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SAFETY TERMS AND SYMBOLS

These terms may appear in this manual or on the product:

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 this product or other property.

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

| DANGER	ATTENTION	Protective	Earth (ground)
High Voltage	refer to Manual	Conductor Terminal	Terminal

FOR UNITED KINGDOM ONLY

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

⚠ WARNING: THIS APPLIANCE MUST BE EARTHED

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

Green/ Yellow:	Earth
Blue:	Neutral
Brown:	Live (Phase)
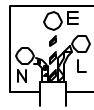
As the colours of the wires in main leads may not correspond with the
colours marking identified in your plug/appliance, proceed as follows:

The wire which is coloured Green & Yellow must be connected to the Earth

terminal marked with the letter E or by the earth symbol ⏚ or coloured

Green or Green & Yellow.

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

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

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

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

EC Declaration of Conformity

We

GOOD WILL INSTRUMENT CO., LTD.

No. 95-11, Pao-Chung Rd., Hsin-Tien City, Taipei Hsien, Taiwan

declares that the below mentioned product

LCR-817/819/827/829/816/826

are herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Law of Member States relating to Electromagnetic Compatibility (89/366/EEC, 92/31/EEC, 93/68/EEC) and Low Voltage Equipment Directive (73/23/EEC).

For the evaluation regarding the Electromagnetic Compatibility and Low Voltage Equipment Directive, the following standards were applied:

EN 61326-1: Electrical equipment for measurement, control and laboratory use — EMC requirements **(1997+A1: 1998)**	
Conducted and Radiated Emissions EN 55011 Group I class A: 1998	Electrostatic Discharge EN 61000-4-2: 1995
Current Harmonic EN 61000-3-2: 2000	Radiated Immunity EN 61000-4-3: 1996
Voltage Fluctuation EN 61000-3-3: 1995	Electrical Fast Transients EN 61000-4-4: 1995

v

2. PRECAUTIONS BEFORE OPERATION

2-1. Unpacking the instrument

The product has been fully inspected and tested before shipping from the factory. Upon receiving the instrument, please unpack and inspect it to check if there are any damages caused during transportation. If any damage is found, notify the bearer and/or the dealer immediately.

2-2. Checking the Line Voltage

The LCR Meters can be operated with AC power source between 100V rated voltage and 240V rated voltage at a frequency of 50 to 60Hz, no AC voltage selector is necessary. Power connection to rear panel is through an AC inlet module comprised of an AC connector and fuse holder. To change the fuse proceed as follows:

- Remove the fuse holder by inserting a small flat head 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.

⚠ **WARNING. To avoid electrical shock the power cord protective grounding conductor must be connected to ground.**

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

2-3. Environment

The normal ambient temperature range of the LCR Meters is from 10° to 50°C. To operate the instrument over this specific temperature range may cause damage to the circuits.

Do not use the LCR Meters in a place where strong magnetic or electric field exists as it may disturb the measurement.

2-4. Equipment Installation and Operation

Ensure there is proper ventilation for the vents in the LCR meters 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. PANEL DESCRIPTION

(1). **Power Switch**

      Turns AC Power on or off.

(2). Function key

(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 or Dissipation or ESR or 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 th e LCR Meters   BIAS

Lforce (current, low)

4. OPERATION

4-1. Connects to DUT

The LCR Meters utilize the structure of four wires measurement which allows accurate, easy, and stable measurements and avoids mutual inductance and interference from measurement signals, noise and other factors inherent with other types of connections. For the accuracy of measurement, GOODWILL produces the cable set and test fixture (option) for connection directly to the front panel BNC connectors.

4-2. Start-Up

Connects the power cord of the LCR Meters to the mains socket -outlet. Presses the **POWER** button of front panel to apply the AC power to the LCR Meters.

4-3. Zeroing

In order to eliminate strayed capacitance and impedance of test cable during the measurement, the LCR Meters should be zeroed to correct for test cable and/or test fixture errors before taking measurements. The corrections are calculated and stored in memory of the LCR Meters during the zeroing process. Open and short circuit zeroing should be done for test cable and/or test fixture. For the best accuracy, the test cable and/or test fixture should be zeroed once per day at least and each time test cable or test fixture is changed in general.

The zeroing process of open and short circuits are following:

Open Circuit
- The test cable or test fixture should be 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 monitor.).

- After the BAR at the bottom of LCD monitor is filled to the full, the zeroing process is done.
- If the zeroing process is successful, a message of "OK" will appear on the LCD monitor. If failed, a message of "FAIL" will appear on the LCD monitor.

Short Circuit
- The test cable should be connected or 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 monitor.).
- After the BAR at the bottom of LCD monitor is filled fully, the zeroing process is done.
- If the zeroing process is successful, a message of "OK" will appear on the LCD monitor. If failed, a message of "FAIL" will appear on the LCD monitor.

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: The "Open Circuit" and "Short Circuit" have to pass the test, otherwise, the accuracy of the LCR Meters will become worse.

```
┌─────────────────────────────────┐
│  L 1.2345H        ┌─────────┐    │
│                   │  SPEED  │    │
│                   │  SLOW   │    │
│  Q 0.6789         ├─────────┤    │
│                   │ DISPLAY │    │
│                   │  VALUE  │    │
│                   ├─────────┤    │
│       TESTING     │  MODE   │    │
│                   │  L/Q    │    │
│                   ├─────────┤    │
│  F : 1.000 kHz  R.H OFF │CIRCUIT││
│                   │ SERIES  │    │
│  V : 1.000 V    C.V OFF │       ││
│                   ├─────────┤    │
│        MANU  INT.B OFF  │ MENU ││
│                   └─────────┘    │
└─────────────────────────────────┘
```

Press menu key

```
┌─────────────────────────────────┐
│                                  │
│  CAP. R/L OFFSET   ┌─────────┐   │
│                    │ OFFSET  │   │
│                    └─────────┘   │
│  SET SORT          ┌─────────┐   │
│                    │  SORT   │   │
│                    └─────────┘   │
│  SET PARAMETER     ┌─────────┐   │
│                    │ SETTING │   │
│                    └─────────┘   │
│  CALIBRATION       ┌─────────┐   │
│                    │ CALBRAT │   │
│                    └─────────┘   │
│                    ┌─────────┐   │
│                    │  EXIT   │   │
│                    └─────────┘   │
└─────────────────────────────────┘
```

Press **F1** key to the zeroing menu

```
┌─────────────────────────────────┐
│                                  │
│  OPEN TEST         ┌─────────┐   │
│                    │   CAP   │   │
│                    │ OFFSET  │   │
│                    ├─────────┤   │
│  SHORT TEST        │   R/L   │   │
│                    │ OFFSET  │   │
│                    └─────────┘   │
│                                  │
│                                  │
│                    ┌─────────┐   │
│                    │  EXIT   │   │
│                    └─────────┘   │
└─────────────────────────────────┘
```

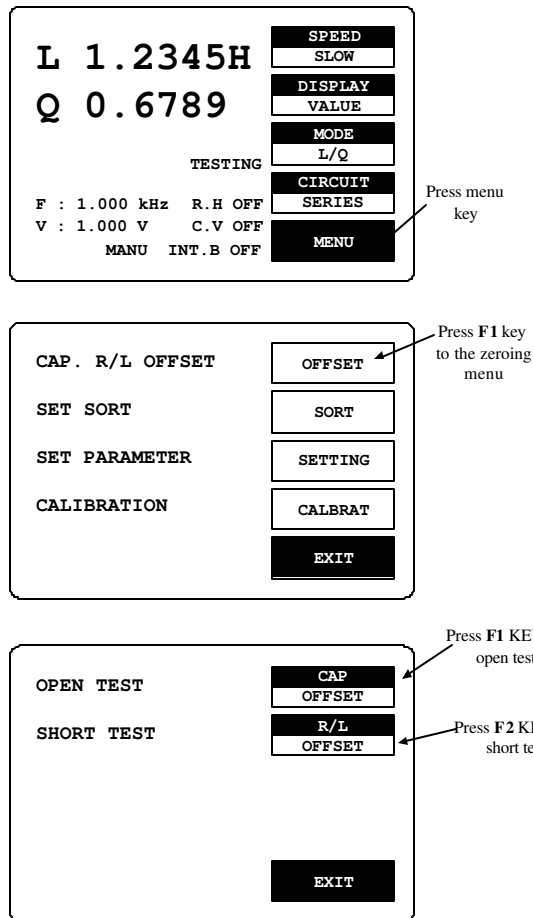Press **F1** KEY for open test

Press **F2** KEY for short test

Figure 4-1: Summary of zeroing menu

4-4. Menu Functions

All the LCR Meters' programmable functions are controlled by the easy to use menu displays. 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. User can enter one of four functions by pressing the corresponding function key (just adjacent LCD monitor, see figure 4-2).

```
┌─────────────────────────────────┐
│                                  │
│  CAP. R/L OFFSET   ┌─────────┐   │
│                    │ OFFSET  │   │
│                    └─────────┘   │
│  SET SORT          ┌─────────┐   │
│                    │  SORT   │   │
│                    └─────────┘   │
│  SET PARAMETER     ┌─────────┐   │
│                    │ SETTING │   │
│                    └─────────┘   │
│  CALIBRATION       ┌─────────┐   │
│                    │ CALBRAT │   │
│                    └─────────┘   │
│                    ┌─────────┐   │
│                    │  EXIT   │   │
│                    └─────────┘   │
└─────────────────────────────────┘
```

Press **F1** key to the zeroing menu

Press **F2** key to the bin sort menu

Press **F3** key to the utility menu

Press **F4** key to the calibration menu

Press **MENU** key to exit menu screen
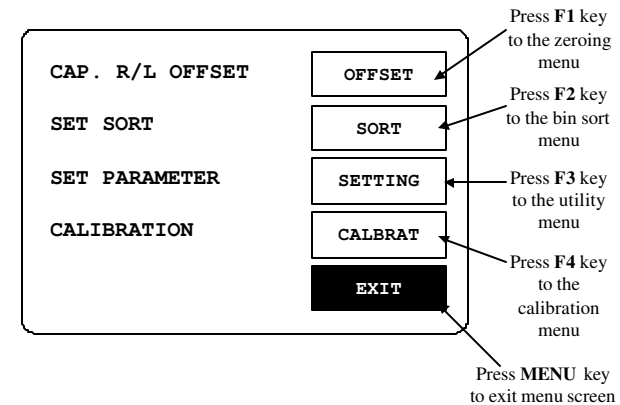
Figure 4-2: four main menu screen

4-4-1. Primary & Secondary Display

For the LCR Meters, four combinations of two parameters can be measured and displayed simultaneously. One referred 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**, and add L&R and Z &**? to LCR-821.** The parameter can be chosen by pressing **F3** key as shown in Figure 4-3.

```
┌─────────────────────────────────────┐
│                                       │
│  L 1.2345H      ┌─────────────┐      │
│                 │   SPEED     │      │
│                 │   SLOW      │      │
│  Q 0.6789       ├─────────────┤      │
│                 │  DISPLAY    │      │
│                 │   VALUE     │      │
│                 ├─────────────┤      │
│         TESTING │    MODE     │      │
│                 │    L/Q      │      │
│                 ├─────────────┤      │
│                 │  CIRCUIT    │      │
│  F : 1.000 kHz  R.H OFF       │ SERIES │
│                 ├─────────────┤      │
│  V : 1.000 V    C.V OFF       │ MENU  │
│  AUTO  MANU  INT.B OFF        │      │
└─────────────────────────────────────┘
```

12
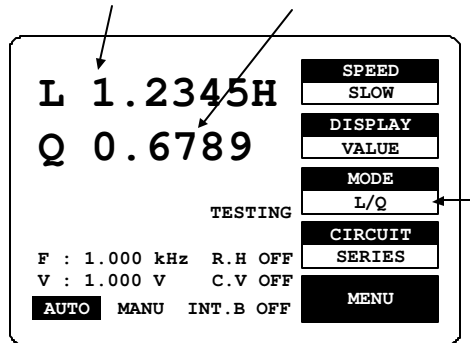
actual "ohmic" series resistance of the wire leads and foils that are in series with the heart of a capacitor physically, because ESR includes also the effect of dielectric loss. ESR is related to D by the formula: $ESR = Rs = D/\omega Cs$. Where ω represents "omega" = 2 pi time frequency.

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 being a better model of the inductor.
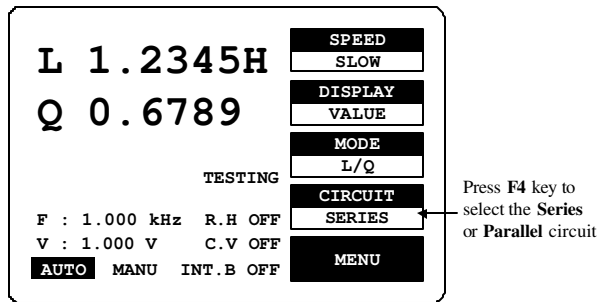

Figure 4-4. Selections of Series & Parallel Circuit

4-4-3. Measurement Displays

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

VALUE

The LCD monitor will display the measured value of both the primary and secondary parameter, shown with decimal and units. The resolution of primary display (L, C, R or Z) is five digits. The resolution of secondary display (D, Q or R with C) is four digits. The resolution of secondary display (?) is at 2 digits after decimal point. The message "TESTING" is displayed when a test is in process.

DELTA%

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

DELTA

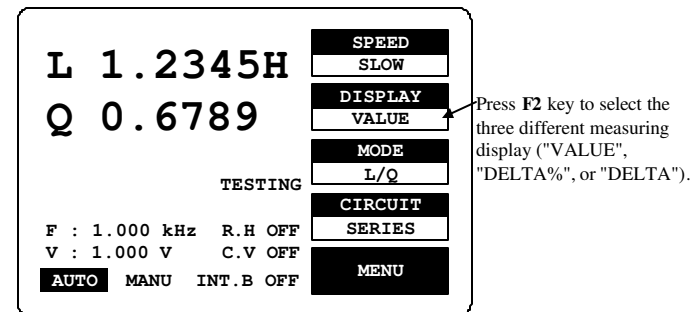The LCR difference is similar to the DELTA% except that the deviation is shown in suitable units (ohms, henries, etc).

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. Units are depended on which measurement displays 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 monitor).
● Input the nominal value via the numeral keys (5 digits with decimal maximum).
● Press ↵ key
● After the BAR at the bottom of LCD monitor is filled fully, the "Nominal Value" input is done

4-4-5. Selection of Measurement Speed

One of three measurement speeds **SLOW**, **MEDIUM**, or **FAST** could be selected (Figure 4-7). The continuous mode speeds are about 1, 5, and 12 measurement per second respectively. The trade-off is accuracy vs. speed. LCR-817/819 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.

* Regarding the models LCR -827 & 829, please refer to 4-6-2 Handler Interface Timing.
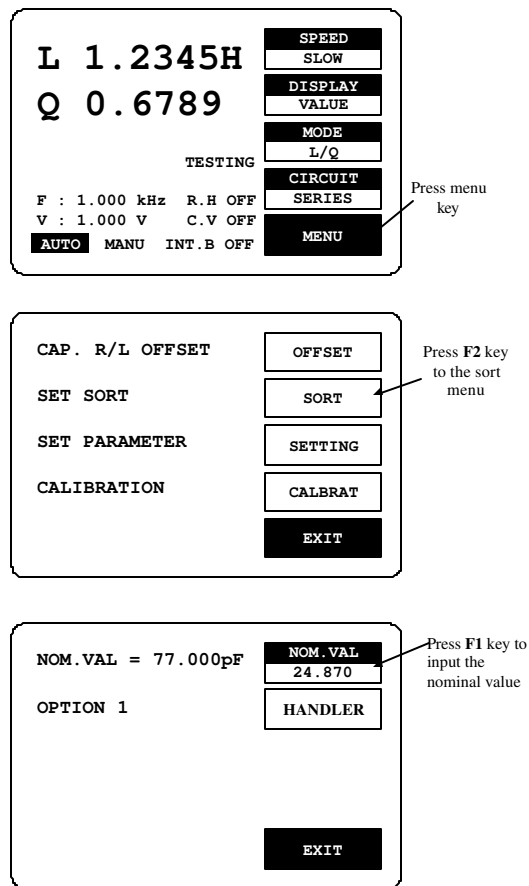
```
L 1.2345H        SPEED
                 SLOW
Q 0.6789         DISPLAY
                 VALUE
          TESTING MODE
                  L/Q
F : 1.000 kHz  R.H OFF   CIRCUIT
V : 1.000 V    C.V OFF   SERIES
AUTO  MANU  INT.B OFF    MENU
```

Press menu key

```
CAP. R/L OFFSET    OFFSET

SET SORT           SORT

SET PARAMETER      SETTING

CALIBRATION        CALBRAT


                   EXIT
```

Press **F2** key to the sort menu

```
NOM.VAL = 77.000pF    NOM.VAL
                      24.870

OPTION 1              HANDLER




                      EXIT
```

Press **F1** key to input the nominal value

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

Press **F1** key to select the three different measurement speed. (SLOW, MEDIUM, or FAST)

```
L 1.2345H        SPEED
                 SLOW
Q 0.6789         DISPLAY
                 VALUE
          TESTING MODE
                  L/Q
F : 1.000 kHz  R.H OFF   CIRCUIT
V : 1.000 V    C.V OFF   SERIES
AUTO  MANU  INT.B OFF    MENU
```
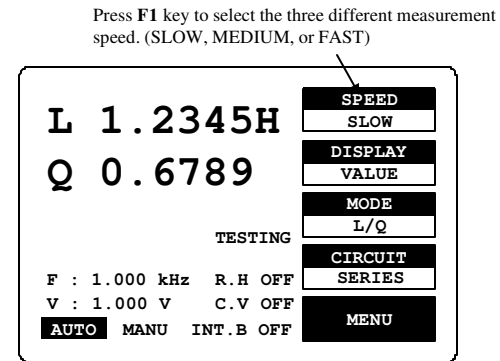
Figure 4-7. Selection of measurement speed

4-5. Measurement Conditions

4-5-1. Bias Voltage

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

Internal:

An internal DC 2 volts bias voltage will apply 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 bias voltage has to be floating, don't connect either side to ground. It's better to wait approximately 1 second for taking a reading after initiating a testing process, therefore, the device under test will stabilize after bias voltage applied. The DC bias voltage should be applied only to capacitors in general. If the DC bias voltage is applied to device of low impedance, the unreliable testing results will occur.

Press the numerical **7** key to select either internal or external bias voltage

Press the numerical **8** key to turn either internal or external bias voltage on or off.

```
  ╭─────╮  ╭──────╮  ╭─────╮   ╭───╮
  │  7  │  │  8   │  │  9  │   │ S │
  │ BIAS│  │ON/OFF│  │     │   │ T │
  ╰─────╯  ╰──────╯  ╰─────╯   │ A │
                               │ R │
  ╭─────╮  ╭──────╮  ╭─────╮   │ T │
  │  4  │  │  5   │  │  6  │   ╰───╯
  │ PPM │  │      │  │     │
  ╰─────╯  ╰──────╯  ╰─────╯

  ╭─────╮  ╭──────╮  ╭─────╮   ╭───╮
  │  1  │  │  2   │  │  3  │   │ ↵ │
  │ C.V │  │      │  │     │   │   │
  ╰─────╯  ╰──────╯  ╰─────╯   ╰───╯

  ╭─────╮  ╭──────╮  ╭─────╮
  │  0  │  │  .   │  │ FREQ│
  │ R.H │  │      │  │     │
  ╰─────╯  ╰──────╯  ╰─────╯
```

```
L 1.2345H            ┌──────────┐
                     │  SPEED   │
                     │  SLOW    │
Q 0.6789             ├──────────┤
                     │ DISPLAY  │
                     │  VALUE   │
                     ├──────────┤
             TESTING │   MODE   │
                     │   L/Q    │
                     ├──────────┤
F : 1.000 kHz  R.H OFF│ CIRCUIT │
                     │  SERIES  │
V : 1.000 V    C.V OFF├──────────┤
AUTO   MANU   INT.B OFF│  MENU   │
                     └──────────┘
```

20
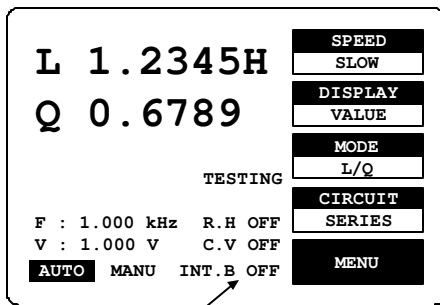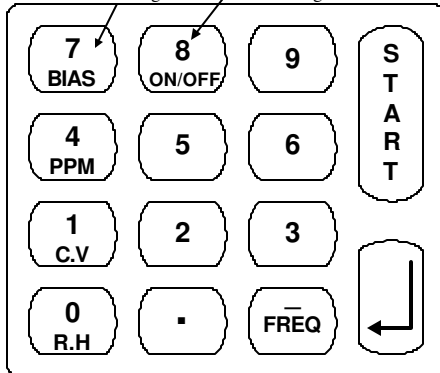
circuit" must be done again for the best accuracy.

```
   ┌───────────────────────────────────┐
   │  ┌─────┐  ┌─────┐  ┌─────┐  ┌───┐  │
   │  │  7  │  │  8  │  │  9  │  │ S │  │
   │  │ BIAS│  │ON/OFF│ │     │  │ T │  │
   │  └─────┘  └─────┘  └─────┘  │ A │  │
   │                             │ R │  │
   │  ┌─────┐  ┌─────┐  ┌─────┐  │ T │  │
   │  │  4  │  │  5  │  │  6  │  └───┘  │
   │  │ PPM │  │     │  │     │         │
   │  └─────┘  └─────┘  └─────┘         │
   │                                    │
   │  ┌─────┐  ┌─────┐  ┌─────┐  ┌───┐  │
   │  │  1  │  │  2  │  │  3  │  │ ↵ │  │
   │  │ C.V │  │     │  │     │  │   │  │
   │  └─────┘  └─────┘  └─────┘  │   │  │
   │                             │   │  │
   │  ┌─────┐  ┌─────┐  ┌─────┐  └───┘  │
   │  │  0  │  │  .  │  │ FREQ│         │
   │  │ R.H │  │     │  │     │         │
   │  └─────┘  └─────┘  └─────┘         │
   └───────────────────────────────────┘
```
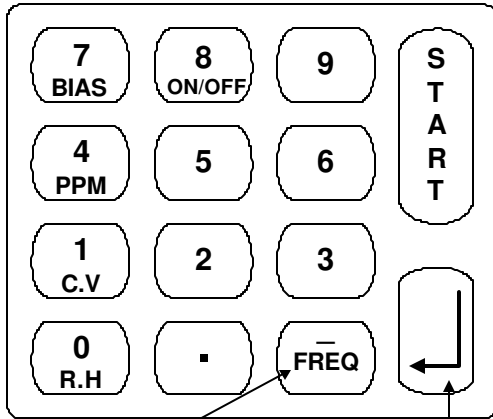
Press - key to input test frequency

Press enter key to confirm the inputs.

```
┌───────────────────────────────────┐
│                     ┌─────────────┐│
│  L 1.2345H          │   SPEED     ││
│                     │    SLOW     ││
│                     ├─────────────┤│
│  Q 0.6789           │  DISPLAY    ││
│                     │   VALUE     ││
│                     ├─────────────┤│
│                     │   MODE      ││
│           TESTING   │    L/Q      ││
│                     ├─────────────┤│
│                     │  CIRCUIT    ││
│  F : 1.000 kHz  R.H OFF │ SERIES  ││
│  V : 1.000 V    C.V OFF ├─────────┤│
│  ┌────┐              │            ││
│  │AUTO│ MANU  INT.B OFF│  MENU    ││
│  └────┘              │            ││
└───────────────────────────────────┘
```

```
L 1.2345H              SPEED
                       SLOW
Q 0.6789              DISPLAY
                       VALUE
                        MODE
            TESTING      L/Q
                       CIRCUIT
F : 1.000 kHz   R.H OFF SERIES
V : 1.000 V     C.V OFF
 AUTO  MANU  INT.B OFF  MENU
```
Press menu key

Test Voltage

```
CAP. R/L OFFSET        OFFSET

SET SORT                SORT

SET PARAMETER          SETTING

CALIBRATION            CALBRAT

                        EXIT
```
Press **F3** key to the setting menu

```
MOMORY NO: 1           MOMORY
                         1
VOLTAGE = 1.000 V       VOLT
                        1.000
AVERAGE = 1             AVGE
                         1



                        EXIT
```
Press **F2** key to input the desired test voltage

Figure 4-10. Programming of test voltage.

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4-5-6. Range Hold

If a DUT is removed from the test cable or fixture during the "Continuous" mode, the feature of "Range Hold" can avoid range switching. Due to the test time can be reduced, "Range Hold" is a useful utility for repetitive devices measurement. User can just press compound key **0** to select the feature of "Range Hold". To disable this feature, press the same key again.

4-5-7. Averaging

If this function is enable, the testing time will multiple by the number of tests (from 1 to 255). Hence, the accuracy can be enhanced. The measurement time will be increased to the contrary. 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
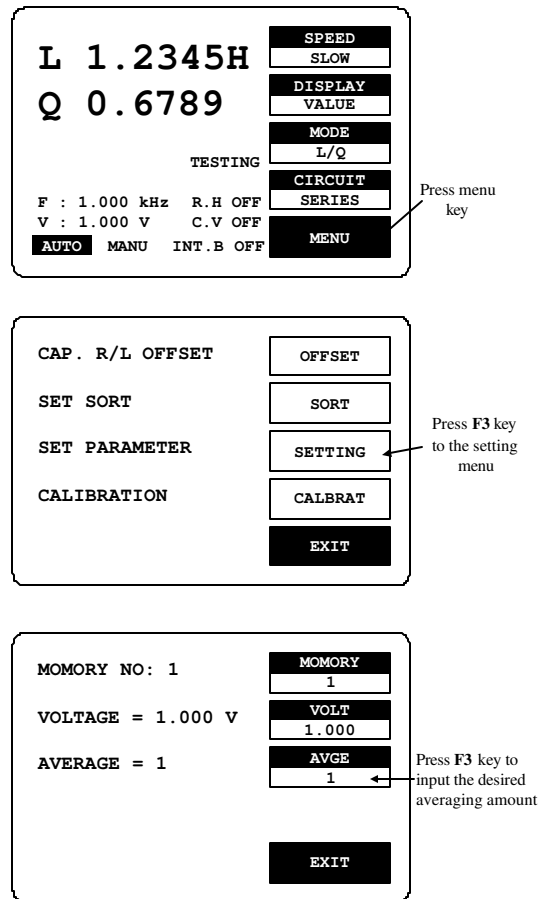- After the BAR at the bottom of LCD monitor is filled to the full, the "Averaging" input is done.

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```
L 1.2345H          SPEED
                   SLOW
Q 0.6789          DISPLAY
                   VALUE
                    MODE
          TESTING    L/Q
                   CIRCUIT
F : 1.000 kHz  R.H OFF  SERIES          Press menu
V : 1.000 V    C.V OFF                      key
 AUTO  MANU  INT.B OFF   MENU
```

```
CAP. R/L OFFSET    OFFSET

SET SORT            SORT              Press F3 key
                                      to the setting
SET PARAMETER      SETTING               menu

CALIBRATION        CALBRAT

                    EXIT
```

```
MOMORY NO: 1       MOMORY
                     1
VOLTAGE = 1.000 V    VOLT
                    1.000
AVERAGE = 1         AVGE          Press F3 key to
                     1            input the desired
                                  averaging amount

                    EXIT
```

Figure 4-11. Programming of averaging.

4-5-8. Memory

The LCR Meters have two memory functions: Recall and Store. The current measurement conditions can be saved into the memory unit or recalled a previously saved measurement conditions set from the LCR Meters memory. There are 100 memory blocks totally. The programming of "Memory Store / Recall" can be used 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 LCD monitor is filled to the full, the process of "Memory Store/Recall" is done.

Remark: For LCR-827/829, the function of Recall and Store is not only used in the normal memory status, also it can be extended to sorting and BIN-SUM setting.
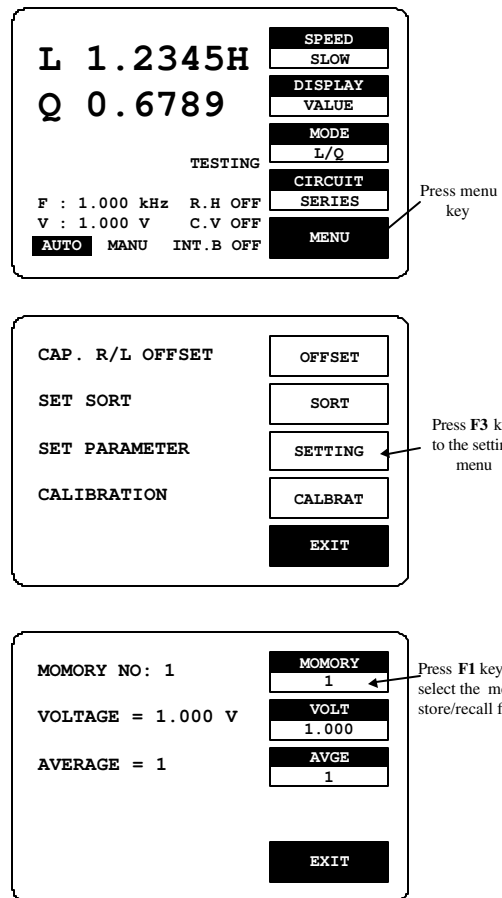
```
L 1.2345H        SPEED
                 SLOW
Q 0.6789         DISPLAY
                 VALUE
        TESTING  MODE
                 L/Q
F : 1.000 kHz  R.H OFF   CIRCUIT
V : 1.000 V    C.V OFF   SERIES
AUTO  MANU  INT.B OFF    MENU
```

Press menu key

```
CAP. R/L OFFSET      OFFSET

SET SORT             SORT

SET PARAMETER        SETTING

CALIBRATION          CALBRAT

                     EXIT
```

Press **F3** key to the setting menu

```
MOMORY NO: 1         MOMORY
                     1
VOLTAGE = 1.000 V    VOLT
                     1.000
AVERAGE = 1          AVGE
                     1

                     EXIT
```

Press **F1** key to select the memory store/recall function

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

Press compound key **1** to select the memory recall function

Press compound key **2** to select the memory store function

```
(1)RECALL:(2)STORE   MOMORY
                     1
VOLTAGE = 1.000 V    VOLT
                     1.000
AVERAGE = 1          AVGE
                     1

                     EXIT
```

Input number of desired memory block for memory recall function

```
RECALL NO:           MOMORY
                     1
VOLTAGE = 1.000 V    VOLT
                     1.000
AVERAGE = 1          AVGE
                     1

                     EXIT
```

Input number of desired memory block for memory store function

```
STORE NO:            MOMORY
                     1
VOLTAGE = 1.000 V    VOLT
                     1.000
AVERAGE = 1          AVGE
                     1

                     EXIT
```

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

4-5-9. Handler Interface(Only for LCR -826/827/829)

FUNCTION	HANDLER INTERFACE	
	Signal Name	Pin NO.
Start Measurement (I)	/I_E_TRIG	24
End of test (O)	/O_EOM	23
Data acquisition over , DUT removal OK.(O)	/O_INDEX	22
RLC FAIL(O)	/O_P_HI	19
	/O_P_LO	20
	/O_P_OVER	15
No-Go , D or Q Fail	/O_S_REJ	21
	/O_S_OVER	14
Go , BIN 1 Judgement	/O_BIN_ 1	1
Go , BIN 2 Judgement	/O_BIN _2	2
Go , BIN 3 Judgement	/O_BIN _3	3
Go , BIN 4 Judgement	/O_BIN_ 4	4
Go , BIN 5 Judgement	/O_BIN_ 5	5
Go , BIN 6 Judgement	/O_BIN_ 6	6
Go , BIN 7 Judgement	/O_BIN_ 7	7
Go , BIN 8 Judgement	/O_BIN_ 8	8
Go , BIN 9 Judgement	/O_BIN_ 9	9
Go , BIN 10 Judgement	/O_BIN_10	10
Go , BIN 11 Judgement	/O_BIN_ 11	11
Go , BIN 12 Judgement	/O_BIN_ 12	12
Go , BIN 13 Judgement	/O_BIN_ 13	13
Panel Lock	/I_K_LOCK	25
GND	GND	16,18
VCC	VCC	17

Handler Interface Typical Electrical Characteristics				
Comparison Signals	Voltage Output Rating		Maximum Current	Note
	Low	High		
/BIN1-/BIN9				
/AUX_BIN				
/OUT_OF_BIN		*	*	
/PHI				

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- **Measurement Complete signal:**

  /O_INDEX: This signal will go the low level when analog measurement is completed and will go the high level when next trigger is active. The handler can then remove the DUT from the fixture and replace it with another DUT during the time when **/O_INDEX** is at low level.

- **Compare Output Signals:**

  /O_BIN_1 - /O_BIN_13 : The GO judgment is active according to the measured value judgment results (low level), for example, if the comparator assigns a component to BIN1, the /O_BIN_1 line will go the low level till **T4** (see Handler Interface Timing). /O_BIN_2 - /O_BIN_13 are all inactive (high level).

  /O_P_HI: Main parameter failure: When the main parameter is greater than **Max,** it will go the low level till **T4** (see Handler Interface Timing).

  /O_P_LO: Main parameter failure: When the main parameter is lower than **Min,** it will go the low level till **T4**(see Handler Interface Timing).

  /O_P_OVER: It will go the low level when main parameter is greater than **Max** or is lower than **Min**.

  /O_S_REJ,/O_S_OVER: It will go the low level when secondary is greater than **D_Max** (if MODE=C/D) or is lower than **D_Min**.

- **Judgment Complete Signal**

  /O_EOM: This signal becomes active (low level) when the measurement and comparator judgment are completed, and all handler interface output are stable. It will go the high level when next trigger Signal (**/I_E_TRIG**) becomes active (low edge).

4-5-10. Handler Interface Timing(only for LCR-826/827/829)
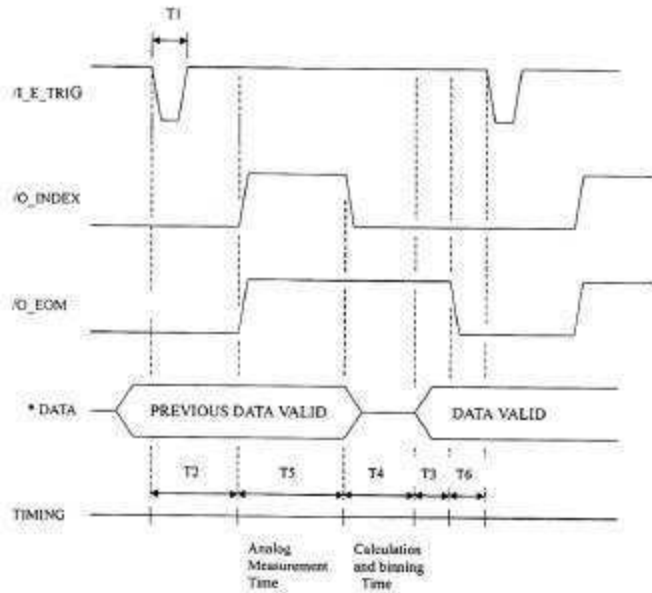
* DATA:/O_BIN_1 - _BIN_13,/O_P_OVER,/O_S_OVER,/O_S_REJ,/O_P_HI,/O_P_LO

	Time	Minimum Value	Maximum Value
T1	Trigger Pulse Width	5 us	
T2	Measurement Start Delay Time	140 us	
T3	/EOM Delay Time After Data Output	5 us	
T4	Calculation and binning Time	6 ms	

SPEED	Analog Measurement Time(T5)						Trigger Wait Time After /EOM Output (T6)		
	0.012kHz	0.1kHz	0.12kHz	1kHz	10kHz	100kHz	OFF	BIN	VALUE
SLOW	817ms	901ms	901ms	903ms	873ms	873ms	2ms	4ms	16ms
MEDIUM	817ms	125ms	105ms	59ms	53ms	53ms	2ms	4ms	16ms
FAST	817ms	125ms	103ms	27ms	17ms	17ms	2ms	4ms	16ms

ACCURACY MODEL	FAST	MEDIUM	SLOW
LCR-827 LCR-829 LCR-826	0.5%	0.2%	0.1%

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), **Impedance (|Z|), Phase angle of Impedance [degree] (?).**

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, Z/?, L/R.

Display Ranges:

Primary Display

Inductance (L)   : 0.00001mH

*For LCR-826/827/829, please refer to 4-5-10. Handler Interface Timing.

Equivalent Circuit:

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

* When select Z/? mode, the PARALLEL circuit is invalid. Please refer to 4-4-2. Series & Parallel Equivalent Circuit from page   for details.

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 the START keypad, the measured result is holding on the LCD monitor until next measurement started.

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 keypad is depressed again.

Test Voltage:

The test voltage range for LCR-817/819/827/829 is from 5mV to 1.275V, each step is 5mV, for LCR-816/826 is from 0.1V to 1.275V, each step is 5mV.

Memory:

100 memory blocks totally.

DC Bias:

A 2V internal bias can apply to capacitors during measurement.

Up to 30VDC external bias can apply to capacitors during measurement via the two terminals (located on the rear panel). The applied current should not over 200mA.

* The external bias specified on the rear panel is at 30VDC, actually, it can be tolerated to 35VDC.

LCD monitor:

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

Battery:

DC source for system memory and calibration data backup, a replaceable 3V lithium battery (BR-2/3A type) which probably needs to be replaced after using for 3 years.

After the battery is replaced, the LCR Meters have to be re-calibrated!

Operation Environment:

Indoor use,

Altitude up to 2000M

Installation Category Ⅱ

Pollution Degree   2

Operating temperature: 10

The Error value of LCR-817/819 (Double the error value for LCR-827/829/816/826)

- The formula for primary readout accuracy of C, R, L, **L and Z**.

C: 0.03% + 0.02% [(1+Ka)$^{\#}$ or (X/Ymax)$^{\#}$ or (Ymin/X)$^{\#}$] (1+

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Table A: (for range 1,2,3) –Kc

Voltage   0.03

Frequency

6. MESSAGE CODE

This section describes the message code for the LCR Meters.

OVER-01

<u>Cause:</u>

1. If the impedance of "Device-under-test" is small than the existing measurement range of the LCR Meters, the "OVER-01" message will be displayed on the LCD monitor.

    Calculation formula:

    Capacitance: XC=1/2

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7-3. Recall Calibration

When the measured value is inaccurate, you can use the Recall Calibration function to rework by proceeding the steps as follows:

- Press **MENU** key. (Figure 7-1)
- Press **F3** key to select "SET PARAMETER" function.

8. OPTION 1

8-2. BIN setting conditions:

MODE setting

F setting (FREQUENCY):

- Press F1/F2 key to select the white inverted characters "F".
- Key-in testing frequency through panel keyboard.
- Press ↵ key shown as Figure 8-6 below. For further details, please refer to 4-5-2

Figure 8-6

V setting (VOLTAGE)

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RANGE setting:

● Press F1/F2 key to select the white inverted characters "RANGE".

● PressF3 or F4 key to select up or down value within 1~4 range shown as Figure 8-10 below.

```
┌─────────────────────────────────┐
│  SET BIN    BIN SUM    ┌──────┐  │
│  MODE:C/D    CIRCUIT:SER. │  ↑   │  │
│  SPEED:SLOW DISPLAY:BIN └──────┘  │
│       C          D     ┌──────┐  │
│                        │  ↓   │  │
│    BIN                 └──────┘  │
│                        ┌──────┐  │
│                        │  UP  │  │
│  F:1.0000kHz MANU      └──────┘  │
│  V:1.000 V    INT.B OFF ┌──────┐ │
│  █RANGE█:1      C.V : OFF│ DOWN │ │
│                        └──────┘  │
│  DELAY:00000mS AVG : 1  ┌──────┐ │
│                        │ EXIT │  │
│                        └──────┘  │
└─────────────────────────────────┘
```
Press **F2** key to the RANGE

Press **F3** .**F4** key to select UP.DOWN
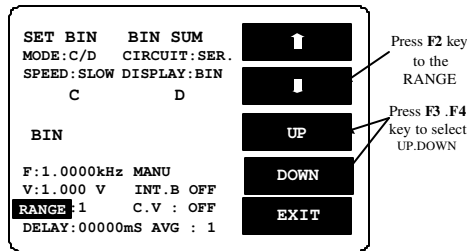
Figure 8-10

C.V setting:

● Press F1/F2 key to select the white inverted characters "C.V".

● Press F3 or F4 key to select ON or OFF shown as Figure 8-11 below. For further details, please refer to 4-5-5.

```
┌─────────────────────────────────┐
│  SET BIN    BIN SUM    ┌──────┐  │
│  MODE:C/D    CIRCUIT:SER. │  ↑   │  │
│  SPEED:SLOW DISPLAY:BIN └──────┘  │
│       C          D     ┌──────┐  │
│                        │  ↓   │  │
│    BIN                 └──────┘  │
│                        ┌──────┐  │
│                        │  ON  │  │
│  F:1.0000kHz MANU      └──────┘  │
│  V:1.000 V    INT.B OFF ┌──────┐ │
│  RANGE:1    █C.V█: OFF  │ OFF  │  │
│                        └──────┘  │
│  DELAY:00000mS AVG : 1  ┌──────┐ │
│                        │ EXIT │  │
│                        └──────┘  │
└─────────────────────────────────┘
```
Press **F2** key to the OFF

Press **F3** .**F4** key to select ON.OFF
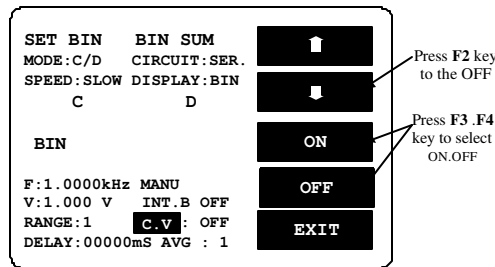
Figure 8-11

DELAY setting:

● Press F1/F2 key to select the white inverted characters "DELAY".

● Key-in Delay value(0~99999ms) through panel keyboard.
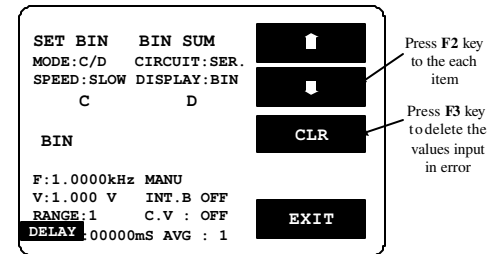
● Press ↵ key. Please refer to Figure 8-12 below.

```
┌─────────────────────────────────┐
│  SET BIN    BIN SUM    ┌──────┐  │
│  MODE:C/D    CIRCUIT:SER. │  ↑   │  │
│  SPEED:SLOW DISPLAY:BIN └──────┘  │
│       C          D     ┌──────┐  │
│                        │  ↓   │  │
│    BIN                 └──────┘  │
│                        ┌──────┐  │
│                        │ CLR  │  │
│  F:1.0000kHz MANU      └──────┘  │
│  V:1.000 V    INT.B OFF          │
│  RANGE:1      C.V : OFF ┌──────┐ │
│  █DELAY█:00000mS AVG : 1│ EXIT │  │
│                        └──────┘  │
└─────────────────────────────────┘
```
Press **F2** key to the each item

Press **F3** key to delete the values input in error

Figure 8-12

AVG setting:

● Press F1/F2 key to select the white inverted characters "AVG".

● Key-in average value through panel keyboard.

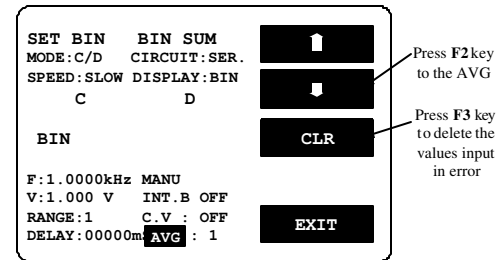● Press ↵ key shown as Figure 8-13 below. For further details, please refer to 4-5-7.

```
┌─────────────────────────────────┐
│  SET BIN    BIN SUM    ┌──────┐  │
│  MODE:C/D    CIRCUIT:SER. │  ↑   │  │
│  SPEED:SLOW DISPLAY:BIN └──────┘  │
│       C          D     ┌──────┐  │
│                        │  ↓   │  │
│    BIN                 └──────┘  │
│                        ┌──────┐  │
│                        │ CLR  │  │
│  F:1.0000kHz MANU      └──────┘  │
│  V:1.000 V    INT.B OFF          │
│  RANGE:1      C.V : OFF ┌──────┐ │
│  DELAY:00000m█AVG█ : 1  │ EXIT │ │
│                        └──────┘  │
└─────────────────────────────────┘
```
Press **F2** key to the AVG

Press **F3** key to delete the values input in error

Figure 8-13

8-3. BIN Range Setting: Component Sorting Range

The step for BIN setting: (Please refer to Figure 8-14)

- When the **SET BIN** inverts to white character, press **F3** key.
- Press **F3** key to select C or D sorting (The selected is a primary parameter, the other one is an assistant parameter.)
- BIN clear setting by pressing **F1** key.
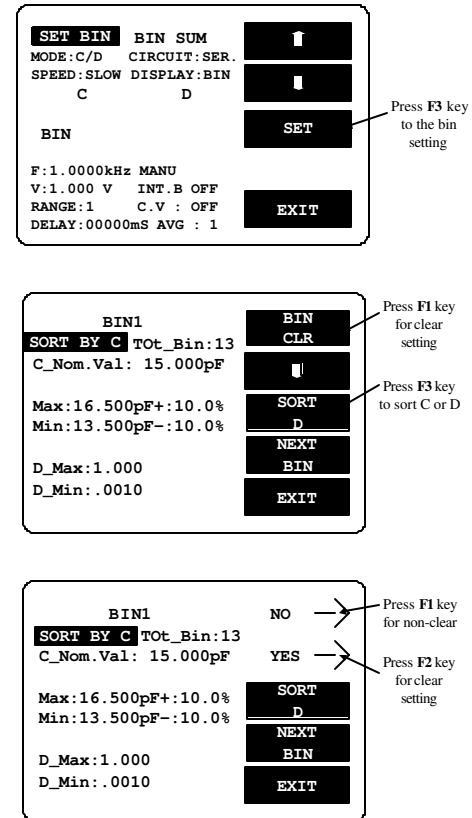- Press **F1** key to maintain setting, Press **F2** key to delete the setting.

Figure 8-14

Tot_BIN setting:

- Press F1/F2 key to select the white inverted characters "Tot_Bin".

- Key-in needed BIN value through panel keyboard.

- Press ↵ key. Please refer to Figure 8-15 below.

  Note: Tot_Bin setting: It can select ascending from 1 to 13 BIN the most.

  For example: If BIN1 sorting range is at

Figure 8-18

Min setting：

- Press F1/F2 key to select the white inverted characters "Min".

- Key-in SORT Min value through panel keyboard.

- Press ↵ key. Please refer to Figure 8-19 below.

The other BIN setting:

● When the BIN 1 setting is finished, press F4 key to continue the BIN 2 setting until all the Tot BIN setting is completed (BIN1~BIN13 the most), please refer to Figure 8-23.

Figure 8-23

TEST RESULT Display Summing-up:

● Press F1/F2 key to select the white inverted characters "BIN.SUM" (Figure 8-24).

● Press **F3** key to see the test result.

```
SET BIN  BIN SUM         ↑           PressF1.F2
MODE:C/D  CIRCUIT:SER                 key to the
SPEED:SLOW DISPLAY:BIN    ↓           BIN SUM
     C        D
                                      Press F3 key
  BIN                     SET         to the test
                                      result
F :1.0000kHz MANU
V :1.000 V  INT.B OFF
RANGE:1     C.V : OFF     EXIT
DELAY:00000mS AVG : 1
```

Figure 8-24

```
SORT BY C    NOM_VAL:15.000pF
D_MIN: .0010  D_MAX: 1.000
         TEST RESULT
FAIL_ITEM         TOTAL      NEXT
  PHI ( C >MAX )             PAGE
  PLO ( C <MIN )
  SREJ( D  NG )       2
  TOTAL               2               Press F4 to
                                      CLR
PASS_ITEM                    CLR.
BIN 1 - BIN 13
                             EXIT
```

Figure 8-25

```
SORT BY C    NOM_VAL:15.000pF
D_MIN: .0010  D_MAX: 1.000
         TEST RESULT
FAIL_ITEM         TOTAL      NEXT    Press F3 to
  PHI ( C >MAX )             PAGE    delete the
  PLO ( C <MIN )                     testing data
  SREJ( D  NG )       2     YES
  TOTAL               2             Press F4 to
                           NO       maintain the
PASS_ITEM                           testing data
BIN 1 - BIN 13
                             EXIT
```

Figure 8-26

```
SORT BY C    NOM_VAL:15.000pF
D_MIN: .0010  D_MAX: 1.000           Press F2 to
         TEST RESULT                 next page
FAIL_ITEM         TOTAL      NEXT
  PHI ( C >MAX )             PAGE
  PLO ( C <MIN )
  SREJ( D  NG )       2
  TOTAL               2
                             CLR.
PASS_ITEM
BIN 1 - BIN 13
                             EXIT
```

Figure 8-27

```
BIN   MIN pF   MAX pF    TOTAL       LAST
                                     PAGE
 1   13.500   16.500   999999
 2   12.750   17.250   999999
 3   12.000   18.000   999999
 4   11.250   18.750   999999
 5   10.500   19.500   999999
 6    9.750   20.250   999999
 7    9.000   21.000   999999
 8    8.250   21.750   999999
 9    7.500   22.500   999999
10    6.750   23.250   999999
11    6.000   24.000   999999
12    5.250   24.750   999999
13    4.500   25.500   999999

                                     EXIT
```

Figure 8-28

9. OPTION 2 (for LCR-816/817/819/821, RS-232 is a standard accessory)

9-1. On-line Procedure

1) Power on the LCR METER.

2) Power on the RS232 function of LCR METER. With the steps as follows (Figure 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 PC LCR-VIEW Program.

4) Check the contents of the Message area under the LCR-VIEW to make sure the Online Procedure has been well done. If not, select the setting items above the LCR-VIEW to change the Com port and make connection again until it is online. Please refer to Figure 9-2, 9-3, 9-4.
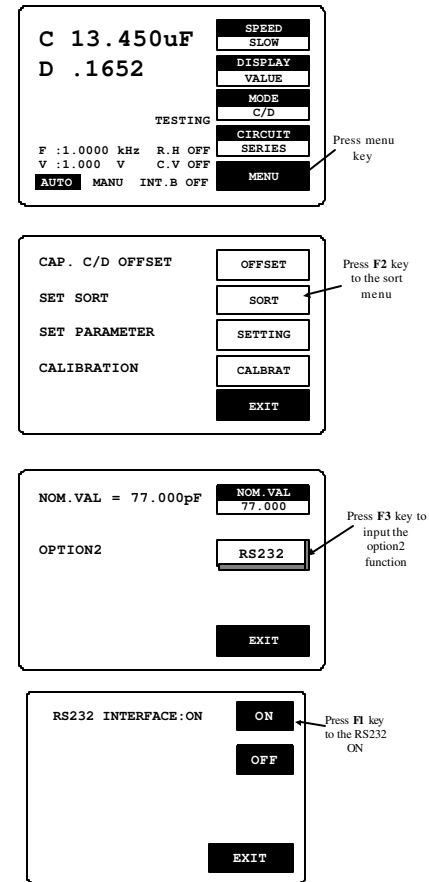
Figure 9-1
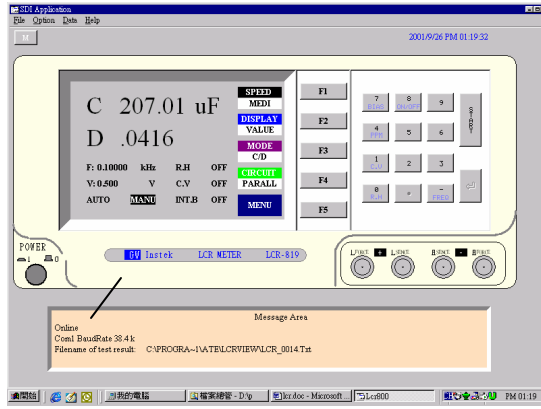
Figure 9-2
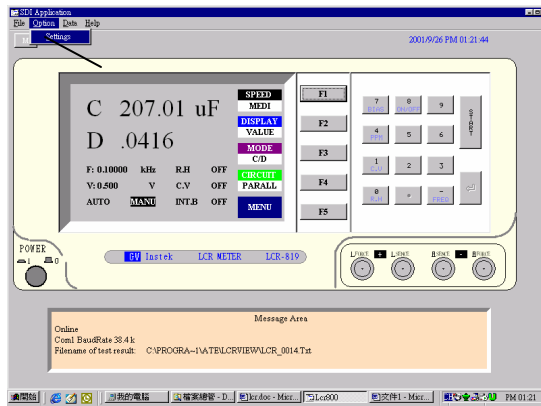
Figure 9-3
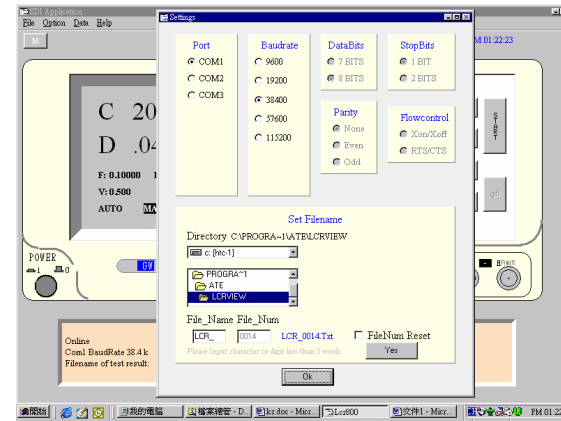
Figure 9-4

5) After online, the picture of LCR Meter will be switched to "RS232 ONLINE", please refer to Figure 9-5.
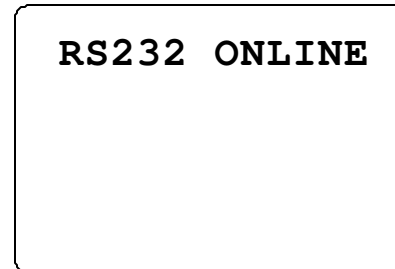
RS232 ONLINE

Figure 9-5

9-2. RS232 VIEWER Software Operation

    1) File

        Press Exit

    2) Option

        Settings

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

        Baudrate: After online, there are five Baudrates available for selection including 9600, 19200, 38400, 57600 and 115200. The default value is 38400

3) Set Filename

This filename setting is the route for saving test result.

Driver: Set driver
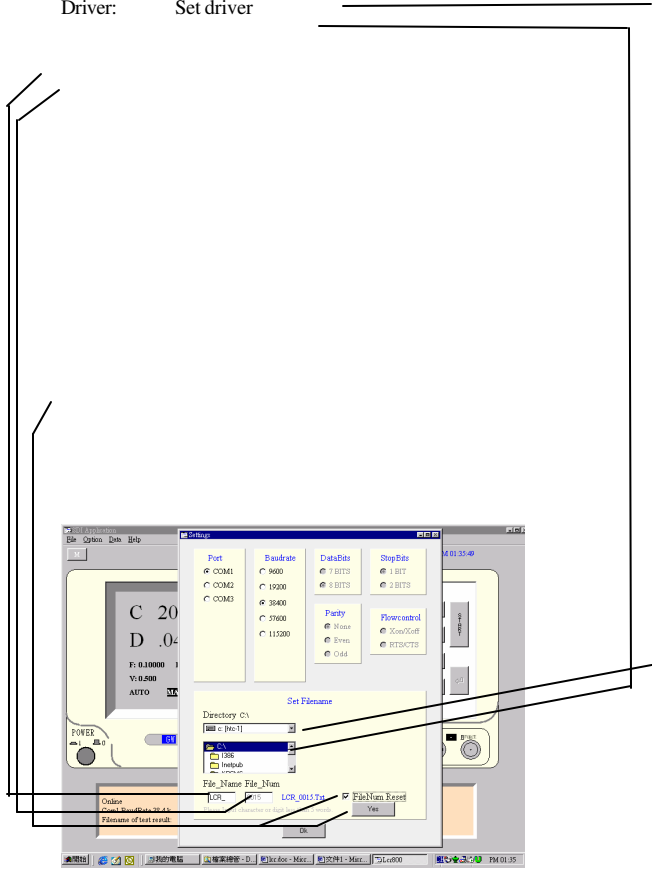
Figure 9-8

4) Data

Result : Display test results. When the test results data reaches to the number of 10000 will be stored in a file automatically. If want to store the data less than the number of 10000, must exit the LCR-VIEW first (the data can be stored automatically), then execute again the LCR -VIEW to start another counting of test result data. Please refer to Figure 99 and 9-10.
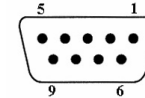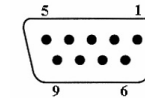

Figure 9-9

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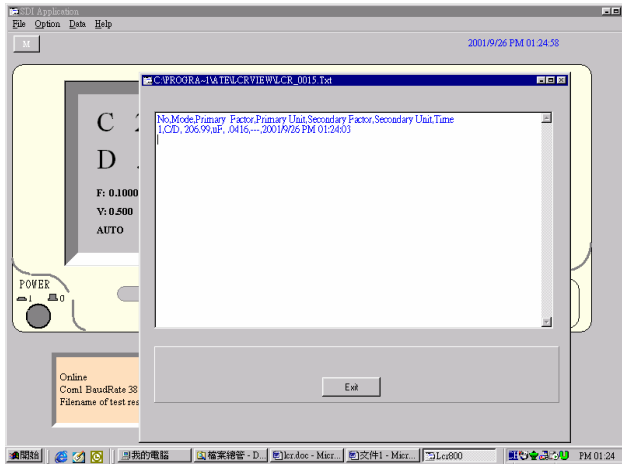
Figure 9-10

9-3. The Configuration of Cable

Use the cable between DCE and DTE.

9 PIN DSUB FEMALE to Computer (D-SUB1)

9 PIN DSUB 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