

# HP StreamSmart 410

## User Guide

For use with the HP Prime Graphing Calculator



HP Part Number: NW278AA-90001

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# 1 HP MCL Introduction

The HP Mobile Calculating Laboratory (HP MCL) consists of one or more Fourier® sensors, an HP StreamSmart 410, and an HP Prime graphing calculator with the DataStreamer app. The HP MCL is used to collect and analyze real-world experimental data.

## Types of supported experiments





The HP MCL supports a number of different types of experiments, as shown in Table 1-1 below.

Table 1-1 Types of supported experiments

Type	Description	Example
Stream	Displays a live time graph (data stream) for up to four sensors simultaneously. See Chapter 2 for details.	Two students each sing a note one octave apart into separate microphones; the HP MCL displays their voice sound waves live so their wavelengths can be compared.
Stream/select events	Same as above	DataStreamer captures the dampened oscillations of a vibrating rod. Students select just the maxima of the oscillations for further analysis.
Selected events	Displays a live meter read-out for up to four sensors simultaneously; you can add a set of readings to your data set at any time. See Chapter 3 for details.	Collect pH and temperature readings from various locations around the edge of a pond.
Events-with-entry	Same as above	Collect pH and nitrate readings from various locations along a stream; add as an entry to each reading the distance from the point in the stream to a runoff drain pipe that empties into the stream.
Log	Set up a stream experiment to collect a certain number of readings at a set sampling rate. See Chapter 2 for details.	Take 20 temperature readings from a cooling cup of coffee for 10 minutes, taking one reading every 30 seconds.








# Manual conventions

Throughout this manual, a few conventions have been employed to help you distinguish calculator keys from touch buttons and other on-screen options.

1. Calculator keys appear in their own special font. For example, the ENTER key appears as . Shifted functions are referenced by both the required key combination and the function name; for example,   (Symbolic Setup).
2. The HP Prime calculators employ menus of context-sensitive touch buttons that appear along the bottom of the display. The touch buttons in these menus are represented with special graphics; for example, ZOOM appears as .
3. The DataStreamer app also employs dialog boxes and input forms. The field names in these are shown in bold type. For example, the field name XRNG is shown in bold as **X Rng**.
4. Screen captures are provided to guide you, though your display may vary slightly from the figures shown.
5. In multi-step procedures, steps are numbered.

## Helpful hints

Remember these helpful hints and shortcuts as you use the DataStreamer app:

- You can reset the DataStreamer app at any time by pressing  then tapping . When prompted, tap . Tap  to restart the app; tap  for a new data stream.
-  is interchangeable with .

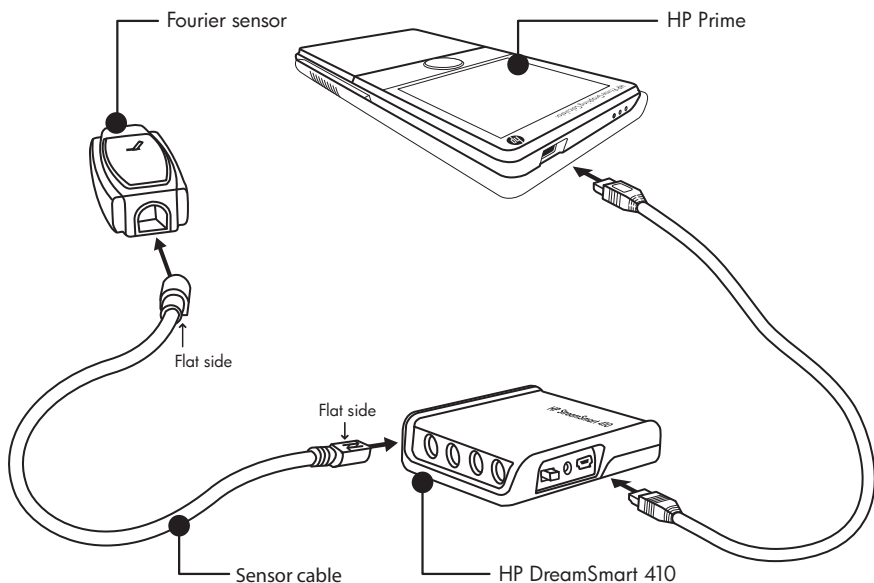
### 1. Charge

Charge the unit. **IMPORTANT!** Before beginning, plug the StreamSmart 410 into your computer with the mini-USB to USB cable that came with your HP StreamSmart 410. You will need to charge the unit for approximately five hours. Your computer must be running for charging to occur. **DO NOT** use the cable attached to the StreamSmart 410 for charging.

### 2. Connect

Connect a Fourier® sensor to the StreamSmart 410 using the sensor cable. The figure below shows the Fourier® light intensity sensor, but any supported sensor connects in a similar manner. Note the sensor cable ends have a flat

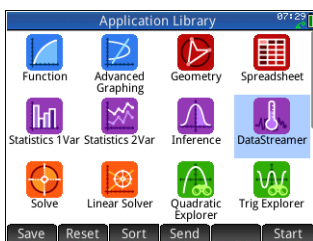
side; be sure the flat side faces up on the connection to the StreamSmart 410. Connect the StreamSmart 410 to the HP Prime graphing calculator using the mini-USB to micro-USB cable that came with your HP StreamSmart 410. Turn on both the calculator and the StreamSmart 410.



Connect the HP MCL

### 3. Launch

The HP MCL is controlled via the DataStreamer app. See the figure below for instructions on accessing the app.

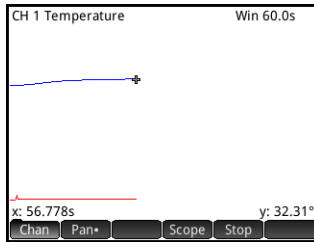


The DataStreamer app

### 4. Stream

The DataStreamer app starts in the Plot view. You will see the message, **Waiting for connection...**, quickly followed by a second message, **Waiting to start...** When this second message appears, tap **Start** to start streaming data. The data stream is a graphical representation of sensor data. The horizontal axis represents time in seconds and the vertical axis

represents sensor data in units of measurement. The Plot view displays a number of other items, as illustrated in the figure below



The Plot view

## The DataStreamer app

The DataStreamer app has the standard Plot and Numeric views, like most of the other HP Prime apps. Table 1-2 below lists the views and their uses in the DataStreamer app. The standard Symbolic view is not used by the DataStreamer app.

Table 1-2 DataStreamer app views





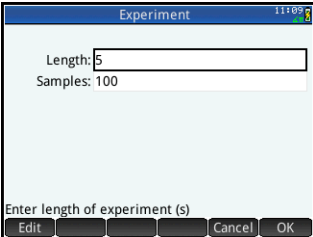
View	Display
Plot view Press 	
Numeric view Press 	
	<ul style="list-style-type: none"> <li>• View up to four data streams graphically as time graphs</li> <li>• Perform streaming experiments</li> <li>• See Chapter 2 for details</li> </ul>
	<ul style="list-style-type: none"> <li>• View up to four sensors numerically in a meter</li> <li>• Perform selected events and events-with-entry experiments</li> <li>• See Chapter 3 for details</li> </ul>





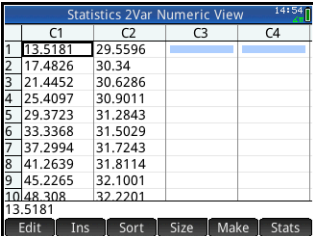
Table 1-2 DataStreamer app views

View	Display
<p>Experiment</p> <p>Press , select <b>Experiment</b>, and tap .</p>	
<ul style="list-style-type: none"> <li>• Set up a data logging experiment with a set duration (in seconds) and set number of samples</li> <li>• The experiment then runs in the Plot view like a streaming experiment</li> <li>• See Chapter 2 for details</li> </ul>	

## The Statistics apps

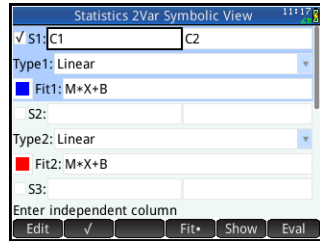
After you have selected the data you want to analyze, you send it to either the Statistics 1Var or the Statistics 2Var app. The Statistics 1Var and Statistics 2Var apps can perform in-depth analysis of the data, including the calculation of summary statistics (for 1 or 2 variables) and modeling bi-variate data with various fits. Table 1-3 summarizes the main views of the Statistics 2Var app; the Statistics 1Var app has similar views for studying univariate data. See the *HP Prime Quick Start Guide* for details.

Table 1-3 Statistics 2Var app views

View	Display																																																												
<p>Numeric view</p> <p>Press  and select <b>Statistics 2Var</b>.</p> <p>Press  to return to this view at any time.</p>	 <table border="1" data-bbox="588 1042 909 1280"> <thead> <tr> <th></th> <th>C1</th> <th>C2</th> <th>C3</th> <th>C4</th> </tr> </thead> <tbody> <tr><td>1</td><td>13.5181</td><td>29.5596</td><td></td><td></td></tr> <tr><td>2</td><td>17.4826</td><td>30.34</td><td></td><td></td></tr> <tr><td>3</td><td>21.4452</td><td>30.6286</td><td></td><td></td></tr> <tr><td>4</td><td>25.4097</td><td>30.9011</td><td></td><td></td></tr> <tr><td>5</td><td>29.3723</td><td>31.2843</td><td></td><td></td></tr> <tr><td>6</td><td>33.3368</td><td>31.5029</td><td></td><td></td></tr> <tr><td>7</td><td>37.2994</td><td>31.7243</td><td></td><td></td></tr> <tr><td>8</td><td>41.2639</td><td>31.8114</td><td></td><td></td></tr> <tr><td>9</td><td>45.2265</td><td>32.1001</td><td></td><td></td></tr> <tr><td>10</td><td>48.308</td><td>32.2201</td><td></td><td></td></tr> <tr><td>13.5181</td><td></td><td></td><td></td><td></td></tr> </tbody> </table>		C1	C2	C3	C4	1	13.5181	29.5596			2	17.4826	30.34			3	21.4452	30.6286			4	25.4097	30.9011			5	29.3723	31.2843			6	33.3368	31.5029			7	37.2994	31.7243			8	41.2639	31.8114			9	45.2265	32.1001			10	48.308	32.2201			13.5181				
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<ul style="list-style-type: none"> <li>• View numerical data in columns</li> <li>• Calculate summary statistics for the data</li> </ul>																																																													

## Symbolic view

Press  .




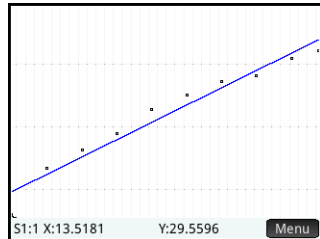
- Choose columns of data for analysis
- Choose a fit type

## Plot view

Press  .

or

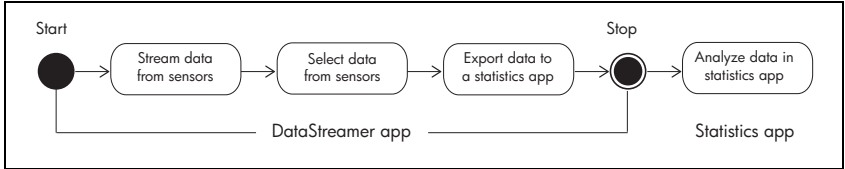
Press  and select **Autoscale**.



- View and trace the scatter plot and the fit of your data

## 2 Streaming Experiments

In streaming experiments, data is collected in real time in up to four separate streams. A streaming experiment is illustrated conceptually in the figure below.



As the data streams across the screen, you can modify how you view the stream(s). Since all four streams share the same horizontal time axis, you can speed the streams up or slow them down simultaneously. Since each stream has its own vertical axis, you can move each stream up or down separately and zoom in or out on each stream vertically. Zooming and panning each stream separately in the vertical dimension allows you to get just the right view on your experimental data. You can also stop and restart the stream(s), and choose a discrete section of the stream(s) to examine more closely.

*Streaming overview* summarizes the flow of streaming experiments in a table. Each section of the table corresponds to one of the bubbles in the figure above. Use this table for quick reference. The sections after Table 2-1 elaborate on each step. Refer to these sections for more detailed information on streaming, selecting, exporting, and analyzing data.

### Streaming overview



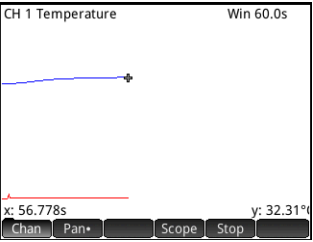
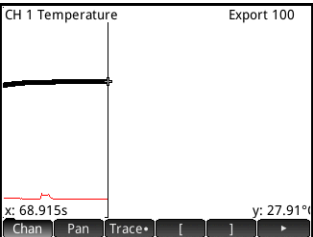






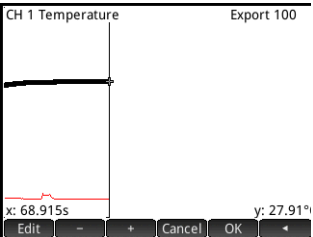
















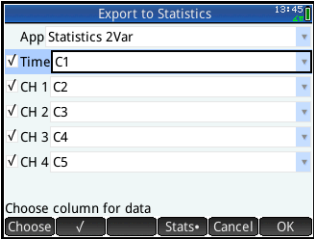
When you start the DataStreamer app, it opens in the Plot view, ready to start streaming data. Press  to return to Plot view at any time. Since the sensors are identified and the window is set for you automatically, all you need to do is tap .

Table 2-1 summarizes how to collect, export and analyze data.

Table 2-1 Streaming overview

View	Display														
<p>Plot view, streaming</p> <p>Press <b>Apps</b>, select <b>Datastreamer</b>, and when DataStreamer opens, tap <b>Start</b> to begin streaming.</p> <p><b>What you see:</b></p> <ul style="list-style-type: none"> <li>• Up to four data streams displayed graphically in real time</li> <li>• Channel number, sensor type, and screen width expressed in seconds</li> <li>• Cursor coordinates showing current sensor time and reading</li> </ul> <table border="1"> <thead> <tr> <th data-bbox="142 712 342 745">Button</th> <th data-bbox="342 712 935 745">Description</th> </tr> </thead> <tbody> <tr> <td data-bbox="142 756 210 789"><b>Chan</b></td> <td data-bbox="342 756 935 789">Select a channel (stream) to trace, etc.</td> </tr> <tr> <td data-bbox="142 801 291 834"><b>Pan•</b> / <b>Zoom</b></td> <td data-bbox="342 801 935 860">Toggle between panning (scrolling) and zooming with direction keys</td> </tr> <tr> <td data-bbox="142 872 210 905"><b>Pan•</b></td> <td data-bbox="342 872 935 905">Scroll up, down, left, and right</td> </tr> <tr> <td data-bbox="142 916 210 949"><b>Zoom</b></td> <td data-bbox="342 916 935 949">Zoom in or out vertically or horizontally</td> </tr> <tr> <td data-bbox="142 961 210 994"><b>Scope</b></td> <td data-bbox="342 961 935 994">Switch to oscilloscope mode</td> </tr> <tr> <td data-bbox="142 1006 291 1039"><b>Start</b> / <b>Stop</b></td> <td data-bbox="342 1006 935 1039">Stop stream flow or start a new stream</td> </tr> </tbody> </table> <p>Tap <b>Start</b> to start streaming. When you see the data you want, tap <b>Stop</b> to stop streaming. Tap <b>Export</b> to select just the data you want.</p>	Button	Description	<b>Chan</b>	Select a channel (stream) to trace, etc.	<b>Pan•</b> / <b>Zoom</b>	Toggle between panning (scrolling) and zooming with direction keys	<b>Pan•</b>	Scroll up, down, left, and right	<b>Zoom</b>	Zoom in or out vertically or horizontally	<b>Scope</b>	Switch to oscilloscope mode	<b>Start</b> / <b>Stop</b>	Stop stream flow or start a new stream	<p>Stream Data</p> 
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View	Display										
<p>Plot view, page 1 of Export menu</p> <p>Tap <b>Stop</b> then <b>Export</b>.</p>	<p>Select Data</p> 										
<p><b>What you see:</b></p> <ul style="list-style-type: none"> <li>• Data streams</li> <li>• Current channel and sensor, with tracer coordinates</li> <li>• Selected data set, based on the current channel, and the number of data points ready for export</li> </ul> <table border="1"> <thead> <tr> <th data-bbox="103 660 310 693">Button</th> <th data-bbox="310 660 943 693">Description</th> </tr> </thead> <tbody> <tr> <td data-bbox="103 702 310 768">  </td> <td data-bbox="310 702 943 768">Zoom, pan, and trace to navigate the data streams and find data of interest</td> </tr> <tr> <td data-bbox="103 776 310 817">  </td> <td data-bbox="310 776 943 817">Crop left and crop right</td> </tr> <tr> <td data-bbox="103 826 310 867">  </td> <td data-bbox="310 826 943 867">(next page) to see more functions</td> </tr> </tbody> </table>	Button	Description		Zoom, pan, and trace to navigate the data streams and find data of interest		Crop left and crop right		(next page) to see more functions			
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View	Display																				
	<p>Tap <b>Trace</b> and trace to the area that contains your data. Use <b>Zoom</b> and <b>Pan</b> to expand the data until it nearly fills the display. Use <b>[</b> and <b>]</b> to crop data from the left and the right. Once you have the data you want, tap <b>OK</b> to export the data for analysis.</p>																				
<p>Export to Statistics view</p> <p>Tap <b>OK</b> from page 2 of the Export menu in Plot view.</p>	<p>Export Data</p> 																				
<p><b>What you see:</b></p> <ul style="list-style-type: none"> <li>Options for choosing the destination for the data you wish to export and analyze</li> </ul> <table border="1"> <thead> <tr> <th data-bbox="163 773 341 806">Field</th> <th data-bbox="341 773 939 806">Description</th> </tr> </thead> <tbody> <tr> <td data-bbox="163 822 341 855"><b>App</b></td> <td data-bbox="341 822 939 888">Use <b>Choose</b> to select Statistics 1Var or Statistics 2Var as the app to which you will export your data</td> </tr> <tr> <td data-bbox="163 905 341 938"><b>Time</b></td> <td data-bbox="341 905 939 938">Choose a destination column for the data timestamps</td> </tr> <tr> <td data-bbox="163 954 341 987"><b>CH 1–CH 4</b></td> <td data-bbox="341 954 939 1053">Choose columns for the data from channels 1–4 of the StreamSmart 410 and select or deselect each one for export</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th data-bbox="163 1062 341 1095">Button</th> <th data-bbox="341 1062 939 1095">Description</th> </tr> </thead> <tbody> <tr> <td data-bbox="163 1103 341 1136"><b>Choose</b></td> <td data-bbox="341 1103 939 1169">Choose destination columns for the data from each sensor</td> </tr> <tr> <td data-bbox="163 1177 341 1210"><b>✓</b></td> <td data-bbox="341 1177 939 1210">Select or deselect each channel for data export</td> </tr> <tr> <td data-bbox="163 1219 341 1252"><b>Stats / Stats</b></td> <td data-bbox="341 1219 939 1318">Choose between following your data to the selected statistics app or remaining in the DataStreamer app after data is exported</td> </tr> <tr> <td data-bbox="163 1326 341 1359"><b>Cancel</b></td> <td data-bbox="341 1326 939 1359">Return to the original data set without saving changes</td> </tr> <tr> <td data-bbox="163 1367 341 1400"><b>OK</b></td> <td data-bbox="341 1367 939 1400">Export the data to the selected statistics app</td> </tr> </tbody> </table>	Field	Description	<b>App</b>	Use <b>Choose</b> to select Statistics 1Var or Statistics 2Var as the app to which you will export your data	<b>Time</b>	Choose a destination column for the data timestamps	<b>CH 1–CH 4</b>	Choose columns for the data from channels 1–4 of the StreamSmart 410 and select or deselect each one for export	Button	Description	<b>Choose</b>	Choose destination columns for the data from each sensor	<b>✓</b>	Select or deselect each channel for data export	<b>Stats / Stats</b>	Choose between following your data to the selected statistics app or remaining in the DataStreamer app after data is exported	<b>Cancel</b>	Return to the original data set without saving changes	<b>OK</b>	Export the data to the selected statistics app	
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<b>Cancel</b>	Return to the original data set without saving changes																				
<b>OK</b>	Export the data to the selected statistics app																				

## View

## Display

Select the Statistics 1Var or Statistics 2Var app as the destination for your data. Choose the columns where your data and the timestamps will be stored. Tap **OK** to continue and you will see your data in the Numeric view of the selected statistics app.

Statistics 2Var  
Numeric view

Analyze Data (numerically)

Tap **OK**.

	C1	C2	C3	C4
1	1.1147	26.7	108.9375	
2	1.5791	26.7115	108.9179	
3	2.0435	26.7164	108.9375	
4	2.508	26.8039	108.9179	
5	2.9724	26.8161	108.9179	
6	3.4369	26.8236	108.9179	
7	3.9013	26.8757	108.9179	
8	4.3658	26.8932	108.9375	
9	4.8302	26.9012	108.9375	
10	5.2946	26.9021	108.9375	

**What you see:**

- Your data arranged in columns

### Key or Button

**Stats**

View summary statistics (tap **OK** to return to Numeric view from summary statistics)

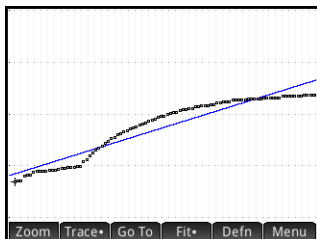
**Num**

Return to the Numeric view at any time

Statistics 2Var  
Plot view

Analyze Data (graphically)

Press **View** and select **Auto Scale**.






**What you see:**

- Scatter plot of your data and your selected fit (if any)

### Key or Button



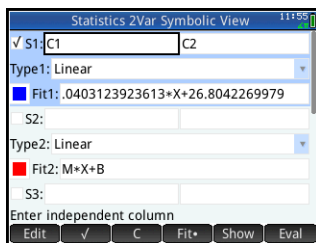
Trace the scatter plot or the fit

View	Display
	Switch between the scatter plot and the fit
	Open the Plot view menu for zooming, tracing, etc.
	Return to the Plot view at any time

## Statistics 2Var Symbolic view

## Analyze Data

Press 



### What you see:

- Five 2-variable analyses, named S1–S5
- The default analysis defined in S1, with:
  - Independent data in C1
  - Dependent data in C2
  - Linear model chosen as the fit

### Key or Button

### Description



Open an edit box to enter column names for your data (C1–C9 and C0)



Select or deselect S1–S5 for plotting



A typing aid for entering the letter C



Toggle plotting the fit on and off



Display the fit equation in textbook format



Resolve references (in a user-defined fit)



Return to the Symbolic view at any time

See the *HP Prime Quick Start Guide* for more details on the Statistics 2Var and Statistics 1Var apps.



# Stream data

Once you tap **Start** in the Plot view, the DataStreamer app displays a graphic representation of the incoming data streams as time graphs. The horizontal dimension represents time in seconds, and the vertical dimension represents the current sensor values in relevant units. The time represented by the width of the display is shown in the upper right corner and changes as you zoom in and out horizontally. Because only one stream may be traced at a time, the display also identifies the current data stream channel, sensor and cursor coordinates.

The DataStreamer app first tries to identify the attached sensors and makes several decisions based on the characteristics of the sensors. The DataStreamer app sets the vertical scales for each data stream based on the units of the sensor and the initial readings. The DataStreamer app also sets the horizontal scale for the length of time represented by the width of the display. These default settings ensure that the streams are visible in the display and moving at a perceptible rate. You can vary the speed and vertical position of the streams while the data is streaming.

Since the DataStreamer app collects thousands of sample readings from the sensor(s) every second, each pixel in a data stream actually represents a set of data points. It is only when you zoom all the way in that each pixel represents exactly one data point. You can zoom in on the data stream to make each pixel represent a smaller data set or zoom out on the data stream to make each pixel represent a larger data set. By default, the DataStreamer app averages the readings in each pixel column data set to arrive at a y-value to plot for that column. Although the data are averaged for graphing purposes, you still have access to all the data.

The figures below illustrate the location and basic functions of the Plot view main menu during and just after streaming. Once you stop the stream, there are three additional touch buttons available: **Trace\***, **Export**, and **▶**.

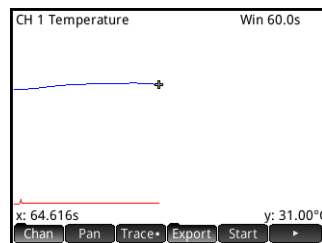
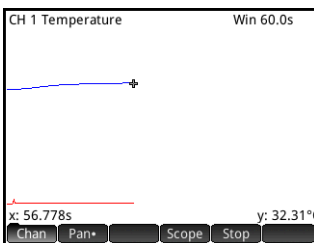


Table 2-2 below describes page 1 of the Plot view main menu during and just after streaming.

Table 2-2 Plot view main menu, page 1

Button	Description
<b>Chan</b>	This button opens the channel selection menu, which allows you to select which stream to trace. By extension, you are also choosing which stream to zoom or pan vertically. You can also use the calculator keys numbered 1 to 4 to select a channel.
<b>Pan•</b> / <b>Zoom</b>	This button is a toggle that determines how the direction keys function. Tap this button to toggle between <i>Pan</i> and <i>Zoom</i> . The active mode is indicated by a small white dot after the button name.
<b>Pan•</b>	When PAN is in active mode, use the direction keys to scroll the data streams up, down, left, and right to find data of interest. Panning horizontally affects all streams uniformly; panning vertically affects only the current stream. You can pan (scroll) the streams vertically to separate or superimpose them.
<b>Zoom•</b>	When ZOOM is in active mode, use the direction keys to zoom in or out, horizontally or vertically, to get the best view of the streams. Zooming horizontally affects all streams uniformly, while zooming vertically affects only the current stream. You can zoom in or out horizontally while data is streaming in, to control the speed of the data streams.
<b>Scope</b>	This button switches to oscilloscope mode. In this mode, the data stream sweeps from left to right, then returns to start from the left for another sweep.
<b>Export</b>	This button replaces <b>Scope</b> after streaming is stopped. It opens the Export menu, where you can find the buttons for isolating and selecting a final data set to export to one of the statistics apps.
<b>Start</b> / <b>Stop</b>	This toggle starts and stops data streaming. Stopping the streams permits exploration of the data and selection of a final data set for export. <b>Start</b> deletes any current data set and starts a new set of streams.
<b>Trace•</b>	When TRACE is active, use the direction keys to trace along the selected data stream.
<b>▶</b>	This button takes you to page 2 of the Plot view main menu.

ZOOM, PAN, and TRACE are touch button toggles that work in conjunction with the direction keys (▲, ▼, ◀, and ▶). Only one function is active at a time. Active status is indicated by a small white dot after the function name. For example, **Pan•** means that panning (scrolling) is active and the direction keys will be used to scroll the stream(s) within the display.

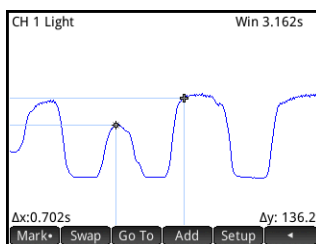
Table 2-3 below describes how these combinations function.

Table 2-3 Zoom, pan and trace

Button and Key		Description
<b>Zoom•</b>	◀ ▶	<ul style="list-style-type: none"> <li>Zoom in/out horizontally on all streams simultaneously</li> <li>If you are actively streaming data, these keys speed up the stream or slow it down</li> <li>If streaming has stopped, trace to data of interest and then toggle to <b>Zoom•</b> to zoom in or out.</li> <li>Press ▶ to zoom in horizontally, decreasing the amount of time represented by the width of the display</li> <li>Press ◀ to zoom out horizontally, increasing the amount of time represented by the width of the display</li> </ul>
<b>Zoom•</b>	▲ ▼	<ul style="list-style-type: none"> <li>Zoom in/out vertically on the current stream</li> <li>Press ▲ to zoom in and press ▼ to zoom out</li> <li>Decrease/increase the vertical scale, in sensor units, of the current stream</li> </ul>
<b>Pan•</b>	◀ ▶	<ul style="list-style-type: none"> <li>Move all stream(s) left and right in the display</li> <li>The screen display is a fixed window that moves back and forth along the stream(s)</li> </ul>
<b>Pan•</b>	▲ ▼	<ul style="list-style-type: none"> <li>Move the current stream up and down in the display</li> <li>Separate or superimpose the streams for viewing purposes</li> </ul>
<b>Trace•</b>	◀ ▶	<ul style="list-style-type: none"> <li>Move left or right from pixel to pixel in the current, selected data stream</li> <li>Display timestamp and sensor data</li> </ul>

Besides navigating and tracing the data set to find data of interest, DataStreamer also lets you compare any two points in a single stream and manually add a data point to a data set. These features are found on page 2 of the Plot view main menu, which is only accessible after streaming has stopped.

MARK and SWAP can be used together to examine the relationship between points in the data stream currently being traced. When you tap **Mark**, the DataStreamer app sets a visible mark at the current tracer location. Once the mark is set you can trace to any other point in the stream. The DataStreamer app displays the change in both x and y between the mark and the current tracer location as shown in the figure below. Tap **Swap** to switch the tracer and mark locations.





ADD and SETUP are used together when you want to build your final data set point by point. For example, suppose a data stream represents a light flashing at different intensities. In this case, you may want to collect just the maxima of the intensities into a data set. Tap **Setup** to choose a statistics app and columns for your data. Once the columns have been chosen, return to your data stream and trace to the first point you want to keep in your data set. Tap **Add** to add the data point to your data set in the statistics app you chose; DataStreamer briefly displays a icon indicating that your data point is being added to the data set. Continue in this fashion until you have collected all the points you want. Start your chosen statistics app to view and analyze your data.

Table 2-4 describes page 2 of the Plot view main menu.




Table 2-4 Plot view main menu, page 2

Button	Description
<b>Mark</b>	This button toggles MARK mode on and off, setting a mark at the current tracer position, or erasing the mark.
<b>Swap</b>	This button switches the positions of the mark and the tracer.
<b>Go To</b>	This button lets you to jump to a specific time along the current stream.
<b>Add</b>	This button adds the current tracer data point to your data set.

Table 2-4 Plot view main menu, page 2

Button	Description
	This button takes you to the Export to Statistics dialog box, where you can set the destination columns for data you are adding.
	This button takes you back to page 1 of the Plot view main menu.

## Select data

Once you have stopped streaming data, you will want to examine the data to find just the data set you wish to analyze. The  touch button opens the Export menu in the Plot view. Here you will find all the tools you'll need to identify and select your final data set. Note that ZOOM, PAN, and TRACE are still available. In addition, you can use  and  to crop data off the left and right sides of the data set. You can also thin the data by subtracting points; if you change your mind, you can add them back.

The following tables describe the new touch buttons available on the two pages of the Export menu.

Table 2-5 Export menu, page 1














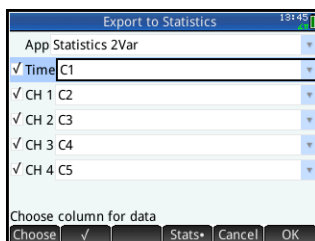
Button	Description
	This button toggles left-cropping on and off. When there is a small white dot on this button (  ) , use  and  to move the left-crop bar. Data to the left of the bar is excluded from the final data set.
	This button toggles right-cropping on and off. When there is a small white dot on this button (  ) , use  and  to move the right-crop bar. Data to the right of the bar is excluded from the final data set.
	This button takes you to page 2 of the Export menu.

Table 2-6 Export menu, page 2

Button	Description
	This button opens a dialog box where you can select a specific number of data points between two time values for export to one of the statistics apps.
	This button closes the Export menu and returns to the Plot view main menu.
	This button exports the current data set to the selected statistics app and deletes all other data.
	This button takes you back to page 1 of the Export menu.

## Export data

From the Export menu in Plot view, tap  to open the Export to Statistics dialog box as shown in the figure below.












There are six fields in the Export to Statistics dialog box: one for the statistics app that is the destination for the data, one for the timestamp associated with each data point, and four for the StreamSmart 410 channels. The four channel fields, (**CH 1**, **CH 2**, **CH 3**, and **CH 4**) and the **Time** field are each preceded by a checkbox. The checkbox allows you to select or deselect the data from each channel for export. By default, all four channels and the time are selected for export. Tap  to toggle between selecting and deselecting a channel. By default, data from each channel appears in a particular column in the selected statistics app. If you want to change the default column for data from a channel, select the channel then tap  to change to another of the columns available in the statistics apps. At any time, you can tap  to cancel the changes you made and return to your data set, or tap  to export the data. Once your data set is exported, all the other data from your experiment is deleted.

Table 2-7 summarizes the fields and touch buttons in the Export to Statistics dialog box


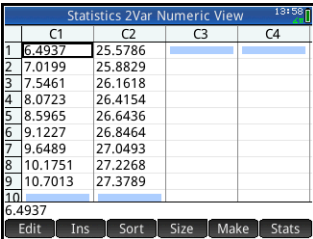
Table 2-7 The Export to Statistics dialog box	
Field	Description
<b>App</b>	Choose to export your data to the Statistics 1Var or Statistics 2Var app, or to a saved app based on one of these apps.
<b>Time</b>	Choose a column for the data timestamps and select or deselect this data for export.
<b>CH 1–CH 4</b>	Choose columns for the data and select or deselect each data stream for export.
Button	Description
	This button opens a drop-down box to make a choice for the selected field.
	This button toggles between selecting and deselecting a field for export.
	This button toggles between remaining in the DataStreamer app and following your data into the selected statistics app. The white dot after STATS indicates that you wish to follow the data and launch the statistics app chosen in the <b>App</b> field.
	This button takes you back to the Plot view without saving any changes.
	This button saves all changes and exports the data as indicated.

## Analyze data





The DataStreamer app provides minimal facilities for examining and analyzing data, as most of this work is done in the Statistics 1Var and Statistics 2Var apps after the data is exported there. The Statistics 1Var and Statistics 2Var apps let you view your data in a table, plot it as a graph, view summary statistics, and create 2-variable models for bi-variate data. All of this functionality is described in detail in the *HP Prime Quick Start Guide*, so it is not repeated here. However, this section contains a brief summary of the views of the Statistics 1Var and Statistics 2Var apps.


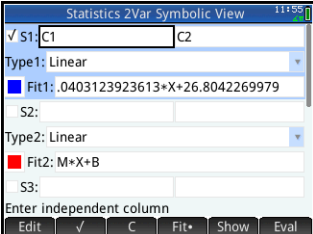
Table 2-8 below uses the Statistics 2Var app to illustrate the views in the statistics apps.

Table 2-8 Views in the statistics apps



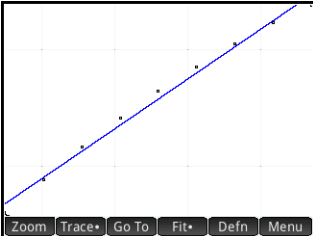
View	Display
<p>Numeric view</p> <p>Press <b>Num</b> .</p>	

The Numeric view shows your columns of data arranged in a table. Although only four columns are displayed, there are actually ten columns available.

Press  and  to move from column to column; press  and  to navigate through the data in a column. Tap **Stats** to view summary statistics for your data set.

<p>Symbolic view</p> <p>Press <b>Symb</b> .</p>	
--	--

In the Symbolic view you can define up to five statistical analyses to perform on data from particular columns. In the Statistics 2Var app (shown above), the analyses are named **S1** to **S5**. In the Statistics 1Var app, the analyses are named **H1** to **H5**.

<p>Plot view</p> <p>Press <b>Plot</b> .</p> <p>or</p> <p>Press <b>View</b>  and select <b>Auto scale</b>.</p>	
---	---



The easiest way to get a good view of your data is to use the **Auto scale** option. Press  $\blacktriangleright$  and  $\blacktriangleleft$  to trace the scatter plot and the fit. Press  $\blacktriangledown$  and  $\blacktriangleup$  to switch between the scatter plot and the fit. The Plot view in the Statistics 2Var app with a linear fit is shown above. In the Statistics 1Var app, the Plot view would show histograms, box-and-whisker plots, and other 1-variable statistical plots.

Numeric view STATS

Press  $\text{Num} \left[ \begin{smallmatrix} \text{View} \\ \text{Copy} \end{smallmatrix} \right]$  then tap  $\text{Stats}$ .

	X	S1		
n	9			
f	9.946590E-1			
R <sup>2</sup>	9.893465E-1			
sCOV	8.833774E-1			
aCOV	7.852243E-1			
$\Sigma XY$	2.0634223E3			

9

Stats\* X Y Size Column OK

Press  $\blacktriangledown$  and  $\blacktriangleup$  to navigate the summary statistics. Tap  $\text{OK}$  to return to the Numeric view of the app. The Numeric view STATS in the Statistics 2Var app is shown above. In the Statistics 1Var app, this view would contain the 5-number summary of the data.

## Data logging

Under certain circumstances, you might want to run an experiment for a particular duration and collect a particular number of samples. You can do this in the StreamSmart 410 with the **Experiment** option.

1. Press  $\text{View} \left[ \begin{smallmatrix} \text{View} \\ \text{Copy} \end{smallmatrix} \right]$ , select **Experiment**, and tap  $\text{OK}$  to open the Experiment dialog box.

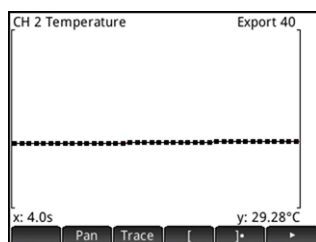
Experiment 11:10:5

Length:

Samples: 100

Enter length of experiment (s)

2. Select **Length**, tap **Edit**, change the experiment length to 4 seconds, then tap **OK**. Then select **Samples**, tap **Edit**, change the number of samples to 40, then tap **OK**. Tap **OK** to close the dialog box.
3. When the **Experiment** dialog box closes, you are returned to the Plot view. Tap **Start** to start logging data.



Data collected from each sensor is shown as a stream, just like a streaming experiment, but `DataStreamer` will only collect the specified number of points over the specified period. The figure above shows 40 data points have been collected (**Export: 40**) and the trace cursor readout at the far left of the screen shows that the elapsed time is approximately 4.0 seconds (**x:4.0s**). You can then select and export a final data set, just like you would in a streaming experiment. Refer to the section *Select data* in Chapter 2 for more details on selecting and exporting a data set.

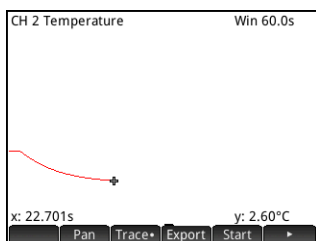
## Streaming experiment example

In the following experiment, a temperature sensor is placed in ice water. Connect the HP Prime, the temperature sensor and the StreamSmart 410 as shown in the figure on Page 2. There is an arrow on the plug for the temperature sensor. This arrow faces up when plugged into the StreamSmart 410.

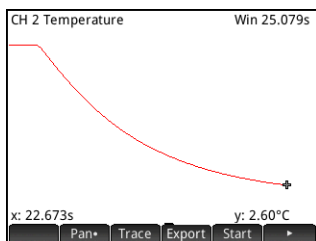
1. Press **Apps** and select **DataStreamer**. The DataStreamer app opens in Plot view with the message “Waiting to start...”



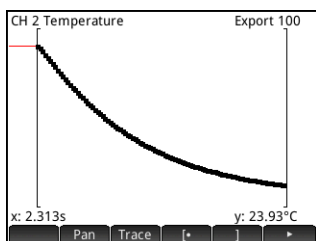
2. Tap **Start** to begin data streaming.
3. Once you see the data stream, place the temperature sensor in the glass of ice water and stir it constantly. Collect data until the temperature falls below  $4^{\circ}\text{C}$ , then tap **Stop**.





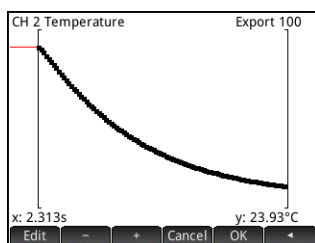
4. Toggle from **Pan+** to **Zoom+** and press  $\blacktriangleright$  and  $\blacktriangleup$  to zoom in until the data stream fills the display well.






5. Tap **Export** then **[**. Press  $\blacktriangleright$  to move the left crop bar to the right to delete the data that corresponds to the time period before you placed the sensor in the ice water.








6. Tap  to access page 2 of the Export menu. Tap  to export your selected data.



7. In the Export to Statistics dialog box, check to make sure that the **App** field is set to **Statistics 2Var**. If it is not, highlight the **App** field, tap , select **Statistics 2Var** and tap . You can leave the rest of the fields with their default settings.

8. Tap . You will leave the Data Streamer app and open the Statistics 2Var app. The Statistics 2Var app opens in the Numeric view.


	C1	C2	C3	C4
1	2.5219	23.5246		
2	2.7297	23.1189		
3	2.9375	22.6879		
4	3.1445	22.2821		
5	3.3523	21.8511		
6	3.5601	21.4454		
7	3.7671	21.0396		
8	3.9749	20.6593		
9	4.1827	20.2536		
10	4.3905	19.8118		
100	2.5219	23.5246		

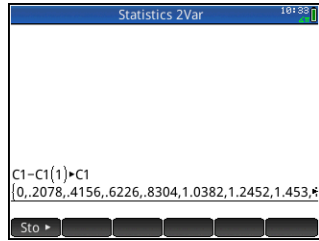
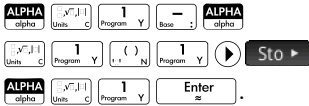
9. The last data point may be incorrect. Press  and  to move to the last data point. Press  to delete the value in column C2. Then press  to move across to column C1 and press  to delete the value there as well.


	C1	C2	C3	C4
92	21.4121	2.86		
93	21.6191	2.8229		
94	21.8269	2.7486		
95	22.0347	2.6743		
96	22.2417	2.6		
97	22.4495	2.5629		
98	22.6573	2.4886		
99	22.8651	2.4143		
100	22.969	23.8543		
101				
101				

	C1	C2	C3	C4
92	21.4121	2.86		
93	21.6191	2.8229		
94	21.8269	2.7486		
95	22.0347	2.6743		
96	22.2417	2.6		
97	22.4495	2.5629		
98	22.6573	2.4886		
99	22.8651	2.4143		
100				
101				




Enter value or expression

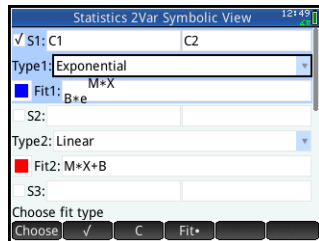
10. We want to reset the initial time value so that it is zero. Press  to enter the home view and enter C1-C1(1)►C1 by pressing the following:




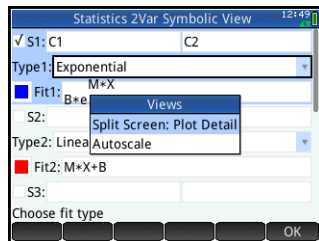
11. Press  to return to the Numeric view. C1(1) should now have a value of zero.


	C1	C2	C3	C4
1	0	23.5246		
2	.2078	23.1189		
3	.4156	22.6879		
4	.6226	22.2821		
5	.8304	21.8511		
6	1.0382	21.4454		
7	1.2452	21.0396		
8	1.453	20.6593		
9	1.6608	20.2536		
10	1.8686	19.8118		
0				

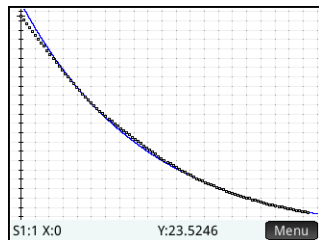
12. Press  to enter the Symbolic view. Highlight the **Type1** field and change it to **Exponential**. Do this by pressing  to cycle through the options or tapping  and selecting **Exponential**.



13. Press  and select **Autoscale**.



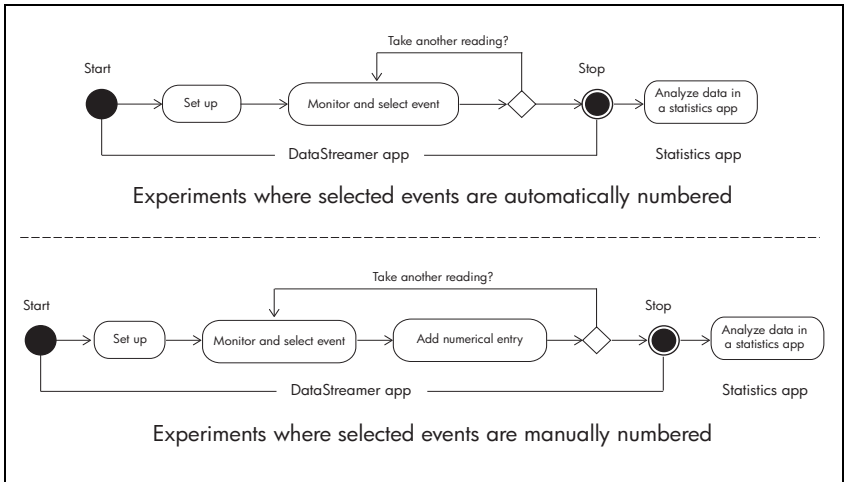
14. The Plot view opens with both the scatter plot of our data and the exponential fit. Tap  to open the Plot view menu, with options to zoom, trace, etc.





# 3 Selected Events Experiments

In this chapter, we show you how to take a few discrete sample readings from up to four sensors at a time and collect them into a data set for analysis. The DataStreamer app lets you capture data at any point in time and have the data point exported to a data set in one of the statistics apps. By default, the readings are auto-numbered in the order in which they are collected, but you can add a numerical entry to each reading when it is taken. The figure below summarizes the steps involved in these types of experiments.



*Selected Events Overview* gives a brief summary, with each bubble explained in a section of Table 3-1. Pages 33–35 give more detailed information on each bubble. The chapter ends with a sample events-with-entry experiment.

## Selected events overview











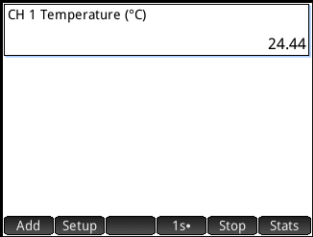









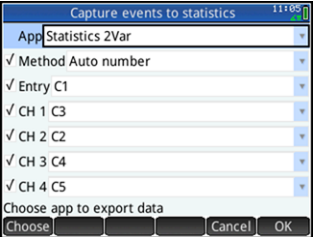











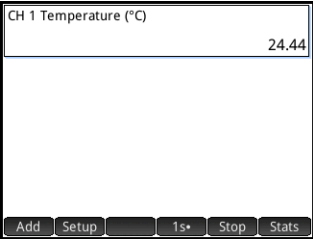







Whether you choose to auto-number your selected events or add a numerical entry to each event, experiments involving a series of distinct events usually start in the Numeric view of the DataStreamer app. To access the Numeric view with the DataStreamer app running, press . The Numeric view displays the current reading for each attached sensor. The readings are updated periodically.

Table 3-1 illustrates the flow of a selected events experiment.

Table 3-1 Overview of selected events experiments

View	Display										
<p data-bbox="151 158 298 183">Numeric view</p> <p data-bbox="138 246 244 270">Press  .</p> <p data-bbox="138 472 293 497"><b>What you see:</b></p> <table border="1" data-bbox="190 517 928 783"> <thead> <tr> <th data-bbox="199 517 268 541">Button</th> <th data-bbox="594 517 712 541">Description</th> </tr> </thead> <tbody> <tr> <td data-bbox="190 563 260 588"></td> <td data-bbox="353 563 866 588">Open the Capture Events to Statistics dialog box</td> </tr> <tr> <td data-bbox="190 607 260 632"></td> <td data-bbox="353 607 928 662">Toggle the sensor read-out refresh rate between 0.5, 1, and 1.5 seconds (after sensor read-out starts)</td> </tr> <tr> <td data-bbox="190 682 260 707"></td> <td data-bbox="353 682 622 707">Start reading sensor data</td> </tr> <tr> <td data-bbox="190 726 260 751"></td> <td data-bbox="353 726 897 781">Leave the DataStreamer app and open the selected statistics app</td> </tr> </tbody> </table>	Button	Description		Open the Capture Events to Statistics dialog box		Toggle the sensor read-out refresh rate between 0.5, 1, and 1.5 seconds (after sensor read-out starts)		Start reading sensor data		Leave the DataStreamer app and open the selected statistics app	<p data-bbox="617 158 669 183">Start</p> 
Button	Description										
	Open the Capture Events to Statistics dialog box										
	Toggle the sensor read-out refresh rate between 0.5, 1, and 1.5 seconds (after sensor read-out starts)										
	Start reading sensor data										
	Leave the DataStreamer app and open the selected statistics app										
<p data-bbox="120 849 329 903">Capture events to statistics dialog box</p> <p data-bbox="138 968 260 992">Tap  .</p> <p data-bbox="138 1191 293 1215"><b>What you see:</b></p> <ul data-bbox="138 1240 928 1295" style="list-style-type: none"> <li>Options for choosing the destination for the data you wish to export and analyze</li> </ul> <table border="1" data-bbox="180 1314 928 1488"> <thead> <tr> <th data-bbox="208 1314 260 1339">Field</th> <th data-bbox="594 1314 712 1339">Description</th> </tr> </thead> <tbody> <tr> <td data-bbox="199 1359 247 1384"><b>App</b></td> <td data-bbox="353 1359 928 1414">Use  to select Statistics 1Var or Statistics 2Var as the app to store your data for analysis</td> </tr> <tr> <td data-bbox="182 1433 265 1458"><b>Method</b></td> <td data-bbox="353 1433 866 1488">Use  to select auto-numbering or adding a numerical entry to each data point</td> </tr> </tbody> </table>	Field	Description	<b>App</b>	Use  to select Statistics 1Var or Statistics 2Var as the app to store your data for analysis	<b>Method</b>	Use  to select auto-numbering or adding a numerical entry to each data point	<p data-bbox="612 849 671 873">Setup</p> 				
Field	Description										
<b>App</b>	Use  to select Statistics 1Var or Statistics 2Var as the app to store your data for analysis										
<b>Method</b>	Use  to select auto-numbering or adding a numerical entry to each data point										



View	Display
Entry	Choose a column for the entry (or auto-numbering) and use  to select or deselect it for export
CH 1-CH 4	Choose columns for the data from channels 1 to 4 of the StreamSmart 410 and select or deselect each one for export
Button	Description
	Open a drop-down box to make a selection
	Select or deselect each channel for data export
	Return to the Numeric view without saving changes
	Save the setup changes and return to the Numeric view
When you have made your changes, tap  to save the changes and return to the Numeric view or tap  to return to the Numeric view without saving your changes.	
Numeric view	Monitor and Select Events
Press  then tap  .	
<b>What you see:</b>	
<ul style="list-style-type: none"> <li>Numeric read-out for each connected sensor</li> </ul>	
Button	Description
	Add the current sensor readings to your data set
	Open the <b>Capture events to statistics</b> dialog box
	Toggle the refresh rate between 0.5, 1, and 1.5 seconds
	Stop reading sensor data
	Leave the DataStreamer app and open the selected statistics app
Tap  to keep adding current sensor readings to your data set until it is complete. Then tap  to analyze your completed data set in the selected statistics app.	

**View****Display**

Statistics 2Var  
Numeric view

Analyze Data (numerically)

Tap **Stats** in the Numeric view of the DataStreamer app.

	C1	C2	C3	C4
1		24.8939		
2		25.2743		
3		26.2379		
4		26.9225		
5		27.1254		
6		27.6325		
7		27.9875		
8		28.0889		
9		28.2157		
10		28.3679		

**What you see:**

- Your data displayed in columns

**Key or Button**

Display summary statistics for your data



Return to the Numeric view at any time

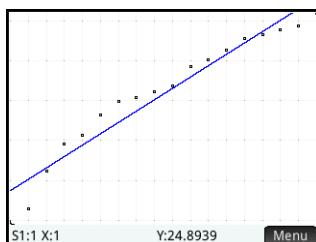
Tap **Stats** in the Numeric view to view summary statistics for your data set. Press **OK** to return to the Numeric view from summary statistics.

**Description**

Statistics 2Var  
Plot view

Analyze Data (graphically)

Press **View Copy** and select **Autoscale**.

**What you see:**

- A scatter plot of your data with a linear fit

**Key or Button**

Trace the scatter plot or the fit



Switch between the scatter plot and the fit



Open the Plot view menu for zooming, tracing, etc.

**Description**

## View



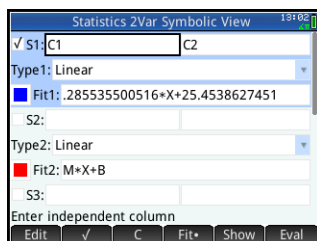
Return to the Plot view at any time

Statistics 2Var  
Symbolic view

Press

## Display

Analyze Data



### What you see:

- Five 2-variable analyses, named S1–S5
- The default analysis defined in S1, with:
  - Independent data in C1
  - Dependent data in C2
  - Linear model chosen as the fit

### Key or Button

### Description

Open an edit box to enter column names for your data (C1–C9 and C0)

Select or deselect S1 to S5 for plotting

A typing aid for entering the letter C

Toggle plotting the fit on and off

Display the fit equation in textbook format

Resolve references (in a user-defined fit)

Return to the Symbolic view at any time

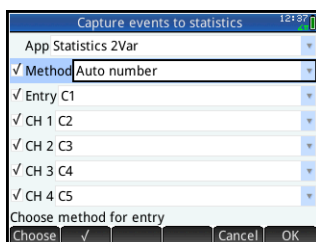
See the *HP Prime Quick Start Guide* for more details on the Statistics 2Var and Statistics 1Var apps.

## Set up experiment

By default, tapping in the Numeric view will capture the current set of readings from sensors attached to channels 1 to 4 of the StreamSmart 410. The readings will be auto-numbered, and the auto-number will be stored in row 1 of

column **C1** in the Statistics 2Var app. The rest of the readings will be stored in row 1 of columns **C2** to **C5**, with the reading from the sensor in channel 1 stored in **C2**, the reading from the sensor in channel 2 stored in **C3**, and so on. The next time **Add** is tapped, the data will be stored in row 2 of these columns. This process can be continued indefinitely.

Tap **Setup** to enter the **Capture events to statistics** dialog box. From this dialog box you can set up where your data will be stored when you tap **Add**. You can choose to store it in either the Statistics 1Var app or the Statistics 2Var app, or any saved app based on one of these apps. You can also choose into which column in the selected statistics app the data from each channel is stored. In addition to choosing columns in which to store your data, you can also choose to add an entry to the data from each selected event. The figure below illustrates the **Capture events to statistics** dialog box.










In the figure above, data will be stored in the Statistics 2Var app, with the auto-number entries (1, 2, 3,...) stored in C1, the data from channel 1 (CH 1) stored in C2, and the data from channel 2 (CH 2) stored in C3. With **Method** highlighted as shown in the figure, you can tap **Choose** to change from **Auto number** to **With entry**, so you can add your own numerical entry to each selected event. You can also tap **✓** to deselect **Method** (and **Entry** as well) and omit sending the auto-number entries at all. Finally, you can tap **OK** to accept all changes and return to the Numeric view, or tap **Cancel** to close the dialog box without saving any changes.

Table 3-2 below describes each of the fields and touch buttons in the Capture events to statistics dialog box.




Table 3-2 **Capture events to statistics** dialog box

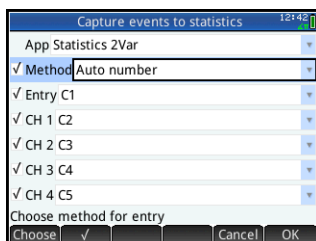
Field	Description
<b>App</b>	Choose the Statistics 1Var or Statistics 2Var app as the app to store your data for analysis.

Table 3-2 **Capture events to statistics** dialog box

<b>Method</b>	Choose to auto-number the data points or manually add a numerical entry to each data point.
<b>Entry</b>	Choose a column destination for the auto-numbered or user-supplied entries.
<b>CH 1–CH 4</b>	Choose column destinations for the data from channels 1 to 4 of the StreamSmart 410.
<b>Button</b>	<b>Description</b>
	This button opens a choose box to make a selection. Use  and  to navigate the list, then tap  to accept your selection and close the choose box.
	This button selects and deselects a channel or entry for data export. Only channels (and entry) that are checked will have their data exported.
	This button closes the dialog box without making any changes and returns to the Numeric view.
	This button saves the changes, closes the dialog box, and returns to the Numeric view.

## Monitor and select events

Once you have activated the proper channels and set destinations for the data from these channels, you are ready to begin collecting data. To capture an event's data in the Numeric view, tap . If you have selected to auto-number event data, you will see an icon that shows that your event data are being added to the current data set. If you have selected to add events to your entry, the Event to Statistics dialog box will appear as shown in the figure below, prompting you to add your numerical entry to the event just captured. Enter your numerical entry and tap . You will return to the Numeric view where you can continue adding data from subsequent events or tap  to open the selected statistics app to analyze your data.



# Analyze data

Once you have captured all your events, tap **Stats** to go to the statistics app where you selected to store your data. For a brief summary of the Statistics 2Var app, refer to the section titled, *Analyze data* in Chapter 2. For more complete information on both the Statistics 1Var and Statistics 2Var apps, please consult the *HP Prime Quick Start Guide*.

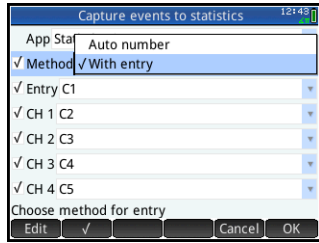
## Selected events experiment example

In the following experiment, a temperature sensor is used to record the temperature in a room at various heights at 25 cm intervals. Connect the HP Prime, the temperature sensor and the StreamSmart 410 as shown in the figure on Page 2. There is an arrow on the plug for the temperature sensor. This arrow faces up when plugged into the StreamSmart 410.

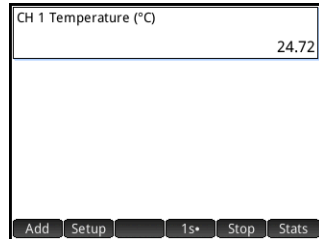
1. Press **Apps** and select **DataStreamer**. Press **Num** to enter the Numeric view. The Numeric view opens with the message “**Waiting to start...**”
2. Tap **Setup** to open the Capture Events to Statistics dialog box. By default, our data will be stored in the Statistics 2Var app for analysis. Select the **Method** field.



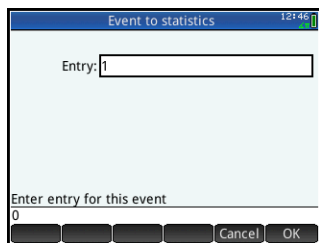
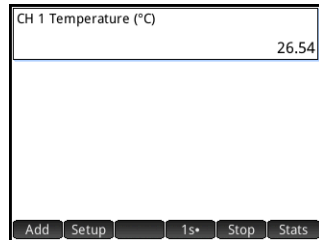
3. Since we want to enter the height in centimeters for each of our temperature readings, we will change the **Method** from **Auto number** to **With entry**. Select **Method**, tap **Choose**, select **With entry** and tap **OK**. Tap **OK** again to close the dialog box.



4. You will return to the Numeric view. Tap **Start** to start monitoring the current temperature. Press **1s•** to toggle between taking readings every 0.5, 1.0, or 1.5 seconds.



5. Place the sensor on the floor, wait until the reading stabilizes, and then tap **Add**. Since we chose to add an entry, the Event to Statistics dialog box opens. Enter 0 as the height of the sensor for the first reading and tap **OK**.



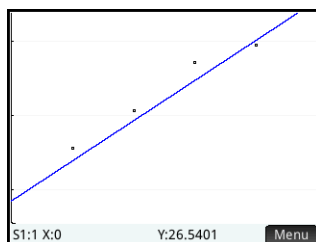
6. Repeat step 5 for sensor heights of 25, 50, 75, 100, and 125 cm.
7. Once you have recorded the 6 selected events, tap **Stats** to leave the DataStreamer app and open the Statistics 2Var app.

8. The Statistics 2Var app opens in the Numeric view, where we can see our six data points in a table. Use  $\leftarrow$ ,  $\rightarrow$ ,  $\uparrow$ , and  $\downarrow$  to navigate the table. Tap **Stats** to see summary statistics for the bivariate data in columns **C1** and **C2**.

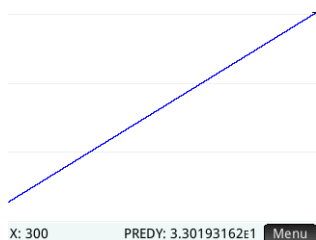
	C1	C2	C3	C4
1	0	26.5401		
2	25	27.5593		
3	50	28.0636		
4	75	28.7229		
5	100	28.9511		
6	125	29.3821		
7				
8				
9				
10				
0				

Buttons: Edit, Ins, Sort, Size, Make, Stats

9. Press **View Copy** and select **Auto scale**. You will see a scatter plot of your data and the linear fit in the Plot view. Use  $\rightarrow$  and  $\leftarrow$  to trace the scatter plot or the fit. Use  $\uparrow$  and  $\downarrow$  to switch between the scatter plot and the fit.



10. Switch to tracing the linear fit. Suppose the ceiling of the room is at 3 m. What is our estimate of the temperature there? Tap **Menu** then **Go To**, enter 300, and tap **OK**. Tap **Menu** to read the predicted y-value of approximately 33.02°C. for  $x=300$ . Your value will differ from the one shown in the figure.



11. Press **Symb Setup** to enter the Symbolic view. Here you can see that the first analysis (**S1**) has been defined to use C1 as the independent data column and C2 as the dependent data column. Also, by default, a linear fit is used. The equation of the fit is shown as well.

Statistics 2Var Symbolic View

✓ S1: C1 C2

Type1: Linear

Fit1:  $.0217653714286 \cdot X + 26.842847619$

S2:

Type2: Linear

Fit2:  $M \cdot X + B$

S3:

Enter independent column

Buttons: Edit, ✓, C, Fit\*, Show, Eval



The constant in the equation is the model's prediction of the floor temperature, while the slope is the model's estimate of the change in temperature per centimeter of height. Your values will differ from those shown. To choose a different fit type, select the **Type1** field, tap **Choose**, make a selection, and tap **OK**. When you return to the Plot view, you will see your new fit. When you return to the Symbolic view after this, you will see the equation of your new fit.



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# 4 Troubleshooting

The table below lists solutions to frequently asked questions about the HP MCL and the DataStreamer app.

Table 4-1 FAQs

Question	Solutions
I connected the HP MCL as shown in the diagram on Page 2 and launched the DataStreamer app, but all I see is the message “ <b>Streamer not connected...</b> ”. What should I do now?	<ol style="list-style-type: none"><li data-bbox="526 378 943 485">1. First, check the cable connections from the HP Prime to the HP StreamSmart 410.</li><li data-bbox="526 508 943 860">2. If checking the connections does not solve the problem, then disconnect the HP Prime from the StreamSmart 410. Wait until the green light on the HP StreamSmart 410 goes off, then reconnect. You must wait for the green light to go off before you can successfully reconnect the HP Prime and the HP StreamSmart 410.</li></ol>
I was using the HP MCL and was changing sensors or disconnecting and reconnecting the StreamSmart 410 when the DataStreamer app seemed to freeze up. Now the HP Prime does not respond to key presses. What should I do now?	<ol style="list-style-type: none"><li data-bbox="526 897 943 1004">1. First, insert the tip of a paper clip into the Reset hole on the back cover of the HP Prime.</li><li data-bbox="526 1027 943 1134">2. If the simple reset does not work, then remove the batteries from the calculator and put them back in.</li><li data-bbox="526 1158 943 1265">3. In either case, when you turn on the calculator, you may have to re-launch the DataStreamer app.</li></ol>

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Table 4-1 FAQs

Question	Solutions
I am using the DataStreamer app and it seems to be running very slowly. What is wrong?	<ol style="list-style-type: none"> <li data-bbox="456 186 955 475">1. The DataStreamer app uses a lot of memory as it captures data in real time. As a result, it may slow down as the HP Prime memory fills up. To free up more memory for the app, delete large and unwanted items such as old notes, app data, and programs.</li> <li data-bbox="456 475 955 640">2. If you do not want to lose these large items, use the HP Connectivity Kit to transfer them to your PC first, then delete them on the HP Prime.</li> </ol>
After I export my data to the Statistics 2Var app, I notice in the Numeric view that my last data point sometimes has a sensor reading that does not seem correct. What should I do?	<ol style="list-style-type: none"> <li data-bbox="456 649 955 930">1. Occasionally, the very last data point gets misread in a streaming experiment. If you suspect this is the case, then delete the last data point. This occurs only in certain streaming experiments and does not affect selected events and events with entry experiments.</li> </ol>
I started the DataStreamer app with a sensor connected, but the DataStreamer app identifies it as some other sensor. What should I do?	<ol style="list-style-type: none"> <li data-bbox="456 938 955 1134">1. Occasionally the DataStreamer app may identify a sensor incorrectly. In this case, tap <b>Stop</b> and then <b>Start</b> to force the app to try to identify the sensor again.</li> </ol>

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# 5 Regulatory Information

## Battery notices

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**WARNING!** To reduce the risk of fire or burns, do not disassemble, crush, or puncture; do not short external contacts; do not dispose of in fire or water.

**WARNING!** Do not try and replace the battery pack. The battery pack is not removable. If you have problems charging the unit, contact the manufacturer using the contact information listed below. If handled improperly, batteries can burst or explode, releasing hazardous chemicals.

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## Federal Communications Commission Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at personal expense.

## Cables

Connections to this device must be made with shielded cables with metallic RFI/EMI connector hoods in order to maintain compliance with FCC Rules and Regulations.

## Modifications

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Hewlett-Packard Company may void the user's authority to operate the equipment.

## FCC operation notice

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## Canadian Notice

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

## Avis Canadien

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

## European Union Regulatory Notice

Products bearing the CE marking comply with the following EU Directives:

- Low Voltage Directive 2006/95/EC
- EMC Directive 2004/108/EC
- Ecodesign Directive 2009/125/EC, where applicable
- RoHS Directive 2011/65/EU

CE compliance of this product is valid if powered with the correct CE-marked AC adapter provided by HP.

Compliance with these directives implies conformity to applicable harmonized European standards (European Norms) that are listed in the EU Declaration of Conformity issued by HP for this product or product family and available (in English only) either within the product documentation or at the following web site: [www.hp.eu/certificates](http://www.hp.eu/certificates) (type the product number in the search field).

Compliance is indicated by the CE-marking as shown below. Where applicable for telecommunications products a 4-digit notified body number may follow it as a suffix.



Please refer to the regulatory label provided on the product. The point of contact for regulatory matters is: Hewlett-Packard GmbH, Dept./MS: HQ-TRE, Herrenberger Strasse 140, 71034 Boeblingen, GERMANY.

### Japanese Notice

この装置は、クラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者は適切な対策を講ずるよう要求されることがあります。

**VCCI-A**

### Korean Notice

A급 기기 (업무용 방송통신기기)	이 기기는 업무용(A급)으로 전자파적합등록을 한 기기이오니 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정 외의 지역에서 사용하는 것을 목적으로 합니다.
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## Disposal of Waste Equipment by Users in Private Household in the European Union



This symbol on the product or on its packaging indicates that this product must not be disposed of with your other household waste. Instead, it is your responsibility to dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service or the shop where you purchased the product.

## Chemical Substances

HP is committed to providing our customers with information about the chemical substances in our products as needed to comply with legal requirements such as REACH (Regulation EC No 1907/2006 of the European Parliament and the Council). A chemical information report for this report can be found at; <http://www.hp.com/go/reach>

### Perchlorate Material - special handling may apply

This calculator's battery may contain perchlorate and may require special handling when recycled or disposed in California.

产品中有毒有害物质或元素的名称及含量  
根据中国《电子信息产品污染控制管理办法》

部件名称	有毒有害物或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
PCA	X	O	O	O	O	O
外观漆 / 字键	O	O	O	O	O	O

O : 表示该有毒有害物在该部件所有均质材料中的含量均在SJ/T 11363-2006标准规定的限量要求以下。

X : 表示该有毒有害物至少在该部件的某一均质材料中的含量超出SJ/T11363-2006标准规定的限量要求。

表中标有“X”的所有部件都符合欧盟RoHS法规

“欧洲议会和欧盟理事会2003年1月27日关于电子电器设备中限制使用某些有害物质的2002/95/EC号指令”

注：环保使用期限的参考标识取决于产品正常工作的温度和湿度等条件

