Tech Support NOTE

GAMRY INSTRUMENTS

Current Ranges- Fixed vs. Autoranging

Introduction

We often get asked by users whether they should use autoranging or run on a fixed range when performing an experiment. The answer depends mostly upon scan rate and sample period.

Autoranging will adjust the current measurement range automatically so that the current is always within the capabilities of the instrument. Setting a fixed current range mean you are forcing the instrument to stay on a single current range during your experiment. Autoranging might sound like the better option to make your life easier but it has its drawbacks. Switching current ranges during a scan can produce noise or instability if you're scanning or sampling too fast. So, how do you decide whether to use autoranging or a run on a fixed current range?

Generally, most corrosion experiments are run at slow scan rates (~0.187 mV/s) and longer sampling periods (~2 s), so autoranging makes sense. For this reason, all DC Corrosion experiments default to autoranging mode. Physical electrochemistry experiments, such as cyclic voltammetry, are generally run with scan rates and sampling periods that are much faster and may possibly produce noise or instability in the measurement. In these cases, the instrument must be used in fixed ranging mode.

In all Physical Electrochemistry and Pulse Voltammetry experiments the user has the ability to select which range mode is used via the I/E Range Mode setting. The box directly below the I/E Range Mode selector is the Max Current parameter. **The user should enter the maximum current value that they expect to see for the experiment, and the instrument will lock into the next highest current range.** In cases where the user is not sure about the max current—a fresh CV scan perhaps—it is suggested to run the experiment first in autoranging mode, observe the maximum current, then run the experiment again in fixed range mode with an appropriate Max Current entered into the parameter box for best results. In cases where autoranging is required but undesirable effects are noticed, you have the capability to make hardware modifications (through software) that can improve the result. Contact Gamry for details.

We've compiled the table below for some general information for you. Reference family potentiostats have the largest number of current ranges while the Interface family of potentiostats has fewer ranges. The table lists the current ranges and their maximum current (applied or measured).

IE Range #	Ref 600+	Ref 3000 / AE	IFC 1010 (BE)	1010T	IFC 5000 (PE)
0	N/A	N/A	N/A	N/A	N/A
1	60 pA	N/A	N/A	N/A	N/A
2	600 pA	300 pA	N/A	N/A	N/A
3	6 nA	3 nA	N/A	N/A	N/A
4	60 nA	30 nA	10 nA	N/A	N/A
5	600 nA	300 nA	100 nA	N/A	N/A
6	6 µA	3 µA	1 µA	1 µA	N/A
7	60 µA	30 µA	10 µA	10 µA	50 µA
8	600 µA	300 µA	100 µA	100 µA	500 µA
9	6 mA	3 mA	1 mA	1 mA	5 mA
10	60 mA	30 mA	10 mA	10 mA	50 mA
11	600 mA	300 mA	100 mA	100 mA	500 mA
12	N/A	3 A	1 A	N/A	5 A
13	N/A	30 A**	N/A	N/A	N/A

**When combined with a Reference 30K Booster

Finally, your choice of fixed versus autoranging depends mostly upon your scan rate and sampling period. For a DC Corrosion experiment, autoranging is automatically selected. For Physical Electrochemistry and Pulse Voltammetry it is your choice. Generally, we recommend running on a fixed mode when possible to ensure the lowest noise data possible.

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