

Solmetric PV ANALYZER PV Analyser Quick Start Guide



Charging the Battery

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



Charging the battery can take up to 6 hours. Once the battery has been charged, the PV ANALYZER will operate for approximately 2 days of normal use. During heavy use, nightly charging is suggested.

The PV ANALYZER Software interface will warn the user when approximately one hour of battery life remains.

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

Computer Minimum Requirements

- Tested and Supported Operating System: Windows 7® (32 and 64bit versions), Windows Vista® (32 bit versions only), Windows XP® SP3
- Two USB Ports (or one USB port if wireless sensors will not be used)
- Display Resolution: 1024 X 600 (minimum)
- Processor Speed: >700 MHz
- RAM: >500 Mbytes
- Available Disc Space: 100 Mbytes or more

Systems that do not meet these requirements may not operate correctly

PV ANALYZER Operational States

The PV ANALYZER 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 20/30 A dc
- Voltage Measurement Range: 0 to 1000/1500 V dc
- Operating Temperature: +0°C to +50° C
- Storage Temperature: -20°C to +60° C
- Operating Humidity: 10 to 80%

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.

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 use the PV ANALYZER 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 PV ANALYZER.
- Connect the test leads to the test device (PV module, string, or array) with the correct polarity.
- Do not use the PV ANALYZER to test devices that produce more than the instrument's specified maximum current and voltage.
- Do not operate at or subject the PV ANALYZER 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.

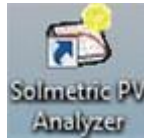
Overview

Proper operation of the Solmetric PV ANALYZER includes the following steps:

- 1. Installing the Software**
- 2. Setting up the PV ANALYZER**
- 3. Setting up a Performance Model**
- 4. Connecting to the PV Equipment**
- 5. Powering up the I-V Measurement Unit**
- 6. Making I-V Measurements**
- 7. Viewing and Analyzing the Data**

1. Installing the Software

1. Start the installer by inserting the pendrive provided/ downloading the setup file, the installation file is available at www.solmetric.com.
2. Follow the instructions in the welcome screen to install the PV ANALYZER software. The drivers for the wireless USB adapter will also be installed. The directory structure shown here is created.
3. When the installation process is finished, start the PV ANALYZER 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. Setting Up the PV ANALYZER

1. Place the I-V Measurement Unit close to the PV device to be measured.

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

NOTE The PV ANALYZER 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 PV ANALYZER is placed, and exposure to direct sunlight.

2. Ensure that the Connector-Saver jumpers are installed on the primary test leads.
3. 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.
4. If long extension cables are used, lay the cables alongside one another to minimize the inductance they add to the measurement circuit path.
5. Connect the Wireless USB Adapter to a USB port in your computer.
6. If you will be using the PV ANALYZER Sensor Kit, refer to the following section for setup information.

3. Setting Up a Performance Model

The following procedure shows how to set up a performance model in the PV Analyzer software to compare with the I-V measurements.

1. In the PV ANALYZER Software, drop down the **Model** menu and select **Properties...**
2. In the **Name** tab, enter a model name.
3. In the **Location** tab, enter Latitude, Longitude and Time Zone.
4. In the **Modules / String** tab, enter string information. Select the Detailed or Simple performance model.
 - a. If you chose the Detailed Performance Model, click on **Change...** and select the PV module manufacturer and model number from the drop down lists.
 - b. If you will be entering performance model parameters from the manufacturer's published specifications, select **Simple Performance Model** and edit the default values to match your module's datasheet.

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.

- c. Enter the number of modules in each string and the number of strings in parallel that are being tested.
2. In the **Inverter** tab, select your inverter (optional step).
3. In the **Wiring** tab, enter the wire gauge and the wire length
 - **Wire Length is** the one-way length of the PV output conductors from the ends of the module/string under test to the point where the PV ANALYZER is connected. (For two 50 footleads running between the I-V unit and the string, enter "50" not "100".)
4. In the **Sensor Methods** tab, select irradiance and temperature sensor methods. See the PV ANALYZER User's Guide for more details.
 - a. If you choose the wireless irradiance sensor, in the **CalFactor** box, enter the cal factor from the sensor label.
 - b. If you choose to enter the irradiance manually, enter the irradiance in the **Irradiance (POA)** text box.
 - c. If you choose to use a wireless temperature sensor, enter a temperature **Offset** number that represents the rise in PV cell temperature compared with the measured temperature.
5. In the **Inverter** tab, select your inverter (optional step).

6. In the **Wiring** tab, enter the wire gauge and the wire length
 - **Wire Length is** the one-way length of the PV output conductors from the ends of the module/string under test to the point where the PV ANALYZER is connected. (For two 50 footleads running between the I-V unit and the string, enter “50”not “100”.)
7. In the **Sensor Methods** tab, select irradiance and temperature sensor methods. See the PV ANALYZER User’s Guide for more details.
 - a. If you choose the wireless irradiance sensor, in the **CalFactor** box, enter the cal factor from the sensor label.
 - b. If you choose to enter the irradiance manually, enter the irradiance in the **Irradiance (POA)** text box.
8. If you choose to use a wireless temperature sensor, enter a temperature **Offset** number that represents the rise in PV cell temperature compared with the measured temperature
9. In the Array Plane tab, enter the slope and azimuth of the PV modules under test. Always perform this step if you are using the Sandia Performance Model and a wireless or manual irradiance sensor.

4. 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.**

1. 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.
2. Press the button on the I-V Measurement Unit to disable the I-V sweep.

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

3. Following safe operating procedures, connect the PV ANALYZER 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.

7. Powering-Up the I-V Measurement Unit



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). If a network is not established within 15 minutes, the I-V Measurement Unit will turn off to conserve the battery.

7. Making I-V Measurements

Ensure that the PC is running the Solmetric PV Analyzer software, that the wireless USB adapter is connected to the PC, that the PV ANALYZER is properly connected to the PV equipment, and that the I-V Measurement Unit is wirelessly connected to the PC (the “Measure Now” button will be colored green).

NOTE If the Wireless USB Adapter used for PV ANALYZER or wireless sensor communication is installed before starting the software, the USB port will be found automatically. If you install the Wireless USB Adapter(s) after starting the software, you must select the proper USB ports on your PC manually using the Utility/Settings menu.

1. Click on the Measure Now button to start a measurement.
 - The Ready button will change to Measuring and blink during the measurement. The red pushbutton on the I-V Measurement Unit will blink once.
 - 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 “Save Trace...” in the Traces tab. Saved trace data can be viewed by a program that can read a csv file, such as Excel®. See the User’s Guide for further instructions.
3. Pause the measurement sequence of the PV ANALYZER by pressing the power button.

WARNING Do not disconnect from the tested string unless the red power button is turned off.

4. Disconnect from the tested string and connect to the next string to be measured.
5. Repeat the process until all strings have been measured.

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.

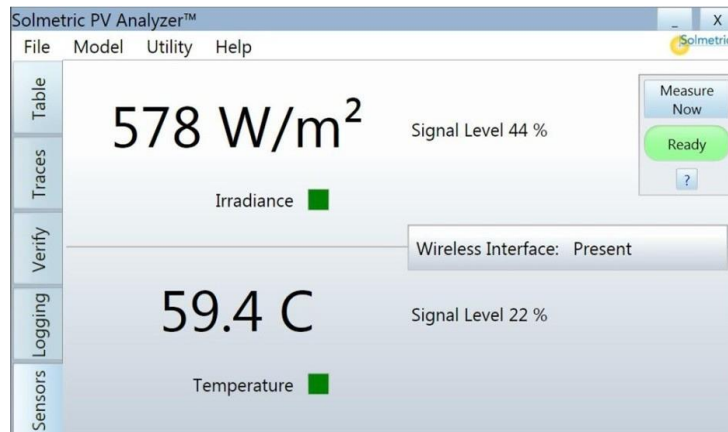
6. If you are using the PV ANALYZER Sensor Kit, perform the following:
 - a. Insert the Wireless Sensor USB Adapter into a second USB port.
 - b. Ensure that the PV ANALYZER Sensor Kit is set up correctly.
 - c. Turn on the sensor transmitters by pressing the I/O button once.

NOTE Always turn on the wireless transmitters **AFTER** starting the PV ANALYZER application.

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.
3. Remove and replace the Wireless USB Adapter.

Click on the **Sensors** tab to access the screen shown in the following screen.



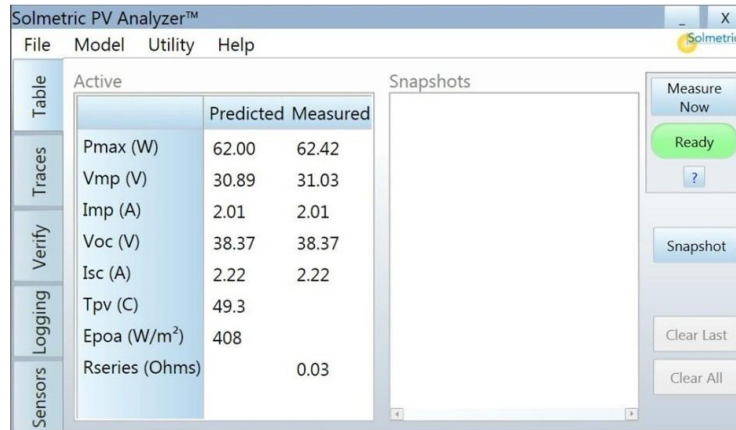
- a. Ensure that the **Irradiance** box blinks green every two seconds. If the box is not blinking, you may need to shorten the distance between transmitter and PC or clear the line-of-sight to the transmitter.
 - b. Ensure that the **Temperature** box blinks green every ten seconds. If the box is not blinking, you may need to shorten the distance between transmitter and PC or clear the line-of-sight to the transmitter.
 - c. If the **Wireless Interface: Not Found** message appears, select **Settings** from the **Utility** menu and set up the wireless sensor USB interface manually. Select the communications port with the "+" sign.
8. Click on the **Measure Now** button to start a measurement. The **Ready** button will change to **Measuring** and blink during the measurement. The red pushbutton on the I-V Measurement Unit will blink once.

8. Viewing and Analyzing the Data

Once an I-V measurement has been taken, the data is presented in several forms.

Table

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



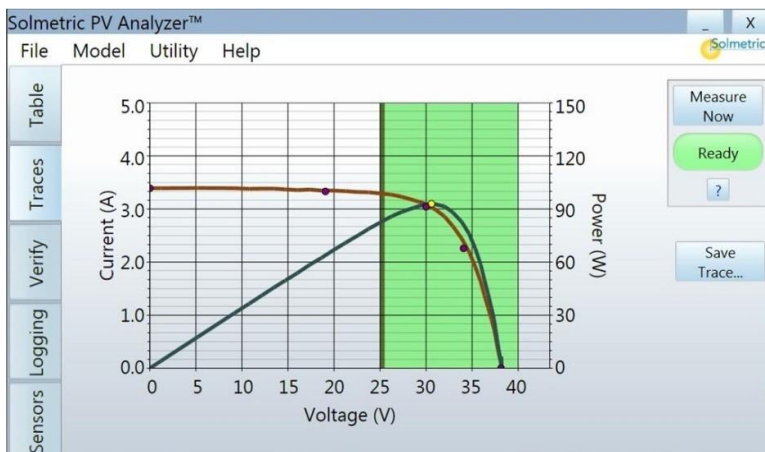
| | Predicted | Measured |
|--------------------------|-----------|----------|
| Pmax (W) | 62.00 | 62.42 |
| Vmp (V) | 30.89 | 31.03 |
| Imp (A) | 2.01 | 2.01 |
| Voc (V) | 38.37 | 38.37 |
| Isc (A) | 2.22 | 2.22 |
| Tpv (C) | 49.3 | |
| Epoa (W/m ²) | 408 | |
| Rseries (Ohms) | | 0.03 |

Press the **Snapshot** button to temporarily store measured values for comparison with subsequent measurements. Temperature and irradiance values appear in the Predicted column if they are being derived from the measured I-V curve

Traces

Click on the **Traces** tab to view the I-V and P-V graphs as shown in the following screen.

NOTE The first time a measurement is made, the trace may appear rough because the PV ANALYZER uses special internal settings to check the voltage and current of the circuit under test before choosing the most appropriate internal settings for the second and subsequent sweeps. In the second measurement, the data will scale properly and should be similar to the graph shown in the following screen.

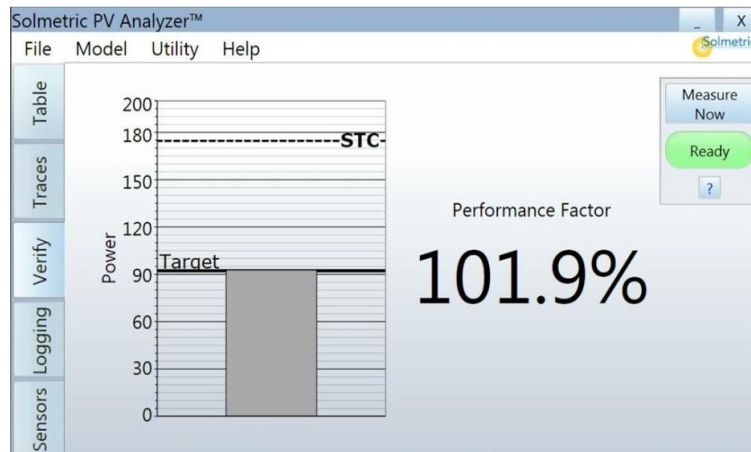


NOTE If the Sandia Model is selected and the array itself is being used as the sensor, the end points of the measured I-V trace typically will match the predicted model points for Isc and Voc. If the 5 Parameter Model is selected and the array itself is being used as the sensor, the end points may not match the predicted points

To save the data to a csv file, click on the **Save Trace...** button then enter a filename in the **Save As** dialog box. The trace data file will be saved in the **Traces** folder. To save time in the field, create in advance a Windows® directory tree with the same architecture as the PV system under test.

Verify

Click on the **Verify** tab to view the numeric **Performance Factor** values as shown in the following screen. The **Performance Factor** is the ratio of actual to predicted maximum power, expressed in percent.



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

