

Theory of Operation

This instrument allows conductivity measurements without any electrical contact between electrodes and process fluid. The measurement is based on inductive coupling of two toroidal transformers by the liquid.

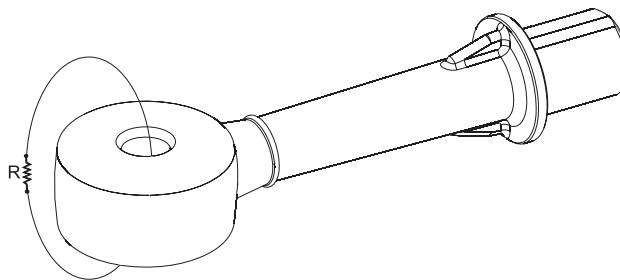
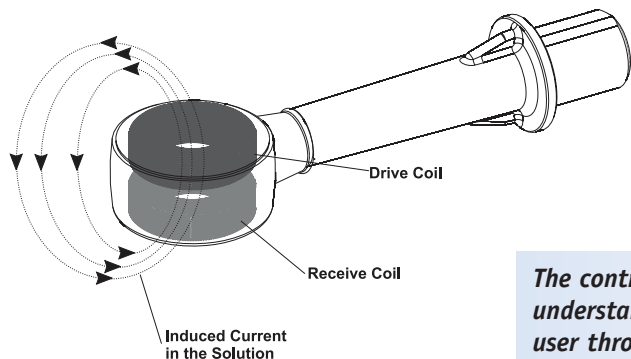
The instrument supplies a high frequency, reference voltage to the "Drive Coil", and a strong magnetic field is generated in the toroid.

The liquid passes through the hole in the toroid and can be considered as one turn secondary winding. The magnetic field induces a voltage in this liquid winding, the current induced in the flow is proportional to this voltage, and the conductance of the liquid one-turn winding is in accordance to Ohm's law.

The conductance is proportional to the specific conductivity and a constant factor determined by the sensor geometry and installation.

The liquid also passes through the second toroid and therefore the liquid turn can be considered as a primary winding of the second toroidal transformer. The current in the liquid will create a magnetic field in the second toroid, and the induced current can be measured as an output.

The output current of this "Receive Coil" is therefore proportional to the specific conductivity of process liquid.



For an inductive cell, the cell constant is defined as the measured conductivity, obtained by making a loop through the sensor with a resistor R, multiplied by that R value.

The cell constant depends only on the sensor geometry. However, when the probe is immersed in a liquid, the induced current in the solution is affected by the piping or any other container where the probe is inserted. This effect is negligible when there is an area of at least 3 cm of liquid around the cell.

Otherwise, it is necessary to multiply measurements by the installation factor: $\text{Conductivity} = (\text{cell constant})(\text{installation factor})/(\text{measured resistance})$. The installation factor is < 1 for conductive piping/containers, and > 1 for nonconductive piping/containers.

Since this type of sensor has no electrodes, common problems such as polarization and contamination are eliminated and will not affect the performance of the electrodeless sensor.

The controllers are equipped with a graphic display that is understandable and straightforward. Simple messages guide the user through all operations and parameter settings.