

CONDUCTIVITY

The basic unit of resistance is the ohm, conductance is reciprocal of resistance, its basic unit of measurement is the mho (International System of units for mhos is Siemens [S]).

The resistance of a conductor is inversely proportional to its cross sectional area and directly proportional to its length. In the measurements of aqueous solutions, conductivity is based on the reciprocal of the resistance of a 1-Cm cube or material measured between opposite faces. This being a Cell constant of 1. Conductivity Cells usually consist of two metallic plates of a determined size mounted in a defined area. The Cell constant "K" is the length "L" (or distance between the plates) of the conducting path in centimeters divided by the effective cross sectional area "A" of the conducting path in square centimeters ($K=L/A$).

The Model 604 is designed to use a Cell with a "K" between 9 and 11.

Conduction in aqueous solutions is by ionic movement and increases with temperature. This change is expressed in percent per degree 'C' relative to 25°C and is called the slope of the solution.

The Model 604 has "Automatic Temperature Compensation" for Slope correction.

The Total Dissolved Solids (TDS) in an aqueous solution that provides conduction is not temperature sensitive, as is the conductivity. By multiplying conductivity by an empirical factor, TDS may be displayed. This empirical factor is determined by the components and temperature of the solution. When the conductivity has been corrected to 25°C, this factor is usually between 0.5 and 0.7. The Model 604 allows standardization with scale factors as low as 0.45 for direct display of TDS in parts per million.

CONDUCTIVITY STANDARDS

Approximate Normality	Weight of KCl in grams/1000 grams of Solution	Conductions in Micromhos @25°C
1.	71.1352	111,342.
.1	7.41913	12,856.0
.01	.745263	1,408.77

MAKING CONDUCTIVITY & TDS MEASUREMENTS with The Model 604

I. Cell Constant determination

Power "ON" (Lo Batt not on)
Cell connected
Function to A.T.C. "ON"
Range to "2000" **mu**

Using three samples of the 718 **mu** standard solution (shipped with the Model 604), held at 25°C, dip the cell into the first solution. Allow the cell to temperature equilibrate to the standard solution. Withdraw cell and dispose of excess solution. Do not touch or wipe off the cell. Repeat this process in the second solution. Place the cell in the third solution for measurement. Measurement is to be made once cell is in the third solution. This reading will be most accurate if the measurement is made as soon as the cell is dipped in the third solution. Readings may change in some cases due to gases or other impurities absorbed from the atmosphere. Using the calibration tool set the standardize control to display .718. By changing the Function Switch to the standardize position, the constant may be read directly from the display. (example: 9.96; 10.00; 10.04). The instrument is now ready to make precise conductivity measurements. In making measurements of unknown solutions, select '200,000' on Range Switch, ATC "ON" with Function Switch. Using three samples of the 'unknown solution', rinse the cell in the first sample solution.

Allow the cell to temperature equilibrate in the solution. Withdraw cell and dispose of excess solution. Do not touch or wipe off cell. Repeat this process in the second sample solution. Place the cell in the third solution for measurement. Measurement is to be made as soon as cell is in the solution. Having selected the appropriate range for reading, record same.

II. Total Dissolved Solids (TDS)

Select the scale factor for TDS of the solution to be measured (Example: one gram per liter of KCl [1000 ppm] will yield a conductivity of 1793 micromhos, $1000/1793=.55772$) multiply the scale factor (.55772) by the cell constant previously determined (Example: $.55772 \times 10.04$ equals 5.6). With Function to 'STANDARDIZE', Range to '2000' adjust front panel standardize so the display reads the product of TDS scale factor and cell constant (5.6).

Make TDS measurements in the appropriate range with ATC 'ON' or the solution at 25°C. The reading of the digital display multiplied by the selected range on the Instrument will be parts per million of TDS in the solution.

CELLS

525 527 / 545

The standard Dip Cell and 23198-022 Flow Cell are coated with sponge black platinum. This coating gives the plates additional effective surface area required for good linearity. Should any part of this coating be removed in any way the cell will be nonlinear and produce erroneous readings. Replatinizing will be necessary.

515 517 / 535

The 23198-016 Dip Cell and 23198-018 Flow Cell have Gold plated plates and have much less tendency to carry over solution from one measurement to the next, as do the platinum cells. The linearity of the Gold (Au) Cells are not guaranteed above 5,000 micromhos.

INTRODUCTION

The Model 604 is a Digital Reading Conductivity Instrument. It features three modes of operation, two for the measurement of solution conductivity over a 0 to 200,000 micromho range in six ranges, and one for standardize. The standardize provides verification of proper operation and provides Scale Factor adjustments for Cell constant and Total Dissolved Solids. The conductivity, TDS measurement data is displayed on a 3½ digit LCD Digital Readout.

BRIEF CIRCUIT DESCRIPTION

A sine wave voltage is applied to the drive plate of the cell. The amplitude of this voltage is determined by the range selected, and/or A.T.C. "ON" or "OFF." The range selected provides one of three different voltages. One voltage for 200,000 & 20,000, another for 2,000 & 200, the third for 20 & 2. With Reference to A.T.C. "OFF" is selected. Selecting A.T.C. "ON" provides a voltage varying, inversely, as to temperature of the solution. This varying voltage compensates for the change in conductivity of the solution across a temperature range of 5°C to 45°C. (See reference to 'SLOPE' in this manual). The current through the solution to the sense plate of the cell is converted to a voltage by the input summing amplifier. This amplitude variable voltage is rectified by a phase sensitive synchronous demodulator, is then filtered and becomes the input to the A to D converter.

SPECIFICATIONS

MEASUREMENT RANGE AND RESOLUTION

mu FULL SCALE	RESOLUTION in mu
2.00	.001
20.00	.01
200.00	.1
2,000.00	1.0
20,000.00	10.0
200,000.00	100.0

INSTRUMENT ACCURACY

Instrument measurement @25°C and plus or minus a Digit Count.

2 Micromho (Full Scale)	.20%
20 Micromho (Full Scale)	.15%
200 Micromho (Full Scale)	.10%
2,000 Micromho (Full Scale)	.10%
20,000 Micromho (Full Scale)	.15%
200,000 Micromho (Full Scale)	.30%

TEMPERATURE COMPENSATION

5 to 45°C—all ranges with reference temperature of 25°C.

For Technical Support, Contact: Amber Science, Inc. (541) 345-6877
in Eugene, Oregon USA or via e-mail : info@amberscience.com

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SLOPE

The Slope correction for the Model 604 is set to an average of .1, .01, & .001 M of the following solutions: Potassium Chloride; Sodium Chloride; Ammonium Chloride; Lithium Chloride; Potassium Nitrate. The following is a representation of that average:

Temperature	Slope	Curve Trace Accuracy
5°C	1.88%/°C	-0.4%
10°C	1.91%/°C	0
15°C	1.94%/°C	+0.2%
20°C	1.97%/°C	+0.2%
25°C	2.00%/°C	0
30°C	2.03%/°C	-0.2%
35°C	2.06%/°C	-0.2%
40°C	2.09%/°C	0
45°C	2.12%/°C	+0.4%

DISPLAY

.5 inch high LCD, 3½ digit, dual slope A/D Converter, 2,000 digits full scale with fixed decimal. Displays '1' for over-range. Display is updated approximately three times per second.

ENVIRONMENTAL LIMITS

Temperature: 5 to 45°C

Humidity: 5 to 90% (Relative, Non Condensing)

POWER REQUIREMENTS

Nine volt Battery (Eveready #522 or equivalent—Nine Volt Transistor Battery). Battery life is approximately 200 hours, with "Lo Batt" indicator illuminating when there is approximately 20 hours of operation remaining. Battery life is independent of range selected and/or solution being measured. An AC Adaptor may be employed as a remote power source if desired (Note: In the event an AC Adaptor is employed, the battery is to remain in the Conductivity Meter, and connected.)

RANGES

The Model 604 has a fixed decimal point. Description of the ranges are as follows:

Ranges	Full Scale
A or 2	0-1.999 micromhos
B or 20	0-19.99 micromhos
C or 200	0-199.9 micromhos
D or 2,000	0-1999. micromhos
E or 20,000	0-19.99 millimhos
F or 200,000	0-199.9 millimhos

THE MODEL 604 HAS A FIXED DECIMAL POINT. THE DECIMAL IS CORRECT IN THE 'A' OR 2 RANGE. WHEN YOU READ THE DISPLAY IN THE 'B' OR 20 RANGE RANGE YOU MUST MULTIPLY THE READING BY 10 AND SO ON. SEE BELOW:

RANGE	MULTIPLY BY	FULL SCALE
A OR 2	1	0 - 1.999 MICROMHOS
B OR 20	10	0 - 19.99 "
C OR 200	100	0 - 199.9 "
D OR 2000	1000	0 - 1999. "
E OR 20,000	10,000	0 - 19.99 MILLIMHOS
F OR 200,000	100,000	0 - 199.9 MILLIMHOS