# LabRecon - Equation wiring object

LabRecon software (Windows, Mac OS X, or Linux) and hardware provides a stimulating educational environment for science and engineering by allowing students and educators to easily create rich graphical interfaces for measurements, robotic control, or simulation. Users can create a "Panel" using a drag-and-drop graphical input and output objects and implement algorithms and calculations using LabRecon's "Wiring" graphical programming language.

One of the many Wiring objects is the Equation object. Equations can be built by wiring individual mathematical operations and constants together, however the Equation object provides a convenient alternate method.

Below is an example of the Equation object being added as a replacement of the alternative method above it wherein individual operations were used to implement Plank's Law for blackbody radiation.


$$L_e = \frac{2hc^2}{\lambda^5} \frac{1}{e^{hc/(2\lambda k_B T)} - 1}$$

Plank's Law (Black Body radiation) nm
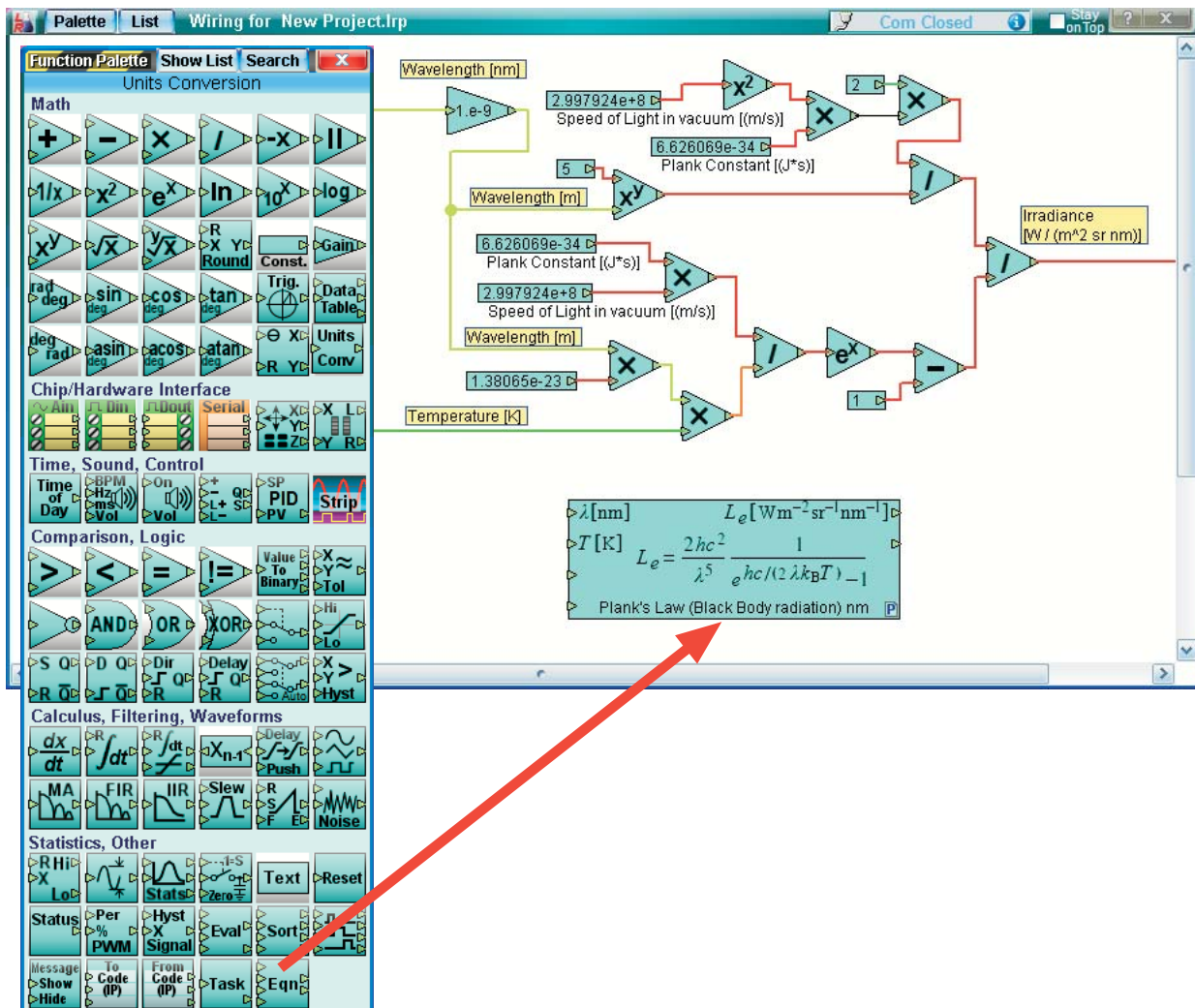
Right-clicking and the Equation object and selecting "Properties" will open its Properties window.

One can scroll through the list of equations to select. Note that multiple Equation objects can be used on the Wiring window to incorporate various calculations.

Clicking of the "Equation Information" button will open a window discussing the equation.

A "Test Values" section shows example values for the selected equation and new input values can be typed or pasted. The object on the Wiring window performs its evaluation based on the wires connected to its inputs on its left side and the result is fed to a wire connected to its output on its right side.
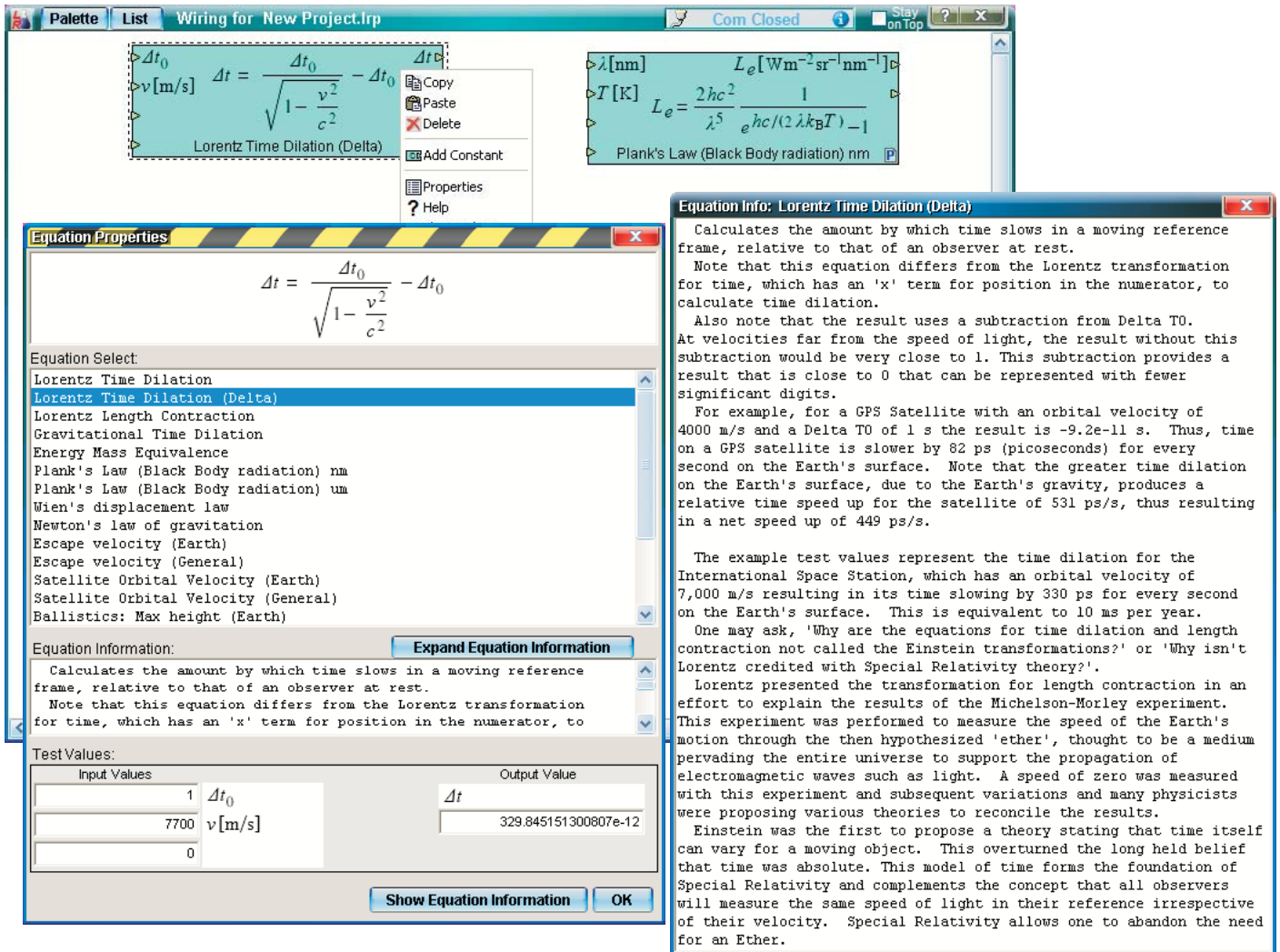

Clicking on the "Start" button and selecting "Open Sample Project" will allow one to open any of about 50 example projects.

The first three "Physics" projects demonstrate use of the Equation object included that on the next page.
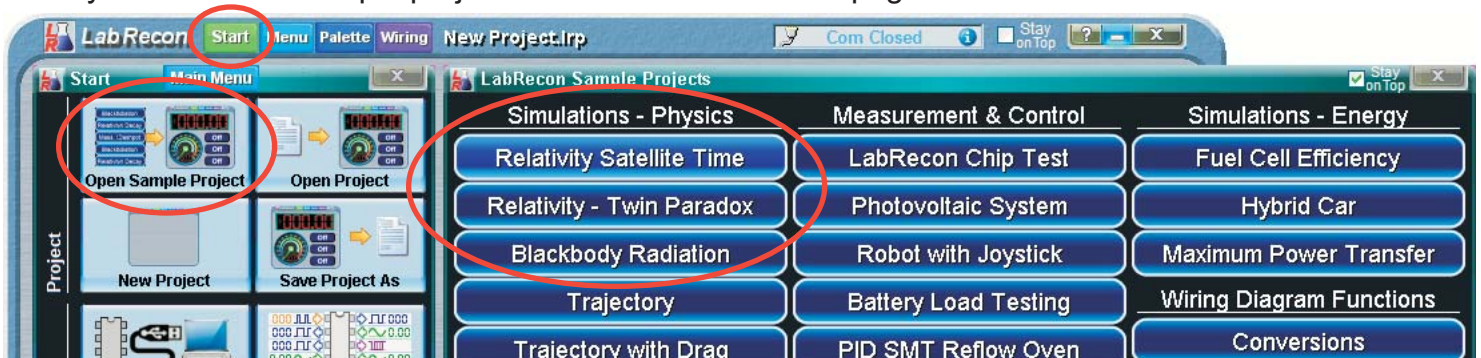
Below is a Sample Project using multiple Equation objects to determine the relavistic time effects on satellites orbiting the Earth. Note that any sample projects can be modified and saved for develop new projects or one can start a project from scratch.

Clicking on the lower left "Help" button will present a discussion on the calculations and one can right-click on any Equation object and select "Help" to view notes specific to the equation shown.

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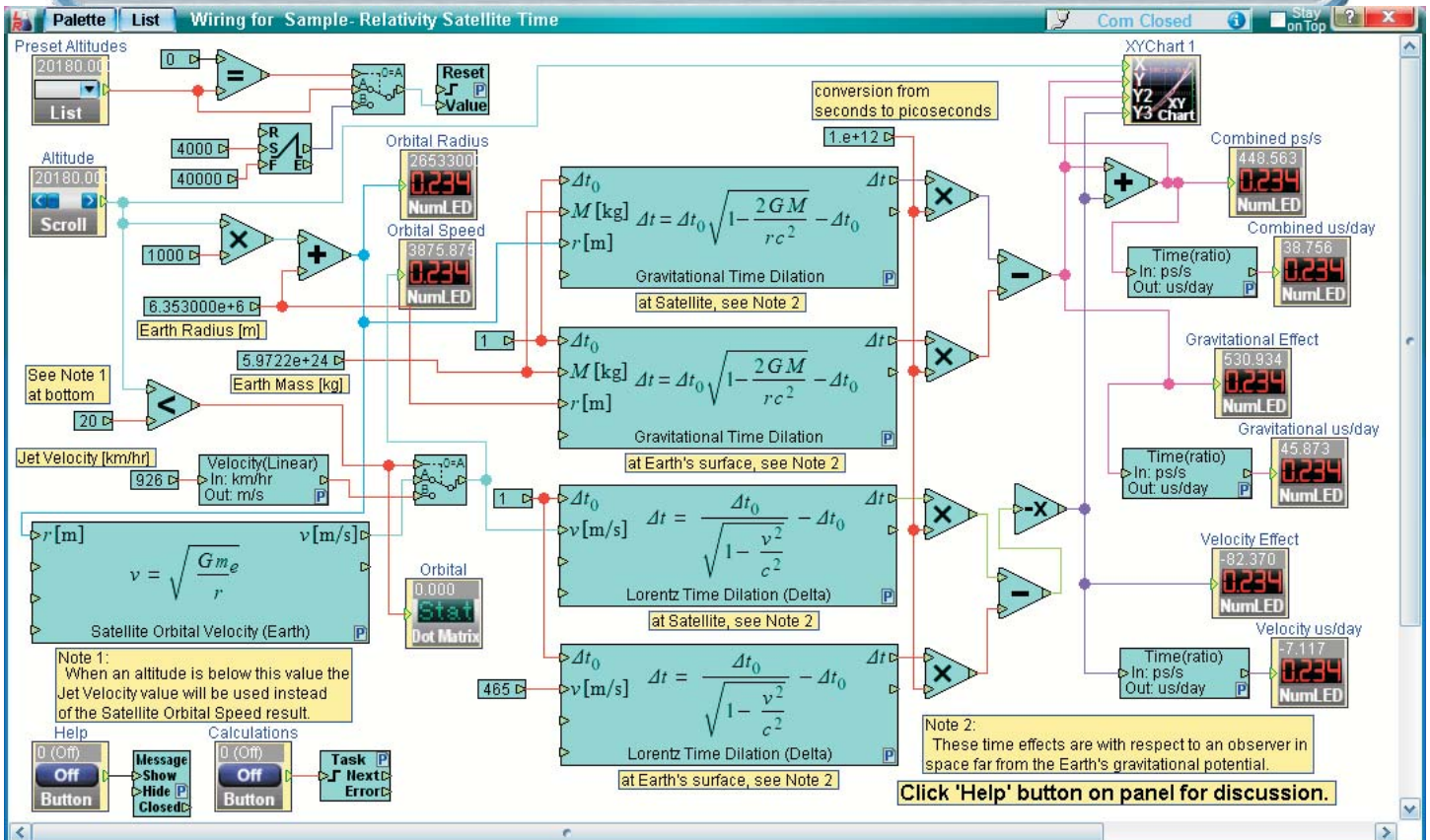
Below is another Sample Project using an Equation object set to calculate "Plank's law" to produce curves for blackbody spectrums at various temperatures.

Two XYCharts were added to present the curves. The bottom chart properties were set to use a logarithmic Y axis scale.

Clicking on the lower left "Information" button will present a discussion on the calculations and one can right-click on any Equation object and select "Help" to view notes specific to the equation shown.
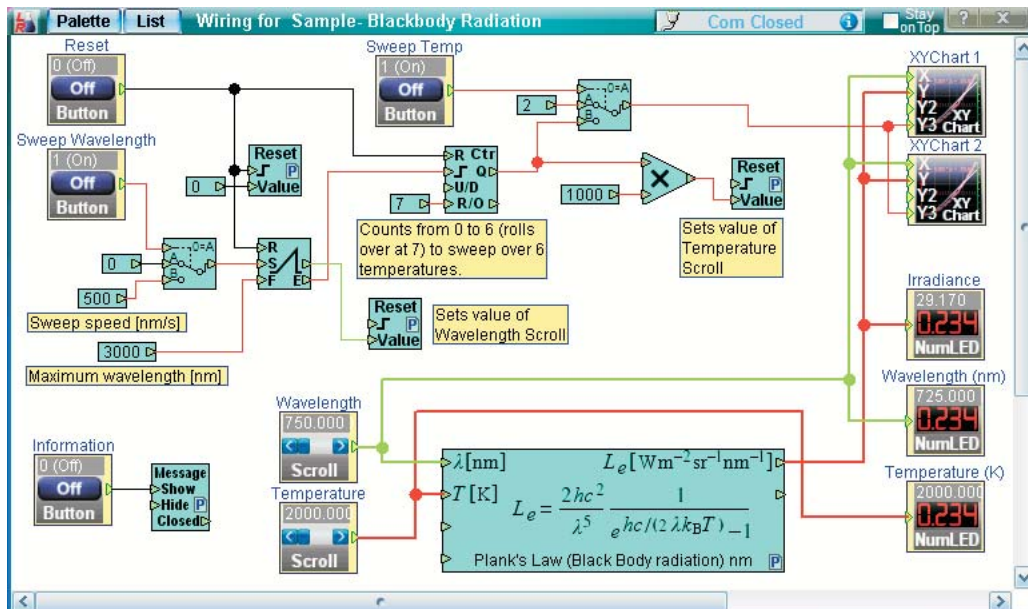
Units Conversion wiring object

The Equation object doesn't have any equations for unit conversions because there is a separate "Units Conversion" Wiring object.

An alternate method for adding Wiring objects comprises using the "List" button to open the object list.

One can further click on the "Search" button to type a name or description of the desired object. As letters are typed a list of closely matching objects is presented and one can drag a name onto the Wiring window.
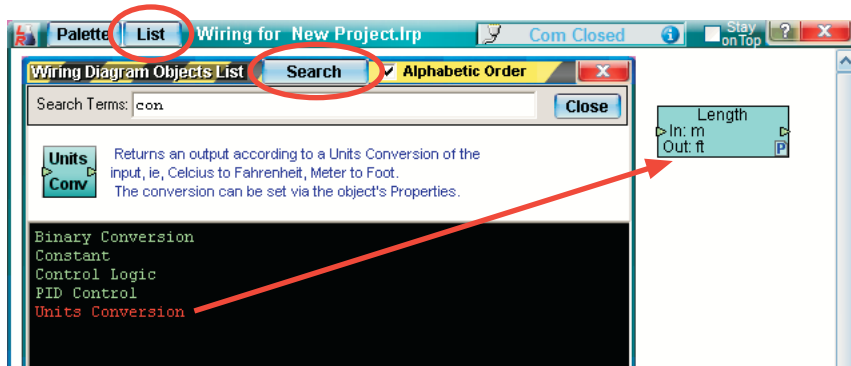
As with most Wiring objects, multiple objects can be added to the Wiring and individually configured.

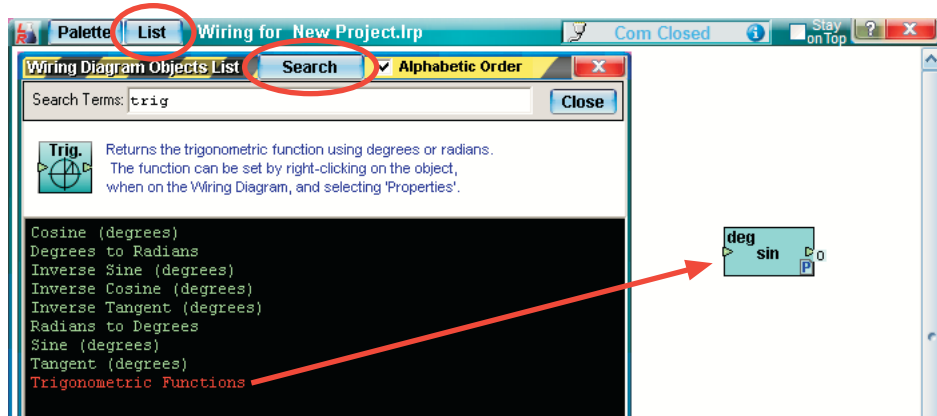The object's Property window is shown below.

As physical quantity selections are made, the appropriate input and output lists are updated, from which input and output units can be selected.
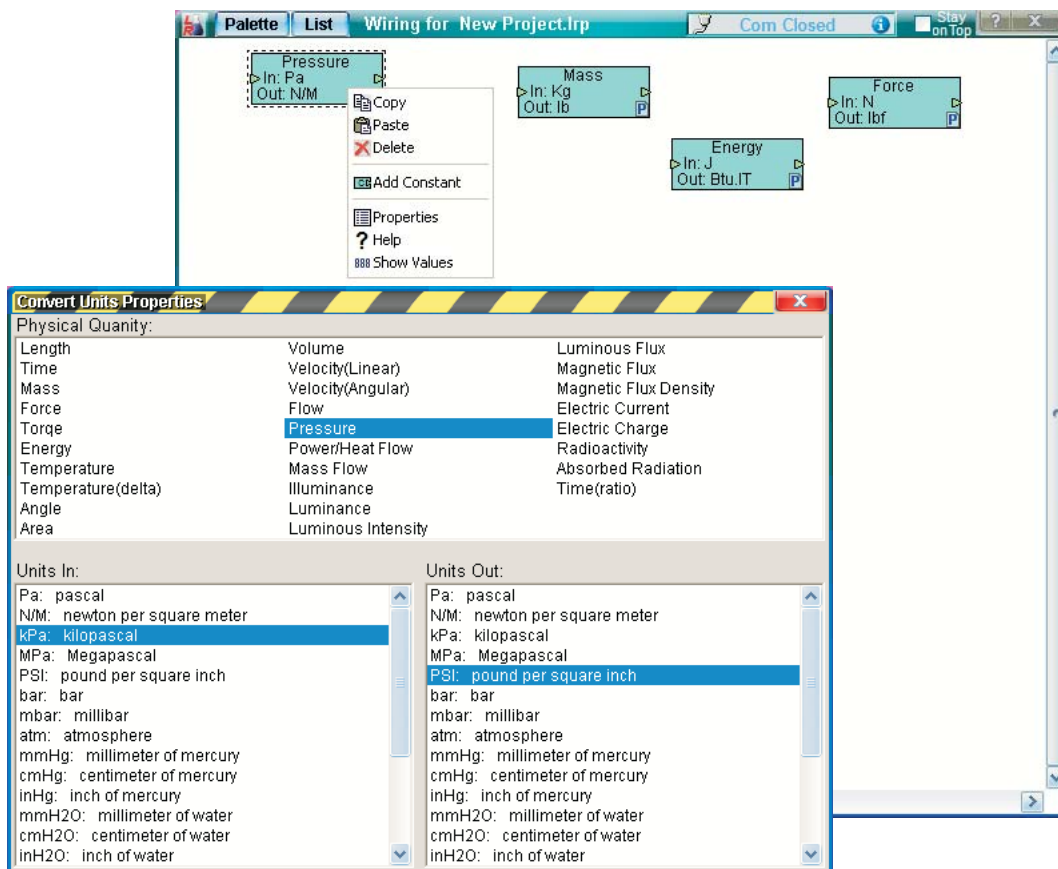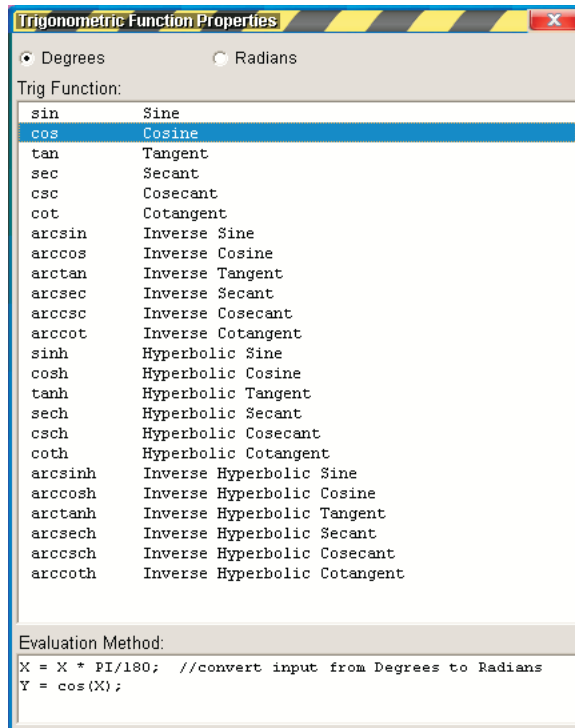
Trigonometric wiring object

There is also a "Trigonometric Functions" Wiring object.

Below it is shown being added using the search feature.

Right-clicking on the object and selecting "Properties" allows one to open the below window to select a function. One can also select between the use of "Degrees" or "Radians" for the claculations.
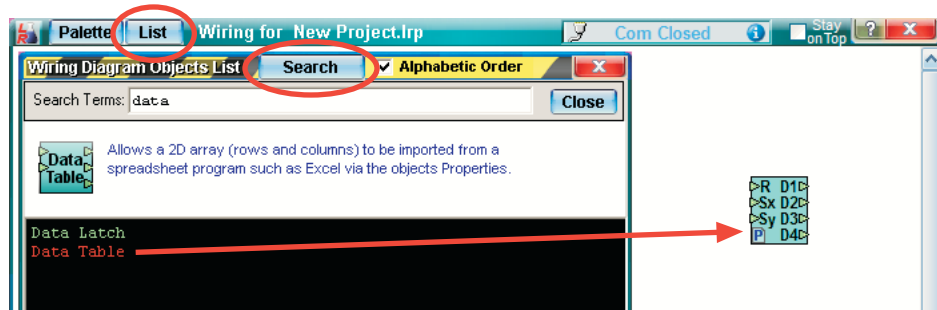
The bottom Evaluation Method box is for information only and shows how the calculation is performed.

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Data Table wiring object

The Data Table object calculates outputs based on linear interpolation of a data set.

Below it is shown being added using the search feature.

Right-clicking on the object and selecting **"Properties"** allows one to paste a data set.

The **"Output Mode"** must be set to **"Sx Selects Row(Interpolated)"** to interpolate between values. Modes for other purposes are available and are explained in the help for this window.

The data columns can be separated with various deliminator characters (commas, semicolons, tabs).

The tab deliminated data shown is for a thermistor temperature sensor with the first column representing resistance and the second temperature.

It is common to select and copy two columns in a spreadsheet program, such as Excel, and then paste the text into the data box. When doing so from Excel, the columns will be tab deliminated.
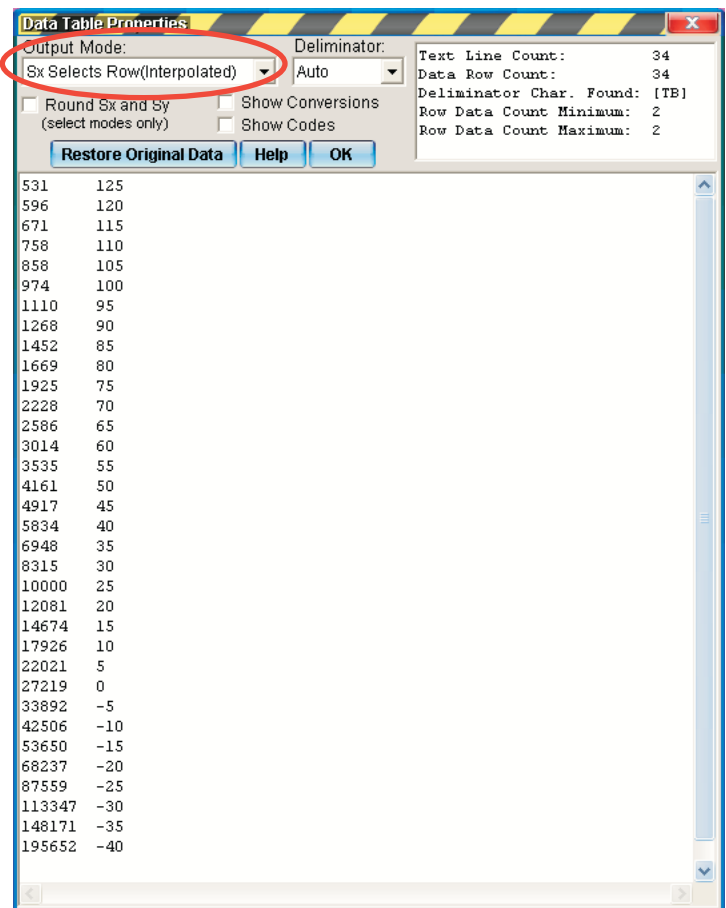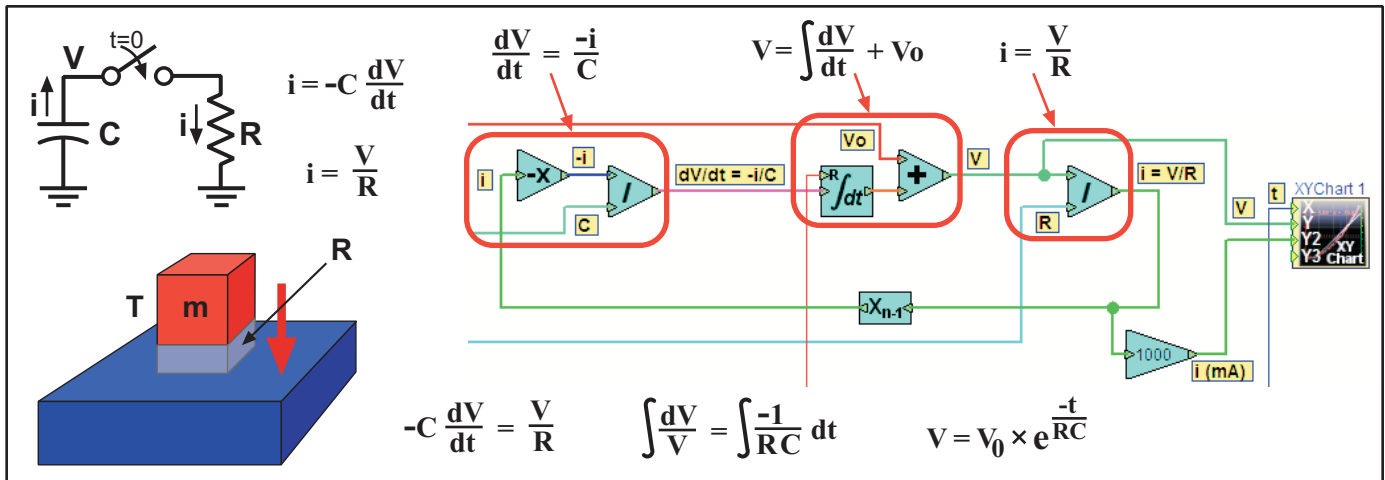
"Getting Started with Simulations" document

As shown on a previous page, the Equation object can be used for for simulations based on one or multiple Equation objects. However, LabRecon's Intergral object allows one to create simulations for dynamics based on differential equations.

The document **"LabRecon - Getting Started with Simulations.pdf"** can be downloaded at **www.LabRecon.com/Documents.html**.

The above document presents various examples of simulations for dynamics of systems such as mechanical and thermal systems. Equavalent electrical models are shown as well as mathematical solutions.

Several Sample Projects for "Simulations" can be opened for these dynamic systems.

Below are some examples from the document.

collection of graphics for 1st order systems
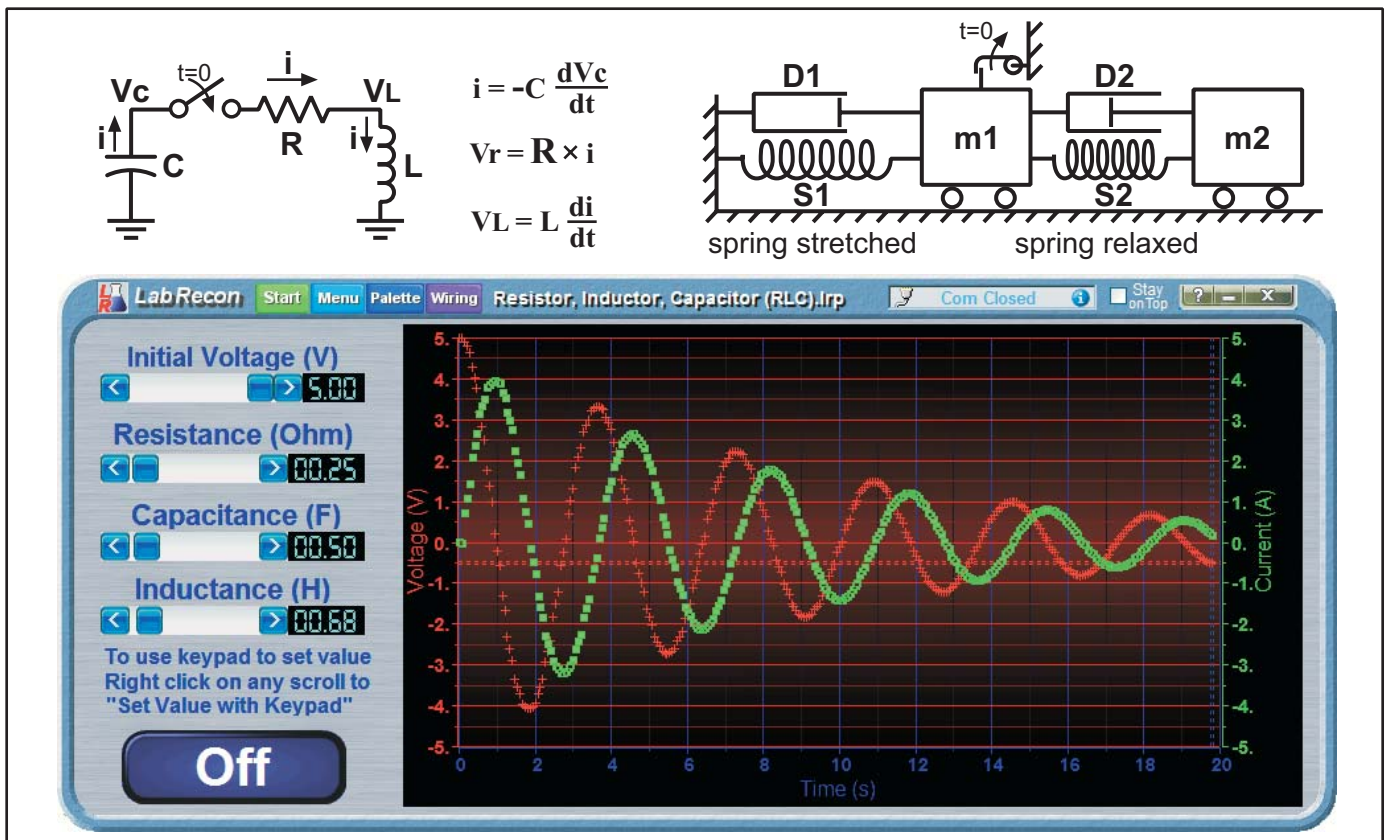
collection of graphics for 2nd order systems

Additional Documents at www.LabRecon.com/Documents

LabRecon - Getting Started with the IoT (Internet of Things).pdf

LabRecon - Getting Started with the Measurement Wizard.pdf

LabRecon - Getting Started with Simulations.pdf

LabRecon - Equation Object.pdf

LabRecon - Getting Started with Robotics.pdf

LabRecon - Chip Datasheet (rev 2.0).pdf

LabRecon - MiniDAQ Datasheet (rev1.0).pdf

LabRecon - Chip Quick Start Sheet.pdf

LabRecon - Breadboard Experimenter (rev0).pdf

LabRecon - Photovoltaics.pdf

LabRecon - Reflow Oven PID Control.pdf

LabRecon - Measurement Configuration.pdf

Instructional Videos

www.LabRecon.com/videos

Revisions to this Document

Rev 0   Initial release

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