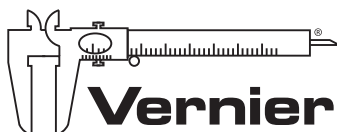


LABQUEST[®] 2

USER MANUAL



SAFETY INFORMATION

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) this device may not cause harmful interference and
- (2) this device must accept any interference received, including interference that may cause undesired operation

RF Exposure Warning

The equipment complies with RF exposure limits set forth for an uncontrolled environment. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

IC Statement

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Industry Canada - Class B This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled "Digital Apparatus," ICES-003 of Industry Canada. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

RF exposure warning: The equipment complies with RF exposure limits set forth for an uncontrolled environment. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'appareil doit accepter tout interférence radioélectrique, même si cela résulte à un brouillage susceptible d'en compromettre le fonctionnement.

*Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de **Classe B** prescrites dans la norme sur le matériel interférant-brouilleur: “Appareils Numériques,” NMB-003 édictée par industrie Canada. L'utilisation est soumise aux deux conditions suivantes: (1) cet appareil ne peut causer d'interférences, et (2) cet appareil doit accepter toutes interférences, y comprises celles susceptibles de provoquer un dysfonctionnement du dispositif. Afin de réduire les interférences radio potentielles pour les autres utilisateurs, le type d'antenne et son gain doivent être choisis de telle façon que l'équivalent de puissance isotrope émis (e.i.r.p) n'est pas plus grand que celui permis pour une communication établie. **Avertissement d'exposition RF:** L'équipement est conforme aux limites d'exposition aux RF établies pour un environnement non supervisé. L'antenne (s) utilisée pour ce transmetteur ne doit pas être jumelée ou fonctionner en conjonction avec toute autre antenne ou transmetteur.*

ABOUT THIS GUIDE

LabQuest 2, released in March 2012, ships with a [Quick-Start Guide](#) to get you up and running with basic data collection and analysis. The LabQuest 2 User Manual is an extended guide detailing the features, hardware, and software of LabQuest 2.

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I. GETTING STARTED WITH LABQUEST 2

What's Included

- LabQuest 2 interface
- Rechargeable battery (in unit)
- AC power adapter
- Computer connection (USB) cable
- Quick-Start guide
- Stylus (in unit)
- Stylus tether

Using LabQuest for the First Time

Install the Battery

LabQuest ships with the battery in place; however, there is protective sticker covering the battery contacts that needs to be removed before the first use:

- Turn LabQuest over and open the battery door by sliding the door lock and lifting the battery cover.
- Remove the battery and remove the small protective sticker covering the battery contacts.
- Reinstall the battery with the label side up, ensuring the battery contacts align with the LabQuest contacts.
- Replace the battery door.



LabQuest with battery door removed

Charge Overnight

We recommend charging the battery for at least 12 hours prior to using LabQuest for the first time on battery power. To do this, connect the included power adapter to LabQuest and an AC power source. You can also charge LabQuest using the [LabQuest 2 Charging Station](#) (order code LQ2-CRG, sold separately).

Getting Started with LabQuest 2

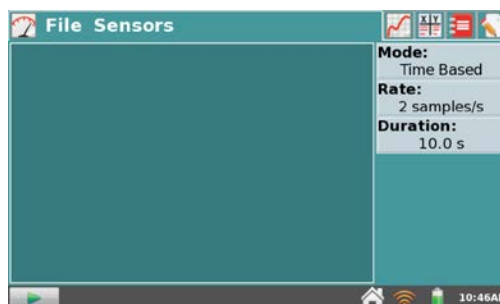
LabQuest uses a high-quality lithium-ion battery. This is the same chemistry used in premium laptop and cell phone batteries, and you can expect similar performance. There is never a need to condition the battery by regular full discharge/charge cycles.

It is safe to leave the battery charging indefinitely, and there is no need to fully discharge the battery before charging. Battery life will depend on the sensors used, but in most cases you can obtain six or more hours of use before recharging. We recommend charging LabQuest overnight to start the next day with a full charge. For more details about the battery, see [LabQuest Battery](#).

Quick Start to Data Collection

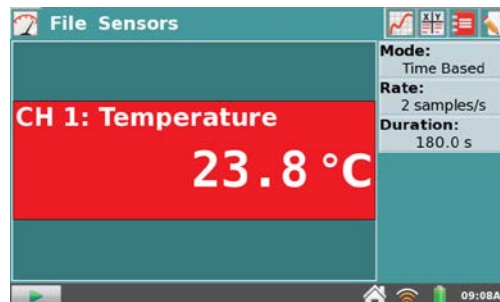
Follow these steps to get up and running quickly with basic data collection. For more detailed instructions, see [Data Collection](#).

1. Press and release the power button located on the top edge of LabQuest to turn on the unit. LabQuest App launches automatically.




2. Connect an analog sensor to the CH 1 port on LabQuest or connect a digital sensor to the DIG 1 port. LabQuest App will auto-ID the connected sensor and automatically set the default collection rate for the sensor.

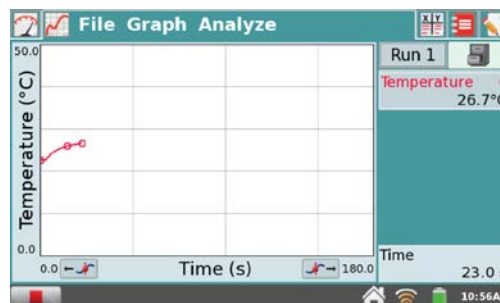
Note: If your sensor is an older-style (DIN) sensor requiring an adapter, the sensor will not auto-ID. Instead, you will need to set up the sensor manually. To do this, choose Sensor Setup from the Sensors menu. Select the field labeled “No Sensor” adjacent to the appropriate port and choose your sensor from the list.





3. Next, tap Collect . Data collection begins and LabQuest graphs the data in real time.

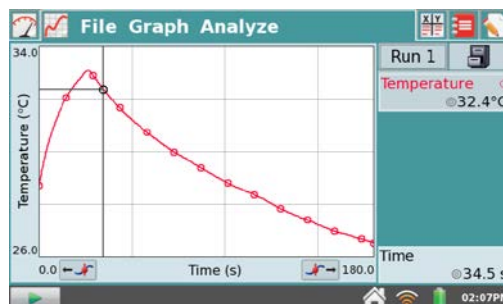
You can stop collection early by tapping Stop .

Once data collection is complete, the graph autoscales to the data.



Getting Started with LabQuest 2

4. Tap the graph to examine a point of interest. The coordinates of the point are shown in the panel to the right of the graph. Tap another point or tap the Examine buttons to move the cursor left  and right .

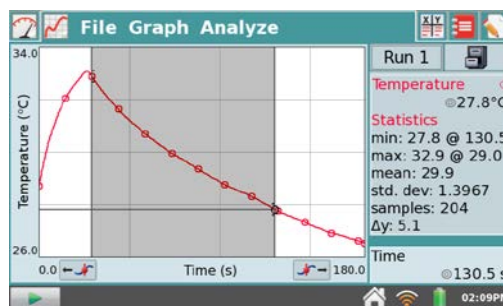


5. To select a region of data for analysis, tap-and-drag across the graph to highlight the desired region. **Note:** To analyze all data, you do not need to select a region.

Statistics

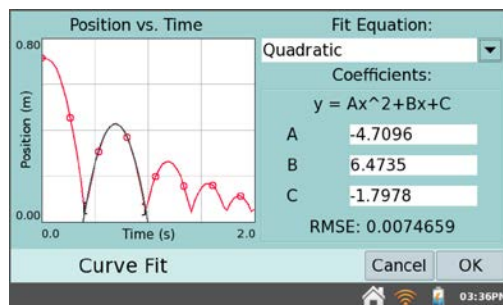
To view statistics for the selected data on the Graph screen, choose Statistics from the Analyze menu. Select the check box to select a data set. The statistics information is then displayed in the panel to the right of the graph.

To remove the displayed statistics, tap Analyze on the Graph screen, choose Statistics, and then select the checked box to clear the selection.



Curve Fit

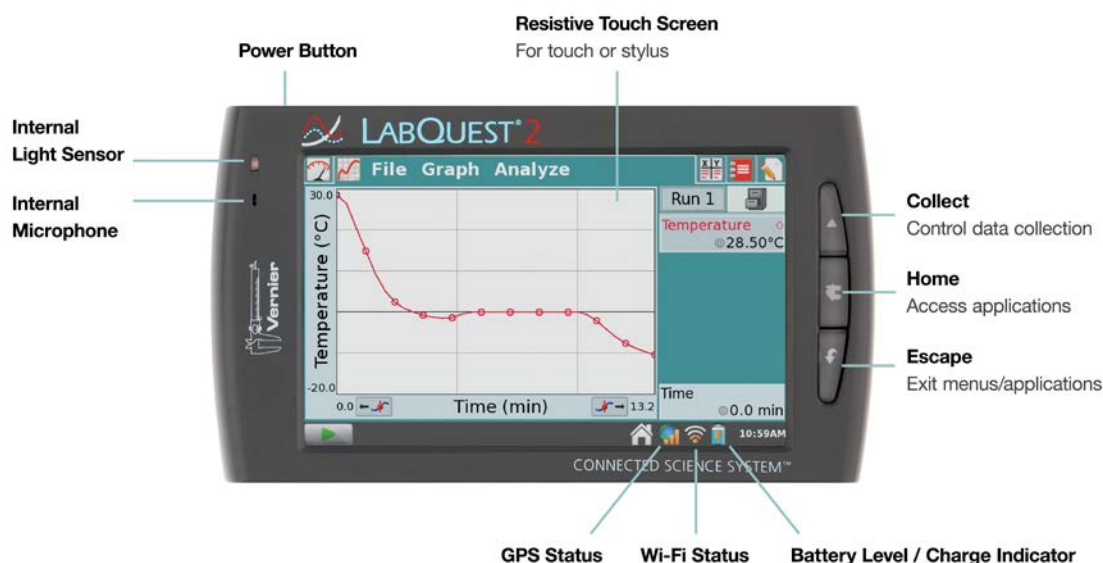
To fit a curve to the selected data on the Graph screen, choose Curve Fit from the Analyze menu. Select the check box to select a data set. Tap Choose Fit and choose the desired fit equation. LabQuest automatically determines and displays the fit coefficients, and displays a preview of the curve fit on the graph. Tap OK to apply the fit and return to the Graph screen.



To remove the fit, choose Curve Fit from the Analyze Menu, and then select the checked box to clear the selection.



Note: The Curve Fit coefficients cannot be manually adjusted. To enter your own parameters, see the [Model](#) tool within [Data Analysis](#).

II. LABQUEST 2 HARDWARE




Once LabQuest is connected to AC power or the battery has been charged, press the power button located on the top of the unit, near the left edge. LabQuest will complete its booting procedure and automatically launch the LabQuest App by default, as shown above. If the screen does not light after a moment when used on battery power, connect the power adapter to LabQuest and to an AC power source, then try the power button again.

Power Button

- **Power on** – If the screen is off for any reason (LabQuest is off, asleep, or the screen has turned off to conserve battery power), press and release the power button to turn LabQuest back on. If LabQuest was off, LabQuest will also complete its booting procedure that takes about a minute and then display LabQuest App.
- **Sleep/wake** – When LabQuest is on, press and release the power button once to put LabQuest into a sleep mode. Note that the sleep mode does not start until you release the power button. In this mode, LabQuest uses less power but the battery can still drain. This mode is useful if you are going to return to data collection again soon, in which case waking LabQuest from sleep is quicker than restarting after shutdown. To wake LabQuest from sleep, press and release the power button.
- **Shut down** – To shut down LabQuest, hold the power button down for about five seconds. LabQuest displays a message indicating it is shutting down. Release the power button, and allow LabQuest to shut down. To cancel the shutdown procedure at this point, tap Cancel. You can also shut down LabQuest from the Home screen . To do this, tap System and then tap Shut Down .
- **Emergency shutdown** – If you hold the power button down for about eight seconds, LabQuest powers off uncleanly. This is the same as pulling the battery out of the unit while it is running. This is not recommended unless LabQuest is frozen, as you may lose your data and potentially cause file system corruption.

Touch Screen

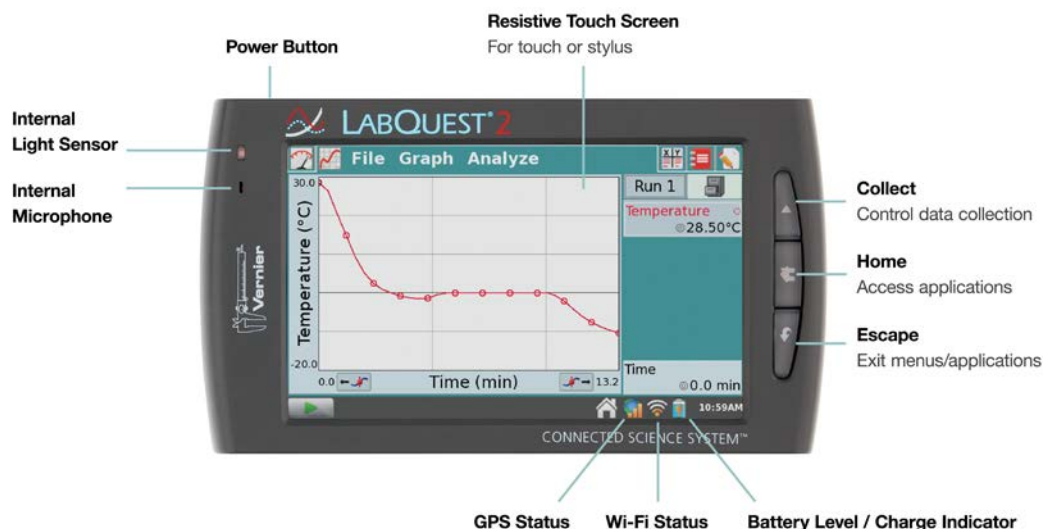
LabQuest has an LED backlit resistive touch screen that quickly responds to pressure exerted on the screen. LabQuest is controlled primarily by touching the screen. The software is designed to be finger-friendly. In some situations, you may desire more control for precise navigation. In such cases, we recommend using the included stylus.

If you are having trouble viewing the color screen or are using LabQuest outside in bright sunlight, we recommend changing to the High Contrast mode. Tap Preferences on the Home screen, then tap Light & Power. Select the check box for High Contrast  to enable this mode.

Hardware Keys

In addition to using the touch screen, the three hardware keys can also be used to control your LabQuest.

- **Collect** – Start and stop data collection within LabQuest App
- **Home** – Launch the Home screen
- **Escape** – Close most applications, menus, and exit dialog boxes without taking action (i.e., cancel dialog boxes)



Sensor Ports

LabQuest has three analog sensor ports (CH 1, CH 2, and CH 3) for analog sensors such as our pH Sensor, Temperature Probe, and Force Sensor. Also included is a full-size USB port for USB sensors, USB flash drives, and USB printers. In addition to the power button, the top edge of LabQuest has two digital sensor ports (DIG 1 and DIG 2) for Motion Detectors, Drop Counters, and other digital sensors.



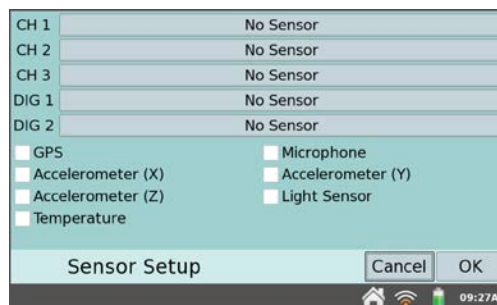
Audio ports are also located adjacent to the digital ports, as well as a microSD card slot for expanding disk storage. On the side opposite of the analog ports, there is a stylus storage slot, an AC power port for recharging the battery, and a mini USB port for connecting LabQuest to a computer. In between these ports, there is a serial connection for charging the unit in a [LabQuest 2 Charging Station](#) (order code LQ2-CRG, sold separately) and a stylus tether attachment point.



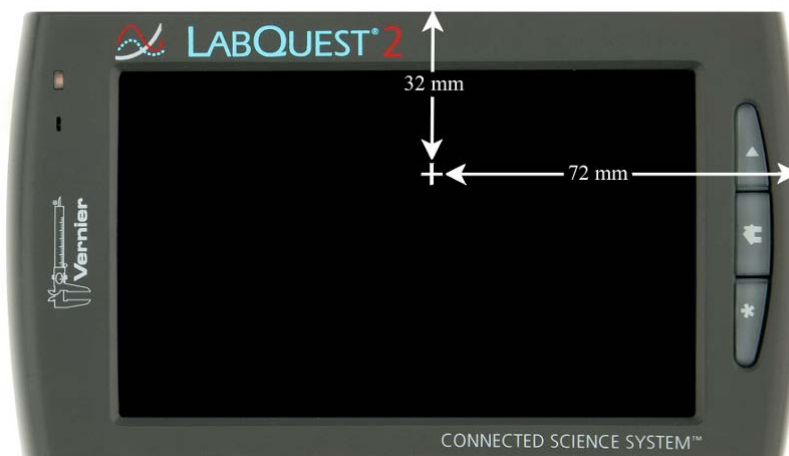
Internal Sensors

LabQuest also has several built-in sensors, including a GPS, microphone, three-axis accelerometer, temperature sensor, and relative light sensor.

To enable internal sensors within LabQuest App, choose Sensor Setup from the Sensors menu. Within the Sensor Setup dialog box, select a check box to enable the associated sensor. Then tap OK to return to the LabQuest App Meter screen.



- **GPS** – The internal GPS collects latitude, longitude, and altitude readings, and may be used with other sensors. You can choose units of decimal degrees, degree minutes, or UTM. *Note: It may take up to 15 minutes to acquire an initial signal outdoors. We do not recommend using GPS indoors.*
- **Accelerometers** – The 3-axis accelerometer measures accelerations up to $\pm 2 g$ in the x-, y-, and z-axis directions. The sensor is located 72 mm from the docking connector and 32 mm from the digital port side of the plastic case.



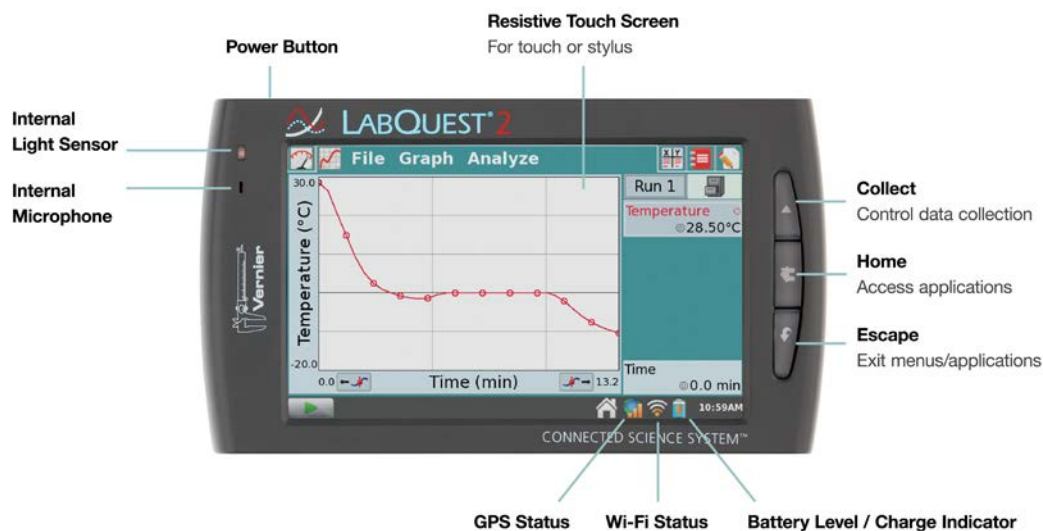
- **Temperature** – The internal temperature sensor monitors ambient temperature. The sensor is located between CH2 and CH3, in front of the BTA connectors.




- **Light Sensor** – The internal light sensor is located on the front of LabQuest, to the left of the screen. This light sensor combines one exposed photodiode (CH0), which is responsive to both visible and infrared light, and one filtered photodiode (CH1), which is responsive primarily to infrared light. The CH1 reading is subtracted from the CH0 reading and then converted to a value in lux that represents illuminance (ambient light level) to approximate the human eye response. The spectral response range for this sensor is approximately 400–800 nm.

LabQuest 2 Hardware

- **Microphone** – The internal Microphone is located on the front of LabQuest to the left of the screen, as shown below, and measures waveforms. ***Note:** This sensor cannot be used with external sensors.*

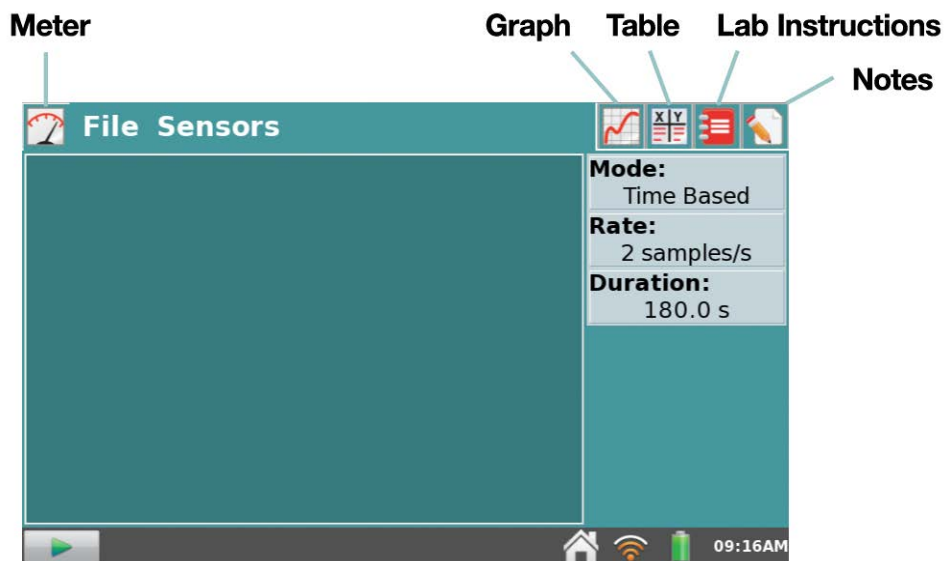


III. LABQUEST APP


The data-collection and analysis software, LabQuest App, is the heart of LabQuest. When you turn on LabQuest, the LabQuest App starts automatically. If the LabQuest App is not displayed on your screen, launch LabQuest App  from the Home screen.

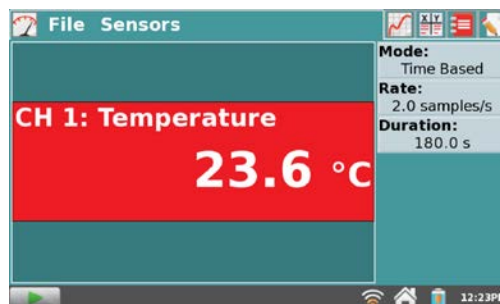
Navigating LabQuest App


LabQuest App has five different screens. Tap on the desired tab to display the associated screen.

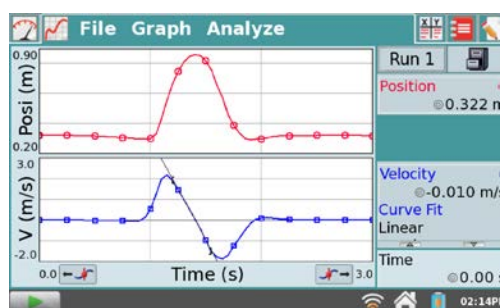


LabQuest App


-  **Meter screen** – Set up sensors, set data-collection parameters, and see a digital meter for your connected sensors. For a detailed description of how the Meter screen is used for data collection, see [Data Collection](#).





-  **Graph screen** – See a graph of your data and perform analyses, including curve fits. For a detailed description of how the Graph screen is used for data analysis, see [Data Analysis](#).

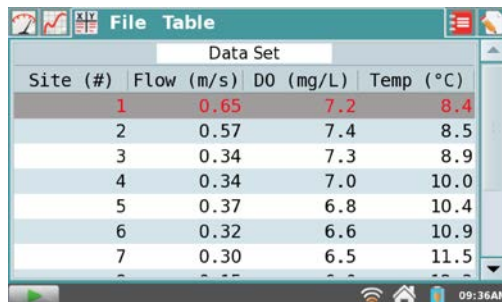


LabQuest App

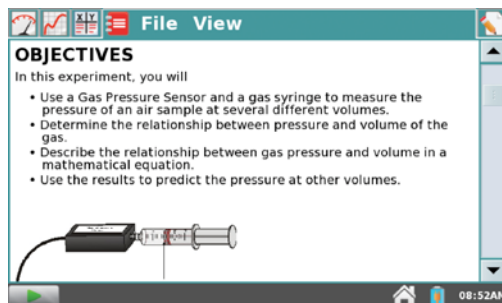
 **Table screen** – See a tabular representation of your data, create calculated columns, and manually enter data. For a detailed description of how the Table screen is used for data analysis, see [Manipulating Data from the Table Screen](#).

 **Lab Instructions screen** – Access one of over 100 preloaded experiments for paperless instructions (more experiments are available online). For detailed instructions on adding additional experiments to LabQuest, see [Viewing Vernier Lab Instructions](#).

 **Notes screen** – Record observations about your experiment. For more information, see [Adding Notes to Your Experiment](#).




Site (#)	Flow (m/s)	DO (mg/L)	Temp (°C)
1	0.65	7.2	8.4
2	0.57	7.4	8.5
3	0.34	7.3	8.9
4	0.34	7.0	10.0
5	0.37	6.8	10.4
6	0.32	6.6	10.9
7	0.30	6.5	11.5

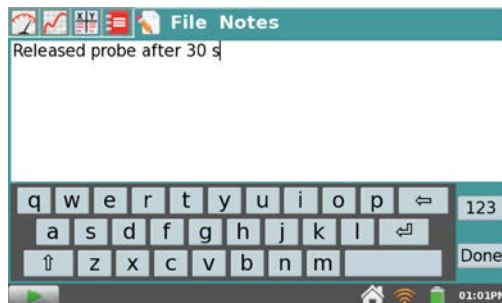


OBJECTIVES

In this experiment, you will

- Use a Gas Pressure Sensor and a gas syringe to measure the pressure of an air sample at several different volumes.
- Determine the relationship between pressure and volume of the gas.
- Describe the relationship between gas pressure and volume in a mathematical equation.
- Use the results to predict the pressure at other volumes.





Released probe after 30 s

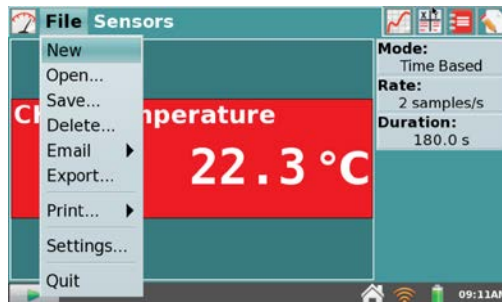
q w e r t y u i o p 123
a s d f g h j k l
↑ z x c v b n m Done

File Menu

A LabQuest App file can contain data-collection settings, graphs, data tables, analyses, and even notes. These files have a *.qmb1* extension and can be saved to the internal storage space on LabQuest or to an external storage space such as a USB flash drive or microSD card. LabQuest App files can also be opened and manipulated on a computer with *Logger Pro* software.

All five tabs within LabQuest App share the same File menu, which is similar to the File menu on a computer. From the File menu, you can perform a number of tasks related to LabQuest App files, such as opening, saving, and closing files, adjusting file settings, printing, and more. These are described in more detail as follows.

- **New** – Choose New from the File menu to reset all data-collection parameters and sensor calibrations back to default values. If you have unsaved data, you will be prompted to either save or discard the data before continuing.















File Sensors

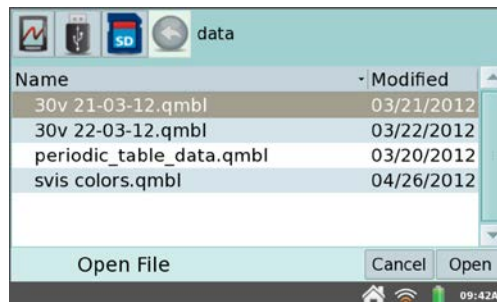
- New
- Open...
- Save...
- Delete...
- Email
- Export...
- Print...
- Settings...
- Quit

Temperature

22.3 °C

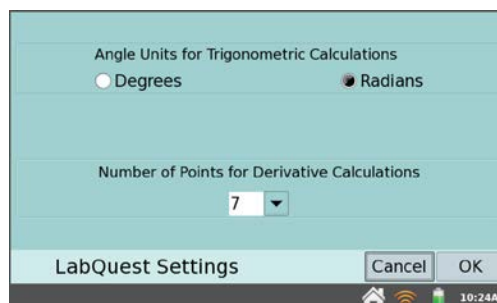
Mode: Time Based
Rate: 2 samples/s
Duration: 180.0 s

- **Open** – Choose Open from the File menu to display a list of files that you have saved on LabQuest. To open a file, tap the file name, then tap Open. To open a file from an external storage source, tap the source icon (, , ) to display the files available on that source, then tap on the file name, and tap Open.
- **Save** – Choose Save from the File menu to display the Save As dialog box where you can tap on a source icon (, , ) to select a destination, then tap in the File name field to assign a name to the file.
- **Delete** – Choose Delete from the File menu to display a file list similar to that accessible by choosing open. Tap on a source icon (, , ) to select the source where the file is located, tap the desired file name, then tap Delete. You can delete only one file at a time.
- **Email** – Choose Email from the File menu to email the Data File, Graph, Text File, or Screen Shot from the current file when LabQuest is connected to a wireless network with Internet. For detailed instructions on setting up this feature, see [Emailing from LabQuest](#).
- **Export**– Choose Export from the File menu to export the current data file in a text format for use with other applications. Tap on a source icon (, , ) to select a destination, then tap OK to complete the export.



A typical use of this feature is to export a text file to an SD card or a USB flash drive for further data manipulation on a computer with a spreadsheet program. The exported file contains all column values from all runs in the current session, delimited by tabs. For more detailed instructions on using this feature, see [Storing LabQuest App Files](#).

- **Print** – Choose Print from the File menu to print the Graph, Table, Lab Instructions, Notes, or Screen from the current file to a USB or Wi-Fi-enabled printer. For detailed instructions, see [Printing from LabQuest](#).
- **Settings** – Choose Settings from the File menu to adjust file settings for the current session. These settings are specific to and saved within the LabQuest file. These settings return to the default upon choosing New from the File menu.
 - **Angle Units for Trigonometric Calculations** – Calculated columns, curve fits, and modeled functions may use trigonometric calculations; choose Degrees or Radians here. The default is set to radians.
 - **Number of Points for Derivative Calculations** – Calculated columns, curve fits, modeled functions, and even the automatic setup for sensors (e.g., Motion Detectors) may use numerical derivatives. The algorithm for such derivatives utilizes a user-defined number of points. The default value of seven points is good for many experiments, but you may want to choose a larger number for human-scale Motion Detector experiments (e.g., our



Motion Match lab), or a smaller number for cart-based Motion Detector experiments (e.g., our Impulse and Momentum lab).

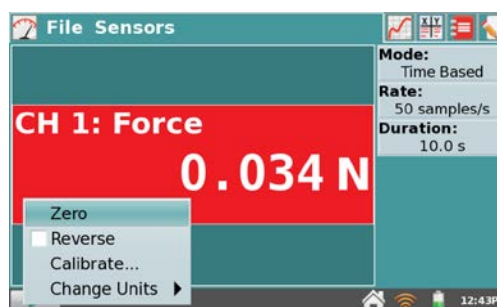
- **Quit** – Choose Quit from the File menu to exit LabQuest App. Since other applications can run simultaneously with LabQuest App, there is typically no need to quit LabQuest App during standard use.

Data Collection

Data collection with LabQuest starts from the Meter Screen, which is the default screen for LabQuest App. From this screen, you can view sensor meters in real time as well as a summary of the data-collection settings. Additionally, you can access tools to modify and customize these settings for your particular experiment.

Digital Meters





A digital meter for each connected sensor is shown on this screen. Tap on a meter to change the sensor's settings. The available options will depend on the sensor and may include options to change the units, calibrate, zero, and reverse the sensor. These options can also be accessed from the Sensors menu.



Data-Collection Summary

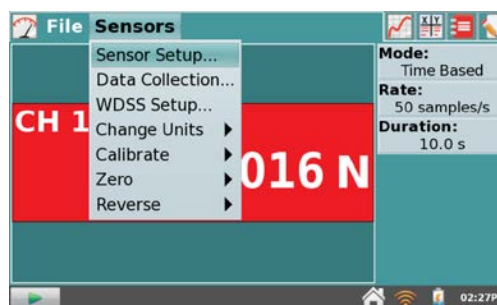
A summary of the data-collection settings (Mode, Rate, Duration) is shown in the panel to the right of the Meter screen. For most sensors, the default data-collection mode is Time Based. The default collection rate for the connected sensor is automatically set up when LabQuest identifies the sensor. To modify the data-collection settings, tap the summary box. Alternatively, you can choose Data Collection from the Sensors menu. For detailed descriptions of data-collection modes and parameters, see [Data-Collection Settings](#).

Data-Collection Controls

To start data collection from any LabQuest App screen, tap Collect . During data collection, tap Stop  to end data collection early. In selected data-collection modes (e.g., Events with Entry), a Keep button  will appear to the right of the Stop button. In this mode, you must tap  to record the data point in the data table. For more information, see [Events with Entry](#).

Data-Collection Settings

The Sensors menu provides access to detailed setup controls. Use this menu to set up internal sensors, non-auto-ID sensors, and the Wireless Dynamics Sensor System (WDSS). You can also use this menu to change the data-collection parameters and adjust sensor-specific settings.



- **Sensor Setup** – Choose Sensor Setup from the Sensors menu to view connected sensors. To manually set up non-auto-ID sensors, tap

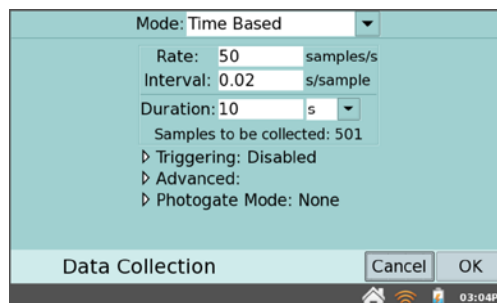
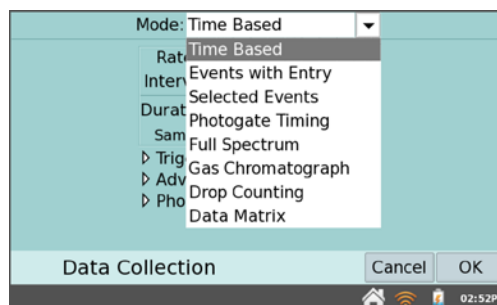
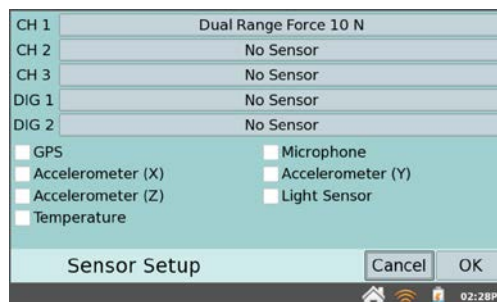
the field displaying “No Sensor” for the channel to which your sensor is connected. Then choose the appropriate sensor from the list and tap OK.

You can also activate (or deactivate) the internal sensors from the Sensor Setup dialog box. Select the check box next to the desired sensor to make that sensor available for data collection.

- **Data Collection** – Choose Data Collection from the Sensors menu to set the data-collection mode and associated parameters. The parameters listed will depend on the mode selected.

- **Mode: Time-Based** – Time-based data collection is the default data-collection mode for most sensors. In this mode, sensor readings are recorded at regular time intervals.

Adjustable parameters for this mode include the rate (or interval) and duration of data collection. The total number of samples to be collected based on these parameters will be displayed.

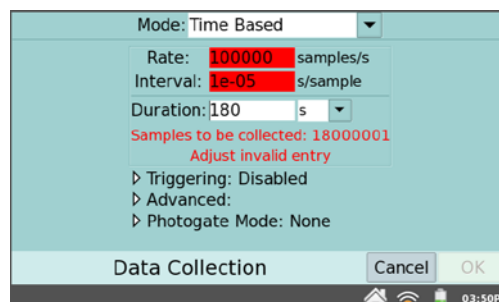
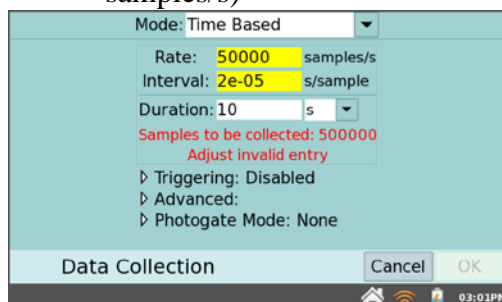


Warning Messages

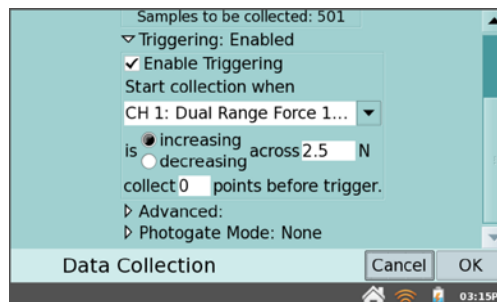
Under some circumstances, the Rate and Duration fields may be highlighted in yellow or red. The *yellow* warning indicates that the rate has been set to a value slower or faster than what is recommended for the connected sensor, or that the number of samples could lead to performance issues. You can still collect data using these settings; however, you may have undesirable results.

The red warning indicates one of the following, and you cannot exit the dialog box until the warning condition has been resolved:

- The rate has been set to a value slower or faster than what a connected device and/or sensor configuration can support
- The number of samples exceeds the storage available
- The number of samples exceeds 2000 (for rates faster than 80,000 samples/s)

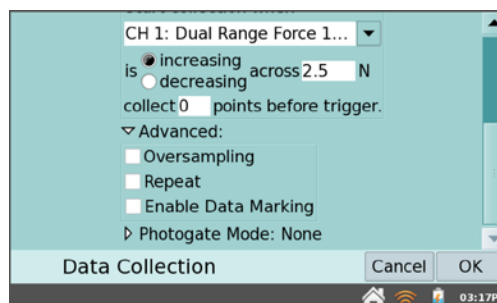


Triggering – Triggering is only available in the Time Based mode. When enabled, LabQuest waits for a trigger condition to be met before beginning data collection. To set the trigger condition, choose the sensor and set the threshold condition. You can also set the number of points to be saved before the trigger condition is met.





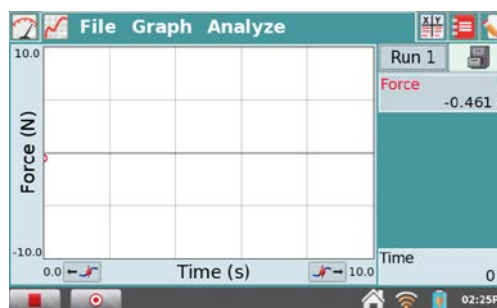
Advanced – The Advanced field has three options that can be independently enabled by selecting the associated check box.

Oversampling can be used with data-collection rates less than ten samples per second. When enabled, the sensor will sample at a higher rate than the number of samples per second that you set, and then LabQuest averages those readings and records the averages in the data table. This setting can be used to reduce measurement noise by combining a burst of readings into one value. As an example, oversampling can sometimes reduce the influence of unseen but real variations, such as those from a flickering light source.



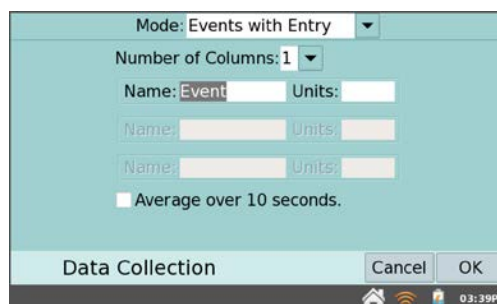
Repeat can be used with data-collection rates less than 250 samples per second. When enabled, a new data-collection run is started as soon as the current run has ended. Data for each run is overwritten when a new run is started. This setting is helpful when doing exploratory investigations.


Data Marking can be used to mark points of interest during a time-based data collection. When enabled, a Mark Data button  will appear during data collection. Tap  to mark that particular point as a point of interest. After completing data collection, data marks can be named using the panel to the right of the graph.

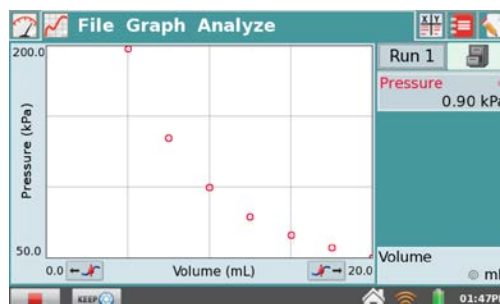


- **Mode: Events with Entry** – Sometimes experiments depend on a quantity other than time. For example, in a Boyle's law experiment, one wants to know the pressure as a function of the volume of gas. In Events with Entry mode, no time information is recorded.

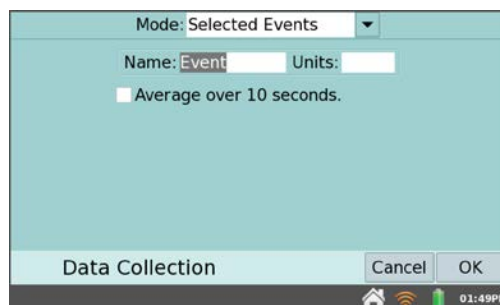
Enter a name and units for each independent variable. You also have an option to average data over ten seconds and report the averaged reading.



In Events with Entry mode, a Keep button  appears during data collection. Tap Keep to record the sensor value (e.g., gas pressure in the Boyle's law experiment). In response, LabQuest prompts you to enter a value for the independent variable (e.g., gas volume in the Boyle's law experiment). Sensor data is plotted against the independent variable, as shown in the screenshot at the right.

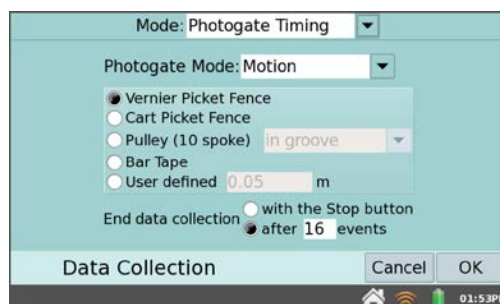


- **Mode: Selected Events** – Selected Events mode is similar Events with Entry, except that entries of 1, 2, 3... are automatically recorded as the independent variable. No time information is recorded in Selected Events mode.



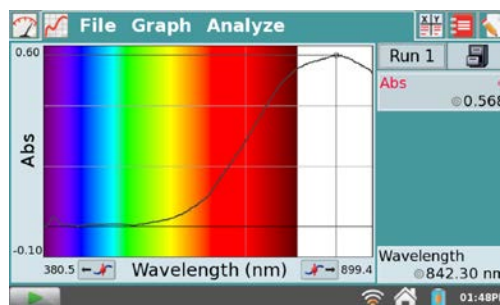
- **Mode: Photogate Timing** – Photogates require a different set of timing options. When a photogate is detected, LabQuest enters the Photogate Timing mode.

You have two options for ending data collection in this mode: tap Stop, or end collection after a defined number of events. A block/unblock pair counts as two events. Choose the proper Photogate Mode for your experiment. For more information, see www.vernier.com/til/1623/



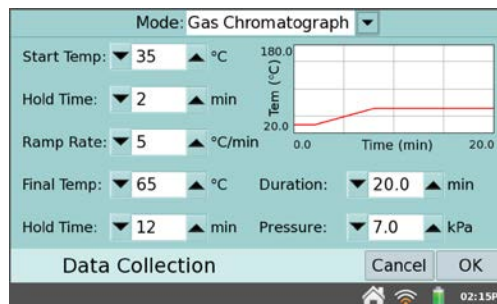
- **Mode: Full Spectrum** – When a spectrometer is detected, LabQuest enters the Full Spectrum mode. In this mode, Intensity, Absorbance, Fluorescence (SpectroVis Plus only), or %Transmittance can be measured as a function of wavelength.

Detailed instructions for setting up data collection with spectrometers are included in each of our [spectrometer labs](#).



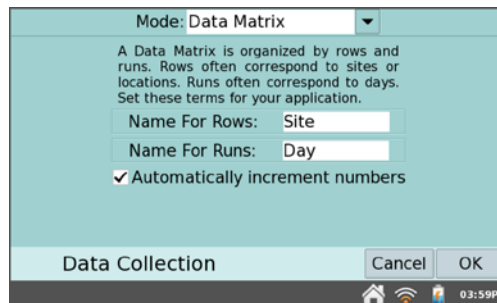
- **Mode: Gas Chromatograph** – When a Vernier Mini Gas Chromatograph (Mini GC) is detected, LabQuest enters the Gas Chromatograph mode. In this mode, various parameters are defined for the user to establish a temperature and pressure profile adequate for the current experiment.

When the mode is first entered, a set of default parameters is displayed. Tap the parameter field to enter a new value, or adjust the default value using the arrows. These values will be reflected in the preview of the time-dependent temperature graph displayed at the right. After setting the parameters, tap OK to initiate the Mini GC warm up.

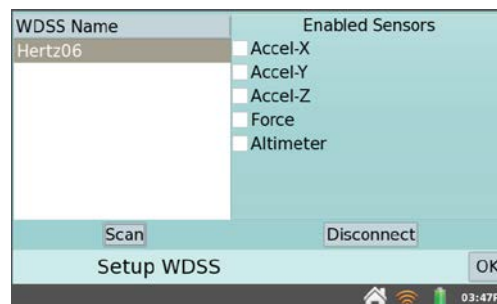


For more detailed information on the Vernier Mini Gas Chromatograph, see www.vernier.com/gc2-mini/

- **Mode: Drop Counting** – This mode is used with the Vernier Drop Counter. When using this mode, data points are recorded every time a drop is detected by the drop counter. For information on calibrating a drop counter, see www.vernier.com/files/manuals/vdc-btd.pdf
- **Mode: Data Matrix** – This mode is helpful for field work. It provides a way to collect data referenced to two parameters, such as the locations of your sampling sites and the dates they were sampled. You can collect data from an unlimited number of sensors by swapping the sensors in and out of LabQuest during data collection. For more detailed information, see www.vernier.com/til/2366/
- **WDSS Setup** – Choose WDSS Setup from the Sensors menu to scan for, select, and configure Wireless Dynamics Sensor Systems. Turn on the WDSS and note its name. Tap Scan to create a list of available WDSS devices. The scan may take 20 to 30 seconds and may have to be repeated several times to find your particular WDSS. Once a scan has found your WDSS, select its name in the list, then tap OK.



Select the check box(es) to enable the sensor(s) you want to use. Tap OK to complete the setup. Adjust the data collection parameters by choosing Data Collection from the Sensors menu. See [Data-Collection Settings](#) for more information.



Note: WDSS cannot be set up for remote data collection using LabQuest. Use Logger Pro on a computer to set up WDSS for remote use.

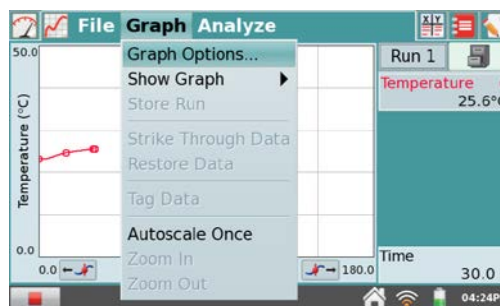
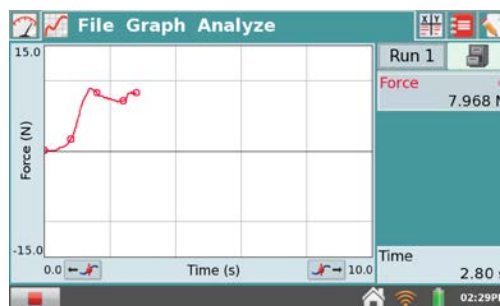
LabQuest App

- **Change Units** – In some cases, you may have the option to display the sensor data in another set of units. Choose Change Units from the Sensors menu to select a different set of units. Choosing a new unit will change all existing runs for that sensor to the new unit, as well as any subsequent runs. If this feature is grayed-out in the menu, then the data for that particular sensor cannot be displayed in another set of units.
- **Calibrate** – Most sensors use a custom factory calibration identified by LabQuest. However, some sensors do require calibration, and you will use the Calibrate tool accessible from the Sensors menu. Follow the detailed calibration instructions provided in the booklet included with the sensor. Booklets are also available online at: www.vernier.com/support/manuals/
- **Zero** – Choose Zero from the Sensors menu to set the current sensor reading to zero. This adds an offset to the current reading. Not all sensors can be zeroed.
- **Reverse** – Some sensors read both positive and negative values. For example, the Dual-Range Force Sensor reads positive values when pulled, and negative when compressed, by default. Choose Reverse from the Sensors menu to swap the sign of the readings with respect to the default settings. Not all sensors can be reversed.

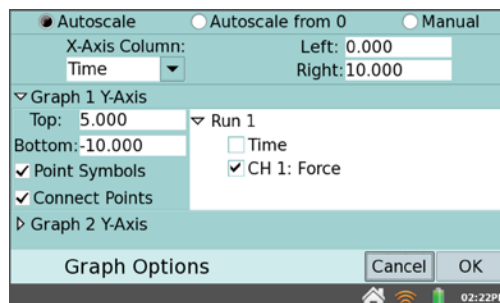
Graph Settings

LabQuest App displays the Graph screen when data collection begins. From this screen, you can adjust graph settings during data collection. You can choose what is plotted, how the graph is scaled, and how the data is formatted.

- **Graph Options** – To control how the data are graphed, choose Graph Options from the Graph menu. Here you can choose the columns used for the x- and y-axes and the axes limits. See [Adjusting the Graph View](#) for more information.

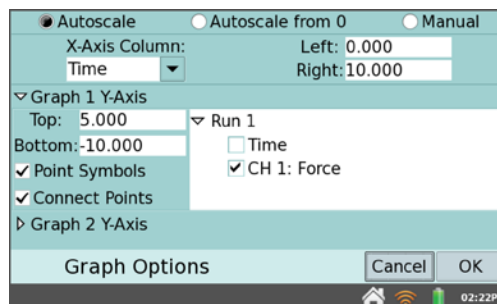


Select **Autoscale** to adjust to the data range after data collection ends. **Autoscale from 0** does the same, but includes the origin. **Manual** scaling will respect values entered in the range limits, unless incoming data falls outside the range. In this case, the range will expand to include the data. To enter range limits, tap in each field and use the keyboard to enter numeric values.



The **Point Symbols** option is selected by default, and will surround some, but not all, of the points with a mark (e.g., a circle or triangle). This allows easy identification of a trace by the corresponding mark in the graph legend. Select the checked box to disable this feature.

The **Connect Points** option connects data points with straight-line segments. These lines help the eye follow the data trend, but in some cases are not appropriate. Select the checked box to disable this feature.



From this screen, you also select the data to be graphed. For the x-axis, choose the desired column from the **X-Axis Column** dropdown menu. For the y-axis, select one or more columns from the run(s) listed under the expanded **Graph 1 Y-Axis** field.



LabQuest can display a single graph, or two graphs sharing a common x-axis and range. Tap the triangle next to **Graph 1 Y-Axis** or **Graph 2 Y-Axis** to show or hide the settings for that axis. If no column is selected for Graph 2, only one graph will be drawn.

When you are done setting Graph Options, tap OK to return to the Graph screen.

Data Analysis

You can analyze data from the Graph screen  or the Table screen . LabQuest analysis features are described in greater detail, below.

Examining Data on the Graph Screen

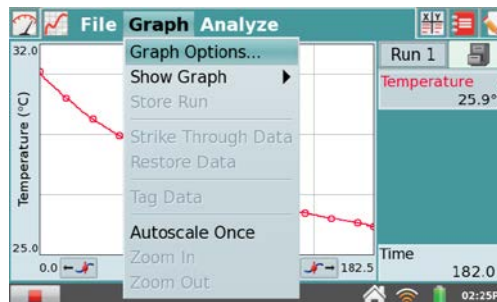
To examine data on the Graph screen, tap on a data point of interest. The Examine cursor jumps to the data point with the nearest x-value. Cursor lines highlight the x- and y-axis values, and the right-side readouts display the associated numerical values of the examined point. You can make fine adjustments to the cursor location by using the Left Examine Button  and Right Examine Button  located on either side of the horizontal-axis label.

In some cases, you may want to examine data for a particular region on the graph. To select a portion for analysis, tap and drag across the desired region. You can adjust the trailing endpoint of the selected region using the Examine Buttons, if needed. For greater control, you can opt to use the stylus.

Adjusting the Graph View

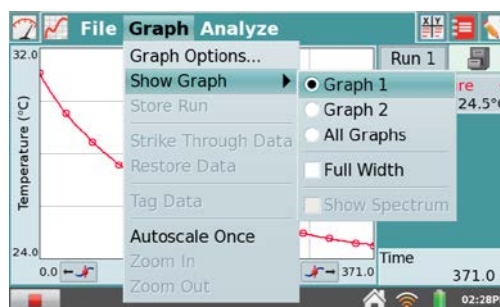
You can adjust the graph view in real time during data collection by applying one of the following actions from the Graph menu.

- **Graph Options** – Tap Graph Options to manually adjust graph settings. To adjust the graph view, change the values in the Left and Right fields for the x-axis and y-axis.



- **Show Graph** – Choose Show Graph from the Graph menu to quickly jump between displaying one or two graphs. You can also choose the Full Width option to remove the data collection summary box and maximize the graphs on the screen.

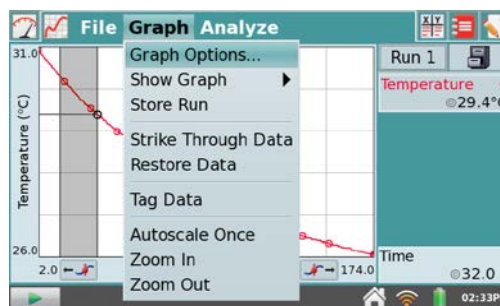
When using spectrometers to collect intensity data, the spectrum is displayed on the graph background by default. Accordingly, Show Spectrum is selected under the Show Graph options. To hide the spectrum, choose Show Spectrum from Graph Options and select the checked box to remove the selection.



- **Autoscale Once** – Choose Autoscale Once from the Graph menu to scale the graph to the data you have collected so far. **Note:** The graph will automatically rescale larger to show data collected that would otherwise be off the graph.
- Tap on a graph axis label to change the data that is plotted on that axis.

Once data collection has ended, zoom options are also available.

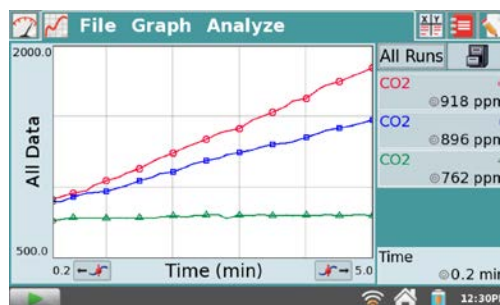
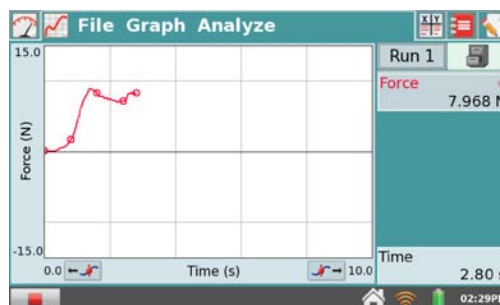
- **Zoom In** – Select a region on the graph, then tap Zoom In to automatically adjust the axes for viewing the selected region.
- **Zoom Out** – Tap Zoom Out to undo a Zoom In and return the graph axes to the previous settings. If Zoom In is used several times, Zoom Out will undo each Zoom In, one at a time.



Collecting multiple runs

- **Store Run** – You can collect several runs for comparison. Choose Store Run from the Graph menu to save the current run and proceed with data collection. As a shortcut, tap the File Cabinet icon.

To collect another run, tap Collect. Your new run is displayed on the graph. To see your first run, tap the Run 2 button to the left of the Filing Cabinet, and select either Run 1 or All Runs. In this way, you can gather multiple runs for comparison, and view just the ones you want.



Striking and Tagging Data from the Graph Screen

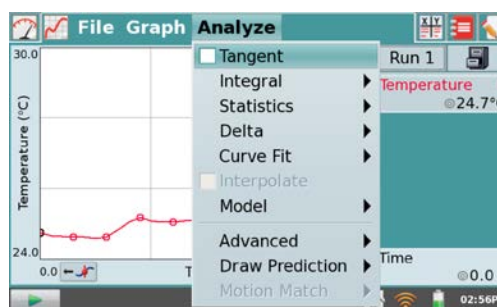
To strike or tag data from the graph screen, tap on the data point or tap and drag to select a region of data. Then, choose the desired tool from the Graph menu and the action will be applied to the data.

- **Strike Through Data** and **Restore Data** – Use these tools to ignore/restore selected data. Struck data are ignored for analysis and graphing, and the graph will update accordingly. To restore all data, tap the Graph menu and choose Restore Data.
- **Tag Data** – Use this tool to tag a data point with a comment. After selecting the point and tapping Tag Data, a large mark (e.g., a circle or square) will be displayed on the graph to tag the data. To add a comment, tap in the panel to the right of the graph and enter a comment into the blank field.

Analyzing Data from the Graph Screen

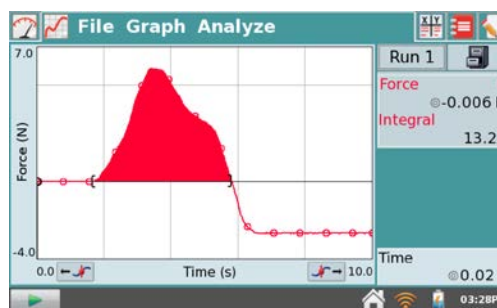
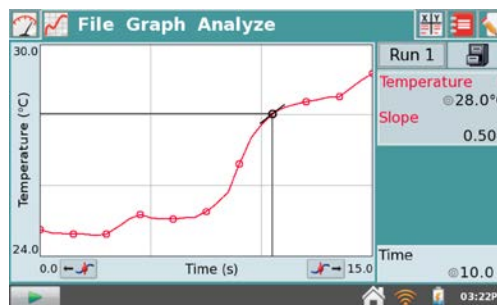
The Analyze menu on the Graph Screen gives you access to additional tools such as tangent lines, integrals, statistics, and curve fits. To apply one of these tools, choose the desired tool from the Analyze menu. If prompted, select the desired column.

Upon enabling an analysis tool, a summary of analysis information is displayed in a panel to the right of the graph. Scroll arrows will appear, if needed. You can tap the summary to display the values on a detail dialog for ease of reading.

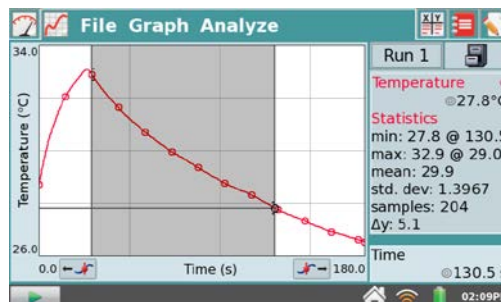


The following analysis tools are available from the Analyze menu.

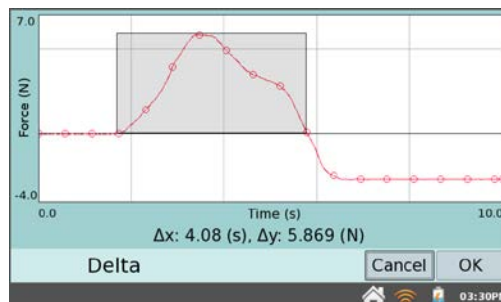
- **Tangent** – The Tangent mode enhances the Examine cursor by adding a tangent line and numeric display of the slope as you tap different locations on the graph.
- **Integral** – The Integral tool numerically integrates graphed data. Select a region, if needed, and choose Integral from the Analyze menu. Enable the tool by tapping on the displayed sensor or column name. The integral is drawn and the numeric result is displayed in a panel to the right of the graph.



- Statistics** – The Statistics tool displays statistics for graphed data. Select a region, if needed, and choose Statistics from the Analyze menu. Enable the tool by tapping on the displayed sensor or column name. Descriptive statistics are displayed in a panel to the right of the graph. If a region is selected, brackets are drawn to indicate the region used for calculations.



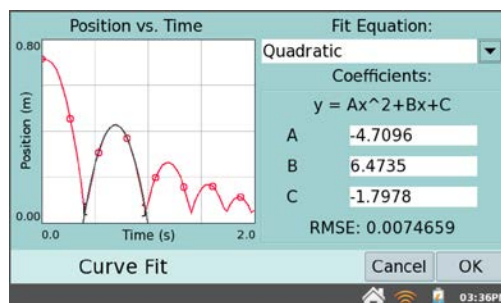
- Delta** – The Delta tool opens a preview window where you can examine x- and y-deltas. Choose Delta from the Analyze menu to open the preview window. Then, tap and drag to create a box overlaid on the graph. The vertical side of the box yields Δy , and the horizontal side of the box yields Δx . Tap OK to keep these values and display the box on the Graph screen. To exit the Delta tool without displaying the box on the Graph screen, tap Cancel.



- Curve Fit** – The Curve Fit tool fits a chosen function to your data. If a region of the graph is selected, only that region is used for fitting. If there is no selection, the entire graph is used.

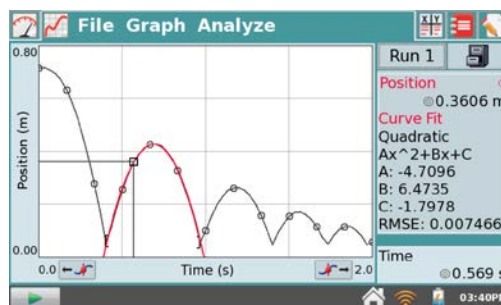
Choose Curve Fit from the Analyze menu. In the Choose Fit list, choose the desired equation.

LabQuest displays the fit in the preview graph at the left. The fit coefficients and Root Mean Square Error (RMSE) are also displayed. Tap OK to keep this fit and display the curve on the Graph screen. To exit the Curve Fit tool without applying the curve, tap Cancel.



Tip: The RMSE (root mean square error) is a measure of how well the fit matches the data. The smaller the RMSE, the closer the data are to the fitted line. The RMSE has the same units as the y-axis data.

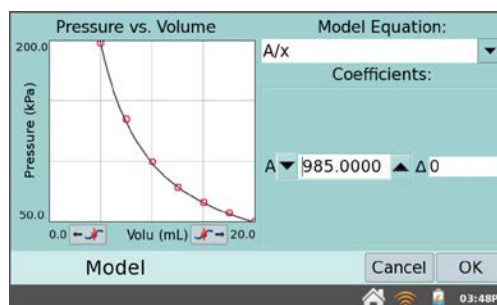
- Interpolate** – Once you have performed a curve fit, you can use the Interpolate tool to read values from the fitted function. Choose Interpolate from the Analyze menu, then tap on the graph. The lines associated with the Examine cursor now locate a position on the fitted function. Coordinates along the fitted line are shown in the panel to the right of the graph. You can tell that LabQuest is in the Interpolation mode by the square Examine cursor.



LabQuest App

- **Model** –The Model tool manually fits a chosen function to your data. Choose Model from the Analyze menu, then choose the desired model equation from the Model Equation list. LabQuest displays the modeled function in the preview graph at left.

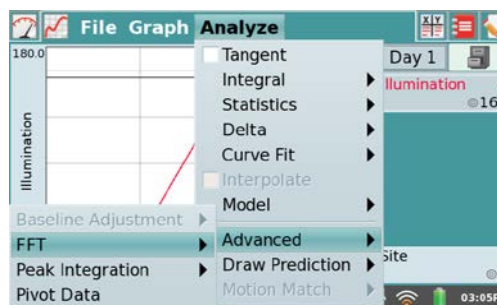
The model parameters (e.g., A, B, and C) are adjustable. Change them by direct entry or by using the arrows.



Tap OK to keep this function and display the modeled function on the Graph screen. To exit the Model tool without applying the function, tap Cancel.

Tip: If no function appears when modeling, your parameters are defining a curve that is outside of the plot window.

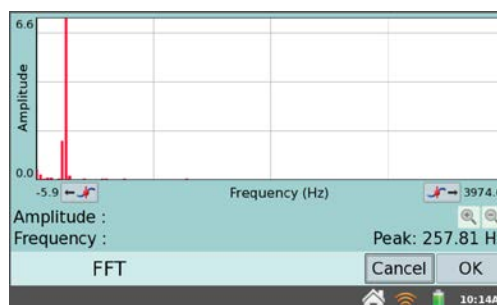
- **Advanced** – Choose Advanced from the Analyze menu to access advanced analysis tools including a Baseline Adjustment, Fast Fourier Transform (FFT), and Peak Integration.



- **Baseline Adjustment** – This tool applies a factor that raises or lowers the x-axis. Because LabQuest App uses the x-axis as its baseline when calculating an integral, adjusting the baseline may result in a better integral. This tool is typically used when analyzing Spirometer data.

- **FFT** – The FFT tool calculates a Fast Fourier Transform of the selected data. The FFT is displayed in a separate graph that can be analyzed. Tap OK to return to the main graph. The peak frequency will be displayed on the graph legend. The FFT tool is typically used when analyzing Microphone data. For more information, see:

www.vernier.com/til/2310

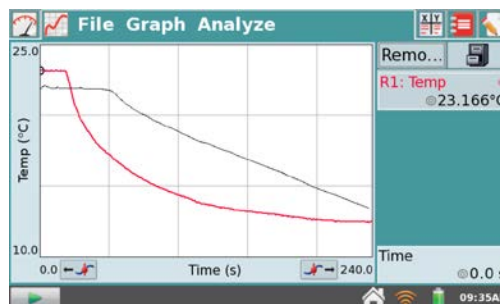


- **Peak Integration** – This tool calculates the integral for a selected portion of a graph. It is most commonly used with the Vernier Mini GC, but it can be applied to any data plot. Peak Integration differs from the Integral tool in that it does not use the x-axis as the baseline. Instead, the integral for Peak Integration is evaluated from the minimum y-values to the left and right of a selected peak.
- **Pivot Data** – This tool is only available in Data Matrix mode. It transposes the rows (usually graphed as the x-axis and representing the sampling site) with the runs (usually selected by tapping on the button to the left of the Filing Cabinet and representing the sampling day). This allows field data to be viewed as the location changes, or pivoted and viewed as the day changes.

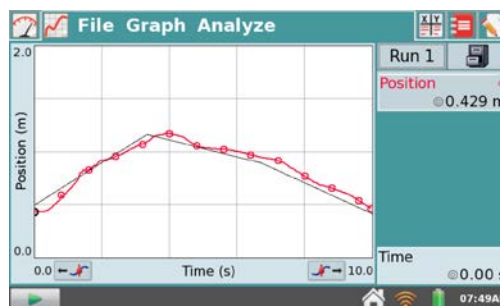
LabQuest App

- **Draw Prediction** – The Draw Prediction tool is a free-hand sketch tool for drawing on the Graph screen. This can be used for a variety of purposes, but is most often used to sketch a prediction of how a graph will appear once data are subsequently collected.

Choose Draw Prediction from the Analyze menu. Then, tap and drag across the screen for smooth curves, or tap the screen to connect subsequent taps with straight-line segments. The Reset button removes your sketch if you need to start over. Tap OK to place your sketch on the main graph. To remove a prediction, choose Draw Prediction again from the Analyze menu.



- **Motion Match** – The Motion Match menu item is only available if a Motion Detector is connected. Choose between a new Position or Velocity match. In each case, LabQuest generates a random target graph for the matching exercise. Only the selected graph, Position or Velocity, is shown. You may collect data over the target graph as many times as you like using the Collect button. To see a new target graph, choose New Position Match or New Velocity Match. Remove Match removes the target graph.



Tip: For additional information on using Motion Detectors with LabQuest, see www.vernier.com/tit/5

Adjusting the Table View

In addition to viewing and manipulating data from the Graph screen, you can also access data from the Table screen. There are several shortcuts on this screen. Alternatively, you can also access the fields by choosing Data Column Options from the Table menu.

- Tap Run 1 in the name field to rename the run.
- Tap a column header (Time, Position, etc.) to change the column name, units, or displayed precision.

Time (s)	Position (m)	Velocity (m/s)	Acceleration (m/s ²)
0.80	0.589	0.328	-1.209
0.85	0.576	0.203	-0.249
0.90	0.595	0.309	0.696
0.95	0.612	0.341	0.546
1.00	0.631	0.361	0.305
1.05	0.649	0.361	0.191
1.10	0.666	0.370	0.302
1.15	0.685	0.391	0.492
1.20	0.706	0.422	0.621

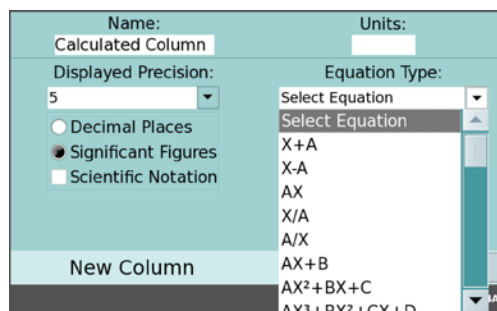
Manipulating Data from the Table Screen

The Table menu allows you to create, modify, or delete columns of data. The following tools are available from the Analyze menu:

- **New Manual Column** – New Manual Column creates an empty column where you can enter or generate values directly. You can add a manual column to a data set that includes sensor data, or you can create a new data set consisting entirely of manually entered data.

Time (s)	Position (m)	Velocity (m/s)	Acceleration (m/s ²)
0.00	0.027		
0.05	0.060		
0.10	0.130		
0.15	0.270		
0.20	0.471		
0.25	0.663		
0.30	0.806		
0.35	0.867		
0.40	0.799		


- New Calculated Column** – New Calculated Column creates a new column whose values are based on other columns by a mathematical formula. Tap the Name field to enter a name for the new column, tap the Units field to enter the units, and then select an equation from the Equation Type list. For example, you might define a calculated column as the inverse square of another column. After creating a calculated column, you can display the calculated data on a graph, or manipulate it further with additional calculated columns.
- Data Column Options** – This allows you to access the fields for setting the column name, units, and displayed precision. Alternatively, you can access these fields by tapping on the column name from the Table screen.
- Delete Data Column** – This allows you to delete a manual or calculated column of data. Note that you cannot delete data collected from a sensor; however, you can hide data using the [Strike Through Data](#) tool.
- Delete Run** – If you have stored at least one run using the [Store Run](#) tool, this option will be available in the Table menu. Upon choosing Delete Run, tap the desired run name to delete the run. You will not be able to delete the last run created.
- Clear All Data** – This action will clear all data in the table. Upon choosing this option, you will be prompted to confirm. This option is used when you wish to clear previously collected data without changing any of the data collection parameters or sensor setup information.
- Strike Through Data and Restore Data** – Use these tools to ignore/restore selected data. Struck data are ignored for analysis and graphing, and the graph will update accordingly. To restore all data, choose Restore Data from the Table menu. Note that you can also access these tools from the Graph menu on the Graph screen.
- Tag Data** – Use this tool to tag a data point with a comment. After selecting the data point within the table, choose Tag Data from the Table menu. A circle will be displayed on the Graph screen to “tag” the data. To add a comment, tap the Graph tab, then tap the info panel to the right of the graph. A list of Data Tags will be displayed. Tap in the blank field to enter a comment for the tag.
- Edit** – This tool allows you to copy and paste values from one location to another. In particular, you might copy a range of values from the table and paste them into notes on the Notes screen.



Additionally, when LabQuest is in the Data Matrix mode, an Advanced Menu is displayed adjacent to the Table menu. Choose **Pivot Data** from the Advanced menu to transpose the rows (usually graphed as the x-axis and representing the sampling site) with the runs (usually selected by tapping on the button to the left of the Filing Cabinet and representing the sampling day). This allows field data to be viewed as the location changes or pivoted to be viewed as the day changes.

Site	Illumination	Temperature (°C)
1	98	23.3
2	167	23.4
3	177	23.4

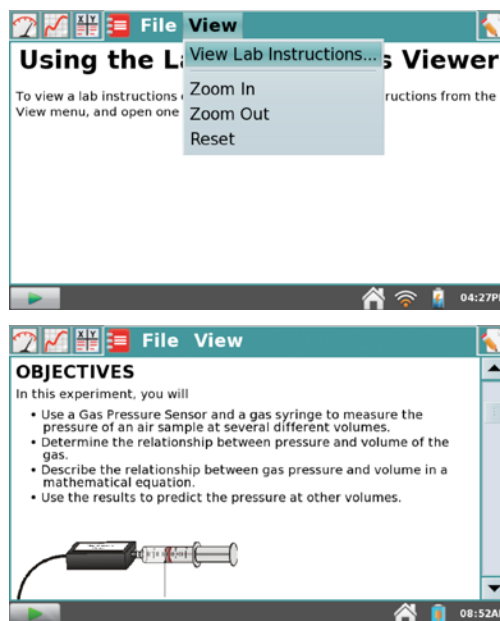
Viewing Vernier Lab Instructions

The Lab Instructions screen, selectable by tapping the Lab Instructions tab , allows students to view lab instructions from Vernier lab books. LabQuest comes preloaded with over 100 experiments. You can easily download experiments from other books that you have purchased and load them onto LabQuest using our easy-to-use web tool, LabQuest Lab Organizer. For more information, see [Adding Experiments to LabQuest](#). You can also create new content using our online LabQuest Lab Creator. For more information, see [Creating Your Own Experiments](#).

Opening Vernier Lab Instructions

From the Lab Instructions screen, choose View Lab Instructions from the View menu. This displays a list of the lab books with experiments preloaded on LabQuest. Select the desired book and experiment, and then tap OK.

In addition to scrolling through the instructions using the scrollbar at right, you can also zoom in on a particular portion of the instructions by choosing Zoom In from the View menu. Choose Zoom Out from the View menu to restore the previous view. Choose Reset from the View menu to restore the original view.



Adding Experiments to LabQuest

If you have purchased Vernier lab books and have experiments in those books that you would like to load onto LabQuest, you can do so using our online tool, LabQuest Lab Organizer. Follow these simple instructions:

1. Visit our web site: www.vernier.com/labquest/organizer/
2. Select the experiments that you wish to add. (Note that you can either select individual experiments or add entire books)
3. Follow the on-screen guide to create and download a LabQuest Library update and save it to a USB flash drive or SD card.
4. Follow the provided instructions to transfer the update from the flash drive or SD card to your LabQuest units.

Creating Your Own Experiments


If you would like to create your own content, you can do so using our online tool, LabQuest Lab Creator. Follow these simple instructions:

1. Visit our web site: www.vernier.com/labquest/creator/

LabQuest App

2. Choose your starting point. You can create a new experiment from scratch, start with a template, or paste an existing experiment into our Lab Creator.
3. Follow the on-screen guide to create your content. Note that you can save your content and finish another time. Click Save, and a web link will be displayed that you can bookmark from your browser for later access.
4. When your content is complete, follow the on-screen guide to preview, name, and download your experiment to a USB flash drive or SD card.
5. Follow the provided instructions to transfer the update from the flash drive or SD card to your LabQuest units.

Adding Notes to Your Experiment

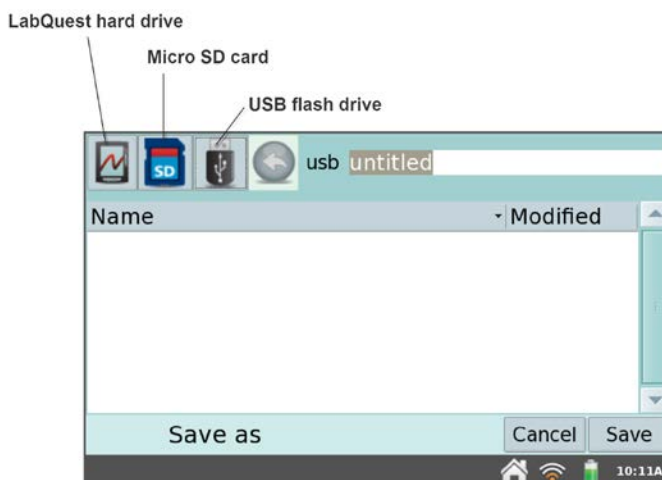
The Notes screen, selectable by tapping the Notes tab , allows students to enter notes as they perform an experiment. The menu provides access to standard edit commands of Cut, Copy, Paste, and Clear All.



Storing LabQuest App Files

LabQuest files have a *.qmb1* extension and can be saved to the internal storage space on LabQuest, or to an external storage space such as a flash drive. LabQuest App files can also be opened and manipulated on a computer with Vernier Logger Pro software.

LabQuest can recognize additional storage space in a connected microSD (Secure Digital) card or a USB flash drive. The drive or card may be formatted in FAT16 or FAT32 (the most common Windows and Mac OS formats) for reading and writing. LabQuest cannot read NTFS or HFS+ formatted drives.



To save a LabQuest App file,

1. If saving to a microSD card or USB flash drive, make sure the drive is inserted in the appropriate port on LabQuest. **Note:** After inserting the drive, wait a few seconds while LabQuest recognizes the drive before proceeding.
2. Choose Save from the File menu. This opens a Save As dialog box.

3. Tap on the appropriate icon to select your storage destination.

 - LabQuest internal hard drive

 - microSD card

 - USB flash drive

4. After selecting your destination, tap on the name field and enter the file name.

5. Tap OK to return to the Save As screen.

6. Tap Save to save the file.

***Note:** You cannot create directories within LabQuest App, but you can use directories that already exist on the SD card or USB drive. We recommend organizing your files on a USB drive or SD card by creating any needed folders on a computer before you use the drive or card with LabQuest.*

Exporting LabQuest App files

In some cases, you may wish to export the LabQuest App file in a text format (.txt) for further analysis within a program other than Logger *Pro*.

To do this, choose Export from the File menu. Follow steps similar to those described in [Storing LabQuest App Files](#), but choose Export from the File menu instead of Save As.

To open the exported .txt file in a spreadsheet program, confirm the program's file browser is set to look for *all* file types. Select your text file.

If you have access to a wireless network with Internet, you can email the data file, graph, text file, or screenshot. For detailed instructions, see [Emailing from LabQuest](#).

IV. USING LABQUEST 2 WITH A MOBILE DEVICE

As part of the Connected Science System[®], LabQuest 2 serves as a Data Sharing source that can wirelessly stream sensor data to Data Sharing apps on mobile devices such as iPad[®] and Android[™] tablets.

How Data Sharing Works

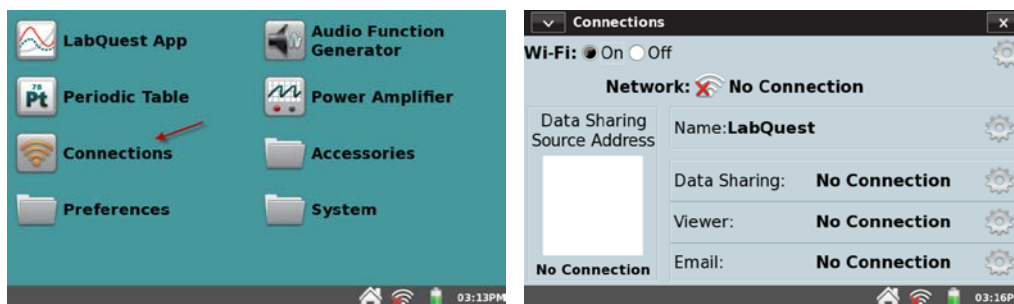
- Students in a lab group set up an experiment with Vernier sensors and a Data Sharing source.
- Students use a Data Sharing app to wirelessly start data collection.
- Experiment data is streamed from the Data Sharing source to each student's Data Sharing app.
- Each lab group member performs an individual analysis on their Data Sharing app.
- Students take their data and analysis home on the Data Sharing app for further analysis and lab reports.

Set Up Data Sharing on LabQuest

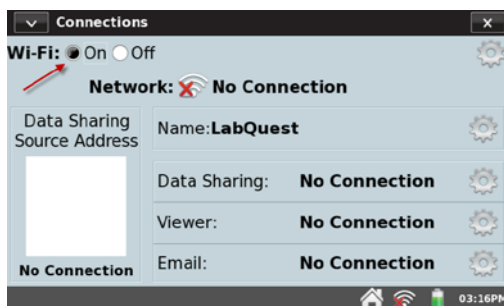
To set up LabQuest as a Data Sharing source, you will need to connect LabQuest to a Wi-Fi Network and enable Data Sharing, described in detail as follows. ***Note:** These instructions are for LabQuest 2.2 or newer.*

Connect LabQuest to a Wi-Fi Network

1. Launch the Connections App from the Home screen.

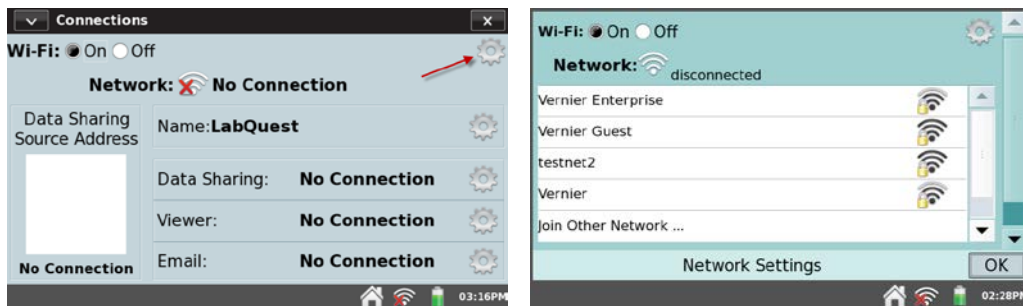


2. Verify Wi-Fi is enabled (On).



Using LabQuest 2 with a Mobile Device

3. Tap the Network Settings gear on the Connections App to open the Network Configuration dialog box. The Network Configuration dialog box lists any networks that LabQuest sees, as well as an option to join networks manually or create your own network.



4. Select a network.

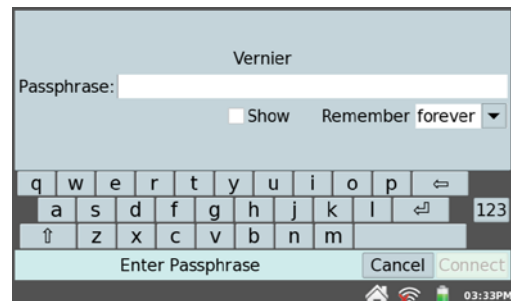
Existing network (Infrastructure Network)

To connect to an existing Wi-Fi network, follow these instructions.

- a. Locate the network within the list and tap on the network name to select it.

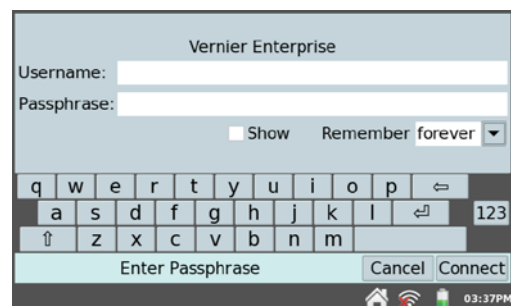


If prompted, enter your network's passphrase and tap Connect.



Note: If your network requires additional network authentication information or if you have an enterprise network that requires a network certificate, see our web site for more instructions:

www.vernier.com/til/2836



Using LabQuest 2 with a Mobile Device

- b. Verify LabQuest is attempting to connect to the network. The network status should say “Connecting.”



- c. Verify LabQuest has successfully connected to the network. The network status should have changed to a numeric IP address.



- d. When LabQuest has successfully connected to the network, tap OK to return to the Connections app.

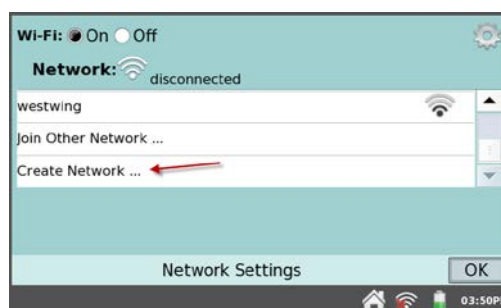
Create a new LabQuest Network (Ad-Hoc Network)

If you do not have access to an existing Wi-Fi network, or are not permitted to access your school's network, you can quickly and easily set up a network with LabQuest 2.

Note: Students can connect to a LabQuest Network with their mobile devices. This network will not support access to the Internet. The email function of LabQuest will not work with a LabQuest ad-hoc network.

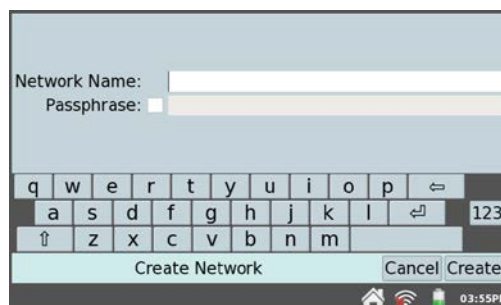
- a. Select Create Network.

Note: If you are in an area with several Wi-Fi networks, you may need to scroll to the bottom of the network list to locate “Create Network.”



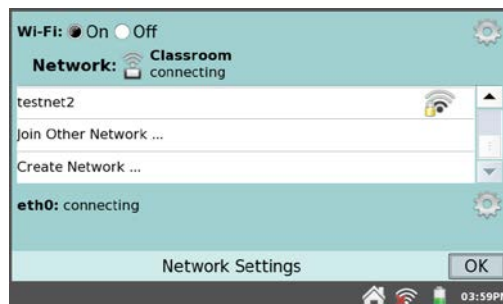
- b. Tap the Network Name field and assign a name to this new network (e.g., Ms. Johnsons classroom). Then, tap Create.

Optional: Protect your network by assigning a password that you will provide only to your students. Select the check box and assign a password to your new network (e.g., Ifrog, scienceisfun!). The Passphrase must meet certain criteria. See our web site for additional information: www.vernier.com/til/2699/



Using LabQuest 2 with a Mobile Device

- c. Verify LabQuest is attempting to connect to the network. The network status should say “Connecting.”



- d. Verify LabQuest has successfully connected to the network. The network status should have changed to a numeric IP address.



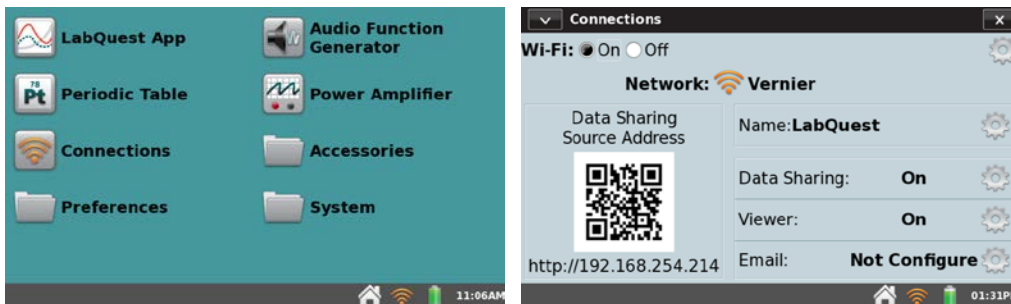
- e. When LabQuest has successfully connected to the network, tap OK to return to the Connections app.

Note: Some Android implementations seem to have trouble viewing and connecting to ad-hoc networks. These devices require the use of an existing (infrastructure) network.

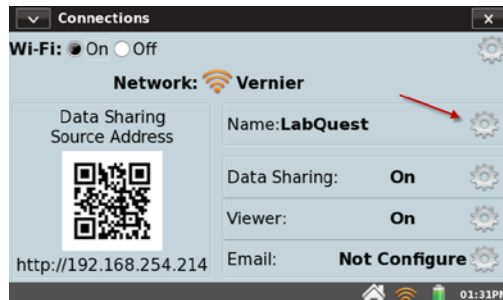
Enable Data Sharing on LabQuest

In addition to connecting to a Wi-Fi network, you will need to set up LabQuest as a Data Sharing Source using the following instructions.

1. Launch the Connections App from the Home screen.



2. *Optional:* To easily identify this LabQuest unit, you can give the unit a unique name. To do this, tap the Name field gear.

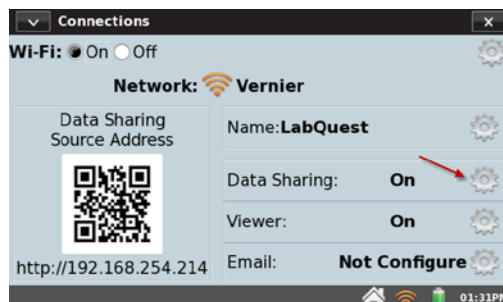


Using LabQuest 2 with a Mobile Device

Tap the Name field to edit the LabQuest name (e.g., LabQuest A). Tap Done to save the name.



3. From the Connections App, tap the Data Sharing gear to open the Data Sharing Settings dialog box.



4. Verify Data Sharing is enabled (On).

Optional: If you want to allow Data Sharing apps on mobile devices to start and stop data collection, select the check box to enable this feature.

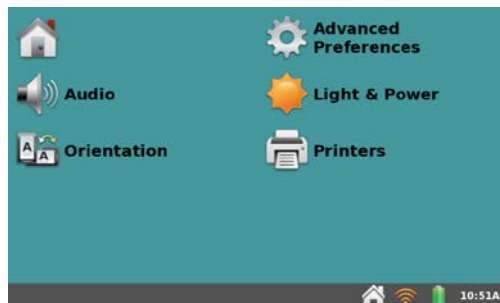


5. Tap OK to save the setup.

Restricting Access to the Connections Setup

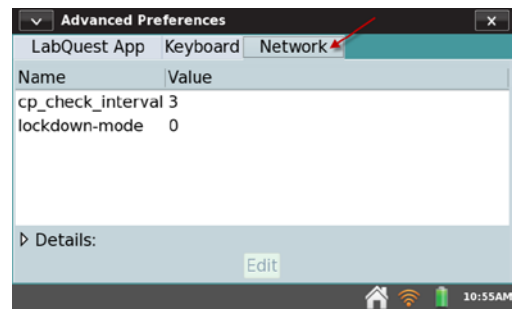
Once your LabQuest is configured as desired, you can set the preferences to restrict access to the Connections setup information. This prevents students from changing your network and Data Sharing settings.

1. Tap Preferences from the home screen, then tap Advanced Preferences.

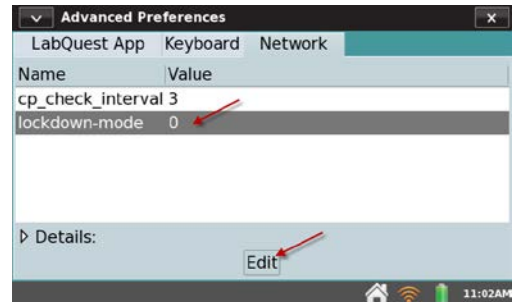


Using LabQuest 2 with a Mobile Device

2. Within the Advanced Preferences dialog box, tap the Network tab.

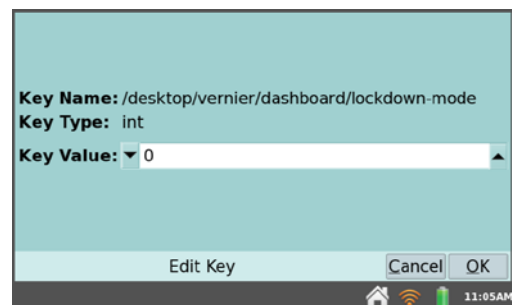



3. Select lockdown-mode and then tap Edit.



4. Change the Key Value using the arrow keys, or tap to enter a value.

- Full access to all settings (**Value = 0**)
Use this setting when you are configuring your Connections settings.
- Access to network settings only (**Value = 1**)
Use this setting when you want to restrict access to settings but want to allow access to different networks.
- Restrict access to all settings (**Value = 2**)
Use this setting when you want to restrict access to all settings, including the network settings.



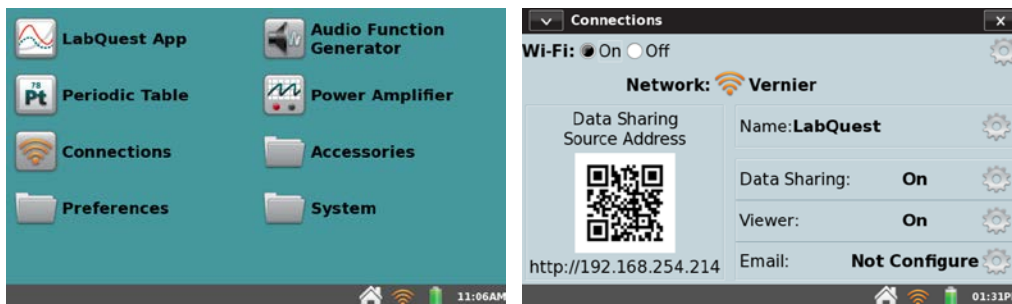
Note: Changes to the Connections main screen will not show if the lockdown mode is changed while the Connections App is running. Tap  to close the application, then launch the Connections App again.

Connect Your Mobile Device to LabQuest

After setting up LabQuest as a Data Sharing source, you can then connect to this source from your mobile device using a data sharing app (Data Share web app or Graphical Analysis for iPad) on that device.

Access LabQuest 2 Data Using the [Data Share Web App](#)

1. Launch the Connections App from the Home screen.



2. Connect your mobile device to the same Wi-Fi network to which you connected LabQuest 2.
3. On your mobile device, open a supported browser and enter the Data Sharing Source Address. Alternatively, if you have a QR code reader on your device, you can access this via the provided QR code.

Access LabQuest 2 Data Using [Graphical Analysis for iPad](#)

1. Connect the iPad to the same Wi-Fi network to which you connected LabQuest 2.
2. Launch Graphical Analysis on the iPad.
3. In Graphical Analysis, tap the Source button in the top-left corner. Discovered Data Sharing Sources will be listed automatically.
4. Tap the name of the LabQuest 2 source to connect. If your LabQuest 2 source is not listed in Data Sharing Sources, you can connect by choosing Specify a Source or Scan Source QR Code.

For information on Graphical Analysis, see the [User Manual](#) on our web site.

V. USING LABQUEST WITH A COMPUTER

Use LabQuest 2 with Logger Lite 1.6 (or newer) or Logger *Pro* 3.8.5 (or newer).

Logger Lite can be downloaded from our web site at:

www.vernier.com/logger-lite/

If you already own a Logger *Pro* 3 license, free updates to Logger *Pro* 3 are available at:

www.vernier.com/updates/logger-pro/

Collecting Data with Logger Lite or Logger *Pro*

To collect data in Logger Lite or Logger *Pro* with LabQuest:

1. Connect a sensor to LabQuest.
2. Connect LabQuest to your computer using the included USB cable. The mini end of the cable connects to LabQuest and the full-sized end connects to an available USB port on your computer.
3. Open Logger Lite or Logger *Pro* on your computer. The computer will detect LabQuest and the attached sensor, and display a graph ready for data collection. LabQuest will display a screen with two arrows indicating it is connected to the computer.
4. Click the Collect button in Logger Lite or Logger *Pro* to collect data.



Transferring Data from LabQuest to a Computer

Automatically Transferring Data

If you collect data in LabQuest App and subsequently connect LabQuest to a computer, Logger Lite or Logger *Pro* will automatically detect the presence of the remote data and display a message indicating the data can be retrieved from LabQuest. Follow the onscreen instructions to download data to the computer.

Manually Transferring Data

To manually transfer saved data from LabQuest, open Logger Lite or Logger *Pro* on your computer and choose LabQuest Browser from the File menu, then choose Open. Choose the desired LabQuest file from the displayed list and click Open. Note that only one LabQuest file can be opened at a time. Once opened on the computer, you may then choose to save the file as a Logger Lite or Logger *Pro* file by choosing Save As from the File menu.

Tip: If sensors are still connected when a LabQuest file is opened in Logger Pro or Logger Lite, the sensors will be ignored. To enable the sensors, choose New from the File menu in Logger Lite or Logger Pro.

Using LabQuest with a Computer

Another method for manually transferring data from LabQuest to Logger Lite or Logger *Pro* is to choose LabQuest Browser from the File menu in the computer software, then choose Import. Import differs from Open in that only the data in the LabQuest file are added to the current computer session. This allows you to compile data from multiple LabQuest sessions into a single computer session for graphing and comparison.

Tip: Compile class results from multiple LabQuest files (or multiple LabQuests) by repeatedly importing data into a single Logger Pro or Logger Lite file.

Manually Moving Data from Computer to LabQuest

Data and/or sensor configurations can be saved to LabQuest from your computer. To do this, open an existing Logger Lite or Logger *Pro* file or set up a new file with the desired data collection settings. Choose LabQuest Browser from the File menu, then choose Save As. Enter a descriptive filename. Any data, as well as the sensor configuration, will be stored on LabQuest as a LabQuest file. Any features in the computer file not existing on LabQuest (such as embedded images, video analysis, graph annotations, or most calculated columns) will be ignored on LabQuest.

Deleting Data on LabQuest

To delete data on LabQuest from Logger Lite or Logger *Pro*, choose LabQuest Browser from the file menu, then choose Delete. Choose the desired file for deletion from the displayed list and click Delete.

Tip: Use this feature to mass delete files from LabQuest by selecting multiple files from the displayed list.

VI. EMAILING FROM LABQUEST

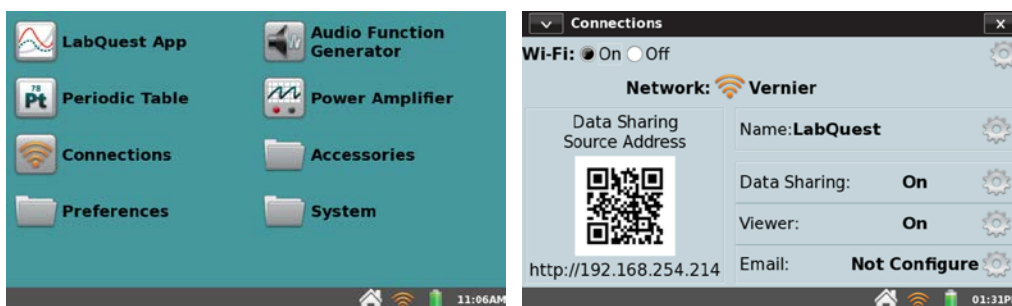
If LabQuest is connected to a network with Internet access, you can email your data file, graph, text file, or screenshot.

To set this up, follow these instructions:

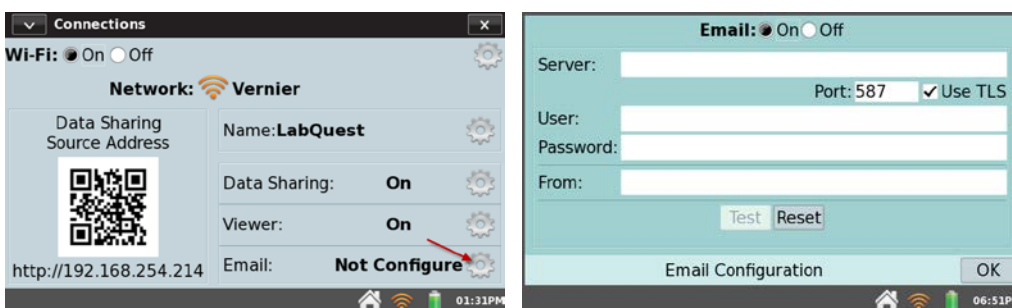
1. Connect LabQuest to a network with Internet access. For detailed instructions, see [Connect LabQuest to a Wi-Fi Network](#).

Note: A LabQuest Network (Ad-Hoc Network) does not have Internet access. You will need to join an existing network with Internet.

2. Launch the Connections App from the Home screen.



3. Tap the Email settings gear to open the Email Configuration dialog box.



Note: If you are not able to access the Email Configuration dialog box, see [Restricting Access to the Connections Setup](#) for more information.

4. Verify email is enabled (On).
5. Enter your outgoing email server information, as well as your username and password, and tap OK. If you don't know your server information, check with your technology specialist.

Note: To test your email settings, tap Test. You should receive a message to your email address stating that you have successfully configured the mailer on your LabQuest. To clear existing setting, tap Reset.

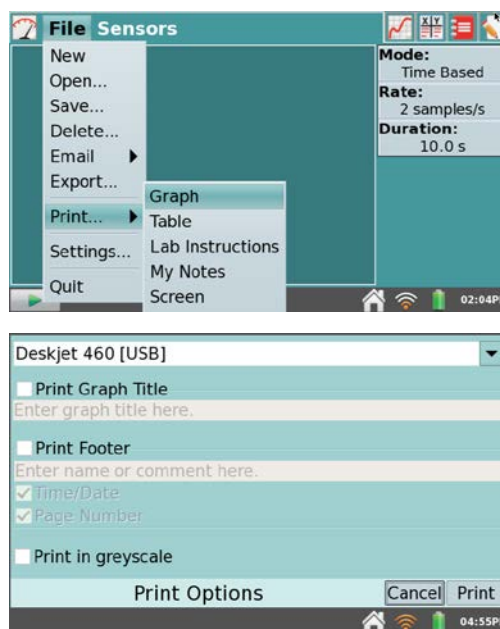
For more information on setting up Gmail accounts, see:
www.vernier.com/til/2643/

VII. PRINTING FROM LABQUEST

You can print a graph, data table, lab instructions, your own notes, or the screen as it is currently displayed in LabQuest App. LabQuest can print to a compatible printer via a USB cable or via a Wi-Fi network. For a list of compatible printers see: www.vernier.com/til/1659/

To print to a compatible printer for the first time, follow the [Printer Setup](#) instructions below. This setup is only required for the first time you use a particular printer. Once a printer has been installed, LabQuest will store the drivers.

To print from LabQuest App to an installed printer, choose Print from the File menu. Then choose the item that you want to print (Graph, Table, Lab Instructions, My Notes, or Screen).



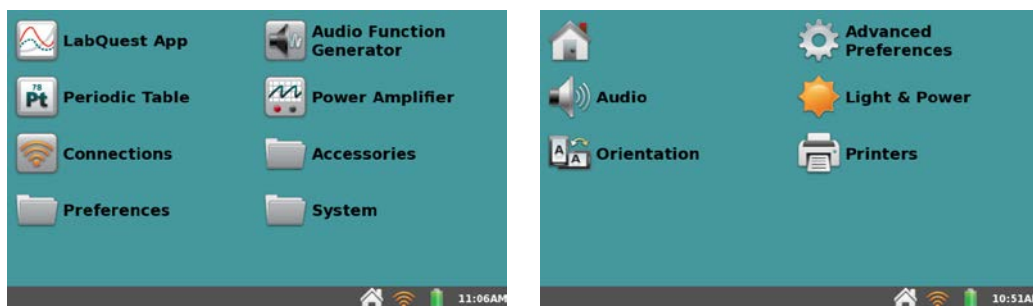
The Print Options dialog box appears where you can choose the installed printer from the dropdown list and set additional print settings (add a title, footer, or print in greyscale).

Printer Setup

1. If printing to a USB printer, connect the printer to the full-size USB port on LabQuest and turn on the printer.

If printing to a Wi-Fi-enabled printer, verify that LabQuest is connected to the same Wi-Fi network as the printer. See [Connect LabQuest to a Wi-Fi Network](#) for more information, if needed.

2. Tap Preferences from the Home screen, and then tap Printers to open the Printer Configuration dialog box.

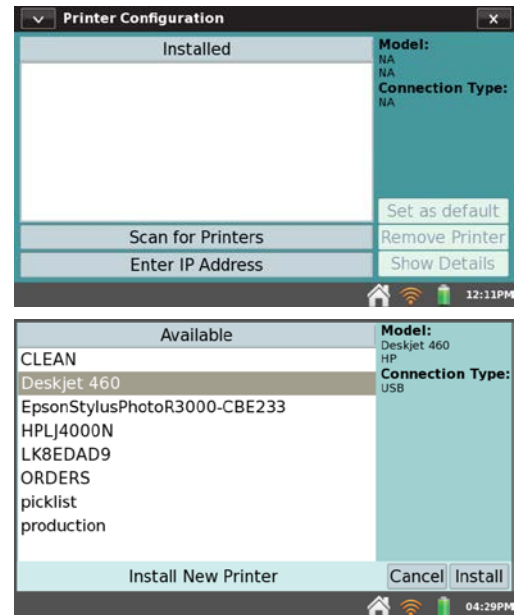


Printing from LabQuest

3. Tap Scan for Printers. In response, LabQuest will search for available printers.

Note: If LabQuest is unable to locate a desired network printer, try accessing it directly by tapping Enter IP Address.

4. Select the desired printer and tap Install to set up the drivers.



Troubleshooting

Even if a driver is found, printing may still fail due to an incompatible printer. If you are sure that the printer is compatible and you are still getting an error, it may be caused by one of the following conditions: out of paper, out of ink/toner, a door on the printer is ajar, a paper jam, or you may have selected the wrong printer on the Print Options screen.

VIII. PROJECTING AND MONITORING STUDENTS' LABQUEST DEVICES

Use our [LabQuest Viewer software \(order code, LQ-VIEW\)](#) to view and control LabQuest wirelessly from your Windows or Macintosh computer. When LabQuest is connected to a computer wirelessly or via USB, LabQuest Viewer can be used in conjunction with a projector to share the LabQuest 2 screen with the entire class.

This allows an instructor to demonstrate LabQuest 2 for a class, and it also allows students to share or present their work to fellow classmates. LabQuest Viewer can also be used with an [original LabQuest \(order code, LABQ\)](#) connected wirelessly to a computer via a Wi-Fi adapter. LabQuest Viewer is part of the [Connected Science System](#).

With LabQuest Viewer, you can:

- View and control one or more LabQuests from a computer.
- Connect to a computer and projector or interactive white board for class demos or sharing.
- Monitor student progress on any LabQuest connected to your network.
- Create screenshots of the LabQuest screen to copy and paste into lab instructions.
- Set customizable permissions that permit viewing without control, or password-protect a connection.
- Install LabQuest Viewer on any computer in your school or college department with the included site license.

System Requirements

- **Windows** – Windows XP (32 bit only), Vista (32 and 64 bit), and Windows 7 (32 and 64 bit)
- **Macintosh** – Macintosh OS X 10.5 (Intel-based Macs only), 10.6, and 10.7

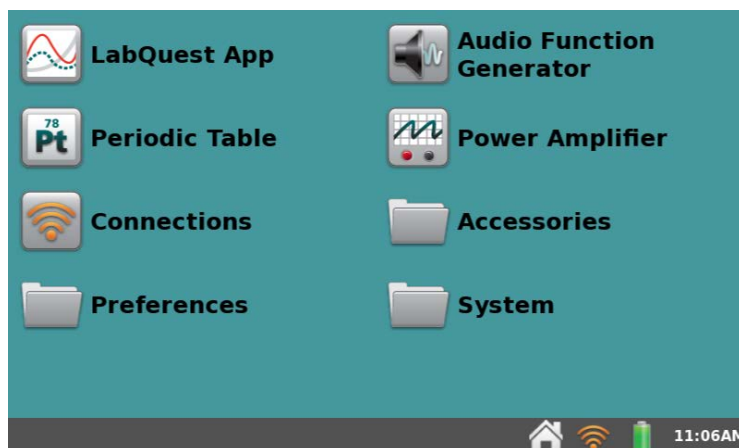
LabQuest Compatibility

- LabQuest 2 (Wi-Fi or USB connection)
- LabQuest with Wi-Fi USB Adapter (Wi-Fi only)

For additional information, see: www.vernier.com/lq-view

IX. ADDITIONAL APPS ON LABQUEST

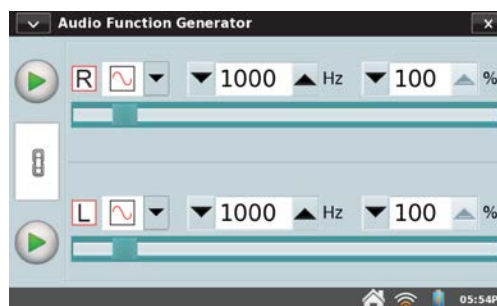
Several accessory applications can be launched from the Home menu. It is not necessary to quit LabQuest App to use these accessories; to return to LabQuest App, either close the accessory using the close button in the upper right corner of the screen, or switch to the LabQuest App by tapping LabQuest App on the Home screen.



Access additional apps and accessories from the Home screen

Audio Function Generator

From the Home screen, tap Audio Function Generator to launch this app. The function generator is used to create waveforms in the audio frequency range. Select a waveform, frequency, and volume for each channel. Start and stop using the buttons at left. The link between left and right channels is on by default, so that both channels start and stop together. Tap the link icon to control the channels independently.

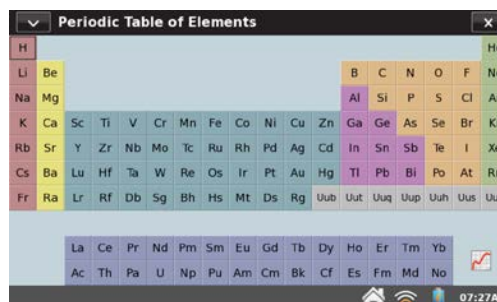


The sliders can also be used to control frequency. Tapping left or right of the slider will halve or double the frequency.

A common use of the Audio Function Generator is to create tones and beats for waveform study using a microphone. For the best waveform quality, connect a powered computer speaker to the audio output jack of LabQuest.

Periodic Table

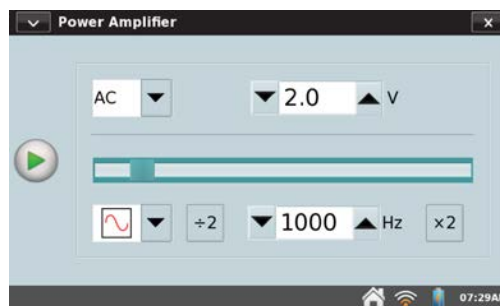
From the Home screen, tap Periodic Table to launch this app. The Periodic Table contains standard reference information on the elements. Tap an element to see details.



Power Amplifier

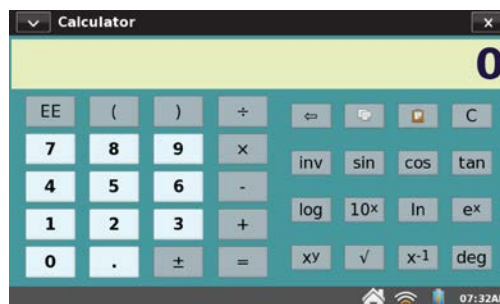
From the Home screen, tap Power Amplifier to launch this app. The Power Amplifier App controls the [Vernier Power Amplifier \(order code PAMP\)](#) used to create waveforms with up to 10 V amplitude and currents of 1 A. Connect the Power Amplifier to the LabQuest audio output.

Select the desired output (AC or DC). DC output levels are limited to 0.2 V steps. AC waveforms include sine, square, sawtooth, and ramps. Select an amplitude and frequency using the controls. The frequency can be changed by factors of two using either the buttons, or in small steps using the slider. Start and stop the output using the control at left.



Calculator

From the Home screen, tap Accessories, and then tap Calculator to launch this app anytime. The calculator is a standard scientific calculator that uses algebraic notation. You can also copy a calculator result and paste it into the Notes tab.



Sound Recorder

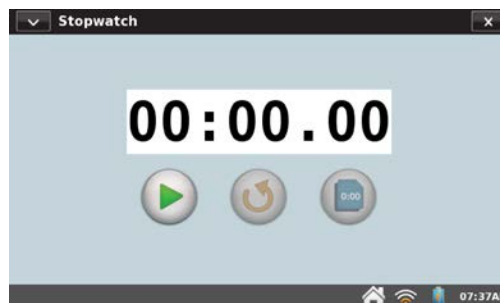
From the Home screen, tap Accessories, and then tap Sound Recorder to launch this app. The sound recorder is used to capture short audio clips, typically for voice notes. To record a clip, tap the record button (red circle). To stop, tap the square red stop button. Play the clip back using the green play button. The disk button allows you to save the clip, which can later be opened using the open file folder icon. The blank page icon clears out any current audio clip.

Tip: Use Sound Recorder to quickly make audio notes on experiments.



Stopwatch

From the Home screen, tap Accessories, and then tap Stopwatch to launch this app. The Stopwatch is a simple timer. Tap the start button to begin timing; tap it again to stop. Subsequent taps will continue to start and stop the timer. Tap the middle reset button to return the timer to zero. The copy button will place the current time on the clipboard for pasting into the Notes screen of LabQuest App, or into the calculator.



APPENDIX A. LABQUEST 2 TECHNICAL SPECIFICATIONS

Display

- 11.2 cm × 6.7 cm (13.1 cm diagonal) screen
- 800 × 480 pixel color display at 188 dpi
- LED backlight
- Portrait or landscape screen orientation
- High-contrast mode for outdoor visibility

Processor

- 800 MHz Application Processor

Connectivity

- Wi-Fi 802.11 b/g/n
- Bluetooth for WDSS

User Interface

- Resistive touch screen
- Touch and stylus navigation for efficiency and precision

Data Acquisition

- 12-bit resolution
- Built-in GPS, 3-axis accelerometer (± 2 g), ambient temperature sensor, light sensor (uncalibrated intensity), and microphone

Maximum Sampling Rate

- 1 sensor - 100,000 samples/s (0.02 seconds max)
- 2 or more sensors - 10,000 samples/s (0.21 seconds max)

Minimum Sampling Rate

- 0.00125 samples/s (800 s/sample)

Maximum Samples (standalone)

- 1 sensor - 2000 samples 20K - 100K samples/s
- 1 sensor - 14,000 - 21,000 samples \leq 10K samples/s
- 2 or more sensors - 12,000 - 14,000 samples @ \leq 10K samples/s

Highest number of samples is for the very first collection after starting LabQuest. The smaller number of samples depends on the number of previous collections and stored runs during this LabQuest session.

Environmental Durability

- Operating Temperature: 0 – 45°C
- Storage Temperature: –30 – 60°C
- Splash resistant
- Rugged enclosure designed to withstand a fall from lab bench

Size and Weight

- Size: 8.8 cm × 15.4 cm × 2.5 cm
- Weight: 350 g

Ports

- 5 sensor channels
- USB port for sensors, flash drives, and peripherals
- USB mini port
- DC power jack
- microSD/MMC slot
- Audio in and out

Storage

- 200 MB
- Expandable with microSD and USB flash drive

Power

- Rechargeable, high-capacity battery
- DC charging/powering through external adapter (included)

Non-compatible Sensors

LabQuest 2 does not support the following sensors at this time:

- Digital Control Unit* (DCU)
- Heat Pulser
- Ohaus balance

* Not supported with LabQuest 2 as a standalone device. The DCU can be used with Logger Pro software and LabQuest 2.

APPENDIX B. LABQUEST MAINTENANCE

LabQuest Battery

LabQuest uses a high-quality lithium-ion battery. This is the same chemistry used in premium laptop and cell phone batteries, and you can expect similar performance. There is never a need to condition the battery by regular full discharge/charge cycles.

Use only the supplied AC adapter or optional [LabQuest 2 Charging Station](#) (order code LQ2-CRG, sold separately) to charge the LabQuest battery. A [replacement adapter](#) can be purchased from our web site (order code LQ-PS).

The battery takes about eight hours to completely charge. It is safe to leave the battery charging indefinitely, and there is no need to fully discharge the battery before charging. Battery life will depend on the sensors used, but in most cases you can obtain six or more hours of use before recharging. We recommend charging LabQuest overnight to start the next day with a full charge.

For use with a computer, either the battery must be charged or LabQuest must be connected to AC power. LabQuest cannot operate on USB power alone. When LabQuest is running and connected to the computer, the USB connection will, however, slowly charge the battery.

When using LabQuest as a standalone device, the screen will dim after a few minutes of no use, even during data collection. However, LabQuest will not turn itself off until the battery is almost discharged. Data loss due to a loss of power is minimized through periodic saving of a backup file.

Battery life depends on the sensors and features used. To optimize day-to-day battery life, set the screen brightness to the minimum acceptable level, and turn off LabQuest when it is not in use. Also disconnect any sensors you are not actively using. To access power-saving options, tap Preferences on the Home Screen, then tap Light & Power.

The long-term life of the battery will vary, but you can expect about three hundred to four hundred full charge/discharge cycles before the battery will need to be replaced. In this count, a charge from half-way to a full charge would count as half of a charge cycle. In typical school use, the battery can last three years or more. Exposure to temperatures over 35°C will significantly reduce battery life.

As a battery reaches the end of its useful life, the run time will become shorter and shorter. Eventually the run time will be too short for your application, and you will want to replace the battery. Rechargeable batteries are considered a consumable, and as such, are warranted for one year. A [replacement battery](#) can be ordered from our web site (order code LQ2-BAT). Recycling information is available at www.call2recycle.org.

LabQuest Case and Screen

LabQuest is water and shock resistant. Do not submerge LabQuest in liquids. Wipe it clean with a damp cloth only; do not use any solvents including ammonia or glass cleaners.

Stylus Tether

LabQuest includes a stylus and a tether. If desired, you can attach the tether to the stylus and LabQuest. Additional styluses are available from Vernier.

LabQuest Software

LabQuest arrives with its own software, LabQuest App, preloaded. The LabQuest App will be updated from time to time to introduce new features and to improve performance. Most users will want to run the latest version available.

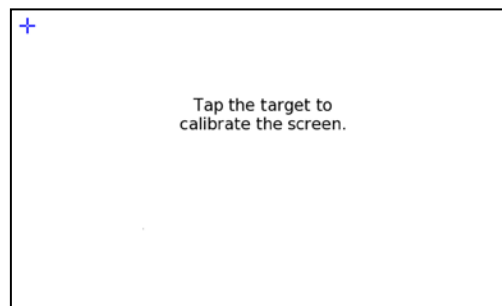
Free updates with step-by-step instructions are available on our web site:
www.vernier.com/downloads/

Screen Calibration

To calibrate the screen, tap System on the Home screen. Then choose Calibrate Screen.

Follow the on-screen instructions for tapping the plus sign with the stylus.

If you are unable to access the Calibration tool, press and hold the Home key until the Calibration tool is displayed.



Getting Additional Help

For access to user manuals, forums, and our technology information library, please visit our web site at:

www.vernier.com/labq2

If you are located in the United States or Canada, you may also contact Vernier directly:

888.837.6437

info@vernier.com

www.vernier.com

Otherwise, please contact Vernier International:

941.349.1000




info@vernier-intl.com

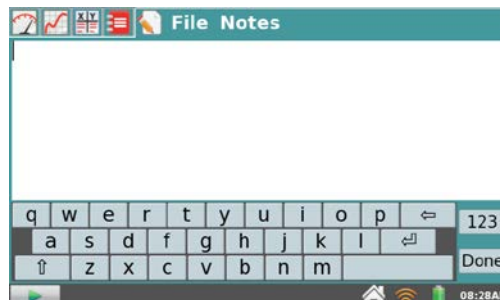
www.vernier-intl.com

APPENDIX C. LABQUEST KEYBOARD


LabQuest App automatically displays the keyboard when text can be entered.

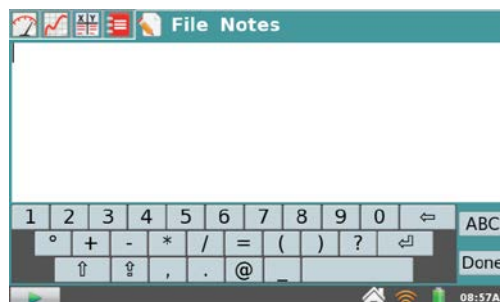
Standard

The standard keyboard displays lowercase letters. To capitalize letters, use the Shift key . To delete the previous entry, use the Backspace key . To start a new line, use the Carriage Return . Note that the spacebar is located to the right of the letter *m*.




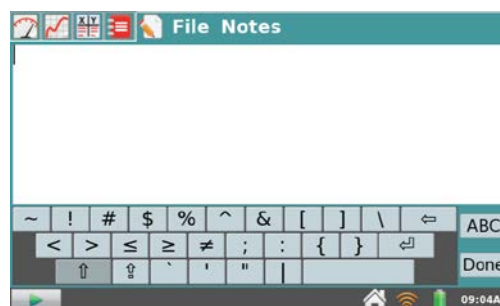
Numeric and special characters

To access the numeric keyboard from the standard keyboard, tap .




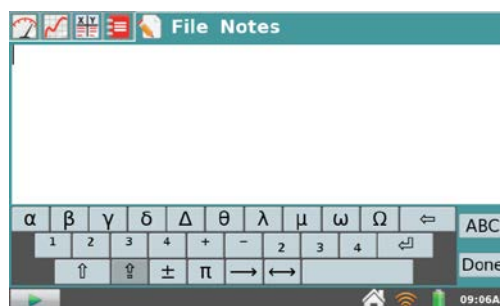
Special characters

To access symbols from the numeric keyboard, tap .



Symbols

To access Greek characters, superscripts, subscripts, and additional operators from the numeric keyboard, tap .



APPENDIX D. LICENSE INFORMATION

This product contains certain open source software originated by third parties that is subject to the GNU General Public License as published by the Free Software Foundation, GNU Library/Lesser General Public License (LGPL) and different and/or additional copyright licenses, disclaimers or notices. These licenses give you the right to redistribute and/or modify the software.

The software is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.

Complete source code for the open source software is available on request from Vernier Software & Technology. Contact us at info@vernier.com, or by writing to

Source Code Request
Vernier Software & Technology
13979 SW Millikan Way
Beaverton OR 97005
USA

Source code will be made available for download, or you may request a CD-ROM of the code. A shipping and handling fee will be charged for a CD-ROM.

The exact terms of GPL, LGPL and some other licenses are provided to you with the source code distribution. You may also read the license at www.gnu.org/licenses.

APPENDIX E. WARRANTY

Vernier warrants this product (with the exception of the battery) to be free from defects in materials and workmanship for a period of five years from the date of shipment to the customer. This warranty does not cover damage to the product caused by abuse or improper use.

The LabQuest battery is a consumable, and as such, Vernier warrants this product to be free from defects in materials and workmanship for a period of one year from the date of shipment to the customer. For more information about the LabQuest battery, see [LabQuest Battery](#).

APPENDIX F. ACCESSORIES, REPLACEMENT PARTS, AND RELATED PRODUCTS



LabQuest 2 Charging Station

Charge and store up to four LabQuest 2 interfaces with this compact and affordable station.

www.vernier.com/lq2-crg



LabQuest 2 Lab Armor

Add extra protection from spills and falls.

www.vernier.com/lq2-armor



LabQuest Battery Boost 2

With the added power of an external battery, data can be collected for extended periods in the field where AC power is not available.

www.vernier.com/lq-boost2



LabQuest 4 GB SD Card

Easily add storage to your LabQuest or move files between LabQuests or a computer.

www.vernier.com/lq-sd4/



Vernier Lanyard

A LabQuest neck strap to prevent accidental drops during field studies.

www.vernier.com/lq-lan



LabQuest 2 Stylus (Set of 5)

Replacement LabQuest 2 styluses (5 pack). One is included with each LabQuest 2.

www.vernier.com/lq2-styl-5

Appendix F – Accessories, Replacement Parts, and Related Products



LabQuest Stylus Tethers (Set of 5)

Replacement LabQuest tethers (5 pack). One is included with each LabQuest 2.

www.vernier.com/lq-teth-5



LabQuest USB Computer Cable

Replacement LabQuest-to-computer USB cable. The cable has a USB mini-B plug and USB standard-A plug. One cable is included with each LabQuest 2.

www.vernier.com/lq-cb-usb



LabQuest 2 Battery

Replacement high-capacity, rechargeable, lithium-ion battery for the Vernier LabQuest 2. One battery is included with each LabQuest 2.

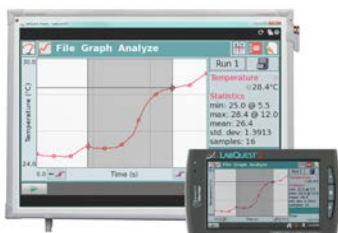
www.vernier.com/lq2-bat



LabQuest Power Supply

Replacement power supply for the LabQuest. One power supply is included with each LabQuest 2.

www.vernier.com/lq-ps



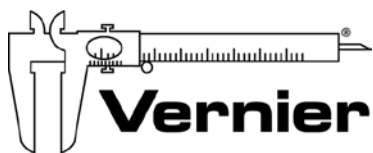
LabQuest Viewer

Display and control LabQuest on a computer to teach students how to use LabQuest, demonstrate experiments, or share class data.

www.vernier.com/lq-view

Curriculum Resources from Vernier Software & Technology

Vernier offers a complete set of lab books for elementary through college. For more information, see www.vernier.com/books.



Measure. Analyze. Learn.™

Vernier Software & Technology

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info@vernier.com • www.vernier.com

Version 1.1

Revised May 31, 2013

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