IVgetter User Manual

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1 Introduction

The purpose of this manual is to explain how to use IVgetter to acquire and save data for IV measurements, and how to give maintenance to the code. Proper and consistent use of this software ensures that all relevant data is saved and that results are easily compared between experiments.

2 Code management

The main file for the IVgetter app is *IVgetter.mlapp*. This file can be opened in the AppDesigner app from Matlab (type *appdesigner* in the command line in Matlab to launch it). This file can be opened and modified as needed (always keep a backup of the original file in case things don't work afterwards).

There are a couple of helper functions that should be present in the same folder when using the IVgetter app (*colors.m*, *ProperRange.m*, etc.). These functions can also be opened in Matlab and modified if required.

Finally, there are other files (images and sound files) that are required fir the app.

To package the app, open Matlab and open *IVgetter.prj*. Adjust the version number to the currect one, and click *Package*. This will create a *IVgetter.mlappinstall* file that you can use to install the app on any computer with Matlab installed.

To install the new version of the app, open Matlab and click on *Install App*. Select the correct file and follow the instructions.

3 Component explanation

The IVgetter software is divided into multiple tabs that allow to perform different aspects of data acquisition. Two of these tabs (New Measurement and Data Management) are essential in performing the measurements and saving the data. The other tabs (Plot and Results) are useful in quickly checking the data as the measurements are taking place.

3.1 New Measurement Tab

This tab is used to connect and disconnect the computer to the Keithley sourcemeter, enter all the parameters and information of the measurement run, and also has a quick preview of the last results in the form of a plot.

3.1.1 *Connect To Sourcemeter* Button

This button located at the lower end of the tab, on the right side, allows you to control the connection of the computer to the Keithely sourcemeter. The status label indicates the current connection status, and it will update whenever the status changes. Press this button to connect, and once again to disconnect.

Connecting to the sourcemeter will enable the buttons that allow you to perform other operations.

3.1.2 Quick Test Configuration

This panel allows you to run a quick test to make sure that the system is setup properly (no shorting the probes, probes actually making contact, or quick assessment of the chip's quality). Enter the starting, ending, and step voltages, along with the compliance to use during the measurement. It is recommended that you use the same starting and ending voltages, as well as the compliance that you will be using for your actual measurement. Also, you can enter a pause to be used during measurements if you want to ensure that your system has time to reach equilibrium before measuring. The voltage step, however, can be quite larger than that used for your measurement, as having a small voltage step will result in a slower test. Once you have entered the correct information, press the *Run Quick Test* button to start the test. Once the test is completed, the *Last Run Preview* plot will update, showing you the results of the test.

3.1.3 Measurement Configuration

This panel is operated in pretty much the same way as the Quick Test Configuration panel. The only difference is that there is a field where you can enter the number of measurements to perform. The system will run through the voltage sweeps as many times as the number entered in this field. Once the information is entered correctly, press the *Run Measurements* button to start the run. *Note that no data will be saved after pressing this button.* If there is any unsaved data from the previous run, there will be a pop up message warning you about this. If you decide to continue with the run, the previously unsaved data will be discarded and lost forever. Once the run is completed, the *Last Run Preview* will be updated to show you all the curves collected during the run.

3.1.4 Sample Information

Here, you should enter all the information of the sample and the specific measurement you are making. Enter the wafer name (names cannot be purely numeric), chip name, the step of the process at which the measurement is being taken, and flick the switch to indicate whether the light is off ("Dark") or on ("Light"). You can also enter any comments about the run, the sample, etc. in the field provided.

Once the information has been entered, you can click the *Store Last Run* button to save all the entered information into the table in the Data Management tab. *Note that no data has been permanently saved yet, and will be lost if you exit the software at this point.*. You can also click the *Discard Last Run* button to discard the data.

3.2 Data Management Tab

This tab stores the data from all the runs, along with the information provided about each run. It also allows you to make changes to the information about the runs, save the data, and even to select which data to preview in the Plottab.

3.2.1 Information Table

You can make changes to the information in the top table. This is helpful to fix mistakes made while entering the information while the measurement was made. You can also check or uncheck the box on the lowest row to indicate whether you want the data from this run to appear in the plot.

3.2.2 Delete Runs

If you want to delete a specific run from the data pool, you need to delete the wafer name for that run (leave the field empty), and then click the *Delete Unnamed Columns. Note that doing this is irreversible, and any data deleted in this way can't be recovered.*

3.2.3 Update Plot

Once you have selected the runs that you want to preview (and made sure nothing else is selected), click the *Update Plot* button to overlay the runs in the Plot tab.

3.2.4 Saving the Data

To save the data, you first need to select a folder. You can do this either by entering the folder path into the field, or by clicking the *Choose Folder* button, and selecting the desired folder. You must also enter a (descriptive) name for the data. Finally, click the *Save Data* button to save the data in the specified location with the name you entered.

Analyzing the data There is also available a checkbox that if ticked will cause the program to save, into the same folder, graphs for each of the chips and results (such as photocurrent, resistance, fill factor, etc.) in excel sheets for each wafer.

3.3 Plot Tab

This tab has no functionalities, and its only purpose is to display the curves from the runs selected in the Data Management tab.

3.4 Results Tab

This tab allows you to quickly verify the photocurrent of each sample under the same conditions, and to compare this value between the different steps in the process where this chip was measured.

3.4.1 Update Photocurrents Table

To update the top table with the latest measurements taken, click the *Refresh Calculations* button. *Note that a chip has to be run under both dark and light, keeping the rest of the conditions the same, for this chip to have a photocurrent.*

3.4.2 Select Wafer

You can select a wafer from among all that have been run in the current session to analyze more carefully. Changing the wafer selection will also update the available chips to choose.

3.4.3 Select Chip

From the drop down menu, select the chip that you want to take a closer look. Once the chip has been selected the two bottom tables will be updated. The left table will show the difference in photocurrents between the different steps for the selected chip, while the right table does the same, but showing the ratio increase in photocurrent instead.

4 Step-By-Step Operation

1. Connect the Keithley sourcemeter to the computer via a USB cable.
2. Open the IVgetter software
3. Turn on the sourcemeter.
4. Click the *Connect To Sourcemeter* button in the New Measurement tab.
5. Following the IV measurements SOP, Contact the chip with the probes.
6. Enter the appropriate parameters and click *Run Quick Test* to run a quick test.
7. If the test looks good, enter all the sample and information.
8. Enter the appropriate parameters and click *Run Measurement* to run the actual measurement.
9. Store the data from the last run by clicking *Store Last Run*, or discard by pressing the *Discard Last Run* button.
10. Repeat steps 5 to 9 for each chip and every condition.

11. Enter or select a folder in the Data Management tab.
12. Enter a (descriptive) name for the data.
13. Decide whether you want to only save the data, or to perform data analysis and save the results as well (untick or tick the checkbox, respectively).
14. Save the data by clicking *Save Data*.
15. Make sure the data has been correctly saved.
16. Exit the IVgetter software.
17. Turn off the sourcemeter.

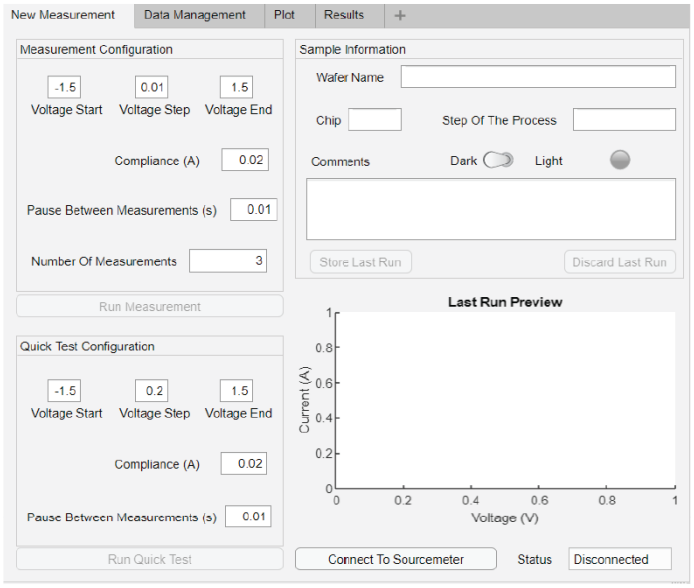

Figure 1: New Measurement tab.

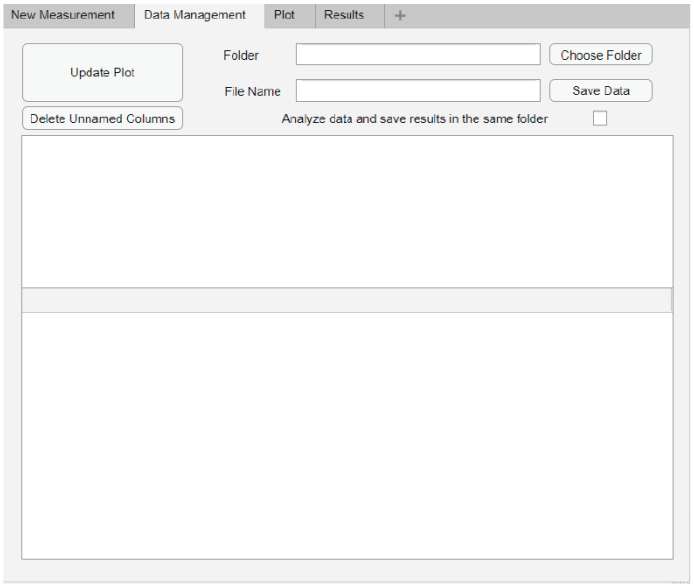

Figure 2: New Measurement tab.

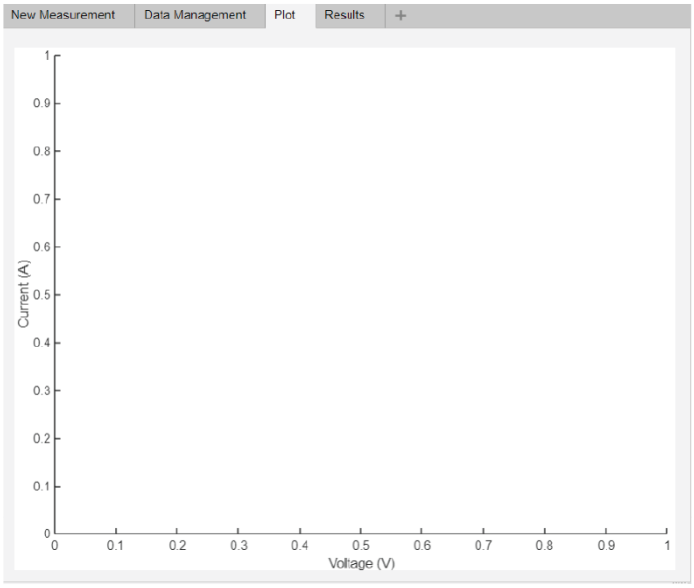

Figure 3: New Measurement tab.

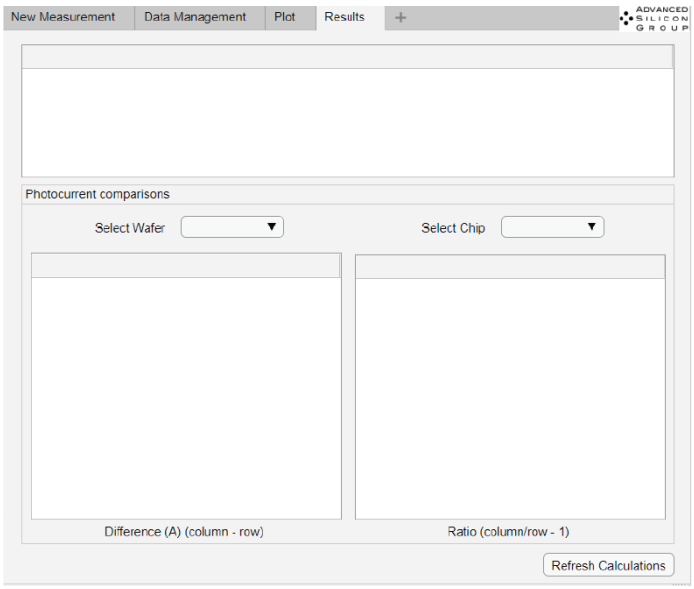

Figure 4: New Measurement tab.