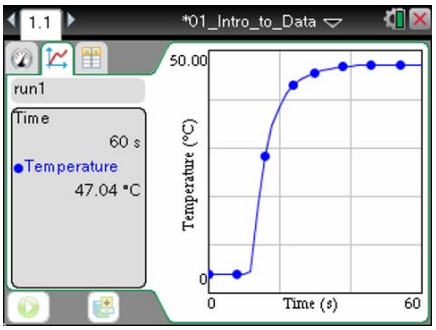
Appendix

B

Using DataQuest on a Handheld

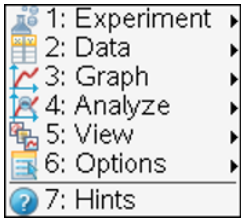


This appendix gives an overview of using the Vernier DataQuest application on a TI-Nspire handheld. It includes information on accessing the common tools in the DataQuest Application.

DataQuest is included in TI-Nspire handheld software versions 3.0 and newer. If you have an older version of TI-Nspire software, you can get updates at education.ti.com.

The TI-Nspire Software

Access Menus



DataQuest can be used to collect, display, and analyze data. Most features can be accessed using the application menus. To access the menus, press menu.

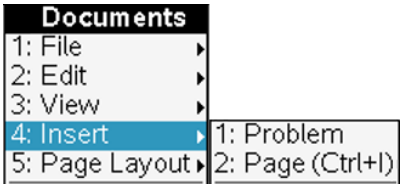
Access Context Menus

To access context menus, move the cursor over the object using the touchpad or arrow keys, and press ctrl menu. Meters, View details boxes, graphs, and the table all have contextual menus.

Open a New Document

To open a new document, press on then select New Document. Having only one TI-Nspire document opened when using DataQuest is recommended.

Add a Page or Problem

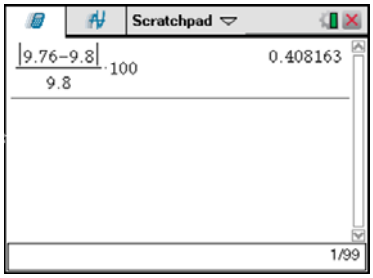


To add a new page or problem to your TI-Nspire document, press doc (ctrl for clickpad handhelds) and choose Problem or Page from the Insert menu. For touchpad handhelds, you can also add a page by pressing ctrl doc.

Save a document

To save your TI-Nspire document, press doc (ctrl for clickpad handhelds) and choose Save from the File menu or press ctrl S.

Scratch Pad Calculator



The Scratch Pad Calculator is a built-in calculator that can be used to perform calculations while you are conducting an experiment. To use the Scratch Pad Calculator, press . (On a click pad handheld, press then select the Scratchpad Calculate option.)

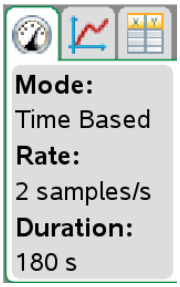
Start DataQuest

DataQuest should automatically start when you connect a TI-Nspire Lab Cradle, EasyLink interface, EasyTemp temperature probe, or Texas Instruments CBR 2™ motion detector to your handheld.

Manually Launch DataQuest

To start DataQuest manually, press [on] then select . You can also press [doc] ([ctrl] for clickpad handhelds) and choose Vernier DataQuest from the Insert menu.

Views in DataQuest

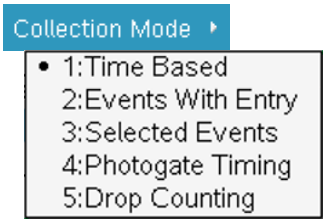


There are three views in the DataQuest application: Meter, Graph, and Table. Click a tab to change views or press [menu] then choose the desired view from the View menu.

On the left side of the screen in each view, you will see the View details box. The Meter View details box shows the data-collection settings. The Graph View details box shows graph trace and analysis information. The Table View details box shows data set variable information.

Data Collection Settings

Change the Data-Collection Mode

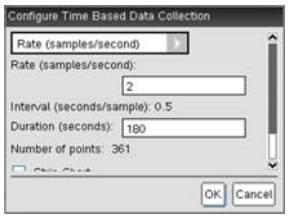


1. Press [menu] then choose Collection Mode from the Experiment menu.
2. Select the data-collection mode you want to use.

   Note: *Changing modes will require you to discard any collected data. To avoid losing data, save the current document and open a new document, or insert a new problem in the current document.*

3. A dialog showing the data-collection settings for the mode you have selected will be displayed. Adjust the settings as desired for your experiment. Use [tab] to move between entry lines.
4. When you are done setting up the data collection, select OK.

Change Data-Collection Settings

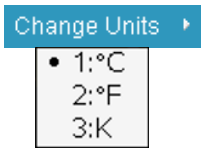


When you have already set up the data-collection mode and want to make changes to the settings, you can change the values you have entered.

1. Press [menu] then choose Collection Setup from the Experiment menu.
2. Make the necessary changes and select OK.

Sensor Settings

Change Units

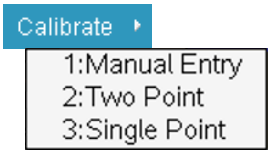


1. Press menu then choose Set Up Sensors ► Change Units from the Experiment menu.
2. Select the unit you want to use. The readings from the sensor and any collected data will be displayed in the new unit.

Calibrate a Sensor

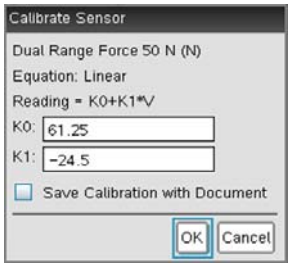
Not all sensors can be calibrated. Check the sensor booklet for specific information about your sensor. For most experiments, the sensor's stored calibration is recommended. In some instances, you may want to calibrate a sensor to get readings that are even more accurate.

1. Press menu then choose Set Up Sensors ► Calibrate from the Experiment menu. Select the appropriate calibration option for your situation:



   - Manual Entry – Use Manual Entry when you know the calibration equation and want to enter the coefficients directly.
   - Two Point – Use Two Point for most calibrations.
   - Single Point – Use Single Point when only one known calibration value is attainable (for example, calibrating a Barometer to match the current atmospheric pressure). Single Point calibration will only affect the intercept of the calibration equation.

2. Perform a live calibration (Two Point or Single Point).
   a. Place the sensor in the desired calibration environment, enter the reference value, wait for the voltage readings to stabilize, and select Keep.
   b. Two Point only – place the sensor in a second calibration environment, enter the reference value, wait for the voltage readings to stabilize, and select Keep.
3. Note the updated calibration equation, modify if necessary (Manual Entry), and select OK.



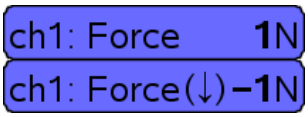
Zero a Sensor

Not all sensors can be zeroed. Check the sensor booklet for specific information about your sensor.

To zero a sensor, press menu then select Set Up Sensors ► Zero from the Experiment menu.
Note: When you have more than one sensor you want to zero, select the All Sensors option.

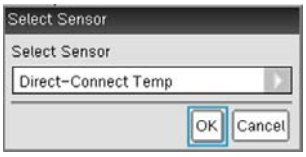
Reverse a Sensor

Not all sensors can be reversed. Check the sensor booklet for specific information about your sensor.



Press menu then choose Set Up Sensors ► Reverse from the Experiment menu. The sign of the sensor reading is changed as noted in the example.

Sensors that do not Auto-ID



The DataQuest Application supports older sensors that do not auto-ID. To manually set up a sensor, connect the sensor to the interface and the interface to your handheld. Press menu then choose Advanced Set Up ► Configure Sensor from the Experiment menu, and select the interface and channel your sensor is connected to. Select your sensor from the drop down list and click OK.

Sensors that do not auto-ID must be set up everytime they are used and will not be identified by the software when opening a saved file.

Data Collection

Start Data Collection

To start data collection, click the Start Collection button or press menu then choose Start Collection from the Experiment menu.

Keep Data Points (Event Based Data Collection)

To store a data point during Events with Entry or Selected Events experiments, click the Keep button or press menu then choose Keep from the Experiment menu.

Stop Data Collection

To stop data collection, click the Stop Collection button or press menu then select Stop Collection from the Experiment menu.

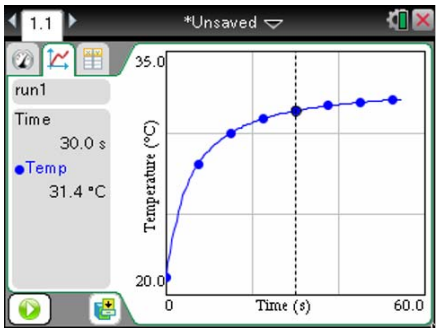
Extend Data Collection (Time Graph Collection)

To extend a time graph experiment to one and one-half times the current duration, press menu then choose Extend Collection from the Experiment menu before or during a collection. The time listed in the menu will be the new duration for the experiment.

Store Data Sets

To store a data set, click the Store Latest Data Set button or press menu then choose Store Data Set from the Experiment menu.

Graphical Display of the Data

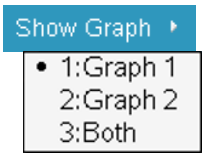


By default, DataQuest will graph the most recent (latest) data set on the graph. When two or more of the same type of sensor are connected, data from those sensors will be plotted on the same graph.

When you have two different types of sensors connected, data from the different sensors will be plotted on two separate graphs.

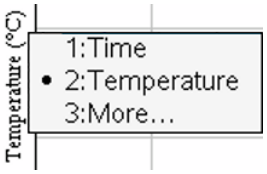
When a Motion Detector is connected, two graphs will be displayed – position and velocity.

Show Graphs



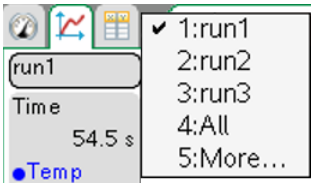
To change the graph displayed, press menu then select Show Graph from the Graph menu. You can select Graph 1, Graph 2, or Both. The two graphs can have different dependent (y-axis) data with different ranges; however, they must have the same independent data and range.

Change what is graphed on the axes



To change the data columns plotted on a graph, move the cursor to the axis label and press ctrl, or press menu then select X-Axis Column or Y-Axis Columns from the Graph menu. Select from the available columns. Use the More option to plot multiple columns on the same axes.

Change which data set is graphed

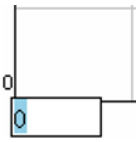


To plot a different data set or multiple data sets on the same graph, click the run indicator or press menu then choose Select Run from the Graph menu.

Select All to display all data sets.

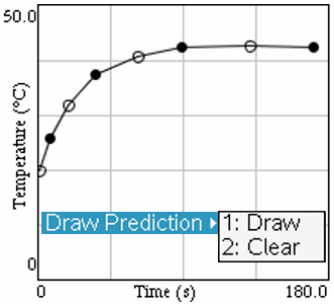
Select More to display any combination of stored data sets.

Adjust the Graph Window Settings



To manually adjust the window settings, click the axis labels or press menu then choose Window Settings from the Graph menu.

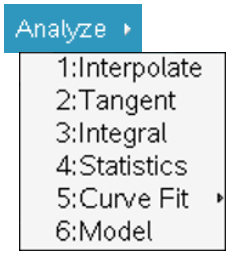
Draw Prediction



Use the draw prediction feature before data collection to predict the outcome of the data collection. To add a prediction to a graph, press menu, choose Draw Prediction from the Analyze menu, then select Draw. Click the graph in the desired locations. When finished press esc.

To remove a prediction, press menu then choose Draw Prediction from the Analyze menu, and select Clear.

Analyze Data

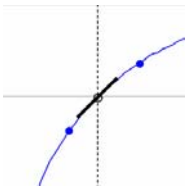


You can perform multiple types of analysis on your data. For most analysis options, the results will apply to all data points unless a region of data is selected first. Press menu then choose your desired analysis option from the Analyze menu.

Interpolate

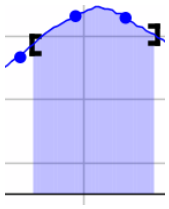
Use Interpolate to examine a graph trace between and beyond the graphed data points. The examine line will move from pixel to pixel instead of data point to data point. This is recommended when examining curve fits.

Tangent



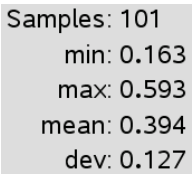
Use Tangent to get a measure of the rate of change of the data at a specific point. A segment is drawn on the graph to help visualize the rate and the rate of change (labeled slope) is displayed in the Graph View details box.

Integral



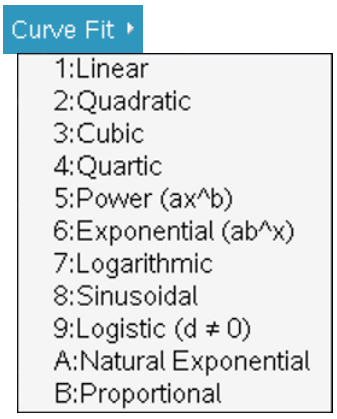
Use Integral to get a measure of the area between your data and the x-axis. Find the area under all data points or under a selected region of the data. You can adjust the region used by clicking and dragging the brackets. The integral region is shaded on the graph and the area is displayed in the Graph View details box.

Statistics



Use Statistics to find minimum, maximum, mean, and standard deviation of your data. Find these values for all data points or a selected region of the data. You can adjust the region used by clicking and dragging the brackets. The statistical values are displayed in the Graph View details box.

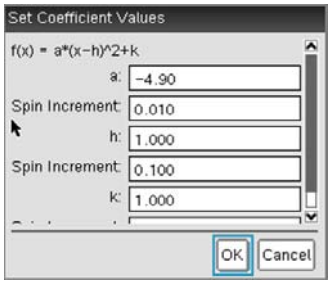
Curve Fits



Use Curve Fits to find the best-fit equation of a curve fit function. Curve fit all data points or a selected region of the data. You can adjust the region used by clicking and dragging the brackets. The curve fit equation is graphed on the axes and the equation values are displayed in the Graph View details box.

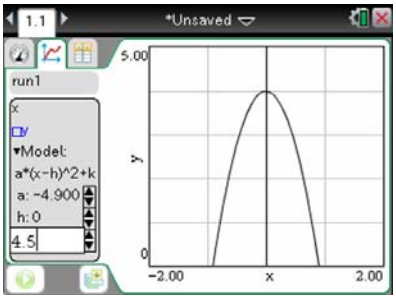
Model

Use Model to manually fit a mathematical equation to your data. A model differs from a Curve Fit in that there are no statistical or iterative processes used to determine the best fit. You can define your models using any function of the variable *x*.



To enter a model:

1. Press menu, then choose Model from the Analyze menu.
2. Select one of the predefined equations or enter your own. The model must be a function of the variable x.
3. Enter your estimates for the coefficient values.
4. Modify the spin increment value if desired.
5. Select OK.



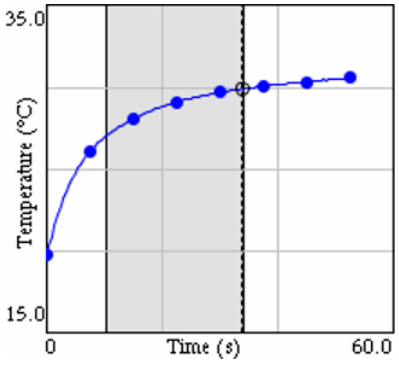
You can adjust the coefficients in your model to obtain a good match of your data.

- Click ( ) on the spin increment buttons ( ).
- Click ( ) on the coefficient and type a new value.
- Move the cursor to the Graph View Details, press ctrl menu then select the Modify Model option.

Remove an analysis feature from a graph

Use the remove option to remove an analysis (integral, statistics, curve fit, or model) from a graph. To do this, press menu then choose Remove from the Analyse Menu. If there are more than one, the analysis options will be listed in the order in which they were created.

Select a Region on a Graph



Select a region when you want to look more closely at a specific region of data or analyze only a portion of the data.

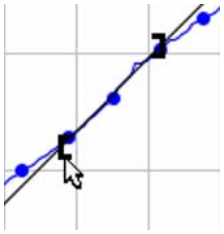
To select a region:

1. Move the cursor to the place you want to start the selected region.
2. Press ctrl to start the selection.
3. Move the cursor to select the region.
4. Press or esc to end the selection.

The selected region is indicated by shading. Once a region is selected, you can:

- Zoom in on the region (Press menu then choose Zoom In from the Graph menu).
- Analyze the region (see above).
- Strike the data within or outside the selected region (see below).

Modify the range of an analysis



Once you have used one of the analysis tools, you can modify the range over which the analysis will apply. To do this directly on the graph, move the cursor over one of the brackets, when the cursor changes to a white arrow, press ctrl to grab the bracket, then use the touch pad or arrow keys to move the bracket. Press esc to release the bracket.

To do this from a menu, move the cursor over the Graph View details box, press ctrl menu, then choose the Modify Range option. If you have more than one analysis, choose the one you want to adjust or choose the Modify All option to apply the change to all of the existing ranges.

Strike Data

	Time	Temp
3	~~1.0~~	~~20.9~~
4	1.5	21.6

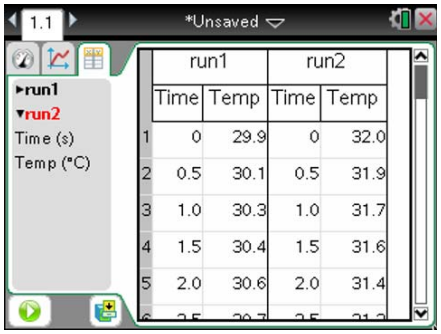
When there are data points that you wish not to have considered in the graphing or analysis of your data, you can "strike" that data. Striking data does not delete the data; rather, data is displayed in the data table with a single line drawn through it and calculated column cells based on struck data will be blank. Struck data is not displayed on the graph.

To strike data, select a region, press menu, then choose Strike Data from the Data menu. Select whether to strike through data inside or outside the selected region.

Restore Data

Use this option to restore struck data. Select a region (optional), press menu then choose Restore Data from the Data menu. Select whether to restore data In Selected Region, Outside Selected Region, or Restore All Data.

Tabular Display of the Data



DataQuest also displays data in a data table. In addition to viewing collected sensor data, you can enter data manually and perform column calculations. Use the scroll bar and scroll buttons to view the data.

Data collected will populate the Latest Data Set in the table. This data set is identified with **red, bolded text** on *CX* handhelds (**bolded text** on other handhelds) in the Table View Details box. Storing a Data Set will change the data set identified as the Latest.

Data Set Options

To change the name of a run or to add notes about the data set, double-click the run name or move the cursor to the table, press ctrl menu then select Data Set Options.

Column Options

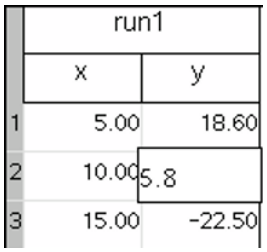
Use the column options to change the name of the column and to modify the display precision of any column. Press menu, choose Column Options from the Data menu, then select the column you wish to modify.

Calculated Columns

Calculated columns are used to generate data based on existing columns in a data set. For example, you may want to calculate gravitational potential energy from height measurements or you may want to linearize pressure-volume data by plotting pressure vs. the reciprocal of the volume data.

To add a calculated column, press menu then choose New Calculated Column from the Data menu. The equation you enter must use one of the data columns in the data set.

Manually Entered Data

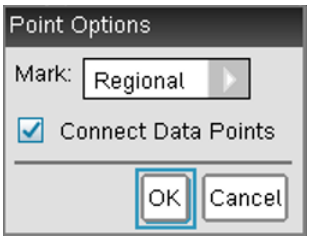


For experiments that require hand-entered data, launch DataQuest in a new document or problem without any sensors connected. Use the default *x* and *y* columns to manually enter data values. You can use the Column Options to rename your columns if desired (see above).

To add additional manual columns, press menu then choose New Manual Column from the Data menu.

DataQuest Options

Points Options

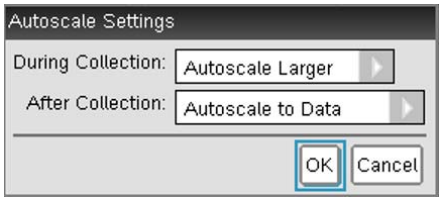


Use the point options to determine how the data are drawn on the graph. To access the Point options, press menu then choose Point Options from the Options menu.

Mark refers to the symbol used to distinguish the different traces on a graph. The Mark options are None, Regional, or All. You can also choose whether to have the data points drawn connected.

Regional/Connected is the default for Time Graph data collection. All/Not Connected is the default for Event based data collection.

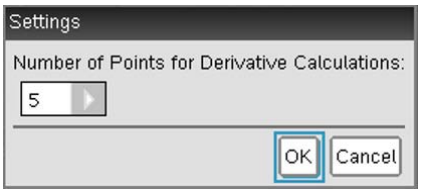
Autoscale Settings



Use the Autoscale Settings to set the scaling behavior of the application during and after data collection. To access Autoscale Settings, press menu then choose Autoscale Settings from the Options menu.

- Autoscale Larger – expands the graph range when needed to ensure each data point appears on the graph. This is the default setting and only applies while collecting data.
- Autoscale From Zero – adjusts the graph range to ensure all data points and the origin (0,0) are displayed with little or no extra space. This only applies after collection is complete.
- Autoscale to Data – adjusts the graph range to show all data points with little or no extra space around the points. This is the default setting and only applies after data collection.
- Do Not Auto Scale – maintains the current window range regardless of the collected data. This can be applied either during or after collection.

Derivative Settings



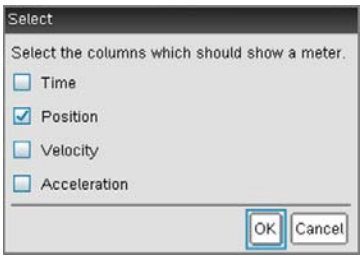
Use the derivative settings to set the number of points used in derivative calculation. The default value is five. To access this setting, press menu then choose Derivative Setting from the Options menu.

Print All Settings

Use the Print All settings to determine which DataQuest views are printed when the Print All printing option is used. Choose from Print Current View (default), Print All Views, or select any one or combination of views to print. The Print All Settings are specific to each DataQuest App so multiple instances of the app must be set up separately.

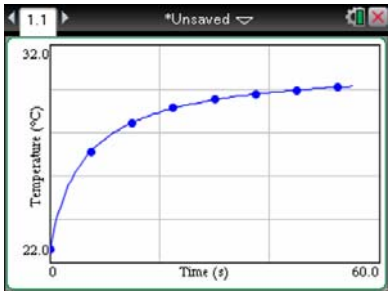
To access Print All Settings, press menu then choose Print All Settings from the Options menu. ***Note:*** *You cannot print a document directly from a handheld. You can only print from the TI-Nspire computer software.*

Show/Hide Meters



You can display (or hide) a meter for any column of data. This is useful for calculated columns of data. To select which meters to display, press menu then choose Show/Hide Meters from the Options menu. **Note:** Meters for calculated columns will only show live values during data collection.

Hide View Details (Show View Details)



The View details boxes, tabs, and collection buttons can be hidden if desired. To hide the View details, press menu then choose Hide View Details from the Options menu. When the details are hidden, use the menus to change views and control data collection.

Note: View details will automatically be hidden in some split screen views and when the application window gets too small.

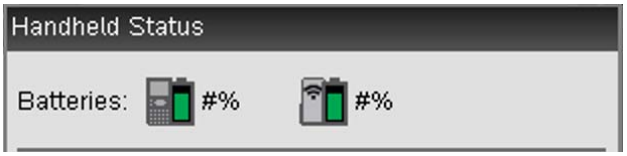
To show View details when they are hidden, press menu then choose Show View Details from the Options menu.

Print a Document

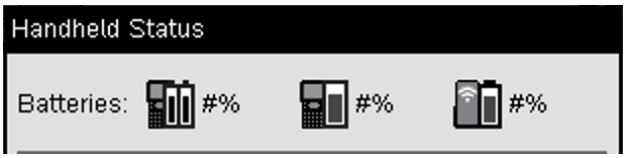
You cannot print a document directly from a handheld. You can only print from the TI-Nspire computer software. See *Appendix* C for more details regarding printing.

Battery Level

The battery icon located in the upper right portion of the screen will display the current battery level available to the handheld. Move your cursor over the battery icon to get an approximate percent of battery life remaining. The level is a combination of all battery types that apply – handheld AAA, handheld rechargeable, and Lab Cradle rechargeable.



For more detailed information regarding the charge level of the different battery types, press on, choose Settings, then select Status.



We recommend not letting your battery level go below 25% as this can affect the identification of your sensors.

The TI-Nspire Lab Cradle can be used to collect data on a handheld while powered using the AC adaptor that comes with the Lab Cradle.

DataQuest Cursors

The DataQuest application uses several different cursors to help identify when there is some special feature available to you through mouse interaction (clicking, right-clicking, clicking and dragging, etc.). The table below will give you a brief explanation of the different cursors used.

Cursor	Description
	Pointer – The standard cursor you see when using DataQuest.
	Horizontal Resize Cursor – This cursor is shown when you are over the location of an object that can be resized in a horizontal direction. The locations where the Horizontal Resize cursor appears are: ► The right edge of and View Details box in Meter, Graph and Table View. This will allow you to resize the details box. ► The left one-third of the horizontal (x-) axis. This allows you to dynamically adjust the x-min window-setting value without changing the x-max value. ► The right one-third of the horizontal (x-) axis. This allows you to dynamically adjust the x-max window-setting value without changing the x-min value. ► The left edge of a table cell. This allows you to adjust the width of the column to the left of the cursor. Press ctrl + to grab the object and resize it. After the object has been grabbed, the cursor changes to . Move the cursor left or right to resize the object. Press esc to release the object.
	Vertical Resize Cursor – This cursor is shown when you are over the location of an object that can be resized in a vertical direction. The locations where the Vertical Resize cursor appears are: ► The space between two DataQuest graphs when both graphs are shown. This will allow you to resize the two graphs as desired. The default is to show both graphs the same height. ► The top one-third of the vertical (y-) axis. This allows you to dynamically adjust the y-max window-setting value without changing the y-min value. ► The bottom one-third of the vertical (y-) axis. This allows you to dynamically adjust the y-min window-setting value without changing the y-max value. Press ctrl + to grab the object and resize it. After the object has been grabbed, the cursor changes to . Move the cursor left or right to resize the object. Press esc to release the object.
	Translation Cursor – This cursor is shown when you are over the location of an object that can be repositioned up-and-down or left-and-right. The locations where the Translation cursor appears are: ► The middle one-third of the horizontal (x-) axis. This allows you to dynamically adjust the x-min and x-max window setting values by the same amount, simultaneously. The graph will appear to move left or right. ► The middle one-third of the vertical (y-) axis. This allows you to dynamically adjust the y-min and y-max window setting values by the same amount, simultaneously. The graph will appear to move up and down. Press ctrl + to grab the object and resize it. Move the cursor to resize the object. When you move the object, the cursor changes to . Press esc to release the object.
	Text Edit Cursor – This cursor is shown when you are over the numeric graph-axis labels. Press to edit the value. Press enter to save the change. Press esc to exit without making a change.

Cursor	Description
	Hollow Pointer – This cursor is shown when the object underneath is selectable in some way. The locations where the Hollow Pointer appears are: ► The graph-axes text label. Press ctrl menu to change what is graphed on the axis. ► The analysis selected-region brackets ([or]). Press ctrl to grab a bracket. Move the cursor left or right to adjust the region used in the analysis calculation. Press esc to release the bracket.
	Pencil Cursor – This cursor is shown when Draw Prediction is active. Move the cursor to the desired location and press to add a point. Repeat as necessary. Press esc to end your prediction.