HIOKI

Instruction Manual

SLURRY ANALYTICAL SYSTEM

Check for the latest edition and other language versions.

EN

Aug. 2025 Edition 1
SA2634A961-00

Contents

Introduction

Thank you for choosing the Hioki Slurry Analytical System.
To ensure you get the most out of this product over the long term, please read this manual carefully and keep it available for future reference.

Request for product user registration

Register your product in order to receive important product information.
https://www.hioki.com/global/support/myhioki/registration/

Information on download site

For details on the product application, the update file for the instrument, and the instruction manual, please check Hioki's website:
https://cloud.gennect.net/dl

The following instruction manuals are provided with the system. Refer to these manuals according to your application.

Type	Details	Printed edition	Electronic edition (file name)
Slurry Analytical System Instruction Manual (this document)	Procedures for operating this system, using the Analytical Software	–	SA2634A961-xx.pdf
SA2634 Analytical Software Download Guide	Information on download site	✓	–
SA9001, SA9001-01 Electrode Cell Instruction Manual	Procedures for handling the Electrode Cell	✓	–
SA9002 Test Fixture Instruction Manual	Procedures for handling the Test Fixture	✓	–

Target audience

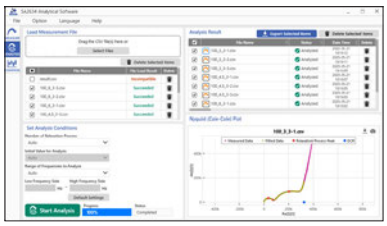
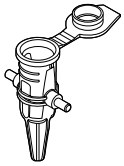
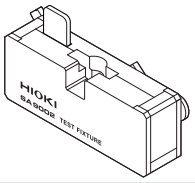
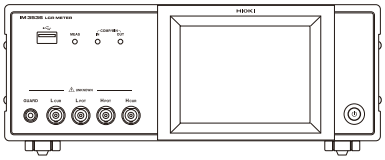
This manual has been written for use by individuals who use the product or provide information about how to use the product.
In explaining how to use the product, it assumes electrical knowledge (equivalent to the knowledge possessed by a graduate of an electrical program at a technical high school).

Trademarks

Microsoft Edge and Windows are trademarks of the Microsoft group of companies.

Product Configuration

The product configuration of the Slurry Analytical System is shown below.
SA9001 and SA9001-01 are hereafter listed as “SA9001.”

☐	SA2634 Analytical Software		p. 26
☐	SA9001/SA9001-01 Electrode Cell (50 pieces)		p. 22
☐	SA9002 Test Fixture		p. 21
☐	IM3536 LCR Meter		p. 19

Symbols and Abbreviations

Safety notations

This manual classifies the seriousness of risks and hazard levels as described below.

⚠DANGER	Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.
⚠WARNING	Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.
⚠CAUTION	Indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury or a potential risk of damage to the supported product (or to other property).
IMPORTANT	Provides important information and content necessary for operating or maintaining the product.
	Indicates prohibited actions.
	Indicates mandatory actions.

Symbols for various standards

CE	Indicates that the product complies with standards mandated by EU directives.

Others

*	Indicates that additional information is described below.
(p.)	Indicates the page number to reference.
START (Bold letters)	The names displayed in the user interface on the screen are indicated in bold or appear in brackets ([ ]).
[ ]	
Windows	Unless otherwise noted, the term Windows is used generically to refer to Windows 8.1, Windows 10, and Windows 11.

Accuracy labeling

The accuracy of the measuring instrument is expressed by defining limit values for errors as a percentage of the reading or a percentage of the full scale.

Reading (display value)	Indicates the value displayed on the measuring instrument. Limit values for reading errors are expressed as a percentage of the reading (% of reading or % rdg).
Full scale (measurement range value)	Indicates each measurement range's value. This is not a maximum display value. This system can display a measured value exceeding the measurement range. Limit values for full-scale errors are expressed as a percentage of the full scale (% of full scale or % f.s.).

Precautions for Use

Be sure to follow the precautions listed below in order to use the product safely and in a manner that allows it to function effectively.
Use of the product should conform not only to its specifications, but also to the specifications of all accessories, options, and other equipment in use.

Check before use

When you receive the product, inspect it to ensure that no damage occurred during shipment. If you discover any damage or find that the product does not perform as indicated in the specifications, please contact your authorized Hioki distributor or reseller.

⚠DANGER

■ **Do not use the device for measurements on any circuits that exceed the ratings or specifications of the device.**

Failure to follow this guidance could cause damage to the device or overheating, resulting in serious bodily injury.

⚠CAUTION

■ **Do not subject the product to vibration or mechanical shock while transporting or handling it.**

Failure to follow this guidance could damage the product.

■ **When disconnecting cables, disengage the lock and then pull out the BNC connector while gripping it at the connection (do not pull on the cable).**

Failure to follow this guidance could damage the BNC connector.

Installing the system

Installation environment

⚠WARNING

Do not use the device in locations such as the following:

- **Where it would be subject to direct sunlight or high temperatures**
- **Where it would be exposed to corrosive or explosive gases**
- **Where it would be exposed to powerful electromagnetic radiation or close to objects carrying an electric charge**
- **Where it would be close to an inductive heating device (such as high-frequency inductive heating devices and IH cooktops)**
- **Where it would be subject to a large amount of mechanical vibration**
- **Where it would be exposed to water, oil, chemicals, or solvents**
- **Where it would be exposed to high humidity or condensation**
- **Where it would be exposed to an excessive amount of dust**
- **Where it would be unstable or inclined**

Failure to follow this guidance could damage the device or cause it to malfunction, resulting in bodily injury.

When installing the IM3536 LCR Meter, refer to the IM3536 Instruction Manual.

Warranty

When the customer incorporates this system into another system or resells the system, Hioki is not responsible for incidental or consequential damage experienced by the customer.

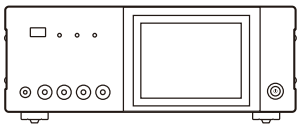
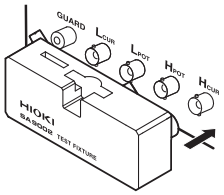
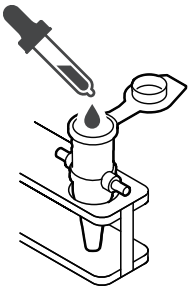
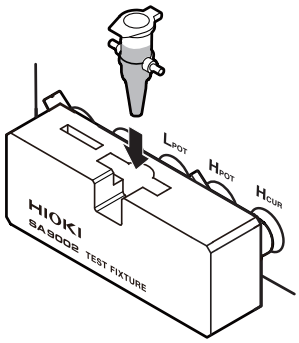
Handling the IM3536

The IM3536 LCR Meter is classified as a Class A device under the EN 61326 standard.
Use of the instrument in a residential setting such as a neighborhood could interfere with reception of radio and television broadcasts.
If you encounter this issue, take steps as appropriate to address it.

Measurement Procedure

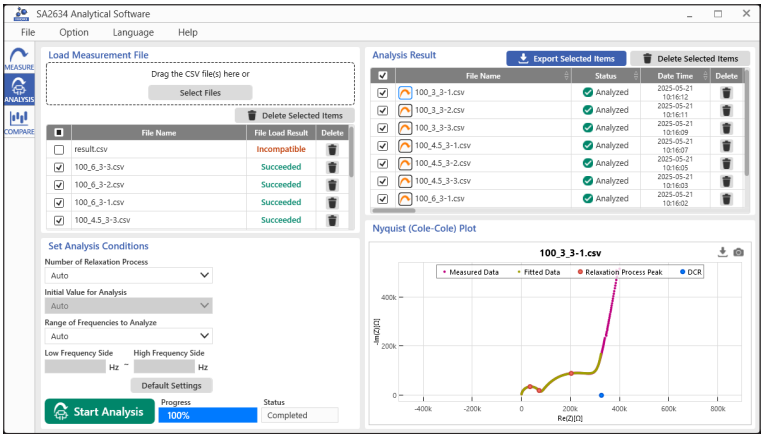
Before using the system, be sure to refer to “Precautions for Use” (p. 8).

Measurement

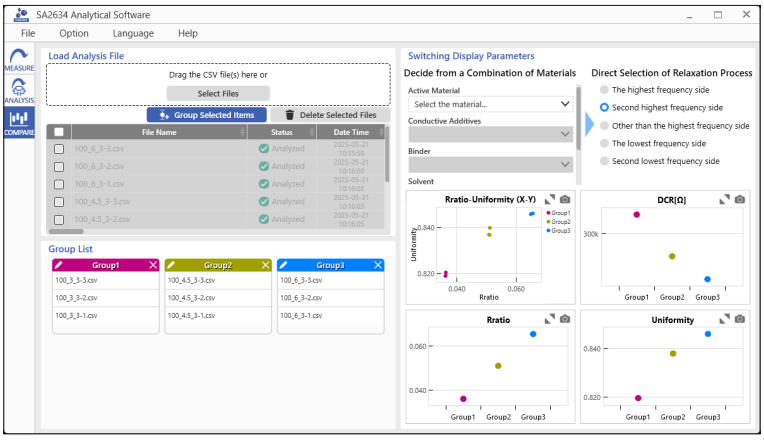
1	Prepare the Hioki IM3536 LCR Meter (p. 19). (For details, refer to the IM3536 Instruction Manual.)	
2	Perform a startup check (p. 25).	
3	Install the SA2634 Analytical Software on the computer (p. 26).	
4	Connect the IM3536 and computer (p. 30).	
5	Attach the SA9002 Test Fixture to the IM3536 (p. 31).	
6	Turn on the IM3536.	
7	Insert the USB license key into the computer and authenticate the license.	
8	(As needed) Correct any errors using the SA2634 Analytical Software (p. 37).	
9	Put liquid to be measured into the SA9001 Electrode Cell (p. 41).	
10	Place the SA9001 Electrode Cell on the SA9002 Test Fixture (p. 43).	
11	Measure the slurry impedance (p. 44).	
12	The measurement data is saved in CSV format.	

To Analysis (p. 11)

Analysis

1	Select the measurement data to analyze (p. 47).
2	Set the analysis conditions and execute analysis (p. 49).
	
3	Save the analysis results in CSV format (p. 52).

Comparison

1	Select the analysis results data to compare (p. 58).
2	Create a group (p. 59).
3	Switch the display parameters (p. 61).
4	Compare the analysis results graph by group (p. 63).
	

1 Overview

1.1 Overview and Features

The Slurry Analytical System is a system which outputs three quantitative indexes that define the conductivity of slurries.
In the development of slurries, differences in the material compositions and manufacturing conditions can be compared based on these indexes.

New indexes for LIB electrode slurries (“Three quantitative indexes” are output.)

The Slurry Analytical System analyzes the electrical properties of a slurry in terms of an equivalent circuit.
The SA2634 Analytical Software calculates the three following quantitative indexes:

Index	Details
Direct current resistance (DCR)	Sum of resistance components in an equivalent circuit with slurry electrical properties
Resistance ratio (Rratio)	Ratio of resistance components of the conductive material in DCR
Uniformity (Uniformity)	Distribution of relaxation by a conductive material

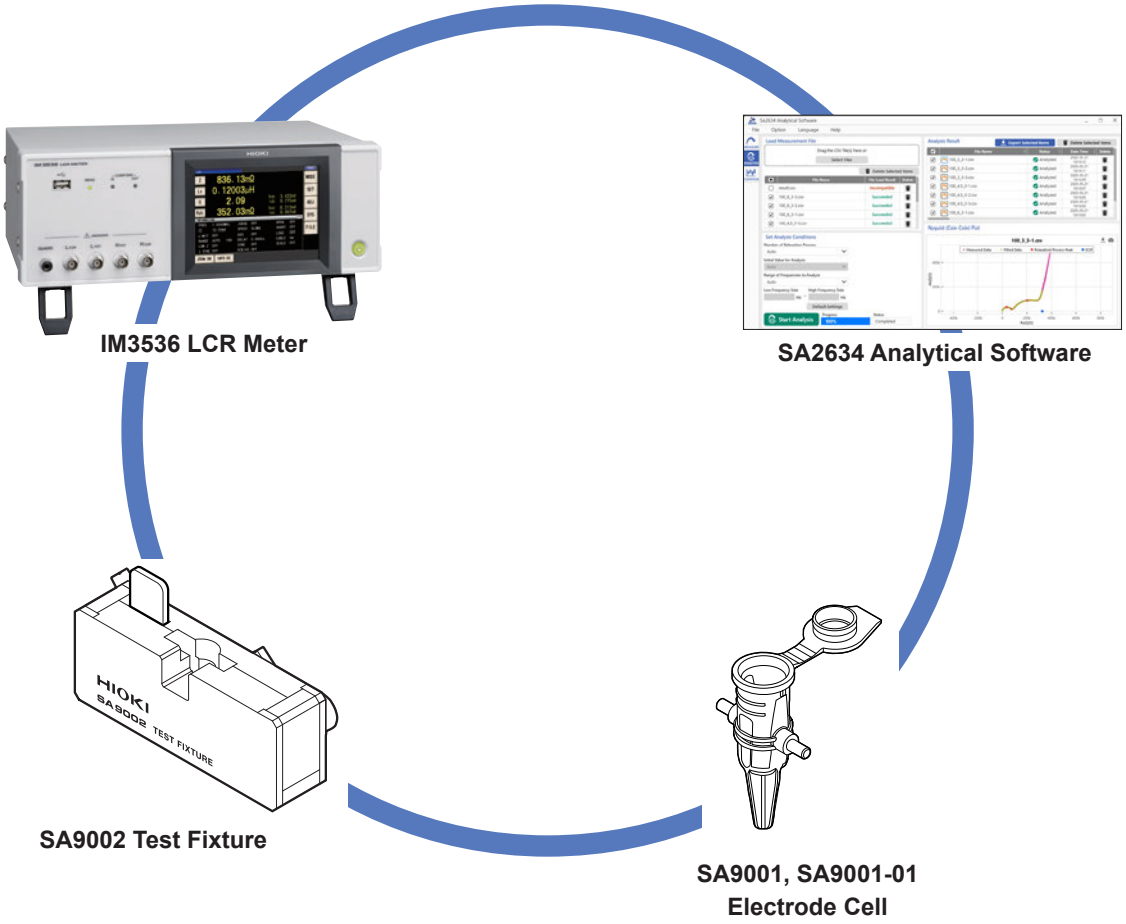
Simple, easy measurement of slurry impedance

The impedance of slurry can be measured using the IM3536 LCR Meter, SA2634 Analytical Software, SA9001 Electrode Cell, and SA9002 Test Fixture.

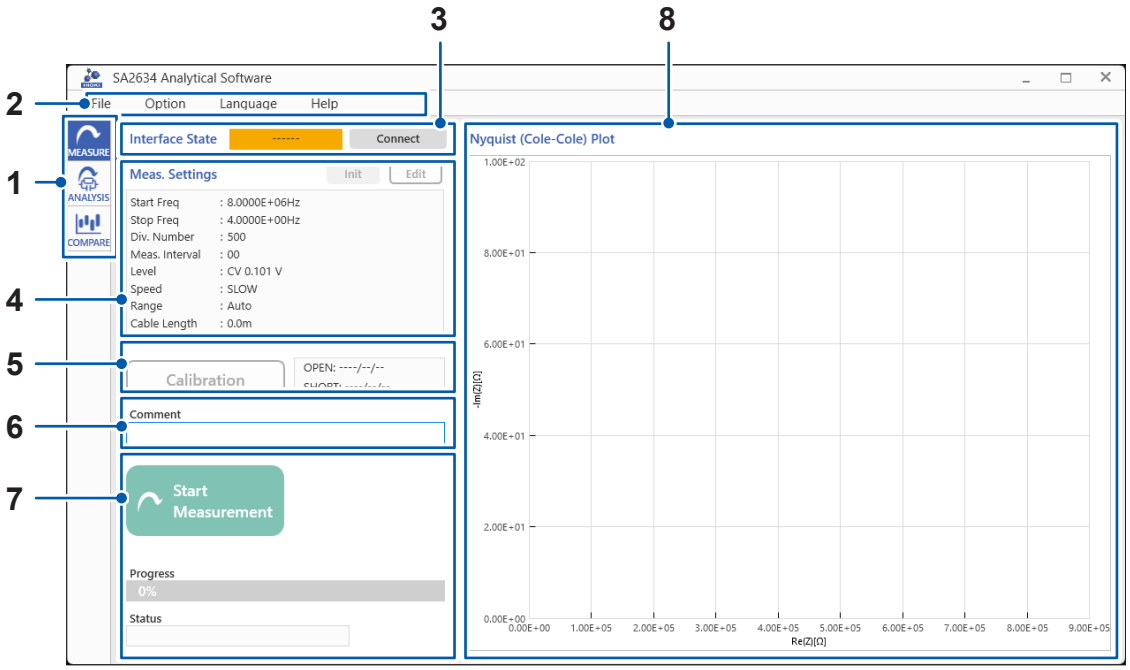
- You can measure the frequency range required to observe the relaxation process of slurry using the IM3536.
- The SA2634 Analytical Software seamlessly performs impedance measurement, analysis, and comparison of the measurement results.
- With the SA9001, which performs measurement with a slurry of approximately 1 mL, you can increase the number of samples even if the amount of slurry is small.
- The SA9001 can be attached to and detached from the SA9002 with a single action.

1.2 Part Names and Functions

Slurry Analytical System

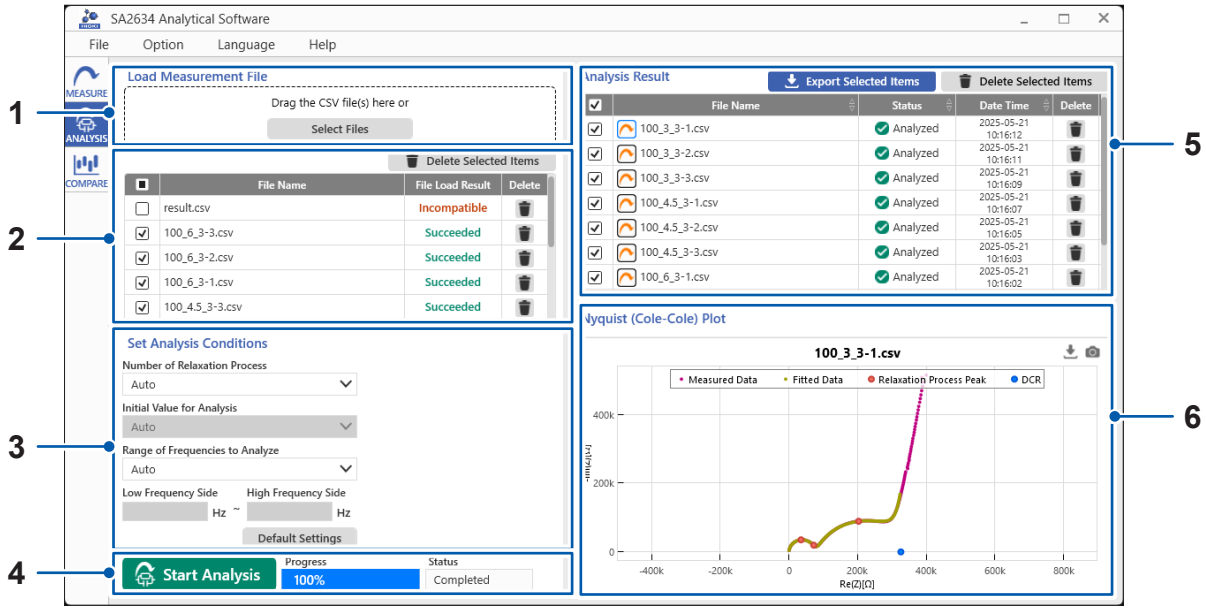


Measurement Screen



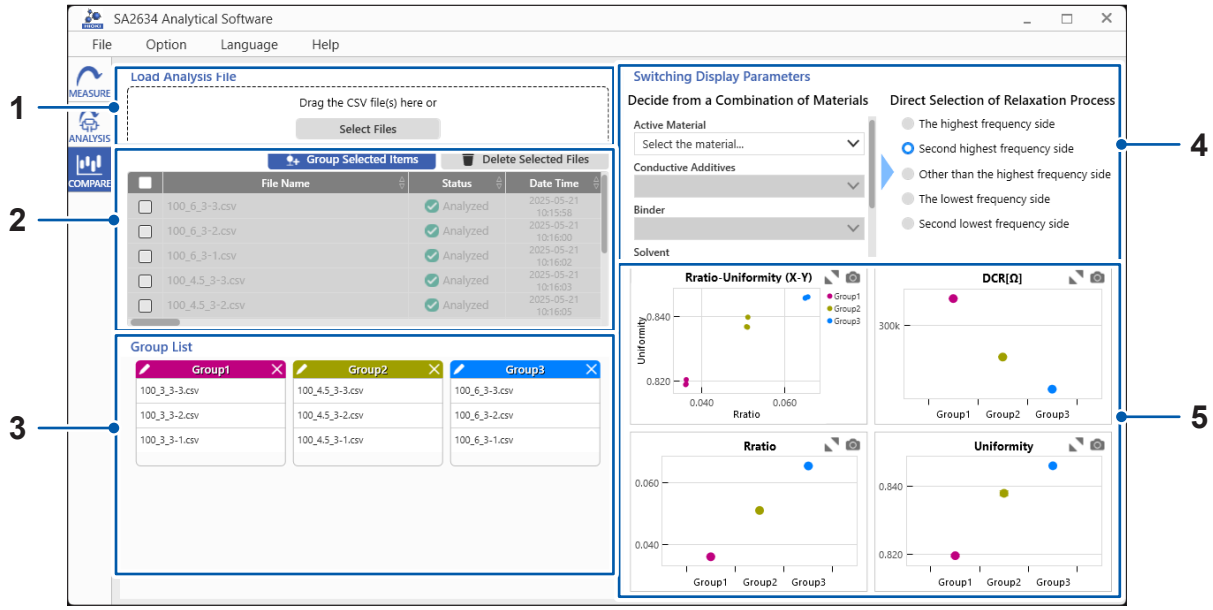
No.	Item name	Details
1	Screen change	These buttons change the display to the measurement screen, analysis screen, and analysis results comparison screen.
2	Menu	Displays the menu selections.
3	Instrument connection status	Displays the connection status of the LCR Meter. Click **[Connect]** to connect the LCR Meter.
4	Measurement settings display	Displays the measurement settings that were set on the measurement settings screen. Click **[Edit]** to display the measurement settings screen. **[Edit]** cannot be pressed if the LCR Meter is not connected.
5	Calibration information	Displays the calibration information. Click **[Calibration]** to launch the calibration screen. **[Calibration]** cannot be pressed if the LCR Meter is not connected.
6	Comment	Enter or display comment information.
7	Measurement status	Click **[Start Measurement]** to start measurement. Click **[Abort]** to stop measurement. **[Progress]** is displayed in the progress bar. The progress rate is indicated as Current measurement count/Total measurement count. The current status is displayed in **[Status]**.
8	Measurement results	Displays the measured values in a Nyquist plot.

Analysis Screen

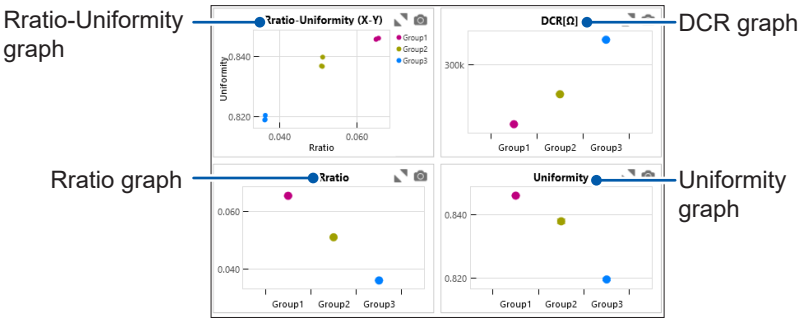


No.	Item name	Details
1	Load measurement results	Drag & drop a measurement result CSV file to register it. Click **[Select Files]** to display the file selection screen and select measurement result CSV files.
2	Measurement results data list	Displays a list of the registered measurement result CSV files. Click **[Delete Selected Items]** to delete the measurement results data with selected check boxes from the list. The list columns are as follows.
	File Name	Name of the measurement result CSV file
	File Load Result	Results from loading measurement result CSV files **[Succeeded]**: Loading was successful. **[Incompatible]**: Loading failed.
	Delete	Click to delete the target row of measurement results data from the list.
3	Set Analysis Conditions	Set the analysis conditions.
4	Analysis status	Displays the analysis status. Click **[Start Analysis]** to start analysis using the specified analysis conditions. **[Progress]** displays the analysis progress. **[Status]** displays the following analysis status. **[Completed]**: Analysis was successful. **[E XXX (XXX is the error number)]**: Analysis error Refer to the analysis error codes in “Troubleshooting” (p. 90).
5	Analysis results data list	Displays a list of the executed analysis results.
6	Fitting results	Displays a Nyquist plot of the analysis results data. **[Measured Data]**: Displays the actual waveform. **[Fitted Data]**: Displays the fitted waveform. **[Relaxation Process Peak]**: Displays the relaxation process peak. **[DCR]**: Displays the DCR.

Analysis Results Comparison Screen



No.	Item name	Details
1	Load analysis results	Drag & drop an analysis result CSV file to register it. Click **[Select Files]** to display the file selection screen and select analysis result CSV files.
2	Analysis results data list	Displays a list of the executed analysis results.
	Group Selected Items	Forms the selected data into a group. The data which is included in the group can no longer be selected.
	Delete Selected Files	Deletes all selected data.
3	Group list	This is a list of the groups that have collected analysis results data. Group name Group data list Group1 100_6_3-3.csv 100_6_3-2.csv 100_6_3-1.csv
	Group name	Title of the group name. Double-click or click (pen icon) to edit the group name. Click (cancel group) to cancel the group.
	Group data list	Displays a list of measurement result file names for the analysis results data contained in the group.
4	Graph display conditions	Directly select a material combination or relaxation process, and decide the index to display in the graph.

No.	Item name	Details
5	Graph display	Displays a graph of the analysis results data, divided by group. The DCR graph, Rratio graph, and Uniformity graph plot the average and an error bar (±deviation) for each grouping. 
	Rratio-Uniformity graph	Graph with Rratio on the X axis and Uniformity on the Y axis
	DCR graph	Graph of DCR (Ω)
	Rratio graph	Graph of Rratio
	Uniformity graph	Graph of Uniformity

IM3536 LCR Meter

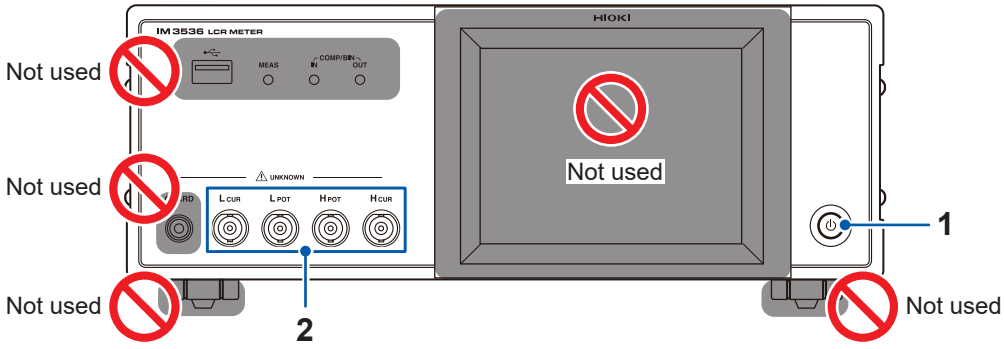
For details, refer to the IM3536 Instruction Manual.

⚠CAUTION

■ **Use the IM3536 LCR Meter without using the stand.**

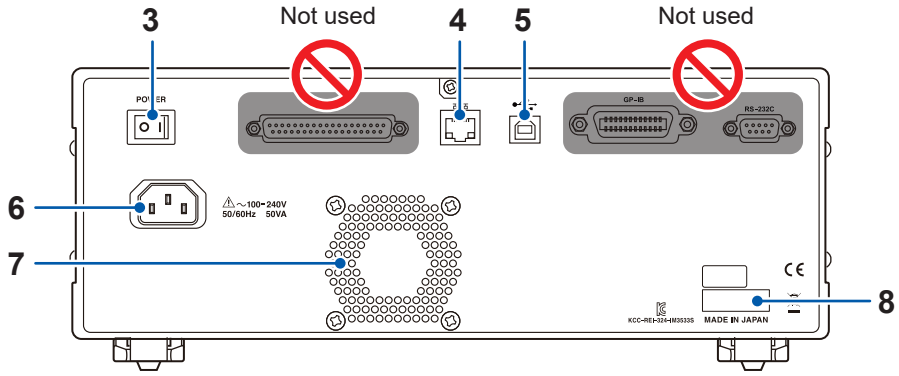
Otherwise, the liquid surface of the SA9001 Electrode Cell tilts and the measured value may be affected.

Front



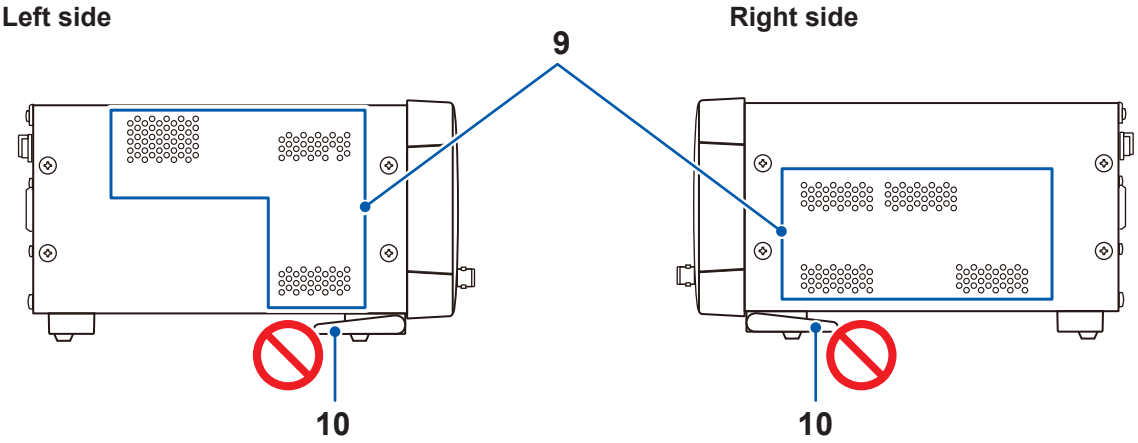
No.	Name	Function
1	Start button	Turns on/off the power with the main power on. (The main power switch is located on the rear side.)
2	Measurement terminals	Mounts the SA9002 Test Fixture. (p. 31)
		• L_{CUR} terminal Current detection terminal • L_{POT} terminal Low-side voltage detection terminal • H_{POT} terminal High-side voltage detection terminal • H_{CUR} terminal Current generation terminal

Rear



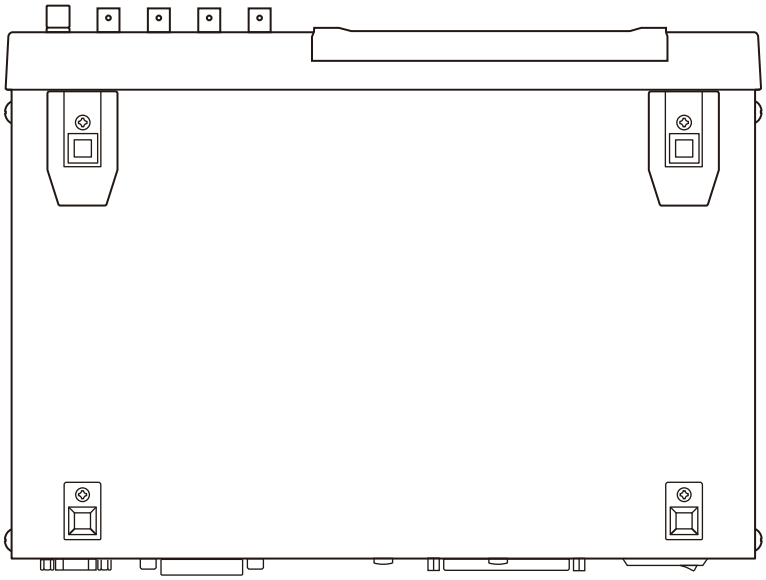
No.	Name	Function
3	Main power switch	Turns on/off the power.
4	LAN connector	A LAN cable is connected.
5	USB connector	A USB cable is connected.
6	Power supply inlet	The power cord is connected.
7	Vent	Ventilation hole to prevent the internal instrument temperature from becoming too high. Do not block or insert any foreign materials into the vent.
8	Serial number	For the latest information, check Hioki's website. Do not remove this sticker because the number is required for product tracking.

Side



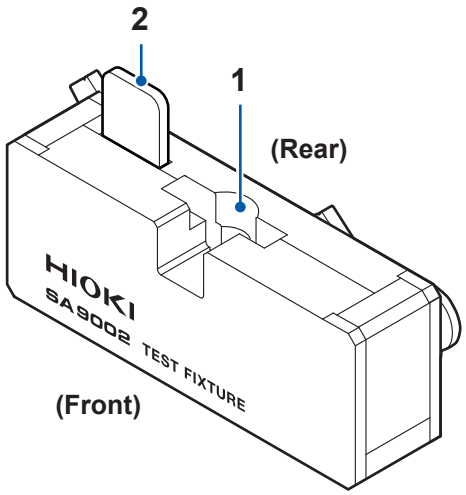
No.	Name	Function
9	Vent	Ventilation hole to prevent the internal instrument temperature from becoming too high. Do not block the vent or insert any foreign materials into it.
10	Stand	Do not set up the stand as the liquid surface of the SA9001 Electrode Cell tilts.

Bottom

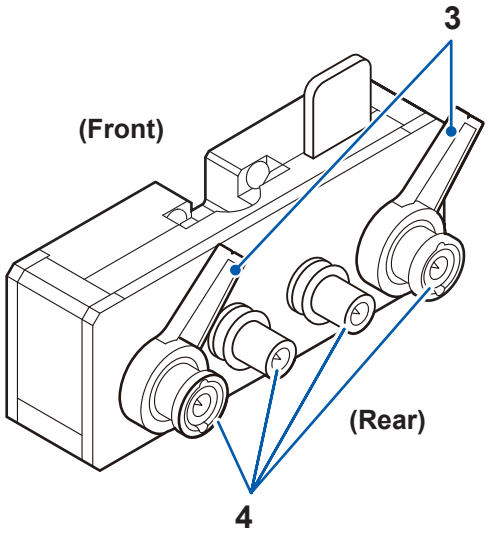


The IM3536 can be mounted on a rack.
See “Appx. Attaching Rack-mounting Hardware to the Instrument” in the IM3536 Instruction Manual.

SA9002 Test Fixture

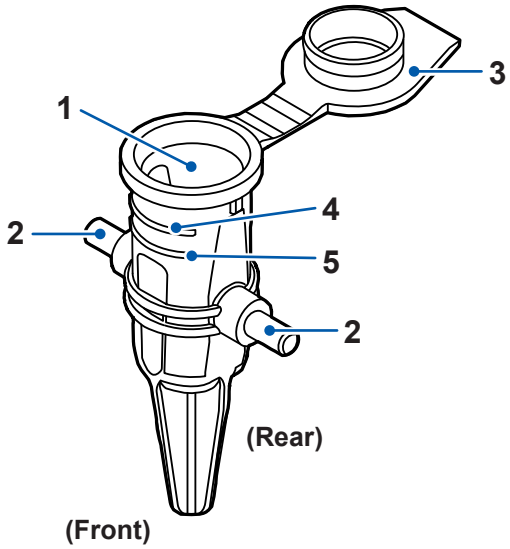


No.	Name	Function
1	SA9001 mounting part	Used to mount the SA9001 Electrode Cell.
2	Shorting plate for compensation	Used to perform short compensation.



No.	Name	Function
3	Lever	Used to fix the SA9002 Test Fixture to the IM3536.
4	Connection terminal	Used to connect the Test Fixture to the measurement terminals of the IM3536.

SA9001/SA9001-01 Electrode Cell



No.	Name	Function
1	Cell	Holds the liquid to be measured.
2	Electrodes	Connect the SA9002 Test Fixture to the liquid to be measured.
3	Lid	Close the lid when performing measurement.
4	Liquid-level upper-limit line	Put the liquid to be measured into the cell so it is below this line. If too much liquid is poured into the cell, it will overflow when the lid is closed.
5	Liquid-level lower-limit line	Put the liquid to be measured into the cell so it is above this line.

IMPORTANT

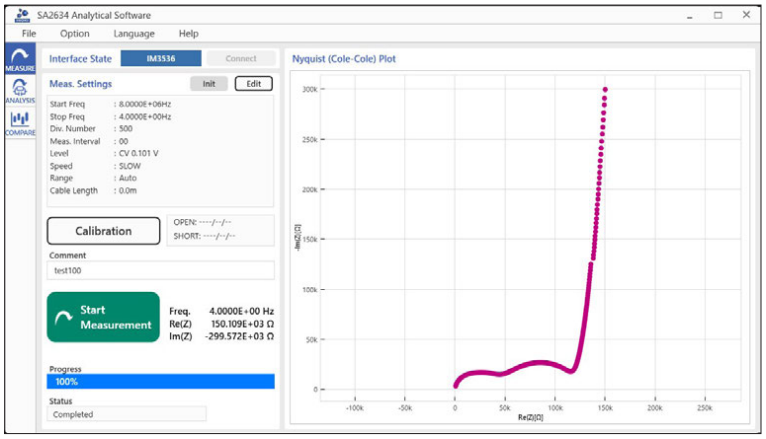
Do not reuse the SA9001 Electrode Cell.

If there is any measured liquid left inside the Electrode Cell, subsequent measurements may be affected.

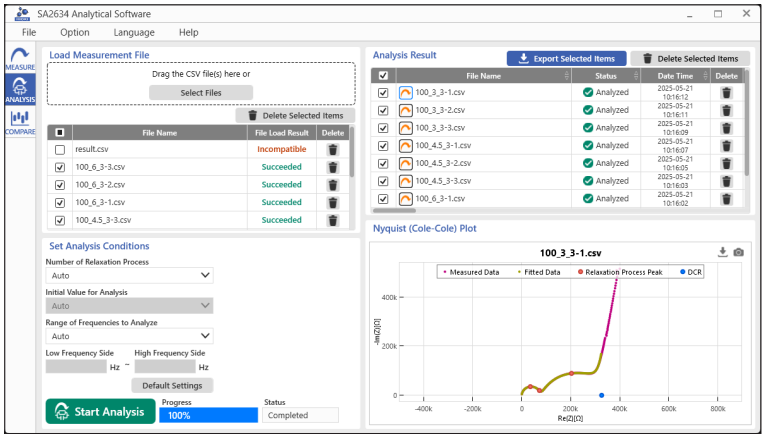
Cleaning the used Electrode Cell causes the pins to be scratched or shifted and subsequent measurements may be affected.

1.3 SA2634 Analytical Software

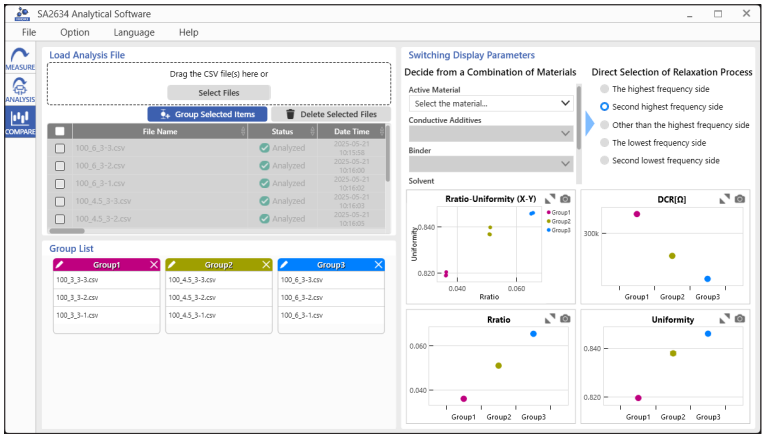
The SA2634 Analytical Software is used to measure, analyze, and compare slurry impedance data.
See “3.1 Starting Up the SA2634 Analytical Software” (p. 33).



Measurement screen



Analysis screen



Analysis results comparison screen

2 Preparations Prior to Acquiring Data for Impedance

2.1 Performing a Startup Check

To use the system properly, verify that it operates normally to ensure that no damage occurred during storage or shipping.

⚠DANGER

■ **Inspect the product and verify proper operation before use.**

Use of the product while malfunctioning could result in serious bodily injury.
If you find any damage, contact your authorized Hioki distributor or reseller.

Check item	Action
The coating of the power cords is not ripped or torn, and no metal parts are exposed.	If the power cord is damaged, there is a risk of electric shock and short circuit accidents. Do not use the system. Please contact your authorized Hioki distributor or reseller.
The coating of the cables is not ripped or torn, and no metal parts are exposed.	If the cables are damaged, the measured values may become unstable or have errors. Replace with cables that are not damaged.
The IM3536 is not damaged.	If the IM3536 is damaged, please contact your authorized Hioki distributor or reseller.
When the IM3536 is turned on, the opening screen (model and version) is displayed.	If the opening screen is not displayed, the power cord may be disconnected or inside the IM3536 may be damaged. Request repair.
No error is displayed on the opening screen.	When the error (Err) is displayed, inside the IM3536 may be damaged. Request repair.

2.2 Installing the SA2634 Analytical Software

Checks and Precautions for Installation

⚠CAUTION

■ **Do not connect the IM3536 LCR Meter and computer until the SA2634 Analytical Software installation is completed.**

Otherwise, the SA2634 Analytical Software may not be installed properly.

Required system configuration (recommended)

RAM	8 GB or more	
Storage	1 GB or more of available space	
Display	Recommended resolution: 1920 × 1080 or higher	
Interface	USB 2.0 or 3.0, LAN	
OS	Windows 10	(32-bit/64-bit)
	Windows 11	(64-bit)

Installation Procedure

Install all of the following software on the computer.

- Microsoft .NET Framework 4.7.2 or newer
- SA2634 Analytical Software

Installing Microsoft .NET Framework 4.7.2

Download Microsoft .NET Framework Runtime from the Microsoft website (URL below) and install it on the computer.

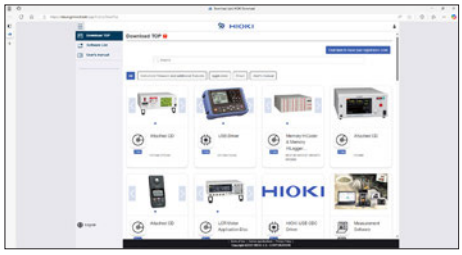
If Microsoft .NET Framework 4.7.2 is already installed on your computer, proceed to the procedure under “Installing the SA2634 Analytical Software” (p. 27).

https://dotnet.microsoft.com/download/dotnet-framework/net472

For the installation procedure for Microsoft .NET Framework 4.7.2, see the Microsoft website.

Installing the SA2634 Analytical Software

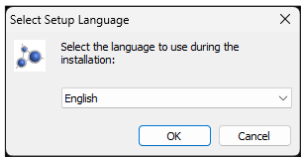
1 **Log into the computer as an administrator.**
Do not start up other applications.



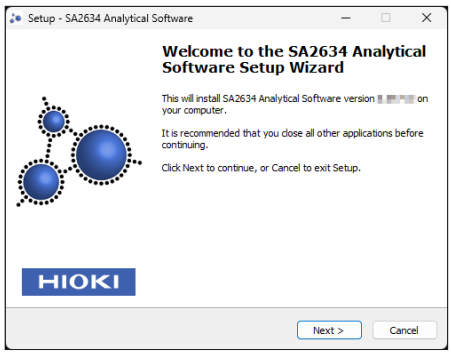
2 **Go to the Hioki download site (https://cloud.gennect.net/dl) and search for “SA2634.”**

3 **Download “setup_SA2634 ANALYTICAL SOFTWARE_V.zip” (the letter V represents the version number).**

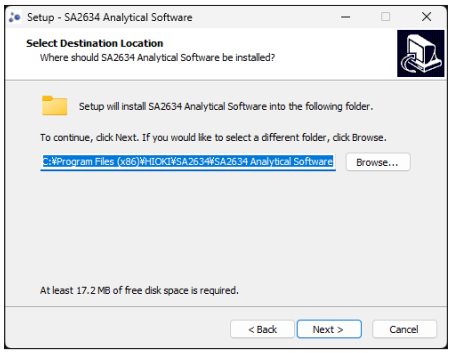
4 **Extract the downloaded zip file and double-click to execute “setup_SA2634 ANALYTICAL SOFTWARE_V.exe” (the letter V represents the version number).**



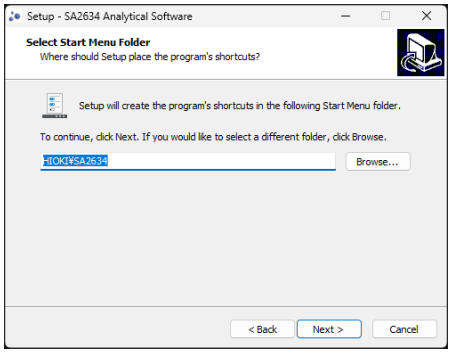
5 **Select the language and click [OK].**



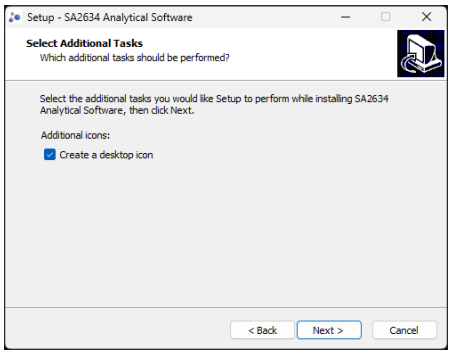
6 **Click [Next].**
The setup wizard starts.



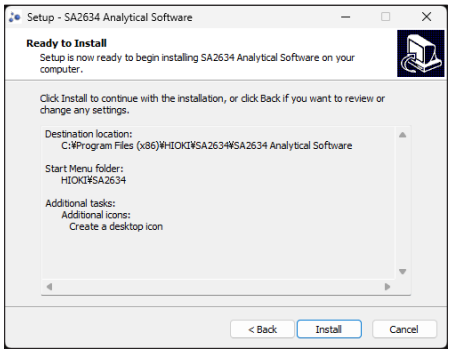
7 **Specify the folder in which the software is to be installed and click [Next].**



8 **Specify the location where a shortcut for the program is to be created in the Start menu and click [Next].**

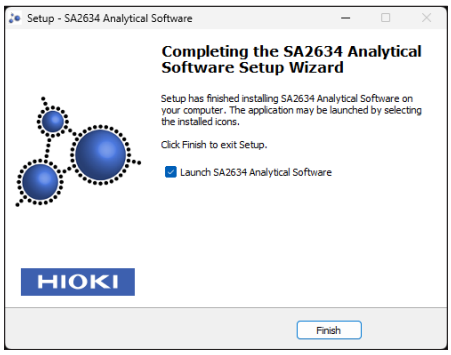


9 **Check the [Create a desktop icon] check box and click [Next].**



10 **Check the setting information and click [Install].**

The installation continues.



11 **Click [Finish].**

The icon is created on the desktop.

The installation is complete.

Uninstalling the SA2634 Analytical Software

Uninstall the SA2634 Analytical Software when it is no longer necessary.

1 **Go to [Start] menu and right-click the program icon.**

2 **Click [Uninstall].**

2.3 Connecting the Power Cord to the IM3536

Connect the power cord to the IM3536.

⚠WARNING

■ **Do not use any cables with the coating melted and metal parts exposed.**

Failure to follow this guidance could result in electric shock or burns.

■ **Connect the power cord to a 3-prong grounded-type (2-pole) power outlet.**

If the power cord is connected to an ungrounded outlet, the operator may experience an electric shock.

■ **Be sure to ground the power cord.**

Otherwise, half of the power voltage will be applied to the housing, causing electric shock accidents.

⚠CAUTION

■ **Make sure that the power voltage connection is correct.**

Failure to follow this guidance could damage the internal circuit.

■ **Do not bend, pull on, or twist cables, including where they connect, with excessive force.**

The cables may be disconnected.

■ **Do not step on cords or allow them to become caught between other objects.**

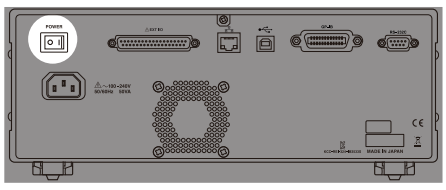
Failure to follow this guidance could damage insulation, resulting in bodily injury.

■ **Do not short-circuit the measurement terminals or input any voltage to the measurement terminals.**

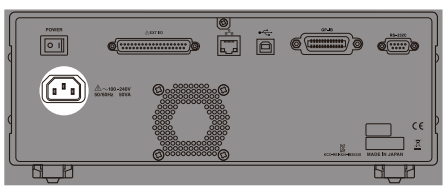
Failure to follow this guidance could damage the instrument.

■ **Before connecting the power cord, verify that the supply voltage you plan to use falls within the supply voltage range noted on the IM3536.**

Supplying a voltage that falls outside the specified range to the IM3536 could damage it, causing bodily injury.



1 **Check that the main power switch (rear) of the IM3536 is set to off (○).**



2 **Connect the power cord provided with the IM3536 to the power supply inlet (100 V to 240 V AC).**

3 **Connect the plug of the power cord to an outlet.**

2.4 Connecting the IM3536 and Computer

Connect the IM3536 and your computer using a cable (provided).
A USB or LAN cable may be used.

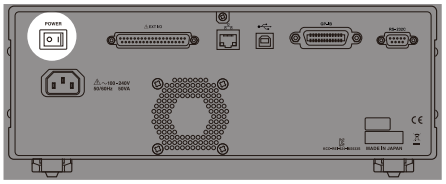
⚠CAUTION

■ **Do not disconnect the cable during communication.**
Failure to follow this guidance may cause a malfunction of the instrument.

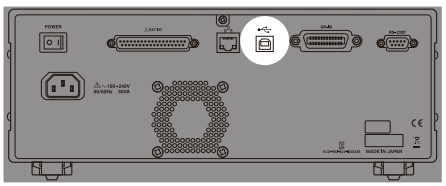
■ **Be sure to install the SA2634 Analytical Software on the computer before connecting the cable to the computer.**
Installing the SA2634 Analytical Software after connecting the cable to the computer may cause a malfunction or failure.

■ **Use a common ground circuit for the IM3536 LCR Meter and computer.**
Using different ground circuits will result in a potential difference between the IM3536 LCR Meter's ground and the computer's ground. If a cable is connected while such a potential difference exists, it may result in equipment malfunction or failure.

Example of USB Connection

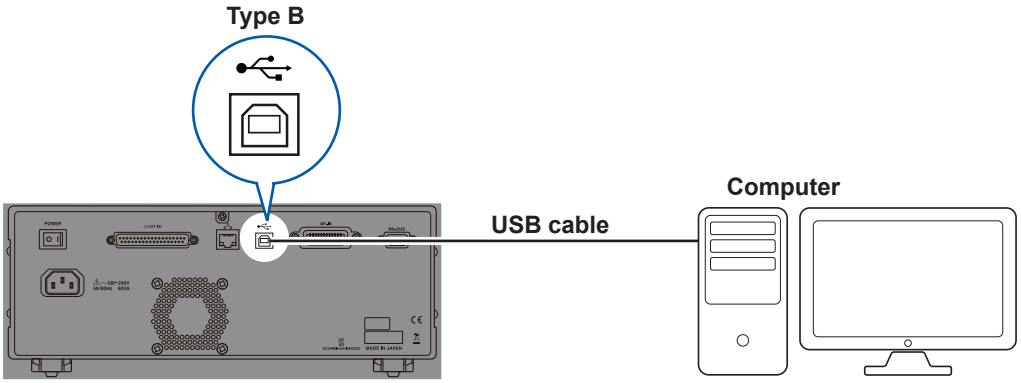


1 **Check that the main power switch (rear) of the IM3536 is set to off (○).**



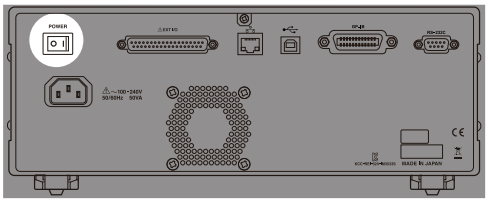
2 **Connect the USB cable to the USB connector of the IM3536.**

3 **Connect the USB cable to the USB terminal of the computer.**

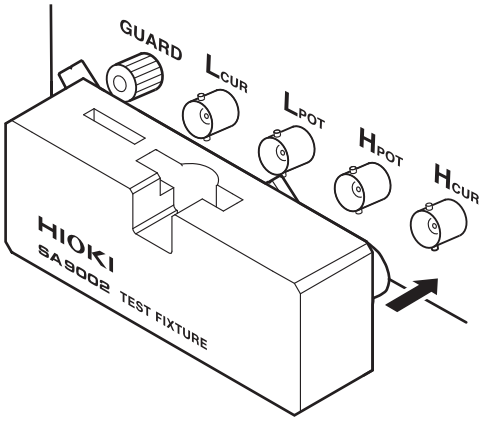


2.5 Mounting the SA9002 Test Fixture

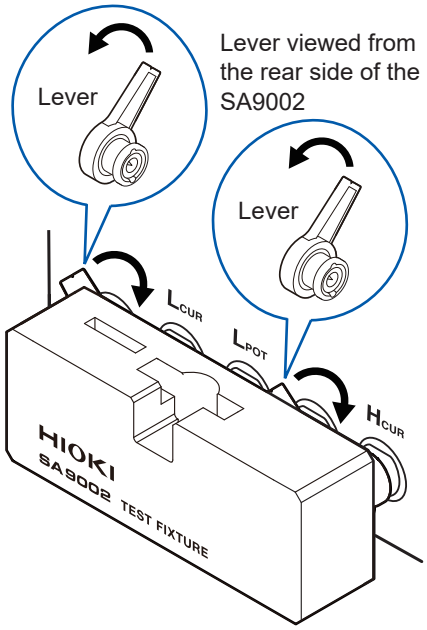
Connect the SA9002 Test Fixture to the measurement terminals of a measuring instrument.



1 **Check that the main power switch (rear) of the IM3536 is set to off (○).**



2 **Face up the SA9001 mounting part of the SA9002 Test Fixture, and insert the SA9002 into the measurement terminals of the IM3536.**



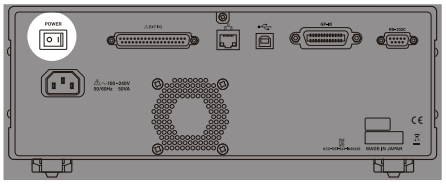
3 **Turn the levers on the left and right sides of the SA9002 Test Fixture clockwise to fix the SA9002 Test Fixture to the IM3536.**

2.6 Turning On the IM3536

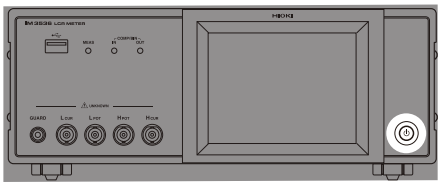
Before turning on the IM3536, refer to the IM3536 Instruction Manual.
See “2 Preparations before Measurement” in the IM3536 Instruction Manual.

With the main power on, pressing the start button at the front can turn on/off the power.

Turn on the IM3536.



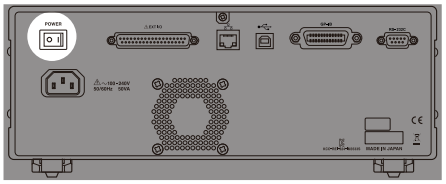
1 **Set the main power switch (rear) of the IM3536 to on (|).**



2 **Press the start button.**

The start button illuminates in green.

Turning Off the IM3536



1 **Set the main power switch (rear) of the IM3536 to off (○).**

3 Acquiring Impedance Data

3.1 Starting Up the SA2634 Analytical Software

Double-click the icon of the SA2634 Analytical Software which was installed in “2.2 Installing the SA2634 Analytical Software” (p. 26) to start it.

3.2 License Authentication

⚠CAUTION

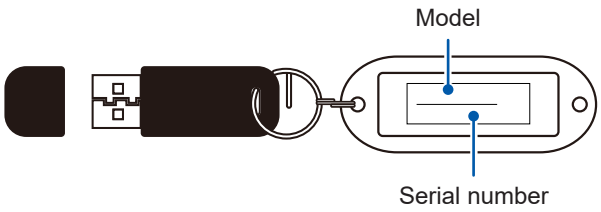
- **Before handling the USB license key, discharge static electricity from your body.**
- **Turn on the device before inserting the USB license key.**

  Failure to follow this guidance could damage the USB license key or cause the device to malfunction. Additionally, the device could fail to turn on.

IMPORTANT

License authentication of the SA2634 Analytical Software is performed at software launch and when measurement starts. Do not remove the USB license key while the application is running.

Insert the USB license key into the computer USB port.



3.3 Checking the Connection Between the IM3536 and Computer

Check the connection between the IM3536 and computer.

1 **Click [Connect].**

2 **Check the connection status in [Interface State].**

IM3536 **: Connected**

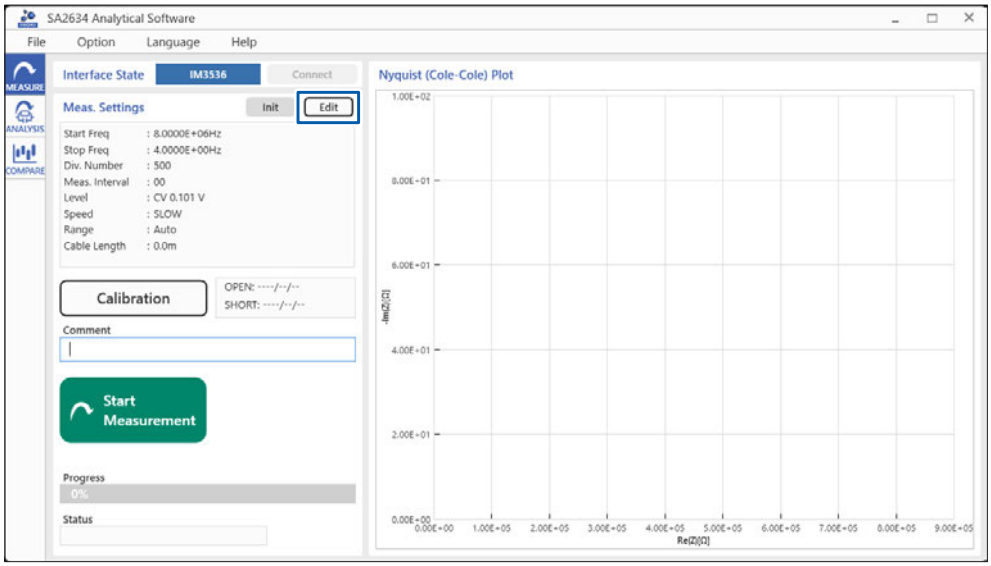
------ **: Not connected**

When the IM3536 and computer cannot be connected, check the connection between the IM3536 and computer (p. 30) and the communication settings (p. 68).
If the problem still persists, reset the IM3536 (system reset) and connect the IM3536 again.
See “11 Maintenance and Service” in the IM3536 Instruction Manual.

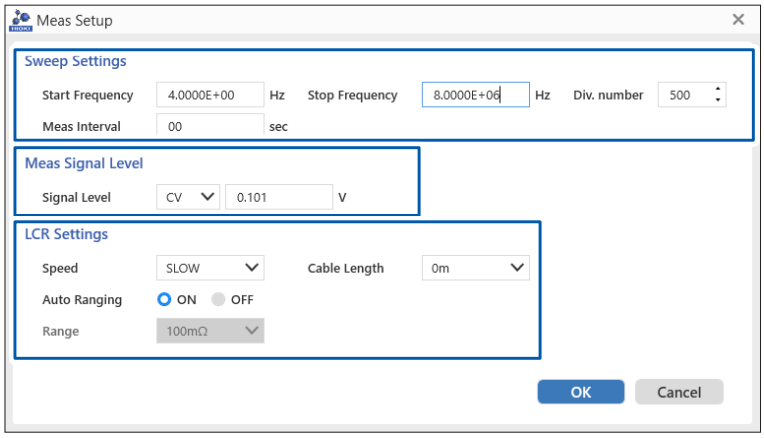
3.4 Setting the Measurement Conditions

1 **Click [Edit].**

The measurement settings screen appears.



2 **Change the measurement conditions in [Meas Setup].**



Sweep settings

Set the measurement start frequency, measurement stop frequency, measurement count, and measurement interval.

Start Frequency	Set the measurement start frequency.
Stop Frequency	Set the measurement stop frequency.
Div. number	Set the measurement count (number of measurement points between start and stop).
Meas Interval	Set the time for the measurement interval.

Meas Signal Level

Set the measurement signal mode and measurement signal level.

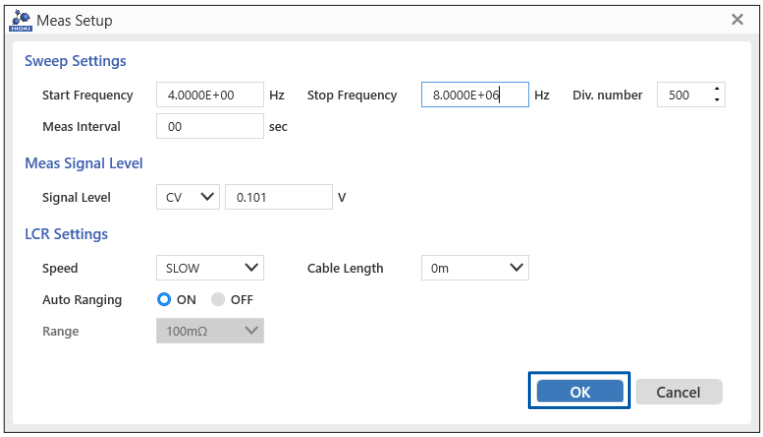
V (V)	Open-circuit terminal voltage
CV (V)	Constant voltage
CC (A)	Constant current

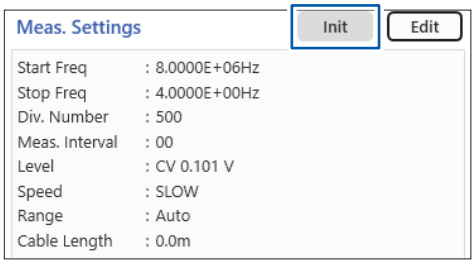
LCR settings

Set the following information for the LCR Meter.

Speed	Set the measurement speed. FAST, MED, SLOW, SLOW2
Cable Length	Set the cable length compensation. • IM3536, IM3590: 0 m, 1 m, 2 m, 4 m • IM3533, IM3570: 0 m, 1 m
Auto Ranging	Set auto ranging on/off.
Range	Set the measurement range. (Set when auto ranging is off.) • IM3570: 100 mΩ, 1 Ω, 10 Ω, 300 Ω, 1 kΩ, 3 kΩ, 10 kΩ, 30 kΩ, 100 kΩ, 1 MΩ, 10 MΩ, 100 MΩ • IM3533, IM3536, IM3590: 100 mΩ, 1 Ω, 10 Ω, 100 Ω, 1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ, 10 MΩ, 100 MΩ

3 Click [OK].





SA2634 Analytical Software screen

Returning the measurement condition settings to the defaults

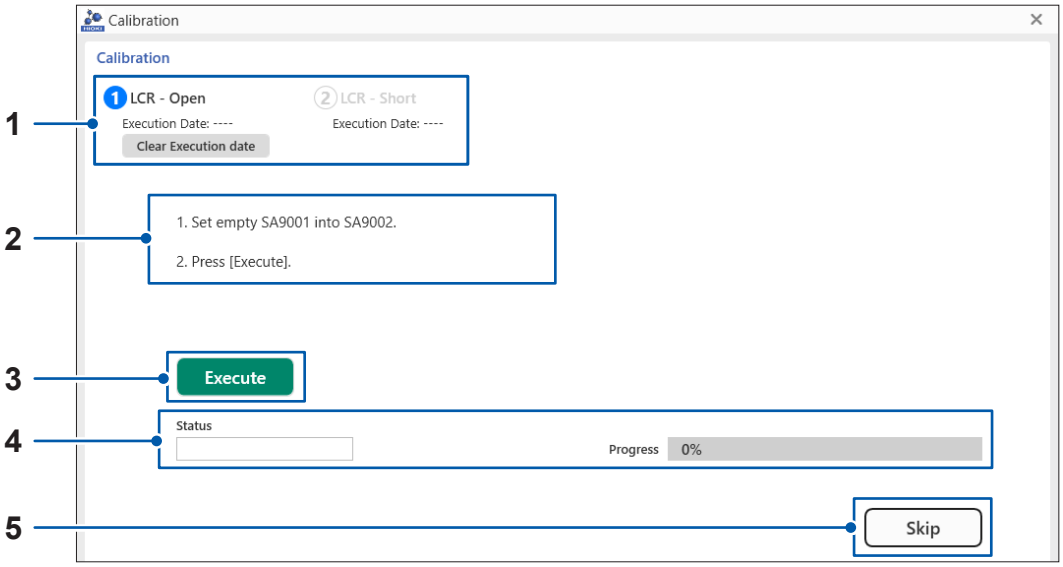
Click **[Init]** to return the measurement conditions to the defaults (measurement conditions recommended by Hioki).

3.5 Correcting Errors (Open Compensation, Short Compensation)

The Test Fixture has stray admittance and residual impedance, which can affect the measured values. Performing open compensation and short compensation can reduce the effect of stray admittance and residual impedance of the Test Fixture and improve the measurement accuracy.

Check the following before performing compensation.

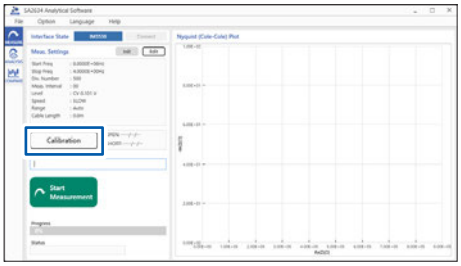
- Warm up the IM3536 for at least 60 minutes after the power is turned on.
- It is recommended that compensation be performed when the IM3536 power is turned on, when the Test Fixture is changed, or once every 24 hours.
- Be sure to perform compensation again when the Test Fixture is replaced. Correct measured values cannot be acquired if compensation is not performed after replacement.
- Make sure that there is no noise source nearby when performing compensation. An error may occur during compensation due to the influence of noise.
  Noise source example: Servo motor, switching power supply, high voltage line
- Perform compensation under conditions similar to the environment in which the actual sample is measured.



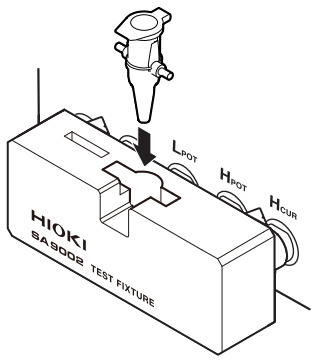
No.	Item name	Details
1	Title Compensation history	Displays the title of each calibration. Displays the date and time when compensation was last performed and Clear Execution date.
2	Procedure	Displays the calibration procedure.
3	Execute (Execute)	Executes calibration.
	Cancel (Cancel)	Cancels IM3533, IM3536, and IM3590 compensation. When an IM3533, IM3536, or IM3590 is connected, compensation can be canceled before it is completed.
4	Status	Displays the calibration status and progress.
5	Skip (Skip)	Moves to the next item.
	Complete (Complete)	Ends compensation and closes the screen.

Open Compensation, Short Compensation

Tools to be prepared: Empty SA9001 or SA9001-01 Electrode Cell, shorting plate for compensation (provided with SA9002)



1 **Click [Calibration].**



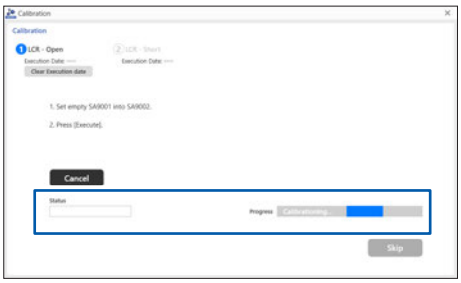
2 **Mount the empty SA9001 Electrode Cell onto the SA9002 Test Fixture.**

If the SA9002 Test Fixture is not open, an error message is displayed on the screen.

Make sure that the SA9002 Test Fixture is properly connected to the IM3536.

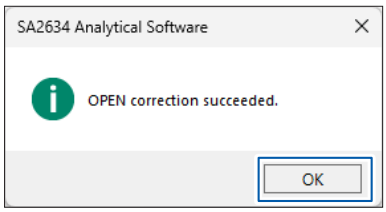
3 **Click [Execute].**

Open compensation starts.



The status and progress during execution can be checked from **[Status]** or **[Progress]** on the SA2634 Analytical Software.

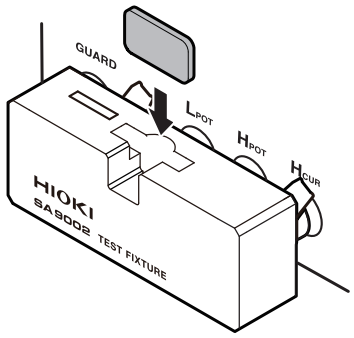
The progress percentage is displayed on the IM3536 LCR Meter screen.



4 **Click [OK].**

The open compensation has been properly completed.

Next, change to the short compensation execution screen.



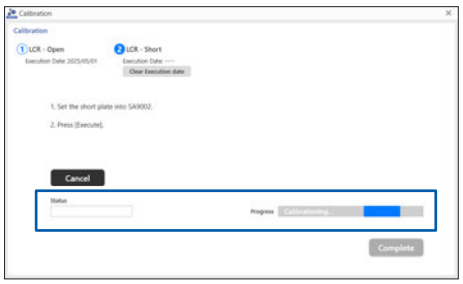
5 **Mount the provided shorting plate for compensation onto the SA9002 Test Fixture.**

Now the SA9002 Test Fixture is short-circuited.

If the SA9002 Test Fixture is not short-circuited, an error message is displayed on the screen. Make sure that the SA9002 Test Fixture is properly connected to the IM3536.

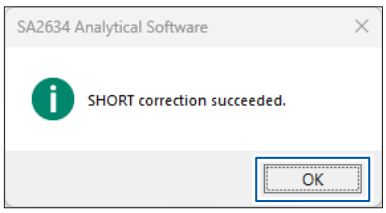
6 **Click [Execute].**

Short compensation starts.



The status and progress during execution can be checked from **[Status]** or **[Progress]** on the SA2634 Analytical Software.

The progress percentage is displayed on the IM3536 LCR Meter screen.

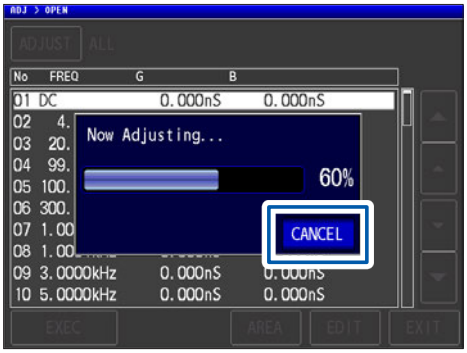


7 **Click [OK].**

Short compensation has been properly completed. When each compensation has been properly performed, the compensation execution date and time are updated.

The compensation is now complete.

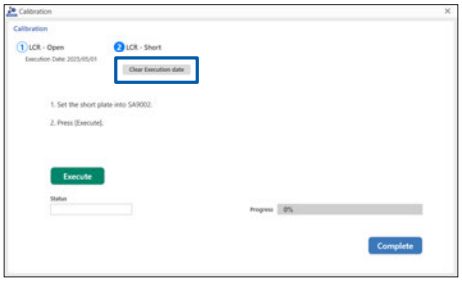
SA2634 Analytical Software screen



IM3536 LCR Meter screen

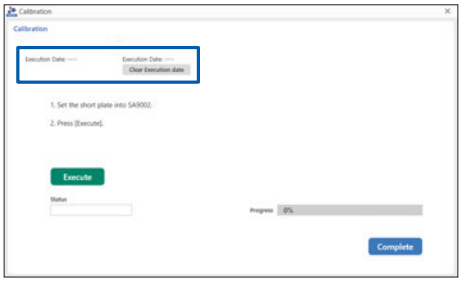
Canceling compensation

Click **[Cancel]** on the SA2634 Analytical Software screen or **[CANCEL]** on the IM3536 LCR Meter.



Resetting the compensation execution date and time

Click **[Clear Execution date]**.
Reset the date and time of the last open compensation and short compensation.



The compensation execution date and time are reset.

3.6 Putting Liquid to Be Measured into the SA9001 or SA9001-01 Electrode Cell

Put the liquid to be measured into the SA9001 Electrode Cell.
The measured impedance value of the liquid to be measured changes due to the temperature and time (the change rate varies depending on the liquid).
Perform measurement in an appropriate environment (stable temperature and same measurement timing).

⚠CAUTION

■ **Do not let the liquid to be measured come in direct contact with your skin.**

The liquid coming in direct contact with your skin may have negative effects on your body. Immediately rinse your skin under running water.

■ **Do not touch the electrodes of the SA9001 Electrode Cell.**

If dirt comes in contact with an electrode surface, accurate measurement may not be performed.

■ **Do not let the liquid to be measured come in contact with the electrodes of the SA9001 Electrode Cell and SA9002 Test Fixture.**

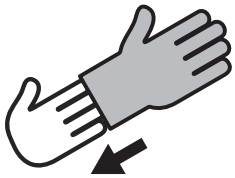
If the liquid comes in contact with an electrode, accurate measurement may not be performed.

Do not touch the liquid to be measured.

Do not touch the electrodes.

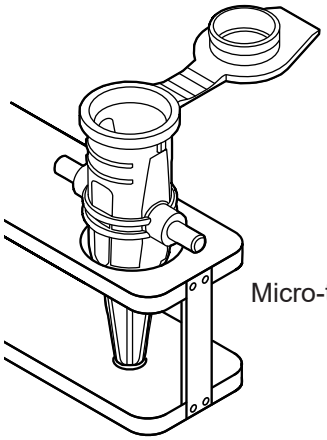
■ **Always wear gloves when handling the Electrode Cell.**

The liquid coming in direct contact with your skin may have negative effects on your body.



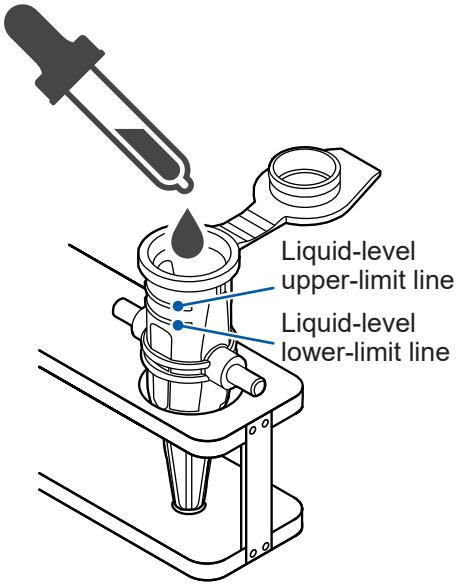
Wear gloves.

Tools to be prepared: dropper, micro-tube stand



1 **Place the SA9001 Electrode Cell on the micro-tube stand.**

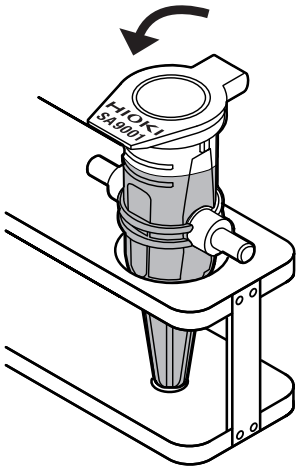
Any commercially available micro-tube stands may be used.



2 **Draw the liquid to be measured using a dropper, spatula, or syringe and put the liquid into the SA9001.**

Be sure to add the liquid so that the liquid level is between the upper limit line and lower limit line of the SA9001.

Do not let any air mix with the liquid since the measured value may vary.



3 **Close the lid of the SA9001.**

3.7 Mounting the SA9001 or SA9001-01 Electrode Cell onto the SA9002 Test Fixture

Mount the SA9001 Electrode Cell onto the SA9002 Test Fixture.

⚠CAUTION

■ **Do not tilt the SA9001 Electrode Cell.**

Otherwise, the liquid surface of the SA9001 Electrode Cell tilts and the measured value may be affected.

■ **Do not let the liquid to be measured come in contact with the electrodes of the SA9001 Electrode Cell.**

If the liquid comes in contact with the electrodes, accurate measurement may not be performed.

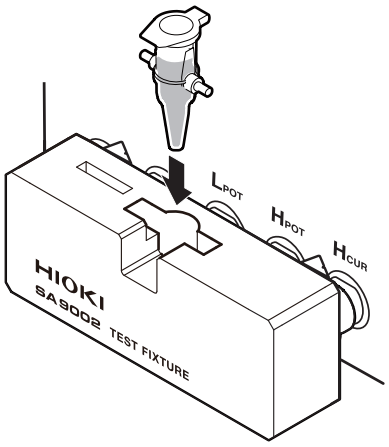
■ **Do not apply excessive force to the SA9001 Electrode Cell and the SA9002 Test Fixture.**

The instrument can be damaged and the liquid can leak.

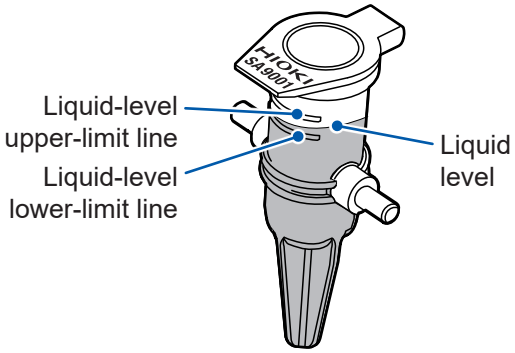
Do not tilt the Electrode Cell.

■ **Securely close the lid of the SA9001 Electrode Cell.**

Otherwise, the liquid in the SA9001 Electrode Cell may spill.



1 **Mount the SA9001 Electrode Cell onto the SA9001 mounting part of the SA9002 Test Fixture.**



Make sure that the SA9001 Electrode Cell is not tilted so that the liquid level of the electrode is between the liquid-level upper-limit line and lower limit line.

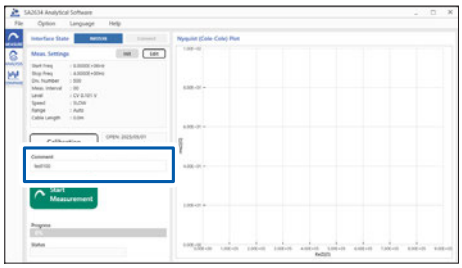
3.8 Starting Measurement

IMPORTANT

If the measurement time exceeds 3 minutes, it is possible that measurement is not being performed correctly. Cancel the measurement and check that the SA9001 Electrode Cell and SA9002 Test Fixture are properly connected.

1 **Click [Start Measurement].**

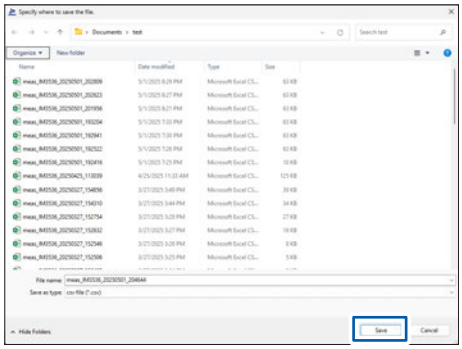
The **[Specify where to save the file.]** window opens.



To add a comment to the CSV file

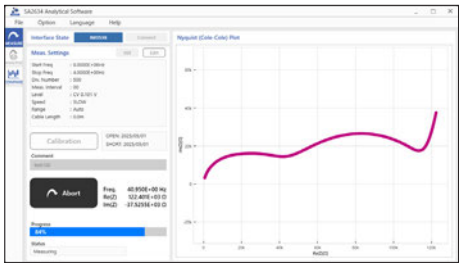
Enter in **[Comment]**.

The entered comment can be checked in the measurement CSV that is saved after measurement.



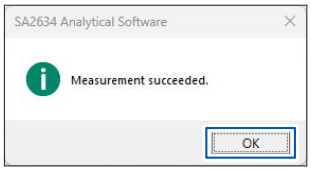
2 **Select the file name and save location, then click [Save].**

The file is saved in the CSV format.



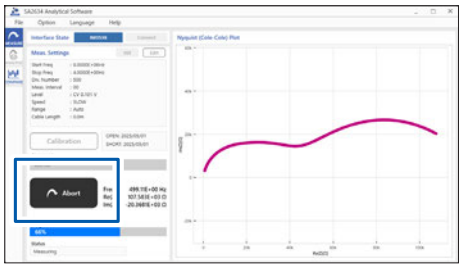
Measurement starts.

The progress status of the measurement being performed can be checked in **[Status]** of the SA2634 Analytical Software.



3 **Click [OK].**

The measurement is complete.

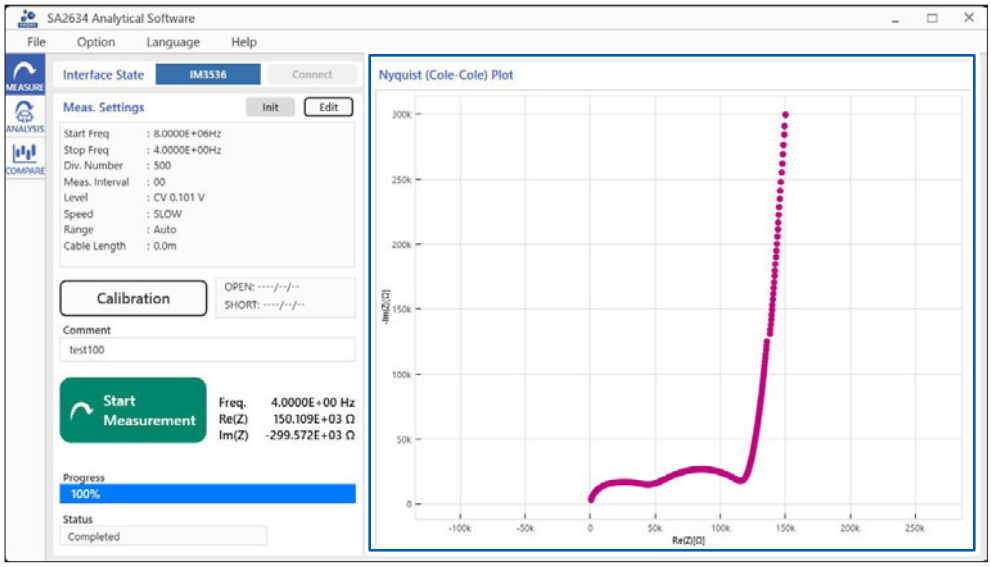


To cancel measurement

Click **[Abort]**.

3.9 Checking the Impedance Data

When measurement is started, the impedance is plotted in real time as a Nyquist plot.



Display changes that can be made with the mouse

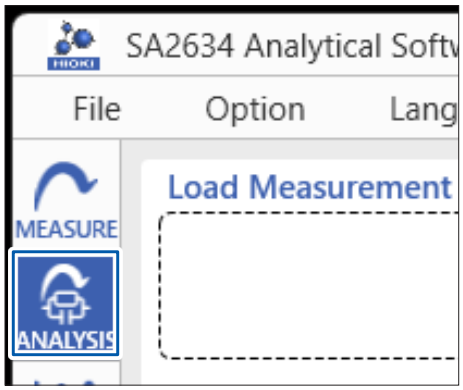
Auto scale display	The graph magnification is automatically adjusted so that all of the target data is displayed.
Zoom in/Zoom out	Operate the mouse in the chart to zoom in or zoom out on the graph. Zoom in: Scroll the mouse wheel forward. (Select an area by dragging the mouse.) Zoom out: Scroll the mouse wheel backward. (Select an area by dragging the mouse.) Return magnification: Double-click.
Value display at mouse cursor position	Moving the mouse cursor to a plot point in the graph displays the value for that position.

4 Analyzing Impedance Data

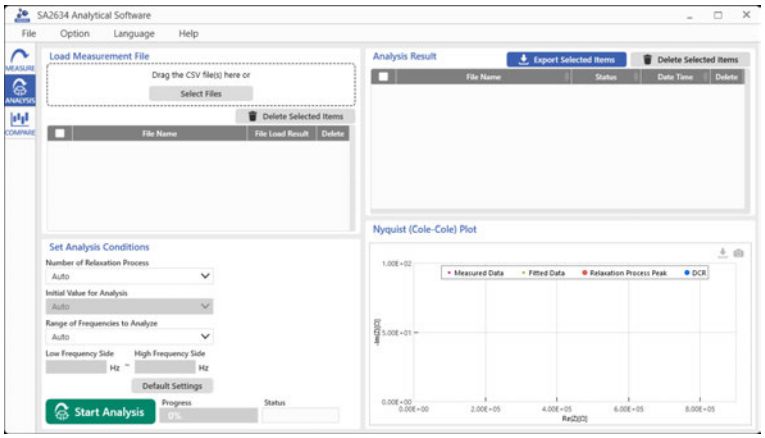
4.1 Loading and Analyzing Measurement Data

Load a measurement result CSV file and perform equivalent circuit analysis. The analysis results can be checked on the right side of the analysis screen. See “4.5 Checking and Saving the Analysis Results” (p. 52).

1 Click [ANALYSIS].

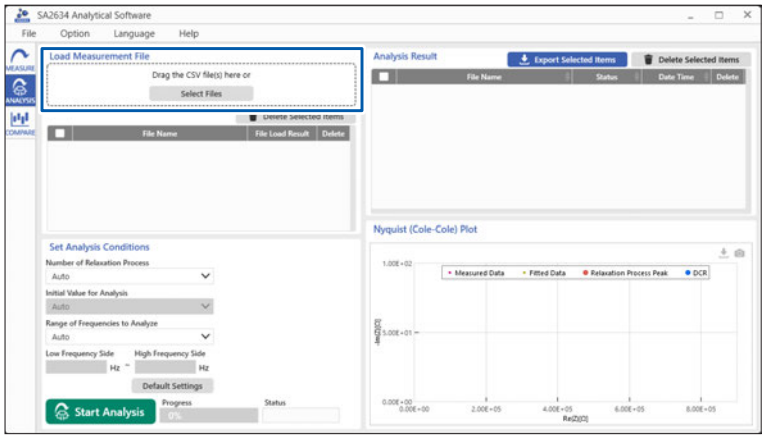


The analysis screen appears.



2 Register an analysis file.

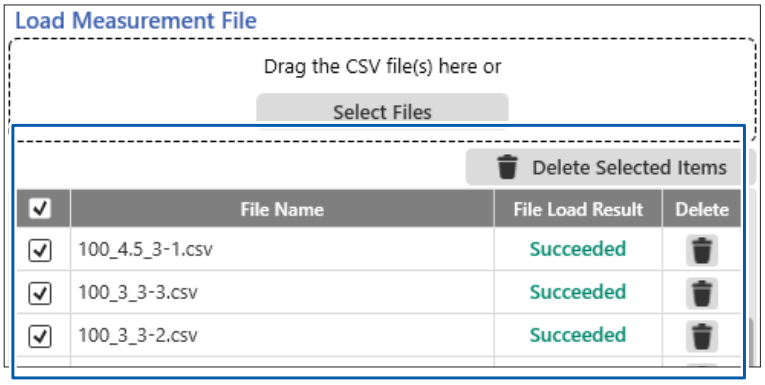
Drag and drop the CSV files to be analyzed into the area shown above or click **[Select Files]** to select the files.

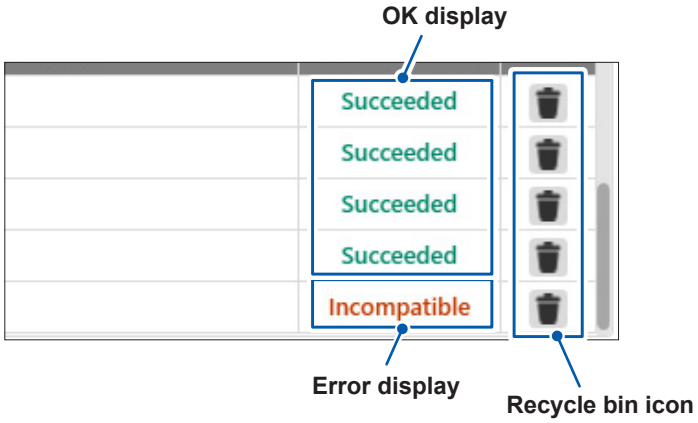


Maximum number of files that can be registered	1000 files
File extension	CSV

4.2 Checking and Selecting the Loaded Measurement Result CSV File

Displays a list of the registered measurement result CSV files.

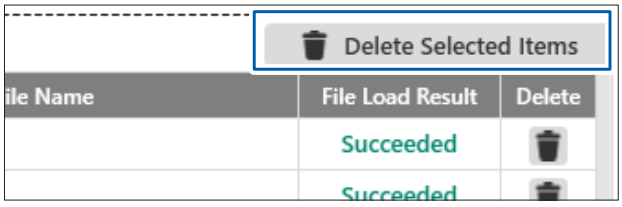




If the format is correct, Succeeded (Succeeded) is displayed.

If Incompatible (Incompatible) was displayed, the format of the CSV file is incorrect. Refer to “Configuring the Application” (p. 66) and set the CSV file format.

Click the recycle bin icon to delete the file.

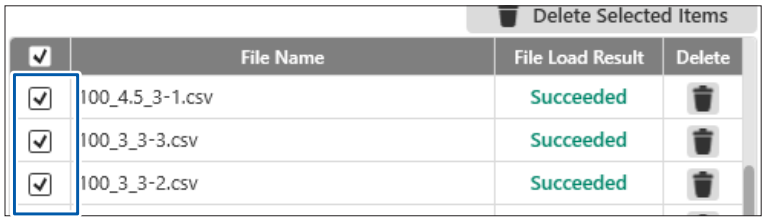


Deleting registered data

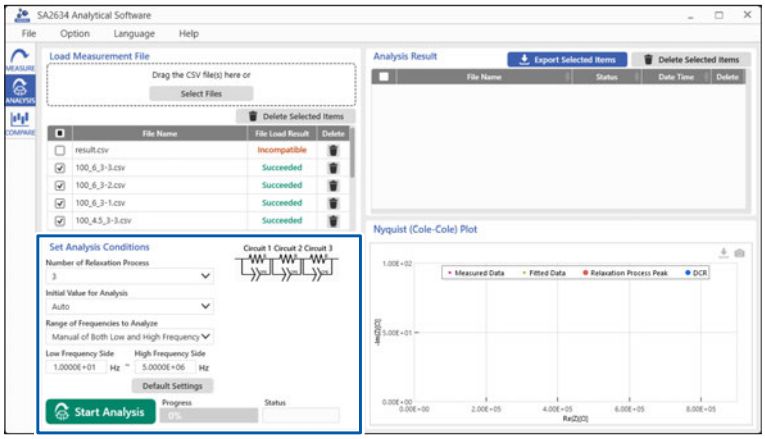
Select the check boxes of the data that you want to delete, then click **[Delete Selected Items]** to delete the selected measurement results data from the list.

4.3 Setting the Analysis Conditions

1 **Select the check boxes of the data to analyze.**



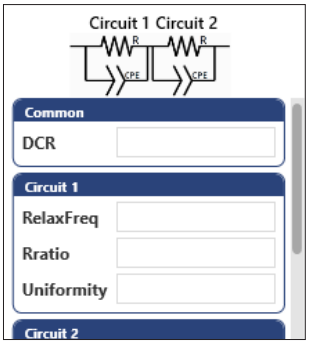
2 **Set the analysis conditions.**



Number of Relaxation Process

Auto	Automatically determines the number of relaxation processes in the equivalent circuit (R//CPE circuit) based on the goodness of fit of the equivalent circuit analysis.
1 to 4	Performs analysis by fixing the number of relaxation processes in the equivalent circuit (R//CPE circuit) at the selected number. Results are output regardless of the goodness of fit of the equivalent circuit analysis.

Initial Value for Analysis

Auto	Decided automatically.
Manual	This can be selected when **Number of Relaxation Processes** is **1** to **4**. According to the number of relaxation processes, the equivalent circuit diagram and default input fields are displayed on the right side of the analysis conditions setting area. The input values are DCR, the relaxation peak frequency, Rratio, and Uniformity for each relaxation. Example: Default input display when the number of relaxation processes is 2 

Range of Frequencies to Analyze

[Auto], **[Manual of High, Auto of Low Frequency Side]**, **[Manual of Both Low and High Frequency Side]**

Lower Frequency Side

Enter the low frequency side of the frequency range.

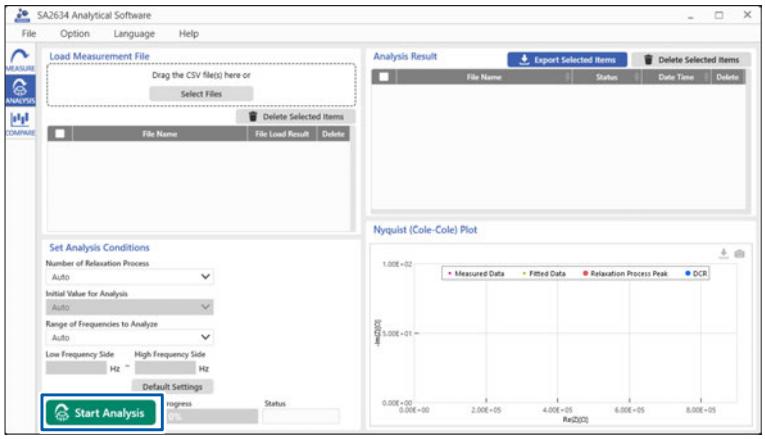
High Frequency Side

Enter the high frequency Side of the frequency range.

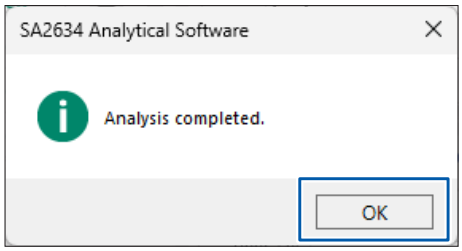
4.4 Starting Analysis

The maximum number of data points that can be analyzed is 1000 (combining “Data Points to be Analyzed” and “Data Points Already Displayed in the Analysis Results List”).

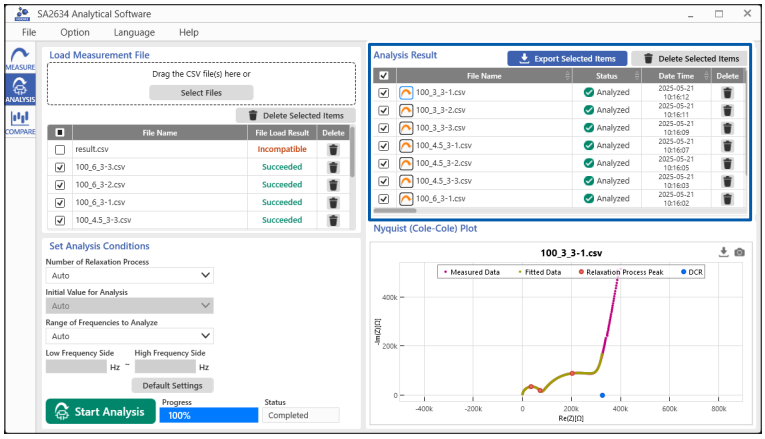
1 **Click [Start Analysis].**



2 **Click [OK].**



3 **The analysis results are added to the analysis results data list.**



4.5 Checking and Saving the Analysis Results

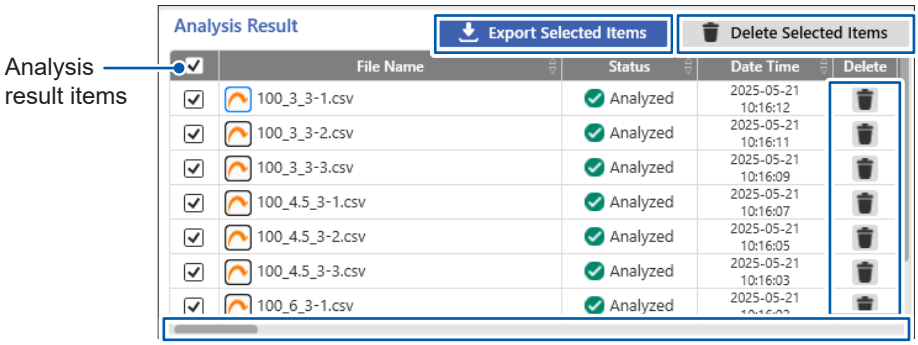
The results from analysis can be checked and saved.
The analysis results can be saved in CSV file format.

1 **Check the analysis results.**

The results of the executed analysis are displayed in a list.

[Status] displays the analysis status. If analysis failed, an error code is displayed.

See “Analysis Error Codes” (p. 92).



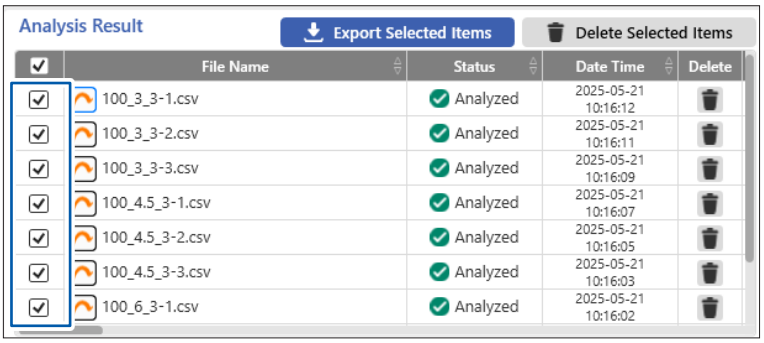
Export Selected Items	Saves all of the selected rows in a single CSV file.
Delete Selected Items	Deletes all of the selected rows.
(recycle bin icon)	Deletes the clicked row.
Slide bar	Slide to check the analysis result items.

Analysis result items

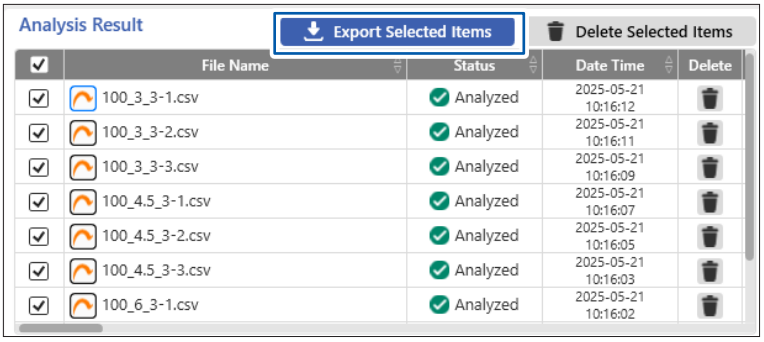
Selection check box	Selects the analysis result row.
File Name	Displays the name of the measurement result CSV file. Click the (waveform button) to display the fitting results at the bottom right of the screen.
Status	If analysis fails, an error code is displayed. See “Analysis Error Codes” (p. 92).
Date Time	Displays the date and time when analysis was completed.
Delete	Deletes the clicked row.
Num of Relax	Displays the number of relaxations.
DCR	Displays the DCR.
Goodness of Fit	Displays the goodness of fit.
Conf. Relax Num	Displays the number of relaxations set in the analysis conditions.
Conf. Init Value	Displays the method of setting the default value set in the analysis conditions.
Conf. Cutoff	Displays the method of deciding the cutoff frequency set in the analysis conditions. **Auto**: Calculated automatically **Manual of High, Auto of Low**: Upper limit is entered manually. Lower limit is calculated automatically. **Manual**: Entered manually.
Conf. High-Freq	Displays the upper limit of the cutoff frequency set in the analysis conditions. When automatic calculation is selected, this is blank.

Conf. Low-Freq	Displays the lower limit of the cutoff frequency set in the analysis conditions. When automatic calculation is selected, this is blank.
RPF <X>	This is the relaxation peak frequency. <X> indicates 1 to 8.
Rratio <X>	This is the analysis result Rratio. <X> indicates 1 to 8.
Unif. <X>	This is the analysis result Uniformity. <X> indicates 1 to 8.
RPF 2-8	This is the relaxation peak frequency of the relaxation with the largest Rratio when comparing Rratio 2 through Rratio 8.
Rratio 2-8	This is the sum of Rratio 2 through Rratio 8.
Unif. 2-8	This is the Uniformity of the relaxation with the largest Rratio when comparing Rratio 2 through Rratio 8.
High-Freq EEC	This is the high frequency side equivalent circuit that was automatically assigned to the relaxation. One of the following is displayed. • None • R-L
Low-Freq EEC	This is the low frequency side equivalent circuit that was automatically assigned to the relaxation. One of the following is displayed. • CPE • R//CPE
Comment	Displays the comment that is saved in the measurement CSV.

2 Select the check boxes of the analysis results data to save.

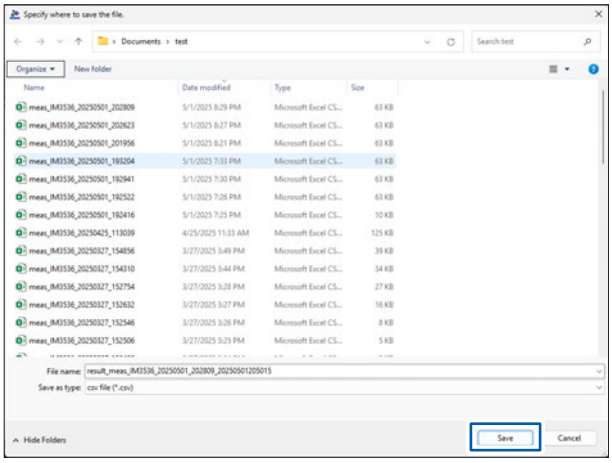


3 Click [Export Selected Items].



The **[Specify where to save the file.]** window opens.

4 **Select the file name and save location, then click [Save].**

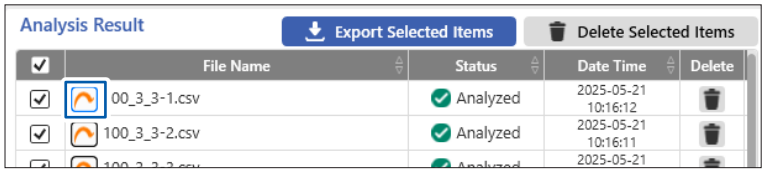


The file is saved in the CSV format.

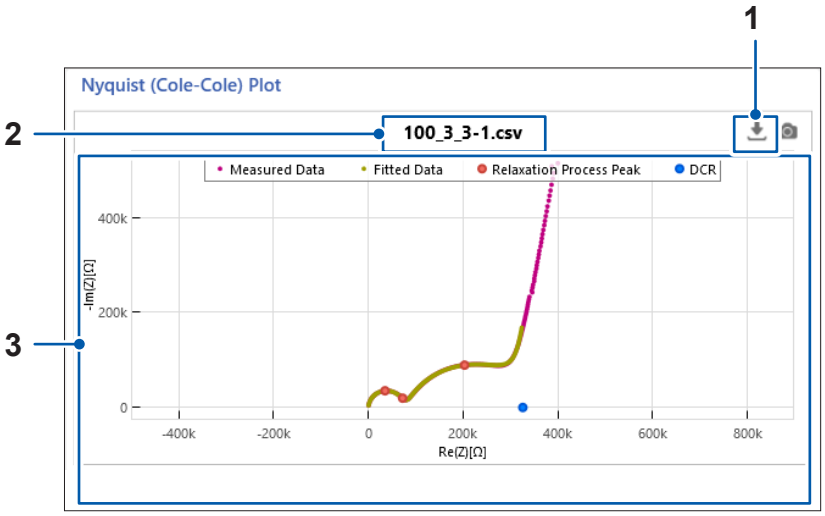
4.6 Checking and Saving the Fitting Results

The fitting results are displayed in a Nyquist plot.

1 Click (waveform button) of the data that you want to display in the Nyquist plot.



2 The analysis results are displayed in the Nyquist plot.



No.	Item name	Details
1	Export Waveforms	Saves the waveform data in a CSV file. Click to display the save window.
2	Title	Displays the name of the analysis result CSV file.
3	Nyquist plot	The fitting results are displayed in a Nyquist plot. Aligning the mouse cursor with a point in the plot displays the data for that point.
	Measured Data	Displays the actual waveform.
	Fitted Data	Displays the fitted waveform.
	Relaxation Process Peak	Displays the relaxation process peak.
	DCR	Displays the DCR.

Analysis results that can be checked on the Nyquist plot

Measured Data **Fitted Data**	Frequency [Hz], Re(Z) [Ω], −Im(Z) [Ω]
Relaxation Process Peak	Frequency [Hz], Rratio, Uniformity
DCR	DCR

Display changes that can be made with the mouse

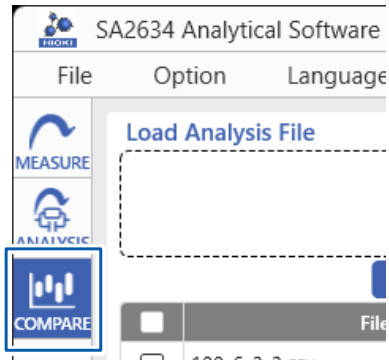
Zoom in	Drag the mouse to select the area to zoom in on. Turn the mouse wheel forward.
Zoom out	Turn the mouse wheel backward.
Return to initial magnification	Double-click in the graph display area.

5 Comparing the Analysis Results

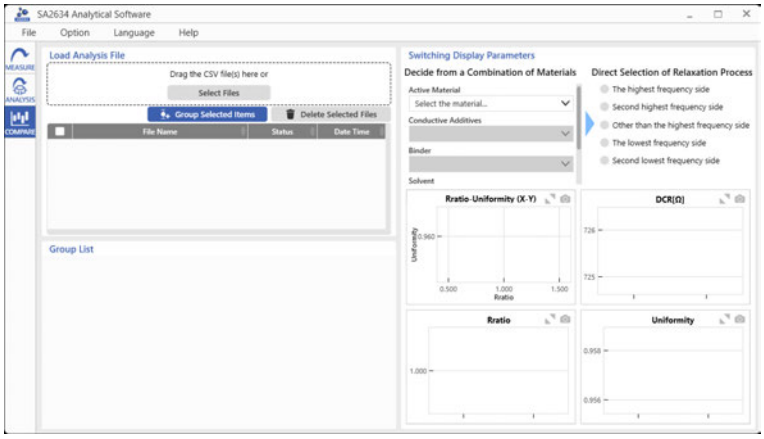
5.1 Loading the Analysis Result CSV File

Load the analysis results.

1 Click [COMPARE].

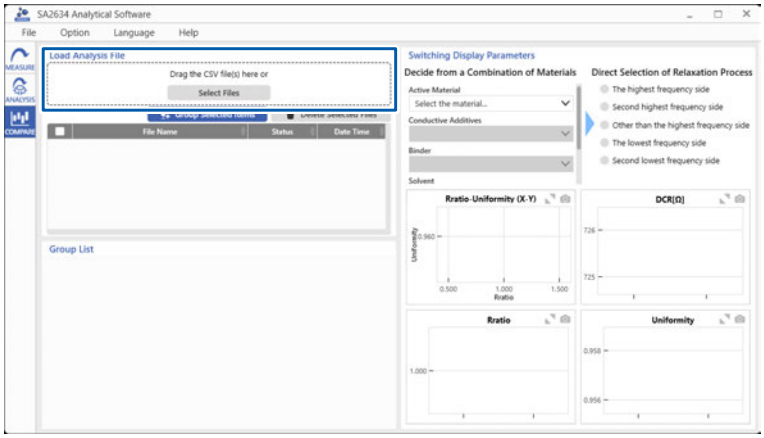


The analysis results comparison screen is displayed.



2 Select the file to load.

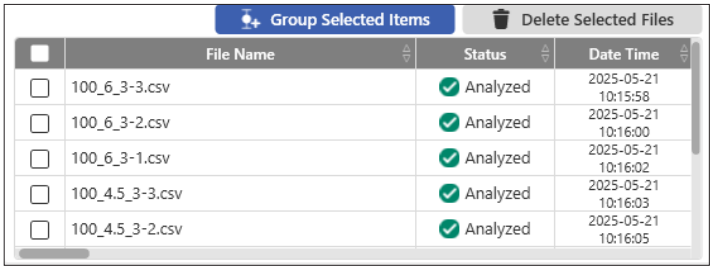
Drag and drop the CSV data to load into the area shown above or click **[Select Files]** and select the file.

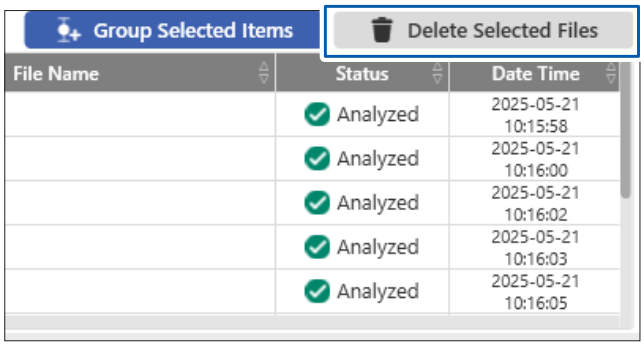


Maximum number of files that can be registered	1000 files
File extension	CSV

5.2 Checking and Selecting the Loaded Analysis CSV File

A list of the registered analysis result CSV files is displayed.





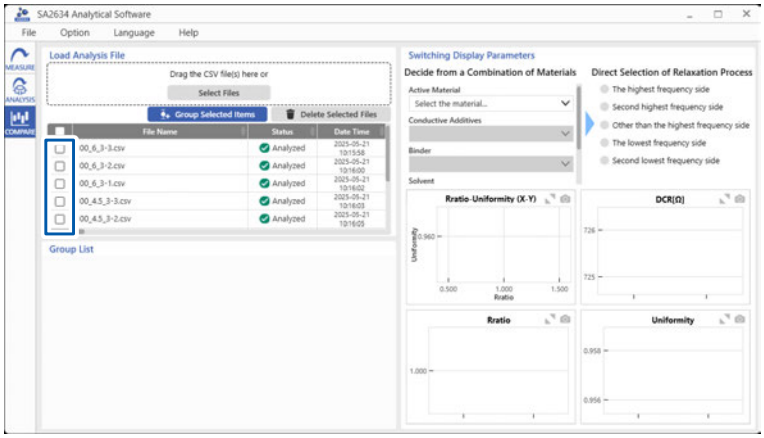
Deleting registered data

Select the check boxes of the data that you want to delete, then click **[Delete Selected Files]**.

5.3 Creating a Group

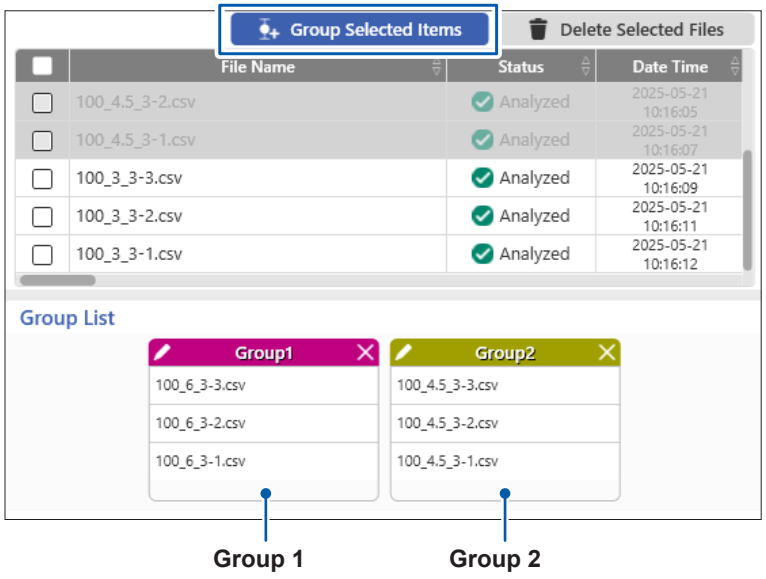
Create a group of data with the same standard, and compare the data within the group.

1 Select the check boxes of the data to include in the group.

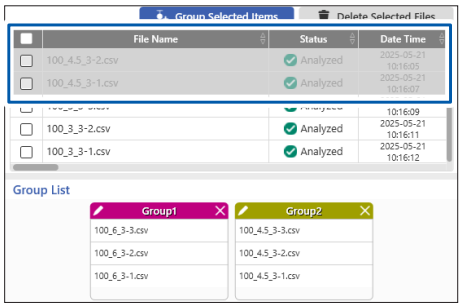


2 Click [Group Selected Items].

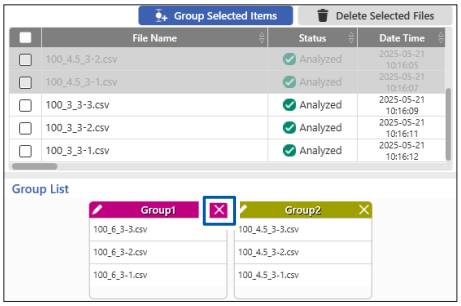
If the calculation method has already been selected, a new series for the added group is added to the graph display area.



Maximum number of created groups	30 groups

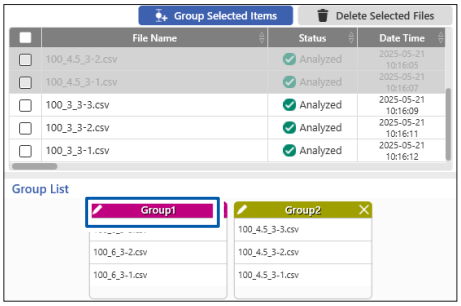


The rows of the grouped files are grayed out, and the check boxes cannot be selected.



Canceling a group

Click (cancel group) to cancel the group.
The analysis results data in the data list returns from inactive to active. (The data is not deleted.)
The series for the canceled group is deleted from the graph display area.



Editing the group name

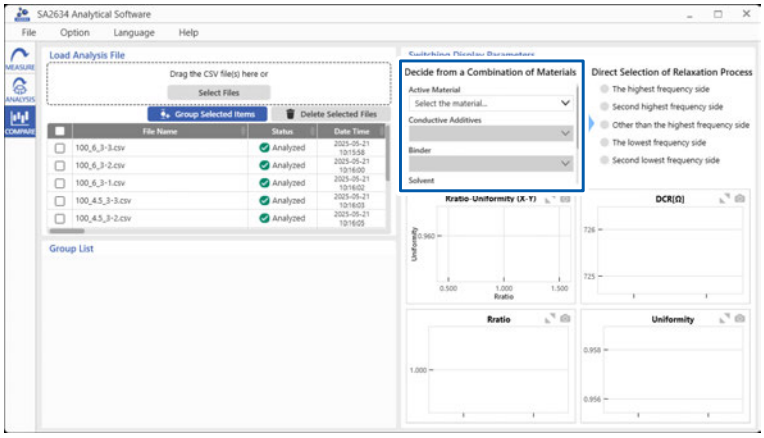
Double-click on the group name or click (pen icon) to edit the group name.
A maximum of 20 characters can be entered for the group name.

5.4 Switching Display Parameters

Select the combination of materials contained in the slurry or directly select relaxation to switch the display parameters.

1 Select the material combination.

Relaxation of the parameters (Rratio, Uniformity) displayed in the graph switches according to the selected material combination.



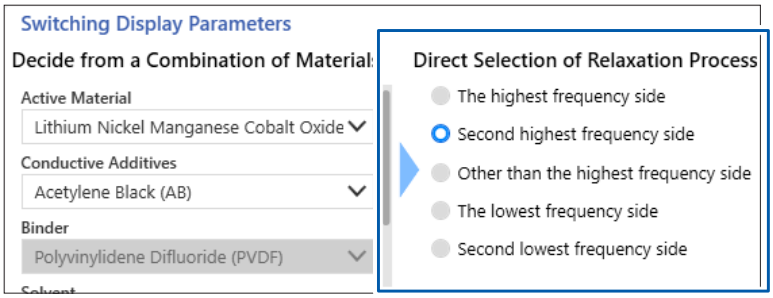
Active Material	Select the active material type from the combination box.
Conductive Additives	Select the conductive additive type from the combination box.
Binder	Select the binder type from the combination box.
Solvent	Select the solvent type from the combination box.
Dispersant	Select the dispersant type from the combination box.

IMPORTANT

The relaxation process of the conductive material in the slurry is decided from the combination of materials. The relationship is based on results acquired from tests performed by Hioki. Even for materials with the same name, results may vary depending on the material manufacturer and grade. Confirm in advance that the intended relaxation process is displayed with the actual material combination.

2 **Switch the target relaxation process.**

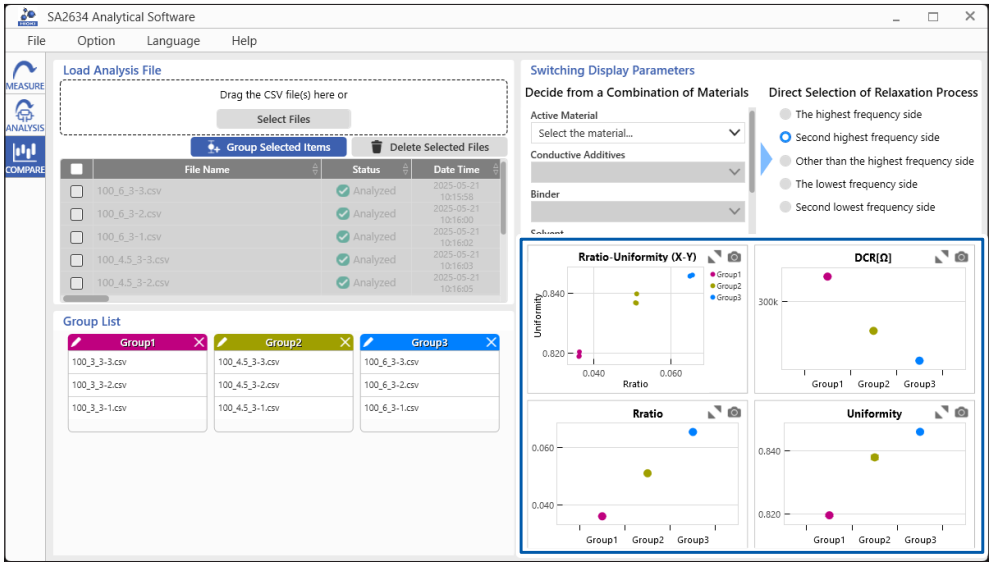
The selected relaxation parameters are displayed.



The highest frequency side	Displays a graph of Rratio1/Uniformity1.
Second highest frequency side	Displays a graph of Rratio2/Uniformity2.
Other than the highest frequency side	Displays a graph of Rratio2-8/Uniformity2-8.
The lowest frequency side	Displays a graph of the relaxation Rratio/Uniformity with the lowest RelaxFreq.
Second lowest frequency side	Displays a graph of the relaxation Rratio/Uniformity with the second lowest RelaxFreq.

5.5 Group Comparison of the Analysis Result Graphs

Four types of graphs are displayed.



Rratio-Uniformity	This is a 2D plot with Rratio on the X axis and Uniformity on the Y axis.
DCR	This is a scatter plot with the group on the X axis and DCR [Ω] on the Y axis. ±Deviation is displayed on the error bar.
Rratio	This is a scatter plot with the group on the X axis and Rratio on the Y axis. ±Deviation is displayed on the error bar.
Uniformity	This is a scatter plot with the group on the X axis and Uniformity on the Y axis. ±Deviation is displayed on the error bar.

Information that can be checked in the graphs

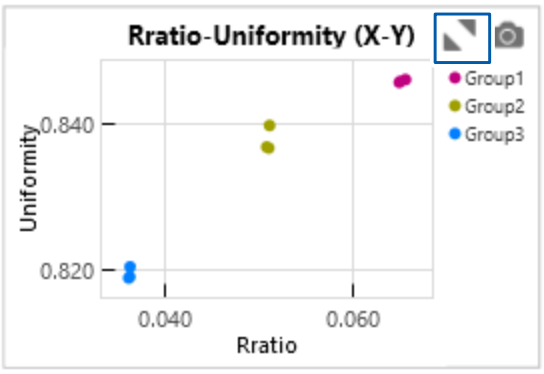
Rratio-Uniformity graph	Measurement file name, Rratio, Uniformity
DCR graph	DCR average, DCR deviation
Rratio graph	Rratio average, Rratio deviation
Uniformity graph	Uniformity average, Uniformity deviation

Display changes that can be made with the mouse

Zoom in	Drag the mouse to select the area to zoom in on. Turn the mouse wheel forward.
Zoom out	Turn the mouse wheel backward.
Return to initial magnification	Double-click in the graph display area.

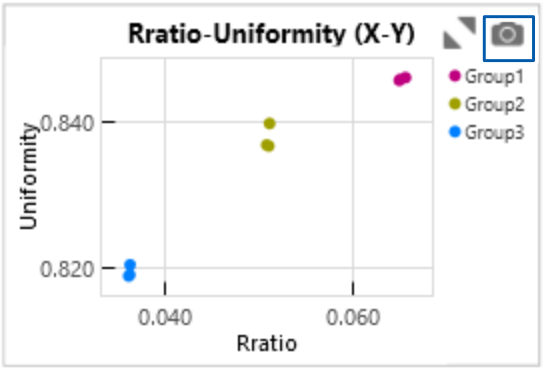
5.6 Expanding the Analysis Result Graph Display

Click to expand the analysis result graph.
The expanded graph is displayed in a separate window.



5.7 Saving the Analysis Result Graph Image

Click to capture an image of the analysis result graph.
The captured image is saved to the clipboard.

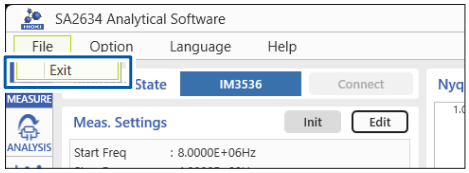


6 Analytical Software Common Settings

6.1 Exiting the Application

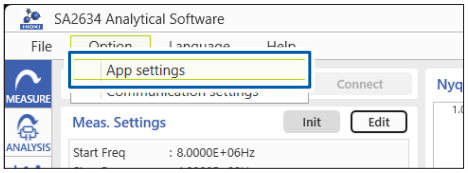
1. Click **[File]**.
2. Click **[Exit]**.

   The application closes.

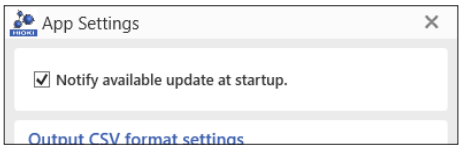


6.2 Configuring the Application

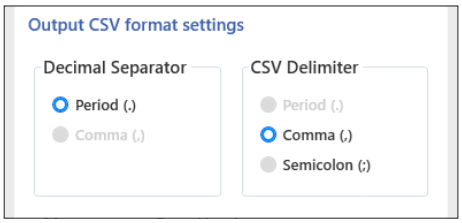
1 **Click [Option], and then click [App settings].**
The application settings screen appears.



2 **Set [Notify available update at startup.].**
When the check box is selected, notification of the latest available version will be provided when the application starts.

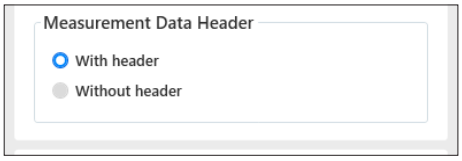


3 **Set [Output CSV format settings].**
When the decimal separator is switched, the CSV file delimiter can be set with the radio button.
Four combinations can be set. (Switching the decimal separator requires restarting the application.)

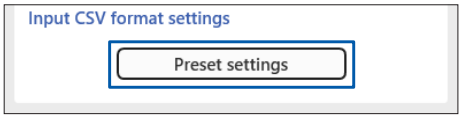


Decimal separator	CSV delimiter
. (Period)	, (Comma)
. (Period)	; (Semicolon)
, (Comma)	. (Period)
, (Comma)	; (Semicolon)

4 **Set [Measurement Data Header].**
Whether or not to output a header in the measurement result CSV file can be set with the radio button.



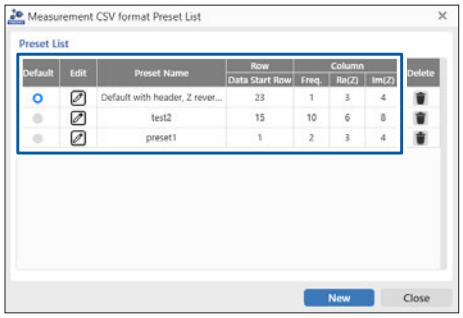
5 **Click [Preset settings].**



6 Check the [Preset List] setting.

Displays a list of presets for the CSV format to be loaded into the analysis function.

Register the measurement CSV file format (data start row, frequency data column, Re(Z) column, Im(Z) column) to enable loading into the analysis function.



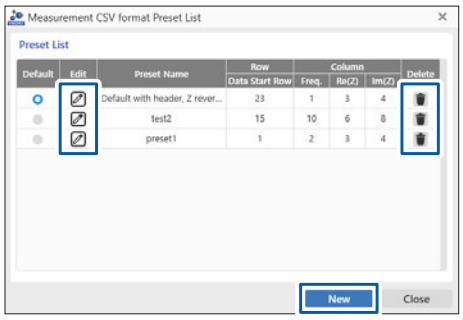
Default		Select the preset to enable using the radio button.
Preset Name		Displays the preset name.
Row (Data Start Row)		Displays the data start row that was set in the preset.
Column	**Freq.**	Displays the frequency data column that was set in the preset.
	Re(Z)	Displays the impedance real component column that was set in the preset.
	Im(Z)	Displays the impedance imaginary component column that was set in the preset.

7 Configure the [Preset List].

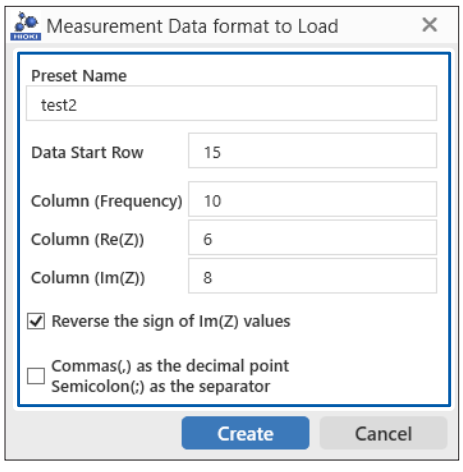
Click (pen icon) to open the settings screen and edit the preset for that row.

Click (recycle bin icon) to open the settings screen and delete the preset for that row.

Click **[New]** to open the settings screen and register a new preset.



8 Set [Measurement Data format to Load].



Preset Name	Preset name
Data Start Row	Set the number of the data start row.

Column (frequency)	Set the column of the frequency data.
Column (Re(Z))	Set the column of the impedance real component.
Column (Im(Z))	Set the column of the impedance imaginary component.
Reverse the sign of Im(Z) values	Select the check box to reverse the Im(Z) sign.
Commas (,) as the decimal point Semicolon (;) as the separator	Select the check box to use , (comma) as the decimal separator and ; (semicolon) as the delimiter.

9 **Confirm or cancel the settings.**

Click **[OK]** to confirm the settings, and click **[Cancel]** to cancel.

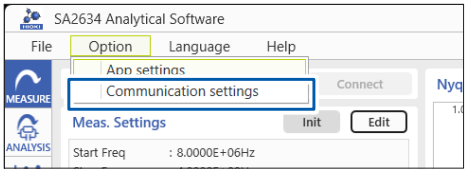
When a new preset has been created, **[OK]** changes to **[Create]**.

10 **Click [OK] to confirm the application settings.**

6.3 Setting the Communication Method

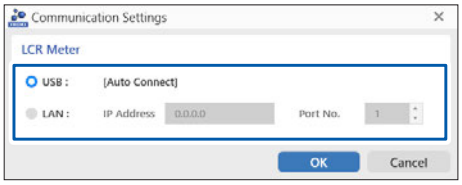
1 **Click [Option], and then click [Communication settings].**

The **[Communication Settings]** window opens.



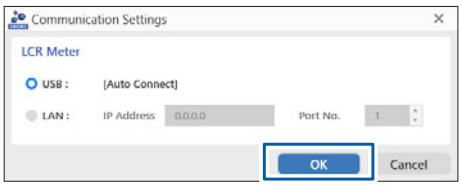
2 **Select the communication method for connecting the IM3536 and computer.**

There are two connection methods.



USB	Automatically connects to the LCR Meter.
LAN	Enter the IP Address and Port No. to connect.

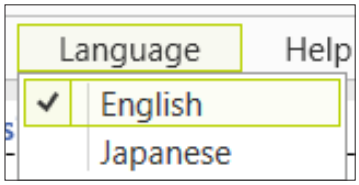
3 **Click [OK].**



6.4 Switching the Display Language

Select the language to be displayed.

1 **Click [Language] and click the language from the drop-down list.**



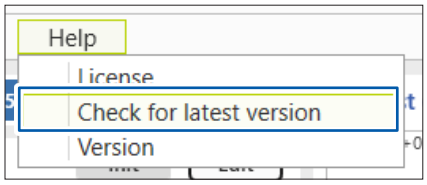
English	The application is displayed in English.
Japanese	The application is displayed in Japanese.

6.5 Checking the Latest Version of the SA2634 Analytical Software

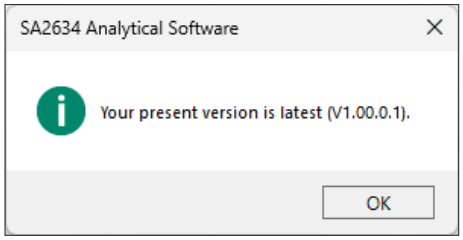
Check whether the latest version of the SA2634 Analytical Software is available.

1 **Click [Help], and then click [Check for latest version].**

The version verification window opens.



2 **Check the version.**

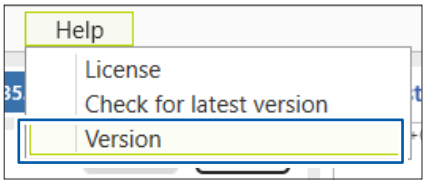


6.6 Checking the Software Version

Check the version of the SA2634 Analytical Software.

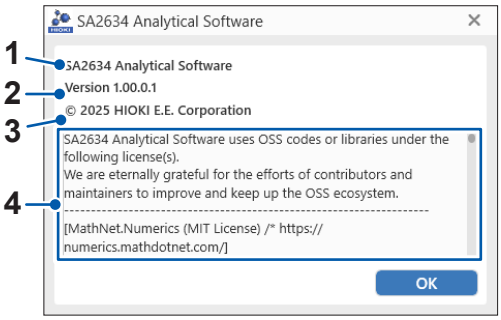
1 **Click [Help], and then click [Version].**

The version window opens.



2 **Check the contents.**

Displays information related to the application.



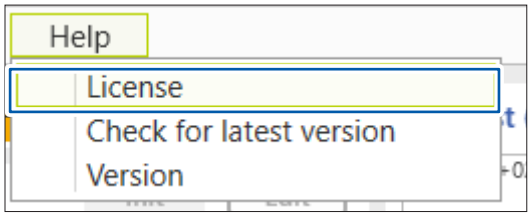
No.	Item name	Details
1	Application name	Displays the application name.
2	Version	Displays the version.
3	Copyright	Displays the copyright.
4	License information	Displays the OSS (Open Source Software) license information.

6.7 Checking the License Information

The license information can be checked.

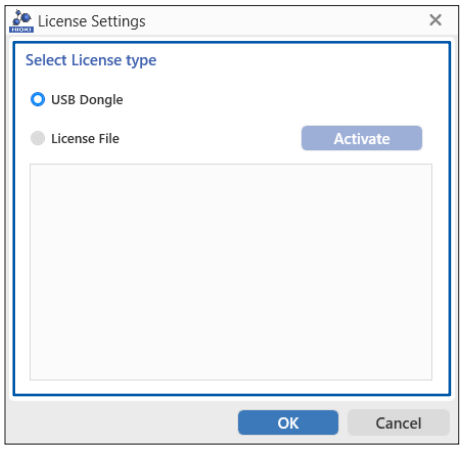
1 **Click [Help], and then click [License].**

The **[License Settings]** window opens.



2 **Set [Select License type].**

The license type is set with the radio button.



USB Dongle	Use the USB license key to authenticate the license. When selected, **[Activate]** is grayed out and the license information field is not displayed.
License File	Use a license file to authenticate the license. (Ordinarily not used.) When selected, **[Activate]** is enabled. Click **[Activate]** to display the file selection screen and select the license file.

License information

User	Displays the username.
Issued Time	Displays the date and time when the license was issued.
Expiration Period	Displays the expiration date.
Version	Displays the license version.

3 **Click [OK].**

7 Specifications

The specifications apply to the Slurry Analytical System.
For the specifications of the IM3536 LCR Meter, refer to the IM3536 Instruction Manual.

7.1 SA2634 Analytical Software

(1) General specifications

	Type	Name
System requirements (computer)	OS	Windows 10 or 11
	RAM	8 GB or more
	Storage	1 GB or more of available space
	Display	Recommended resolution: 1920 × 1080 or higher
	Interface	USB 2.0 or 3.0, LAN
	.NET Framework	4.7.2 or higher
Instrument to be controlled	• IM3536 LCR Meter • IM3533 LCR Meter • IM3570 Impedance Analyzer • IM3590 Chemical Impedance Analyzer	
License authentication	Authentication method: USB license key Can be used only when the license is valid.	
Accessories	• USB license key • USB cable (A-B type) • Download Guide	
Language	English, Japanese	
Product warranty duration	1 year	
Version management	• Function that can be selected to display a notification at startup when the latest version becomes available • Display of the version, copyright, and OSS license information	

(2) Function specifications (measurement)

Function	Detailed specifications
Instrument connection	• Controls the IM3536 / IM3533 / IM3570 / IM3590. • Connected by USB/LAN. • Maximum 1 unit can be connected.

<table>
<tr><th>Function</th><th>Detailed specifications</th></tr>
<tr><td>Measurement conditions settings</td><td>
<table>
<tr><th>Type</th><th>Setting item</th><th>Description</th></tr>
<tr><td rowspan="3">Sweep settings</td><td>Start frequency [Hz]</td><td rowspan="2">The setting range is different for each instrument.
IM3570: 4.00 to 5.0000E+06
IM3536: 4.00 to 8.0000E+06
IM3533: 0.0010 to 200.00E+03
IM3590: 0.0010 to 200.00E+03</td></tr>
<tr><td>Stop frequency [Hz]</td></tr>
<tr><td>Div. number</td><td>Number of measurement points. Logarithmic interpolation is performed between the start frequency and stop frequency using the number of divisions to calculate the frequency.
Input range: 150 to 999</td></tr>
<tr><td></td><td>Measurement interval [sec]</td><td>Frequency sweep interval time
Wait time before the next frequency measurement (sec)
Input range: 0 to 99</td></tr>
<tr><td>Meas Signal Level</td><td>Measurement signal level [V], [A]</td><td>• Open-circuit terminal voltage (V) mode (10 mV to 1 V)
• Constant voltage (CV) mode (10 mV to 1 V)
• Constant current (CC) mode (10 µA to 10 mA)</td></tr>
<tr><td rowspan="4">LCR Meter settings</td><td>Speed</td><td>FAST / MED / SLOW / SLOW2</td></tr>
<tr><td>Cable length [m]</td><td>
<table>
<tr><th>IM3536, IM3590</th><th>IM3533, IM3570</th></tr>
<tr><td>0 m, 1 m, 2 m, 4 m</td><td>0 m, 1 m</td></tr>
</table>
</td></tr>
<tr><td>Auto Ranging</td><td>Select enabled/disabled.</td></tr>
<tr><td>Range [Ω]</td><td>
<table>
<tr><th>IM3570</th><th>IM3533, IM3536, IM3590</th></tr>
<tr><td>• 100 mΩ
• 1 Ω
• 10 Ω
• 300 Ω
• 1 kΩ
• 3 kΩ
• 10 kΩ
• 30 kΩ
• 100 kΩ
• 1 MΩ
• 10 MΩ
• 100 MΩ</td><td>• 100 mΩ
• 1 Ω
• 10 Ω
• 100 Ω
• 1 kΩ
• 10 kΩ
• 100 kΩ
• 1 MΩ
• 10 MΩ
• 100 MΩ</td></tr>
</table>
</td></tr>
</table>
</td></tr>
<tr><td>Compensation</td><td>• Open compensation, short compensation
• Operated in a wizard format.
• Compensation date/time display and clear function</td></tr>
<tr><td>Comment input</td><td>Saved in the measurement CSV header.</td></tr>
<tr><td>Measurement</td><td>• Impedance measurement with a frequency sweep determined by the measurement conditions settings
• Measurement starts after specifying the measurement CSV file name and save directory.</td></tr>
<tr><td>Waveform display</td><td>• Nyquist plot display
• Realtime display
• Auto scale display
• Zoom-in/zoom-out and measured value display by mouse operation</td></tr>
<tr><td>Measurement CSV save</td><td>• CSV format
• Saves measurement frequency f [Hz], equivalent series resistance Rs (ReZ) [Ω], and reactance X (ImZ) [Ω].
• Measurement conditions are saved in the header.</td></tr>
</table>

(3) Function specifications (analysis)

Measurement CSV loading and list display

- Can load measurement CSV that were acquired with this software, or in a format registered in the preset settings.
- CSV format compatibility judgment function
- Loaded CSV delete function
- Maximum loaded CSV files: 1000

Analysis

- Analysis method: Equivalent circuit analysis of impedance data and calculation of various indexes
- Calculated indexes: DCR, Rratio of each relaxation, Uniformity of each relaxation

- Parameters required for analysis

Parameter	• Frequency f [Hz] • Equivalent series resistance Rs (ReZ) [Ω] • Reactance X (ImZ) [Ω]
Low Frequency Side	0.9 mHz to 110 kHz
High Frequency Side	190 kHz to 310 MHz
Data point count	150 points to 1100 points (logarithmic interval)*1

*1. The frequency data interval is judged as shown below.

$$0.0135 \geqq \frac{1}{N}\sum_{i=1}^{N}(log_{10}f_{i+1} - log_{10}f_i)$$

N: Data point count, f_i: Frequency
Data which satisfies the above formula can be analyzed.

- Analysis conditions settings

Setting item	Setting contents
Number of Relaxation Process	Select “Auto” or “1” to “4.”
Default	“Auto” or “Manual”
Range of Frequencies to Analyze	Select from the following. • Auto • Manual of high, Auto of low frequency side • Manual of both low and high frequency side
Low Frequency Side	When the frequency range is Manual, enter the lower-limit value for the range of frequencies to analyze.
High Frequency Side	When the frequency range is Manual, enter the upper-limit value for the range of frequencies to analyze.

Analysis results display and save

- Maximum displayed results: 1,000 data
- Displayed results CSV save function
- Displayed results select and delete function

- Contents of the analysis results list (column display in the application)

Selection check box	Analysis result row selection
File Name, waveform button	• Name of measurement result CSV file • Click the (waveform button) to display the fitting results at the bottom right of the screen.
Status	Displays the error code when an analysis error occurs.
Date Time	Analysis completion date/time
Action	Delete from the list.
Num of Relax	Num of Relax
DCR	DCR
Goodness of Fit	Goodness of Fit
Conf. Relax Num	Number of relaxation processes (analysis condition)
Conf. Init Value	Method of deciding default value (analysis condition)
Conf. Cutoff	Method of deciding range of frequencies to analyze (analysis condition) Auto: Calculated automatically Manual of High, Auto of Low: Upper limit is entered manually. Lower limit is calculated automatically. Manual: Entered manually.
Conf. High-Freq	Upper-limit value for frequency range (blank for automatic calculation) (analysis condition)
Conf. Low-Freq	Lower-limit value for frequency range (blank for automatic calculation) (analysis condition)
RPF <X>	Peak frequency of each relaxation (<X> is 1 to 8.)
Rratio <X>	Rratio of each relaxation (<X> is 1 to 8.)
Unif. <X>	Uniformity of each relaxation (<X> is 1 to 8.)
RPF 2-8	Relaxation peak frequency of relaxation with largest Rratio when comparing Rratio 2 through Rratio 8
Rratio 2-8	Sum of Rratio 2 through Rratio 8
Unif. 2-8	Uniformity of relaxation with largest Rratio when comparing Rratio 2 through Rratio 8
High-Freq EEC	One of the following is displayed. • None • R-L
Low-Freq EEC	One of the following is displayed. • CPE • R//CPE
Comment	Displays comment saved in measurement CSV.

Fitting results display and save

- Display switched from analysis results list.
- X axis: Re(Z), Y axis: −Im(Z). Displays the following.
  - Measurement CSV waveform
  - Fitted data
  - Relaxation process peak
  - DCR
- Fitted data CSV save function

(4) Function specifications (analysis results comparison)

Analysis CSV loading and display

- Analysis CSV that were created with this application can be loaded.
- A list of analysis results is displayed on the analysis results comparison screen.
- Delete from list function

Grouping

- Select data for grouping from analysis results list and create group.
- Group cancel function
- Group name edit function
- Maximum 30 groups can be created.

Graph display switching

The Rratio and Uniformity display is switched by selecting the following.

Selected item (index calculation method)	Graph display contents
The highest frequency side	Rratio1 / Uniformity1
Second highest frequency side	Rratio2 / Uniformity2
Other than the highest frequency side	Rratio2-8 / Uniformity2-8
The lowest frequency side	Relaxation Rratio/Uniformity with the lowest RelaxFreq
Second lowest frequency side	Relaxation Rratio/Uniformity with the second lowest RelaxFreq

Selecting from the following material list automatically decides the index calculation method.
Active material, conductive additives, binder, solvent, dispersant

Group comparison display

Displayed graph

Rratio-Uniformity	2D plot with Rratio on the X axis and Uniformity on the Y axis
DCR	Scatter plot with the group on the X axis and DCR [Ω] on the Y axis ±Deviation display on the error bar
Rratio	Scatter plot with the group on the X axis and Rratio on the Y axis ±Deviation display on the error bar
Uniformity	Scatter plot with the group on the X axis and Uniformity on the Y axis ±Deviation display on the error bar

(5) Function specifications (Input/Output CSV settings)

Measurement CSV format

- Switching the decimal separator and CSV delimiter. Select from the following combinations.

Decimal separator	CSV delimiter
. (Period)	, (Comma)
. (Period)	; (Semicolon)
, (Comma)	. (Period)
, (Comma)	; (Semicolon)

- Header presence/absence setting function

Measurement CSV format preset

Specify the data start row, Rs (ReZ) column, and X (ImZ) column of the measurement CSV to be loaded for analysis.
- Specified contents list save function
- Select from list function
- Saved contents edit/delete

7.2 SA9001/SA9001-01 Electrode Cell

Dimensions	Approx. 27W × 42H × 37D mm (1.1W × 1.7H × 1.5D in.) (including the electrode) With the lid closed: Approx. 27W × 40H × 20D mm (1.1W × 1.6H × 0.8D in.) (including the electrode)
Weight	Approx. 2.3 g (0.1 oz.)
Material	Container: Polypropylene (PP) Electrode: Brass Electrode surface treatment: Nickel plating (SA9001) Gold plating (SA9001-01)
Capacity	Approx. 1 mL
Electrode pin	Number of pins: 2 Length: 10.5 mm ±0.1 mm Diameter (Area where liquid to be measured comes in contact): 3 mm ±0.1 mm Diameter (Area where the fixture comes in contact): 3 mm ±0.1 mm Electrode interval: 6 mm ±0.3 mm Surface finish: Nickel-plated surface (SA9001) Gold-plated surface (SA9001-01)
Aspect ratio	Depth: approx. 16.5 mm Diameter: approx. 8.6 mm
Operating temperature and humidity range	23°C ±5°C (73°F ±9°F), 80% RH or less (non-condensing)
Storage temperature and humidity range	−10°C to 50°C (14°F to 122°F), 80% RH or less (non-condensing)
Operating environment	Indoors, altitude up to 2000 m (6562 ft.)
Accessory	Instruction Manual
Quantity	50

7.3 SA9002 Test Fixture

Measurable frequency	DC to 10 MHz
Connectable sample	SA9001 Electrode Cell SA9001-01 Electrode Cell
Residual impedance	Residual resistance during short circuit 200 mΩ or less (reference for 100 Hz) Inter-electrode stray capacitance 0.2 pF or less (reference for 1 MHz)
Dimensions	Approx. 98W × 38H × 24D mm (3.9W × 1.5H × 0.9D in.) (excluding protruding parts)
Weight	Approx. 210 g (7.4 oz.)
Connection method	BNC connector
Operating temperature and humidity range	23°C ±5°C (73°F ±9°F), 80% RH or less (non-condensing)
Storage temperature and humidity range	−10°C to 50°C (14°F to 122°F), 80% RH or less (non-condensing)
Operating environment	Indoors, altitude up to 2000 m (6562 ft.)
Accessories	Instruction Manual, shorting plate for compensation
Product warranty duration	3 years

8 FAQ

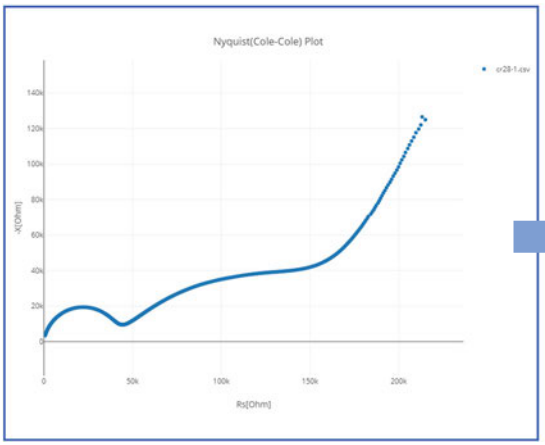
For details on the frequently asked questions, visit the Hioki's website.

8.1 Equivalent Circuit Analysis Method

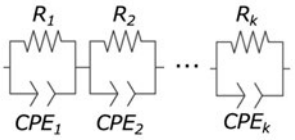
Q **How are the slurry electrical equivalent circuit parameters found?**

A Because the characteristics of the electric double layer capacitor formed by the electrode pin of the electrode cell and the slurry interface are included in the slurry impedance data, these characteristics are detected and used for compensation by incorporating them into the slurry electrical equivalent circuit.
The circuit parameters are found by the least squares method. The initial values are input automatically, and the parameters are optimized.
Once the parameters have been optimized, when the adjusted coefficient of determination is equal to or greater than the threshold value and the number of relaxation processes is minimized, the slurry electrical equivalent circuit parameters are decided.
This threshold value was decided experimentally from the values of LIB electrode slurry impedance measured by Hioki. This results in an algorithm that reduces the number of relaxation processes in order to avoid increasing the non-physical parameters by pursuing only goodness of fit.

Measured impedance value



Electrical equivalent circuit (EEC)



Replaced by an electrical circuit with the same response as the slurry impedance response.

8.2 DCR, Rratio, and Uniformity Calculation Methods

Q **How are DCR, Rratio, and Uniformity found during slurry analysis?**

A Quantitative indexes indicating the electron conductivity of the slurry are calculated using the slurry electrical equivalent circuit parameters. Each index is shown below.

- DCR (Direct current resistance)
  This is the sum of resistance components in an equivalent circuit with slurry electrical properties, and is equivalent to the total resistance of the slurry.
  The units are Ω.

- Rratio (Resistance ratio)
  This is the ratio of conductive material resistance components to DCR. It has no units and the maximum value is 1. With the maximum value of 1, it is believed that all conductive paths in the slurry are formed by conductive material.

- Uniformity
  This is an index that indicates the distribution of the relaxation processes produced by the conductive material. It quantifies the distribution using the CPE index p. It has no units and the maximum value is 1. With the maximum value of 1, it is believed that all conductive materials in the conductive paths are in the same state.

Electrical equivalent circuit (EEC)

DCR (Direct current resistance)

Sum of resistance components in an equivalent circuit with slurry electrical properties (Total slurry resistance)

$$DCR \equiv \sum_{\lambda} R_{\lambda}$$

Rratio (Resistance ratio)

Ratio of resistance components of the conductive material in DCR

$$\mathrm{Rratio}_{\lambda} \equiv \frac{R_{\lambda}}{DCR}$$

Uniformity

Distribution of relaxation by a conductive material

$$\mathrm{Uniformity}_{\lambda} \equiv p_{\lambda}\,(CPE\ index)$$

8.3 Method of Identifying the Relaxation Process Produced by the Conductive Material

Q **How is the relaxation process produced by the conductive material identified during slurry analysis?**

A It is possible to identify the relaxation process produced by the conductive material from the trend in Rratio change when slurries containing different percentages of conductive material are analyzed. Because the relaxation process of each material in the slurry has different frequency characteristics depending on the material, this produces differences in the relaxation process positions.

Fig. 1 is the Nyquist plot of LIB positive electrode mixture slurry. The slurry impedance data is believed to be a combination of the relaxation process produced by the materials (in this case, active material, conductive additives, and binder solution) contained in the slurry. The impedance data is subjected to equivalent circuit analysis, and is separated into three relaxation processes. The orange points in the graph are the peak frequency of each relaxation.

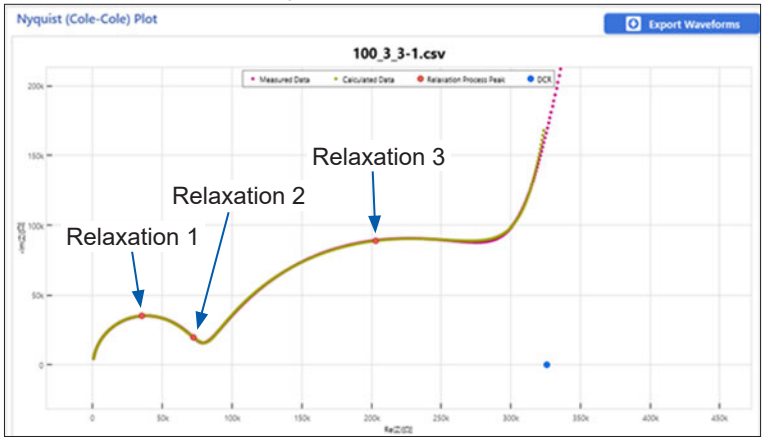


Fig. 1: Nyquist plot of LIB positive electrode mixture slurry and equivalent circuit analysis results

When slurries containing different percentages of conductive material are analyzed, the relaxation process that changes Rratio according to the percentage content is the relaxation process produced by the conductive material. The relaxation process produced by the conductive material in this slurry is relaxation 2 (the arc in the center).

Fig. 2 plots changes in the Rratio of each relaxation when the percentage of conductive additive in the positive electrode mixture slurry is changed in three steps. You can see that the Rratio of relaxation 2 is higher corresponding to the increase in the percentage of the conductive additive.

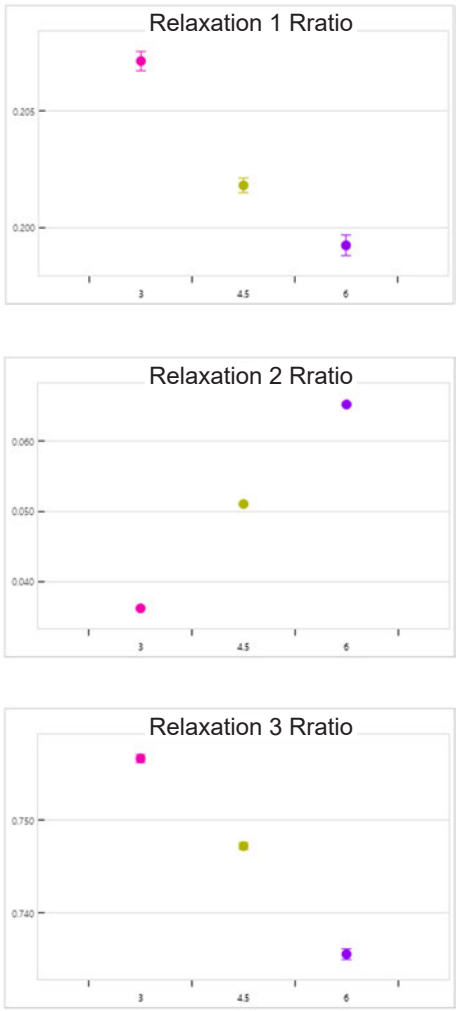
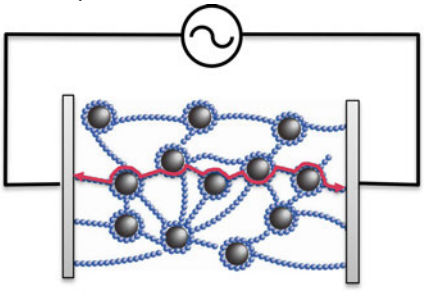


Fig. 2: Changes in Rratio of each relaxation corresponding to the percentage of conductive additive in the positive electrode mixture slurry

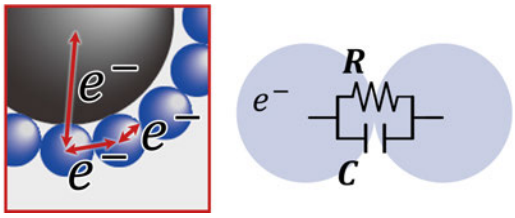
8.4 Relaxation Processes

Q **What do “resistance components” and “relaxation processes” indicate in the slurry analysis?**

A The following figure is an image of slurry impedance measurement. A measurement electrode is inserted into the slurry and AC voltage is applied to the slurry. The current response at this point is acquired as the measured value of impedance.



The figure below shows the movement of electrons within the material and between the materials when measurement is performed.
The application of AC voltage causes the electrons to travel back and forth in a primary particle, between the contact points of the same material, and between the contact points of different material. At this point, resistance component R indicates the difficulty of electron movement, and the capacitance component C indicates the ease of electron accumulation.



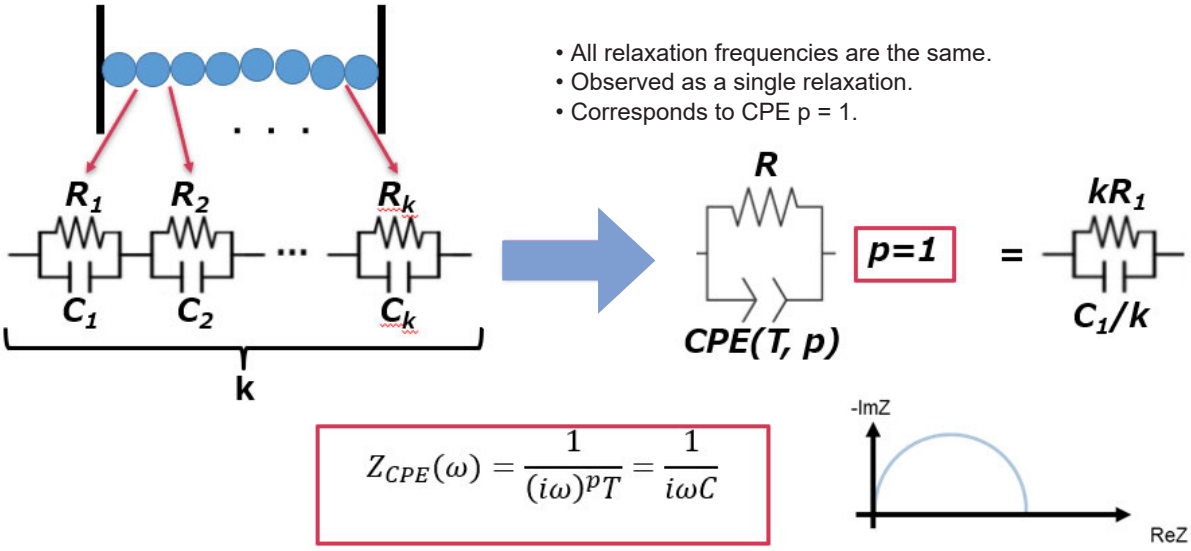
Relaxation processes exist in
the contact points of the material
bulk and between materials.

When electrons flow through something that connects R and C in parallel, the electrons first remain in C and then flow to R. The phenomenon of the electrons that charged C leaking to R is known as a relaxation process. When slurry impedance is actually measured, impedance characteristics equivalent to this relaxation process are obtained. Therefore, it is believed that relaxation processes exist in the material bulk and contact points between materials suspended in the slurry.

8.5 Relaxation Process Uniformity

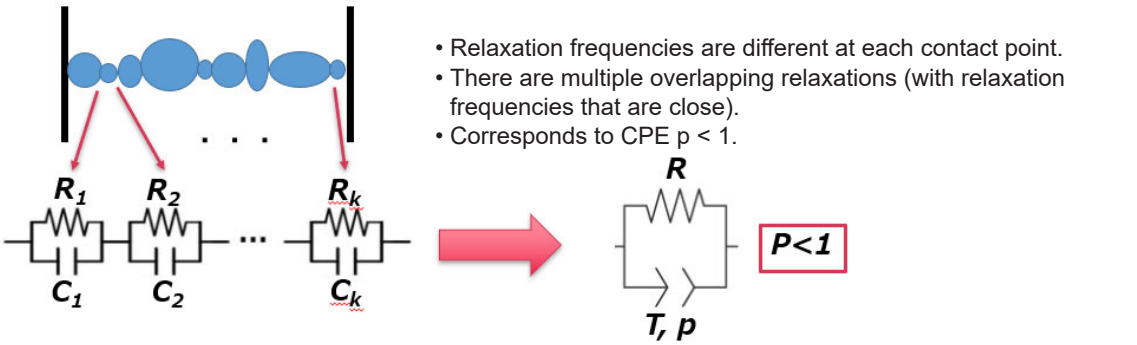
Q **What kind of state does “relaxation process uniformity” indicate in slurry analysis?**

A The relaxation processes produced by the same material are affected by the contact conditions when they are distributed.
When the particle contact conditions are uniform, the relaxation processes produced between the conductive materials in the conductive path have the same parameters.
The Nyquist plot obtained at this point is a semicircle. The distribution of the relaxation processes produced by the same material is expressed by CPE. When the particle contact conditions are uniform, p of CPE is 1.
However, when the particle contact conditions are not uniform, distribution is affected by the frequency characteristics of the relaxation processes produced between the conductive materials in the conductive path. The Nyquist plot obtained at this point is a crushed arc, and p of CPE is 1 or less.



- All relaxation frequencies are the same.
- Observed as a single relaxation.
- Corresponds to CPE p = 1.

$$Z_{CPE}(\omega) = \frac{1}{(i\omega)^p T} = \frac{1}{i\omega C}$$



- Relaxation frequencies are different at each contact point.
- There are multiple overlapping relaxations (with relaxation frequencies that are close).
- Corresponds to CPE p < 1.

The higher non-uniformity is, the more the arc is crushed and the smaller p is.

8.6 Goodness of Fit

Q **What does the value of the results file item “Goodness of fit” indicate?**

A This value indicates how close the actual measured impedance and the calculated impedance are. The closer this value is to 1, the less relative difference there is between the two (goodness of fit is relatively high). “Goodness of fit” is defined as follows.

$$Goodness\ of\ fit = 1 - \frac{\frac{1}{2N-p-1}\left\{\sum_i (R_{s,meas,i} - R_{s,calc,i})^2 + \sum_i (X_{meas,i} - X_{calc,i})^2\right\}}{\frac{1}{2N-1}\left\{\sum_i (R_{s,meas,i} - \bar{T})^2 + \sum_i (X_{meas,i} - \bar{T})^2\right\}}$$

$$\bar{T} = \frac{1}{2N}\left(\sum_i R_{s,meas,i} + \sum_i X_{meas,i}\right)$$

$R_{s,means,i}$ and $X_{means,i}$ are the calculated impedance; T is the average value of measured impedance; N is the number of measurement points; p is the number of electrical equivalent circuit (EEC) parameters.
The goodness of fit is a value that indicates the conditions of the calculation, and is not a value that indicates the quality of the slurry.

8.7 Impedance Data Analysis

Q **What kind of impedance data can be analyzed in slurry analysis?**
(How the gold-plated surface and nickel-plated surface in an electrode cell are used)

A We assume that analysis is performed of impedance data such as that shown in the figure below. The impedance data can be checked in the Nyquist plot.

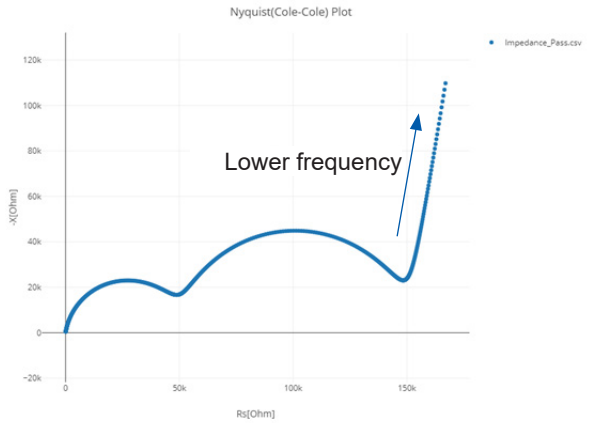


Fig. 1: Impedance data that can be analyzed

- Contains relaxation processes. (An arc is observed when the Nyquist plot is displayed.)
- The electrode pin in the electrode cell and the slurry interface form only an electric double layer capacitor. (The low frequency side is a straight line when the Nyquist plot is displayed.)

In the case of data such as the following, there is the risk of analysis errors.

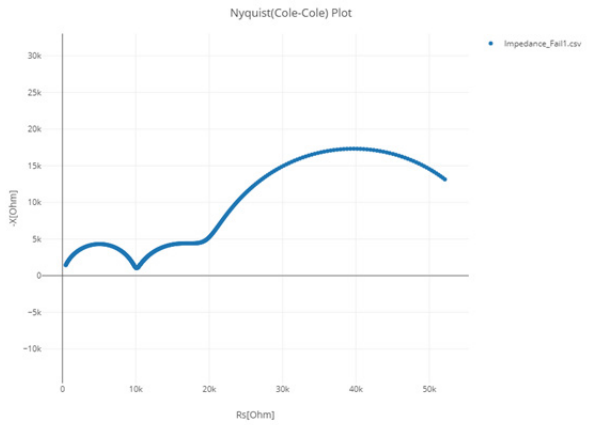


Fig. 2: Impedance data that cannot be analyzed (1)

The electrode pin in the electrode cell and the slurry interface are not only an electric double layer capacitor. (The low frequency side is not a straight line when the Nyquist plot is displayed.)
It is possible that an electrochemical reaction is occurring between the electrode pin and slurry. This may be improved through the use of an electrode cell with a gold-plated surface (SA9001-01).
Alternatively, it is possible that the conductive material in the slurry is in direct contact with the electrode pin. This may be improved by lowering the concentration of conductive material, or by promoting a dispersal process.

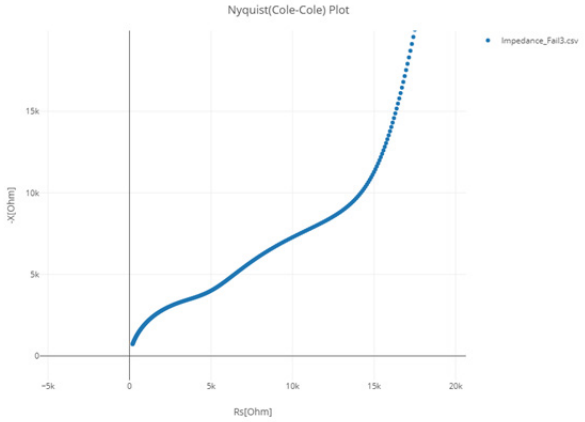


Fig. 3: Impedance data that cannot be analyzed (2)

The frequency characteristics of the slurry bulk and interface are close. (The boundary between the arc and straight line is not clear when the Nyquist plot is displayed.)
Formation of an interface between the slurry and electrode pin is insufficient. In this case, stable measurement is not possible and the measured values may change over time. With a water-based slurry, the measured values may be stable immediately after filling as a result of using an electrode cell with a gold-plated surface (SA9001-01).

9 Maintenance and Service

9.1 Repair, Calibration, and Cleaning

⚠WARNING

■ Do not modify, disassemble, or repair the product.

Touching any of the high-voltage points inside the product is very dangerous. Failure to follow this guidance could result in electric shock or fire.

Calibration

The calibration period varies with the conditions and environment of use.
It is recommended to determine a calibration period based on those factors and to have the system regularly calibrated by Hioki. Please contact your Hioki distributor to have your system periodically calibrated.

Backing up the data

The system may be reset (The factory default settings may be restored) when it is repaired or calibrated.
Before you ask for repair or calibration, it is recommended to back up (save or record) the measurement conditions and measured data.

Shipping of this system

⚠CAUTION

Observe the following when shipping the product.

- **Remove the accessories and options from the product.**
- **Attach a description of the malfunction when sending the product for repair.**
- **Use the packaging in which the product was initially delivered and then pack that in an additional box.**

Failure to do so could damage the product.

Cleaning

⚠CAUTION

■ **If the product becomes dirty, wipe it clean with a soft cloth slightly moistened with water or a neutral detergent.**

Using solvent-containing detergents, such as benzine, alcohol, acetone, ether, ketone, thinner, and gasoline, or wiping the product with excessive force could cause deformation or discoloration.

When the SA9001 mounting part of the Test Fixture is stained, gently wipe it using a soft cloth with a small amount of alcohol.

9.2 Troubleshooting

If damage is suspected, refer to the “Before Returning for Repair” (p. 90) section to address the issues.
If this does not help you, contact your authorized Hioki distributor or reseller.

Before Returning for Repair

Symptom	Cause	Solution and reference
The SA9002 Test Fixture cannot be connected to the IM3536 LCR Meter.	The BNC connector is deformed or damaged.	If the connector is deformed or damaged, purchase a new connector.
	The SA9002 Test Fixture is improperly fixed.	Properly fix the SA9002 Test Fixture. “2.5 Mounting the SA9002 Test Fixture” (p. 31)
There is variation in the measured values.	• Air is mixed in with the liquid to be measured when it is poured into the SA9001 Electrode Cell. • The liquid level of the SA9001 Electrode Cell is inappropriate.	“3.6 Putting Liquid to Be Measured into the SA9001 or SA9001-01 Electrode Cell” (p. 41)
	The electrode pins are damaged.	Use new pins.
There is a leak from the electrode of the SA9001 Electrode Cell.	The SA9001 Electrode Cell is deformed or damaged.	Contact your authorized Hioki distributor or reseller.
It is difficult to pour the liquid into the SA9001 Electrode Cell.	–	If the SA9001 Electrode Cell cannot be stood, it is recommended that you use a micro-tube stand. “3.6 Putting Liquid to Be Measured into the SA9001 or SA9001-01 Electrode Cell” (p. 41)
The liquid to be measured spills when the lid of the SA9001 Electrode Cell is closed.	An excessive amount of liquid is put into the Electrode Cell.	Put the liquid so it is below the upper limit line of the SA9001 Electrode Cell. “3.6 Putting Liquid to Be Measured into the SA9001 or SA9001-01 Electrode Cell” (p. 41)
The lid of the SA9001 Electrode Cell cannot close.	An excessive amount of liquid is put into the Electrode Cell.	Put the liquid so it is below the upper limit line of the SA9001 Electrode Cell. “3.6 Putting Liquid to Be Measured into the SA9001 or SA9001-01 Electrode Cell” (p. 41)
	The SA9001 Electrode Cell is deformed or damaged.	Contact your authorized Hioki distributor or reseller.
The SA2634 Analytical Software and the IM3536 LCR Meter cannot be connected.	The IM3536 LCR Meter is off.	Turn on the power of the IM3536 LCR Meter. “2.6 Turning On the IM3536” (p. 32)
	The cable between the IM3536 LCR Meter and the computer is not connected.	Properly connect the IM3536 LCR Meter and the computer using a cable. “2.4 Connecting the IM3536 and Computer” (p. 30)

Symptom	Cause	Solution and reference
Open compensation cannot be performed.	The SA9002 Test Fixture gets dirty.	Clean the SA9002 Test Fixture before performing compensation. “9.1 Repair, Calibration, and Cleaning” (p. 89)
	The empty SA9001 Electrode Cell is improperly placed on the SA9002 Test Fixture.	“3.5 Correcting Errors (Open Compensation, Short Compensation)” (p. 37)
	The SA9001 mounting part of the SA9002 Test Fixture is deformed or damaged.	If the connector is deformed or damaged, purchase a new connector.
Short compensation cannot be performed.	The SA9002 Test Fixture gets dirty.	Clean the SA9002 Test Fixture before performing compensation. “9.1 Repair, Calibration, and Cleaning” (p. 89)
	The shorting plate for compensation has contact defect.	“3.5 Correcting Errors (Open Compensation, Short Compensation)” (p. 37)
	The shorting plate for compensation is improperly placed on the SA9002 Test Fixture.	–
	The SA9001 mounting part of the SA9002 Test Fixture is deformed or damaged.	If the connector is deformed or damaged, purchase a new connector.
Measurement takes a long time.	When the impedance of liquid to be measured is low, such as 10 Ω DC or less, a constant voltage of 101 mV cannot be applied and correct measurement may not be performed.	–
The measurement CSV cannot be loaded.	The incorrect data format is used.	“4.1 Loading and Analyzing Measurement Data” (p. 47)

When there is no apparent cause

Reset the IM3536 (perform the system reset) and reconnect it.

See “11 Maintenance and Service” in the IM3536 Instruction Manual.

Error Message

When an error occurs in the IM3536, an error message is displayed on the screen.
See the following table to check the error information and troubleshooting.

Error message	Solution and reference
Open compensation failed. Check the settings.	Check the open compensation settings. “3.5 Correcting Errors (Open Compensation, Short Compensation)” (p. 37)
Short compensation failed. Check the settings.	Check the short compensation settings. “3.5 Correcting Errors (Open Compensation, Short Compensation)” (p. 37)

Analysis Error Codes

Error code	Details
E002	The number of measurement data is invalid. Check the Analytical Software specifications “Parameters required for analysis” (p. 75).
E003	The minimum frequency of the measurement data is outside the range. Check the Analytical Software specifications “Parameters required for analysis” (p. 75).
E004	The maximum frequency of the measurement data is outside the range. Check the Analytical Software specifications “Parameters required for analysis” (p. 75).
E005	The frequencies of the measurement data are not in logarithmic intervals. Check the Analytical Software specifications “Parameters required for analysis” (p. 75).
E006	Automatic cutoff of low frequency data failed. Please set the cutoff frequency manually.
E007	The number of measurement data points after cutoff is invalid. Check the Analytical Software specifications “Parameters required for analysis” (p. 75).
E008	The minimum frequency of the measurement data after cutoff is outside the range. Check the Analytical Software specifications “Parameters required for analysis” (p. 75).
E009	The maximum frequency of the measurement data after cutoff is outside the range. Check the Analytical Software specifications “Parameters required for analysis” (p. 75).
E010	The frequencies of the measurement data after cutoff are not in logarithmic intervals. Check the Analytical Software specifications “Parameters required for analysis” (p. 75).
E011	The impedance of the low frequency area did not fit available equivalent circuit models. Please adjust the cutoff frequency of the low frequency area.
E013	Equivalent circuit analysis failed. This data cannot be analyzed.
E015	The calculation timed out. This data cannot be analyzed.
E016	Failed to determine initial values for equivalent circuit analysis. This data cannot be analyzed.
E017	The imaginary part of the impedance (ImZ) sign is invalid. Check the file. When the ImZ sign is positive, configure the preset setting in “Input CSV format settings” for **[App settings]** under **[Option]**.
E018	Data density is low. Check the Analytical Software specifications “Parameters required for analysis” (p. 75).
E020	Relaxation was detected in the low frequency area. Check the validity of the results. Or analyze again after changing the analysis conditions (by fixing the number of relaxations or adjusting the cutoff frequency).
E021	Multiple relaxations were detected. Check the validity of the results. Or analyze again after changing the analysis conditions (by fixing the number of relaxations or adjusting the cutoff frequency).

Error code	Details
E022	The CPE-p of the equivalent circuit is now 1 or more. Check the validity of the results. Or analyze again after changing the analysis conditions (by fixing the number of relaxations or adjusting the cutoff frequency).
E024	The CPE-p of the equivalent circuit is now 1 or more. Check the validity of the results. Or analyze again after changing the analysis conditions (by fixing the number of relaxations or adjusting the cutoff frequency).

9.3 Disposal

Have a waste management company authorized by the relevant local government dispose of the Electrode Cell with the measured liquid adhered.

IMPORTANT

Do not reuse the SA9001 Electrode Cell.
If there is any measured liquid left inside the Electrode Cell, subsequent measurements may be affected.
Cleaning the used Electrode Cell causes the pins to be scratched or shifted and subsequent measurements may be affected.

For details on disposal of the IM3536, refer to “11 Maintenance and Service” in the IM3536 Instruction Manual.

HIOKI

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