

Verify Tab

Click on the **Verify** tab to compare the measured and predicted max power values. Their ratio, in percent, is the **Performance Factor**.

History Tab

Click on the **History** tab to view up to 20 recent measurements. This display is useful for checking the consistency of string performance at a combiner box, and for comparing steps in a troubleshooting process.

Meg Test Tab

Click on the **Meg Test** tab to record insulation test data taken with other equipment. Click on Add Measurement to input new data points.

Date/Time	Array Location	ID	Resistance (MOhm)	Voltage	Description
6/8/12 4:07 PM	I1-C2-S1	1	2.35	500.00	Dry

For more information:

More information about the analysis of the data is available in the PVA-600 User's Guide, which is accessible from the DVD, via the Help menu in the PVA-600 Software interface, and on the Solmetric website.

Solmetric PVA-600 PV Analyzer Quick Start Guide



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PVA-600 PV Analyzer

PC Software Version 2.0

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performance model, five dots will display along with the trace, representing the predicted I-V curve shape. The red dot at the left predicts I_{sc} . The dot at the right predicts V_{oc} . The middle dot predicts the maximum power point. The second and fourth dots add additional definition to the curve. See the User Guide for details.

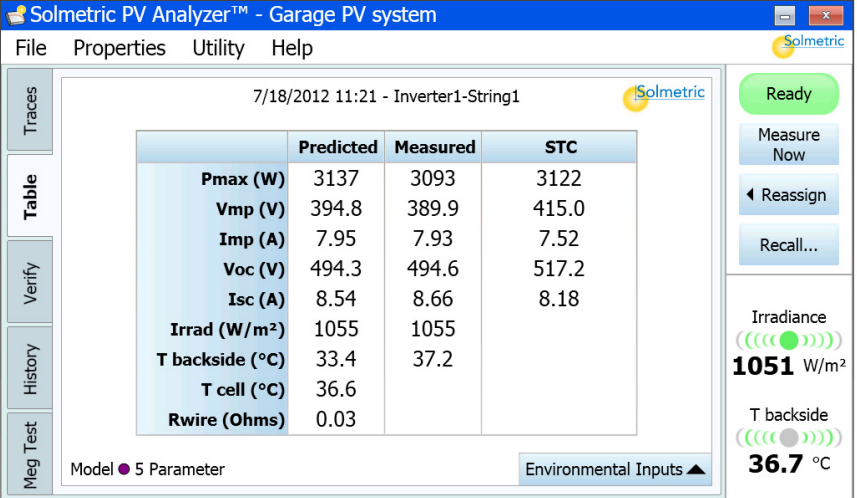
Click the Environmental Inputs button to bring up the controls for selecting the source of the irradiance and temperature information.

NOTE If the Sandia Model is selected and the irradiance and temperature are being determined From IV Data, the end points of the measured I-V trace typically will typically match the I_{sc} and V_{oc} values predicted by the PV model. If the 5 Parameter Model is selected and From IV Data is used, the end points may not match the predicted points.

When using the wireless PVA Sensor Kit or manual sensors, the end points typically will not exactly match the predicted points when using the Sandia or 5 Parameter Performance Models.

Table Tab

Click the **Table** tab to observe **Predicted** and **Measured** values.



The screenshot shows the Solmetric PV Analyzer software interface for a 'Garage PV system'. The 'Table' tab is selected, displaying a table of predicted and measured values for various parameters. The table has columns for 'Predicted', 'Measured', and 'STC' values. To the right of the table, there are buttons for 'Ready', 'Measure Now', 'Reassign', and 'Recall...'. Below these buttons, the current irradiance is shown as 1051 W/m² and the backside temperature as 36.7 °C. The software is running on 7/18/2012 at 11:21 for 'Inverter1-String1'. The model selected is '5 Parameter'.

	Predicted	Measured	STC
Pmax (W)	3137	3093	3122
Vmp (V)	394.8	389.9	415.0
Imp (A)	7.95	7.93	7.52
Voc (V)	494.3	494.6	517.2
Isc (A)	8.54	8.66	8.18
Irrad (W/m²)	1055	1055	
T backside (°C)	33.4	37.2	
T cell (°C)	36.6		
Rwire (Ohms)	0.03		

The STC column translates measured values to STC conditions.

Over-Current Protection

If greater than 20 A dc is applied to the I-V Measurement Unit, the PVA-600 detects the over-current condition and switches into disabled mode automatically and an I-V measurement does not take place.

NOTE Conventional PV modules and strings may be measured in parallel up to the specified maximum current of the PVA-600. High-efficiency modules should NOT be measured in parallel.

Reverse Polarity Protection

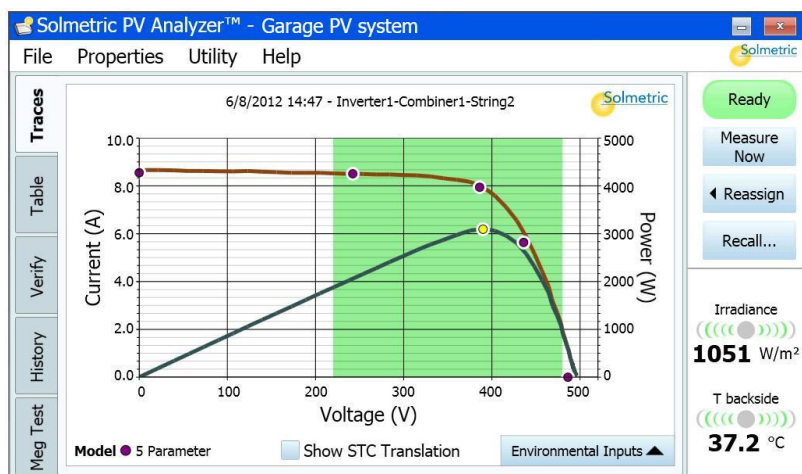
If the I-V Measurement Unit is connected with the wrong polarity across a string, the PVA-600 detects the condition and switches into disabled mode automatically, and an I-V measurement does not take place.

8. Viewing and Analyzing the Data

Once an I-V measurement has been taken, the data is presented in several forms that are accessible via the tabs at the left edge of your screen.

Traces Tab

Click on the **Traces** tab for the I-V graph.



The red and blue curves represent the measured I-V curve and the P-V (power versus voltage) curve that is calculated from it. If you are using an advance

Welcome!

Thank you for purchasing the Solmetric PVA-600 PV Analyzer. Please verify that you have received all of the following items:

- I-V Measurement Unit
- Soft Case
- Wireless USB Adapter
- PVA-600 Software
- Battery Charger
- MC-4 to MC-4 Connector-Saver Cable (1 pair)
- MC-4 to MC-3 Adaptor Cables (1 set)

The User's Guide is in electronic form only and is accessible from the DVD, via the Help menu in the PVA-600 Software, and on the Solmetric website.

Be sure to visit our web site at:

www.solmetric.com for software updates and new products.

The Solmetric PVA-600 PV Analyzer

The PVA-600 PV Analyzer is a portable test instrument designed to measure the current-voltage (I-V) curves of PV modules and strings and immediately compare the results to the predictions of on-board PV models. Measurement results are easily saved for future reference and analysis.

Safety and Regulatory

Before operating the PVA-600, familiarize yourself with the following notations.

WARNING A *Warning* calls attention to a procedure which, if not performed correctly, could result in personal injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.

CAUTION A Caution calls attention to a procedure that, if not performed correctly, could result in damage to, or destruction of, the instrument. Do not proceed beyond a caution note until the indicated conditions are fully understood and met.

NOTE A *Note* provides important or special information.



The IEC HV symbol indicates the presence of hazardous voltages. Danger exists of electrical shock that can cause severe injury or death.

Charging the Battery

The battery in the PVA-600 is not removable. It may be recharged by attaching the battery charger to the connector on the PVA-600 shown below and plugging the charger into an AC wall-plug.



Charging the battery takes 6 hours. Once the battery has been charged, the PVA-600 will operate for approximately 2 days of normal use. During heavy use, nightly charging is suggested.

The PVA-600 Software interface will warn the user when approximately one hour of battery life remains. Click on the Ready (Status) indicator within 5 minutes after any I-V measurement for a display of battery voltage.

The software user interface displays the Disabled alert (above the **Measure Now** button) when the battery is nearing the end of its charge. In this state, no measurements can be taken.

Over-Temperature Protection

Built-in safeguards prevent the I-V Measurement Unit from operating at potentially damaging internal temperatures.

Thermal Shutdown

When the internal temperature approaches the battery's high-temperature limit, the measurement unit automatically shuts down (disables itself). To recover from thermal shutdown, wait for the measurement unit to cool. Placing it in the shade or a cool place will speed the recovery.

Operating Under High-Temperature Conditions

The most demanding thermal conditions for the measurement unit are:

- Hot day
- No wind
- No shade
- High open circuit voltage
- I-V sweeps taken in rapid sequence

If you expect these conditions, plan ahead to minimize the temperature rise in the I-V Measurement Unit. Shade the unit from direct sunlight, elevate it above hot surfaces, and allow more time between I-V sweeps.

The I-V Measurement Unit is also equipped with a thermal fuse that will open permanently when the temperature inside the unit reaches 85°C. This condition requires returning the unit to Solmetric for repair.

Over-Voltage Protection

If a voltage in excess of 650V dc is detected, the I-V Measurement Unit switches into disabled mode. Clicking on the “Disabled” message in the Status display pops up a warning that the voltage specification was exceeded and the I-V Unit may have been damaged.

WARNING When the over-voltage condition is detected, the I-V Unit is immediately reprogrammed to a disabled state to prevent continued use of a damaged unit. Resetting the I-V Unit or restarting the PC software will not re-enable it. Please contact Solmetric support to arrange for repairs.

WARNING PV circuits continue to present danger of electrical shock while system is paused. FAILURE TO TAKE APPROPRIATE SAFETY PRECAUTIONS COULD LEAD TO PERSONAL INJURY OR LOSS OF LIFE.

NOTE If no measurements are taken for 15 minutes, the I-V Measurement Unit will turn itself off to conserve battery. Press the power button to turn it back on.

Environmental Inputs

Click the Environmental Inputs button to bring up the following controls:

Environmental Inputs ▼			
Irradiance	Wireless Sensor ▼	1055 W/m ²	Adjust Sensors Cal...
T backside	Wireless Sensor ▼	37.2 °C	

Use the drop lists to select your source for irradiance and temperature data. Use Wireless Sensor for best accuracy and speed. Select From IV Data for simple curve shape measurements and for situations where you do not want to deploy sensors.

NOTE Use the **Adjust Sensors Cal...** button to enter the wireless sensor calibration from the label on the side of the irradiance sensor, and to edit the Module Backside to PV Cell Temperature Offset Factor. To calculate the PV cell temperature, which is required by the PV models, the PVA adds an offset to the measured backside temperature. It does this on a prorated basis, adding the full, user-entered Wireless Temperature Sensor Offset Value if the irradiance is 1000W/m², and adding successively smaller offsets at lower irradiance values, at which there is less heating.

CAUTION Do not operate the PVA-600 while charging.

WARNING To prevent electrical shock, disconnect the PVA-600 from the PV system and/or battery charger before cleaning. Use only a dry cloth or cloth slightly dampened with water to clean the external case and hard enclosure parts. Do not attempt to clean internally.

Computer Minimum Requirements

- Tested and Supported Operating System: Windows 7® (32 and 64 bit versions), Windows Vista® (32 bit versions only), Windows XP® SP3
- Two USB Ports (or one USB port plus a portable USB hub)
- Display Resolution: 1024 X 600 (minimum)
- Processor Speed: A Windows Experience Index (Processor component) of 2.3 or greater is recommended. This value is available on your PC's Control Panel under "Performance Information and Tools".
- RAM: 1 GB minimum, 2 GB recommended
- Available Disc Space: 100 MB or more

Systems that do not meet these requirements may not operate correctly.

PVA-600 Operational States

The PVA-600 can be in any of the following operational states:

- Power off – LED off (I-V Measurement Unit is turned off)
- Network search – LED blinking (press the power button once to turn the Unit on and start it searching for the PC)
- Sweep enabled – LED on (I-V network exists and sweep is enabled)

- Sweeping – LED blinks once at start of each sweep when the I-V Measurement Unit receives a sweep trigger from the PC.
- Sweep disabled – LED off (press the power button once to disable the I-V sweep)
- Reset – LED blinking (press and hold the power button for more than 5 seconds to force a power-up type reset)

Specifications

- Current Measurement Range: 0 to 20 A dc
- Voltage Measurement Range: 20 to 600 V dc
- Operating Temperature: +0°C to +50° C
- Storage Temperature: -20°C to +60° C
- Operating Humidity: 10 to 80%

See the User’s Guide for complete specifications.

NOTE Conventional PV modules and strings may be measured in parallel up to the current limit specified above. High-efficiency modules should NOT be measured in parallel.

Precautions

PV Connectors

Always keep Connector-Saver jumpers attached to the primary test leads to extend the life of the primary PV connectors. To prevent damage to mating connectors, replace the Connector-Saver jumpers when they have been connected 100 times. **Cut off the used-up connectors to prevent re-use.**

PV/Electrical Safety Precautions

PV systems differ widely in design and construction. Therefore the guidance provided in this section is general in nature.

5. Ensure that the **Temperature** indicator blinks green approximately every ten seconds. Follow the above steps if the signal level is low.

8. Making I-V Measurements

Follow these steps, starting in the **Traces** tab (I-V curve screen):

1. Click on the **Measure Now** button to start a measurement.
 - The status indicator button in the upper right corner of your screen will blink **Measuring** while the measurement is being made and the data processed. The red button on the I-V Measurement Unit will blink once.
 - The first measurement takes longer because the I-V Measurement Unit sends cal data to the PC (“Initializing”), and auto-ranges for the type of PV device that is connected (“Optimizing”).
 - The I-V Measurement Unit measures a single I-V curve each time the user clicks on the **Measure Now** button. I-V data is transmitted to the PC shortly after each I-V sweep is taken.
2. Save the trace by pressing the **Assign and Save...** button. When the Array Navigator tree appears, click the string that you measured. Then click the **Assign and Save** button to save your data to that tree location. If you wish to display the PV model points but do not yet want to save the trace, click the **Assign** button instead. If you are measuring more than one string in parallel, highlight them all before saving.
3. If you are measuring strings at a combiner box, lift the fuse of the measured string and insert the fuse of the next string to be measured. Repeat this measurement cycle until all strings have been measured.
4. PV current is stopped automatically at the end of each I-V measurement. To ensure that another sweep cannot accidentally be started, press the power button to disable the measurement sequence. Pressing the power button again re-enables the measurement unit. .

WARNING Do not disconnect conductors from the tested string unless the red power button on the I-V Measurement Unit is turned off.

Press the power button once on the I-V Measurement Unit.



The LED will begin to blink indicating that the I-V Measurement Unit is attempting to establish communication with the wireless USB adapter connected to the PC. If the wireless USB adapter is inserted into an operating PC, a network will be established and the LED will become continuously lit (no blinking) and on your PC screen, the indicator above the “Measure Now” button will turn green and say “Ready”. If a network is not established within 15 minutes, the I-V Measurement Unit will turn off to conserve the battery.

NOTE If communications are not established within one minute:

1. Move the PC closer to the I-V Measurement Unit.
2. Reset the I-V Measurement Unit, by holding down the power button for more than 5 seconds.
3. Remove and replace the Wireless USB Adapter.

7. Powering up the Wireless Sensor Kit

If you are using the PVA Sensor Kit, perform the following:

1. Insert the Wireless Sensor USB Adapter into a second USB port. If you have only one USB port, use a notebook USB expander.
2. Ensure that the PVA Sensor Kit is set up correctly.
3. Turn on the sensor transmitters by pressing the I/O button once. A green LED will blink, but you may not be able to see it outdoors. A red LED blinks three times when you turn the transmitter off.
4. Ensure that the **Irradiance** indicator on your PC screen blinks green approximately every two seconds. If it is not blinking and few or no ‘bars’ are green, you may need to shorten the distance between transmitter and PC or clear the line-of-sight to the transmitter.

WARNING The operator must assess the potential dangers of each PV system, and take appropriate precautions. **FAILURE TO TAKE APPROPRIATE SAFETY PRECAUTIONS COULD LEAD TO PERSONAL INJURY OR LOSS OF LIFE.**

WARNING Do not remove instrument covers. There are no user serviceable parts within. Operation of the instrument in a manner not specified by Solmetric may result in personal injury or loss of life.

- Do not work alone.
- Do not use the PVA-600 in wet environments.
- Wear electrical safety gloves and eye protection.
- Assume that metal surfaces are energized unless proven otherwise.
- Isolate the PV source circuit to be tested from the inverter and from other PV source circuits before making any electrical connections to the test device (PV module or string).
- Always disable the measurement sequence using the LED-illuminated pushbutton switch on the I-V unit before connecting or disconnecting the test leads of the PVA-600.
- Connect the test leads to the test device (PV module, string, or array) with the correct polarity.
- Do not use the PVA-600 to test devices that produce more than the instrument’s specified maximum current and voltage.
- Do not operate at or subject the PVA-600 to temperatures beyond the published operating and storage temperature specifications.
- Inspect cables and connectors for damage before using. Do not use if damaged.
- Do not use the I-V Measurement Unit if it is damaged. Always inspect for damage before using.
- Do not use the I-V Measurement Unit if it is performing abnormally. Contact Solmetric for guidance or return the I-V Measurement Unit to the factory for service.

Overview

Proper operation of the Solmetric PVA-600 includes the following steps:

1. **Installing the Software**
2. **Setting up the PVA-600**
3. **Setting up the Wireless Sensor Kit (Optional)**
4. **Setting up a Performance Model**
5. **Connecting to the PV Equipment**
6. **Powering up the I-V Measurement Unit**
7. **Making I-V Measurements**
8. **Viewing and Analyzing the Data**

Each step is explained in this guide.

1. Installing the Software

1. Insert the PVA-600 DVD into the DVD drive on your Windows® computer. Alternatively, the installation file is available at www.solmetric.com. If the welcome screen does not automatically open, double-click on the **setup.exe** file on the DVD or run **setup.exe** from the **Run** dialog.
2. Follow the instructions in the welcome screen to install the PVA-600 software. The drivers for the wireless USB adapter will also be installed.
3. If requested, connect your PC to the internet to load prerequisites.
4. When requested, insert the Wireless USB adapter in a USB port.
5. When the installation process is finished, start the PVA-600 software by double-clicking on the shortcut icon on your desktop as shown below. Or, in the Start menu, select Programs>Solmetric>PV Analyzer>Solmetric PV Analyzer.

2. Press the button on the I-V Measurement Unit to disable the I-V sweep. The red LED indicator in the button should turn off.

WARNING PV circuits continue to present danger of electrical shock when fuses are pulled and the PVA-600 system is paused.

3. Following safe operating procedures, connect the PVA-600 to the test string. The connection may be made at PV connectors at the ends of the test string, or by clipping to the de-energized buss bars in a DC combiner box, using suitable test leads with MC-4 connectors at one end and insulated alligator clips at the other end.
4. If one or both of the terminals of the test device must be some distance from the I-V Measurement Unit, use extension cables made of UL (or equivalent) listed PV wire, with correctly installed connectors. Select a wire gauge that will introduce minimal voltage drop.
5. When extension cables are longer than 10 feet (one-way), lay the cables close to one another to minimize added cable inductance.
6. If connecting at a fused combiner box, insert one fuse to select the string to be measured.

6. Powering-Up the I-V Measurement Unit

Ensure that the PC is running the Solmetric PV Analyzer software, that the wireless USB adapter is connected to the PC, and that the PVA-600 is properly connected to the PV equipment.

NOTE If the “Ready” indicator does not appear within 30 seconds, to to the **Utility/Settings** menu and select the port marked with the “+” sign.

- In the Site Info page, enter the various site parameters. If web connected, use **Roof Measurement Tool...** and **Elevation...** tools. Enter azimuth and tilt from measurements or design documents.
- In the **Array Navigator** page, use the auto-configuration button to create a tree representation of your PV system.



Select your inverter from the database (optional step). Enter **Number of Inverters**. Click **Using Combiners** box if applicable. Enter the number of **Combiners**, **Strings**, and **Modules** and click **OK**. You can also use the other icons to create or edit your tree.

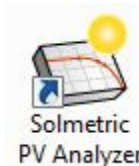
To enable the PV model to account for wire losses for a string, highlight the string in the tree and enter wire length & gauge. If you highlight a combiner, inverter or system, all strings below the selected level will be set to the length and gauge that you enter.

- Press **Finish** to complete creating your Project.

5. Connecting to the PV Equipment

WARNING PV systems differ widely in design and construction. Therefore the procedure described below is general in nature. The operator must assess the potential dangers of each particular PV system, and take appropriate safety precautions. **FAILURE TO TAKE APPROPRIATE SAFETY PRECAUTIONS COULD LEAD TO PERSONAL INJURY OR LOSS OF LIFE.**

- Isolate the PV module string to be tested (test string) from the inverter and from other strings in the array. If the measurement is being made at a fused DC combiner box, isolate the combiner box by means of the DC disconnect switch, then isolate the PV strings from one another by pulling their fuses.



Special XP Operating System Instructions

This section applies to computers running the XP operating system only.

Older computers running the XP operating system require special steps during the installation of the wireless USB driver. Please pay close attention to onscreen prompts.

In addition, please be aware that XP will require the re-installation of the driver if you insert the wireless USB adapter in a different USB port. Therefore, we recommend one of the following when using the XP operating system:

- Select a single convenient USB port for the wireless interface and always use that port.
- Sequentially insert the wireless USB adapter into each USB port in your computer and follow the same installation process (as instructed on screen) for each port.

2. Setting Up the PVA-600

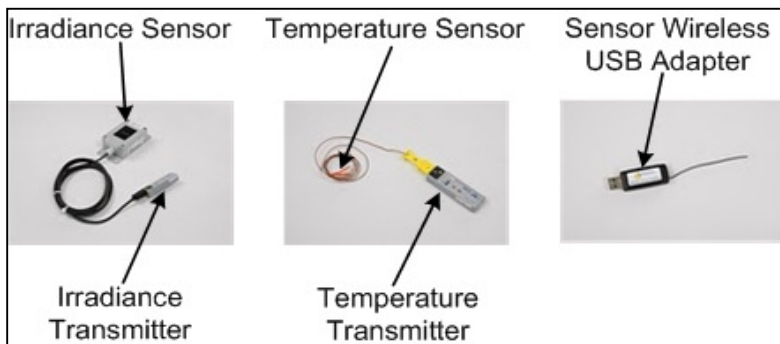
- Place the I-V Measurement Unit close to the PV device to be measured.
- Ensure that the Connector-Saver jumpers are installed on the primary test leads.
- If using alligator clip leads or extension cables, connect them to the connector-saver jumpers. Be sure these leads are rated for the maximum current and voltage of the I-V Measurement Unit.
- If long extension cables are used, lay the cables alongside one another to minimize the inductance they add to the measurement circuit path.
- Connect the Wireless USB Adapter to a USB port in your computer.
- If you will be using the PVA Sensor Kit, refer to the following section for setup information.

CAUTION In hot weather, place the PVA-600 in the shade to reduce the likelihood of thermal shutdown. Don't place the PVA-600 on hot asphalt or the roof in direct sun.

NOTE The PVA-600 will automatically shut down if its internal temperature reaches a preset limit. Internal temperature is increased by PV energy collected during I-V sweeps, and also by heat absorbed from the environment, including high ambient air temperature, hot surfaces on which the PVA-600 is placed, and exposure to direct sunlight.

3. Setting Up the Wireless Sensor Kit

The PVA Sensor Kit (shown below) includes an irradiance sensor and a temperature sensor. Each sensor is connected to a transmitter that communicates wirelessly with the Sensor Wireless USB Adapter.



1. Before starting the PVA software, connect the Sensor Wireless USB Adapter to a USB port in your computer. If a second USB position is not available, a USB hub with short connecting cable may be used.
2. Ensure that the transmitter with the "I" label is connected to the irradiance sensor, and that that the transmitter with the "T" label is connected to the temperature sensor. Observe polarity markings.

3. Position the irradiance sensor within at least 1-degree of the same plane as the modules under test. For example, on the surface of a neighboring module that is not in the string under test.
4. Tape the tip of the temperature sensor firmly to the backside of a PV module near the center of the module (away from the cooler edges).
5. Turn on the sensor transmitters by pressing the **I/O** button on each transmitter. A green LED blinks (faintly) when the a transmitter is turned on. A red LED blinks 3 times when it is turned off.

OTHER SENSOR KIT NOTES

Ensure that the transmitters are not resting on the ground or on the roof, and are not placed against a metal surface. Elevating the transmitters improves the transmission range.

When not in use, turn the transmitter power off to conserve battery life.

If the LOW BAT LED on either transmitter is blinking, replace the battery with a freshly charged battery. You can substitute Alkaline AAA batteries but battery life will be shorter

4. Setting Up a Project

The following procedure is used to set up a Project, which contains your PV modeling and your I-V measurement data.

1. In the PVA-600 Software, drop down the **File** menu and select **New Project...** The **New Project Wizard** will open.
2. In the **Notes / Info** page, enter project name and notes.
3. In the **Performance Model** page, click **Select...** to choose a PV module manufacturer and name from the database. If your module is not in the database, click the **Custom** radio button and click **New...** Expand the **Simple** model and enter module datasheet values.

NOTE Enter temperature coefficients in units of % / C. If the manufacturer supplies coefficients for Voc (STC) in units of V / C, this value can be converted to % / C by dividing the supplied number by Voc and multiplying by 100.
