

For most fish keepers the subject of conductivity is one that rarely comes to mind.

You may have heard the term used, but do you know precisely what it means or how useful an understanding of conductivity can be? In this article we will attempt to unravel this mysterious subject and demonstrate how both you and your fish can benefit; regardless of the fish species you keep.

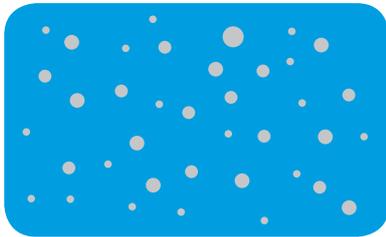
WHAT IS CONDUCTIVITY?

So, first things first, just what is conductivity?

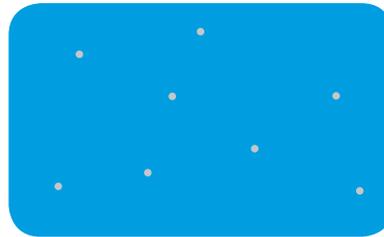
Conductivity (or electrical conductivity to be precise), is a measure of a material's ability to carry an electric current. The better the conductor, the higher the conductivity level will be. Water may only carry an electrical current if it contains dissolved salts and/or minerals. Hence, pure, distilled water has a conductivity level of zero, as it has been stripped of all its salts and minerals during the distilling process.

The greater the salt and/or mineral content, the higher the conductivity level.

Therefore, saltwater has a higher conductivity than tap water, and tap water has a higher conductivity than R/O water or distilled water.



SALT WATER (high mineral content)
Higher Conductivity



TAP WATER (low mineral content)
Lower Conductivity

There are two measuring units for conductivity.

Freshwater is measured in **µs** (microSiemens)

Saltwater is measured in **ms** (milliSiemens).

Both are correlated and express the same thing, similar to grams and milligrams.

1 ms (milliSiemens) = 1,000 µs (microSiemens)

SO WHAT HAS THAT GOT TO DO WITH FISH?

Conductivity can be seen as the 'mother of all water parameters', as it is a measure of the total level of dissolved salts and minerals present in the water. In that respect it is very much like measuring body temperature to give an overall view of a person's health - any sudden change in temperature will require further investigation, just as any major fluctuation in aquatic conductivity will indicate a change in water quality which may require attention.

APPLICATIONS FOR MARINE AQUARISTS

As we are effectively evaluating salt levels, the most obvious application is to use conductivity to measure the salinity of salt water. Water in marine aquaria should be kept at a conductivity level of approx 52-54 ms. As water evaporates, salinity, and therefore conductivity will naturally increase, so regular monitoring of conductivity is an ideal way for marine aquarists to keep a close eye on salt levels.

FOR FRESHWATER AQUARISTS, KNOWLEDGE OF CONDUCTIVITY IS EVEN MORE USEFUL

Whilst the conductivity of seawater is relatively constant worldwide, relative freshwater conductivity varies wildly across the globe and is influenced by a number of factors. One of the most important is the surrounding geology, specifically the rock and soil type of the lake and surrounding river beds. For example, areas rich with limestone tend to have high conductivity levels due to the limestone leaching carbonate minerals into the water.

ADJUSTING CONDUCTIVITY FOR FISH HEALTH AND WELL-BEING

Fish living in these differing environments have evolved over millennia to thrive in those specific conditions. In order to minimise stress, maximise lifespan and obtain ideal fish health and spawning ability it is advisable to mimic the conductivity levels experienced in the fish's natural habitat, exactly as we do with pH levels.

Discus breeders are well aware of this fact and know that most Discus will spawn far more readily in RO (reverse osmosis) water that has a low conductivity level of less than 50µs, similar to that of their natural environment. In contrast, many livebearers such as Guppies, Mollies and Tanganyikan Cichlids prefer a high conductivity level of more than 500µs. Fish in community aquariums should be kept at an average conductivity level taken across the various species kept.

Keeping fish at an incorrect conductivity level is comparable to taking a Bedouin from the Sahara and sending him to Antarctica for the remainder of his life. He'll survive, but his body will be struggling against thousands of years of evolution that have adapted him to his natural environment, resulting in a shorter life span and poorer quality of life.

HOW TO ALTER CONDUCTIVITY

To create perfect conditions you need the ability to alter your aquarium's conductivity level. Fortunately this is very simple.

To raise conductivity, carefully add dissolved aquarium salt to the aquarium water.

To lower conductivity, perform a partial water change, replacing the water removed with R/O (Reverse Osmosis) water (available from most aquatic stores). R/O water usually has a conductivity of around 20-30 μ s.

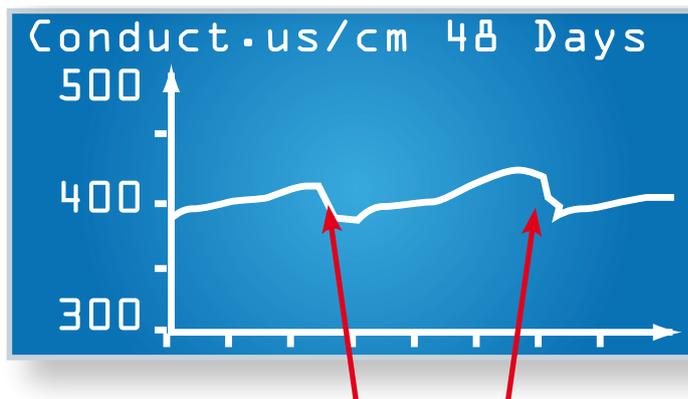
Any large water changes should be performed in stages over the course of several days to minimise the effect on beneficial bacteria.

HOW TO MEASURE CONDUCTIVITY

Specialist conductivity meters are available from specialist aquatic stores and over the internet. When buying, be sure that the meter compensates for water temperature, which has a direct effect on conductivity. You should also be aware that most meters require regular calibration to remain accurate - this needs to be done using water of a known conductivity level which you will need to obtain separately.

The new Fluval G filter from Hagen is the world's first filter to include an integrated conductivity meter. It is temperature compensated and, uniquely, it never requires calibration.

Conductivity level is constantly monitored and is graphed over time on the filter's LCD screen, providing an easy historical reference point.



One further use of Fluval G's conductivity meter is that you can easily see when and how often you have conducted water changes from the fluctuation which will inevitably occur

UTILISING CONDUCTIVITY READINGS TO KEEP SUPERB WATER QUALITY

Once your conductivity level is adjusted to the correct level for the fish species you keep, you can use the conductivity level to tell you at a glance whether your water quality is acceptable or not. Rather than using a set schedule or a rigorous and time consuming testing regime, you will be able to accurately determine exactly when a water change is needed...and not before.

In nature, conductivity levels remain relatively constant because the ecosystem naturally remains in perfect balance. In the closed environment of your aquarium, any added pollutants (such as nitrates and phosphates resulting from fish waste or uneaten food) will result in a corresponding rise in conductivity, as will the gradual evaporation of water.

To better understand the complex chemical interactions in your aquarium, you should initially perform your usual water testing regimen once you have established a status quo - that is a matured aquarium with correct temperature, pH and conductivity.

1. Write all checked values (e.g. conductivity, general hardness, phosphates, nitrates, etc.) down and monitor your conductivity over the next few days/weeks.
2. Test these parameters again as soon as your conductivity has risen by around 10%.
3. If the tests show that it's time for a water change then you will know, without the need for further testing, that in the future a water change should be performed after a 10% conductivity increase. However, if your water tests indicate that a water change is not yet required, you can test again after a 15 or 20% increase until you find your own unique 'water change marker'.

If you have a way of constantly measuring conductivity and setting alerts for maximum levels (as found in Hagen's Fluval G filter) things get even easier as the meter will tell you when the maximum level is reached and you'll know it's time for a water change.

Levels will vary from aquarium to aquarium but once you have an understanding of the relationship between the rise in pollutants and their impact on conductivity in your unique aquarium it puts **you** in control.

Monitoring conductivity gives you a quick and easy overview of the general quality of your water - just like measuring your body temperature for an overview of general health. This form of water monitoring results in maintenance being performed at the ideal time, **before** toxins are allowed to get out of hand.

Conductivity can be a complex subject and we've only scratched the surface, but the basics we have discussed, combined with an effective conductivity meter, can revolutionise the way you maintain your aquarium and care for your fish.