

ST4030A L R for Coil Demo Application Manual

Overview

The ST4030A L R for Coil Demo Application (hereafter referred to as "this application") allows you to obtain estimated values of the inductance (L) and resistance (R) to be measured by equivalent circuit analysis with ST4030A/ST4030(hereafter referred to as "this instrument").

動作環境

- CPU: Operating clock 1 GHz or more
- Memory: 4 GB or more
- OS: Windows 10, Windows 11
- Microsoft .NET Framework 4.7.2 must work
- Interface: USB
- Monitor resolution: 1024 x 768 dots or more
- Hard drive: At least 10 MB of free space

(if .NET Framework 4.7.2 is not installed, an additional approximately 4.5 GB is required.)

Installing this application

1. Double-click "Setup_ST4030A_L_R_for_Coil_DEMO.exe".

The installer screen is displayed.

2. Click "Next" for everything.
3. The installation begins.

Once the installation is complete, if an icon was created on the desktop, a shortcut for the next icon will be created.



Uninstalling this application

The application can be uninstalled by opening the Windows Setting, choosing Apps.

Connecting this instrument to your computer

- Connecting this instrument via USB

The device driver is included with the Impulse Winding Tester Application Disc. The Impulse Winding Tester Application Disc can be downloaded from Hioki website.

After installing the device driver, connect this instrument to the PC with a USB cable.

Recommended cable: L1002 USB cable (A-B)

Launching this application and connecting to this instrument

The procedure for starting this application and connecting it to instrument is shown.

1. Select and run this application from the start menu, or double click on the shortcut created on the desktop.

The language selection screen is displayed when starting for the first time.



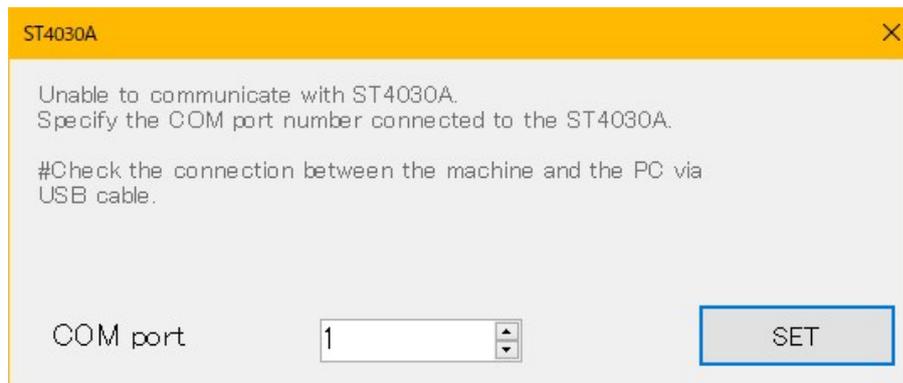
Select the language you want to use.

Warning

When measurements are performed with this application, the ST4030A settings will be initialized.

2. This application communicates with this instrument via a virtual COM port.

If the virtual COM port numbers do not agree, a screen for specifying the port number is displayed.



If this screen is displayed, set the port number.

You can check the port number in the device manager or the content displayed by clicking the "Safely remove hardware and eject media" icon in the notification area on the taskbar, or in the device manager.

If the connection with this instrument is successful, the screen on the next page will be displayed.

Explanation of this application

With this application and this instrument, it is possible to obtain estimated values of the inductance and resistance to be measured. The characteristics to be measured can be easily grasped with 2 numerical values.

The screenshot shows the application interface with several key areas highlighted by callouts:

- Settings:** A group of configuration options including Applied voltage (100 V), Measurement pulses (10), Degauss pulses (30), Voltage adjustment method (INTERNAL), Sampling frequency (AUTO), and Charge voltage (100 V).
- Control buttons:** A set of buttons for ABORT, COPY, WAVE, and START.
- Estimated values table:** A table showing average, maximum, and minimum values for inductance (L) and resistance (R).
- Graph:** A scatter plot titled "L vs R [100 V/Charge/200 MHz/100 V]" showing a single data point for "COIL".

	L [mH]	R [ohm]
AVG	0.953	16.768
MAX	0.954	17.106
MIN	0.952	16.397

The graph displays a single data point for "COIL" at approximately L = 0.953 mH and R = 16.768 ohm. The y-axis is labeled "R [ohm]" and ranges from 15 to 19. The x-axis is labeled "L [mH]" and ranges from 0.85 to 1.1. Below the graph, there are options for "Display area": ZOOM, NORMAL (selected), and WIDE.

Callout 1: "Show the estimated value as a value." points to the table.

Callout 2: "Show estimated values in a graph." points to the graph.

The graph is not displayed before measurement.

Test voltage setting

To set the test voltage, click on the applied voltage frame.

The screenshot shows the ST4030A software interface with the following settings:

- Applied voltage: 100 V (highlighted with a red box and arrow)
- Measurement pulses: 10
- Degauss pulses: 30
- Voltage adjustment method: INTERNAL
- Sampling frequency: AUTO
- Charge voltage: 100 V

Measurement results table:

	L [mH]	R [ohm]
AVG	0.953	16.768
MAX	0.954	17.106
MIN	0.952	16.397

The graph on the right is titled "L vs R [100 V/Charge/200 MHz/100 V]" and shows a scatter plot of R [ohm] vs L [mH]. The data points are clustered around L = 0.95 mH and R = 16.7 ohms. The legend indicates the data is for "COIL".

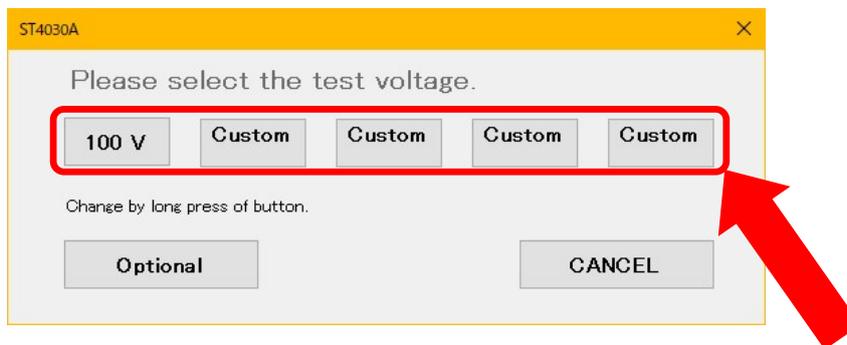
Display area options: ZOOM, NORMAL, WIDE

Click to display the test voltage setting screen.

The dialog box titled "ST4030A" contains the following elements:

- Text: "Please select the test voltage."
- Buttons: "100 V", "Custom", "Custom", "Custom", "Custom"
- Text: "Change by long press of button."
- Buttons: "Optional", "CANCEL"

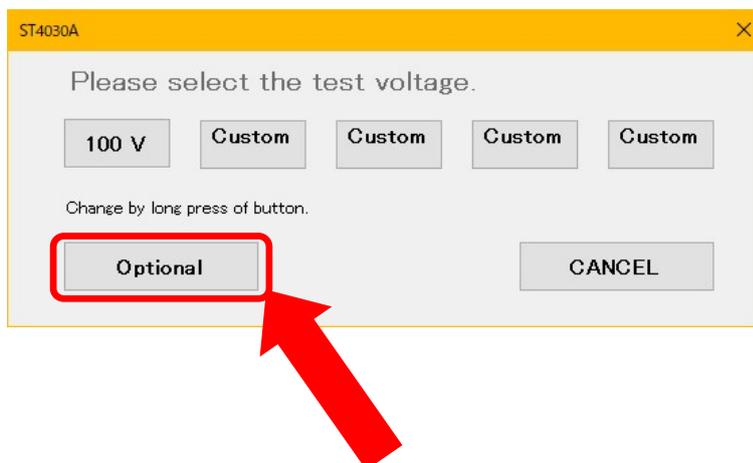
Click the 5 buttons to select the voltage displayed on the buttons.



You can change the voltage set on the button by pressing and holding the button. The voltage value input screen will be displayed, so please enter the voltage value.

There is no voltage assigned to the button marked as “Custom”.

If you click the “Optional” button, you can freely set the voltage regardless of the voltage displayed on the 5 buttons.



Setting the number of measured pulses

To set the number of measurement pulses, click on the “Measurement pulses” frame.

The screenshot shows the ST4030A software interface with the following settings:

- Applied voltage: 100 V
- Measurement pulses: 10 (highlighted with a red box and arrow)
- Degauss pulses: 30
- Voltage adjustment method: INTERNAL
- Sampling frequency: AUTO
- Charge voltage: 100 V

Buttons: ABORT, COPY, WAVE, START

	L [mH]	R [ohm]
AVG	0.953	16.768
MAX	0.954	17.106
MIN	0.952	16.397

Graph: L vs R [100 V/Charge/200 MHz/100 V]

Y-axis: R [ohm] (15 to 19)
X-axis: L [mH] (0.85 to 1.1)

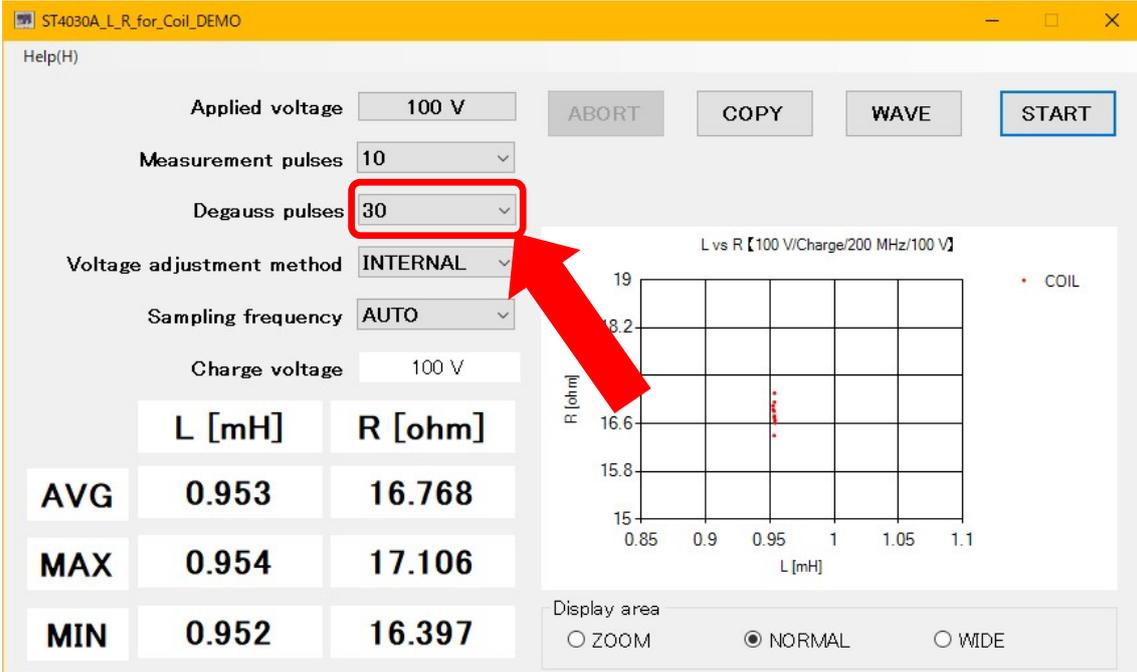
Legend: COIL

Display area: ZOOM NORMAL WIDE

The types of settings for the number of the “Measurement pulses” are 10, 20, 30, 40, 50, 80, 100, 200, 300, 400, 500, 800, 1000 .

Setting the number of degauss pulses

To set the number of degauss pulses, click on the “Degauss pulses” frame.



The screenshot shows the ST4030A software interface. The 'Degauss pulses' dropdown menu is highlighted with a red box and a red arrow pointing to it. The interface includes a 'START' button and a graph titled 'L vs R [100 V/Charge/200 MHz/100 V]'. The graph displays a vertical cluster of red data points for 'COIL' at approximately L = 0.953 mH and R = 16.768 ohm. Below the graph, there is a table of measurement results.

	L [mH]	R [ohm]
AVG	0.953	16.768
MAX	0.954	17.106
MIN	0.952	16.397

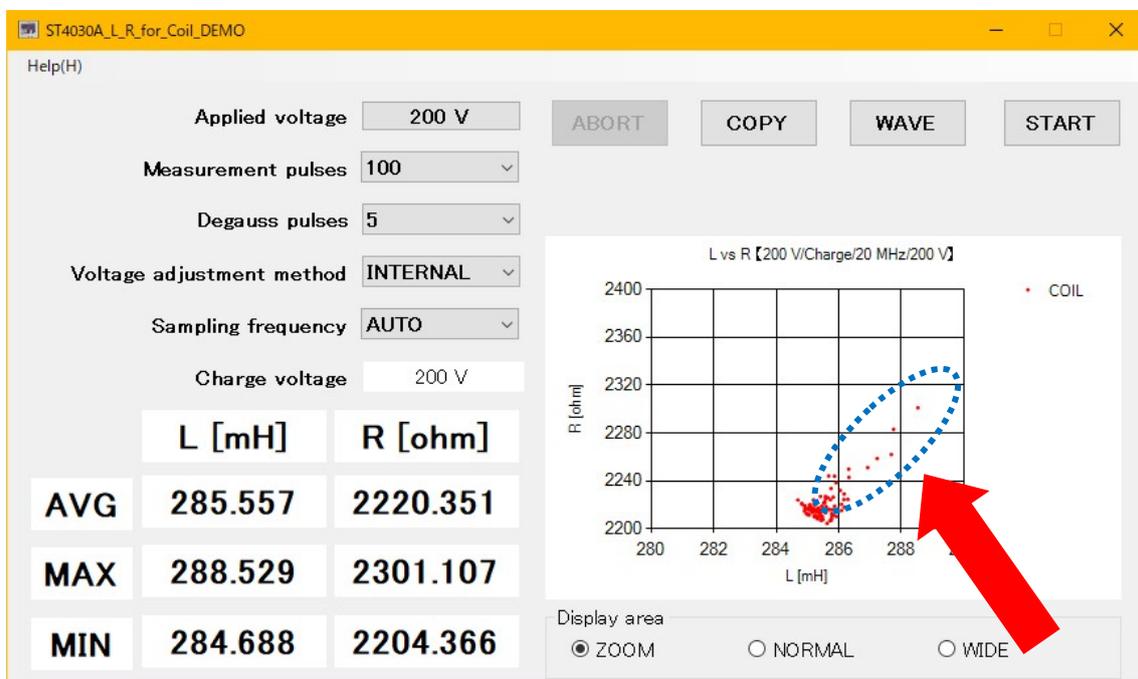
The types of settings for the number of the “Degauss pulses” are

5, 10, 20, 30 .

Degauss pulses are used to adjust for variability in magnetization of the object to be measured.

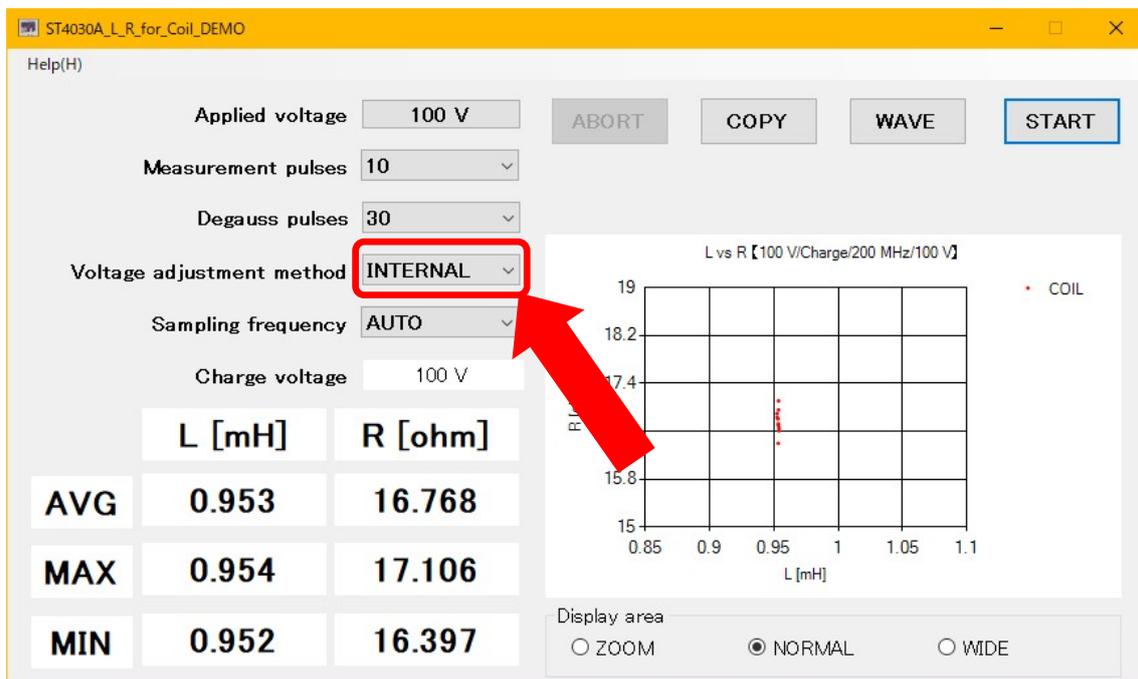
In object under measurement where the magnetization state of the core is likely to remain, if the number of degauss pulses is low, the measured value may not stabilize with several pulses until the measured value settles down.

In the graph below, some points of the measured value is not stable, because the number of degauss pulses is insufficient.



Setting the voltage adjustment method

To set the voltage adjustment method, click on the “Voltage adjustment method” frame.



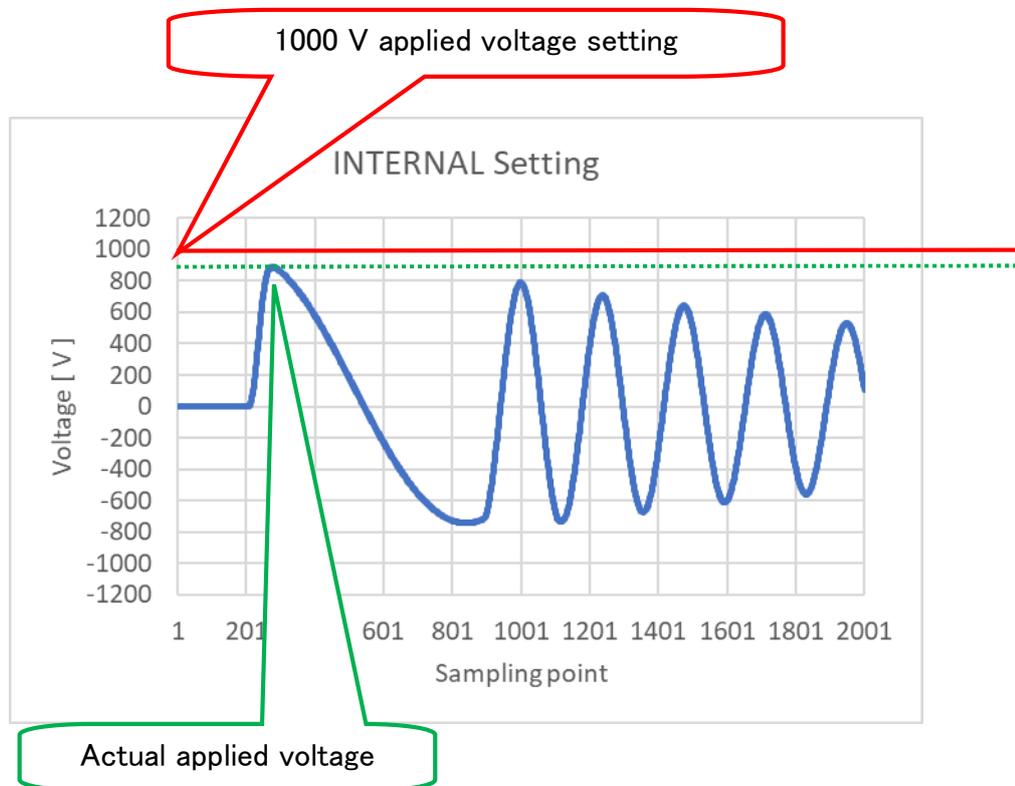
The types of settings for the voltage adjustment method are

INTERNAL, TOP, MAX .

[INTERNAL] The internal charging voltage of this instrument is fixed to the applied voltage setting.

Normally, you should measure with this setting.

The voltage which applied to the object under measurement is slightly lower than the set voltage.



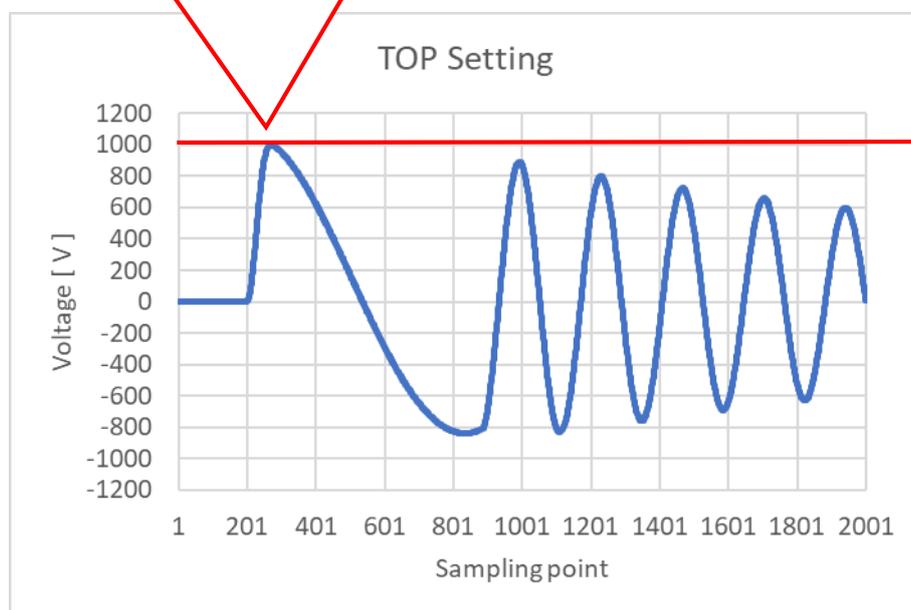
Warning

Depending on the characteristics of the object under measurement, a voltage higher than the set voltage may be applied.

[TOP] Adjust the voltage so that the voltage at the first peak of the waveform is set to the applied voltage.

It is used when the actual applied voltage agreement the set voltage.

The 1000 V applied voltage setting agreement the actual applied voltage.



Warning

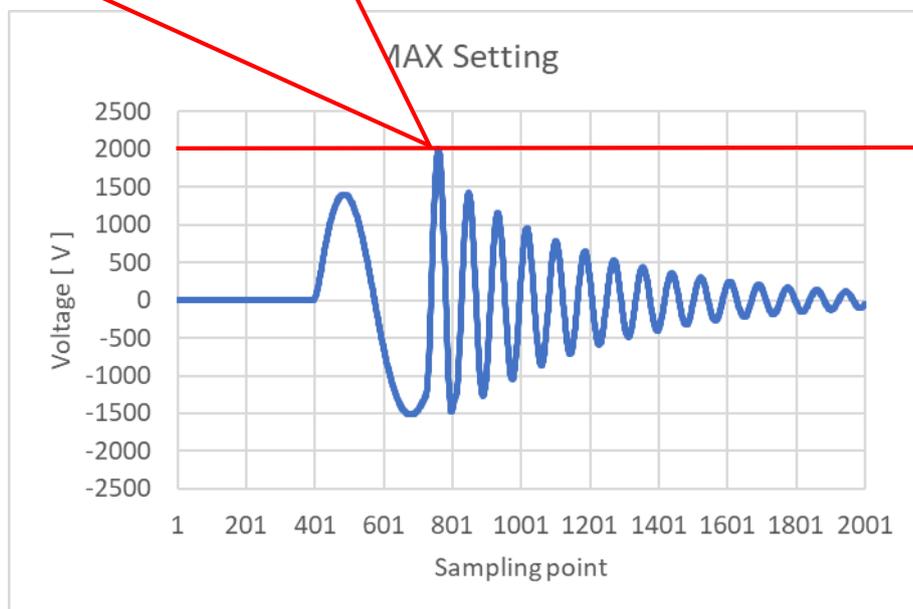
When the inductance is small or when the object under measurement is close to a short circuited state, the internal charging voltage of this instrument is considerably larger than the applied voltage setting because the voltage drop is large.

Consequently, depending on the state of the object under measurement, a higher voltage than the setting may be applied.

[MAX] Adjust the voltage so that the maximum amplitude of the waveform is set to the applied voltage.

It is used when the maximum amplitude of the waveform is larger than the first peak of the waveform, and when the maximum amplitude is adjusted to the applied voltage.

The 1000 V applied voltage setting agreement the maximum amplitude of the waveform.



Warning

When the inductance is small or when the object under measurement is close to a short circuited state, the internal charging voltage of this instrument is considerably larger than the applied voltage setting because the voltage drop is large.

Consequently, depending on the state of the object under measurement, a higher voltage than the setting may be applied.

Setting the sampling frequency

To set the sampling frequency, click on the “Sampling frequency” frame.

The screenshot shows the ST4030A software interface with the following settings:

- Applied voltage: 100 V
- Measurement pulses: 10
- Degauss pulses: 30
- Voltage adjustment method: INTERNAL
- Sampling frequency: **AUTO** (highlighted with a red box and arrow)
- Charge voltage: 100 V

	L [mH]	R [ohm]
AVG	0.953	16.768
MAX	0.954	17.106
MIN	0.952	16.397

The graph displays 'L vs R [100 V/Charge/200 MHz/100 V]' with a legend for 'COIL'. The x-axis is labeled 'L [mH]' and ranges from 0.85 to 1.1. The y-axis ranges from 15.1 to 19. The graph shows a cluster of red data points around L = 0.95 mH and R = 16.7 ohms.

The types of settings for the sampling frequency are

AUTO, 10MHz, 20MHz, 50MHz, 100MHz, 200MHz .

It is usually used with the AUTO setting.

Use settings other than AUTO when agreement sampling frequency settings with other measurements.

Carrying out measurements

To perform a measurement, click the “START” button.

The screenshot shows the ST4030A software interface with the following settings:

- Applied voltage: 100 V
- Measurement pulses: 10
- Degauss pulses: 30
- Voltage adjustment method: INTERNAL
- Sampling frequency: AUTO
- Charge voltage: 100 V

	L [mH]	R [ohm]
AVG	0.953	16.768
MAX	0.954	17.106
MIN	0.952	16.397

The graph displays L vs R [100 V/Charge/200 MHz/100 V] with R [ohm] on the y-axis (15 to 19) and L [mH] on the x-axis (0.85 to 1.1). A red dot labeled 'COIL' is visible at approximately (0.953, 16.768). The 'START' button is highlighted with a red box and a red arrow.

After setting up this instrument, a confirmation screen will be displayed

MESSAGE

Connect
the RED lead to the coil terminal
and
the BLACK lead to the other coil terminal.
Press OK to start measurement.

OK CANCEL

Click OK to begin the measurement.

Measurement interruption

To stop the measurement, click the “ABORT” button.

The screenshot shows the ST4030A software interface for measuring a coil. The window title is "ST4030A_L_R_for_Coil_DEMO". The interface includes a "Help(H)" menu, a settings panel on the left, and a graph on the right. The settings panel includes:

- Applied voltage: 100 V
- Measurement pulses: 7
- Degauss pulses: 30
- Voltage adjustment method: Charge
- Sampling frequency: 200 MHz
- Charge voltage: 100 V

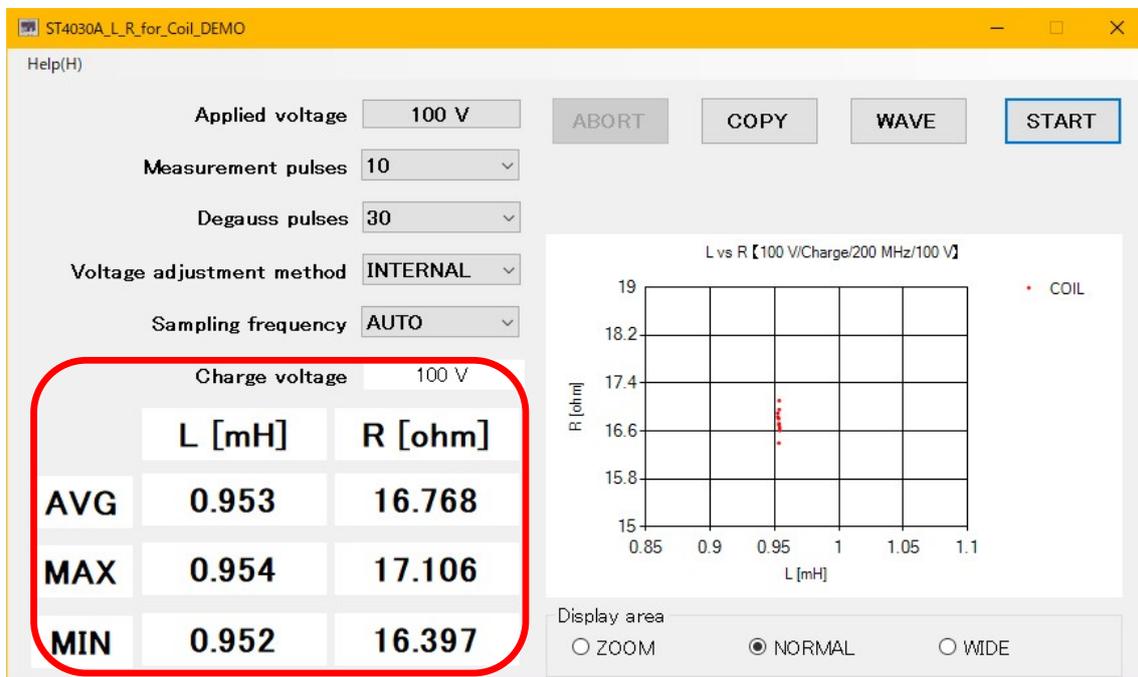
Below the settings are three rows of buttons for "AVG", "MAX", and "MIN", each with two columns for "L [mH]" and "R [ohm]". The graph on the right is titled "L vs R" and shows a scatter plot of R [ohm] versus L [mH]. The y-axis ranges from 16 to 17, and the x-axis ranges from 0.95 to 0.96. A legend indicates "COIL" with a red dot. The "ABORT" button is highlighted with a red box, and a red arrow points to it from the graph area.

Buttons at the top right of the interface include "ABORT", "COPY", "WAVE", and "START".

Display area options at the bottom right include "ZOOM" (selected), "NORMAL", and "WIDE".

Estimated results

After measurement, the average values, maximum values, and minimum values of the inductance value and resistance value estimation results are displayed.



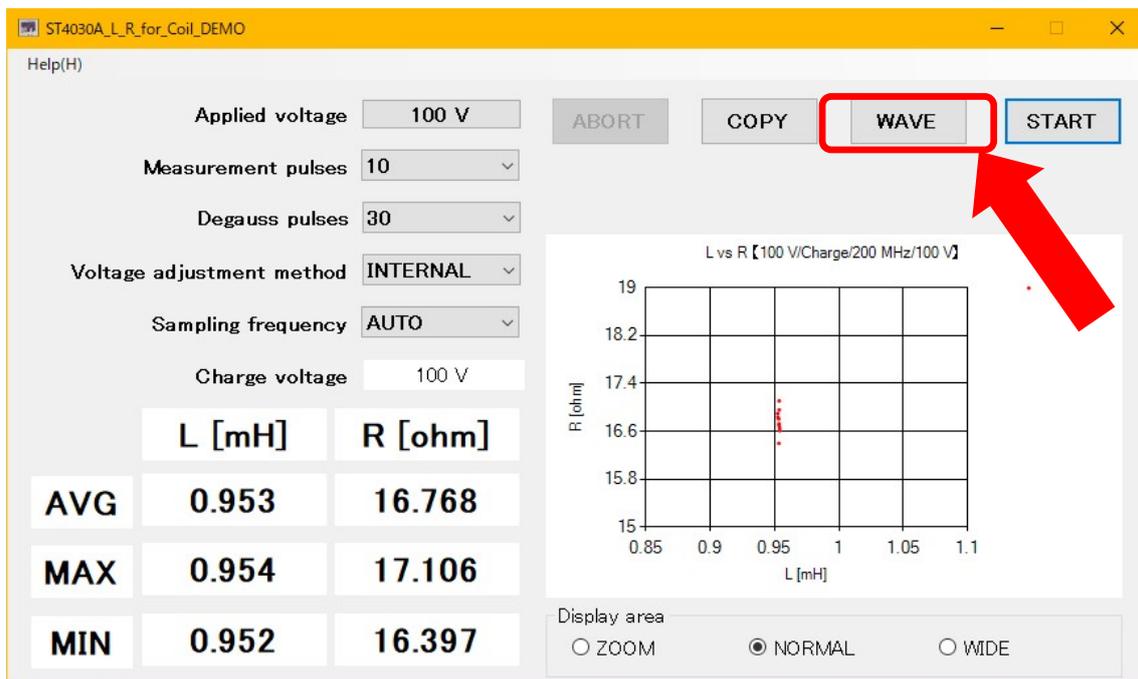
“L” is the inductance value. “R” is the resistance value.

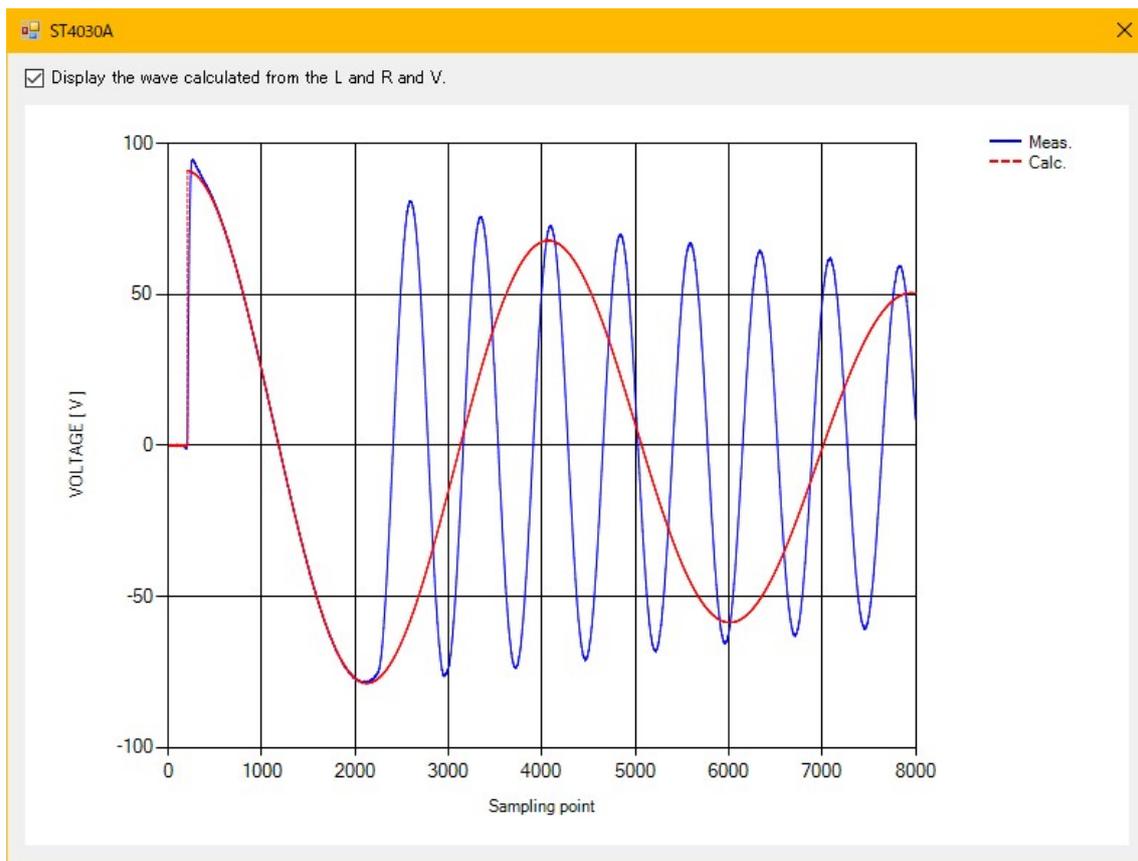
“Charge voltage” shows the voltage charged to the internal capacitor of this instrument.

As you variation the display area, the magnification of the estimated value graph changes.

Waveform graph display

If you click the “WAVE” button after measurement, the measured waveform will be displayed in a separate window.





The blue waveform is the waveform measured by this instrument.

The red waveform is the waveform calculated from estimated values such as inductance and resistance.

With the check box at the top left of the window, you can switch whether to display the waveform calculated from the estimated value.

Out of multiple measurement pulse waveforms, only one waveform is displayed.

Copy estimated results

After measurement, click the “COPY” button to copy estimated values etc. to the clipboard.

The screenshot shows the ST4030A software interface. On the left, there are control panels for 'Applied voltage' (100 V), 'Measurement pulses' (10), 'Degauss pulses' (30), 'Voltage adjustment method' (INTERNAL), 'Sampling frequency' (AUTO), and 'Charge voltage' (100 V). Below these is a table of results:

	L [mH]	R [ohm]
AVG	0.953	16.768
MAX	0.954	17.106
MIN	0.952	16.397

On the right, there is a graph titled 'L vs R [100 V/Charge/200... 100 V]' showing a scatter plot of R [ohm] vs L [mH]. The y-axis ranges from 15 to 19, and the x-axis ranges from 0.85 to 1.1. A red arrow points to the 'COPY' button, which is highlighted with a red box.

At the bottom right, there is a 'Display area' section with radio buttons for 'ZOOM', 'NORMAL' (selected), and 'WIDE'.

Contents copied to the clipboard can be pasted directly into spreadsheet software.

The data is pasted into the spreadsheet software in the following format.

	ITEM	VALUE	UNIT	SUMMARY	
E.	L(AVG)	9.52E-04	[H]	Estimated inductance.	} A.
F.	R(AVG)	1.68E+01	[ohm]	Estimated resistance(loss).	
G.	V(AVG)	9.11E+01	[V]	Initial value of estimated voltage transient response	
H.	E(AVG)	1.34E-01	[V]	The root mean square error of the waveform calculation	
I.	C(AVG)	9.74E-10	[F]	Floating capacity value converted from the difference	
	L(MAX)	9.53E-04	[H]		} B.
	R(MAX)	1.70E+01	[ohm]		
	V(MAX)	9.12E+01	[V]		
	E(MAX)	1.43E-01	[V]		
	C(MAX)	9.89E-10	[F]		
	L(MIN)	9.52E-04	[H]		} C.
	R(MIN)	1.65E+01	[ohm]		
	V(MIN)	9.10E+01	[V]		
	E(MIN)	1.24E-01	[V]		
	C(MIN)	9.66E-10	[F]		
J.	Applied voltage	100	[V]		} D.
K.	Measurement pulses	10			
L.	Degauss pulses	30			
M.	Voltage adjustment method	INTERNAL			
N.	Sampling frequency	200	[MHz]		
O.	Charge voltage	100	[V]		

- A. The average value of each estimate.
- B. The maximum value of each estimate.
- C. The minimum value of each estimate.
- D. This is the setting at the time of measurement.
- E. Estimated inductance.
- F. Estimated resistance (loss).
- G. The initial voltage of the estimate transient response.

H. The root mean square error. It was calculated from the waveform calculated from estimated value and the measured waveform.

At the estimation, various compensation are performed on the measured waveform, and then the error is calculated. Consequently, the root mean square error which directly calculated from the waveform calculated from the estimated value and the measured waveform, that is different from this value.

I. It is the parasitic capacitance (floating capacitance), it was converted from the initial voltage of the estimate transient response. It is assumed that the internal charging voltage was dropped by the parasitic capacitance (floating capacitance) to be measured. Because it is a simple conversion, it is very different from the actual parasitic capacitance (floating capacity) value.

J. This is the set value of the voltage to apply to the object under measurement.

K. Value of the number of measurement pulses.

L. Value of the number of degauss pulses.

M. The setting how to adjust the voltage.

N. Sampling frequency.

O. Voltage value charged to the capacitor inside the instrument.

FAQs

Q01. What are the advantages of finding inductance and resistance from impulse waveforms?

A01. There are a number of advantages.

- You can grasp the characteristics of the object under measurement with easy-to-understand values such as inductance and resistance values.
- You can compare to what extent the waveform of the master product and the waveform to be tested are similar using only 2 numerical values.
- It will be possible to compare and consider other types of measured value such as LCR meters.

Q02. Aren't measurements and settings difficult?

A02. Measurement is possible if only the applied voltage (test voltage) is set.

Q03. Is voltage calibration required on the master sample?

A03. Inductance and resistance can be determined without voltage calibration or master samples.

Q04. Why are measurements and settings so easy?

A04. The LC value/RC value analysis function has evolution. An impulse waveform analysis engine is configured by this instrument and this application. With the superior algorithms of the advanced impulse waveform analysis engine, it is possible to obtain estimated values without complex settings or operations.

Q05. Can this application be used with impulse testing machines other than ST4030A/ST4030?

A05. Since an impulse waveform analysis engine cannot be configured with anything other than this instrument, this application cannot be used.

Q06. If the measurement lead is extended or the coil configuration is complex, ringing may occur in the waveform or the waveform may fluctuate, but is it possible to analyze such waveforms?

A06. The impulse waveform analysis engine is equipped with an analysis algorithm that is highly resistant to ringing and waveform rippling, so it is possible to analyze anything other than vibration waveforms that fluctuate extremely.

Q07. Why are units attached to estimates?

A07. Priority was given to the simplicity of handling values and ease of understanding.

Q08. What is the range of inductance that can be estimated?

A08. The range of inductance that can be estimated well is roughly in the range of 100 μ H to 10mH. Estimation is available even when it exceeds 10mH, but the deviation between the measured waveform and the waveform calculated from estimated values such as inductance and resistance estrangement to be greater.

Q09. How precision are the estimates?

A09. The object under measurement is regarded as an equivalent circuit in which inductance and resistance are connected in series. Since the value is calculated depends on the inverse problem analysis method, there is no precision. Suitable for comparison as relative values.

Q10. Is there a way to determine whether the estimation has been made well?

A10. It can be determined by whether the two waveforms agreement to some extent. That is a waveform calculated from the estimated values such as inductance and resistance and measured waveform. Or click the copy button to copy the measurement results to the clipboard. The value of the degree of agreement can be acquisition with the root mean square error value recording in the measurement result.

Q11. When the sampling frequency was set slower, the estimated value became negative.

A11. Estimation may not be possible if the sampling frequency is not set appropriately. In this case, the estimate will be negative.

Q12. When the measurement was performed, "Disconnection." was displayed.

A12. There is a possibility that there is a disconnection point in the measurement lead, wiring, or internal the object under measurement, or poor contact has occurred.

Q13. "Disconnection." was displayed even though the wire was not broken.

A13. Determining disconnection in this application is simple. It is displayed when the inductance to be measured is too large or the resistance value is too large. Or the sampling frequency is not set properly.

Q14. When the measurement was performed, "Short circuit." is displayed.

A14. There is a possibility that there is a short circuited in the measurement lead, wiring, or internal the object under measurement.

Q15. "Short circuit." was displayed even though there was no short circuited.

A15. Determining a short circuited in this application is simple. It is displayed when the inductance to be measured is too small.

Q16. "Set voltage too high." was displayed.

A16. An applied voltage that exceeds the voltage that can be applied with this instrument has been set. In particular, when object under measurement with low inductance, the voltage drop increases, so the maximum value of voltage that can be applied becomes smaller.

Q17. "Communication error occurred." was displayed when the STOP button on this instrument was pressed during measurement with this application.

A17. There is no issues even if the instrument 's STOP button is pressed during measurement for the purpose of stopping the voltage output of this instrument. However, if this instrument is operated during measurement with this application, a communication errors may occur.

Q18. "Check the software version of the instrument." was displayed.

A18. You need to update your instrument 's software version to the latest version.

Q19. "This device is not supported." was displayed.

A19. The COM port to which instrument other than ST4030A/ST4030 are connected has been selected.

Q20. "ST4030A settings will be initialized. Can ST4030A be initialized?" was displayed.

A20. This application initializes the instrument 's settings during measurement. If you want to keep the settings, save the settings of this instrument in the settings file before performing measurements with this application.

Q21. The measured waveform and the waveform calculated from the estimated value do not agreement from the middle of the waveform.

A21. There is a diode in the voltage application circuit inside the instrument, and when the voltage application is completed, the voltage application circuit inside the instrument is disconnected. Consequently, after voltage is applied, the waveform variation. Since the waveform calculated from the estimated value does not include the operation of the diode, the waveform after the voltage application is finished does not agreement.

Q22. Even for object under measurement without iron loss, the resistance value is greater than the copper loss value.

A22. This is due to the effect of the voltage applied circuit elements inside this instrument. When the applied voltage is 100V with a 1mH inductor, the value is roughly 15 ohms larger. This value fluctuation depending on the magnitude of the applied voltage and the object under measurement.

Q23. The estimated value does not agreement the value measured by the LCR meter.

A23. The estimated value does not often agreement the value measured with an LCR meter due to the following factors, etc.

- Difference between measuring frequency of LCR meters and vibration frequency of transient response.
- Difference between voltage value and current value during measurement.
- Nonlinearity of the characteristic of the measurement target.
- When measuring estimated values, the capacitor inside the instrument dominates the transient response. On the other hand, when measuring with an LCR meter, the parasitic capacitance (floating capacity) to be measured dominates.

Q24. Is it possible to convert LC value/RC value and estimated inductance/resistance value?

A24. When measuring estimated values, the capacitor inside the instrument dominates the transient response. On the other hand, when measuring with an LCR meter, the parasitic capacitance (floating capacity) to be measured dominates. Consequently, the vibration period, voltage, current, etc. differ depending on the object under measurement and measurement condition. Therefore, the relationship between estimated inductance/resistance and LC value/RC value also differs individually depending on the object under measurement and measurement condition. Consequently, conversion is difficult.

Q25. What are the advantages compared to LC values and RC values?

A25. Since the size of the waveform attenuates drastically in coils with large losses, it may be difficult to calculate LC values and RC values. The new inductance and resistance estimation method analyzes the first period of the impulse waveform. The amplitude of analyze area of the waveform is large. Consequently, analysis that makes effective use of voltage resolution is possible. Also, since there is no need for a master waveform or voltage calibration, measurement work to compare past measured values is also easy. Additionally, the waveform for calculating the estimated value is dominated by the capacitor that applies the voltage inside the instrument. Consequently, it is less likely to be affected by the measurement lead or the parasitic capacitance (floating capacity) of the wire/measurement target.

Q26. The estimated inductance is now abnormally large.

A26. This may occur if the sampling frequency is not set properly.

Q27. How should I set the sampling frequency appropriately?

A27. The interval from the leftmost plus side peak of the waveform on the screen of this instrument (usually the maximum voltage value of the waveform) to the next right side negative peak (usually the minimum voltage value of the waveform) is important. Set the sampling frequency so that the interval is between 1 square and 6 squares or less on the screen of this instrument.

Q28. Why is there a slight deviation between the estimate of the initial voltage of transient response and the actual peak voltage value in the measured waveform?

A28. The impulse waveform analysis engine performs analysis by assuming that the voltage value is maximum and the current value is 0 at the timing of voltage application. In actual measurements, when the measured waveforms is at its peak, current has already begun to flow to the object under measurement. Mainly for this reason, there is a slight deviation between the estimate of the initial voltage of transient response and the actual peak voltage value of the measured waveform.

Q29. Is it suitable for detecting partial electrical discharge?

A29. It is not suitable for detecting partial electrical discharge.

Q30. Can it be used to detect spark electrical discharge?

A30. If a spark electrical discharge occurs, the deviation between the maximum and minimum estimated values may increase. However, since waveforms often variation greatly, consider using other methods of determination.

Q31. The measured value and waveforms displayed on the instrument 's screen are not stable.

A31. There is also a possibility that there is poor contact between the measurement lead, wiring, and object under measurement.

Disclaimer

This application is freeware. Hioki is not liable for any damage or loss sustained as a result of its use or for any bugs, issues, or defects that it may contain.

Please note that Hioki is unable to respond to questions about this software.