



Dispersion Technology Inc.

Characterization of Concentrated Dispersions and Emulsions, Liquids and Porous materials

Model DT- 700: Non-aqueous Conductivity Probe.



Model DT-700 is a stand alone instrument for measuring electric conductivity of low polar (alcohols) down to completely non-polar liquids (toluene, hexane, etc) within the range of 7 orders of magnitude. This measurement can be used for studying ionic composition of such liquids, which affects many properties of the liquids, emulsions and dispersions. Consequently, this instrument is suitable for the quality control of these properties.

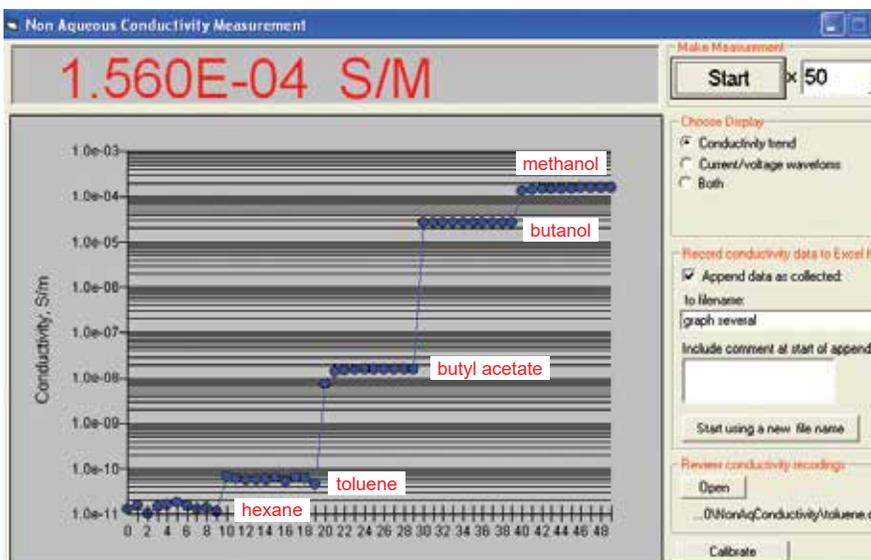
This instrument design eliminates several problems existing in previous instruments of the same purpose.

First of all it works within the full range of the conductivity without using different sub-ranges as previous designs.

Secondly, conductivity probe by itself can be easily taken apart and then re-assembled, which simplifies cleaning.

Thirdly, user has ability to calibrate probe by himself using measurement of toluene, liquid with well defined dielectric permittivity.

Finally, Windows based software allows displaying results of multiple measurements, which is important for tracking time dependences. All results can be saved to Excel files.



Principles of Operation:

The measuring cell consists of an outer and inner coaxial cylindrical electrode, as well as a guard electrode to eliminate leakage paths between the two. The outer electrode can be unscrewed from the body of the probe to facilitate cleaning of messy samples as shown in the figure below.

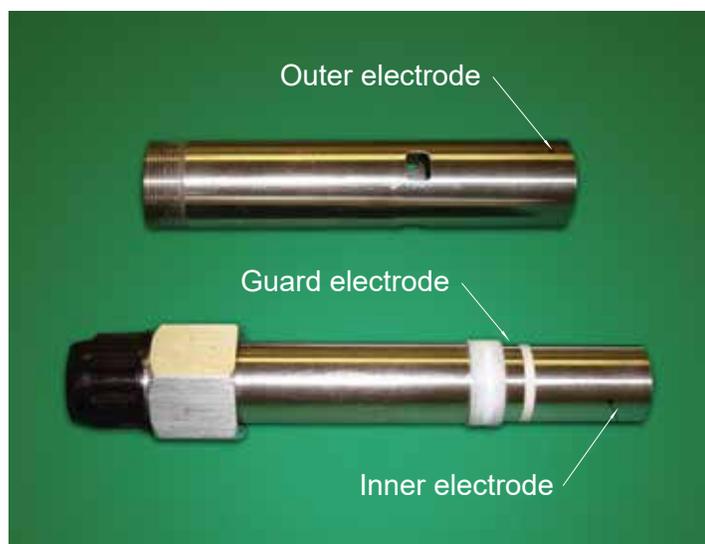
During a measurement the instrument applies a sinusoidal voltage to the outer electrode and measures the current that flows through the sample to the inner electrode. The frequency of this applied voltage is changed depending on the measured conductivity. The lowest conductivity samples are measured at 1 Hz, the highest ones at 10 Hz. The required sine wave voltage values are computed vs. time and converted to an actual voltage by a Digital to Analog converter. This voltage, after suitable filtering, is then connected to the outer electrode, simultaneously measured with an Analog to Digital converter, and optionally displayed in the application window on the Display.

The current is measured with a log amplifier, so no “range selection” is required by the user as was common in older designs. At the same time that the voltage waveform is being applied to the outer electrode, the output signal from the log amp is captured by a second channel of the Analog to digital converter. The desired

current waveform is calculated from the captured logamp values by performing an inverse log calculation. This log/ inverse log technique allows measurements to be made over many decades of current without the need for any range selection switches. The amplitude and phase of both the voltage and current waveforms is then computed from the first order Fourier coefficients of the respective waveforms. The Complex Conductance of the cell contents is then computed from the current voltage ratio. Finally the specific conductivity of the sample material is determined by computing the real part of the complex conductance and then multiplying by a cell constant that is determined by the geometry of the cell.

Cell constant is determined with calibration that employs toluene as a liquid with well known dielectric permittivity 2.38. It is assumed that cell constant for dielectric permittivity measurement of toluene is identical to the cell constant that is required for correcting for geometry of electric field lines during conductivity measurement.

Results of multiple measurements for several liquids are shown on front page Figure illustrating DT-700 software screen.



Nominal Specifications:

Range available for conductivity measurement is 7 orders of magnitude: from $10E-11$ to $10E-4$ S/m.

Precision equals to $\pm (1\% + 10E-11 \text{ S/m})$ over the complete range.

Physical Specifications.

Weight: electronic unit 5 kg, Power: 100-250 VAC, 50-60 Hz, <300 W. Software: embedded Windows XP.