

# Conductivity Theory

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Conductivity is the ability of a solution to conduct electric current. The principle by which instruments measure conductivity is simple - two plates are placed in the sample, a potential is applied across the plates and the current is measured. Generally, the potential is in the form of a sine wave. Conductivity is determined from the voltage and current values according to Ohm's Law:

$$G=1/R=I \text{ (amps)}/E \text{ (volts)}$$

Since the charge on the ions in solution facilitates the conductance of electrical current, the conductivity of a solution is proportional to its ion concentration.

**NOTE:** Some solutions may not show a direct correlation to concentration, ionic interactions can alter the linear relationship between conductivity and concentration in some highly concentrated solutions like sulfuric acid.

The basic unit of measurement for conductivity is the siemens (S). Since cell geometry affects conductivity values, standardized measurements are expressed in specific conductivity units (S/cm) to compensate for variations in electrode dimensions.

Conductivity measurements are temperature dependent. The degree to which temperature affects conductivity varies from solution to solution and can be calculated.

Most conductivity electrodes only have two plates, usually made of platinum or carbon (graphite). The four plate or 'Bull's Eye' design results in higher accuracy for measuring pure water.

The following shows optimum conductivity ranges for cells of three different constants:

CELL CONSTANT	OPTIMUM CONDUCTIVITY RANGE (uS/cm)
0.1	0.5 to 400
1.0	10 to 2,000
10.0	1000 to 200,000

Conductivity electrodes should be calibrated using a standard solution before using. When selecting a standard, choose one that has the approximate conductivity of the solution to be measured. After using the probe for some time, you might consider cleaning the plates with a mild liquid soap or acetone - **NOTE:** Do not use abrasive materials in cleaning.

## APPLICATIONS

- o Boiler blowdown
- o Reverse osmosis
- o Rinse baths
- o Waste water treatment
- o Desalination
- o Level Detection
- o Salinity testing
- o TDS testing
- o Water treatment