1. Charge

Charge the unit. **IMPORTANT!** Before beginning, plug the StreamSmart 410 into your computer with the mini USB to USB cable that came in the package with your HP graphing calculator. 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 following experiment uses the Fourier® light intensity sensor, but you can use any sensor and still follow along with this guide. 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 cable to the HP graphing calculator. Turn on both the calculator and the StreamSmart 410. Aim the sensor at a florescent light source. Make sure the switch on the sensor is set to C: 0 – 600 lux.
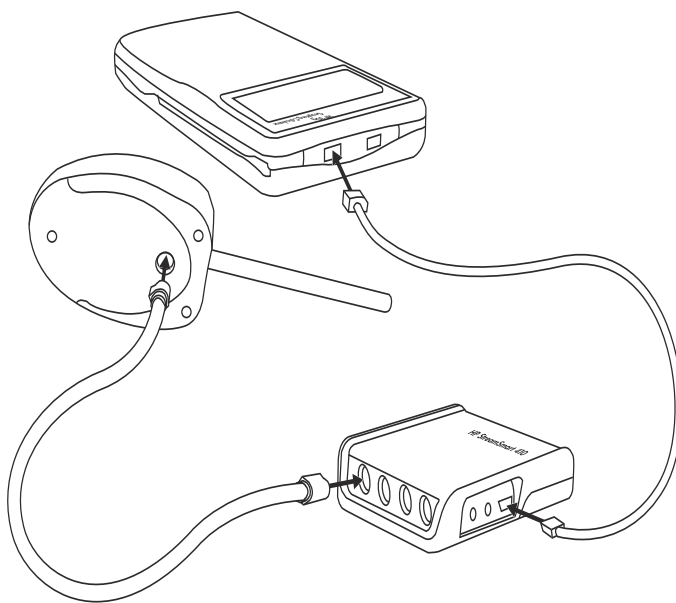
Figure 1-1

1

3. Start the Application

The StreamSmart Aplet is located in the Aplet Library in the HP 39/40gs, and in the APPS menu in the 50g. See Figure 1-2 below for instructions on accessing the application.
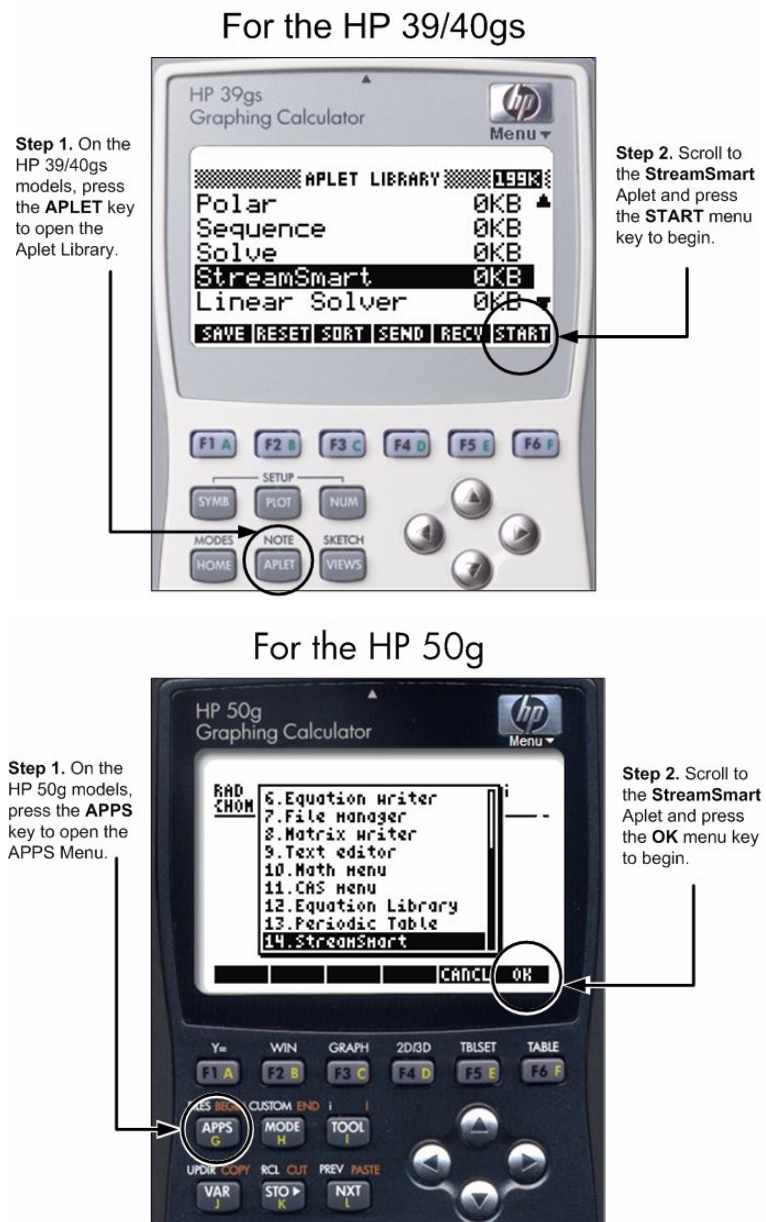
For the HP 39/40gs

Step 1. On the HP 39/40gs models, press the **APLET** key to open the Aplet Library.

Step 2. Scroll to the **StreamSmart** Aplet and press the **START** menu key to begin.

For the HP 50g

Step 1. On the HP 50g models, press the **APPS** key to open the APPS Menu.

Step 2. Scroll to the **StreamSmart** Aplet and press the **OK** menu key to begin.

Figure 1-2

4. Stream

1. Once the StreamSmart Aplet starts, you will see the message, "**Waiting for connection...**," then data should automatically start streaming. Your data stream may differ from that shown below. Move the sensor around and notice how the readings vary.

2. Press the **STOP** menu key. You have now collected your first data set. 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 appropriate units (in this case, lux). The plot window displays a number of items, as illustrated in Figure 1-3 below. Note that no setup is necessary; most settings are done automatically.

For the HP 39/40gs

Sensor ID: Channel 1 has a light sensor measuring lux.

Graph: a horizontal time graph indicates the light intensity appears constant.

Win: the display window represents 5.0 seconds of data.

Ch1: Light (lx)   Win:5.0s

X:,Y: at time x=3.898s, the sensor measured light intensity at y=411 lux.

x:3.898s   y:411 lx

|PAN ■| |SCOPE|STOP|

PAN/ZOOM: toggles between PAN and ZOOM to dynamically adjust the data stream.

SCOPE: enters oscilloscope mode.

STOP: ends data streaming.

For the HP 50g

Ch1: Light (lx)   Win:5.0s

x:3.573s   y:438.5 lx

SETUP| |PAN ■| |METER|STOP

SETUP: opens a menu of options.

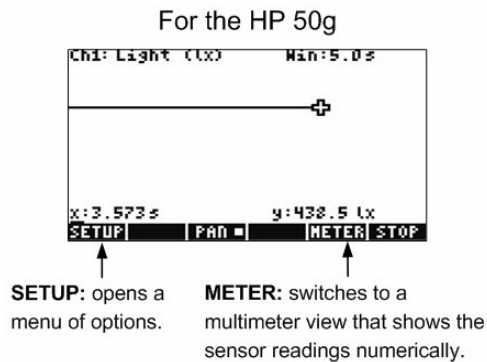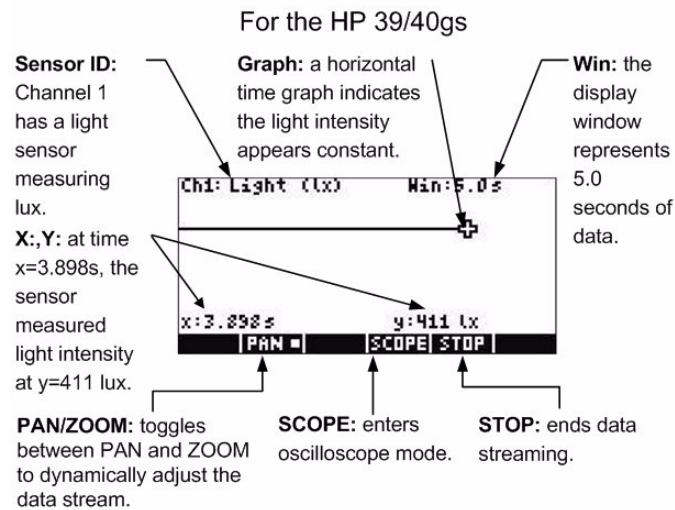**METER:** switches to a multimeter view that shows the sensor readings numerically.

Figure 1-3

Basically, the streaming application works similarly for the 39/40gs models and the 50g calculators, with only minor differences in how you access the functions. For example, in Figure 1-3, to access the

second and third pages of the menu on the 50g, press the NXT key. On the 39/40gs, use the left-and right-arrow menu keys. Thus, if you wish to view the **SCOPE** option on the 50g menu, simply press the NXT key to view the next page of the menu. Also, note the **METER** menu key shown on the HP 50g performs the same function as the PLOT and NUMERIC keys on the HP 39/40gs.

3. Press the **PAN** key to activate panning; note the small square indicates activation. Use the up-and down-cursor keys to translate the stream and center it in the display, as shown in Figure 1-4.
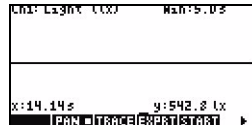
Figure 1-4

4. We will now zoom in horizontally on our data. Press the **PAN** menu key to toggle to **ZOOM**. Then press the right-cursor key to start zooming in. Keep the key depressed and zooming will continue smoothly.

Figure 1-5

5. In Figure 1-6, we have zoomed in approximately 100 times; the window now represents approximately 0.05 seconds of data. Use the up-cursor key to zoom in vertically on the graph until it fills most of the display. You may have to pan again to get the graph just as you want it.

Figure 1-6

6. You can now see the light intensity fluctuates in such a way as to produce almost 6 cycles in 1/20th of a second. This is consistent with 120 cycles per second, which would be expected from AC electricity in the United States at 60 cycles per second.

7. Now here is your first surprise! Press the **START** menu key and you should see these same waves in real time. The HP MCL collects data in real time at rates over 5,000 samples per second. In fact, you can zoom and pan as you did in steps 3-5 while data streaming is occurring. Try it now to get familiar with the pan and zoom controls.

8. When your data stream appears similar to Figure 1-6, press the **STOP** menu key.

Figure 1-7 describes the menu items in more detail. The figure shown is for the HP 39/40gs. For the HP 50g, use the NXT key to access the second page of the menu to view these functions.
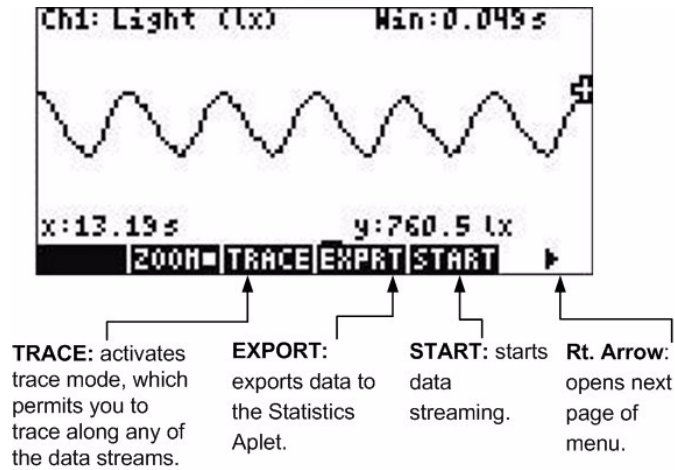
Figure 1-7

9. We will now select a data set and download it for statistical analysis. On the HP 39/40gs, press the **EXPRT** (export) menu key. On the 50g, press the NXT key to open the second page of the menu and press the **EXPRT** menu key. We will use the cropping tools to select just the data we want. Press the left-crop menu key to activate it, as shown in Figure 1-8 below. Use the left- and right-cursor keys to crop data from the left. Similarly, use the right-crop tool to crop data from the right.
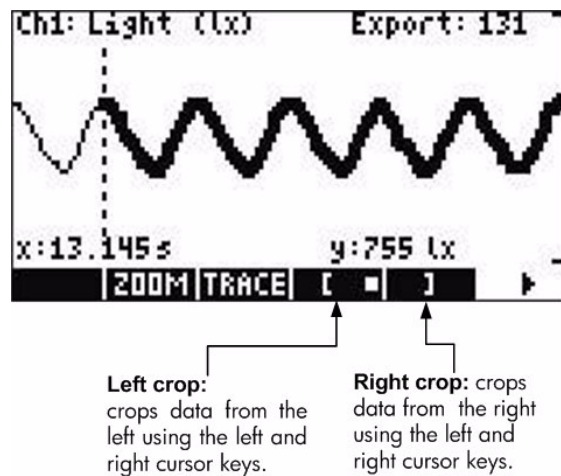

Figure 1-8

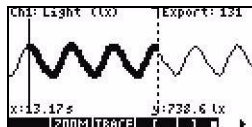In Figure 1-9, the cropping tools have been used to select three cycles of the data.

Figure 1-9

10. Once the final data set has been selected, it is ready to be exported for statistical analysis. For the HP 39/40gs, press the right-arrow menu key, followed by the **OK** menu key to see Figure 1-10. If you are using the HP 50g, press the NXT key and then the **OK** menu key to see Figure 1-11. In either case, the Export menu allows you to select the columns used for storing your data. Usually, the default settings shown are the best.
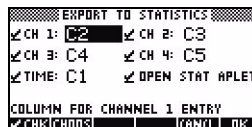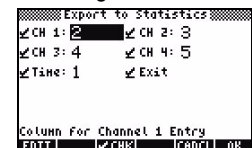

Figure 1-10

Figure 1-11

11. Press the **OK** menu key to accept these default settings.

12. You will see a message informing you that your data has been exported and all other data has been deleted. Press any key to continue. On the HP 39/40gs, you will find yourself in the Statistics Aplet, as shown in Figure 1-12.
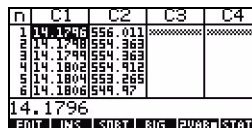

Figure 1-12

On the HP 50g, the message tells you that your data has been saved in the reserved variable, Σ **DAT**. In RPN mode, press the VAR key, followed by the Σ **DAT** menu key, then the down-cursor key to view the data (Figure 1-13). The columns have been widened here to show the data.
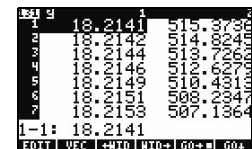

Figure 1-13

In Algebraic mode, press the VAR key, followed by the Σ **DAT** menu key, then the ENTER key. Press the down-cursor key to view the data.

For more information on using the StreamSmart 410 to perform experiments, refer to the user's guide on the product CD included in your StreamSmart 410 package.

For more information about analyzing your data, refer to the user's guide of your HP calculator.

User manuals, user guides, and other information about HP calculators can be found at **www.hp.com/calculators**.