FAQ: **BI-ZTU**

Questions and Answers for Using the Brookhaven **BI-ZTU**

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4. **Why does the flow cell fail to fill properly?**

   The most common reason for the sample cell failing to fill properly is that there is an air leak. Most commonly, the leak is a crack in the glass flow cell. The **BI-ZTU** was designed so that the circulation pump creates a vacuum in the flow cell and draws liquid into the flow cell. In this way, if there is a leak, the **BI-ZTU** will pull air into the system rather

than pump liquid through the leak. This strategy helps to prevent significant damage to the zeta potential instrument.

Before checking for leaks, ensure that the circulation pump is working. On the titrator menu choose **Fill Cell** and listen for the pump located on the front of the **BI-ZTU**.

If the pump is turning, then examine the glass flow cell for any cracks. If there is a crack, it is probably a leak which prevents the flow cell from operating properly. Replace the glass cuvette. See the last paragraph of Appendix A of the manual. The Appendix is entitled "Clearing Blockages & Removing Bacterial Growth," but it also discusses removing and replacing the cuvette. Also, see the warning sheet with the title "BI-ZTU Important Warning for Flow Cell."

If there are no cracks, check the four M2 screws holding the round disc (to which the cuvette is glued) to the electrode holder. Tighten each about ¼ turn. Use the short arm of the hex key for leverage, not the long arm, to prevent over tightening and damage. Then, check the fittings connecting the flow cell to the **BI-ZTU**. Check to make sure the black fitting is connected to the black bulkhead union and the red fitting is connected to the red bulkhead union. Ensure that both fittings are finger tight. Tighten them as much as possible WITHOUT using a wrench or pliers. Check the fittings on the peristaltic pump, which also only need to be finger tight.

5. **Why does the BI-ZTU not achieve the target pH values exactly?**

The **BI-ZTU** is attempting to control hydrogen ion concentration over a range from about 10^{-2} Molar to about 10^{-12} Molar (ten decades) in chemical systems with unknown constituents. This is a difficult challenge.

If the volume of sample is very small, or if the concentrations of acid and base in the bottles and initial volume of sample are not accurately entered into the Titrator Setup dialog, or if the pH probe calibration is bad, the **BI-ZTU** will not perform as well. The software attempts to correct for all of these problems, and tolerates significant (20%) errors.

Try increasing the volume of sample (to 25 mL) and check the concentration of acids and bases in the bottles against the values entered into the Titrator Setup Dialog. Also, please check that correct value for the initial sample volume is entered. To confirm acid and base concentrations, use the pH probe to check the pH of each reagent bottle. Be sure to calibrate the pH probe first. For the acids, the concentration can then be calculated according to the formula 10^{-pH}. That is, a pH of 1 corresponds to an acid concentration of 0.1 molar. For base, the concentration can be calculated according to the formula $10^{(-14+pH)}$. That is, a pH of 13 corresponds to a base concentration of 0.1 molar and a pH of 11 corresponds to a base concentration of 0.001 molar. Finally, we recommend that the steps are a full pH unit. That is, perform a titration from pH 3 to pH 11 in 9 steps (i.e., every full pH unit) instead of 17 steps (i.e., every ½ pH unit).

6. **If the BI-ZTU overshoots a pH value, why doesn't it titrate in reverse to reach the target pH value?**

   Some surfaces do not act the same as the pH is increased or decreased. That is, there is hysteresis. Therefore, to change from adding acid to adding base, or the opposite could corrupt the data the user is trying to collect. Also, if a reverse titration is performed, the salt content of the sample would be increased, which will also influence the zeta potential. In order to preserve the quality of the user's data, titration is performed in only one direction.

7. **Why do I have results of two measurements at the same pH?**

   The **BI-ZTU** attempts to reach each target pH in succession. If the **BI-ZTU** fails to change the pH after a certain number of iterations, it stops and measures zeta potential anyway. This could occu because the system is buffered or one of the pumps is out of reagent. An additional reason for two measurements at the same or nearly the same pH is that sometimes the **BI-ZTU** will overshoot. The sample is then at a pH that is higher (or lower) than desired. If this new pH is closest enough to the next target pH, the measurement is taken and should be close to the previous one.

8. **Is the pH in the flow cell different from the pH in the sample cup?**

   Although the pH is measured in the cup, the difference in pH between the cup and flow cell is eliminated by mixing the flow cell contents with the cup contents before measuring the pH used for zeta potential determination.

9. **How can I tell if the metering pumps are primed?**

   Under the titrator menu, choose S*etup*. Click on the **Prime Pump 1** button (or the button corresponding to the pump of interest) and observe the cup to ensure that drops of reagent are deposited into the cup by the pump. Once it is clear that drops are falling, then click **Cancel** on the interim dialog box to stop the pump. Sometimes drops are hard to see since they are small and fast-moving. Therefore, check the surface of the liquid in the cup for ripples as the drops fall, or use a dry cup so the drops are apparent when they land. For more insight, remove the curved cover on top of the **BI-ZTU** by removing four M4 x 8 black button head screws. Observe the tubing and pumps. Check for air pockets that are moving as the pumps are enabled. Generally, removing the cover is unnecessary.

10. **Why isn't the pH probe responding?**

    It is possible that the pH probe is not plugged into the back of the **BI-ZTU**. The **ZetaPlus** and **ZetaPALS** both have a pH meter circuit installed. In addition, the **BI-ZTU** uses its own, independent pH meter circuit on the back of the **BI-ZTU**. If the pH probe installed in the **BI-ZTU** is plugged into the back of the **ZetaPlus** or **ZetaPALS**, the titrator menu items will not respond to the pH probe.

11. How can I replace the cuvette at the bottom of the flow cell?

The cuvette at the bottom of the flow cell can be replaced in the field. Glass cuvettes at the bottom can be ordered from BIC. Order catalog number BI-SCGO (square cell, glass, open top). Use Momentive (formerly GE) RTV 108 to attach a glass cuvette to the plastic disc that acts as an oven cover.

The replacement procedure is as follows. Remove the four M2 screws holding the plastic disc to the body of the electrode assembly by loosening them little by little in an X-pattern. Clean the old glue from the plastic disc (oven cover) thoroughly to ensure good adhesion. Attach the oven cover (with no glass) to your flow cell using the four M2 screws. Be certain to tighten the screws in an X-pattern. You are using the flow cell as a jig to ensure that the glass is on straight. Then, turn over the flow cell so it is upside down. Gently secure the upside-down flow cell so that the oven cover is level. Slide the glass cuvette over the flow cell. If it does not fit, rotate the cuvette 90 degrees. Once the glass is seated within the oven cover, apply silicone all the way around, ensuring that the "moat" is completely sealed. Allow to cure for at least 24 hours.

After curing, the flow cell is ready to test.