

## Electrodeless Conductivity Measurement

### Introduction

Conductivity measurements must often be made in solutions that will coat, foul or plate the surface of conventional electrode-type (contacting) conductivity sensors. When measuring solutions over 10,000 microSiemens/cm with conventional electrode-type sensors, large cell constants must be used. These sensors have small electrode surface areas and, consequently, are very susceptible to fouling and polarization, causing inaccurate measurements. Electrodeless conductivity sensors were developed to solve these problems.

### Operation

The electrodeless conductivity sensor operates by inducing an alternating current in a closed loop of solution, and measuring the magnitude of this current to determine the conductivity of the solution. As shown in Figure 1, the conductivity analyzer's oscillator circuit

drives Coil 1 (transmitter). Coil 1 then induces an alternating current in the solution to be measured. This AC signal flows in a closed loop through the sensor bore and surrounding solution. Coil 2 (receiver) senses the magnitude of the induced current, which is measured by the analyzer electronics and processed to display the corresponding reading.

Electrodeless conductivity sensors eliminate common problems associated with contacting-type conductivity sensors that use graphite or metal electrodes exposed to the process. Oily fouling, process coating or non-conducting electrochemical plating are no longer concerns.

BI electrodeless conductivity sensors do not have contacting electrodes, and can be used in solutions as low as 0-200 microSiemens/cm with temperatures of 0-125°C. All BI electrodeless conductivity measurement systems are automatically temperature compensated over this range.

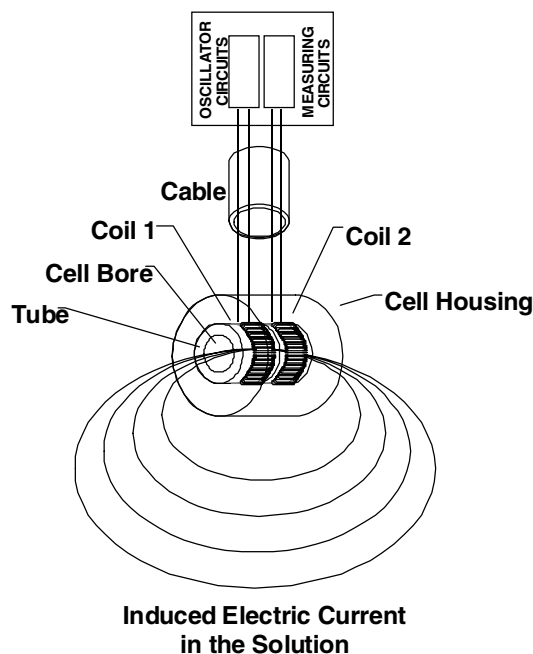


FIGURE 1 -- Electrodeless Conductivity Measurement Operating Details

## Applications

Typical applications for electrodeless conductivity sensors include measuring concentrations of acid, caustic or salt solutions. Note the curve for HCL in Figure 2. Both 9% and 34% concentrations of HCL are approximately 600,000  $\mu\text{S}/\text{cm}$ . The conductivity of HCL increases as concentration increases up to approximately 19% where it then decreases. Since two different HCL concentrations can have the same conductivity value, the measuring range must be restricted so that it does not cross the 19% concentration point. If possible, the instrument range should be confined to a linear portion of the concentration curve. Otherwise non-linear scales are required. **Note:** When measuring solutions have the same conductivity value for more than one concentration, the instrument can only be used to measure that specific portion of the curve between a minimum and maximum value.

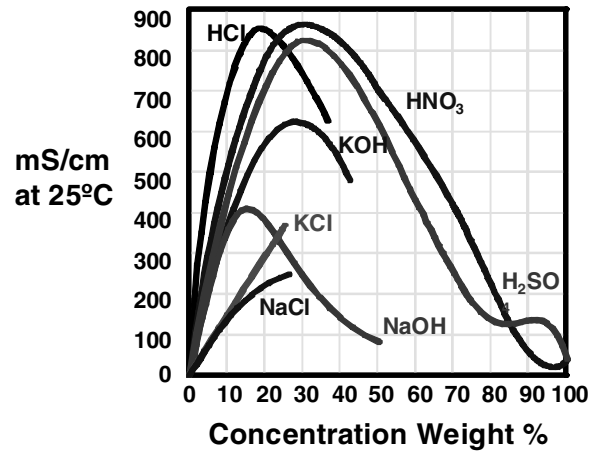


FIGURE 2  
Acid, Caustic, and Salt Solution  
Concentrations versus Conductivities