In highly buffered (high KH) water, or a pH calibration solution different test methods will generally agree within a small tolerance. This is fine as most PH test systems are designed for lab use where solutions are highly buffered. However buffer strength can affect the results from different pH measurement systems when used in lower KH solutions. This is because in low ionic strength solutions neither the electrical (in pH probes) or chemical (liquid tests) response needed for the measurement are strong enough.

It is important to remember that PH is a ratio that shows the balance of +/- ions in solution not the amount of ions, if you want to learn more on PH then please follow this link.

PH probes work by the concentration of hydrogen ions creating a milivolt output that the probes calculate a pH from. In a low ionic strength liquid, this reaction can be small and the pH probe may not have enough of a sensitivity to calculate an accurate pH. Therefore if you have a tropical discus tank with low KH and a probe system that is calibrated correctly in highly buffered solutions chances are it will not read correctly in the aquarium.

This link is to a manufacturer's website explaining the problem in their own words.

An old or dirty probe in this situation it will probably report the same or similar PH value regardless of what is actually happening. In lab use in low buffer solutions different style probes and algorithms are used to the normal.

All test systems will report a value even if not correct and it’s not uncommon to see a difference of 1 pH point between different test methods and devices in very low KH water (softwater). The data for the chart below was produced by a PHD student trying to better understand the differences in aquariums. We have applied the coloured bands to help people better understand how ph calibration solutions (buffers) are so different to aquarium water and most devices are comparable in pure buffer solutions.
Part of the confusion is caused by the fact the consumer is given buffered solutions with high ionic strengths to calibration so of course the probe shows an accurate response. The user then places the pH probe in a low KH solution and expects it to respond, the chances are it won’t move from its set point of 7 (+/- calibration values).

All pH liquid test will have a pH themselves (they are liquid) so if the ionic strength of the solution you are testing is lower than that of the test kits then it will not pull the test kit away from its own pH point. The lower the KH the less chance you achieve this. Different test kits will have a different pH to try and help overcome this. A normal range may have a pH of 7 where as a low range may have a pH or 4. This means you can get very different results depending on your KH level.

Dip strips these have some of the issues you see in the test kits as depending on range they have different set pH set points. This technology although harder to read is more sensitive to low KH as less signal strength is needed for the reaction which is why we based our technology on a similar chemistry.

The chemistry on the seneye slide has been specifically calibrated to work in a kH that is more like that normal aquarium water. We use two different algorithms based on marine and fresh water. If you believe you may have a problem with your slide then please read this.
So pH is just a ratio of +/- ions unlike popular understanding it does not directly show the energy of the solution (substance).

To use an analogy; a balance bar (scales) with a matching ball on either side would be balanced (if this was +/- ions it would be pH 7). Also a balance bar with a billion balls on each side would also balance (so would also be pH 7) but with different power. The weight or amount of balls in this analogy is the ionic strength and most often measured in KH (or alkalinity) it’s the third dimension in understanding pH.

As you can imagine it would be difficult to use the same balance bar for both tests as it would most likely lack sensitivity. Would you use the same microphone to listen to a mouse and an aircraft taking off? or the same scales to weight a diamond as an elephant? and expect them to work? Obviously not but this is what we tend to do with pH – take a one device fits all approach.

So different test methodologies will give different values at lower KH depending on their respective sensitivity.

The lower the sensitivity of the test equipment and the lower the KH the less chance of an accurate response (targeting).

In a closed circuit aquarium the lower your KH the greater the pH swings you will have.

Having some KH in the aquarium or pond is essential for fish and bacteria health; click here to learn more.

RO water should have a theoretical pH neutral of 7, but cannot be measured with traditional test methods discussed above as there is not enough ionic strength to create the reaction.