Handheld Digital LCR Bridge

LCR · R / C / L Precision Measurement

HANDHELD DIGITAL LCR BRIDGE · USER MANUAL

Model **LCR-2+**



■ LCR · R / C / L Precision Measurement

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About this manual

This manual describes the safe operation, functions and specifications of the LCR-2+ handheld digital LCR bridge — a high-precision handheld instrument with a built-in battery internal-resistance function for measuring resistance, capacitance, inductance and their characteristic parameters. The battery-resistance section uses an aviation-plug input for measuring battery voltage and internal resistance. It features a 2.8-inch TFT color display and four-terminal (Kelvin) measurement input.

1 Safety

To avoid possible electric shock, fire or personal injury, read the safety precautions before use. Use the product only for its intended purpose, otherwise the protection provided by the product may be impaired.

- Before use, check the case for cracks or missing plastic and carefully inspect the insulation near the input terminals.
- Use the correct input terminals and correct settings, and measure within the specified ranges as described in this manual.
- Do not use the product around explosive gas or vapor, or in damp environments.
- Before measuring a battery, make sure its voltage is within the measurement range; voltages above 36V may cause severe injury — avoid electric shock.
- Do not short-circuit the battery terminals during measurement, to avoid sparks or damage.
- Do not use the product with the front cover or rear cover removed.
- Low battery voltage may affect measurement accuracy; charge the battery promptly.
- Make sure the circuit is not live before LCR measurement, and discharge capacitors before testing.
- LCR measurement and battery-resistance measurement use different input terminals — never mix them up, or the instrument may be damaged.

2 Parts and keys

2.1 Panel description

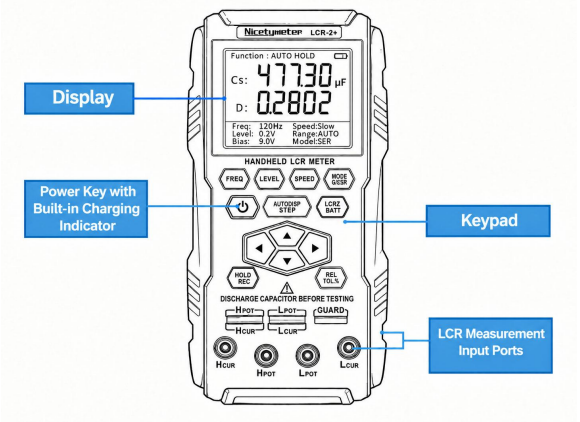


Fig. 1 Instrument panel

The top of the body is the USB charging port and the battery-resistance input; the front contains the 2.8-inch display and the keypad; the bottom is the LCR measurement input; the power key has a built-in charging indicator.

2.2 Keypad

Key	Function
Power	Turns the instrument on or off
FREQ	Selects the measurement frequency
LEVEL	Selects the measurement level
SPEED	Selects the measurement speed
LCRZ	Switches the displayed secondary parameter

AUTO/S/P SETUP	Short press toggles the equivalent circuit mode; long press opens the system settings
X/D/Q Ω/ESR	Switches between measurement functions
Arrow keys	Up/down moves through menus; left/right changes settings
HOLD/REC	Short press holds the reading; long press enters recording mode and toggles the PC software
REL/TOL%	Short press enters tolerance mode; long press zeroes the main reading

3 Display description

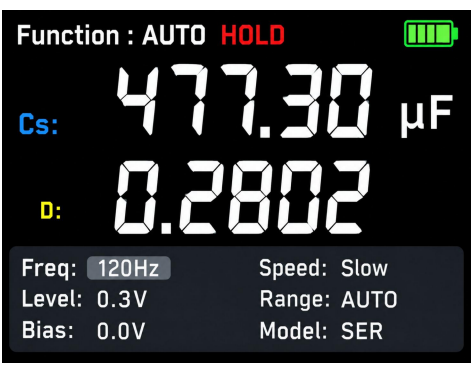


Fig. 2 Display

①	Function	Shows the measurement function: Auto, R, C, L, Z, ECAP or battery resistance
②	HOLD	Indicates data-hold mode
③	Battery symbol	Shows the battery level
④	Main reading	Shows the primary measurement value
⑤	Function symbol	Symbol of the current function; s = series, p = parallel equivalent
⑥	Unit symbol	Unit of the main reading
⑦	Secondary reading	Shows the secondary measurement value
⑧	Secondary parameter	Symbol of the current secondary parameter
⑨	Unit symbol	Unit of the secondary reading
⑩	Result	Pass/fail judgement in tolerance mode: PASS or FAIL
⑪	Frequency	Shows the set measurement frequency
⑫	Level	Shows the set measurement level
⑬	Nominal value	Nominal value set in tolerance mode
⑭	Speed	Shows the set measurement speed
⑮	Range	Shows the set resistance measurement range
⑯	Tolerance limit	Allowed error range set in tolerance mode
⑰	Tolerance	Percentage error between measured and nominal values

4 LCR measurement

4.1 Measurement terminals



Fig. 3 LCR measurement input

①	High terminal	Gold-plated clip for the component lead; positive pin for polarized parts
②	Low terminal	Gold-plated clip for the component lead; negative pin for polarized parts
③	Guard	Ground terminal of the measurement cable
④	Hcur	High current sensing, red Kelvin lead
⑤	Hpot	High voltage sensing, red Kelvin lead
⑥	Lpot	Low voltage sensing, black Kelvin lead
⑦	Lcur	Low current sensing, black Kelvin lead

a. Component leads can be inserted directly into terminals ① and ②.
b. Terminals ④⑤⑥⑦ are four-wire inputs; use the supplied four-wire terminal to clip the component leads. c. Never apply voltage or measure live circuits at these terminals.

4.2 Measurement method



Fig. 4 Four-wire Kelvin measurement with insulating spacer

1. Power on and wait a few seconds for the internal circuit to stabilize.
2. Clip the four-wire Kelvin clips onto both ends of the component, or insert the leads directly into the clip terminals.
3. Read the value on the display.

> a. Never apply voltage to the LCR terminals; make sure the component is not live and discharge capacitors first. b. For four-wire measurements, insert the supplied insulating spacer to separate the clips and improve accuracy. c. For low-impedance and high-impedance loads, the clip terminals are recommended (lower stray parameters). d. Choose a suitable frequency, level and equivalent mode for the component (see the recommended conditions table in 4.7).

4.3 Measuring resistance

1. Use AUTO mode or select the resistance mode and clip both ends of the resistor.

2. For small resistances ensure good surface contact; surface oxidation affects accuracy.
3. For very high or low resistances, the clip terminals are recommended.

4.4 Measuring capacitance

1. Use AUTO mode or select the capacitance mode and clip both ends of the capacitor.
2. Discharge the capacitor before testing to avoid damaging the instrument.
3. If the value exceeds the range, the display shows “OL”.
4. For capacitors above 1μF, 1KHz or 100Hz is suitable; below 1μF, 1KHz or 10KHz is suitable.

4.5 Measuring inductance

1. Use AUTO mode or select the inductance mode and clip both ends of the inductor.
2. For inductors above 1H, 1KHz or 100Hz is suitable; below 1H, 1KHz or 10KHz is suitable.
3. If auto ranging gives large errors on large inductors, switch to a suitable manual range.

4.6 Range / level / speed settings

Press the left/right arrows to select Range, then the up/down arrows to adjust it.

- Ranges: Auto, 100Ω, 1KΩ, 10KΩ, 100KΩ; Auto is suitable for most cases.
- Select a range manually to examine range-specific behaviour or for special-impedance parts.

▪ If the impedance is unknown, start at 100Ω and step up; results improve at higher ranges — if the reading jumps, step back one range.

Press the left/right arrows to select Level, then the up/down arrows or LEVEL to adjust it.

▪ Levels: 0.1V, 0.3V, 0.6V; 0.6V for normal use. For in-circuit measurement use 0.3V or 0.1V to avoid triggering other components.

Press the left/right arrows to select Speed, then the up/down arrows or SPEED to adjust it.

▪ Speeds: slow, medium, fast; slow gives the most stable results, choose as required.

4.7 Frequency settings and recommended conditions

Press the left/right arrows to select Frequency, then the up/down arrows or FREQ to adjust it.

▪ Frequencies: 100Hz, 120Hz, 1KHz, 10KHz, 100KHz; 1KHz is suitable for most cases.

▪ Press FREQ to compare component behaviour at different frequencies.

Component	Specification	Frequency	Mode
Capacitor	<1μF	≥1KHz	Auto, parallel
Capacitor	≥1μF (non-electrolytic)	≤1KHz	Auto, parallel
Capacitor	≥1μF (electrolytic)	≤1KHz	Auto, series
Inductor	<1H	≥1KHz	Auto, series
Inductor	≥1H	≤1KHz	Auto, series
Resistor	<10KΩ	1KHz	Auto, series
Resistor	≥10KΩ	1KHz	Auto, parallel

4.8 Equivalent mode

Press the left/right arrows to select Model, then the up/down arrows to adjust it.

- Modes: Auto, series, parallel; Auto is suitable for most cases.
- Press the left/right arrows to compare behaviour in different modes.

4.9 Tolerance mode

Tolerance mode compares the measured value against a nominal value and allowed error, and produces a pass/fail result with the tolerance percentage — ideal for batch screening.

1. Short-press REL/TOL% to enter or exit tolerance mode; the nominal and tolerance fields appear.
2. Press the up/down arrows to enter the nominal value; use left/right to move the decimal point and up/down to set the digits.
3. Press AUTO/S/P to confirm and exit.

4.10 Recording mode

1. Long-press HOLD/REC to enter automatic recording mode and toggle the PC software function.
2. The TYPE-C port supports SCPI instrument protocol for remote control and data logging.

5 Battery resistance measurement

5.1 Measurement method



Fig. 5 Battery resistance measurement

1. Power on and wait a few seconds for the internal circuit to stabilize.
2. Press LCRZ to switch the measurement function to the battery-resistance screen.
3. Insert the supplied aviation-plug clips and attach them to the positive and negative terminals of the battery.
4. Read the battery internal resistance and voltage on the display.

a. Red clip to the positive terminal, black clip to the negative terminal.
b. Do not short-circuit the battery terminals during measurement. c. For resistance references, see the appendix tables (5.3, 5.4).

5.2 Input terminal

The input is an aviation plug with a maximum allowable input voltage of DC 100V; AC voltage input is strictly prohibited.

5.3 Appendix 1 Reference internal resistance of battery types

Battery type	Specification	Reference resistance
Lead-acid battery	Starter battery	2-5 mΩ
Lead-acid battery	Deep-cycle battery	5-20 mΩ

Lead-acid battery	VRLA battery	2-10 mΩ
Lithium-ion battery	18650	20-90 mΩ
Lithium-ion battery	Polymer lithium-ion	10-50 mΩ
Lithium-ion battery	LiFePO4 battery	10-30 mΩ
NiMH battery	AA/AAA NiMH	50-200 mΩ
NiMH battery	High-capacity NiMH	20-100 mΩ
NiCd battery	AA/AAA NiCd	50-150 mΩ
NiCd battery	High-capacity NiCd	20-100 mΩ
Alkaline battery	AA/AAA alkaline	100-300 mΩ
Zinc-carbon battery	AA/AAA zinc-carbon	200-600 mΩ
LiPo battery	High-rate LiPo	1-5 mΩ
LiPo battery	Standard LiPo	10-50 mΩ
Supercapacitor	Supercapacitor	0.1-10 mΩ

> Internal resistance varies with temperature — the lower the temperature, the higher the resistance. New batteries have lower resistance, which gradually increases with use. The ranges above are for reference only; refer to the battery datasheet for actual values.

5.4 Appendix 2 Internal resistance of batteries by capacity

No.	Capacity	Voltage	Resistance	No.	Capacity	Voltage	Resistance
1	0.8Ah	12V	120mΩ	33	150Ah	12V	4mΩ
2	1.3Ah	12V	102mΩ	34	200Ah	12V	3mΩ
3	2.2Ah	12V	63.7mΩ	35	230Ah	12V	2mΩ
4	3.3Ah	12V	55.7mΩ	36	250Ah	12V	1mΩ
5	4Ah	12V	46.9mΩ	37	1.3Ah	6V	55mΩ

6	5Ah	12V	37.4mΩ	38	2.8Ah	6V	40mΩ
7	6Ah	12V	30.2mΩ	39	3.2Ah	6V	28.5mΩ
8	7Ah	12V	23mΩ	40	4Ah	6V	24mΩ
9	8Ah	12V	20mΩ	41	5Ah	6V	18.3mΩ
10	9Ah	12V	19mΩ	42	7Ah	6V	14mΩ
11	10Ah	12V	18.7mΩ	43	10Ah	6V	12mΩ
12	12Ah	12V	14.4mΩ	44	110Ah	6V	4.3mΩ
13	14Ah	12V	13.6mΩ	45	200Ah	6V	1.7mΩ
14	15Ah	12V	13mΩ	46	100Ah	2V	1mΩ
15	17Ah	12V	12.1mΩ	47	150Ah	2V	0.83mΩ
16	18Ah	12V	11.4mΩ	48	170Ah	2V	0.76mΩ
17	20Ah	12V	10.6mΩ	49	200Ah	2V	0.7mΩ
18	24Ah	12V	9.8mΩ	50	250Ah	2V	0.68mΩ
19	25Ah	12V	9.5mΩ	51	300Ah	2V	0.65mΩ
20	26Ah	12V	9.2mΩ	52	350Ah	2V	0.6mΩ
21	28Ah	12V	8.9mΩ	53	400Ah	2V	0.5mΩ
22	31Ah	12V	8.6mΩ	54	420Ah	2V	0.48mΩ
23	33Ah	12V	8.4mΩ	55	450Ah	2V	0.45mΩ
24	38Ah	12V	8.2mΩ	56	462Ah	2V	0.43mΩ
25	40Ah	12V	7.9mΩ	57	500Ah	2V	0.4mΩ
26	60Ah	12V	6.5mΩ	58	600Ah	2V	0.32mΩ
27	65Ah	12V	5.8mΩ	59	800Ah	2V	0.24mΩ
28	75Ah	12V	5.5mΩ	60	1000Ah	2V	0.2mΩ
29	80Ah	12V	5.3mΩ	61	1500Ah	2V	0.16mΩ
30	85Ah	12V	5mΩ	62	2000Ah	2V	0.12mΩ
31	100Ah	12V	4.5mΩ	63	3000Ah	2V	0.11mΩ
32	120Ah	12V	4.3mΩ				

> This table is for reference only. Internal resistance varies between brands and manufacturing processes; refer to the factory-measured values of the battery.

6 System settings and firmware upgrade

6.1 System settings

Long-press AUTO to open the system settings: language, backlight, auto power-off, buzzer, calibration and factory reset. Use up/down to select an item and left/right to change it; long-press AUTO or short-press LCRZ to exit.

6.2 Bridge calibration

Select Bridge calibration in the settings and calibrate 0Ω, 10mΩ, 100mΩ, 1Ω, 10Ω, 100Ω, 1KΩ, 10KΩ, 100KΩ, 1MΩ, 10MΩ and OPEN individually or all together. a. Select the point with left/right, connect the standard resistor and press AUTO to start; calibration takes about 45 seconds. b. Green means OK, red means NG; press LCRZ to exit. c. Use non-inductive standard resistors (never wire-wound); use four-wire resistors for 10mΩ and 100mΩ; leave OPEN unconnected.

6.3 Battery-resistance calibration

Select Battery-resistance calibration in the settings and calibrate the resistance points 0Ω, 1mΩ, 10mΩ, 100mΩ, 1Ω, 10Ω, 100Ω, 1KΩ and the voltage points -60V, -10V, -1V, 1V, 10V, 60V individually or all together. a. Select the point with left/right, connect the corresponding standard source and press AUTO to start; calibration takes a few seconds. b. Green means OK, red means NG. c. Use non-inductive standard resistors (never wire-wound); use four-wire resistors for

10mΩ and 100mΩ; voltage calibration requires a standard DC voltage source.

> The instrument is 100% calibrated before shipment — no user calibration is required. If calibration values become inaccurate or corrupted, restore factory settings to return to the factory calibration.

6.4 Firmware upgrade

1. With the instrument off, hold X/D/Q and press the power key; “USB-Boot” appears on the display.
2. Connect to a computer with a TYPE-C cable; an LCR disk appears.
3. Copy the firmware file into the LCR disk; the upgrade runs automatically — do not operate the instrument during the upgrade.
4. The display returns to the measurement screen when the upgrade succeeds.

7 Specifications

7.1 General specifications

Item	Specification
Display (TFT)	2.8 inch, 320×240
Range	Auto
Material	ABS+TPE
Sampling rate	Adjustable
Data hold	Yes
Backlight	Yes
Low battery indication	Yes
Auto power-off	Yes

7.2 Mechanical specifications

Item	Specification
Dimensions	180×95×40mm
Weight	350g (with battery)
Battery	18650 / 2000mAh lithium battery ×1
Warranty period	One year

7.3 Environmental specifications

Item	Specification
Operating temperature	0~40℃
Operating humidity	<75%
Storage temperature	-20~60℃
Storage humidity	<80%

7.4 Functional specifications

Feature	Specification
Measurement functions	Auto, R, C, L, Z, ECAP, battery resistance
Primary parameters	L, C, R, Z
Secondary parameters	X, D, Q, θ, ESR
Equivalent circuit	Series, parallel
Inductance range	0~100H
Capacitance range	0~100000μF
Resistance range	0~10MΩ
Test frequency	100Hz, 120Hz, 1KHz, 10KHz, 100KHz

Test level	0.1V, 0.3V, 0.6V
Basic accuracy	0.3%
Measurement speed	1, 2 or 4 readings per second
Output impedance	100Ω
Battery-resistance section	Voltage: ±100V; resistance: 0.1mΩ~200Ω; resistance accuracy: 0.5%; voltage accuracy: 0.2%
Languages	Chinese, English
Brightness	25%, 50%, 75%, 100%
Auto power-off	15, 30, 45, 60 minutes, off
Buzzer	On, off
Bridge calibration	Short, open
Battery life	13h

7.5 Accuracy reference table

Type	Range	100/120Hz	1KHz	10KHz	100KHz
Capacitance	1mF~100mF	5%±5	5%±5	—	—
Capacitance	1μF~1mF	1%±5	1%±5	—	—
Capacitance	1nF~1μF	2%±5	0.5%±5	0.5%±5	1%±5
Capacitance	1pF~1nF	—	1.5%±5	2%±5	2%±5
Inductance	1H~100H	3%±5	3%±5	—	—
Inductance	1mH~1H	0.5%±5	0.5%±5	—	—

Inductance	10μH~1mH	3%±5	0.5%±5	0.5%±5	1.5%±5
Inductance	1μH~10μH	—	3%±5	3%±5	4%±5
Resistance	100KΩ~10MΩ	5%±5	3%±5	—	—
Resistance	1KΩ~100KΩ	0.4%±5	0.3%±5	0.3%±5	0.5%±5
Resistance	1Ω~1KΩ	1.5%±5	0.3%±5	0.3%±5	0.5%±5
Resistance	0.01Ω~1Ω	4%±5	3%±5	3%±5	5%±5

7.6 Bridge symbol description

Symbol	Description	Symbol	Description
R	Resistance	BATT	Battery resistance
C	Capacitance	LEVEL	Level
L	Inductance	SPEED	Speed
Z	Impedance	AUTO	Auto
X	Reactance	SETUP	Setup
D	Dissipation factor	HOLD	Hold
Q	Quality factor	REC	Recording mode
θ	Phase angle	TOL	Tolerance mode
ESR	Equivalent series resistance	REL	Zero the reading
S	Series equivalent	Hpot	High voltage sensing
P	Parallel equivalent	Hcur	High current sensing
ECAP	Electrolytic capacitor	Lpot	Low voltage sensing
FREQ	Frequency	Lcur	Low current sensing

8 In the Box

Item	Qty	English label
LCR-2+ Meter	×1	LCR-2+ Meter
Kelvin clip leads (4 banana plugs, for the four front-panel jacks)	×1 set	Kelvin Clip Leads (4-Terminal)
Kelvin clip leads (multi-pin round plug, for the top connector)	×1 set	Kelvin Clip Leads (Multi-Pin)
Yellow comb plate	×1	Short-Circuit Calibration Plate
USB-A to Type-C cable	×1	USB Type-C Cable
Black zippered carrying pouch	×1	Carrying Pouch
User manual	×1	User Manual

9 Maintenance

Except for battery replacement, do not attempt to repair or modify the instrument unless you are qualified and have the corresponding calibration, performance-test and service instructions.

9.1 Cleaning

Clean the case with a damp cloth and mild detergent; do not use abrasives or solvents. Dust or moisture in the test terminals may affect reading accuracy.

> Remove all input signals before cleaning.

9.2 Charging the battery

When the low-battery symbol appears at the top-right of the display, charge the battery promptly:

1. Connect the supplied TYPE-C cable to a DC 5V adapter.
2. The charging indicator shows red during charging.
3. The indicator turns green when fully charged.

10 Warranty

This product is covered by a one-year warranty from the date of purchase. The warranty does not cover damage to general accessories, or damage caused by accidents, negligence, misuse, modification, contamination or abnormal operating conditions.

If the instrument freezes or malfunctions during use, restart it.

11 Compliance

11.1 Waste disposal and environmental protection (WEEE)

This product must not be disposed of as unsorted municipal waste. To minimize potential pollution to the environment and risks to human health, separate this product from other waste and recycle it responsibly through an authorized local recycling facility.

11.2 Directives and standards

This product complies with the relevant EU directives and standards for CE certification.

Notes