The Health Metric Guide to TDS and Hydroponics

What is TDS?

TDS stands for Total Dissolved Solids. It is a measure of all the dissolved substances in a water sample. These "dissolved solids" are mostly inorganic salts like sodium, calcium, magnesium and potassium cations along with chloride, bicarbonate, carbonate, phosphate, sulfate and nitrate anions. TDS also includes dissolved organics compounds too. True TDS measurements must be performed in an analytical laboratory. The water sample is weighed then heated under tightly controlled conditions to evaporate the water. The remaining weight of the leftover "solids" are used to calculate the total dissolved solids in the water sample. The unit of measure is parts per million (ppm), which is the same as milligrams per liter (mg/l). For most applications including hydroponics, this level of accuracy is not necessary. It is expensive and must be performed in a lab. A much faster method is to use a TDS meter.

The truth about TDS meters

TDS meters don't really measure total dissolved solids. Remember, TDS is determined by evaporating the water and weighting the remaining solids. Hand-held TDS meters actually measure EC (electrical conductivity). Dissolved salts and minerals conduct electricity. The more minerals in the water sample, the higher the conductivity. The meter converts the EC reading into TDS as parts per million (ppm). Dissolved organic compounds don't conduct electricity and aren't detected by the meter. For most hydroponic growers TDS meters are easy to use and provide relatively accurate TDS readings that are useful for monitoring the nutrient solution. The Health Metric TDS meter provides the EC level in microsiemens µS and TDS in ppm.

TDS meter conversion factors

Because the meter's TDS reading is based on conductivity, a conversion factor is used to convert EC to TDS. There are three main conversion factors used by meter manufacturers to calculate TDS. There is some debate as to which conversion factor is "best" for measuring hydroponic nutrient solutions. The conversion factor is selected by the meter manufacturer and varies by meter brand and model. The conversion factors are based on sodium chloride, potassium chloride and the "442" standards. The chart

EC µS (microsiemens)	**NaCl (.50)**	**KCl (.55)**	**442 (.70)**
100	50 ppm TDS	55 ppm TDS	70 ppm TDS
200	100 ppm TDS	110 ppm TDS	140 ppm TDS
300	150 ppm TDS	165.0 ppm TDS	210 ppm TDS

shows how the TDS reading can vary depending on which conversion factor is used by the EC/TDS meter. It is possible to test the same nutrient solution with two different brands of TDS meters and get two different TDS levels. That's why it is important to know which conversion factor the meters use if you're comparing your TDS meter's reading with someone else's meter. The Health metric TDS/EC meter

uses the NaCl conversion factor. Here's an example how the meter calculates TDS:

1. The Health Metirc meter measures EC in MICROsiemens (µS). Example: 0500 on the display = 500 microsiemens.
2. The meter calculates TDS: 0500 µS x .5 conversion factor = 250 ppm TDS

Millisiemens vs microsiemens

Be careful not to confuse "milli" with "micro." Both are a levels of EC but use different units of measure. Some nutrient guides use the millisiemen scale when referring to recommended EC levels. For example, an EC recommendation of 1.2, is in the millisiemen scale (mS).

- mS = millisiemens: 1 mS = 1000 microsiemens (µS)
- µS = microsiemens: 1000 µS = 1 millisiemens (mS)

The Health Metric TDS/EC meter uses the µS scale, which does not need a decimal point. You can easily convert microsiemens to millisiemens by dividing by 1000.

Example: EC = 1200 µS

1200/1000 = 1.2 mS (millisiemens)

What is CF?

You may read about CF in hydroponic guides and wonder what it means. It is used mainly in Australia and England. CF or "conductivity factor" is the same as EC but without the decimal point. It is 10 times the EC level.

Example: 15 CF = 1.5 millisiemens or 1500 microsiemens

Using the Health Metric TDS/EC meter for hydroponics

Hydroponic growers use TDS/EC meters to measure the strength of their nutrient solution. Most use the EC measurement instead of the TDS feature. When using the meter in EC mode, you don't have to worry about using conversion factors to compare TDS levels. Inorganic nutrient solutions increase the electrical conductivity of the water in the system. Keep in mind that unless you're using distilled or reverse osmosis water, your tap water will have a baseline EC that adds to the total EC level in the water. Here are some general guidelines to consider when measuring EC in your nutrient solution.

- As plants take in nutrients the EC level will decline.
- When water evaporates from the hydroponic system the EC will rise because the nutrients are becoming more concentrated in the water.
- EC does cannot tell you, for example, if the nitrogen level is low. It is simply a general indicator of the overall concentration of dissolved inorganic nutrients in the water.

- Replace the nutrient solution every 7-10 days to ensure the nutrients are balanced.

Organic nutrients and EC

Complex organic nutrients don't conduct electricity, so they can't be detected by a TDS/EC meter. The nutrients contained in the organics are made available to the plants when beneficial microbes digest the organics and release the nutrients into the water around the plant roots. The nutrient process is gradual and on-going. This means, unlike inorganic nutrients that are added all at once, the organic method provides a slow, controlled release of the same essential nutrients. EC won't be as high because the inorganic nutrient level in the water is lower, but fed to the plants on a continual basis. You'll have to experiment and monitor your plant growth so what works best for your crop.

Summary

- EC is the easiest way to monitor the nutrient solution strength since no conversion factor is used.
- TDS meters using different conversion factors will provide different TDS readings from the same solution. TDS on a meter is less accurate than EC. TDS is a rough calculation based on EC.
- Millisiemens and microsiemens are often confused by growers. Make sure you are using the right unit of measure when comparing EC readings.