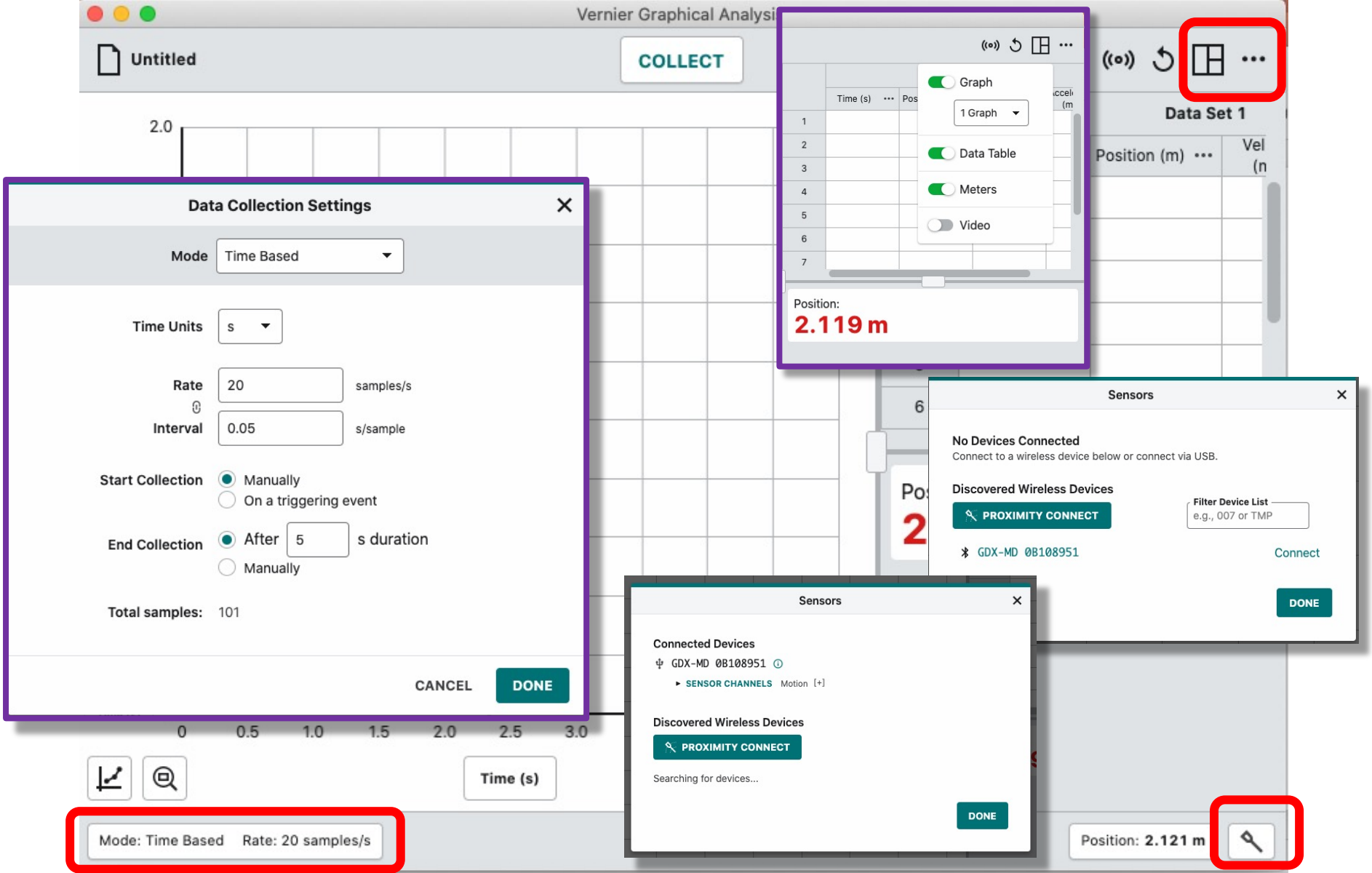
GoDirect Motion

Acceleration and deceleration of a model VW Bus

The bus should never get any closer than about a foot away from the detector.
It needs to stay aligned as it moves for best results. It only needs to move a few meters – do NOT try to make it go as far as possible!

1. Connect GoDirect Motion detector to Graphical Analysis – either by Bluetooth (check unit ID number) or USB cable.
2. Under Data Collection Settings make the duration of the experiment 8 seconds (the default is 5 s).
3. Align the VW Bus with the line of sight of the detector. Pull back the bus about 6 to 10 inches. Click on the Collect button (or press space bar) and then release the bus.
4. Graphs should show clearly the motion of bus from release until it stopped. If there are any erratic points then make adjustments to your procedure and repeat the experiment.
5. Measure with meter stick the total distance bus moved.
6. Once you have satisfactory graphs, share the data with team members and save the file to your laptop.


Vernier Graphical Analysis
Untitled
COLLECT
Data Set 1
Position (m)
Vel (n
2.0
Data Collection Settings
Mode
Time Based
Time Units
s
Rate
20
samples/s
Interval
0.05
s/sample
Start Collection
Manually
On a triggering event
End Collection
After
5
s duration
Manually
Total samples:
101
CANCEL
DONE
0
0.5
1.0
1.5
2.0
2.5
3.0
Time (s)
Graph
1 Graph
Data Table
Meters
Video
Time (s)
Position:
2.119 m
Sensors
No Devices Connected
Connect to a wireless device below or connect via USB.
Discovered Wireless Devices
PROXIMITY CONNECT
Filter Device List
e.g., 007 or TMP
GDX-MD 0B108951
Connect
DONE
Sensors
Connected Devices
GDX-MD 0B108951
SENSOR CHANNELS
Motion
Discovered Wireless Devices
PROXIMITY CONNECT
Searching for devices...
DONE
Mode: Time Based
Rate: 20 samples/s
Position: 2.121 m

Using Velocity vs. Time

1. Trace to determine the average acceleration caused by the "motor" (spring) – is this acceleration constant?
2. Find a point or interval for which the acceleration was zero while the bus was in motion.
3. Put a line of best fit on the interval when the bus was coasting to a stop (after the motor quit). Based on the coefficients of the best fit equation, what was the acceleration for this part of the motion?
4. Under the graph tools choose View Integral and note the "Area" result. Is this equivalent to the displacement of the bus? Compare to your measurement of the distance traveled.

Using Position vs. Time

1. Use the graph tools to determine the maximum speed – is your result consistent with the Velocity vs. Time data?
2. Trace along the graph and use the initial and final positions to calculate the overall displacement that occurred. Compare to the area under the curve from Velocity vs. Time and also the distance measured with meter stick.
3. Highlight the part of the graph where the motor was working. What would be an appropriate curve fit – choose one that you think is best.
4. Repeat the previous step but highlight the interval where the bus was coasting and choose quadratic. View the actual data points – is this a good match?

Using Acceleration vs. Time

1. Compare the acceleration values shown on this graph with the acceleration values determined using the Velocity Graph.
2. Experiment with the Integral tool on this graph – what would area under the curve represent? Try highlighting the positive accelerations and negative accelerations separately.
3. At what point(s) in time is acceleration zero while the bus is in motion? What is happening at that time? How does this relate to the velocity and position graphs?