Automated Program User Manual

PROGRAM DEVELOPED FOR AUTOMATING E-AB SENSOR DATA ANALYSIS IN MICRO-TISSUE ENGINEERING LAB

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## Preparation

Setting up your environment

When the python script is downloaded on your device, you can open the script in a compiler platform (e.g. VScode).

Before running the program, you'll need to ensure that you've installed the following libraries:

- Pandas
- Numpy
- Scipy
- Matplotlib
- customtkinter

To install the libraries:

1. open terminal from workspace tab "Terminal" or via hotkeys "Control + Shift + ` "
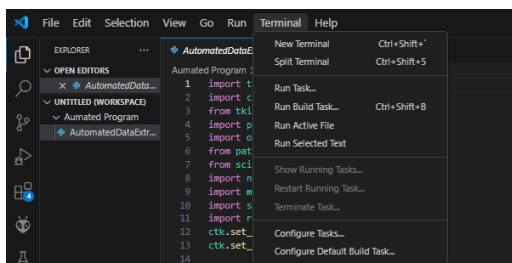
2. enter the following prompts:

   a. pip install pandas
   b. pip install numpy
   c. pip install scipy
   d. pip install matplotlib
   e. pip install customtkinter

Preliminary folder management

Before operating the program, your data files should be saved in the correct format.

*This program was developed specifically for automating the data processing operation in the Square-Wave Voltammetry data generated by the Chi1040c potentiostat instrument.

Ensure the collected data are stored in the following format to avoid errors:

1. Create a main folder for the experiment (*no naming restrictions)

2. Create 2 subfolders. One for "ON signal" data, one for "OFF signal" data

3. Save each data in text file format (can include .bin files but program will only read .txt files)

Naming conventions:

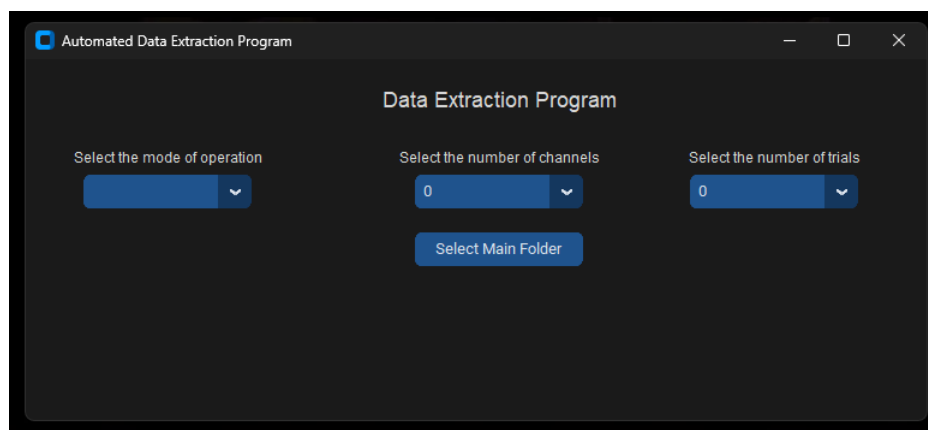Degradation curve data: "hhmm.txt" (e.g. "0530.txt" = 5 hrs 30mins after start time)

Calibration curve data: "50uM-ON-2.txt" = 2nd repetition of 50uM "ON" signal testing

Once all files are saved in correct folders, you're ready to automate the data processing operation.

Operation

Once you've completed the preparation steps, go ahead and run the script.
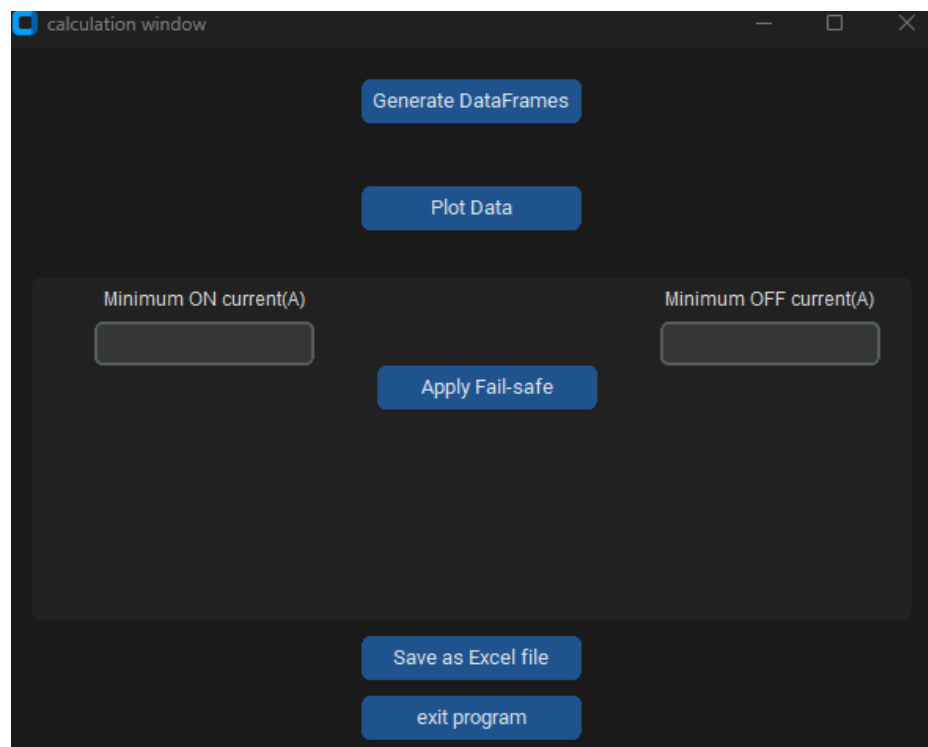
Main Window

The first thing you'll be greeted with is the Main Window which has 3 parameter-tabs and a folder selection button.

1. On the left tab, you'll need to specify which type of data analysis will be operated.
   a. Degradation curve extracts peak current data over a timeframe
   b. Calibration curve extracts peak current data over levels of concentration
2. On the middle tab, select the number of channels (electrode) that you've used, or are in each SWV data file.
3. On the right tab, select the number of trials you've recorded in the folders.

After selecting the correct parameters for your data, use the bottom button to select the main folder of the entire dataset.

Calculation Window

After selecting the correct main folder, the calculation window will pop up. You can use the following buttons to operate the automation.

i. The Generate DataFrames button (top) is responsible for the iterations across all SWV data files. You can see each file being extracted to compile the appropriate data frames in the VScode terminal.

ii. The "Plot Data" button allows you to view the quick visualisation of the dataset, either the Degradation curve or the Calibration curve. At this stage, you can easily point out the faulty data (if there are any) from the quick visualisation. (Skip step iii if there are no faulty data)

iii. Once you've identified the corresponding timestamp, or concentration level of where the faulty data is. You can locate the faulty data within the data frame. (either from the terminal or you can save the 'faulty' dataset as an excel file).

iv. When you've determined the minimum threshold current in either the ON or OFF signal, or both. You can enter the values in scientific format (e.g. 5e-7 is 5×10^{-7}). Apply Fail-safe, then return to the top and repeat step i and ii. You can repeat this procedure as much as you prefer, if you'd like to change the threshold current.

v. Once you're happy with the data. Use the Save as Excel file button to save the data frame for further analysis procedures, such as more in-depth manual adjustments and data visualization.

vi. Exit the program in the end.