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Drop Counter Sensor

Product Number: ENDRP-AD100

Overview

The Drop Counter sensor is an optical sensor that accurately records the number of drops of titrant added during a titration. The Drop Counter sensor software can automatically convert the number of drops into volume. It will also record pH and temperature values and calculates the first and second derivatives of pH for easy equivalence point determination.

Our Drop Counter sensor now features housing for two electrode sensors, an anti-twist mechanism, an indicator LED and two cable guides.

Typical experiments

Chemistry

- Simple drop counting
- Collecting pH vs. Volume data in a typical acid–base titration
- Collecting Conductivity vs. Volume data in a typical conductometric titration
- Collecting Temperature vs. Volume data
- Monitoring temperature and pH simultaneously

How it works

The Drop Counter sensor has an optical-path slot that is 4.3 cm (1.6 inches) in length. When the infrared beam between the source and the detector is blocked by a drop of titrant, a digital signal is sent to the data logger, and the data collection program records a drop. The drops can be converted to volume units (milliliters), using the calibration feature inMiLABExEx™ software.

Sensor specification

Range :	0 to 4095 drops
Detector Rise Time	<70 ns
Detector Fall Time:	<70 ns
Resolution (12-bit) - Drop Counter:	1
Resolution (12-bit) - Volume:	1*volume of one drop
Sampling Rate for Titration:	Up to every second
Infrared Source:	Peak at 890 nm
Used Data Logger Port:	Digital

Note: sensor cables sold separately

Technical Notes

- Use of a magnetic stirrer is recommended. As an alternative to using the magnetic stirrer, students can use a stirring rod to stir manually (this is not recommended as a standard method).
- It is important to remind students that a slow drip is important. This provides enough time for the drop to be added to the solution and be mixed thoroughly, as well as for the pH sensor (or other sensor) to respond.
- Use of the Micro-stirrer supplied with the Drop Counter sensor will help deliver the solution directly to the pH bulb, increasing the response rate to fresh drops.
- It is also helpful if the amount of titrant in the beaker is minimized as less liquid means faster mixing. It is recommended to use a 100 mL beaker instead of a 250 beaker whenever possible.
- Using the plastic reagent reservoir supplied with the Drop Counter sensor, instead of a

standard burette, provides a wider diameter and less change in the hydrostatic pressure per unit volume of titrant above the two-way valve.

- If you want to allow for more thorough mixing when you are near the equivalence point, you can also manually release drops at a lower rate for that period.
- The plastic reagent reservoir has a pair of two-way valves, using one for drop rate adjustment, and the other as an on-off valve. This eliminates the need for a fine adjustment during the initial readings

Data logging and analysis

Android

1. Take your einstein™ Tablet OR pair your einstein™ LabMate with your Android or iOS tablet via Bluetooth
2. Insert the adaptor into the drop counter
3. Insert one end of a sensor cable into to the adaptor and the other end into one of the sensor ports
4. Launch MiLABEx and tap LAB- Start an Experiment
5. Tap on Sensors
6. Tap on Generic
7. Select Drop Counter and tap V to confirm selection
8. Calibrate the sensor (as described in the following section)
9. Go back to LAB – Start an Experiment.

Desktop

1. Pair your einstein™ LabMate with your PC, MAC, or Linux machine via Bluetooth, or connect it via the USB cable (found in the einstein™ LabMate box).
2. Insert the adaptor into the drop counter
3. Insert one end of a sensor cable into to the adaptor and the other end into one of the sensor ports
4. Launch MiLABEx

5. Click Full Setup, located at the bottom of the Current Setup Summary window to program the data
6. logger's sample rate, number of samples, units of measurement, and other options

7. Click the Run button on the main toolbar of the Launcher View to start logging

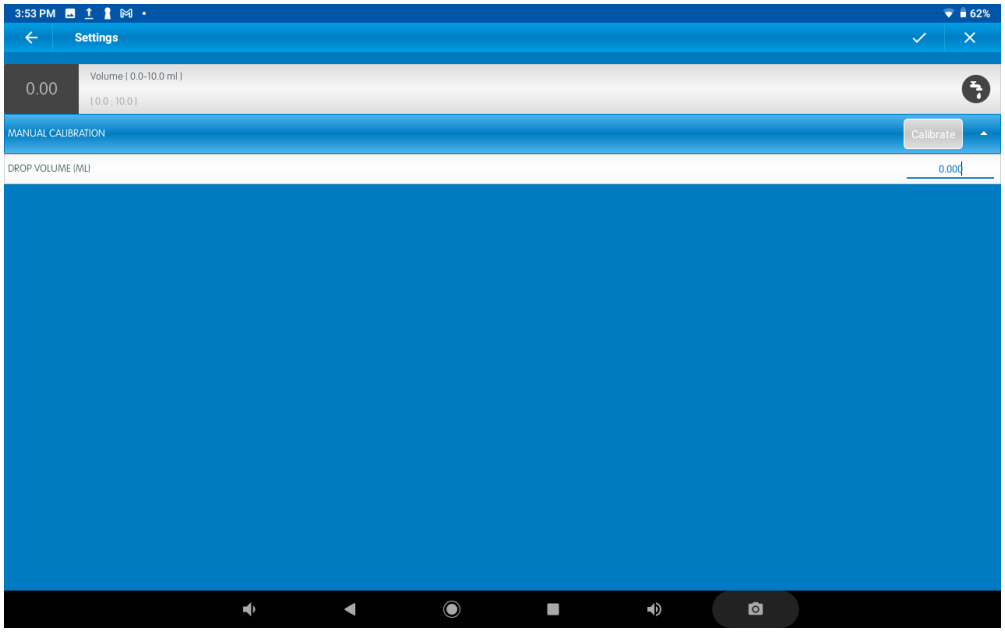
Calibration

Before collecting data you should 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 two-way valve; then slowly open the top valve until a very slow drip is achieved at a rate of one drop per second. Now close the bottom valve.

You can also manually calibrate by the Drop Counter by setting the volume of each drop.
The Calibration can be made only on the volume measurement. The counter measurement does not need any calibration.

Android

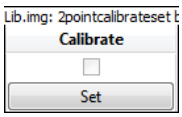
1. Connect the drop counter to your
2. Launch MiLABEx
3. Tap on LAB – Start an Experiment
4. Tap on sensors
5. Tap on the arrow icon on the Volume measurement



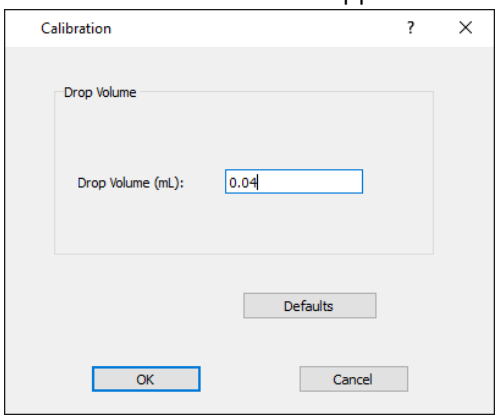
6. Tap Manual Calibration
7. Tap the "Drop Volume (ml)" field to type in your chosen volume for each drop
8. Tap Calibrate
9. Tap V to confirm the settings
10. You are ready to start an Experiment.

Desktop

1. Go to the Full Setup window and in the Calibrate column click Set



2. The Calibration window will appear



3. Click in the "Drop Volume (ml)" box to type in your chosen volume for each drop
4. Click OK
5. Minimize the full setup and you are ready to start an Experiment.

Experiment set up

An important note about adaptors

When using the Drop Counter, you must use an Einstein "DT-to-EN" adaptor in order to plug into einstein™ products.

The Drop Counter comes equipped with:

- One Drop Counter
- One DT-to-EN adaptor
- One Plastic reagent reservoir
- One Plastic valve with double stopcock fitting (screws onto the base of the reagent reservoir, with a gentle half turn)
- One Micro-stirrer

An example of using the Drop Counter

Acid-Base Titration

Acids and bases neutralize, or reverse, the action of one another. By adding an acid with a known concentration to a basic solution, until the base is completely neutralized, the concentration of the base can be determined. This procedure is called: Acid-Base Titration. In this experiment we measure the pH changes versus the acid volume.

- Plastic Reagent Reservoir
- Plastic valve with double stopcock fitting
- Micro-stirrer
- Magnetic stirrer
- Ring stand
- 100 mL beaker
- Utility clamp

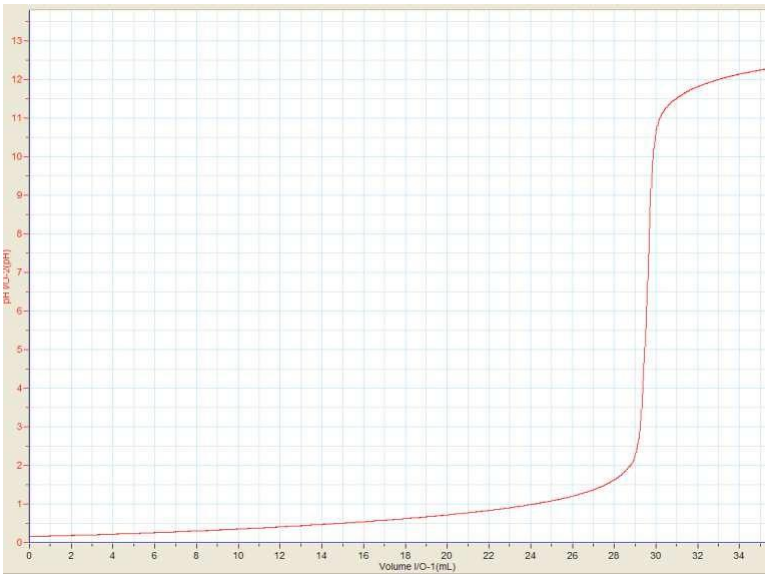
- pH sensor
- Temperature sensor

Equipment Setup

1. Arrange the magnetic stirrer on the base of the ring stand. Place a 100 mL beaker on the center of the stirrer.
2. Insert the pH sensor through the large hole on the drop counter.
3. Connect the spout and the double stopcock valve to the plastic reservoir. The bottom valve is used as an on-off valve and the top valve as an adjustment valve, to deliver drops at a slow consistent rate.
4. Making sure that both valves are in the closed position (horizontal), add about 30 mL of titrant to the plastic reagent reservoir. For your first run, we recommend using a 0.1 M NaOH solution.
5. Tighten the turn screw of the drop counter to the stand, to hold it firmly in place.
6. Tighten the reagent reservoir to the stand, to hold it firmly in place.
7. Before collecting data or calibrating the drops, you should 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 two-way valve; then slowly open the top valve until a very slow drip is achieved at a rate of one drop per second. Now close the bottom valve.

Titration Experiment

1. Add the solution to be titrated to the 100 mL beaker. For the first run, we recommend using 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 35-40 mL).
   If you are going to use a small magnetic stirring bar, or use a stirring rod, less distilled water will be required (about 15- 20 mL).
2. Optional: Add two drops of phenolphthalein indicator.
3. Connect the Temperature sensor to your einstein™ device to compensate for temperature changes.
4. Connect the Drop Counter sensor to your einstein™ device.
   Note: The Drop Counter sensor has to be connected to a digital input.
5. Connect the pH sensor to your einstein™ device.
6. Set up the data logger to measure volume at the rate of one sample per second.
7. Turn on the magnetic stirrer.
8. Click Run on the main tool bar to start recording.
9. Below is a typical graph displaying typical results to such an experiment



Troubleshooting

If the Drop Counter isn't automatically recognized byMiLABEx, please contact Fourier Education's technical support.

Technical support

For technical support, you can contact the Fourier Education's technical support team at: Web: www.einsteinworld.com/support
Email: support@fourieredu.com

Copyright and Warranty

All standard Fourier Systems sensors carry a one (1) year warranty, which states that for a period of twelve months after the date of delivery to you, it will be substantially free from significant defects in materials and workmanship.
This warranty does not cover breakage of the product caused by misuse or abuse.
This warranty does not cover Fourier Systems consumables such as electrodes, batteries, EKG stickers, cuvettes and storage solutions or buffers.