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Find the *Instek LCR-8101* at our website: *Click HERE*

Precision LCR Meter

LCR-8101

USER MANUAL

GW INSTEK PART NO. 82CR-81010MA1

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ISO-9001 CERTIFIED MANUFACTURER GW INSTEK

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SAFETY INSTRUCTION

This chapter contains important safety instructions that you must follow when operating LCR-8101 and when keeping it in storage. Read the following before any operation to insure your safety and to keep the best condition for LCR-8101.

Safety Symbols

These safety symbols may appear in this manual or on LCR-8101.

WARNING	Warning: Identifies conditions or practices that could result in injury or loss of life.
CAUTION	Caution: Identifies conditions or practices that could result in damage to LCR-8101 or to other properties.
	DANGER High Voltage
	Attention Refer to the Manual
	Protective Conductor Terminal
	Earth (ground) Terminal

Safety Guidelines

General Guideline

CAUTION

- Do not place any heavy object on LCR-8101.
- Avoid severe impacts or rough handling that leads to damaging LCR-8101.
- Do not discharge static electricity to LCR-8101.
- Do not block or obstruct the cooling fan vent opening.
- Do not perform measurement at circuits directly connected to Mains (Note below).
- Do not disassemble LCR-8101 unless you are qualified as service personnel.

(Measurement categories) EN 61010-1:2001 specifies the measurement categories and their requirements as follows. LCR-8101 falls under category I.

- Measurement category IV is for measurement performed at the source of low-voltage installation.
- Measurement category III is for measurement performed in the building installation.
- Measurement category II is for measurement performed on the circuits directly connected to the low voltage installation.
- Measurement category I is for measurements performed on circuits not directly connected to Mains.

Power Supply

WARNING

- AC Input voltage: 115V/230V, 50/60Hz
- The power supply voltage should not fluctuate more than 10%.
- Connect the protective grounding conductor of the AC power cord to an earth ground, to avoid electrical shock.

Fuse

WARNING

- Fuse type: T3A/250V
- Make sure the correct type of fuse is installed before power up.

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- To ensure fire protection, replace the fuse only with the specified type and rating.
- Disconnect the power cord before fuse replacement.
- Make sure the cause of fuse blowout is fixed before fuse replacement.

Cleaning LCR-8101

- Disconnect the power cord before cleaning.
- Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid.
- Do not use chemical or cleaner containing harsh material such as benzene, toluene, xylene, and acetone.

Operation Environment

- Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (Note below)
- Relative Humidity: < 80%
- Altitude: < 2000m
- Temperature: 0°C to 40°C

(Pollution Degree) EN 61010-1:2001 specifies the pollution degrees and their requirements as follows. LCR-8101 falls under degree 2.

Pollution refers to "addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity".

- Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.
- Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.
- Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. In such conditions, equipment is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.

Storage environment

- Location: Indoor
- Relative Humidity: < 80%
- Temperature: −40°C to 70°C

Power cord for the United Kingdom

When using LCR-8101 in the United Kingdom, make sure the power cord meets the following safety instructions.

NOTE: This lead/appliance must only be wired by competent persons

WARNING: THIS APPLIANCE MUST BE EARTHED

IMPORTANT: The wires in this lead are coloured in accordance with the following code:

Green/ Yellow:	Earth
Blue:	Neutral
Brown:	Live (Phase)



As the colours of the wires in main leads may not correspond with the colours marking identified in your plug/appliance, proceed as follows:

The wire which is coloured Green & Yellow must be connected to the Earth terminal marked with the letter E or by the earth symbol or coloured Green or Green & Yellow.

The wire which is coloured Blue must be connected to the terminal which is marked with the letter N or coloured Blue or Black.

The wire which is coloured Brown must be connected to the terminal marked with the letter L or P or coloured Brown or Red.

If in doubt, consult the instructions provided with the equipment or contact the supplier.

This cable/appliance should be protected by a suitably rated and approved HBC mains fuse: refer to the rating information on the equipment and/or user instructions for details. As a guide, cable of 0.75mm2 should be protected by a 3A or 5A fuse. Larger conductors would normally require 13A types, depending on the connection method used.

Any moulded mains connector that requires removal /replacement must be destroyed by removal of any fuse & fuse carrier and disposed of immediately, as a plug with bared wires is hazardous if a engaged in live socket. Any re-wiring must be carried out in accordance with the information detailed on this label.

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GETTING STARTED

This chapter describes LCR-8101 in a nutshell, including its main features, front / rear panel appearance, and power up sequence. Use the Tutorial section for a quick access to the main functionalities, step by step.



Main Features	Main Features	10
Measurement item	Measurement item	11
	Measurement combination	11
Panel overview	Front Panel Overview	12
	Rear Panel Overview	15
Tilt stand / Power up	Tilt stand	16
	Power up	17
	Select AC mains frequency (50/60Hz)	18
Fixture connection	Fixture structure	19
	Fixture connection	20
Tutorial	Basic measurement (without Pass/Fail test)	21
	Pass/Fail test (Single step)	22
	Pass/Fail test (Multiple step)	24
	Graph mode	26
Measurement tip	Measurement tip	28

Main Features

Performance	• 20Hz ~ 1MHz wide test frequency • 6 digit measurement resolution • 10mV ~ 2V measurement drive level • 0.1% basic measurement accuracy
Operation	• Spot frequency measurement • Multi-step measurement, maximum 64 programs with up to 30 steps each • Actual measurement value display • Measurement in absolute value or percentage difference from the nominal value • Pass/Fail test • Precision fixture with four-wire + ground connection • Fixture trimming, open and closed connection • Bar display mode for easy adjustment of variable components • Graph mode for visual representation of measurement data • Retains panel setup after power-Off • Large LCD display, 320x240 resolution • Intuitive user interface, comprehensive measurement functions
Interface	• GPIB • RS-232C

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Measurement Type

Measurement item

Primary measurement	Capacitance (C)	Inductance (L)
	Reactance (X)	Susceptance (B) (=1/X)
	Impedance (R)	Admittance (Y) (=1/Z)
	DC Resistance (R_{DC})	
Secondary measurement	AC Resistance (R_{AC})	Quality factor (Q)(=1/D)
	Dissipation factor (D)	Angle (θ) (for Z and Y)

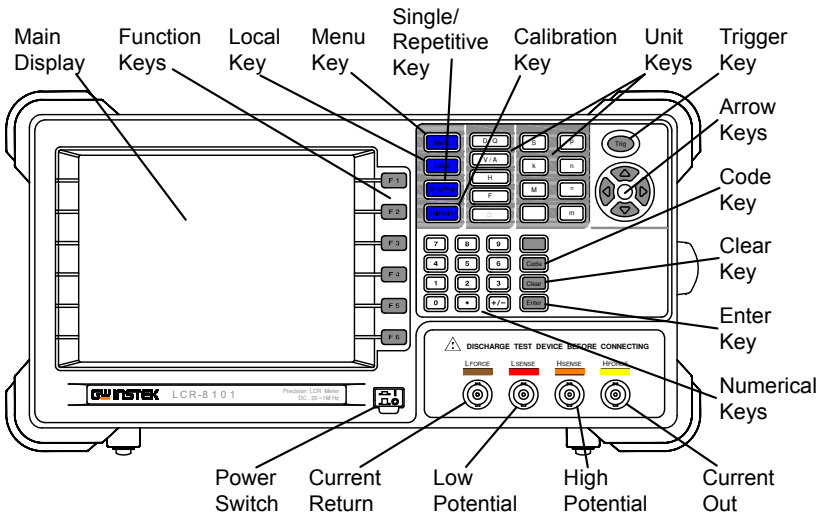
Measurement combination

●:Available, —:Not available

1st measurement	2nd measurement					Circuit model		Graph	Prog
	Q	D	R_{AC}	G	Angle	Series	Parallel		
Capacitance (C)	●	●	●	●	—	●	●	●	●
Inductance (L)	●	●	●	●	—	●	●	●	●
Reactance (X)	●	●	●	—	—	●	—	●	●
Susceptance (B)	●	●	●	●	—	—	●	●	●
Impedance (Z)	—	—	—	—	●	—	—	●	●
Admittance (Y)	—	—	—	—	●	—	—	●	●
DC Resistance(R_{DC})	—	—	—	—	—	—	—	—	●
Quality factor (Q)						●	●	●	●
Dissipation factor (D)						●	●	●	●
AC Resistance (R_{AC})						●	●	●	●
Conductance (G)						—	●	●	●
Angle (θ)						—	—	●	●

*Prog: Multi-step program

Front Panel Overview



Main display	320 by 240, DST LCD display.	
Function keys	F 1 ~ F 6	Assigned to the menu on the right side of the display.
Local key	Local	When the instrument is under remote control mode, sets the instrument back into local panel operation. For remote control details, see page97.
Menu key	Menu	Shows the main menu on the display.
Single/Repetitive key	Sing/Rep	Selects Single measurement mode (manual triggering) or Repetitive measurement mode (automatic triggering). See page49 for details.

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Calibration key — Calibration — Enters the calibration mode. See page113 for calibration details.

Unit keys — Enters unit when editing values.

- D/Q — Dissipation factor or Quality factor
- V/A — Voltage or Ampere
- H — Henry (for Inductance)
- F — Farad (for Capacitance)
- Ω — Ohm (for Resistance, Impedance)
- S — Siemens (for Susceptance, Admittance)
- k — Kilo (10^3)
- M — Mega (10^6)
- p — Pico (10^{-12})
- n — Nano (10^{-9})
- μ — Micro (10^{-6})
- m — Milli (10^{-3})

Trigger key — Trig — Manually triggers measurement. Available only in Single measurement mode (page49).

Arrow keys — Selects menu items or parameters. The Up/Down and Left/Right keys are used in pairs.

Code key — Code — Enters system codes for changing drive Voltage/Current display (page51) or frequency adjustment resolution (page46).

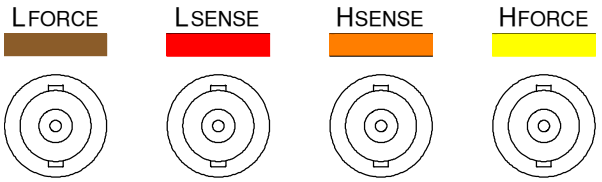
Clear key — Clear — Clears all previous entries when editing values.

Enter key — Enter — Confirms the entered value or selection.

Numerical keys — 7 8 9 / 4 5 6 / 1 2 3 / 0 • +/− — Enters numeric values.

Measurement terminals — Accepts measurement fixture. For connection details, see page19.

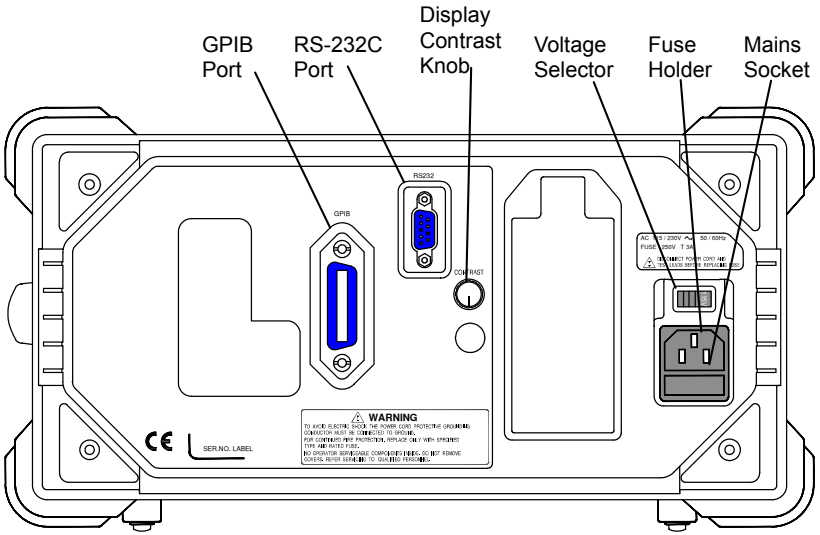
LFORCE	Current return
LSENSE	Low potential
HSENSE	High potential
HFORCE	Current output



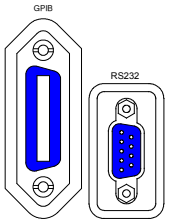
Power switch — Turns On ▬ or Off ■ the main power. For power up sequence, see page17.

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Rear Panel Overview



GPIB port / RS-232C port



Accepts remote control cables.

GPIB: 24-pin female

RS-232C: DB-9 pin male

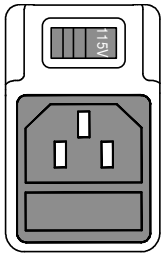
See page97 for remote control details.

Display contrast knob



Sets the display contrast level. See page17 for details.

Voltage selector / Fuse holder / Mains socket



Voltage selector sets the AC mains Voltage, 115V or 230V.

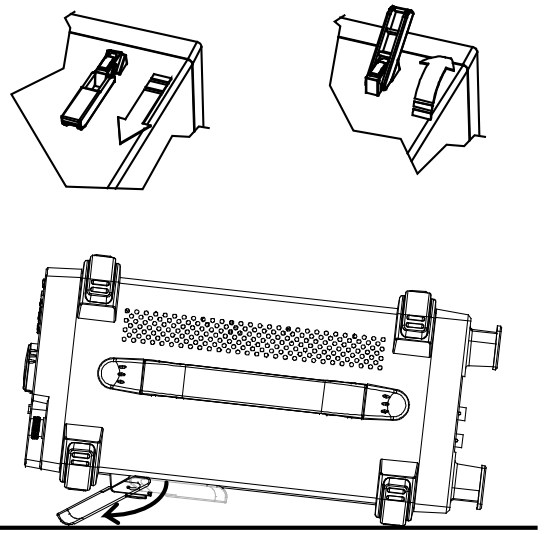
Fuse holder contains the main fuse, T3A/250V. For fuse replacement details, see page119.

Mains socket accepts power cable. See page17 for power-up details.

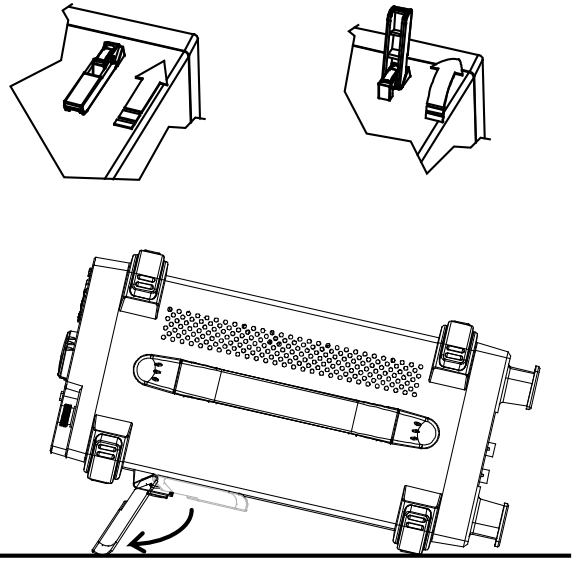
Tilt Stand & Power Up

Tilt stand

Low angle



High angle



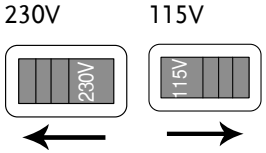
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Power up

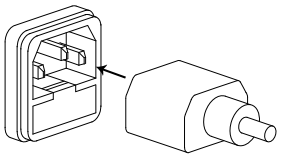
Panel operation



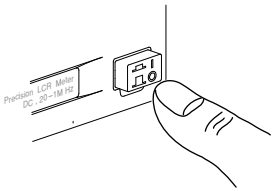
1. Set the rear panel Voltage selector to the correct position according to the AC mains voltage.



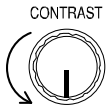
2. Connect the power cord to the socket.



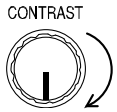
3. Turn On the power switch. The display becomes active in 2~3 seconds.



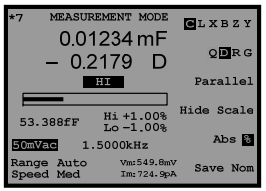
4. Use the contrast knob on the rear panel to adjust the LCD display brightness.

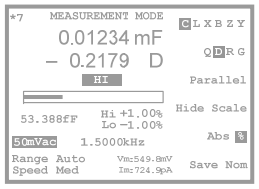


Counter-clockwise: Dark



Clockwise: Light





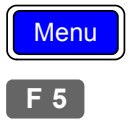
Select AC mains frequency (50/60Hz)

Background

Although LCR-8101 works under both 50 and 60Hz power frequencies, we recommend selecting the frequency that matches the local setting to get the best measurement precision, especially at lower frequencies (< 100Hz).

Panel operation

1. Press the Menu key, then F5 (System). The system menu appears.

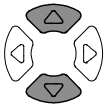



```
   Precision LCR Meter LCR-8101
Software version 2.03 Oct 25 2008

Frequency          1MHz
RS-232             ✓
Graph mode         ✓
GPIB               ✓

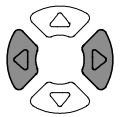
Line frequency     : 50Hz
Beep               : OFF
GPIB address       : 5
Average            : 10
```

2. Press the Up/Down key and move the cursor to Line frequency.



```
Line frequency     : 50Hz
```

3. If necessary, press the Left/Right key to select the frequency, from 50 to 60Hz or from 60Hz to 50Hz.



```
Line frequency     : 60Hz
```


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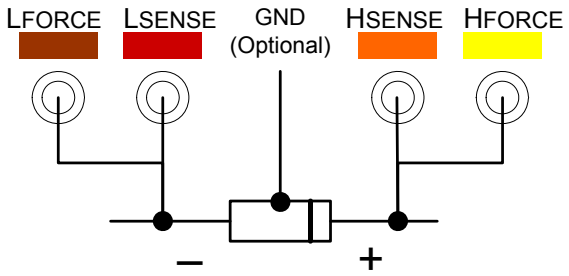
Fixture Connection

Fixture structure

Background

The standard fixture is a four-wire type with a common terminal for screen connection. The outer terminals (Hforse and Lforce) provide the current and the inner terminals (Hsense and Lsense) measures the potential.

Diagram



Description

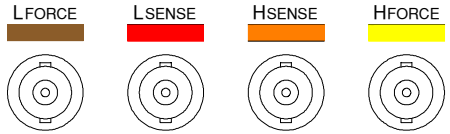
HFORCE	Carries the signal current source. Connected to the + side of the device under test.
HSENSE	Together with Lsense, monitors the Potential. Connected to the + side of the device under test.
LSENSE	Together with Hsense, monitors the Potential. Connected to the – side of the device under test.
LFORCE	Accepts the signal current return. Connected to the – side of the device under test.
GND	If the test component has a large metal area NOT connected to either of the terminals, connect the GND clip to minimize noise level.

Fixture connection

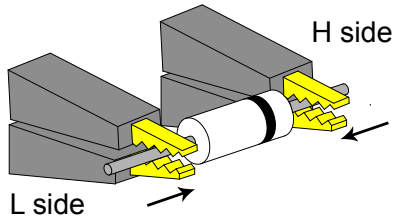
Panel operation

1. Discharge the test component before connecting the fixture set.

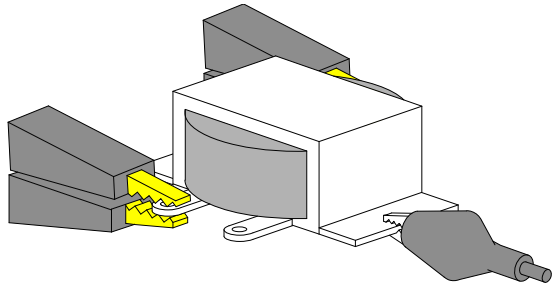
2. Connect each fixture terminal to the front panel BNC connector with matching color.



3. Connect the fixture to the test component. If the component has polarity, connect the H side to the positive lead and the L side to the negative lead. Make sure the distance between the lead base and fixture clip is short enough.



4. If the test component has an outer case unconnected to either of the lead, connect the ground terminal for noise level reduction.



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Tutorials (Step by Step Operations)

Basic measurement (without Pass/Fail test)

Step	Description	Details
1. Connect fixture	Connect the fixture to the DUT.	Page19
2. Enter menu	Press the Menu key, followed by F1 (AC measurement) or F2 (Rdc).	Page41
3. Hide scale	Press F4 (Show/Hide Scale) to hide the scale (or show the circuit diagram)	Page43
4. Select measurement item	Press F1 (First) and F2 (Second) repeatedly to select the measurement item.	Page44
5. Select series/ parallel circuit	If available, press F3 (Series/Parallel) to select the equivalent circuit model.	Page43
6. Set measurement frequency	Press the Left/Right arrow key and move the cursor to the Frequency. Use the numerical and unit keys to set the level.	Page46
7. Set measurement Voltage	Press the Left/Right arrow key and move the cursor to the Voltage. Use the numerical and unit keys to set the level.	Page48
8a. Select Single measurement	Press the Sing/Rep key to select Single (manual trigger) measurement. To trigger measurement, press the Trig key.	Page49
8b. Select Repetitive measurement	Press the Sing/Rep key to select Repetitive (automatic trigger) measurement. Press the Left/Right arrow key and move the cursor to Speed. Press the Up/Down key to select the speed.	Page50
Optional settings	To hide the drive Voltage/Current, press the Code key and type 80, the Enter key.	Page51
	Set the Range (internal setting) to Auto, use the Left/Right key to move the cursor and Up/Down key to change the setting.	Page45

Pass/Fail test (Single step)

Step	Description	Details
1. Connect fixture	Connect the fixture to the DUT.	Page19
2. Set buzzer sound	Press the Menu key, then F5 (System). Press the Up/Down arrow key to move the cursor to Beep, then use the Left/Right key to select setting (Off recommended).	Page54
3. Set Average	Press the Menu key, then F5 (System). Press the Up/Down arrow key to move the cursor to Average, then use the numerical keys to enter an average number (1-256). Press enter to confirm the number.	Page55
4. Enter menu	Press the Menu key, followed by F1 (AC measurement) or F2 (Rdc).	Page41
5. Show scale	Press F4 (Show/Hide Scale) to show the scale (or hide the circuit diagram)	Page55
6. Select measurement item	Press F1 (First) and F2 (Second) repeatedly to select the measurement item.	Page44
7. Select series/ parallel circuit	If available, press F3 (Series/Parallel) to select the equivalent circuit model.	Page57
8. Set measurement frequency	Press the Left/Right arrow key and move the cursor to the Frequency. Use the numerical and unit keys to set the level.	Page46
9. Set measurement Voltage	Press the Left/Right arrow key and move the cursor to the Voltage. Use the numerical and unit keys to set the level.	Page48
10a. Select Single measurement	Press the Sing/Rep key to select Single (manual trigger) measurement. To trigger measurement, press the Trig key.	Page49

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10b. Select Repetitive measurement	Press the Sing/Rep key to select Repetitive (automatic trigger) measurement. Press the Left/Right arrow key and move the cursor to Speed. Press the Up/Down key to select the speed.	Page50
11a. Select Absolute measurement	Press F5 (Abs/%) to select Abs. Press the Left/Right key to move the cursor to Lo (Low limit). Use the numerical and unit keys to set the Low limit. Repeat this for Hi (Hi limit) as well.	Page59
11b. Select Percentage measurement	Press F5 (Abs/%) to select %. Press the Left/Right key to move the cursor to the Nominal value. Use the numerical and unit keys to set the numerical level. Then move the cursor to Lo (Low limit) and set the percentage. Repeat this for Hi (Hi limit) as well. To save the latest measurement result as Nominal, press F6 (Save Nom).	Page60
Optional settings	To hide the drive Voltage/Current, press the Code key and type 80, the Enter key.	Page51
	Set the Range (internal setting) to Auto, use the Left/Right key to move the cursor and Up/Down key to change the setting.	Page45

Pass/Fail test (Multiple step)

Step	Description	Details
1. Connect fixture	Connect the fixture to the DUT.	Page19
2. Set buzzer sound	Press the Menu key, then F5 (System). Press the Up/Down arrow key to move the cursor to Beep, then use the Left/Right key to select setting (Off recommended).	Page63
3. Set Average	Press the Menu key, then F5 (System). Press the Up/Down arrow key to move the cursor to Average, then use the numerical keys to enter an average number (1-256). Press enter to confirm the number.	Page64
4. Enter multiple step mode	Press the Menu key, then F3 (Multi step).	Page64
5. Select measurement item	Press the arrow keys to move the cursor to Step 01 Func. Press F1 (Prog) repeatedly to select the item.	Page67
6a. Set parameters	Press the arrow keys to move the cursor to the parameters below. Use the numerical and unit keys for editing values or F1 (Prog) for selecting options.	Page67
6b. Add steps	Move the cursor to the first empty step and press F1 (Prog).	Page67
6c. Copy to the next step	Press F2 (Copy). The selected step contents are copied and inserted to the next step.	Page70
6d. Delete step	Press F3 (Delete). The selected step is deleted.	Page70
7. Save program	Press F4 (Save). The edited program is saved.	Page74
8. Enter Run menu	Press F6 (Run). The Run menu opens.	Page71

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9. Set Single or Repetitive	Press the Sing/Rep key to select Single (manual trigger) or Repetitive (auto trigger).	Page71
10. Start running	If the test has not started yet, press F1 (Start) or Trig key. Press F6 (Set) to go back to the setup menu.	Page71
File operation: new program	Press F5 (File), then F4 (New). Press the Left/Right keys to move the cursor and press the Down key to select character. To confirm the file name, press the Enter key. A new file appears. To delete a character, press the Up key. To quit, press the Clear key.	Page65
File operation: load	Press F5 (File), then F1 (Load). Use the arrow keys to select the program and press F1 (Load).	Page76
File operation: delete	Press F5 (File), then F2 (Delete). Use the arrow keys to select the program and press F5 (Del).	Page77
File operation: save as	Press F5 (File), then F3 (Save as). Press the Left/Right keys to move the cursor and press the Down key to select character. To confirm the file name, press the Enter key. A new file appears. To delete a character, press the Up key. To quit, press the Clear key.	Page74

Graph mode

Step	Description	Details
1. Connect fixture	Connect the fixture to the DUT.	Page19
2. Enter graph mode	Press the Menu key, then F4 (Graph).	Page79
3. Select item	Press F5 repeatedly to select the graph item.	Page80
4a. Set horizontal scale (frequency)	Press the Up/Down key to move the cursor to Sweep. Press the Left/Right key to select Frequency. Then move the cursor to Start Frequency, set the value using the numerical and unit keys. Repeat this for Stop Frequency and Level (drive Voltage).	Page83
4b. Set horizontal scale (voltage)	Press the Up/Down key to move the cursor to Sweep. Press the Left/Right key to select Voltage. Then move the cursor to Start Voltage, set the value using the numerical and unit keys. Repeat this for Stop Voltage and Freq (frequency).	Page81
5. Select speed	Press the Up/Down key to move the cursor to Speed. Press the Left/Right key to select the measurement speed.	Page92
6. Select step size	Press the Up/Down key to move the cursor to Step size. Press the Left/Right key to select the data step (all or sampled).	Page92
7. Select linear or log scale	Press F1 (Lin/Log) to select linear or logarithmic horizontal scale.	Page81
8a. Set vertical scale (Absolute + Auto fit)	Press F2 (Abs/%) to select Abs, then press F3 (Manual/Auto fit) to select Auto fit. LCR-8101 automatically configures the vertical scale.	Page89

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8b. Set vertical scale (Absolute + Manual fit)	Press F2 (Abs/%) to select Abs, then press F3 (Manual/Auto fit) to select Manual fit. Move the cursor to Hi, set the Hi value. Repeat this for Lo as well. The minimum and maximum vertical range is manually configured.	Page85
8c. Set vertical scale (Percentage + Auto fit)	Press F2 (Abs/%) to select %, then press F3 (Manual/Auto fit) to select Auto fit. Move the cursor to Nominal and set the nominal value. LCR-8101 automatically configures the vertical range around the nominal value.	Page90
8d. Set vertical scale (Percentage + Manual fit)	Press F2 (Abs/%) to select %, then press F3 (Manual/Auto fit) to select Auto fit. Move the cursor to Hi, set the Hi percentage. Repeat this for Lo and Nominal. The minimum and maximum vertical range is manually configured.	Page87
9. Plot graph	Press F4 (Start). The graph is drawn on the display. To abort, press F6 (Abort).	Page93
10. Fit graph into display	When plotting is finished, press F1 (Function), then F2 (Fit). The vertical scale is automatically adjusted to include all the plotted line. Press F1 (View) to go back.	Page95
11. Move marker	Press the Left/Right keys to move the marker on the graph. To move the marker to the peak, press F1 (Function) and F3 (Peak). To move to the dip, press F4 (Dip). Press F1 (View) to go back.	Page96
12. Return to previous menu	Press F6 (Return) or press the Menu key to go back to the previous or the other menu.	Page96

Measurement tip

Hi/Low impedance	If the measured impedance is greater than 1kΩ, the standard four-terminal connection is not necessary. Run S/C trim to remove the effect of series lead impedance. If the measured impedance is lower than 1kΩ, four-terminal connection can reduce the effect of contact resistance at the test component.
Metal component case connection	A large area of metal can add noise to the measurement. Here is how to minimize the effect. If the metal is connected to one of the terminals, this should be connected to the Hforce (Yellow) terminal side. If the metal is NOT connected to either of the terminals, connect the GND clip.
Small-sized capacitor	When measuring small, SMD-size capacitors, run O/C trim at the measurement frequency (Spot trimming) to eliminate the residual capacitance. Make sure the measurement lead positions are fixed during trimming.
Small-sized inductor	When measuring small, SMD-size inductors, run S/C trim at the measurement frequency (Spot trimming). LCR-8101 measures the difference between the inductance of S/C trimming and the inductance of test component. Four-terminal fixture set is recommended and make sure the measurement leads are fixed during trimming.
Wire capacitance	When measuring the wire capacitance, the fixture clips that are marked with H_F(High Force)/H_S (High Sense) should always be connected to the point that is influenced the most by noise.

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Wire inductance	The wire inductance should be subtracted from the measurement result. • 5cm, 1mm diameter wire has 50nH inductance • 5cm, 2mm diameter wire has 40nH inductance
Frequency factor in inductor measurement	When an inductor is measured at a frequency much lower than that for which it is designed (for example, an HF choke tested at AF), the inductor tends to behave as an inductive resistor. In these circumstances, measurement accuracy is widened by (1 + 1/Q) where Q is the quality factor.
Air-cored coils	Air-cored coils can pick up noise very easily, therefore they should be kept well clear of any test equipment that may contain power transformers or display scan circuitry. Also, keep the coils away from metal objects which may modify inductor characteristics.
Iron-cored and ferrite inductor	The effective value of iron-cored and ferrite inductors can vary widely with the magnetization and test signal level. Measure them at the AC level and frequency in use. When core materials are damaged by excessive magnetization (for example: tape heads and microphone transformers), check that the test signal is acceptable before connection.

BASIC MEASUREMENT

Basic measurement measures DUT in numerical style. Advanced measurements are available in Pass/Fail test mode (page52), where measurement results are compared with user-defined limits, and in Graph mode (page78), where measurement data is displayed in graphical representation.

Measurement item	Measurement combination	31
	Series/Parallel circuit models	32
	Resistance (R) and Conductance (G = 1/R)	34
	Capacitance (C)	35
	Inductance (L)	36
	Reactance (X) and Susceptance (B = 1/X)	37
	Impedance (Z) and Admittance (Y = 1/Z)	38
	Quality factor (Q) and Dissipation factor (D)	39
	Angle (θ)	40
Measurement overview	Enter measurement mode	41
	Display overview	42
	Show circuit model or scale (pass/fail)	43
Measurement configuration	Select measurement item	44
	Set measurement range to Auto	45
	Set measurement frequency	46
	Set measurement voltage	48
Run measurement	Select Single measurement	49
	Select Repetitive measurement	50
	Hide drive Voltage/Current	51

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Measurement Item Description

In general, two items, primary and secondary, are combined in a single measurement. The following table shows the available combinations. Overview of each measurement items is listed from the next page.

Measurement combination

●:Yes —:No

1st measurement	2nd measurement					Circuit model		Graph	Prog
	Q	D	RAC	G	Angle	Series	Parallel		
Capacitance (C)	●	●	●	●	—	●	●	●	●
Inductance (L)	●	●	●	●	—	●	●	●	●
Reactance (X)	●	●	●	—	—	●	—	●	●
Susceptance (B)	●	●	●	●	—	—	●	●	●
Impedance (Z)	—	—	—	—	●	—	—	●	●
Admittance (Y)	—	—	—	—	●	—	—	●	●
DC Resistance(RDC)	—	—	—	—	—	—	—	—	●
Quality factor (Q)						●	●	●	●
Dissipation factor (D)						●	●	●	●
AC Resistance (RAC)						●	●	●	●
Conductance (G)						—	●	●	●
Angle (θ)						—	—	●	●

*Prog: Multi-step program

- The graph measurement is described in graph mode chapter, page78.
- The multi-step program mode is described in the Pass/Fail test chapter, page62.

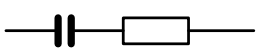
Series/Parallel circuit models

Background

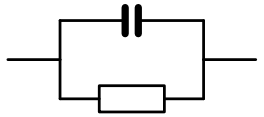
For measuring AC Resistance, Capacitance, Reactance, Inductance, and Susceptance, series and parallel equivalent circuit models are available. Select the model according to the component value.

Capacitance (C)

Series diagram



Parallel diagram



Series formula

$$C_S = C_P\left(1 + D^2\right)$$

D=dissipation factor

Parallel formula

$$C_P = \frac{C_S}{\left(1 + D^2\right)}$$

D=dissipation factor

When to use Series (CS)

Small capacitance:
Reactance (X_C) < 1kΩ

Note: $X_C = \frac{1}{2\pi fC}$

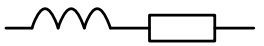
When to use Parallel (CP)

Large capacitance:
Reactance (X_C) > 1kΩ

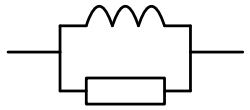
Note: $X_C = \frac{1}{2\pi fC}$

Inductance (L)

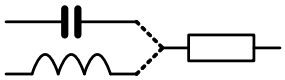
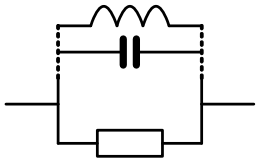
Series diagram



Parallel diagram



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	Series formula	Parallel formula
	$L_S = \frac{L_P}{\left(1+\frac{1}{Q^2}\right)}$	$L_P = L_S\left(1+\frac{1}{Q^2}\right)$
	Q=quality factor	Q=quality factor
	When to use Series (LS)	When to use Parallel (LP)
	Small capacitance: Reactance (X_L) < 1kΩ	Large capacitance: Reactance (X_L) > 1kΩ
	Note: $X_L = 2\pi fL$	Note: $X_L = 2\pi fL$
Resistance	Series diagram	Parallel diagram
		
	Series formula	Parallel formula
	$R_S = \frac{R_P}{(1+Q^2)}$	$R_P = R_S(1+Q^2)$
	Q=quality factor	Q=quality factor
	When to use Series (RS)	When to use Parallel (RP)
	Small resistance: < 1kΩ	Large resistance: > 1kΩ

Resistance (R) and Conductance (G = 1/R)

Background

Resistance measures how difficult it is for the electricity to flow between two terminals. Conductance is the reciprocal of Resistance and measures how easily the electricity flows.

	Resistance	Conductance
Type	• Series Resistance R_S • Parallel Resistance R_P • DC Resistance R_{dc}	• Parallel Conductance G_P (= $1/R_P$) Note: Conductance is available only for parallel circuit model.
Range	0.01mΩ ~ 1GΩ	0.001nS ~ 1GS
Measurement combination	• $C_S + R_S$ • $L_S + R_S$ • $X_S + R_S$ • $C_P + R_P$ • $L_P + R_P$ • $B_P + R_P$ • R_{dc}	• $C_P + G_P$ • $L_P + G_P$ • $B_P + G_P$
Formula	$R = \frac{I}{V} = \frac{1}{G} = Z_S - jX$ $= Z_S - j\omega L = Z_S + \frac{j}{\omega C}$ $\lvert Z_S\rvert = \sqrt{(R^2 + X^2)}$ $\lvert Z_P\rvert = \frac{RX}{\sqrt{(R^2 + X^2)}}$ $R_S = \lvert Z\rvert\cos\theta$	$G_P = \frac{I}{V} = \frac{1}{R} = Y_P - jB$ $= Y_P - j\omega C = Y_P + \frac{j}{\omega L}$ $\lvert Y_S\rvert = \frac{GB}{\sqrt{(G^2 + B^2)}}$ $\lvert Y_P\rvert = \sqrt{(G^2 + B^2)}$ $G_P = \lvert Y\rvert\cos\theta$

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Capacitance (C)

Background

Capacitance measures the amount of electronic charge stored between two terminals.

Range

0.001pF ~ 1F

Type

- Series Capacitance C_S
- Parallel Capacitance C_P

Combination

- C_S + Q
- C_S + D
- C_S + R_S
- C_P + Q
- C_P + D
- C_P + R_P
- C_P + G_P

Formula

$$Z_S = R - \frac{j}{\varpi C}$$

$$Q = \frac{1}{\varpi C_S R_S}$$

$$D = \varpi C_S R_S$$

$$Y_P = G + j\varpi C$$

$$Q = \varpi C_P R_P \quad D = \frac{G_P}{\varpi C_P}$$

Inductance (L)

Background

Inductance measures the amount of magnetic flux generated in certain electrical current.

Range

0.1nH ~ 100kH

Type

- Series Inductance L_S
- Parallel Inductance L_P

Measurement combination

- L_S + Q
- L_S + D
- L_S + R_S
- L_P + Q
- L_P + D
- L_P + R_P
- L_P + G_P

Formula

$$Z_S = R + j\varpi L$$

$$Q = \frac{\varpi L_S}{R_S}, \quad D = \frac{R_S}{\varpi L_S}$$

$$Y_P = G - \frac{j}{\varpi L}$$

$$Q = \frac{R_P}{\varpi L_P}, \quad D = \varpi L_P G_P$$

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Reactance (X) and Susceptance (B = 1/X)

Background

Reactance measures the imaginary part of Impedance (Z) caused by capacitors or inductors. Susceptance is the reciprocal of Reactance and measures the imaginary part of Admittance (Y), which is also the reciprocal of Impedance.

Type

Series Reactance (X_S)	Parallel Susceptance (B_P)
Note: Reactance is available only in series circuit model.	Note: Susceptance is available only in parallel circuit model.

Range

0.01mΩ ~ 1GΩ	0.001nS ~ 1GS

Measurement combination

• X_S + Q	• B_P + Q
• X_S + D	• B_P + D
• X_S + R_S	• B_P + R_P
	• B_P + G_P

Formula

$X = \frac{1}{B} = \lvert Z \rvert \sin\theta$	$B = \frac{1}{X} = \lvert Y \rvert \sin\theta$
$\lvert Z_S \rvert = \sqrt{(R^2 + X^2)}$	$\lvert Y_S \rvert = \frac{GB}{\sqrt{(G^2 + B^2)}}$
$\lvert Z_P \rvert = \frac{RX}{\sqrt{(R^2 + X^2)}}$	$\lvert Y_P \rvert = \sqrt{(G^2 + B^2)}$
$X_S = \lvert Z \rvert \sin\theta$	$B_P = \lvert Y \rvert \sin\theta$

Impedance (Z) and Admittance (Y = 1/Z)

Background

Impedance measures the total amount of opposition between two terminals in an AC circuit. Admittance is the reciprocal of Impedance and measures how easily the electricity flows in an AC circuit.

Type

Impedance (Z)	Admittance (Y)

Range

0.01mΩ ~ 1GΩ	0.001nS ~ 1GS

Formula

$Z = \frac{E}{I} = \frac{1}{Y}$	$Y = \frac{I}{E} = \frac{1}{Z}$
$Z_S = R + jX$	$Y_P = G + jB$
$= R + j\omega L = R - \frac{j}{\omega C}$	$= G + j\omega C = G - \frac{j}{\omega L}$
$\lvert Z_S \rvert = \sqrt{(R^2 + X^2)}$	$\lvert Y_S \rvert = \frac{GB}{\sqrt{(G^2 + B^2)}}$
$\lvert Z_P \rvert = \frac{RX}{\sqrt{(R^2 + X^2)}}$	$\lvert Y_P \rvert = \sqrt{(G^2 + B^2)}$
$R_S = \lvert Z \rvert \cos\theta$	$G_P = \lvert Y \rvert \cos\theta$
$X_S = \lvert Z \rvert \sin\theta$	$B_P = \lvert Y \rvert \sin\theta$

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Quality factor (Q) and Dissipation factor (D)

Background

Both Quality factor and its reciprocal, Dissipation factor, are used for measuring the rate of energy dissipation relative to the measurement frequency.

- Low energy dissipation: high Q, low D
- High energy dissipation: low Q, high D

Type	Quality factor (Q)	Dissipation factor (D)
Range	0.1 ~ 9999.9	0.0001 ~ 9.9999
Formula	$Q = \frac{\varpi L_S}{R_S} = \frac{1}{\varpi C_S R_S}$	$D = \frac{R_S}{\varpi L_S} = \varpi C_S R_S$
	$= \frac{R_P}{\varpi L_P} = \varpi C_P R_P$	$= \frac{G_P}{\varpi C_P} = \varpi L_P G_P$
	$= \frac{1}{\tan(90-\theta)^\circ} = \frac{1}{D}$	$= \tan(90-\theta)^\circ = \frac{1}{Q}$

Angle (θ)

Background

The Angle (θ) measures the phase on which Impedance (Z), Admittance (Y), Quality factor (Q), and Dissipation factor (D) are measured.

Type

Angle (θ)

Range

–180° ~ +180°

Formula

$Z_S = R + jX$ $\quad Y_P = G + jB$

$= R + j\varpi L = R - \frac{j}{\varpi C}$ $\quad = G + j\varpi C = G - \frac{j}{\varpi L}$

$Q = \frac{1}{\tan(90-\theta)^\circ} = \frac{1}{D}$ $\quad D = \tan(90-\theta)^\circ = \frac{1}{Q}$

$R_S = |Z|\cos\theta$ $\quad G_P = |Y|\cos\theta$

$X_S = |Z|\sin\theta$ $\quad B_P = |Y|\sin\theta$

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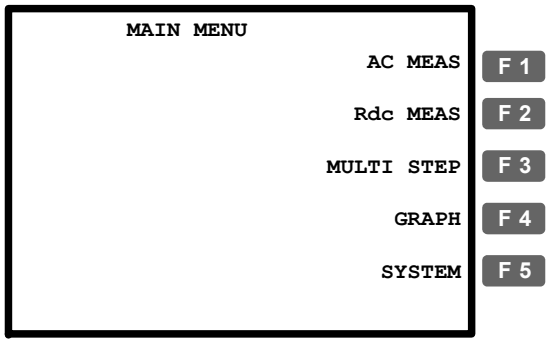
Measurement Mode Overview

Enter measurement mode

Type	AC	C, L, X, B, Z, Y, Q, D, R, G, θ
	DC	Rdc

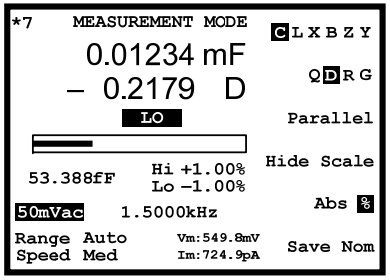
Panel operation

1. Press the Menu key. The main menu appears.

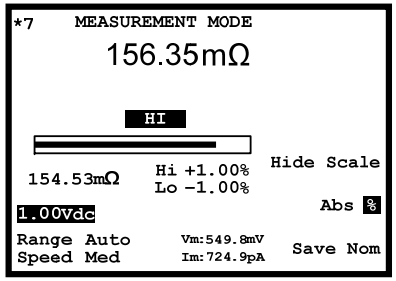


2. For Rdc measurement, press F2 (Rdc Meas).
   For any other measurement, press F1 (AC Meas). The measurement mode display appears.

AC measurement

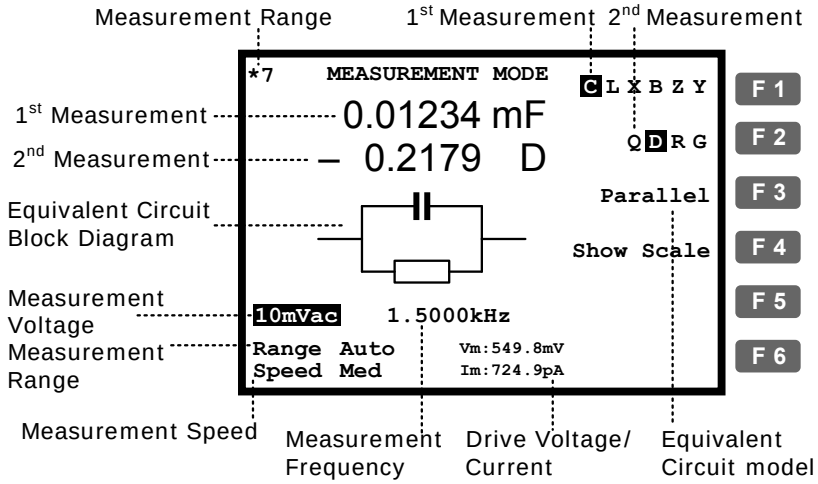


DC measurement (Rdc)

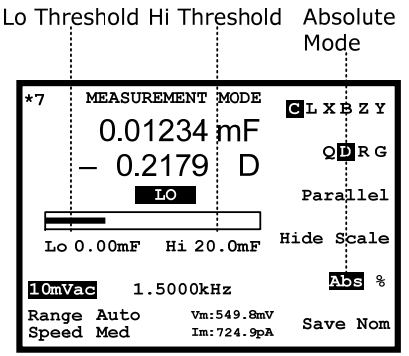


Display overview

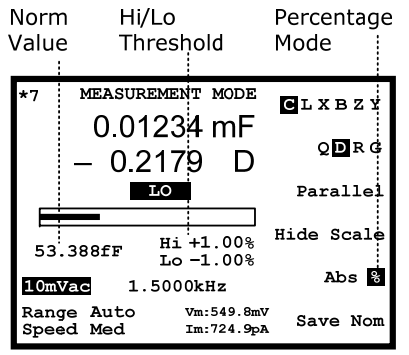
Normal mode



Absolute mode (Pass/Fail test)



Percentage mode (Pass/Fail test)



For Pass/Fail test details, see page52.

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Show circuit model or scale (pass/fail)

Background

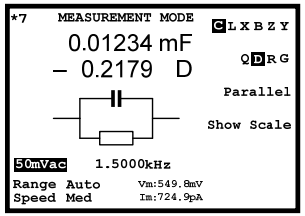
The center of the display can be filled with the diagram of equivalent circuit model, or the measurement scale with Pass/Fail test result. This selects not only the diagram/scale but also whether running the Pass/Fail test or just measuring the value.

Panel operation

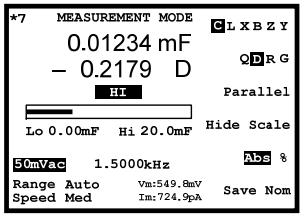
Press F3 (Show/Hide scale) to select circuit model or scale.

F 3

Normal



Pass/Fail test



Pass/Fail test

For Pass/Fail test details, see page52.

Parameter Configuration

Select measurement item

*This is not necessary for Rdc measurement.

Measurement combination

The following list shows the available combination of the first and second measurement items.

Capacitance (C)	Series	C-Q, C-D, C-R
	Parallel	C-Q, C-D, C-R, C-G
Inductance (L)	Series	L-Q, L-D, L-R
	Parallel	L-Q, L-D, L-R, L-G
Reactance (X)	Series	X-Q, X-D, X-R
Susceptance (B)	Parallel	B-Q, B-D, B-R, B-G
Impedance (Z)		Z-Angle
Admittance (Y)		Y-Angle

Panel operation

To select the first measurement item, press F1 repeatedly.

F 1

C L X B Z Y

To select the second measurement item, press F2 repeatedly.

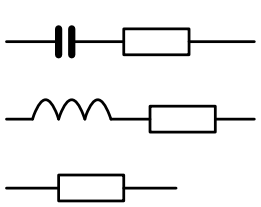
F 2

Q D R G

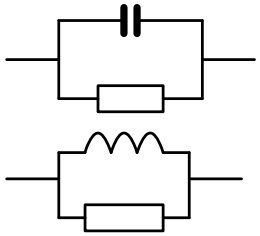
To select the circuit model, series or parallel, press F3 repeatedly.

F 3

Series



Parallel

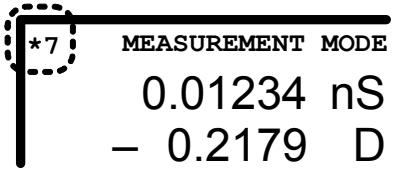


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Set measurement range to Auto

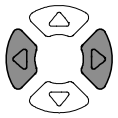
Background

The measurement range is an internal parameter defining the search range for each measurement item. Make sure the Auto setting is always selected, to obtain the best measurement accuracy. The active range appears at the top left corner of the display.



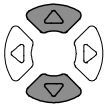
Panel operation

1. Press the Left/Right key repeatedly to move the cursor to Range position.



Range Auto
Speed Slow

2. If the range is NOT set to Auto, press the Up/Down key repeatedly to set it back to Auto.



Range 5 → Range Auto
Speed Slow Speed Slow

Set measurement frequency

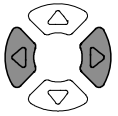
*This setting does not apply to Rdc measurement.

Background

The measurement frequency, together with the measurement voltage, defines the electrical condition of each measurement item. Make sure the appropriate frequency is selected, according to the component characteristics.

Panel operation

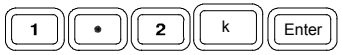
1. Press the Left/Right key repeatedly to move the cursor to Frequency.



2.00 Vac 195.00kHz

2. Enter the frequency using the numerical keys.

Range 20Hz ~ 1MHz

1.2kHz 

1MHz 

Backspace 

All clear 

Increase 

Decrease 

When the entered value does not fit in the range, LCR-8101 automatically selects the nearest value.

Nearest Available

When the wrong unit (such as Ω) is entered, the value is cancelled.

Unit Mismatched

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Select frequency step resolution

For frequency increase/decrease using Up/Down keys, fine and coarse step settings are available.

Fine 1st digit: 1, 2, 3, 4, 5, 6...

Coarse 2nd digit: 10, 12, 15, 20, 25, 30, 40, 50, 60, 80

1. Press the Code key. 

2. Enter the system code using the numerical keys, then press the Enter key. A confirmation message appears on the display.

Fine: 10 



Coarse: 11 



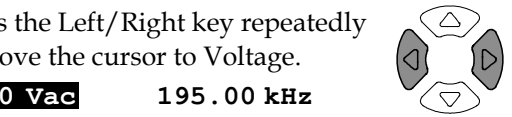
Set measurement voltage

Background

The measurement voltage, together with the measurement frequency, defines the electrical condition of each measurement item. Make sure the appropriate voltage is selected, according to the component characteristics.

Voltage setting

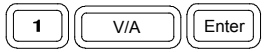
1. Press the Left/Right key repeatedly to move the cursor to Voltage.



2. Enter the voltage using the numerical keys.

Range 10mV ~ 2V

100mV 

1V 

Backspace 

All clear 

Increase 

Decrease 

When the entered value does not fit in the range, LCR-8101 automatically selects the nearest value.



When the wrong unit (such as Ω) is entered, the value is cancelled.



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Running Measurement

Select Single measurement

Background

The data capture can be manually controlled (Single) or automatically updated (Repetitive).

In single measurement, the measurement is activated by pressing the Trigger key.

In repetitive measurement, the measurement is automatically done and the display is updated according to the speed (timing) setting.

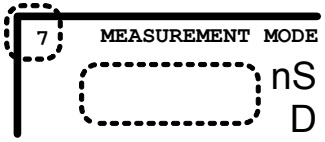
Panel operation

1. Press the Sing/Rep key repeatedly until the "Single Shot Mode" message appears on the display.

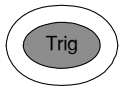


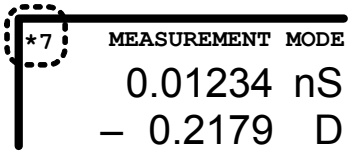


2. The measurement update indicator (*) does not appears at the top left corner of the display.



3. To capture measurement data, press the Trigger key. The measurement update indicator (*) blinks and the measurement result is updated on the display.





Select Repetitive measurement

Background

The data capture can be manually controlled (Single) or automatically updated (Repetitive).

In single measurement, the measurement is activated by pressing the Trigger key.

In repetitive measurement, the measurement is automatically done and the display is updated according to the speed (timing) setting.

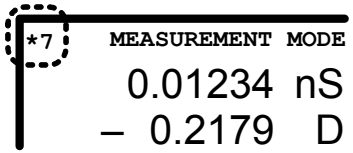
Panel operation

1. Press the Sing/Rep key repeatedly until the "Repetitive Mode" message appears on the display.

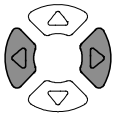




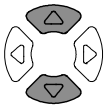
2. The measurement update indicator (*) keeps blinking and the measurement result is updated on the display.



3. Press the Left/Right key repeatedly to move the cursor to measurement speed.



4. Press the Up/Down key repeatedly to select the time per update.



Slow	600mS (AC), 500mS (Rdc)
Med	450mS (AC), 120mS (Rdc)

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	Fast	150mS (AC), 60mS (Rdc)
	Max	75mS (AC), 30mS (Rdc)

Beep setting

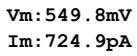
If the beep setting (page54) is active and the display is in Pass/Fail test mode, it might sound continuously depending on the measurement result. If this happens, press the Sing/Rep key and set the mode to Single. Then turn Off the buzzer.



Hide drive Voltage/Current

Background

The drive voltage and current shows the actual voltage/current level applied to the device under test.



Panel operation

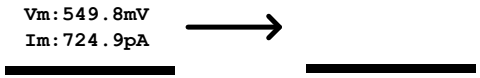
1. Press the Code key.



2. Enter the system code using the numerical keys, then press the Enter key.

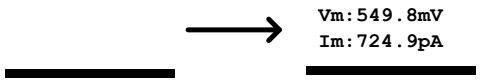
Hide drive V/I: 80





Show drive V/I: 81





PASS-FAIL MODE

In the Pass/Fail test mode, measurement results are compared with user-defined limits and the results are displayed. Two types of tests are available: Single and Multi-Step. The Single test shares the same interface with the basic measurement, and tracks one item. The Multi-Step test runs a program comprised of multiple measurement items with different parameters.

Single-step configuration	Overview	53
	Configure beep setting	54
	Configure the Average	55
	Select test item and scale (Pass/Fail test)	56
	Set parameters	57
Single-step run	Run in Absolute mode	59
	Run in Percentage mode	60
	Use display value as nominal	61
Multi-step configuration	Overview	62
	Configure beep setting	63
	Configure the Average	64
	Enter multi-step mode	65
	Create new program	65
	Edit program step	67
	Copy (duplicate) program step	70
	Delete program step	70
Multi-step run	Run program	71
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	Recall (load) existing program	76
	Delete existing program	77

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Single-Step Test Configuration

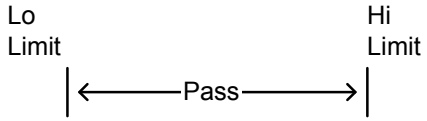
Overview

Background / test type

Pass/Fail test checks whether the measurement result sits between the Hi(high) and Lo(low) limit. Two methods are available: absolute limit and percentage limit.

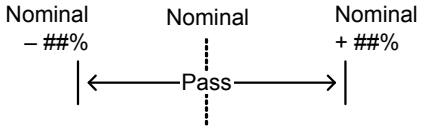
Absolute limit

The Hi and Lo limit are defined by absolute values.



Percentage limit

The Hi and Lo limit are defined by the distance (percentage) from the Nominal value.



Test item

Cs	Series capacitance	X	Reactance
Cp	Parallel capacitance	B	Susceptance
Ls	Series inductance	Z	Impedance
Lp	Parallel inductance	Y	Admittance
Rs	Series resistance	Rdc	DC Resistance
Rp	Parallel resistance	θ	Angle

For detailed description of each item, see page31.

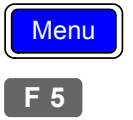
Configure beep setting

Background

The beep sounds when the pass/fail test result matches the setting: failed or passed.

Panel operation

1. Press the Menu key, then F5 (System). The system configuration appears.

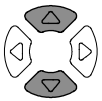



```
   Precision LCR Meter LCR-8101
Software version 2.03 Oct 25 2008

Frequency          1MHz
RS-232             ✓
Graph mode         ✓
GPIB               ✓

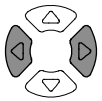
Line frequency     : 50Hz
Beep               : OFF
GPIB address       : 5
Average            : 10
```

2. Press the Up/Down key and move the cursor to Beep.



Beep : **OFF**

3. Press the Left/Right key to select the beep setting, Off, Pass, or Fail.



Off	Beep is turned Off
Pass	Beeps when the test result is pass
Fail	Beeps when the test result is fail

Beep in repetitive mode

If the repetitive measurement is On, the beep might sound continuously. If this becomes a problem, either use the Single mode (press Sing/Rep key) or turn Off the beep.

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Configure the Average

Background

The Average function sets the number of samples used, which are then averaged as the final output. The number of samples varies from 1 to 256.

Panel operation

1. Press the Menu key, then F5 (System). The system configuration appears.

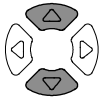



```
   Precision LCR Meter LCR-8101
Software version 2.03 Oct 25 2008

Frequency          1MHz
RS-232             ✓
Graph mode         ✓
GPIB               ✓

Line frequency     : 50Hz
Beep               : OFF
GPIB address       : 5
Average            : 10
```

2. Press the Up/Down key and move the cursor to Average.



Average : 10

3. Use the number pad to select numerical keys to enter the number of samples to be averaged. A maximum of 256 samples can be selected for averaging.



Select test item and scale (Pass/Fail test)

Test item

To select the first measurement item, press F1 repeatedly.



C L X B Z Y

To select the second measurement item, press F2 repeatedly.



Q D R G

Circuit model

To select the circuit model, series or parallel, press F3 repeatedly.

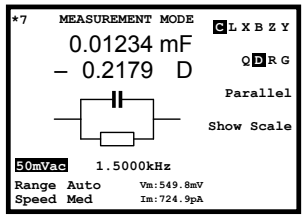


Scale

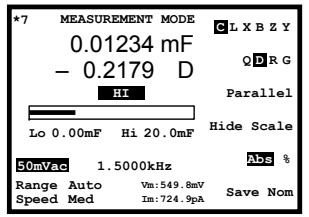
Press F4 (Show/Hide scale) to select scale (Pass/Fail test).



Normal



Pass/Fail test



Normal mode

For Normal (basic) mode details, see page30.

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Set parameters

For more detailed descriptions, see Basic measurement, page41.

How to edit

Example 100mV



Backspace 

All clear 

Increase 

Decrease 

When the entered value does not fit in the range, the nearest available value is selected.

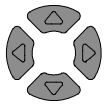


When the wrong unit (such as Ω) is entered, the value is cancelled.



Measurement range (to Auto)

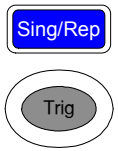
Press the Left/Right key repeatedly to move the cursor to Range position, and use the Up/Down key to select Auto (if necessary).





Single mode

Press the Sing/Rep key repeatedly to select Single (manual trigger). To trigger measurement, press the Trigger key.



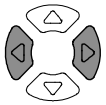
Repetitive mode

Press the Sing/Rep key repeatedly to select Rep (automatic trigger). Press the Left/Right key repeatedly to move the cursor to Speed, and use the Up/Down key to select the update rate.



Frequency (except Rdc)

Press the Left/Right key repeatedly to move the cursor to Frequency, and use the numerical and unit keys to enter the value.





Frequency step resolution

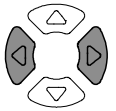
For frequency increase/decrease using Up/Down keys, fine and coarse step settings are available.

Press the Code key and enter 10 (Fine) or 11 (Coarse).



Voltage

Press the Left/Right key repeatedly to move the cursor to Voltage, and use the numerical and unit keys to enter the value.





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Single-Step Test Run

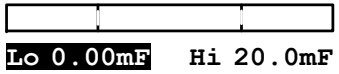
Run in Absolute mode

1. Press F5 to select Absolute measurement.

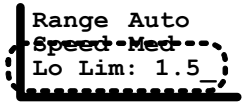


2. Use the Left/Right key to move the cursor to Hi/Lo value for editing.





3. Use the numerical keys and unit keys to enter the value. The editing value appears at the bottom left corner of the display.



Example 1.2mΩ



Backspace



All clear



Increase



Decrease



Hi and Lo values are automatically swapped if necessary

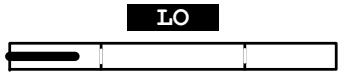


4. The display updates the Hi/Lo result immediately. The result is pass if the bar stays in the central area. The buzzer sounds accordingly.

Result > Hi



Result < Lo



Lo < Result < Hi (Pass)



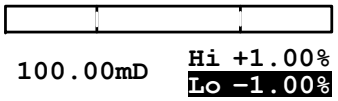
Run in Percentage mode

1. Press F5 to select Percentage measurement.

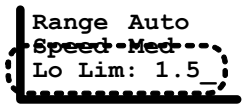


2. Use the Left/Right key to move the cursor to Hi/Lo value for editing.

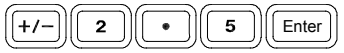




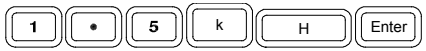
3. Use the numerical keys and unit keys to enter the value. The editing value appears at the bottom left corner of the display.



–2.50%



1.5kH



Backspace



All clear



Increase



Decrease



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Hi and Lo values are automatically swapped if necessary

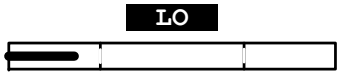


4. The display updates the Hi/Lo result immediately. The result is pass if the bar stays in the central area. The buzzer sounds accordingly.

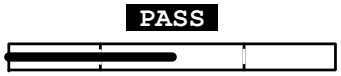
Result > Hi



Result < Lo



Lo < Result < Hi (Pass)

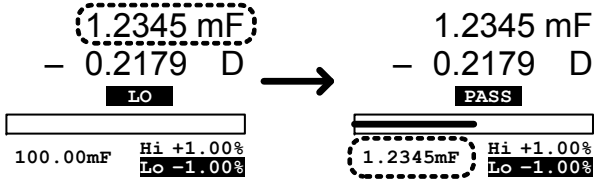


Use display value as nominal

Panel operation

(For Percentage only) The displayed value can be used as the nominal value. Press F6 (Save Nom) to copy the display value to the nominal value.

F 6



Multi-Step Test Configuration

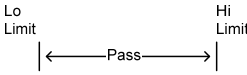
Overview

Background

The multi-step function can configure and run multiple measurement steps. Maximum 64 programs, 30 steps each, can be programmed and stored in the instrument.

Limit type

Only the absolute limit testing is available. For percentage limit test, use the single mode (page53).



Test item

Cs	Series capacitance	X	Reactance
Cp	Parallel capacitance	B	Susceptance
Ls	Series inductance	Z	Impedance
Lp	Parallel inductance	Y	Admittance
Rs	Series resistance	Rdc	DC Resistance
Rp	Parallel resistance	θ	Angle

For detailed description of each item, see page31.

Parameters

No. of step	Maximum 30 for each program
No. of program	Maximum 64
Drive Voltage	10mV ~ 2V, 1mV step
Frequency	20Hz ~ 1MHz
Bias	Reserved item: internal use only
Speed	Max, Fast, Med, Slow
Hi / Lo Limit	Follows the measurement range
Delay	0 ~ 9999ms, 1ms step
Single trigger	Program runs when the Trigger key or F1 (Start) is pressed.
Automatic trigger	Program runs when LCR-8101 detects the DUT.

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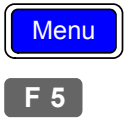
Configure beep setting

Background

The beep sounds when the pass/fail test result matches the setting: failed or passed.

Panel operation

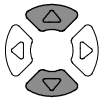
1. Press the Menu key, then F5 (System). The system configuration appears.




```
   Precision LCR Meter LCR-8101
Software version 2.03 Oct 25 2008

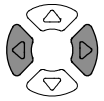
Frequency          1MHz
RS-232             ✓
Graph mode         ✓
GPIB               ✓
Line frequency     : 50Hz
Beep               : OFF
GPIB address       : 5
Average            : 10
```

2. Press the Up/Down key and move the cursor to Beep.



```
Beep               : OFF
```

3. Press the Left/Right key to select the beep setting, Off, Pass, or Fail.



Off	Beep is turned Off
Pass	Beeps when the test result is pass
Fail	Beeps when the test result is fail

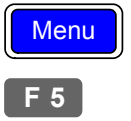
Configure the Average

Background

The Average function sets the number of samples used, which are then averaged as the final output. The number of samples varies from 1 to 256.

Panel operation

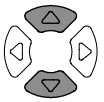
1. Press the Menu key, then F5 (System). The system configuration appears.




```
   Precision LCR Meter LCR-8101
Software version 2.03 Oct 25 2008

Frequency          1MHz
RS-232             ✓
Graph mode         ✓
GPIB               ✓
Line frequency     : 50Hz
Beep               : OFF
GPIB address       : 5
Average            : 10
```

2. Press the Up/Down key and move the cursor to Average.



```
Average            : 10
```

3. Use the numerical keys to enter the number of samples to be averaged. A maximum of 256 samples can be selected for averaging.



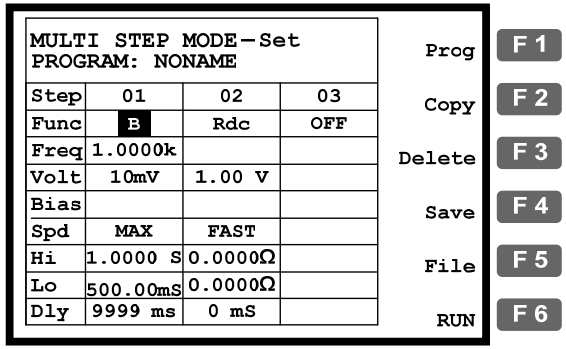
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Enter multi-step mode

Panel operation

Press the Menu key, then F3 (Multi Step). The multi-step mode menu appears. The last recalled program appears on the display.



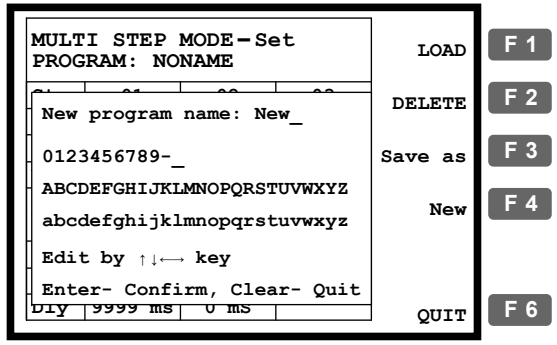


Create new program

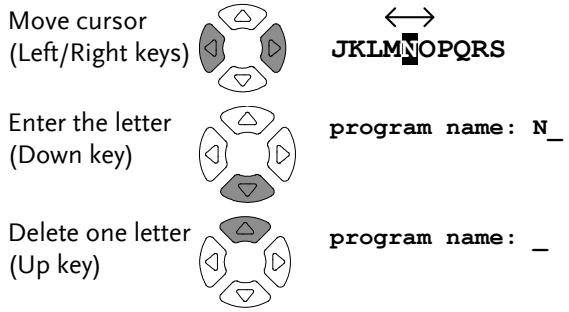
Panel operation

1. In the multi-step mode, press F5 (File), then F4 (New). The new program name dialogue opens.

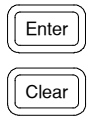




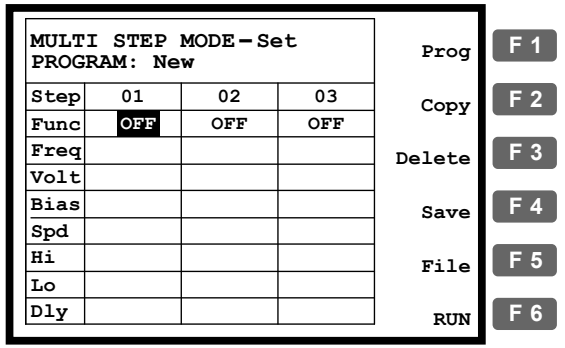
2. Enter the new program name using the arrow keys.



3. Press the Enter key to confirm the file name. To quit the new program mode, press the Clear key.

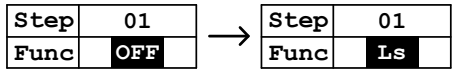


4. A blank program with the entered name appears.



5. Press F1 (Prog). Step 01 becomes active and changes to Ls measurement mode. For further editing details, see the next page.



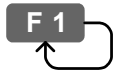


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Edit program step

How to edit parameter

- For selecting parameters, press F1 (Prog) repeatedly.



- For entering values, use the numerical and unit keys.

Example:
0.5kHz



Backspace



All clear



Increase

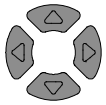


Decrease



How to move cursor

To move the cursor to the editing point, use the arrow keys: up, down, left, and right.



Note: The cursor cannot move into blank columns or steps.

Panel operation

1. Create new step

To create a new step in a program, press F1 (Prog) at Func column "OFF". The step becomes active and the function changes to Ls. Up to 30 steps are available in a program.



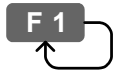
Step	01
Func	OFF

→

Step	01
Func	Ls

2. Select item (function)

Move the cursor to Func column, press F1 (Prog) repeatedly. The measurement item (function) changes in the following order.



Ls → Lp → Q → Cs → Cp → D → Z → θ → Rs → Rp → X → G → B → Y → Rdc → Ls

Set frequency

Move the cursor to Freq column. Enter the frequency using the numerical keys and unit keys.

Func	Ls
Freq	500.00
Volt	2.00 V

Range 20Hz ~ 1MHz, 5 digit resolution

Example:
0.5kHz (500Hz)



Set voltage

Move the cursor to Volt column. Enter the voltage using the numerical keys and unit keys.

Freq	500.00
Volt	2.00 V
Bias	

Range 10mV ~ 2V, 1mV step

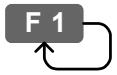
Example:
100mV



Select data capture rate

Move the cursor to Spd column. Select the capture rate by pressing F1 (Prog) repeatedly.

Bias	
Spd	MAX
Hi	1.0000H



Slow	600mS (AC), 500mS (Rdc)
Med	450mS (AC), 120mS (Rdc)
Fast	150mS (AC), 50mS (Rdc)
Max	75mS (AC), 30mS (Rdc)

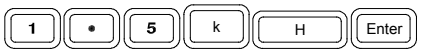
Set Hi limit

Move the cursor to Hi column. Enter the Hi limit using the numerical keys and unit keys.

Spd	MAX
Hi	1.0000H
Lo	0.0000H

Range follows the specification for each measurement item

Example: 1.5kH (for Ls)



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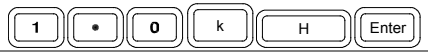
Set Lo limit

Move the cursor to Lo column. Enter the Lo limit using the numerical keys and unit keys.

Spd	MAX
Hi	1.0000H
Lo	0.0000H

Range: follows the specification for each measurement item

Example: 1.0kH (for Ls)



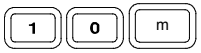
Set trigger delay

Move the cursor to Dly (Delay) column. Enter the amount of trigger delay time using the numerical keys and unit keys.

Hi	1.0000H
Lo	0.0000H
Dly	10 ms

Range: 0 (no delay) ~ 1000ms

Example: 10ms



Copy (duplicate) program step

Background

Copying the step inserts a new, identical step next to the current step (= the step where the cursor resides).

Panel operation

Press F2 (Copy). A new step with identical contents appears on the right side.

F 2

Before (step 3 empty)

Step	01	02	03
Func	B	Rdc	OFF
Freq	1.0000k		
Volt	10mV	1.00 V	
Bias			
Spd	MAX	FAST	
Hi	1.0000 S	0.0000Ω	
Lo	500.00mS	0.0000Ω	
Dly	9999 ms	0 mS	

After (step 2 copied to 3)

Step	01	02	03
Func	B	Rdc	Rdc
Freq	1.0000k		
Volt	10mV	1.00 V	1.00 V
Bias			
Spd	MAX	FAST	FAST
Hi	1.0000 S	0.0000Ω	0.0000Ω
Lo	500.00mS	0.0000Ω	0.0000Ω
Dly	9999 ms	0 mS	0 mS

Delete program step

Background

Deleting the step deleted the currently selected step (= where the cursor resides). The other step numbers are decreased by 1 (shifted to the left in the table).

Panel operation

Press F3 (Delete). The current step is deleted, and the whole table shifts to the left.

F 3

Before (step 2 deleted)

Step	01	02	03
Func	B	G	Rdc
Freq	1.0000k		
Volt	10mV	1.20 V	1.00 V
Bias			
Spd	MAX	MED	FAST
Hi	1.0000 S	1.5000kS	0.0000Ω
Lo	500.00mS	0.0000S	0.0000Ω
Dly	9999 ms	10 mS	0 mS

After (step 3 becomes 2)

Step	01	02	03
Func	B	Rdc	OFF
Freq	1.0000k		
Volt	10mV	1.00 V	
Bias			
Spd	MAX	FAST	
Hi	1.0000 S	0.0000Ω	
Lo	500.00mS	0.0000Ω	
Dly	9999 ms	0 mS	

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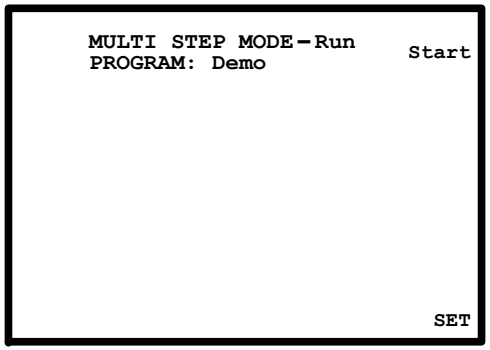
Multi-Step Program Run

Run program

Panel operation

1. When editing is completed, press F6 (Run) to run the multi-step program. The display changes to program running mode.

F 6



2. Press the Sing/Rep key to select Single (manual trigger) or Repetitive (automatic trigger).

Sing/Rep

Manual trigger

Manual trigger

Trig

F 1

Starts running the program when the Trigger key or F1 (Start) is pressed.

Auto trigger

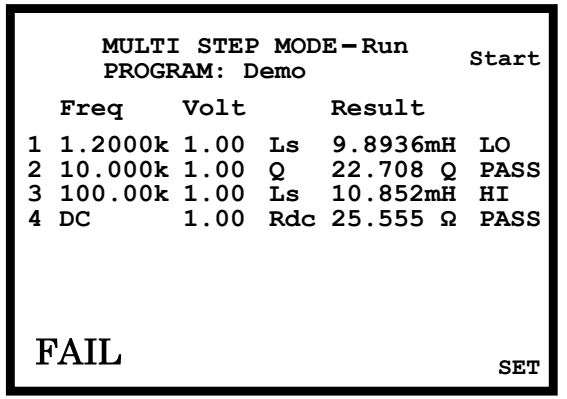
Auto trigger

Starts running the program when LCR-8101 detects the DUT is connected to the fixture (scans the fixture continuously). Manual triggering is also available.

3. In Manual (single) mode press F1 (Start) or the Trigger key to manually start the program. The test results show up according to the program contents.

Trig

F 1

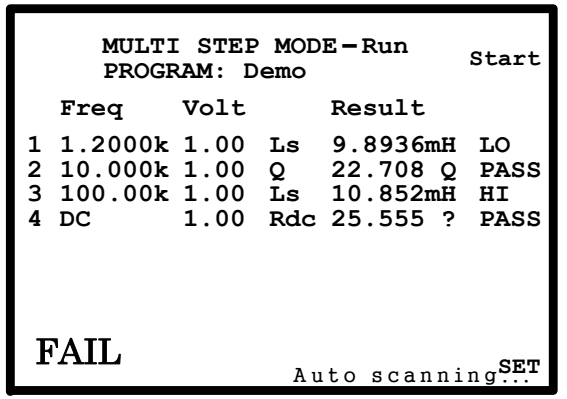


Manual (single) Mode

4. In Auto trigger mode, it will autoscan continuously and will not start until a DUT has been detected. To manually trigger the program, press F1 (Start) or the Trigger key.

Trig

F 1



Auto trigger (repetitive) mode

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The rightmost row shows the result for each step.

LO	Failed: below the Lo limit
HI	Failed: above the Hi limit
PASS	Passed

The left bottom corner shows the result for the whole program.

PASS	All steps passed
FAIL	One or more steps failed

5. To return to the program setting menu, press F6 (Set). F 6

Multi-Step Program File Operation

Save program

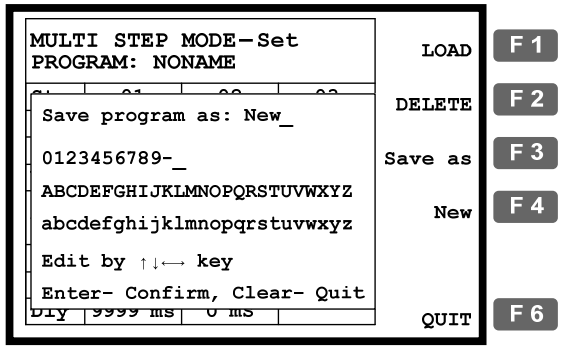
Save (overwrite)

Press F4 (Save) to save the program being edited. A confirmation message appears on the display. F 4

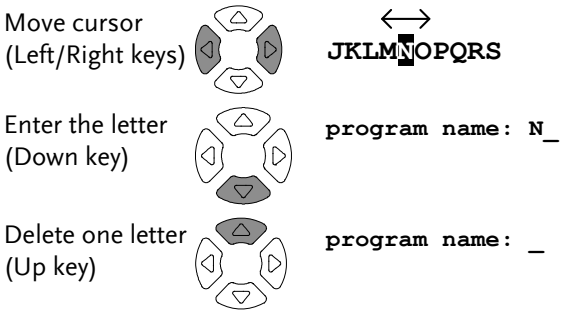
```
Program saved
```

Save as (new program)

1. Press F5 (File), then F3 (Save As). The new program name dialogue appears. F 5 F 3

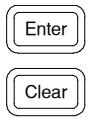


2. Enter the new program name using the arrow keys.

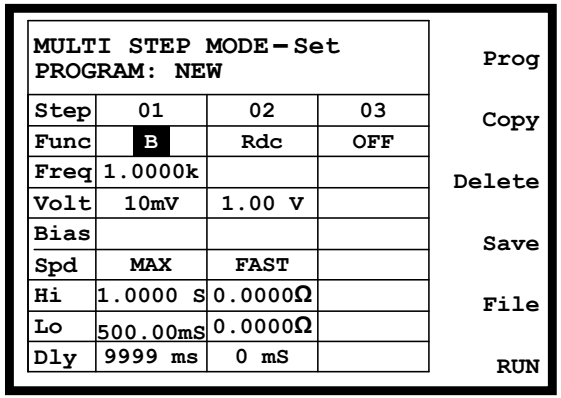


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3. Press the Enter key to confirm the file name. To quit the Save as mode, press the Clear key.



4. The display goes back to the previous mode, with the program changed to the new name.



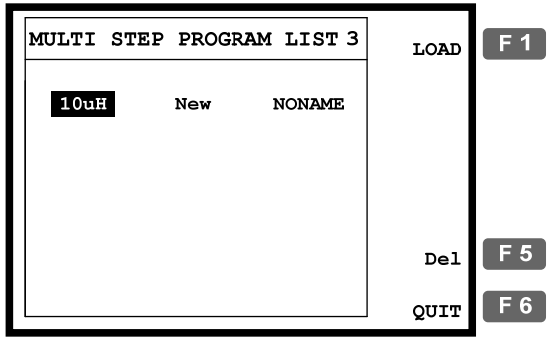
Recall (load) existing program

Panel operation

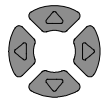
1. Press F5 (File). The file menu appears.



2. Press F1 (Load). The existing programs appear, listed in alphabetical order.



3. Use the arrow key to move the cursor to the program to be recalled (loaded).



4. Press F1 (Load) to recall the selected program on the display.



5. To cancel loading and go back to the previous menu, press F6 (Quit).



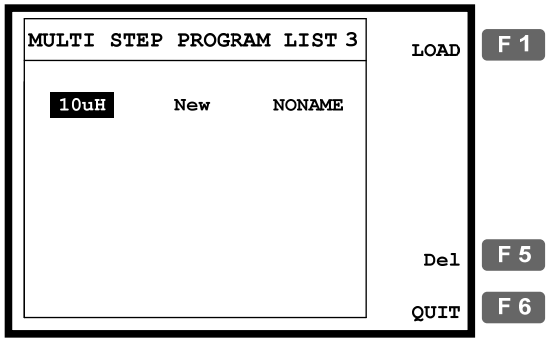
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Delete existing program

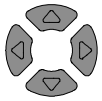
Recall program

1. Press F5 (File), then F2 (Delete). The existing programs appear, listed in alphabetical order.

F 5



2. Use the arrow key to move the cursor to the program to be deleted.



3. Press F5 (Del). The buzzer beeps and a warning sign appear. Press the Enter key (confirm) or the Clear key (cancel).

F 5

Enter

Clear

```
DELETE FILE
   Delete New ?
Enter-Yes  Clear-Quit
```

Note: the currently active program cannot be deleted. An error message appears.

```
program being used!
```

4. To go back to the previous menu without deleting any program, press F6 (Quit).

F 6

GRAPH MODE

The graph function shows the component characteristics in visual manner. Voltage and Frequency sweep are selectable for the horizontal scale. When the graph gets out of the vertical range, LCR-8101 can automatically adjust the scale. Marker operation is available for detailed observation.

Item selection	Enter graph mode	79
	Select measurement item	80
Horizontal scale setting	Set horizontal axis (Voltage)	81
	Set horizontal axis (Frequency)	83
Vertical scale setting	Set vertical axis (Manual + Absolute)	85
	Set vertical axis (Manual + Percentage)	87
	Set vertical axis (Auto + Absolute)	89
	Set vertical axis (Auto + Percentage)	90
Speed/Step Setting	Select measurement speed (capture timing)	92
	Select step size	92
Running Graph Measurement	Run measurement	93
	Adjust vertical scale	95
	Observe Graph Data	96

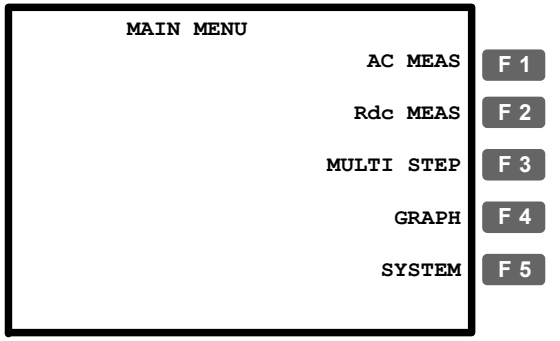
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Item Selection

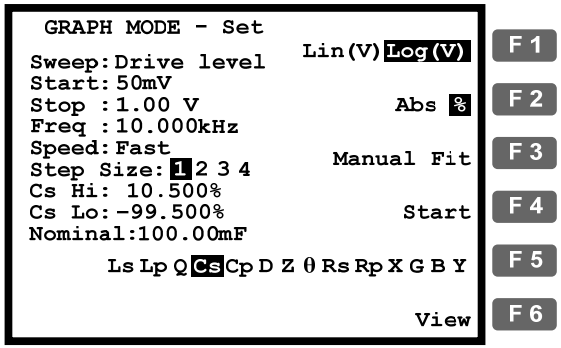
Enter graph mode

Panel operation

1. Press the Menu key. The main menu appears.



2. Press F4 (Graph). The Graph mode display appears.



Select measurement item

Range

Ls	Series inductance	θ	Angle
Lp	Parallel inductance	Rs	Series resistance
Q	Quality factor	Rp	Parallel resistance
Cs	Series capacitance	X	Reactance
Cp	Parallel capacitance	G	Conductance
D	Dissipation factor	B	Susceptance
Z	Impedance	Y	Admittance

For detailed description of each item, see page31.

Panel operation

Press F5 repeatedly to select the graph measurement item. F 5

Ls Lp Q Cs Cp D Z θ Rs Rp X G B Y

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Horizontal Scale Setting

Set horizontal axis (Voltage)

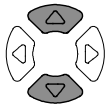
Background

The X (horizontal) axis is selectable from Voltage and Frequency sweep.

- When Voltage sweep is selected: measurement Frequency is fixed
- When Frequency sweep is selected: measurement Voltage is fixed

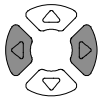
Select Drive level (Voltage)

1. Press the Up/Down key and move the cursor to Sweep.



Sweep: Frequency

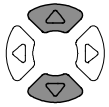
2. If necessary, press the Left/Right key to change the sweep setting to Voltage (Drive Level).



Frequency ⟶ **Drive Level**

Set start Voltage

3. Press the Up/Down key and move the cursor to Start.

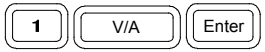


Start: 50mV

Use the numerical keys to enter the starting Voltage.

Range 10mV ~ 2V, 1mV resolution

100mV 

1V 

Backspace  All clear 

If a wrong unit is entered, the value is cancelled.

Unit Mismatched

If a value outside of the range is entered, the closest available value is automatically selected.

Nearest Available

If the entered start Voltage level is higher than the stop Voltage, the two values are swapped.

Hi and Lo Swapped

Set stop Voltage

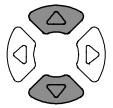
4. Repeat the above step for the stop Voltage.

Stop: 1.00 V

Range 10mV ~ 2V, 1mV resolution (stop Voltage must be higher than the start Voltage)

Set measurement Frequency

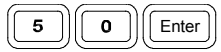
5. Use the Up/Down key to move the cursor to Frequency setting (Freq).



Freq : 10.000kHz

Use the numerical keys to enter the measurement frequency.

Range 20Hz ~ 1MHz

50Hz 

1MHz 

Backspace  All clear 

Select Lin/Log scale

6. Press F1 to select the horizontal scale, Linear or Logarithmic.



Lin (V) Log (V)

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Set horizontal axis (Frequency)

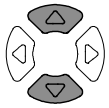
Background

The X (horizontal) axis is selectable from Voltage and Frequency sweep.

- When Voltage sweep is selected: measurement Frequency is fixed
- When Frequency sweep is selected: measurement Voltage is fixed

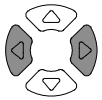
Select Frequency

1. Press the Up/Down key and move the cursor to Sweep.



Sweep: Drive Level

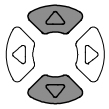
2. If necessary, press the Left/Right key to change the sweep setting to Frequency.



Drive Level ⟶ **Frequency**

Set start Frequency

3. Press the Up/Down key and move the cursor to Start.

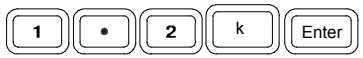


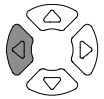
Start: 20.000Hz

Use the numerical keys to enter the starting Frequency.

Range 20Hz ~ 1MHz (stop Frequency must be higher than the start Frequency)

50Hz 

1.2kHz 

Backspace  All clear 

If a wrong unit is entered, the value is cancelled.

Unit Mismatched

If a value outside of the range is entered, the closest available value is automatically selected.

Nearest Available

If the entered start Frequency is higher than the stop Frequency, the two values are swapped.

Hi and Lo Swapped

Set stop Frequency

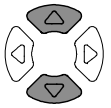
4. Repeat the above step for the stop Frequency.

Stop: 1.00 V

Range 20Hz ~ 1MHz (stop Frequency must be higher than the start Frequency)

Set measurement Voltage

5. Use the Up/Down key to move the cursor to Voltage setting (Level).

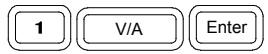


Level: 1.00 V

Use the numerical keys to enter the measurement Voltage.

Range 10mV ~ 2V

100mV 

1V 

Backspace  All clear 

Select Lin/Log scale

6. Press F1 to select the horizontal scale, Linear or Logarithmic.



Lin (Hz) Log (Hz)

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Vertical Scale Setting

Set vertical axis (Manual + Absolute)

Background

The Y (vertical) axis configuration is available for:

- Manual or Automatic fit: Selects whether the vertical range is manually set or automatically adjusted as the graph is plotted.
- Absolute or Percentage: Selects how the vertical range is defined, as absolute values (minimum and maximum) or percentage of the nominal (center) value.

Panel operation

1. Press F2 to select Abs.

   F 2

   Abs %

2. Press F3 to select Manual Fit.

   F 3

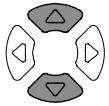
   Manual Fit

3. The maximum (Hi) and minimum (Lo) level of the vertical axis appears.

   Step Size: 1 2 3 4
   Cs Hi: 5.8240mF
   Cs Lo: 3.5626mF

Set Hi level

4. Press the Up/Down key to move the cursor to Hi level.

   Cs Hi: 5.8240mF

5. Use the numerical keys to enter the Hi level.

   Range: According to each measurement item (see page31).

   1.2mΩ: 1 • 2 m Ω Enter

1.5kH: 1 • 5 k H Enter

Backspace: 

All clear: Clear

If a wrong unit is entered, the value is cancelled.

Unit Mismatched

If a value outside of the range is entered, the closest available value is automatically selected.

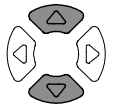
Nearest Available

If the entered Lo level is higher than the Hi level, the two values are swapped.

Hi and Lo Swapped

Set Lo level

6. Press the Up/Down key to move the cursor to Lo level and repeat the same step.

   Cs Lo: 3.5626mF

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Set vertical axis (Manual + Percentage)

Background

The Y (vertical) axis configuration is available for:

- Manual or Automatic fit: Selects whether the vertical range is manually set or automatically adjusted as the graph is plotted.
- Absolute or Percentage: Selects how the vertical range is defined, as absolute values (minimum and maximum) or percentage of the nominal (center) value.

Panel operation

1. Press F2 to select % (Percentage). F 2

   Abs %

2. Press F3 to select Manual Fit. F 3

   Manual Fit

3. The Hi percentage, Lo percentage, and the nominal value of the vertical axis appear.

   Step Size: 1 2 4 8
   Cs Hi: 10.500%
   Cs Lo: -19.500%
   Nominal:100.00mF

Set Hi level

4. Press the Up/Down key to move the cursor to Hi percentage.

   Cs Hi: 10.500%

5. Use the numerical keys to enter the percentage.

   Range –1.0x10¹² (Tera) ~ 1.0x10¹² (Tera) %

   50% 5 0 Enter

   1200% 1 • 2 k Enter

Backspace Clear All clear

If a wrong unit is entered, the value is cancelled.

Unit Mismatched

If the entered Hi level is lower than the Lo level, the two values are swapped.

Hi and Lo Swapped

Set Lo level

6. Press the Up/Down key to move the cursor to Lo percentage and repeat the same step.

   Cs Lo: -19.500%

   Range –1.0x10¹² (Tera) ~ 1.0x10¹² (Tera) %

Set Nominal

7. Press the Up/Down key to move the cursor to Nominal.

   Nominal: 1.0000mF

8. Use the numerical keys to enter the nominal value on which the Hi and Lo percentages are based.

   Range According to each measurement item (see page31).

   1.2mΩ 1 • 2 m Ω Enter

   1.5kH 1 • 5 k H Enter

   Backspace All clear Clear

If a wrong unit is entered, the value is cancelled.

Unit Mismatched

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If a value outside of the range is entered, the closest available value is automatically selected.

```
Nearest Available
```

Set vertical axis (Auto + Absolute)

Background

The Y (vertical) axis configuration is available for:

- Manual or Automatic fit: Selects whether the vertical range is manually set or automatically adjusted as the graph is plotted.
- Absolute or Percentage: Selects how the vertical range is defined, as absolute values (minimum and maximum) or percentage of the nominal (center) value.

Panel operation

1. Press F2 to select Abs (Absolute). F 2

```
Abs %
```

2. Press F3 to select Auto Fit. F 3

```
Auto Fit
```

3. Nothing new appears on the display: LCR-8101 automatically configures the vertical scale according to the measured data.

```
Step Size: 1 2 4 8
```


Set vertical axis (Auto + Percentage)

Background

The Y (vertical) axis configuration is available for:

- Manual or Automatic fit: Selects whether the vertical range is manually set or automatically adjusted as the graph is plotted.
- Absolute or Percentage: Selects how the vertical range is defined, as absolute values (minimum and maximum) or percentage of the nominal (center) value.

Panel operation

1. Press F2 to select % (Percentage). F 2

```
Abs %
```

2. Press F3 to select Auto Fit. F 3

```
Auto Fit
```

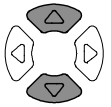
3. The nominal value appears on the display.

```
Step Size: 1 2 4 8

Nominal:1.0000mF
```

Set Nominal level

4. Press the Up/Down key to move the cursor to Nominal.



```
Nominal:1.0000mF
```

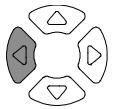
5. Use the numerical keys to enter the nominal value on which the Hi and Lo percentages are based.

Range: According to each measurement item (see page31).

1.2mΩ: 1 • 2 m Ω Enter

1.5kH: 1 • 5 k H Enter

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Backspace  All clear 

If a wrong unit is entered, the value is cancelled.

```
Unit Mismatched
```

If a value outside of the range is entered, the closest available value is automatically selected.

```
Nearest Available
```

6. LCR-8101 automatically configures the percentage (below and above the nominal level) of the vertical scale.

Speed / Step Setting

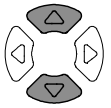
Select measurement speed (capture timing)

Background

The speed is the same setting used in the basic measurement (page50), except in the graph mode, maximum speed setting is not available.

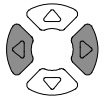
Panel operation

1. Press the Up/Down key and move the cursor to Speed.



```
Speed: Fast
```

2. If necessary, press the Left/Right key to change the setting (time per capture).



Slow	600mS (AC), 500mS (Rdc)
Med	450mS (AC), 120mS (Rdc)
Fast	150mS (AC), 60mS (Rdc)

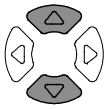
Select step size

Background

The step size selects whether to plot every captured data (step size 1) or to plot only the selected data (step size 2, 4, 8 = every 2, 4, 8 data).
Step size 1: detailed graph, slow capturing
Step size 2, 4, 8: simplified graph, fast capturing

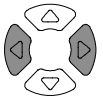
Panel operation

1. Press the Up/Down key and move the cursor to Step size.



```
Step Size: 1 2 4 8
```

2. If necessary, press the Left/Right key to change the setting.



Range	1 (plot all data), 2, 4, 8

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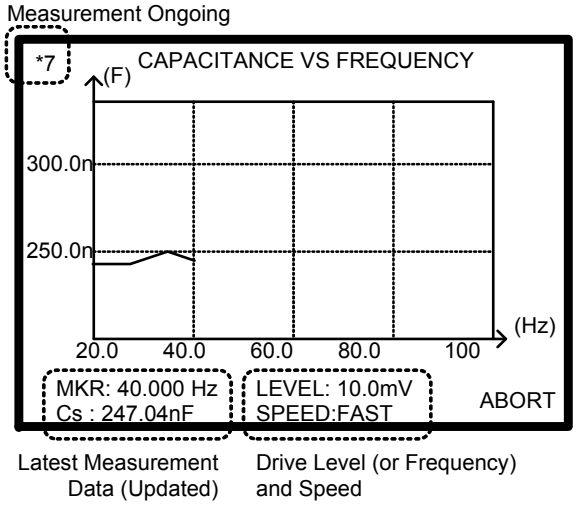
Running Graph Measurement

Run measurement

Panel operation

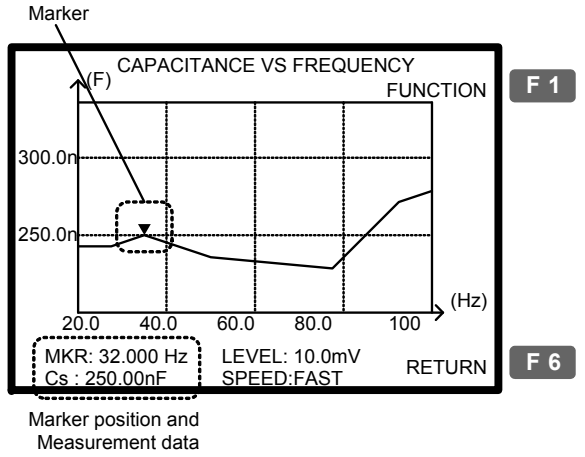
1. When the configuration is completed, press F4 (Start) to start the graph measurement. **F 4**

2. The display changes into graph mode and starts plotting the measurement data.



3. To abort the measurement, press F6 (Abort). **F 6**

4. When completed, the buzzer sounds once and the display shows the whole plotted data.



5. To go back to the configuration mode, press F6 (Return). **F 6**

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Adjust vertical scale

Background

When the measured data does not fit into the original vertical scale, use this function so that LCR-8101 automatically adjust the scale to include the whole plotted data.

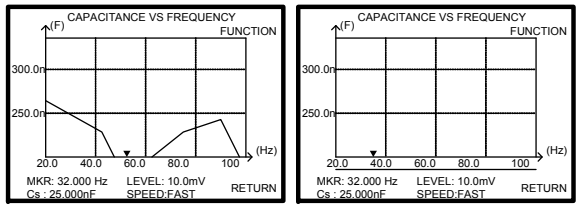
Panel operation

1. If part or all of the plotted data are out of the vertical range, use the automatic fit function. Press F1 (Function), then F2 (Fit).

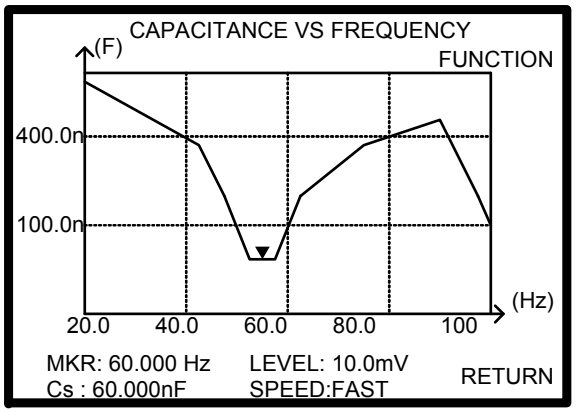
F 1

F 2

(Partially out of range) (Totally out of range)



2. The vertical range is automatically adjusted to include the whole plotted data.



Observe Graph Data

Background

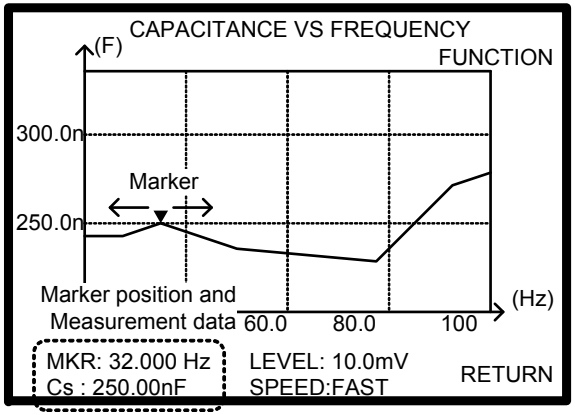
When the graph is completed (page93) and the vertical scale is adjusted (page95), use the marker to observe the measurement data in detail.

In the configuration mode, if the graph is already available, it can be viewed by pressing F6 (View).

F 6

Panel operation

1. To move the marker, press the Left/Right key. As the marker moves, the marker position and measurement data changes.



Move marker to the peak

2. To move the marker to the peak of the plot, press F1 (Function) and F3 (Peak). Press F1 (View) to go back to the previous display.

F 1

F 3

Move marker to the bottom

3. To move the marker to the bottom of the plot, press F1 (Function) and F4 (Dip). Press F1 (View) to go back to the previous display.

F 1

F 4

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REMOTE CONTROL

This chapter describes basic aspects of IEEE488.2 based remote control. Both RS-232C and GPIB interface can be used for remote control.

Interface Configuration	Configure RS-232C interface	98
	Configure GPIB interface	99
Command syntax	Command Syntax	101
Command set	System command	102
	Measurement command	103
	Multi-step program command	105
	Calibration command	107
	Graph command	108

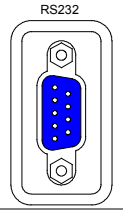
Interface Configuration

Configure RS-232C interface

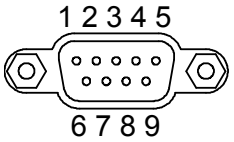
RS-232C configuration

Connector	DB-9, Male
Baud rate	9600
Parity	None
Data bit	8
Stop bit	1

Connect the RS-232C cable to the rear panel port: DB-9 male connector.



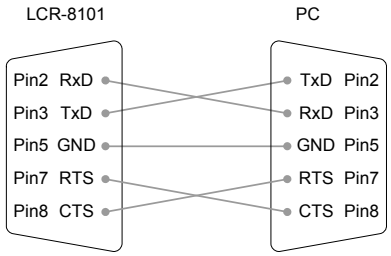
Pin assignment



2: RxD (Receive data)
3: TxD (Transmit data)
5: GND
7: RTS (Request to send)
8: CTS (Clear to send)
1, 4, 6, 9: No connection

PC connection

Use the Null Modem connection as in the below diagram.

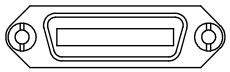


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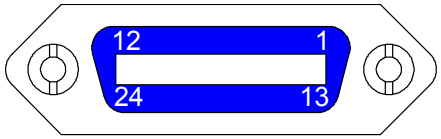
Configure GPIB interface

Connection

Connect the GPIB cable to the rear panel port: 24-pin female connector.



Pin assignment



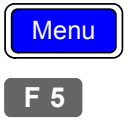
Pin1	Data line 1	Pin13	Data line 5
Pin2	Data line 2	Pin14	Data line 6
Pin3	Data line 3	Pin15	Data line 7
Pin4	Data line 4	Pin16	Data line 8
Pin5	EOI	Pin17	REN
Pin6	DAV	Pin18	Ground
Pin7	NRFD	Pin19	Ground
Pin8	NDAC	Pin20	Ground
Pin9	IFC	Pin21	Ground
Pin10	SRQ	Pin22	Ground
Pin11	ATN	Pin23	Ground
Pin12	Shield (screen)	Pin24	Signal ground

GPIB constraints

- Maximum 15 devices altogether, 20m cable length, 2m between each device
- Unique address assigned to each device
- At least 2/3 of the devices turned On
- No loop or parallel connection

Select GPIB address

1. Press the Menu key and F5 (System). The system configuration appears.

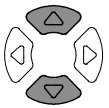



```
   Precision LCR Meter LCR-8101
Software version 2.03 Oct 25 2008

Frequency          1MHz
RS-232             ✓
Graph mode         ✓
GPIB               ✓

Line frequency     : 50Hz
Beep               : OFF
GPIB address       : 5
Average            : 10
```

2. Press the Up/Down key and move the cursor to GPIB.



```
GPIB address       : 5
```

3. Use the numerical keys to enter the GPIB address, 1 ~ 30.

```
GPIB address       : 30
```

Address 5 

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Command Syntax

Compatible standard	• IEEE488.2, 1992 (fully compatible) • SCPI, 1994 (partially compatible)

Command format



1: command header
2: single space
3: parameter
4: message terminator

Parameter	Type	Description	Example
	<Boolean>	boolean logic	0, 1
	<NR1>	integers	0, 1, 2, 3
	<NR2>	decimal numbers	0.1, 3.14, 8.5
	<NR3>	floating point	4.5e-1, 8.25e+1
	<disc>	discrete data	on, off, max

Message terminator

Terminates a command line. Note that LCR-8101 accepts only LF (line feed) as the terminator.

⚠	LF	line feed code

Note

- Commands introduced here are described in abbreviated style (same functionality)
- Commands are non-case sensitive.

Command Set

System command

*cls	Clears the Event Status Register and associated status data structure.
*ese <NR1> *ese?	Sets or returns the current contents of the Standard Event Status Enable Register as an integer in the range 0 to 255.
*esr?	Returns the current contents of the Standard Event Status Register as an integer in the range 0 to 255. It also clears ESR.
*idn?	Returns oscilloscope ID as Manufacturer, Model No, Serial No, Firmware version. Example: GW INSTEK, 8101, 0, 1.84
*loc	Sets the instrument to local state.
*opc	Sets the OPC bit of the ESR register.
*opc?	Always returns 1 as instrument commands are always processed sequentially.
*opt?	Returns the hardware options installed in the instrument. Example: 1MHz, GPIB, RS232, GRAPH MODE
*rst	Resets LCR-8101.
*sre <NR1> *sre?	Sets or returns the current contents of the Service Request Enable Register as an integer in the range 0 to 63 and 128 to 255.
:stat:oper:con?	Reads Status Operation Condition register.
:stat:oper:enab <NR1>	Sets Status Operation Enable register.
:stat:oper:even?	Reads Status Operation Event register.

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*stb?	Returns the current contents of the Status Byte with the Master Summary bits as an integer in the range 0 to 255. Bit 6 represents Master Summary Status rather than Request Service.
*trg	Triggers a direct measurement, but does not return the results to the controller. This is the same as a GET (Group Execute Trigger) command.
*wai	Command has no effect as commands are processed sequentially.

Measurement command

:dump-bmp	Returns the current display as a windows compatible bitmap.
:beep <disc> :beep?	Sets or returns the buzzer condition. Set parameter: off (disabled), pass (beeps when passed), fail (beeps when failed) Return parameter: 0 (off), 1 (pass), 2 (fail)
:loc-trig <NR1>	Turns On/Off local triggering in remote control Parameter: on (local control), off (remote control)
:meas:equ-cct <NR1> :meas:equ-cct?	Selects or returns equivalent circuit. Send parameter: ser, par Return parameter: 0 (parallel), 1 (series)
:meas:freq <NR3> :meas:freq?	Sets or returns frequency of AC measurement in Hz. Parameter example: (1kHz) 1k, 1000 Hz, 1E3
:meas:func <disc>	Selects first or second AC measurement function. Parameter: c, l, x, b, z, y, q, d, r, g Example: :meas:func:c;d (C+D measurement)
:meas:func:major ?	Returns the first AC function. Parameter: 0 (C), 1 (L), 2 (X), 3 (B), 4 (Z), 5 (Y)

:meas:func:minor ?	Returns the second AC function. Parameter: 0 (Q), 1 (D), 2 (R), 3 (G) If the first function is Z or Y, this command returns the last non-polar setting
:meas:hi-lim <NR2> :meas:hi-lim?	Sets or returns scale high limit as percentage. Example: :meas:hi-lim 5.0 (+5.0%)
:meas:lev <NR2> :meas:lev?	Sets or returns drive level for currently selected test. Parameter example: (200mV) 0.2V, 200m
:meas:limit <disc> :meas:limit?	Sets or returns percentage or absolute scale limits. Send parameter: abs (absolute), perc (percentage) Return parameter: 0 (absolute), 1 (percentage)
:meas:lo-lim <NR2> :meas:lo-lim?	Sets or returns scale low limit as percentage. Example: :meas:hi-lim –5.0 (–5.0%)
:meas:nom <NR3> :meas:nom?	Sets or returns nominal value for scale. Send parameter: according to the active unit (1e-6f = 1uF) Return parameter example: .10000000e-1 = 10mH
:meas:range <NR1> :meas:range?	Selects or returns auto-ranging or range-hold on range N. Send parameter: auto, hold, 1 ~ 7 Return parameter: 0 (auto), 1 ~ 7
:meas:scale <disc> :meas:scale?	Shows or hides the scale bar or returns the status. Send parameter: on, off Return parameter: 0 (scale hidden), 1 (scale visible)

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:meas:speed <disc> :meas:speed?	Selects or returns measurement speed. Send parameter: max, fast, med, slow Return parameter: 0 (max), 1 (fast), 2 (med), 3 (slow)
:meas:test:ac	Selects AC measurement.
:meas:test:rdc	Selects Rdc measurement.
:meas:test?	Returns measurement type. Parameter: 0 (AC measurement), 1 (Rdc measurement)
:meas:trig	Triggers an AC or Rdc measurement manually. Returns the 1st and 2nd measurement (only the 1st in Rdc). Example: –396.283E-6, 99.558 (uF/D)
:mode?	Query the currently selected operating mode.
:rep <disc> :rep?	Enables or returns repetitive measurements when unit is returned to local control. Send parameter: on (repetitive), off (single shot) Return parameter: 0 (single shot), 1 (repetitive) Example: :rep on (repetitive mode)
:trig	Triggers a measurement in the current mode.

Multi-step program command

:multi:set	Switches to the multi-step set-up page.
:multi:del	Removes a step in the program. Parameter: 1 ~ 30 Example: :multi:del 2 (deletes step 2)

:multi:delay <NR2> :multi:delay?	Sets or returns trigger delay time for currently selected step in millisecond. Parameter: 0ms ~ 1000ms Example: :multi:delay 10m (10ms)
:multi:freq <NR2> :multi:freq?	Sets or returns the frequency for the currently selected step in Hz. Parameter: 20 ~ 1MHz Example: :multi:freq 1e3 (1kHz)
:multi:func <NR1> :multi:func?	Sets or returns measurement type for the currently selected step. Send parameter: LS, LP, Q, CS, CP, D, Z, PHASE, RS, RP, X, G, B, Y, RDC Return parameter: 1 (Z), 2 (Ls), 3 (Lp), 4 (Cs), 5 (Cp), 7 (Y), 8 (G), 9 (P), 10 (Q), 11 (D), 12 (Rs), 13 (Rp), 14 (B), 15 (X), 16 (Rdc) Example: :multi:func ls (Series inductance)
:multi:hi-lim <NR3> :multi:hi-lim?	Sets or returns the higher test limit of the currently selected step. Example: :multi:hi-lim 10 (limit to 10.0)
:multi:lev <NR3> :multi:lev?	Sets or returns the drive level for the currently selected step in Voltage. Parameter: 10mV ~ 2V Example: :multi:lev 200m (200mV)
:multi:load <filename>	Loads an existed file to run or edit. Example: :multi:load demo (file name demo)
:multi:lo-lim <NR3> :multi:lo-lim?	Sets or returns the lower test limit of the currently selected step. Example: :multi:lo-lim –5 (limit to –5)
:multi:new <filename>	Create a new multi-step program. Example: :multi:new demo (file name demo)

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:multi:res?	Query the results of the test for each step. Parameter: 0 (Pass), 1 (Fail Hi), 2 (Fail Lo) Example: 1, +1.5E-7, 0, –0.2E-4 (step 1 failed on high limit, step 2 passed)
:multi:run	Switches to the multi-step run page.
:multi:save	Save currently edited file.
:multi:speed <disc> :multi:speed?	Sets or returns the measurement speed for the currently selected step. Send parameter: Max, Fast, Med, Slow Return parameter: 0(Max), 1(Fast), 2(Med), 3(Slow) Example: :multi:speed max (maximum speed)
:multi:test <NR1> :multi:test?	Selects or returns the step being edited. Parameter: 1 ~ 30 Example: :multi:test 1(step 1 selected)
:multi:trig	Starts running multi-step measurements.

Calibration command

:cal:oc-trim <NR1>	Performs open circuit trimming. Parameter: 1 (Spot trim), 2 (<10kHz), 3 (<100kHz), 4 (All frequency) Example: :cal:oc-trim 4 (calibrate for all frequency)
:cal:sc-trim <NR1>	Performs short circuit trimming. Parameter: 1 (Spot trim), 2 (<10kHz), 3 (<100kHz), 4 (All frequency), 5 (Rdc) Example: :cal:sc-trim 4 (calibrate for all frequency)
:cal:res?	Returns the result of the calibration performed. Parameter: 0 (fail), 1 (pass)

Graph command

:graph	Select graphing mode / path.
: graph:func <disc>	Set the measurement function for the graph mode. Parameter: ls lp q cs cp d z phase rs rp x g b y rdc Example: :graph:func lp
: graph:func?	Returns the current measurement function of the graph mode. Return parameter: 1 (Z), 2 (Ls), 3 (Lp), 4 (Cs), 5 (Cp), 7 (Y), 8 (G), 9 (P), 10 (Q), 11 (D), 12 (Rs), 13 (Rp), 14 (B), 15 (X), 16 (Rdc), 0 (none)
: graph:sweep <disc>	Set the sweep mode for the graph mode. Parameter: freq, lev Example: (drive level) :graph:sweep lev
: graph:sweep?	Returns the current sweep mode of the graph mode. Return Parameter: 0(frequency), 1(drive level)
: graph:st <NR3>	Set the start frequency or level for the sweep. Parameter: (26 Hz) 26, 2.6e1, 2.600000e+01, .026k. Example: :graph:st 2.6e1
:graph:st?	Returns the start frequency or level of the sweep.
:graph:sp <NR3>	Set the stop frequency or level for the sweep. Parameter: (260 Hz) 260, 2.6e2, 2.600000e+02 (.26k) Example: :graph:sp 260
:graph:sp?	Returns the stop frequency or level of the sweep.
:graph:freq <NR3>	Set the frequency if the sweep mode is drive level. Parameter: (150 kHz) 150000, 1.5e5, 1.500000e+05 (1.5k) Example: :graph:freq 150k

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:graph:freq?	Returns the frequency if the sweep mode is drive level
:graph:lev <NR3>	Set the drive level if the sweep mode is frequency. Parameter: (.1 volts) .1v, 100m, 1e-1, 1.000000e-1 Example: :graph:lev 100m • NOTE: e1or e+1 is invalid for the lev command. 2 volts maximum.
:graph:lev?	Returns the drive level if the sweep mode is frequency.
:graph:speed <disc>	Set measurement speed for the sweep. Parameter: fast, med, slow Example: :graph:speed med
:graph:speed?	Returns the measurement speed of the sweep. Return Parameter: 1(fast), 2 (med), 3(slow)
:graph:step <NR1>	Select the number of pixels between each measured point. Parameter: 1(step size 1),2(step size 2),3(step size 4),4(step size 8) Example: (step size 8) :graph:step 4
:graph:step?	Query the current step size for the plot.
:graph:hi-lim <NR3>	Set the maximum value for Y-axis in the graph mode. Parameter: real number up to 1^12 (1e+12) Example: graph:hi-lim 8.5e9 Note: Set the low limit before setting the high limit. The graph limits will only work whilst the "autofit" function is set to "off"
:graph:hi-lim?	Returns the maximum value of Y-axis in the graph mode.

:graph:lo-lim <NR3>	Set the minimum value for Y-axis in the graph mode. Parameter: real number up to 1^12 (1e+12) Example: :graph:lo-lim -8.5e9 Note: The graph limits will only work whilst the "autofit" function is set to "off"
:graph:lo-lim?	Returns minimum value for Y-axis of the graph mode.
:graph:nom <NR3>	Set the nominal value for the graph. Parameter: 3, 1e-1, 100e1 Example: :graph:nom 1e-1 Note: Nominal can only be set if the graph limit is set as a %(percentage)
:graph:nom?	Returns the current graph nominal.
:graph:logf<disc>	Selects the frequency scale type. Parameter: on, off Example: :(on) graph:logf on
:graph:logf?	Returns the current frequency scale type. Returned parameter 1(on), 0(off).
:graph:limit <disc>	Selects absolute or relative plotting. Parameter: perc(% relative), abs(absolute) Example: :graph:limit abs
:graph:limit?	Returns the current graph plotting mode. Returned parameter: 0(abs), 1(percentage)

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:graph:mk?	Returns the measurement from the current marker position. Returned parameter: Depending on the measured parameters. Example: (Series inductance) -3.510606e-03 (mH) Note: A graph must be plotted first.
:graph:mkf <NR3>	Move the marker to the frequency nearest the supplied value. Parameter: (150 kHz) 150000, 150k, 1.5e5 Note: the marker must be within the limits of the currently drawn graph. The x-axis must be frequency bound.
:graph:mkf?	Returns the current marker frequency.
:graph:set	Go to the graph mode set-up page. Example: :graph:set
:graph:view	Redraw the graph. Example: :graph:view
:graph:autofit <disc>	Set auto-fit condition for the graph mode. Parameter: on, off Example: : graph:autofit on
:graph:autofit?	Query the auto-fit condition. Returned parameter: 0 (off), 1 (on)
:graph:fit	Fit the Y-axis scale to the current measurement data. Example: :graph:fit Note: The graph will only scale. It will not plot again.
:graph:trig	Start plotting a graph with the current settings. Example: :graph:trig

:graph:peak	Move the marker to the highest point on the current graph. Example: :graph:peak
:graph:dip	Move the marker to the lowest point on the current graph. Example: :graph:dip
:graph:print	Print the current graph on an Epson compatible printer. Example: :graph:print

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CALIBRATION

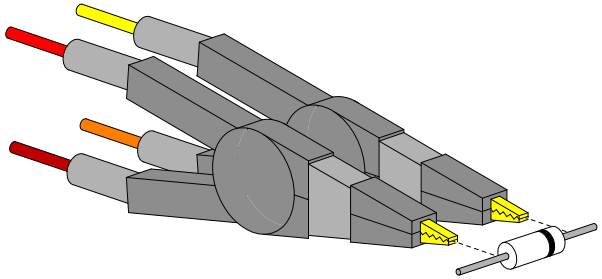
Overview

Background

Calibration (trimming) eliminates stray capacitance and series impedance from the testing fixture. It is required when using the instrument in a new environment, or using a new set of testing fixtures.

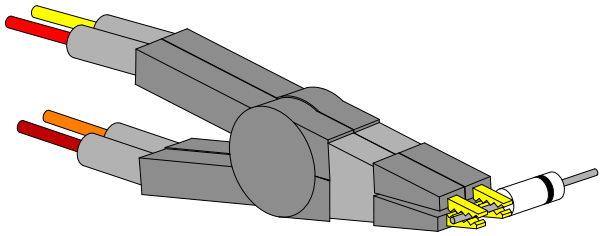
O/C trimming

The testing fixture clips are separated by a distance equal to the normal testing position.



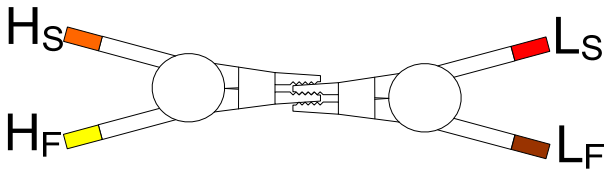
S/C trimming

The testing fixture clips are connected by a piece of wire or a component lead.



Alternative S/C trimming

An alternative method of S/C trimming.



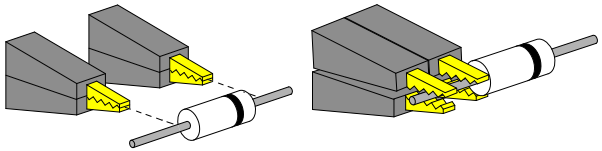
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Trim LCR-8101

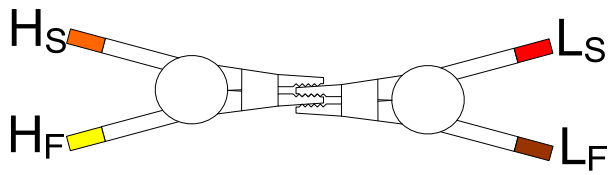
Fixture setting

Prepare the fixture accordingly. (In order to run a complete trimming, both O/C and S/C trimming have to be done.)

O/C trimming S/C trimming



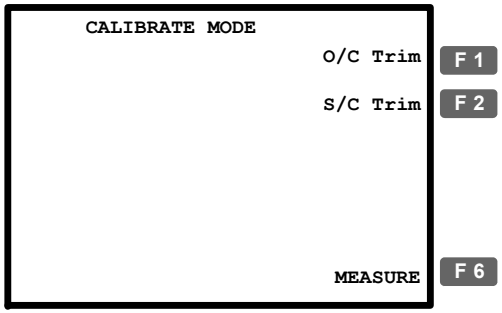
Alt. S/C trimming



Panel operation

1. Press the Calibration key. The calibration mode menu appears.

Calibration



* To go back to the measurement mode, press F6 (MEASURE).

F 6

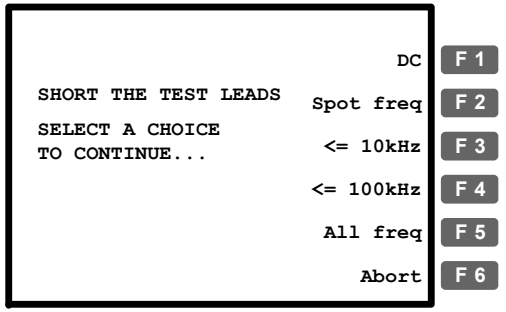
2. Press F1 (O/C Trim) or F2 (S/C Trim) to select the trimming mode.

F 1

F 2

3. The trimming menu appears.

S/C trimming



4. Always select F5 (All freq) when using the standard fixture set included in LCR-8101 package.

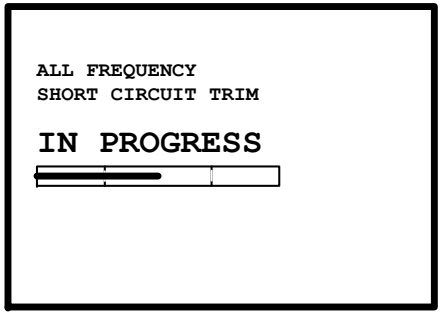
F 5

DC	(S/C trimming only) Trims at 0Hz.
Spot freq	Trims at the frequency set in the measurement mode (page30).
<= 10kHz	Frequency range is 0Hz ~ 10kHz.
<= 100kHz	Frequency range is 0Hz ~ 100kHz.
All freq	Frequency range is 0Hz ~ 1MHz.

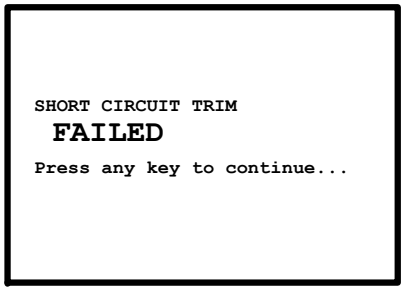
Frequency limit example: When using a special fixture set, trimming failed at 50kHz which is outside of the test component range (up to 5kHz). In this case, use F3 (<= 10kHz).

5. The trimming starts and ends automatically.

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Trim pass	The display goes back to the calibration mode menu.
Trim fail	The Fail message appears on the display. Press any other key to go back to the original menu.



6. Switch the fixture setting from O/C to S/C (or from S/C to O/C) and repeat from step 1.

FAQ

Q1. The beep keeps sounding.

A1. The beep sounds according to the pass/fail test result, which in this case is set to repetitive mode. Do one of the following.

- Set the test mode to Single (manual trigger), so that the beep sounds only when the test is initiated manually. Press the Sing/Rep key to change the setting. For details, see page49.
- Turn Off the beep entirely. Press the Menu key, F5 (System), move the cursor to Beep and select Off using the arrow keys. For details, see page54.

Q2. Panel operation seems disabled.

A2. Panel (local) operation is disabled in the Remote control mode (page97). Press the Local key to bring back the instrument to local operation mode (remote control is cancelled).

Q3. I cannot see the display clearly.

A3. Use the display contrast knob on the rear panel to adjust the brightness.

For more information, contact your local dealer or GWInstek at www.instek.com / marketing@goodwill.com.tw.

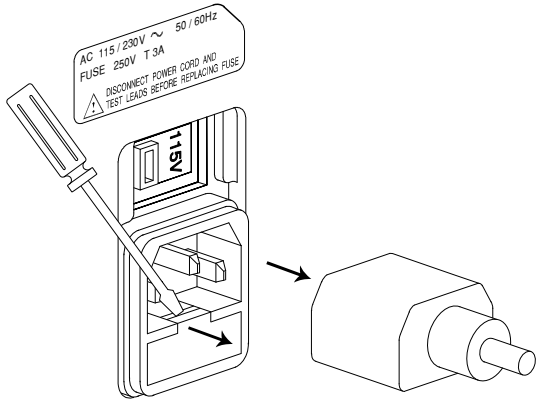
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APPENDIX

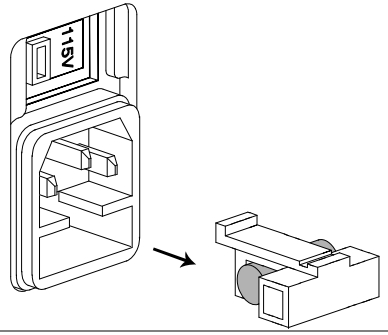
Fuse Replacement

Step

1. Take off the power cord and remove the fuse socket using a minus driver.

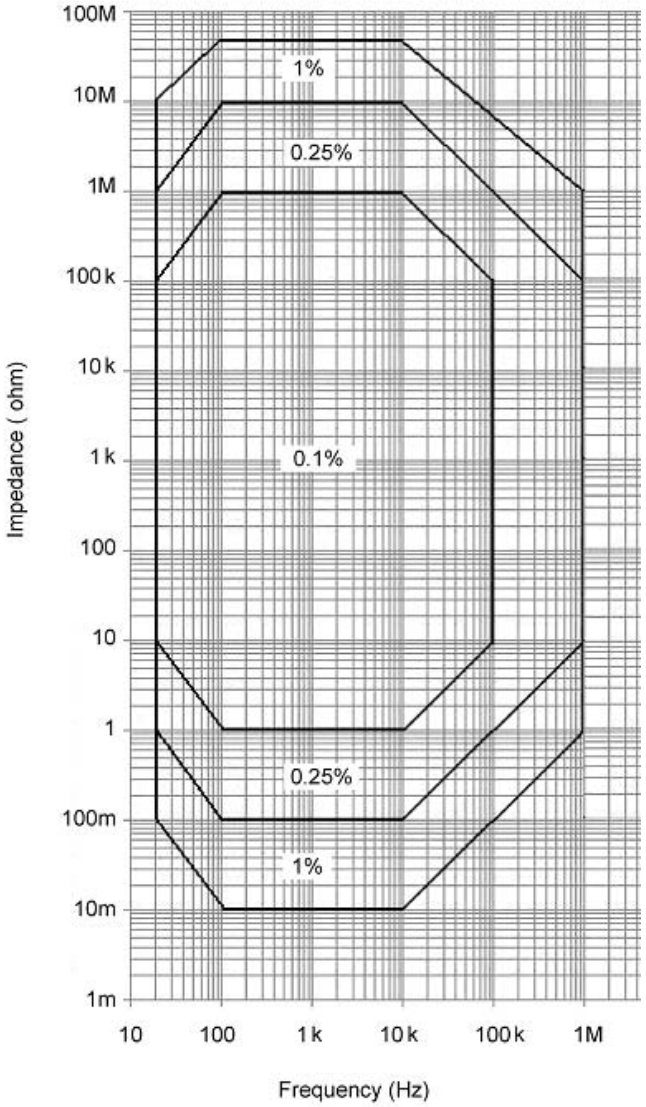


2. Replace the fuse in the holder.



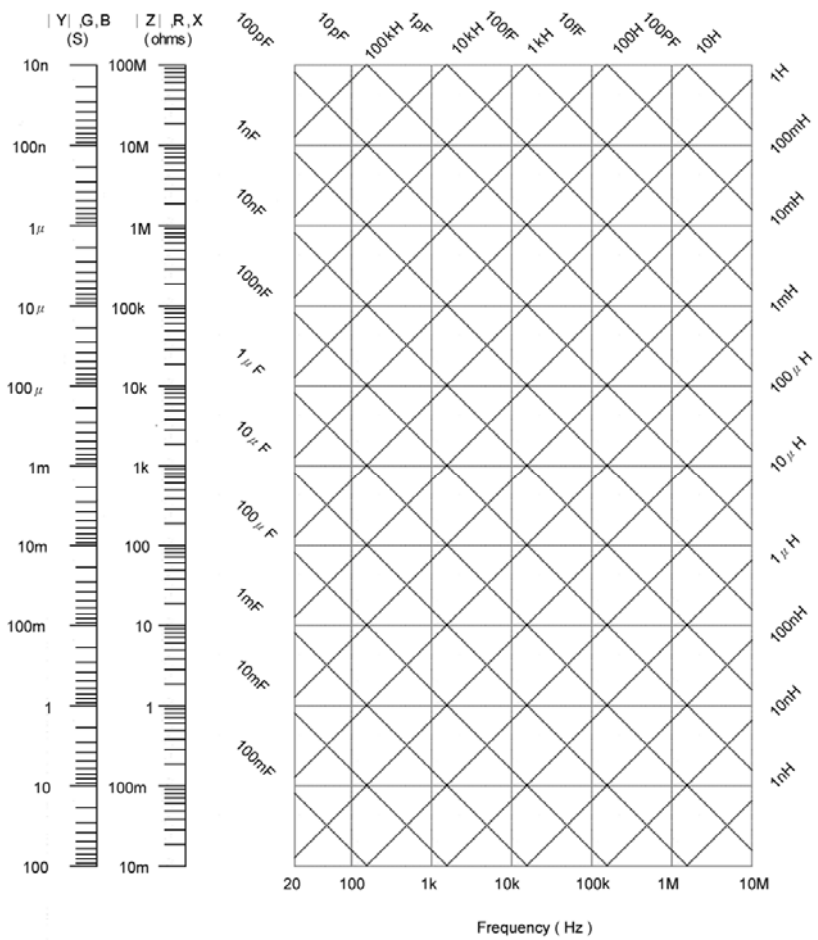
Rating T3A/250V

|Z| Accuracy Chart



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|Z| vs L, C Chart



Accuracy Definition

|Z|, |Y|	High Impedance	Ae[%]=±((A+0.0000001*Zx)*Kv*Kt)			
	Low Impedance	Ae[%]=±((A+0.1/Zx)*Kv*Kt)			
L, C, X, B	High Impedance when D < 0.1 Ae[%] = ± ((A + 0.0000001*Zx) * Kv * Kt) High Impedance when D ≥ 0.1 Ae[%] = ± (((A + 0.0000001*Zx) * Kv*Kt)* $\sqrt{(1+D^2)}$)				
	Low Impedance when D < 0.1 Ae[%] = ± ((A + 0.1/Zx) * Kv * Kt) Low Impedance when D ≥ 0.1 Ae[%] = ± (((A + 0.1/Zx) * Kv * Kt) * $\sqrt{(1+D^2)}$)				
R, G	High Impedance when Qx < 0.1 Ae[%] = ± ((A + 0.0000001*Zx) * Kv * Kt) High Impedance when Qx ≥ 0.1 Ae[%] = ± (((A + 0.0000001*Zx) * Kv*Kt)* $\sqrt{(1+Q^2)}$)				
	Low Impedance when Qx < 0.1 Ae[%] = ± ((A + 0.1/Zx) * Kv * Kt) Low Impedance when Qx ≥ 0.1 Ae[%] = ± (((A + 0.1/Zx) * Kv * Kt) * $\sqrt{(1+Q^2)}$)				
D	± (Ae/100) when D ≤ 0.1 ± ((Ae/100) * (1+D^2)) when D > 0.1				
Q	± (((Qx²*De) / (1±Qx*De)) when (Qx*De)< 1				
θ	± ((180*|Z|Ae[%]) / (π /100))				
Convention	A	Accuracy taken from the Accuracy chart			
	Zx	Measured value of unknown component			
	Kv	Test Voltage factor			
		Level	Kv	Level	Kv
		≥ 1.250	1.2	≥ 0.078	2
		≥ 0.625	1	≥ 0.039	2.5
		≥ 0.313	1.2	≥ 0.02	5
		≥ 0.156	1.5	≥ 0.010	10
	Kt	Temperature factor			
		Temperature	Kt	Temperature	Kt
		8-18°C	2	28-35°C	2
		18-28°C	1		
	Qx	Measured Q value			
	De	Relative D accuracy			

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Specification

Test Frequency	20Hz ~ 1MHz, 5 digits, ±0.005%		
Input Impedance	100Ω		
Basic Accuracy	±0.1% (R, Z, X, G, Y, B, L, C)		
Test Speed	AC	Max 75ms, Fast 150ms, Medium 450ms, Slow 600ms	
	DC	Max 30ms, Fast 60ms, Medium 120ms, Slow 500ms	
Test Signal Levels	10mV ~ 2Vrms, 1mV step, ±2.5%		
Short Circuit Current	Max. 20mA		
Display Range	R, Z, X	0.01mΩ ~ 1GΩ	
	G, Y, B	0.001nS ~ 1kS	
	L	0.1nH ~ 100kH	
	C	0.001pF ~ 1F	
	D	0.00001 ~ 9.9999	
	Q	0.01 ~ 9999.9	
	Rdc	0.1mΩ ~ 100MΩ	
	θ	–180° ~ +180°	
Measurement Parameters	Impedance (Z)		Phase Angle (θ)
	Inductance (L)		Capacitance (C)
	AC Resistance (Rac)		Quality Factor (Q)
	Dissipation Factor (D)		Admittance (Y)
	Conductance (G)		Reactance (X)
	Susceptance (B)		DC Resistance (Rdc)
Equivalent Circuit	Series and Parallel	C+R, C+D, C+Q, L+R, L+Q	
	Series Only	X + R, X + D, X + Q	
	Parallel Only	C + G, B + G	
Polar Form	Z + Phase Angle, Y + Phase Angle		
LCD Display	320 x 240 Dot Matrix		
Interface	RS-232C, GPIB		
Power Source	AC 115V/230V (Selectable), 50/60Hz		
Accessories	User manual x 1, Power cord x 1 Test lead x 1		
Dimensions	330 (W) x 170 (H) x 340 (D) mm		
Weight	Approx. 5kg		

Declaration of Conformity

We
GOOD WILL INSTRUMENT CO., LTD.
(1) No.7-1, Jhongsing Rd., Tucheng City, Taipei County, Taiwan
(2) No. 69, Lu San Road, Suzhou City (Xin Qu), Jiangsu Sheng, China
declare, that the below mentioned product
Type of Product: Precision LCR Meter
Model Number: LCR-8101
are herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Law of Member States relating to Electromagnetic Compatibility (89/336/EEC, 92/31/EEC, 93/68/EEC) and Low Voltage Directive (73/23/EEC, 93/68/EEC).
For the evaluation regarding the Electromagnetic Compatibility and Low Voltage Directive, the following standards were applied:

◎ **EMC**

Conducted Emission Radiated Emission EN 55022: Class A 1998 + A1:2000	Electrostatic Discharge EN 61000-4-2: 1995 + A1:1998 + A2:2001
Current Harmonics EN 61000-3-2: 2000	Radiated Immunity EN 61000-4-3: 2002
Voltage Fluctuations EN 61000-3-3: 1995 + A1:2001	Electrical Fast Transients EN 61000-4-4: 1995 + A1:2000 + A2:2001
----------	Surge Immunity EN 61000-4-5: 1995 + A1:2001
----------	Conducted Susceptibility EN 61000-4-6: 1996 + A1:2001
----------	Power Frequency Magnetic Field EN 61000-4-8: 1993 + A1:2001
----------	Voltage Dip/ Interruption EN 61000-4-11: 2001

◎ **Safety**

Low Voltage Equipment Directive 73/23/EEC & amended by 93/68/EEC Safety Requirements IEC/EN 61010-1: 2001

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