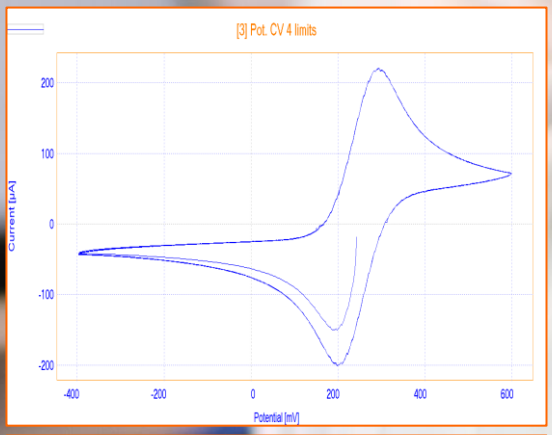
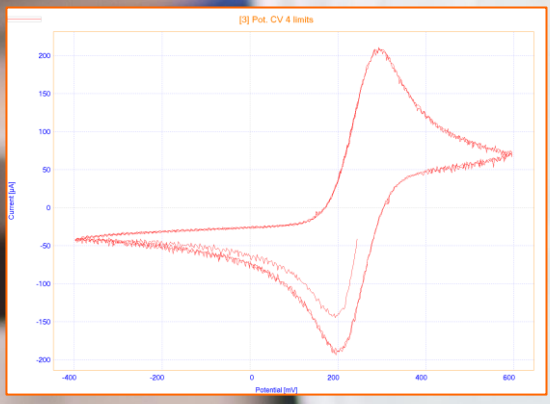
APPLICATION NOTE

General Electrochemistry AP-GE18

REJECTION FILTER (50 OR 60 HZ) FOR REMOVING ENVIRONMENTAL NOISES





In this application note, influence of using rejection filter was investigated on the environmental noise and perturbation coming from different power sources and environmental noises.

APPLICATION NOTE

General Electrochemistry AP-GE18

INTRODUCTION

"Filter rejection" is an option available in OrigaMaster software found in the parameter of most electrochemical methods as it is shown in figure 1.

Open circuit at end	Yes
Save points	Yes
Auxiliary input	No
Rejection 50 Hz	**Yes**

Figure 1: "Rejection 50 Hz" filter used to remove environment noises

This option is mostly used to remove environmental noise and noises which come from the perturbation of electricity power supply (for example electricity power source by frequency of 60 or 50 Hz, figure 2).

For instance, while using alligator clamps with unshielded cables this filter play serious role on removing noises.

The other application is during perming very low scan rate voltammetry tests and long term slow electrochemical reactions.

Figure 2: Different frequency electricity power supplies in different countries

CELL SETUP

Electrochemical tests were run on ferri-ferro cyanide solution with 3 electrodes configuration (working, reference and auxiliary), but the used cables and connections were unshielded and alligator clamps were used as much as possible, all are done to create noisy results to show the influence of "rejection filter". Figure 3 shows the connections and cell setup.

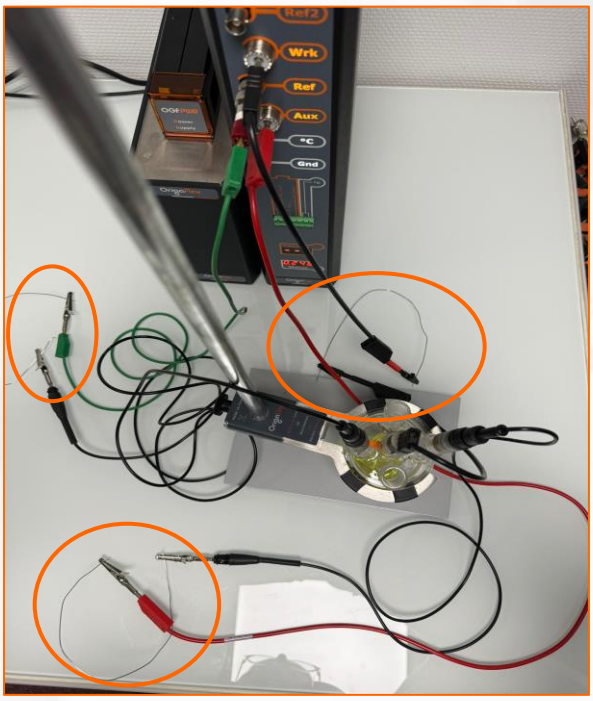


Figure 3: Unshielded connections used to create noisy results

PARAMETERS

In the first step, user should define the frequency of electricity power supply where the potentiostat is connected. It could be 50 Hz or 60 Hz (figure 4).

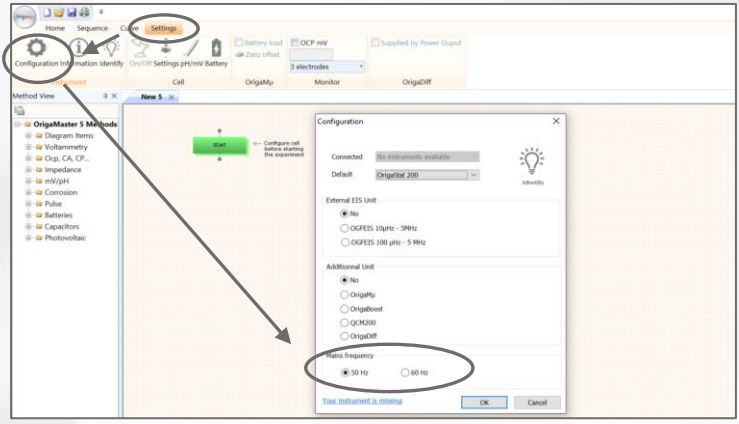


Figure 4: Set the parameters of "Rejection filter" in "Setting"

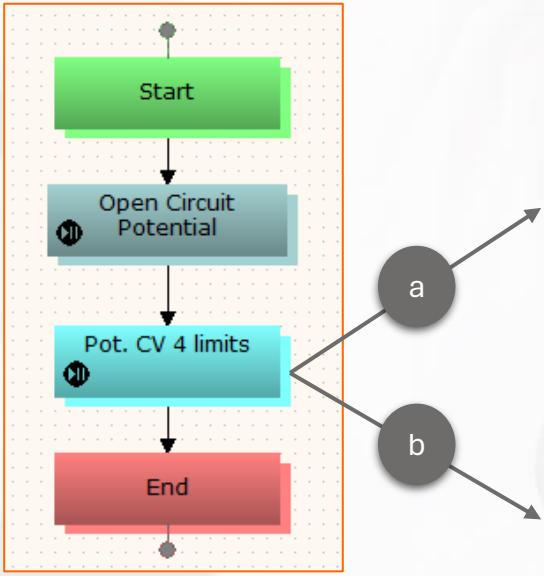
Then in the method, "Rejection 50 Hz (or 60 Hz)" will be appeared and must be defined as "Yes" as it is shown in figure 5.

Ohmic Drop Comp.	No
Maximum range	Auto
Minimum range	Auto
Analog Filter	Auto
Digital Filter	0
Cycle	2
Open circuit at end	Yes
Save points	Yes
Auxiliary input	No
Rejection 50 Hz	No
	Yes
	No

Figure 5: "Rejection filter" must be selected as "Yes"

PARAMETERS

Cyclic Voltammetry was run on the sample with and without "rejection filter". The parameters of the test are shown in figure 6.



Pot. CV 4 limits	
Initial (mV)	0, FREE
Vertex 1 (mV)	-400, REF
Vertex 2 (mV)	600, REF
Final (mV)	0, FREE
Scan rate (mV/sec.)	112.5, 0.02, 2.25
Sampling rate 1 point out of...	1
Cycle	2
Maximum current (mA)	500
Minimum current (mA)	-500
Ohmic Drop Comp.	No
Maximum range	Auto
Minimum range	Auto
Analog Filter	No
Digital Filter	0
Auxiliary input	No
Open circuit at end	Yes
Rejection 50 Hz	No

Pot. CV 4 limits	
Initial (mV)	0, FREE
Vertex 1 (mV)	-400, REF
Vertex 2 (mV)	600, REF
Final (mV)	0, FREE
Scan rate (mV/sec.)	112.5, 0.02, 2.25
Sampling rate 1 point out of...	1
Cycle	2
Maximum current (mA)	500
Minimum current (mA)	-500
Ohmic Drop Comp.	No
Maximum range	Auto
Minimum range	Auto
Digital Filter	0
Auxiliary input	No
Open circuit at end	Yes
Rejection 50 Hz	Yes

Figure 6: Parameters of cyclic voltammetry method: a) without "rejection filter"; b) with "rejection filter"

NOTE: OCP method is run before main electrochemical test to make sure that sample is stable.

PARAMETERS

In all voltammetry methods while user activate the "rejection filter" it is important to define the "step duration" correctly.

A) If the frequency of power supplier is 50 Hz and rejection filter is selected as 50 Hz respectively, it means each frequency of power supplier will tack 20 mS, so the step duration must be multiple of 20 mS to have the same harmony with the electricity power supply to be well filtered. For example, 40 mS, 120 mS, 40 mS, … (figure 7).

B) If the frequency of power supply is 60 Hz, means each frequency tacks 0.016666… , so the step duration must be multiple of this value.

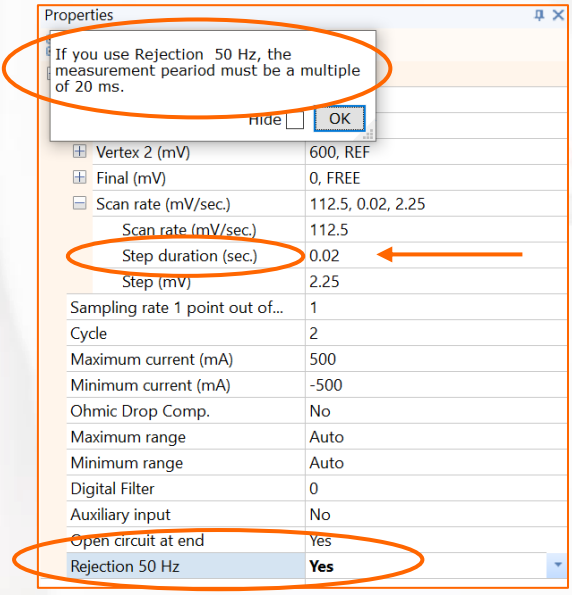


Figure 7: Step duration must be defined correctly regarding the frequency of power supply

RESULTS AND DISCUSSIONS

Figures 8 and 9 are related to cyclic voltammetry test on Ferri-Ferro Cyanide showing influence of using "rejection filter" on the results while using unshielded cables and alligator clamps .

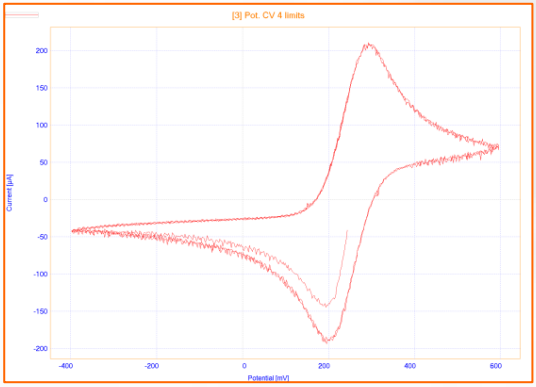


Figure 8: Cyclic voltammetry on Ferri-Ferro Cyanide solution without "rejection filter"

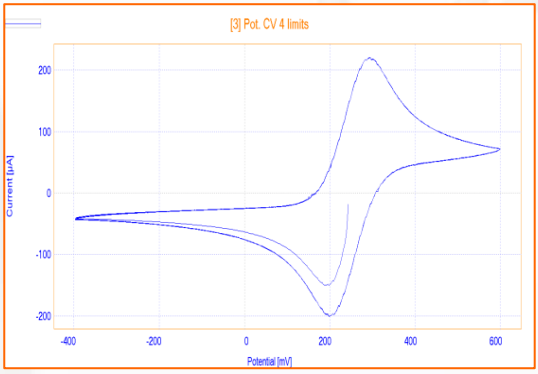


Figure 9: Cyclic voltammetry on Ferri-Ferro Cyanide solution with "rejection filter 50 Hz"

INSTRUMENT AND ELECTRODES

TEST SETUP	
Reference Electrode (REF)	Calomel Type: OGR003
Auxiliary Electrode (AUX)	Platinum wire Ø1mm Type: OGV005
Working Electrode (WRK)	Pt tip Ø2mm EMOGTPTD2CIAL
Electrolyte	Ferri-Ferro Cyanide 5 mM + 10 gr KCl
Instrument	OrigaFlex OGF^{+}01A
Software	OrigaMaster 2.5.0.4

REF
Calomel

AUX
Platinum wire Ø1 mm

WRK
Platinum Ø2 mm