3$ where s is second, A is ampere, kg is kilogram, m is meter
- 1 mho/m = 1 S/m (siemens per meter)
- 1 EC = 1 µS/cm = 1 x 10^{-6} S/m
- 1 CF = 10 EC = 10 µS/cm = 1 x 10^{-5} S/m
- ppm_{500} = 500 x (conductivity in mS/cm) (USA)
- ppm_{640} = 640 x (conductivity in mS/cm) (Europe)
- ppm_{700} = 700 x (conductivity in mS/cm) (Australia)
- 1 mg/L = 1 ppm (assuming that the density of water is 1.00 g/mL)

Conductivity in Water Treatment

Different applications require different levels of water purity. As an example, the electrical conductivity of drinking water will usually be less than 1 mS/cm. Meanwhile, the semiconductor and pharmaceutical industries require extremely pure water, with an even lower electrical conductivity value than drinking water. The conductivity of pure water used in such applications is typically less than 1 µS/cm.

6007 S. Railroad Street Burlington, WI 53105 USA 262.716.0105 technical@intell-i-watch.com.
© 1991–2026 Pan America Environmental, Inc. · Intell-i-Watch, A Pan America Environmental Brand