Setting Up A Co2 System

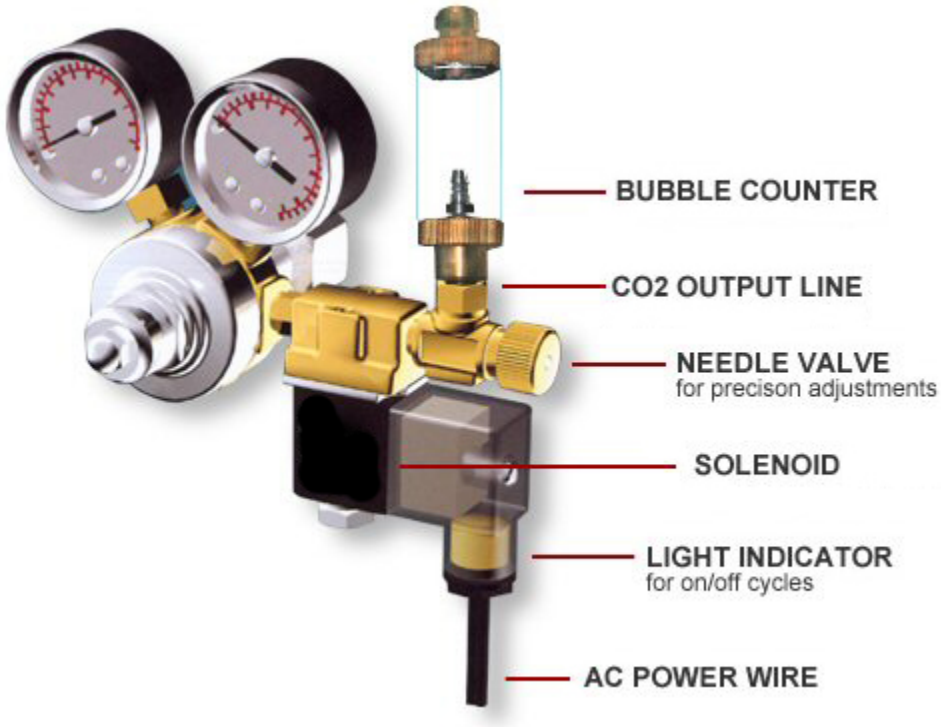
Intro

CO2 is perhaps the most important nutrient in a planted tank. Carbon contents in tank water can vary depending on fish load (respiration), surface agitation (gas exchange) and of course plant uptake. In low light tanks CO2 is not necessary, the speed at which the plants grow is slow enough that most nutrients including CO2 are being introduced into the water faster than the plants are consuming them. Plants have a hard time absorbing CO2 from water, they do it a lot more efficiently from the air which is why many plants will start to grow considerably faster when they reach the surface. Adding CO2 to a low-moderate light tank will speed up growth, improve quality and allow you to grow many plants that would otherwise do poorly without CO2. With higher lighting, CO2 become essential as the tank quickly becomes CO2 limited, leading to growth deficiencies and unwanted algae.

Methods of adding CO2 to a tank

CO2 can be added to a tank in a couple of different ways. The most common are pressurized CO2 cylinders, DIY CO2 and liquid forms of organic CO2. Liquid forms of Co2 such as Flourish Excel are great for smaller tanks. It requires daily dosing and doesn't seem to have the same effect on all plants. CO2 in gas form is more efficient than liquid carbon so the first two options are the most common. DIY CO2 is a good way to get started into planted aquaria however at some stage most people will want to upgrade to a pressurized setup which provides higher, more constant levels of CO2 without the weekly task of preparing a new mixture as the DIY setup would call for.

What you'll need:



CO2 bottle
CO2 cylinders are made either in steel or aluminum, either is fine, aluminum is lighter and probably looks a little nicer but that's about it. They come in various sizes from 2.5lb up, the most common being a 5lb tank as this will fit nicely inside a standard tank stand and will last around 8-12 months on say a 55 gallon tank before a refill is needed. Used cylinders can also be of interrest if the price is right, however do check that they have a valid pressure test date stamped on them. All cylinders need to be tested every 5 years. If you have decided to trade your CO2 tank in each time for a full one, you may need to purchase the first full tank at the same place where you will be trading it in each time it's empty. Some stores will take an empty tank that was purchased elsewhere and swap it for a full one, while others will only swap out tanks that were originally purchased from them. So ask before you buy!

Regulator
A regulator simply reduces the pressure of the gas from the bottle to usable amounts. There is not much to be said about regulators, you have hundreds of models to choose from.
For those looking for the least amount of work and DIY tasks, a complete regulator may be more interesting. Those interested in using PH controllers or want to turn off CO2 at night, these are your best solution. These regulators come with needle valve, check valve, solenoid and bubble counter:

Needle Valve
A needle valve allows minute adjustments to be made to the amount of CO2 going into the tank. Considering we are talking 30-60 bubbles per minute on an average tank, it's obvious that we need an accurate needle valve that will provide a stable rate.

Check Valve
A check valve stops water from flowing backwards from the aquarium to the CO2 tank. Although this will not happen while the CO2 is being erogated, it can happen when the CO2 runs out or something is disconnected during maintenance. Seeing you don't want to flood the house or send water into the regulator, a check valve is a must in my opinion. You can use a regular plastic check valve used for air pumps, this should be changed at least once a year as the CO2 gas will damage it.

Bubble Counter
A bubble counter allows you to monitor the rate at which CO2 is being erogated into the tank. While it provides little to no hint as to the actual concentration in the tank itself (more on this later), it does allow you to adjust the needle valve quickly after maintenance or to make minor

adjustments to the bubbles per minute that are dosed. A bubble counter, if not purchased with a complete regulator shown above can be added inline to any setup.

CO2 proof tubing
You'll need tubing to bring the CO2 into the tank. Regular soft silicon airline tubing will do the trick. Although not 100% CO2 proof, it holds up well over 2 years and is cheap enough to replace once a year.

CO2 Diffuser/Reactor
A diffuser is something that diffuses the gas in the tank, similar to regular air stones... In short, the gas is pushed through a porus medium that releases it in the tank as a fine mist of CO2 bubbles, the finer the better. These bubbles are partially absorbed into the water molecules as they make their way up to the surface. Obviously any bubbles that do reach the surface are usually lost to the atmosphere and so it's safe to say that a diffuser is not as efficient as a reactor. A diffuser should be made of ceramic, glass or other CO2 proof material. Regular air stones are not going to work as the CO2 breaks the bond of the glue holding them together.
A reactor on the other hand usually consists of a chamber where water is pushed downwards through the chamber and CO2 bubbles are diffused from the bottom. As the bubbles try to float to the top, the water flowing down keeps them trapped in the reaction chamber until completely absorbed by the water. Little to no CO2 is wasted using this method however it is a more complex and expensive method of diffusion, of most interest to those with tanks around 55 gallons and bigger. Reactors can be placed inside the tank (an eye-sore) or externally in a closed loop or inline with a canister filter.

If you have a canister filter you have one more option. That is to send the CO2 directly into the intake tube and use the canister filter itself as a reaction chamber. I find this to be the best compromise between esthetics, simplicity and efficiency. It requires no added equipment, it's next to invisible and is just as effective as a reactor. You obviously want to make sure your canister expels trapped air/gas easily and will not "airlock". Eheim Classic series canisters in have never had one airlock due to CO2 or other trapped gasses in the canister.

Other interesting products exist such as combination units and complete CO2 startup kits.

Setting the pressure
Close the regulator by turning the adjustment screw counter-clockwise until it turns freely. Open the needle valve a couple turns, this is to avoid damaging the valve in case too much pressure is sent to it by mistake. Open the tank valve. No CO2 should be coming out however the high pressure gauge should indicate the pressure inside the tank (Around 800psi when full). Close the needle valve (never overtighten) and slowly turn the regulator's adjustment screw clockwise until the low pressure gauge reads 10psi.

Open the needle valve to test the unit, some diffusers require a little time for pressure to build up and start diffusing. It's impossible to say how much CO2 is required for any given tank, best thing to do is to start low and monitor the CO2 concentration using the KH/PH Chart. A conservative starting point would be a bubble every 3-4 seconds. Aim for an initial CO2 concentration of around 15-20ppm, you can figure out exactly how much you want later based on your own tank.