I-V CURVE

SOFTWARE MANUAL

Manual version: 4.0.B
Software version: 4.0

Contents

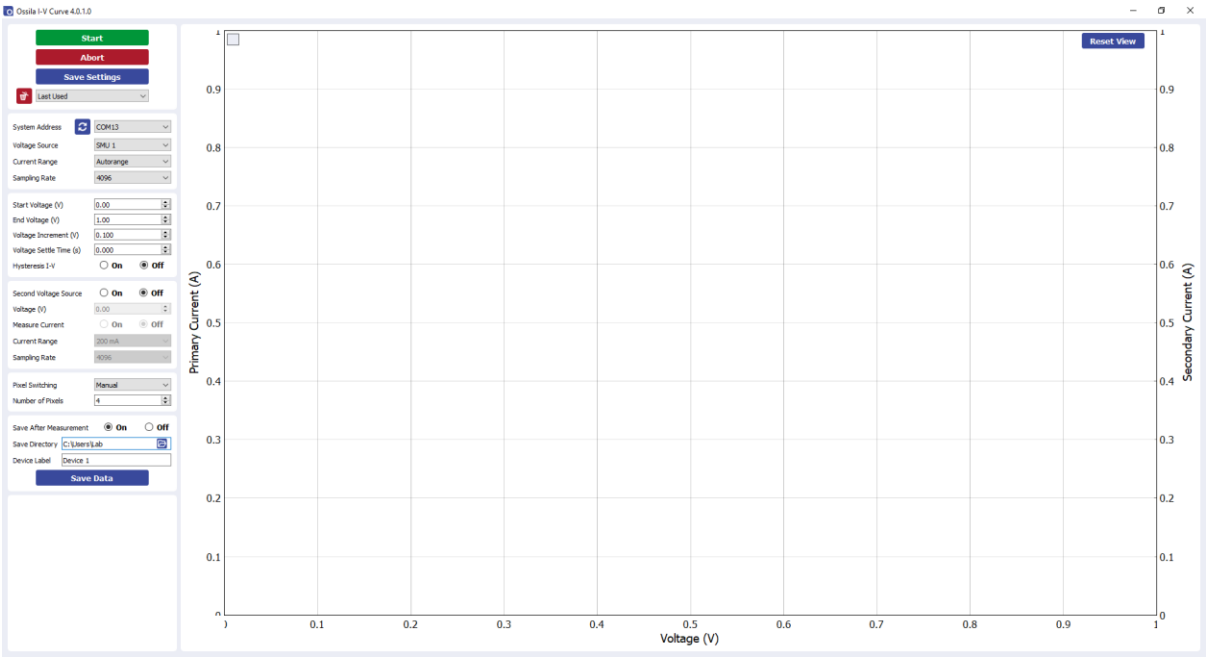
1. Overview

The Ossila I-V Curve software enables you to perform current-voltage measurements using an Ossila Source Measure Unit, without having to write any code yourself. Measurements are completely customisable, allowing you to tailor the software to your experiment.

With it, you can:

- Perform voltage sweeps anywhere between -10 and 10V
- Take high resolution measurements, with voltage increments as low as 333 µV.
- Manage the experiment more directly, with custom settle times between applying voltage and measuring current.
- Measure device hysteresis by performing consecutive measurements in forwards and backward directions.
- Measure devices such as FETs, as the second SMU channel can be set to simultaneously output a voltage.

Data is saved to .csv (comma-separated values) files, which are formatted to be easy to read and analyse. Furthermore, settings are saved along with the data, making it easier to keep a record of the parameters used for each experiment.



2. Requirements

Table 2.1 details the minimum computer specifications for the Ossila I-V Curve software.

Table 2.1. Ossila I-V Curve software requirements.

Operating System	Windows 10 or 11 (32-bit or 64-bit)
CPU	Dual Core 2 GHz
RAM	2 GB
Available Hard Drive Space	127 MB
Monitor Resolution	1680 x 1050

3. Installation

1. Install the Ossila Solar Cell IV software on your PC.
    I. Run the file 'Ossila-IV-Curve-Installer-vX-X-X-X.exe' on the USB memory stick provided.
    II. Follow the on-screen instructions to install the software.
2. Connect an Ossila Source Measure unit to your PC using a USB-B cable, or an Ethernet cable if preferred.
    I. If using USB, the necessary drivers will install automatically when the unit is connected.
    II. If the unit is not detected, or driver installation fails, please refer to the SMU USB Driver Installation Guide found on the USB memory stick.

Note: The I-V Curve software and Source Measure Unit USB drivers can also be downloaded from www.ossila.com/pages/software-drivers

4. Operation

4.1 Taking a Measurement

1. Start the Ossila IV Curve software. The window shown in **Figure 4.1** will open.
2. Set the appropriate settings in the software (explained in more detail in **Section 4.1**).
3. Click the 'Measure' button.
    I. If a voltage has been set for the secondary SMU channel, this will be applied first.

II. The primary SMU will then apply a series of voltages determined using the start and end voltages, and the voltage increment.
III. At each voltage the current through the device will be measured.
    - If a voltage settle time has been set, then the current will be measured after this time has elapsed.
IV. If hysteresis measurements are turned on, the measurement will then be repeated in reverse.

4. If automatic saving is turned on, the measurement data and settings will then be saved.

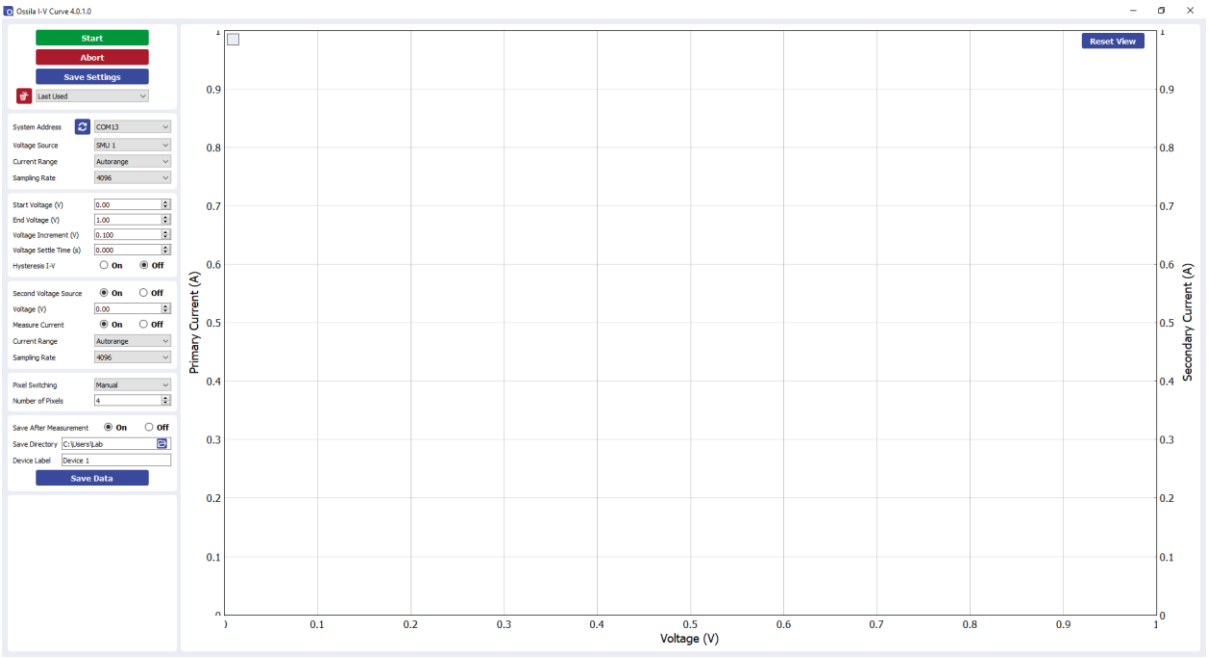


Figure 4.1. Ossila IV Curve software.

4.2 Software Settings

4.2.1 System Settings

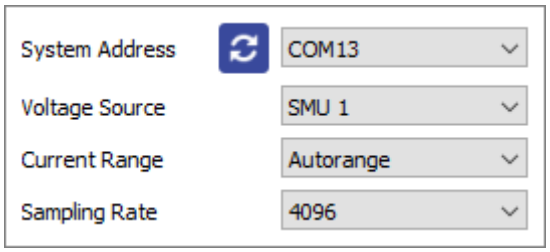


Figure 4.2. System settings.

(I) System Address

- Select the COM port or IP address of the connected unit you intend to use (USB and Ethernet connection respectively).
    I. This box will be populated automatically with the addresses of any units connected to the computer.

(II) Voltage Source

- Select which SMU channel of the Source Measure Unit the test board is connected to.
    I. 'SMU 1' will be automatically selected when pixel switching is set to 'Automated'.

(III) Current Range

- Select the range of currents to be used for the measurement.
    I. This defines the upper limit and accuracy of current measurements that can be performed by the unit. The values for each range are given in **Table 4.1**.
    II. Automatic range selection will start on the lowest current range and automatically switch to higher ranges if the current increases above the maximum for a range.

Table 4.1. Maximum current and accuracy for the current ranges of the Ossila Solar Cell I-V Test System.

Maximum Current	Accuracy	Precision	Resolution
±200 mA	±500 µA	10 µA	1 µA
±20 mA	±10 µA	1 µA	100 nA
±2000 µA	±1 µA	100 nA	10 nA
±200 µA	±100 nA	10 nA	1 nA
±20 µA	±10 nA	1 nA	100 pA

(IV) Sampling Rate

- Select the number of samples to be taken for each data point.
    I. A higher number of samples per point will improve the accuracy and precision of the measurement. However, this will increase the time taken for the measurement to be performed.

4.2.2 I-V Measurement Settings

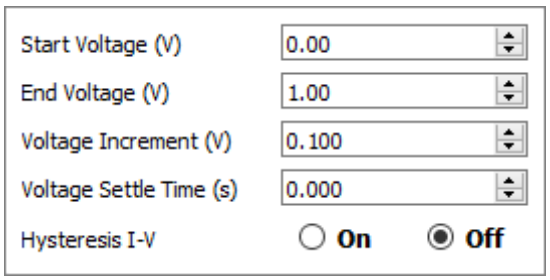


Figure 4.3. I-V Measurement Settings.

(I) Start Voltage

- Set the voltage in volts at which to start the current-voltage measurement.
    I. This can be set between -10 V and +10 V.

(II) End Voltage

- Set the voltage in volts at which to end the current-voltage measurement.
    I. This can be set between -10 V and +10 V.

(III) Voltage Increment

- Set the step size in volts for changing the voltage during current-voltage measurement.

(IV) Voltage Settle Time

- Set the time in seconds between applying a voltage and measuring the current.
    I. This has a maximum of 10 seconds.

(V) Hysteresis I-V

- This option performs a reverse current-voltage measurement after the forward current-voltage measurement has completed.
    I. This reverses the set start and end voltages and uses the same voltage increment and settle time as the forward measurement.

4.2.3 Secondary SMU Settings

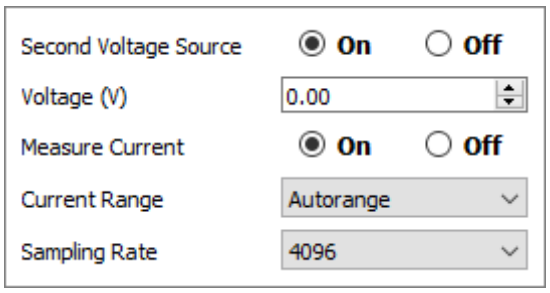


Figure 4.4. Secondary SMU Settings.

These settings are for applying a voltage through the SMU channel that is **not** being used for the current-voltage measurement (such as may be needed for an FET measurement).

(I) Second Voltage Source

- Select whether to use the second voltage source.

(II) Voltage

- Set the voltage in volts to be output by the secondary SMU.
    I. This can be set between -10 V and +10 V.

(III) Measure Current

- Set whether current will be measured on the second SMU channel.

(IV) Current Range

- Select the range of currents to be used for the measurement.
    I. This defines the upper limit and accuracy of current measurements that can be performed by the unit. The values for each range are given in **Table 4.1**.
    II. Automatic range selection will start on the lowest current range and automatically switch to higher ranges if the current increases above the maximum for a range.

(V) Sampling Rate

- Select the number of samples to be taken for each data point.
    I. A higher number of samples per point will improve the accuracy and precision of the measurement. However, this will increase the time taken for the measurement to be performed.

4.2.4 Device Details

Figure 4.5. Device Details settings.

(I) Pixel Switching

- Select whether changing the connection to the pixel on the device will be performed manually (by the user), or automatically (by the system).
    I. Automatic pixel switching can only be performed using an Ossila Multiplexing Test Board.

(II) Number of Pixels

- Set the number of individual solar cells in the device being measured.

(III) Pixels to Test

- Set which pixels in the device to measure.
    I. The pixel numbers are labelled on the test board.

4.2.5 Saving and Loading Settings

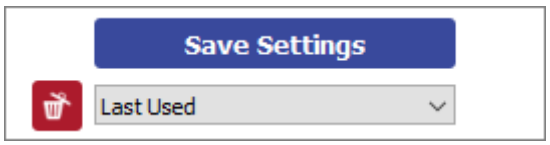


Figure 4.6. Controls for saving and loading settings profiles.

(I) Save Settings

- Saves the current settings as a profile that can be loaded quickly for use at another time.
- When clicked, you will be prompted to name the settings profile.
    I. If the name is already in use, you will be asked if you wish to overwrite the previous profile.
    II. The name cannot contain the characters: \ / : * ? " < > |
    III. You can change the default settings by choosing the name 'Default'.
- The settings profile will be added to the drop-down box using the given name.

(II) Load Settings

- Opens a dialog box to navigate to a settings file that has been created as part of a previous measurement.
    I. The settings fields will be populated with the values in the settings file.

(III) Settings Profiles

- Select a saved settings profile from the drop-down box.
    I. The settings fields will be populated with the saved values.
- Settings profiles can be deleted by selecting the profile and then clicking the red 'delete' icon next to the drop-down box.

4.2.6 Saving Results

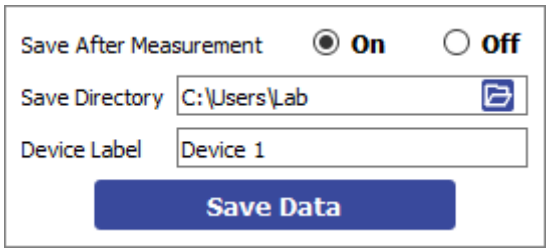


Figure 4.7. Data Saving settings.

(I) Save After Measurement

- The program allows for data to be saved automatically (or manually) once the measurement is complete.
    I. To enable or disable automatic saving, choose the appropriate option from the drop-down box.
    II. For automatic saving, the 'Save Directory' and 'Experiment Name' fields must be filled in before the measurement can start. These are detailed below.

(II) Save Directory

- Set the location in which to save the results.
- This can be set either by:
    I. Manually typing the directory into the field.
    II. Copying and pasting it from your file explorer.
    III. Clicking the 'Select Directory' button, which will open a dialog box for you to select a folder to save to.

(III) Device Label

- Sets the name of the save file.

I. The name cannot contain the characters: \ / : * ? " < > |

(IV) Save Results

- Clicking this button will manually save the measurement results.

(V) Saved Data Format

- The specified directory will be populated with 2 .csv (comma-separated value) files:
  I. The data for the current-voltage measurement.
  II. The settings of the experiment (this file can be loaded by the program if you wish to use the same settings again).

> **Note:** If you forget to change the experiment name, your previous files will not be overwritten as the filenames include the date and time the file was saved.

4.2.7 Controls

Figure 4.8. Controls for the measurements.

(I) Measure

- Clicking this button will start the measurement using the chosen settings.
- This button cannot be clicked if the software has not detected a unit.

(II) Cancel

- Stops a measurement that is currently in progress.
  I. Note that if the measurement is stopped before it completes, you will be unable to save the experimental data.

5. Troubleshooting

Most of the issues that may arise will be detailed here. However, if you encounter any issues that aren't detailed here, you can contact us by email (info@ossila.com) and we will respond as soon as possible.

Problem	Possible Cause	Action
Software does not start	The wrong version of Windows is installed on the computer.	Install the software on a computer with Windows 10 or newer.
	The software has not installed properly.	Try reinstalling the software.
Cannot connect to the Source Measure Unit via USB	The USB cable may not be connected properly.	Ensure the USB cable is firmly plugged in at both ends.
	The USB cable may not be connected to a working USB port.	Try connecting the unit to a different USB port on the computer.
	The USB drivers may not be installed or may not have installed properly.	Try installing or reinstalling the USB drivers. If the drivers on the USB provided are not working, try following the Windows 7 installation instructions found in the Installation Guide.
	The USB cable is defective.	Try using a different USB-B cable, and contact Ossila if necessary.
Cannot connect to the Source Measure Unit via network	The MAC address of the unit is not registered with the internal network.	Register the system on the network using the MAC address obtained via a USB connection (see Source Measure Unit manual).
	The Ethernet cable may not be connected properly.	Ensure the Ethernet cable is firmly plugged in at both ends.
	The Ethernet cable is defective.	Try using a different Ethernet cable.

6. Related Products

6.1 Related Consumables

ITO Coated Substrates

Our range of ITO substrates for OPV, OLED, and sensing applications.

Product codes: S111 / S101 / S211 / S281 / S171

Flat Tip Tweezers

Provides a good substrate grip without scratching.

Product code: C121

FTO Coated Substrates

Designed to be used as transparent electrodes for thin-film photovoltaics.

Product codes: S301 / S302 / S303 / S304

Substrate Cleaning Rack

Holds 20 substrates for a variety of processing techniques.

Product code: E101

6.2 Related Equipment

Source Measure Unit

Source voltage, measure current, get data. Simplify and accelerate your data collection!

Product code: P2005A2

Solar Cell I-V Test System

Reliable and accurate characterisation of photovoltaic devices – no programming knowledge necessary!

Product codes: T2002 / T2003

LED Measurement System

Provides a low cost and complete solution for performing current-voltage-luminance characterisation of LEDs.

Product code: T2005

Push-Fit Test Boards

For fast and secure electrical connections, this product makes PV and OLED device testing easy.

Product code: P2008A1 / P2011A1 / P2012A1