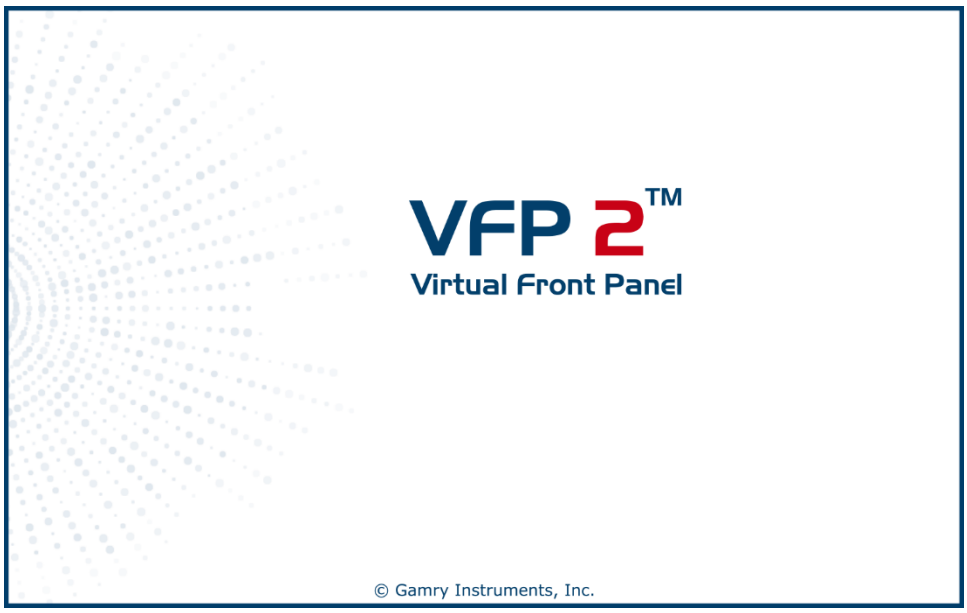
VFP 2™ Virtual Front Panel

Operator's Guide



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Internet	https://www.gamry.com/support-2/
Phone	(215) 682-9330 9:00 AM−5:00 PM (US Eastern Standard Time) (877) 367-4267 (Toll-free US & Canada Only)

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Table of Contents

Chapter 1: Product Description

Thank you for choosing the VFP 2 Virtual Front Panel. This front panel gives the user a new level of control over their Gamry potentiostat. Interactions between the user and the hardware are available in real-time. This means that the user can make manual changes to potentiostat settings during data acquisition. This panel is intended for use as a replacement for a hardware front panel. It is not intended to replace any of the Gamry Framework applications, which utilize the Explain™ scripting language. Rather, it is meant as an additional option when experimenters wish to run simple experiments and have instantaneous control over their potentiostat settings.

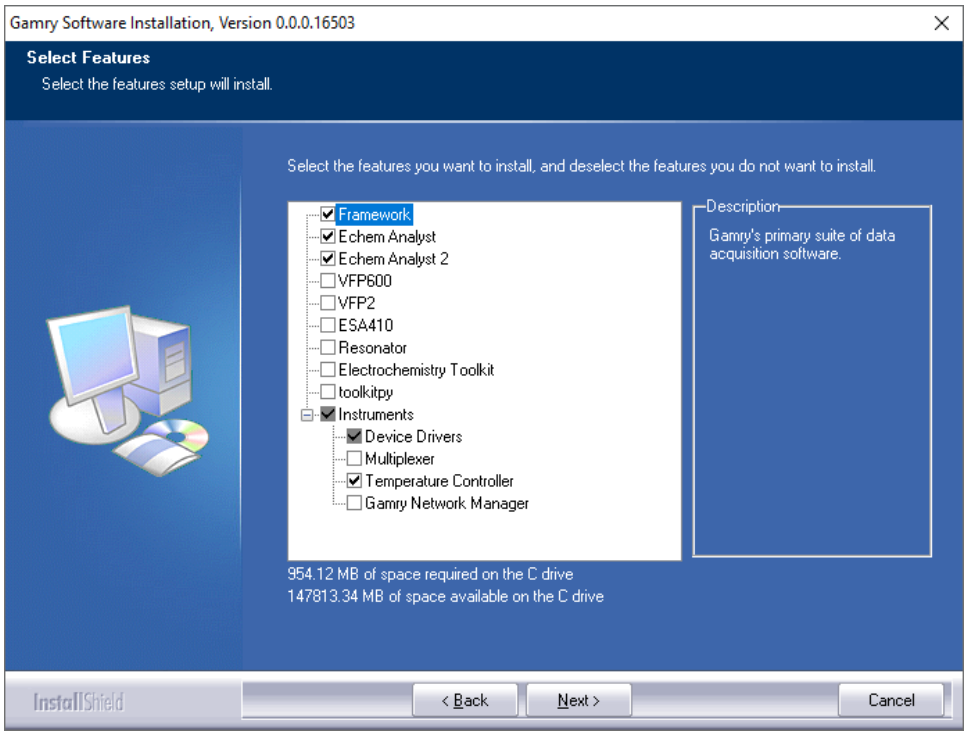
Installation

VFP 2 installs separately from other Gamry software. If the VFP 2 is not installed yet and you own one of our instruments, you can find an installation file on our website using Gamry's Client Portal. You may install copies of the VFP 2 on multiple computers.

During the installation process, you are being asked to add different features to the installation. By default, the Echem Analyst 2 is already selected among others such as Gamry Framework.

The VFP 2 may not be automatically selected. Click on the checkbox next to it, to add the software for installation.

Figure 1-1
Feature selection window during Gamry software installation.

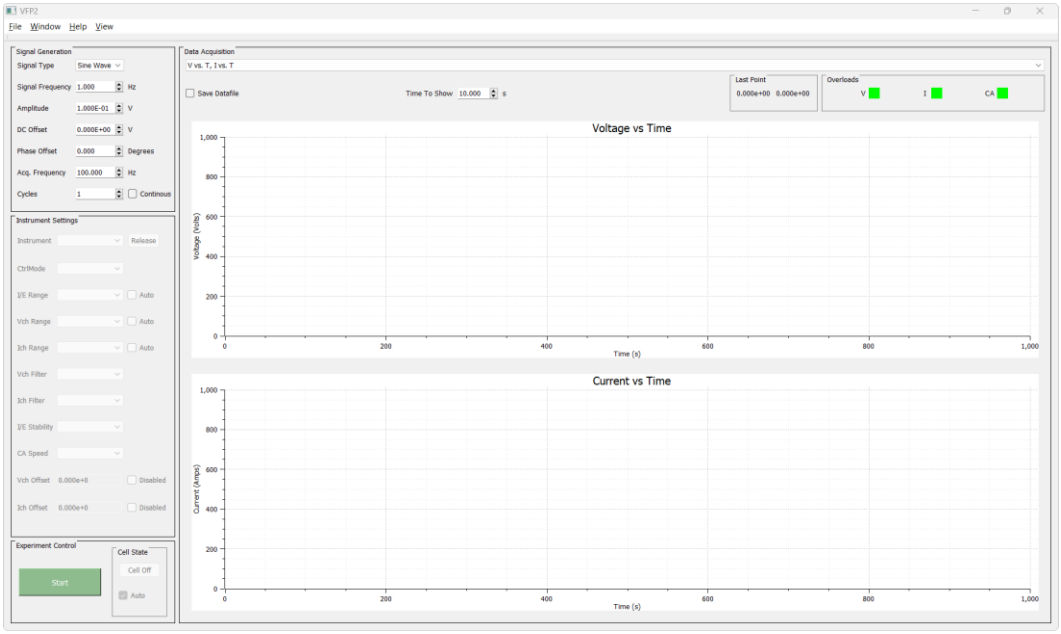


Follow the next steps during the installation procedure. Once installed, you are ready to use the VFP 2.

Chapter 2: Front Panel Interface

The Virtual Front Panel (VFP 2) consists of a single user interface window which presents hardware settings, acquisition settings, signal settings, and collected data. The VFP 2 is broken up into four distinct regions. These regions, listed below, will each be discussed in their own sections.

- Data Acquisition
- Signal Generation
- Instrument Settings
- Experiment Control



Data Acquisition

This Data Acquisition section of the Virtual Front Panel is used to present the acquired data to the user. It shows the real-time graph when running a measurement including overload indicators. The user can select what graph types are displayed and modify the graphical interface such as axis format, number format, axis labels, line colors, etc.

Graph Selector

The graph selector allows the user to determine which graph they would like to use for their data presentation.

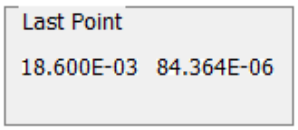
Five different graphs are available for the user to choose from. They are:

- Voltage vs. Time and Current Vs. Time (*V* vs. *T*, *I* vs. *T*)
- Current vs. Voltage (*I* vs. *V*)
- Voltage vs. Current (*V* vs. *I*)
- Temperature vs. Time (Temp vs. *T*)

Please note that the Temperature vs. Time graph is disabled by default. To enable the feature, go to the menu list under **View > Temperature Plot**. The function is grayed out for instruments without temperature sensor capability.

Last Point

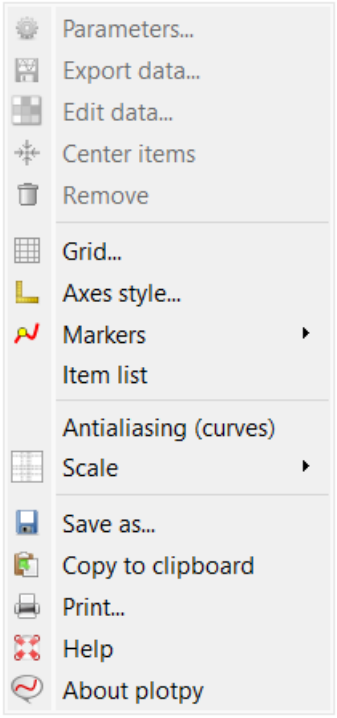
The Last Point indicator shows the most recently acquired pair of data values. Depending on the graph displayed, it shows the measured voltage data in volts and current data in amperes. On temperature graphs it will list data in degree Celsius.



Graph Controls

There are several options for the user to interact with the chart.

- **Chart menu**

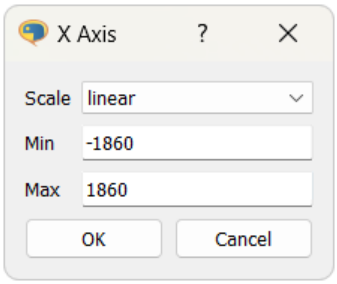


Right-click with your mouse anywhere in the chart area to open the chart menu. Here you can fully modify the chart style such as grid lines, marker and line style, axis label, units, etc., for each individual axis..

Further you can save the current chart as image (`*.png`) or as `*.pdf` for use in other programs. You can also save the entire VFP2 window under **File > Print Window**.

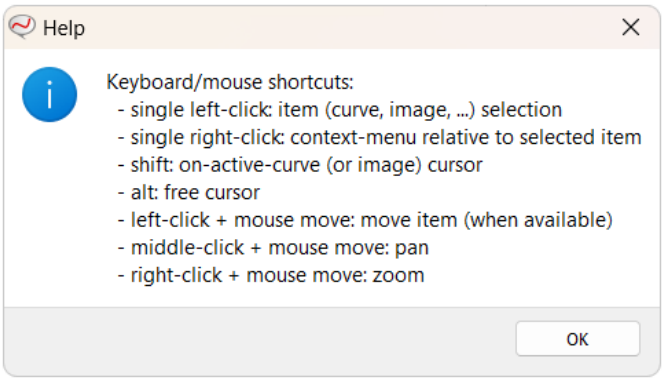
The Help dialog box summarizes all keyboard and mouse shortcuts.

- **Scale axis**



Alternatively, you can double-click with your mouse on either axis to open the axis menu. Within the dialog box, you can change the axis scale from linear to logarithmic and set the minimum and maximum axis value.

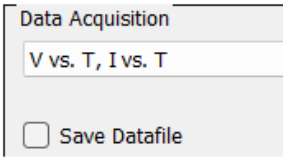
- **Shortcuts**



Several keyboard and mouse shortcuts are available to either select items or change the view settings.

Save Datafile

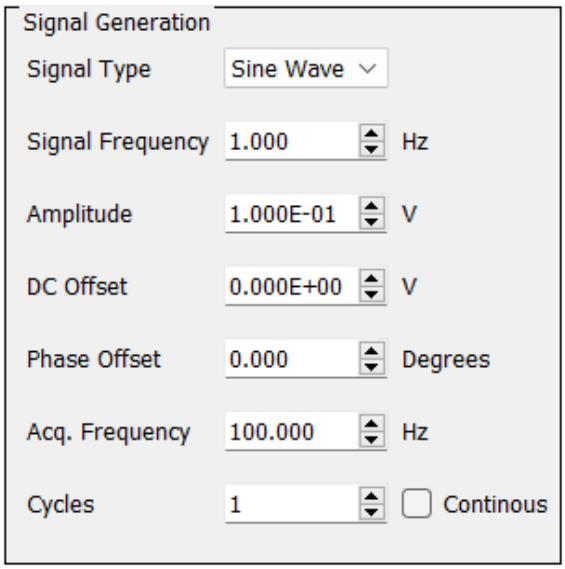
If the **Save Datafile** checkbox is checked upon the start of an experiment, the user will be prompted for a location and filename for the log file via a standard Windows file dialog. Otherwise, the data will simply be displayed on the graph and then discarded.



We recommend saving measured data files as Gamry data files with the extension *.DTA. This gives you the ability to view the file in the Echem Analyst 2 (EA2) without any restrictions and using its analysis tools.

Signal Generation

The Signal Generation section of the Virtual Front Panel is used to select the signal to be applied by the potentiostat to the cell and to control the timing of data acquisition.



Signal Type

There are **nine signal types** that the VFP can apply to a cell.

- ### Sine Wave and Cosine Wave

  These predefined signals output a sine or cosine wave. The setup parameters for Sine and Cosine Wave are identical.

Signal Frequency	Applied frequency of the sawtooth wave in Hz. Please note that the Acquisition Frequency must be greater than two times the Signal Frequency in order to meet the **Nyquist criterion**.
Amplitude	Peak amplitude of the signal.
DC Offset	The DC Offset control sets the constant DC Offset at which the signal is centered. The default for this is 0 volts. If you want to center the signal around the open circuit of the cell, this is where the value for the open circuit would be entered.
Phase Offset	Phase-offset in degrees.
Acq. Frequency	Acquisition rate at which data is sampled by the potentiostat. Please see your hardware manual for details on the proper range for this value. The upper limit for acquisition will be dependent upon your computer's performance but is ultimately limited to 10 kHz. Make sure that the filter settings of the potentiostat correspond accordingly with the Acquisition Frequency setting. A filter setting which is too low can cause data loss to occur.
Cycles	The number of complete cycles of the signal or waveform to apply. To maintain an indefinite number of cycles, check the **Continuous** checkbox.

- ## Triangle

This predefined signal outputs an up-down linear ramp. The triangle waveform starts at the initial value, proceeds to the final value, and back to the initial value again. This will continue for the designated number of cycles.

Initial	Initial value and final value of the triangle signal.
Final	Reversal point of the triangle signal.
Scan Rate	Scan Rate determines how quickly the potentiostat applies the signal.
Acq. Frequency	Acquisition rate at which data is sampled by the potentiostat. Please see your hardware manual for details on the proper range for this value. The upper limit for acquisition will be dependent upon your computer's performance but is ultimately limited to 10 kHz. Make sure that the filter settings of the potentiostat correspond accordingly with the Acquisition Frequency setting. A filter setting which is too low can cause data loss to occur.
Cycles	The number of complete cycles of the signal or waveform to apply. To maintain an indefinite number of cycles, check the **Continuous** checkbox.

- ## Square Wave

This predefined signal outputs a square wave.

Signal Frequency	Applied frequency of the sawtooth wave in Hz. Please note that the Acquisition Frequency must be greater than two times the Signal Frequency in order to meet the **Nyquist criterion**.
Amplitude	Peak amplitude of the signal.
DC Offset	The DC Offset control sets the constant DC Offset at which the signal is centered. The default for this is 0 volts. If you want to center the signal around the open circuit of the cell, this is where the value for the open circuit would be entered.
Duty Cycle	The Duty Cycle control sets the duty cycle (on/off) time for the square wave. A symmetrical square wave will have a duty cycle of 50%.
Acq. Frequency	Acquisition rate at which data is sampled by the potentiostat. Please see your hardware manual for details on the proper range for this value. The upper limit for acquisition will be dependent upon your computer's performance but is ultimately limited to 10 kHz. Make sure that the filter settings of the potentiostat correspond accordingly with the Acquisition Frequency setting. A filter setting which is too low can cause data loss to occur.
Cycles	The number of complete cycles of the signal or waveform to apply. To maintain an indefinite number of cycles, check the **Continuous** checkbox.

- ## Sawtooth

This predefined signal outputs a sawtooth wave.

Signal Frequency	Applied frequency of the sawtooth wave in Hz. Please note that the Acquisition Frequency must be greater than two times the Signal Frequency in order to meet the **Nyquist criterion**.
Amplitude	Peak amplitude of the signal.
DC Offset	The DC Offset control sets the constant DC Offset at which the signal is centered. The default for this is 0 volts. If you want to center the signal around the open circuit of the cell, this is where the value for the open circuit would be entered.
Phase Offset	Phase-offset in degrees.
Acq. Frequency	Acquisition rate at which data is sampled by the potentiostat. Please see your hardware manual for details on the proper range for this value. The upper limit for acquisition will be dependent upon your computer's performance but is ultimately limited to 10 kHz. Make sure that the filter settings of the potentiostat correspond accordingly with the Acquisition Frequency setting. A filter setting which is too low can cause data loss to occur.
Cycles	The number of complete cycles of the signal or waveform to apply. To maintain an indefinite number of cycles, check the **Continuous** checkbox.

- ## Ramp

This predefined signal outputs a linear ramp.

Initial	Initial value of the ramp signal.
Final	Final value of the ramp signal.
Scan Rate	Scan Rate determines how quickly the potentiostat applies the signal.
Acq. Frequency	Acquisition rate at which data is sampled by the potentiostat. Please see your hardware manual for details on the proper range for this value. The upper limit for acquisition will be dependent upon your computer's performance but is ultimately limited to 10 kHz. Make sure that the filter settings of the potentiostat correspond accordingly with the Acquisition Frequency setting. A filter setting which is too low can cause data loss to occur.

- ## Single Point

The Single Point signal outputs a simple voltage or current value to the potentiostat. The signal is not changed unless the user interacts with the front panel. The value may be dynamically changed by the user.

DC Offset	The DC Offset control sets the constant DC Offset at which the signal is centered. The default for this is 0 volts. If you want to center the signal around the open circuit of the cell, this is where the value for the open circuit would be entered.
Acq. Frequency	Acquisition rate at which data is sampled by the potentiostat. Please see your hardware manual for details on the proper range for this value. The upper limit for acquisition will be dependent upon your computer's performance but is ultimately limited to 10 kHz. Make sure that the filter settings of the potentiostat correspond accordingly with the Acquisition Frequency setting. A filter setting which is too low can cause data loss to occur.

- **OCP**

  Measure the open-circuit potential of an electrochemical cell. In many cases, you just want to measure cell potential until the cell becomes stable (when *Eoc* stops drifting).

DC Offset	The DC Offset control sets the constant DC Offset at which the signal is centered. The default for this is 0 volts. If you want to center the signal around the open circuit of the cell, this is where the value for the open circuit would be entered.
Acq. Frequency	Acquisition rate at which data is sampled by the potentiostat. Please see your hardware manual for details on the proper range for this value. The upper limit for acquisition will be dependent upon your computer's performance but is ultimately limited to 10 kHz. Make sure that the filter settings of the potentiostat correspond accordingly with the Acquisition Frequency setting. A filter setting which is too low can cause data loss to occur.
Seconds	Acquisition time in seconds.

- **From File**

  This signal type allows a user to define a signal using numbers in a linefeed-delimited ASCII text file.

Acq. Frequency	Acquisition rate at which data is sampled by the potentiostat. Please see your hardware manual for details on the proper range for this value. The upper limit for acquisition will be dependent upon your computer's performance but is ultimately limited to 10 kHz. Make sure that the filter settings of the potentiostat correspond accordingly with the Acquisition Frequency setting. A filter setting which is too low can cause data loss to occur.
Cycles	The number of complete cycles of the signal or waveform to apply. To maintain an indefinite number of cycles, check the **Continuous** checkbox.
File	Either enter a path and filename or use the Browse button to open standard Windows file dialog.

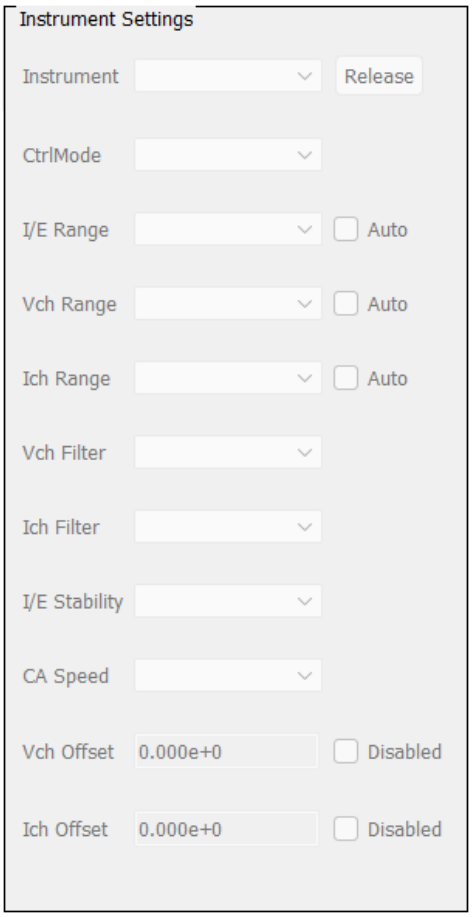
  There should be one number per text line in the file. This number should represent the voltage (in volts) or current (in Amps) which is to be applied by the potentiostat. The rate at which the signal is applied is controlled by the Acquisition Frequency. If the acquisition frequency is set to 10 Hz, ten lines will be read from the file every second. There is a one-to-one relationship between an acquired point and the signal.

VFP2 can record and store up to 800000 data points in a single output file. The Acq. Frequency also helps to determine the Number of Points in a data curve as follows:

$$\text{Number of Points} = \frac{\text{Total Time}}{\text{Acq. Frequency}}$$

Instrument Settings

This section of the Virtual Front Panel allows the user to change the hardware settings of the potentiostat. Please note that the following descriptions are simply an overview of the potentiostat's settings. Please consult your hardware manual for further details on these options.



Instrument

This control allows the user to select which potentiostat (in a multi-potentiostat system) to use for the experiment. The potentiostat selector is only active prior to the start of data acquisition. After data acquisition has begun, this selector will become disabled. The potentiostat is selected by its label, which will be displayed in the dropdown list. If a potentiostat is powered on or off while the application is running, this list will refresh. The Virtual Front Panel may be unresponsive while it responds to this occurrence.

When using a Reference 3000, the user has the ability to select the Compliance mode:

- High-Voltage, Low-Current Mode (+/-32V @ +/-1.5A)
- Low-Voltage, High-Current Mode (+/-15V@+/-3A)

Control Mode

This control allows the user to specify the controlling mode of the potentiostat. Potentiostat mode causes the hardware to control the potential while monitoring the current. Galvanostat mode causes the hardware to control the current while monitoring the potential. ZRA mode controls the two working electrodes to the same potential (or a biased potential) while monitoring the voltage and current fluctuations.

Vch, Ich, and I/E Range

These controls are used to specify the voltage and current channel gain stages, as well as the I/E Range resistor. When set to auto, the control will be disabled and will display the current value for that particular setting.

Vch and Ich Filter

Sets the analog filter available on the voltage or current channel of the potentiostat. This filter should be set appropriately based upon the data acquisition frequency of the potentiostat. The filter setting should be higher than the setting for the acquisition frequency.

I/E Stability

This setting controls the I/E converter stability for potentiostat mode. The slower settings apply more filtering, and faster settings apply less filtering. If the potentiostat is showing high speed oscillation that depends on the current range in use, try increasing the Stability setting. If your curves are noisy at low currents, try setting Stability to Slow. In Galvanostat mode, this control will be disabled, and the setting will be automatically set to Fast.

CA Speed

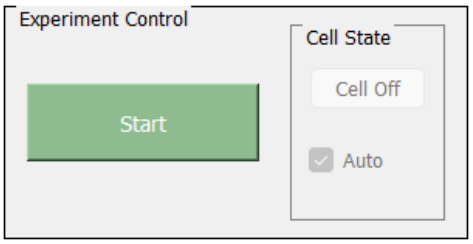
The CA Speed setting sets the roll-off filter on the potentiostat control amplifier. This affects the overall stability of the potentiostat. This setting largely depends on the cell being examined, and as such CA speed settings offered are only a guideline. The Normal setting is appropriate for most cells. However, if the potentiostat oscillates on all of the current ranges, alter this setting.

Vch and Ich Offset

These fields are used to enter a fixed offset value for the Voltage and Current channels. This DC offset is subtracted from the measured signal prior to the A/D converter (and in the case of Ich Offset, after the I/E Range resistor). This allows the A/D converter to give more sensitive measurements on the actual AC component of the signal. This offset should be used carefully. If an incorrect offset is selected, the measurement may become flat-lined due to a saturated Voltage or Current Range. Please note that this option is not available on all potentiostats.

Experiment Control

This section of the Virtual Front Panel allows the user to begin an experiment and control the external cell of the potentiostat.



Start

This button controls the starting and stopping of data acquisition. The button will be disabled if there are no valid potentiostats connected to the system.

Cell State

This control allows the user to turn on or off the external cell of the potentiostat. Normally, the user should leave the Auto checkbox in the enabled state, as this will turn the cell on at the beginning of an experiment, and turn it off at the end, automatically. If further control is desired, simply disable the Auto feature, and the potentiostat's cell will be under full manual control.

Appendix: Index