LCR Meter

AMM-3035

User's Manual

http://www.tmatlantic.com

Contents

Safety Summary

The following safety precautions apply to both operating and maintenance personnel and must be observed during all phases of operation, service, and repair of this instrument.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS

Instrument covers must not be removed by operating personnel. Component replacement and internal adjustments must be made by qualified maintenance personnel.

DO NOT SUBSTITUTE PARTS OR MODIFY THE INSTRUMENT

Do not install substitute parts or perform any unauthorized modifications to this instrument. Return the instrument to distributor for service and repair to ensure that safety features are maintained.

WARNINGS AND CAUTIONS

WARNING and ***CAUTION*** statements, such as the following examples, denote a hazard and appear throughout this manual. Follow all instructions contained in these statements.

A ***WARNING*** statement calls attention to an operating procedure, practice, or condition, which, if not followed correctly, could result in injury or death to personnel.

A ***CAUTION*** statement calls attention to an operating procedure, practice, or condition, which, if not followed correctly, could result in damage to or destruction of part or all of the product.

Safety Guidelines

To ensure that you use this device safely, follow the safety guidelines listed below:

- This meter is for indoor use, altitude up to 2,000 m.
- The warnings and precautions should be read and well understood before the instrument is used.
- When measuring in-circuit components, first de-energize the circuits before connecting to the test leads.
- Discharge capacitor before testing.
- Use the meter only as specified in this manual. Otherwise, the protection provided by the meter may be impaired.
- The power for the meter is supplied with six standard 1.5V batteries.

CAUTION ⚠

- **Do not measure a capacitor that is not fully discharged. Connecting a charged or partially charged capacitor to the input terminals will damage the instrument.**
- **When measuring within a circuit, the circuit must be de-energized before connecting the**

test leads.

- **When used in a dusty environment, the instrument should be wiped and cleaned regularly.**
- **Do not leave the instrument exposed to direct heat from the sun for long periods of time.**
- **Before removing the cover, ensure that the instrument is disconnected from any circuit and is powered OFF.**

Functional description

Introduction

The LCR meter could measure Inductance/Capacitance/Resistance with secondary parameters including dissipation factor(D), quality factor(Q), phase angle(θ), equivalent series/parallel resistance(ESR or Rp). The meter is fully auto ranging operation for AC impedance & DC resistance measurement. It means the user could measure the L/C/R components directly at AUTOLCR smart mode without changing the function key. User could also select the target test frequencies of 100Hz/120Hz/1kHz/10kHz/100kHz depending on DUT(device under test) type. Components could be measured in series or parallel mode according to the DUT impedance automatically.

Features

- Dual LCD display
- AutoLCR smart check and measurement
- Series/Parallel modes are selectable
- Ls/Lp/Cs/Cp with D/Q/θ/ESR parameters
- Support DCR mode 200.00Ω~200.0MΩ
- Five different test frequency are available: 100/120/1k/10k/100k Hz
- Test AC signal level: 0.6mV_{RMS} typ.
- Test range: (ex. F=1kHz)

  L: 200.00 µH ~ 2000.0 H

  C: 2000.0 pF ~ 2.000 mF

  R: 20.000 Ω ~ 200.0 MΩ
- Multi-level battery voltage detector
- Support Backlight & Buzzer sound driver

- Primary Parameters Display:

    DCR : DC Resistance
    Ls : Serial Inductance
    Lp : Parallel Inductance
    Cs : Serial Capacitance
    Cp : Parallel Capacitance
    Rs: Serial Resistance
    Rp: Parallel Resistance

- Second Parameter Display:

    θ: Phase Angle
    ESR : Equivalence Serial Resistance
    D : Dissipation Factor
    Q : Quality Factor

FRONT PANEL OVERVIEW

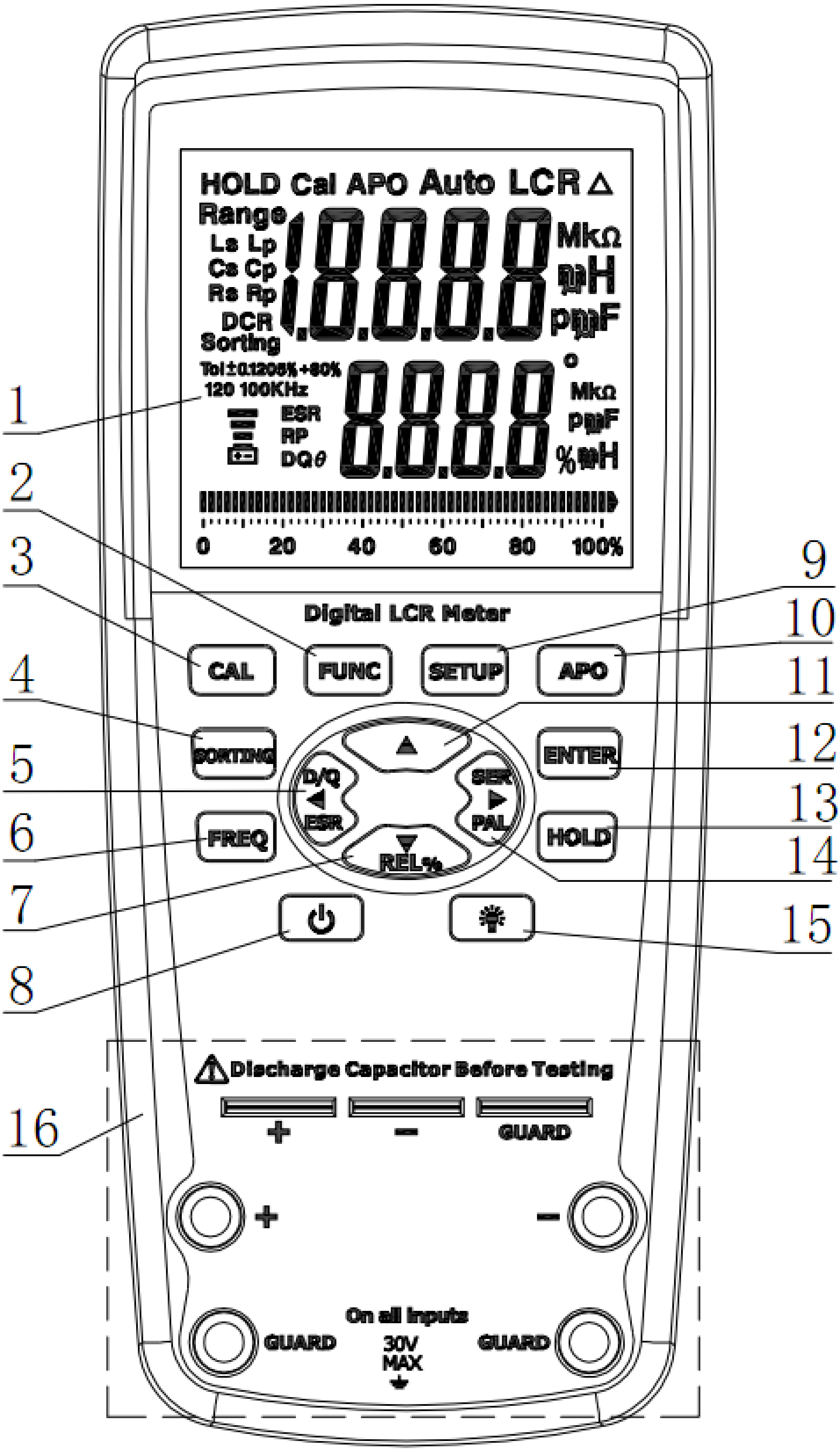


Figure 1 - Front Panel Display

Front Panel Display Descriptions

1. LCD Display
2. Mode (Auto LCR / L / C / ACR / DCR) selection button
3. Calibration mode selection button
4. Sorting mode button
5. Secondary Display mode (for dissipation factor(D), quality factor (Q), phase angle (θ), equivalent series resistance (ESR), equivalent parallel resistance(Rp) measurement) selection and the modify sorting value (◁) button
6. Test Frequency selection button
7. Relative mode and the modify sorting value (▽) button
8. Power ON/OFF button
9. Enter modify sorting value mode button
10. APO (Auto power off) button
11. Modify sorting value (△) button
12. Confirm and select the value user need to modify in sorting mode
13. Hold Display mode button
14. Parallel or Series measurement method selection and the modify sorting value (▷) button
15. Back light button
16. Input sockets (banana jack inputs) and terminals for positive, negative, and guard (see "Guard Terminal" in "SUPPLEMENTAL INFORMATION" section for details)

POWERING INSTRUMENT

Before beginning to operate the instrument, a power source is necessary for it to turn on.

Installing Battery

The LCR meter use battery to provide power to the instrument so that it can be portable. It use six standard 1.5V size batteries.

1. Place the meter upside down. Open up the back-flip stand, and locate the screw that
   tightens the battery compartment cover. Use a screwdriver to unscrew and remove the cover.
2. Insert six 1.5V batteries into compartment. Note the positive (+) and negative (-) terminals as indicated inside the battery compartment. Be sure to insert the battery with matching polarity.
3. Place the battery compartment cover piece. Place screw at the bottom of the cover piece and tighten down with a screw driver.
4. Push and hold down the  button for 2 seconds to turn on the instrument.

Low Battery Indication

The LCR meter has a battery indicator to notify the user when to replace battery.

When it displays , the battery voltage is below normal working voltage. In this case, accuracy of the meter will also decrease. It is recommended that the battery be replaced as soon as possible before continuing operation. See “Installing Battery” for instructions.

OPERATION INSTRUCTIONS

Push key function allowed to be active will be marked as “◆”

Keypads	FUNC	HOLD	DQθ	S/P	BKLIT	SORT	REL%	FREQ
AUTOLCR	◆	◆			◆			◆
L	◆	◆	◆	◆	◆	◆	◆	◆
C	◆	◆	◆	◆	◆	◆	◆	◆
ACR	◆	◆		◆	◆	◆	◆	◆
DCR	◆	◆			◆	◆	◆	

1. **Power ON/OFF**
   When LCR power on , all of the LCD segments will be ON for 2 seconds. Then the default initialization process will be started. The default mode is AUTOLCR smart mode and the default test frequency is 1 kHz. When the PWR_KEY is pushed during power-on mode, the meter will enter power-off mode. The LCD will show the “OFF” state before the whole system enters the power off status.

2. **Auto power off**
   In order to extend the battery life, except of using external power supply, APO feature will be helpful. It can be enabled or disabled APO function by press the APO button and the LCD will show whether the function is enable or not. When all function keypads do not be pushed or impedance range switching detected within 5 minutes, the system will launch the alarm buzzer beep at three times before the auto power-off status. During the period of alarm, the meter will be kept in operation by pushing any function key again. If any key is not in operation further, the system power will be off.

3. **Buzzer**
   If the function keypad available is pushed, the buzzer output beeps once. If the function keypad not available is pushed, the buzzer beeps twice.

4. **Backlight**
   When user push the button, the backlight will be active. Push the key again to disable the backlight. When the backlight is active to last for 60 seconds, the backlight will be disabled automatically.

5. **Battery detect**

The meter will detect the battery multi-level voltages periodically. The LCD indicators of battery life will be disappeared according to the decreasing of battery voltage.

6. **Primary impedance with secondary parameter test mode**

When *AUTO/L/C/R* function selection key FUNC is pushed, the main test mode could be selected sequentially: Auto-LCR mode → Auto-L mode → Auto-C mode → Auto-R mode → DCR mode → Auto-LCR mode. The default test mode is Auto LCR mode which could check the type of impedance smartly and enter to the L/C/R measurement mode automatically. The secondary parameter will follow the L/C/R measurement. It means that (L +

Q) , , are combined in one group respectively. When Auto-L or Auto-C mode is selected, the impedance measurement is auto ranging. The primary LCD display will show the inductance or capacitance of DUT (device under test). The secondary LCD display will show the quality or

dissipation factor. The D/Q/θ/ESR value can also be shown by pressing the D/Q ◄ ESR button. When Auto-R (ACR mode) or DCR mode is selected, the secondary parameter is omitted.

[1]Note: When Auto-LCR mode is active, the secondary parameter will show the equivalent resistance in parallel mode (Rp) to replace the D factor if the C measured value of DUT is less than 5pF.

[2]Note: Auto-LCR mode only. During Auto-R mode or DCR mode, the secondary parameter is not available.

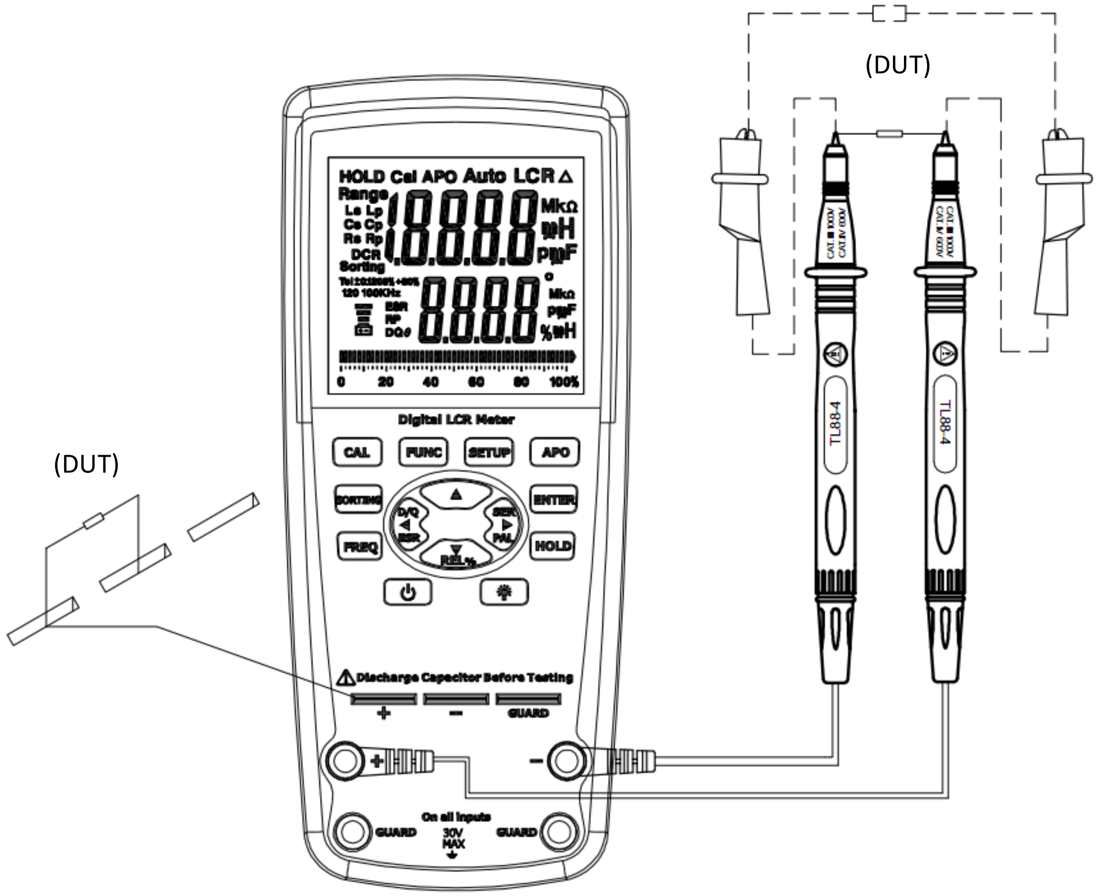
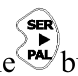


Figure 2 – Device under test display

7. **Series/Parallel mode select**
   The LCR meter offers the option to select between parallel or series measurement mode. Depending on which mode is selected, the method to measure the component will be different. Additionally, one measurement mode may provide better accuracies over the other measurement mode depending on the type of component and the value of the component to be tested. For more details, refer to the "**SUPPLEMENTAL INFORMATION**" section.
   When any L/C/R functional mode is selected, the default measurement in series or parallel mode is auto selected and the AUTO segment will be shown on LCD display. It depends on the total equivalent impedance measured. If the impedance is larger than 10kΩ, parallel mode is set and Lp/Cp/Rp is shown on the display. If it is less than 10kΩ, series mode is set and Ls/Cs/Rs is shown on the display. When the  button is pressed, the impedance measurement will be set in series mode or in parallel mode sequentially. The LCD indicators for LS/LP/CS/CP/RS/RP symbols will be indicated by related LCR measurement mode setting.

8. **Hold mode**
   The data hold function allows the user to freeze the display when pressed, holding the

measured value until data hold is turned off.

Turn On Data Hold

To use data hold, press the button HOLD once. The "**HOLD**" indicator will display on the screen when data hold is active.

Turn Off Data Hold

To disable the data hold, press HOLD again. The "**HOLD**" indicator will disappear on the screen, and meter will remain in normal operation mode.

9. Relative mode

Press the ▼REL% button reserve the current DUT readings (DCUR) on primary display as a reference value (DREF) and the "Δ" indicator will be active . The secondary display will show the percentage of relative value REL%. The REL% = (DCUR – DREF) / DREF * 100%. Press the ▼REL% button again to show the reference value DREF on primary display and the "Δ" segment will be blinking. The percentage range is -99.9%~99.9%. When the relative value is larger than double of reference value (DREF), the "OL%" indication will be shown on the secondary display. Press and hold down the ▼REL% button for 2 seconds to exit the relative mode.

10. Calibration mode

In order to improve the accuracy of high/low impedance, it is recommended to do OPEN/SHORT calibration mode before measurement. Press and hold down the CAL button for 2 seconds to enter calibration mode. The calibration procedure: OPEN ready[1] → CAL → OPEN calibration(30s) → CAL → SHORT ready[2] → CAL → SHORT calibration(30s) . During open or short calibration processing, the 30-second countdown will be shown on LCD panels. If the calibration procedure is finished, the PASS or FAIL symbol will shown on the primary display. If PASS symbol for both OPEN and SHORT modes, the calibration data will be saved after push CAL key again.

1 OPEN ready means the input sockets or terminals have nothing connected

2 SHORT ready means put a shorting bar or a short piece of conductive metal (i.e. paper clip) across the "+" and "-" input sockets or terminals.

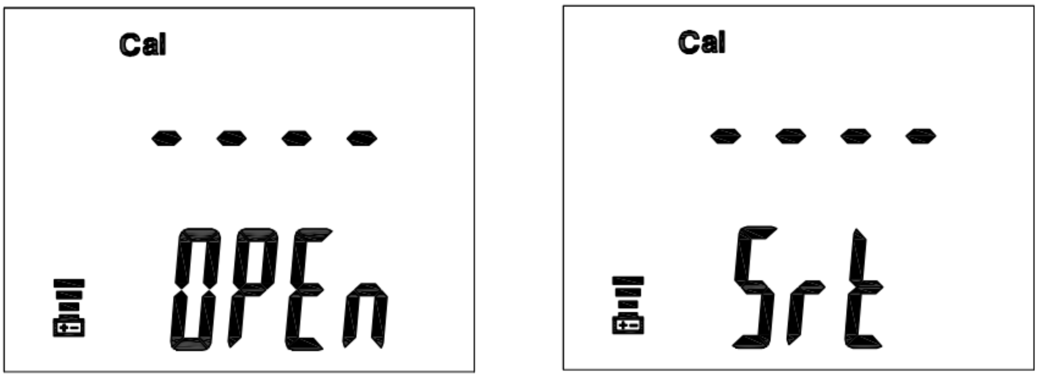


Figure 3 - Open Calibration (left) and Short Calibration (right)

11. Sorting mode

The sorting mode could help the user to make a quick sort for a bunch of components. Select the primary measurement mode (L/C/R) based on the type of components to be measured. Insert the component to be used as the “standard” reference value. Another words, insert a known “good” component that will be used for testing against all other components. Press **SORTING** button to enter to the sorting mode. The sorting mode cannot be activated unless the meter senses a component is connected to either the input sockets or terminals . When sorting mode is activated, the reference value, range and the tolerance settings can be modified.

The setting process:

SETUP → range setting(use ◁ / ▷) → **ENTER** → reference value setting (use △ / ▽ / ◁ / ▷) → **ENTER** → tolerance setting(use ◁ / ▷) → **ENTER** →sorting mode

The tolerance range setting selection: ±0.25% → ±0.5% → ±1% → ±2% → ±5% → ±10% → ±20% →+80%-20%. The default tolerance is ±1%.

In the sorting mode, the primary display to show PASS or FAIL status depends on whether the impedance measured exceeds tolerance range. The current measurement result will be shown on the secondary display. Press the **SORTING** button to exit this mode.

> **WARNING:** If the component to be measured is a capacitor, be sure that the capacitor is fully discharged **BEFORE** inserting it into the input sockets or terminals. For large capacitors, it may take longer periods of time for a full discharge. Inserting a charged or partially charged capacitor into the meter’s input sockets or terminals may produce an electric hazard and may also damage the instrument, making it unusable.

12. Test frequency select

When the **FREQ** button is pressed, the test frequency will be changed sequentially.

There are five different test frequencies (100Hz/120Hz/1kHz/10kHz/100kHz) can be selected. The test frequency can affect the accuracy of the results depending on what frequency is selected and what type and value of a component is being measured or tested.

For details on selecting the optimal test frequency for measurement, refer to the "**SUPPLEMENTAL INFORMATION**" section.

Accuracy Specification

Notes:

1. Measurement performed at the test socket.
2. Measurements performed after correct open and short calibration.
3. DUT and test leads must be properly shielded to guard if necessary.
4. Q value is the reciprocal of DF.
5. Accuracies based within 10% to 100% of full scale of range; values outside of range should be used as reference only.
6. --- means parallel or series measurement mode.

Inductance @ Ta =18 ~ 28 °C (De)

Frequency = 100 Hz/120 Hz

Range	Resolution	Lx Accuracy	DF Accuracy	Measurement Mode
20.000mH	1uH	1.5% ± 10d	1.5%± 50d	Series
200.00mH	0.01mH	1.4% ± 15d	1.4%± 50d	Series
2000.0mH	0.1mH	1.5% ± 15d	1.5% ± 50d	Series
20.000H	1mH	1.6%± 10d	1.6% ± 50d	---
200.00H	0.01H	1.3% ± 10d	1.3% ± 50d	Parallel
2000.0H	0.1H	2.0% ± 15d	2.0% ± 50d	Parallel
20.000kH	0.001kH	2.5% ± 15d	2.5% ± 50d	Parallel

Frequency = 1kHz

Range	Resolution	Lx Accuracy	DF Accuracy	Measurement Mode
2000.0uH	0.1uH	1.3% ± 10d	1.3%± 50d	Series
20.000mH	1uH	1.2% ± 10d	1.2%± 50d	Series
200.00mH	0.01mH	1.2%± 10d	1.2%± 50d	Series
2000.0mH	0.1mH	1.5%± 15d	1.5%± 50d	---
20.000H	1mH	1.5%± 15d	1.5%± 50d	Parallel
200.00H	0.01H	2.0%± 10d	2.0%± 50d	Parallel
2000.0H	0.1H	2.5%± 15d	2.5%± 50d	Parallel

Frequency = 10kHz

Range	Resolution	Lx Accuracy	DF Accuracy	Measurement Mode
200.00uH	0.01uH	1.8%± 10d	1.8%± 50d	Series
2000.0uH	0.1uH	1.5%± 10d	1.5%± 50d	Series
20.000mH	1uH	1.2%± 10d	1.2%± 50d	Series
200.00mH	0.01mH	1.5%± 15d	1.5%± 50d	---
2000.0mH	0.1mH	2.0%± 10d	2.0%± 50d	Parallel

20.000H	1mH	2.5%± 15d	2.5%± 50d	Parallel

Frequency = 100kHz

Range	Resolution	Lx Accuracy	DF Accuracy	Measurement Mode
20.000uH	0.001uH	2.5%± 10d	2.5%± 50d	Series
200.00uH	0.01uH	1.5%± 10d	1.5%± 50d	Series
2000.0uH	0.1uH	1.3%± 15d	1.3%± 50d	Series
20.000mH	1uH	2.0%± 15d	2.0%± 50d	Parallel
200.00mH	0.01mH	2.5%± 15d	2.5%± 50d	Parallel

Capacitance @ Ta =18 ~ 28 °C (De)

Frequency = 100 Hz/120 Hz

Range	Resolution	Cx Accuracy	DF Accuracy	Measurement Mode
20.000nF	1pF	2.5%±10d	2.5%±50d	Parallel
200.00nF	0.01nF	1.2%±10d	1.2%±50d	---
2000.0nF	0.1nF	0.9%±10d	0.9%±50d	---
20.000uF	1nF	1.0%±15d	1.0%±50d	Series
200.00uF	0.01uF	1.2%±10d	1.2%±50d	Series
2000.0uF	0.1uF	2.5%±10d	2.5%±50d	Series
20.00mF	0.01mF	5.0%±10d	5.0%±50d	Series

Frequency = 1kHz

Range	Resolution	Cx Accuracy	DF Accuracy	Measurement Mode
2000.0pF	0.1pF	3.5%± 15d	3.5%± 50d	Parallel
20.000nF	1pF	1.0%± 10d	1.0%± 50d	---
200.00nF	0.01nF	0.9%± 10d	0.9%± 50d	---
2000.0nF	0.1nF	1.0%± 10d	1.0%± 50d	Series
20.000uF	1nF	1.2%± 15d	1.2%± 50d	Series
200.00uF	0.01uF	2.5%± 10d	2.5%± 50d	Series
2000uF	1uF	4%± 20d	4%± 50d	Series

Frequency = 10kHz

Range	Resolution	Cx Accuracy	DF Accuracy	Measurement Mode
200.00pF	0.01pF	3.0%± 8d	3.0%± 50d	Parallel
2000.0pF	0.1pF	1.0%± 10d	1.0%± 50d	---
20.000nF	1pF	0.9%± 10d	0.9%± 50d	---
200.00nF	0.01nF	0.8%± 10d	0.8%± 50d	Series
2000.0nF	0.1nF	1.0%± 8d	1.0%± 50d	Series
20.000uF	1nF	2.0%± 8d	2.0%± 50d	Series

200.0uF	0.1uF	4.5%± 15d	4.5%± 50d	Series

Frequency = 100kHz

Range	Resolution	Cx Accuracy	DF Accuracy	Measurement Mode
200.00pF	0.01pF	2.5%± 15d	2.5%± 50d	Parallel
2000.0pF	0.1pF	1.0%± 8d	1.0%± 50d	Parallel
20.000nF	1pF	1.8%± 8d	1.8%± 50d	Parallel
200.00nF	0.01nF	1.5%± 10d	1.5%± 50d	Series
2000.0nF	0.1nF	2.5%± 15d	2.5%± 50d	Series

Resistance @ Ta =18 ~ 28 °C (De)

Frequency = 100 Hz/120 Hz

Range	Resolution	Rx Accuracy	Measurement Mode
200.00Ω	0.01Ω	1.2%± 10d	---
2.0000kΩ	0.1Ω	0.8%± 5d	---
20.000kΩ	1Ω	0.9%± 5d	---
200.00kΩ	0.01kΩ	0.7%± 3d	---
2.0000MΩ	0.1kΩ	1.0%± 5d	---
20.000MΩ	1kΩ	2.2%± 10d	---
200.0MΩ	0.1MΩ	2.5%± 10d	---

Frequency = 1kHz

Range	Resolution	Rx Accuracy	Measurement Mode
20.000Ω	1mΩ	1.2%± 10d	---
200.00Ω	0.01Ω	0.8%± 5d	---
2.0000kΩ	0.1Ω	0.8%± 3d	---
20.000kΩ	1Ω	0.7%± 3d	---
200.00kΩ	0.01kΩ	1.0%± 5d	---
2.0000MΩ	0.1kΩ	1.5%± 10d	---
20.000MΩ	1kΩ	1.8%± 10d	---
200.0MΩ	0.1MΩ	6.0%± 50d	---

Frequency = 10kHz

Range	Resolution	Rx Accuracy	Measurement Mode
20.000Ω	1mΩ	1.5%± 10d	---
200.00Ω	0.01Ω	0.8%± 10d	---
2.0000kΩ	0.1Ω	0.9%± 5d	---
20.000kΩ	1Ω	0.8%± 3d	---
200.00kΩ	0.01kΩ	1.0%± 5d	---

2.0000MΩ	0.1kΩ	2.5%± 10d	---
20.00MΩ	0.01MΩ	2.8%± 10d	---

Frequency = 100kHz

Range	Resolution	Rx Accuracy	Measurement Mode
20.000Ω	1mΩ	2.3%± 10d	---
200.00Ω	0.01Ω	1.5%± 5d	---
2.0000kΩ	0.1Ω	0.8%± 20d	---
20.000kΩ	1Ω	0.8%± 20d	---
200.00kΩ	0.01kΩ	1.5%± 10d	---
2.000MΩ	1kΩ	2.5%± 30d	---

DC resistance @ Ta =18 ~ 28 °C (De)

Frequency = 100Hz/120Hz/1kHz/10kHz/100KHz

Range	Resolution	Rx Accuracy	Measurement Mode
200.00Ω	0.01Ω	1.8%± 10d	---
2.0000kΩ	0.1Ω	0.6%± 20d	---
20.000kΩ	1Ω	0.6%± 10d	---
200.00kΩ	0.01kΩ	0.5%± 3d	---
2.0000MΩ	0.1kΩ	1.5%± 5d	---
20.000MΩ	1kΩ	2.0%± 5d	---
200.0MΩ	0.1MΩ	2.5%± 5d	---

D value Accuracy @ Ta =18 ~ 28 °C (De)

Freq. / Z	0.1- 1Ω	1 – 10Ω	10 – 100kΩ	100k – 1MΩ	1M – 20MΩ	20M−200MΩ
100/120Hz	±0.030	±0.010	±0.009	±0.010	±0.020	±0.040
1kHz	±0.030	±0.010	±0.009	±0.010	±0.020	±0.090
10kHz	±0.030	±0.010	±0.009	±0.009	±0.010	±0.040
100kHz	±0.040	±0.030	±0.010	±0.010	±0.020	±0.040

θ value Accuracy @ Ta =18 ~ 28 °C

Freq. / Z	0.1- 1Ω	1 – 10Ω	10 – 100kΩ	100k – 1MΩ	1M – 20MΩ	20M−200MΩ
100/120Hz#	±0.65°	±0.36°	±0.23°	±0.45°	± 0.65°	±1.35°
1kHz	±0.65°	±0.36°	±0.23°	±0.45°	±0.65°	±3.63°
10kHz	±0.65°	±0.36°	±0.23°	±0.45°	±1.35°	N/A
100kHz	±1.27°	±0.65°	±0.49°	±0.65°	±1.35°	

SUPPLEMENTAL INFORMATION

This section provides supplemental information for user consideration when operating the LCR meters. Some recommendations and explanations are provided to help aid in the use of some functions and features, in which can help the user gain optimal and accurate measurement results.

Selecting Test Frequency

Test frequency can greatly affect the results of measurement reading, especially when measuring inductors and capacitors. This section provides some recommendations and suggestions to consider.

Capacitance

When measuring capacitance selecting, the right frequency is important in obtaining the most accurate measurement results. Generally, a 1 kHz test frequency is used to measure capacitors that are 0.01 µF or smaller. For capacitors that are 10 µF or larger, a lower frequency of 120 Hz is used. Following this trend, high test frequencies are best for testing very low capacitance components. For large capacitance components, low frequency would be optimal. For example, if the capacitance of the component is to be in the mF range, than selecting 100 Hz or 120 Hz for test frequency would give much better results. The results will also be obvious because if the same component was tested with 1 kHz or 10 kHz, the measured readings may look erroneous on the display.

In all cases, it is best to check with the manufacturer's data sheet in order to determine the best test frequency to use for measurement.

Inductance

Typically, a 1 kHz test frequency is used to measure inductors that are used in audio and RF circuits. This is because these components operate at higher frequencies and require that they be measured at higher frequencies such as 1 kHz or 10 kHz. However, a 120 Hz test signal is used to measure inductors that are used for applications such as filter chokes in power supplies, in which are typically operated at 60 Hz AC (in U.S.) with 120 Hz filter frequencies.

In general, inductors below 2 mH should be measured at 1 kHz frequency while inductors above 200 H should be measured at 120 Hz.

In all cases, it is best to check with the manufacturer's data sheet in order to determine the best test frequency to use for measurement.

Selecting Series or Parallel Mode

Just as test frequency can greatly affect measurement results, selecting between series or parallel measurement mode can also affect the accuracy of the meter, especially for capacitive and inductive components. Below are some recommendations to consider.

Capacitance

For most capacitance measurement, selecting parallel mode is the best. Most capacitors have very low dissipation factor (high internal resistance) compared to the impedance of the capacitance. In these cases, the paralleled internal resistance has negligible impact upon the measurement.

Though in some cases, series mode would be preferred. For instance, measuring a large capacitor would require using series mode for optimal reading. Otherwise, the meter may show the reading results as out of accuracy or erroneous. Series mode is use because large capacitors often have higher dissipation factor and lower internal resistance.

Inductance

For most inductance measurement, selecting series mode is the best. This is because in this mode, accurate Q (quality factor) reading can be obtained from reading low Q inductors and ohmic losses are significant.

Though in some cases, parallel mode would be preferred. For example, iron core inductors operating at higher frequencies where hysteresis and eddy currents become significant would require measurement in parallel mode for optimal results.

Accuracy Discrepancies

In some special cases, inaccuracies may occur in the measurement of capacitive, inductive, and resistive components.

Capacitance

When measuring capacitors, it is always most desirable if the dissipation factor is low. Electrolytic capacitors inherently have a higher dissipation factor due to their normally high internal leakage characteristics. In some cases, if the D (dissipation factor) is excessive, measurement accuracy may degrade and even read out of specification.

Inductance

Some inductors are intended to operate at a certain DC bias to achieve a certain inductance value. However, the LCR meters cannot produce such biasing scheme and external biasing should not be attempted because external power would be applied to the instrument and cause serious damage to the meter. Therefore, in some cases, measured inductance reading may not agree with manufacturer's specification. It is important to check if specification pertains to DC biasing or not.

Resistance

When measuring resistance of devices, it is important to know that there are two types or ways of measurement. One type is DC resistance measurement. Another type is AC resistance measurement. The LCR meter provide both of types for measurement. When measuring a resistive component that is designed to be measured with DC, readings will be incorrect or inaccurate. Before using the meter to measure resistance, please verify whether the DUT (device under test) requires DC or AC resistance measurement method. Depending on the method, results will vary greatly.

Guard Terminal

One of the input sockets and terminals is labeled as "**GUARD**". This terminal does not have to be used in all instances for the meter to make measurements. But in some instances, it is very useful. Guard terminal generally serves two purposes.

If user is using test leads, the guard terminal can be used to connect to the shielding of the test leads. Doing so can be useful when making large resistive component measurements. For example, when measuring a 10 MΩ resistor with test leads, at the high range the reading may seem to be unstable as a few digits may continuously be changing. Having the shield of the test leads connected to the guard terminal will help stabilize the reading in some instances.

Guard terminal is also used to minimize noise and to help minimize parasitic effects coming from the component to be measured, thus allowing high precision results.