

TechLab Prep: Data Studios

motion sensor and Data Studio basics

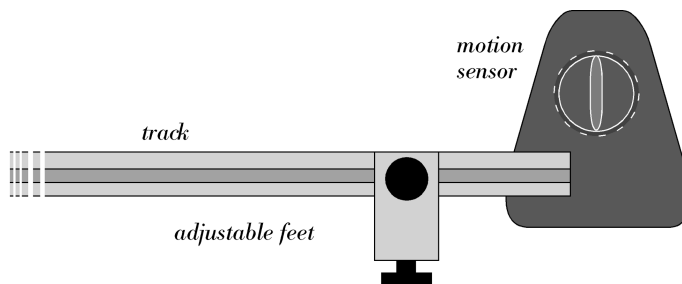
PERIOD	1.		
	2.		
GROUP	3.		
	4.		

• Purpose •

In this activity you will learn how to customize Data Studio's analysis of motion sensor data.

• Apparatus •

- ___ PASCO Introductory Dynamics System (dynamics carts, track, and accessories)
- ___ computer (Phyz MacBook)
- ___ motion sensor (PASport)
- ___ interface device (USB link)



• Setup •

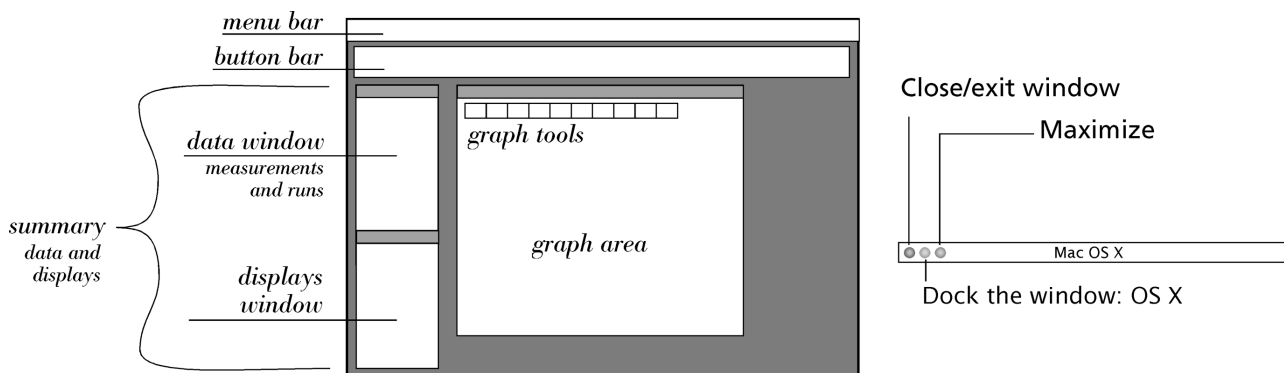
1. Start the computer.
2. Arrange the track so that it is level.
3. Attach the end stop to the "far end" (high number on the yellow tape side) of the track so that the Velcro side faces the track.
4. Push the motion sensor onto the "near end" of the track so that it grips the track as shown in the diagram above. Aim the sensor horizontally along the track, facing the Velcro end stop.
5. Adjust the sensor switch to the short range (cart) setting. When in that setting, the sensor cannot "see" anything closer than 15 cm from the sensor. Keep that in mind throughout the activity.
6. Connect the sensor to the interface device. Connect the interface device to the computer. When the computer tells you it found a sensor and asks what you'd like to do, remove your hands from the computer until you are in the process of completing procedure 1 below.

• Procedure •

1. DATASTUDIO FROM SCRATCH

In other activities, you may be asked to open a configuration file. Such configuration files have been designed ahead of time to facilitate completion of the corresponding activity. In this activity, you'll learn how to use DataStudio from scratch.

- a. Choose "Launch DataStudio." The diagram below shows the basic layout of the DataStudio screen that will appear.



- b. List the items in each area.
 - i. What are the names of the menus in the menu bar?
 Apple | DataStudio |
 - ii. What are the names of the buttons in the button bar?
 Summary |
 - iii. What are the names of the data measurement(s) in the upper portion of the summary window?
 - iv. What are the names of the displays that could be selected (in the summary window)?
 - v. What are the names of the graph tools in the graph window? (Move the cursor over a tool icon to see its name.)

2. Do a trial

- a. If the graph window does not show a particular measurement being graphed, drag the word "Position" from the data window to the graph area.
- b. Set a dynamics cart on the track about 20 cm in front of the motion sensor.
- c. Click the on-screen Start button.
- d. **After the clicking begins**, move the cart *slowly* out and back along the *full* length of the track once while keeping your hand on the cart at all times. Allow it to take about 10 seconds for the whole trip out and back. Do not slosh the cart back and forth multiple times.
- e. Click the on-screen Stop button to terminate the data sampling. If your trial did not go well, go to the Experiment Menu and Delete Last Data Run.
- f. Maximize the graph window by clicking the maximize box in the title bar of the window.
- g. Use the Scale to Fit graph tool to maximize the use of available graph window space.
- h. Save the activity as "DataStudios1 PG" (File: Save Activity As...) but use the period and group letter instead of PG. Save the activity in the appropriate folder.
- j. What was the cart doing when the resulting plotted line of its position has
 - i. positive slope?
 - ii. negative slope?
 - iii. zero slope?
- k. What was the position of the cart at 5.20 seconds? Use the Smart Tool to find out.
 - i. Click the Smart Tool icon in the graph window. (Move the cursor over any tool icon to see its name.)
 - ii. Drag the Smart Tool crosshairs onto the plotted line using the trackpad and trackpad button.
 - iii. Use the arrow keys to move the Smart Tool along the plotted line until it's on the 5.20 s mark. What is the value of the position?

iv. Why don't position values measured by the motion sensor *necessarily* match the position values given on the yellow tape on the track?

3. Track velocity vs. time

- a. Click the Setup button in the button bar. The Setup window will appear, showing the current settings for the motion sensor.
- b. Select the checkbox for "Velocity."
- c. Close the Setup window.
- d. Drag the Data Measurement "Velocity" (not Run 1 or Run 2, **Velocity**) in the Data window into the graph area and release. A velocity vs. time graph will appear below the position vs. time graph.
- e. Click the alignment tool (with the lock icon) that aligns the time axes of the two graphs into sync. (The graphs will still be stacked, but their time axes will be aligned.) Then click anywhere in the position graph and click the Scale to Fit tool. Click anywhere in the velocity graph and click the Scale to Fit tool.
- f. What does it mean when the plotted line on the velocity graph is
 - i. above the time axis?
 - ii. below the time axis?
 - iii. on the time axis?
- g. What was the velocity of the cart at 5.15 seconds? Use a Velocity graph Smart Tool to find out. You cannot drag the Position graph Smart Tool on to the Velocity graph. So click within the velocity graph and then click the Smart Tool. When you do this, a new Smart Tool will appear in the Velocity graph.

4. Track velocity vs. position

- a. Close the stacked Position and Velocity graphs and verify your intention. You now have empty space where the graph window had been.
- b. Drag the **main** Graph icon (not "Graph 1") from the Displays Window onto the Velocity data measurement in the Data Window and release. Doing so will create a new Velocity vs. Time graph in a new Graph window.
- c. Drag the Position measurement from the Data window to the graph area. Drag it to the Time axis and release. Doing so **successfully** will replace the Time axis with a Position axis. If you are unsuccessful, you will get stacked Position and Velocity graphs again. If this happens, close the Graph Window and start over at step 4.a.
- d. What was a velocity of the cart when the cart was 50 cm from the motion sensor? (There may have been more than one value for velocity when the cart was 50 cm from the sensor.) Use the Smart Tool to determine one of them.
- e. Use the Note Tool to make a note that points to the point on the graph referred to in the previous question. Indicate that "The velocity of the cart is V when the position is X ," but use the actual values, not V and X .
- f. Re-save the activity (File: Save Activity).

5. Watch just a portion of the track.
 - a. Delete all data (use the Experiment menu). **Do not delete the graph!** Delete all notes, too. (Select the note so that its handles are active, then press the delete key on the keyboard.) OK the deletion. **Then**, click anywhere in the graph.
 - b. Click the Setup Button.
 - c. Click the Sampling Options tab.
 - d. Click the Delayed Start tab.
 - e. Set the start condition to Data Measurement: Position Rises Above 0.3 m.
 - f. Click the Automatic Stop tab.
 - g. Set the stop condition to Data Measurement: Position Rises Above 0.7 m.
 - h. Click OK to accept the new conditions. Close the Setup window if it's still open.
 - i. Place the cart about 10 cm in front of the motion sensor. Click the on-screen Start button. **After the clicking begins**, push (and release) the cart toward the Velcro end stop. Allow it to coast and stick to the Velcro. Keep hands and other obstructions out of the space between the sensor and the cart. If the run doesn't go well, delete it (Experiment: Delete Last Data Run) and try again.
 - j. Maximize the graph window.
6. Customize THE graph window
 - a. Double click inside the graph area.
 - b. Click the Axis Settings tab. Set the scale of the velocity axis from 0 to 1 and the scale of the position axis from 0.2 to 0.8.
 - c. Activate "Lock Scaling" and deactivate "Adjust Axis to Fit Data." Do not click OK yet.
 - d. Click the Tools tab. Remove access to all graph tools other than the Smart Tool, the Notes tool, and the Remove tool.
 - e. Click OK to accept these settings.
 - f. Delete the on-screen Smart Tool if a Smart Tool still exists on the graph. Do **not** deactivate access to the tool.
 - g. File: Save Activity As... "Track Watcher PG" using **your** Period and Group in the appropriate location within the Student Work folder on the hard drive.
 - h. Secure a PhysBlessing so the teacher can verify your graph settings and setup option settings.