**TABLE OF CONTENTS**

ePBR Setup Guide

* Part Identification
* Assembly of ePBR
* Culture Vessel Assembly
* Installing LED Assembly
* Installing Jacket Temperature Probe
* Installing Thermistor Probe
* Installing Tygon Tubing
* Installing pH Probe
* Installing Reference Probe
* Installing Ethernet Cable
* Installing the Emitter and Detector Cables to Turbidity Sensors

**Using the ePBR pH Probes**

Care and Maintenance of pH Probes

ePBR Setup Guide

**Part Identification**

Carefully unpack all parts and check to make sure that all parts are accounted for.



1. Controller Tower

2. Heating and Cooling Jacket (Jacket)

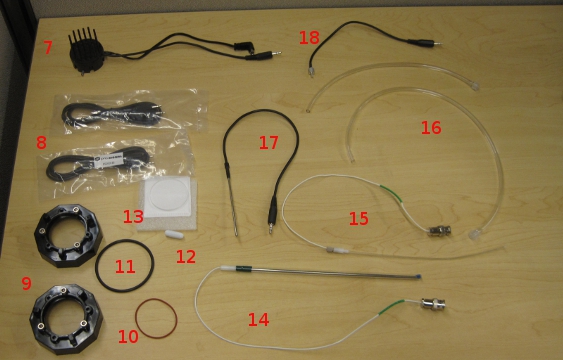
3. Clear Culture Vessel (CV)

4. Ethernet Cable

5. Power Cable

6. Router 4 port \*

\* One Router will support 3 units at a time



7. LED

8. Turbidity Cables (2)

9. Caps (2)

10. Orange O-ring

11. Black O-ring

12. Stir bar

13. Glass Lens

14. pH probe

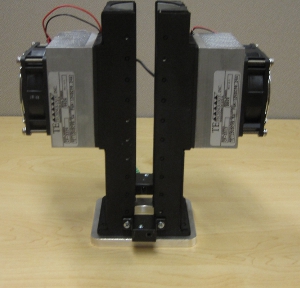
15. Reference for pH probe

16. Tygon tubing (2) – short and long tubes

17. Thermistor probe

18. Temperature reference probe

**Assembly of ePBR**



Front view of jacket assembly

The emitter and detector can be set at

variable heights



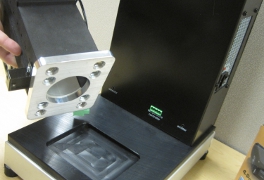
Connector for temperature

controller

Side view of the jacket assembly

Emitter

Detector



Setting the jacket assembly on the plate

Place the jacket on the fitted groove on the plate. The base fits perfectly in the groove, make sure the green plug is toward the back.

Don't plug the temperature controller plug into the green outlet on the tower until there is something inside the culture vessel to heat. If the thermistor is exposed to just air, it cannot detect the jacket assembly trying to heat the vessel and it may burn out the jacket assembly.

**Culture Vessel Assembly (CV)**



Glass Lens (#13 on parts list)

Orange O-ring (#10 on parts list)

Cap (#9 on parts list)

Black O-ring (#10 on parts list)

Top of the clear culture vessel (#3 on parts list)

Place the larger black O-ring on the top of the CV, then screw the cap onto the top of the CV.

Place the smaller orange O-ring onto the recessed round top of the cap around the opening where the lens will be placed.

Place the lens onto the Orange O-ring.

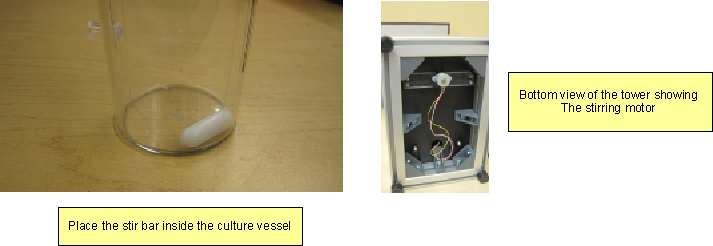
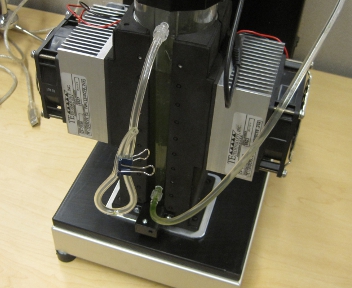
Attach the Tygon tubing to the two plugs on the culture vessel - the longer tube should be on the bottom and the shorter one on the top.

*Note: It is important that the lens is clear at all times, avoid scratching on the surface and keep it clean from film building up on it. It is important that the light from the LED can pass freely through this lens.*

*This Culture Vessel is made of polycarbonate and can be autoclaved up to ten times, before it should be replaced. To preserve clarity of the plastic it is recommended to use chemical sterilization instead. Ethanol works the best, a brief bleaching solution (~5%) will also work. Do not use organic solvents such as acetone as it will cloud the plastic.*

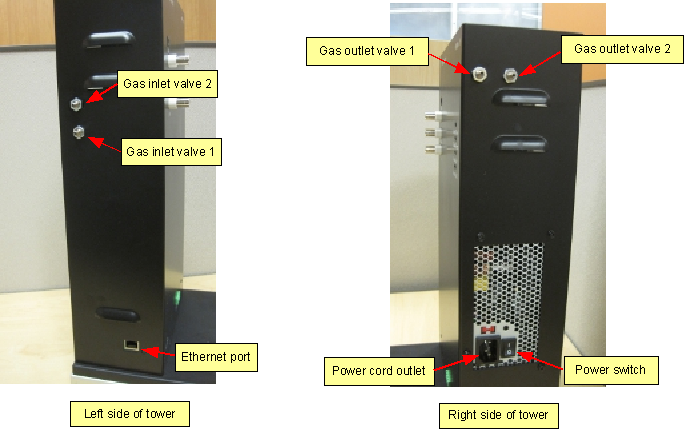
The stir bar goes into the clear culture vessel and is controlled by the software and operated by a magnetic stir plate on the underside on the controller tower.

Place the CV in the Temp Control assembly with the tubing facing away from the tower. The vessel should be carefully placed in the temp control assembly, not forcefully wedged into the assembly.

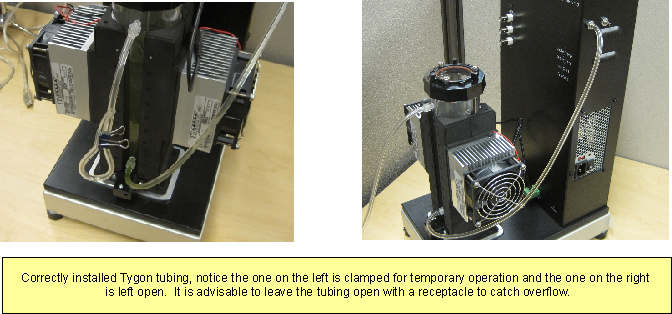


Connect the bottom tubing to gas valve 1 on the right side of the tower toward the front.

*Note that when pumping gas into the vessel the top tube needs to be unobstructed so the pressure will not build up inside the vessel. The tube may leak a little so you may want to place a container to catch anything that may come out.*



120V to 220V Switch

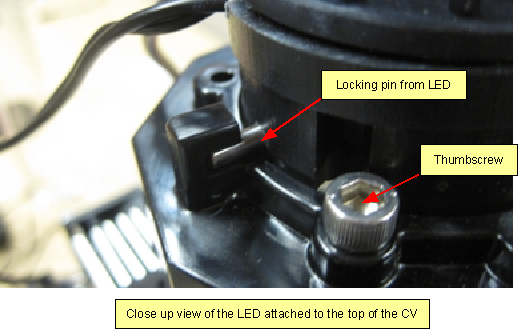


Connect the gas source to Gas Inlet 1 on the left side of the unit, there are two ports and the lower one is for the gas inlet, while the other is for future expansion or customization. Some models do not have a second gas inlet or outlet valve.

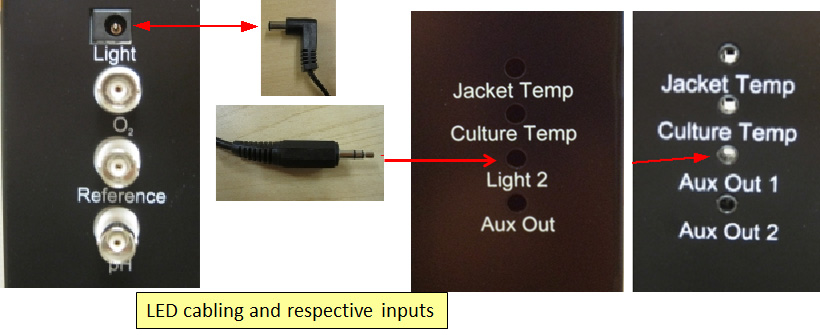
*Note: The max input for the valve is 100 PSI, be sure to set your regulator to not exceed this rate.*

**Installing the LED Assembly**

Place the LED on top of the window lens. Turn the LED so that the metal pins fit into the inserts.

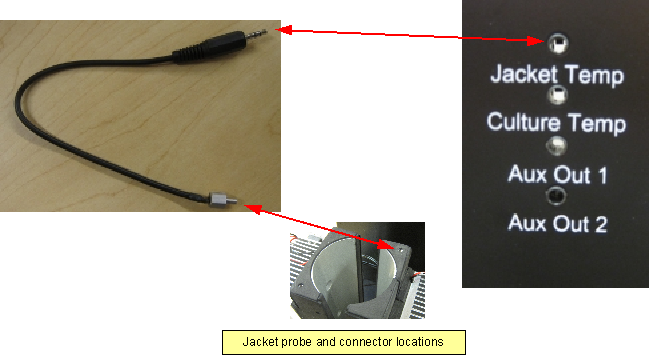


Plug the power cable from the LED into the port labeled “light” (on some units this may be labeled as “Light 1”), then plug the other jack into the port labeled “Light 2” (On some units this may be labeled as “Aux Out 1”). The Aux Out 1 port provides power to a heating element within the LED to prevent condensation.



**Installing Jacket Temperature Probe**

Next locate the jacket temperature probe. It has a screw on one end of it. Screw the end in on the top corner of the jacket assembly on the right back corner. The screw only needs to be in finger tight, do not attempt to tighten it down too tight.



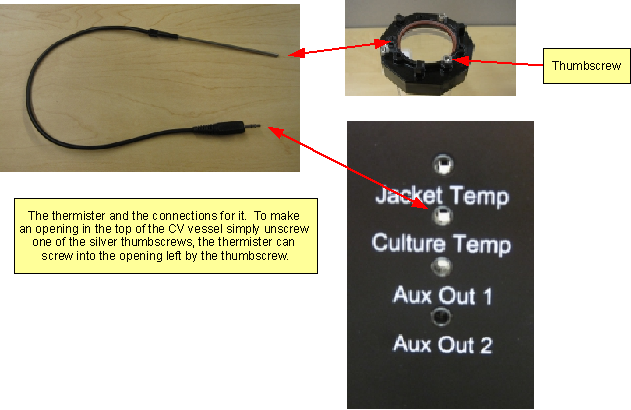


Plug the other end in the port labeled “Jacket temp”.

**Installing the Thermistor Probe**

The thermistor probe is very delicate and care must be taken when handling it, whether you are inserting it into the vessel or removing it. On the top of the vessel there are three thumbscrews, remove one of these thumbscrews and insert the probe into the hole.





Tighten the probe down to only finger tight, remember that these probes are delicate and further tightening may result in probe damage. Plug the jack into the port labeled “Culture Temp”.

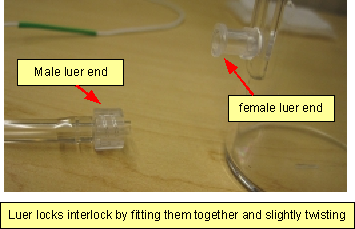
The Jacket Temperature probe tells the software what the temperature is of the jacket and heating/cooling system.

The Temperature Thermistor probe tells the software the temperature of the culture media.

Both of these systems work together to help regulate ad monitor the temperature of the culture and the media.

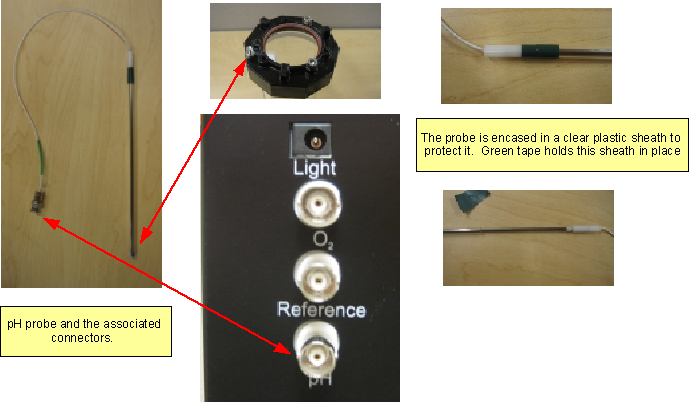
**Installing the Tygon Tubing**

The tubing used for the ePBR is Tygon tubing (ID 1/8" OD 3/8" Formula R-3603), there is a Luer lock on the one end that connects to the culture vessel. If the culture vessel is more than half full it is recommended that a container be placed next to the ePBR and the upper tube placed into it to catch overflow from the bubbling. When adding or removing tubing simply twist the end. If the CV is leaking around the female Luer end, it can be fixed by unscrewing the end, applying superglue, and screwing it back in.



**Installing the pH Probe**

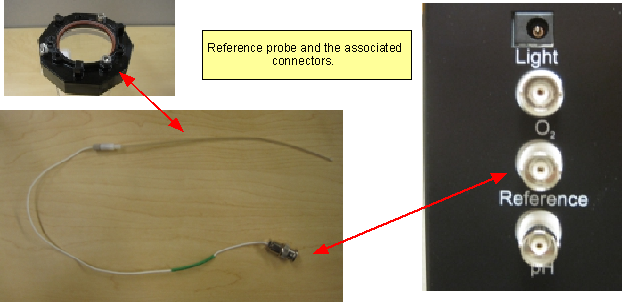
For the pH probe (optional), remove the green tape towards the top, the protective sheath can then be slid off.



Before installing the probe make sure to rinse the storage buffer off it first. When the probe is not in use it should be stored in storage buffer (KCl) to prevent damage. Connect the end of the cable to the port labeled “pH”.

**Installing the Reference Probe**

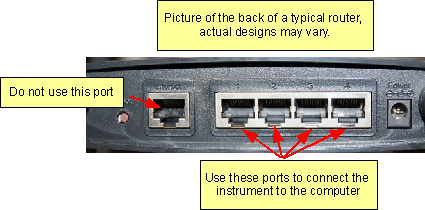
The pH probe cannot operate without the reference probe. As with the thermistor and the pH probe, remove one of the thumbscrews and install the reference probe into the culture vessel. Plug the other end into the port labeled “Reference”. Make sure that the pH and Reference probes do not touch inside the vessel, as this will give an incorrect rreading.



*Note: The O2 sensor is for a future product design and is not in use at this time.*

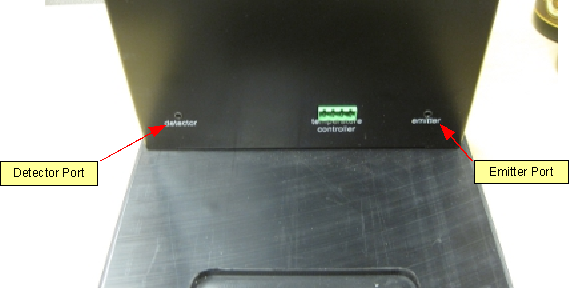
**Installing the Ethernet Cable and Router**

Plug the Ethernet cable into the jack on the right side of the ePBR instrument (see illustration 6). The other end is plugged into a router. A router is necessary and highly recommended due to the fact the software is designed to interface with a router. A computer cannot be directly linked to the instrument, as the software will have difficulty detecting the instrument. When linking a computer with the router and then to the ePBR, make sure not to use the “internet” or “uplink” ports.

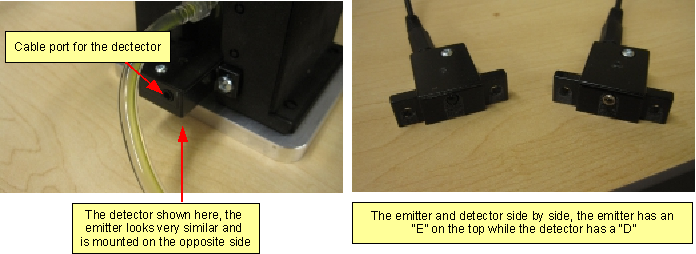


**Installing the Emitter and Detector Cables to the Turbidity Sensors**

On the front side of the control tower the left and right inputs are the emitter and detector ports.



The emitter and detector are part of the Turbidometer or Optical Density sensors (OD) and are installed on the jacket assembly, one in the front and one in the back. The emitter and detector look identical, except for the fact that the emitter is located to the front of the jacket and has an “E” on the case and the detector is located to the back, indicated by a “D” on the case.



The two turbidity cables that shipped with the unit (part #8) are interchangeable and can be used for either the emitter or the detector. Take one cable and plug it into the emitter and plug the other end into the emitter port on the tower (see illustration above). And take the other turbidity cable, plug it into the detector and the other end into the detector port.

*Note: The emitter and detector can be adjusted to measure turbidity at different depths. If you wish to change the depth of the reading unscrew both the emitter and detector and screw them back in at the desired height on the jacket. If you are having trouble locating the screw holes they may be covered by the foam material that insulates the jacket. They can be located by finding the small circles on the jacket and removing the foam from them. Make sure the emitter and detector are at the same height or the turbidity reading will be faulty!*

Now you should have your ePBR set up and you are ready to install and open the Algal Command software included on the CD. Following set-up procedure using Algal Command software you will be ready to insert media and seed algae.

PLEASE OPEN THE ALGAL COMMAND SOFTWARE USER GUIDE.

Please have a PAR light meter to calibrate the LED light and pH buffers for 4, 7, and 10pH to calibrate the pH probe (optional).

See next section for care and maintenance of pH probe.

Using the ePBR pH Probes

**pH Probes and Reproducibility**

Checking calibration –The user calibrates the pH and Reference probes using a PAR meter and following Algal Command software prompts by inserting the probes in pH buffers 4, 7, and 10. To test the calibration at the end of the calibration procedure, place the probes in another buffer, like pH4 buffer, and click on the ‘Measure’ button. This should give the unit time to measure the new pH level. Sometimes you have to hit the ‘Measure’ button repeatedly to get the right measurement as it takes some time for the probe to register the change. When using the buffers make sure that the reference and pH probe are not physically touching in the solution.

pH can vary- pH varies a great deal due to the fact that algae is constantly using CO2 to create oxygen and this process influences the pH, not necessarily in a linear fashion.

pH Probe Accuracy – pH probes are not as accurate for algae grown in fresh water, as salt concentrations effects the probe’s performance due to low ionic conditions. pH measurements in low ionic, de-ionized water or low conductivity solutions may create several problems for standard pH electrodes.

Typical difficulties include:

- Slow sluggish or drifting readings

- Unrepeatable readings

- Premature electrode failure

See : <http://www.eutechinst.com/tips/ph/14.pdf>

Autoclaving pH Probe – the Phenometrics pH probe is NOT autoclavable. If it is autoclaved it will destroy the probe and void the warrantee. Remove the pH probe and Reference probe before autoclaving the culture vessel.

CO2 Levels –pH levels are affected by CO2 concentrations. Adding CO2 makes the culture media more acidic and as the Algae use CO2 to grow the pH becomes more basic. Algae also have carbon concentrating mechanisms that can rapidly take up CO2 from the media during photosynthesis. As the amount of CO2 the algae absorbs varies greatly from hour to hour until the algae are saturated, the effect on pH from injecting CO2 may not behave as you expect. When the algae grow to a high density, the flow rate or CO2 concentration may not be high enough to acidify the culture down to the set point specified in the software. Precise pH control may not be possible and using CO2 for pH control may cause different cultures to receive different amounts of CO2, causing them to have different growth rates.

If the goal is simply to ensure that the algae receive enough CO2, then it is easier to use the gas valve timeshare to give each ePBR a precise amount of CO2 and use the pH logging to monitor whether or not the timeshare is providing enough CO2.

**pH Cleaning/Storage/Shelf Life**

The Phenometrics ePBR Reference electrode is supplied with a soaker storage barrel with special soaker solution. The pH probe and reference probes will have longer shelf lives if the user stores them in a solution, compared to probes that are stored dry after use. The special soaker bottle solution that comes with the probe, provides an environment that maintains pH glass hydration in an acidic environment as well as keeping the reference junction wet, which will enable the probe to communicate effectively to the ePBR directly. If the original solution is no longer available, the following are acceptable storage media for pH electrodes in order of preference:

- 4.00 pH Buffer

- 7.00 pH Buffer

**Note: Never store a pH electrode in de-ionized water. De- ionized water is only for rinsing.**

Since pH electrodes have limited lives*,* it is important to keep one or more spare electrodes available for replacement. An important aspect of the performance of any spare pH electrode is that it will it work when you need it.

**Q: How should a pH electrode be cleaned?**

A: The bulb can be cleaned as follows:  
  
• For protein layers, soak in a freshly prepared solution of 1% pepsin in 0.1N HCl for 30 minutes.   
• For inorganic deposits, wash with a 1M EDTA solution, 2M ammonia, or 2M acid.  
• For grease and similar films, wash with acetone, methanol, etc.

**Q: How should an electrode be reconditioned?**

A: Prolonged use, excessive alkaline immersion, or high-temperature operation will cause surface leaching of the membrane glass. The result is extremely noisy and/or sluggish response, which cannot be remedied simply by cleaning the electrode. If this occurs, the following procedures will often provide stability and pH sensitivity. Always consider the electrode's materials of construction before using these procedures.  
  
1. Empty the reference chamber, rinse with de-ionized water, empty and refill with the specified filling solution. It is easier to replace the outer barrel tube.  
2. Soak the electrode in hot (50°C – 60°C) reference electrolyte for a few minutes.  
3. Soak the electrode overnight in pH 4 buffer.  
4. Remove any exterior salt deposits with distilled water.  
5. Reference electrode is too small to put pressure on, just replace with new barrel.

6. Sometimes the material clogging the junction requires more severe action. Should the above procedure fail, proceed as follows:  
  
a. Use a solvent specific to the solution or material plugging the junction, if possible.  
b. Soak the membrane overnight in 0.1 M HCI.  
c. If measurements have been made in samples containing protein, remove protein deposits by soaking the electrode bulb in 0.1 M HCl containing 1% pepsin.  
d. Repeat from step 1.  
  
Please notify Phenometrics as to whether the probe’s malfunction is due to any of the above procedures. If all these procedures fail, the electrode should be discarded safely and replaced.