

DataDrop

The DataDrop program is intended to be used to collect data with the Vernier Drop Counter. Essentially, it will automate titration/equivalence point data collection. DataDrop will work with the LabPro or CBL 2 interfaces and the following Texas Instruments handheld devices:

TI-73, TI-82, TI-83, TI-83 Plus, TI-83 Plus Silver Edition, TI-86, TI-89, TI-92, TI-92 Plus, and Voyage 200. The DataDrop program will not work with the original CBL.

Starting Out with DataDrop

- Make sure that LabPro or CBL 2 has proper power, either from batteries or the AC adapter.
- Connect your TI handheld to LabPro or CBL 2 using the short link cable.
- Plug the Vernier Drop Counter into the DIG/SONIC 1 channel of LabPro or the DIG/SONIC channel of CBL 2.
- Plug your pH, ORP, Conductivity, Ion Selective or other sensor into CH1 of LabPro or CBL 2.
- If you are interested in monitoring the temperature during your experiment, plug a Stainless Steel Temperature probe into CH2 of LabPro or CBL 2.
- Start the DataDrop program.

Main Screen

After starting the DataDrop program an introductory screen appears briefly, then the main screen displays.

CH1:PH	4.526
CH2:TEMP(C)	22.6
1:SETUP 4:CALIBRATE CH1	
2:START 5:CALIBRATE DROPS	
3:GRAPH 6:QUIT	

The sensor names and current values are displayed in the upper portion of the main screen. Options such as SETUP and GRAPH are displayed in the lower portion of the main screen. To choose an option, simply press the number key associated with that option.

The first time the program is run on your TI handheld, it will check to see if any sensors are present and set them up before it displays the main screen. If the program has been run previously, it should recall the last sensor setup. To reset the channels and have the program check for auto-id sensors (ex. PH-BTA, Stainless Steel Temperature), press the button. It is a good practice to always start by pressing the button.

Note: A value of -999.9 or -1000 displayed as a sensor value on the main screen indicates that the LabPro or CBL 2 needs to be reminded which sensors are set up. To do this, press the button (on the TI-86 press the button, on the TI-89, TI-92, TI-92 Plus, and TI-Voyage press the backspace button).

Each of the six options on the lower part of the main screen is described in the sections below. To select one of the six options from the main screen simply press the key associated with that option. For example, press the button if you want to choose the SETUP option to set up a non-auto-id sensor in CH1 of your LabPro or CBL 2.

Setup Menu

On the DataDrop main screen, select SETUP to choose a sensor for CH1.

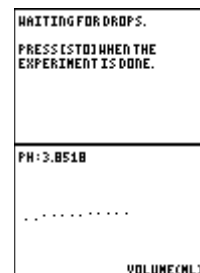


Choose a sensor from the given list of sensors. The program will set up that sensor in CH1 and return to the main screen.

Start Option

Select START from the main screen to begin data collection. Be sure to have your experimental equipment ready before choosing START.

1. Before the Drop Counter detects the first few drops, a message will be displayed.



2. After the Drop Counter detects the first few drops, a live graph of CH1 values versus Volume will be drawn. The current value of CH1 is displayed in the upper left corner of the graph.

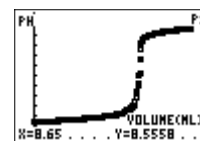
3. Press the **[STO▶]** button at any time to stop data collection. The 1st and 2nd derivative of CH1 versus Volume are calculated after data collection is stopped. Data collection will end automatically after about 40 minutes if it is not terminated by the user.

Note: The program requires at least 6 data points to be collected in order to calculate the 1st and 2nd derivative and plot the resulting graphs successfully.

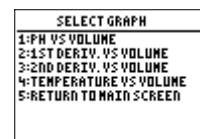
Graph Menu

The plot of CH1 versus Volume (drops counted by the Drop Counter) is automatically displayed when data collection is completed or when GRAPH is selected from the main screen.

1. Use the **[◀]** and **[▶]** keys to navigate between data points on the graph. The values of the selected data points will be displayed on the bottom of the graph screen. Press **[ENTER]** to leave Trace Mode and the graph screen.



2. The graph menu will be displayed, showing a list of additional plots available for viewing. Select the plot you would like to view or select RETURN TO MAIN SCREEN.



Calibrate CH1 Option

When a sensor is set up in CH1, DataDrop automatically loads the standard calibration settings. Further calibration is usually not needed. To understand the calibration process, it is helpful to understand the operation of Vernier probes. During their operation, the probes produce a voltage that is linearly dependent upon a quantity being measured. For example, the pH Sensor produces a voltage that varies linearly with the pH of the solution in which it is submerged. During the calibration process, we allow the TI handheld to establish the linear relationship between voltage and pH. There are two ways to calibrate a sensor or, in other words redefine the linear relationship between the quantity being measured and the voltage produced by the sensor. The first method is known as a two point calibration. The second method is to manually enter the values corresponding to the slope and intercept of the linear relationship. The examples shown below are for the pH sensor.

To calibrate the pH sensor by using the two-point calibration method, you will need two solutions with known pH values: for example, solutions with values of 4 and 8. Follow these steps:

1. The current calibration will be displayed. Select CALIBRATE NOW.

CALIBRATION	
PH	
CALIBRATION-LINEAR	
SLOPE	INT
-3.838	13.72
1:OK	
2:CALIBRATE NOW	
3:MANUAL ENTRY	

2. Put the pH sensor in the pH-4 solution. Wait until the voltage number on the screen stabilizes and then press .

CALIBRATE SENSOR	
MONITOR VOLTAGE, WHEN	
STABLE, PRESS [ENTER].	
VALUE	VOLTAGE
POINT 1:	2.388
POINT 2:	

3. Key in 4 and press .

ENTER VALUE		1
?4		

5. Repeat steps 3 and 4 for the pH-8 solution.
6. Select OK to return to the Setup screen.

To calibrate the pH sensor by entering values manually, follow these steps:

1. From the calibration screen select MANUAL ENTRY.

CALIBRATION	
PH	
CALIBRATION-LINEAR	
SLOPE	INT
-3.838	13.72
1:OK	
2:CALIBRATE NOW	
3:MANUAL ENTRY	

2. Key in the slope and press **ENTER**.

```
SLOPE: -3.65
```

3. Key in the intercept and press **ENTER**. The calibration screen is displayed with the new values.

```
SLOPE: -3.65  
INTERCEPT: 12.5
```

4. Select OK to return to the main screen

Calibrate Drops Option

The program assumes that a Drop Counter is plugged into DIG/SONIC 1 (DIG/SONIC on the CBL 2) and sets it up accordingly. Every dropper, buret or valve opening has a different diameter and thus a different number of drops/ml. The program needs to know how many drops make up one milliliter of titrant. By default the program uses the value of 20 drops/milliliter. There are two ways to calibrate the Drop Counter. You can perform a live calibration or manually enter a value.

To perform a live calibration:

1. The current calibration will be displayed. From the drop counter calibration screen, select CALIBRATE NOW.

```
DROP COUNTER CALIBRATION  
  
20 DROPS/ML  
  
1:OK  
2:CALIBRATE NOW  
3:MANUAL ENTRY
```

2. Open the valve on your buret and allow a known amount of titrant to drip through the Drop Counter (10 ml is sufficient.) A rate of about one drop/second or slower is a good drip rate. After a known amount of titrant drips through the Drop Counter close the valve on the buret and press **ENTER**.

```
CALIBRATE DROP COUNTER  
  
LET ABOUT 9 OR 10 ML OF  
TITRANT DRIP THROUGH DROP  
COUNTER. WHEN DONE, CLOSE  
VALVE AND PRESS ENTER.  
  
DROPS: 38
```

3. Key in the actual volume of titrant (in ml) that you allowed to drip through the Drop Counter.

```
ACTUAL VOLUME IN  
MILLILITERS: 11.5
```

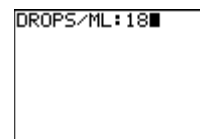
4. Select OK to return to the main screen.

To calibrate the drop size for your buret by entering a value manually:

1. From the the drop counter calibration screen, select MANUAL ENTRY.

```
DROP COUNTER CALIBRATION  
  
20 DROPS/ML  
  
1:OK  
2:CALIBRATE NOW  
3:MANUAL ENTRY
```

2. Key in the value for the number of drops of titrant in one milliliter.



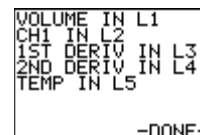
DROPS/ML: 18

3. Select OK to return to the main screen.

Quit

Select QUIT from the DataDrop main screen to exit the program.

The calculator displays where your data is stored and exits the program.

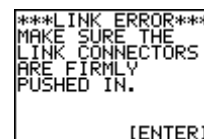


VOLUME IN L1
CH1 IN L2
1ST DERIV IN L3
2ND DERIV IN L4
TEMP IN L5
-DONE-

Tips and Tricks

Below are a few things to consider before starting to use the DataDrop program.

- If the TI handheld fails to establish communications with a LabPro or CBL 2, a link error message will appear. Check to be sure that the LabPro or CBL 2 is properly powered and that the link cable is firmly connected to the LabPro or CBL 2 and the TI handheld, then press **ENTER** to continue.
- Any auto-id sensor from Vernier can be used in CH1. Only a Stainless Steel Temperature Sensor or the older Texas Instruments Temperature Probe can be used in CH2.
- The program for the TI-82 will work with any sensor in CH1 if it is an auto-id sensor. It only has names for the following sensors: PH, Conductivity (all ranges), and Ion Selective Electrodes. All other sensors will be labeled Volt(V).
- If you use any of the Vernier Ion Selective Electrodes, their names will be generalized as: ISE(MV), and their readings will be representative of millivolts rather than the standard milligrams/liter. As a result, the calibration of any ISE will be a linear relation rather than the modified power relation normally used.
- The rate at which the titrant is dripping through the Drop Counter is crucial to the quality of the collected data. In general slower drip rates produce cleaner data. For a typical acid-base titration, a rate of about one drop/second should yield good data. At one drop/second and slower you can expect the program to capture a data point for every drop of titrant. For rates faster than one drop/second, the program may only capture a data point for every 2 or 3 drops of titrant. For experiments where large amounts of titrant are needed, a faster drop rate may be desirable.



LINK ERROR
MAKE SURE THE
LINK CONNECTORS
ARE FIRMLY
PUSHED IN.
[ENTER]

The drop rate can even be modified during the experiment. For example, you may wish to have a fast drop rate while approaching the equivalence point, then slow down the drop rate near the equivalence point in order to get finer resolution.