About Calcium Reactors:

A calcium reactor is a device that dissolves calcium carbonate by using co2 gas to create an acidic condition within the reaction chamber. A circulation pump is used to move the water many times per hour through the chamber as water from the display is slowly introduced and allowed to mix with the water inside the reactor. This Ion rich water is now slowly returned to the aquarium at a rate to match what is being consumed by the inhabitants.

Things you will need to install and operate your GEO calcium reactor.

- The complete calcium reactor as provided by the manufacture
- Calcium Carbonate media, larger grain size is recommended for proper flow and long term stability
- One cobalt MJ pump to feed the reactor (MJ1200 recommended, other sizes will work)
- Complete co2 system including the regulator, check valve, tank. Use of a controller is optional
- pH meter, calcium and alkalinity test kits.

Set up and installation instructions

The reactors are shipped wrapped in plastic with some assembly required. Parts are shipped removed from the unit to prevent damage in transit. The tubing and pump install kit are packaged inside the reaction chamber and the Pump intake manifold is secured to the chamber using plastic wrap. Follow the pump installation procedure for your reactor found on the website geosreef.com.

Once assembled it is a good idea to rinse the reactor and give it a bench test to make sure there are no leaks. After testing and addressing any issues you can fill the reactor with washed calcium carbonate media. (Wash media by running water through it while in a bucket until water runs clear)
Fill the reactor with media to about two inches from the underside of the lid, or about the bottom of the GEO decal found on most units. Install the lid and tighten the thumbscrews in a staggered pattern as if you were tightening lug nuts on a wheel. There is no need to use a tool on the thumbscrews and no need to over tighten, just uniformly snug is all that is required to create a seal.
Install the intake manifold and position the calcium reactor into the location of operation.

The 1/4” outside diameter black PVC tubing provided will serve as both the effluent line and the co2 feed. Cut the tube to length for the effluent line and use the balance to attach the co2 equipment.

The 3/8” outside diameter clear PVC tubing provided is the feed line, use this to attach the cobalt feed pump to the reactor. The snap clamp on the adapter fitting will secure the pumps output to the tube on the fitting.

With the effluent valve open and all of the fittings secure you can turn on the feed pump and allow the reactor to fill. Once the reactor is filled and water is being returned to your display you can plug in the circulation pump. Allow the reactor to run like this for several hours or over night to purge any air that was trapped in the media from the unit.

After the reactor has been running and the air in the chamber has been purged the co2 can be introduced and the dial in process can begin.

Understanding Your Calcium Carbonate reactor

Before we start with dialing in the reactor it is important to understand how it operates.
Water from the display aquarium is fed into a chamber filled with calcium carbonate and mixed with co2 gas. The co2 gas drops the pH to create an acidic condition withing the chamber allowing the media to break down; as the media is breaking down it is releasing calcium and alkalinity ions and mixing with the water in the chamber. This calcium rich water is then added back into the display at a rate to meet what is being consumed by the inhabitants of the display.
Note: Calcium and Alkalinity are provided in proportion with each other and cannot be adjusted separately.
Adjustments to control the amount being provided are done with the rate of co2 gas and the rate of the effluent flow.
Co2 gas is introduced one bubble at a time and are counted per minute, or bubbles per minute (BPM)
The effluent flow rate is measured in milliliters per minute and must be measured by how long it take to fill a vial. ML are not the same as drips and if you are counting drips your flow rate is too slow. It takes roughly 18 drips from the effluent valve to equal just one milliliter.

The reactor will be dialed in by adjusting the effluent drip rate and/or the effluent pH. Adjusting the flow of co2 into the chamber dictates the acidity of the water in the chamber, adjusting the effluent flow dictates the dwell time and these setting need to be adjusted to meet the rate of consumption.

Dialing In Your Calcium Reactor

Before dialing in your reactor you will want to have your target values for the aquarium in place. If adjustments need to be made do so with the appropriate buffers. You will also want to record these values to track the effect of your adjustments during the dial in process.
There is no set rule for BPM to gallons of water as each display can have very different needs and each reactor will be tuned with different settings to meet those needs.

With the display water tested and those values recorded set the effluent drip rate and the co2 bpm of the reactor and record those numbers as well. The initial settings are an arbitrary number but should be set slow to start. 30 ml per minute and 20 bubbles per minute is a safe place to start for most systems. If you are using a controller it will need to be set to target your desired pH, anywhere between 6.0 and 7.0 (lower pH is more acid), again it is better to start slow and ramp up as required. A pH of 6.5 is most typical, but try to target a pH of 6.7 to start.

Let the reactor run with these settings for 24 hours and then test the alkalinity of both the effluent and the display and record these numbers along with the effluent pH. The alkalinity of the effluent will be greater than that of the display and the pH of the effluent should be below 7.0.
Now by comparing the alkalinity of the current and the previous test you can determine if any further adjustments are required. If the aquarium alkalinity has dropped the reactor is not putting enough back to keep up, if it has raised the reactor is adding too much and the reactor will need to be dialed down.
Generally the values will need to be ramped up to meet the demands of the display.

If no controller is being used (less common):
Dialing in a reactor manually was once the most common method but with the popularity of all in once aquarium controllers it is now the less common way to tune. With out the controller in place adjusting the effluent drip rate and the co2 bubble count will have an effect on the output of the reactor.

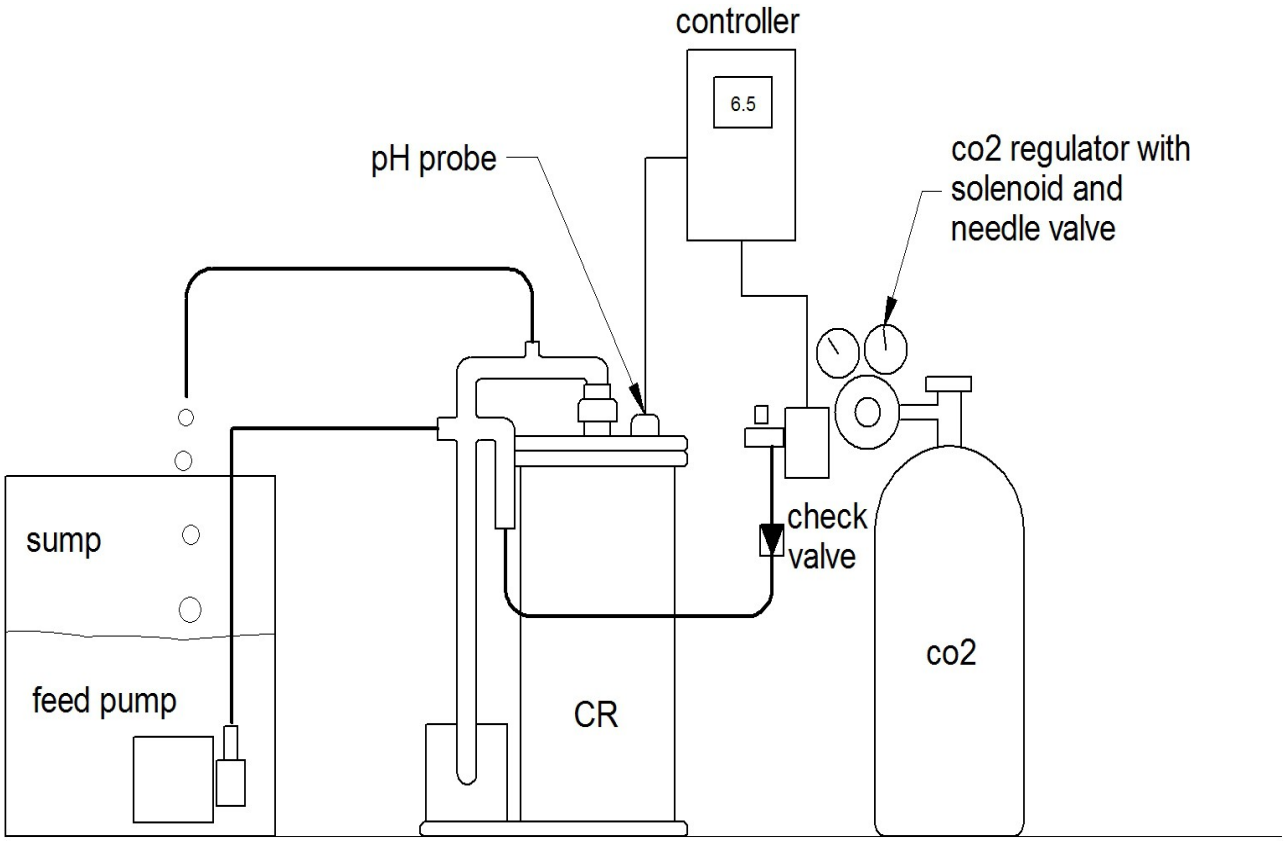
To raise the effluent alkalinity- You would need to either lower the effluent pH by adding more co2 bubbles per minute or decrease the effluent flow rate. By adding more gas you will make the chamber more acid and by decreasing the effluent flow rate you will increase the dwell time in the reactor.

To lower the effluent alkalinity- you would need to raise the effluent pH by decreasing the co2 bubbles per minute or increase the effluent flow rate to decrease the dwell time inside the reactor.

If a controller is in use (most common):
The controller will want to keep your target pH by opening and closing the solenoid on the regulator as required to maintain the target pH value. Your solenoid will be plugged into an outlet that is controlled based on the reading provided by the pH probe. *Even with a controller in use the bubble count should be slow and deliberate, never fast to where the controller is triggering the solenoid many times per day.* The controller should really be looked at as more of a safety device than a controlling device. The controller will however stop the flow of gas into the reactor if the bubble count is too great for the target, and will also allow you to make adjustments to the effluent drip rate without worrying too much about the co2 bubble count. With the controller in use and the target pH being kept you can increase the output of the reactor by simply increasing the effluent flow rate. Adjustments can also be made with the effluent pH by adjusting the bubble count/controller settings. Remember more acid=greater output.

If after testing you find the reactors output is greater than needed by the display the effluent rate can be slowed and/or the effluent pH raised.

Always make *minor* adjustments to your settings and wait 12 to 24 hours between test. It is important to allow the reactor to balance out before making more adjustments.



This is a diagram of a typical calcium reactor installation. The cobalt MJ (or other) feed pump draws water from the display sump and pumps it into the calcium reactor. Water is mixed with co2 circulated through the calcium carbonate media in the chamber and then allowed to flow back into the sump.

A pH probe placed in the lid of the reactor allows the controller to monitor the effluent pH, and in turn will tell the solenoid to either open or close the flow of co2 into the reactor. A check valve is provided with the reactor but one should also be added as part of the co2 equipment to help further reduce the possibility of a back flow.

Trouble shooting

Leaks

- **Leaking at the lid**- leaks at the lid could be caused from a bad or miss-aligned o-ring, debris on the o-ring, from overfeeding water to the reactor trough a manifold system or from the thumbscrews not being tight.

Tip: silicone lubricant for plumbing can be fount in any hardware store and will go a long way in helping seal a troublesome o-ring.

- **Leaking at a fitting**-Leaks at a fitting must be repaired by removing the fitting and reapplying thread sealing tape or paste.

Effluent flow slowing or coming to a stop

- **Air/gas build build up and the drip stops**- To solve this issue you must first determine if the build up is air or gas.

1. Purge the reactor of the build up by letting the run with the effluent valve wide open.
2. Turn off the co2 and reset the effluent flow rate.

If the build up persist the reactor is pulling air. This can be from a leaking fitting on the reactor or from the feed pump. Be sure the feed pump is not in an area of the sump with air in the water and check the fittings on the reactor for drips.

If the build up stops then it was too much co2 gas, continue using the reactor but dial back the amount of gas being introduced.

- **No air in the chamber but the effluent stops**- This is generally caused by the effluent rate being too slow, remember it needs to be measured in milliliters not drips. This can also be caused by blockage in the feed line. Check the fittings for any debris that could stop flow.

CO2 Delivery

- **Fluctuating BPM**- This can be caused by a leak in your co2 system. Check for leaks by applying soapy water to the threaded connections, any leak will blow a bubble.
- **CO2 tank has gone empty rather quick**- This is also caused by a leak somewhere on the co2 system.

Pump is making noise

- **Pump makes a sizzle sound**- This is normal as co2 is fed through the reactor and gas hits the impeller will make a sizzle sound.
- **Pump Chatter**- Pump chatter is a result of foreign matter in the impeller. The pump must be removed and cleaned.
- **Pan world pump is hot**- The smaller pumps without the built in fan will run a little warm. If the pump is new and running hot odds are the rubber stoppers were not removed during assembly.

Effluent pH is not dropping

- **If you are pumping co2 into the chamber and the circulation pump is running the co2 is dropping. This is just how it works regardless if the pH if being measured. The issue is not with the reactor but with the method of measuring the pH.**

Be sure the probe is working and calibrated with new test solution. Probes that are going bad will not hold calibration and the solution used to calibrate should always be new.
Probes generally last about 12-18 months before they need to be replaced. Faulty probe reading are the number one reason for reactor tuning and stability issues.

T**he Calcium and Alkalinity are not raising simultaneously**

- This is caused by the ionic balance between the calcium and the alkalinity being off. You will need to manually raise the level with a buffer, this in turn will lower the other to bring them back into balance. Your reactor cannot raise or lower one or the other it will just maintain the levels you have set.

Aquarium pH has dropped after installing the reactor

- Some systems will run with the pH a little low after running a reactor. To help prevent the pH dip the reactors effluent should be returned to a more turbulent area of the sump to help blow off and residual co2.