The most common titration is an acid-base equivalence-point indicator experiment conducted with a burette. However, there is a lot more useful information available if one is able to easily track and plot titrant volume with respect to pH, temperature, conductance, or other solution properties.

A drop counter and a drop dispenser will do this well. They will not break, their resolution is better than a burette, and their operator doesn’t get tired or distracted. First and second derivative plots of drop counter data can be calculated and plotted in seconds and buffer regions are clearly visible. There is time to evaluate an experiment and run it again if necessary.

MicroLab’s Model 154 Constant Volume Drop Dispenser is a rugged, accurate, and cost-effective alternative to a burette or a plastic syringe for automated drop counter titrations. It is easily calibrated by weighing a counted number of drops of titrant. The MicroLab real-time formula tool can be used to calculate and plot delivered volume during a titration.

- **The MicroLab drop dispenser is easy to use.** Its multi-turn industrial needle valve gives smooth and precise control of drop rate in contrast to the small fractional rotation required to set drop rate with an often-sticky nylon or glass stopcock.

- **Titrant Drop volume and drop rate are essentially constant** over a 30-50 mL delivery. Decrease in titrant pressure head will cause drop rate and drop size to change during a titration. Delivery of 30 mL of titrant results in a 32 cm change in pressure head with a burette, a 5 cm change in a 60 mL syringe, and a 1 cm change with the MicroLab 154. As a result of the small pressure head change, drop rate and drop volume are essentially constant for the MicroLab 154.

- **Drop size for the MicroLab drop dispenser is smaller than a burette** - about 0.034 mL/drop, compared to about 0.050 mL/drop for a burette. This gives the MicroLab 154 about 1.5 x better resolution and better end point determinations and derivative plots in a titration.

- **A separate on/off stopcock** can be used after drop rate is set with the needle valve.

- **The MicroLab 154 is made of industrial quality components** – chemically-resistant polypropylene and polycarbonate.

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**Specifications**

**Model 154 Drop Dispenser**

- Titrant reservoir: 50 mL
- Drop volume: 0.034 mL
- Overall length: 16.5 cm
- Diameter at top: 6.3 cm
- Clamp area dia.: 3.8 cm
- Mass: 114 g

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**Graph: Drop Mass vs Delivered Volume**

Drop mass (and volume) is essentially constant over 1000 delivered drops (34 mL) for the MicroLab 154 drop dispenser. The correlation coefficient between drop count and mass and volume is 0.99999.
Drop size is determined by the surface tension of the titrant, the size of the delivery tip, and the pressure head from the liquid above the tip. Pressure head on a burette changes about one cm per mL of titrant. The upper curve, left, shows the change in drop volume over delivery of 900 drops or about 45 mL. Drop size at time = 0, the beginning of the titration, is 0.05052 mL.

The lower plot is data from a MicroLab Model 154 constant volume drop dispenser. Because of the small change in pressure head with this unit, the drop mass changes $2.667 \times 10^{-7}$ mL per drop. This is about an order of magnitude more constant than the burette. The drop size at the beginning of the titration is 0.03440 mL.

The MicroLab Constant Volume drop dispenser gives 1.5 times better resolution and much better linearity than a burette.

This titration of phosphoric acid with sodium hydroxide was done with a MicroLab drop counter and constant volume drop dispenser. Neutralization of the first and second hydrogens from the phosphoric acid is shown by the two inflections in the pH / titrant volume graph, and are marked by the peaks in the first derivative plot of this data. The end point can be determined to one drop. pKa1 and pKa2 can be determined by observing the solution pH when the un-reacted acid and salt are at equal concentrations - at the midpoint of each neutralization curve. This titration took about 12 minutes and produced “text-book” quality data.

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