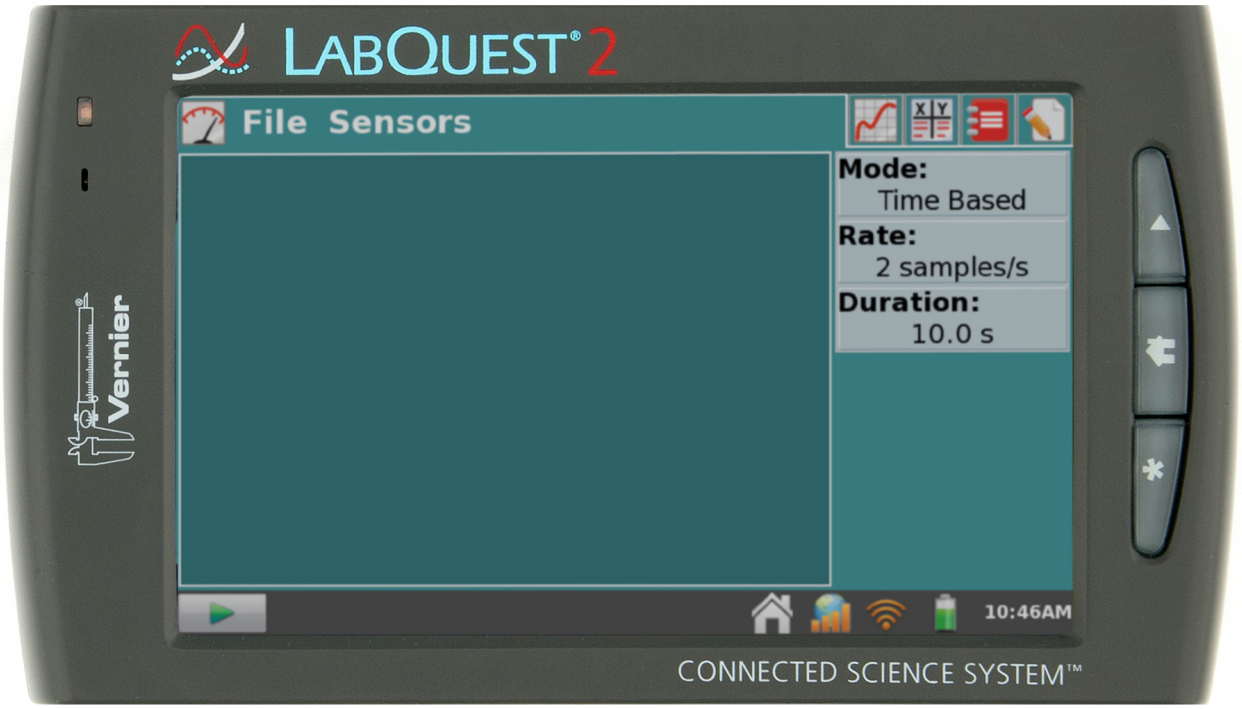
LabQuest® 2—User Manual



Version 2.8.6
December 2020

ABOUT THIS GUIDE

LabQuest 2, first shipped in March 2012, comes with a Quick-Start Guide to get you started with basic data collection and analysis. The LabQuest 2 User Manual is an extended guide detailing the features, hardware, and software of LabQuest 2.

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 disfonctionnement du dispositif. Afin de réduire les interférences radio potentielles pour les autres utilisateurs, le type d'antenne et son gain doivent être choisie 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 jumelés ou fonctionner en conjonction avec toute autre antenne ou transmetteur.*

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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 a protective tab covering the battery contacts that needs to be removed before the first use. Pull the tab out of the unit before using LabQuest.

Charge Overnight

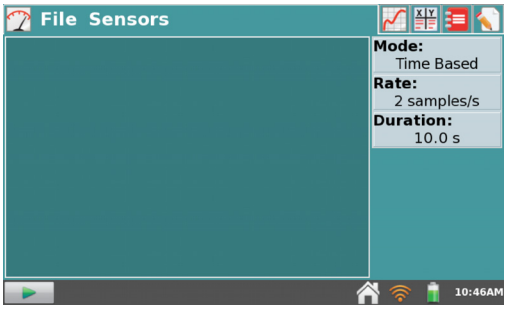
We recommend charging the battery for at least 12 hours prior to using LabQuest for the first time on battery power. To do this, connect the included power adapter to LabQuest and an AC power source. You can also charge LabQuest using the LabQuest Charging Station (order code LQ2-CRG, sold separately).

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

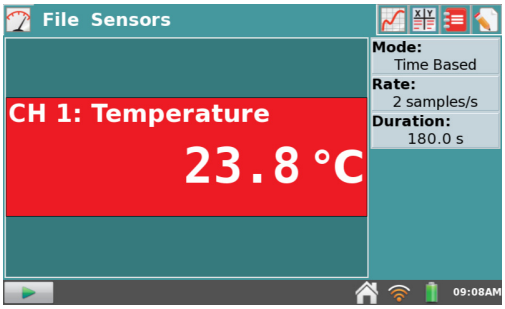
Follow these steps to quickly get started with basic data collection. For more detailed instructions, see Data Collection.



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.

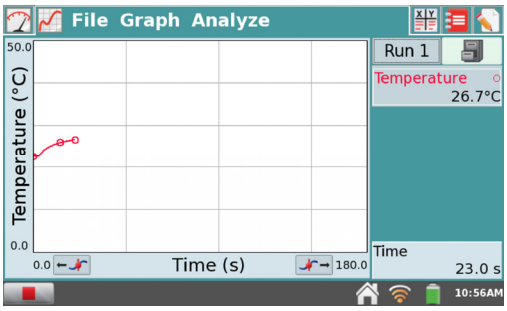
   TIP! *If your sensor is an older-style (DIN) sensor requiring an adapter, the sensor will not auto-ID. Instead, you will need to set up the sensor manually. See* *Sensor Setup*.



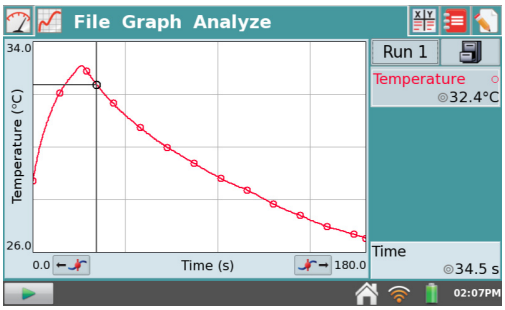
3. Next, tap Collect . Data collection begins and LabQuest graphs the data in real time.

   You can stop collection early by tapping Stop .

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



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 .

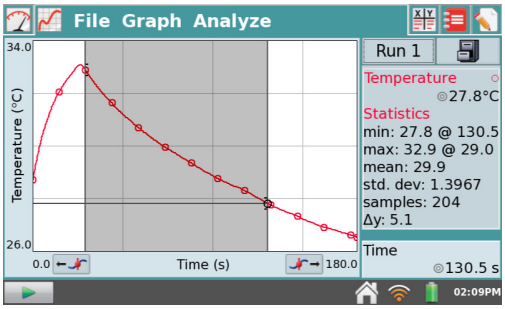


5. To select a region of data for analysis, tap-and-drag across the graph to highlight the desired region. ***TIP!*** *To analyze all data, you do not need to select a region.*

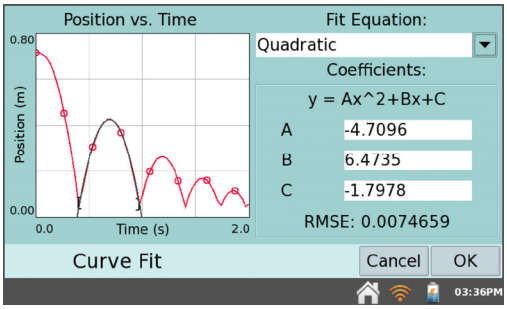
   Statistics

   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 column. 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

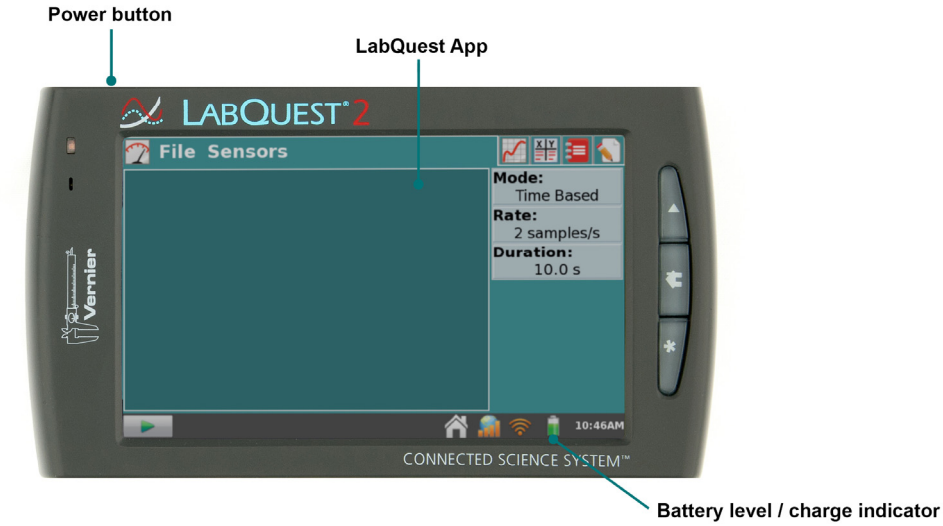


To fit a curve to the selected data on the Graph screen, choose Curve Fit from the Analyze menu. Select the check box to select a data column. Tap Choose Fit and choose the desired fit equation. LabQuest automatically determines and displays the fit coefficients, and displays a preview of the curve fit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

TIP! *The Curve Fit coefficients cannot be manually adjusted. To enter your own parameters, see the Modeltool within Data Analysis.*

II. LABQUEST® 2 HARDWARE



Once LabQuest is connected to AC power or the battery has 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 momentarily shows a charge battery icon or 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, which 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 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. When LabQuest is left asleep for one week it will automatically shutdown.

- **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

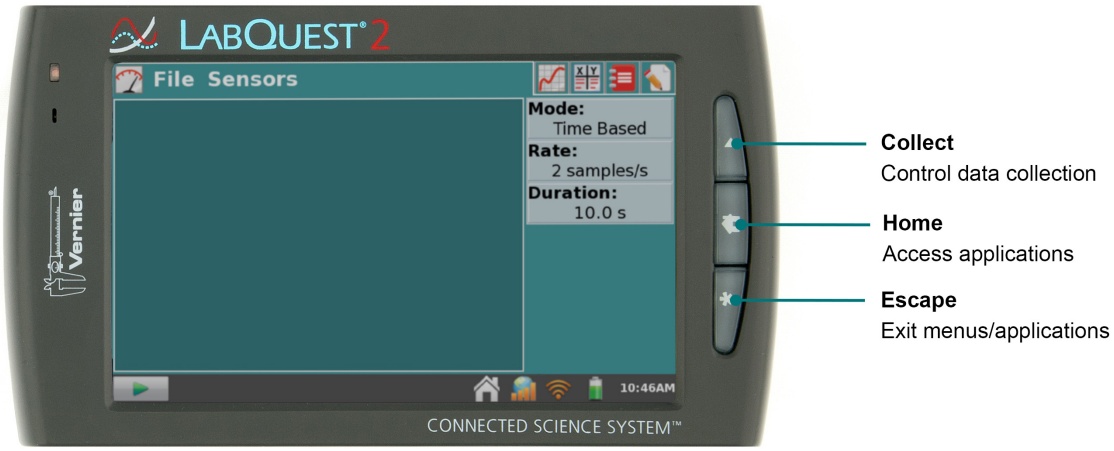
LabQuest has an LED backlit resistive touch screen that quickly responds to pressure exerted on the screen. LabQuest is controlled primarily by touching the screen. The software is designed to be finger-friendly. In some situations, you may desire more control for precise navigation. In such cases, we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

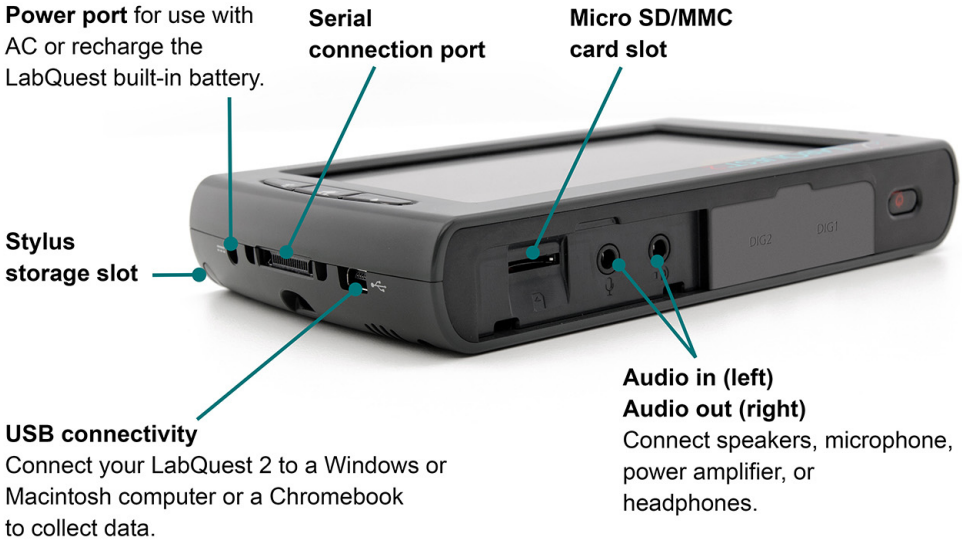
- **Collect**—Start and stop data collection within LabQuest App
- **Home**—Launch the Home screen to access other applications
- **Escape**—Close most applications, menus, and exit dialog boxes without taking action (i.e., cancel dialog boxes)



Sensor Ports

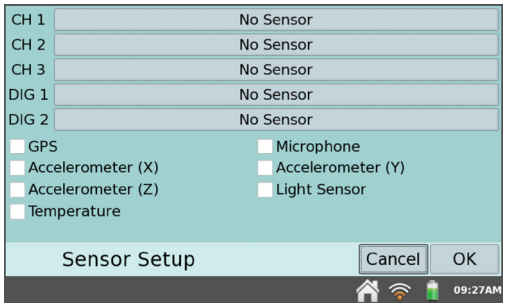
LabQuest has three analog sensor ports (CH 1, CH 2, and CH 3) for analog sensors such as our pH Sensor, Temperature Probe, and Force Sensor. Also included is a full-size USB port for USB sensors, USB flash drives, and USB printers. In addition to the power button, the top edge of LabQuest has two digital 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 Charging Station (order code LQ2-CRG, sold separately) and a stylus tether attachment point.



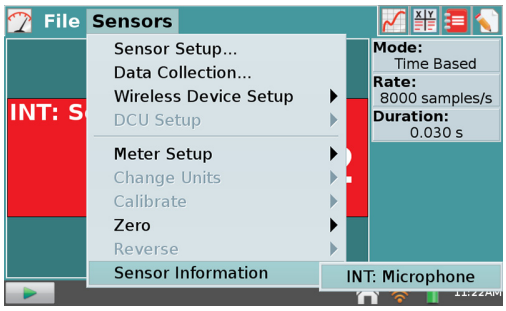
Internal Sensors

LabQuest also has several built-in sensors, including 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.

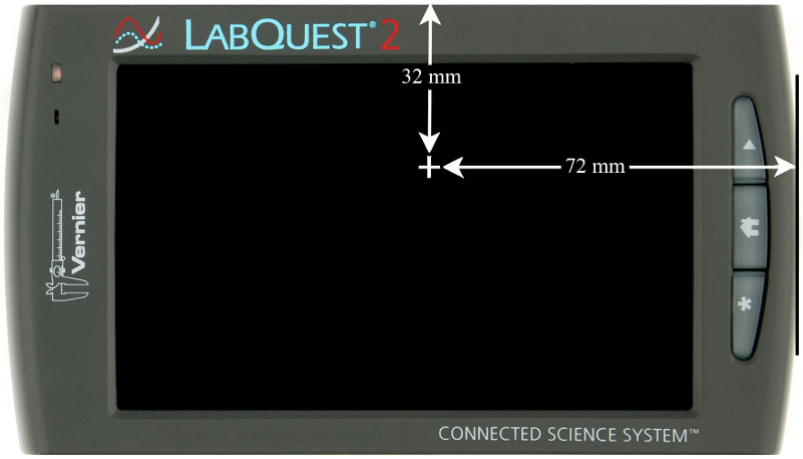
For additional information on internal sensors, enable the sensor and then choose Sensor Information from the Sensors menu. Choose the desired sensor from the list of enabled internal sensors.



- **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.

  TIP! *It may take up to 15 minutes to acquire an initial signal outdoors. We do not recommend using GPS indoors.*

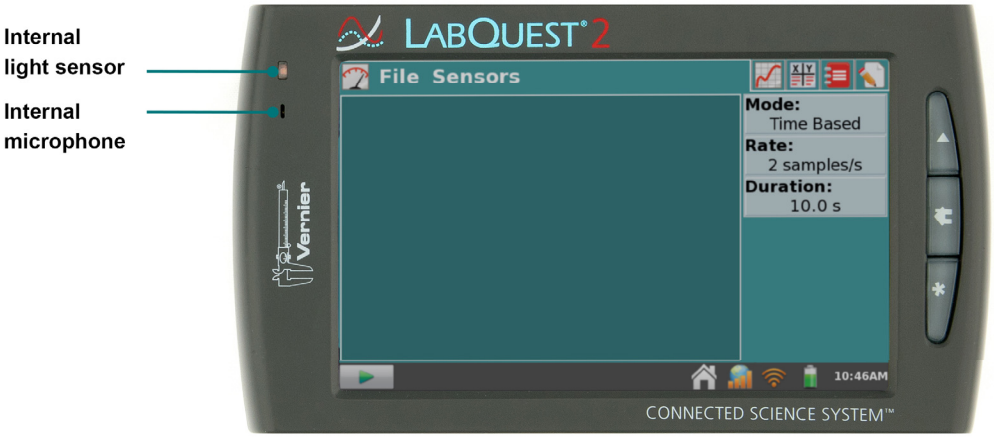
- **Accelerometers**—The 3-axis accelerometer measures accelerations up to ±2 *g* in the x-, y-, and z-axis directions. The sensor is located 72 mm from the docking connector and 32 mm from the digital port side of the plastic case.



- **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.

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

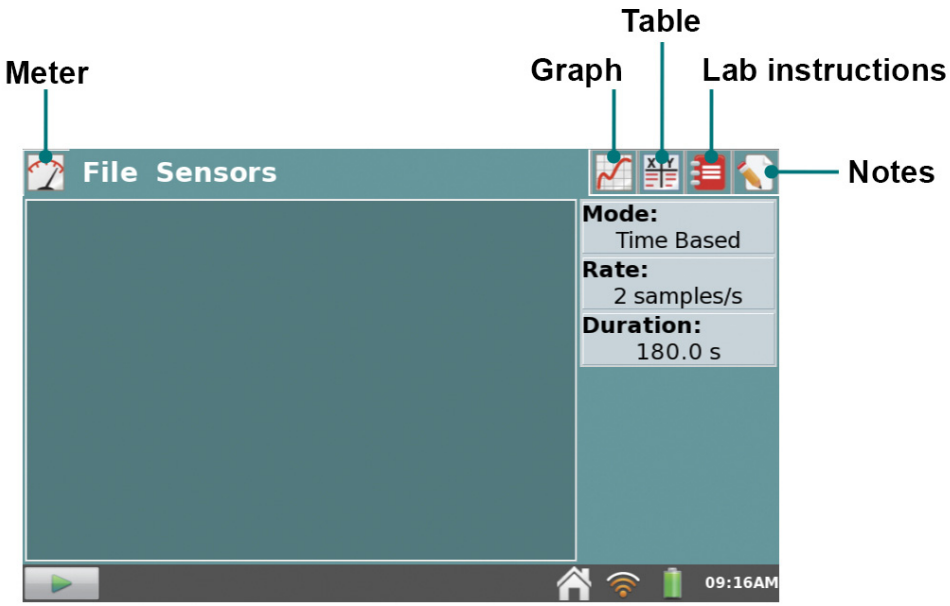


III. LABQUEST® APP

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

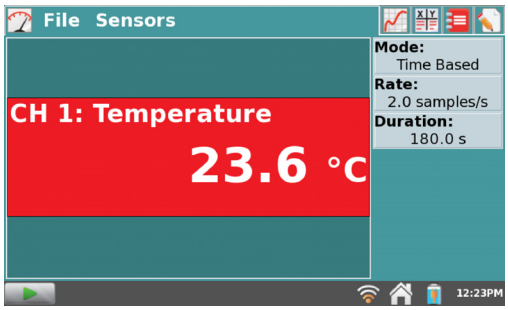
LabQuest App has five different screens. Tap on the desired tab to display the associated screen.



LabQuest App

Meter screen—Set up sensors, set data-collection parameters, and see a 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.

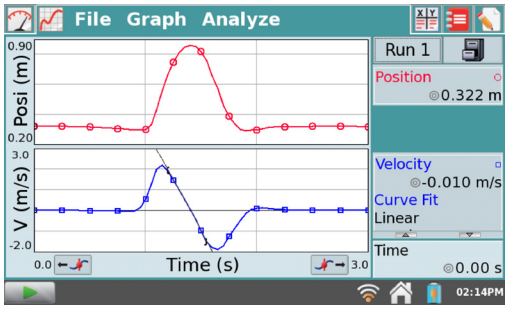
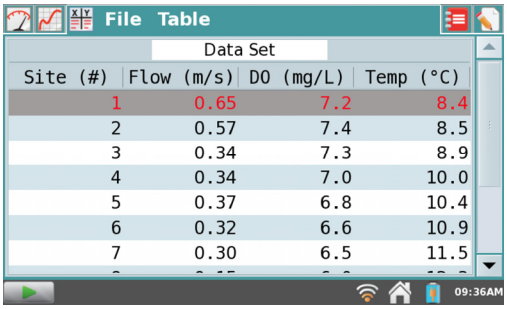


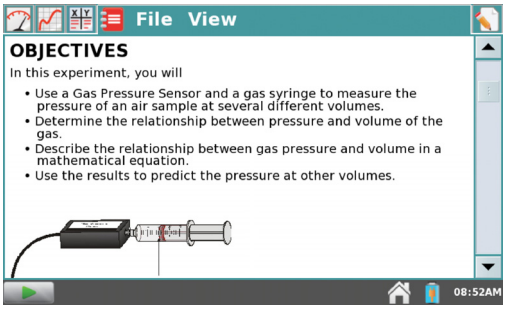
Table screen—See a tabular representation of your data, create calculated columns, and manually enter data.

For a detailed description of how the Table screen is used for data analysis, see Manipulating Data from the Table Screen.



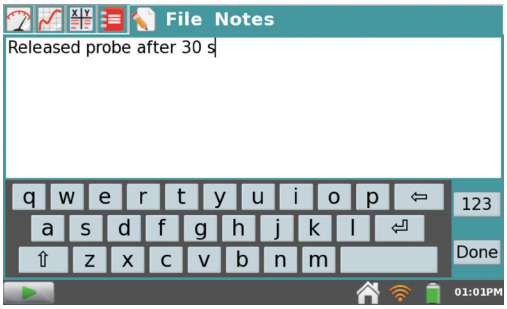
Lab Instructions screen—Access one of over 100 preloaded experiments for paperless instructions.

For detailed instructions on accessing the preloaded experiments on LabQuest, see Viewing Vernier Lab Instructions.



Notes screen—Record observations about your experiment.

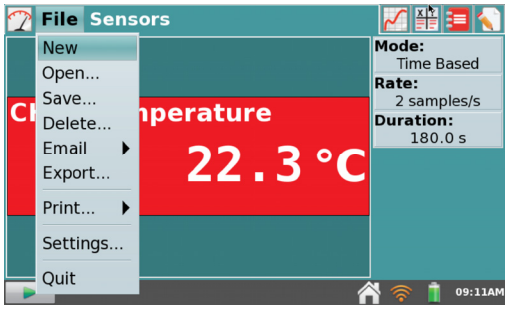
For more information, see Adding Notes to Your Experiment.



File Menu

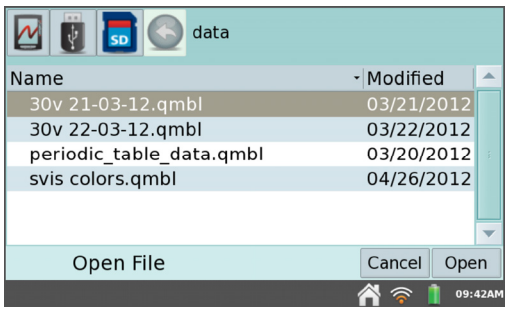
A LabQuest App file can contain data-collection settings, graphs, data tables, analyses, and even notes. These files have a *.qmbl* extension and can be saved to the internal storage space on LabQuest or to an external storage device such as a USB flash drive or microSD card. LabQuest App files can also be opened and manipulated on a computer with Logger *Pro*® 3 and Logger Lite 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.

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 (USB, SD) 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 (USB, SD, LabQuest) to select a destination. 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 (USB, SD, LabQuest) 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 screenshot 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 (USB, SD) 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.

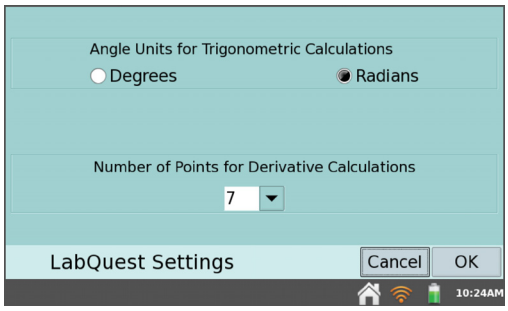
Print—Choose Print from the File menu to print the Graph, Table, Lab Instructions, Notes, or Screen from the current file to a USB or Wi-Fi-enabled printer. You can also save a PDF file on a USB flash drive or SD card using the Print to File option. For detailed instructions, see Printing from LabQuest.

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 default upon choosing New from the File menu.

- **Angle Units for Trigonometric Calculcations**

  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 experiment).

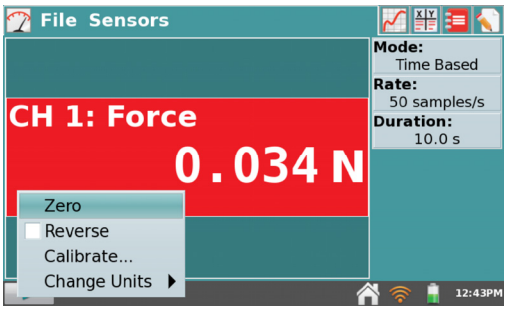
Quit—Choose Quit from the File menu to exit LabQuest App. Since other applications can run simultaneously with LabQuest App, there is typically no need to quit LabQuest App during standard use.

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 readings updated in real time as well as a summary of the data-collection settings. Additionally, you can access updated tools to modify and customize these settings for your particular experiment.

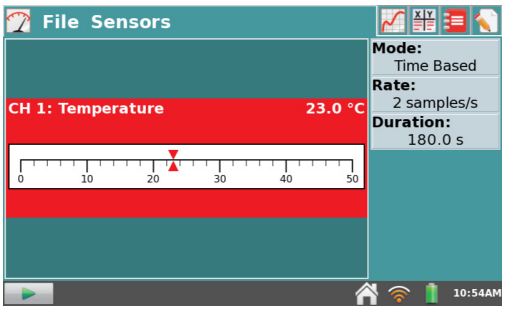
Digital Meters

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

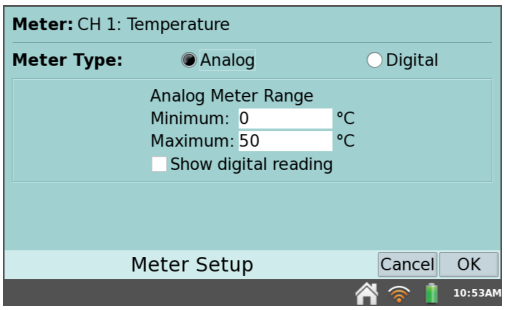


Analog Meters

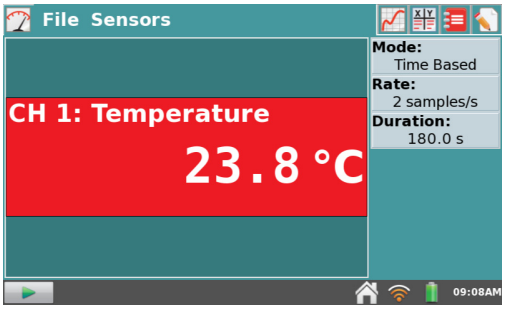
To display an analog meter, choose Meter Setup from the Sensors menu, or as a shortcut, tap the digital meter on the Meter screen.



Within the Meter Setup dialog box, enter the minimum and maximum values for the meter range. If you want to view both the analog and digital readings for a sensor, select the Show digital reading check box.



Data-Collection Summary

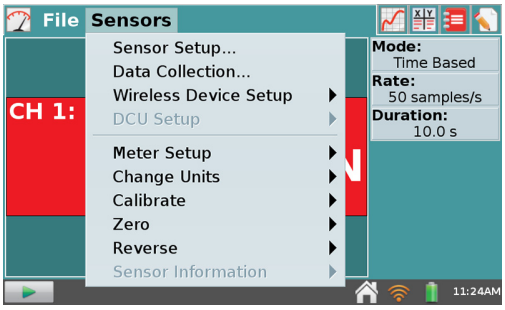


A summary of the data-collection settings (Mode, Rate, Duration) is shown in the panel to the right of the Meter screen. For most sensors, the default data-collection mode is Time Based. The default collection rate for the connected sensor is automatically set up when LabQuest identifies the sensor. 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.

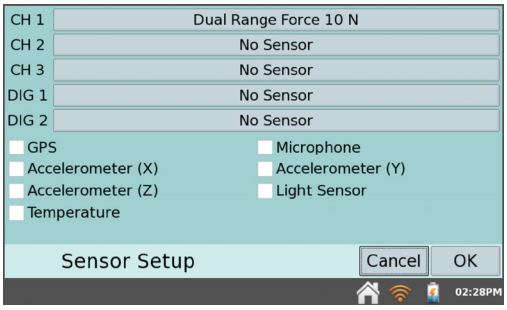
Data-Collection Controls

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



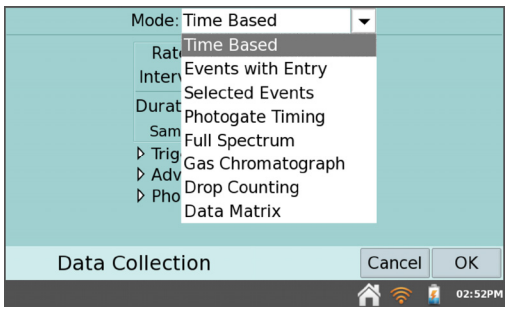
The Sensors menu provides access to detailed setup controls. Use this menu to set up internal sensors, non-auto-ID sensors, and wireless sensors. You can also use this menu to change the data-collection parameters and adjust sensor-specific settings.



- **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.

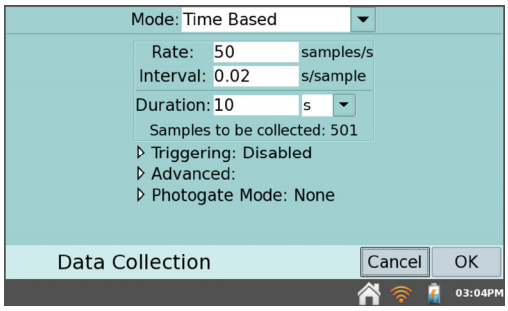
  You can also activate (or deactivate) the internal sensors from the Sensor Setup dialog box. Select the check box next to the desired sensor to make that sensor available for data collection.

- **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. Data-collection modes include Time Based, Events with Entry, Selected Events, Photogate Timing, Full Spectrum, Gas Chromatograph, Drop Counting, and Data Matrix.



  - **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.

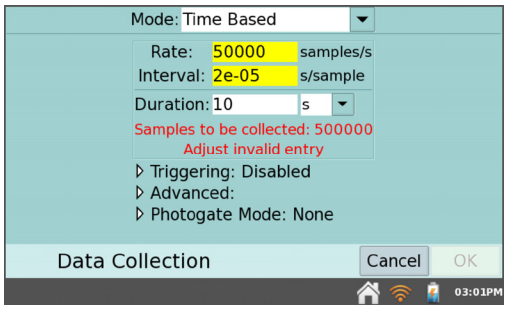


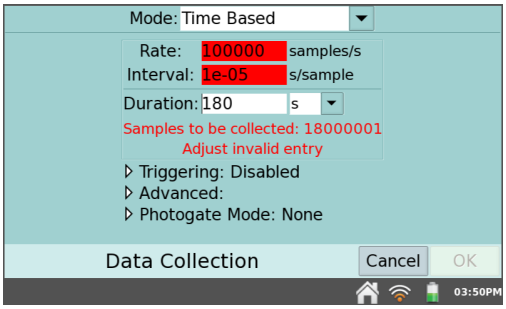
Warning Messages

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.

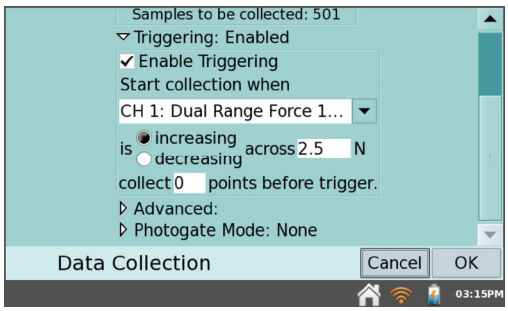
The red warning indicates one of the following, and you cannot exit the dialog box until the warning condition has been resolved:

- 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)

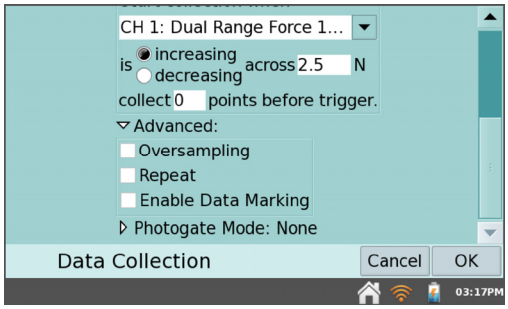




Triggering—Triggering is only available in the Time Based mode. When enabled, LabQuest waits for a trigger condition to be met before recording data collection. To set the trigger condition, choose the sensor and set the threshold condition. You can also set the number of points to be saved before the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



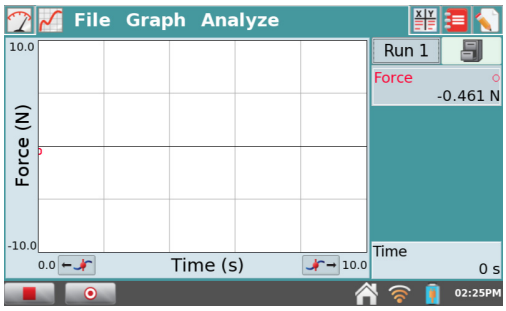
Advanced—The Advanced field has three options that can be independently enabled by selecting the associated check box.



- **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 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.

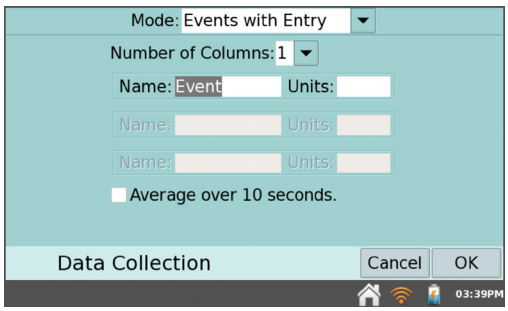
- **Enable Data Marking** can be used to mark points of interest during a time-based data collection. When enabled, a Mark Data button will appear during data collection. Tap to mark that particular point as a point of interest. After completing data collection, data marks can be named using the panel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



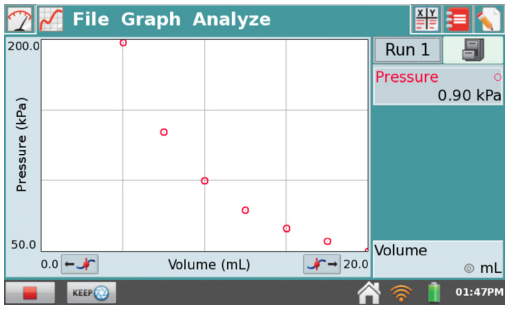
- **Photogate Mode** is used for photogate experiments that also use a time-based sensor such as a force sensor. Examples include impulse and momentum and centripetal force experiments. See Photogate Timing.

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

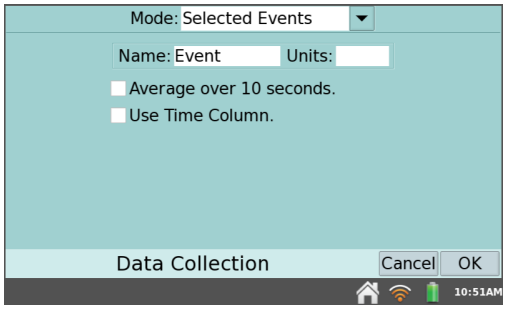
  Enter a name and units for each independent variable. You also have an option to average data over ten seconds and report the averaged reading.



  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 are plotted against the independent variable, as shown in the screenshot to the right.



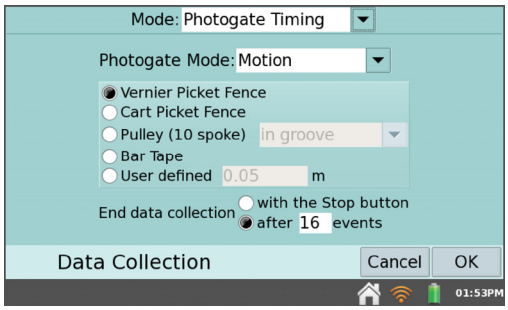
- **Mode: Selected Events**—Selected Events mode is similar to Events with Entry, except that entries of 1, 2, 3... are automatically recorded as the independent variable. To record time information in place of an entry value, select the check box for Use Time Column.



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

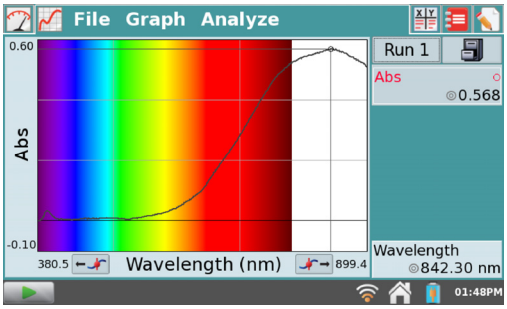
  You have two options for ending data collection in this mode: tap Stop, or end collection after a defined number of events. A block/unblock pair counts as two events.

  Choose the proper Photogate Mode for your experiment. For more information, see www.vernier.com/til/3329



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

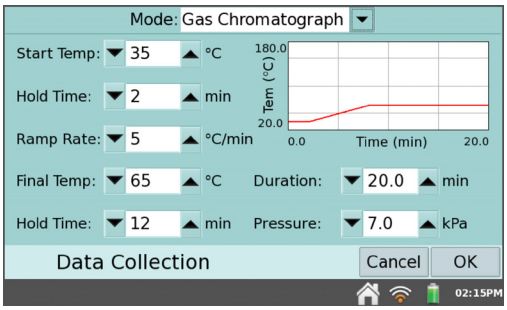
  Detailed instructions for setting up data collection with spectrometers are included in each of our spectrometer experiments.



- **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 available for the user to establish a temperature and pressure profile adequate for the current experiment.

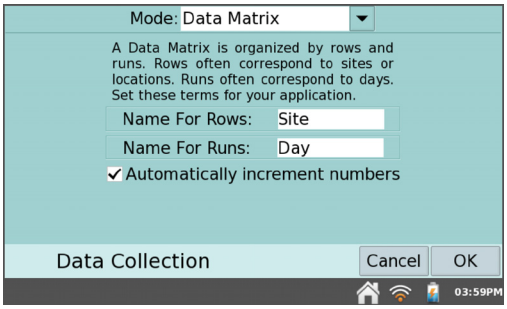
  When starting data collection, a set of default parameters is displayed. Tap the parameter field to enter a new value, or adjust the default value using the arrows. These values will be reflected in the preview of the time-dependent temperature graph displayed to the right. After setting the parameters, 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/

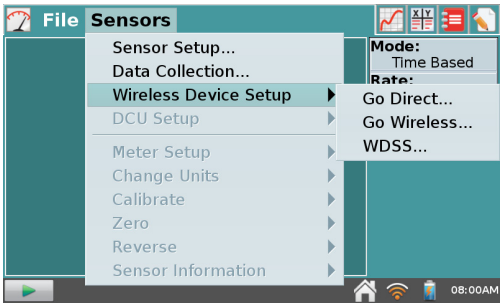


- **Mode: Drop Counting**—This mode is used with the Vernier Drop Counter. When using this mode, data points are recorded every time a drop is detected by the drop counter. For information on calibrating a drop counter, see www.vernier.com/manuals/vdc-btd

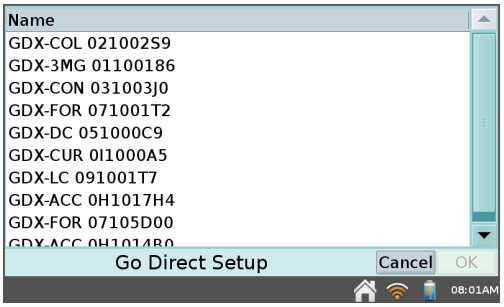
- **Mode: Data Matrix**—This mode is helpful for field work. It provides a way to collect data referenced to two parameters, such as the locations of your sampling sites and the dates they were sampled. You can collect data from an unlimited number of sensors by swapping the sensors in and out of LabQuest during data collection. For more detailed information, see www.vernier.com/til/2366/



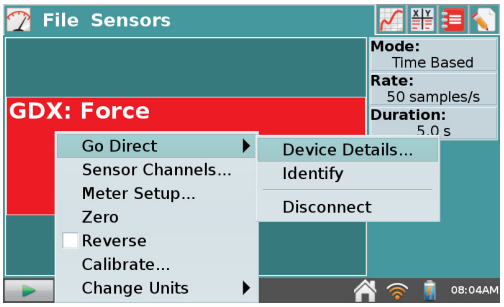
- **Wireless Device Setup—**Use Wireless Device Setup to connect to wireless sensors and interfaces, such as our Go Direct® sensors, Go Wireless® Heart Rate, Go Wireless Link, or Wireless Dynamics Sensor System.



  - **Go Direct…—**Choose Wireless Device Setup ▶ Go Direct from the Sensors menu to scan for and select Go Direct senors such as Go Direct Temperature, Go Direct Force and Accleration, or Go Direct pH. Select the serial number of your device from the list, and tap OK. Repeat as needed to connect up to three Go Direct sensors.

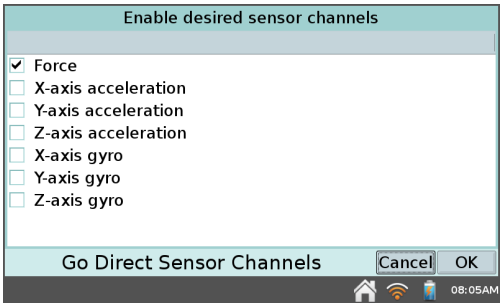


    Once connected to a Go Direct device, tap on its meter and choose Go Direct ▶ to access additional setup options.

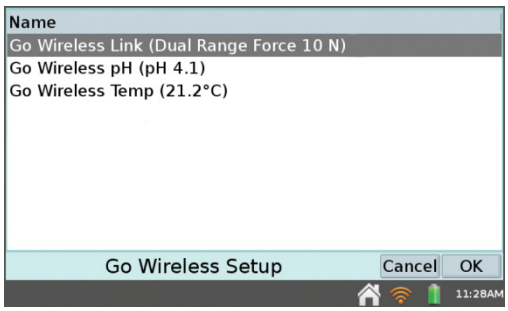


    - Choose Device Details to determine the battery level or to view hardware and firmware details.
    - Choose Identify to flash the LED on the Go Direct sensor to ensure you are connected with the desired sensor.
    - Choose Disconnect to end connection to the sensor.

    Some Go Direct sensors have multiple sensor channels. These sensors have a default configuration that may not show all available channels. Choose Sensor Channels to modify the Go Direct sensor channel configuration as needed for your experiment.

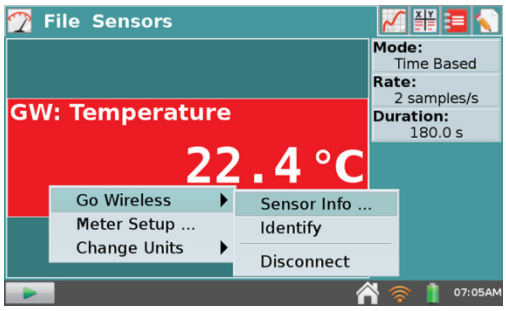


- **Go Wireless—**Choose Wireless Device Setup ▶ Go Wireless from the Sensors menu to scan for and select Go Wireless sensors such as Go Wireless Heart Rate, Go Wireless Temp, Go Wireless pH, or Go Wireless Link. Select the name of your sensor from the list, and tap OK. Repeat as needed to connect up to three Go Wireless sensors.

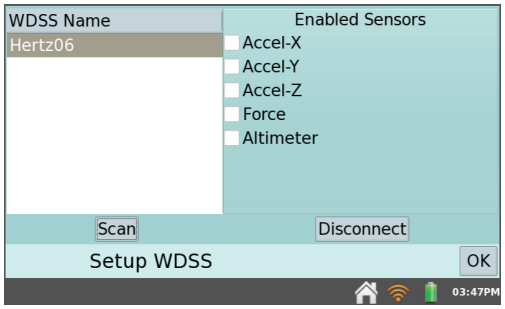


  Once connected to a Go Wireless sensor, tap on its meter and choose Go Wireless to access additional setup options.

  - Choose Sensor Info to view or change the device name, determine the battery level, or view hardware and firmware details.
  - Choose Identify to flash the LED on the Go Wireless sensor to ensure you are connected to the desired device.
  - Choose Disconnect to end connection with the sensor.

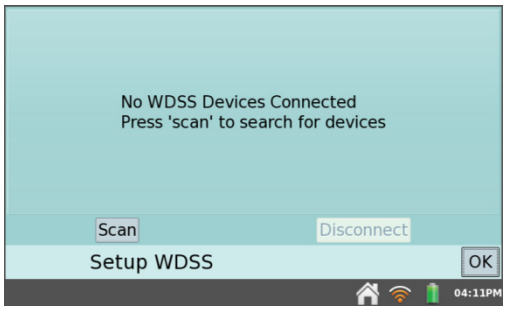


- **WDSS**—Choose Wireless Device Setup ▶ WDSS from the Sensors menu in LabQuest App to scan for, select, and configure Wireless Dynamics Sensor Systems (WDSS). If no WDSS units are found, tap Scan to search for WDSS sensors again. The scan may take 20 to 30 seconds and may have to be repeated several times to find your particular WDSS. Once a scan has found your WDSS, select its name in the list, then tap OK.



  Select which of the five sensors you want for data collection and tap OK.

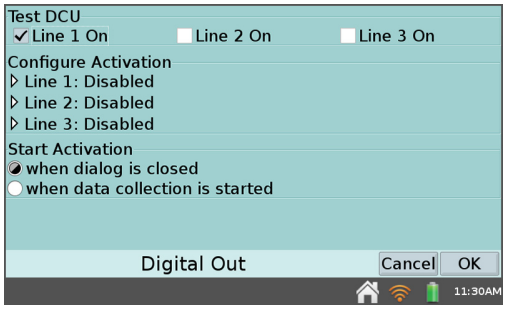
  To adjust the data-collection parameters, choose Data Collection from the Sensors menu. See Data-Collection Settings for more information.

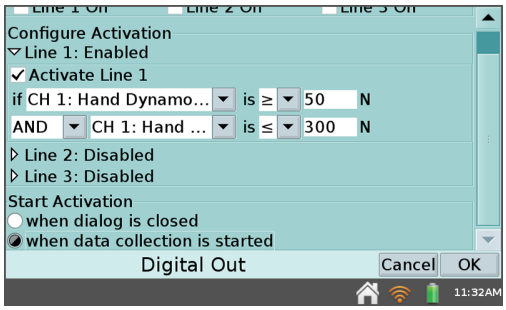


  TIP! *WDSS cannot be set up for remote data collection using LabQuest. Use Logger* Pro® *3 on a computer to set up WDSS for remote use.*

- **DCU Setup—**Connect a Digital Control Unit (DCU) to one of the LabQuest digital ports. Choose DCU Setup from the Sensors menu and select the DCU for setup.
  - **Test DCU**—Manually turn on and off the digital lines.
  - **Configure Activation**—Use logic statements to activate digital lines based on sensor readings.
  - **Start Activation**—Apply digital output logic immediately or only while collecting data.

    TIP! *Once digital output has been activated, automatic identification of sensors is disabled for the port used by the DCU. The LabQuest App will not detect the removal of the DCU or the addition of any other digital sensor in that port. To turn off the digital output and enable auto-ID, tap* **File ► New**.





- **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 data for that sensor to the new unit, as well as any subsequent data. If this feature is grayed-out in the menu, then the data for that particular sensor cannot be displayed in another set of units.

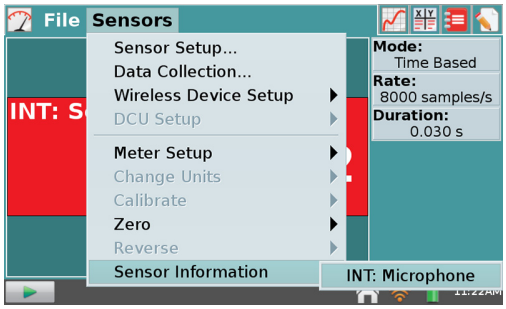
- **Calibrate**—Most sensors use a custom factory calibration identified by LabQuest. However, some sensors do require calibration, and you will use the Calibrate tool accessible from the Sensors menu. Follow the detailed calibration instructions provided in the sensor booklet available online at www.vernier.com/support/manuals

- **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 values 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.

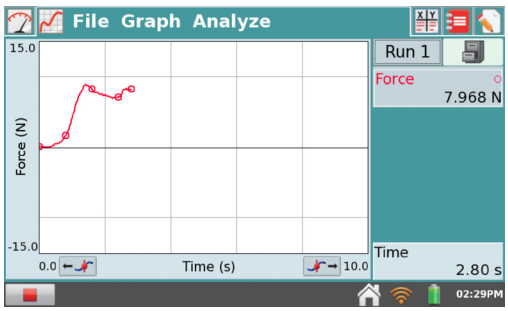
- **Sensor Information**—Choose Sensor Information and select an internal sensor to view sensor detailed specifications. Sensor Information is only available when an internal sensor has been set up for data collection.

  For mor information on internal sensors, see Internal Sensors

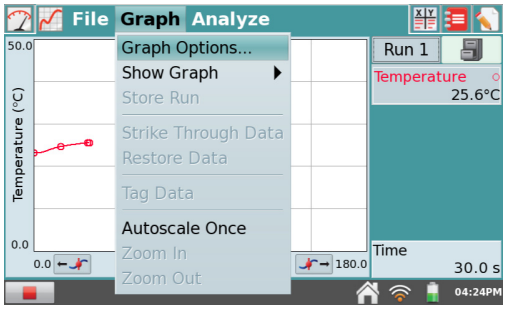


Graph Settings

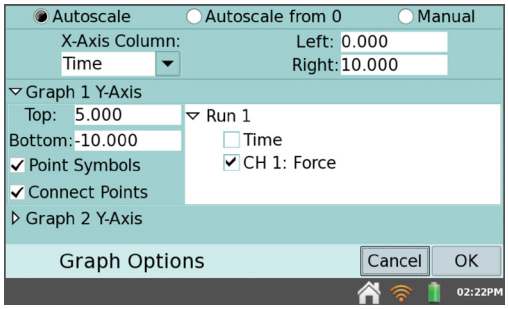
LabQuest App displays the Graph screen when data collection begins. From this screen, you can adjust graph settings. You can choose what is plotted, how the graph is scaled, and how the data are formatted.



- **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. 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). You can easily identify 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.

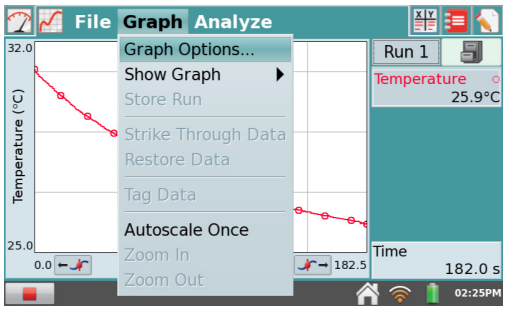
Examining Data on the Graph Screen

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.

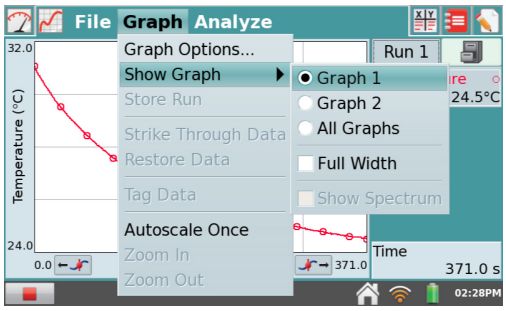
In some cases, you may want to examine data for a particular region on the graph. To select a portion for analysis, tap-and-drag across the desired region. You can adjust the trailing endpoint of the selected region using the Examine Buttons, if needed. For greater control, you can opt to use the stylus.

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.

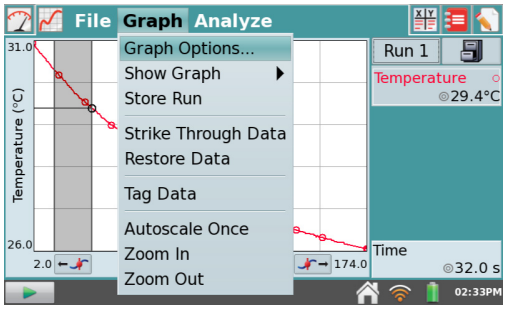
  When using spectrometers to collect full spectrum data, the spectrum is displayed on the graph background by default. Accordingly, Show Spectrum is selected under the Show Graph options. To hide the spectrum, tap on Show Spectrum to deselect that option.

- **Autoscale Once**—Choose Autoscale Once from the Graph menu to scale the graph to the data you have collected so far.

  TIP! *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 are plotted on that axis.

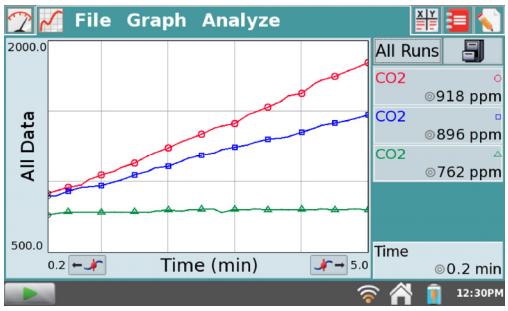
Once data collection has ended, zoom options are also available.



- **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.

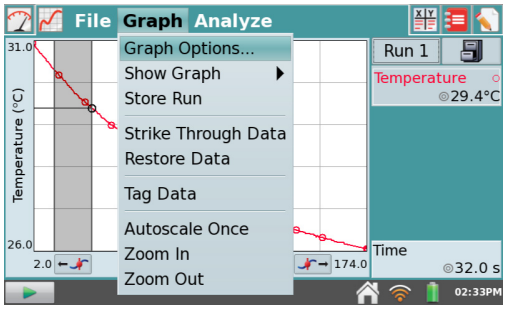
Collecting multiple runs



- **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 .

  To collect another run, tap Collect. Your new data set is displayed on the graph. To see your first data set, 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

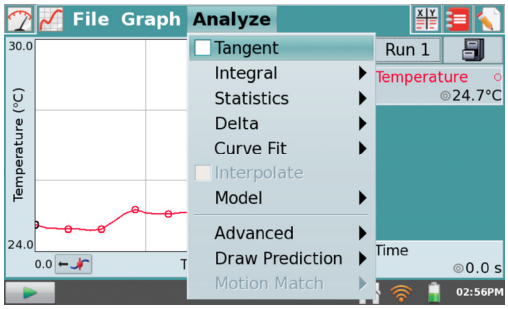


To strike or tag data from the graph screen, tap on the data point or tap-and-drag to select a region of data. Then, choose the desired tool from the Graph menu and the action will be applied to the data.

- **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.

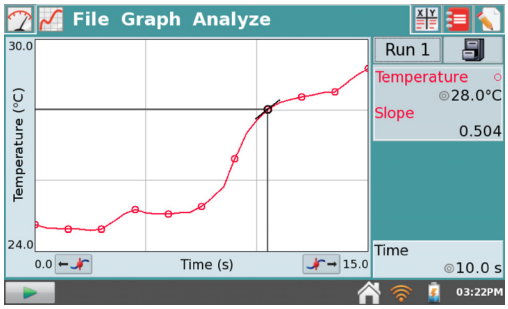
Analyzing Data from the Graph Screen



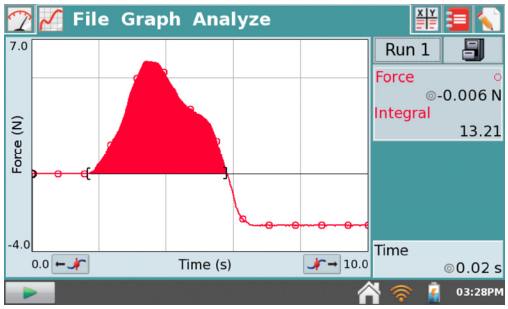
The Analyze menu on the Graph Screen gives you access to additional tools such as tangent lines, integrals, statistics, and curve fits. To apply one of these tools, choose the desired tool from the Analyze menu. If prompted, select the desired column.

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.

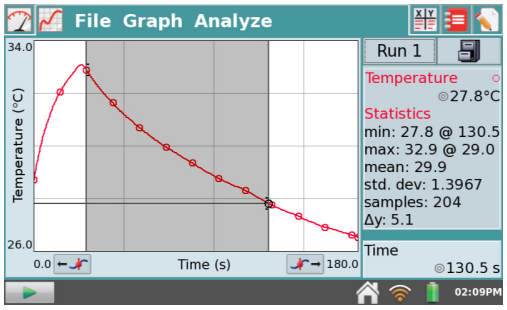
The following analysis tools are available from the Analyze menu.



- **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.

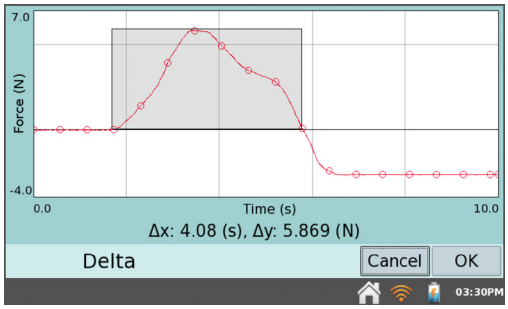


- **Integral**—The Integral tool numerically integrates graphed data. Select a region, if needed, and choose Integral from the Analyze menu. Enable the tool by tapping on the displayed sensor or column name. The integral is drawn and the numeric result is displayed in a panel to the right of the graph.



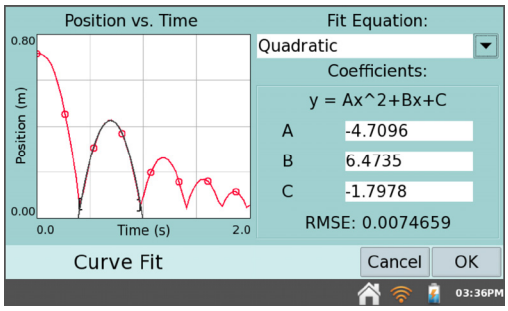
- **Statistics**—The Statistics tool displays statistics for graphed data. Select a region, if needed, and choose Statistics from the Analyze menu. Enable the tool by tapping on the displayed sensor or column name. Descriptive statistics are displayed in a panel to the right of the graph. If a region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

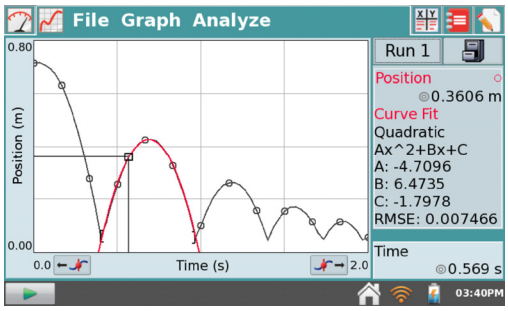
  Choose Curve Fit from the Analyze menu. In the Choose Fit list, choose the desired equation. LabQuest displays the fit in the preview graph at the left. The fit coefficients and Root Mean Square Error (RMSE) are also displayed.



  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.

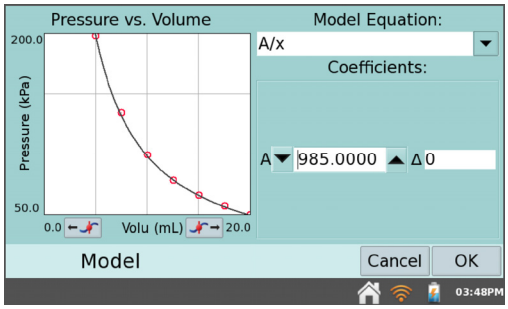
  TIP! *The RMSE (root mean square error) is a measure of how well the fit matches the data. The smaller the RMSE, the closer the data are to the fitted line. The RMSE has the same units as the y-axis data.*

- **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. One way to determine that LabQuest is in the Interpolation mode is by the square Examine cursor.



- **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.

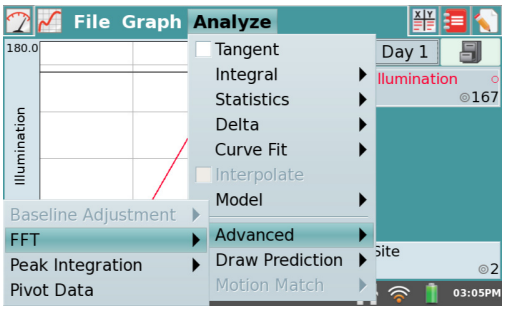
  The model parameters (e.g., A, B, and C) are adjustable. Change them by direct entry or by using the arrows.



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.

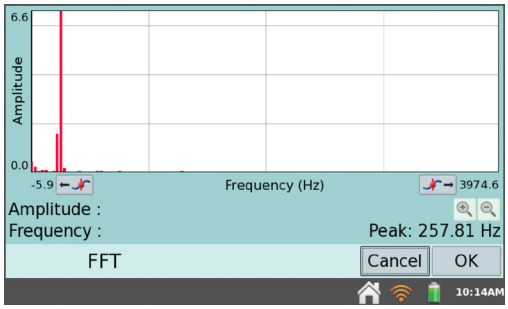
TIP! *If no function appears when modeling, your parameters are likely defining a curve that is outside of the plot window.*

- **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

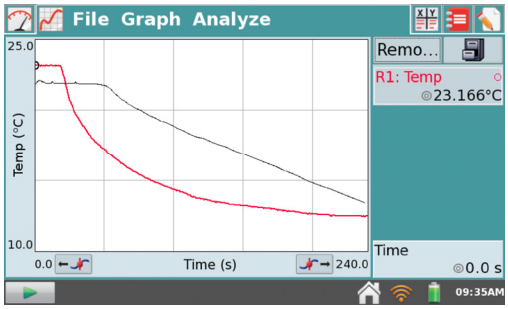


  - **Peak Integration**—This tool calculates the integral for a selected portion of a graph. It is most commonly used with the Vernier Mini GC, but it can be applied to any data plot. Peak Integration differs from the Integral tool in that it does not use the x-axis as the baseline. Instead, the integral for Peak Integration is evaluated from the minimum y-values to the left and right of a selected peak.

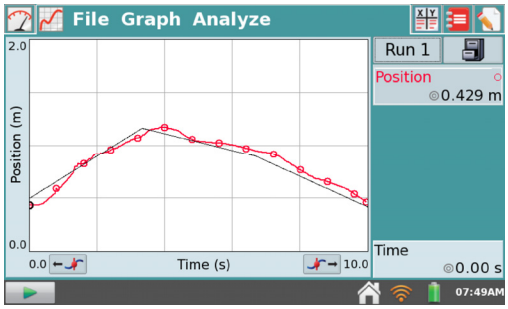
  - **Pivot Data**—This tool is only available in Data Matrix mode. It transposes the rows (usually graphed as the x-axis and representing the sampling site) with the runs (usually selected by tapping on the button to the left of the Filing Cabinet and representing the sampling day). This field data can be viewed as the location changes, or pivoted and viewed as the day changes.

- **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.



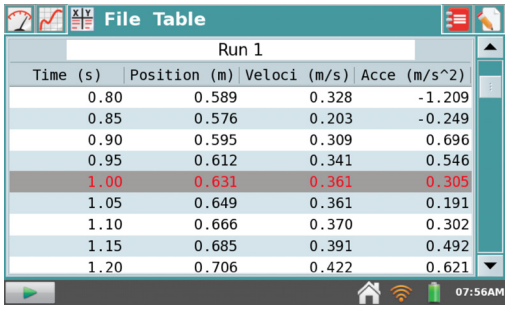
TIP! *For additional information on using Motion Detectors, see* www.vernier.com/til/5.

Adjusting the Table Screen

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.

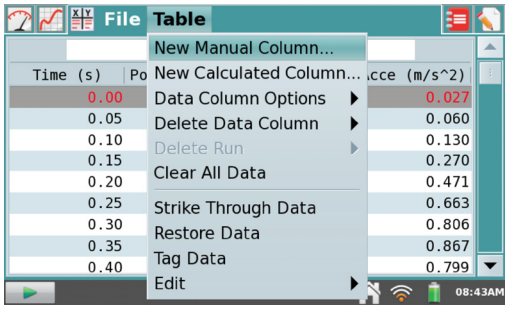
Alternatively, you can also access the fields by choosing Data Column Options from the Table menu.

- 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.

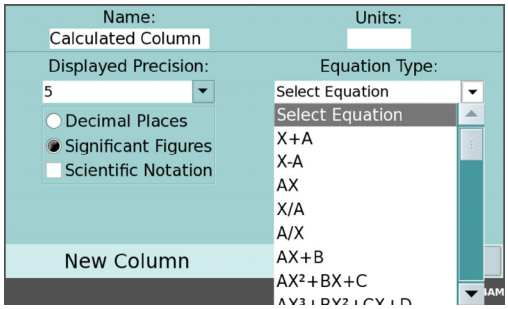


Manipulating Data from the Table Screen

From the Table menu, you can create, modify, or delete columns of data. The following tools are available from the Table 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.



- **New Calculated Column**—New Calculated Column creates a new column with values that 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**—Use these options 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**—Use this 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 data set created.

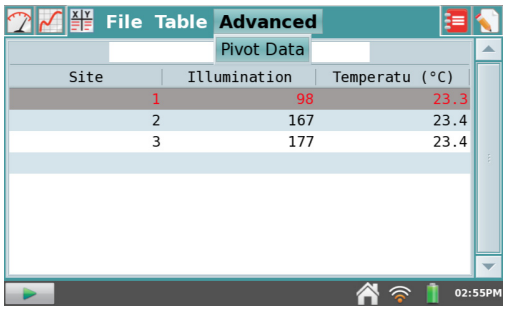
- **Clear All Data**—This action will clear all data in the table. Upon choosing this option, you will be prompted to confirm. This option is used when you wish to clear previously collected data without changing any of the data-collection parameters or sensor setup information.

- **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**—Use this tool 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.

Advanced Table Option

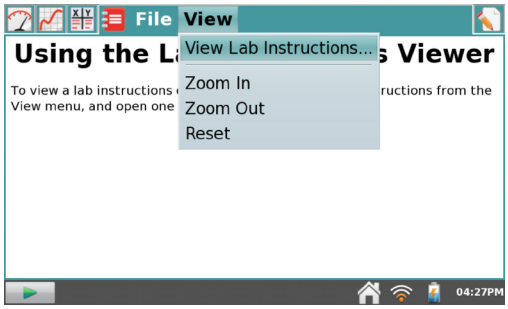


When LabQuest is in the Data Matrix mode, an Advanced Menu option is displayed adjacent to the Table menu. Choose **Pivot Data** from the Advanced menu to transpose the rows (usually graphed as the x-axis and representing the sampling site) with the runs (usually selected by tapping on the button to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

Viewing Vernier Lab Instructions

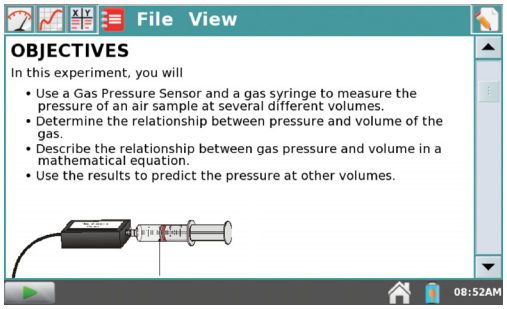
From the Lab Instructions screen, selectable by tapping the Lab Instructions tab , students can view select experiment instructions from Vernier lab books. LabQuest comes preloaded with over 100 experiments.

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 select experiments preloaded on LabQuest. Select the desired book and experiment, and then tap OK.

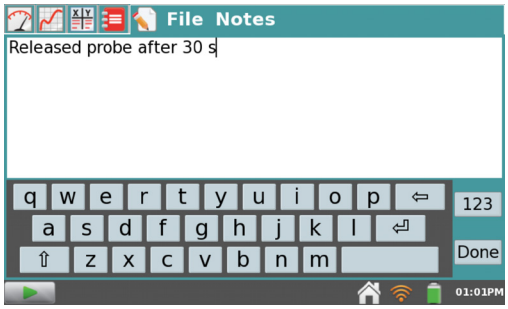
In addition to scrolling through the instructions using the scrollbar at right, you can also zoom in on a particular portion of the instructions by choosing Zoom In from the View menu. Choose Zoom Out from the View menu to restore the previous view. Choose Reset from the View menu to restore the original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



To stop viewing a particular experiment instruction, choose View Lab Instructions from the View menu, select the file named **default.html**, and then tap OK.

Adding Notes to Your Experiment

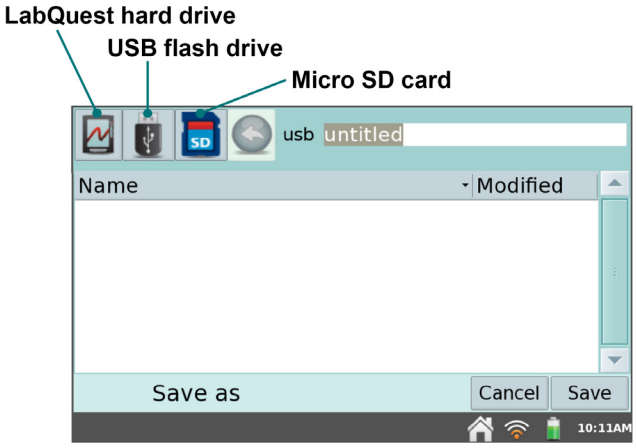
From the Notes screen, selectable by tapping the Notes tab , students can enter notes as they perform an experiment. The menu provides access to standard edit commands of Cut, Copy, Paste, and Clear All.



Storing LabQuest App Files

LabQuest files have a *.qmbl* extension and can be saved to the internal storage space on LabQuest, or to an external storage device such as a USB flash drive or microSD card. LabQuest App files can also be opened and manipulated on a computer with Vernier Logger Lite or Logger *Pro*® 3 software.

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



To save a LabQuest App file, follow these instructions:

1. If saving to an SD card or USB flash drive, make sure the drive is inserted in the appropriate port on LabQuest. It can take several seconds for LabQuest to recognize the drive.
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. Tap OK.
5. Tap Save to save the file.

TIP! *You cannot create directories within LabQuest App, but you can use directories that already exist on the microSD card or USB drive. We recommend creating any needed folders on a flash drive or SD card using 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 Lite or Logger *Pro*® 3.

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. You must connect a microSD card or USB flash drive to export a file.

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. DATA SHARING: USING LABQUEST® 2

As part of the Connected Science System®, LabQuest 2 serves as a Data Sharing source that can wirelessly stream sensor data to Vernier Graphical Analysis™ or Graphical Analysis™ Pro running on computers, Chromebook™ notebooks, or mobile devices such as iOS, iPadOS®, and Android™ tablets and phones.

How Data Sharing Works

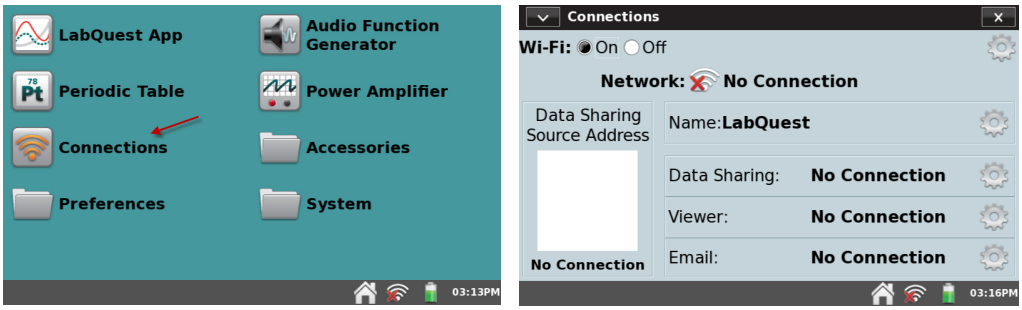
- Students in a lab group set up an experiment with Vernier sensors and LabQuest 2.
- Students use Vernier Graphical Analysis or Graphical Analysis Pro app to wirelessly connect to the LabQuest 2 using Wi-Fi.
- Experiment data are streamed from LabQuest 2 to each student's device.
- Each lab group member performs an individual analysis of the shared data on their device.
- Students can take their data and analysis home for further analysis and lab reports.

Set Up Data Sharing on LabQuest

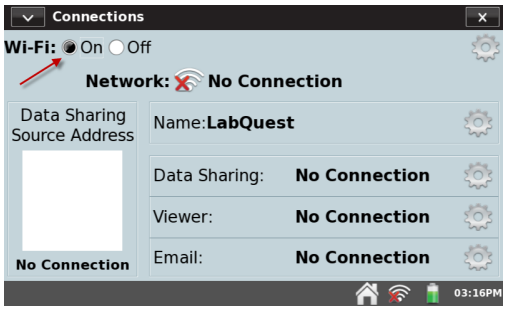
To set up LabQuest as a Data Sharing source, you will need to connect LabQuest to a Wi-Fi Network and enable Data Sharing.

Connect LabQuest to a Wi-Fi Network

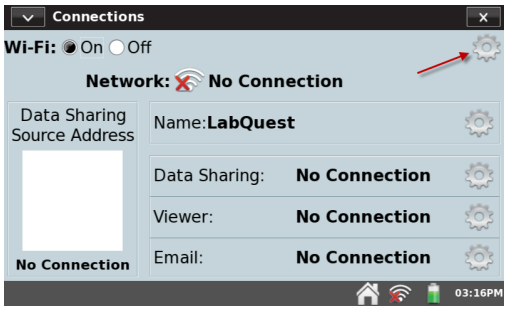
1. Launch the Connections app from the Home screen.

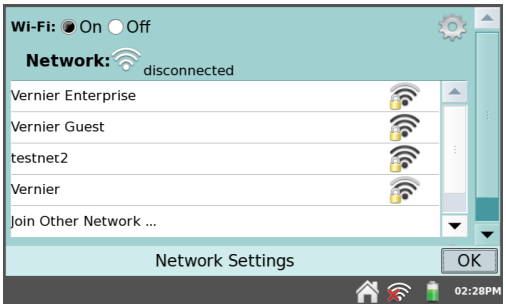


2. Verify Wi-Fi is enabled (On).



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 identifies, as well as an option to join networks manually or create your own network.



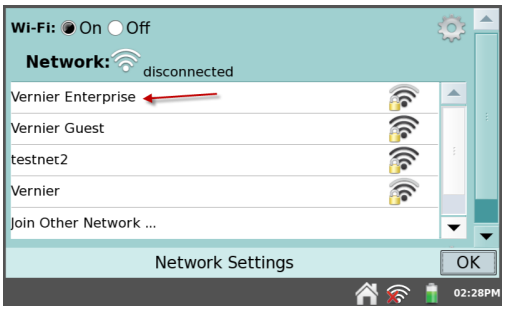


4. Select a network.

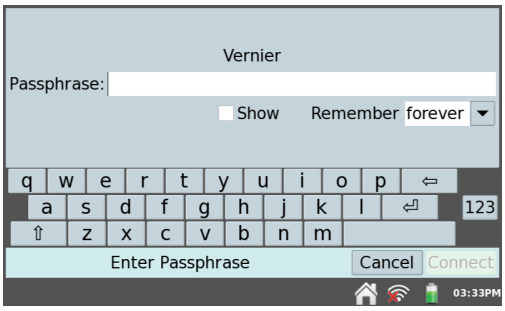
Existing Network (Infrastructure Network)

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

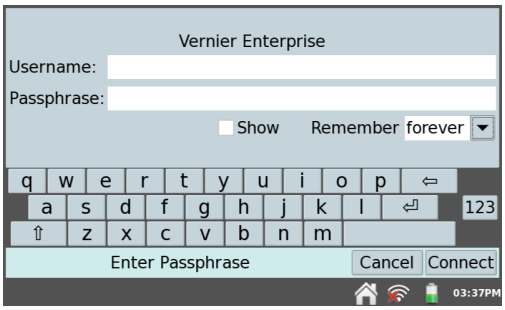
a. Locate the network within the list and tap on the network name to select it.



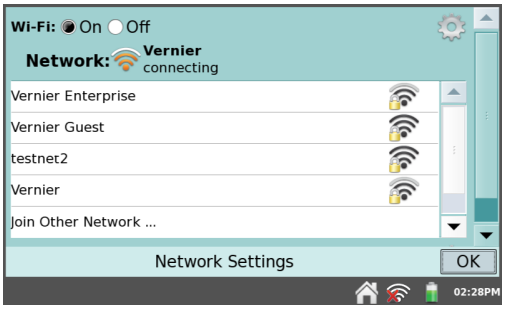
If prompted, enter your network's passphrase and tap Connect.



TIP! *If your network requires additional network authentication information or if you have an enterprise network that requires a network certificate, see our website for more instructions:* www.vernier.com/til/2836

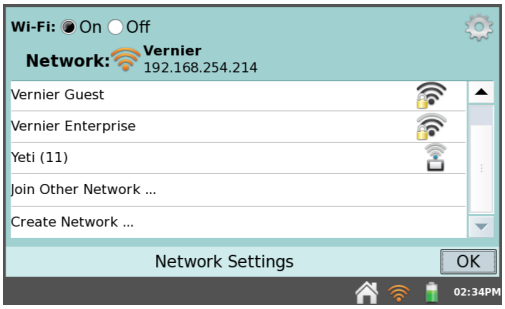


b. Verify LabQuest is attempting to connect to the network. The network status should indicate "Connecting."



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

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



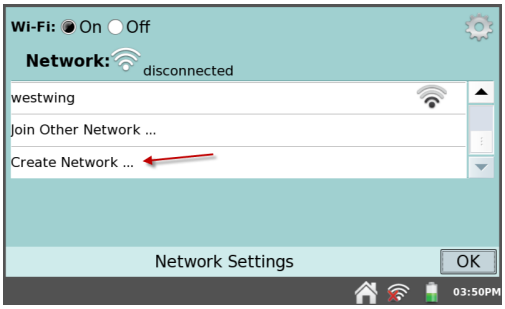
Create a new LabQuest Network (Ad-Hoc Network)

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.

TIP! *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.

TIP! *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.

c. Verify LabQuest is attempting to create a network. The network status should indicate "Connecting."

d. Verify LabQuest has successfully created a network. The network status should change to a numeric IP address.

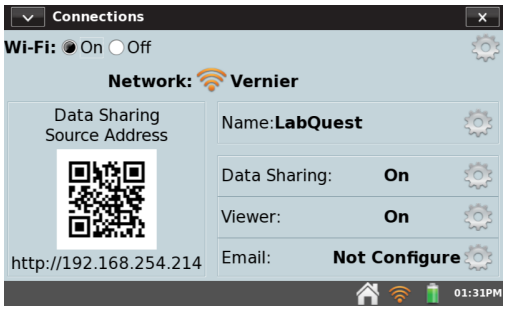
   When LabQuest has successfully created a network, tap OK to return to the Connections app.

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

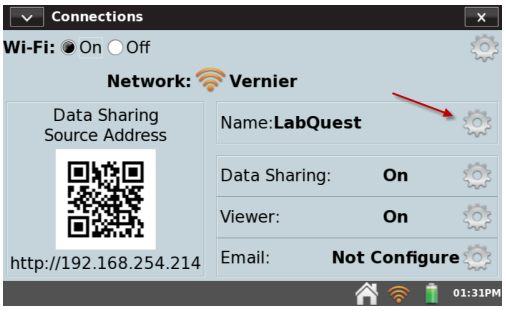
Enable Data Sharing on LabQuest

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.

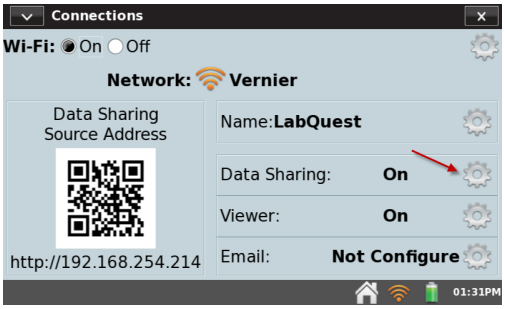


2. To easily identify this LabQuest unit, you can give the unit a unique name. To do this, tap the Name field gear.



   Tap the Name field to edit the LabQuest name (e.g., LabQuest1). Tap Done to save the name.

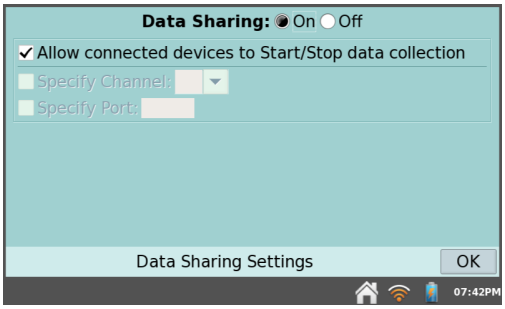
3. From the Connections app, tap the Data Sharing gear to open the Data Sharing Settings dialog box.



4. Verify Data Sharing is enabled (On).

   TIP! *If you want to allow students to start and stop data collection from their computing device, select the check box to enable this feature.*

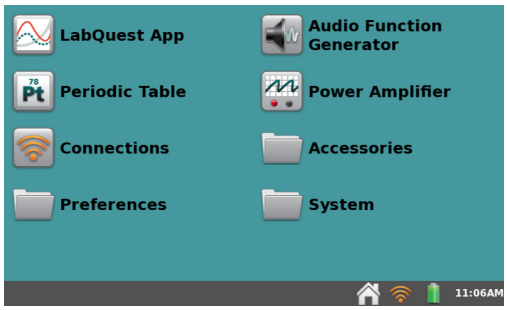
   Tap OK to save the setup.

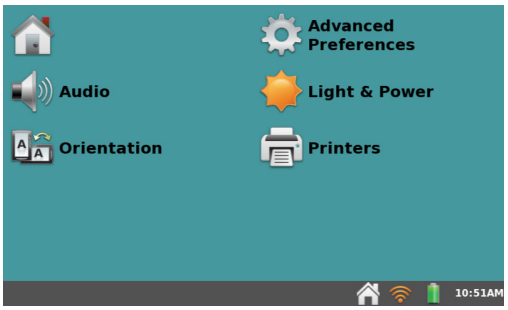


Restricting Access to the Connections Setup

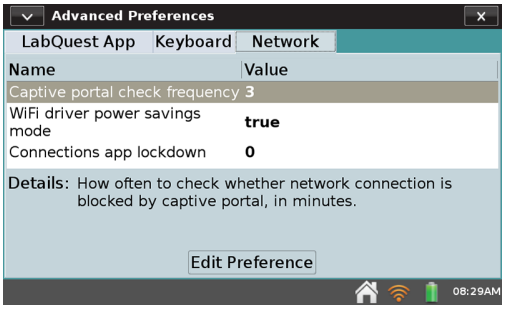
Once your LabQuest is configured as desired, you can set the preferences to restrict access to the Connections setup information. This prevents students from inadvertently changing your network and Data Sharing settings.

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

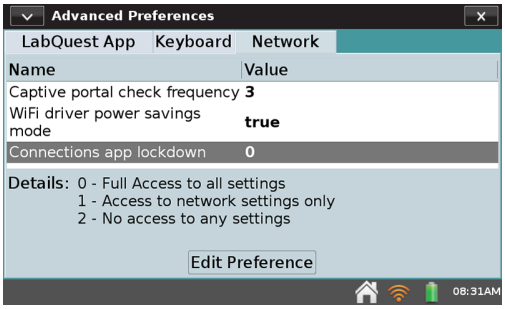




2. Within the Advanced Preferences dialog box, tap the Network tab.

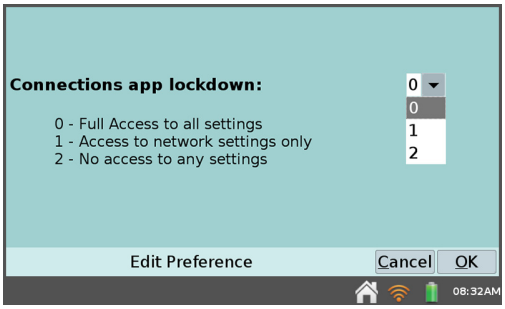


3. Select Connections app lockdown and then tap Edit Preference.



4. Select the desired setting.

   TIP! *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 to LabQuest 2 from Your Device

After setting up LabQuest as a Data Sharing source, you can then connect to this LabQuest from your computer, Chromebook™, or mobile device.

Access LabQuest 2 Data Using Graphical Analysis or Graphical Analysis Pro

1. Connect your Chromebook or mobile device to the same Wi-Fi network to which you connected LabQuest 2.

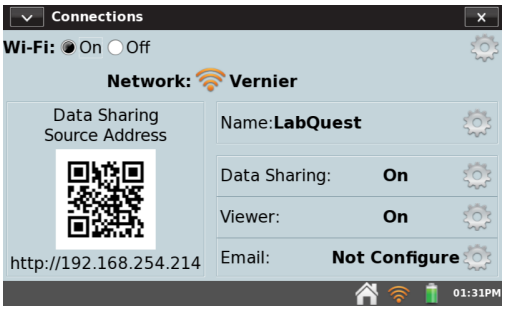
2. Launch Graphical Analysis on your computer, Chromebook, or mobile device.

3. From the New Experiment dialog, select Data Sharing. If you are using Graphical Analysis Pro, click or tap the Local tab. 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 Source and manually entering the LabQuest Data Sharing source address, or by scanning the QR Code.

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 computer, Chromebook™, or 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.

V. USING LABQUEST® 2 WITH A COMPUTER OR CHROMEBOOK™ VIA USB

LabQuest 2 can be used via USB connection with the following software:

- Logger Lite—www.vernier.com/logger-lite
- Logger *Pro*® 3—www.vernier.com/lp
- Vernier Graphical Analysis—www.vernier.com/ga
- Graphical Analysis Pro—https://www.vernier.com/gapro

Collecting Data with Logger Lite, Logger *Pro 3*, Graphical Analysis, or Graphical Analysis Pro

LabQuest 2 can be used as a USB sensor interface with a computer or Chromebook. To collect data, follow these steps:

1. Connect a wired (BTA or BTD) sensor to LabQuest. **Note:** USB and Wireless sensors cannot be used when LabQuest is being used as a sensor interface.

2. Connect LabQuest to your computer or Chromebook 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 or Chromebook.

3. Open the data-collection software on your computer or Chromebook. The software 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 or Chromebook.

4. Click the Collect button in the computer or Chromebook to start data collection.

Transferring Data from LabQuest to Logger *Pro* 3 or Logger Lite

Automatically Transferring Data

If you collect data in LabQuest App and subsequently connect LabQuest to a computer, then Logger Lite or Logger *Pro* 3 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 (see Storing LabQuest App Files), open Logger Lite or Logger *Pro* 3 on your computer, choose LabQuest Browser from the File menu, and 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 (*.gmbl*) or Logger *Pro 3* (*.cmbl*) file by choosing Save As from the computer software File menu.

TIP! *If sensors are still connected when a LabQuest file is opened using Logger* Pro *3 or Logger Lite, the sensors will be ignored. To enable the sensors, choose New from the File menu in Logger Lite or Logger* Pro *3.*

Another method for manually transferring data from LabQuest to Logger Lite or Logger *Pro 3* 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. You can 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 LabQuest units) by repeatedly importing data into a single Logger* Pro *3 or Logger Lite file.*

Manually Moving Data from Logger *Pro* 3 or Logger Lite 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* 3 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 from Logger *Pro* 3 or Logger Lite

To delete data on LabQuest from Logger Lite or Logger *Pro 3*, 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.*

Transferring Data from LabQuest to Graphical Analysis or Graphical Analysis Pro

Collected data can only be transferred from LabQuest to Graphical Analysis and Graphical Analysis Pro through wireless Data Sharing via Wi-Fi. You cannot access data saved on LabQuest 2 through a USB connection.

For more information on Data Sharing, see Data Sharing: Using LabQuest® 2.

VI. EMAILING FROM LABQUEST® 2

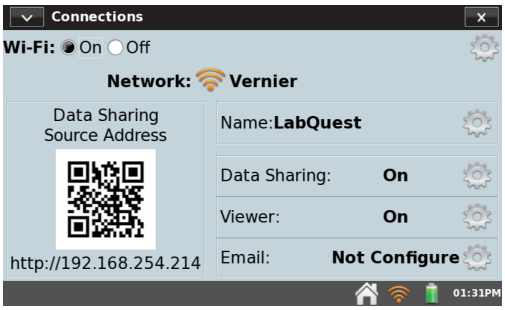
If LabQuest is connected to a network with Internet access, you can email your data file, graph, text file, or screenshot.

To set this up, follow these instructions:

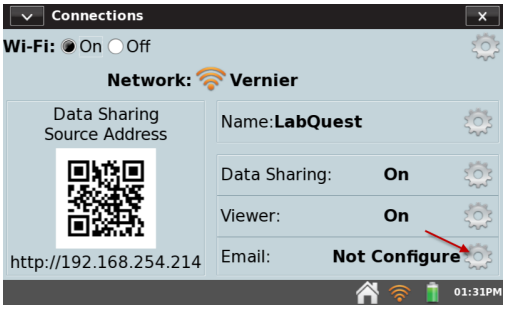
1. Connect LabQuest to a network with Internet access. For detailed instructions, see Connect LabQuest to a Wi-Fi Network

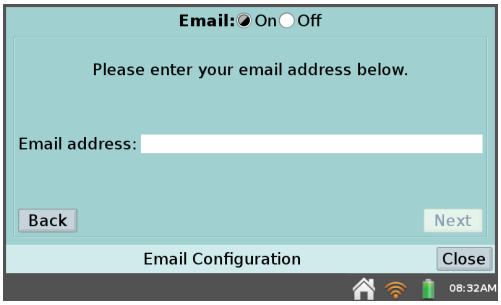
   TIP! *A LabQuest Network (Ad-Hoc Network) does not have Internet access. You will need to join an existing network with Internet.*

2. Launch the Connections app from the Home screen.



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





   TIP! *If you are not able to access the Email Configuration dialog box, you may need to update the Connections app lockdown settings. See Restricting Access to the Connections Setup for more information.*

4. Verify email is enabled (On).

5. Enter the email address you want to use with LabQuest.

   TIP! *This is used to access the outbound email server associated with this email account required for sending emails. You cannot receive incoming emails on LabQuest 2.*

6. Follow the on-screen prompts to register LabQuest with your email provider (e.g., Gmail). For more information, see www.vernier.com/til/2643.

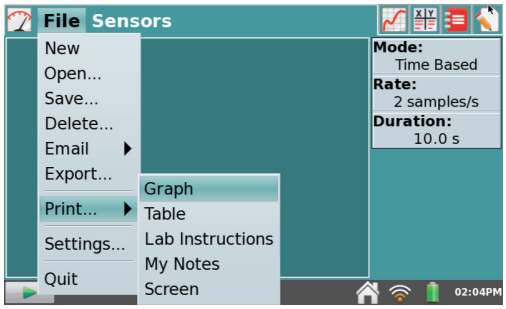
VII. PRINTING FROM LABQUEST® 2

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. In addition, if a printer is not available, you can use the Print to File option to save a PDF file on a USB drive or microSD card to print at a later time. For a list of compatible printers, see www.vernier.com/til/1659

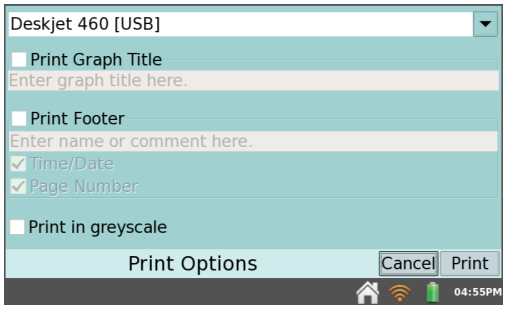
To print to a compatible printer for the first time, follow the Printer Setup instructions below. This setup is only required for the first time you use a particular printer. Once a printer has been installed, LabQuest will store the drivers.

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).

TIP! *Options for printing Table, Lab Instructions, and My Notes are not available when those items have no data to print.*



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

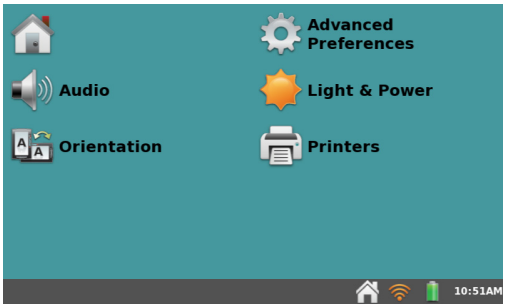


Printer Setup

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

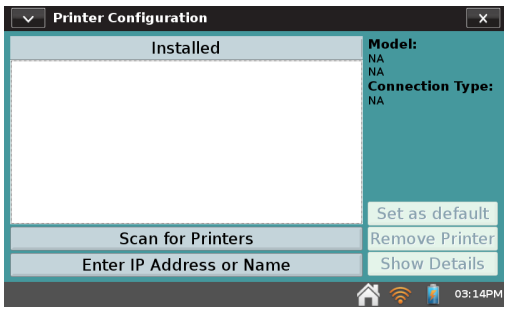
   If printing to a Wi-Fi-enabled printer, verify that LabQuest is connected to the same Wi-Fi network as the printer. See Connect LabQuest to a Wi-Fi Network for more information, if needed.

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

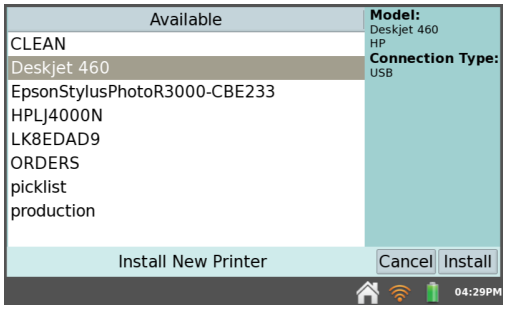


3. Tap Scan for Printers. In response, LabQuest will search for available printers.

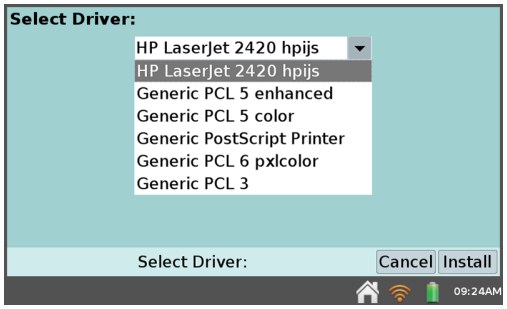
   TIP! *If LabQuest is unable to locate a desired network printer, try accessing it directly by tapping Enter IP Address or Name.*



4. Select the desired printer and tap Install.



5. Select a driver for your printer. For more information on determining which driver you should select, see www.vernier.com/til/3657



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® 2 DEVICES

Use our LabQuest Viewer software (order code, LQ-VIEW) for Windows® and macOS® computers or LabQuest Viewer® for iPad® to view and control LabQuest wirelessly from your computer or iPad. LabQuest Viewer can be used in conjunction with a projector to share the LabQuest 2 screen with the entire class.

Instructors can demonstrate LabQuest 2 for a class, and students can share or present their work to fellow classmates.

With LabQuest Viewer, you can:

- View and control one or more LabQuest units from a computer or iPad.
- Connect to a 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.

System Requirements

- **Windows**—Windows 7 (SP1), Windows 8, Windows 8.1, and Windows 10
- **macOS**—macOS X 10.8 or newer
- **iPad**—iOS 8 or newer or iPadOS (any version)

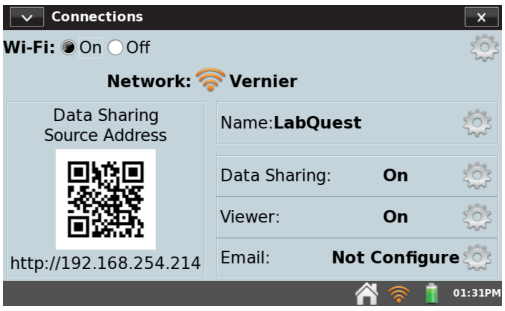
LabQuest Setup

To set up your LabQuest to communicate with LabQuest Viewer App for iPad, or LabQuest Viewer software on your macOS or Windows computer, follow these instructions.

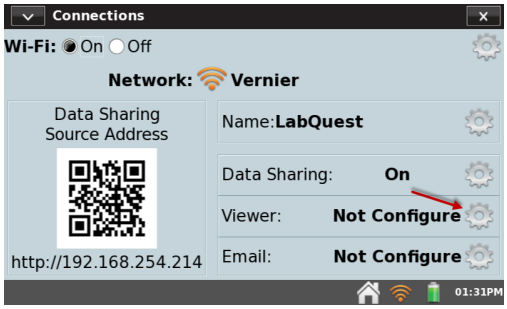
1. Connect LabQuest to a network. For detailed instructions, see Connect LabQuest to a Wi-Fi Network

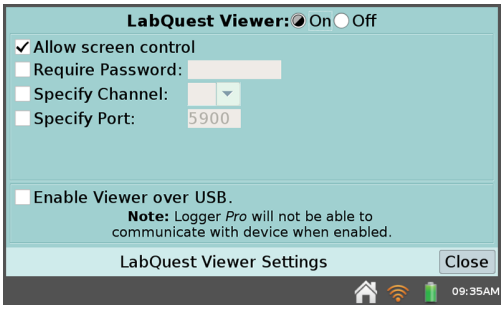
   TIP! *The Network used for the LabQuest Viewer does not require Internet connectivity.*

2. Launch the Connections app from the Home screen.



3. Tap the Viewer settings gear to open the Viewer Settings dialog box.





4. Enable LabQuest Viewer (On).
5. Select the check box to Allow screen control.
6. Tap OK to exit the LabQuest Viewer settings.

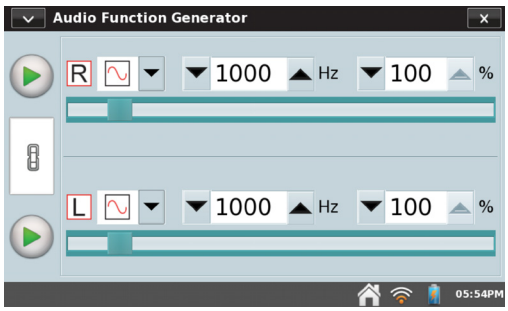
IX. ADDITIONAL APPS ON LABQUEST® 2

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 the 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.

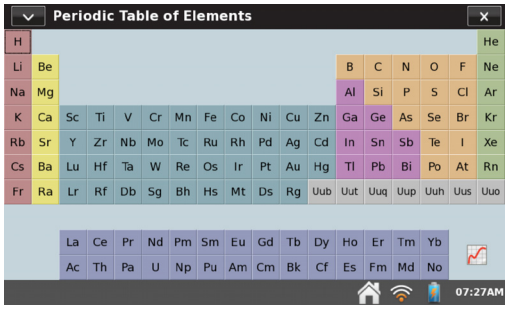


Use the sliders to also control frequency. Tapping left or right of the slider will halve or double the frequency.

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 LabQuest audio output jack.

Periodic Table

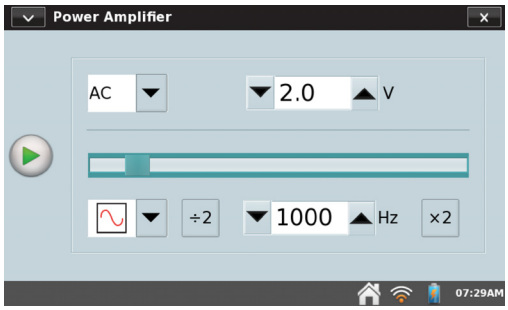
From the Home screen, tap Periodic Table to launch this app. The Periodic Table contains standard reference information on the elements. Tap an element to see details.



Power Amplifier

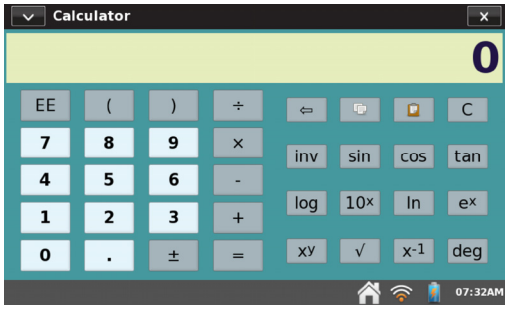
From the Home screen, tap Power Amplifier to launch this app. The Power Amplifier app controls the Vernier Power Amplifier (order code PAMP) used to create waveforms with up to 10 V amplitude and currents of 1 A. Connect the Power Amplifier to the LabQuest audio output.

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 on the left.



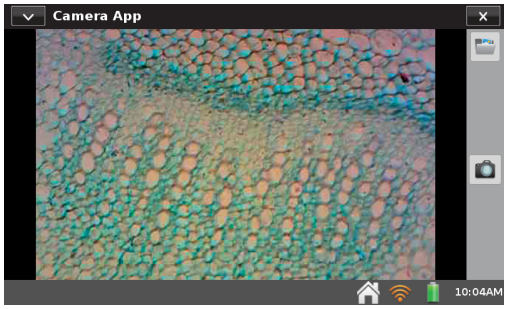
Calculator

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



Camera App

From the Home screen, tap Accessories, and then tap Camera App to launch this app. The Camera App works with digital (USB) cameras. See www.vernier.com/til/3659 for more information regarding supported digital cameras. Use the Camera App to view a live image feed from the camera as well as capture images for later viewing.



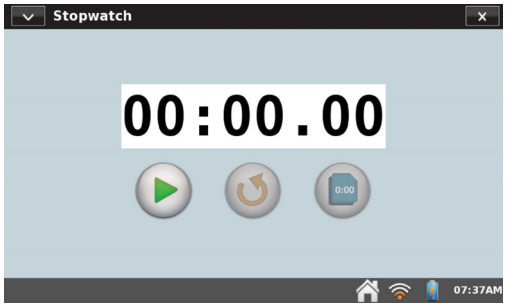
Sound Recorder

From the Home screen, tap Accessories, and then tap Sound Recorder to launch this app. The sound recorder captures short audio clips, typically for voice notes. To record a clip, tap the record button . To stop, tap the square red stop button. Play the clip back using the green play button. Tap the disk button 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 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, the calculator, or a manual column cell.



X. APPENDICES

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)

Maximum Samples (standalone)

- 1 sensor: 2000 samples 20K–100K samples/s
- 1 sensor: 14,000–21,000 samples* ≤ 10K samples/s
- 2 or more sensors: 12,000–14,000 samples* @ ≤ 10K samples/s

Minimum Sampling Rate

- 0.00125 samples/s (800 s/sample)

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:

- Heat Pulser
- Vernier Flash Photolysis Spectrometer

**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.*

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 Charging Station (order code LQ3-CRG, sold separately) to charge the LabQuest battery. A replacement adapter can be purchased from our website (order code LQ3-PS).

The battery takes about 12 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 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 and the battery will begin to swell. 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 website (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 or allow liquids to sit on the screen for any extended time. 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.

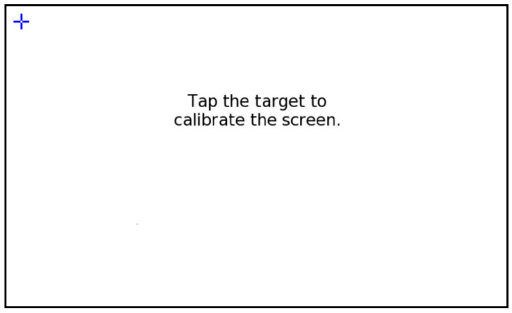
Free updates with step-by-step instructions are available on our website:
www.vernier.com/downloads/

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 hard-key, the center of the three hard-keys located to the right of the screen, until the Calibration tool is displayed.



Getting Additional Help

For access to user manuals, forums, and our Technology Information Library, please visit our website at

www.vernier.com/labq2

You may also contact Vernier directly:

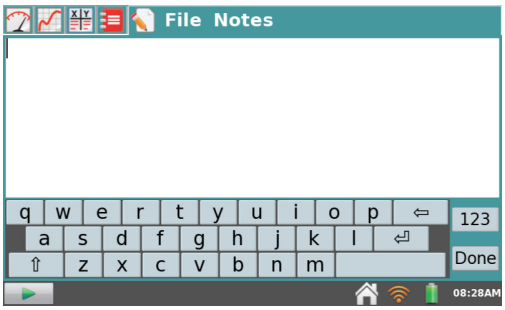
888.837.6437
support@vernier.com

Appendix C—LabQuest Keyboard

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

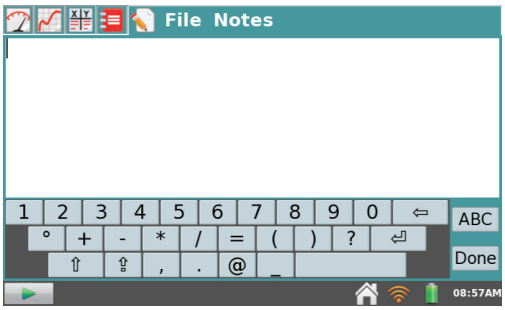
Standard

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*.



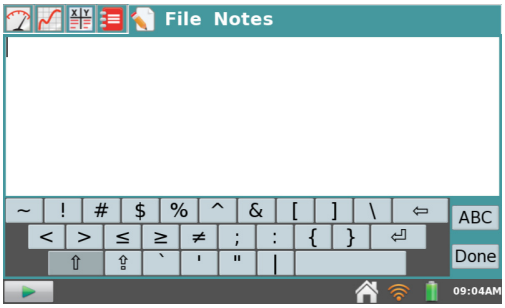
Numeric and special characters

To access the numeric keyboard from the standard keyboard, tap 123.



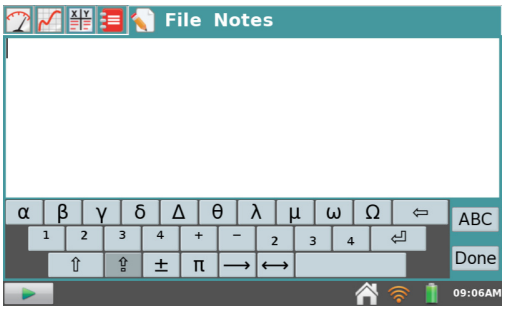
Symbols

To access symbols from the numeric keyboard, tap ⇧.



Special characters

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

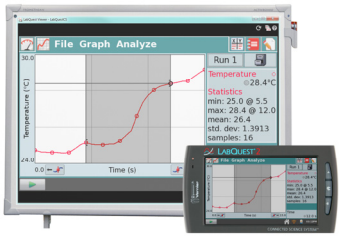
Vernier warrants this product (with the exception of the battery) to be free from defects in materials and workmanship for a period of five years from the date of shipment to the customer. This warranty does not cover damage to the product caused by abuse or improper use. This warranty covers educational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

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—Curriculum Resources

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

Appendix G—Accessories, Replacement Parts, and Related Products



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

Also available, LabQuest Viewer® for iPad®
www.vernier.com/lq-view-ipad

LabQuest Charging Station

Charge and store up to four LabQuest 2 interfaces with this compact and affordable station.
www.vernier.com/lq3-crg

LabQuest 2 Lab Armor

Add extra protection from spills and falls.
www.vernier.com/lq2-armor

LabQuest Battery Boost 3

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-boost3

LabQuest 4 GB SD Card

Easily add storage to your LabQuest or move files between LabQuest units and a computer.
www.vernier.com/lq-sd4

Vernier Lanyard

The LabQuest neck strap helps 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

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/cb-usb-mini

LabQuest USB-C Computer Cable

LabQuest to computer USB C cable
The cable has a USB mini-B plug and USB-C plug. This cable is recommended for computers and Chromebook™ notebooks that only have USB-C ports.
www.vernier.com/cb-usb-c-mini

Replacement Battery for LabQuest 2

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

Appendix H—Disposal

When disposing of this electronic product, do not treat it as household waste. Its disposal is subject to regulations that vary by country and region. This item should be given to an applicable collection point for the recycling of electrical and electronic equipment. By ensuring that this product is disposed of correctly, you help prevent potential negative consequences on human health or on the environment. The recycling of materials will help to conserve natural resources. For more detailed information about recycling this product, contact your local city office or your disposal service.

Battery recycling information is available at www.call2recycle.org

Do not puncture or expose the battery to excessive heat or flame.

The symbol, shown here, indicates that this product must not be disposed of in a standard waste container.

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Toll Free (888) 837-6437 • (503) 277-2299 • FAX (503) 277-2440
support@vernier.com • www.vernier.com/

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