SPARK SLS
User's Guide

Version 1.4.0

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Limited Warranty

For a description of the product warranty, see the PASCO catalog.

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All required licenses for software components of SPARKvue, SPARKvue HD, and the SPARK Science Learning System can be found on the CD-ROM or DVD-ROM included with the product or are included in the software download. To obtain source code for GPL/LGPL licensed software components, contact PASCO at by phone at 1-800-772-8700 (in the U.S), +1 916 786 3800 (worldwide), or by email at support@pasco.com

Contents

1   Introduction

About the SPARK Science Learning System

The SPARK Science Learning System is an all-in-one mobile device that seamlessly integrates the power of probeware with inquiry-based content and assessment. With its large, full-color display, finger-touch navigation and data collection and analysis capabilities, SPARK redefines the concept of easy-to-use — so the focus remains on the learning of science.

The SPARK Science Learning System (SPARK SLS) is designed to become the center of your school's discovery-based science learning environment, providing both teacher and student the embedded support for exploring scientific concepts.

The SPARK Science Learning System includes 61 free pre-installed SPARKlabs™ — standards-based guided inquiry labs in a unique electronic notebook format. These SPARKlabs integrate background content, data collection and analysis, even assessment — all within the same environment. Everything you need is right there in context.

Getting started

There are three basic ways to start an investigation in SPARK SLS. They are:

- *Open* an embedded SPARKlab and follow the on-screen instructions;
- *Show* a SPARKlab with one measurement in a graph, table, digits display, and meter; and
- *Build* a custom SPARKlab with your choice of data, displays, text, and pictures.

To start learning SPARK SLS, install the software, connect an interface to your computer, plug in a sensor, and start the software from the desktop icon. If you need help doing a task, you'll find step-by-step instructions in this guide.

Technical and Teacher Support

For help with SPARK SLS and other PASCO products, you can contact PASCO's Technical and Teacher Support staff by phone, email, or on the Web.

Phone:	1-800-772-8700 (in the U.S.)
	+1 916 786 3800 (worldwide)
Email:	support@pasco.com
Web:	www.pasco.com/support

2 Starting an experiment

Turning on the SPARK SLS

1. If the battery is not charged, connect the included AC adapter to a wall outlet and to the AC adapter port on the bottom of the SPARK.
2. Press and hold the power button.

The SPARK turns on, boots up, and displays the Home screen.

1. AC adapter port. 2. Power button.
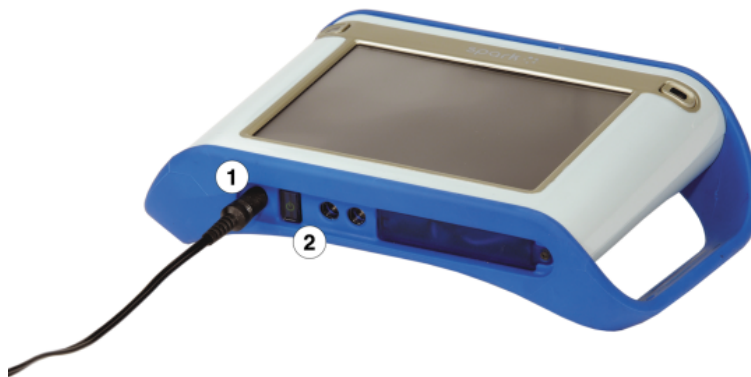
Connecting sensors to the SPARK SLS

1. PASPORT ports. 2. Temperature port. 3. Voltage port.
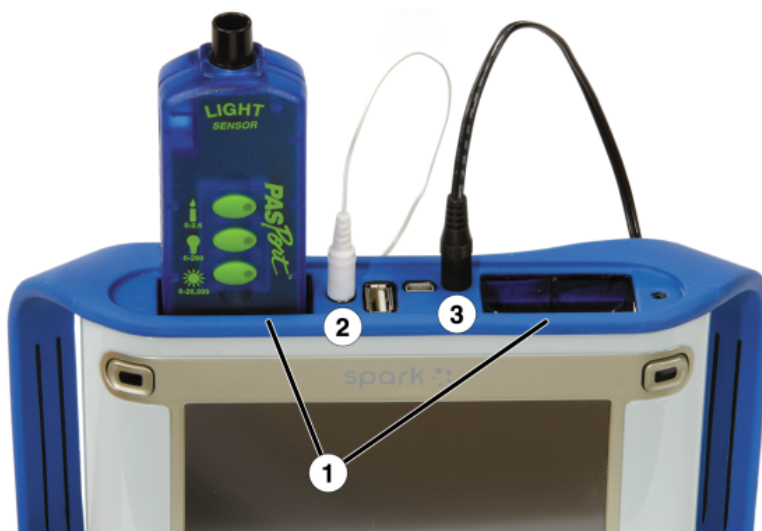
You can use up to two PASPORT sensors plus a temperature probe and a voltage probe.

Complete one or more of the following tasks to connect sensors to the SPARK.

- Connecting PASPORT sensors
- Connecting a temperature probe
- Connecting a voltage probe

Connecting PASPORT sensors

1. Plug a PASPORT sensor into one of the PASPORT ports on the top of the SPARK SLS.
2. Optionally, plug a second PASPORT sensor into the other PASPORT port.

Connecting a temperature probe

Plug the included fast-response temperature probe (or other type of temperature probe) into the temperature port on the top of the SPARK SLS.

Connecting a voltage probe

Plug the included voltage probe into the voltage port on the top of the SPARK SLS.

Monitoring live data

Live data from all connected sensors are displayed whenever the Home screen is open.

The Home screen is the first screen that appears when SPARK SLS starts.

If the Home screen is not visible, touch the Home button to return to the Home screen.

Moving on from the Home screen

With the Home screen displayed, you are ready to move into a SPARKlab. A SPARKlab is a multi-page environment where your science investigation takes place.

Complete one of the following tasks to open an embedded SPARKlab, show a measurement in a SPARKlab, or build a custom SPARKlab.

Opening a SPARKlab

The SPARK Science Learning System includes over 60 embedded SPARKlabs. Complete these steps to open a SPARKlab:

1. Connect the sensors required for the SPARKlab that you wish to do.
2. If there are unneeded sensors connected, disconnect them.
3. In the Home screen, touch Open.
     A list of folders appears.
4. Touch the folder corresponding your subject area.
5. If necessary, touch a subfolder.
6. Touch the SPARKlab that you would like to open.
7. Touch OK.

The SPARKlab opens.
Follow the on-screen instructions to continue your science investigation. Touch the Page Navigator to turn pages.

Showing a SPARKlab

A show-path SPARKlab is the fastest way to record data and display it in a graph, table, digits display, and meter. Complete these steps to show a SPARKlab:

1. Connect a sensor.
2. In the Home screen, touch the measurement that you would like to show.
     The selected measurement is highlighted.
3. Touch Show.
    Note: A measurement must be selected for Show to be available.

A four-page SPARKlab opens.

Touch the Start button to record data.

Touch the Page Navigator to see your data in the different displays.

Building a SPARKlab

When you build a custom SPARKlab, you design each page with your choice of measurements and displays. You can also add text and pictures. Complete these steps to start building a SPARKlab:

1. Connect a sensor (or sensors).
2. In the Home screen, touch Build.
    The Page-build screen opens.
    Page-build screen: 1. Measurements. 2. Data display, image box, text box, and spacer buttons. 3. Preview.
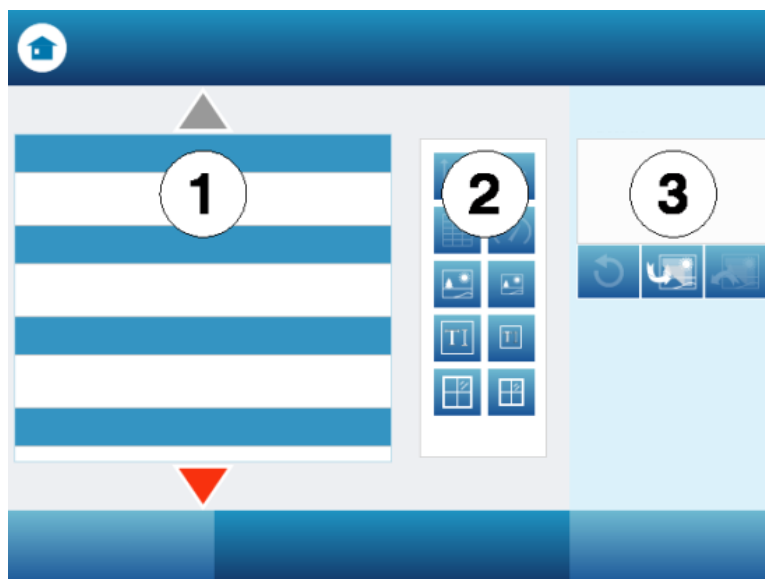
3. Touch the measurement (or measurements) that you would like to show in the first data display.

Selected measurements are highlighted. Touch a measurement again to clear a selection.
4. Touch one of the data display buttons for a graph, table, digits display, or meter.
Data display buttons: graph, digits display, table, and meter.

If you touch just one measurement, all data displays are available. If you touch two measurements, only the graph and table are available. If you touch three or more measurements, only the table is available.
The measurements and display that you have touched appear in the preview section of the page-build screen.
5. Optionally, do any of the following:
   - Repeat the steps above to select more measurements and add another data display.
   - Touch one of the image box buttons to add a large or small image box. (After the page has been added to the SPARKlab, you can touch the image box to select an image to display in the box.)

   - Touch one of the text box buttons to add a large or small text box. (After the page has been added to the SPARKlab, you can touch the text box to enter text.)

   - Touch the Undo button to remove an element from the preview.

6. When you are satisfied with the preview and ready to build your page, touch OK.

Your new SPARKlab opens showing the page that you have just built.

Touch the Start button to record data.

Touch the New Page button to build another page and add it to your SPARKlab.

3   Setting up an experiment

- Customizing data collection
- Customizing how numbers are displayed
- Calibrating sensors
- Using sensor adapters

Customizing data collection

You can start recording data using the default settings, or complete one or more of the following tasks to change the sampling rate or sampling mode.

- Setting the sample rate
- Putting SPARK SLS into periodic sampling mode
- Putting SPARK SLS into manual sampling mode
- Setting an automatic stop condition

Setting the sample rate

With SPARK SLSin periodic sampling mode (the default mode), complete these steps to set how many data points are recorded each second or how much time elapses between data points:

1. Touch the Sampling Options button.

   The Sampling Options screen opens.
2. Touch the Sample Rate Unit: box and touch Hz, seconds, minutes, or hours.
3. Touch the Sample Rate: box and touch a value.
4. Touch OK.

Putting SPARK into periodic sampling mode

In periodic sampling mode (the default mode, sometimes known as "continuous" mode), SPARK records data points at regular intervals. If SPARK is in manual sampling mode, complete these steps to put it into periodic sampling mode:

1. Touch the Sampling Options button.

The Sampling Options screen opens.
2. Touch Periodic.
3. Touch OK.

Putting SPARK into manual sampling mode

In manual sampling mode, a single value from each measurement is recorded each time you manually trigger SPARK. Complete these steps to put SPARK into manual sampling mode:

1. Touch the Sampling Options button.

The Sampling Options screen opens.
2. Touch Manual.
3. Touch OK.

Setting an automatic stop condition

When a stop condition is set, SPARK SLS automatically stops recording data after a set time interval. Complete these steps to set a stop condition:

1. Touch the Sampling Options button.

The Sampling Options screen opens.
2. Under Automatic Stop Condition, touch the Condition: box and touch Stop after duration.
3. Touch the Value: box and enter a time value.
4. Touch the Units: box and touch units of time.
5. Touch OK.

Customizing how numbers are displayed

- Setting the number of decimal places displayed
- Setting the number of significant figures displayed
- Displaying numbers in scientific notation
- Changing the units of a measurement

Setting the number of decimal places displayed

1. Touch the Experiment Tools button.

   The Experiment Tools screen opens.
2. Touch DATA PROPERTIES.
   The Data Properties screen opens.
3. Touch the Measurement: box and touch a measurement or other variable.
4. Touch Number Format.
   The number format options appear.
5. Touch the Number Style: box and touch Fixed Precision.
6. Use the Digits: arrows to select the number of digits to be displayed after the decimal point.
7. Touch OK.

Setting the number of significant figures displayed

1. Touch the Experiment Tools button.

   The Experiment Tools screen opens.
2. Touch DATA PROPERTIES.
   The Data Properties screen opens.
3. Touch the Measurement: box and touch a measurement or other variable.
4. Touch Number Format.
   The number format options appear.
5. Touch the Number Style: box and touch Significant Figures.
6. Use the Digits: arrows to select the number of significant figures to be displayed.
7. Touch OK.

Displaying numbers in scientific notation

1. Touch the Experiment Tools button.

    The Experiment Tools screen opens.
2. Touch DATA PROPERTIES.
    The Data Properties screen opens.
3. Touch the Measurement: box and touch a measurement or other variable.
4. Touch Number Format.
    The number format options appear.
5. Touch the Number Style: box and touch Scientific Notation.
6. Use the Digits: arrows to select the number of digits to be displayed.
7. Touch OK.

Changing the units of a measurement

Do one or both of the following tasks to select different units for a measurement.

- Changing the units of a measurement in an existing display
- Changing the default units of a measurement

Changing the units of a measurement in an existing display

Complete these steps to change the units of a measurement displayed in an existing graph, digits display, table, or meter:

1. Touch the Tools button of a graph, digits display, table, or meter to open the tools palette.

2. Touch the Properties button to open the Properties screen.

3. Touch the Units: box and select a unit of measure.
4. Touch OK.

The display shows the measurement with the selected units.

Changing the default units of a measurement

Complete these steps to change the units that will be used by default when you select a measurement in the future:

1. Touch the Experiment Tools button to open the Experiment Tools screen.

2. Touch DATA PROPERTIES to open the Data Properties screen.
3. Touch the Measurement: box and select a measurement.
4. Touch the Units: box and select units of measure.
5. Touch Set As Default to select it.
    When Set As Default is selected, it is highlighted.
6. Touch OK.

The next time you select that measurement for display, it will appear with the units that you selected.

Calibrating sensors

Sensor calibration is an optional step that can help to make measurements more accurate.

Complete the following tasks to select a measurement and calibration type and perform a calibration.

1. Selecting a measurement to calibrate and a calibration type
2. Performing a calibration

Selecting a measurement to calibrate and a calibration type

1. Touch the Experiment Tools button.

    The Experiment Tools screen opens.
2. Touch CALIBRATE SENSOR.
    The Calibrate Sensor: Select Measurement screen opens.

3. Touch the Sensor: box and touch the sensor to be calibrated.
4. Touch the Measurement: box and touch the measurement to be calibrated.
5. Touch the Calibration Type: box and touch a calibration type.
    See the instructions provided with your sensor for information about what type of

calibration is appropriate for your sensor.

6. Touch NEXT.

The Calibrate Sensor: Enter Values screen opens.

Now that you have selected a measurement, you can perform a calibration as described in the next task.

Performing a calibration

After you have selected a measurement to be calibrated and a calibration type (see previous task), you are ready to perform a calibration.

Depending on the calibration type that you have selected, perform a 2-point calibration, a 1-point offset-only calibration, or a 1-point slope-only calibration.

- Performing a 2-point calibration
- Performing a 1-point offset-only calibration
- Performing a 1-point slope-only calibration

Performing a 2-point calibration

In the Calibrate Sensor: Enter Values screen, complete these steps:

1. Apply a known quantity to the sensor.
    For example, place a pH probe in a pH 4 buffer solution.
2. Under Calibration Point 1 touch the Standard Value: box and enter the known value.
    For example, enter the known pH of the buffer solution.
3. Under Calibration Point 1 touch Read From Sensor.
    The value measured by the sensor is transferred to the Sensor Value: box.
4. Apply a different known quantity to the sensor. For example, place the pH probe in a pH 7 buffer solution.
5. Under Calibration Point 2 touch the Standard Value: box and enter the known value.
    For example, enter the known pH of the buffer solution.
6. Under Calibration Point 2 touch Read From Sensor.
    The value measured by the sensor is transferred to the Sensor Value: box.
7. Touch OK.

Calibration is complete.

Performing a 1-point offset-only calibration

In the Calibrate Sensor: Enter Values screen, complete these steps:

1. Apply a known quantity to the sensor.
    For example, place a temperature probe in ice water known to be 0 °C.
2. Under Calibration Point 1 touch the Standard Value: box and enter the known value.
    For example, enter the known temperature of the water.
3. Under Calibration Point 1 touch Read From Sensor.
    The value measured by the sensor is transferred to the Sensor Value: box.
4. Touch OK.

Calibration is complete.

Performing a 1-point slope-only calibration

In the Calibrate Sensor: Enter Values screen, complete these steps:

1. Apply a known quantity to the sensor.
    For example, place a dissolved oxygen probe in a bottle known to contain 9.1 mg/L of dissolved oxygen.
2. Under Calibration Point 2 touch the Standard Value: box and enter the known value.
    For example, enter the known dissolved oxygen concentration.
3. Under Calibration Point 2 touch Read From Sensor.
    The value measured by the sensor is transferred to the Sensor Value: box.
4. Touch OK.

Calibration is complete.

Using sensor adapters

- [Connecting a sensor through a Digital Adapter or Photogate Port](#)
- [Connecting a sensor through an Analog Adapter](#)

Connecting a sensor through a Digital Adapter or Photogate Port

The Digital Adapter (PASCO part PS-2159) allows digital switch-type sensors such as photogates and smart pulleys to be connected to a PASPORT interface and used with SPARK SLS. It also allows the use of a *ScienceWorkshop* Motion Sensor (CI-6742A) or Rotary Motion Sensor (CI-6538).

The Photogate Port (PS-2123) is a type of adapter that supports switch-type sensors, but not the Rotary Motion Sensor or Motion Sensor.

Complete these steps to connect and configure a sensor with a Digital Adapter or Photogate Port:

1. Connect the adapter to your PASPORT interface.
2. Connect a digital sensor to the adapter.

    You can connect a switch-type sensor to either port of the adapter.

    If you are connecting a Motion Sensor or Rotary Motion Sensor, connect the yellow plug to Port 1 and the black plug to Port 2.
    A list of digital sensors and sensor configurations appears.
3. Optionally, connect a second switch-type sensor to the other port of the adapter.
4. In the list, touch one of the sensors or configurations to select it and touch OK.
    You may need to touch the arrows to scroll the list.
5. If SPARK SLS prompts you to enter one or more measurements specific to your equipment, enter the value or values and touch OK.
    The measurements that you enter will be used to compute data such as the velocity of an object passing through a photogate.

Connecting a sensor through an Analog Adapter

The Analog Adapter (PASCO part PS-2158) allows analog *ScienceWorkshop* sensors to be

connected to a PASPORT interface and used with SPARK SLS.

Complete these steps to connect and configure a sensor with an Analog Adapter:

1. Connect the Analog Adapter to your PASPORT interface.
2. Connect an analog sensor to the adapter. A list of sensors appears.
3. Touch one of the sensors to select it and touch OK.
   You may need to touch the arrows to scroll the list.
4. Optionally, touch the Gain: box and touch a gain setting.
5. Touch OK again.

4   Data recording

The following tasks describe how to record a data run with SPARK SLS in periodic sampling mode and manual sampling mode. Over the course of a science investigation, you can record multiple data runs and sets.

- Recording a run of periodically sampled data
- Recording a set of manually sampled data
- Deleting data runs

Recording a run of periodically sampled data

With SPARK in periodic sampling mode (the default mode, sometimes known as "continuous" mode), complete these steps to record a data run:

1. Touch the Start button.

    You can press one of the record buttons instead of touching the on-screen Start button.

    SPARK creates a new data run and starts recording data points into it.

2. To stop recording data, touch the Stop button.

    You can press one of the record buttons instead of touching the on-screen Stopbutton.

    SPARK stops recording data.

Repeat these steps to record another data run.

Recording a set of manually sampled data

To record manually sampled data, first put SPARK into manual sampling mode. See Putting

SPARK into manual sampling mode.

In manual sampling mode, a single value from each measurement is recorded each time you manually trigger SPARK. A series of values is recorded in a data set. Complete these steps to start a data set, trigger points to be recorded, and close the data set:

1. Optionally, turn to a page in your SPARKlab where you will be able to see your data in a table. You can record data with any type of display visible (or no display at all), but it is typical to record manually sampled data while looking at a table.
2. Touch the Start button.

SPARK creates a new data set. Live data appear in the data displays.
3. When you are ready to record a data point, touch the Keep button.

You can press one of the record buttons instead of touching the on-screen Keep button.

SPARK records a single value from each measurement.
4. Repeat the previous step as many times as necessary to record all of the data that you want in the data set.
5. When the entire set has been recorded, touch the Stop button.

The data set closes.

Repeat these steps to record another data set.

Deleting data runs

1. Touch the Experiment Tools button.

The Experiment Tools screen opens.
2. Touch MANAGE RUNS.
The Manage Runs screen opens.
3. Do one of the following:

    -   Touch Delete Last Run.

    -   Touch Delete All Runs.

    -   Touch Delete Run... and touch the run that you want to delete.

4. Touch Done.
5. Touch OK.

5   Data display

Displaying data in a line graph

Creating a new line graph

To create a new graph, do one of the following:

- If the Home screen is visible, create a new SPARKlab:
    1. Touch a measurement.
    2. Touch Show.

  A graph appears on page 1 of the SPARKlab.
- If a SPARKlab is open, add a new page:
    1. Touch the New Page button.

  The Page-build screen opens.
    2. Touch a measurement (or two measurements).
    3. Touch the Graph button.

    4. Touch OK.

  A new page containing a graph is added to the SPARKlab.

Showing and hiding the line graph tool palette

● To show the tool palette, touch the blue Graph Tools button near the lower left corner of the graph.

● To hide the tool palette, touch the orange Graph Tools button.

Adjusting the scale of a line graph

Do one or more of the following tasks (in any order) to change the range and domain of a graph.

- Scaling a graph to fit all data
- Scaling by direct manipulation

Scaling a graph to fit all data

1. Touch the Graph Tools button to open the tool palette.

2. Touch the Scale-to-fit button.

The graph adjusts to fit all data (or all highlighted data).

Scaling by direct manipulation

Complete one or more of these steps in any order:

- Touch one of the numbers labeling the x-scale of the graph and drag it left or right.
  The graph expands or contracts horizontally.
- Touch one of the numbers labeling the y-scale of the graph and drag it up or down.
  The graph expands or contracts vertically.
- Touch the middle of the graph and drag it in any direction.
  The graph moves.

1. Expanding and contracting horizontally. 2. Expanding and contracting vertically. 3. Moving.
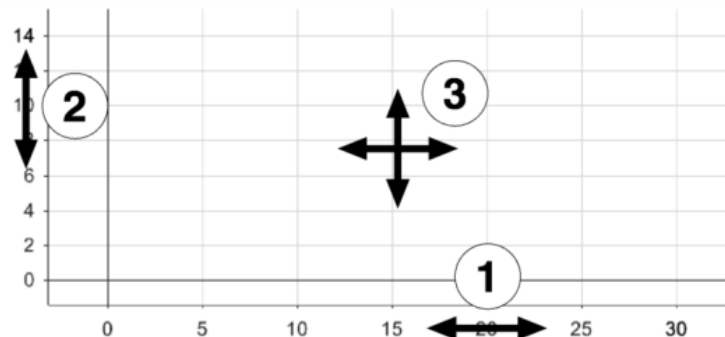
Selecting data to show in an existing line graph

- Showing and hiding data runs in a graph
- Changing the variable on the x- or y-axis

Showing and hiding data runs in a graph

1. Touch the graph legend.
   The legend enlarges to show available data runs.
2. Select or clear (touch) the check box next to each data run that you want to show or hide.
3. Optionally, touch outside the legend to reduce the size of the legend.

Graph legend
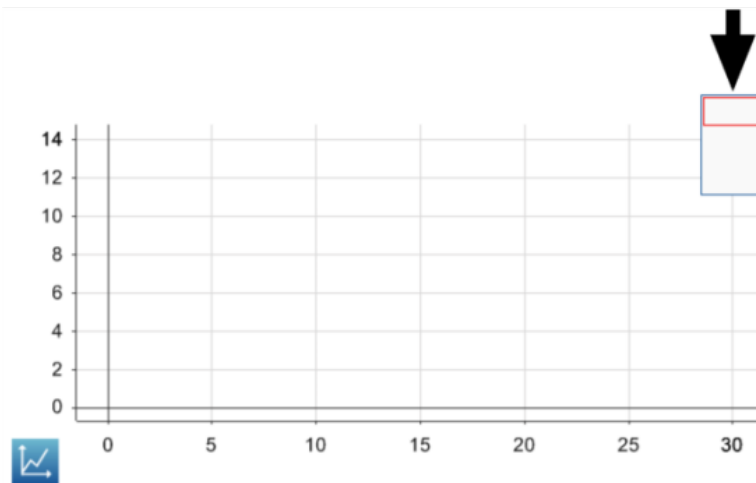
Changing the variable on the x- or y-axis

1. Touch the Graph Tools button to open the tool palette.

2. Touch the Properties button to open the Properties screen.

3. For each axis, touch the Measurement: box and touch a measurement or other variable.

Selecting data for operation in a line graph

- Selecting a data run for operation in a line graph
- Selecting part of a data run for operation in a line graph

Selecting a data run for operation in a line graph

In the graph legend, a red outline surrounds the run that is selected for operation. Complete these steps to change which run is selected:

1. Touch the graph legend.
   The legend enlarges.

2. In the legend, touch the symbol (but not the check box) of the run that you want to select.
    The red outline moves to the selected run.

Graph legend
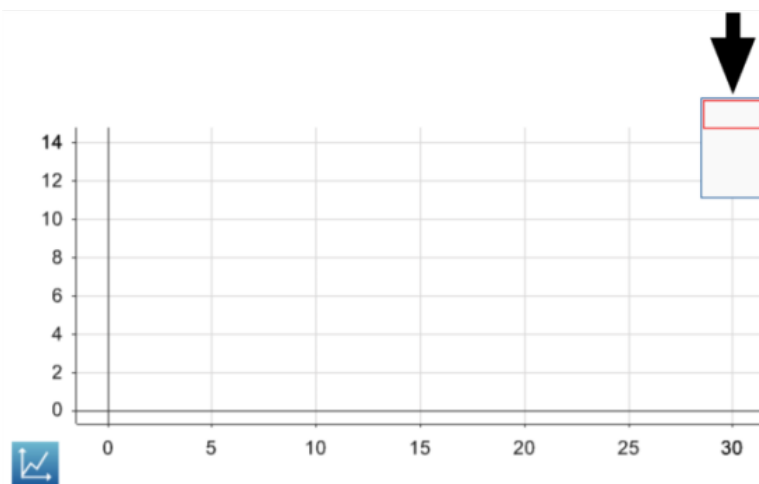
When you turn on statistics, graph tools, or curve fits, they are applied to the selected run.

Selecting part of a data run for operation in a line graph

If part of a data run is selected for operation, the selected data points are highlighted. Scale-to-fit, statistics, graph tools, and curve fits are applied only to the selected data points. Complete these steps to select part of a data run:

1. If there is more than one data run on the graph, first select the run from which you will select data points:
    a. Touch the graph legend.
        The legend enlarges.
    b. In the legend, touch the symbol of the run that you want to select.
        The red outline moves to the selected run.
2. Touch the Graph Tools button to open the tool palette.

3. Touch the Select button.

    The button turns orange.
4. Touch somewhere on the graph; then, within one second, touch somewhere else on the graph.
    The two locations that you touch define the corners of a selection box. A selection box appears. Data points inside the box are highlighted.

5. Optionally, adjust the size and position of the selection box by dragging the handles at the corners of the box.

6. When the desired data points are highlighted, touch OK.
     The selection box disappears, but the points remain selected.

To clear the selection, touch the Select button again.

Annotating data in a line graph

*   Adding an annotation
*   Editing or deleting an annotation

Adding an annotation

1. If there is more than one data run on the line graph, first select the run that the annotation will be attached to:
    a. Touch the graph legend.
        The legend enlarges.

  b. In the legend, touch the symbol of the run that you want to select.
    The red outline moves to the selected run.
2. Touch the Graph Tools button to open the tool palette.

3. Touch the Select button.

  The button turns orange.
4. Touch a point on the graph.
5. Touch OK.
6. Touch the Annotation button.

  The on-screen keyboard appears.
7. Enter a note and touch OK.
  An annotation appears on the graph.
8. Touch the Select button.
  The button turns blue.

Editing or deleting an annotation

1. If necessary, touch the Graph Tools button to open the tool palette.

2. Touch the annotation that you want to edit or delete.
  The annotation is highlighted.

3. Touch the Annotation button.

The on-screen keyboard appears.
4. Edit or delete the annotation and touch OK.

Displaying data in a Multiple y-axis graph

Creating multiple y-axes

Working with multiple y-axes

Lock origin of multiple y-axes

Creating a multiple y-axes line graph

To create a new line graph with multiple y-axes, do one of the following:

- If the Home screen is visible, create a new SPARKlab:

1. Touch **Build**.

2. In the Create your first page screen, choose at least three measurements. The last measurement selected will be the x-axis

3. Touch the **Multiple Y-Axis** button.

4. Touch **OK**.

A graph with multiple y-axes displays.
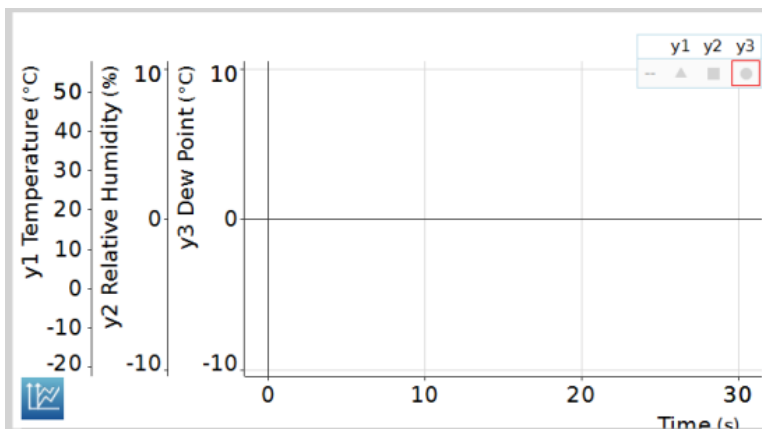
- If a SPARKlab is open, add a new page:

5. Touch the **New Page** button.

The Build your new page screen opens.

6. Touch at least three measurements. The last measurement selected will be the x-axis.

7. Touch the **Multiple Y-Axis** button.

8. Touch **OK**.

A new page containing a multiple y-axes graph is added.

Working with multiple y-axes

Most of the actions you can perform on a single y-axis graph can be performed on multiple y-axes graphs. You can:

Adjusting the scale of a line graph

Selecting data to show in an existing line graph

Selecting data for operation in a line graph

Annotating data in a graph

Lock origin of multiple y-axes

In addition to the typical line graph actions the multiple-y axes can be locked at the same zero point.

1. Touch the **Multiple Y**-**Axis** button.

2. Touch on the **Lock Origin** button

The button turns orange.

The origins of all of the measurements are all locked together.

Displaying data in a bar graph

Creating a new bar graph

Showing and hiding the bar graph tool palette

Showing data in bar graphs

Annotating data in bar graphs

Viewing bar graphs

Customizing axes labels and units in bar graphs

Creating a new bar graph

To create a new bar graph, do one of the following:

- From the Home screen create a new SPARKlab:

1. Touch **Build**.

2. Touch a measurement (optional).

3. Touch the Bar Graph button.

4. Touch **OK**.

A bar graph appears on page 1 of the SPARKlab.

- Within a SPARKlab add a new page:

5. Touch the **New Page** button.

The Page-build screen opens.

6. Touch a measurement (optional).

7. Touch the **Bar Graph** button.

8. Touch **OK**.

A new page containing a bar graph is added to the SPARKlab.

Showing and hiding the bar graph tool palette

- To show the tool palette, touch the blue **Bar Graph Tools** button near the lower left corner of the graph.

Showing data in bar graphs

When you create a new bar graph, the first bar is already created for you. You will need to name the bar and add additional bars in your bar graph and record data for each bar.

Adding bars and bar names

Editing bars and bar names

Adding data

Adding additional data runs

Adding additional data runs using sensor readings

Showing and hiding data runs

Selecting data for operation

Adding bars and bar names in bar graphs

1. Name the bar by touching the gray placeholder bar. This will open the bar edit menu. A gray placeholder bar appears in the bar graph. Note: this tool will already be active when a bar graph is first created.

2. Touch the gray bar.

The bar edit menu opens.

3. Touch the default bar name above the numeric keypad, such as **Bar 1**.

4. Enter a new name, and touch **OK** twice to return to the bar graph.

A new placeholder bar is automatically added.
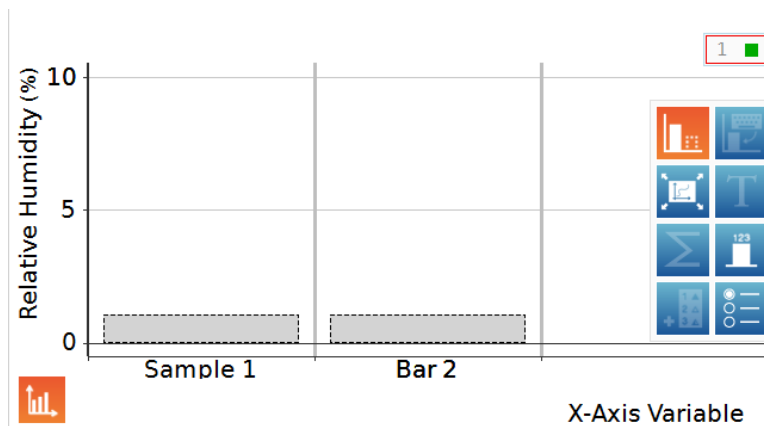
5. To name the new bar, touch it, and repeat steps 2 through 4.

6. Continue adding the bars you need.

7. When you finish adding bars, touch the Bar Add and Edit button to turn off the tool. Turning this tool off removes the last placeholder bar.

Editing bars and bar names in bar graphs

1. If necessary, touch the blue **Bar Graph Tools** button near the lower left corner of the bar graph to open the tool palette.

2. Touch the **Bar Edit** button.

3. Touch the bar you want to edit.

The bar edit menu opens.

4. Touch in the bar name box, delete the old name, and enter a new name.

5. Touch **OK** twice to return to the bar graph.

Adding data in bar graphs

You can add data to bars either manually or through collecting data using a sensor.

Entering data manually

Collecting data using a sensor

Entering data into bar graph manually

1. If necessary, touch the blue **Bar Graph Tools** button near the lower left corner of the bar graph to open the tool palette.

2. Touch the **Bar Edit** button.

3. Touch the bar you want to edit.

The bar edit menu opens.

4. Use the numeric keypad to enter a value for the bar.

5. Touch **OK**.

Collecting data for bar graph using a sensor

1. It is recommended that the bars are given names either before or during data collection. This can be done through the use of the **Bar Add and Edit Tool**. Refer to steps 2-4 from the section on renaming bars above.

2. Touch the record arrow to record data for the first empty bar in a data run.

The first bar becomes active and displays the data being collected, and the record button changes to a checkmark.

3. Touch the checkmark to stop collecting for the current bar and move to the next bar. Note: the bar will remain gray if it does not have a name assigned to it.

4. Touch the Stop button to stop collecting data.

Adding additional data runs to a bar graph

You can show multiple data sets in a bar graph at once.

1. If necessary, touch the blue **Bar Graph Tools** button near the lower left corner of the bar graph to open the tool palette.

2. For manually entered data, touch the **Run Addition** button.

3. Enter or record the data for each bar.

Adding additional data runs to a bar graph using sensor readings

You can show multiple data sets in a bar graph at once.

1. For data collected using a sensor, touch the **record arrow**.

2. Follow steps 3 and 4 under the section on collecting data with a sensor.

Showing and hiding data runs in a bar graph

1. Touch the graph legend.

The legend enlarges to show available data runs.

2. Select or clear (touch) the check box next to each data run that you want to show or hide.

3. Optionally, touch outside the legend to reduce the size of the legend.

Bar Graph legend
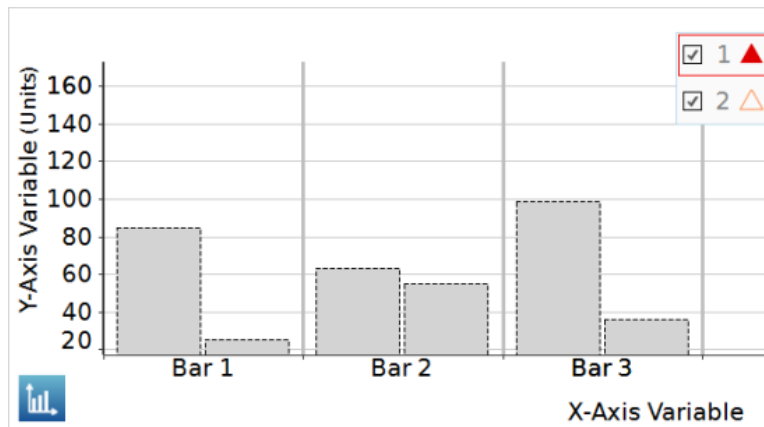
Selecting data for operation in a bar graph

In the graph legend, a red outline surrounds the run that is selected for operation. Complete these steps to change which run is selected:

1. Touch the graph legend.

The legend enlarges.

2. In the legend, touch the symbol (but not the check box) of the run that you want to select.

The red outline moves to the selected run.

Graph legend
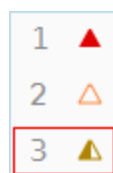
When you apply bar graph statistics, such as mean or standard deviation, they are applied to the selected run.

Annotating data in bar graphs

You can add annotation and show numeric values on bars.

Adding annotations to bars

Editing or deleting annotations to bars

Showing numeric values on bars

Adding annotations to bars

If there is more than one data run on the graph, first select the run that the annotation will be attached to:

1. Touch the graph legend.

The legend enlarges.

2. In the legend, touch the symbol of the run(s) that you want to annotate.

3. Touch the **Bar Graph Tools** button to open the tool palette.

4. Touch the **Annotation** button.

5. Touch a bar.

The Enter Note screen appears.
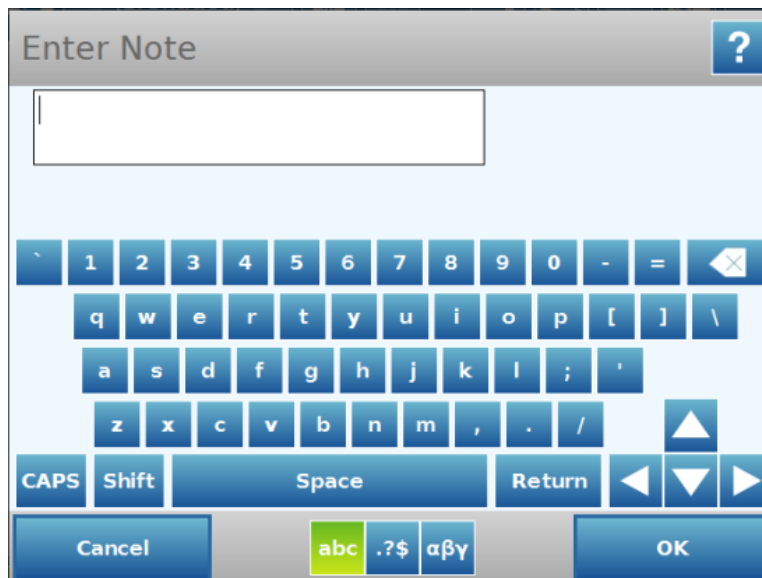
6. Enter a note, and touch **OK**.

An annotation appears on the bar graph.
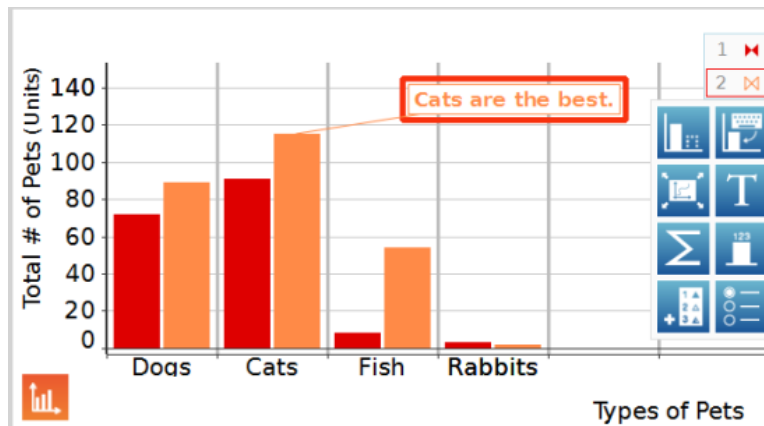
Editing or deleting annotations to bars

1. If necessary, touch the **Graph Tools** button to open the tool palette.

2. Touch the annotation that you want to edit or delete.

The annotation is highlighted.

3. Touch the **Annotation** button.

The Enter Note screen appears.

4. Edit or delete the annotation text, and touch **OK**.

If you delete all the text, the annotation is removed. If you change the text, the new text appears in the annotation box on the bar graph.

Showing numeric values on bars

To show numeric values at the tops of bars in a bar chart for a data run:

1. If there is more than one data run on the graph, first select the run that will display the numeric values:

2. Touch the graph legend.

The legend enlarges.

3. In the legend, touch the symbol of the run that you want to annotate.

A red box appears around the data run that will display numeric values.

4. Touch the **Bar Graph Tools** button to open the tool palette.

5. Touch **the Numeric Values** button.

Numeric values appear at the top of the selected data run. To show numeric values at the tops of bars in another data run, touch the symbol of the run in the graph legend.
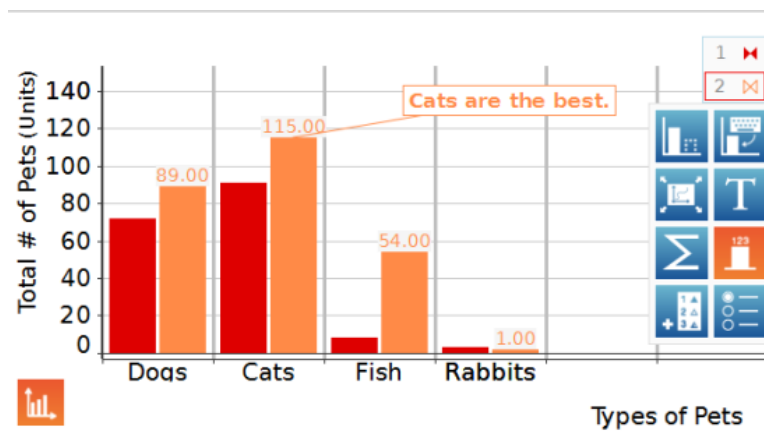
Viewing bar graphs

You can scroll and scale bar graphs to help you view all data in the graph:

Scrolling a bar graph

Scaling a bar graph to show all data

[Scaling a bar graph by expanding or compressing the axes](#)

Scrolling a bar graph

To scroll and change the view of a bar graph, touch the middle of the graph and drag it up, down, side-to-side, or diagonally. Note: touching a bar will not scroll the screen. Instead, it will open the graph edit menu. Turning off the bar edit tools will prevent this from occurring, allowing the screen to be scrolled without this menu opening up.
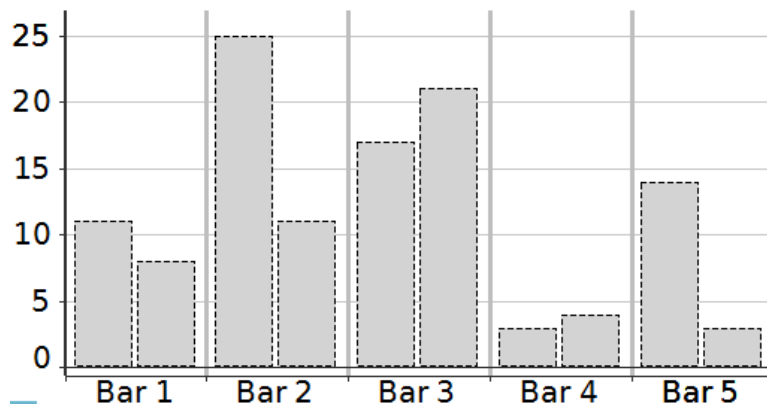
Scaling a bar graph to show all data

1. If necessary, touch the **Bar Graph Tools** button to open the tool palette.

2. Touch the **Scale-to-fit** button.

The graph adjusts to fit all data (or selected data).

Scaling a bar graph by expanding or compressing the axes

You can change the scale of a bar graph by expanding or compressing the X-axis, Y-axis, or both. To do this, complete one or both of the following actions:

- Touch one of the labels on the X-axis and drag horizontally (left or right).

The graph expands or contracts horizontally, making each bar area wider or narrower.

- Touch one of the labels on the Y-axis, and drag vertically (up or down).

The bars in the bar graph display larger or smaller depending on the scale adjustment.

Customizing axes labels and units on bar graphs

To create an axis label:

1. Touch the **Bar Graph Tools** button to open the tool palette.

2. Touch the **Properties** button.

The Bar Graph Properties box opens.

3. Touch the **Measurement** box for either the X-axis variable or Y-axis variable.

4. Touch **Create Data Set**.

The Define Data Set box displays.

5. Touch the **Measurement Name** box.

6. Type the label text, and touch **OK**.

7. Touch the **Unit Name** box (if desired).

Type the type of unit, and touch **OK**.

8. Touch **OK** two more times to close all property boxes.

The new axis label(s) and unit(s) display in your bar graph.

Displaying data in a table

- [Creating a new table](#)
- [Showing and hiding the table tool palette](#)
- [Scrolling a table](#)
- [Selecting data to show in an existing table](#)
- [Selecting cells for operation in a table](#)

Creating a new table

To create a new table, do one of the following:

- If the Home screen is visible, create a new SPARKlab:
    1. Touch a measurement.
    2. Touch Show.
        A SPARKlab appears.

3. Touch the Page Navigator to turn to the table on page 3 of the SPARKlab.

- If a SPARKlab is open, add a new page:
    1. Touch the New Page button.

    The Page-build screen opens.
    2. Touch a measurement (or up to six measurements).
    3. Touch the Table button.

    4. Touch OK.
    A new page containing a table is added to the SPARKlab.

Showing and hiding the table tool palette

- To show the tool palette, touch the blue Table Tools button near the upper left corner of the table.

- To hide the tool palette, touch the orange Table Tools button.

Scrolling a table

Touch the middle of the table and drag it up or down.

7	1.20	19.930
8	1.40	23.422
9	1.60	24.352
10	1.80	28.708
11	2.00	31.012
12	2.20	33.269
13	2.40	33.364

Selecting data to show in an existing table

- Selecting a run for display in an existing column
- Changing the variable displayed in an existing column
- Adding a column
- Removing a column

Selecting a run for display in an existing column

1. Touch the run number at the top of the column.
   A list of available runs appears.
2. Touch the run that you want to see.

Changing the variable displayed in an existing column

1. Touch the Table Tools button to open the tool palette.

2. Touch the Properties button to open the Properties screen.

3. Touch the Column: box and select the column that you want to change.
   Columns are number 1, 2, 3, *etc.* from left to right.
4. Touch the Measurement: box and touch the measurement or other variable that you want to see.

5. Touch OK.

Adding a column

A table can contain up to six columns. Complete these steps to add a column to a table:

1. Touch the Table Tools button to open the tool palette.

2. Optionally, touch a position in the table where the new column will be inserted:
    a. Touch the Select button.

        The button turns orange.
    b. Touch the column to the right of where you want the new column to appear.
        If you do not touch a position, the new column will be added to the right side of the table.
3. Touch the Add Column button.

A new, empty column is added to the table.
Touch the Properties button to select a measurement or other variable to display in the new column.

Removing a column

1. Touch the Table Tools button to open the tool palette.

2. Touch the Select button.

The button turns orange.
3. Touch the column that you want to remove.
4. Touch the Remove Column button.

Selecting cells for operation in a table

If a group of table cells is selected for operation, the selected cells are outlined. If statistics are displayed, they apply only to the data in the selected cells. Complete these steps to select cells:

1. Touch the Table Tools button to open the tool palette.

2. Touch the Select button.

The button turns orange.
3. On the table, drag down a column, across a row, or diagonally across rows and columns to select a group of cells. The selected group of cells is outlined.

1. Selecting cells in a single column. 2. Selecting cells in a single row. 3. Selecting cells in multiple columns and rows.
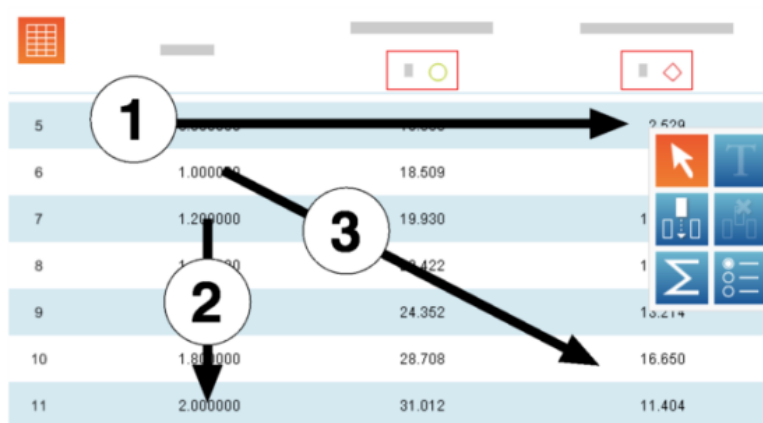
To clear the selection, touch the Select button again.

Displaying data in a digits display

- Creating a new digits display
- Showing and hiding the digits display tool palette
- Changing the variable in a digits display

Creating a new digits display

To create a new digits display, do one of the following:

- If the Home screen is visible, create a new SPARKlab:
    1. Touch a measurement.
    2. Touch Show.
        A SPARKlab appears.
    3. Touch the Page Navigator to turn to the digits display on page 2 of the SPARKlab.

- If a SPARKlab is open, add a new page:
    1. Touch the New Page button.

        The Page-build screen opens.

2. Touch a measurement.
3. Touch the Digits Display button.

4. Touch OK.
 A new page containing a digits display is added to the SPARKlab.

Showing and hiding the digits display tool palette

- To show the tool palette, touch the blue Digits Display Tools button near the lower left corner of the digits display.

- To hide the tool palette, touch the orange Digits Display Tools button.

Changing the variable in a digits display

1. Touch the Digits Display Tools button to open the tool palette.

2. Touch the Properties button to open the Properties screen.

3. Touch the Measurement: box and select the measurement or other variable that you want to see.
4. Touch OK.

Displaying data in a meter

- Creating a new meter
- Showing and hiding the meter tool palette
- Adjusting the scale of a meter
- Changing the variable displayed in a meter
- Customizing the appearance of a meter

Creating a new meter

To create a new meter, do one of the following:

- If the Home screen is visible, create a new SPARKlab:
    1. Touch a measurement.
    2. Touch Show.
       A SPARKlab appears.
    3. Touch the Page Navigator to turn to the meter on page 4 of the SPARKlab.

- If a SPARKlab is open, add a new page:
    1. Touch the New Page button.

       The Page-build screen opens.
    2. Touch a measurement.
    3. Touch the Meter button.

    4. Touch OK.
   A new page containing a meter is added to the SPARKlab.

Showing and hiding the meter tool palette

- To show the tool palette, touch the blue Meter Tools button near the lower left corner of the meter.
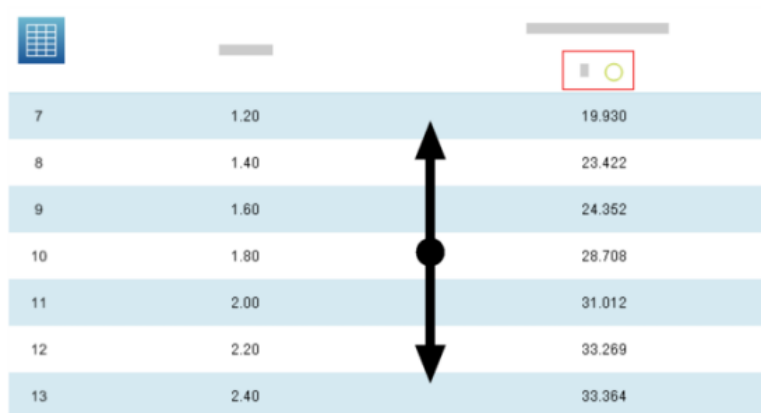
- To hide the tool palette, touch the orange Meter Tools button.

Adjusting the scale of a meter

- Scaling a meter to fit all data
- Setting the scale of a meter

Scaling a meter to fit all data

1. Touch the Meter Tools button to open the tool palette.

2. Touch the Scale-to-fit button.

The scale of the meter adjusts to fit the currently displayed data run.

Setting the scale of a meter

1. Touch the Meter Tools button to open the tool palette.

2. Touch the Properties button to open the Properties screen.

3. For the Always Scale to Fit: option touch off.
4. Touch the Minimum: box and enter the low value of the desired range.
5. Touch the Maximum: box and enter the high value of the desired range.
6. Touch OK.

Changing the variable displayed in a meter

1. Touch the Meter Tools button to open the tool palette.

2. Touch the Properties button to open the Properties screen.

3. Touch the Measurement: box and touch the measurement or other variable that you want to see.
4. Touch OK.

Customizing the appearance of a meter

1. Touch the Meter Tools button to open the tool palette.

2. Touch the Properties button to open the Properties screen.

3. Touch the Sweep Range: box and touch Small Sweep, Semicircle, or Large Sweep.
4. Touch OK.

6   Image capture

Connecting a camera or other video device

Connect the camera or other imaging device to your computer. If your computer has a built in camera, it will be detected automatically.

On the Home screen, you will see the camera(s)appear in the measurements list.

Displaying a camera image

From the Home screen

1. In the Home screen, touch an **Image** measurement.

When selected, **Image** is highlighted in orange.
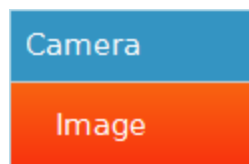
2. Touch Show.

A camera image display appears in a SPARKlab.

3. Touch the **Live Image** button at the center of the display.

A live camera view appears in the display.

From within a SPARKlab

1. Touch the **New Page** button.

The build a new page screen opens.

2. Touch an **Image** measurement.

When selected, **Image** is highlighted in orange.

3. Touch the large or small **Image** button.

An image display is added to the preview.

4. Touch **OK**.

A new page containing an image display is added to the SPARKlab.

5. Touch the **Live Image** button at the center of the display.

A live camera view appears in the display.

Showing and hiding the image tool palette

- To show the image tool palette, touch the blue **Image Tools** button near the lower left corner of the graph.

- To hide the tool palette, touch the orange **Image Tools** button.

Capturing a camera image

1. Touch the **Image Tools** button to open the tool palette.

2. Touch the blue **Live Image** button on the tool palette to show a live image if a live image is not displayed.

A live image must be showing before you can capture a still image. When a live image is show-ing, the button is orange.

3. Touch the **Capture** button to capture a still image.

The live image is replaced by the captured still image.

Switching between live and captured camera images

- To switch from a captured still image back to a live image:

1. Touch the **Image Tools** button to open the tool palette.

2. Touch the blue **Live Image** button in the tool palette.

The still image is replaced with a live image.

- To switch from a live image to a previously captured still image:

3. Touch the image legend.
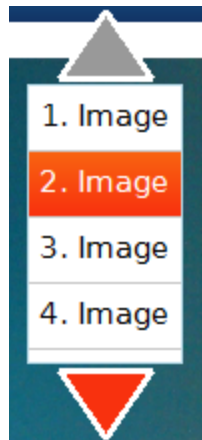
The legend expands to show all captured images.

4. Touch the image to display.

Selecting a captured camera image for display

1. Touch the image legend.
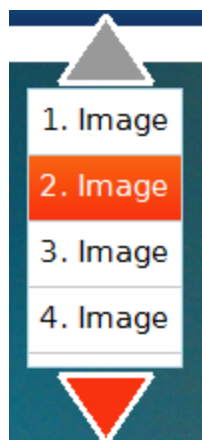
The legend expands to show a list of captured images.

2. Touch the image to display.

Adjusting the scale and position of a camera image

Zooming in

In the tool palette, touch the **Zoom In** button.

The display zooms in toward the center.

Zooming out

In the tool palette, touch the **Zoom Out** button.

The display zooms in toward the center.

Scale to fit

To show the entire image, touch the **Scale-to-fit** button.

Panning a camera image

You can view different parts of an image by panning, or touching a point on the image and drag it left, right, diagonal, up, or down.

Measuring in a camera image

You can use a measurement tool on an image to measure the distance between two points. By default, the distance is reported in pixels (px), but you can calibrate the measurement tool to report the distance in other units. The following topics describe how to position and calibrate measurement tools.

Placing a Measurement tool

Moving a Measurement tool

Deleting a Measurement tool

Calibrating camera image measurements

Placing a Measurement tool

While displaying a still image, complete the following steps.

1. In the tool palette, touch the **Measurement** button.

The Measurement button turns orange, and the measurement toolbar appears.

2. To change the measurement marker color, touch the color button in the palette.

3. Touch one point on the image.

4. Touch a second point on the image.

A measurement arrow appears displaying the distance between the two points.

You can add additional measurement arrows, if needed.

Moving a Measurement tool

Measurements added to images can be moved. To move a measurement arrow:

1. Touch the box at one end of the measurement, and drag it to the desired location.

2. If necessary, touch the box at the other end of the measurement tool and drag it to the desired location.

Deleting a Measurement tool

Measurements added to images can be removed. To remove a measurement arrow:

1. Touch the **Image Tools** button to open the tool palette.

2. In the tool palette, touch the Measurement button.

The **Measurement** button turns orange, and the measurement toolbar

appears.

3. In the measurement toolbar, touch the **Erase** button.

The **Erase** button turns orange.

4. Touch the box at one end of a measurement arrow.

The measurement arrow is deleted.

Calibrating camera image measurements

To calibrate measurements, the image must include an object of known length.

1. Touch the **Image Tools** button to open the tool palette.

2. In the tool palette, touch the **Measurement** button.

3. Touch the point on the image at one end of the object of known length.

4. Touch the point on the image at the other end of the object of known length.
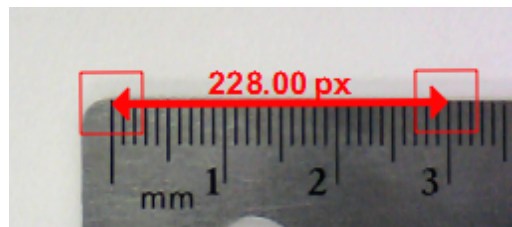
5. If necessary, drag the ends of the measurement tool so that it exactly represents the known length.

6. Touch the **Measurement** button again.

The **Measurement** button turns orange, and the measurement toolbar appears.

7. In the measurement toolbar, touch the **Properties** button.

The buttons turns orange.

8. Touch the box at one end of the measurement arrow.

The Image Measurement Properties screen opens.

9. Touch the **Known length:** box, type the known length in your desired units, and touch **OK**.

10. Optionally, touch the **Digits:** arrows to increase or decrease the number of decimal places that will be displayed.

11. Touch the Units: box, delete the existing units, type the name of the units, and touch **OK**.

12. Touch **OK** to close the Image Measurement Properties screen.

All measurement tools on the image now use the new calibration. Any new measurement tool that you add will also use the new calibration.

Drawing on a camera image

You can draw and erase on image using one of the follow tools.

Drawing

Erasing

Erasing all

Drawing

1. Touch the **Image Tools** button to open the tool palette.

2. In the tool palette, touch the **Draw** button.

The button turns orange and the drawing toolbar appears.

3. To change the pen color, touch the color button.

4. Touch a point on the image and drag to draw lines.

5. Touch the **Draw** button again to turn off the drawing pen and hide the drawing toolbar.

Erasing

Erasing pixels

1. Touch the **Image Tools** button to open the tool palette.

2. In the tool palette, touch the **Draw** button.

The button turns orange and the draw palette appears.

3. To change the color, touch the color button in the palette.

4. Touch a point on the image and drag to draw lines.

5. Touch the **Draw** button again to turn off the drawing pen and hide the drawing toolbar.

Erasing all

1. Touch the **Image Tools** button to open the tool palette.

2. In the tool palette, touch the **Draw** button.

3. The button turns orange and the draw palette appears.

4. In the draw palette, touch the **Eraser** button.

The button turns orange.

5. To erase parts of a drawing, touch a point on the drawing and drag over it.

6. To erase all drawings from the image, touch the **Erase** button again.

7. Touch **Yes**.

8. Touch the **Draw** button again to hide the draw palette.

Annotating a camera image

You can annotate an image using one of the follow tools.

Adding an annotation

Moving an annotation

Editing an annotation

Deleting an annotation

Adding an annotation

If there is more than one image, first select the image that the annotation will be attached to:

1. Touch the image legend.

The legend expands.
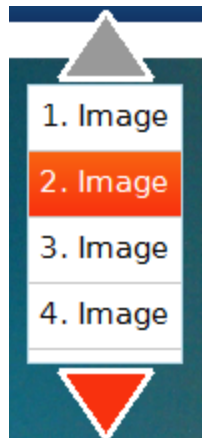
2. In the legend, touch the image that you want to select.

The red outline moves to the selected image.
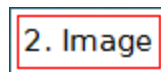
3. Touch the **Image Tools** button to open the tool palette.

4. Touch the **Annotation** button.

The Annotation button turns orange, and the image annotation bar opens, showing the eraser and text color box.

5. Touch the color box until you see the color you want to use.

6. Touch the screen in the location to place the annotation.

The on-screen keyboard appears.

7. Enter a note and touch **OK**.

An annotation appears on the image, the image annotation bar closes, and the **Annotation** button turns blue.

Moving an annotation

You can move the text and pointer arrow on an annotation:

- To move annotation text on an image, touch the text and drag it to a new location.
- To move an annotation arrow on an image, touch the point of the arrow and drag it to a new location.

Editing an annotation

1. If necessary, touch the Image Tools button to open the tool palette.

2. Touch the Annotation button.

The Annotation button turns orange and the image annotation toolbar displays.

3. Touch the annotation you want to edit.

The on-screen keyboard opens.

4. Edit the text and touch OK.

The on-screen keyboard closes and the revised annotation displays.

Deleting an annotation

1. If necessary, touch the **Image Tools** button to open the tool palette.

2. Touch the **Annotation** button.

The Annotation button turns orange and the image annotation toolbar displays.

3. Touch the **Eraser** button on the image annotation bar.

The Eraser button turns orange.

4. Touch the annotation you want to delete.

The annotation is deleted.

5. Touch any other annotations you want to delete.

6. When you finish deleting annotations, touch the orange **Eraser** button to turn off the deletion tool.

The Eraser button turns blue and is no longer active.

Naming an image

1. Touch the **Experiment Tools** button to open the Experiment Tools screen.

2. Touch **Manage Data** to open the Manage Data screen.

3. Touch **Manage Images** to open the Manage Images screen.

4. Touch **Rename Image...** to open the Rename Image... screen.

5. Touch the image that you would like to rename and touch **OK**.

The Enter Image Name screen opens with the onscreen keyboard.

6. Type the new name of the image and touch **OK**.

7. Touch **OK** to close the Manage Images screen, touch **OK** again to close the Manage Data screen, and touch **OK** to close the Experiment Tools screen.

Deleting an image

1. Touch the **Experiment Tools** button to open the Experiment Tools screen.

2. Touch **Manage Data** to open the Manage Data screen.

3. Touch **Manage Images** to open the Manage Images screen.

4. Do one of the following:

- To delete all images, touch **Delete All Images**, and touch **Yes**.

- To delete a single image, touch **Delete Image...**, touch the image to delete, and touch **Yes**.

5. Touch **OK** to close the Manage Images screen, touch **OK** again to close the Manage Data screen, and touch **OK** to close the Experiment Tools screen.

Exporting an image

1. Touch the **Sharing** button to open the Sharing screen.

2. Touch the **Images** tab.

3. Touch **Export Images**.

4. After saving your images, touch **OK** to return to your SPARKlab.

7   Data analysis

In any display, you can view the statistics of data runs, including minimum value, maximum value, mean value, standard deviation, and count (or number of points). In a graph, the area statistic is also available.

A graph also allows you to apply curve fits; draw predictions; and find coordinates, distances, and slopes on data plots.

- Analyzing data in a graph
- Viewing statistics in a table
- Viewing statistics in a digits display
- Viewing statistics in a meter

Analyzing data in a graph

- Viewing statistics in a line graph
- Applying a curve fit
- Removing a curve fit
- Drawing a prediction
- Finding the x- and y-values of a point
- Finding the x- and y-difference between two points
- Finding the slope at a point on a data plot
- Finding the correlation coefficient (r)
- Displaying the RMSE Root-Mean-Square Error
- Analyzing data in a multiple-y axes graph
- Analyzing data in a bar graph

Viewing statistics in a line graph

Complete these steps to see the minimum, maximum, mean, standard deviation, count, and area-under-the-curve of a data run:

1. If more than one data run is displayed, first select a run:
   a. Touch the graph legend.
      The legend enlarges.
   b. In the legend, touch the symbol of the run that you want to select.
      The red outline moves to the selected run.
2. Touch the Graph Tools button to open the tool palette.

3. Touch the Statistics button to open the Statistics screen.

4. Touch one or more of the statistics.
     Selected statistics are highlighted.
5. Touch OK.
     Statistics appear on the graph.
6. Optionally, touch part of the data set for statistics to be applied to.

To remove the statistics, touch the Statistics button again.

Applying a curve fit

Complete these steps to apply a linear, quadratic, power, inverse, inverse square, or sine fit to a data run:

1. If more than one data run is displayed, first select a run:
    a. Touch the graph legend.
         The legend enlarges.
    b. In the legend, touch the symbol of the run that you want to select.
         The red outline moves to the selected run.
2. Touch the Graph Tools button to open the tool palette.

3. Touch the Curve Fit button to open the Curve Fit screen.

4. Touch one curve fit to select it.
5. Touch OK.
     The curve and parameters of the curve appear on the graph.
6. Optionally, select part of the data set for the curve fit to be applied to.

Removing a curve fit

1. Touch the Graph Tools button to open the tool palette.

2. Touch the Curve Fit button.

Drawing a prediction

Complete these steps to manually sketch on a graph:

1. Touch the Graph Tools button to open the tool palette.

2. Touch the Prediction button.

3. Do one of the following:
    - Trace a continuous curve on the graph.
    - Touch several locations on the graph to draw a series of connected points.
4. Touch OK.

To delete the prediction, touch the Prediction button again.

Finding the x- and y-values of a point

Complete these steps to select a point on a graph and display its coordinates:

1. If more than one data run is displayed, first select a run:
    a. Touch the graph legend.
       The legend enlarges.
    b. In the legend, touch the symbol of the run that you want to select.
       The red outline moves to the selected run.

2. Touch the Graph Tools button to open the tool palette.

3. Touch the Select button.

The button turns orange.
4. Touch a point on the graph.
The x- and y-values of the selected point are displayed.
5. Optionally, touch the arrows of the point selector to change which point is selected.
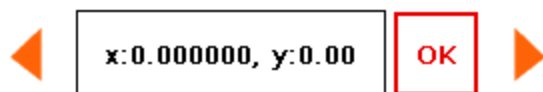
Touch the Select button again to clear the selection.

Finding the x- and y-difference between two points

Complete these steps to select a range of points and display the change-in-x and change-in-y between the first and last points in the selected range:

1. If more than one data run is displayed, first select a run:
    a. Touch the graph legend.
        The legend enlarges.
    b. In the legend, touch the symbol of the run that you want to select.
        The red outline moves to the selected run.
2. Touch the Graph Tools button to open the tool palette.

3. Touch the Select button.

     The button turns orange.
4. Touch somewhere on the graph; then, within one second, touch somewhere else on the graph.
    The two locations that you touch define the corners of a selection box. A selection box appears. Data points inside the box are highlighted.

5. Optionally, adjust the size and position of the selection box by dragging the handles at the corners of the box.

6. When the desired data points are highlighted, touch OK.
     The selection box disappears, but the points remain selected.
7. Touch the Coordinates button.

An annotation with the following information appears on the graph:

- The x- and y-values of the first point in the selected range (*x1* and *y1*),
- The x- and y-values of the last point in the selected range (*x2* and *y2*), and
- The x- and y-differences between those two points (*dx* and *dy*).

To clear the annotation, touch the Coordinates button again. To clear the selection, touch the Select button again.

Finding the slope at a point on a data plot

Complete these steps to display the slope at a selected point:

1. If more than one data run is displayed, first select a run:
   a. Touch the graph legend.
      The legend enlarges.
   b. In the legend, touch the symbol of the run that you want to select.
      The red outline moves to the selected run.
2. Touch the Graph Tools button to open the tool palette.

3. Touch the Slope Tool button.

   The Slope Tool appears on the graph displaying the slope at one point.

   The Slope Tool appears in the middle of the data run or, if part of the data run has been selected, in the middle of the selected part.

4. Touch the arrows of the point selector to move the slope tool to nearby points.
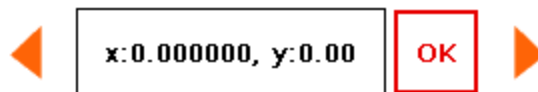
To hide the Slope Tool, touch the Slope Tool button again.

Finding the correlation coefficient (r)

To find the correlation coefficient (r):

If more than one data measurement run is displayed, first select a measurement run:

1. Touch the line graph legend.

The legend enlarges.

2. In the legend, touch the symbol of the measurement run to analyze.

A red outline appears around the selected run.

3. Touch the **Graph Tools** button to open the tool palette.

The line graphs tools palette displays.

4. Touch the **CurveFit** button.

The Select Desired Curve Fit screen displays.

5. Touch the **Linear Fit** button, and touch **OK**.

The statistics appear on the line graph and the Curve Fit button appears orange.

6. To move the statistics box, drag it.

7. To remove the statistics box, touch the orange **Curve Fit** button.

The statistics are removed from the line graph.

Displaying the RMSE Root-Mean-Square Error

To find the Root Mean Square Error (RMSE):

If more than one data measurement run is displayed, first select a measurement run:

1. Touch the line graph legend.

The legend enlarges.

2. In the legend, touch the symbol of the measurement run to analyze.

A red outline appears around the selected run.

3. Touch the **Graph Tools** button to open the tool palette.

The line graphs tools palette displays.

4. Touch the **Curve Fit** button.

The Select Desired Curve Fit screen displays.

5. Touch a curve fit option, and touch **OK**.

The statistics appear on the line graph and the Curve Fit button appears orange.

6. To move the statistics box, drag it.

7. To remove the statistics box, touch the orange **Curve Fit** button.

The statistics are removed from the line graph.

Analyzing data in a multiple-y axes graph

All of the actions performed on a single y-axis graph can be performed on multiple-y axes graphs. The only difference will be initially touching on the **Multiple-y axes tools** button.

Once selected, you can perform the following:

- Viewing statistics in a graph
- Applying a curve fit
- Removing a curve fit
- Drawing a prediction
- Finding the x- and y-values of a point
- Finding the x- and y-difference between two points
- Finding the slope at a point on a data plot

Viewing Statistics in a bar graph

To see the minimum, maximum, mean bar values; or standard deviation of a data run:

1. Touch the **Bar Graph Tools** button to open the tool palette.

2. Touch the Statistics button to open the Statistics screen.

3. Touch one or more of the statistics options to select it. Selected statistics options appear orange.

4. Touch **OK**.

Statistics are added to the chart and the Statistics button appears orange. Touch the orange Statistics button to remove the statistics.

Viewing statistics in a table

Complete these steps to see the minimum, maximum, mean, standard deviation, and count of data runs:

1. Touch the Table Tools button to open the tool palette.

2. Touch the Statistics button to open the Statistics screen.

3. Touch one or more of the statistics.
    Selected statistics are highlighted

4.   Touch OK.
      Statistics appear at the bottom of each column.
5.   Optionally, touch a group of cells for statistics to be applied to.

Touch the Statistics button again to remove the statistics.

Viewing statistics in a digits display

Complete these steps to see the minimum, maximum, mean, standard deviation, or count of a data run:

1.   Touch the Digits Display Tools button to open the tool palette.

2.   Touch the Statistics button to open the Statistics screen.

3.   Touch one of the statistics to select it.
4.   Touch OK.

The selected statistic appears in the digits display (instead of the most recently collected value that normally appears).
Touch the Statistics button again to return the digits display to normal.

Viewing statistics in a meter

Complete these steps to see the minimum, maximum, mean, standard deviation, or count of a data run:

1.   Touch the Meter Tools button to open the tool palette.

2. Touch the Statistics button to open the Statistics screen.

3. Touch one of the statistics to select it.
4. Touch OK.

The meter indicates the selected statistic (instead of the most recently collected value that it normally indicates).
Touch the Statistics button again to return the meter to normal.

8   Calculations and manually entered data

- [Working with calculations](#)
- [Entering data manually](#)

Working with calculations

1. [Opening the calculator screen](#)
2. [Creating a calculation](#)
3. [Displaying a calculation](#)

Opening the calculator screen

1. Touch the Experiment Tools button.

   The Experiment Tools screen opens.
2. Touch CALCULATED DATA.
   The calculator screen opens.

Creating a calculation

Complete one or more of the following steps in any order to enter an expression in the calculator screen:

- To start a new expression, touch Insert.
- To insert a measurement into the expression, touch Measurements.
- To cycle through the various functions available for use in the expression, touch the button under Functions:.
- If the expression contains a trigonometric function, touch RAD or DEG to indicate how angles are measured.
- To enter words or letters into the expression, touch the Letters button.

- To enter Greek letters into the expression, touch the Greek Letters button.

- Touch CAPS or SHIFT to switch between lowercase and uppercase Greek letters.
- To enter subscript and superscript numbers, use the number keys on the Greek keyboard. Touch SHIFT to switch between subscript and superscript.
- Touch the Numbers button to return to the main calculator keyboard.

- When you have finished entering the expression, touch RETURN.
   The SPARK SLS may prompt you to enter definitions for variables and constants used in the expression.
- To exit the calculator screen, touch Done.

Displaying a calculation

Once you have created a calculation, it is available to be shown in any data display. Complete these steps to select the calculation for display.

1. Touch the Tools button of a graph, digits display, table, or meter to open the tools palette.

2. Touch the Properties button to open the Properties screen.

3. Touch the Measurement: box and touch the calculation.
4. Touch OK.

Entering data manually

These steps outline the process of manual data entry.

See the following tasks for detailed instructions.

1. Open the measurements list in the Page-build screen or the Table Properties screen.
   Opening the measurements list
2. Create a empty data set for number or text data entry.
   Creating a data set for manual entry
3. Prepare a table for data entry.
   Preparing a table for manual data entry
4. Enter data in the table.
   Entering data into a manual data set
5. Optionally, display the entered data in other displays.
   Displaying manually entered data
6. Optionally, edit any manually entered number or text.
   Editing manually entered data

Opening the measurements list

Do one of the following to open the measurements list:

- If the Home screen is open, touch Build.
  The Page-build screen containing the measurements list opens.
- If a SPARKlab is open and you want to enter data into a *new* table, touch the New Page button.

  The Page-build screen containing the measurements list opens.
- If you want to enter data into an *existing* table, complete these sub-steps:
  1. Touch the Table Tools button to open the tool palette.

  2. Touch the Add Column button to add a new empty column.

3.   Touch the Properties button to open the Properties screen.

4.   Touch the Measurement: box to open the measurement list.
The measurement list opens.

Now that the measurement list is open, you can create an empty data set as described in the next task.

Creating a data set for manual entry

Complete one of the following tasks.

- Creating a data set for manually entered numbers
- Creating a data set for manually entered text

Creating a data set for manually entered numbers

1.   In the measurement list under Experiment Clock, touch Create Data Set.
The Define the Data Set screen opens.
2.   Select the Measurement Name: box and enter a name for the new data set.
3.   Optionally, touch the box and enter the name of the units.
4.   Touch OK.

Creating a data set for manually entered text

1.   In the measurement list under User-entered Text Data, click Create Data Set.
The Define the Data Set screen opens.
2.   Click the Measurement Name: box and enter a name for the new data set.
3.   Click OK.

Preparing a table for manual data entry

After you have completed the previous task, the SPARK returns either to the Page-build screen or to the Table Properties screen. Depending on which screen you see, do one of the following:

- If the Table Properties screen is open, touch OK.
The table appears displaying the empty data set ready for data entry.
- If the Page-build screen is open, build a page containing the empty data set displayed in a table:

1. In the measurement list, touch the data set that you just created to select it.
2. Touch the Table button.

3. Touch OK.
   A new table appears displaying the empty data set ready for data entry.

Entering data into a manual data set

After creating a data set as described in the previous tasks, complete these steps to enter data:

1. If the table tool palette is not already open, touch the Table Tools button.

2. Touch the Select button.

3. Enter data in a cell:
   a. Touch the first table cell where you want to enter data.
   b. Touch the Data Entry button and enter a number or text (depending on what type of data set you created).

4. Repeat the previous step to enter data in other cells.

Displaying manually entered data

Once you have created a data set, it is available to be shown in any data display such as a graph. Complete these steps to select the data set for display.

1. Touch the Tools button of a graph, digits display, table, or meter to open the tools palette.

2. Touch the Properties button to open the Properties screen.

3. Touch the Measurement: box and touch the data set.
4. Touch OK.

Editing manually entered data

1. If the table tool palette is not already open, touch the Table Tools button.

2. Touch the Select button.

3. Touch the table cell containing the data that you want to change.
4. Touch the Data Entry button and change or delete the number or text.

9   Building SPARKlab pages

- [Starting a new SPARKlab page](#)
- [About adding elements to a SPARKlab page](#)
- [Removing an element](#)
- [Adding a display to a SPARKlab page](#)
- [Adding a text box](#)
- [Adding an image](#)
- [Adding a camera element](#)
- [Removing or replacing an image in a image box](#)
- [Locking an image](#)
- [Deleting a SPARKlab page](#)

Starting a new SPARKlab page

Complete one of these steps to start building a new page:

- From the Home screen, touch Build.
- From within an existing SPARKlab, touch the New Page button.

The Page-build screen appears.
Page-build screen: 1. Measurements. 2. Data display, image box, text box, and spacer buttons. 3. Preview.
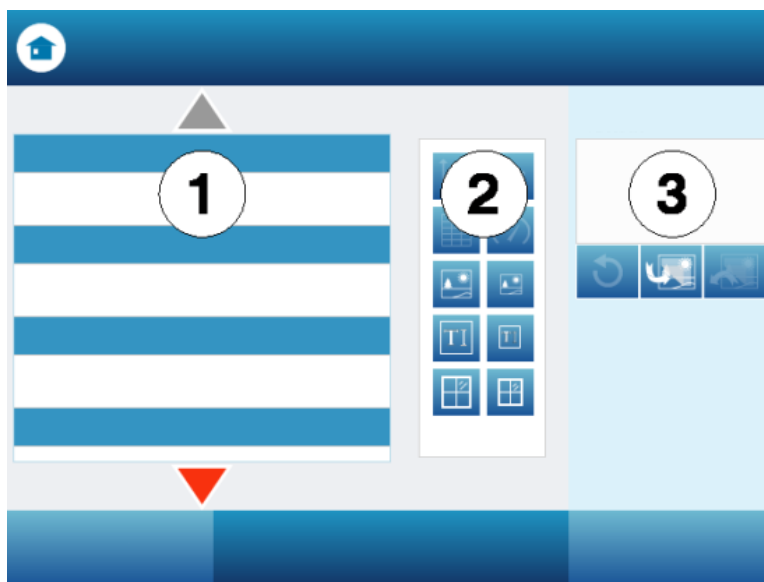
About adding elements to a SPARKlab page

A SPARKlab page is built by adding elements one at a time in the Page-build screen. As elements are added, they are shown in the preview section of the Page-build screen.

Each page can contain multiple displays, images, and text boxes. A page can also contain spacers, which are transparent place-holding elements that allow the background image to show. The maximum number of elements on a page depends on the sizes of the elements.

A page can contain:

- up to two large elements,
- up to six small elements, or
- one large element and up to two small elements.

The large elements are:

- line graphs
- tables
- multiple y-axes graphs
- image boxes
- camera elements
- text boxes

The small elements are:

- digital displays
- meters
- bar graphs

- image boxes
- camera elements
- text boxes

As you add elements to a page, they are automatically arranged and aligned.

Examples of screen layouts: 1. One large or small element. 2. Two large elements. 3. Two small elements. 4. One large and two small elements. 5. Three small elements. 6. Six small elements.
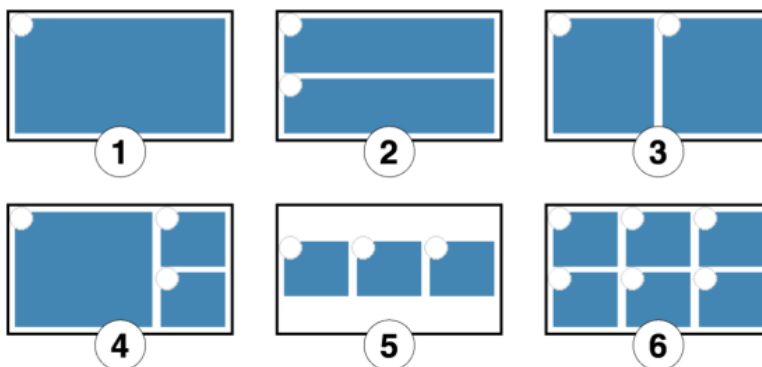
Removing an element

Elements can be removed while the Page-build screen is still open. Elements are removed in the reverse order in which they were added.

Touch the Undo button.

The most recently added element is removed from the preview.

Touch the Undo button again to remove another element.

Adding a display to a SPARKlab page

In the Page-build screen, complete one or more of the following tasks to add displays.

- Adding a graph
- Adding a table
- Adding a digits display

- [Adding a meter](#)

Adding a line graph

Complete these steps in the Page-build screen:

1. Touch one or two measurements (or other variables) to select them.
   If you select just one measurement, it will be plotted on the y-axis with time on the x-axis. If you select two measurements, the first selected will be plotted on the y-axis, and the second selected will be plotted on the x-axis.
2. Touch the Graph button.

A line graph is added to the preview.
If you have finished adding elements to the page, touch OK to exit the Page-build screen.

Adding a table

Complete these steps in the Page-build screen:

1. Touch one or more measurements or other variables (up to six) to select them.
2. Touch the Table button.

A table is added to the preview.
If you have finished adding elements to the page, touch OK to exit the page-build screen.

Adding a digits display

Complete these steps in the Page-build screen:

1. Touch one measurement or other variable to select it.
2. Touch the Digits Display button.

A digits display is added to the preview.

If you have finished adding elements to the page, touch OK to exit the Page-build screen.

Adding a meter

Complete these steps in the Page-build screen:

1. Touch one measurement or other variable to select it.
2. Touch the Meter button.

A meter is added to the preview.
If you have finished adding elements to the page, touch OK to exit the Page-build screen.

Adding a text box

Start these steps in the Page-build screen:

1. Touch the large or small Text Box button.

    A text box is added to the preview.
2. Optionally, add other elements to the page.
3. Touch OK.
    The new page containing the empty text box appears.
4. Touch the text box and enter text.
    You can enter text (such as experiment instructions) as part of the initial experiment setup or leave the text box empty as a place to enter notes or answers to questions during the experiment.

Adding a camera element

Start these steps in the Page-build screen:

1. Touch **Image** below the camera device name.

2. Touch the large or small **CameraElement** button.

A camera image element is added to the preview.

3. Optionally, add other elements to the page.

4. Touch **OK**.

The new page containing the camera element appears, and displays the **Live Image** button.

5. Touch the **Live Image** button to start the camera. You can create an image (such as a sample picture) as part of the initial experiment setup or leave the camera element showing the **Live Image** button as a place to start the camera and create an image during the experiment.

Adding an image

To add an image to a SPARKlab page, you first add an image box in the Page-build screen and later load an image from a saved file into the image box.
You can use an image of any size; SPARK SLS will resize and stretch it to fit the box. To prevent distortion, use an image with the pixel dimensions of:

- 640 x 354 (full page),
- 640 x 175 (half page horizontal),
- 317 x 354 (half page vertical),
- 417 x 354 (2/3 page), or
- 209 x 175 (1/6 page).

An image of different pixel dimensions but equivalent aspect ratio can also be displayed without distortion.

Start these steps in the Page-build screen:

1. Touch the large or small Image Box button.

      An image box is added to the preview.
2. Optionally, add other elements to the page.

3. Touch OK.
    The new page containing the empty image box appears.
4. On a computer, save an image file to a USB flash drive (or other USB storage device).
5. Connect the flash drive to USB port of the SPARK.
6. On the SPARKlab page, touch the image box.
    The image palette appears.
7. Touch the Load button.

    The Open window appears.

8. Touch an image file to select it.
9. Touch Open.
    The image from the selected file appears in the image box.
10. Optionally, touch the image to hide the image palette.
11. Optionally, remove the USB flash drive.

Removing or replacing an image in a image box

Touch the image to open the image palette.
Do one of the following:

- Touch the Remove button to delete the image.

- Touch the Load button to load a new image file.

Locking an image

Once an image is locked it cannot be changed or removed. However, the SPARKlab page that contains the locked image can be deleted.

1. Touch the image to open the image palette.
2. Touch the Lock button.

Deleting a SPARKlab page

While viewing the page in a SPARKlab, touch the Delete Page button.

10 Saving and sharing

- Saving a SPARKlab
- Printing a lab
- Exporting data
- Opening a saved lab

Saving a SPARKlab

Complete these steps to save your work on the SPARK or on a USB flash drive (or other USB storage device):

1. Optionally, connect a USB flash drive to the SPARK.
2. Touch the Sharing button to open the Sharing screen.

3. Touch SAVE FILE AS.
    The File-save screen opens.
4. Touch the Name: box and enter a name for your experiment.
5. If you plan to save the lab on a USB flash drive touch USB.
6. Optionally, touch a folder to select it.
    The experiment will be saved in the selected folder.
7. Optionally, touch an existing file to select it.
    The selected file will be overwritten.
8. Touch SAVE.
    The experiment is saved, and the SPARK returns to the Sharing screen.
9. Touch Done to return to your SPARKlab.

After you have saved a file once using the procedure above, you can quickly save the file again by touching SAVE FILE instead of SAVE FILE AS in the Sharing screen.

Printing a lab

The SPARKlab cannot be printed directly; however, you can capture SPARKlab pages in the journal and print the journal

You will need a compatible USB printer. Most USB inkjet printers manufactured by HP are compatible with SPARK.

Complete these steps to take snapshots of SPARKlab pages and print the snapshots:

1. On each SPARKlab page that you wish to print, touch the Snapshot button.

Each time you touch the Snapshot button, the Snapshot Quick View appears briefly and an image of the page is added to the journal.
2. Connect a printer to USB port of the SPARK.
3. Touch the Sharing button to open the Sharing screen.

4. Touch the JOURNAL tab.
5. Touch PRINT JOURNAL to open the journal print page.
6. Touch OK.
    The journal is printed, and the SPARK returns to the Sharing screen.
7. Touch Done to return to your SPARKlab.

Exporting data

To export data, you will need a USB flash drive (or other USB storage device). The data that you have collected will be saved on the flash drive in a tab-delimited text file that can be opened on a computer.

Note that exporting data is *not* equivalent to saving the lab. If you plan to later reopen your work on the SPARK SLS, you must also save the lab.

Complete these steps to export data:

1. Connect a flash drive to USB port of the SPARK SLS.
2. Touch the Sharing button to open the Sharing screen.

3. Touch EXPORT DATA to open the export data page.
4. Touch the Name: box and enter a filename.
5. Touch EXPORT.
    A data file is saved on the USB flash drive, and the SPARK SLS returns to the Sharing screen.
6. Touch Done.

To view the saved data, connect the flash drive to a computer. Open the file in a spreadsheet program, mapping program, word processor, or text editor.

Opening a saved lab

1. If necessary, touch the Home button to return to the Home screen.

2. In the Home screen, touch Open.
3. Touch the SAVED WORK tab.
4. If necessary, touch the folder where the file is saved.
5. Touch the file that you would like to open.
6. Touch OK.

The lab opens.

Opening a lab saved on a USB flash drive

1. Connect a USB flash drive (or other USB storage device) to the SPARK SLS.
2. Touch the Date/Time/Battery icon to open the Device Tools screen.

3. Touch Manage Files.
4. Copy or move the lab from the flash drive to the SPARK SLS (see next section).
5. Optionally, disconnect the USB flash drive.
6. Open the file.

Managing files and folders

- Creating a new folder
- Deleting a file or folder
- Moving a file
- Copying a file

Creating a new folder

When you save, move, or copy a file, you will see the option to create a new folder.

1. Touch the existing folder that will contain the new folder.
   You can skip this step if you are creating a new folder on a USB flash drive (or other USB storage device).
2. Touch New Folder.
3. Enter the name of the new folder.

A new folder is created.

Deleting a file or folder

1. Touch the Date/Time/Battery icon to open the Device Tools screen.

2. Touch Manage Files to open the Manage Files screen.
3. Touch DELETE FILES.
   A list of file locations, folders, and files appears.
4. If necessary, touch the folder and subfolders that contain the file or folder.
5. Touch the file or folder that you want to delete.
6. Touch Delete.

Moving a file

Complete these steps to move a file between folders within the SPARK SLS, or between the SPARK SLS and a USB flash drive (or other USB storage device).

1. Optionally, connect a USB flash drive to the SPARK SLS.
2. Touch the Date/Time/Battery icon to open the Device Tools screen.

3. Touch Manage Files to open the Manage Files screen.
4. Touch MOVE FILES.
   A list of file locations, folders, and files appears.
5. Touch the location (SPARK SLS or USB) of the file that you want to move.
6. If necessary, touch the folder and subfolders that contain the file.
7. Touch the file that you want to move.
8. Touch NEXT.
9. Touch the destination (SPARK SLS or USB).
10. Touch the folder and subfolders where you would like the file to be moved.
11. Touch MOVE.

Copying a file

Complete these steps to copy a file between folders within the SPARK SLS, or between the SPARK SLS and a USB flash drive (or other USB storage device).

1. Optionally, connect a USB flash drive to the SPARK SLS.
2. Touch the Date/Time/Battery icon to open the Device Tools screen.

3. Touch Manage Files to open the Manage Files screen.
4. Touch COPY FILES.
     A list of file locations, folders, and files appears.
5. Touch the location (SPARK SLS or USB) of the file that you want to copy.
6. If necessary, touch the folder and subfolders that contain the file.
7. Touch the file that you want to copy.
8. Touch NEXT.
9. Touch the destination (SPARK SLS or USB).
10. Touch the folder and subfolders where you would like the copy of the file to be saved.
11. Touch COPY.

11   Keeping a journal

The journal allows you to keep a record of your work in a series of pictures and captions as your science investigation progresses.

These steps outline the process of keeping a journal. See the following tasks for detailed instructions.

1. Take a snapshot. An image of the SPARKlab page is recorded.
2. Optionally, add a caption to the snapshot.
3. Repeat the previous steps at anytime during your science investigation.
4. Save, export, or print the journal.

Taking a snapshot

At any time during your science investigation, complete these steps to save an image of the SPARKlab page.
Touch the Snapshot button.

The SPARK records an image of the SPARKlab page, and the Snapshot Quick View appears briefly.

The Snapshot Quick View

You can let the Snapshot Quick View close automatically or use the buttons in the Snapshot Quick View to open the journal or delete the snapshot.

Opening the journal

Touch the Journal button.

Adding a caption to a snapshot or editing an existing caption

Touch inside the caption area and enter or change the caption.
1. Journal entry. 2. Thumbnails. 3. Caption area
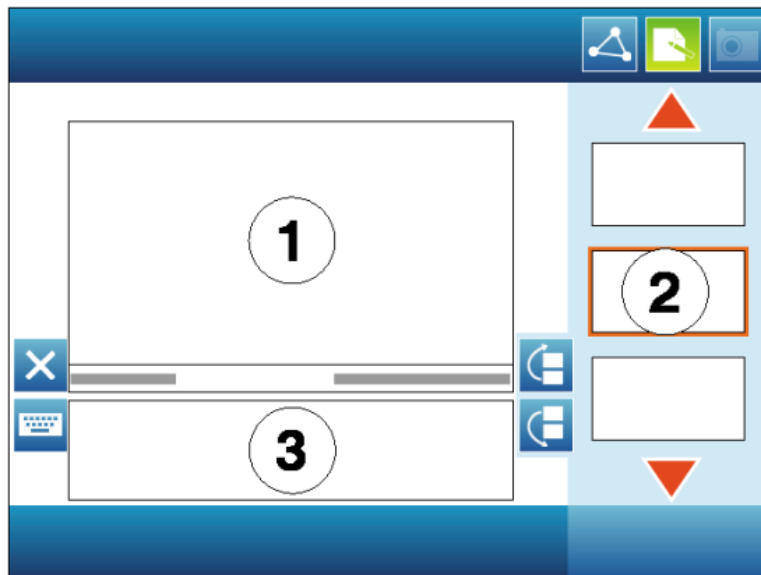
Navigating in the journal

- In the journal, touch a thumbnail on the right side of the screen to view a journal entry.
- Touch the arrows to scroll through the thumbnails

Deleting a journal entry or snapshot

In the journal or the Snapshot Quick View, touch the Delete button to delete the currently visible journal entry.

Rearranging journal entries

In the journal, touch the Move Journal Entry Up button or Move Journal Entry Down button to change the position of the currently visible entry.

Closing the journal

Touch Done to close the journal and return to the SPARKlab.

Saving a journal

Do one of the following to save a journal:

- Save the entire lab.   The journal is saved as part of the lab.
- Export the journal. See next task. The journal is saved in format that can be viewed in a web browser.

Exporting a journal

To export a journal, you will need a USB flash drive (or other USB storage device). The journal will be saved on the flash drive as a group of files that can be viewed in a web browser on a computer.

Note that exporting the journal is *not* equivalent to saving the lab. If you plan to later reopen your work on the SPARK SLS, you must also save the lab.

Complete these steps to export a journal:

1. Connect a USB flash drive or other USB storage device to the SPARK SLS.
2. If you are currently viewing the journal, touch Done to return to the SPARKlab.
3. Touch the Sharing button to open the Sharing screen.

4. Touch the JOURNAL tab.
5. Touch EXPORT JOURNAL to open the journal export page.
6. Touch the Name: box and enter a name for your journal.
7. Optionally, touch a folder on the flash drive where you would like the journal to be saved. If you skip this step, the journal will be saved in a folder at the root level of the flash drive.
8. Touch EXPORT.
   The SPARK SLS creates a new folder on the flash drive with the filename that you entered and saves a group of text and image files plus an HTML file in it. It returns to the Sharing screen after these files have been saved.
9. Touch Done to return to your SPARKlab.

To view the saved journal, connect the flash drive to a computer and open the HTML file in a web browser.

Printing a journal

To print a journal, you will need a compatible USB printer. Most USB inkjet printers manufactured by HP are compatible with SPARK.

1. Connect a printer to USB port of the SPARK.
2. If you are currently viewing the journal, touch Done to return to the SPARKlab.
3. Touch the Sharing button to open the Sharing screen.

4. Touch the JOURNAL tab.
5. Touch PRINT JOURNAL to open the print journal page.
6. Touch OK.
   The journal is printed, and the SPARK returns to the Sharing screen.
7. Touch Done to return to your SPARKlab.

12   Common tasks

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Turning pages

- Touch the arrows of the Page Navigator to turn to the next page or previous page.

Returning to the Home screen

Touch the Home button to close a SPARKlab and return to the Home screen.

Entering text and numbers using the on-screen keyboard

If you are using SPARK SLS on a device without an external keyboard, you can use the on-screen keyboard for text or number input. If you have an external keyboard, you can type on either the external or on-screen keyboard whenever the on-screen keyboard appears.
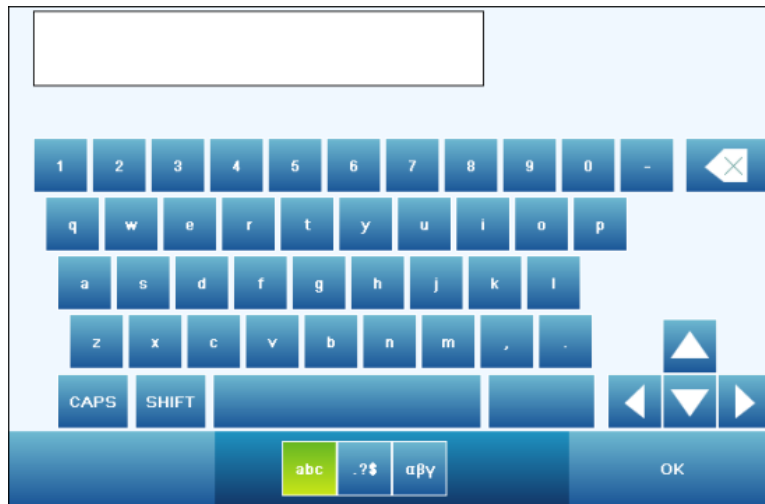
- To enter capital letters, touch CAPS or SHIFT.
- To enter punctuation and other symbols, touch the Punctuation button.

- To enter Greek letters, touch the Greek Letters button.

- Touch CAPS or SHIFT to switch between lowercase and uppercase Greek letters.
- To enter subscript and superscript numbers, use the number keys on the Greek keyboard.
- Touch CAPS or SHIFT to switch between subscript and superscript.
- To start a new line, touch RETURN.
- When you have finished entering text or a number, touch OK.

Opening the About SPARK SLS screen

1. Touch the Date/Time/Battery icon to open the Device Tools screen.

2. Touch About SPARK SLS to view information about the firmware version installed on the SPARK SLS.

Setting the language

1. Touch the Date/Time/Battery button to open the DeviceTools screen.

2. Touch Languages.
3. Touch the Languages box and touch a language.
4. Touch OK.
5. Touch Done.
6. Turn the SPARK off and on again.

13 Managing the SLS device

- Updating the SPARK Science Learning System
- Charging the battery
- How battery status is indicated
- Setting the date and time
- About sleep modes
- Customizing sleep modes
- Adjusting the screen brightness
- Calibrating the touch-screen
- Product End of Life Disposal Instructions
- SPARK Battery Replacement and Disposal Instructions

Turning off the SPARK Science Learning System

Press and hold the power button on the bottom of the SPARK.

Updating the SPARK Science Learning System

1. Check the firmware version installed on the SPARK:
   a. Touch the Date/Time/Battery icon to open the Device Tools screen.

   b. Touch About SPARK.
2. Visit www.pasco.com/spark to check for the latest update.
3. Follow the instructions on the website to download and install the update.
4. Also check for the latest version of this user's guide on the website.

Charging the battery

1. Connect the SPARK SLS to the AC Adapter.

2. Connect the AC Adapter to a wall outlet.

The battery begins to recharge.

How battery status is indicated

When the SPARK SLS is turned on, the Battery icon indicates battery status.

Battery icons: full, low, and nearly empty

When the SPARK SLS is connected to AC power, the status light indicates battery status:

Constant green
    fully charged
Flashing green
    battery sleep mode
Constant red
    low battery
Flashing red
    charging

Status light

Setting the date and time

1. Touch the Date/Time/Battery icon to open the Device Tools screen.

2. Touch Set Date & Time to open the Set Date & Time screen.
3. Set the date, time, and time zone.
4. Touch OK.
5. Touch Done.

About sleep modes

There are two types of sleep mode that the SPARK SLS may go into to conserve battery charge:

Screen Sleep mode
Screen Sleep mode occurs when the SPARK SLS is running on battery power and has received no user input for a certain amount of time. The screen goes dark, but the SPARK

SLS will continue to record data (if it is recording). If the SPARK SLS is recording data, the record buttons continue to flash blue.

Battery Sleep mode

Battery Sleep mode occurs when the SPARK SLS is running on battery power, has received no user input for a certain amount of time, *and* is not recording data. The screen goes dark and power to the sensors is cut off. The status light flashes green.

Status light

Reactivating the SPARK Science Learning System when it is in sleep mode

If the SPARK has received no input for several minutes, it may go into sleep mode. To reactivate it, do one of the following:

- Touch the screen.
   This will reactivate the SPARK only if it is in Screen Sleep mode. See About sleep modes.
- Press and hold the power button.
- Press one of the record buttons. If the SPARK is in Screen Sleep mode, this will also cause it to start or stop data recording or keep a data point.

Customizing sleep modes

Complete these steps to set the amount of idle time that will elapse before the SPARK SLS

goes into each type of sleep mode:

1. Touch the Date/Time/Battery icon to open the Device Tools screen.

2. Touch Display Settings to open the Display Settings screen.
3. Touch the Screen Sleep Time (Battery) [minutes] arrows to adjust the idle time for Screen Sleep mode.
4. Touch OK.
5. Touch Power Settings to open the Power Settings screen.
6. Touch the Battery Sleep Time [minutes] arrows to adjust the idle time for Battery Sleep mode.
7. Touch OK.
8. Touch Done.

Adjusting the screen brightness

1. Touch the Date/Time/Battery icon to open the Device Tools screen.

2. Touch Display Settings to open the Display Settings screen.
3. Touch the Screen Brightness arrows to adjust the screen brightness.
4. Touch OK.
5. Touch Done.

Calibrating the touch-screen

1. Hold down both record buttons and touch the screen three times. The first of a series of green boxes appears.
2. Touch the center of each green box.
3. Touch OK.

Opening the About SPARK SLS screen

1. Touch the Date/Time/Battery icon to open the Device Tools screen.

2. Touch About SPARK SLS to view information about the firmware version installed on the SPARK SLS.

# Product End of Life Disposal Instructions

This electronic product is subject to disposal and recycling regulations that vary by country and region. It is your responsibility to recycle your electronic equipment per your local environmental laws and regulations to ensure that it will be recycled in a manner that protects human health and the environment. To find out where you can drop off your waste equipment for recycling, please contact your local waste recycle/disposal service, or the place where you purchased the product.

The European Union WEEE (Waste Electronic and Electrical Equipment) symbol (above) and on the product or on its packaging indicates that this product *must not* be disposed of in a standard waste container.

SPARK Battery Replacement and Disposal Instructions

Removal/Replacement- Tools required: #0 or #1 Phillips screw driver. Remove the single screw holding the battery door (see figure), and remove the battery door from the Spark. Disconnect the battery cable, and slide out the Li-Poly battery pack. Reverse these instructions to replace the battery.
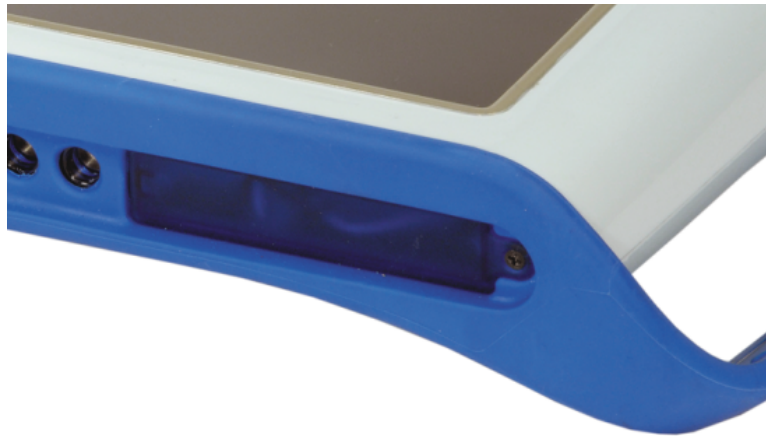
Battery Disposal- Batteries contain chemicals that, if released, may affect the environment and human health. Batteries should be collected separately for recycling, and recycled at a local hazardous material disposal location adhering to your country and local government regulations. To find out where you can drop off your waste battery for recycling, please contact your local waste disposal service, or the place where you purchased the product.

The Lithium Polymer (Li-Poly) rechargeable battery used in this product is marked with the International symbols (above) to indicate the need for the separate collection and recycling of batteries.