

## PC-BOD System Maintenance Manual

### Priming Reagent Lines – Beginning of the day

At the beginning of a day the system will be used, the lines will need to be filled with fresh reagent. Often, the database will have an autorun button on the main screen designed to guide you through this procedure. If this is not found, follow the instructions below to prime the lines.

1. Place the tubing into the reagent bottles below the liquid level in the bottle.
2. Place a beaker under the tips on the autosampler arm to catch the waste. When priming the dilution pump line, it is best if the tips are in the beaker as the water will eject with some pressure once it reaches the tip. This can be done by moving the autosampler in manual control or by holding the beaker up around the tips.
3. Manually turn on the dilution pump(s) using the switch on the front of the module until the dilution water is ejecting from the tip and there are no bubbles in the lines. Turn the pump to the auto position to allow the software to control the pump during the run.
4. Manually turn on the remaining pumps using the switch on the front of each pump and let them run until the lines are full and no bubbles are present. This can also be done by turning on the pumps in manual control. Once complete, turn the pumps to the auto position to allow the software to control them during the run.

### Rinsing out Reagent Lines – End of the day

At the end of each day, it is important to empty the lines of all reagents to prevent growth. This is especially important for dilution and seed solutions since growth can occur very rapidly if left in the lines.

1. Lift the tubing in the reagent bottles above the liquid level in the bottle.
2. Place a beaker under the tips on the autosampler arm to catch the waste. When emptying the dilution pump line, it is best if the tips are in the beaker as the water will eject with some pressure. This can be done by moving the autosampler in manual control or by holding the beaker up around the tips.
3. Manually turn on the pumps using the switch on the front of each pump and let them run until the lines are empty. Turn the pumps off. This can also be done by turning on the pumps on manual control.
4. Place the tubing from the reagent bottles into a beaker of DI water.
5. Manually turn on the pumps as above and let the lines fill with DI water.
6. Once sufficient water is present, remove the ends of the tubing from the DI water beaker and let the lines fill with air.
7. When complete, turn the pumps to the auto position.
8. Store the probe in a BOD bottle with 1 inch of water over night. This can be done manually or by using the 'Park Probe' autorun button on the main screen.

### Changing the DO Probe Membrane –once a month or as needed

It will be necessary during the operation of the BOD system to change the DO probe membrane and add electrolyte solution to the probe. An autorun button has been set up with a schedule that allows easy access to the probe without removing it from the system.

The membrane can last anywhere from a few hours to several weeks depending on the nature of the samples being analyzed and how the probe is cared for. Probe readings that are erratic or do not stabilize are the most common indicator that electrolyte needs to be added to the probe or that the membrane needs to be changed.

1. On the main screen, select the '**Change Membrane**' autorun button.

2. When the 'Run BOD Analysis' screen is open, click on the 'Start' button, enter a valid rack number and press 'OK'.
3. The autosampler will move the probe to the front center of the rack to allow easy access to the membrane.
4. Unscrew the old membrane from the bottom of the DO probe. Fill the new membrane half way with electrolyte, screw it back into place and press 'OK'.
5. The probe will need to sit for at least 30 minutes in a BOD bottle containing 1 inch of water before calibrating or running samples.

## Checking the Flow Rate of a BOD Reagent Addition Pump – Once a Month

The flow rate of a pump should be checked once a month or if issues arise with BOD results. Also if any of the tubing is changed on a pump, the flow rate will need to be verified.

### Automated Pump Calibration

Use the following instructions if your database contains schedules already setup to assist in the pump calibrations. These schedules would have the following names:

- Dilution Pump Cal
- Inhibitor Pump Cal
- Rinse Pump Cal
- Seed Pump Cal
- Spike Pump Cal

If these schedules are not in the database refer to the instructions found below.

1. From the main screen, click on 'BOD' and select 'Run BOD'.
2. On the BOD analysis screen, click the 'Schedule' button and select the pump calibration schedule for the pump to be calibrated. Press 'OK'.
3. Fill out the sample name column with the name of the pump to be calibrated.
4. Press 'Start'.
5. Follow the instructions displayed on the screen. The pump will automatically be turned on/off after the specified amount of time (usually 60 seconds).
6. The pump calibration will be performed 5 times so that the results can be averaged.
7. Follow the instructions below to enter the flow rate into the software.

### Manual Pump Calibration

The following instructions can be used for any of the pumps present on the PC-BOD system but will be described using a seed pump.

The pump calibration can be done using de-ionized water or seed.

1. Place the end of the tubing in a bottle of seed or a beaker of water.
2. Using the switch on the front of the module, manually turn on the pump until the line is fully primed. Discard any liquid obtained.
3. Place an appropriately sized graduated cylinder (see per chart below) under the tips on the BOD sampler arm and manually turn on the pump for exactly 1 min (Use a stop watch or the clock on your computer). Note: if performing a calibration on a high flow rate pump, such as the dilution pump, a time of 15 or 30 seconds can be used and the result multiplied by four or two respectively to give the flow rate per minute.

Pump	Approximate Flow Rate (ml/min)
Dilution	400-600 for single headed and 1000-1200 for dual headed
Seed	10-20ml
Inhibitor	10-20ml
Spike	10-20ml
Rinse	200 - 250ml

4. Record the volume pumped.
5. Repeat at least 2 more times and average the results
6. Once this is complete the flow rate in the software will need to be changed using the instructions below.

### Changing the Flow Rate

1. From the main screen, go into '**Interface**', and select '**Hardware Setup**'.
2. Click on the '**Digital/Amplifiers**' tab and then '**Basic digital I/O**'.
3. Select digital 2 for the seed pump. Look at the chart below for the correct digital to modify if a different pump was calibrated.

Pump	Digital to change in Hardware Setup
Dilution	Output 1
Seed	Output 2
Inhibitor	Output 3
Spike	Output 13*
Rinse	Output 17*

\*These digitals are found in the extended digital tab I/O section

4. Enter the average flow rate obtained above in the flow rate box and click on OK.

With an accurate flow rate, the software will be able to accurately deliver the volumes specified on the run screen.

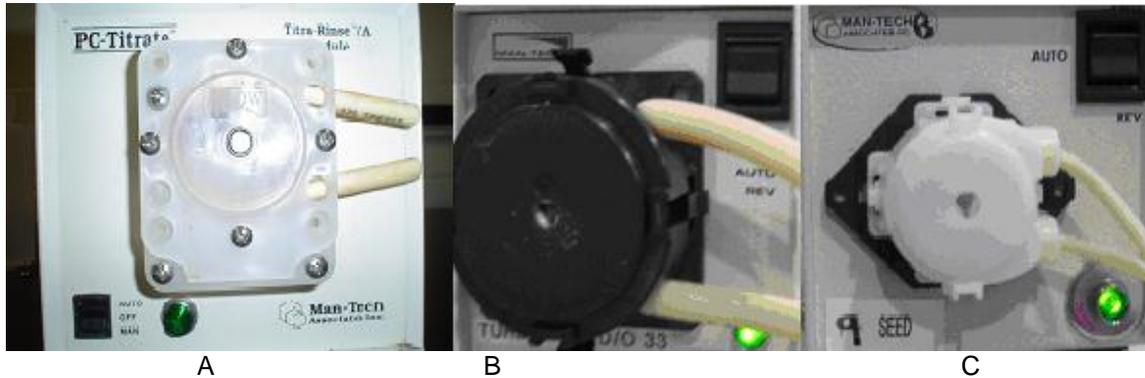
### Replacing Pump Tubing – Once every 3 months

To keep the system running optimally, pump tubing should be replaced every 3 months or when any algae is present in the lines.

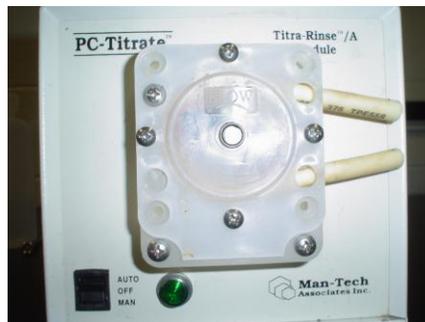
Complete tubing kits for each pump can be purchased from MANTECH INC or your local distributor to ensure correct tubing sizes and fittings are used.

1. Lift the tubing in the reagent bottles above the liquid level in the bottle.
2. Place a beaker under the tips on the autosampler arm to catch the waste. When emptying the dilution pump line it is best if the tips are in the beaker as the water will eject with some pressure. This can be done by moving the autosampler in manual control or by holding the beaker up around the tips.
3. Manually turn on the pumps using the switch on the front of the module and let them run until the lines are empty. Turn off the pumps.
4. Place the tubing from the reagent bottles into a beaker of DI water.
5. Manually turn on the pumps and let the lines fill with DI water.
6. Once sufficient water is present, remove the ends of the tubing from the DI water beaker and let the lines fill with air. Turn off the pumps and place them in the auto position.
7. Remove the fittings and attached tubing from the yellow tubing that goes into the pumps.
8. Undo the spiral wrap from around the tubing going to the autosampler arm and detach the tubing from the probe holder by pulling straight up.
9. All tubing should now be free to remove from the system. Note you may want to keep the old lines so that they can be used to measure the new lengths of tubing.

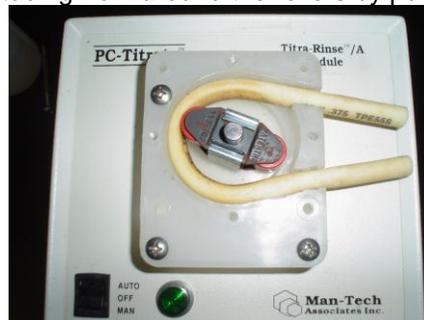
Look at the pumps shown below to determine the next step. If the system contains a pump like that shown in 'A' below, follow the instructions in steps 10-17. If the system contains a pump like those shown in 'B' or 'C' follow steps 18-23.



10. To change the inner pump tubing, the faceplate on the pump will need to be removed. Using a Philips screwdriver, undo the four screws holding the faceplate in place.



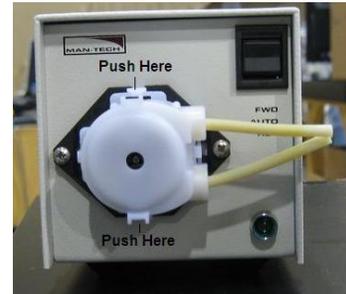
11. Gently pull out the yellow tubing from around the rollers by pulling it towards yourself.



12. Replace with the new tubing. In order to get the tubing back around the rollers it is often helpful to manually turn on the pump. This is more easily accomplished with slow speed pumps so be careful if using this technique with the rinse pump or dilution pump as they rotate quickly.
13. Once the tubing is in the place, replace the faceplate and secure it with the 4 screws.
14. Measure out the new tubing and attach it back to the pumps using the fittings included in the tubing kits. **Note:** the input tubing which comes from the reagent bottle should be attached to the bottom of the pump and the outlet to the sampler arm attached to the top.
15. Once all tubing is connected, use the spiral wrap to hold the tubing going to the sampler arm neatly together.
16. Perform a flow rate check on the pumps as described above.
17. Rinse the new lines with DI water and then with reagent prior to sample analysis.

The following instructions are applicable for both pump B and pump C shown above.

18. Remove the pump head by pushing on the clips at the top and bottom of the pump head and sliding it off.
19. Attach the new pump head by pushing it onto the shaft and clicking it into place.
20. Measure out the new tubing, using the old tubing if possible and attach it back to the pumps using the fittings included in the tubing kits. The pump head will have arrows depicting where the intake and outlet are; the intake of the pump should lead from the water carboy or reagent bottle.
21. Once all tubing is connected, use the spiral wrap to hold the tubing going to the sampler arm neatly together.
22. Perform a flow rate check on the pumps as described in Section 12.40.
23. Rinse the new lines with DI water and then with reagent prior to sample analysis.



Document Change Log

Version	Date	Author	Changes
2	25-July-2019	Heather Jasumani	<ul style="list-style-type: none"> <li>• Document ID assigned</li> <li>• Formatting</li> </ul>



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