VOLTCRAFT

Operating Instructions

LCR-500

TFT Display LCR Meter, 40000 Count

Item No.: 3088970

Table of Contents

Safety

Review these safety precautions carefully to avoid personal injury or damage to the device and connected products. Use the device only as specified in the instructions.

- **Maintenance**: Only authorized personnel should perform maintenance.
- **Covers**: Do not operate the device with the outer cover or panel open.
- **Suspected Damage**: If you suspect the device is damaged, have it inspected by qualified service personnel before use.
- **Environment**: Do not use the device in wet or damp conditions or explosive environments.
- **Cleanliness**: Keep the device clean and dry.
- **Security Warning**: Follow all safety guidelines to prevent injury or damage.

Safety Guidelines

To ensure safe use:

- **Indoor Use**: Suitable for indoor use. Contact with moisture should be avoided under all circumstances.
- **Read instructions**: Understand all warnings and safety information before use.
- **Functionality**: Use the device as specified in the instructions.
- **Circuit Safety**: Ensure circuits are off and capacitors discharged before measurement.
- **Power Supply**: Powered by a lithium battery (18650) or USB-C®. Charge using the USB-C® port.

Safety Symbols

Warning: The symbol warns of hazards that can lead to personal injury.

Environment

- **Conditions**: Avoid dusty, vibrating, or corrosive environments and direct sunlight.
- **Temperature and Humidity**: Operate between 0℃ and 40℃ with relative humidity ≤75%. Store between 5℃ and 40℃ with humidity <85%RH.
- **Electromagnetic Fields**: Keep away from strong electromagnetic fields to ensure accurate measurements.

Use of Test Fixture

- **Accessories**: Use only the provided test fixture or cable. Using others may result in incorrect measurements.
- **Cleanliness**: Ensure the test fixture, cable, and device pins are clean for a good connection.

Warm-up

    - **Warm-up Time**: Allow at least 30 minutes for warm-up to ensure accurate measurements.
- **Power Cycling**: Avoid frequently turning the device on and off to prevent data errors.

Delivery contents

- Handheld LCR (lithium battery installed)
- USB-C® communication cable
- AC power adapter
- Red / black banana plug-alligator clip test lead
- Short-circuit bar
- Carrying case
- Safety sheet
- Operating instructions
- 1 x CD

Introduction

This handheld LCR meter is designed for measuring inductance, capacitance, and resistance, making it versatile for both desktop and mobile use. Powered by a 3.7V lithium battery, it offers:

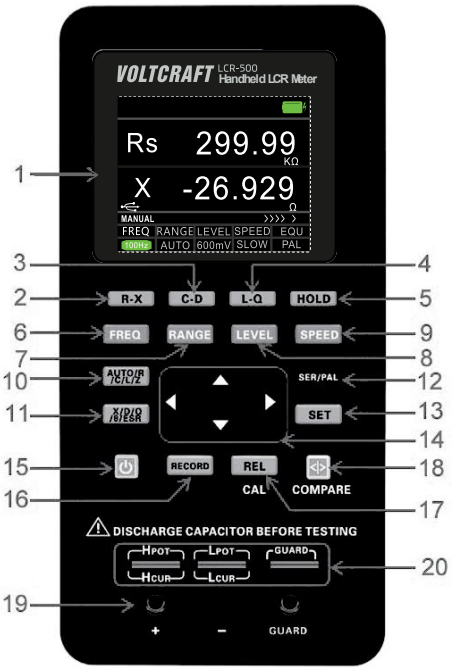
- **High Resolution**: 40,000 counts for main parameters and 0.0001 for secondary.
- **Frequency and Levels**: Up to 100kHz measurement frequency with 0.6Vrms and 0.3Vrms levels.
- **Automatic Ranging**: Displays results in fast, medium, or slow modes, selecting optimal parameters based on component characteristics.
- **Accuracy**: Measurement accuracy up to 0.25%.

Features:

- **User-Friendly Operation**: Simple interface for selecting test frequency, parameters, and speed.
- **Data Recording**: Includes a mode for easy data reading.
- **Correction Functions**: Open and short circuit correction for improved accuracy.
- **Configuration Menu**: Options for setting the buzzer, auto shutdown, language, and more.
- **Remote Communication**: Connect to a PC via USB-C® for remote control and data acquisition.

Chapter 1 Overview of front panel

1.1 Front panel

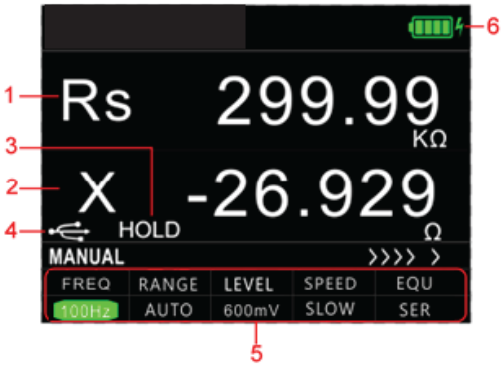


1. **Display:** 2.8-inch TFT LCD screen showing all instrument functions
2. **R-X Shortcut Key:** Directly select R as the main parameter and X as the secondary
3. **C-D Shortcut Key:** Directly select C as the main parameter and D as the secondary
4. **L-Q Shortcut Key:** Directly select L as the main parameter and Q as the secondary
5. **Data Hold Key**: Toggle the data hold function on or off
6. **Frequency Key:** Switch to a fixed frequency
7. **Range Key:** Auto, 10Ω, 100Ω, 1kΩ, 10kΩ, or 100kΩ. "Auto" automatically selects the appropriate range
8. **Level Shortcut Key:** Quickly switch between fixed levels (300mV, 600mV RMS)
9. **Choose the measurement speed**: Fast, Medium, or Slow
10. **Main Parameter Key:** Auto, R, L, C, Z. "Auto" selects the optimal parameter combination
11. **Secondary Parameter Key**: Quickly switch secondary parameters. Not functional if the main parameter is set to Auto
12. **Equivalent Mode Key:** Switch between SER and PAL modes according to testing needs
13. **Set Key:** Access settings for language, auto shutdown, brightness, boot state, and buzzer. Press again to view system info, and once more to return to testing
14. **Arrow Keys:** Use left/right to move the cursor and up/down to select parameters
15. **Power Key:** Turn the instrument on or off
16. **Data Holding Key:** Cycle through MAX, MIN, and AVG, returning to normal after one cycle. Exits if parameters change. Disabled in auto mode
17. **Relative/Correction Key:** Short press to toggle relative value (REL) function. Long press to activate correction
18. **Comparator/Tolerance Key:** Long press to toggle comparator. Short press to switch tolerance limits
19. **3-Terminal Test Jack**
20. **5-Terminal Test Notch**

***Note**: Use the supplied adapter. Using other adapters may cause damage. When connected to an external power supply, the internal battery circuit is automatically cut off to charge the battery. The LCR has an independent charging controller, which operates even when the instrument is off.*

1.2 User's Interface

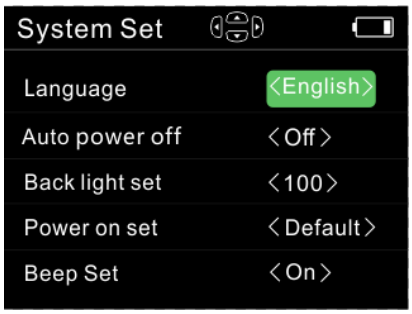
1.2.1 Measurement Interface



1. **Main Parameter Display**: Shows the primary measurement data.
2. **Secondary Parameter Display**: Displays additional measurement information.
3. **'HOLD' Indicator**: Signifies that data is being held.
4. **USB Connection Status**  :
   - **Disconnected**: No icon displayed.
   - **Connected**: A white USB icon appears when initially connected, indicating connectivity. Keys remain unlocked.
   - **Active Communication**:
     The icon turns green after the first command is received, indicating successful communication.
     The front panel buttons unlock when USB is disconnected or the *GTL command is used, returning the icon to white.
5. **Measurement Parameter Settings**: Configure measurement parameters.
6. **Battery Power Icon**: Displays remaining battery life. Charge when low.

1.2.2 System settings interface

Users can configure language, auto power-off, brightness, power settings, and the buzzer. You can also view the instrument's model and version.



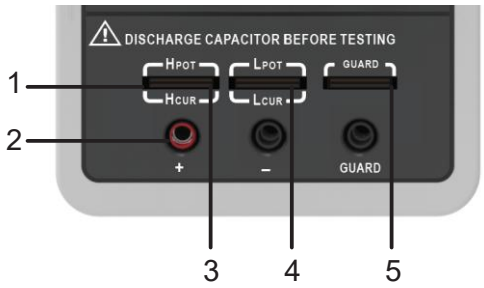
- **Entering Settings**: Press the [SET] key to access the system settings.
- **Navigating Options**: Use the arrow keys to select and highlight options. Use them again to adjust specific settings.
- **Viewing Model/Version**: Press [SET] again to see the model and version.
- **Exiting Settings**: Press [SET] once more to exit.

Power-On Setting:

- **Default**: If set to "Default," all settings revert to system defaults at the next startup.
- **Last**: If set to "Last," test parameters, system language, auto shutdown, backlight, and beep settings are saved for the next startup.

1.3 Test port

The serial LCR meter features both 3-terminal and 5-terminal test ports, combining convenience with high accuracy. Refer to the figure for the test terminals.



1. 5-terminal test slot
2. 3-terminal test jack
3. High
4. Low
5. Guard

- **3-Terminal Port**: Uses a standard rubber jack, allowing the use of affordable rubber plug-alligator clips. This setup is convenient for extended testing but offers lower accuracy.
- **5-Terminal Port**: For a dedicated test fixture, enabling full four-terminal measurements to ensure high accuracy, even with extension lines.

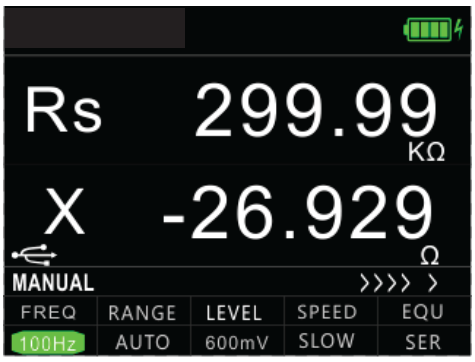
Chapter 2 Operation instruction

2.1 Startup and shutdown

- Press the power key to start the instrument and the measurement interface is shown (default).
- Press the power key again to shutdown it.

2.2 Test parameter

2.2.1 Test frequency



The handheld LCR meter applies an AC test signal to measure the device under test (DUT). The frequency of this AC signal is a critical parameter. Components often exhibit non-ideal behavior and have distributed parameters, while test terminals introduce their own distributed parameters. As a result, measurements of the same component may vary at different test frequencies. For accurate results, it is essential to select an appropriate test frequency.

You can change the test frequency using two methods:

1. Method 1: Press [FREQ] key to cycle through available frequencies.
2. Method 2: Use the arrow keys:
    - Press right or left arrows to move the cursor to the FREQ zone on the display.
    - Press up or down arrows to switch between frequencies.

.

2.2.2 Test level

The handheld LCR meter applies an AC test signal to measure the device under test (DUT). Both the frequency and signal level of this AC source can be adjusted.

You can change the test signal level using two methods:

1. Method 1: Press [LEVEL] key to cycle through different test signal levels.
2. Method 2: Use the arrow keys:
    - Press right or left arrows to move the cursor to the LEVEL zone on the display.
    - Press up or down arrows to switch between levels

2.2.3 Test range

The handheld LCR meter allows you to change the test range. There are two methods to accomplish this:

1. Method 1: Press [RANGE] key to cycle through different test ranges.
2. Method 2: Use the arrow keys:
    - Turn on the instrument to display the measurement screen.
    - Press left or right arrows to move the cursor to the RANGE zone.
    - Press up or down arrows to switch between ranges (AUTO, 100Ω, 1kΩ, 10kΩ, 100kΩ).

2.2.4 Test speed

There are two ways to change the test speed:

The handheld LCR meter offers two methods to change the test speed:

1. Method 1: Press [SPEED] key to cycle through measurement speeds:
    - Turn on the instrument to display the measurement screen.
    - Press [SPEED] to switch between Fast (4 times/s), Medium (2 times/s), and Slow (1 time/s).
    - The current speed is displayed above the status bar.
2. Method 2: Use the arrow keys:
    - Turn on the instrument to display the measurement screen.
    - Press left or right arrows to move the cursor to the SPEED zone.
    - Press up or down arrows to switch between test speeds.

2.2.5 Main parameters

Parameter and symbol

R: resistance C: capacitance L: inductance Z: impedance

To select the measurement parameter:

1. Choose the main parameter:
   Press [AUTO/R/L/C/Z] key to cycle through the main parameters in this order: R, L, C, Z, and AUTO.
2. AUTO mode:
   When AUTO is selected as the main parameter, its font is displayed in red.

2.2.6 Secondary parameters

Parameter and symbol

X: reactance D: dissipation factor Q: quality factor θ: phase angle

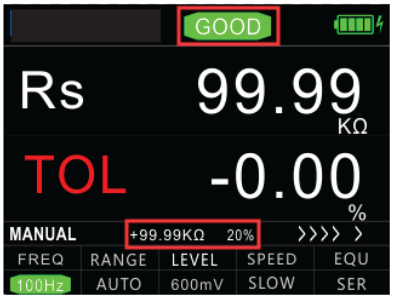
ESR: Equivalent Series Resistance

To select a secondary parameter:

Press [X/D/Q/θ/ESR] key to choose the desired secondary parameter.

Note: If AUTO is selected as the main parameter, the [X/D/Q/θ/ESR] key will not function.

2.2.7 Set nominal value of tolerance mode



Setting the Nominal Value for Comparison:

1. Turn on the instrument to display the measurement screen.
2. Place the component with the desired nominal value on the instrument's test clip.
3. Long press [COMPARE] to activate the comparator. The measured value becomes the nominal value.

Display:

- The nominal value and tolerance appear in the status bar.
- The deviation between the current test value and the standard value shows in the secondary parameter position.

Adjusting Tolerance:

- Short press [COMPARE] to cycle through tolerance values: 1%, 5%, 10%, 20%.

Visual Indicators:

- A color bar at the screen top shows GOOD/NG status.
- Green: Within tolerance (GOOD)
- Red: Beyond tolerance (NG)
- The [COMPARE] key's indicator light illuminates.

Exiting Comparison Mode:

- Long press [COMPARE] again, or
- Change the primary or secondary parameters.

Note: This function cannot work if the main parameter is set to Auto.

2.2.8 Equivalent mode

1. **Non-Ideal Components**: Real electronic components do not behave perfectly and are modelled as combinations of ideal components.
2. **Equivalent Models**: There are two models to approximate a component's behaviour:
    - **Series Model**: Used for low-impedance components (below 100Ω).
    - **Parallel Model**: Used for high-impedance components (above 10kΩ).
3. **Model Selection**: Choosing the right model improves measurement accuracy. For components with impedance between 100Ω and 10kΩ, the model choice is less critical.
4. **Switching Models**: You can switch between series and parallel models by pressing the [SER/PAL] button on the meter.

2.3 Relative mode

Press [REL] to activate the relative mode. The current measurement value will be set as the reference. The reference value will be shown in the secondary display, while the relative value appears in the main display. To exit the relative mode, simply press the [REL] key again..

2.4 Reading hold mode (HOLD)

The data hold mode freezes the displayed measurement results. While the instrument continues to measure, the LCD display does not update with new readings.

To activate data hold:

- Press the [HOLD] key. "HOLD" will appear on the LCD, indicating that the data hold mode is active.
- The main and secondary parameter displays will show the measurements captured at the moment the HOLD key was pressed.

To deactivate data hold:

- Press the [HOLD] key again while in hold mode.
- The "HOLD" indicator will disappear from the LCD, and the instrument will return to normal measurement mode, updating the display with current readings.

2.5 Data recording function

Data Recording Mode for Unstable Measurements

If the Device Under Test (DUT) shows poor stability with fluctuating measurements, use the data recording mode to acquire more reliable readings. This mode dynamically calculates the maximum, minimum, and average values within a specified range.

Activating Data Recording:

1. Press the [RECORD] key to enable the data recording function.
2. The recorded value will appear on the secondary display.
3. Press the [RECORD] key repeatedly to cycle through maximum, minimum, and average values.

Function Details:

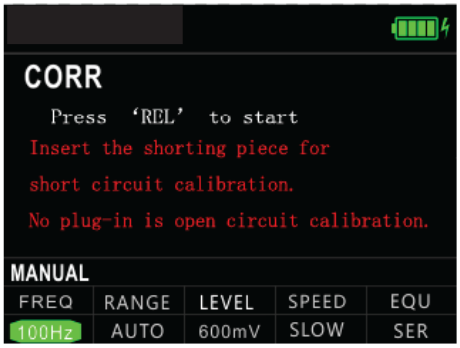
- Records the maximum and minimum values of the main parameter.
- Calculates the average of the last ten measurements.

Important Notes:

- The data recording function automatically deactivates when changing the measurement parameter type.
- This function is not available when the main parameter is set to Auto.

2.6 Correction function

Correction Function: Open and Short Circuit



The correction function minimizes measurement errors caused by distributed parameters in the test line. It includes two types:

1. Short Circuit Correction: Reduces the impact of contact resistance and lead resistance when measuring low impedance elements.
2. Open Circuit Correction: Minimizes the effect of distributed capacitance and resistance between test line ends when measuring high impedance elements.

Correction Procedure:

1. Preparation:
    - Ensure test terminals are in the appropriate state (open or short-circuited) before initiating the correction function.
    - Long press the [REL] key to access the correction interface.
2. Performing Correction:
    - Short press the [REL] key to toggle between open (OPEN) and short (SHORT) circuit correction.
    - The instrument automatically detects the circuit state.
    - Correction outcome:
        - Success: Secondary display shows "SUCCESS"
        - Failure: Secondary display shows "FAILED"

Note: Maintain the test terminals' state throughout the correction process.

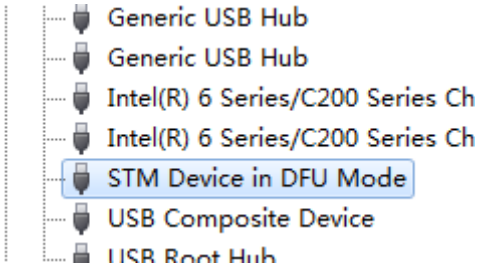
3. Completing Correction:

    - After successful correction, press the [REL] key to return to the measurement display.

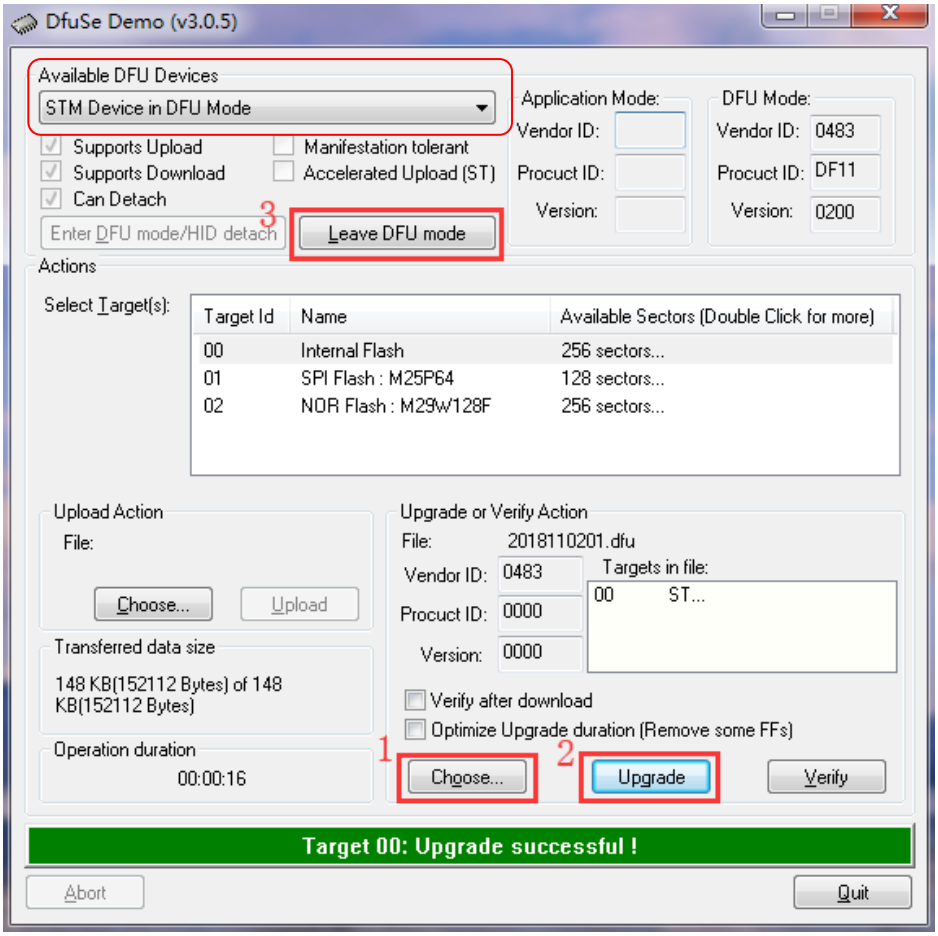
2.7 Firmware Update

1. Download the tool "DfuSe Demo v3.0.5" and install it. Download upgrade firmware (***. Dfu).
2. In the shutdown state, keep pressing R-X key and insert the USB cable into the USB-C® port of the device to connect the device to the computer.

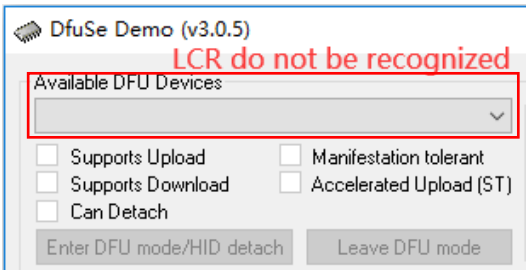
You can see the device is identified in device manager of the PC:



3. Open DfuSe Demo software, click "Choose" button to select the Upgrade firmware (***. Dfu), and click "Upgrade" to Upgrade it. After finished it, click "Leave DFU mode" to exit the programming mode.



If the device is not identified, please repeat step 2.



4. Close the “DfuSe Demo” software.

Chapter 3 Quick application guide

Warning:

Capacitor Safety:

- ***Never measure charged capacitors to prevent instrument damage.***

On-Board Device Measurements:

- ***Ensure power is off when measuring on-board devices.***
- ***Active circuits cannot be measured directly.***

Environmental Considerations:

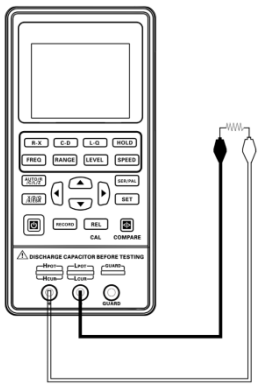
- ***In dusty environments, clean the instrument regularly:***
  - ***Protect the test port from dust ingress.***
  - ***Dust accumulation can become conductive and affect instrument performance.***
- ***Avoid placing the instrument in:***
  - ***Explosive environments***
  - ***Direct sunlight***
  - ***Areas with excessive heat***

Measurement Preparation:

1. *Accuracy Optimization:*
   - *Before measurement, perform open and short circuit corrections.*
   - *Refer to the "correction function" section for detailed instructions.*
2. *Test Fixture Options:*
   - *Use rubber plug - alligator clip configuration (see accompanying figure).*
   - *Alternatively, insert components directly into the test notch.*

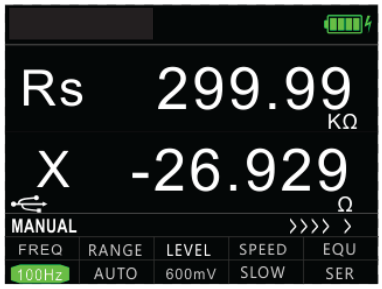
Note: The following examples primarily utilize the rubber plug - alligator clip configuration.

3.1 Resistance measurement



See the below figure for the connection test.

1. Press the power key to start the instrument.
2. Press the [AUTO/R/C/L/Z] key until Rs/Rp is displayed on the interface which means to select resistance measurement.
3. Insert the resistor into the test notch, or choose the appropriate test accessories (rubber plug - alligator clip) and connect it with the measured resistance.
4. Press the [FREQ] key to select the desired test frequency, press [LEVEL] to select the desired level.
5. Read the measurement results from the screen.



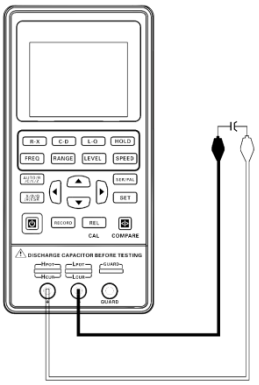
Note:

The AC signal is used by the instrument to measure the resistance, so the test result reflects the AC resistance characteristics of the instrument instead of its DC resistance.

3.2 Capacitance measurement

Warning:

Make sure that the capacitor has been fully discharged before measuring.



See the below figure for the connection test.

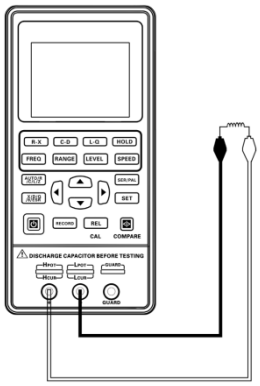
1. Press the power key to start the instrument.
2. Press the [AUTO/R/C/L/Z] key until Cs/Cp is displayed on the interface which means to select capacitance measurement.
3. Insert the capacitor into the test notch, or choose the appropriate test accessories (rubber plug - alligator clip) and connect it with the measured capacitor.
4. Press the [FREQ] key to select the desired test frequency, press [LEVEL] key to select the desired level.
5. Read the measurement results from the screen.

Note:

The capacitor or capacitive device must be fully discharged before the test; a capacitor with large capacity may need a longer time to discharge. If the capacitive device is not fully discharged before connection, it can damage the components inside the instrument.

3.3 Inductance measurement

See below figure for the connection test.



1. Press the power key to start the instrument.
2. Press the [AUTO/R/C/L/Z] key until Ls/Lp is displayed on the interface which means to select inductance measurement.
3. Insert the inductor into the test notch, or choose the appropriate test accessories (rubber plug - alligator clip, Kelvin test fixture, etc.) and connect it with the measured inductor.
4. Press the [FREQ] key to select the desired test frequency, press [LEVEL] to select the desired level.
5. Read the measurement results from the screen.

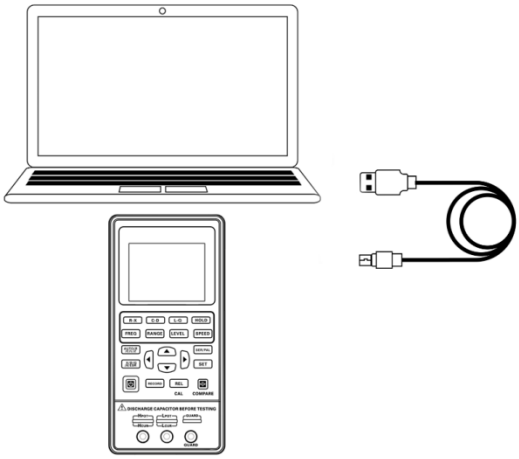
3.4 Impedance measurement

1. Press the power key to start the instrument.
2. Press the [AUTO/R/C/L/Z] key until Z is displayed on the interface which means to select impedance measurement.
3. Insert the component into the test notch, or choose the appropriate test accessories (e.g., rubber plug, alligator clip, Kelvin test fixture) and connect them to the component.
4. Press the [FREQ] key to select the desired test frequency, press [LEVEL] to select the desired level.
5. Read the measurement from the screen.

Chapter 4 Telecommunication

The instrument can be connected to a computer through the USB-C® interface. After installing the driver on the computer, the product can be controlled from or the test results acquired by the computer through the virtual serial port.

4.1 Connect the instrument to PC



Refer to following steps to connect to a computer:

1. Navigate to conrad.com.de and enter the Item number.
2. Download and install the software.
3. Use the USB-C® cable to connect the instrument to the USB port of the computer
4. Press the power key to start the instrument.
5. After the installation is completed, check the serial number via Windows Device Manager.

Remote Control State:

When the LCR receives the remote operation state instruction from the host, the instrument automatically enters into the remote-control state. USB icon is displayed in green to show the entry into the remote-control state. To exit the remote-control state, please send the “*GTL” command.

Command Protocol:

Handheld LCR uses SCPI command set to transfer control command and return query information and data with string. The terminator specified by the protocol shows the end of a command line or information enquiry line.

Using SCPI command set enables the interaction control of PC over the instrument by programming. The command format meets the standard which is easy to understand and use.

Data type

The data in the form of ASCII characters transmitted on the bus may have the following types:

Type	Meaning	Example
<NR1>	Integer	+800,-200,100
<NR2>	Decimal	+1.56,-0.001
<NR3>	Exponential floating number	+2.345678E+04 -1.345678E-02

Rules of grammar

Notation	Definition
:	Colon, enter the next level of the command
;	Semicolon, the same level of command
*	Asterisk, public command
,	Comma, multi-parameter separator
?	Question mark indicates the query
	Spacing, separating commands and parameters
“ ”	Quotes for quoted part

Symbols used in instruction

These marks are added in order to specify the command format, but are not part of the command.

Marks	Definition
[ ]	The optional command parameters are given in the square brackets
|	Division mark—to select one from many
< >	The definition of the variable parameter is given or the variable parameters listed in the angle brackets
( )	Interpretation which is not seen in the actual command

Abbreviations and capitalization:

Command Format and Abbreviations:

1. Command Formats:
    - Commands have two formats: full and abbreviated.
    - In command descriptions:
        - Capitalized letters indicate the abbreviated form.
        - Full and abbreviated commands are functionally equivalent.
2. Abbreviation Guidelines:
    - Standard abbreviations typically use the first four letters of the complete command.
    - Caution: Non-standard abbreviations not listed in the command table will be interpreted as incorrect commands.
3. Capitalization in ASCII Commands:
    - The ASCII commands transmitted on the bus are case-insensitive.
    - Parameter letters are also case-insensitive.

Error codes

Code	Content	Definition
E10	Unknown Command!	Unknown Command
E11	Parameter Error!	Parameter Error
E12	Syntax Error!	Syntax Error
E13	Data Not Ready!	Data Not Ready

Terminator

You can choose anyone of the following characters to end.

<CR> (Enter 0x0D)

<LF> (Line break 0x0A)

<CR> <LF>

4.2 Command Reference

4.2.1 Public command

Public command applied universally to various kinds of instrument defined by the public command IEEE488, the public command starts with *. For example, *IDN?，*GTL，*LLO. This machine supports only a few Public commands.

(1) *IDN?

Description: inquiry instrument information and version information

Return: < instrument hardware name >, < software version >, < serial number >, < hardware version >

(2) *GTL

Description: used to unlock keyboard and resume keyboard operation

Return: None

4.2.2 Subsystem commands

FREQuency Subsystem

(1) FREQuency <value>

Description: set the measurement frequency

Parameter: 100, 120, 400, 1000, 4000, 10000, 40000, 50000, 75000, 100000 or 100Hz,120Hz, 400Hz, 1kHz, 4kHz, 10kHz ,40kHz, 50kHz, 75kHz, 100kHz

Return: None

(2) FREQuency ?

Description: query current test frequency

Parameter: None

Return: <100|120|400|1000|4000|10000|40000|50000|75000|100000>

FUNCtion Subsystem

(1) FUNCtion:impa <R|L|C|Z|Auto>

Description: Select the main parameter type

Parameter: <R|L|C|Z|Auto>

Return: None

(2) FUNCtion:impa ?

Description: Query the main parameter type

Parameter: None

Return: <l-auto|c-auto|z-auto|r|l|c>

(3) FUNCtion:impb <X|Q|D|THETA|ESR>

Description: Select a secondary parameter type

Parameter: <X|Q|D|THETA|ESR>

Return: None

(4) FUNCtion:impb ?

Description: Query a secondary parameter type

Parameter: None

Return: <rec|q-auto|d-auto|theta-auto|x|q|d|theta|esr>

(5) FUNCtion:RANGe <AUTO|10|100|1000|10000|100000>

Or FUNCtion:RANGe <AUTO|10ohm|100ohm|1kohm|10kohm|100kohm>

Description: Select the range

Parameter: <AUTO|10|100|1000|10000|100000>

Or <AUTO|10ohm|100ohm|1kohm|10kohm|100kohm>

Return: None

(6) FUNCtion: RANGe ?

Description: Query the range

Parameter: None

Return: <auto|10|100|1000|10000|100000>

(7) FUNCtion:LEVel <300|600>

Or FUNCtion: LEVel <300mv|600mv>

Description: Select the level

Parameter: <300|600> or <300mv|600mv>

Return: None

(8) FUNCtion: LEVel ?

Description: Query the level

Parameter: None

Return: <300|600>

(9) FUNCtion:EQUivalent <SER|PAL>

Or FUNCtion:EQUivalent <SERIES| PARALLEL>

Description: Select the equivalent mode

Parameter: <SER|PAL> or <SERIES| PARALLEL>

Return: None

(10) FUNCtion: EQUivalent ?

Description: Query the equivalent mode

Parameter: None

Return: <ser|pal>

FETCh Subsystem

FETCh ?

Description: Query data

Parameter: None

Return: <NR3,NR3,NR1> Main parameters, secondary parameters, gear number

Chapter 5 Specification

5.1 General Specification

Measurement parameters	Main parameter: L/C/R/Z Secondary parameter: X/D/Q/ θ /ESR
Equivalent mode	Series, parallel
Mode of range	Manual, automatic
Measurement speed	Fast(4 times/s), medium(2 times/s), slow(1 times/s)
Configuration of the test terminal	3-terminal, 5-terminal
Correction function	Short circuit, Open circuit
Communication interface	Type C(virtual serial port)
Test signal frequency	100Hz, 120Hz, 400Hz, 1kHz, 4KHz, 10kHz, 40kHz, 50KHz, 75KHz, 100kHz
Test signal level	0.3Vrms, 0.6Vrms
Output impedance	100Ω
Highest accuracy (see accuracy index for details)	Resistance: 0.25% Capacitance: 0.4%
Measurement range	L: 0-2000H C: 0-20mF R: 0-20MΩ
Power Source	3.7V Lithium Battery or DC 5V input

5.2 Accuracy

Notes:

- *Environment temperature: 20℃ ± 2℃, humidity: ≤75% R.H;*
- *Preheat the instrument for at least 30 minutes before the test;*
- *Test at the test notch on the end face of the instrument;*
- *It is better to conduct open and short circuit correction before the test;*
- *Measure with the recommended equivalent mode;*
- *The percentage in terms of error indicates:± (% of the reading + last digit)*
- *If the actual measurement of the instrument and the display exceeds the scope specified in the table, the accuracy of the excessive part will not be given;*
- *The meaning of the subscript*
- *S- series equivalent; p- parallel equivalent; e- accuracy*
- *Some parameters cannot be given in the data table, and it can only be calculated based on the measurement results;*

Capacitance C and dissipation D

100Hz/120Hz/400Hz

Range	Range of display	Accuracy Ce	Accuracy De	Equivalent mode recommended
20mF	4.000mF~20.000mF	8.00%+5 digits	0.0800	Series
4mF	400.0μF~3.9999mF	2.00%+3 digits	0.0200	Series
400μF	40.00μF~399.99μF	0.60%+2 digits	0.0060	Series
40μF	4.000μF~39.999μF	0.40%+2 digits	0.0040	Series
4μF	400.0nF~3.9999μF	0.40%+2 digits	0.0040	----
400nF	40.00nF~399.99nF	0.4%+2 digits	0.0040	Parallel
40nF	4.000nF~39.999nF	0.5%+3 digits	0.0050	Parallel
4nF	0pF~3.999nF	1.5%+5 digits	------	Parallel

1kHz/4KHz

Range	Range of display	Accuracy Ce	Accuracy De	Equivalent mode recommended
1000uF	400.0uF~999.9uF	3.00%+5 digits	0.0300	Series
400μF	40.00μF~399.99μF	1.50%+3 digits	0.0150	Series
40μF	4.000μF~39.999μF	0.60%+2 digits	0.0060	Series
4μF	400.0nF~3.9999μF	0.40%+2 digits	0.0040	----
400nF	40.00nF~399.99nF	0.4%+2 digits	0.0040	Parallel
40nF	4.000nF~39.999nF	0.6%+3 digits	0.0060	Parallel
4nF	400.0pF~3.9999nF	0.6%+3 digits	0.0060	Parallel
400pF	0.0pF~399.9pF	3%+5 digits	------	Parallel

10kHz

Range	Range of display	Accuracy Ce	Accuracy De	Equivalent mode recommended
100μF	40.00μF~100.00μF	4.00%+5 digits	0.0400	Series
40μF	4.000μF~39.999μF	2.0%+3 digits	0.0200	Series
4μF	400.0nF~3.9999μF	0.60%+2 digits	0.0060	Series
400nF	40.00nF~399.99nF	0.4%+2 digits	0.0040	Series
40nF	4.000nF~39.999nF	0.4%+2 digits	0.0040	------
4nF	400.0pF~3.9999nF	0.4%+2 digits	0.0040	Parallel
400pF	40.00pF~399.99pF	0.6%+3 digits	0.0060	Parallel
40pF	0.00pF~39.99pF	2.5%+5 digits	------	Parallel

40kHz/50KHz

Range	Range of display	Accuracy Ce	Accuracy De	Equivalent mode recommended
100μF	40.00μF~100.00μF	6.00%+5 digits	0.0600	Series
40μF	4.000μF~39.999μF	4.0%+3 digits	0.0400	Series
4μF	400.0nF~3.9999μF	1.0%+2 digits	0.0100	Series
400nF	40.00nF~399.99nF	0.6%+2 digits	0.0060	Series
40nF	4.000nF~39.999nF	0.6%+2 digits	0.0060	------
4nF	400.0pF~3.9999nF	0.6%+2 digits	0.0060	Parallel
400pF	40.00pF~399.99pF	1%+3 digits	0.0100	Parallel
40pF	0.000pF~39.999pF	3%+5 digits	------	Parallel

75KHz/100kHz

Range	Range of display	Accuracy Ce	Accuracy De	Equivalent mode recommended
10μF	4.000μF~10.000μF	8.0%+20 digits	0.0800	Series
4μF	400.0nF~3.9999μF	5.0%+10 digits	0.050	Series
400nF	40.00nF~399.99nF	1.5%+5 digits	0.0150	Series
40nF	4.000nF~39.999nF	1%+2 digits	0.0100	Series
4nF	400.0pF~3.999nF	1%+2 digits	0.0100	------
400pF	40.00pF~399.99pF	1.5%+2 digits	0.0150	Parallel
40pF	4.000pF~39.999pF	2%+5 digits	0.0200	Parallel
4pF	0.000pF~3.999pF	5%+10 digits	------	Parallel

Inductance L and quality factor

100Hz/120Hz/400Hz

Range	Range of display	Accuracy Le	Accuracy De*	Equivalent mode recommended
1000H	400.0H~999.9H	2.00%+3 digits	0.0200	Parallel
400H	40.00H~399.99H	0.60%+2 digits	0.0060	Parallel
40H	4.000H~39.999H	0.40%+2 digits	0.0040	Parallel
4H	400.0mH~3.9999H	0.40%+2 digits	0.0040	----
400mH	40.00mH~399.99mH	0.4%+2 digits	0.0040	Series
40mH	4.000mH~39.999mH	0.6%+3 digits	0.0060	Series
4mH	0uH~3.999mH	3.0%+5 digits	------	Series

1kHz/4KHz

Range	Range of display	Accuracy Le	Accuracy De*	Equivalent mode recommended
1H	400.0mH~999.9mH	1.50%+3 digits	0.0150	Parallel
400mH	40.00mH~399.99mH	0.4%+2 digits	0.0040	Parallel
40mH	4.000mH~39.999mH	0.4%+2 digits	0.0040	------
4mH	400.0uH~3.9999mH	0.4%+2 digits	0.0040	Series
400uH	40.00uH~399.99uH	0.8%+3 digits	0.0080	Series
40uH	0.0uH~39.9uH	3.0%+5 digits	------	Series

10kHz

Range	Range of display	Accuracy Le	Accuracy De*	Equivalent mode recommended
100H	40.00H~100.00H	2.0%+3 digits	0.0200	Parallel
40H	4.000H~39.999H	0.60%+2 digits	0.0060	Parallel
4H	400.0mH~3.9999H	0.40%+2 digits	0.0040	Parallel
400mH	40.00mH~399.99mH	0.4%+2 digits	0.0040	------
40mH	4.000mH~39.999mH	0.4%+2 digits	0.0040	Series
4mH	400.0uH~3.9999mH	1%+3 digits	0.0100	Series
400uH	0.00uH~399.99uH	3.0%+5 digits	------	Series

40kHz/50KHz

Range	Range of display	Accuracy Le	Accuracy De*	Equivalent mode recommended
1H	400.0mH~999.9mH	2.0%+4 digits	0.0200	Parallel
400mH	40.00mH~399.99mH	0.8%+2 digits	0.0080	Parallel
40mH	4.000mH~39.999mH	0.8%+2 digits	0.0080	------
4mH	400.0uH~3.9999mH	0.8%+2 digits	0.0080	Series
400uH	40.00uH~399.99uH	1.5%+3 digits	0.0150	Series
40uH	0.000uH~39.999uH	4.0%+5 digits	------	Series

*** Calculate Qe according to the formula below,:**

$Qe = \pm\frac{Qx\ x\ De}{1+Qx\ x\ De}(Qx\ x\ De < 1)$ Qx: the measured Q value (quality factor) Qe: the accuracy of Q

75KHz/100kHz

Range	Range of display	Accuracy Le	Accuracy De*	Equivalent mode recommended
400mH	40.00mH~399.99mH	2.5%+2 digits	0.0250	Parallel
40mH	4.000mH~39.999mH	1.5%+2 digits	0.0150	Parallel
4mH	400.0μH~3.9999mH	1.0%+2 digits	0.0100	------
400μH	40.00μH~399.99μH	1.0%+2 digits	0.0100	Series
40μH	4.000μH~39.999μH	1.5%+5 digits	0.0150	Series
4μH	0.000μH~3.999μH	4%+10 digits	------	Series

Impedance Z and phase angle θ

100Hz/120Hz/400Hz/1kHz/4KHz/10kHz

Range	Range of display	Accuracy Ze	Accuracy θ_e	Equivalent mode recommended
20MΩ	4.000MΩ~20.000MΩ	3.0%+10 digits	3.4°	Parallel
4MΩ	400.0kΩ~3.9999MΩ	1.2%+3 digits	0.7°	Parallel
400kΩ	40.00kΩ~399.99kΩ	0.3%+3 digits	0.2°	Parallel
40kΩ	4.000kΩ~39.999kΩ	0.25%+2 digits	0.1°	------
4kΩ	400.0Ω~3.9999kΩ	0.25%+2 digits	0.1°	Series
400Ω	40.00Ω~399.99Ω	0.25%+2 digits	0.1°	Series
40Ω	4.000Ω~39.999Ω	0.5%+3 digits	0.3°	Series
4Ω	0.4000Ω~3.9999Ω	2.0%+3 digits	1.1°	Series
0.4Ω	0.0000Ω~0.3999Ω	4.0%+3 digits	------	Series

40kHz/50KHz

Range	Range of display	Accuracy Ze	Accuracy θ_e	Equivalent mode recommended
20MΩ	4.000MΩ~20.000MΩ	7.0%+41 digits	4.0°	Parallel
4MΩ	400.0kΩ~3.9999MΩ	2.5%+3 digits	1.4°	Parallel
400kΩ	40.00kΩ~399.99kΩ	1.0%+4 digits	0.6°	Parallel
40kΩ	4.000kΩ~39.999kΩ	1.0%+4 digits	0.6°	------
4kΩ	400.0Ω~3.9999kΩ	0.5%+3 digits	0.3°	Series
400Ω	40.00Ω~399.99Ω	0.5%+3 digits	0.3°	Series
40Ω	4.000Ω~39.999Ω	0.7%+4 digits	0.4°	Series
4Ω	0.4000Ω~3.9999Ω	2.0%+6 digits	1.1°	Series
0.4Ω	0.0000Ω~0.3999Ω	5.0%+10 digits	------	Series

75KHz/100kHz

Range	Range of display	Accuracy Ze	Accuracy θ_e	Equivalent mode recommended
20MΩ	4.000MΩ~20.000MΩ	9.0%+20 digits	5.2°	Parallel
4MΩ	400.0kΩ~3.9999MΩ	4.0%+10 digits	2.3°	Parallel
400kΩ	40.00kΩ~399.99kΩ	1.5%+4 digits	0.9°	Parallel
40kΩ	4.000kΩ~39.999kΩ	1.0%+2 digits	0.6°	Parallel
4kΩ	400.0Ω~3.9999kΩ	0.7%+2 digits	0.4°	------
400Ω	40.00Ω~399.99Ω	0.7%+2 digits	0.4°	Series
40Ω	4.000Ω~39.999Ω	1.0%+5 digits	0.6°	Series
4Ω	0.4000Ω~3.9999Ω	3.0%+10 digits	1.7°	Series
0.4Ω	0.0000Ω~0.3999Ω	7%+20 digits	------	Series

Chapter 6 Maintenance

Warning:

Maintenance and Repairs:

- Do not attempt to repair the instrument yourself.
- All maintenance and repairs should be performed by qualified professional personnel only.

Liquid and Object Exposure:

- Keep the instrument away from all liquids.
- Do not insert or leave any objects inside the instrument, especially conductive materials.

6.1 Troubleshooting

1. Power-On Failure:
   - Check the battery condition and replace if necessary.
   - Verify the external power supply connection and integrity.
   - Inspect the power jack for any visible damage or loose connections.
   - Test all keys for proper functionality.
2. Abnormal Test Results:
   - Examine test accessories for signs of wear or damage.
   - Inspect the test notch spring for proper tension and integrity.
   - Review the operating instructions to ensure correct measurement procedures are being followed.
3. Unresolved Issues:
   - Do not attempt to replace components or specific parts yourself.
   - For persistent problems or issues you cannot diagnose, contact customer service.

6.2 Cleaning the product

- **Pre-Cleaning**: Turn off the device, remove the battery, and disconnect any external power sources.
- **Liquid Protection**: Prevent liquids from entering slots, keys, and joints. If any liquid does enter, stop using the device, remove the power and battery, and seek support.
- **Cleaning Method**: Use a soft cloth with diluted neutral detergent to gently wipe the dirty areas. Avoid scratching the surfaces.
- **Post-Cleaning**: Ensure the device is completely dry before using it again.