MiLAB

Version 1.0

User Manual

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Overview

MiLAB is a data analysis tool that makes science learning and analysis easier for students, by providing them with user-friendly and intuitive tools to help them express their curiosity, creativity and collaboration through science. It supports the NOVA LINK and einstein™LabMate™ data loggers.

For technical support, you can contact our technical support team at:

Web: http://einsteinworld.com/contact-form/

Email: support@einsteinworld.com

System Requirements

To work with MiLAB you will need a computer system with the following:

Windows

Software

- Windows XP and above

Hardware

- Dual Core Processor or higher
- 4 GB RAM
- 100 MB of free disk space

Apple

Software

- OS X 10.6 and above

Hardware

- 4 GB RAM
- 100 MB free disk space

Additional Requirements (For einstein™ LabMate wireless connection)

Support for Bluetooth devices.

Consult your computer manual to determine if your computer is compatible with Microsoft Bluetooth Stack. If your computer is not Bluetooth capable, you can purchase a 3rd party Bluetooth adapter.

NOTE: Bluetooth is not needed to use the einstein™ LabMate. The einstein™ LabMate has the ability to connect via USB cable or Bluetooth connection.

Multilingual MiLAB

The MiLAB user interface supports English, Russian, German and Lithuanian. In order to switch languages:

1. Click on the File menu.

2. Place the cursor over Language.
3. Select the language you want.
4. Note: after switching languages you will need to restart MiLAB.

Technical Support

Fourier Help Desk:

E-mail: support@einsteinworld.com

USA:

1-877-266-4066 (toll-free from within USA only)

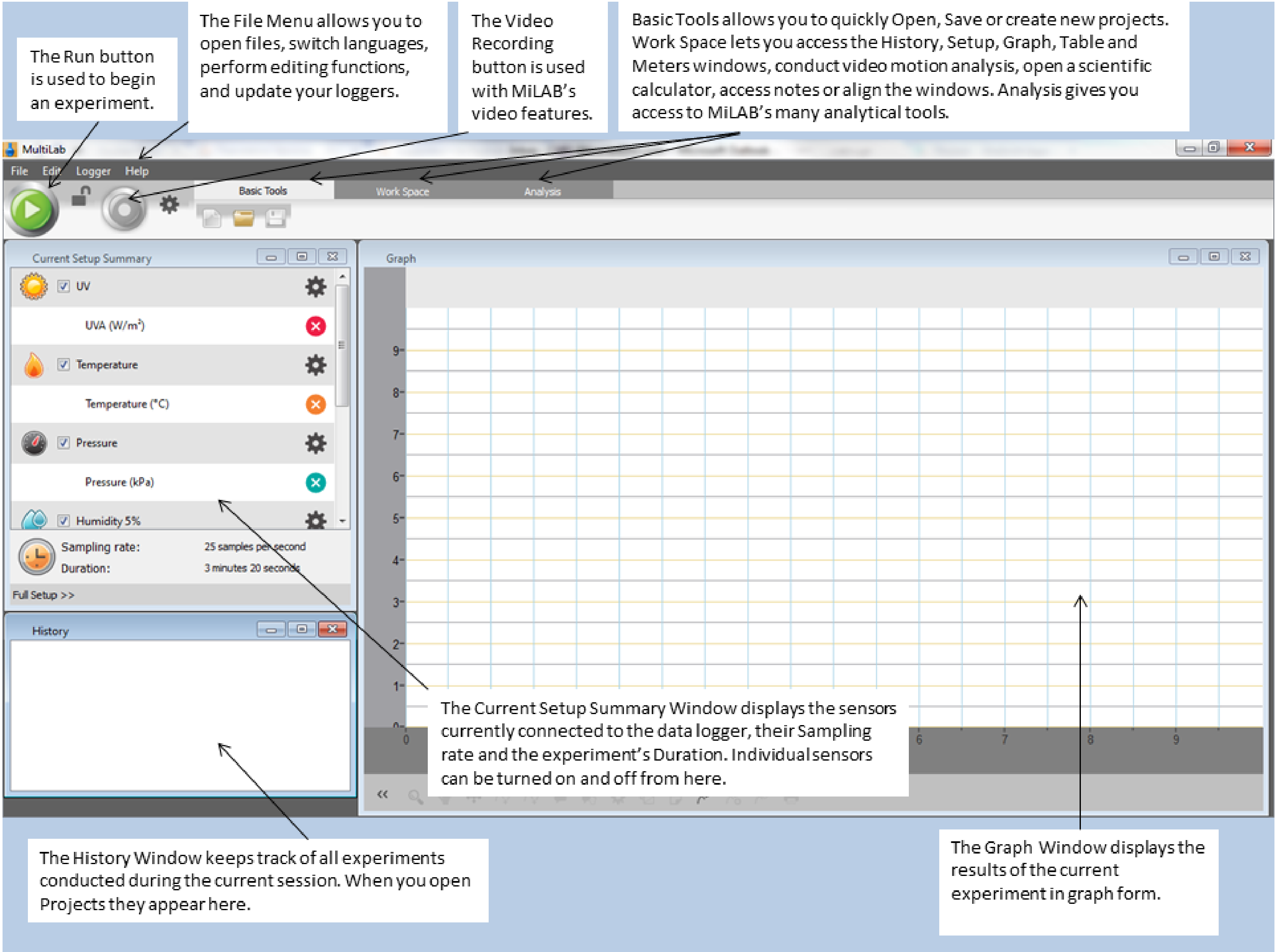
International:

+972-3-901-4849 ext. 232

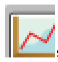
MiLAB- Getting Started

This section will get you started on your first MiLAB experiments.

MiLAB Layout



Quick Start

1. Connect your NOVA LINK or einstein™ LabMate data logger to your PC.
2. Turn on your data logger.
3. Plug in any external sensors.
4. Launch the MiLAB software.
5. Click the Run button  to begin recording.
6. Click the Stop button to stop recording.
7. Results of your experiment are displayed in the Graph window.
8. To open more graphs go to Work Space and click on Graph Window , MiLAB supports opening a number of graphs and tables simultaneously.

Connecting the NOVA LINK

On Windows Vista, Windows 7 and Windows 8

1. Connect the mini USB cable to your NOVA LINK and connect the cable to a USB port on your PC.
2. Connect at least one sensor to the NOVA LINK.
3. Windows should automatically detect the new hardware.
4. If Windows does not detect the sensor, click on the Logger Menu and select Connect. This will allow you to try and manually connect the logger.

Connecting the einstein™ LabMate™

1. Press the Power button on the front of the device to turn it on.
2. When the einstein™ LabMate powers up it will display either a green, blue or red and green flashing light.
   A blue flashing light indicates that the einstein™ LabMate is on and paired with a computer.
   A green flashing light indicates that the einstein™ LabMate is on but not paired with a computer.
   A red and green flashing light indicates that the einstein™ LabMate is low and battery and should be plugged into the USB charging cable.

Note: The **einstein™ LabMate™** can also be connected to the computer via a USB cable.

Basic Tools

Click on Basic Tools to Open, Save and start New projects.

Working with Projects

Every time you start a new experiment, MiLAB automatically creates a new project file. All the information you collect and process for a given experiment is stored in a single project file. Each of these files contains all the data sets you collect with the data logger, the analysis functions you have processed, specific graphs and tables you've created and the settings for the experiment.

New Projects are created when:

1. You open the MiLAB program, which automatically opens a new project.
2. You click the **New** button  on the toolbar.

Opening Files

1. Click **Open**  on the main toolbar.
2. Navigate to the folder in which the project is stored.
3. Double click the file name to open the project.

Saving Data

1. Click **Save**  on the main toolbar or select **Save** from the **File menu** to save your project. This will save all the data sets, graphs and tables in the project.
2. Saving the project will also save any special formatting and scaling you did.
3. Select **Save As**… from the **File menu** to save your project under another name.

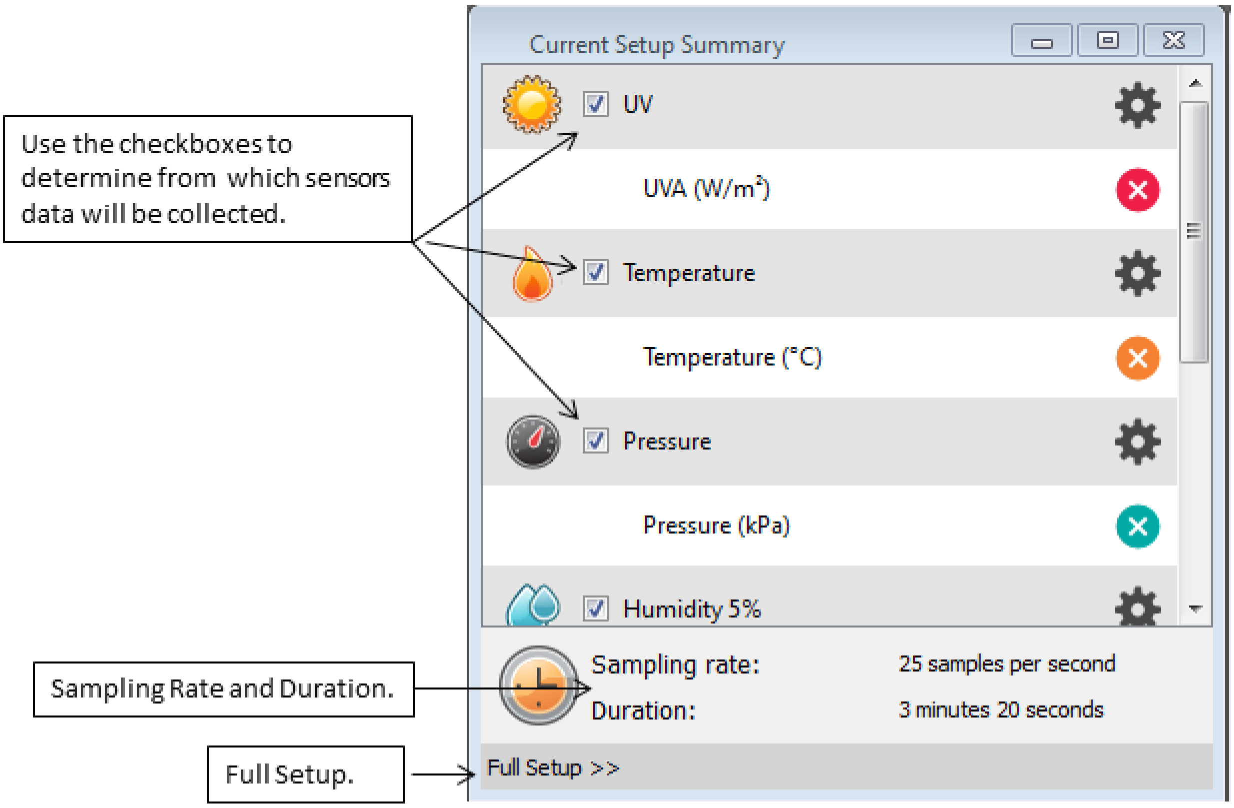
Note: To delete a data set, use the History Window.

Running an Experiment

Running an experiment involves connecting the equipment, setting up the data recording options and analyzing the data.

Using the Current Setup Summary Window

The **Current Setup Summary** window indicates which sensors are collecting data, the current **Sampling rate** and **Duration** of the experiment. To alter the setup click on **Full Setup**.



Sampling Rate

Sampling rate

The Sampling rate should be determined by the frequency of the phenomenon being sampled. For example, sound recordings should be sampled at the highest sampling rate possible, but changes in room temperature can be measured at slower rates such as once per second or even slower, depending on the speed of the expected changes.

If the phenomenon is periodic, sample at a rate of at least twice the expected frequency.

There is no such thing as over-sampling. For extremely smooth graphs, the sampling rate should be about 20 times the expected frequency.

Note: Sampling at a rate slower than the expected rate can cause frequency aliasing. In such a case, the graph will show a frequency much lower than expected.

Auto and Manual Sampling

Manual sampling

Use this mode for:

w Recordings or measurements that are not related to time

w Situations in which you have to stop recording data after each sample is obtained, in order to change your location, or any other logging parameter

Note: During the experiment no changes can be made to the configuration.

To sample manually:

1. Click on Full Setup from the Current Setup Summary window.
2. Select Manual from the Sampling dropdown menu.
3. Select the number of samples you would like to take from the Samples dropdown menu.
4. Close the Full Setup window
5. Click the Manual sample button  to take a sample. Each time the button is clicked, a sample is taken.

Auto sampling

Use this mode for:

w logging data continuously

To use Auto sampling:

1. Click on Full Setup from the Current Setup Summary window.
2. Select Auto from the Sampling dropdown menu.
3. Select the Rate from the Rate dropdown menu.
4. Select the number of Samples from the Sample dropdown menu.

5. Close the Full Setup window

6. Click the Run button  to begin taking samples.

Duration

Duration is determined by the Sampling rate and the number of samples. For example, a Rate of 10 samples per second with 100 samples would yield a Duration of 10 seconds.

Full Setup

The **Full Setup** window lets you determine exactly how your sensor will operate.

- The **Autodetection** menu lets you toggle between MiLAB automatically connecting sensors and letting you manually connect sensors
- The **Sensors** window allows you to choose which sensors will be active for the experiment. For some sensors different functions can be turned on and off for the experiment. This window lists other important information for each sensor
    - **Port** displays which port in the data logger the sensor is connected to
    - **Name** displays the sensor's name
    - **Range** displays the sensor's range, for multi-range sensors this is used for selecting which range will be used for this experiment
    - **Icon** displays the sensor's icon
    - **Measurements** displays the units of measurement for a sensor and for sensors with multiple units of measurement, allows you to select which one to use. The checkbox allows you to select and unselect individual sensors.
    - **Color** displays what color the sensor's measurement will appear on the graph. You can change the color by clicking on it and choosing a new color from the palette
    - **Plot** allows you to determine the type of line used to plot the sensor's measurements as they appear on the graph

Scale allows you to limit the measurements recorded by the sensor

- **Current Reading** shows the live data from a sensor even though the logger is not logging data. Click Set  to set the current value as the Zero or Base value. Reset  cancels this action
- [**Trigger**]() **-** Allows you to start the data recording at a specific time or condition. Selecting Trigger will bring up the trigger menu allowing you to start recording after a certain time, when a measurement has passed a certain level or when a measurement has fallen below a certain level
- **Calibrate** **-** Allows you to calibrate the sensors with MiLAB

- **Sampling** allows you to toggle between Automatic and Manual Sampling
- **Rate** allows you to determine the Sampling Rate
- **Samples** allows you to determine the number of Samples taken during the experiment
- **Duration** calculates how long the experiment will last
- **X-Axis** allows you to determine what variable the X-Axis on the graph will represent

Calibrating with MiLAB

Calibration Overview

Most Fourier sensors are sold fully calibrated, however some might need calibration. Further details can be found both below and with the sensor’s documentation.

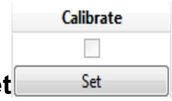
MiLAB enables you to calibrate any of the sensors manually via the software. This calibration is much more accurate than the automatic calibration performed by the data logger. With MiLAB, you can calibrate the sensor using a known value or values instead of the "offset calibration" used by the data logger:

Automatic Zero Calibration
The data logger is able to automatically calibrate the sensor offset for all analog sensors accurately, quickly, and for every new experiment conducted.
The calibration method is very simple. Whenever you plug in a sensor, the data logger checks to see if the selected sensor measures a value within ±2% of its "zero value". If so, the data logger sets that value as zero. To enable this feature, make sure that the sensors are at their "zero values" when you plug them in. For voltage sensors, short the voltage sensor plugs to ensure the most accurate results.

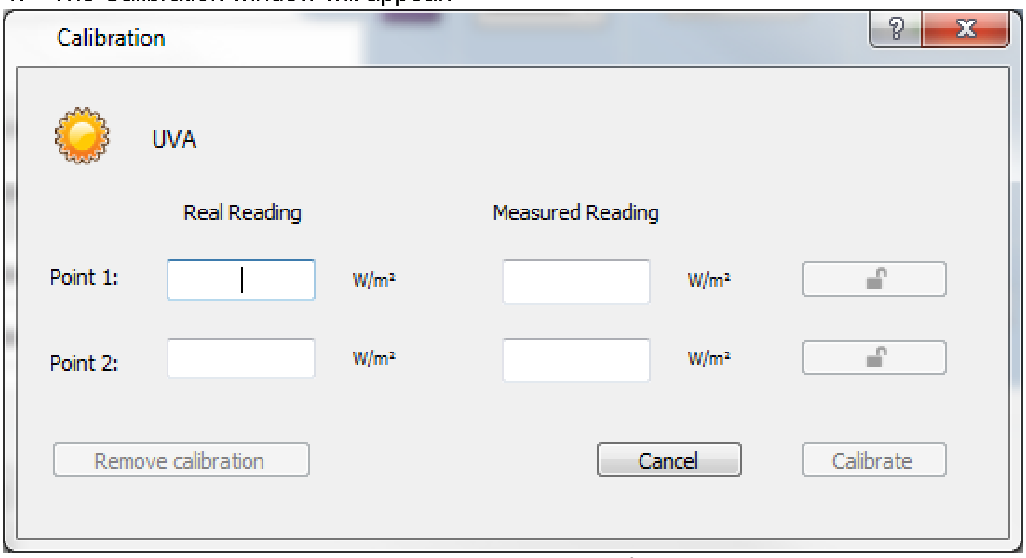
Set Zero Calibrations
In the Current Reading column, click Set 

to set the current value as the zero or base value. Reset 

cancels this action

One and Two Point Calibration
1. Connect the data logger to the PC.
2. Go to the **Full Setup** window.
3. In the Calibrate column click **Set** 

.
4. The Calibration window will appear:



5. Note that some sensors will only have one point of calibration.
6. Prepare something that has a known value (e.g. a solution with a known pH of 7). Enter this known value in the Real Reading field.
7. Use the sensor to measure the data. This data will appear in the Measured Reading field. Click on the lock icon to have MiLAB calibrate the sensor using a comparison between the Real Reading and the Measured Reading. If the sensor you are using only has one point calibration, select **Calibrate** to calibrate the sensor. If your sensor requires two point calibration you'll need to prepare a second item with a known value and follow step 7 again.
8. Note that two point calibration should be conducted with one point below the expected measurement and one point above the expected measurement. For instance if you expect to measure a solution with a pH of around 8 do not calibrate with a 4 pH and 7 pH solution.
9. To remove this calibration, select **Remove calibration**.

Note: The calibrated sensor parameters will be saved, so there is no need to calibrate it every time you open MiLAB.

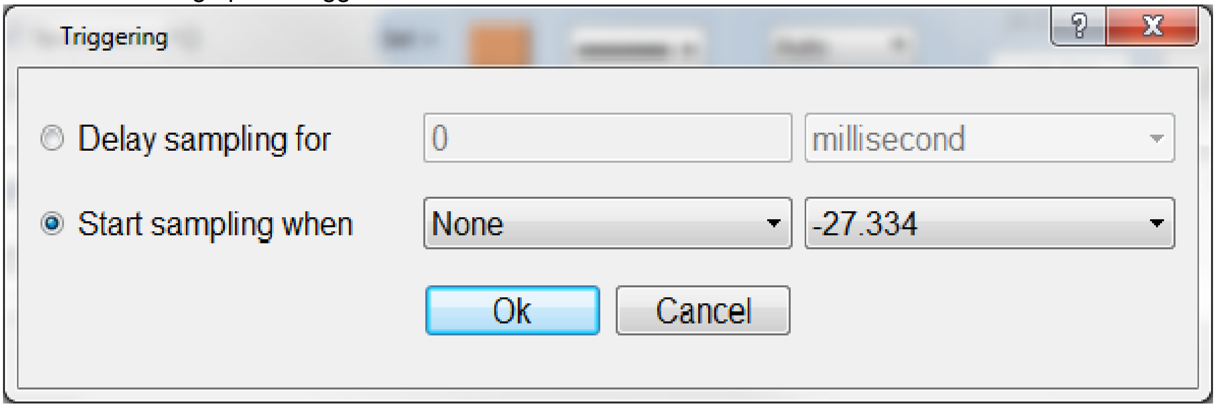
Using a Trigger

Sometimes you will only want to start logging data under certain circumstances - this is called Triggering.

In order to set a Trigger:

1. In the Full Setup menu, in the Trigger column click the Radio button and then click the **Set** button 

.
2. This will bring up the Trigger menu:



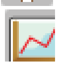
3. To start logging after a certain time, select **Delay sampling for**. Then type in a number and select a time unit to determine when to start logging.
4. To start logging when measurements are above or below a certain level, select **Start sampling when**. Then use the dropdown menu to choose to begin after or before measurements have reached a certain level. Use the second dropdown menu to determine the exact measurement.
5. Click **Ok** to set the trigger or **Cancel** to cancel the trigger.

The Work Space Window

The Work Space Window gives you access to the various ways to view your data

w **History Window**  toggles the History window on and off

w **Setup Window**  toggles the Current Setup window on and off

w **Graph Window**  adds additional Graph windows to the screen
Note: MiLAB can open multiple graphs at the same time

w **Table Window**  adds additional Tables to the screen
Note: MiLAB can open multiple tables at the same time

w **Meter Window**  displays the data in a form of one of four meters
Note: MiLAB can open multiple meters at the same time

w **Video Window**  activates MiLAB's video tools

w **Calculator**  displays MiLAB's built in scientific calculator

w **Notes**  brings up a notepad for taking notes on your experiment

w **Align to Grid**  aligns all the open windows for easier viewing

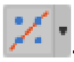
The Analysis Window

The Analysis Window allows you to work with the data your experiment has generated. The functions available to you are:

w Curve fit
w Statistics
w Math functions
w Slope
w Area
w Average
w Photogate

Curve Fit

Curve Fit allows you to form your data into a smooth curve allowing you to more easily understand the data:

1. Use the Cursor function to select a range in the graph.
2. Click **Curve Fit** .

There are three types of **Curve Fit:**

w **Linear** $y = ax + b$ - Draws a line of linear least square fit

w **Polynomial** $y = a_0 x^n + a_1 x^{n-1} + \cdots + a_n$ - Draws a line of polynomial least square fit (you must select an order between 1 and 6)

w **Power $a*x^b$** - Draws a line of power least square fit

w **Exponential $a*e^{(x*b)}$** -Draws a line of exponential least square fit

MiLAB displays the curve fit equation and the correlation coefficient (R^2) on the information bar below the graph.

Statistics

Use the **Statistics** tool to display statistics of a selected data set or a range of data.

The statistics include:
Average – The average of all the values in the range.
StDev – The standard deviation.
Min – The smallest value in the range.
Max – The largest value in the range.
Sum – Sum of all the values in the range.
Area – The area between the graph and the x-axis in the range.
Samples – The number of data points in the range.
Rate – The Sampling Rate.

To display statistics:

1. Use the Cursor function to select the graph and the data range to which you want to apply the statistics.
2. Click **Statistics** .
3. MiLAB will open a statistics window and will display the results.

Math Functions

Use Math functions to analyze data:

1. Use the Cursor function to select a range in the graph.

1. Click **Math functions** .
2. Select a function from the **Function** drop-down list.
3. Select an input(s) from drop-down list.

Note: If you used the cursor to select a section of the graph it will appear as G1 but you have the option of selecting a different data set.

4. Click **OK.**
5. The function will appear on your graph and in the History window.

Use Math Functions to execute real-time analysis:

6. Click **Math functions** .
7. Select a function from the **Function** drop-down list.
8. Select an input(s) from drop-down list.

Note: If you used the cursor to select a section of the graph it will appear as G1 but you have the option of selecting a different data set.

9. Click **OK.**
10. The function will appear on your graph and in the History window.
11. This function will still be active in subsequent recordings.
12. To remove this function, click **Reset Online Function** in the **Math Function** window.

Slope

Slope draws a tangent line based on the selected point on the graph.

1. Use the **Cursor** function to select a point on the graph.
2. Click **Slope** **.**

Area

Area highlights and measures the area between the X-Axis and selected data points:

1. Use the **Cursor** function to select two data points.
2. Click **Area** .

Average

Average allows users to average out results of an experiment. This function replaces every point with an average of *n* neighboring points on either side of the point:

1. Use the **Cursor** function to select a range of the graph.
2. Click **Average** **.**
3. From the menu, select Minimal (n=1), Low (n=2), Medium (n=5) or High (n=20) averaging. There is also the option of creating a Custom averaging equation.

Photogate

Photogate helps users analyze experiments with the Photogate.

1. Attach the Photogate(s) to the data logger.
2. Conduct the Experiment.
3. Use the **Cursor** function to select a range of the graph.
4. Click Photogate .
5. Choose to measure **Time**, **Velocity** or **Acceleration** and click **Next.**
6. If you choose to measure **Time** you must then choose **At one gate**, **Between gates** or **Pendulum (one gate).**
7. If you choose to measure **Velocity**, you must then choose **At one gate**, **Between gates**, or **Collision (two gates).**
8. If you choose to measure **Acceleration**, you must then choose **At One Gate** or **Between Gates**. In these types of experiments flags are often used to help collect the data. For an accurate measurement you must input the width of the body you are measuring in the Width box.
9. Click **Finish.**

Measuring Methods
Photogate offers you various methods of analyzing the different measurements. In some measurements you will be asked to enter the dimension of the moving body, or the distance between the two Photogates to allow for the calculation of velocity and acceleration.
The methods depend on the selected **Measurement**:

Time
At one gate
Measures the time it takes the body to cross the photogate (e.g. between blocking and unblocking the infrared beam).

Between gates
Measures the time it takes the body to move from one photogate to the second photogate (e.g. between blocking the first and blocking the second infrared beams).

Pendulum
Measures the time period of an oscillating body (e.g. the time interval between blocking the beam the first and third times).

Velocity
At one gate
Measures the time it takes the body to cross the photogate (e.g. between blocking and unblocking the infrared beam) and returns the velocity.
You should enter the body's width.

Between gates
Measures the time it takes the body to move from one photogate to the second photogate (e.g. between blocking the first and blocking the second infrared beams) and returns the average velocity.
You should enter the distance between gates.

Collisions
Measures the crossing time intervals at each gate and returns the corresponding velocities.
You should enter the bodies' width (the width of the two bodies must be identical).

Acceleration
At one gate
A card with two flags must be attached to the moving body. The Timing Wizard measures the crossing time

intervals of the two flags and returns the acceleration.
You should enter the flag's width.

Between gates
Measures the crossing time at the first gate, the time it takes the body to move from one gate to the second gate and the crossing time at the second gate and returns the average acceleration.
You should enter the distance between the gates.

Experiment Mode

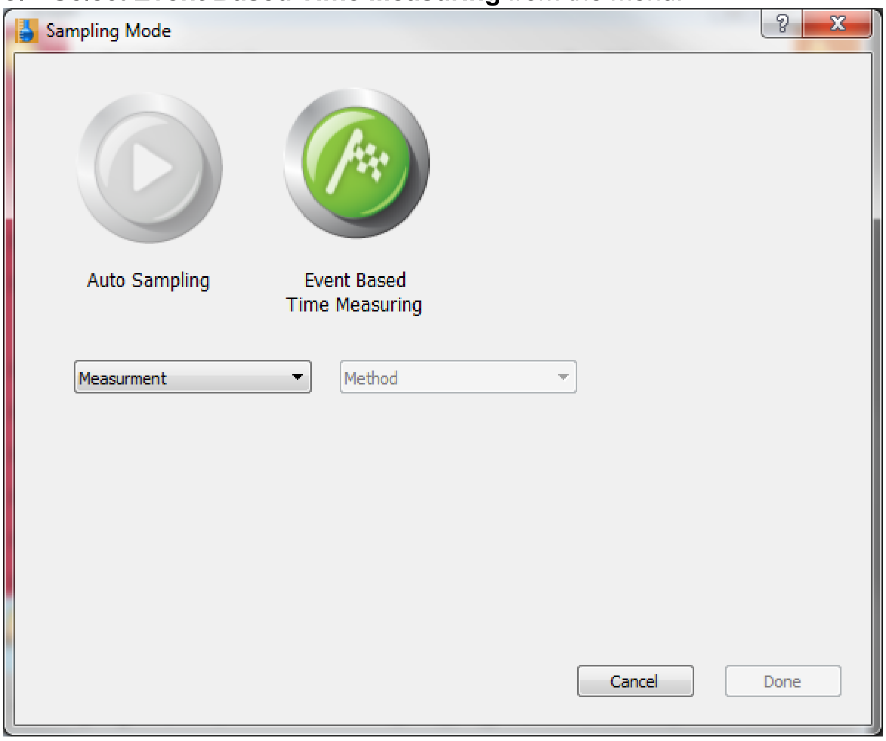
Experiment Mode allows you to switch between different Sampling Modes. The two choices are Auto Sampling - the default mode - and Event Based Time Measuring - primarily used with the Photogate and Smart Pulley.

Event Based Time Measuring

Event Based Time Measuring is mainly used with the Photogate and Smart Pulley sensors.

To use Event Based Time Measuring:

1. Attach the Photogate(s) or Photogate and Smart Pulley sensor(s) to the data logger.
2. Select **Experiment Mode** .
3. Select **Event Based Time Measuring** from the menu:



4. From the **Measurement** dropdown choose either **Time**, **Volume** or **Acceleration** (see details below).
5. Choose a **Method** from the dropdown menu (your choices are determined by the measurement method (see details below).
6. These sensors often use flags for more accurate measurements. After choosing a method, you will be able to enter the **Width** of the flag. By default MiLAB assumes you are working with 3 cm flags.
7. Click Done.
8. The **Run** button will be replaced by the Event Based Time Measuring button .
9. Click the **Event Based Time Measuring** button. For the duration of the experiment, the Photogate will record data according to the set parameters (for details see below).

Measuring Methods

Therearevarious methods of analyzing the different measurements. In some measurements you will be asked to enter the dimension of the moving body, or the distance between the two Photogates to allow for the calculation of velocity and acceleration.
The methods depend on the selected **Measurement**.

Time

At one gate

Measures the time it takes the body to cross the Photogate (e.g. between blocking and unblocking the infrared beam).

Between gates

Measures the time it takes the body to move from one Photogate to the second Photogate (e.g. between blocking the first and blocking the second infrared beams).

Pendulum

Measures the time period of an oscillating body (e.g. the time interval between blocking the beam the first and third times).

Velocity

At one gate

Measures the time it takes the body to cross the Photogate (e.g. between blocking and unblocking the infrared beam) and returns the velocity.
You should enter the body’s width.

Between gates

Measures the time it takes the body to move from one Photogate to the second Photogate (e.g. between blocking the first and blocking the second infrared beams) and returns the average velocity.
You should enter the distance between gates.

Acceleration

At one gate

A card with two flags must be attached to the moving body. The Timing Wizard measures the crossing time intervals of the two flags and returns the acceleration.
You should enter the flag's width.

Between gates

Measures the crossing time at the first gate, the time it takes the body to move from one gate to the second gate and the crossing time at the second gate and returns the average acceleration.
You should enter the distance between the gates.

Working with Graphs

MiLAB displays new data in the graph window every time you start a new recording.
To add previously collected data to a new graph:

1. Click on **Graph Window** to open a new graph.
2. Drag the results from any Run into a graph to view the results in graph format. If the graph already contains results from a different Run, both results will be displayed in the graph.

Graphs come with several tools to help understand and analyze the data:

Zoom shows a detailed view of part of a graph:

1. Click the **Zoom** button .
2. Use your mouse to select an area in the graph to zoom in on.

Pan allows you to move a graph around within the window:

1. Click **Pan** .
2. Use your mouse to move the graph around within the window.

Autoscale allows you to resize the graph:

1. Click **Autoscale** to resize the graph allowing you to view the full data display.
2. Dragging your cursor along the X or Y axis will allow you to manually adjust the size of the display.

Cursor allows you to define a certain area of the graph to work on:

1. Click **Cursor** .
2. Drag the point that appears in the graph to the earliest data you want to collect.
3. Click **Second Cursor** .
4. Drag the point that appears in the graph to the latest data you want to collect.

Note: Using the cursor to define an area in the graph is often necessary for data analysis.

Annotation allows you to add notes to your graphs. Note: Annotations can only be added to a graph with at least one cursor point:

1. Click **Annotation** . A blank note will appear on your graph.
2. Type your remarks into the notepad.

Move Annotation allows you to move your annotations:

1. Click **Move Annotation** .
2. Drag your annotation to a different position in the graph. The annotation will still be linked to the cursor point.

Properties allows you to change certain aspects of your graph:

1. Click **Properties** .
2. Use the Plot menu to determine which data set you are changing.
3. Click on Color to change the color of the plot line.
4. Use the Unit menu to change the unit measure.

Copy Graph allows you to copy the graph to the clipboard as a picture and then paste it to other programs such as Word and PowerPoint:

1. Click **Copy Graph** .
2. Open the destination file.

3. In the destination file, right click and select Paste.

Export allows you to export the graph as a .csv file which can be read by a number of programs such as Excel or OpenOffice:

1. Click **Export** .
2. Navigate to the desired folder.
3. Name the file.
4. Click **Save.**

Predict allows you to draw your predictions directly on the graph and then see how well you do:

1. Begin an experiment.
2. Click **Predict** .
3. Click **Stop.**
4. Click **Add Prediction** .
5. Click points on the graph where you believe the data will go.
6. Use **Erase Prediction** to correct errors you may make.
7. Click **Predict** to proceed with the experiment and see how accurate your predictions were.

Print allows you to print out your graphs:

1. Click the **Print** icon .
2. Select your printer and any options (if necessary).
3. Click **Print.**

Working with Tables

Tables display the data from an experiment in table format:
To open a table:

1. Click on **Work Space**.
2. Click on **Table Window** .

When you run an experiment, the results will automatically appear in the table.

To add existing data to a new table:
1. Open a new table.
2. Drag the Run into the new table.

To add existing data to a table:
1. Drag the Run to the table.
2. If a table already contains results from a different Run both results will be displayed in the table.

Tables provide the following options:

Font Settings allows you to choose a variety of fonts to display the data:

1. Click on **Font Settings**  **.**
2. Select the Font style and color.
3. Click **OK.**

Print allows you to print out your tables:

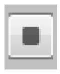
1. Click the **Print** icon **.**
2. Select your printer and any options (if necessary).
3. Click **Print**.

Working with Meters

Meters allow you to view your data in yet another way.

To open a new meter:
1. Click on **Work Space.**
2. Click on **Meter Window** .
3. When you run an experiment, the results will automatically appear in the Meter.

There are 4 different types of meters available:
- Analog
- Digital
- Bar
- Color

To switch between the types of Meters click on either the Analog , Bar , Color  or Digital  icons. To determine what data each meter will display use the drop down menu in the Meter window.

Working with NOVA LINK

NOVA LINK External Connections

Sensor Inputs

Sensor input/output (I/O) sockets are marked on the NOVA LINK casing as I/O-1, I/O-2, I/O-3 and I/O-4. These sockets are used to connect the sensors. Normally, all four sockets can be used simultaneously.
To connect a sensor to the NOVA LINK, use one of the mini-din cables. Plug one end of the cable into the data logger - arrow facing up, and the other end into the sensor - arrow facing down.
If you are using only one sensor connect it to I/O socket 1. If you are using two sensors connect them to I/O sockets 1 and 2, and so on.

In order to connect more than 4 sensors at a time, use Fourier splitter cables, which will let you connect up to 8 sensors simultaneously. When a splitter cable is connected, sensors must be connected to the socket in the correct numerical order (for example, with 5 sensors, connect the splitter cable to the I/O-1 socket). One of the two splitter cables is marked with arrows - that is the main input (the lower I/O number), the second line is marked with the letter S (split) - indicating that it is the secondary input (the higher I/O number). Connect up to four input splitters to split the NOVA LINK's inputs starting with I/O-1 (the splitters must be connected in order):

• I/O-1 splits into I/O-1 and I/O-5
• I/O-2 splits into I/O-2 and I/O-6
• I/O-3 splits into I/O-3 and I/O-7
• I/O-4 splits into I/O-4 and I/O-8

Note: Before connecting the mini-din cable to the data logger or the sensor sockets, make sure that the mini-din plug is correctly positioned in front of the socket. Connecting the cable in an awkward position might cause damage to the cable pins.

PC Mini USB communication socket

The NOVA LINK must be connected to your PC with a USB cable with one Type B plug and one Type A plug.

Working with the LabMate

Overview

The einstein™ LabMate turns any computer or tablet into a wireless science lab. This device enables teachers and students to conduct a wider range of scientific experiments that were previously unapproachable due to the limitations of cables and cords. Together with Fourier's catalogue of over 65 educational sensors, the einstein™ LabMate provides real-time performance and improved reliability during experimentation. The einstein™ LabMate+ includes 6 built-in sensors for even greater convenience.

Connecting the sensors

1. Plug the sensor into one of the ports labeled 1,2,3 or 4.
2. MiLAB should automatically detect connected sensors.

Note: Some sensors may require an extra cable or adapter.

Adding more sensors

In order to connect more than 4 sensors at a time, use einstein™ splitter cables, which will let you connect up to 8 sensors simultaneously.

Working with Video

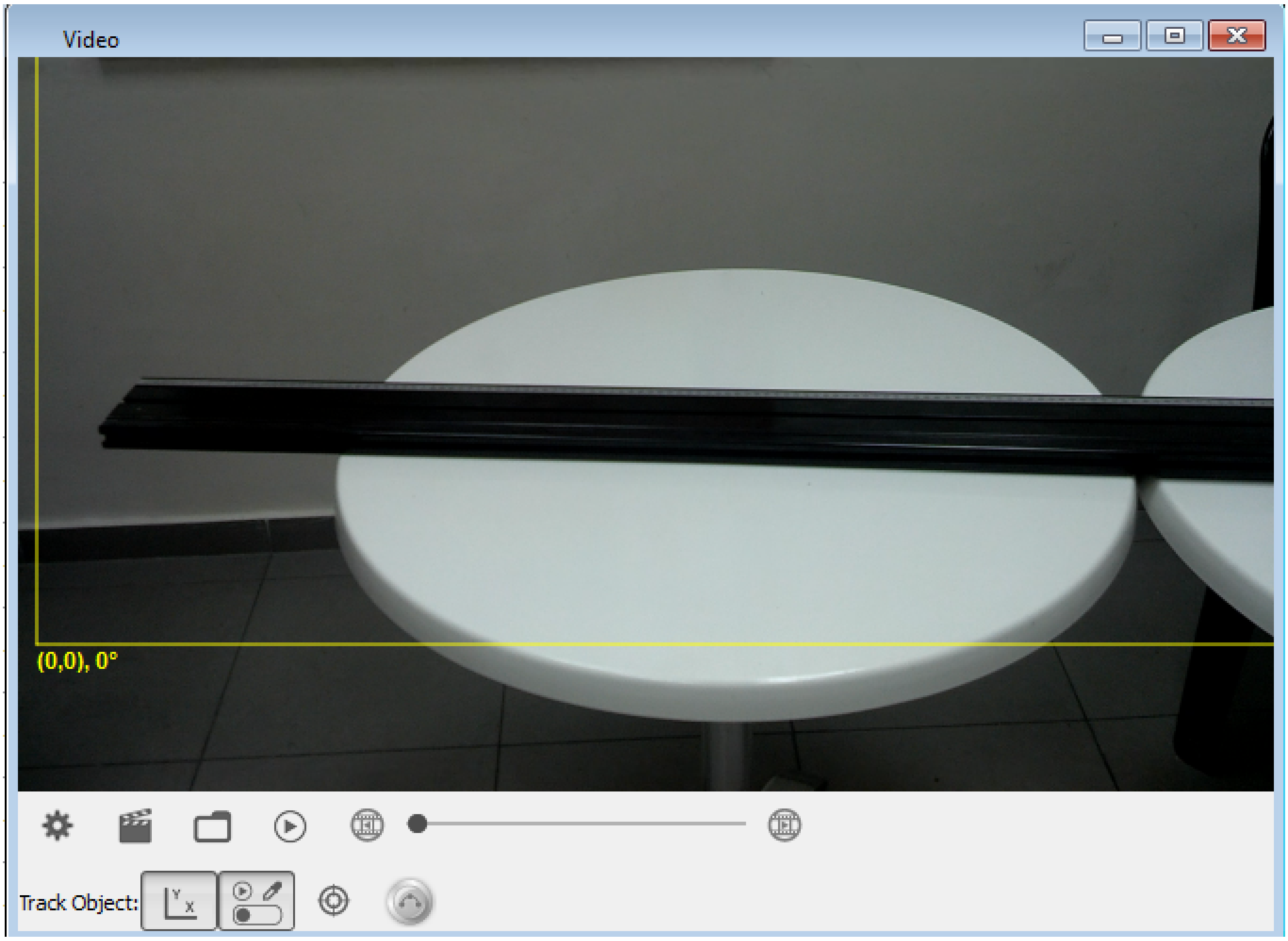
MiLAB includes two video tools –Video Motion Analysis and Video Sync.

Video Motion Analysis

Video Motion Analysis lets you to capture position and time from videos, convert this information to data sets and analyze the data with all of MiLAB's analysis tools the same way you would analyze data from the data logger. Video Motion Analysis is most commonly used on existing videos.

To use Video Motion Analysis:

1. Click on the **Video Window** button .



2. Click on the **Open** button .

3. Select a video. The video will open in the Video window along with two yellow lines indicating the X and Y axes. To move the axes place your cursor over the Origin where it will form a cross. Click

and drag the cursor to move the axes. In order to change the angle of the axes, place the cursor over the X-axis where it will form a hand. Click and drag the cursor to change the angle.

4. Now you'll need to select an object within the video whose movements you will be measuring.

Automatic Tracking Mode

By default, Video Motion Analysis is set to Automatic Tracking Mode.

1. Define an object by clicking the **Set Object** button , your cursor will turn into a cross. Click and drag with your cursor to define the object (e.g. a flag on a cart).

2. Click the **Start Tracking** Button . The video will start playing and MiLAB will start tracking the object you defined, recording its location on a graph and /or table.

Manual Tracking Mode

1. Click the **Tracking Mode** button so it's on Manual Tracking Mode

2. Click the **Set Object** button .

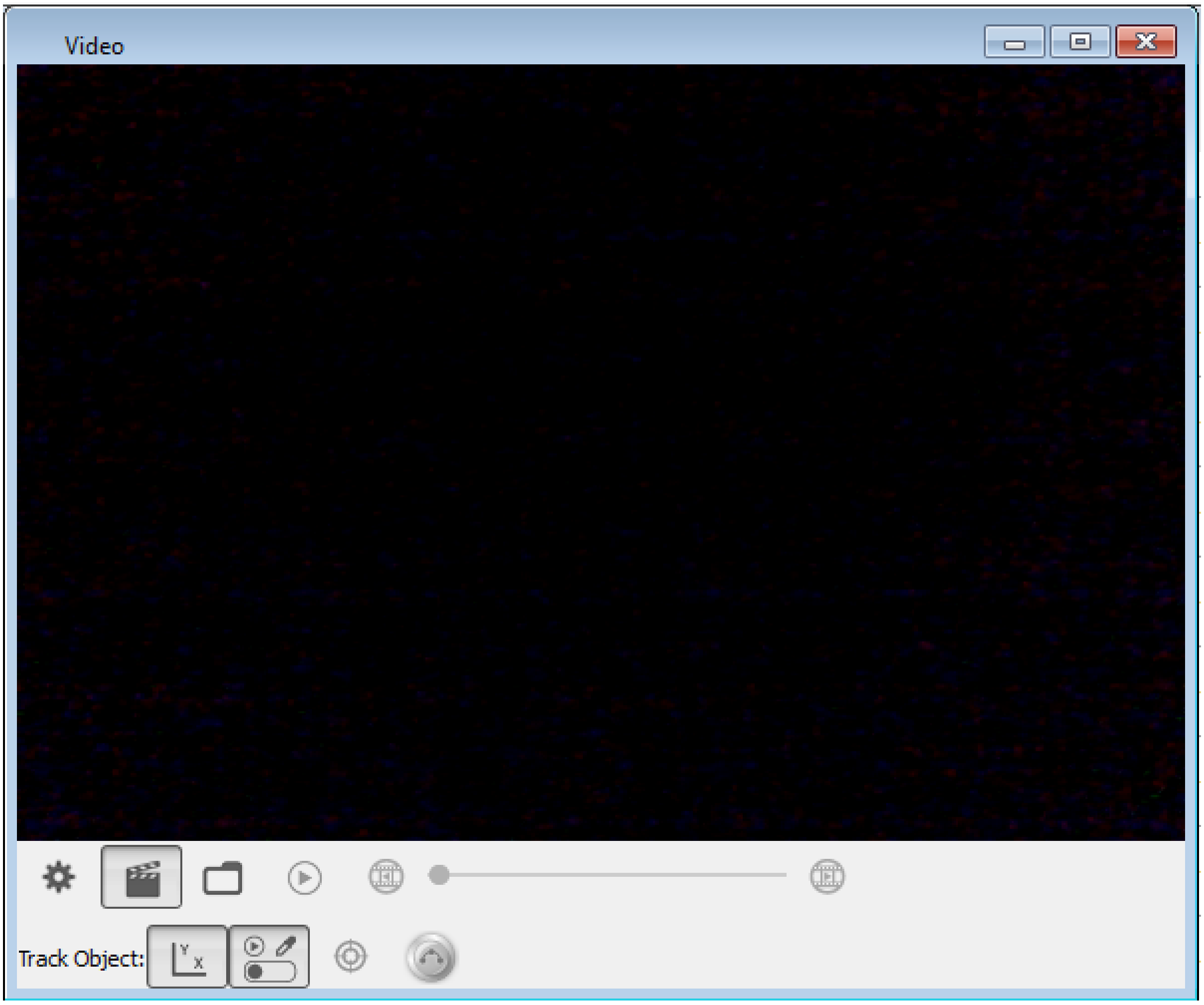
3. Click on the object you want to measure (e.g. a flag on a cart), when you click, the video will advance one frame. You can then click on the object again etc.

Video Sync

Video Sync is flexible tool allowing you to add video elements to your experiments and even sync them to your results. This would allow you to film an introduction to an experiment and then sync a recording of yourself conducting the experiment. Syncing the recording allows you to compare what was happening to your experiment when certain results were achieved. For example, in an experiment to find the boiling point of a liquid, you can take a video recording of the liquid while measuring the temperature and then afterwards go back and click on the graph to observe the liquid at different temperatures.

To use Video Sync:

1. Click on the **Video Window** button . This will activate the **Record** button next to the **Run** button and the Video window.



2. Your camera should be activated automatically. If not, or if you want to use a different camera, click on the **Setup Video** button  and click **Video** to set up your video camera and **Audio** to set up your microphone.

3. Clicking the **Record** button will begin the recording. The **Lock/Unlock** icon between the Run and Stop buttons indicates whether or not the video is synced to graph and/or data results. The **Unlock** icon  indicates there is no syncing. Use this setting to record an introduction or conclusion for your experiment.

Clicking the **Unlock** icon will change it to a **Lock** icon . This means the video will be synced to the data. When the two buttons are synced clicking either the **Run** button or the **Record** button will start the experiment and the video recording.

Both data recording and the video will end when the experiment reached its duration or either **Stop** button is clicked.

The experiment's results are stored in a Run; the Run icon of an experiment containing a video is treated like any other Run but will be marked with a special video icon.

To rerun the experiment click the **Play** button, this will replay both the video and graph results.

Use the **Next Frame** and **Previous Frame** buttons to step through the video frame by frame.

Note: By default two yellow axes will appear on the video screen. You can get rid of these by clicking the **Show Axes** button.

Troubleshooting

I pressed the ON key on the einstein™ LabMate and it did not turn on.
Try charging the battery, it may be weak.

MiLAB was unable to connect to the data logger.
Check to make sure the NOVA LINK USB cable is plugged in.
Check to make sure the einstein™ LabMate is connected to your computer by a USB cable or by a wireless Bluetooth connection (the LED on the einstein™ LabMate should be flashing blue).

While running with an active trigger, MiLAB does not complete the data logging.
The trigger condition has not been fulfilled.

I see voltage units when sampling using the microphone.
The microphone is monitoring the sound wave shape, which is displayed in voltage units. The sound level, measured in decibel values, is another mathematical description of the sound amplitude.

I started an experiment and the data logger stopped immediately afterwards.
Check to see if the sampling rate was so fast that the experiment began and ended in less than a second.

The recorded data is "noisy."
With voltage or current sensors, use short connections between the circuit being tested and the sensor. In some cases it is advisable to connect the (-) of the current sensor to the ground terminal.
Avoid working near strong electromagnetic fields. (e.g. engines, fluorescent lights).

I turned the calibration screw but did not obtain the accurate calibration.
The calibration screw is high-resolution and has 15 turns. Try continuing to turn the screw, or change the direction of rotation.

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