EIS Dummy Cell Test Procedure

Preparation

- ZIVE SP/MP electrochemical workstation
- EIS Dummy cell.

```
            ┌──────────┐
            │  3kOhm   │
  ┌───────┐ ├──────────┤
──│200Ohm │─┤          │──
  └───────┘ │   1uF    │
            └──────────┘
```
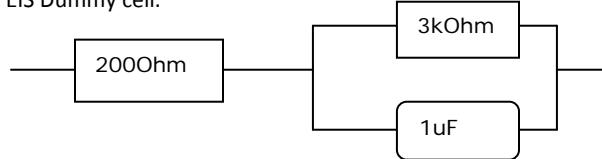
Cell Connection

Connect each cell lead terminal to connectors on EIS dummy cell.
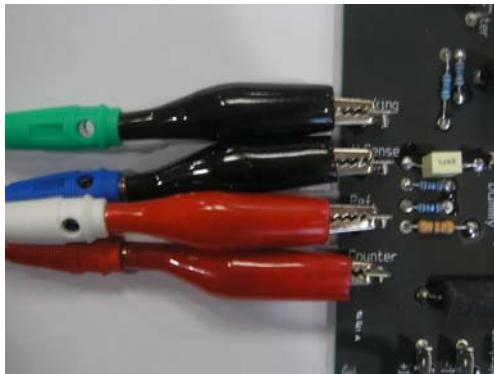
Working Electrode (Green lead)
Working Sense electrode(Blue lead)
Counter electrode (Red lead)
Reference Electrode (White lead)

Procedure

1. Turn the Power switch on the ZIVE SP/MP electrochemical workstation
2. Open the SM software by clicking the SM icon. The following progress box will appear, and will show the progress of checking instrument configuration and communication between ZIVE SP/MP electrochemical workstation and PC.

If the link is successfully connected, Click "OK" button on the box then the progress box will automatically disappear and SM software will appear. If the link failed, The following progress box will display then click the "Retry" button.

If the link failed again after clicking "Retry" button, you need to check USB cable connection.

3. Click Technique function icon (or select Technique function on Experiment menu)
   Then you can see the following menu
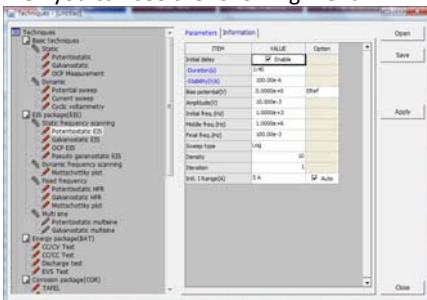
4. Select Potentiostatic EIS at left technique selection region. The parameter editing region is located at right.
   Input figure for parameter setting as the follows.

ITEM	VALUE	Option
Initial delay	☐ Enable	
-Duration(s)	1:40	
-Stability(V/s)	100.00e-6	
Bias potential(V)	0.0000e+0	ERef
Amplitude(V)	10.000e-3	
Initial freq.(Hz)	1.0000e+6	
Middle freq.(Hz)	1.0000e+6	
Final freq.(Hz)	100.00e-3	
Sweep type	Log	
Density	10	
Iteration	1	
Init. I Range(A)	5 A	☑ Auto

5. Click "Save" button to save the technique file which contains the above parameter and setting file name.
6. You can assign this technique file to channel(s) which you want by click "APPLY" button or select schedule file using file selection on "Single channel control/monitor" or "multi channel control/monitor"
   If you click "apply" button on technique menu, You can see the following channel selection menu.
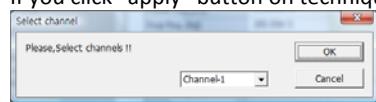
Select channel and click OK then this technique file will be assigned on the channel.
Click "Close" button or minimize technique window.

7. If you want control ZIVE SP/MP electrochemical workstation using "Single channel control/monitor", you can see following windows.


To start experiment, click Start button

If you want control ZIVE SP/MP multichannel, you can see the following window


To start experiment for specific channel, click Start button on the channel. If you want to start experiment for multiple channel,

click on Group column which you want to start and click Start button **at bottom side.**

8. After click start button, you can see the following box.
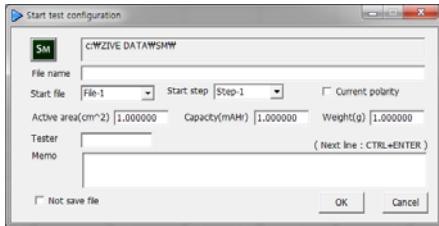
The data file name is automatically determined as default value but if you want to change data file folder then click icon

You can make new folder which you want to save.

◆ If you want use your file name, input your file name on "File name"

◆ If you did not make file name manually, new data folder which named as sequence file name or technique file name under data folder and it's subfolder will be created with name as date. The data file will be saved in this folder. The data file name will be determined automatically as string with sequence file name or technique file name and hour and minute and second, finally channel number will be added.

example) If you used sequence file for test and its file name is testabc.zsc and channel number is 1 and test date is 2000 year January 1st time is 15:30: 1 then the data file will be saved as

C:\Zive data\sm\data**testabc.zsc\2000010115\3001_01**.sdo (If data file have DC data only)

Or

C:\Zive data\sm\data**testabc.zsc\2000010115\3001_01**.sde (If data file have DC data and EIS data)

Or

C:\Zive data\sm\data**testabc.zsc\2000010115\3001_01**.seo (If data file have EIS data only)

e.g.) schedule file name with extension\yearmonthdayhour\minutesecond_channel number
If you input file name as "tommy" then
C:\Zive data\sm\data**testabc.zsc\2000010115\tommy3001_01**.sdo (sde,seo)

① Start Step: If your sequence file has several steps, you can select starting step.

② Start file: If batch file is loaded, select file number

③ Current polarity: If you want reverse polarity for measured current, check on this box.

④   Active area: For calculation of current density

⑤   Capacity: For C-rate value calculation

⑥   Weight: For specific capacity calculation

⑦   Tester: Operator name

⑧   Memo: Text information for test (For line change, use CTRL+ENTER)

➢   No Save file: If you click this check box, the data will NOT be saved.

If you are ready to test, click OK button then experiment will be started.

9. You can see real time plot as the following.

Real time EIS graph shows sub window at right upper side. This window display sine wave or E vs. I graph to check data quality. Default display is sine wave.
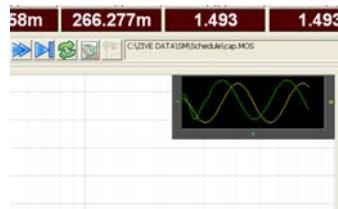
This shows two sine wave graphs. One is for current (green line) and the other is for voltage (Yellow line).

If you switch this graph to I vs E, double click on the graph then graph format will be changed.

When experiment done, the display will be changed as following.
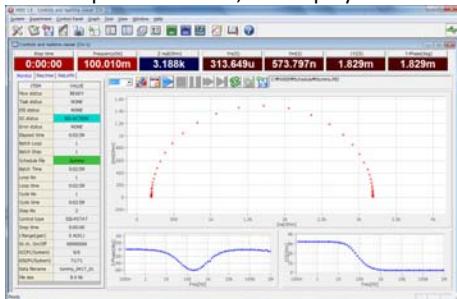
10. You can display graphic by clicking button ![EIS] on tool bar
    Click "Open data file" icon and select data file which you run the experiment.
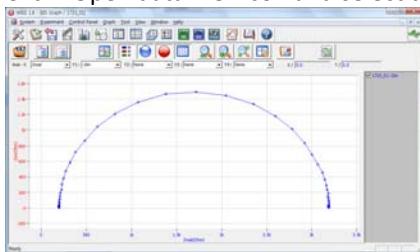
You can select Bode plot by clicking ![icon] icon or Nyquist plot by clicking ![icon] icon.
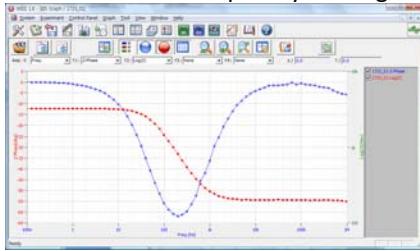
For user defined graphic, you can select X axis and Max 4 Y axis parameter as you wanted.
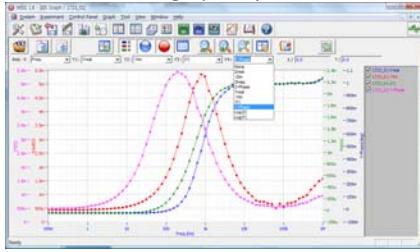
Data Analysis

1. Open "ZMAN" by clicking ZMAN icon. ZMAN program is located c:\program files\zivelab\zman2.2 folder.
2. You can see the following window.
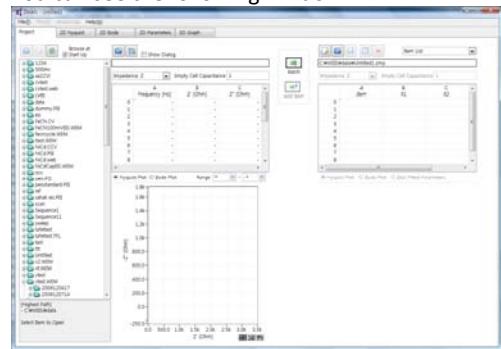
3. Click Right button of mouse
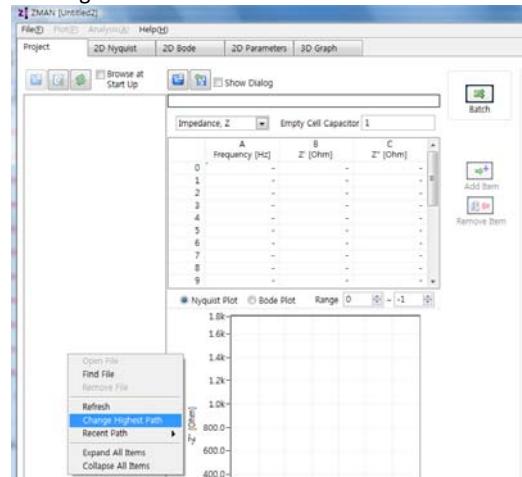
Select Change Highest Path and select the folder which contain zive data.

4. Select data file by double clicking
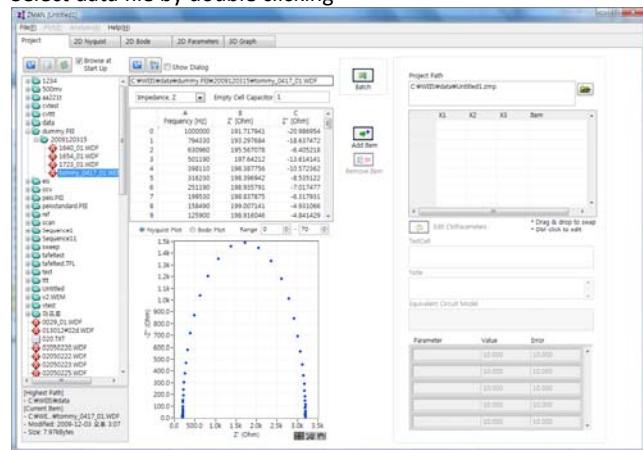
5. You can see Impedance,Admittance,Modulus,Dielectric Constant by selecting as the following
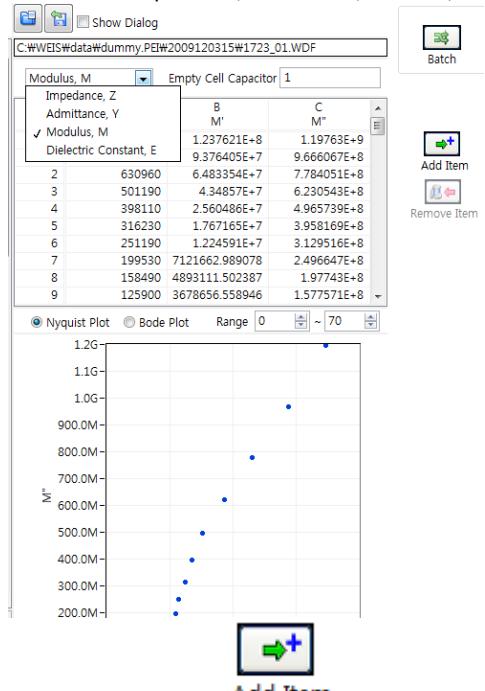
6. Click "Add item" icon **Add Item** then now you are ready to analysis data.
7. Click 2D nyquist plot
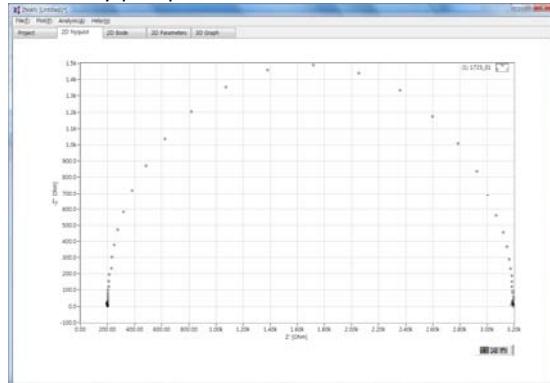
You can see "Echem style" by clicking right button of mouse and select "Echem style"
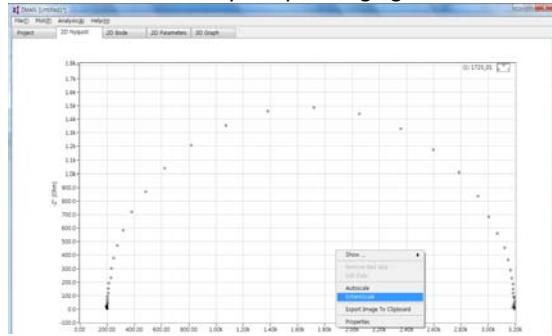
Echem style is X axis scale and Y axis scale on graph is same.
You can check each data value by selecting "cursor" with clicking right button of mouse.
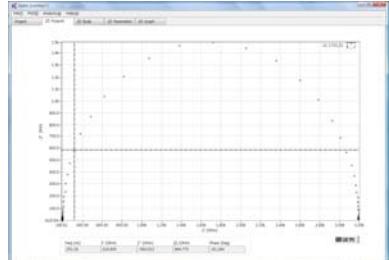

You can move the point by dragging the mouse.

8. Click 2D Bode
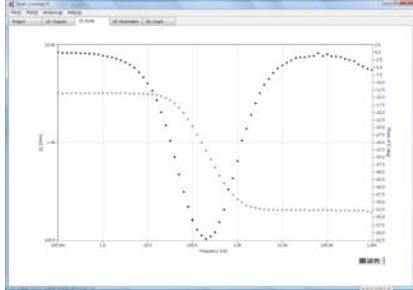
Anaysis

1. Circular fit
Select circular fit on Analysis
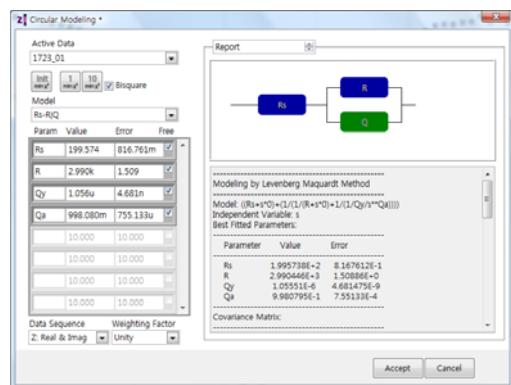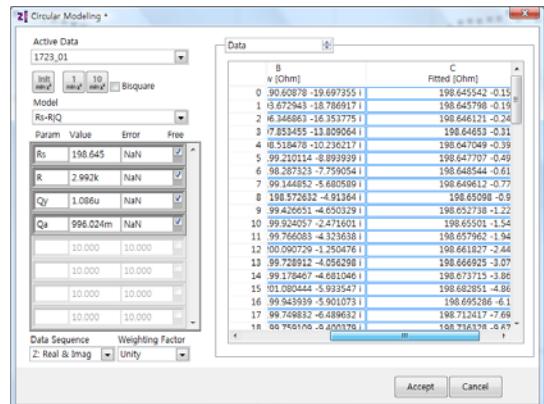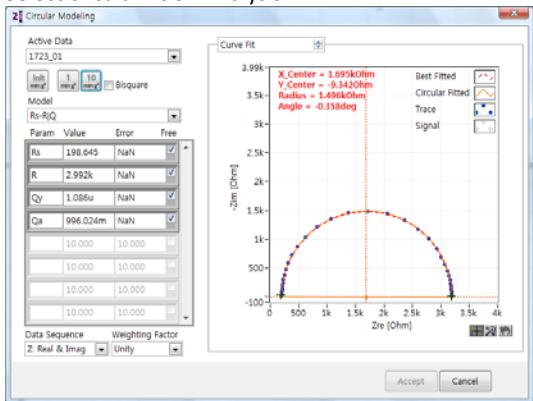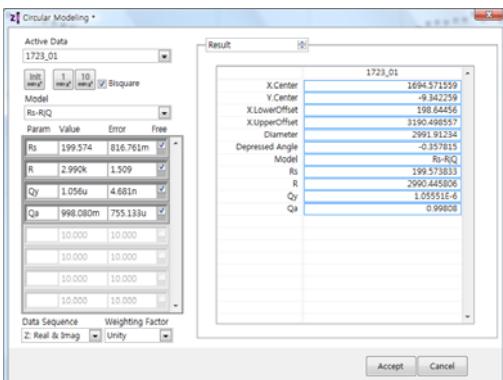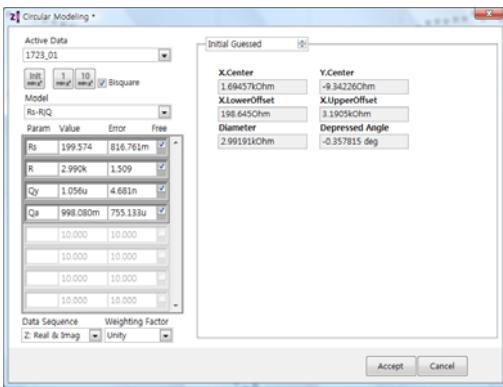
Click accept button if you want use this parameters

2. Select Modeling on Analysis
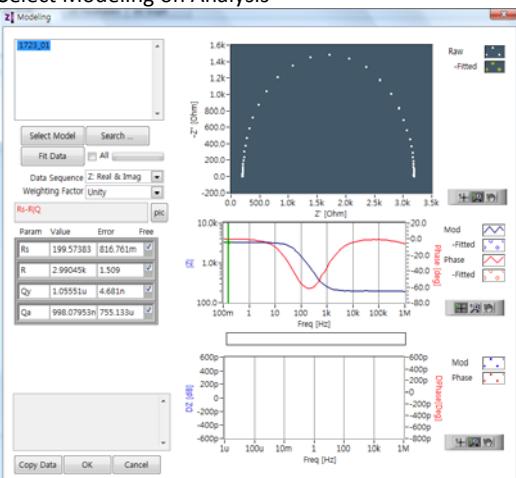
Click Fit data
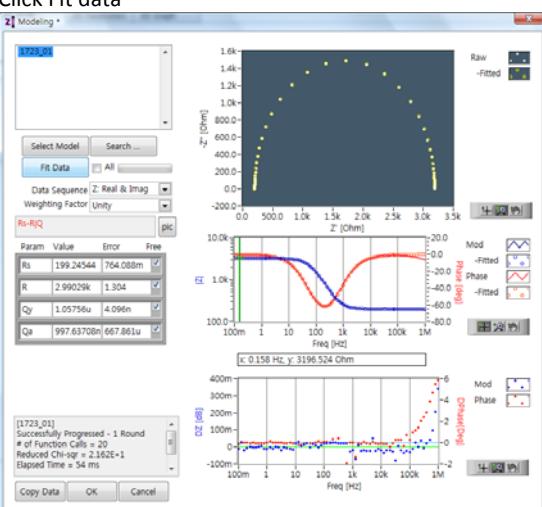
3. If you do not want use circular fitting result, click "Search" button then automatic model searching will proceed.

4. Subtract R:200Ohm