

Getting the Most Out of Your Hudson SOLO

Alan H. Katz, PhD, Hudson Robotics, Inc.

Pipetting volumes at the 1 μL level presents some interesting challenges for robotic pipettors. As with any pipettor, the technique used with Hudson's SOLO robotic pipettor will greatly effect the accuracy and consistency of the results. One does not normally have to worry about these issues when moving relatively large quantities of liquid, but when down to the single microliter level, they can become very important. We'd like to pass on a few hints that might help you attain the best results.

Some of the key factors that influence dispensing results are:

1. Size of the tip
2. Size of the syringe
3. Pre-aspirate/Blow-Off and TipTouch
4. Percentage of air in the system

1. Size of the tip

You should use the smallest tip you can get away with. No surprise here, but when a protocol contains multiple dispense steps of different volumes, users often opt for a tip that's large enough to handle all of the steps. Unfortunately, this means the results for steps involving smaller volume dispenses won't be as good as they can be. In such a situation, it may be worth introducing two different tip sizes to the protocol. The following table shows the effect of tip size on a 4 μL dispense by a SOLO:

Tip Size	%CV
10	0.77
20	1.33
50	1.35
250	2.56

2. Size of the syringe

Here's another trade-off. It is intuitive that using a smaller syringe will give you greater accuracy, but you will run into problems if you need to also dispense larger quantities of liquid. However, if you need to dispense sub microliter quantities with CV's below 3%, the answer is to install a smaller syringe. Yet, if you need accuracy at both large and small volumes, consider a SOLO equipped with multiple syringes. SOLOSoft can be programmed to choose the small syringe for the low volumes and the larger syringe for the higher volumes.

3. Pre-Aspirate/Blow-Off and Tip Touch

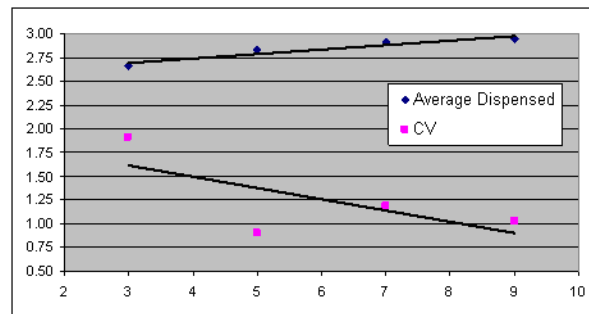
Inserting a pre-aspiration step, followed by a blow-off will increase the amount of liquid dispensed by clearing the tip of residual droplets. However, we find that it decreases the precision due to the air compression issues discussed in the next section. We found that the larger the pre-aspirate/blow-off combination, the poorer the consistency (higher CV). We suggest that this technique be reserved for dispenses of greater than 5 μ L.

Tip touch is very important for dispensing below 5 μ L of liquid, but one needs to be sure the tip doesn't go deep into the well during the preceding aspirate step. When this happens, the dispense amount is artificially raised by addition of liquid that attaches to the outside of the tip. This problem can be completely avoided by using the SOLO's liquid level sensing feature.

4. Percentage of air in the system

An important factor to consider when transferring liquid from one location to the other is the amount of air above the liquid in the tip. The more air, the greater the degree that air compression competes with liquid dispensing when the plunger is lowered. This can be observed quantitatively in the following chart in which different amounts of water are aspirated into a pipette before 3 μ L is dispensed. The top line shows the average amount dispensed in 10 trials. The x-axis reports the amount of liquid aspirated into a 10 μ L tip before the dispense.

Notice that the amount dispensed goes down as the ratio of air to liquid goes up. The upper line shows that the precision of the dispense improves as air is removed from the system (ie., more liquid is aspirated into the tip), with CVs dropping below 1% when 9 μ L of liquid is aspirated into the tip.



In practice, one needs to use the smallest tips available for the job, and when feasible, one should modify the protocol to aspirate larger amounts of liquid, dispense the desired amount, and return the remainder or add to it for a subsequent dispense. Also, when aspirating large amounts with the intention of carrying out multiple dispenses, it's a good idea to refill the tip more frequently to keep the up the volumes of the later dispenses. Alternatively, factors can be included in the requested dispense volumes to compensate for this effect. So slightly greater volumes need to be requested as the tip empties out.

We hope this tips help you in optimizing the use of your SOLO pipettor. Please let us know your experience, and let us know if you need help in adjusting your protocol to implement these techniques.