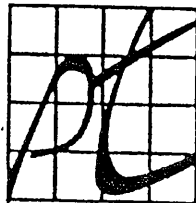


COFFEE TEST METER

Model DP-17

PRESTO-TEK



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DESCRIPTION

The Model DP-17 is a two-range conductivity instrument used to measure the quantity of soluble solids in the coffee beverage and the quantity of total dissolved solids in water. It is temperature compensated from 55°F to 200°F. This is a portable battery powered instrument using a standard 9-volt transistor battery. A 3000-Hz oscillator and amplifier provides a balanced AC signal to the sensor. The sensor electrodes are mounted in a remote probe attached to an 18-inch cable for maximum utility. The case and probe are molded ABS plastics, and the instrument, excluding probe, measures overall only 8" x 3" x 2½". It weighs a total of 10 ounces.

The meter scale is calibrated in both percent solids in solution for measurement of the coffee beverage and in parts per million for measurement of water. An extraction grid is also super-imposed above the instrument scale. By indexing the extraction grid to the actual coffee-to-water ratio used in the beverage preparation, the extraction percentage can be determined within a given range.

When measuring the water used in the coffee beverage preparation, the instrument measures the TDS, total dissolved solids, as parts per million (ppm). This reading can also be converted to ppm of NaCl, CaCO₃, or micromhos by using Table II in this manual.

The range of the instrument for measuring percent solids in solution for the coffee beverage runs from 0% to 1.5%, covering a coffee-to-water ratio up to 4.00 ounces of coffee per 60 fluid ounces of water. The range of the instrument for measuring total dissolved solids in water runs from 0 ppm up to 1000 ppm which is the normal range of most metropolitan water systems.

The meter is provided with three controls and an adjustment for indexing the extraction grid. There is a test button for water and coffee tests and a three-position switch labeled B, W, & C, which stand for battery, water and coffee, respectively. The third adjust is labeled zero for zeroing-out the water conductivity when performing the coffee test.

OPERATION

The DP-17 Coffee Conductivity Meter measures the conductivity of both water and coffee in the range of 0 to 2700 micromhos.

The DP-17 incorporates a fixed resistor for instrument calibration and battery tests. To check the battery and electronics, depress the "Test" button. The pointer reads low, it is an indication of low battery voltage. Replacement is accomplished by removing the four corner screws in the bottom of the case, then lifting the cover to expose the battery. Replace with an equivalent 9-volt transistor battery. The battery life should be from six months to one year. In the event the battery replacement does not correct the calibration error, see calibration instructions, or return instrument to Presto-Tek for repair and calibration.

It is important that the electrode surfaces be kept clean. After use, the probe should be rinsed in distilled water. **DO NOT ALLOW COFFEE, NOR TAP WATER TO DRY ON THE ELECTRODES.** Calibration should be performed about every three months regardless of the battery condition.

The electronics employs four operational amplifiers in a single integrated circuit package. These amplifiers perform the functions of oscillator, buffer amplifier, temperature compensation, and meter driver. The voltage applied to the sensor is less than one volt AC. The corresponding low ion current helps to keep electrodes clean and trouble free.

Temperature compensation is accomplished with a thermistor located in the center projection between the sensor electrodes. Over the temperature range of 55 to 200 degrees F, the accuracy is 2% of full scale. The temperature response is approximately 15 seconds.

CALIBRATION PROCEDURE

To calibrate the DP-17, a standard test solution of 1000 ppm is required. This may be ordered direct from the Presto-Tek Corporation, and is available in pint or quart plastic bottles. Since the electronics and scales readout linearly, a single point calibration is adequate.

Calibration should be performed at least every 3 months. Prior to calibration a battery test should be performed, and if

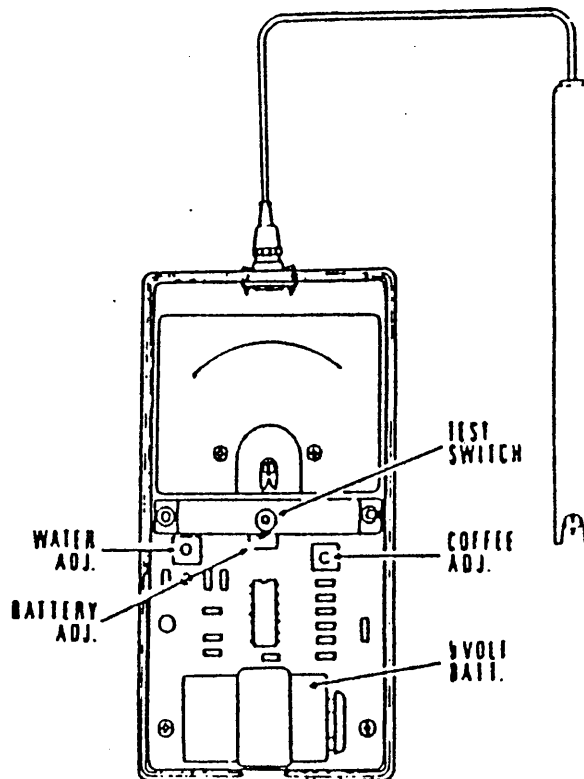
the meter does not indicate in the black at mid-scale, a new battery should be installed.

Remove the four corner screws on the bottom of the case, then remove cover to provide access to the three adjustment potentiometers shown in the outline drawing below.

Use a clean plastic or glass cup with the calibration solution. First calibrate for the water conductivity by switching the selector switch on the cover to the W (water) position. With the probe tip in the test solution, depress the test switch at least 15 seconds for the temperature compensation to react. Using a small screwdriver slowly turn the water adjust potentiometer until the meter reading corresponds with the value of the calibration solution or 1000 ppm.

Next, calibrate for coffee conductivity by setting "Zero knob" to the far right or clockwise, rotate the selector switch to the "C" coffee position; push test switch button and adjust coffee adjust potentiometer as marked in drawing. for a reading of .85% coffee solids.

OUTLINE DRAWING



Finally, rotate the selector switch to the B(battery position) and adjust the battery potentiometer until the meter reads in the black area at center scale. The test switch must be depressed to accomplish the three potentiometer adjustments.

Your DP-17 is now calibrated and ready for testing.

TESTING PROCEDURE

Step #1 — Water Analysis

- a. At the completion of the coffee brew preparation, pull off one cup of water from the coffee brewer.
- b. Measure and record the Total Dissolved Solids, using the coffee conductivity meter in the following manner:
 - (1) Check the battery.
 - (2) Set the selector switch to the "W" (water) position.
 - (3) Place the probe in the water and allow 15 seconds for the automatic temperature compensation to take effect.
 - (4) Push the test button and read the lower scale as "ppm" (parts per million) Total Dissolved Solids.
- c. When measuring the water used in the coffee beverage preparation, the instrument measures the total dissolved solids, TDS, in parts per million. This reading can also be converted to ppm of NaCl, CaCO₃, or micromhos by using Table II in this manual.

Step #2 — Soluble Solids Analysis

- a. Measure and record the coffee solids in solution using the coffee conductivity meter in the following manner:
 - (1) Turn the selector switch to the "C" (coffee) position.
 - (2) With the probe in the *water* sample previously tested and by using the Zero Knob, manually adjust the instrument reading to "0" while pressing the "Test" button.

NOTE: It is necessary to eliminate the effect of the solids dissolved in the water to accurately measure the dissolved solids contributed solely by the coffee. The Zero Knob is connected to a potentiometer in the circuit which compensates for the additional conductivity of the water. Use of the Zero Knob then allows the instru-

ment to measure only the soluble solids extracted from the coffee.

- (3) Place the probe in the coffee sample and allow 15 seconds for the temperature compensation to take effect.
 - (4) Press the "test" button and read the upper scale as "percent solids in solution."
- b. Conductivity can be used effectively to measure the soluble solids in coffee because the ratio of ionized coffee solids to total coffee solids remains constant throughout the relevant range of coffee brewing formulas and coffee blend types.

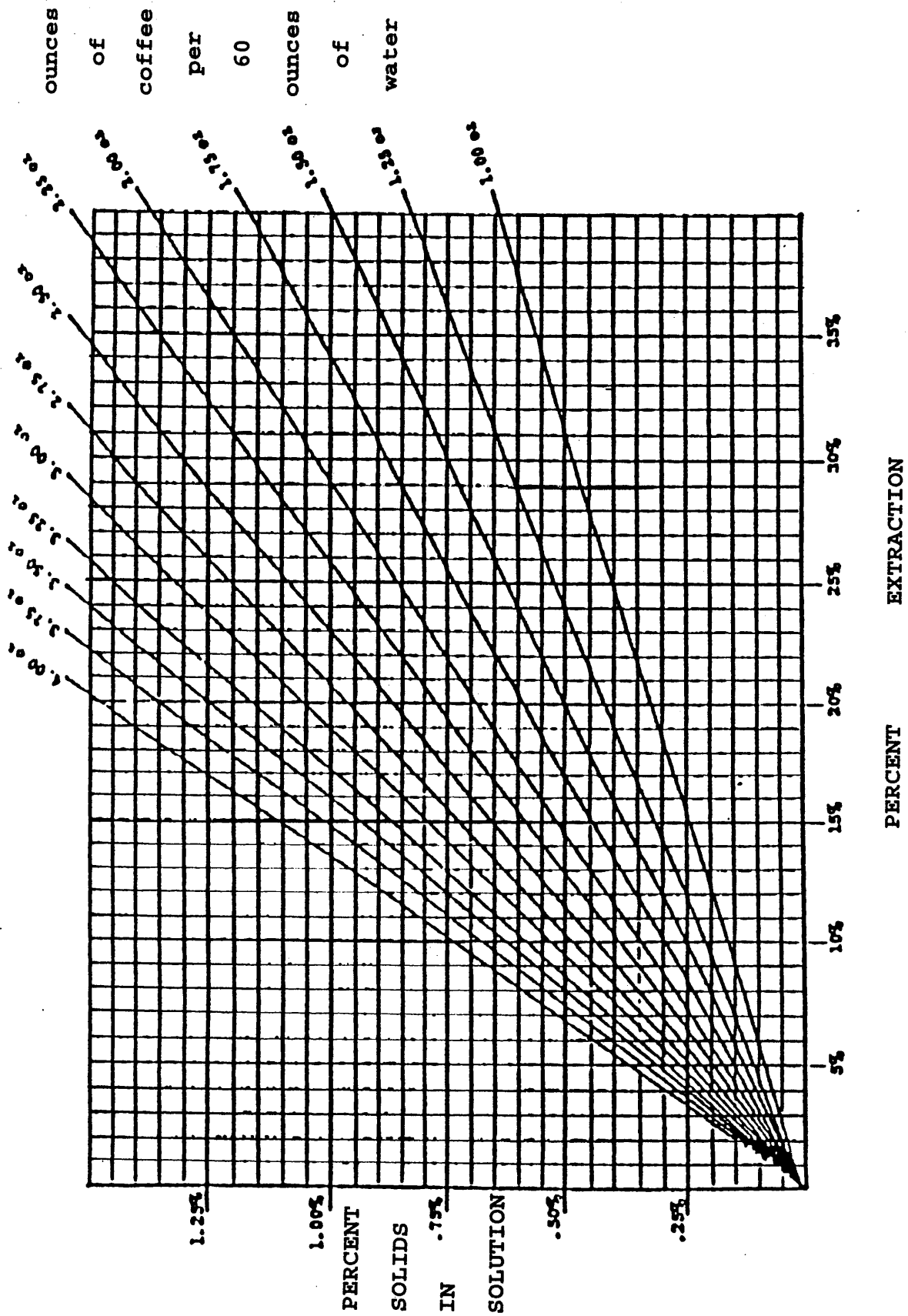
Step #3 — Percent Extraction Analysis

- a. Compute the extraction percentage, using the graph on the following page of the manual in the following manner:
 - (1) Using the percent solids in solution reading from the upper scale of the coffee conductivity meter, find the percent solids in solution point on the left-hand scale of the graph
 - (2) Follow a *horizontal* line across the graph to the right until the line intersects the diagonal line of the brewing formula used for the preparation of the coffee beverage.
 - (3) At the intersection of the horizontal and diagonal lines, follow a *vertical* line down to the "percent extraction" scale on the bottom of the graph.
 - (4) Read the "percent extraction" at the bottom scale.
- b. The Brewing Formulas indicated by the diagonal lines on the graph have been calculated in terms of ounces of coffee per sixty (60) fluid ounces of water.
- c. For quick visual estimate of the extraction percentage, the Extraction Grid may be utilized. Instructions in the use of the Extraction Grid may be found on page 8.

Reading Beyond the Range of the Instrument

If the instrument "pegs out," it means that the water or coffee sample being tested is beyond the range of the meter. To double the range, mix $\frac{1}{2}$ sample with $\frac{1}{2}$ distilled or deionized water. Then multiply the reading by two (2). To triple or quadruple the range, cut the sample with $\frac{2}{3}$ or $\frac{3}{4}$ distilled water, then multiply the reading by three (3) or four (4), respectively.

BREWING FORMULAS



Care and Cleaning of the Electrodes in the Probe

It is recommended that the electrodes be rinsed in distilled water before and after each test to prevent the accumulation of "coffee tars" (amino acids) on the electrode surfaces. **DO NOT** use any abrasive cleaners on the electrodes. Dry with Kleenex or Kimwipes after using. The electrodes must be clean for the instrument to record accurate readings. Periodic cleaning of the electrodes may be accomplished by using a mild detergent and a tooth brush, followed with a distilled water rinse.

Optional Instrument Carrying Case

The instrument case and probe are ABS injection molded plastic, and the internal circuits are completely solid state, which allows for a reasonably rugged instrument. However if the instrument is dropped or banged around while being transported, or if the electrodes or thermistor in the probe are broken or damaged, the coffee conductivity meter will not function properly. It is, therefore, strongly recommended that an Instrument Carrying Case be purchased to protect the instrument when it is not in use.

EXTRACTION GRID

The Extraction Grid provides a quick, visual estimate of the percentage extraction of soluble coffee solids, based on the actual coffee-to-water ratio used during the beverage preparation.

To use the grid, first index the grid to the appropriate brewing formula. This is accomplished by rotating the arrow below the grid until it is lined up opposite the appropriate ounces of coffee mark on the Brew Formula scale. The scale is marked in increments of .25 ounces of coffee in a range of 1.00 ounce through 4.00 ounces of coffee. The Brew Formula is calibrated in units of ounces of coffee per sixty (60) fluid ounces of water.

With the Extraction Grid in position, the middle of the grid corresponds to a 20% extraction rate. The Extraction Grid has been divided into three (3) extraction ranges: "Lo" — low range; "M" — middle range; and "Hi" — high range. The actual extraction percentage within each range will vary slightly, depending on the coffee-to-water ratio used during the beverage preparation. The actual ranges of the Extraction Grid for each specific Brew Formula are listed in Table I.

For example, if a coffee-to-water ratio of 3.00 ounces of coffee per 60 fluid ounces of water is used for the beverage preparation, the red arrow on the Extraction Grid would be rotated to align with the "3" on the Brew Formula scale. If when the coffee was tested, the instrument pointer fell in the "M" range of the Extraction Grid, with a reading of 1.05% solids in solution, this would indicate that the percentage of extraction of the coffee was between 19.5% and 20.5%.

CONVERSION TABLE

TDS instruments that are used for the determination of dissolved solids in water are basically water conductivity measuring instruments. The fact that the quantity of dissolved solids in parts per million by weight is directly proportional to conductivity in micromhos per unit volume, makes possible the use of a conductivity measurement to indicate the amount of dissolved solids in a water sample. Table II shows the relationship of sodium chloride and calcium carbonate in parts per million vs. conductivity in micromhos. The average drinking water contains other dissolved solids as well as sodium chloride. These have a higher weight per ion and, therefore,

are higher in parts per million for a given conductivity value. TDS meters are calibrated to more closely approximate municipal water characteristics. Table II shows the TDS calibration vs. Micromhos, which is the accepted calibration used for conductivity instruments.

SAMPLE DILUTION

If the conductivity exceeds the range of the instrument, the sample may be diluted with distilled or deionized water. To reduce the conductivity by a factor of ten, add 1 part of sample solution to 9 parts of distilled water. Test the combined solution and multiply readings by ten.

Example:

1 oz of 30,000 u mho solution
 9 oz of distilled water

10 oz Total

Conductivity of combination = 3,000

$3,000 \times 10 = 30,000$ u mhos

TABLE I

Brewing Formula Oz of Coffee	Extraction Ranges, %		
	Lo	Mid	Hi
4.00	18.0-19.5	19.5-20.5	20.5-22.0
3.75	18.0-19.5	19.5-20.5	20.5-22.5
3.50	18.0-19.5	19.5-20.5	20.5-22.5
3.25	18.0-19.5	19.5-20.5	20.5-22.5
3.00	17.0-19.5	19.5-20.5	20.5-23.0
2.75	17.0-29.5	19.5-20.5	20.5-23.0
2.50	17.0-19.5	19.5-20.5	20.5-23.0
2.25	17.0-19.5	19.5-20.5	20.5-23.0
2.00	16.5-19.0	19.0-21.5	21.5-24.0
1.75	16.5-19.0	19.0-21.5	21.5-24.0
1.50	16.0-18.5	18.5-22.0	22.0-24.5
1.25	15.0-18.0	18.0-22.0	22.0-25.0
1.00	14.0-18.0	18.0-22.0	22.0-26.0

TABLE II

TDS PPM	u mmhos	NACL PPM	CACO ₃ PPM
10,000	15,000	8,400	7,250
6,660	10,000	5,500	4,700
5,000	7,500	4,000	3,450
4,000	6,000	3,200	2,700
3,000	4,500	2,350	2,000
2,000	3,000	1,550	1,300
1,000	1,500	750	640
750	1,125	560	475
666	1,000	490	420
500	750	365	315
400	600	285	250
250	375	175	150
100	150	71	60
66	100	47	40
50	75	35	30
40	60	28	24
25	37.5	17.5	15
6.6	10	4.7	4

WARRANTY

The Model DP-17 meter is fully warranted for a period of one year, as to defects in material or workmanship. Equipment returned is prepaid to the factory. If in the opinion of the factory, failure was due to material or workmanship, repair or replacement will be made without charge and returned at no charge. A normal service charge will be made for repairs made due to mistreatment, normal wear, or made on equipment out of warranty.