

# Vernier Drop Counter

(Order Code VDC-BTD)

The Vernier Drop Counter is used to perform accurate, automatic titrations. This digital sensor can be used in conjunction with a pH Sensor (or other sensor) to accurately record the volume of titrant added during a titration.

The Vernier Drop Counter has many features that help simplify its use:

- Adjustable clamp, fits most laboratory ring stands and lattices
- Wide drop-detecting area
- Large sensor slot, fits most conventional stick-style sensors
- Smaller, adjustable slot for temperature sensors
- Accurate drop counting at rates up to 6 drops/second
- Red LED, near the detecting area, flashes to indicate a drop has been recorded

**Note:** Vernier products are designed for educational use. Our products are not designed nor are they recommended for any industrial, medical, or commercial process such as life support, patient diagnosis, control of a manufacturing process, or industrial testing of any kind.

## What's Included

- Vernier Drop Counter
- Plastic reagent reservoir
- Plastic valve with a double stopcock fitting
- Vernier microstirrer (a magnetic stirrer that fits on the tip of your sensor)

## Compatible Software and Interfaces

See [www.vernier.com/manuals/vdc-btd](http://www.vernier.com/manuals/vdc-btd) for a list of interfaces and software compatible with the Vernier Drop Counter.

## Getting Started

1. Connect the Drop Counter and additional sensor (pH Sensor, Conductivity Probe, etc.) to the interface (LabQuest Mini, LabQuest 2, etc.).
2. Start the appropriate data-collection software (Logger Pro, LabQuest App) if not already running, and choose New from File menu.

The software will identify the sensors and load a default data-collection setup. You are now ready to continue your experiment.

If you are collecting data using a Chromebook™, mobile device such as iPad® or Android™ tablet, or a Vernier wireless sensor or interface, please see the following link for up-to-date connection information:

[www.vernier.com/start/vdc-btd](http://www.vernier.com/start/vdc-btd)



## Using the Product

1. Assemble the equipment. (**Note:** The Vernier Stir Station, pH Sensor, 100 mL beaker, and utility clamp are not included with the Vernier Drop Counter.)
  - a. Place a 100 mL beaker on the center of the Stir Station or a ring stand and magnetic stirrer.
  - b. Remove the storage bottle from the sensor (if applicable). Insert the sensor body through the larger round hole on the Vernier Drop Counter.
  - c. Slip the Microstirrer onto the bottom of the sensor. Slide the Vernier Drop Counter down the ring stand to a level such that the Microstirrer is very close to the bottom of the beaker. Tighten the turn screw of the Drop Counter to hold it firmly in place.
  - d. Connect the spout and two 2-way valves to the plastic reagent reservoir. **Note:** There are two 2-way valves below the reagent reservoir. In this setup, use the bottom valve as an on-off valve (either completely open or completely shut). Use the top valve as an adjustment valve to adjust to a slow, consistent rate.



2. Make sure that both 2-way valves are in the closed position (horizontal). Add about 20 mL of titrant to the plastic reagent reservoir. For this example, we will use 0.1 M NaOH solution.
3. Before collecting data or calibrating the drops, adjust the flow rate of the two valves of the reagent reservoir. Temporarily, place another beaker below the spout of the reagent reservoir. First, completely open the bottom 2-way valve; then slowly open the top valve until a very slow drop rate is achieved—a rate of one drop every two seconds, or slower. Close the bottom valve.



- Add the solution to be titrated to the 100 mL beaker. For this example, use about 5 mL of 0.1 M HCl solution. Add enough distilled water so the solution level covers the bulb of the pH Sensor (about 35 to 40 mL). If you are going to use a small magnetic stirring bar, less distilled water will be required (about 1 to 20 mL). Turn on the magnetic stirrer. **Important:** Minimizing volumes of solution titrated and maximizing stirring efficiency will significantly improve your titration results.
- Connect the sensor following the steps in the Getting Started section of this user manual.
- No data will be collected until the first drop falls through the Drop Counter. Carefully center the spout of the reagent reservoir to allow the drops to pass through the Drop Counter. Completely open the lower 2-way valve (the upper valve should still be set to a slow drop rate). You will now see pH vs. volume data being plotted on a graph. When you are satisfied that the titration has proceeded past the equivalence point, shut off the lower 2-way valve of the reagent reservoir and stop the data collection.

## Videos

View videos related to this product at [www.vernier.com/vdc-btd](http://www.vernier.com/vdc-btd)

## Calibration

There are three different ways to handle the reporting of volume:

- Use the stored calibration.
- Manually enter a drops/mL ratio value. If you have done a previous calibration with a particular apparatus, you can enter the drops/mL ratio.
- Perform an Automatic drops/mL calibration. You can calibrate the reagent reservoir or a buret. To perform your own drops-per-mL calibration, follow these steps:
  - Place a 10 mL graduated cylinder below the slot of the Drop Counter.
  - Fill the reagent reservoir about 3/4 full with the titrant solution.
  - Choose to calibrate the Drop Counter in your data-collection program.
  - Open the bottom 2-way (on-off) valve to begin releasing drops through the Drop Counter.
  - Release drops until there is 9–10 mL of liquid in the graduated cylinder.
  - Close the bottom valve to stop the drops.
  - Type the exact volume, to the nearest 0.1 mL, of liquid in the graduated cylinder in the Volume (mL) box of the Calibrate drops dialog box.
  - Choose to stop the calibration routine of your program.
  - The number of drops/mL will be displayed.
  - You can now continue with the titration.

## How the Sensor Works

The sensor has an infrared LED emitter on one end of the area through which the drop falls (1.3 × 3.7 cm) and a detector on the other end. When the infrared beam (centered at 890 nm) between the source and detector is blocked by a drop of titrant, a digital signal is sent to the data-collection interface. The drops are then converted to volume units (e.g., milliliters) in the data-collection program. A red

LED indicator light flashes each time a drop of liquid passes through the Drop Counter.

## Troubleshooting

- Set a slow drop rate. For the best, most accurate data, we recommend setting the rate at 2 seconds/drop or slower. A slow rate provides enough time for each drop of titrant to be thoroughly mixed in the solution and the pH sensor (or other sensor) to respond.
- Minimize the volume of solution to be titrated. We recommend 5–10 mL of test solution. Larger volumes will take longer to mix and may require a very slow drop rate for best results.
- Use the Vernier Microstirrer. It helps deliver solution directly to the pH bulb, minimizing the response time. Also, you can run a magnetic stirrer at a very high speed and the Microstirrer will not form a visible vortex, which prevents splashing.
- Add only as much distilled water to the titrated solution as is necessary to cover the bulb of the pH Sensor (or other sensor).
- Use the plastic reagent reservoir that is supplied with the Drop Counter. The reagent reservoir provides a wider diameter and less change in the hydrostatic pressure per unit volume of titrant above the 2-way valve.
- Use the pair of 2-way valves; one for drop rate adjustment and the other as an on-off valve. This eliminates the need to do a fine adjust during the initial readings and also allows for a consistent rate to be set.
- Manually release drops at a slower rate to allow for more thorough mixing when near the equivalence point.
- Use the Vernier Drop Counter with other Vernier sensors such as our Ion-Selective Electrodes, Conductivity Probe, or older Vernier pH Sensors that do not auto-ID. The Vernier Drop Counter can accommodate many third-party electrodes when used in conjunction with the Electrode Amplifier. Simultaneous pH and temperature readings can also be taken while using the Drop Counter.

## Repair Information

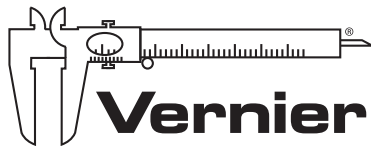
If you have watched the related product video(s), followed the troubleshooting steps, and are still having trouble with your Vernier Drop Counter, contact Vernier Technical Support at [support@vernier.com](mailto:support@vernier.com) or call 888-837-6437. Support specialists will work with you to determine if the unit needs to be sent in for repair. At that time, a Return Merchandise Authorization (RMA) number will be issued and instructions will be communicated on how to return the unit for repair.

## Accessories/Replacements

Item	Order Code
Reagent Reservoir, 2 Valves, and Tip	VDC-RR
Microstirrer	MSTIR
Stopper Stem	PS-STEM
Plastic 2-Way Valve	PS-2WAY

## Warranty

Vernier warrants this product to be free from defects in materials and workmanship for a period of five years from the date of shipment to the customer. This warranty does not cover damage to the product caused by abuse or improper use. This warranty covers educational institutions only.



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