MHO ..... ℧

MILLIMHO ..... ℧ m

MICROMHO .... ℧ mm

The numbers on a KELWAY salinity tester are "millimhos" and you can forget the rest of the details. On the other hand if you ever run into these other terms you will be able to make the conversion to millimhos. On later model SSTs a second scale appears showing PPM for measuring water or nutrient solutions (parts per million).

FURTHER DISCUSSION OF 1:2, 1:5 and 1:10 SOLUTIONS AND "SPECIAL CASE"

The chart provided with your instructions is based on the use of a test solution of 1 part soil to 2 parts water. This is discussed in the instructions as is the use of the other solutions.

We have advised use of a 1 to 2 soil to water test solution whenever practical. If you decided to use a 1 to 5 solution you would expect to get a lower reading from the test because you would expect the lower concentration of dissolved salts in the more dilute solution to provide less Conductivity. Normally this would be true — which is why we advise multiplying such a result by 2½ to refer back to the chart. Sometimes you do not actually get a lower reading with the 1 to 5 solution. This is caused by the presence of salts which are not very soluble — and which only dissolve when extra water is present, such as in the 1 to 5 or even the 1 to 10 solutions. If you try a 1 to 5 test solution and you find that your reading is not lower than with a 1 to 2 test solution you can suspect the soil has salts like sulfates or carbonates present. If this is the case, then — for this special situation — use the reading that you get from the 1 to 5 or 1 to 10 test solution — without multiplying to convert it back for the chart provided. If you have a serious concern as to this situation we suggest you consult with your local Agricultural Extension Service or other suitable reference point.

CONVERSION FROM MILLIMHOS TO PARTS PER MILLION

Occasionally one sees a reference to salts in terms of "PPM" (parts per million). You can convert from millimhos to **approximate** parts per million by multiplying the readings from a **1 to 2 solution** in millimhos by 1500.

Example: a 1 to 2 solution gives a reading of 0.5 millimhos.
0.5 times 1500 = 750 parts per million of salts.

To convert from millimhos to PPM **using water** (not a soil in water solution), such as tap or irrigation water, multiply the reading in millimhos by 640. This is useful for Hydroponic Nutrient Solutions.

Examples: a water sample reads 1.0 millimhos on the meter.
1.0 times 640 = 640 PPM (approx.)
a water sample reads 2.0 millimhos on the meter.
2.0 times 640 = 1280 PPM (approx.)

SUGGESTED REFERENCES ON THE SUBJECT OF SALINITY

1.) "SOIL", The 1957 Yearbook of Agriculture. U.S.D.A.

2.) "Diagnosis and Improvement of Saline and Alkali Soils". U.S.D.A. Ag. Handbook No. 60.

3.) "Bulletin #1S: Interpretation of Conductivity Readings on Soils"
"Bulletin No. 2S: Use of Brackish Waster for Irrigation in New Jersey"
Dr. Roy Flannery, Specialist in Soils, Cook College, Rutgers University, New Brunswick, N.J.

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CONVERSION CHART*

Millimhos	Parts Per Million (PPM)
0.5	320
1.0	640
1.5	960
2.0	1280
2.5	1600
3.0	1920
3.5	2240
4.0	2560
4.5	2880
5.0	3200
5.5	3520
6.0	3840

*For use in testing water or Hydroponic nutrient solutions and other liquids.

KEL INSTRUMENTS CO., INC.

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Teaneck, NJ 07666

"KELWAY® PRODUCTS"

KELWAY® SST: OPERATING INSTRUCTIONS

For determining salinity (soluble salts content) by measuring electrical conductivity.

READ THESE INSTRUCTIONS THOROUGHLY PRIOR TO USE

I. **Description.**

The Kelway SST is an electrical conductivity tester which measures soluble salts content. It provides the ability to make "in the lab" or "in the field" tests for salinity of water, of hydroponic nutrient solutions or of solutions of soil (or other media) in water. Soluble salts are determined by measuring electrical conductivity. This tester gives an accurate reading of conductivity in "millimhos per centimeter" (m ℧ /cm.). Use this to measure soil salinity. There is also a scale in parts per million (PPM) for measuring hydroponic nutrient solutions or water.

Included with the SST are a built in electrode (cell), a thermometer, a calibrated test jar, a syringe, a 9 volt battery and a carrying case. To operate the tester, prepare a test solution, fill the electrode (cell) "pit" and make a reading. Then consult the chart provided.

II. **Brief Theory.**

Soluble salts content means the total of all soluble minerals present which can dissolve in water. The accumulation of soluble salts by soils, impairs their "productivity" by reducing the rate at which plants absorb water, consequently retarding growth. Insufficient soluble salts means lack of fertilizer which can be equally harmful. In either case, testing leads to proper remedial practises.

We suggest you read the KELWAY TECHNICAL BULLETIN "S"(enclosed) for a more detailed understanding of salinity.

III. **Preparation of Sample.**

Make a 1 to 2 soil to water solution. Do this by filling the calibrated test jar with deionized or distilled water to the "C" mark. Add soil (or other media to be tested) until the solution level reaches the "A" mark. Close the test jar, shake vigorously for about 30 seconds and then allow it to settle for about 1 minute. While doing so measure the temperature of the solution with the thermometer provided. Adjust to 25°C (77°F.).

NOTES: 1.) Do not use tap water to make the test solution. Tap waters vary and almost all contain soluble salts in varying amounts. You can measure your tap water by testing it without adding soil. Testing deionized or distilled water should yield zero or near zero readings.

2.) To make a 1 to 5 soil to water solution - fill the test jar with deionized or distilled water to the "B" mark. Add soil until the solution level reaches the "A" mark. Then proceed as in the case of the 1 to 2 solution. The use of a 1 to 5 solution is discussed later in this set of instructions.

IV. **Making the Test.**

Place the Kelway SST tester horizontally on your work surface. Using the syringe, transfer some of the upper portion of the test solution to the "electrode pit" (hopefully this is now a fairly clear "supernatant" liquid) — but if it is not fully clear don't let this deter you — just be prepared to do a better clean out job in the "electrode pit" after the test. For the test, the "pit" should be filled approximately to the level of the inner edge, below the top ridge. In other words fill the "pit" without overflowing it.

Press the white button which is on the upper left of the face of the tester and **while holding this button down** slowly turn the black dial button from zero in a clockwise direction. When you first depressed the white button the red light on the upper right will have flashed on and then off. Now, keep turning the black dial button very slowly to the right (clockwise) until the red light again flashes on. If you turn the black button slightly further the red light will go out. The reading you want is taken at the point where the red light stays on. If you fail to get a reading — you probably forgot to keep the white button depressed.

After getting your reading pour the solution out of the "pit" and rinse the "pit" with some deionized or distilled water. Wipe it clean and dry with a suitable paper tissue or clean soft cloth. If soil had settled in the "pit" you may have to repeat the clean-out procedure. The objective is to clean the "pit" thoroughly but carefully (without harming the two electrode contact points which are visible in the "pit" and without spilling water on the tester's surface). The tester is carefully constructed but water seepage is hard to prevent and obviously this can be harmful to the electronic circuits within. Simple care is all that is needed. **Never put solvents into the "pit"** and it would be wise to avoid use of solvents on the plastic housing (case) of the tester.

V. **Interpretation of Readings.** A) For soil in water solutions using the millimhos/cm scale.

The reading(s) you have obtained is **conductivity** expressed in millimhos per centimeter (m ℧ /cm.). It is common to refer to these units simply as millimhos. An explanation of the units is contained in the KELWAY TECHNICAL BULLETIN "S" which accompanies this tester. Now refer to the chart which "translates" the numerical reading into words describing salinity level and most important — into plant condition.

NOTE: DO NOT USE THE "PPM" SCALE TO READ SOIL IN WATER SOLUTIONS!

Relative Salt Level	1 to 2 Solution		Plant Condition
	Inorganic Soil	Organic Soil	
Low	0-0.2	0-0.5	Too Low. Plants may be starved.
Medium	0.2-0.5	0.5-1.0	OK range most plants.
High	0.5-0.8	1.0-1.5	Slightly higher than desirable. Germinating seeds or seedlings may be injured.
Excessive	Above 1.5	Above 2.0	Plants usually dwarfed and crop often fails.

B) For hydroponic nutrient solutions use the "PPM" scale.

VI. **Discussion of 1 to 2, 1 to 5 or 1 to 10 soil to water solutions.**

Most times with most soils a 1 to 2 soil to water solution will give you the correct test results. Sometimes a problem can occur. If your soil is very high in organic matter (peat, for example) you may not be able to dissolve it in the amount of distilled water available in the 1 to 2 solution. You may need more distilled water. In this case you should make a 1 to 5 soil to water solution. If the amount of water is still not adequate, make a 1 to 10 soil to water solution. This is done by filling the test jar with distilled water to a point halfway between the "A" and the "B" mark. Then add soil to bring the level to the "A" mark. Shake solution, settle, adjust temperature as when using the 1 to 2 solution and make the test reading. **HOWEVER,** when you get the reading in millimhos per centimeter you must make a conversion in order to interpret the readings from the chart (the chart was established for use with 1 to 2 solutions).

To use the chart with a 1 to 5 soil to water solution:
Multiply your reading by 2½ and then use the chart.

To use the chart with a 1 to 10 soil to water solution:
Multiply your reading by 5 and then use the chart.

VII. **SPECIAL CASE:** For soils known to contain excessive sulfates and-or excessive carbonates: We suggest that you refer to KELWAY TECHNICAL BULLETIN "S" enclosed.

VIII. **After the testing.**

Once you know the salinity of your soil you can take steps to increase it, decrease it or maintain it at its current level. If you combine salinity testing with a chemical analysis of your soil so that you know its make-up, you can create the desired chemical balance for the crop (or plants) you desire to grow and then maintain the proper amount of fertilizer content by testing the salinity level on a regular basis. Some general ideas on how to proceed are contained in the KELWAY TECHNICAL BULLETIN "S". These ideas may help you to pursue more specific solutions to your own soil problems through use of available literature, consulting with the local Agricultural Extension Service, etc.

We recommend removal of the battery from the Kelway SST if you do not plan to use it regularly.

When the battery becomes weak the red light tends to stay lit through a wider swing of the black dial button — and eventually the red light will not light. Replace with a 9 volt battery.

GUARANTEE

The Kelway SST is guaranteed against defective workmanship or materials. If such defect does arise during the period of 90 days from date of purchase, and if in the opinion of Kel Instruments Co., Inc. the defect is due to the aforenamed factors, the product will be repaired or replaced free of charge, provided that the tester be returned to Kel Instruments Co., Inc. accompanied by "Proof of Purchase" including date of purchase. This guarantee does not apply to any damage or defect caused by abuse or accident.