**Introduction**
This document contains helpful hints and information on using Logger Pro. If you think something is missing, let us know and we’ll include it!

**Understanding the Toolbar**
At the top of the Logger Pro file, below the menu bar, you will find a tool bar that looks like this:

(Can’t see the names of the buttons on your Logger Pro file? Go to the menu bar, click on “LoggerPro” and then scroll down to select “Customize Toolbar...” In the window that opens, on the lower left, click on the drop-down menu next to “Show” and scroll down to select “Icon and Text”. When you are done, click “Done”.)

Below, the function of each of these icons is described briefly.

![New Icon]
Clicking on this icon opens a new, blank Logger Pro file. NOTE: Logger Pro can only have one file open at a time. You might want to save your file before starting a new one. Logger Pro will ask if you want to save the current file before opening a new one.

![Open Icon]
Clicking on this icon will open a new window where you can select an existing Logger Pro file (extension cmbl) to open. NOTE: Logger Pro can only have one file open at a time. You might want to save your file before starting a new one. Logger Pro will ask if you want to save the current file before opening another one.

![Save Icon]
Clicking on this icon will save the current file. A new window appears where you select the directory where the file is to be saved, and the name for the file.

![Print Icon]
Prints what is visible on the Logger Pro screen. Lab computers are not connected to a printer, so you will not be able to print your Logger Pro files. However, you can use this option to save your file as a pdf.

![Previous Icon]
For Logger Pro files with multiple pages, this button takes you to the previous page.
For Logger Pro files with multiple pages, you can scroll down to select the page you want to view.

For Logger Pro files with multiple pages, this button takes you to the next page.

Clicking on this icon opens a window where you can see data sets and variables. On this window you can do things like: add a new data set, add a new column, add a new calculated column, and delete data sets or variables.

Clicking on this icon opens a new window where you can import data from a TI device.

Clicking on this icon rescales the graph selected to show all the data points. It is very useful if your graph is set to, say, 20 seconds, but you only collected data for, say, 3 seconds. It automatically zooms to the appropriate level to show all the data points.

Clicking on this icon zooms in on the selected region of a graph. If no region is selected, clicking this button will zoom in on the entire graph for a pre-determined amount, centered on the center of the graph.

Clicking on this icon zooms out on the graph.

Clicking on this icon will make a vertical bar and a box appear on the selected graph. The vertical bar can be moved by moving the mouse over the graph to the left or right. The box displays the values of the data point corresponding to the location of the vertical bar. To remove the vertical bar and the box, click on the icon a second time.
Clicking on this icon will make a short, dark line and a box appear on the selected graph. The short line represents the line tangent to the data point selected, while the box displays the value of the dependent variable and the calculated slope at that point. To select a different data point, move the mouse over the graph to the left or right. To remove the tangent line and the box, click on the icon a second time.

Clicking on this icon will display a box with statistics about the data point on the graph. Statistics displayed are: minimum value, maximum value, mean, median, standard deviation, and number of data points (samples). To remove the box, click on the “X” on the top left corner of the box.

Clicking on this icon calculates the area under the curve for the selected region of a graph or for the entire graph, if no region is selected. The area under the curve will be filled in with the color corresponding to the variable that was used in calculating the integral. The value of the integral is given in a box. To remove the coloring and the box, click on the “X” on the top left corner of the box.

Clicking on this icon will fit the selected data points to a straight line. A line representing the best fit appears on the graph, along with a box with the equation and the fit coefficients, as well as information on the goodness of the fit. To remove the best fit line and the box, click on the “X” on the top left corner of the box.

Clicking on this icon will open a new window where you can fit the selected data points to an equation. Full explanation of this feature is given in the “Fitting an Equation” section of this document.

Clicking on this icon will open a new window where you can get information or set parameters for collecting data with the sensors connected to the computer. Important settings that can be changed are: duration of data collection, sampling rate, and triggering procedure.

Clicking on the “Collect” icon will begin data collection. The icon will turn into the “Stop” button while data is being collected. NOTE: the previous data run will be overwritten if it is not saved. Data will be collected for the time set under “Data Collection”, or until you click on the “Stop” icon.
**Change Data Collection Time**
In order to change how long your sensor collects data after you click the "Collect" button follow these steps:
- Go to the menu bar on Logger Pro and click on “Experiment”
- Drag down to “Data Collection...” A new window will open.
- Enter how long you want each data collection run to last. Alternatively, if you wish to continue collecting data until you click on the “Stop” button, select the box next to “Continuous Data Collection”.
- Click “Done”.

**Zeroing a sensor**
Sometimes it is convenient to re-scale the readings of a sensor. For example, if you are adding sugar to a cup and want to measure the mass of the sugar while disregarding the mass of the cup, you can "zero" the balance with the empty cup on it. That way any reading on the balance as you add the sugar to the cup will reflect the mass of the sugar only.
To zero a sensor in Logger Pro:
- Go to the menu bar on Logger Pro and click on “Experiment”
- Drag down to "Zero..." Sensor will begin re-calibrating as soon as you click on this option.
- Wait a few seconds.
- Alternatively, you can type “command + 0” on the keyboard.

**Making a New Graph**
- Go to the menu bar on Logger Pro and click "Insert"
- Scroll down and select “Graph”. A new window will appear.
- Logger Pro will try to guess what you want to graph. If Logger Pro guessed wrong, you can change the variables you want to plot by clicking on the variable name on either the x- or the y-axis once. A list of the available variables should appear.
- Select the variable you want on that axis. If you don't see the variable you want on the list, click on 'more...' A new window should appear.
- In this new window you can select the variable you want from the drop-down menu. You can also set the scale of the axis and other things.
- Click “OK”

**Opening a Movie File**
- Go to the menu bar on Logger Pro and click “Insert”
- Scroll down and select “Movie...” A new window will open.
- Select the movie file you wish to open, then click “Open”.


Adding a New Variable (New Calculated Column)
Sometimes you need to add or calculate a quantity that is not directly measured by the sensors connected to the computer.

- Go to the menu bar on Logger Pro and click on “Data”
- Drag down to “New Calculated Column ...” A new window will open.
- Give your variable a name, a shorthand name (what will appear in the table and the graphs) and units.
- Make sure you select the appropriate data set, if you have more than one. If you only have one data set, then no need to worry about selecting the wrong one.
- Write an equation for calculating the new variable. Under ‘functions’ you can select a function that is already programmed. Under ‘variables’ you can select the variables that go into calculating the new variable. Select the function first and the variable second.
  - Example: if I want to calculate the median of variable X, I would go to functions, scroll down to statistics, and select median. Then I would go to variables and scroll down to X. What appears in the equation box is "median("X")".
- When you are done, click ‘Done’. The window closes and you should see the new column in the table on the left of the screen.

Excluding Data
Do this if there is data in your data file that you wish to ignore. For example, you start collecting data before anything interesting happens, and these data points mess up your graphs or calculations.

- Go to the graph where you have plotted the variable of interest versus time and select (highlight) the data points you want to exclude.
- Go to “Edit” on the menu bar and scroll down to “Strike through data cells”
  - The data point you selected should disappear from the graph, and you should see the data on the table to the left with a line through them (strikethrough).

Graphing Data with Non-connected Symbols
The default in Logger Pro is to make plots with connected dots. If you want the dots to not be connected do the following:

- Double-click on the graph area (anywhere that is not the axes). A new window should appear.
- On the “Graph Options” tab, there should be a box called “Plot Appearance”.
- Make sure to de-select the checkbox next to “Connect Points”.
- Click “OK” when you are done.
**Fitting an Equation**

When you want to see if two variables have a particular relationship, as predicted by a model, you can fit your data to an equation. To do this, make sure you have a graph of your data, and you have excluded any data points obtained when nothing interesting was happening.

- Go to the menu bar and click on “Analyze”
- Scroll down to “Curve Fit...” A new window will open. It looks something like this:

![Curve Fit Window](image)

- On the upper-left you see the graph of your data. Below that, on the box labeled “General Equation” you can select the equation you would like to fit. Scroll down to see more equations. Once you have found the one you want, select it.
  - If your data does not start at time = 0, but your equation assumes that it does, select the box “Time Offset”
- Click on the button “Try Fit”. After a few seconds the best fit function is plotted on top of your data, and the best fit coefficients are displayed on the right.
  - Computers are very fast, but they are not very smart. Sometimes the “best fit” Logger Pro finds is not very good – you can tell by looking at the graph. If this is the case, you can enter educated guesses into the boxes for the best fit coefficients and then press the “Try Fit” button again. Sometimes this helps Logger Pro find a true best fit.
- When you are done with finding the best fit, click “OK”. The best fit line, equation, and coefficients should appear on the graph.
Making a Histogram
If you want to make a histogram of your data, do the following:

- Highlight the column of the data you would like to include in the histogram
- Go to the menu bar on Logger Pro and click on “Insert”
- Scroll down to “Additional Graphs” and then select “Histogram”. A new graph with the histogram should appear.
- If you add new data on the data column, the histogram should auto-update.
- You can adjust the number and size of the bins in the histogram by double-clicking on the x-bin axis of the histogram.
  - A new window will open.
  - On the bottom-right, you can set “Bin Size”, which determines the range of values to be included in each bin.
  - On the bottom-right, you can set “Bin Start”, which determines the value for the initial bin.

Store Latest Run
Sometimes you want to take more data without losing the data you already collected. In order to avoid having Logger Pro overwrite your precious data, once you are sure you want to keep the data run, simultaneously press the “command” button and the “L” button on your keyboard.

Adding a New Trail when Analyzing a Video
Sometimes you want to analyze the motion of different objects that are on the same video. Logger Pro assumes that every time you click on the screen, you are selecting the position for the same object. In order to avoid confusion, you can add a new trail, which is how you tell Logger Pro that you are now analyzing the motion of another object. To add a new trail:

- Make sure you have a movie open in Logger Pro
- Click on the lower-right button, “Enable/Disable video analysis”. The video analysis bar should appear to the right of the movie.
- Click on the sixth button from the top, “set active point”. A list appears.
- Select “Add point series”
- As long as the “Add point” button (second one from the top) is selected, you can simply click on the object of interest, and Logger Pro will record the object’s location and time. The points you select for this new object will be a different color than for the previous one.

Adding Error Bars to a Graph
- Double-click on one of the data points. A new window should appear.
- Select the “Options” tab on the top, then select the “Error Bar Calculations” box on the lower right.
- Depending on the nature of the uncertainty of the quantities plotted, enter either an “Error Constant”, or select the column for the calculated uncertainty under “Use Column”.
- Click “Done”
Inserting Text Annotations on a Graph

If you want to label parts of your graph, you can insert annotations following these steps:

- Go to the menu bar on Logger Pro and select “Insert”
- Scroll down and select “Text Annotation”
- A text box appears on your graph. Type the text you want in the text box.
  - You can select the text box and move it to a convenient location
  - The text box comes with a line that can be moved around to label a desired data point
  - Logger Pro is very temperamental about the location of the text boxes and lines, so while this feature is useful, it is far from perfect.