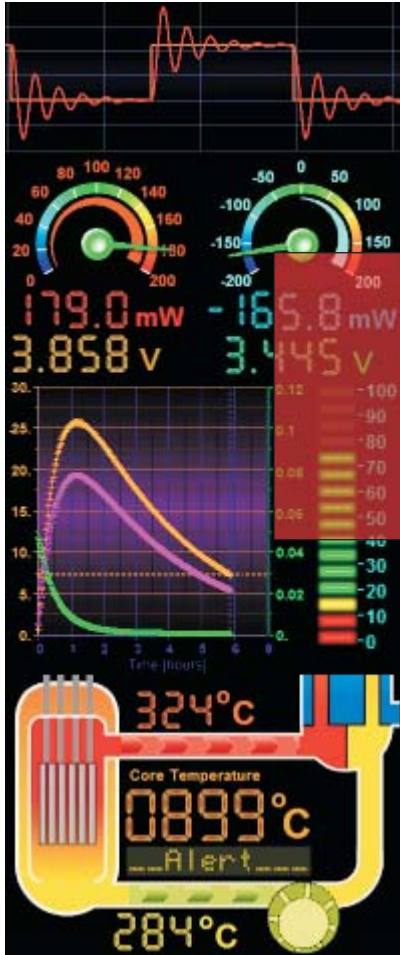


LabRecon - Getting Started with the Measurement Wizard

LabRecon's Measurement Wizard utilizes a built-in database of over 500 commercially available sensors and hundreds of circuit combinations to allow one to quickly configure measurements.



LabRecon

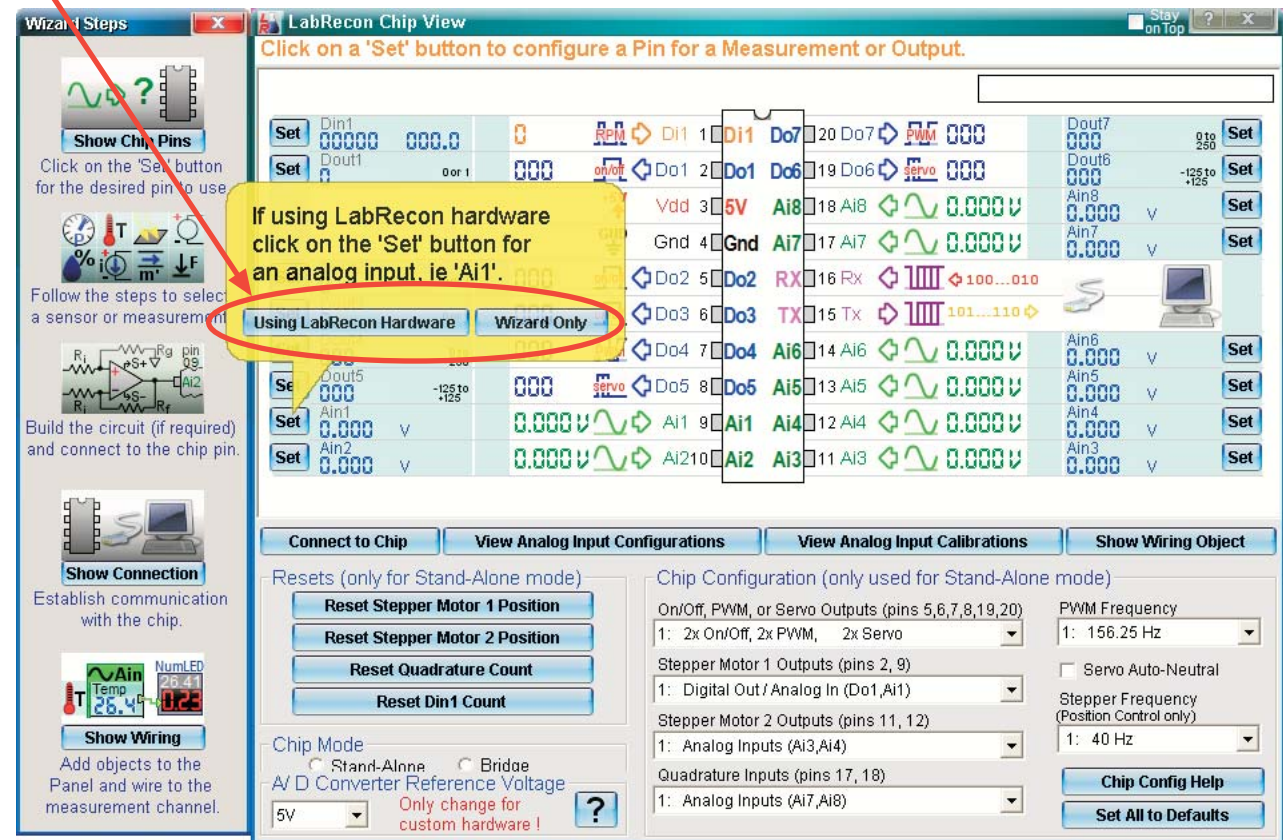
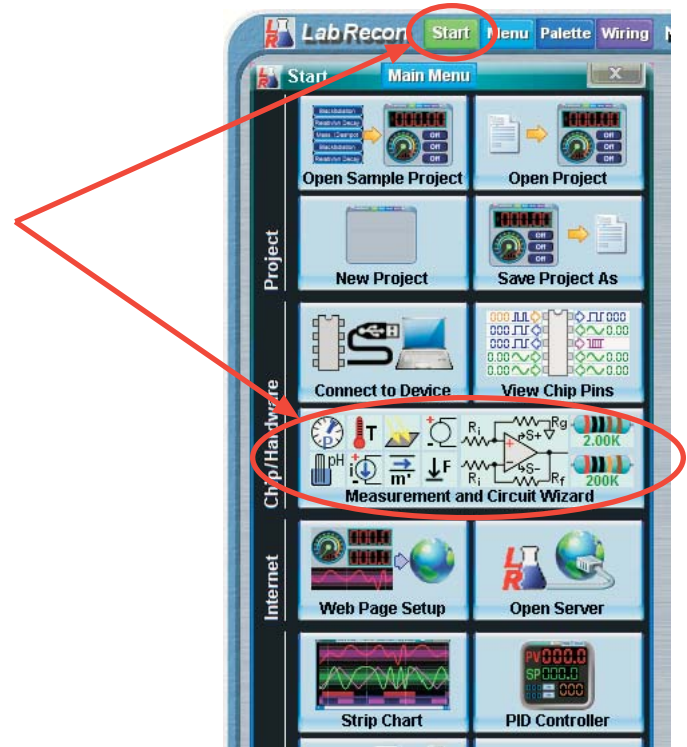
*Software and Hardware for
Measurement, Control and Simulation*

LabRecon's **Measurement Wizard** utilizes a built-in database of over **500 commercially available sensors and hundreds of circuit combinations** to allow one to quickly configure measurements.

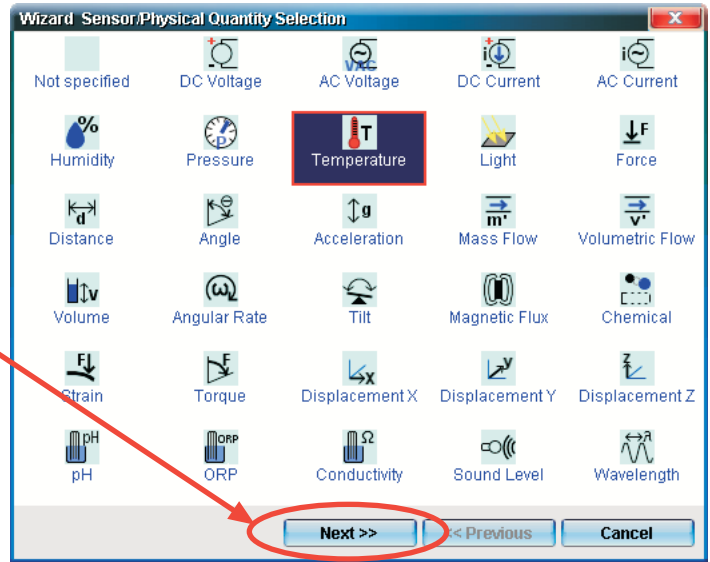
Click on the top **"Start"** button and then on the **"Measurement and Circuit Wizard"** tile.

Note that most LabRecon windows have a top **"?"** button for help.

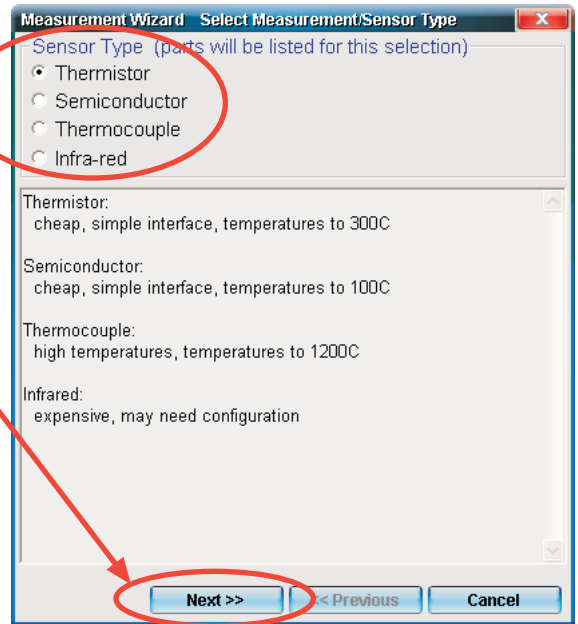
If a channel of a LabRecon chip or LabRecon hardware is being configured, click on **"Using LabRecon Hardware"** and then select the **"Set"** button for the proper **"Ai"** channel, otherwise click **"Wizard Only"** to access the feature.



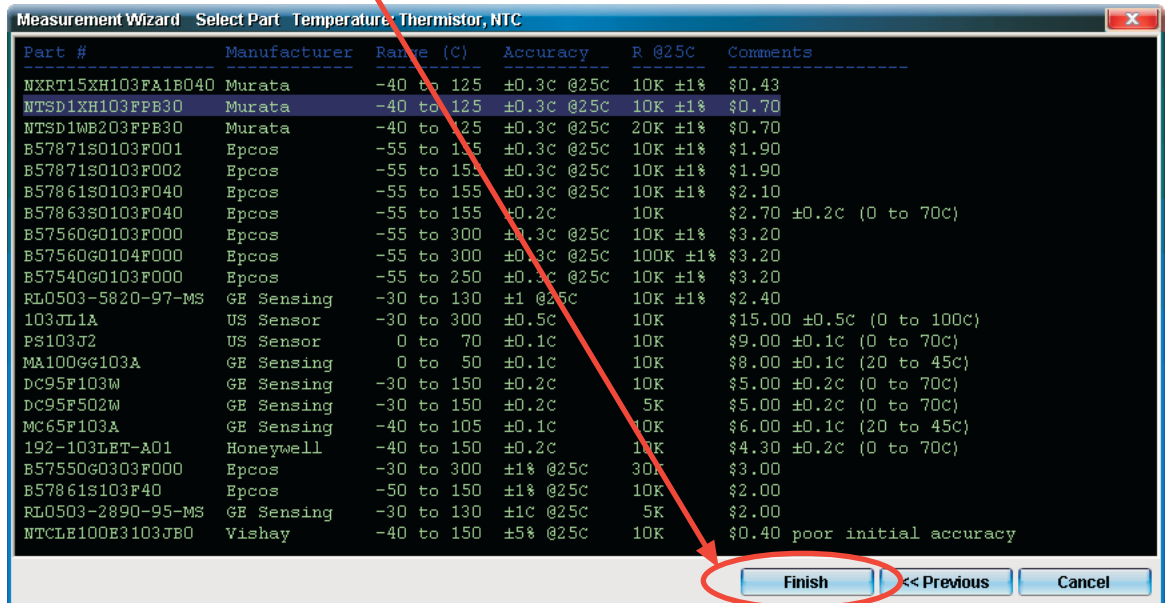
Select a physical quantity and click “Next”.



The sensors or circuit types for some physical quantities are grouped according to sensor types. Select the desired sensor type and click “Next”.



Select the desired sensor from the list and click “Finish”. One can also click “Previous” to go back to select a different sensor type.



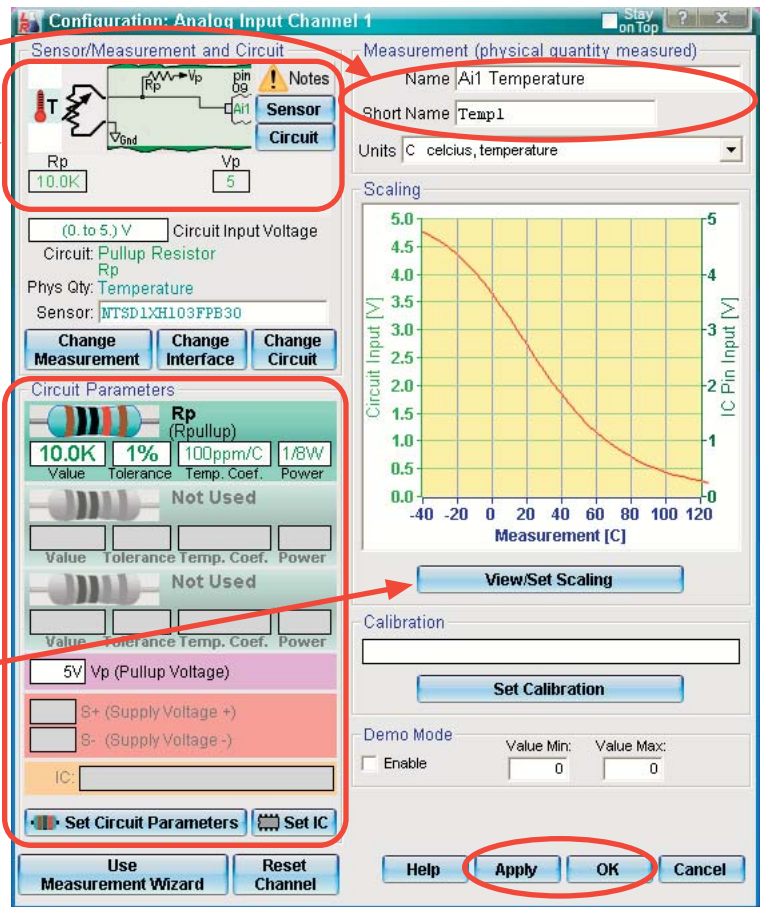
If desired, new names can be entered for the channel. The **“Short Name”** will be used on the **“Wiring”** window.

The resultant circuit is presented with **“Sensor”** and **“Circuit”** buttons to open information windows.

Circuit components, including resistor color codes, is presented for circuit construction.

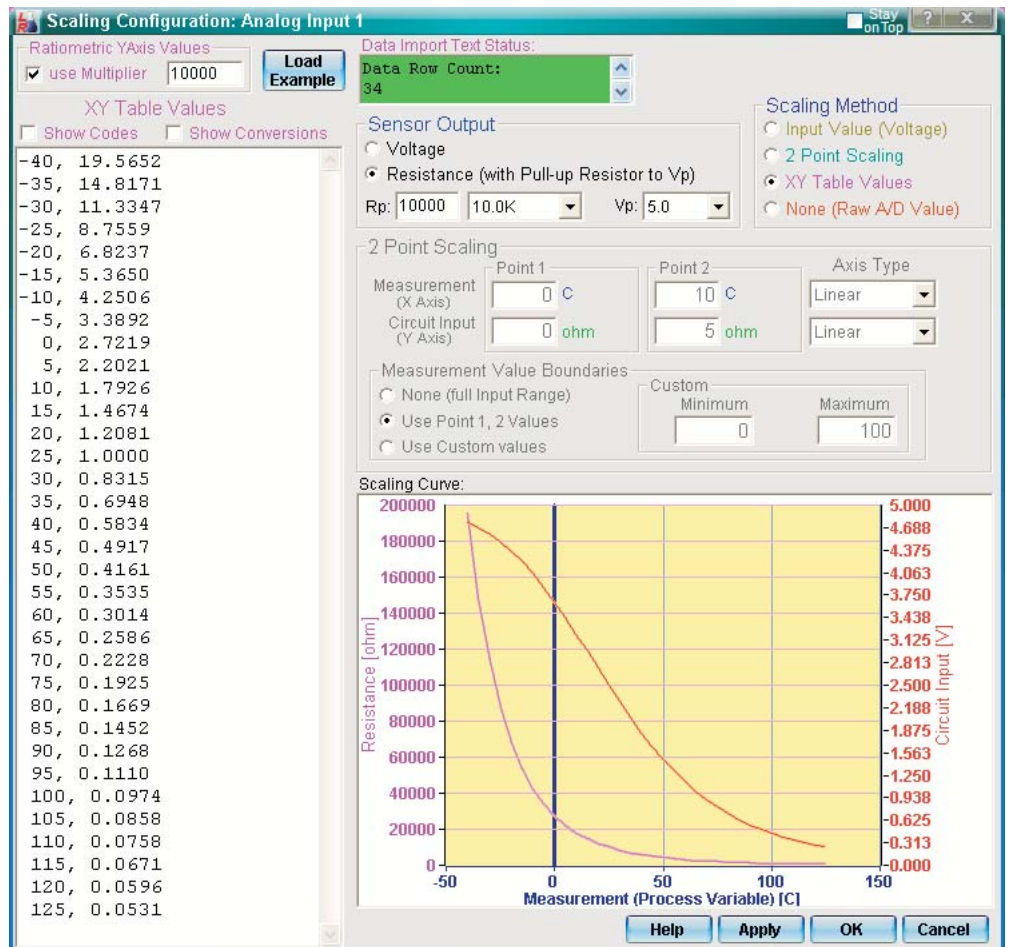
Click the bottom **“Apply”** button and then **“OK”** to close this window. The Wizard can be entered again to configure additional channels.

If desired, **“View/Set Scaling”** can be clicked to open the Scaling window shown below.



This window allows viewing and editing of scaling parameters for the channel. After using the wizard, the resultant scaling will be shown. One can also skip the wizard to manually configure scaling by entering parameters or pasting table data.

The scaling/linearization can be defined either by table data or 2 points on linear or logarithmic scales or by table data. For resistive sensors, such as thermistors, calculations for the specified bias resistance are performed.



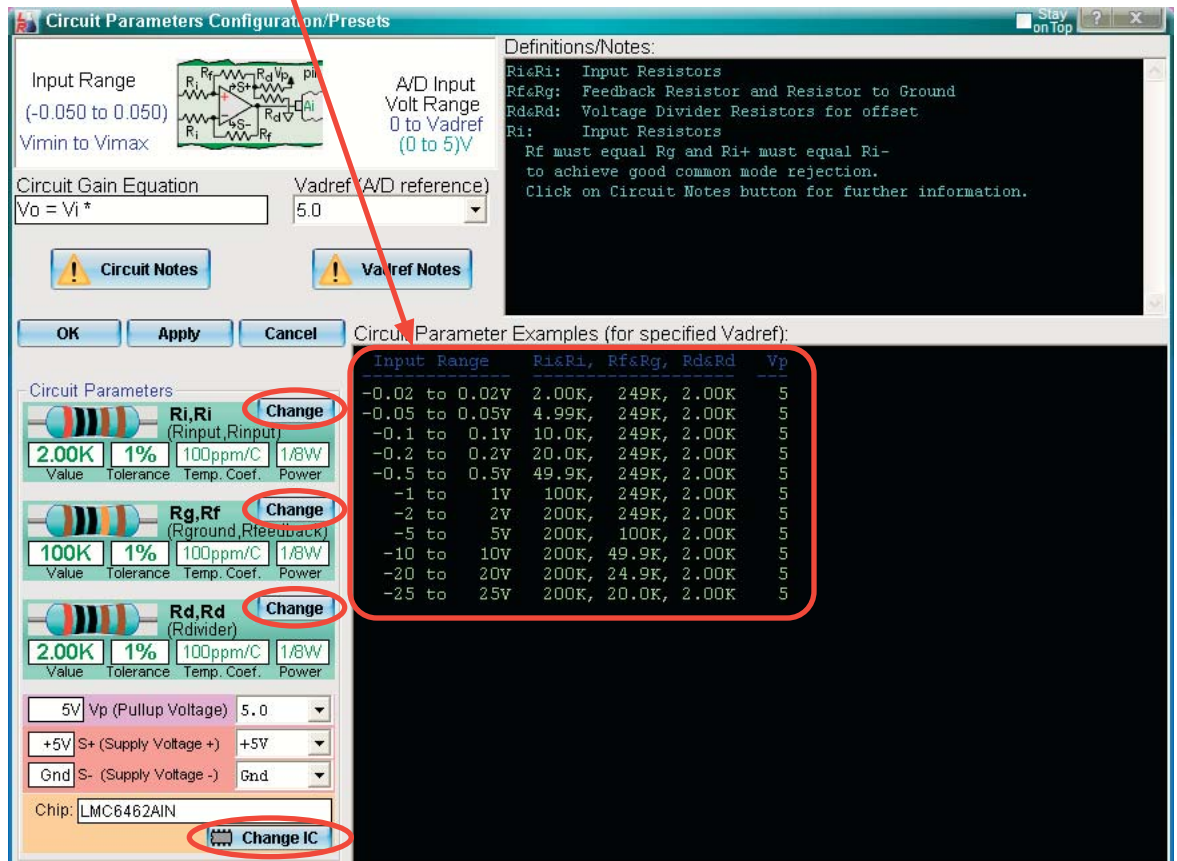
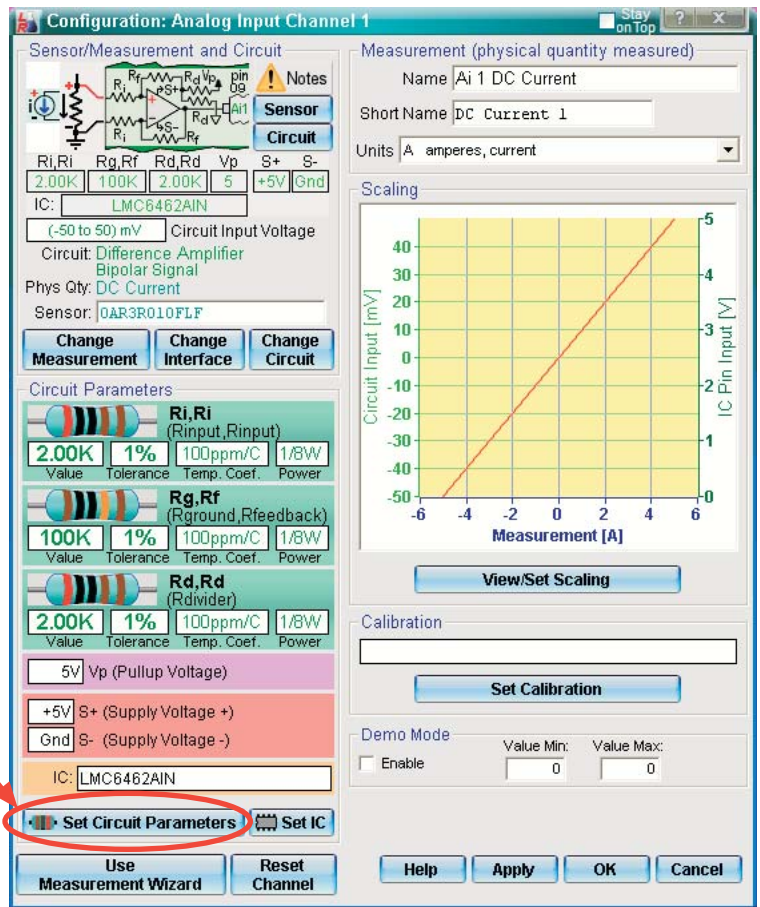
This is the resultant Channel Configuration window for a **DC Current** (bipolar) measurement using a 0.01 ohm shunt.

The presented circuit consists of 3 resistors and an op-amp.

Note that commonly available 1% resistors are recommended by default, but more expensive 0.1% resistors (with a lower temperature coefficient) if desired. A part number of a precision op-amp with rail-to-rail inputs/outputs is also recommended.

If desired, one can click on “**Set Circuit Parameters**” will open the below window to modify parameters.

For many circuits a list of **input range options** can be selected from and new resistor values will be calculated. Optionally, one can adjust individual resistor values using its “**Change**” button. The bottom “**Change IC**” button presents op-amp options.



The Resistor Picker allows one to select from common resistor values.

1% Tolerance Standard Values (some values below 100ohm omitted)

| | | | | | | | | | | | | |
|------|-----|-----|-----|-------|-------|-------|-------|-------|-------|------|------|-------|
| 10.0 | 100 | 215 | 464 | 1.00K | 2.15K | 4.64K | 10.0K | 21.5K | 46.4K | 100K | 215K | 464K |
| 10.5 | 102 | 221 | 475 | 1.02K | 2.21K | 4.75K | 10.2K | 22.1K | 47.5K | 102K | 221K | 475K |
| 11.0 | 105 | 226 | 487 | 1.05K | 2.26K | 4.87K | 10.5K | 22.6K | 48.7K | 105K | 226K | 487K |
| 12.1 | 107 | 232 | 499 | 1.07K | 2.32K | 4.99K | 10.7K | 23.2K | 49.9K | 107K | 232K | 499K |
| 12.4 | 110 | 237 | 511 | 1.10K | 2.37K | 5.11K | 11.0K | 23.7K | 51.1K | 110K | 237K | 511K |
| 13.0 | 113 | 243 | 523 | 1.13K | 2.43K | 5.23K | 11.3K | 24.3K | 52.3K | 113K | 243K | 523K |
| 14.0 | 115 | 249 | 536 | 1.15K | 2.49K | 5.36K | 11.5K | 24.9K | 53.6K | 115K | 249K | 536K |
| 15.0 | 118 | 255 | 549 | 1.18K | 2.55K | 5.49K | 11.8K | 25.5K | 54.9K | 118K | 255K | 549K |
| 16.2 | 121 | 261 | 562 | 1.21K | 2.61K | 5.62K | 12.1K | 26.1K | 56.2K | 121K | 261K | 562K |
| 18.2 | 124 | 267 | 576 | 1.24K | 2.67K | 5.76K | 12.4K | 26.7K | 57.6K | 124K | 267K | 576K |
| 19.1 | 127 | 274 | 590 | 1.27K | 2.74K | 5.90K | 12.7K | 27.4K | 59.0K | 127K | 274K | 590K |
| 20.0 | 130 | 280 | 604 | 1.30K | 2.80K | 6.04K | 13.0K | 28.0K | 60.4K | 130K | 280K | 604K |
| 20.5 | 133 | 287 | 619 | 1.33K | 2.87K | 6.19K | 13.3K | 28.7K | 61.9K | 133K | 287K | 619K |
| 21.0 | 137 | 294 | 634 | 1.37K | 2.94K | 6.34K | 13.7K | 29.4K | 63.4K | 137K | 294K | 634K |
| 24.3 | 140 | 301 | 649 | 1.40K | 3.01K | 6.49K | 14.0K | 30.1K | 64.9K | 140K | 301K | 649K |
| 24.9 | 143 | 309 | 665 | 1.43K | 3.09K | 6.65K | 14.3K | 30.9K | 66.5K | 143K | 309K | 665K |
| 25.5 | 147 | 316 | 681 | 1.47K | 3.16K | 6.81K | 14.7K | 31.6K | 68.1K | 147K | 316K | 681K |
| 28.0 | 150 | 324 | 698 | 1.50K | 3.24K | 6.98K | 15.0K | 32.4K | 69.8K | 150K | 324K | 698K |
| 30.1 | 154 | 332 | 715 | 1.54K | 3.32K | 7.15K | 15.4K | 33.2K | 71.5K | 154K | 332K | 715K |
| 34.8 | 158 | 340 | 732 | 1.58K | 3.40K | 7.32K | 15.8K | 34.0K | 73.2K | 158K | 340K | 732K |
| 39.2 | 162 | 348 | 750 | 1.62K | 3.48K | 7.50K | 16.2K | 34.8K | 75.0K | 162K | 348K | 750K |
| 40.2 | 165 | 357 | 768 | 1.65K | 3.57K | 7.68K | 16.5K | 35.7K | 76.8K | 165K | 357K | 768K |
| 41.2 | 169 | 365 | 787 | 1.69K | 3.65K | 7.87K | 16.9K | 36.5K | 78.7K | 169K | 365K | 787K |
| 48.7 | 174 | 374 | 806 | 1.74K | 3.74K | 8.06K | 17.4K | 37.4K | 80.6K | 174K | 374K | 806K |
| 49.9 | 178 | 383 | 825 | 1.78K | 3.83K | 8.25K | 17.8K | 38.3K | 82.5K | 178K | 383K | 825K |
| 51.1 | 182 | 392 | 845 | 1.82K | 3.92K | 8.45K | 18.2K | 39.2K | 84.5K | 182K | 392K | 845K |
| 60.4 | 187 | 402 | 866 | 1.87K | 4.02K | 8.66K | 18.7K | 40.2K | 86.6K | 187K | 402K | 866K |
| 69.8 | 191 | 412 | 887 | 1.91K | 4.12K | 8.87K | 19.1K | 41.2K | 88.7K | 191K | 412K | 887K |
| 75.0 | 196 | 422 | 909 | 1.96K | 4.22K | 9.09K | 19.6K | 42.2K | 90.9K | 196K | 422K | 909K |
| 80.6 | 200 | 432 | 931 | 2.00K | 4.32K | 9.31K | 20.0K | 43.2K | 93.1K | 200K | 432K | 931K |
| 90.9 | 205 | 442 | 953 | 2.05K | 4.42K | 9.53K | 20.5K | 44.2K | 95.3K | 205K | 442K | 953K |
| 97.6 | 210 | 453 | 976 | 2.10K | 4.53K | 9.76K | 21.0K | 45.3K | 97.6K | 210K | 453K | 1.00M |

5% Tolerance Standard Values

| | | | | | |
|-----|----|-----|------|-----|------|
| 1.0 | 10 | 100 | 1.0K | 10K | 100K |
| 1.1 | 11 | 110 | 1.1K | 11K | 110K |
| 1.2 | 12 | 120 | 1.2K | 12K | 120K |
| 1.3 | 13 | 130 | 1.3K | 13K | 130K |
| 1.5 | 15 | 150 | 1.5K | 15K | 150K |
| 1.6 | 16 | 160 | 1.6K | 16K | 160K |
| 1.8 | 18 | 180 | 1.8K | 18K | 180K |
| 2.0 | 20 | 200 | 2.0K | 20K | 200K |
| 2.2 | 22 | 220 | 2.2K | 22K | 220K |
| 2.4 | 24 | 240 | 2.4K | 24K | 240K |
| 2.7 | 27 | 270 | 2.7K | 27K | 270K |
| 3.0 | 30 | 300 | 3.0K | 30K | 300K |
| 3.3 | 33 | 330 | 3.3K | 33K | 330K |
| 3.6 | 36 | 360 | 3.6K | 36K | 360K |
| 3.9 | 39 | 390 | 3.9K | 39K | 390K |
| 4.3 | 43 | 430 | 4.3K | 43K | 430K |
| 4.7 | 47 | 470 | 4.7K | 47K | 470K |
| 5.1 | 51 | 510 | 5.1K | 51K | 510K |
| 5.6 | 56 | 560 | 5.6K | 56K | 560K |
| 6.2 | 62 | 620 | 6.2K | 62K | 620K |
| 6.8 | 68 | 680 | 6.8K | 68K | 680K |
| 7.5 | 75 | 750 | 7.5K | 75K | 750K |
| 8.2 | 82 | 820 | 8.2K | 82K | 820K |
| 9.1 | 91 | 910 | 9.1K | 91K | 910K |

When the "Change IC" button is clicked this window presents a list of common precision op-amps.

Dual Op-Amp Package: DIP8, SOIC8, MSOP8

Quad Op-Amp Package: DIP14, SOIC14

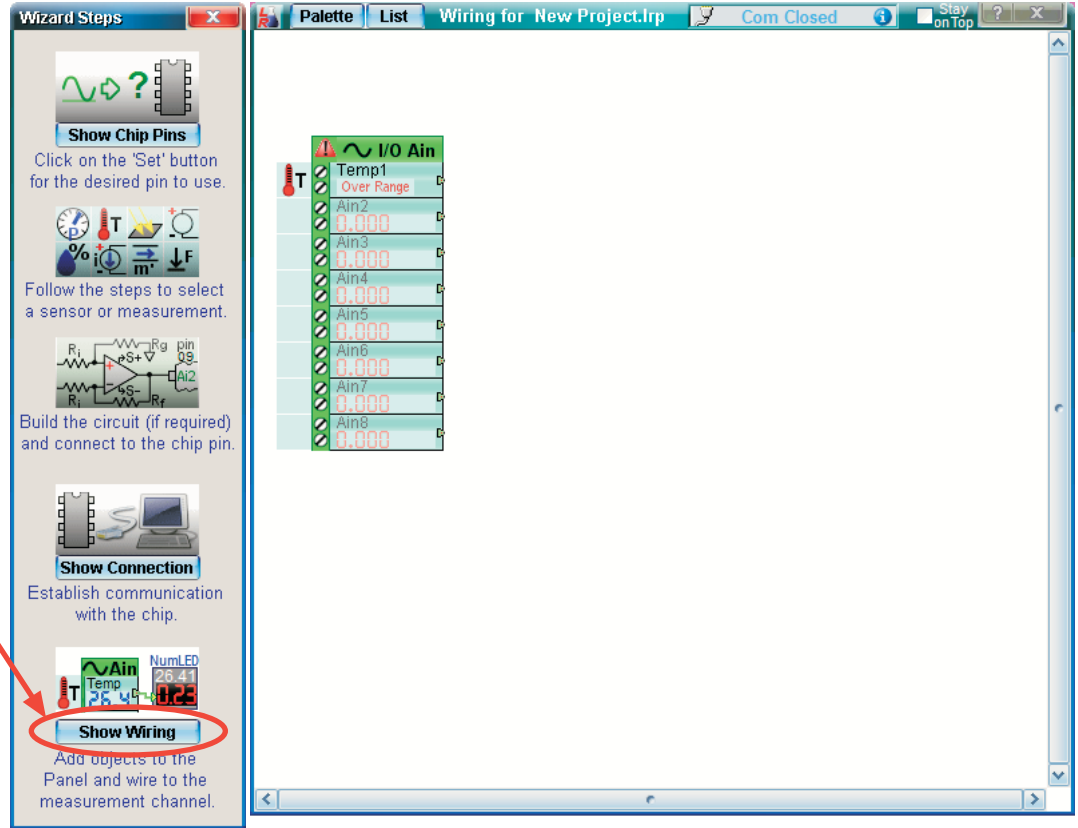
Wos: Offset Voltage (typical)
 Vosd: Offset Voltage Drift (typical)
 Ibm: Input Bias Current (typical)
 Num: Number of op-amps in package
 Vi Swing: Input Voltage Range with S+=5V, S-=Gnd
 Vo Swing: Output Voltage Range with S+=5V, S-=Gnd

| Part # | Package | Num | Vos (uV) | Vosd (uV/C) | Ibm (nA) | Supply Range (V) | Vi Swing (S+=5V, S-=Gnd) | Vo Swing (S+=5V, S-=Gnd) | Comments |
|------------|---------|-----|----------|-------------|----------|------------------|--------------------------|--------------------------|---------------------------------|
| LMC6462AIN | DIP8 | 2 | 250 | 1.5 | <.01 | 3-15.5 | -0.20-5.30 | 0.005-4.995 | CMOS, Rail-to-Rail Input-Output |
| LMC6464AIN | DIP14 | 4 | 250 | 1.5 | <.01 | 3-15.5 | -0.20-5.30 | 0.005-4.995 | CMOS, Rail-to-Rail Input-Output |
| LMC6482AIN | DIP8 | 2 | 110 | 1 | <.01 | 3-15.5 | -0.30-5.30 | 0.1-4.9 | CMOS, Rail-to-Rail Input-Output |
| LMC6484AIN | DIP14 | 4 | 110 | 1 | <.01 | 3-15.5 | -0.30-5.30 | 0.1-4.9 | CMOS, Rail-to-Rail Input-Output |
| TLV2472CP | DIP8 | 2 | 250 | 0.4 | <.01 | 2.7-6 | 0-5 | 0.07-4.96 | CMOS, Rail-to-Rail Input-Output |
| LM6142AIN | DIP8 | 2 | 300 | 3 | 170 | 1.8-24 | -0.25-5.25 | 0.005-4.995 | Rail-to-Rail Input-Output |
| LM6144AIN | DIP14 | 4 | 300 | 3 | 170 | 1.8-24 | -0.25-5.25 | 0.005-4.995 | Rail-to-Rail Input-Output |
| OPA4342 | DIP14 | 4 | 1000 | 3 | <.01 | 2.7-5.5 | -0.30-5.30 | 0.001-4.999 | CMOS, Rail-to-Rail Input-Output |
| TLV2474CP | DIP14 | 4 | 250 | 0.4 | <.01 | 2.7-6 | 0-5 | 0.07-4.96 | CMOS, Rail-to-Rail Input-Output |
| LT1638CN8 | DIP8 | 2 | 200 | 2 | 20 | 2.5-44 | 0-5.30 | 0.003-4.98 | Rail-to-Rail Input-Output |
| LT1639CN | DIP14 | 4 | 300 | 2 | 20 | 2.5-44 | 0-5.30 | 0.003-4.98 | Rail-to-Rail Input-Output |
| FAN4274IM | MSOP8 | 2 | 8000 | 2.9 | <.01 | 2.5-5.5 | 0-5.30 | 0.01-4.99 | CMOS, Rail-to-Rail Input-Output |
| LM358AN | DIP8 | 2 | 1000 | 7 | 45 | 0-30 | 0-3 | 0.005-3.5 | |
| LM324AN | DIP14 | 4 | 1500 | 7 | 40 | 4-32 | 0-3.5 | 0.005-3.5 | |
| OPA2277P | DIP8 | 2 | 10 | 0.1 | 0.5 | 4-36 | -3-3 ** | -4.5-3.8 | Precision, swing spec @ S-=5V |
| OPA2277PA | DIP8 | 2 | 20 | 0.15 | 0.5 | 4-36 | -3-3 ** | -4.5-3.8 | Precision, swing spec @ S=-5V |
| OPA4277PA | DIP14 | 4 | 20 | 0.15 | 0.5 | 4-36 | -3-3 ** | -4.5-3.8 | Precision, swing spec @ S=-5V |
| LMP7702MA | SOIC8 | 2 | 32 | 1 | <.01 | 2.7-12V | -0.20-5.20 | 0.03-4.06 | CMOS, Rail-to-Rail Input-Output |
| LMP7704MA | SOIC14 | 4 | 32 | 1 | <.01 | 2.7-12V | -0.20-5.20 | 0.03-4.06 | CMOS, Rail-to-Rail Input-Output |
| LMP2022MA | SOIC8 | 2 | 0.4 | 0.004 | .025 | 2.2-5.5V | -0.20-4.20 | 0.065-4.917 | Zero Drift, EMI Hardened |

Wiring (graphical programming)

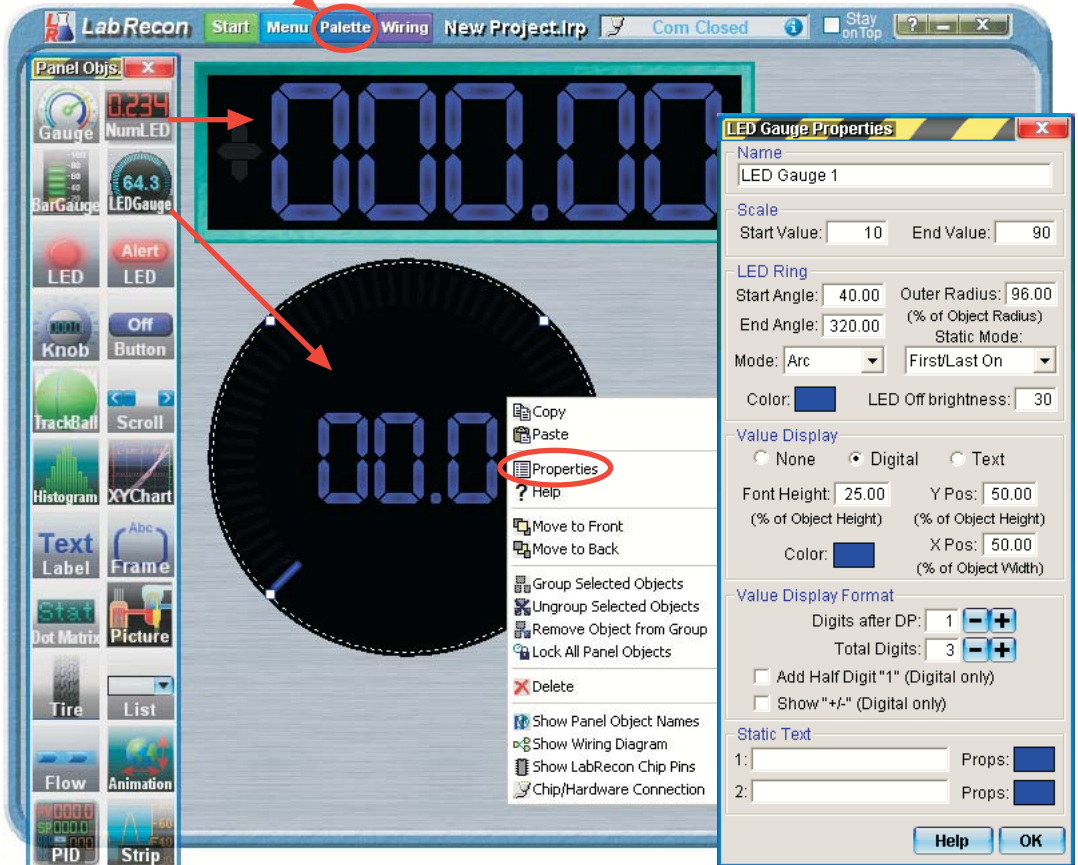
Clicking on “**Show Wiring**” button will open the **Wiring** window and will add the **Ain (Analog Inputs)** wiring object.

Note that clicking on the Panel’s top “**Wiring**” button will also open the **Wiring** window.



Clicking on the Panel’s top “**Palette**” button will open the **Panel Objects** palette. Objects can be dragged onto the Panel.

Right-clicking on any object and selecting **Properties** will allow one to customize the object.

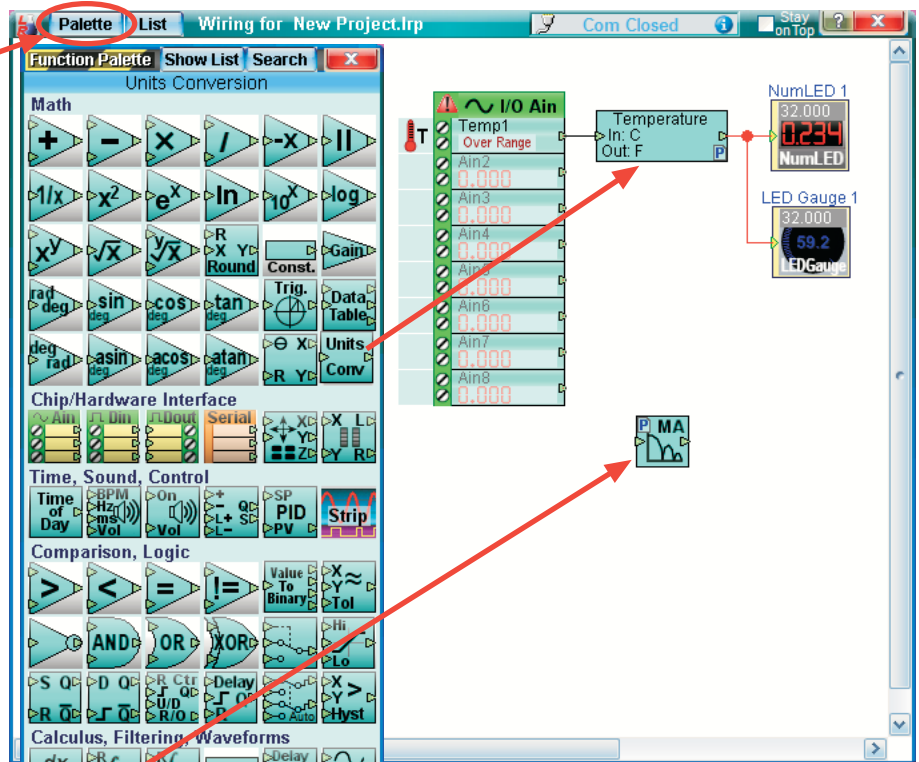


Clicking on the top “**Palette**” button allows one to drag objects onto the **Wiring** window.

Right-clicking on a Wiring object and selecting “**Properties**” allows one to configure the object.

A **Units Conversion** object was added and wired between the configured channel and the **Panel** objects added on the **Panel**.

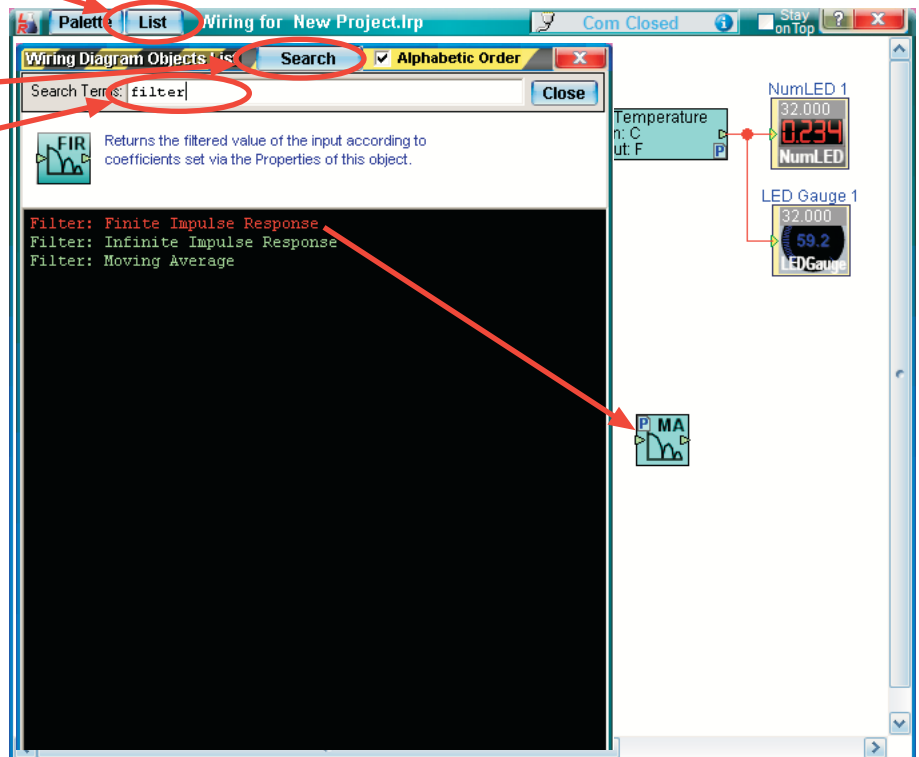
Optionally a **Moving Average Filter** object can be added in series to filter noisy measurements.



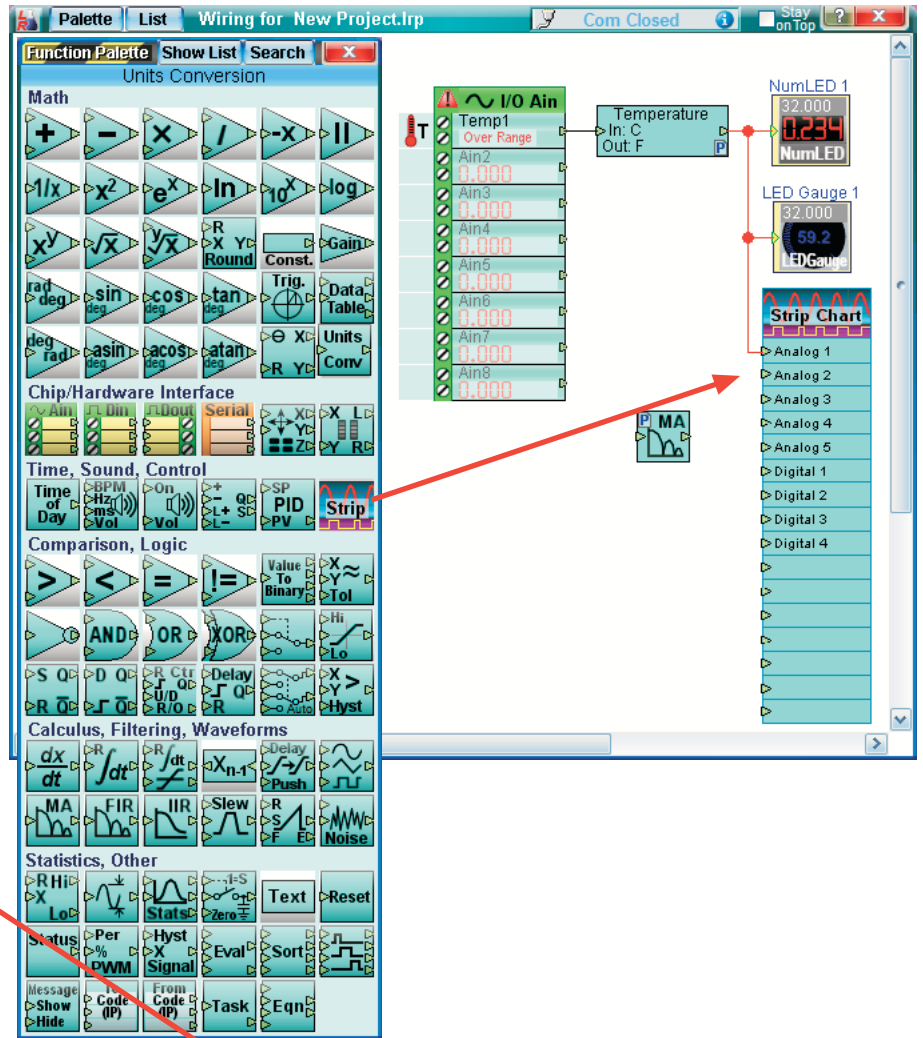
An alternative method to find objects is to click the top “**List**” button.

Furthermore, one can click “**Search**” and then type a description to display matching objects.

The desired object can then be dragged onto the Wiring window.

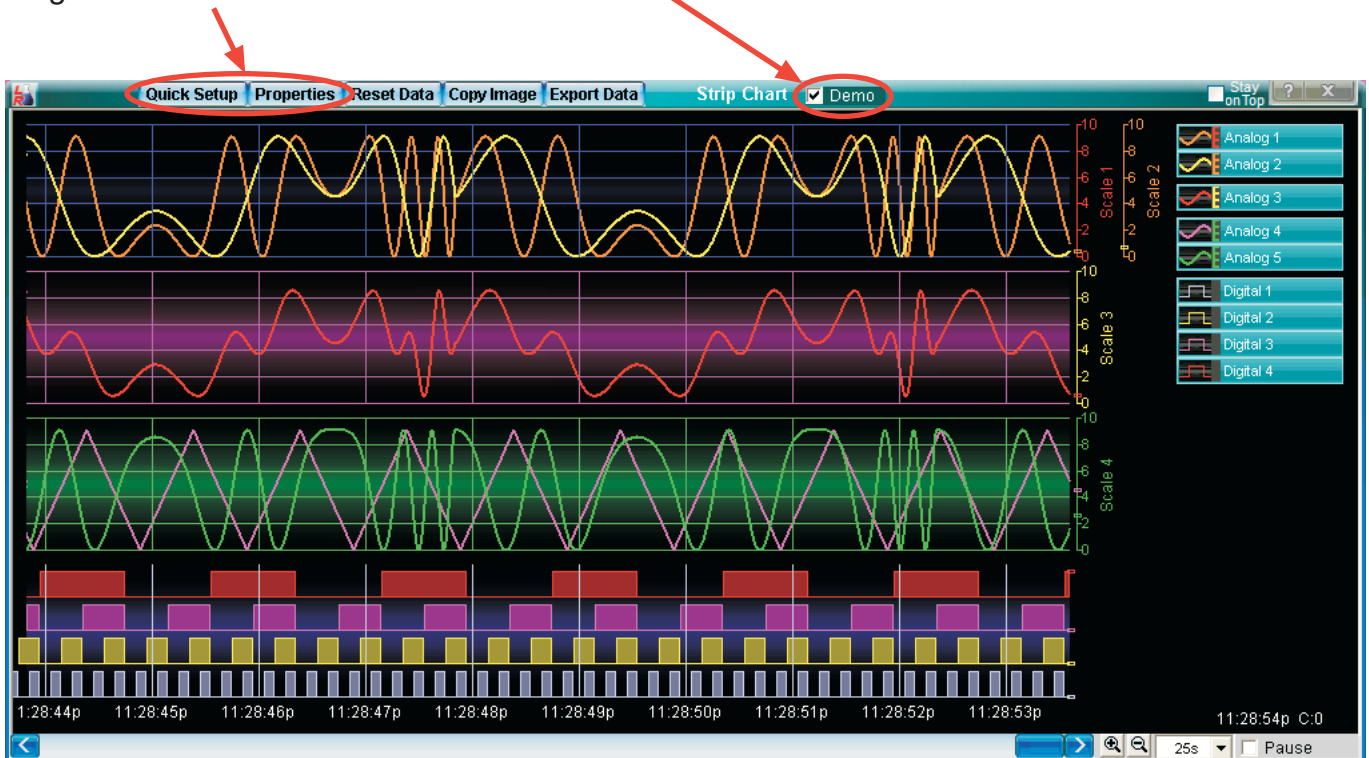


The “Strip” object can also be dragged onto the **Wiring** window and wired to multiple signals.



Note that the Stripchart shown below has “**Demo**” checked to show how analog and digital traces can look.

The “**Quick Setup**” or “**Properties**” buttons open configuration windows.



Additional objects can be dragged from the **Panel Object Palette** onto the Panel. Below is a Panel that was created for a Photovoltaic-Lithium Ion-LED lamp, which includes **Gauges, XY Charts, Animations, and Pictures** for imported graphics.

Right-clicking on an object and opening “**Properties**” allows many customizations.

Note that the **XYCharts** were also configured to calculate and display **curve fits**.

Control objects, such as **Buttons, Scrolls, Knobs, Dropdown Lists, and Trackballs**, can also be added to control devices. Below a button and scroll was added to the upper left of the Panel to control the light source.

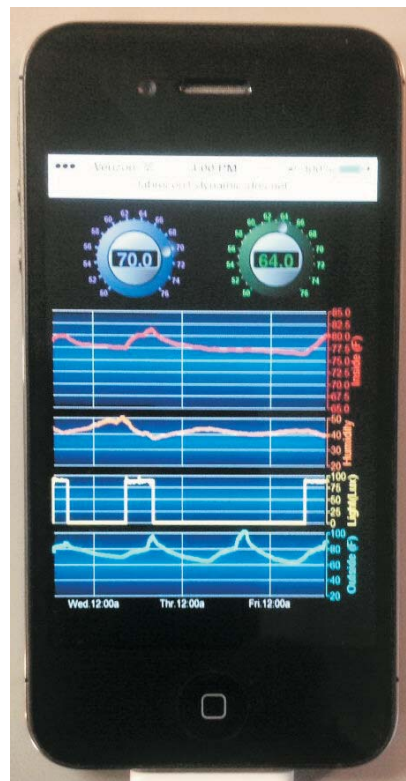
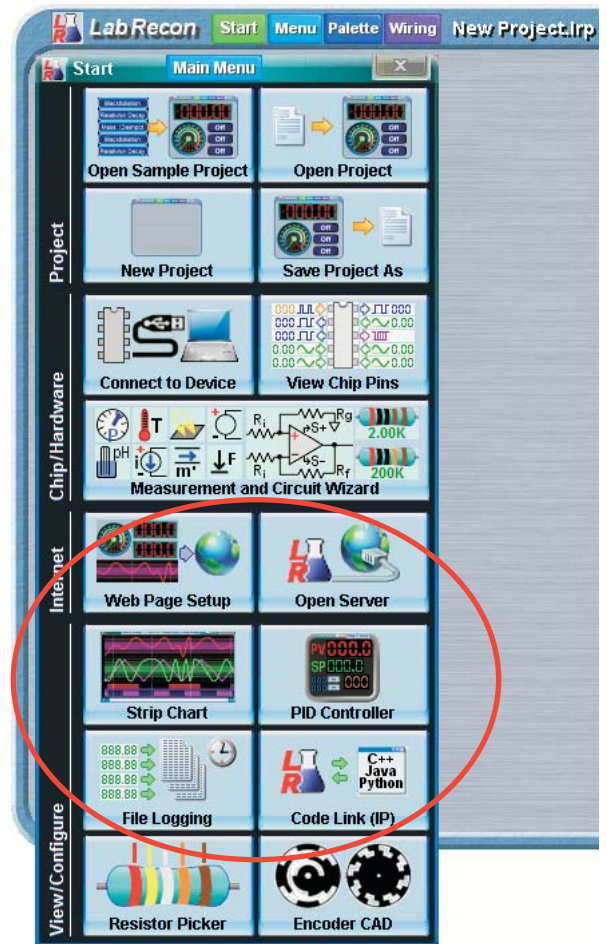


Internet Web page generation is one of LabRecon’s most powerful features, which allows any Panel to be accessed over the Internet from a smart phone, tablet, or computer. Below is a photograph of an **iPhone displaying a smart thermostat** created in LabRecon.

LabRecon generates HTML/HTML5, CSS, and Javascript based on the Panel and includes a **built-in server** to allow access. The document “**LabRecon-Getting Started with IoT (Internet of Things).pdf**” covers this feature.

Other features, that can be accessed from the **Start** menu, include **PID Control**, **File Logging**, and **Code Linking**.

The **Code Link** features allows measurement and control variables on the Wiring window to be shared with code, such as **C/C++**, **Java**, **Javascript**, **Python**, developed by the user.

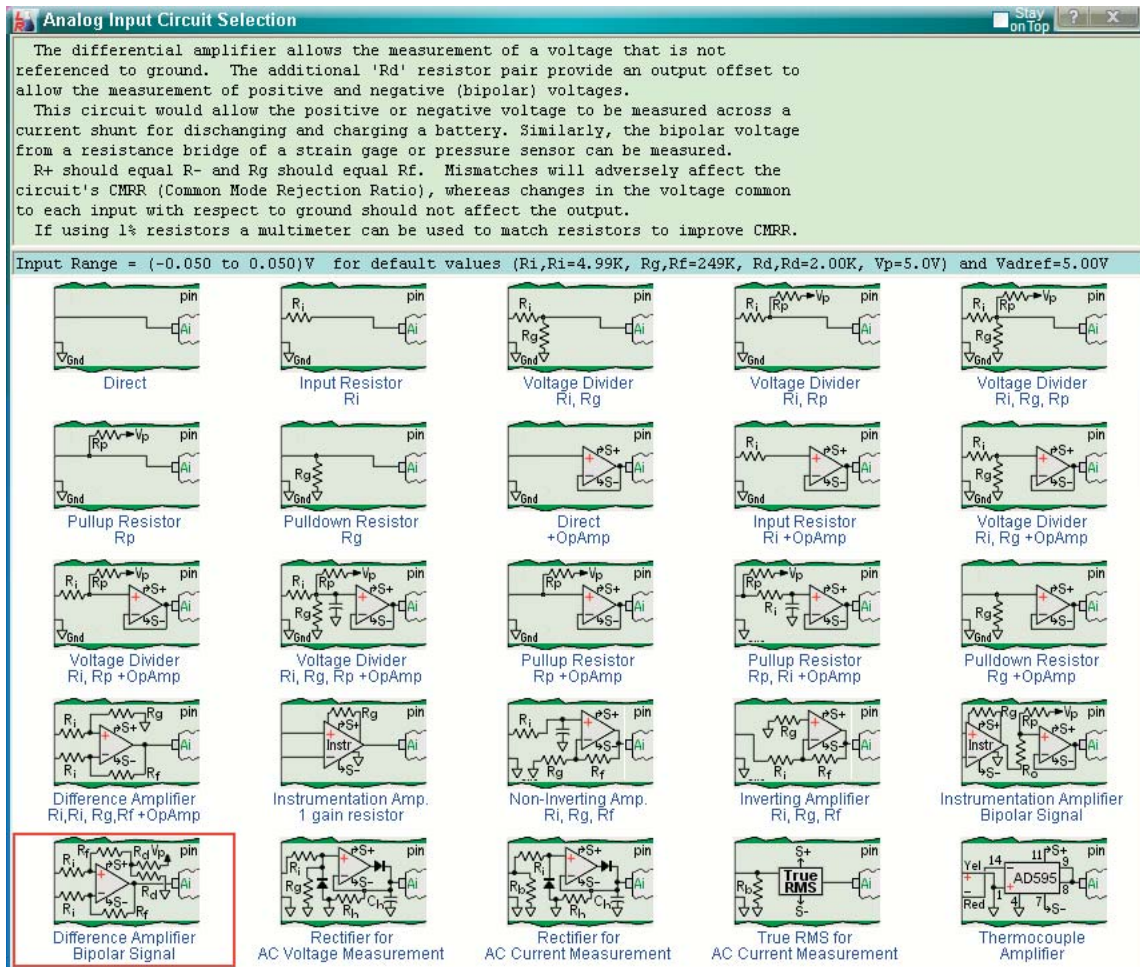
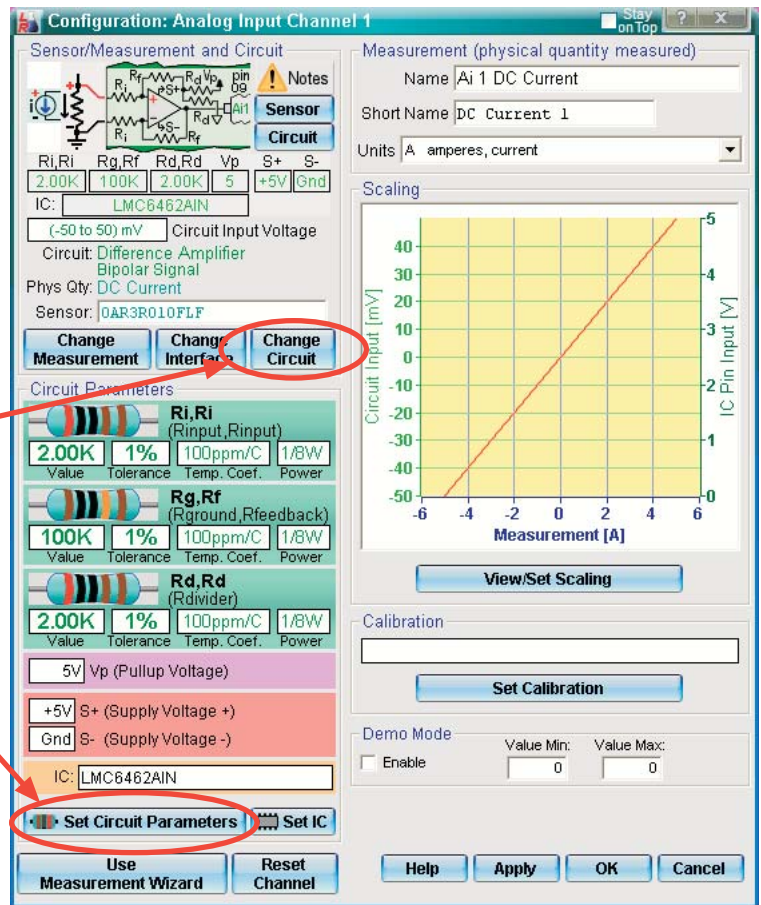


Advanced Measurement Configuration

As shown earlier, the **Analog Input Channel Configuration** window shows measurement and circuit parameters determined by the Measurement Wizard.

One can click on **“Change Circuit”** to open the **Analog Input Circuit Selection** window, shown below, to select a different circuit.

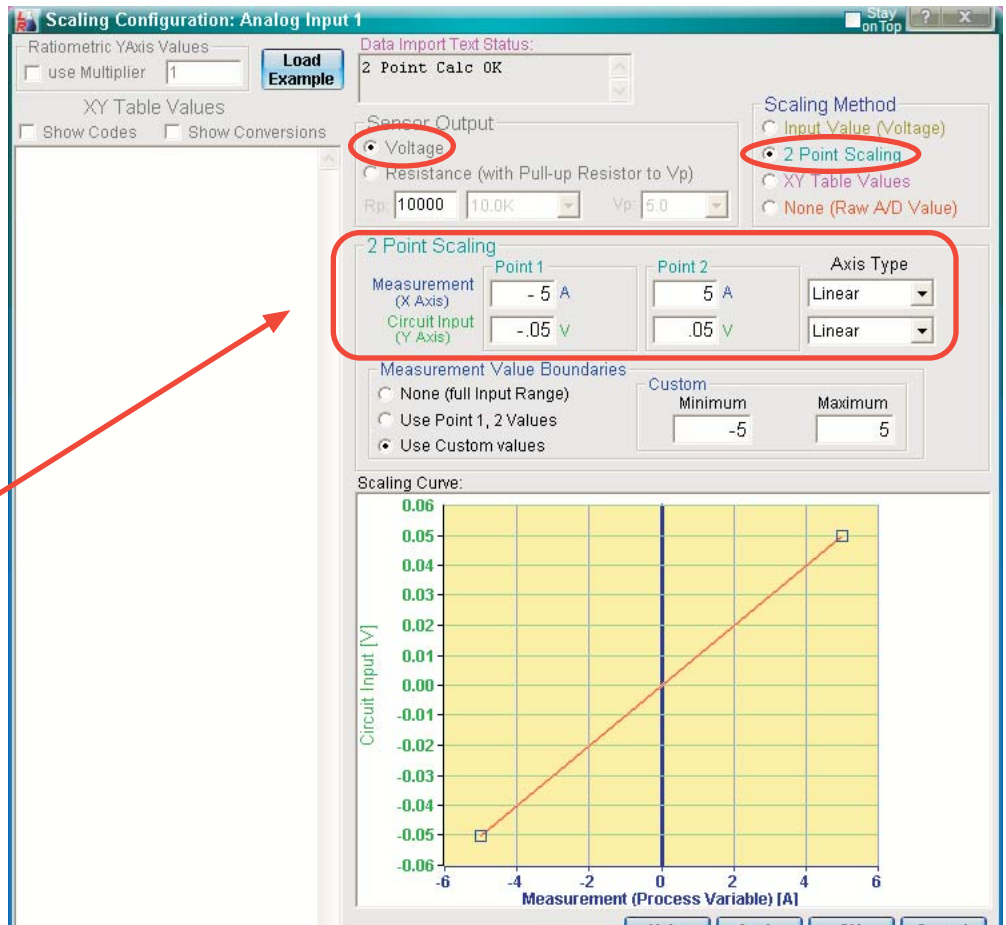
As shown previously, clicking **“Set Circuit Parameters”** will allow one to select from gain presets or change resistor values.



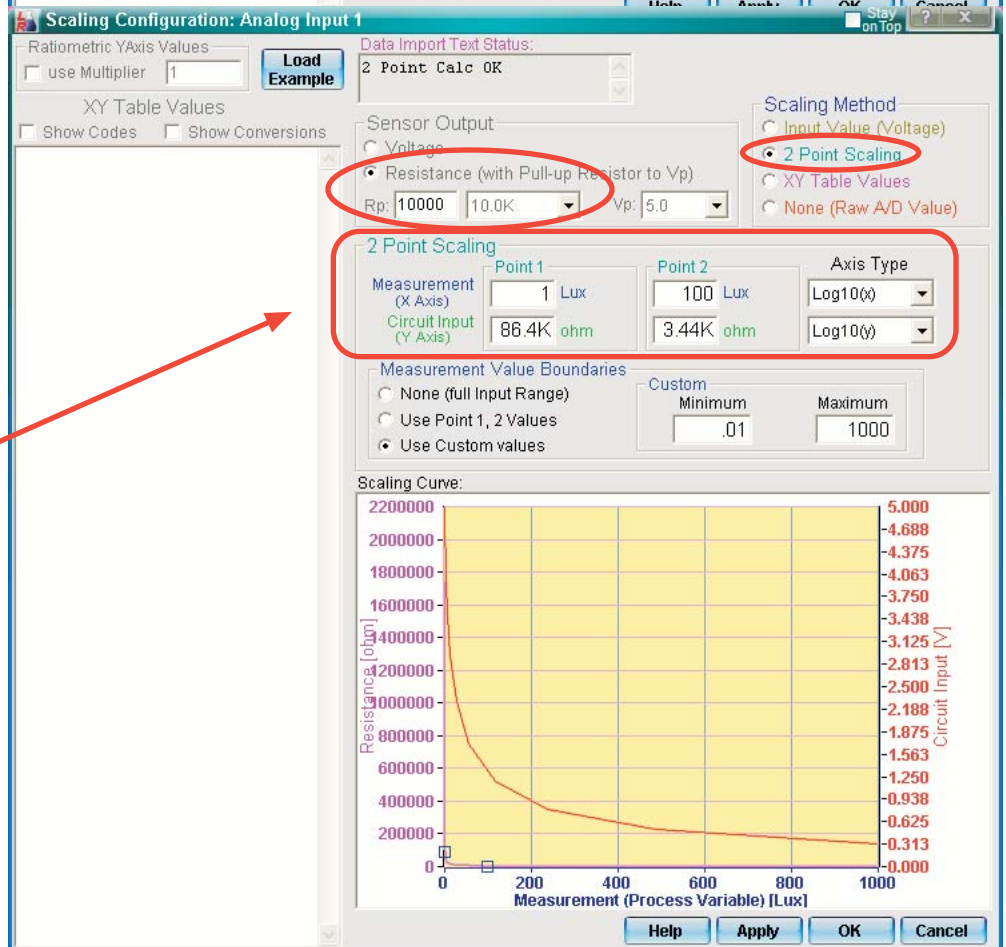
Advanced Measurement Configuration, cont.

This window, as shown earlier, used table data for a thermistor temperature measurement.

Here is an example of a **linear relationship** for a bipolar DC current measurement. It is defined by **2 points on 2 linear axes**. The **Sensor Output** is set to **Voltage** because there is no bias resistor, as used with a thermistor.

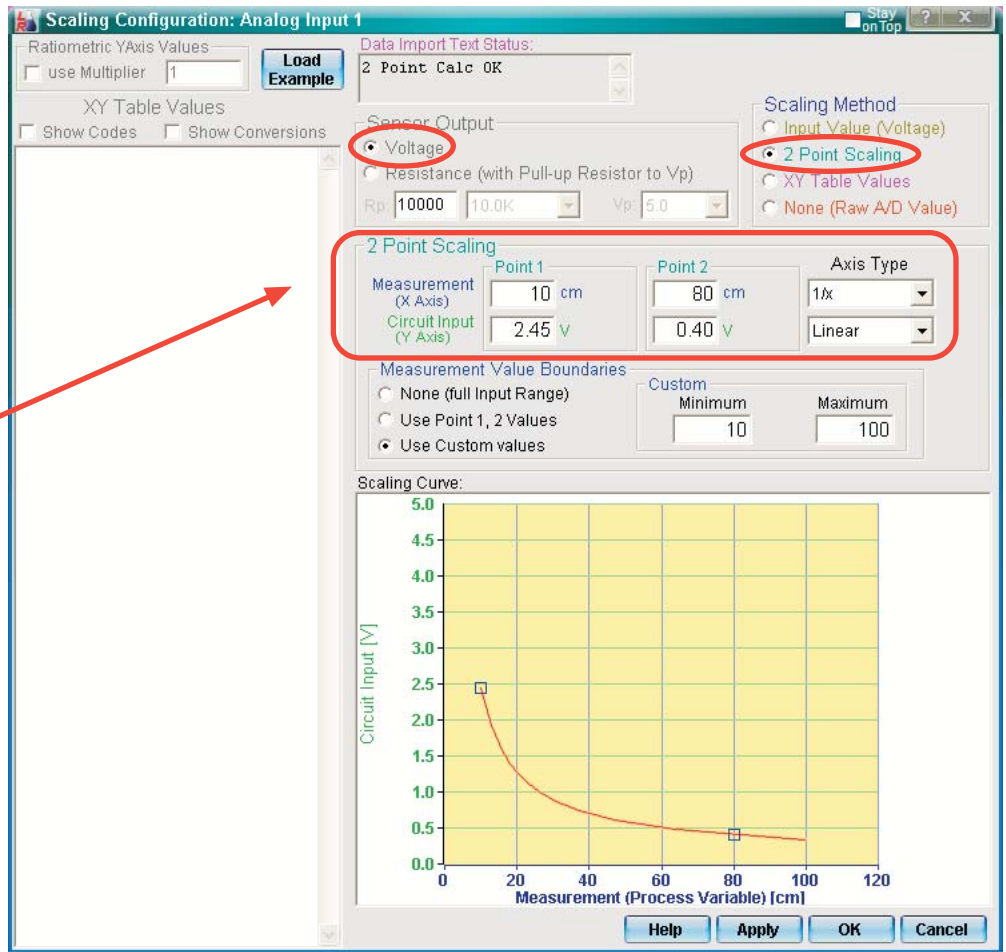


Here is an example of a **logarithmic relationship** for a CdS photocell light measurement. It is defined by **2 points on 2 Log base10 axes**. The **Sensor Output** is set to **Resistance** and **10K** for a bias resistor.



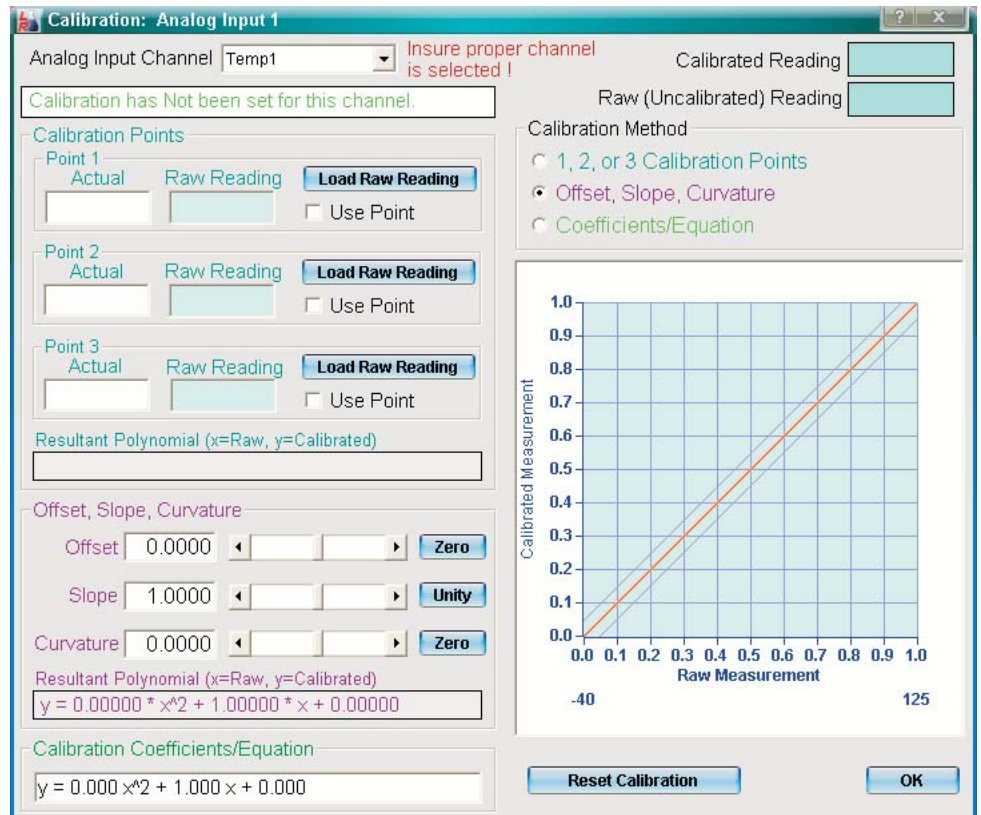
Advanced Measurement Configuration, cont.

Here is an example of a **reciprocal relationship** for a triangulation distance sensor. It is defined by **2 points** on a **reciprocal (1/x)** and a **linear axis**. The **Sensor Output** is set to **Voltage** because there is no bias resistor.



In many applications this window may not be used, but it allows for minor calibration adjustments to correct for sensor and/or circuit component inaccuracies.

The Channel Configuration window on the previous page also has a "Set Calibration" button to open this window. Various methods are available to adjust calibration parameters. Click "?" for help on using the various methods.



Documents at www.LabRecon.com/Documents

LabRecon - Getting Started with LabRecon.pdf
LabRecon - Getting Started with the Measurement Wizard.pdf
LabRecon - Getting Started with Simulations.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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