

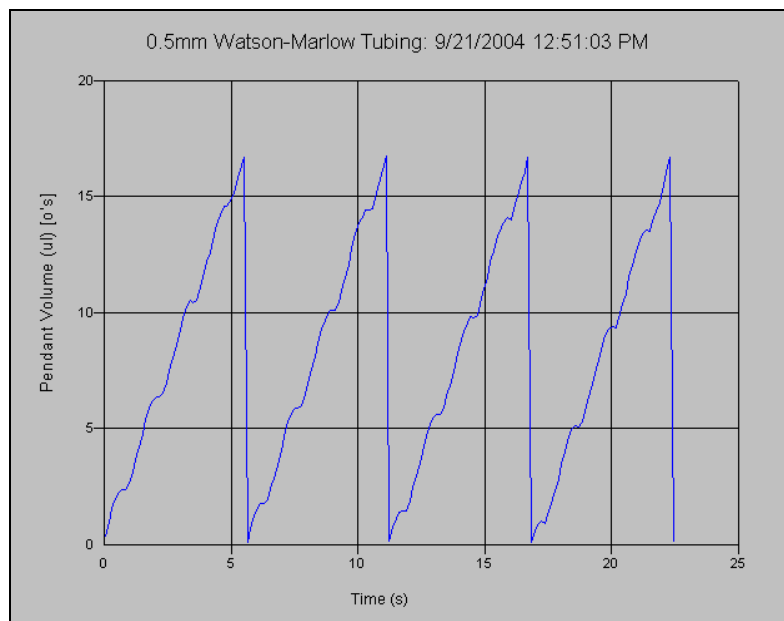
Introduction to the Peristaltic Pump

29 October 2004

The peristaltic type pump offers a low cost method of automatic fluid delivery. It has the advantage of being self-priming and has a disposable fluid path (which consists simply of special tubing).

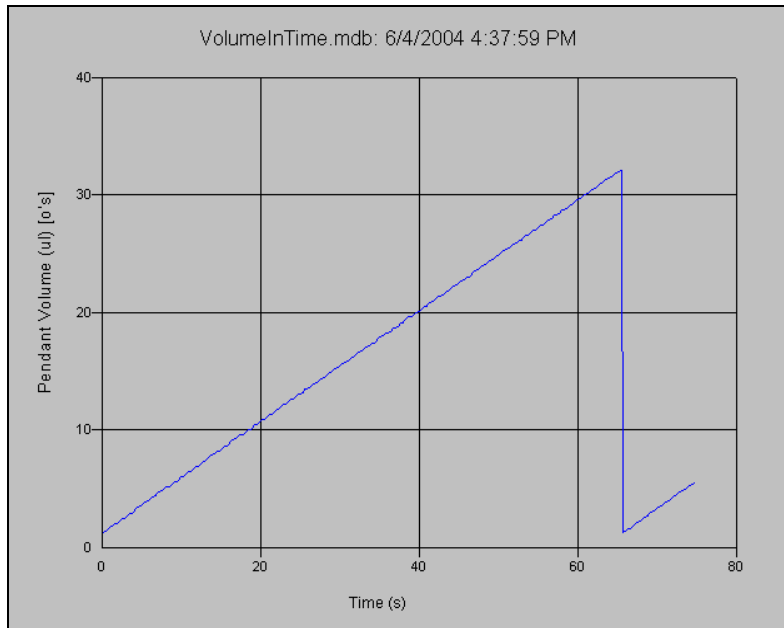
The internal diameter of the tubing plays a role similar to the internal diameter of a syringe: it sets the pump rate for any given motor speed. A range of tubing internal diameters is available from 0.19mm to 1.6mm. However a good choice is 0.5mm. This tubing is rugged, has long life, and yet offers good precision for contact angle dispense applications.

The principal limitation of the peristaltic pump is that its fluid delivery is not absolutely uniform. There is a trade-off with the tubing diameter between uniform delivery and lifetime and convenience. The graph below shows typical performance of the recommended 0.5mm ID tubing:



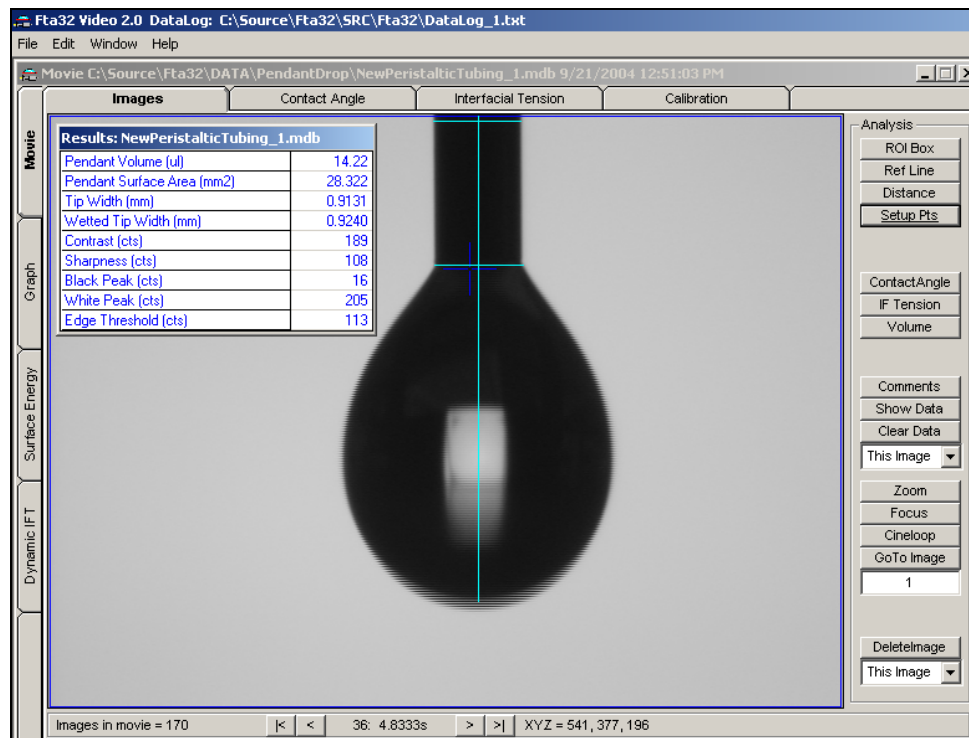
Measured volume versus time for 0.5mm tubing at 3 μ l/s delivery.

The following is a similar plot for 0.19mm ID tubing. It is smoother but pumps at a slower rate, which is sometimes inconvenient.



Measured volume versus time for 0.19mm tubing at 0.5 μ l/s delivery.

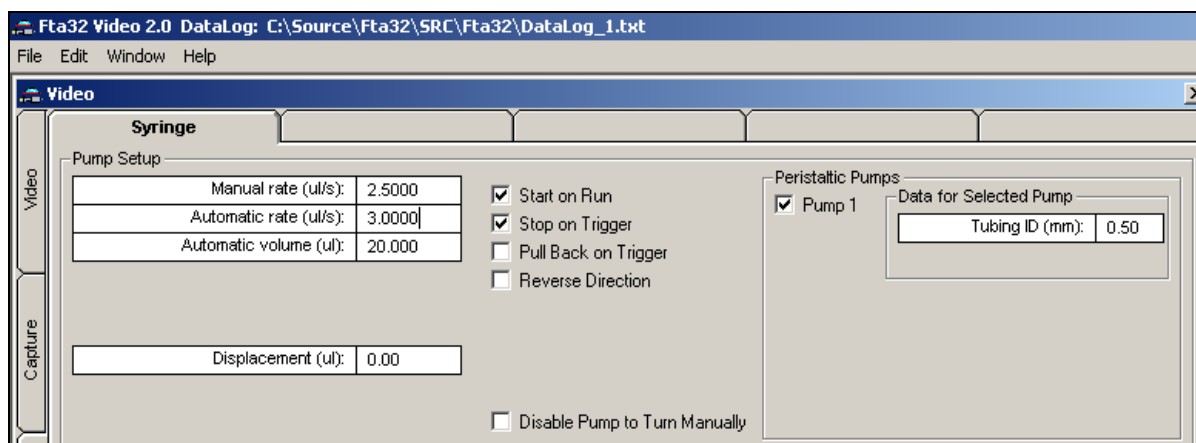
For ordinary contact angle dispense, the variations in flow rate are absolutely unimportant because the pump will be stopped as soon as the image processing system determines the drop has detached from the dispense tip. You will see some vibration in the pendant drop as it forms on the dispense tip. The following image shows the maximum amount you are likely to see. It is the worst image from the movie that generated the 0.5mm graph on the previous page.



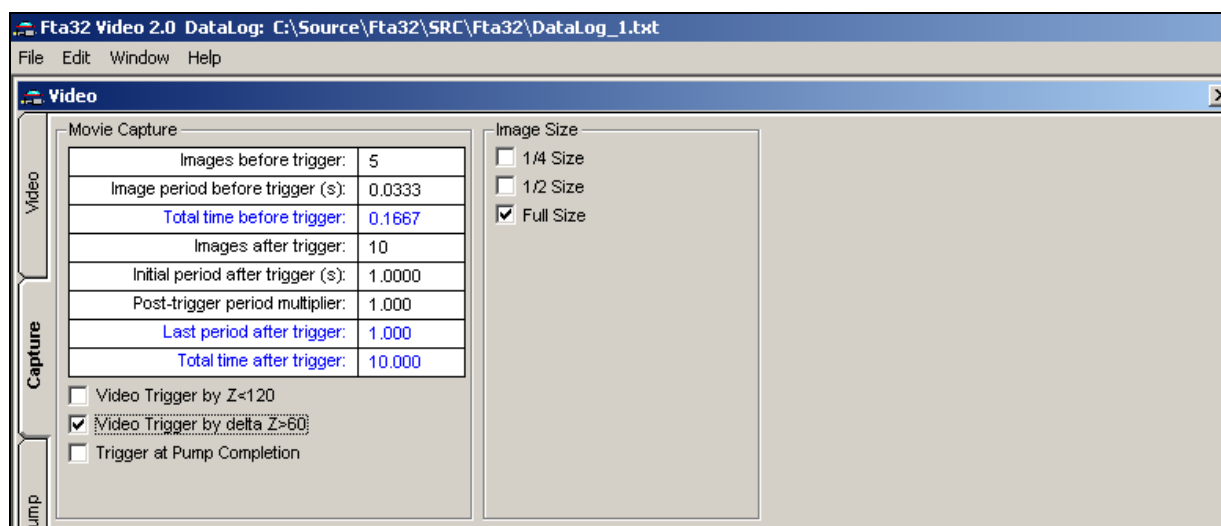
Vibration of drop on tip.

Software Setup

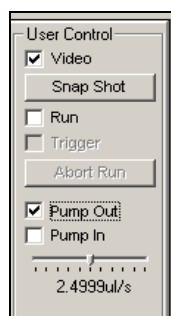
You must enter the tubing ID on the Pump tab.



Then setup a video trigger for the Movie:



You may also pump out a certain amount into a pendant drop using the manual controls on the Video form and then lower the tip to touch-off the drop. This is convenient for SnapShots.



To Load Peristaltic Tubing

A convenient length of tubing is between 60 and 100 centimeters (2 to 3 feet). The length required depends on the placement of the pump with respect to the tip. Allow a little extra length to start with.

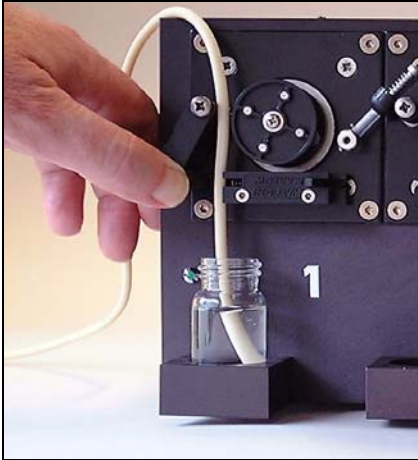
The tubing wraps around the rotor and is pressed against the rotor by the semi-circular tension clamp. The pressure of the clamp against the tubing, and the tubing against the rotor, is important but also easy to adjust. Turn the socket head screw to adjust the compression of the spring. The instrument is shipped with the correct tension for 0.5mm tubing. The basic method of adjusting the tension is to start with it tight enough that it stalls the motor when the manual pumping is set at 100% speed. You can then back off about ten turns on the screw before the tension becomes so loose that the pumping action stops. A good compromise is about 3 turns tighter than the point at which pumping stops because it is too loose. Since the adjustment is not critical, you do not need to adjust it if it seems to be pumping OK.

To load the tubing into the pump

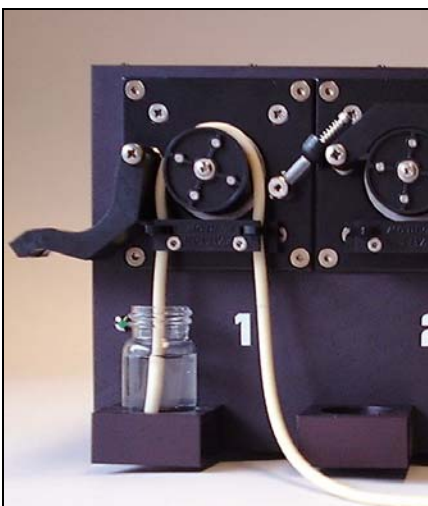
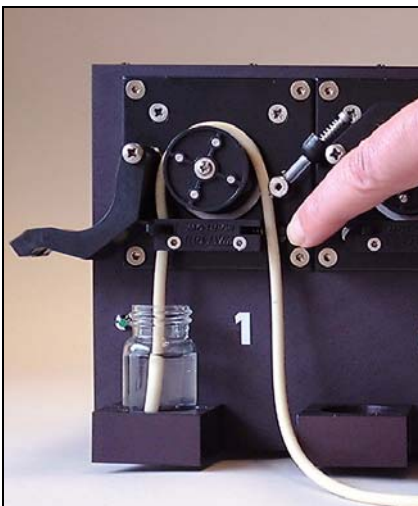
1. Flip the latch with the socket head screw and spring back so the semi-circular clamp plate can be swung open.



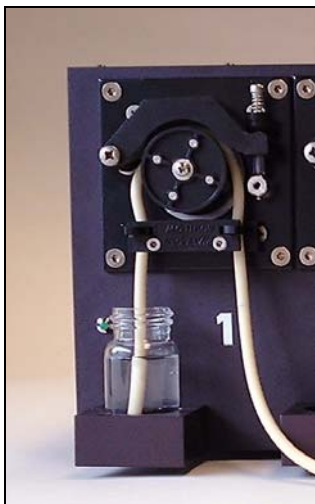
2. You must hold the tubing spring clamps open to slide the tubing in.
3. Lay one end of the tubing in the bottom of the source bottle or vial for the liquid.



4. Wrap the tubing around the rotor snugly. The spring clamps will hold the tubing in place.



-
5. Close the tension clamp on the tubing.



6. Dress the tubing to the dispense tip. Push the end of the tubing on to the 1/16" barb fitting on the top of the adaptor. Use a small amount of 100% IPA (isopropyl alcohol) to lubricate the barb if necessary.
7. Place a Luer hub needle on the bottom of the adaptor.

To prime the pump, manually start the pump in the forward direction at its maximum rate of speed. It will take about a minute to move liquid from the source container through the tubing to the needle. You are then ready to dispense. The best dispense rate for a peristaltic pump is several microliters per second, say 3 to 5.