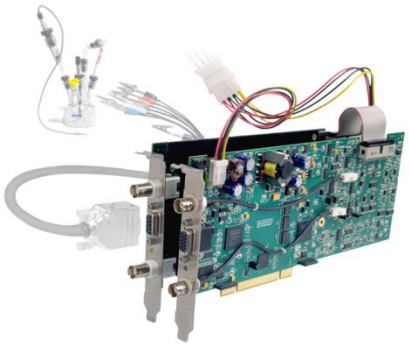
MME Standard Operating Procedure (SOP)

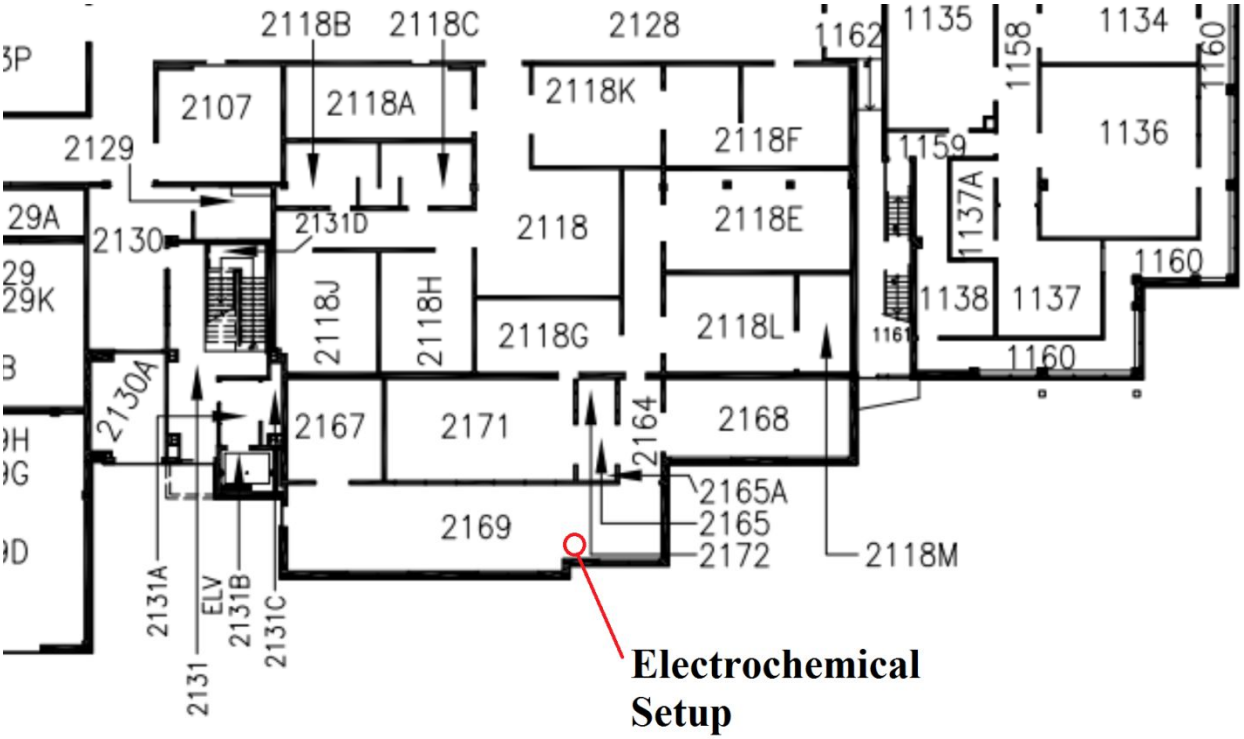
Name	• Electrochemical Setup
Description	• Gamry Series G 300
Location	• E3 -2169
SOP Creation Date	• 2015-10-27
SOP Created By	• Robert Liang
SOP Revision Date	•
SOP Revised By	•
SOP Location	• E3 -2169
Manual Location	• E3 -2169
Equipment Owner	• Dr. Norman Zhou
Authorized Trainers	• Robert Liang
Support Technicians	• N/A



Significant Hazards	• The cell design incorporates non-insulated contact points as well as exposed electrode surfaces hence electric shock is a major risk. Electric shock is the effect produced on the body and particularly on the nervous system by an electrical current passing through it. The effect depends on the current strength which itself depends on the voltage and body resistance i.e. path length and surface resistance of skin (which is much reduced when wet). Death can be the result of the normal voltage of 240 V causing currents of greater than 30 mA to flow through the body for more than 40 ms. Minor shocks may also cause injury following involuntary muscle contraction. • Burns caused by the passage of heavy currents through the body. • Explosion and fire caused by electrical sparks, short circuits or overload heating, old wiring in the presence of flammable material. • The by-products of many electrochemical reactions are gaseous and occur in the confined volume of the cell. As a consequence injury from flying glass and other debris as well as the possible injury and contamination from the reaction media during an explosion exists. • Electrochemical cells are designed to be opaque and glass is predominantly the preferred fabrication material hence cuts from damaged or broken glass and poisoning following cuts by contaminated glassware are possible.
Administrative Controls	Instrument can be used independently at any time by a trained and authorized student or an employee Students need to register previously before usage an should be monitored by instrument administrator Instrument Administrator frequently visit the lab to observe the safety operation of the instrument
Engineering Controls	• none
PPE Required	• Gloves when handling chemicals
Relevant Standards and Codes	• none
Relevant MSDS	• Compressed gas cylinders, acidic and basic salts for electrolyte solutions

Accident Procedure	**Electric Shock** Switch off the power before touching the injured person. **Fire** Never use water on an electrical fire. **Escape of gas** If the gas escape is large follow the procedure of the Safety Office and remember even an inert gas can kill by asphyxiation. For small non-toxic leaks, inform a member of staff, ventilate, evacuate, seal and secure the room. **Falling Cylinder** If a cylinder falls over, NEVER attempt to catch it. It is much too heavy and will cause you serious injury. It is also very robust and is unlikely to be damaged although it may make a loud noise. Do not attempt to upright it by yourself but get competent help. **Cuts from Glassware** Always treat cut and burns immediately. Apart from very minor injuries, call for First Aid treatment. Contact Team Leader, university safety office – ext:33587
Emergency Shutdown Procedure	• Turn off the equipment Examples of a causal situation are: ○ fire alarm ○ medical emergency ○ building evacuation

Location of Setup



Pre-start Checklist

Document everything that needs to be done before starting the equipment or process. Include items such as:

- Have electrolytes ready and any necessary chemicals or accessories
- people to notify- Paola Russo (if you do not have the key to enter theE3-2169 room)
- space conditions – Work area should be clean and organized

Start-up Procedure

The leads on Gamry cell cables are color-coded for easy installation. The meanings of the colors are below. Color codes are also on the Gamry mouse pad shipped with the potentiostat.

Clip Color	Electrode
Green	Working
Blue	Working Sense
White	Reference
Red	Counter
Orange	Counter Sense
Black (long)	Floating ground
Black (short	Earth ground

Notes: blue and green leads – If you have used other manufacturers' potentiostats and cell cables, you may be puzzled by Gamry's use of two leads for working electrodes. The two working electrode leads make it possible to devise a greater variety of experiments. However, to do a standard three-electrode potentiostatic experiment, connect both the green and blue clips to the working electrode (or clip the green to the blue, and then clip the blue to the electrode). orange lead – The orange lead is used only in ZRA (zero resistance ammeter) experiments.

Grounding: The grounding leads both have black clips. The longer of the two leads is the floating ground. The shorter lead with a black clip is the earth ground. The short lead can be clipped to an independent earth ground. (The short lead is connected internally to the computer chassis.) When using a Faraday Cage, connecting both ground leads to the cage usually results in the lowest noise. However, leave the short black lead open if the experiment setup is earth grounded. For example, if the Faraday Cage, electrolyte circulation pump, or a metal vessel for the cell is grounded, do not connect the short lead to anything.

Operating Procedure

The procedure for running any experiment is:

1) Connect the cell cable leads to the appropriate electrodes on the electrochemical cell. Refer to the table on this page or the Gamry mouse pad for the color coding of the leads.

2) Select the script you want to run. To use a standard Gamry script, select it from the application submenus, such as DC Corrosion or Electrochemical Impedance, accessible from the Experiment menu. To use a custom script, select it from the "Scripts" folder (Experiment > Named Scripts). This folder contains all scripts (standard and custom), as well as global scripts used by other scripts.

3) Name the .dta output file that will contain the experiment data generated by the test. This ASCII text file will be created in "My Gamry Data" (or the new destination you specify using the Options menu).

4) Specify parameter values. When the window used to run a script opens, the parameter values most recently used for this script will be displayed. At this point you have several choices.

• You can edit the parameter values. You can save the new values to a ".set" file for future use by clicking on Save. When assigning a name to the saved parameter values, it is a good idea to include the name of the script or experiment in the file name.

• You can use values stored in an existing .set file by clicking on Restore. A window will open that contains all the .set files for all experiment types. Pick a file of values for this type of experiment.
• You can use the Gamry default values for this script by clicking on Default.
5) Start the experiment and activate the potentiostat by clicking on OK in the experiment window. Depending on the script you selected, one or more messages may be displayed containing advice for running the experiment.
6) If any messages are displayed, follow the advice, and then acknowledge the messages by clicking on OK.
7) While the experiment is running, plotted data will be displayed. Messages in the status bar allow you to monitor progress of the test. You can cancel the experiment by clicking on F1-Abort (no test data stored), skip the current stage of the experiment by clicking on F2-Skip, or temporarily halt the experiment by clicking on F3-Pause.
8) At the conclusion of the experiment, an "Experiment Done" message is displayed. The message contains instructions for closing the window used to start the test. 9) Press the F2 (Skip) button.

Shutdown Procedure

Program will stop test automatically. Logoff computer when completed.

Clean-up

Document the clean-up. Include items such as:

- The scope of the cleanup: : Weekly cleanup of lab. The cleaning of the working area is performed after the end of the experiments.
- Use logs or documentation: Operating conditions should be recorded in log book. Problems should be documented on log book.
- where the waste goes: No chemicals, plant operation cleaner

Lockout

Document the lockout procedure to use when maintenance or repairs are taking place. Identify and address all sources of hazardous energy.

Maintenance and Repair

Document the maintenance and repair procedures making sure to include items such as:

- schedules and logs
- parts lists
- reference manuals
- suppliers and service companies