

J-V Apparatus Guide

1 Overview

This guide will walk you through the process of using the J-V apparatus. The process is split into three parts: Setup, Data Collection, and Experiment Wrap-up.

Note

The exported data files contain current (I) in milliamps — this is the raw quantity the Keithley instrument measures. In your analysis, you convert current to current density ($J = I / \text{pixel area}$), which allows meaningful comparison across devices of different sizes. This is why the photovoltaics community refers to this as “J-V characterization.” You will see **IV** in the data filenames and **Current (mA)** in the CSV headers — this reflects the raw data before your conversion to J .

2 Apparatus Components

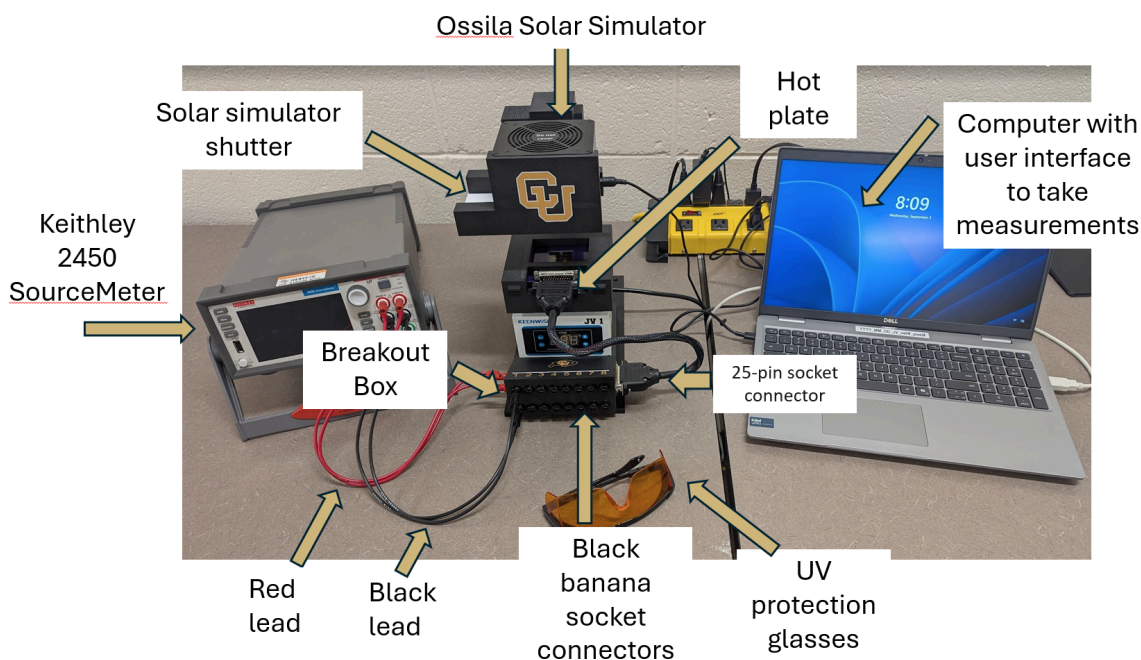


Figure 1: J-V apparatus overview

3 Setup

This portion of the guide covers the steps for setting up your solar cell to take J-V measurements.

1. Collect your cell from the stressing room.
2. Open the lid on the hot plate and place your cell inside the alignment cavity. The cell pixel mask should be visible from the top, as shown in Figure 2.



Figure 2: Cell in alignment jig

3. Snap the lid closed.
4. Plug the 25-pin connector from the breakout box into the cell.
5. Put on UV protection glasses.
6. Completely open the solar simulator shutter (see Figure 3).

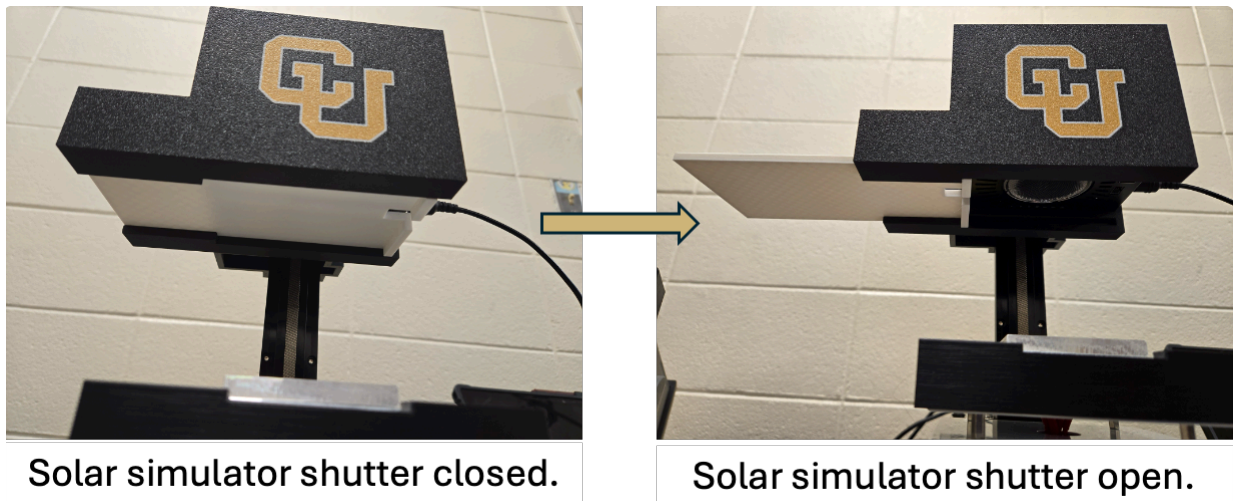


Figure 3: Solar simulator shutter

7. Let your cell sit under the open solar simulator for 10 mins to reach the testing temperature. Set a timer!
8. While you are waiting for your cell to equilibrate, someone on your team should log into the laptop using their IdentiKey, open a web browser, and log into your team's Google Drive. Set up a folder for this week's measurements.
9. Open the **"PHYS 2150 Measurement Suite"** app on the Desktop and select **"J-V Measurement"** (or press "J" on your keyboard).
10. Make sure the banana plugs of the black and red leads are plugged into the appropriate banana socket connectors. The red leads should be plugged into the side red banana sockets on the J-V breakout box – they will remain here for all of your measurements. The black leads should be plugged into the Pixel 1 banana sockets. The black leads will be moved as you do measurements for different pixels. Your starting setup should look like Figure 4.



Figure 4: J-V breakout box

Once your 10 minute timer has gone off, you are ready to move on to data collection.

4 Data Collection

This portion of the guide covers the steps for collecting the J-V measurements for all of the pixels of your solar cell. All of your measurements will be taken through the user interface you opened while you were waiting for your cell to equilibrate. Enter your cell number into the pop-up window that appears after the app launches. The default settings for the start, end, or step voltages should be left as-is (unless the instructor or TA communicates a necessary change).

1. Click the **Start Measurement** button. A pop-up window will appear for you to specify which pixel number you want to measure. Type the appropriate number and click **Start**.
2. Wait for data collection to complete.
3. **Verify that the forward and reverse sweeps look like you expect them to.** If you are not sure if your data are as expected, ask your TA to take a look.
4. After the measurement is complete, a window will appear asking you to save the data file. The filename should be set as: `YYYY_MM_DD_IV_cell#_pixel#.csv` – save the file in an appropriate location.
5. **Move the CSV file to your team's Google Drive folder.**
6. Move the black leads to the next banana socket connector (e.g., 1 $\rightarrow$ 2).
7. Repeat Data Collection Steps 1–6 until you have J-V measurements for remaining pixels.

5 Experiment Wrap-up

This portion of the guide covers the steps for completing your J-V measurements and resetting the apparatus for the next group.

1. Close the solar simulator shutter.
2. Remove your UV protection glasses and disinfect them with an alcohol wipe.
3. **Close the “PHYS 2150 Measurement Suite” user interface.** If you do not, the next group will not be able to take their measurements.

4. **Make sure all of your measurements are in your team's Google Drive folder.**
5. **Log out of the laptop.**
6. Unplug the 25-pin connector from your cell.
7. Take your cell back to its stressor spot. If you have not yet taken your EQE measurements for the week, your cell will stay on the stressor until it is your turn.