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SAFETY TERMS AND SYMBOLS

The following symbols may appear in this manual or on the instrument:

WARNING: Warning statements identify condition or practices that could result in injury or loss of life.

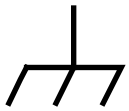
CAUTION: Caution statements identify conditions or practices that could result in damage to the instrument or other property.

The following symbols may appear in this manual or on the product:

DANGER
High Voltage

ATTENTION
refer to Manual

Protective
Conductor
Terminal



Frame or
Chassis
Terminal

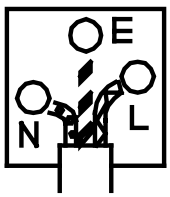
FOR UNITED KINGDOM ONLY

NOTE: This lead / appliance must only be wired by a competent person.

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 a competent electrician or the RS Technical Helpline on 01536 402888

This cable/equipment should be protected by a suitably rated and approved HBC mains fuse: refer to the rating information on the equipment and/or these user instructions for details. As a guide, cable of 0.75mm^2 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 a live socket. Any re-wiring must be carried out in accordance with the information detailed in this booklet and comply with current regulations.

1. INTRODUCTION

The Isotech LCR-819 meter is an automatic, user programmable instruments which provides good reliability and high precision for measuring a wide variety of impedance parameters. The measurement frequency range of the LCR-819 covers from 12Hz to 100kHz and the basic measurement accuracy is 0.05%. The measured results can be displayed on the high quality LCD screen which also shows decimal points and units. The measured result resolution is five full digits for Inductance (**L**), Capacitance (**C**), and Resistance (**R**) (four full digits for Dissipation (**D**), Quality factor (**Q**) or C with R). In addition, the LCD screen also shows the control status and parameters of the settings. The keypads are easy to use for menu programming. Test conditions can be stored and recalled from internal the memory, which will reduce the setup time for measurement preparation.

2. PRECAUTIONS BEFORE OPERATION

2-1. Unpacking the instrument

This instrument has been thoroughly inspected and tested before shipment from the factory. Upon receiving the instrument, please unpack and inspect it for any damage caused during transportation. If any damage is found, notify the bearer and/or RS Components Ltd. immediately.

2-2. Checking the Line Voltage

The LCR Meter can be operated with a power source between 100 and 240 Volts a.c. with a frequency of 50/60Hz; no voltage selection is necessary. Power connection to the rear panel is through an a.c. inlet module comprising of an a.c. connector and fuse holder. To change the fuse proceed as follows:

WARNING. To avoid personal injury, disconnect the power cord before removing the fuse holder.

- Remove the fuse holder by inserting a small flat blade screwdriver behind the small tab to force the holder outward.
- Install the correct fuse (slow-blow, 3A, 250Vac).
- Re-install the fuse holder back into the LCR Meters AC inlet module, push in and lock.

2-3. Environment

The normal operating ambient temperature range of the instrument is from 10° to 50°C. Operating the instrument outside this temperature range may cause damage to the internal circuitry and will invalidate the warranty.
Do not use the instrument in the presence of strong magnetic or electric field, as they may disturb the measurement and give erroneous readings.

2-4. Equipment Installation and Operation

Ensure there is proper ventilation for the vents in the instruments case. If this equipment is used not according to the specification, the protection provided by the equipment may be impaired.

WARNING: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

3. CONTROL PANEL DESCRIPTION

(1). Power Switch
Turns AC Power on or off.

(2). Function key—F1
Soft key functions as indicated on the adjacent LCD screen.

(3). Function key—F2
Soft key functions as indicated on the adjacent LCD screen.

(4). Function key—F3
Soft key functions as indicated on the adjacent LCD screen.

(5). Function key—F4
Soft key functions as indicated on the adjacent LCD screen.

(6). MENU key
Enters menu display mode or exits sub menu back to main menu.

(7). Compound key
- For making numerical entries as labeled.
- Turns the "RANGE HOLD" mode on or off.

(8). Compound key
- For making numerical entries as labeled.
- Turns the "CONSTANT VOLTAGE" mode on or off.

(9). Compound key
- For making numerical entries as labeled.
- Measures the unit of Dissipation and Quality Factor in PPM.

(10). Compound key
- For making numerical entries as labeled.
- Selects the "INTERNAL BIAS" mode or "EXTERNAL BIAS" mode. (If this key function is switched to "INTERNAL BIAS" mode, the bottom of LCD monitor will display the "INT.B" message. If the external DC bias is selected, the bottom of LCD monitor will display the "EXT.B" message.)

(11). Compound key
- For making numerical entries as labeled.
- Turns the INTERNAL BIAS mode or EXTERNAL BIAS mode "ON" or "OFF".

(12). Compound key
- For making numerical entries as "－" (the negative sign).
- Inputs the "TEST FREQUENCY".

(13). **START** (Compound key)
- Starts measurement sequence. Normally used in the "MANU" (Triggered) mode.
- Selects "AUTO" or "MANU" mode by pressing this key for 3 seconds at least.
- The LCR Meters will process the measurement automatically, if the "AUTO" mode is selected.

(14). ↵ key (ENTER)
This key enables programming of all special functions, test frequency, test voltage, averaging, delay, and nominal value etc.

(15). ・ Symbol key
Inputs the decimal point

(16). Numeral key—"2"

(17). Numeral key—"3"

(18). Numeral key—"5"

(19). Numeral key—"6"

(20). Numeral key—"9"

(21). Primary Display
This line can display the measured Inductance, Capacitance, or Resistance.

(22). Secondary Display

This line can display the measured Quality Factor Q, Dissipation Factor Tan δ, Equivalent Series Resistance ESR, or Equivalent Parallel Resistance EPR.

(23). Instrument status or indicates measurement results based on entered test limits.

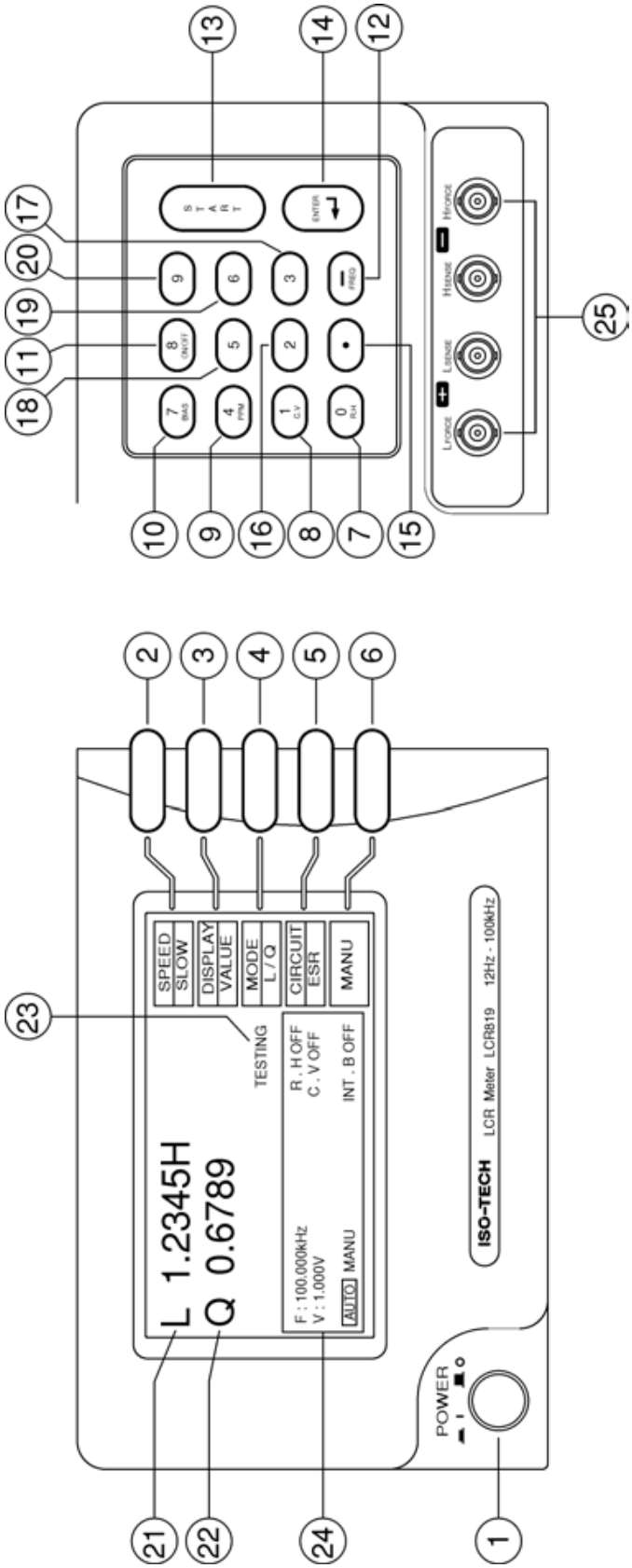
(24). Test conditions

(25). Input terminals
BNC connectors, connects to device under test (DUT).

Connectors of the LCR Meter BIAS

Lforce (current, low)	+
Lsense (potential low)	+
Hsense (potential high)	—
Hforce (current, high)	—

FRONT PANEL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23
21
22
24
1
SPEED
SLOW
DISPLAY
VALUE
MODE
L / Q
CIRCUIT
ESR
MANU
TESTING
R . H OFF
C . V OFF
INT . B OFF
L 1.2345H
Q 0.6789
F : 100.000kHz
V : 1.000V
AUTO MANU
ISO-TECH LCR Meter LCR819 12Hz - 100kHz
POWER

4. OPERATION

4-1. Connections to Device Under Test (DUT)

The LCR-819 uses a four wire measurement technique which allows accurate, easy and stable measurements. This avoids stray capacitance, mutual inductance effects, interference from measurement signals, noise and other factors inherent with other types of connections.

4-2. Start-Up

Connect the power cord of the instrument to the mains socket-outlet. Press the **POWER** button on the front panel to apply the a.c. power to the instrument.

4-3. Zeroing

In order to negate the effects of stray capacitance and impedance of test leads and fixtures, the instrument should be zeroed before taking measurements. The corrections are calculated and stored in the internal memory of the instrument during the zeroing process. Both open and short circuit zeroing should be carried out. For the consistent accuracy, the instrument and test cable and/or test fixture should be zeroed once per day at least and every time alterations are made to the test leads or fixture.

The zeroing process of open and short circuits are as follows:

Open Circuit

- The test cable or fixture should be connected to the LCR meter, but left open with no component connected.
- Press **MENU** key.
- Press **F1** key to select “OFFSET” menu.
- Press **F1** key to select open circuit zeroing (the “CAP OFFSET” is indicated on the adjacent LCD screen).
- After the BAR at the bottom of LCD screen is filled to full, the zeroing process is complete.
- If the zeroing process is successful, a message of “OK” will appear on the LCD screen. If unsuccessful, the message “FAIL” will appear.

Short Circuit

- The test cables should be connected together or the test fixture shorted (using a clean copper wire, as short as possible).
- Press **MENU** key.
- Press **F1** key to select “OFFSET” menu.

- Press **F2** key to select short circuit zeroing (the "R/L OFFSET" is indicated on the adjacent LCD screen).
- After the BAR at the bottom of LCD screen is filled to full, the zeroing process is complete.
- If the zeroing process is successful, a message of "OK" will appear on the LCD screen. If unsuccessful, the message "FAIL" will appear.

Test Condition:
Test voltage=1V
Test speed = SLOW
R.H = OFF
C.V = OFF

For the summary, the zeroing menu can be chosen through menu selection as shown in Figure 4-1 above.

NOTE: Both "Open Circuit" and "Short Circuit" zeroing operations must be successful, otherwise the specified accuracy of the instrument will not be achieved.

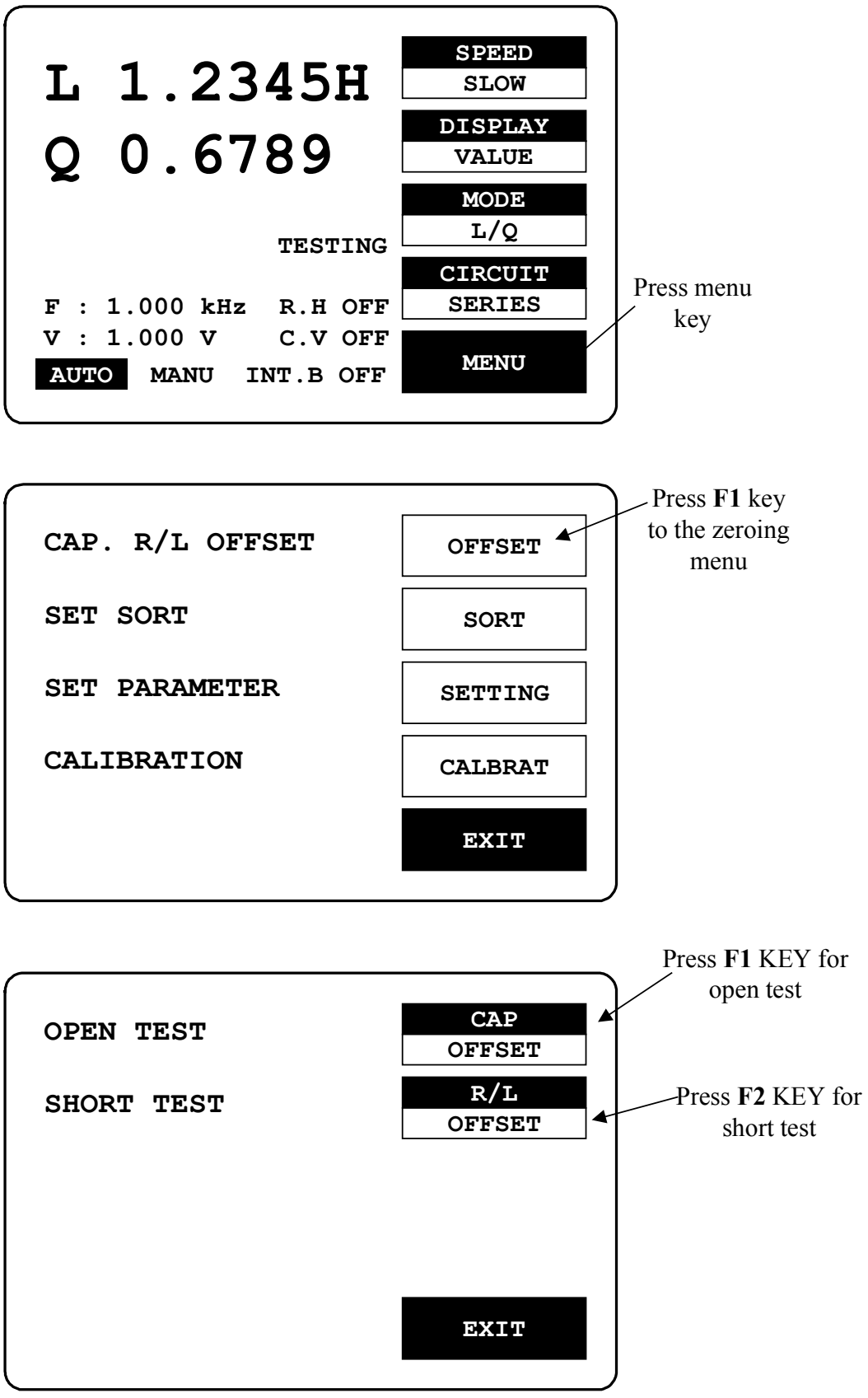


Figure 4-1: Summary of zeroing menu

4-4. Menu Functions

All the instruments' programmable functions are controlled by the easy to use menu displays. The user can enter the menu mode by selecting the **MENU** key that calls up four top level menus, **OFFSET**, **SORT**, **SETTING** and **CALBRAT**. Each one of these is comprised of a sub menu list whose functions are described in detail below. The user can enter one of four functions by pressing the corresponding function key (adjacent to the LCD screen, see figure 4-2).

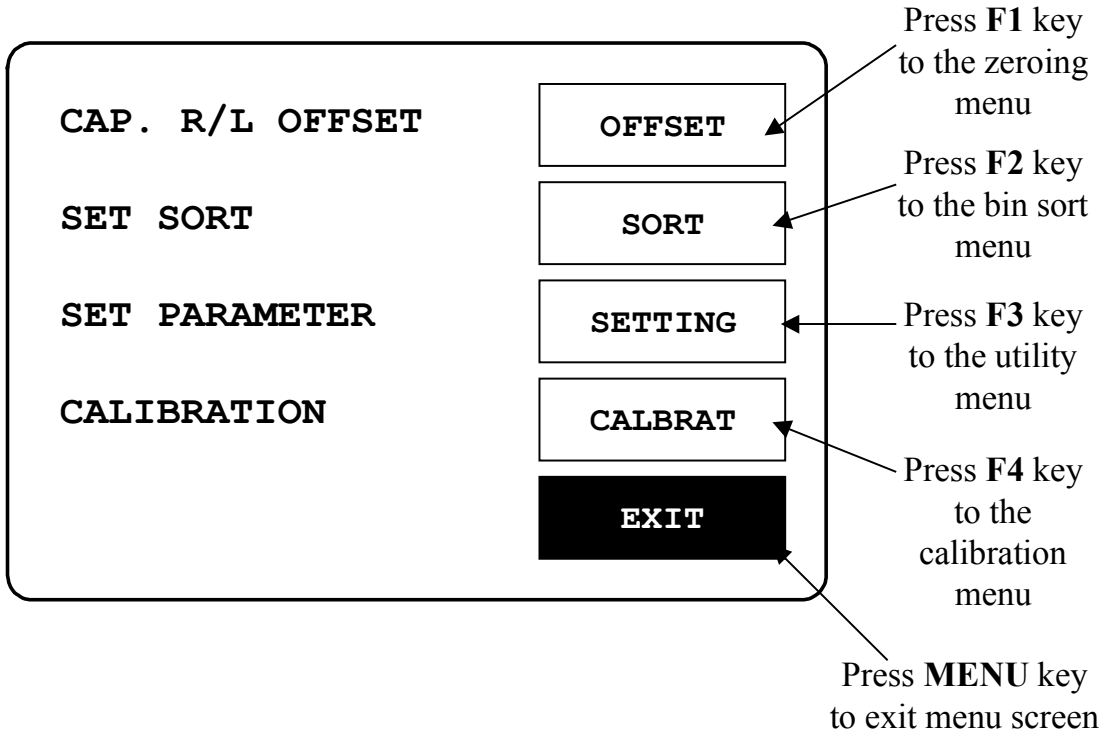


Figure 4-2: four main menu screen

4-4-1. Primary & Secondary Display

With this instrument, four combinations of two parameters can be measured and displayed simultaneously. One refers to the **"Primary Display"** (displayed first) and the other to the **"Secondary Display"**. Depending on the component type, the primary and secondary display could be **L** & **Q**, **C** & **D**, **C** & **R,** or **R** and **Q**. The parameter can be chosen by the user through the **F3** key as shown in Figure 4-3.

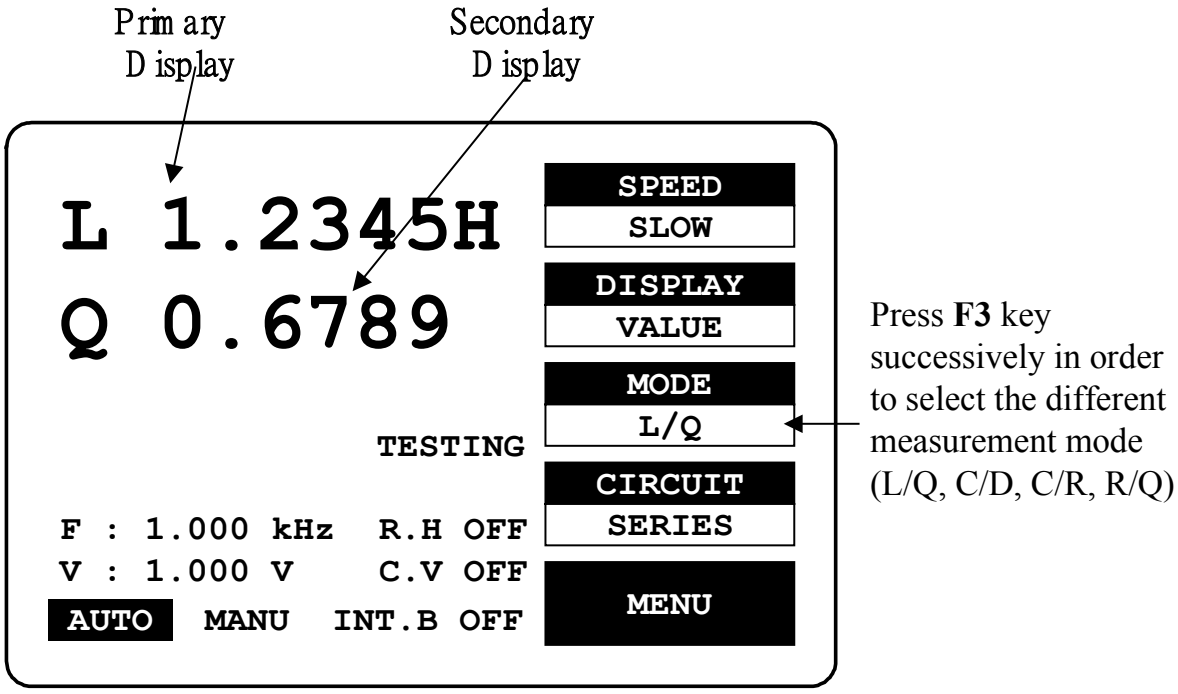


Figure 4-3. Primary & Secondary display

The user can select **R/Q** for resistor measurement, select **L/Q** for inductor measurement, or select either **C/D** or **C/R** for capacitor measurement.

4-4-2. Series & Parallel Equivalent Circuit

Impedance that is neither a pure resistance nor a pure reactance can be represented at any specific frequency by either a series or a parallel combination of resistance and reactance. Such representation is called the "equivalent

circuit". The component value of the "Primary Display" depends on which equivalent circuit (series or parallel) is chosen. The component manufacturer will normally specify how a component is to be measured (usually series) and at what frequency.

Suggested Test Conditions:

Inductors less than 10μH: Series, 100kHz.
Inductors from 10 μH to 1mH: Series, 10kHz.
Inductors from 1mH to 1H: Series, 1kHz.
Inductors greater than 1H: Series, 0.1kHz.
Capacitors less than 10pF: Parallel, 100kHz.
Capacitors from 10 to 400pF: Series or Parallel, 10kHz.
Capacitors from 400 to 1μF: Series, 1kHz.
Capacitors greater than 1μF: Series, 0.1 or 0.12kHz.
Resistor less than 1kΩ: Series, 1kHz.
Resistor from 1kΩ to 10MΩ: Parallel, 0.25kHz.
Resistor greater than 10 MΩ: Parallel, 0.03kHz

Unless for particular reason, always select "Series" for capacitors and inductors. This has traditionally been standard practice. For very small capacitance or inductance, select a higher test frequency for greater accuracy. For very large capacitance or inductance, select a lower test frequency. For dc resistance, select the lowest test frequency to minimize a.c. effects.

Because the reactive component most likely to be represented in a low resistance resistor is series inductance, the "Series" setting is selected for a resistor below about 1kΩ. If the resistor is larger than 10MΩ, select "Parallel" because the reactive component most likely to be represented in a high value resistor is shunt capacitance. If the Q is less than 0.1, the measured Rp is probably very close to the dc resistance.

The total loss of a capacitor can be expressed in several ways, including D and "ESR" (Equivalent Series Resistance). "ESR" is typically much larger than actual "ohmic" series resistance of the wire leads and foils that are in series with the heart of a capacitor physically, because ESR includes also the effect of dielectric loss. ESR is related to D by the formula: $ESR = Rs = D/\omega Cs$. Where ω represents "omega" = 2 pi time frequency ($\omega = 2\pi f$)

Although it is traditional to measure series inductance of inductors, there are situations in which the parallel equivalent circuit better represents the physical component. For small "air-core" inductors, the significant loss mechanism is usually "ohmic" or "copper loss" in the wire, therefore the series circuit is appropriate. Nevertheless, for an "iron core", the significant loss mechanism can be "core loss", therefore, the parallel equivalent circuit is appropriate which gives a better model of the inductor.

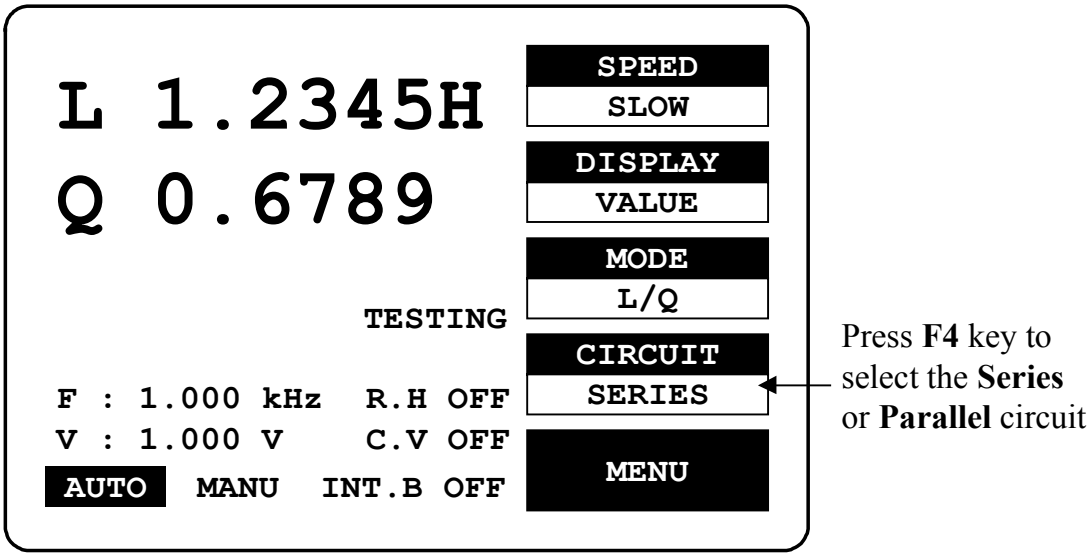


Figure 4-4. Selections of Series & Parallel Circuit

4-4-3. Measurement Displays

The measured results of the LCR Meters can be shown on the LCD screen in three ways: VALUE, DELTA%, or DELTA. The user can press the F2 key to select the appropriate item for measurement.

VALUE

The LCD screen will display the measured value of both the primary and secondary parameter, shown with decimal point and units. The resolution of the primary display (L, C, or R) is five digits. The resolution of secondary display (D, Q or R with C) is four digits. The message "TESTING" is displayed when a test is in progress

DELTA%

The "DELTA%" shows the percent deviation of the measured L, C, or R value from a stored NOMINAL VALUE. The sign of deviation is indicated.

DELTA

The LCR difference is similar to the DELTA% except that the deviation is shown in suitable units (Ohms, Henries, etc).

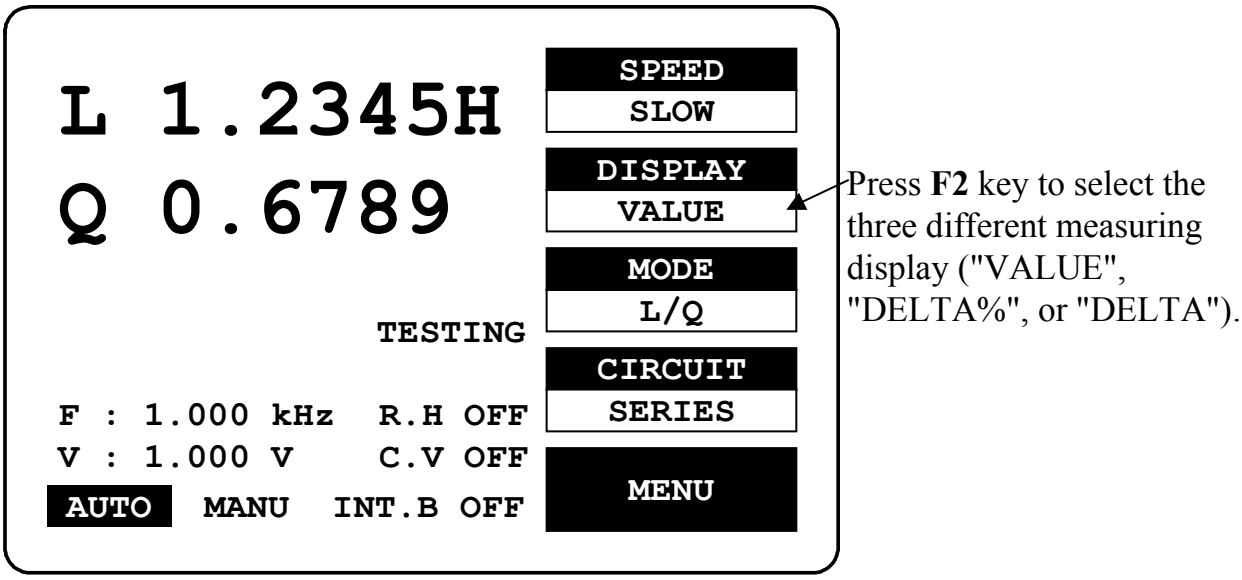


Figure 4-5. Types of measurement display

4-4-4. Nominal Value

Allows entry of a “Nominal Value” for the primary parameter which is the basis for the measurement result in “DELTA” or “DELTA %”. Accepts numerical entry up to five digits with decimal point. The units are depended on which measurement display is selected.

Steps of "Nominal Value" input (Figure 4-6):

- Press **MENU** key.
- Press **F2** key to select "SORT" menu.
- Press **F1** key to select "Nominal Value" (the "NOM.VAL" is indicated on the adjacent LCD screen).
- Input the nominal value via the numeral keys (5 digits with decimal point maximum).
- Press ↵ key
- After the BAR at the bottom of LCD monitor is filled, the "Nominal Value" input is complete.

4-4-5. Selection of Measurement Speed

One of three measurement speeds **SLOW**, **MEDIUM**, or **FAST** may be selected (Figure 4-7). The continuous mode speeds are about 1, 5, or 12 measurement per second respectively. The trade-off is accuracy vs. speed. The instrument will take a more accurate measurement at a slower rate. The trade-off is as follows

SLOW speed : More than 1 measurement per second, at 0.05% accuracy (or better)*

MEDIUM speed : More than 3 measurements per second, at 0.1% accuracy (or better)*

FAST speed : More than 7 measurements per second, at 0.24% accuracy (or better)*

* For the details of accuracy, please refer to the specifications.

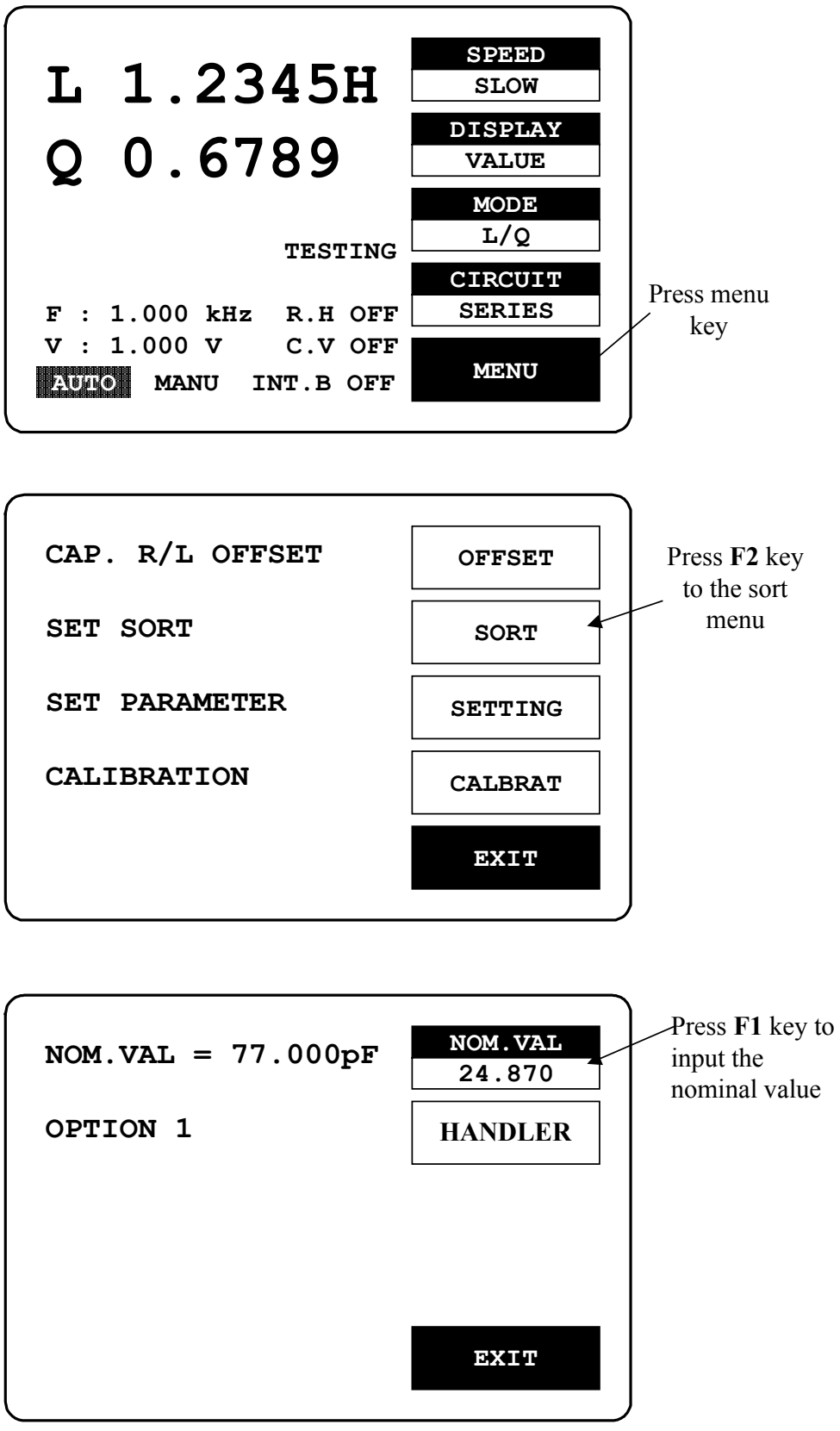


Figure 4-6. Steps of "Nominal Value" input.

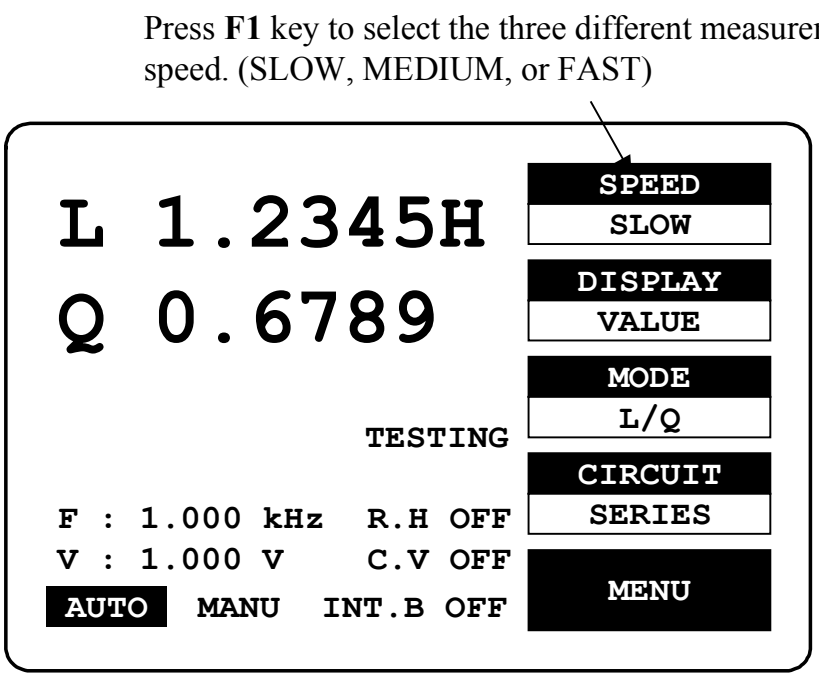


Figure 4-7. Selection of measurement speeds

4-5. Measurement Conditions

4-5-1. Bias Voltage

There are two available bias voltage modes: “Internal” and “External”.

Internal:

An internal 2 volts d.c. bias voltage will be applied to the device under test.

External:

An external DC bias voltage between 0 and 30 volts can be applied to the device under test. The external bias connection is located on the rear panel. The maximum current is 200mA. The supply of the bias voltage must be fully floating, with no connection to ground. Allow approximately 1 second between initiating a test and taking the reading. This will ensure the device under test has stabilized and give a more accurate reading. The DC bias voltage should generally only be applied to capacitors. If the DC bias voltage is applied to device of low impedance, the unreliable test results will occur.

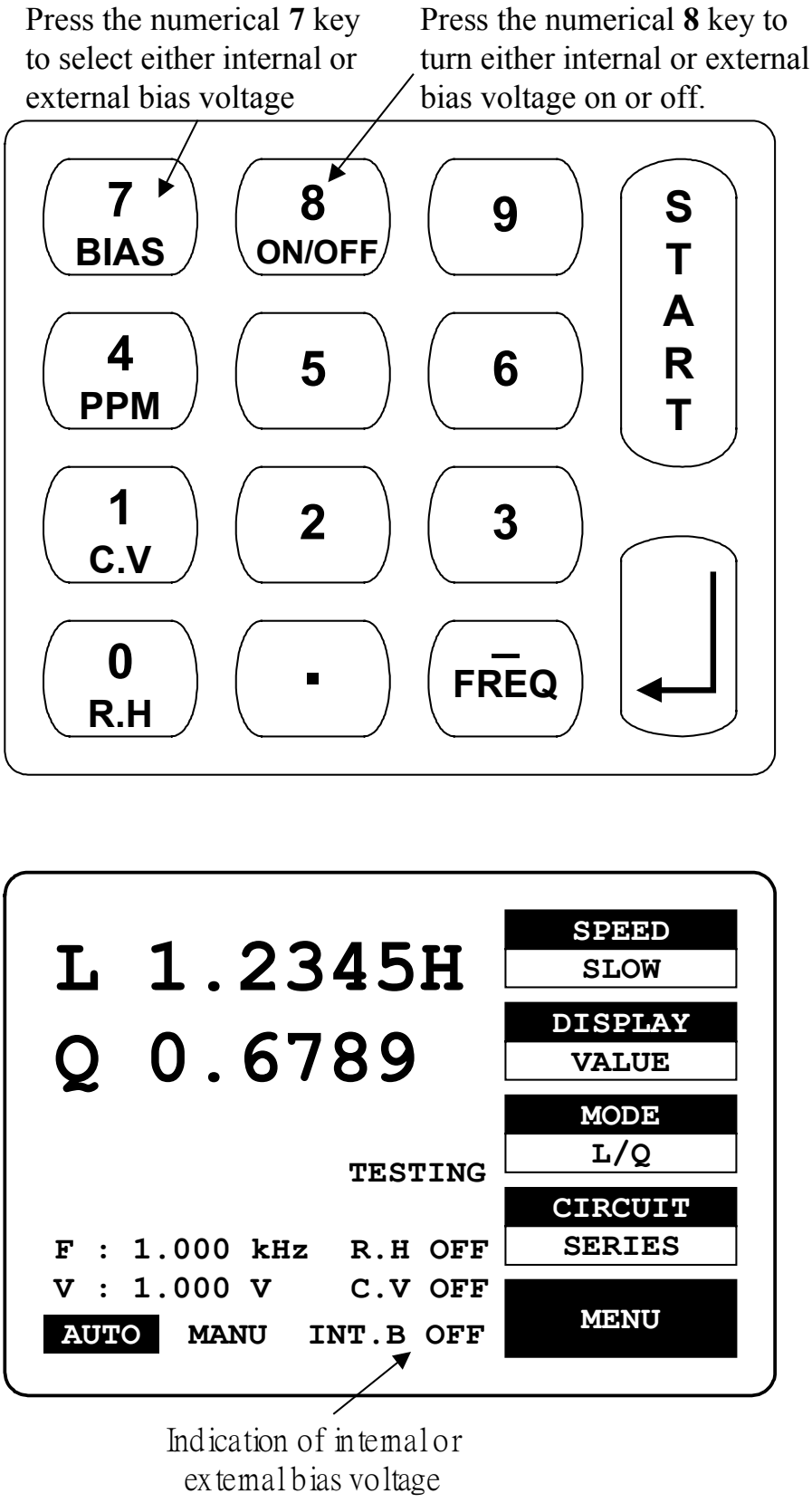


Figure 4-8. Selection of "BIAS" voltage

Steps for "BIAS" voltage selection (Figure 4-8):

- Press compound key 7 to selects the "INTERNAL BIAS" or "EXTERNAL BIAS" on the main menu. (If this key function is switched to "INTERNAL BIAS", the bottom of LCD screen will display the "**INT.B**" message. If the external DC bias is selected, the bottom of LCD screen will display the "**EXT.B**" message.
- Press compound key 8 to turn either "INTERNAL BIAS" or "EXTERNAL BIAS" mode "ON" or "OFF" on the main menu.

4-5-2. Test Frequency

The numerical input of test frequency accepts up to 5 digits with decimal point. User can input any desired frequencies, however, the actual frequency executed for the LCR Meters is always the closest one of the 503 available frequencies. The 503 frequencies can be calculated by the following formulas:

3kHz/n,	where n range is from 13 to 250	(freq. 0.012 to 0.23077kHz)
60kHz/n,	where n range is from 4 to 256	(freq. 0.23438 to 15kHz)
200kHz/n,	where n range is from 2 to 13	(freq. 15.385 to 100kHz)

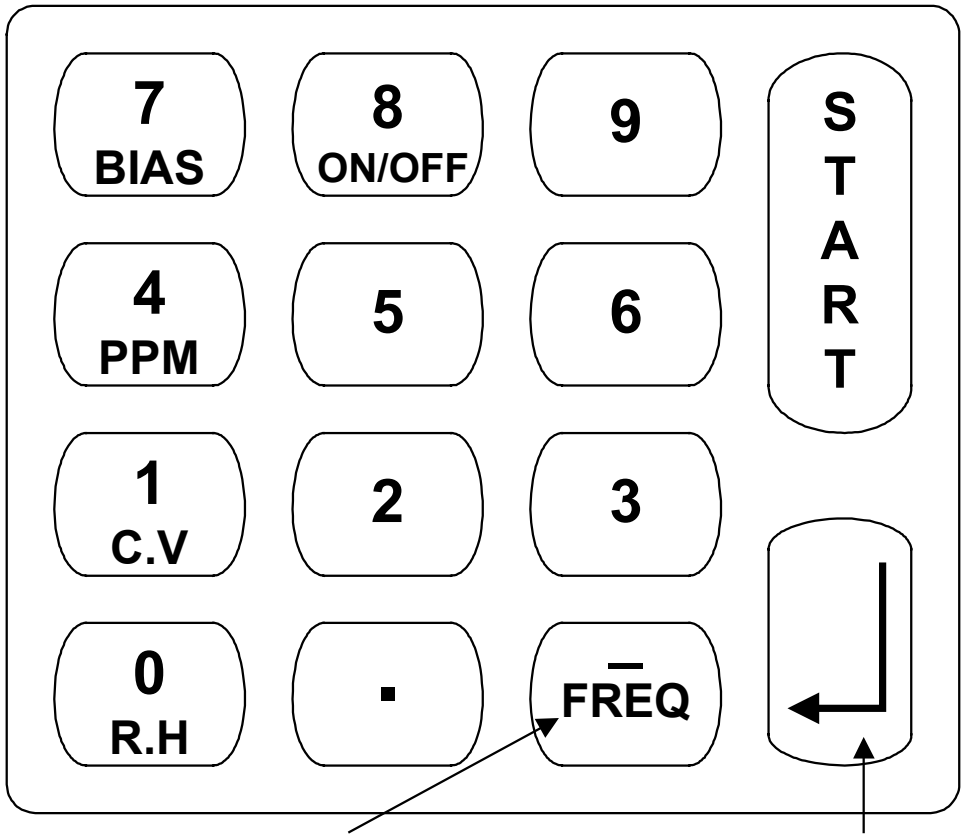
The "nominal value" of an available frequency can be calculated from the appropriate formula above.

The range of test frequency is between 12Hz and 100kHz. To select the test frequency, enter the desired frequency via these numerical keys. The instrument will select the nearest available test frequency from the 503 settings.

Steps of "Test Frequency" selection (Figure 4-9):

- Press compound key $\overline{\textbf{FREQ}}$.
- Input the desired frequency in kilohertz.
- Press ↵ key.

Note: After the test frequency has been changed, the "Open/Short circuit" calibration must be repeated to obtain the specified accuracy.



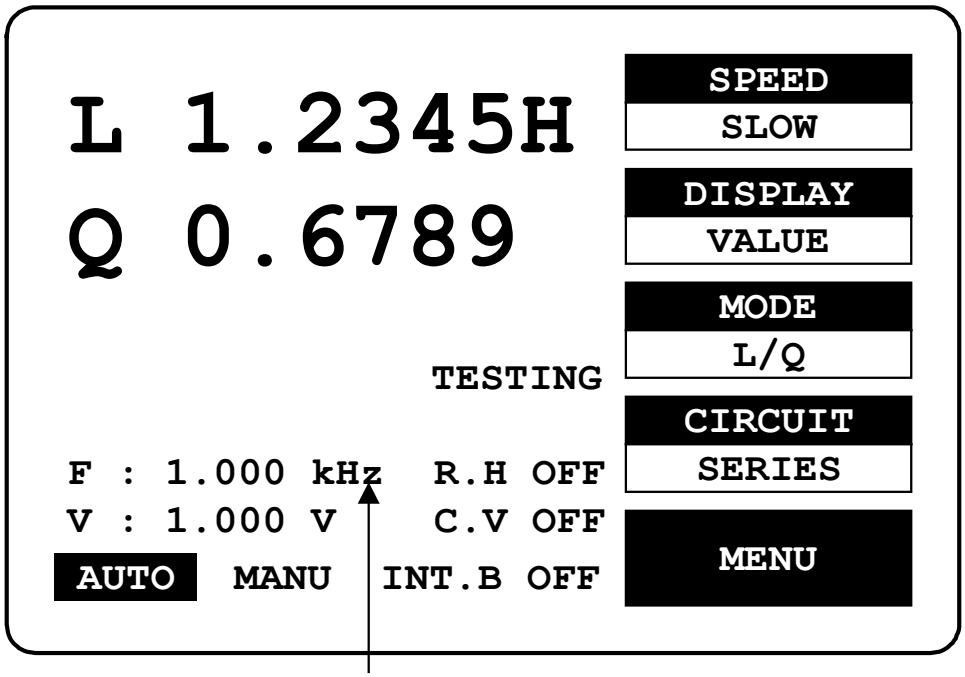


Figure 4-9. Inputs of test frequency

4-5-3. D/Q in PPM (parts per million)

If the value of D or Q is less than 0.0100, user can select DQ in PPM to improve the resolution by a factor of 100. The units of D and Q in PPM are dimensionless and expressed as a decimal ratio with the multiplier of 1000000. User can just press compound key **4** to select the unit of D or Q in PPM. To disable the DQ in PPM feature, press the same key again.

4-5-4. Test Voltage

The range of test voltage is from 5mV to 1.275V in increments of 5mV. The actual voltage applied to the DUT is never more than the source voltage. The DUT impedance and the source resistance of the instrument decide the actual test voltage. The smallest voltage applied to the DUT will be 20% less than the source voltage in general. The programming of test voltage is as follows (Figure 4-10):

- Press **MENU** key.
- Press **F3** key to select "SETTING" menu.
- Press **F2** key to select "VOLT" menu.
- Input the desired value via the numeral keys.
- Press **↵** key
- After the BAR at the bottom of LCD monitor is filled, the "Test Voltage" input is complete.

4-5-5. Constant Voltage Source

If the DUT has to be measured at a particular test voltage, the instrument has a constant voltage facility. After "Constant Voltage" is selected, The instrument will maintain a source resistance of 25Ω. Therefore, the test voltage is kept constant for any DUT whose impedance is greater than 25Ω. If "Constant Voltage" is selected, the measurement accuracy will cause be reduced by a factor of three. Press compound key **1** to select the feature of "Constant Voltage". To disable this feature, press the same key again.

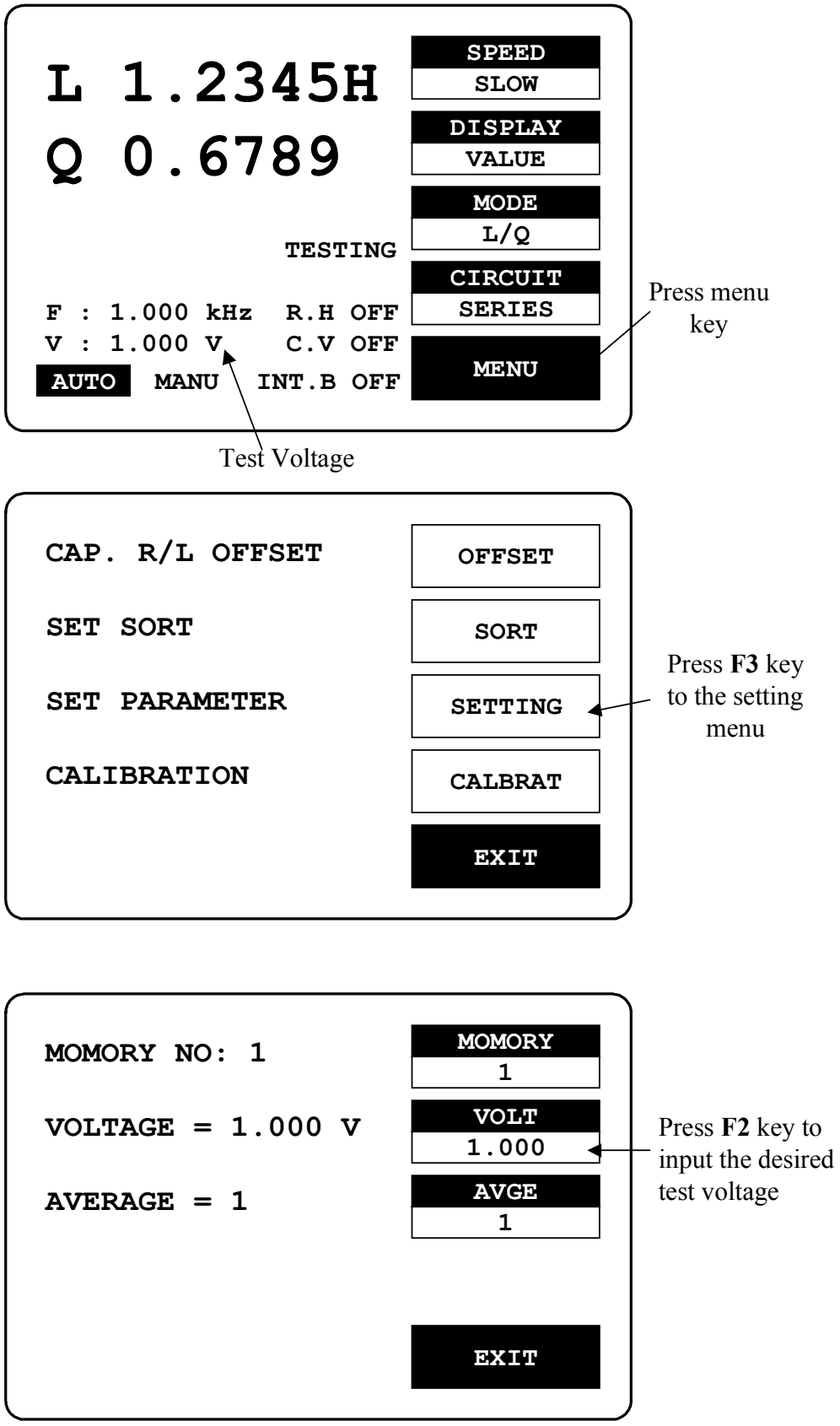


Figure 4-10. Programming of test voltage.

4-5-6. Range Hold

If a DUT is removed from the test cable or fixture during the "Continuous" measurement mode, the instrument will change ranges automatically. "Range Hold" may be enabled to prevent this, thus reducing the time taken for repetitive measurements. Press compound key **0** to select the feature of "Range Hold". To disable this feature, press the same key again.

4-5-7. Averaging

Enabling this function will allow a test to be repeated a number of times (between 1 and 255) to increase the measurement accuracy. An average of the readings will be calculated by the instrument and displayed on the LCD screen

The programming of "Averaging" is as follows (Figure 4-11):

- Press **MENU** key.
- Press **F3** key to select "SETTING" menu.
- Press **F3** key to select "AVGE" menu.
- Input the desired value via the numeral keys.
- Press **↵** key
- After the BAR at the bottom of LCD monitor is filled, the "Averaging" input is complete.

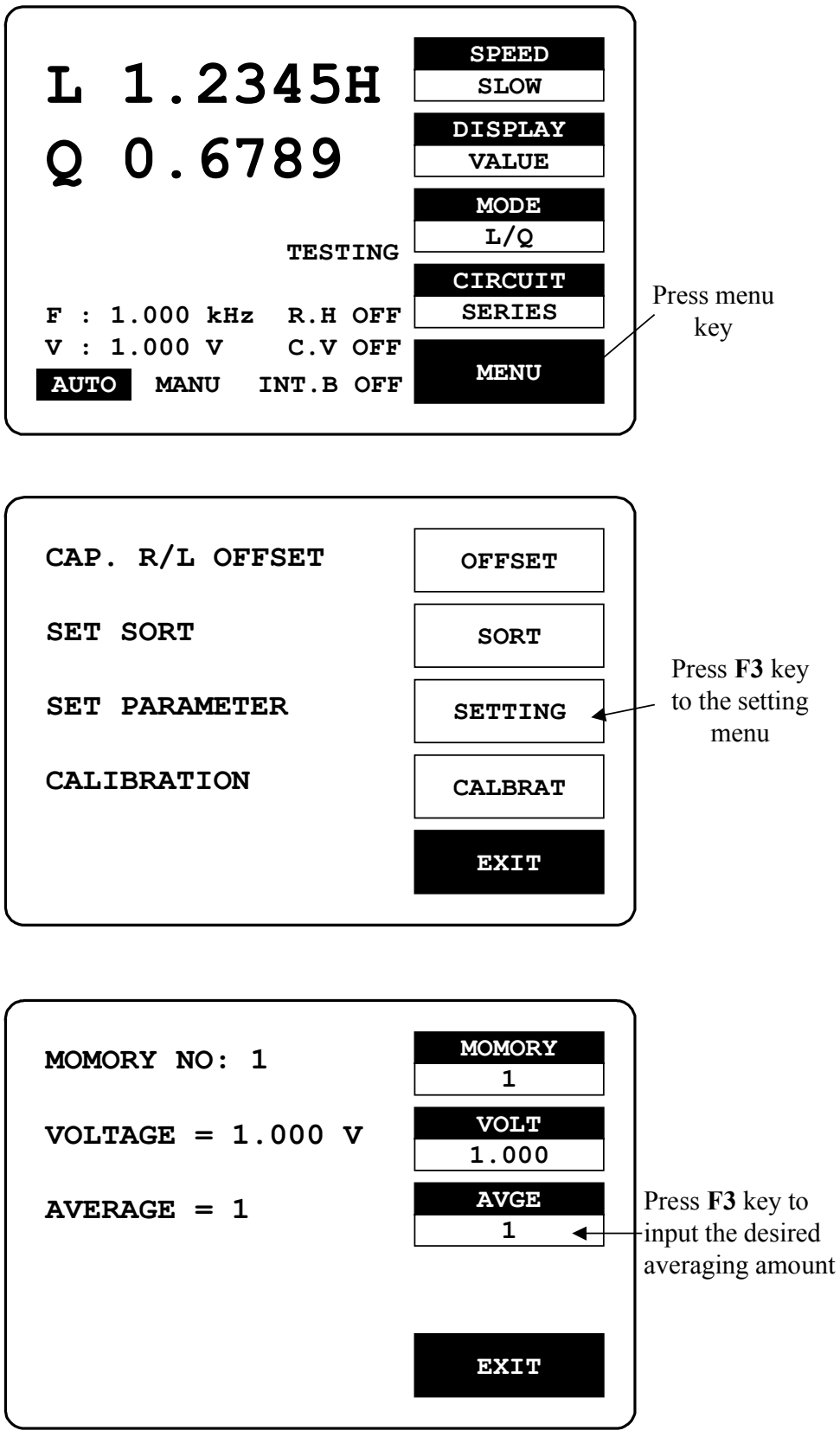


Figure 4-11. Programming of averaging.

4-5-8. Memory

The instrument has two memory functions: Store and Recall. The current measurement conditions can be saved into the memory, or a previously saved configuration may be recalled. There are 100 memory blocks in total. The programming of "Memory Store / Recall" can be performed as described below (Figure 4-12):

- Press **MENU** key.
- Press **F3** key to select "SETTING" menu.
- Press **F1** key to select "MEMORY" menu.
- Press compound key **1** to recall a previously saved memory block. or
- Press compound key **2** to store the current measurement conditions into memory.
- Input the number of desired memory block. (1~100)
- Press **↵** key
- After the BAR at the bottom of the LCD screen is filled, the process of "Memory Store/Recall" is complete.

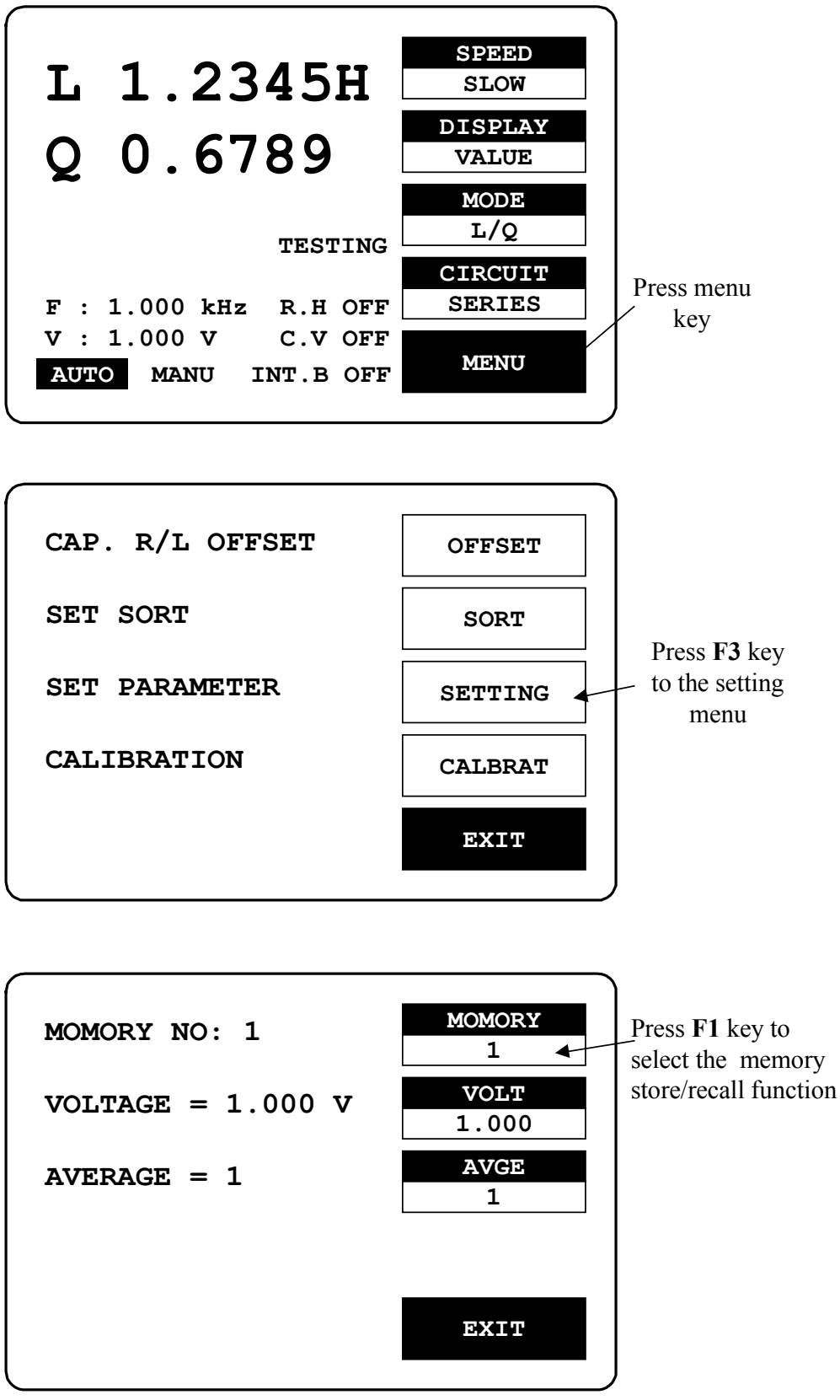


Figure 4-12. Programming of memory store/recall.

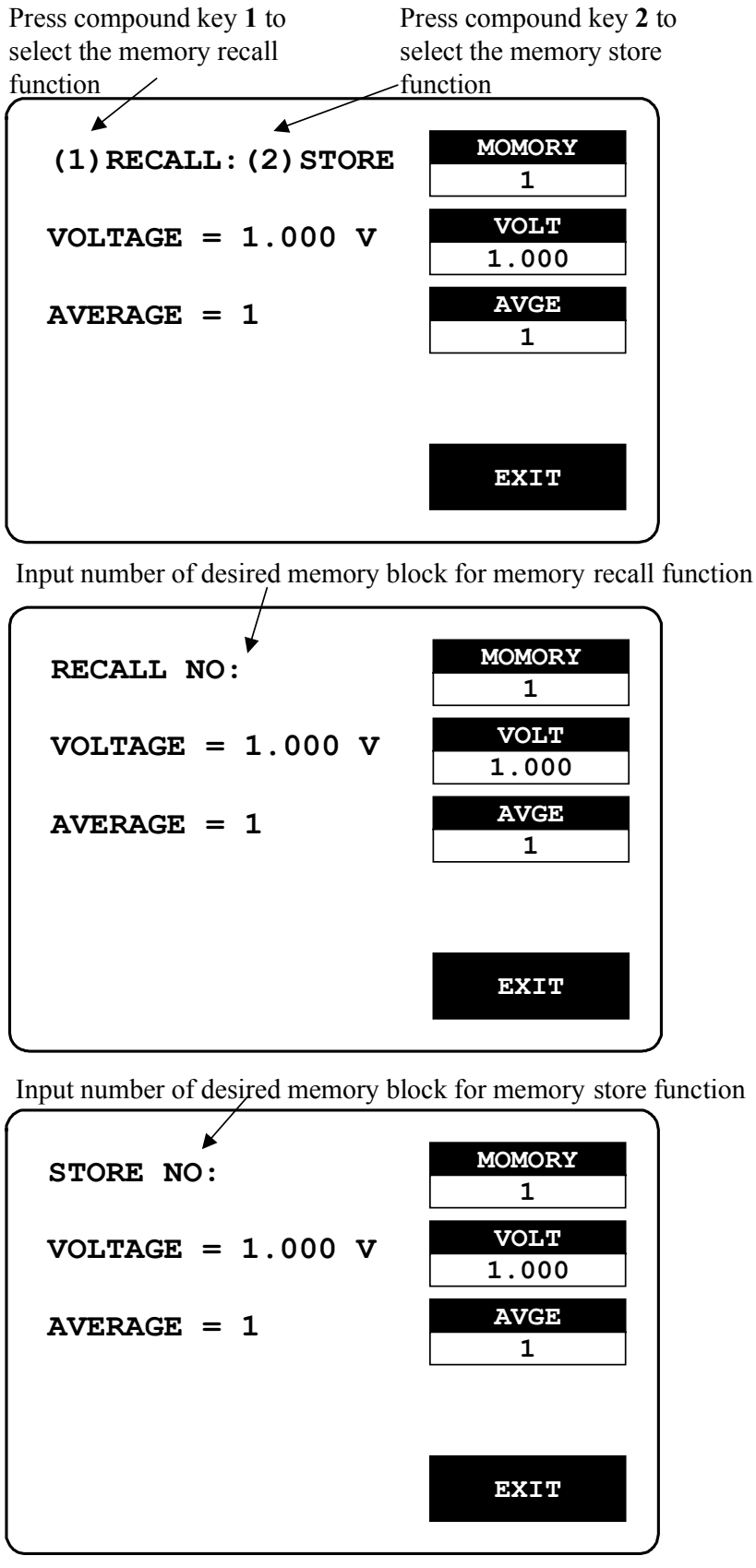


Figure 4-12. Programming of memory store/recall. (Cont.)

5. SPECIFICATIONS

Measurement Parameters:

Inductance (L_s/L_p)*, Capacitance (C_s/C_p), Resistance (R_s/R_p), Dissipation (D), Quality Factors (Q), Equivalent Series Resistance (ESR) and Equivalent Parallel Resistance (EPR).

Measurement Models:

Four kinds of measurement model can be selected. Two measurement parameters measured and displayed simultaneously.

R/Q, C/D, C/R, L/Q

Display Ranges:

Primary Display

Inductance (L)	: 0.00001mH	～ 99999H
Capacitance (C)	: 0.00001pF	～ 99999 μF
Resistance (R)	: 0.00001 Ω	～ 99999k Ω

Secondary Display

Dissipation factor (D)+	: 0.0001	～ 9999
Quality factor (Q)***	: 0.0001	～ 9999

* s=series, p=parallel, ESR=Rs ** with R *** with L or R + with C

Equivalent Series Resistance (ESR)[+]	: 0.0001Ω	～	9999 kΩ
Equivalent Parallel Resistance (EPR)[+]	: 0.0001Ω	～	9999 kΩ
Dissipation factor (D)[+] in ppm	: 1 ppm	～	9999 ppm
Quality factor (Q)[**] in ppm	: 1 ppm	～	9999 ppm
DELTA %	: 0.00001%	～	99999%

If any of these quantities is negative, the "-" negative indicator is displayed

Accuracy:

R, L, C: 0.05% (Basic)[+]
D, Q: 0.0005 (Basic)[+]

Test Frequency:

There are 503 test frequencies between 12Hz and 100kHz which may be selected using the keypad.

Measurement Displays:

The measured results can be shown on the LCD screen in four ways:

1. VALUE : The measured quantities of **R/Q, C/D, C/R,** or **L/Q.**
*The resolution of the primary display (L, C, or R) is five digits.
*The resolution of the secondary display (D, Q or R with C) is four digits.

[+] Please refer to page41~43 for details.

2. DELTA : The LCR difference is similar to the DELTA% except that the deviation is shown in suitable units (ohms, henries, etc.)

3. DELTA % : The DELTA% shows the percent deviation of the measured L, C, or R value from a saved NOMINAL VALUE. The sign of deviation is indicated.

Measurement Speed1:

SLOW : 896ms

MEDI : 286ms

FAST : 135ms

Equivalent Circuit:

The L, C, or R equivalent SERIES or PARALLEL circuit can be selected by the keypad.

Measurement Modes:

Two modes are available: AUTO and MANUAL.

“AUTO” mode is measuring continuously, updating the display after each measurement.

“MANUAL” mode is activated by pressing the START button and the measured result is displayed. The reading remains on the LCD screen until the next measurement is made.

Average:

The AVERAGE of any number of measurements from 1 to 255 can be made as desired in either of the two measurement modes.

In “AUTO” mode, only the final value is shown.

In “MANUAL” mode, the running average is shown and the final value held until the “START” key is depressed again.

Test Voltage:

The test voltage range is from 5mV to 1.275V, in 5mV steps.

Memory:

100 memory blocks total.

DC Bias:

A 2V internal bias can be applied to capacitors during measurement.

Up to 30Vd.c. external bias can be applied to capacitors during measurement via the two terminals (located on the rear panel). The applied current should not exceed 200mA.

LCD screen:

240×128 dot matrix C.C.F.L. back light LCD with adjustable contrast.

Battery:

A replaceable 3V lithium battery (BR-2/3A type) for system memory and calibration data backup, with a life expectancy of approximately 3 years.

After the battery is replaced, the instrument MUST be re-calibrated!

Operating Environment:

Indoor use,

Altitude up to 2000m

Installation Category II,

Pollution Degree 2

Operating temperature: 10℃～50℃, < 85% relative humidity

Storage temperature: －20℃～60℃

AC Power Source:

100 to 240V a.c., 50/60Hz

Power Consumption:

45 Watts maximum

Fuse Replacement:

Slow-Blow, 3A, 250V, 5 x 20 mm High Breaking Capacity.

Dimensions:

330mm (W) × 149mm (H) × 437mm (D)

Weight:

5.5 kg

Instrument error values:

- The formulae for primary readout accuracy of C, R, and L are;

C: 0.03% + 0.02% [(1+Ka)$^{\#}$ or (X/Ymax)$^{\#}$ or (Ymin/X)$^{\#}$] (1+ ｜ D ｜)(1+Kb+Kc)
R: 0.03% + 0.02% [(1+Ka)$^{\#}$ or (X/Ymax)$^{\#}$ or (Ymin/X)$^{\#}$] (1+ ｜ Q ｜)(1+Kb+Kc)
L: 0.03% + 0.02% [(1+Ka)$^{\#}$ or (X/Ymax)$^{\#}$ or (Ymin/X)$^{\#}$] (1+ 1 / ｜ Q ｜)(1+Kb+Kc)

- The formulae of secondary readout accuracy for D and Q are;

	Error
D with **C**	2count±0.0003 + 0.0002[(1+Ka)$^{\#}$ or (X/Ymax)$^{\#}$ or (Ymin/X)$^{\#}$] (1+ ｜ D ｜ +D×D)(1+Kb+Kc)
Q with **R**	2count±0.0003 + 0.0002[(1+Ka)$^{\#}$ or (X/Ymax)$^{\#}$ or (Ymin/X)$^{\#}$] (1+ ｜ Q ｜ +Q×Q)(1+Kb+Kc)
Q with **L**	2count±0.0003 + 0.0002[(1+Ka)$^{\#}$ or (X/Ymax)$^{\#}$ or (Ymin/X)$^{\#}$] (1+ ｜ Q ｜ +Q×Q)(1+Kb+Kc)

#: 1. if X≧Ymax, select (X/Ymax)
2. if X≦Ymin, select (Ymin/X)
3. if Ymin<X<Ymax, select (1+Ka)

- The formulae for secondary readout accuracy of R with C are;

	Error
D≧1	2count + 0.02%[(1+Ka)* or (Rx/Rmax)* or (Rmin/Rx)*] (1+ 1/ ｜ D ｜)(1+Kb+Kc)+0.03%
D≦1	2count + 0.02%[(1+Ka)** or (Cx/Cmax)** or (Cmin/Cx)**] (1+ 1/ ｜ D ｜)(1+Kb+Kc)+0.03%

**: 1. If Rx≧Rmax, select (Rx/Rmax)*
2. if Rx≦Rmin, select (Rmin/Rx)
3. if Rmin<Rx<Rmax, select (1+Ka)

***: 1. If Cx≧Cmax, select (Cx/Cmax)*
2. if Cx≦Cmin, select (Cmin/Cx)
3. if Cmin<Cx<Cmax, select (1+Ka)

Where

***Ka**: Constant Voltage factor*

Constant Voltage On , Ka = 2

Constant Voltage Off, Ka = 0

***Kb**: Test Speed factor*

Speed = SLOW , Kb = 0

Speed = MEDIUM , Kb = 3

Speed = FAST ,Kb = 10

***Kc**: Frequency & RMS Voltage factor (refer to Table A)*

***X**: X is value of the component being tested.*

***Y**: Y is range constant (refer to Table B)*

***Rx** and **Cx** are value of the component being tested.*

***Rmax**, **Rmin**, **Cmax** and **Cmin** are range constants (refer to Table B).*

Table A: (for range 1,2,3) –Kc

Voltage / Frequency	0.03≦V＜0.1	0.1≦V＜0.25	0.25≦V＜1	1≦V≦1.265
0.012≦F＜0.03	35	12	9	7
0.030≦F＜0.1	30	8	5	3
0.1≦F＜0.25	25	6	3	2
0.25≦F＜1	20	5	2	1
1	14	4	1	0
1＜F≦3	15	5	2	1
3＜F≦6	15	6	3	2
6＜F≦10	15	8	5	3
10＜F≦20	20	10	6	5
20＜F≦50	30	22	18	15
50＜F≦100	50	40	35	30

F: test frequency in kHz

Table A: (for range 4)-Kc

Voltage / Frequency	0.03≦V＜0.1	0.1≦V＜0.25	0.25≦V＜1	1≦V≦1.265
0.012≦F＜0.03	70	20	10	7
0.030≦F＜0.1	50	13	6	3
0.1≦F＜0.25	35	9	4	2
0.25≦F＜1	25	6	2	1
1	15	4	1	0
1＜F≦3	17	6	3	2
3＜F≦6	25	15	10	6
6＜F≦10	60	30	20	15
10＜F≦20	Not specified	100	65	50
20＜F≦50	This range is not used above 20kHz			
50＜F≦100				

F: test frequency in kHz

Table B-1: Range Hold

Component / Range	Inductor		Capacitor		Resistor	
	Max	**Min**	**Max**	**Min**	**Max**	**Min**
Range1	16mH /f	1mH /f	25uF /f	1.6uF /f	100Ω	6.25Ω
Range2	256mH /f	16mH /f	1600nF /f	100nF /f	1.6kΩ	0.1kΩ
Range3	4100mH /f	256mH /f	100nF /f	6.4nF /f	25.6kΩ	1.6kΩ
Range4*	65H/f	4.1H /f	6400pF /f	400pF /f	410kΩ	25.6kΩ

f = test frequency in kHz

**: This range is not used above 20kHz*

Table B-2: Auto Range

Component / Range	Inductor		Capacitor		Resistor	
	Max	**Min**	**Max**	**Min**	**Max**	**Min**
Auto range	65H /f**	1mH /f	25uF /f	400pF /f **	410kΩ**	6.25Ω**

***: Above 20kHz, Cmin = 6.4 nF/f ,and Lmax = 4100mH/f*

6. MESSAGE CODES

This section describes the message codes which may be displayed on the LCD screen..

OVER-01

Cause:

1. If the impedance of "Device-under-test" is smaller than the selected measurement range of the instrument, the "OVER-01" message will be displayed on the LCD screen.
   Calculation formula:
   Capacitance: XC=1/2 πfC
   Inductance: XL=2 πfL
   where f=test frequency in Hz
2. If the inductor of "Device-under-test" is very large at a very high "test frequency", the "Resonance effect" will occur and the impedance will decrease. Hence, the measured value is useless. Meanwhile, an "OVER-01" message will be displayed on the LCD screen.

Solution:

1. Turn on the "Constant Voltage" mode (please refer to 4-5-5. Constant Voltage Source, page 22, for details).
2. Select a lower measurement range. Refer to table B-1: Range Hold, page 41, in order to reach an appropriate measurement range. Turn on the "Range Hold" mode after the measurement range is set.

Note: Both solutions will reduce the accuracy of the instrument.

7. MAINTENANCE

This section includes the basic maintenance information for the instrument.

7-1. Cleaning

Remove the AC input power (disconnect and remove the power cord) from the instrument before attempting to clean it.
To clean the instrument, use soft cloth dampened in a solution of mild detergent and water. Do not spray cleaner directly onto the instrument, since it may leak into the cabinet and cause damage.
Do not use chemicals containing benzine, benzene, xylene, acetone, toluene, or similar solvents.
Do not use abrasive cleaners on any portion of the equipment.

7-2. Battery Replacement

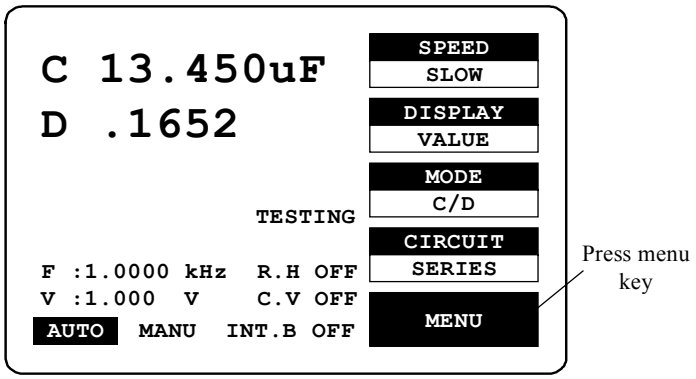
A replaceable 3V lithium battery (type BR-2/3A) supplies the backup power for the non-volatile memory for the instrument. This battery has an expected life of approximately 3 years.

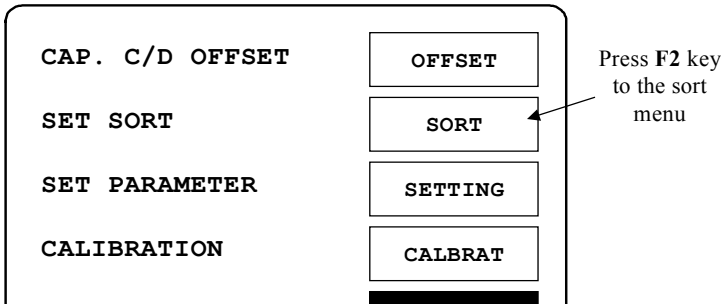
CAUTION: Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type. Discard used batteries according to the manufacturer's instructions and local environmental regulations.

8. RS-232 OPTION

8-1. On-line Procedure

1) Apply power to the instrument and switch it on.
2) Enable the RS232 function of the instrument as follows (Figure 8-1):
   - Press **MENU** key.
   - Press **F2** key to select “SORT” function.
   - Press **F3** key to select “OPTION 2” function.
   - Press **F1** key to select “RS232” ON.
3) Run the PC LCR-VIEW Program.
4) Check the contents of the Message area under the LCR-VIEW to ensure the connection has been successful. If not, select the setting items above the LCR-VIEW to change the Com (serial) port and attempt connection again until communication is established. Refer to Figure 8-2, 8-3, 8-4.





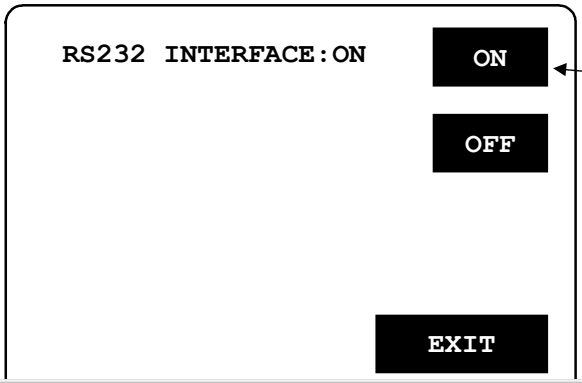


Figure 8-1

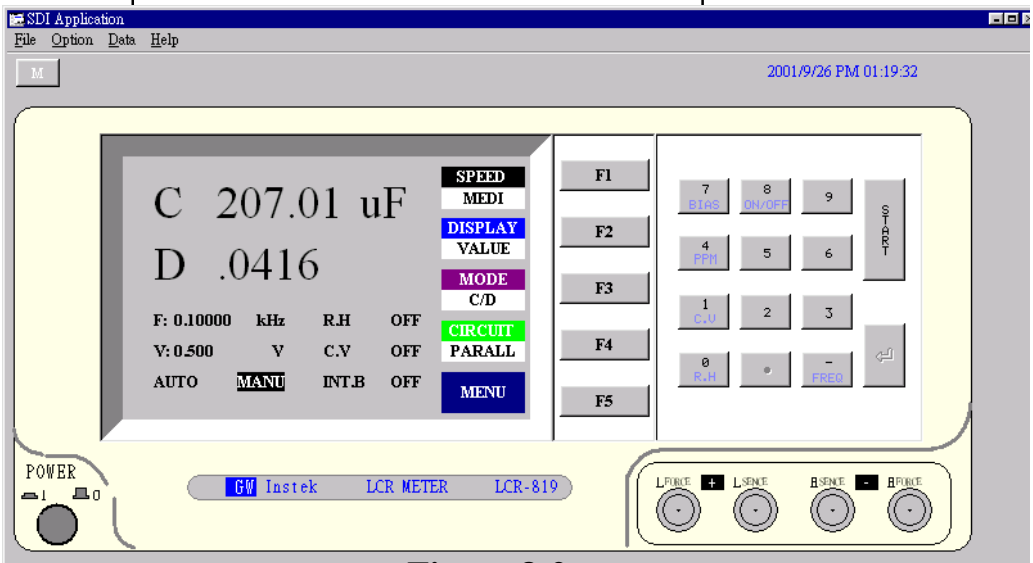


Figure 8-2

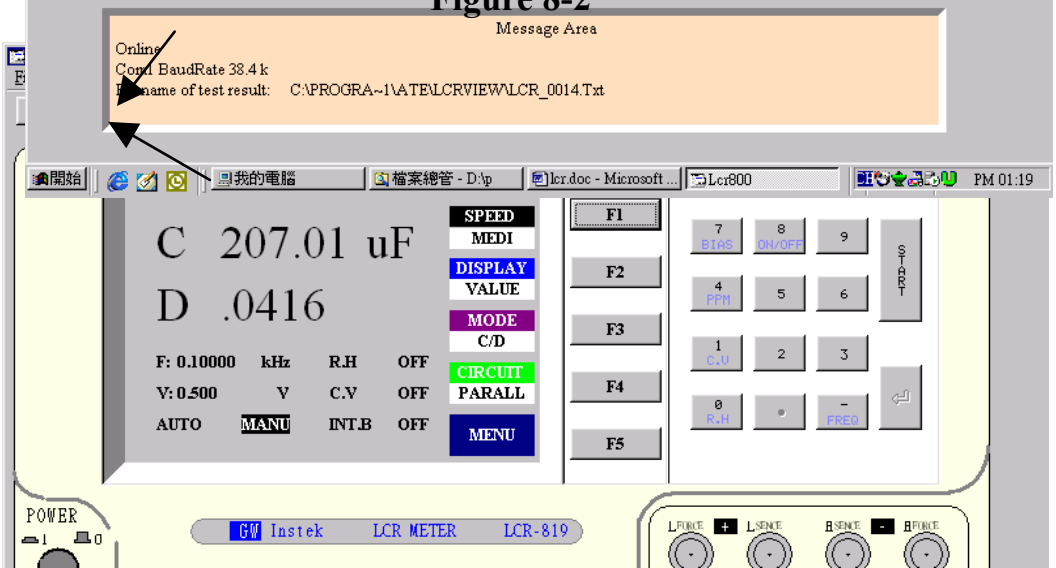


Figure 8-3

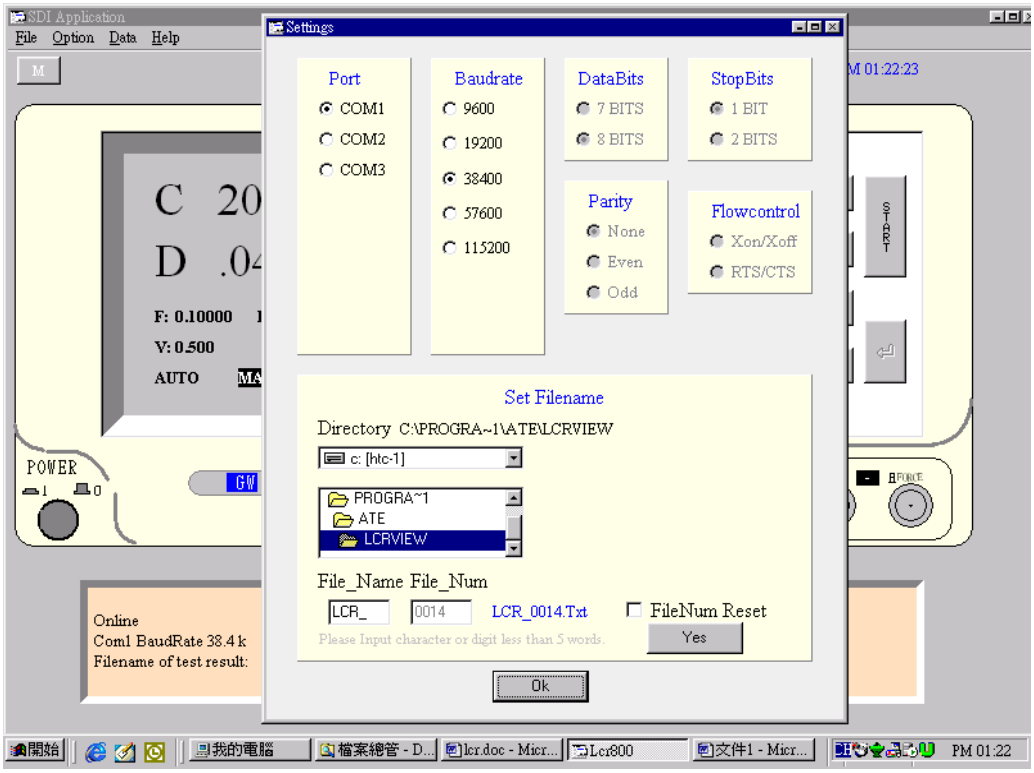
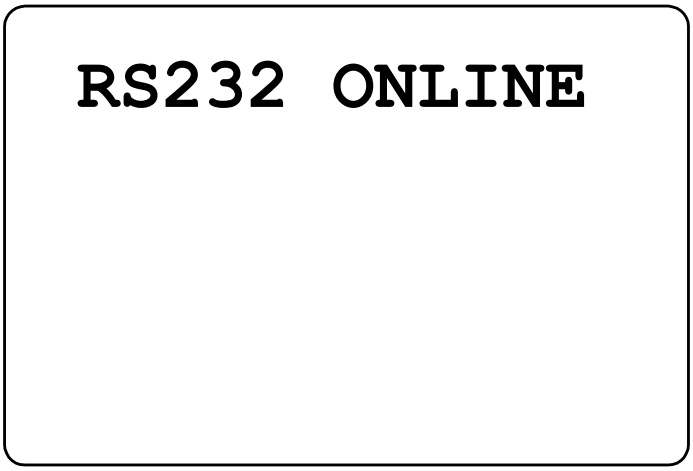


Figure 8-4

5) When connection is successfully established, “RS232 ONLINE” will appear on the instruments’ LCD screen.

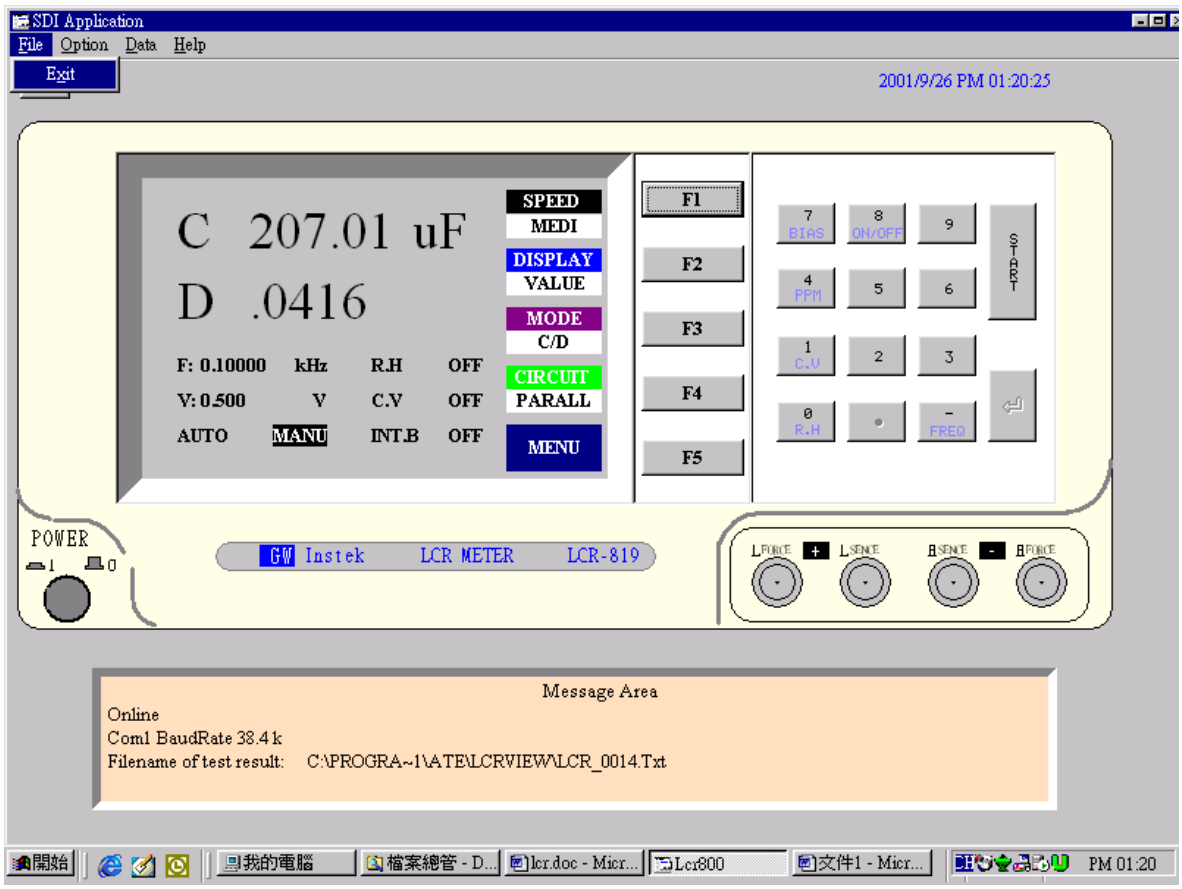
Figure 8-5



8-2. RS232 VIEW Software Operation

1) File

Press Exit（Figure 8-6）, or press Power to leave the program.



2) Option Settings:

Port: There are three Ports available for selection: Com1, Com2 and Com3. The default value is Com1.

Baud rate: There are five Baud rates available for selection: 9600, 19200, 38400, 57600 and 115200. The default value is 38400。

Digital Word
Format: 8 Data bits, no parity, 1 stop bit. These settings cannot be altered, (Figure 8-7).

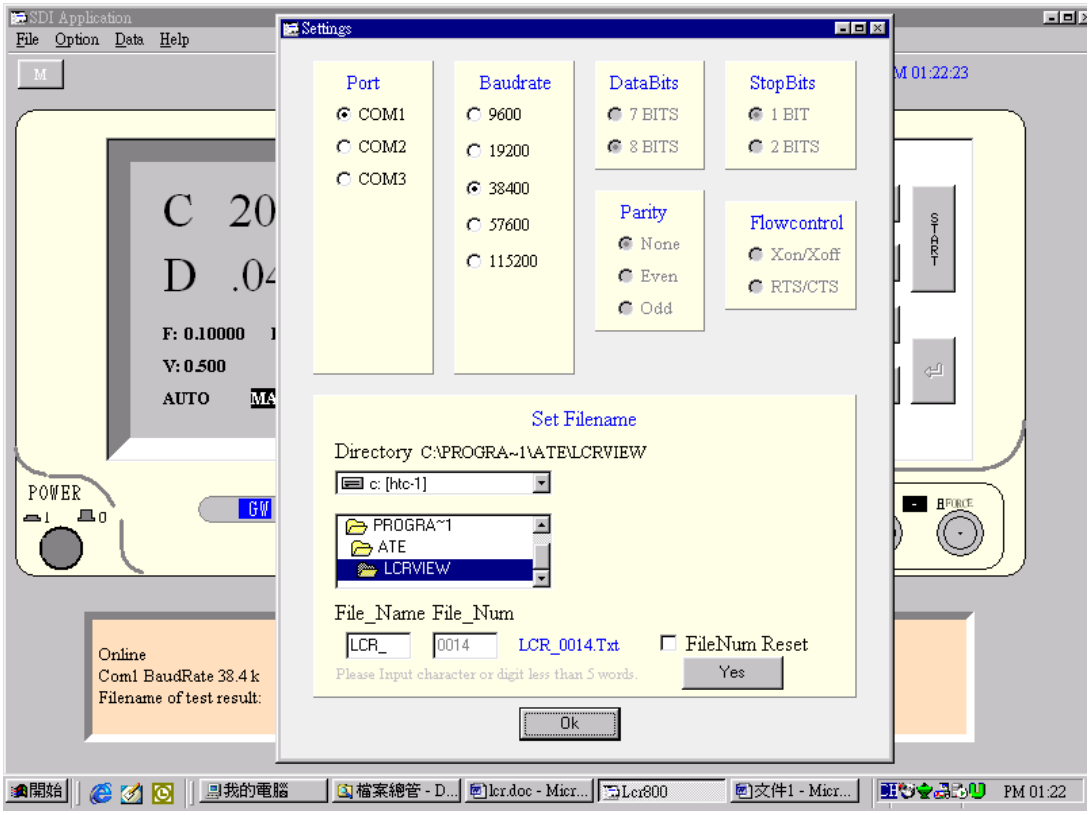


Figure 8-7

3) Set Filename

This filename setting is the route for saving test result.
Driver: Set driver。
Directory: Set directory。

File_Name: Set file name with 4 letters or 4 numbers.

File_Num: Set 4 digits of file number from 0001 to 9999. When the recorded test results data reaches 10000 readings, it can be stored with a file number.

Test Result	File_Name	File_Num	Filename
1-10000	LCR_	0001	LCR_0001.Txt
10001-20000	LCR_	0002	LCR_0002.Txt
20001-30000	LCR_	0003	LCR_0003.Txt
30001-40000	LCR_	0004	LCR_0004.Txt
40001-50000	LCR_	0005	LCR_0005.Txt
50001-60000	LCR_	0006	LCR_0006.Txt
99980001-99990000	LCR_	9999	LCR_9999.Txt

FileNum Reset (refer to the following figure): File_Num is 0001.

Ps. File_Num will continue from last file number of test results. If last file number ends at 0006, the next file number is starts from 0007 when power is next applied to the instrument.

To start from 0001, reset the FileNum (refer to Figure 8-8).

Figure 8-8

4) Data Result :

Display test results. When the test results count reaches 10,000, it will be stored in a file automatically. If you want to store less than 10,000 results, you must exit the LCR-VIEW first (the data will be stored automatically), then start the LCR-VIEW again to begin another recording of test result data. Refer to Figure 8-9 and 8-10.

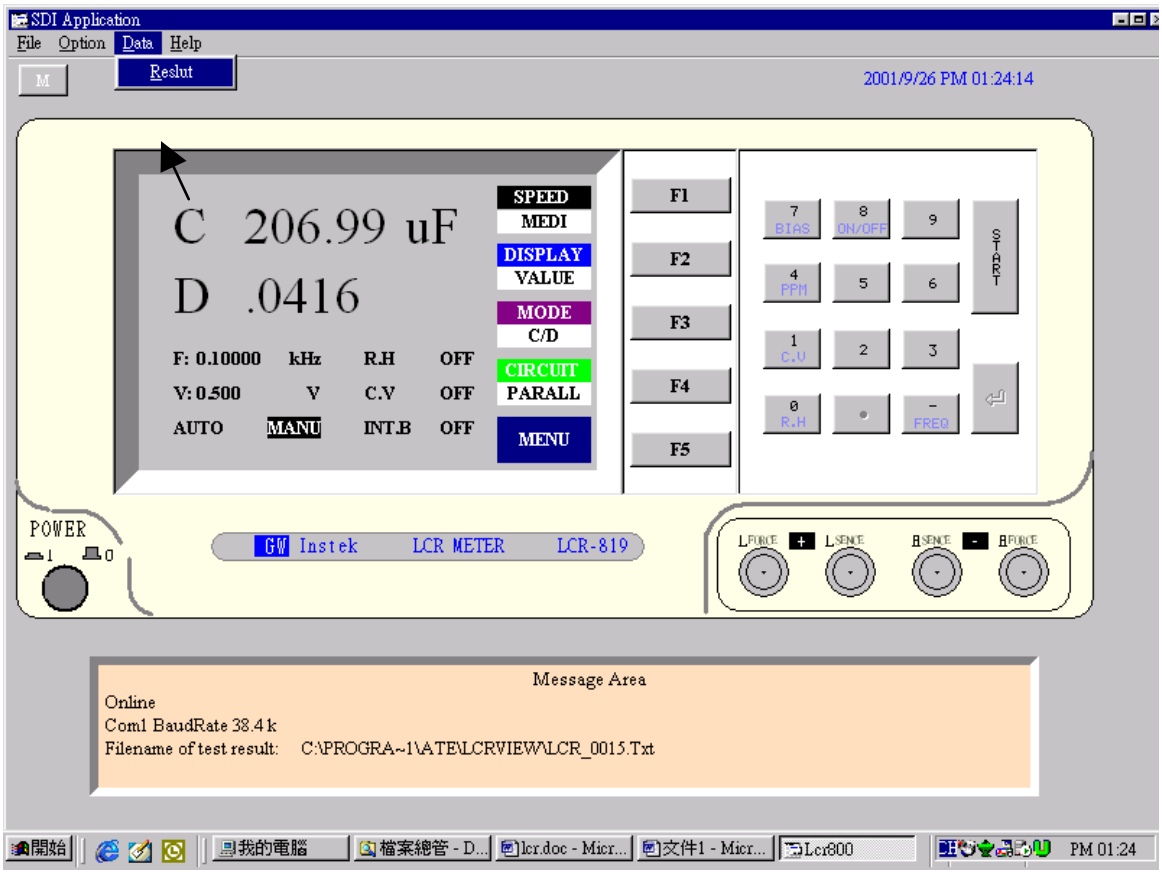


Figure 8-9

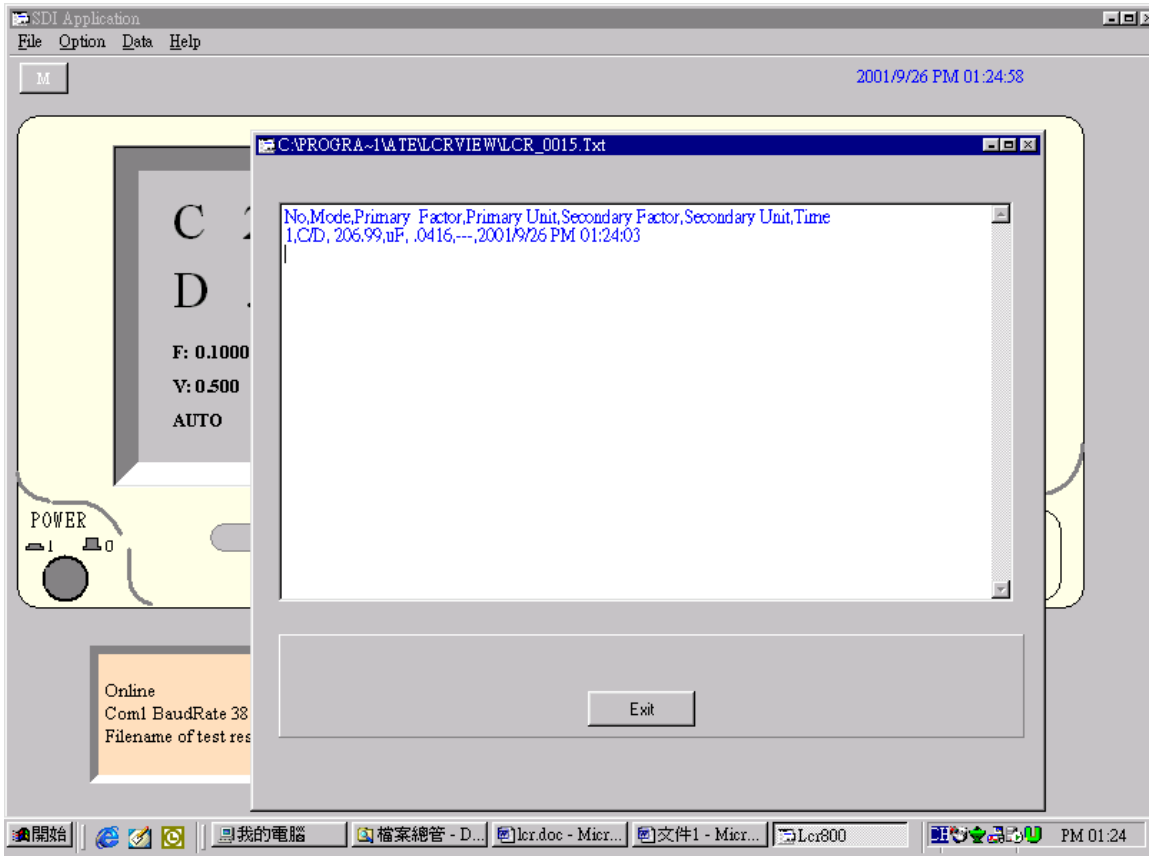
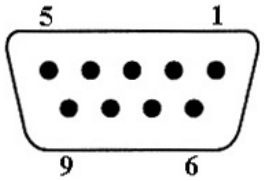

SDI Application
File Option Data Help
M
2001/9/26 PM 01:24:58
C:\PROGRA~1\ATE\LCRVIEW\LCR_0015.Txt
No,Mode,Primary Factor,Primary Unit,Secondary Factor,Secondary Unit,Time
1,C/D, 206.99,uF, .0416,---,2001/9/26 PM 01:24:03
F: 0.1000
V: 0.500
AUTO
POWER
Online
Com1 BaudRate 38
Exit
開始
我的電腦
檔案總管 - D...
lcr.doc - Micr...
文件1 - Micr...
Lcr800
PM 01:24

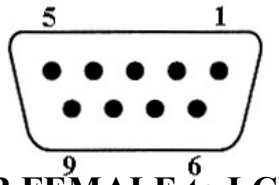
Figure 8-10

8-3. Data cable configuration:

Use the cable between DCE and DTE.



9 PIN D-SUB FEMALE to Computer (D-SUB1)



9 PIN D-SUB FEMALE to LCR Meter (D-SUB2)

	D-SUB 1	D-SUB 2	
Receive Data	2	3	Transmit Data
Transmit Data	3	2	Receive Data
Data Terminal Ready	4	6+1	Data Set Ready + Carrier Detect
System Ground	5	5	System Ground
Data Set Ready + Carrier Detect	6+1	4	Data Terminal Ready
Request to Send	7	8	Clear to Send
Clear to Send	8	7	Request to Send