L2 USERS MANUAL

PRELIMINARY DRAFT

This is the preliminary draft of the L2 Users Manual. It is pretty rough and the pictures need to be updated, and more added, but I think it covers most of the main points.

I would greatly appreciate any feedback you may have. I still have quite a bit to add and plenty of revisions to perform, but I wanted to at least get this into everyone's hands. I visited a few local customers and found that a few things that I take for granted as obvious were not clear to everyone.

So if you see something on here that makes you step back and change part of your setup, please note that item and let me know what part helped you clarify the function or intent of the unit.

Please feel free to contact me at anytime

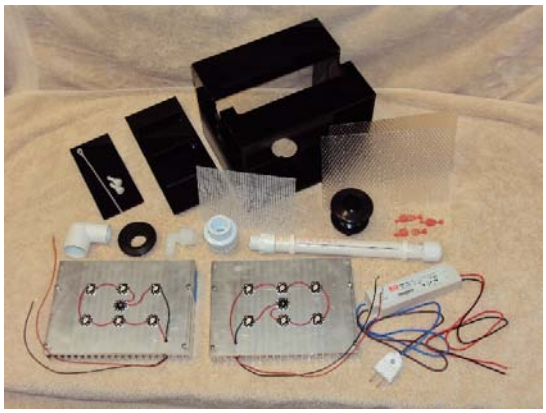
Bud Carlson
bud@turbosaquatics.com

Call or Text
515-240-9739

I just got an iPhone, so if you need to Facetime or Skype, I can do that, at an arranged time.

Thank you for purchasing the L2 Algae Scrubber. This manual will guide you through the unpacking, assembly, setup, startup, and maintenance of your Algae Scrubber.

The L2 Algae Scrubber comes with everything shown in the picture below:



Acrylic scrubber main body
Lid with crossbraces
False Bottom panel
3/4" ~~1"~~ ABS Bulkhead
1" Uniseal Bulkhead & 1" Schedule 40 PVC Street Elbow for secondary/emergency drain
3/4" Schedule 40 PVC Pipe assembly with 6" slot and bonded End Cap & Threaded Adapter
3/4" Schedule 40 PVC Threaded Union
3/4" Threaded-to-5/8" Hose Barb Elbow Adapter (or other adapter as requested)
6" wide x 4" tall (exposed area) roughed-up #7 Mesh Plastic Canvas screen (smooth area at top)
Beaded Cable Tie for holding screen in slot
~~(2) 8.5" x 6" Aluminum Heat Sinks from HeatSinkUSA~~ MAKERSLED HEAT SINKS
(14) 3W LEDs - (12) 660nm Deep Red, (2) 455nm Royal Blue, mounted and wired (Name-brand or Off-brand, your choice)
(3) sets of electrical connectors, installed
Meanwell LPC-35-700 Constant Current Non-Dimmable LED Driver
Plug adapter for Meanwell Driver (installed)
(2) Prismatic Diffuser plates, approximately 5" x 8-1/4"
(2) Nylon Thumbscrews for holding heat sinks in place

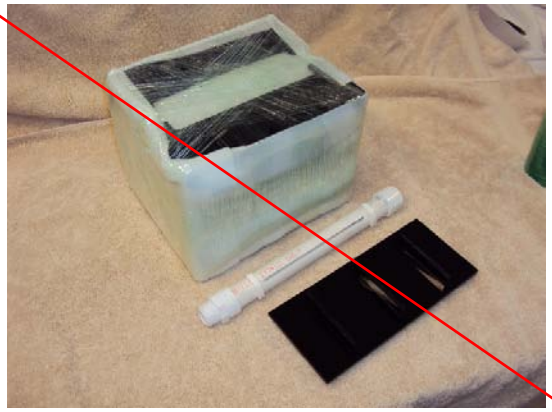
If you ordered one, you will also have received ~~an Eheim Compact 1000 pump, which is rated 40-265~~ A RIO 1100 PUMP GPH

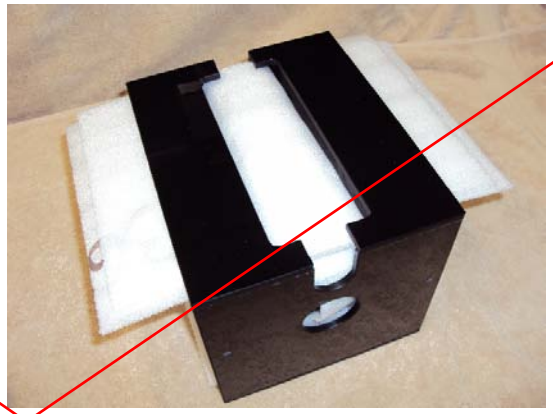
The scrubber is packed with all components inside the box, with the exception of the slot pipe and the lid (and pump, if ordered). The main box is foam wrapped and then stretch-wrapped. Carefully remove the wrapping with a scissors or by hand; if you use a razor blade or box cutter, this should be done carefully in order to avoid scratching the acrylic, and you will only need to cut the stretch wrap.

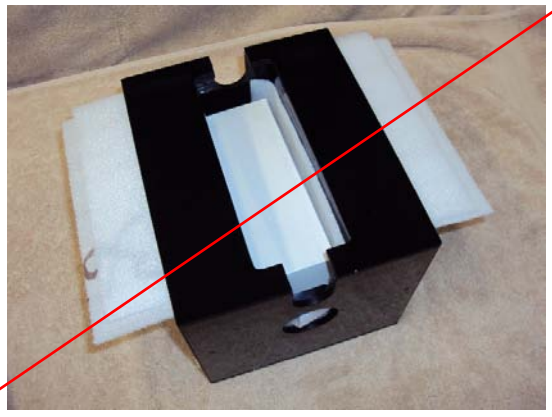
The LED fixtures are packed into the sides of the main housing and are held in place by the stretch wrap and protected by a layer of foam. Take care when removing the wrapping to ensure that the heat sinks do not fall out – gently pull on the wedged-in part of the wrap above the fixture, placing the other hand behind the heat sink, then remove the fixture and set it aside, and discard the foam.

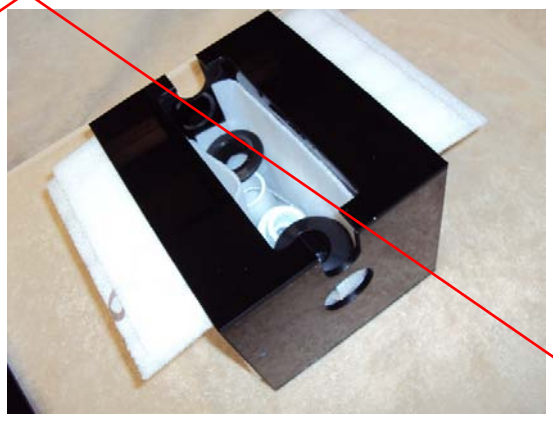
Whenever you remove the LED fixtures from the scrubber, ensure that the power is disconnected (unplug the driver) and the fixtures have had adequate time to cool, then lay the fixtures on a flat surface with the LEDs face-up. Never set the heat sinks with the LEDs face down, never stand the heat sink on edge, and never lay anything on top of the LEDs.

Remove the parts located inside the main box and verify that all parts are accounted for.









Installing the Emergency Drain

The first step in the setup process is to install the secondary Emergency Drain. This should be performed with an empty main scrubber body – no other parts, such as the LED fixtures or the false bottom – should be in place.

Place the main scrubber body on a flat surface, preferably on top of a cloth or towel.

Insert the Uniseal Bulkhead Alternative into the hole on the side panel of the scrubber body.

Insert the “street” elbow into the Uniseal by pushing and turning the elbow. The elbow should stick through to the inside slightly, and you should be able to rotate the elbow after it is installed.

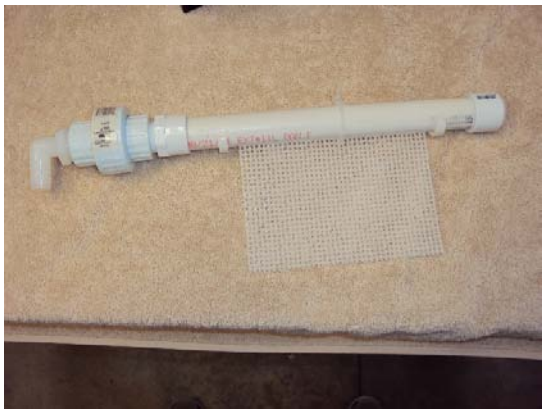
After installing the scrubber, cut and insert a section of 1” Schedule 40 PVC pipe into the elbow to extend the emergency drain outlet to just above the operating water level in the tank or sump upon which the scrubber is installed.

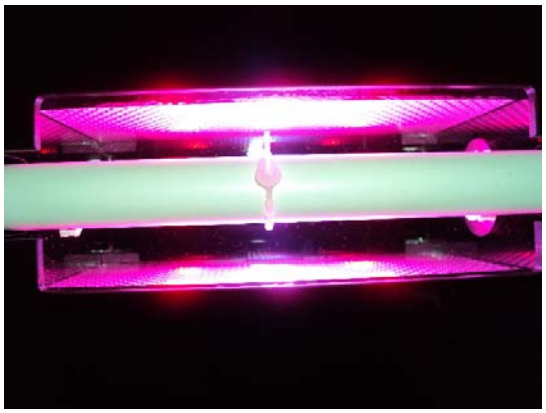
Assembling the Slot Pipe

The slot pipe comes with the end cap and threaded adapter already bonded in place. Locate the union and the 90 degree thread-to-hose-barb adapter. Wrap the threading of both the hose barb adapter and the adapter on the slot pipe with Teflon pipe tape, and screw into the union. You may orient the union whichever way you desire, however I prefer to position is such that the "nut" is on the hose barb side.

Insert the screen into the slot. The smooth section of the screen should be inserted fully into the slot, such that it touches the inside of the pipe. Push the beaded cable tie through a hole near the center of the screen in the first exposed row of holes below the slot. Pull the cable tie through about to the halfway point, and insert the beaded end into the clasp. The tie should be tightened to the last bead that you can get through the clasp without forcing the clasp or stretching the tie, or pinching the slot closed. Trim the excess cable tie material, leaving at least a couple of beads so you can easily remove the screen and re-assemble after cleaning. Alternatively, you can leave the cable tie in tact and just rotate it so that it points down, or at least not straight up (which would get in the way of the lid).

Note that the beads should not "push" the screen so that it is snug against one side of the slot, as this will choke off the flow to that side of the screen. The beads should "straddle" the slot, allowing the screen to "float" in the slot. Water flow will cause the screen to stay roughly in the center of the slot.

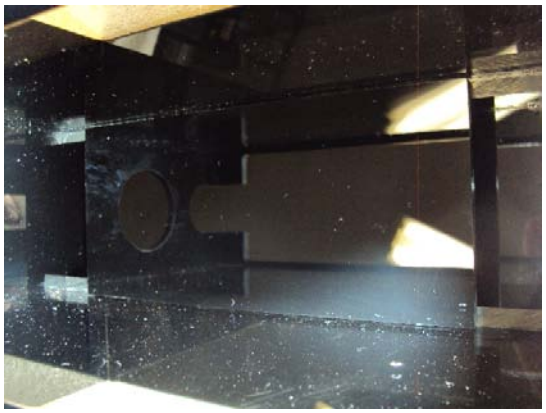




ROTATABLE
RING NOW USED

After the unit is installed in its intended operating location, install the 1" ABS bulkhead into the hole in the bottom of the box and tighten the nut. Do not use a wrench to tighten the nut, it should only need to be hand-tightened.

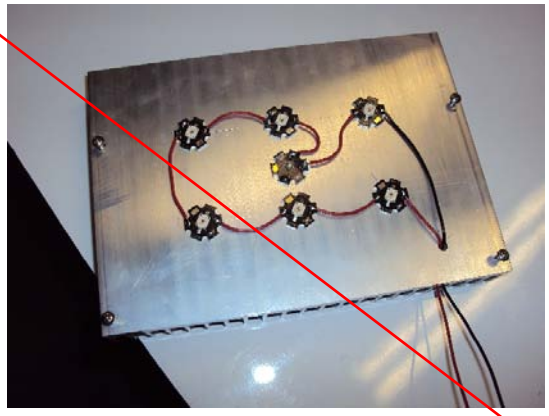
Next, insert the false bottom (tabs face down), and put the slot pipe in place, with the threaded/union end on the same side as the emergency drain.

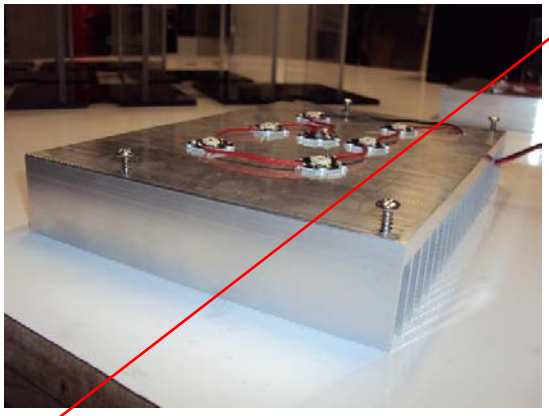


Installing the LED light fixtures.

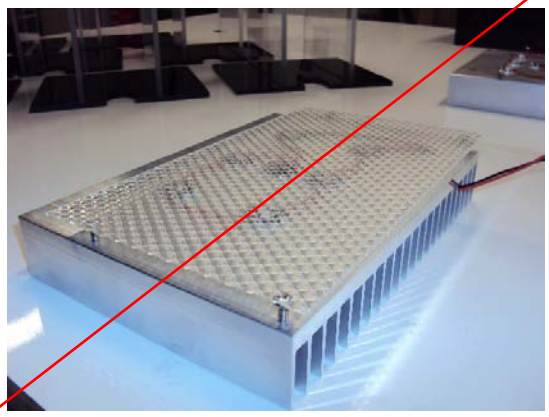
The LED fixtures are shipped in the location and orientation at which they are intended to be during operation. However, there are 4 stand-off screws on each fixture that must be backed out before they are installed. The purpose of these screws is to ensure that the LEDs are not directly touching the diffuser plate or the clear acrylic window of the scrubber box.

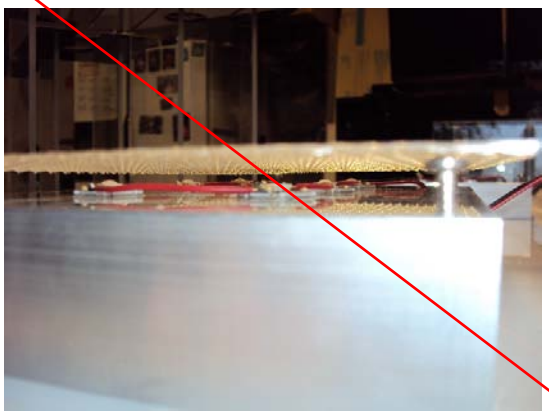
Start by placing the fixtures on a flat surface, preferably on a towel or cloth to prevent the heat sinks from scratching the surface. Then turn each screw counter-clockwise with a Phillips screwdriver until they protrude about ½" above the surface of the heat sink. The ends of the screws should be slightly poking out of the holes on the back side of the heat sink.





Here is an example of how far the screws should be backed out

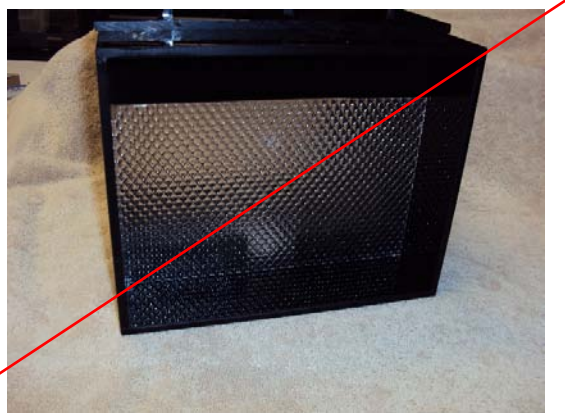


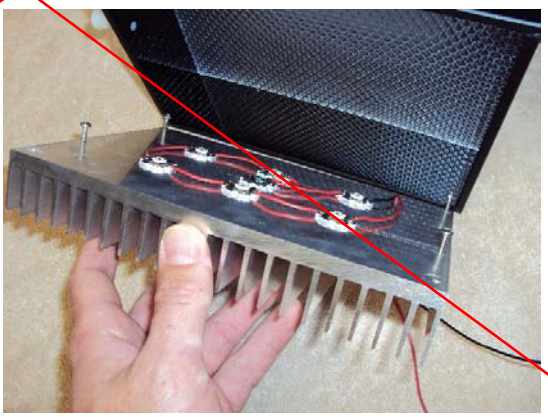


The diffuser plate should be installed in the side of the box prior to installing the light fixture. There are sections on each diffuser that are blacked out with a permanent marker. Near the bottom edge, the middle is blacked out to prevent stray light from illuminating the area underneath the false bottom. There is also a black dot near the center of each diffuser, which is intended to reduce the intensity of the blue LED. More on this later.

Like the light fixtures, the diffuser plates are shipped in their intended location and should be re-installed in the same location.

The light fixtures should be installed back into the location at which they were shipped. The fixture should be oriented such that the power wires are near the bottom of the scrubber box, and closest to the end opposite the emergency drain and slot pipe union. Set the bottom edge of the fixture on the inside of the bottom panel of the fixture pocket, tip it up so that it is fully vertical, and push the fixture in as far as it will go (the stand-off screws will hold the diffuser against the clear window).





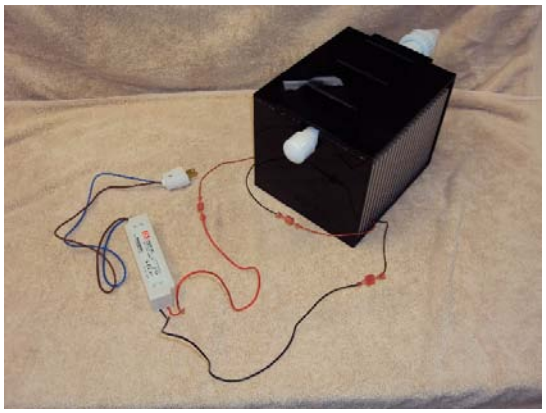
MOSTLY STILL APPLIES

Insert the plastic thumbscrew into the threaded hole next to the emergency drain and turn the thumbscrew clockwise until it is snug. Do not over-tighten this screw, but it should not be loose. The purpose of the thumbscrew is to keep the fixture from falling out if the unit it bumped or tipped. It may not keep the fixture in place if the unit is shaken or tipped at a large angle.

Each LED fixture has 7 LEDs connected in a series string. To connect the LED fixtures to the driver, the fixtures must be connected together so that a single series string of 14 LEDs is formed. This allows both fixtures to operate off of a single Meanwell LPC-35-700 driver.

Each fixture has a red (positive) and black (negative) power lead. There are “male” and “female” connectors on these wires, as well as on the red and black wires on the driver. On the fixtures, each red wire has the same connector, and each black wire has the opposite connector. On the driver, the red connector is the opposite of that on the fixtures.

Connect one of the red wires on one of the fixtures to the black wire on the other fixture. It doesn’t matter which pair you connect – you cannot connect it wrong, as long as it’s red to black (the connectors will fit together, male to female). Connect the remaining red and black wires to the red and black wires from the Meanwell LPC-35-700 driver (these will also fit together, male to female).



Add the lid and the unit it fully assembled.

If you skipped installing the bulkhead, please remember to do so prior to or just after installing the unit in its intended location of operation.

Placement of the LED driver and disconnecting the driver/fixtures.

The driver for the LEDs should be placed in a location where it can be secured to some sort of structure. While it is not generally necessary to provide a heat sink for the driver, keep in mind that the surface temperature of LED drivers can exceed 120F. The driver must be plugged into a GFCI protected receptacle.

You may periodically need to disconnect the LED fixtures from the driver and each other. Before doing so, you must unplug the LED driver. To disconnect, you will need to firmly grasp each side of the connector set (NOT the wires) and pull them apart. Some connectors are easier to pull apart than others, so pull as needed and wiggle the connectors back and forth to slowly work them apart. Some connectors are so tightly clasped that you may actually pull the rubber insulating boot off the metal connector. In this case you may need to get a pliers to pull the set apart. Again, do not pull on the wires themselves as you may pull the wires out from the connector.

Support for the L2 Scrubber

There are many ways to support the L2 scrubber, however this is going to be very specific to your individual setup. So here are just a few examples:

Cut a piece of plywood, acrylic, or polycarbonate to span your sump. Drill a hole for the bulkhead, and if necessary, another hole for the emergency drain and pump feed line. The latter 2 may not be necessary depending on the orientation of the scrubber. If you use plywood, I recommend ¾" plywood or chipboard, and it is a good idea to paint the plywood with a marine paint, or oil-based paint, and let it dry for 24 hours. I would not recommend particle board or MDF. If you use acrylic, I recommend minimum 3/8" material, and preferably ½", and any brand will do (a cheap extruded is fine). Polycarbonate (Lexan) is fine as well, but it is a little harder to work with than acrylic. Please take all safety precautions necessary, regardless of material used.

One could also fashion a shelf using a few layers of egg crate. This would be acceptable if the span was short, such as across the short dimension of a 30 Long or 55 gallon tank. Cut the egg crate so that it sits on top of the tank rim (not on the inside lip where you would set a glass lid) and put one layer of egg crate on top of another, then use zip-ties to secure them together. Cut out the egg crate in the middle for the drain bulkhead. For a longer span, you could sandwich a couple pieces of ½" PVC pipe in between the egg crates, or just use one piece of egg crate and a ¾" or 1" PVC pipe, all secured together with zip-ties, of course. Schedule 40 (ore better) should be used for this, instead of DWV piping which has thinner walls and flexes more.

One could also fashion a stand made out of PVC pipe. However, such a stand would have to have a wider base, or at least feet "extensions" to keep the L2 scrubber stable and prevent it from tipping over easily if accidentally bumped.

Any stand or shelf needs to be secured in some fashion to the piece of equipment upon which it is installed. This means some kind of lip, strap, or clamp to minimize the probability of the Algae Scrubber falling or shifting in such a way that may cause it to fall into the water or into another piece of equipment.

Silent and bubble-free drain

Due to the nature of the enclosed-box algae scrubber, the unit will tend to 'gurgle' as air and water enter the drain in the bottom of the box, and this air/water mixture typically results in bubbles exiting the drain.

The L2 Algae Scrubber was designed with resolution of this situation in mind. The following procedure will allow for the reduction and/or elimination of bubbles and noise emanating from the unit. Please note that this is only possible with this design due to the incorporation of the secondary emergency drain, which should have a 1" PVC pipe inserted into it to extend it to the water surface below the unit.

The procedure it simple – you need to restrict the flow out of the bottom bulkhead to the point where the water level does not rise inside the scrubber box, and air is not longer sucked down the drain. To do this, you will need to add a valve to the bulkhead below the unit. Essentially, you "tune" the drain so that it is always running with the pipe full of water. This is a similar concept to the full siphon line of a "tuned" overflow piping system for a display tank, such as the "Herbie" or "BeanAnimal" system.

The bulkhead is threaded on the outflow side, so you will need a threaded adapter. I recommend that you get a 1" threaded-to-3/4" slip adapter, then a small section of ¾" PVC, and a ¾" slip-slip ball valve. The length of pipe you need depends on how far above the water level your unit is installed. The ball valve should be just above the water surface so that it is as close to the point of discharge into the tank/sump as possible. An additional short section of pipe may be installed into the discharge side of the valve to extend the overall plumbing line so that the drain outlet is just below the water level.

I recommend adding some lubricant to the ball valve prior to installation. Close the valve, then apply a dab of silicone grease to either side of the ball, then open and close it several times. Repeat as necessary. You may also use a gate valve, as this is easier to adjust.

To tune the pipe, you will need to have the scrubber connected with water running through it, and the emergency drain in place and extended to the water surface. One of the heat sinks and diffusers will need to be removed so that the interior of the box can be viewed. With the water flowing, you should see a tornado-like vortex of air right above the drain. Adjust the ball valve until you can still see the vortex, but the air stops getting sucked into the drain. If you close the valve too much, the vortex will shrink and/or disappear and the box will start to fill up.

Startup, Cleaning and Maintenance

The lights should be placed on a timer such that they are running a maximum of 9 hours/day. This can be done in one block, or split into multiple periods. Most users have this photoperiod take place on a schedule opposite of the display tank lighting, which can assist in maintaining pH. However, this is not necessary.

The screen will take 4-6 weeks to mature to the point where it can be relied on for filtration capacity. This is referred to as the "curing period". The screen should be serviced every 7 days, using the following procedure:

1) Unplug the LED driver
2) Shut off the pump or water supply to the slot pipe
3) Disconnect the slot pipe union and remove the slot tube & screen assembly.
    a. Take care not to lose the rubber o-ring that is part of the union.
    b. Use a pan or cutting board to ensure that water doesn't get dripped onto the scrubber box or light fixture as you are removing the screen assembly from the box
4) Remove the false bottom
5) Take the slot tube & screen assembly and false bottom to a sink
6) Rinse and scrub the false bottom
7) Disconnect the beaded cable and remove the screen from the slot
8) Rinse and scrub the slot pipe
9) Run the screen under room temperature running tap water. Gently rub the roughed-up area of the screen with your fingertips only. Do not use a brush, fingernail, or the sink sprayer to completely remove growth from the screen. You only want to rinse away anything that is loose and easily detaches.
10) Use a brush on the smooth part of the screen (the top 1" or 7 rows). Make sure this area is 100% free of algae
11) Re-install the screen into the slot pipe and clasp the zip tie
12) Re-install the false bottom
13) Re-install the slot tube & screen assembly and tighten the union
14) Adjust slot pipe so that the slot is pointed down
15) Turn on pump/water supply
16) Plug in LED driver

This process should take about 10 minutes.

Depending on your specific system conditions, your screen will grow/cure at slightly different rates. Modifications to the cleaning process should be done as follows:

1) If there are long strands of green hair algae that you cannot rub off with your fingers, you may switch to using the back of your fingernails or a plastic pan scraper or acrylic aquarium scraper, gently. Remove longer strands, leaving shorter strands alone.
2) If you have a lot of this growth, you can clean most of it off.
3) If you have very little of this growth, leave it all on the screen
4) In any case, scrape all the strands off the lower ½" to 1" of the screen
5) If you see that the holes are filling in with algae, this is a sign that your screen is maturing. You may take a more aggressive approach to cleaning, meaning that you can scrape more of the algae off (still do not use a brush or sprayer)

The screen is considered "mature" or "cured" once a vast majority of the holes have filled in with algae growth. When you scrape the screen, leave this growth alone.

Maintaining a mature/cured screen

Once your screen is fully cured, it is recommended that you continue to follow the cleaning schedule.

Extended growth cycle options.

You may allow for a longer period of time between screen cleanings, up to 10 days, and in some cases, as long as 14 days. However, if you allow the screen to go longer than 7 days, I recommend that you perform an interim cleaning at the 7 day point. This cleaning would be as follows:

1) Include all the normal cleaning steps, such as
    a. Cleaning the slot pipe
    b. Cleaning the top of the screen
    c. Cleaning the false bottom
    d. Removing strands of algae that extend beyond the screen material
2) Do not scrape the screen
3) Rinse the entire screen in room-temperature tap water, either running or in a bucket. Rub your fingers gently throughout the algae mat.
    a. This kills baby copepods which host on the screen and eat the algae, causing the roots to detach.
    b. This also releases anything loosely trapped in the algae mat, as well as allow any weak strands to detach
    c. You may use a sink sprayer on medium flow to perform this action

Since you are taking the same amount of time you normally would to clean the screen, you may adopt the alternative method of only cleaning one side of the screen every 7 days. With this technique, you alternate which side of the screen you clean every 7 days. This allows for one side to grow the full 14 days. So you would follow the above procedure, but you would fully scrape one side of the screen at 7 days, then 7 days later you would scrape the other side, etc. This has the benefit of allowing light to better penetrate through to the side that was not cleaned, meaning that the “roots” on that side will maintain strength longer and hold better through to the 14 day period of growth for that side.

RO/DI Rinse Option

Depending on your growth, you may be able to get away with simply shutting off the flow to the screen and rinsing the screen with RO/DI water. The main purpose of the mid-week cleaning is to prevent baby copepods from eating the algae and causing a detachment to occur. Freshwater kills these baby copepods instantly. So for this shortcut method, you would:

1) Unplug the LED driver
2) Shut off the flow to the screen
3) Take the top off the scrubber
4) Fill a container with RO/DI water
5) Pour this slowly, right on top of the slot pipe above the screen
6) Turn flow to the scrubber back on
7) Plug in LED driver

If you choose this method, I would recommend performing this action a little more often than just at the 7 day point. You can do it as often as you wish, it does not harm the algae to rinse it in this manner.

Some DOs and DON'Ts:

Don't orient the heat sinks so that the wires come out of the holes at the top of the heat sink. They are supposed to be at the bottom so that a "drip loop" is formed.

Don't place the heat sinks such that the interconnection is done on the same side as the emergency drain and slot pipe union. If you must do it this way, please extend the wiring as necessary so that there is not possible way that water could come in contact with any electrical connectors.

Don't place the scrubber on top of wiring or connectors.

Don't place the driver such that it is below the scrubber without an appropriate drip loop that would prevent water from making contact with any electrical connection point or the driver itself.

Do install the extension pipe for the emergency drain. This is required, regardless of whether or not the bottom drain has a valve on it or not.

Do ensure that the slot points straight down and the that the beaded cable tie is rotated to allow free movement of the screen.

Don't lose the o-ring that is part of the union. Don't drop it into the sump while removing the screen for cleaning, and don't drop it down the drain while cleaning!!

Don't remove the algae in the holes when cleaning the screen