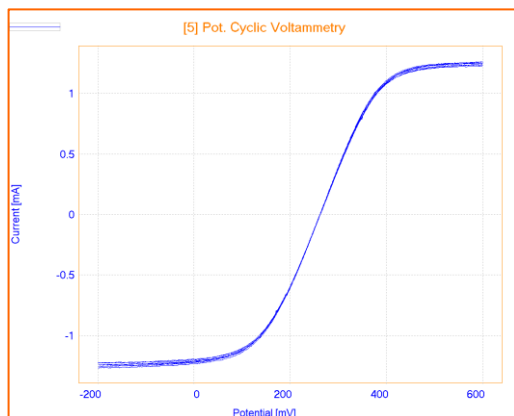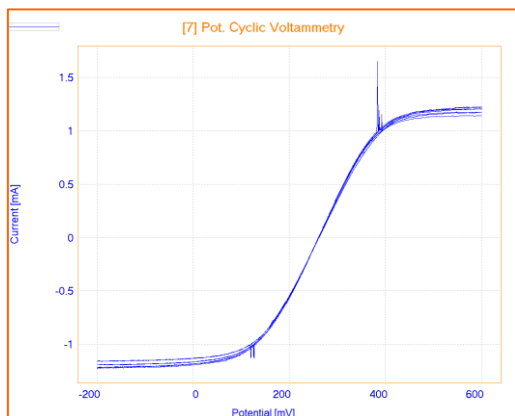## General Electrochemistry
AP-ORI08

"Auto ranging delay" and its influence on voltametric methods in low scan rates
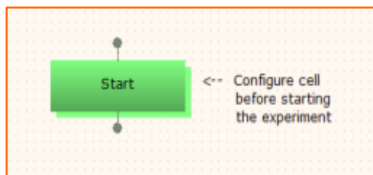

This Application Note describes a very important parameter in Start box of OrigaMaster software as "Auto ranging delay" and its influence during voltametric methods on the results and curves.
At the end, the user will understand how to define this parameter specially in low scan rates analysis.

Application Note

INTRODUCTION

The Start method is an essential box required as the first method of all OrigaMaster sequence.

The Start method gathers all initialisation settings necessary to run a sequence such as electrode configuration, current and voltage limitations. The initial values of variables are also entered here. One of these important variables is « Auto ranging delay ».

Figure 1: « Auto ranging delay » parameter available in start box

Definition and Application

This is a time based parameter for setting the time of automatic change of current range. This delay is only active from an upper current range to a lower current range.

For example when switching from the 1mA range to 10mA, the timer is started and enabled, then no turning back to the range 1mA is authorized until the end of the duration of the delay.

> **TIPS:** This functionality avoids continuous range changes when the current measurements are very noisy, especially when working in low scan rates. This is coming from chain measurement of instrument.

PARAMETERS

To better understand the application of this parameter, cyclic voltammetry test was performed in low scan rate (1 mV/sec.) in two ways by RDE electrode as working electrode.

1 In the first experiment the "Auto ranging delay" was defined as 200 msec.
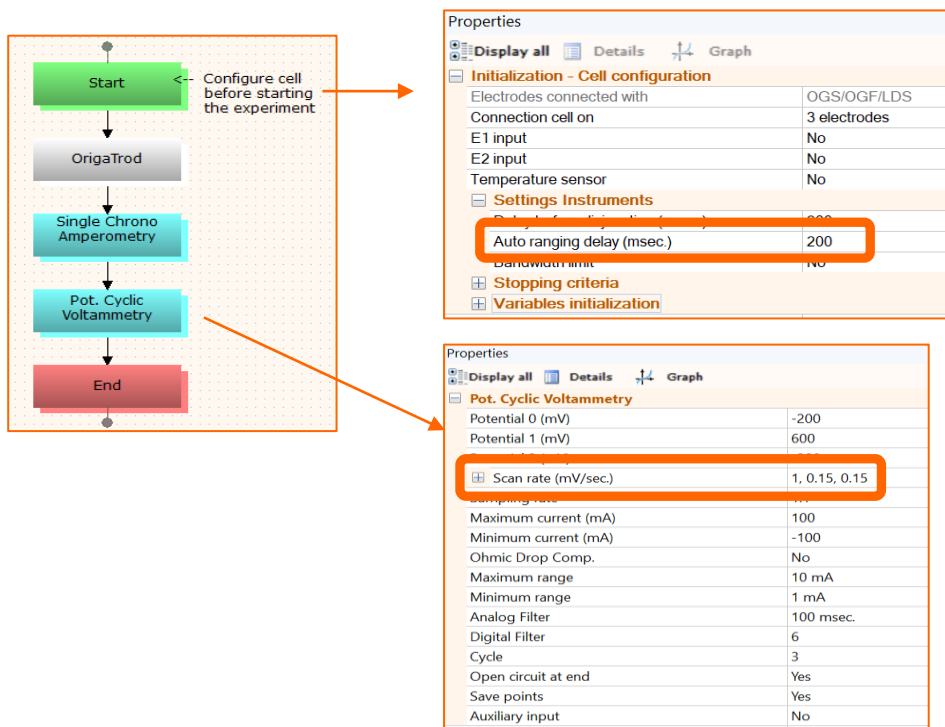

Figure 2: Parametres of the first Cyclic Voltammetry test

2 In the second test the duration of this parameter was defined longer as 20,000 msec.
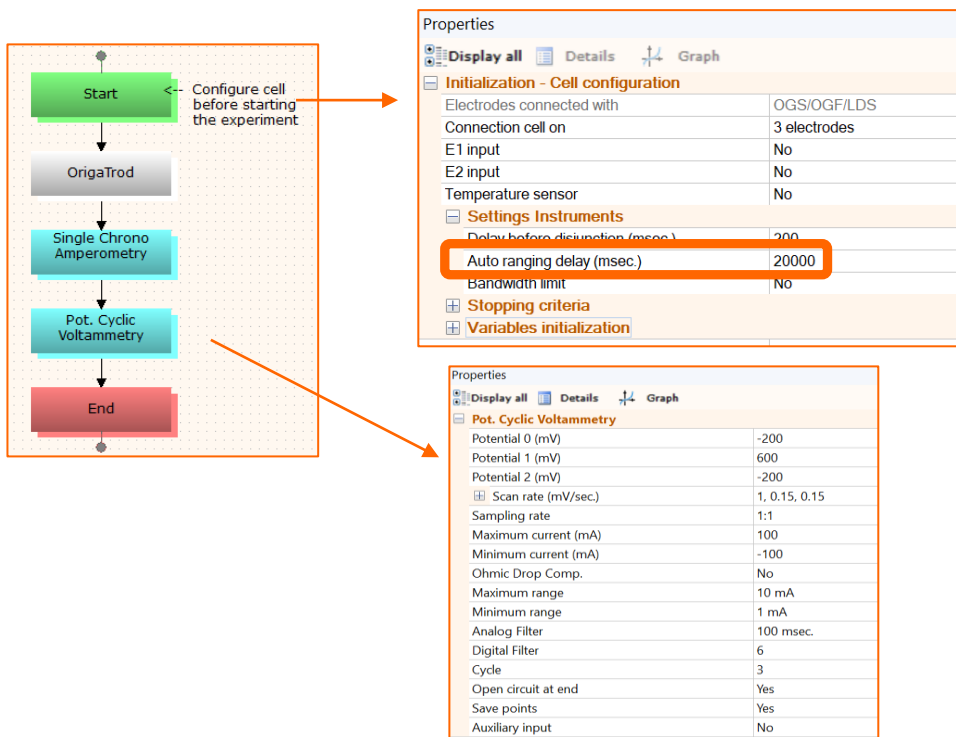

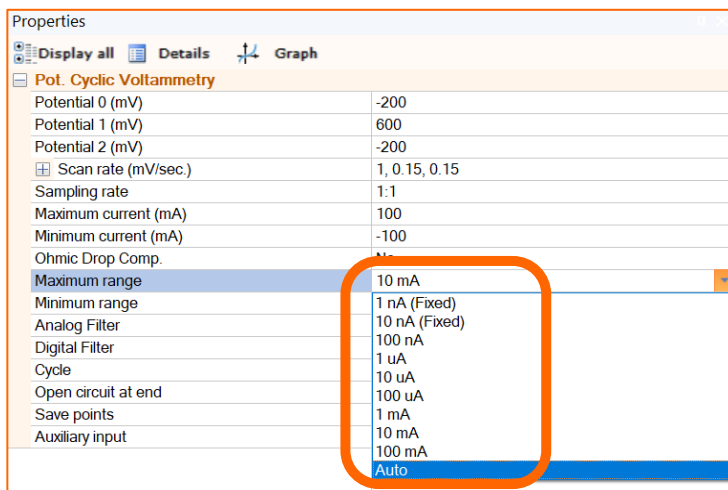Figure 3: Parametres of second Cyclic Voltammetry test

The parameters of the tests are shown in figure 2 and 3.

The speed rotation of RDE was 500 rpm in each test. Single Chrono Amperometry is used for stabilization of working electrode.

IMPORTANT NOTES

All two Cyclic Voltammetries were performed by OGS100. The current ranges in OGS100 is from 100 mA to 100 nA as show in figure 4.

Figure 4: OGS100 curent ranges

According to these current ranges, for example when the current passed the 1 mA the current range will change from 100 µA to 1 mA. In the low scan rates in the border of changing current range, more current fluctuation will be seen because the rate of sweeping potential is very long.

TIPS: If the « Auto ranging delay » duration is defined in a short way (like figure 2 = 200 msec.), then these fluctuations will be recorded like noise (figure 5).

RESULTS WITH 200 MSEC

1 mA and -1 mA, these are the current range change boundaries in OGS100. The scan rate is 1 mV/sec, during changing the current range, current fluctuations will be recorded as noise.
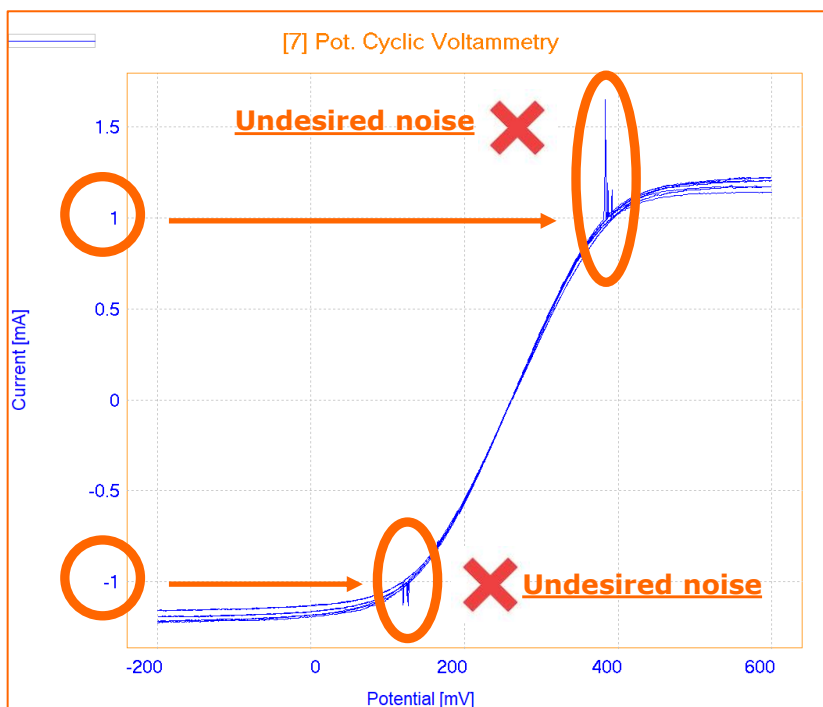

Figure 5: In this test « Auto ranging delay » duration is short as 200 msec.

NOTE: It must be noticed that the noise which is seen in low scan rates like what we see in Figure 5 is not coming from electrode or the sample. This noise is from the measuring system of current in instrument.

RESULTS WITH 20,000 MSEC

In the current range change boundry in low scan rates, during changing the current range, while the « Auto ranging delay » duration is defind longer like 20000 mSec, there will be enough time to have no fluctuation in measuring current when the current range is changed.
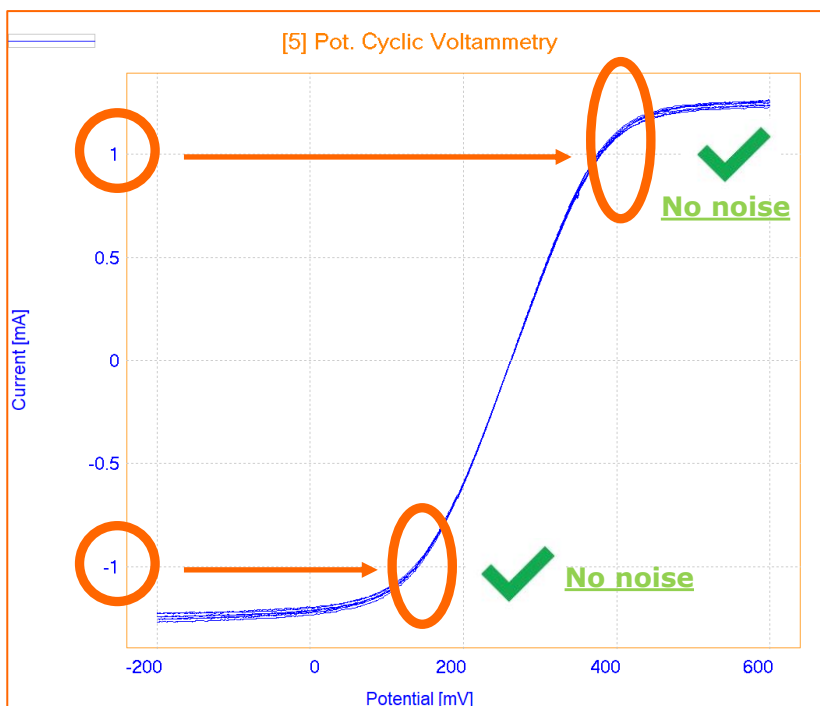

Figure 6: In this test « Auto ranging delay » duration is 20,000 msec.

NOTE: While the duration of "Auto ranging delay" increases from 200 msec to 20,000 msec, here the instrument and software have more time for recording the changing current ranges and measuring the current, so current fluctuations will not be recorded (Figure 6).

Figure 7: OrigaStat OGS100

Electrode setup

Reference Electrode (REF)	Calomel Type: OGR003
Counter Electrode (AUX)	Platinum wire Ø1mm Type: OGV005
Working Electrode (WRK)	Platinum Ø5mm Type: EMEDTPTD5 + OrigaTrod
Electrolyte	Ferri/Ferrate solution 5×10^{-2} M in KCl
Instrument	OrigaStat OGS100
Software	OrigaMaster

REF
Calomel

AUX
Platinum wire Ø1 mm

WRK
OrigaTrod
+ Platinum Ø5 mm