



## Applications Tip of the Week

### Conductivity and Total Dissolved Solids

#### What is TDS?

The term Total Dissolved Solids (or TDS) refers to the total amount of substances in a water sample, which are dissolved and can not be filtered out.

#### Why is TDS Measured?

Waters of high TDS are generally of inferior palatability; therefore, a secondary drinking water standard of 500 mg/L TDS is established in the U.S. as the maximum recommended level for TDS in a drinking water. TDS is also a water quality parameter used to monitor the quality of watershed source waters, such as rivers, lakes, and ponds.

High TDS can indicate hard water, brackish or saline water, and/or nutrient loading of water. Hard water may be unsuitable for industrial, aquarium, spa, swimming pool, and reverse osmosis water treatment systems. Brackish or saline water may be unsuitable for agriculture, hydroponics, and aquaculture. Nutrient loading may compromise the health of a water body and impact its use as a potable water source.

#### How is TDS Measured?

TDS is commonly determined by gravimetry, chemical analysis, or conductivity.

- The gravimetry protocol requires that a volume of filtered sample be evaporated to dryness at about 100 C, then dried to a constant weight at 180C. The increase in dish weight represents the total dissolved solids per the filtered sample volume.
- The chemical analysis protocol requires that the sample be measured for major ions (such as sodium, potassium, calcium, magnesium, chloride, sulfate, phosphate, and fluoride) and other parameters, such as nitrate and alkalinity. The results are used to calculate TDS.
- The conductivity protocol requires only a conductivity measurement to be made. This measurement is multiplied by a factor (previously determined) to yield an estimate of TDS.

Of the three common TDS measurement protocols, only conductivity is suited for field testing and continuous monitoring. In addition, it is a much quicker and simpler measurement, which requires very little training for good results. Certain compliance reporting requirements may require a TDS measurement to be made by gravimetric testing.



## How is Conductivity Used to Determine TDS?

To determine TDS by conductivity, measure the conductivity of a water sample using an Orion conductivity probe, such as Orion 013005MD, and a Star meter. Set up the meter as follows:

1. Enable on the conductivity temperature compensation option.
2. Select the temperature coefficient. A factor of 2.1% is common for a salt solution.
3. Select the TDS factor. A factor of 0.49 is common for a salt solution. If the samples in question have a different factor, enter that factor.
4. Calibrate the meter with a conductivity standard near the concentration of interest.
5. Insert the conductivity probe into the sample and record the TDS in mg/L.

## How is the TDS Factor Determined?

To determine the exact TDS factor for your sample type, measure the conductivity of a representative number of your typical sample. Then perform the gravimetric test on the same samples. Calculate the TDS factor as: the TDS in mg/L (gravimetric results) divided by the conductivity in uS/cm. Use the average TDS factor in the meter setup, as noted in step 3 above.

## What is A Typical TDS Factor Value?

The Orion Star meter allows a TDS factor of 0.10 to 10.0 to be entered during setup. A default of 0.49 is used, because it is appropriate for salt solutions such as sodium chloride, calcium chloride, and potassium chloride, when conductivity values are near 1500 uS/cm. Naturally occurring fresh waters typically have a factor of about 0.6 to 0.7, depending on the dissolved constituents and the amount of dissolved solids present.

Note that TDS factors generally increase when samples have high conductivity values. For example, see Table 1 below. Note that the TDS factor for NaCl at 1413 uS/cm is 0.49, while the TDS factor for NaCl at 12,900 uS/cm is 0.56. If your TDS values are in the higher range, verify the TDS factor and adjust if necessary, to assure good accuracy.

Table 1: TDS Values and Factors for Orion Standards

Orion Number	Conductivity at 25C, uS/cm	TDS as NaCl, ppm	Factor
011008	100	47	0.47
011007	1413	692	0.49
011006	12,900	7230	0.56