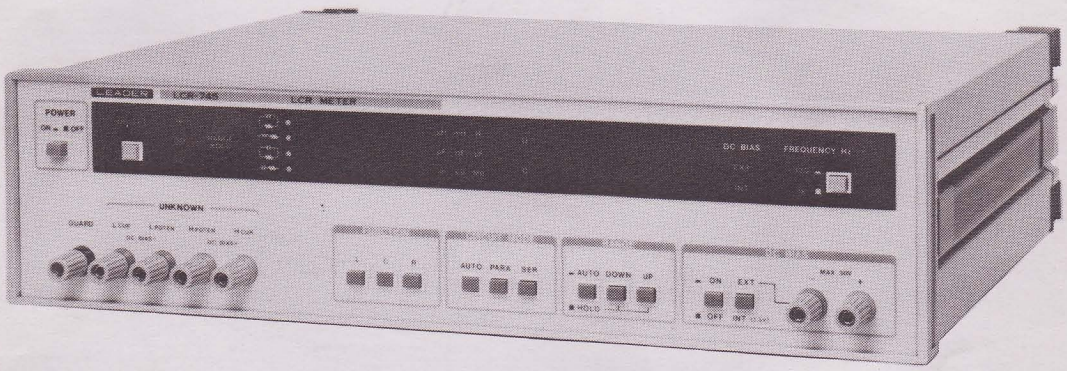
LEADER TEST INSTRUMENTS

MODEL LCR-745

LCR METER

INSTRUCTION MANUAL



LEADER ELECTRONICS CORP.

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1. INTRODUCTION

The LCR-745 is a digital LCR meter designed with a built-in CPU for measurements of capacitance (C), inductance (L), resistance (R), dissipation factor (D) (at capacitance measurement) and quality (Q) (at inductance measurement) at a high degree of accuracy. As this LCR meter has a wide range of measurements and the measuring ranges are automatically selected, quick and highly accurate measurement is possible. Further, equipped with an abundance of functions including automatic offset function, this LCR meter can be used for a wide range of applications such as production lines, research and development, etc.

2. SPECIFICATIONS

Measuring items:
Inductance (L) - Quality (Q)
Capacitance (C) - Dissipation Factor (D)
Resistance (R)

Indications:
L, C, R ..... 3 1/2 digits
D ..... 3 1/2 digits
Q ..... 3 digits

Circuit modes:
Parallel equivalent circuit and series equivalent circuit
Automatic switching (AUTO) and parallel/series selection

Measuring terminals:
Consist of 5 terminals of voltage, current and guard terminals.

Range selection:
Automatic selection with RANGE HOLD.

Test Frequency: 1 kHz and 120 Hz ± 5%

DC bias
(only when capacitance is measured):
Internal + 1.5 V
External 0 ~ +30 V

Measuring range:
Accuracy assuring temperature range:
23 ± 5°C, humidity: 40 ~ 85%

1. Inductance-Quality Measurements
1-1 Measuring Frequency : 1 kHz

Range		0	1	2	3	4	5	6	7
		199.9μH	1.999mH	19.99mH	199.9mH	1999mH	19.99H	199.9H	
(1) Measuring signal	~	80mA	10mA	1mA	100μA	10μA	—		
	⊣	—			1V				
	AUTO	Same as ~				Same as ⊣			
(2) Accuracy	~	±(1%±3 counts) × $(1+\frac{1}{Q})$	±(0.35%±2 counts) × $(1+\frac{1}{Q})$				—		
	⊣	—			±(0.5%±3 counts) × $(1+\frac{1}{Q})$		±(1%±3 counts) × $(1+\frac{1}{Q})$		
	AUTO	Same as ~				Same as ⊣			
(3) Q Accuracy	~	±5 × (1+Q)% ±$(10+\frac{2000}{L})$ counts	±2 × (1+Q)% ± $(10+\frac{2000}{L})$ counts				—		
	⊣	—			±2×(1+Q)% ± $(10+\frac{L}{50})$ counts		±5 × (1+Q)% ± $(10+\frac{L}{50})$ counts		
	AUTO	Same as ~				Same as ⊣			

Notes: (1) Approximate values
(2) When Q ≧ 1.
(3) L count is above 50, Q ≦ 50, L in the specifications denotes number of counts

1-2 Measuring Frequency : 120 Hz

Range		0	1	2	3	4	5	6	7
		1.999mH	19.99mH	199.9mH	1999mH	19.99H	199.9H		
(1) Measuring signal	~	80mA	10mA	1mA	100μA	10μA	—		
	⊣⊢	—			1V				
	AUTO	Same as ~				Same as ⊣⊢			
(2) L Accuracy	~	±(1.5%±3 counts) × $(1+\frac{1}{Q})$	±(0.4%±3 counts) × $(1+\frac{1}{Q})$				—		
	⊣⊢	—			±(0.5%±3 counts) × $(1+\frac{1}{Q})$		±(1.5%±3 counts) × $(1+\frac{1}{Q})$		
	AUTO	Same as ~				Same as ⊣⊢			
(3) Q Accuracy	~	±5 × (1+Q)% ±$(10+\frac{2000}{L})$ counts	±2 × (1+Q)% ± $(10+\frac{2000}{L})$ counts				—		
	⊣⊢	—			±3 × (1+Q)% ± $(10+\frac{L}{50})$ counts		±5×(1+Q)% ± $(10+\frac{L}{50})$ counts		
	AUTO	Same as ~				Same as ⊣⊢			

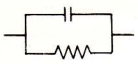
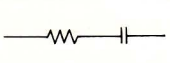
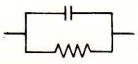
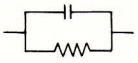
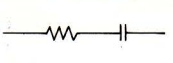
Notes: (1) Approximate values
(2) When Q ≧ 1
(3) L count is above 50, Q ≦ 50, L in the specifications denotes number of counts

2. Capacitance-Dissipation Factor Measurement
2-1 Measuring Frequency : 1 kHz

Range		0	1	2	3	4	5	6	7
		199.9pF	1999pF	19.99nF	199.9nF	1.999μF	19.99μF	199.9μF	1999μF
(1) Measuring signal	⊣⊢	1V					—		
	-||-	—			10μA	100μA	1mA	10mA	80mA
	AUTO	Same as ⊣⊢				Same as -||-			
(2) C Accuracy	⊣⊢	±(1%±3 counts) × (1 + D)	±(0.35%±2 counts) × (1 + D)				—		
	-||-	—			±(0.5%±3 counts)×(1 + D)			±(1%±3 counts) × (1 + D)	±(2%±5 counts) × (1 + D)
	AUTO	Same as ⊣⊢				Same as -||-			
(3) D Accuracy	⊣⊢	±5% ±$(10+\frac{2000}{C})$counts	±2% ± $(10+\frac{2000}{C})$ counts				—		
	-||-	—			±2% ± $(10+\frac{C}{50})$ counts			±5% ± $(10+\frac{C}{50})$ counts	
	AUTO	Same as ⊣⊢				Same as -||-			

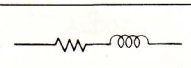
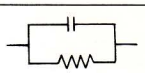
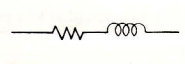
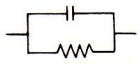
Notes: (1) Approximate values
(2) When D ≦ 1.000
(3) C counts is above 50, D ≦ 1.000, C in the specifications denotes number of counts

2-2 Measuring Frequency : 120 Hz

Range		0	1	2	3	4	5	6	7
		1999pF	19.99nF	199.9nF	1.999μF	19.99μF	199.9μF	1999μF	
(1) Measuring signal		1V					—		
		—			10μA	100μA	1mA	10mA	
	AUTO	Same as 				Same as 			
(2) C Accuracy		±(0.5%±3counts) × (1 + D)	±(0.4% ± 2 counts) × (1 + D)				—		
		—			±(0.5%±3 counts) × (1 + D)		±(1%±3 counts) × (1 + D)	±(2%±5 counts) × (1 + D)	
	AUTO	Same as 				Same as 			
(3) D Accuracy		±5% ±(10+ $\frac{2000}{C}$)counts	±2% ± (10 + $\frac{2000}{C}$) counts				—		
		—			±2% ± (10 + $\frac{C}{50}$) counts		±5% ± (10 + $\frac{C}{50}$) counts		
	AUTO	Same as 				Same as 			

Notes: (1) Approximate values
(2) When D ≦ 1.000
(3) C counts is above 50, D ≦ 1.000, C in the specifications denotes number of counts

3. Resistance Measurement
Both 1 kHz and 120 Hz

Range		0	1	2	3	4	5	6	7
		1.999Ω	19.99Ω	199.9Ω	1999Ω	19.99kΩ	199.9kΩ	1999kΩ	19.99MΩ
(1) Measuring signal		80mA	10mA	1mA	100μA	10μA	—		
		—			1V				
	AUTO	Same as 				Same as 			
R Accuracy		±(1%±3 counts)	±(0.35% ± 2 counts)				—		
		—			± (0.5% ± 3 counts)				±(1%±3 counts)
	AUTO	Same as 				Same as 			

Notes: (1) Approximate values

Offset Function

(1) Automatic zero correction of residual component
Range of correction: Inductance: 0 ~ 15 μH,
Capacitance: 0 ~ 15 pF,
Resistance: 0 ~ 15 mΩ

(2) Deviation Measurement
Range of zero correction: All ranges
Indicating value: (Measured value-reference value) + 0 or 1 count

Measuring time: Max. about 0.5 seconds
Power supply: 50/60 Hz 100 V (can be set at 120, 220, and 240 V by changing the transformer taps)
Size and weight: 400(W) x 100(H) x 300(D) mm; 5.5 kg
Accessories supplied: Short-circuit plate x 2
Instruction Manual

3. PRECAUTIONS IN OPERATION

3.1 Supply Voltage

Operate this LCR meter at supply voltage within ± 10% of the specified value. If operated below −10% of the specified value, the meter may not operate properly. Further, if operated above +10% of the specified value, the power supply unit may be burnt. Confirm the range of voltage and fuse rating shown on the rear panel of the meter.

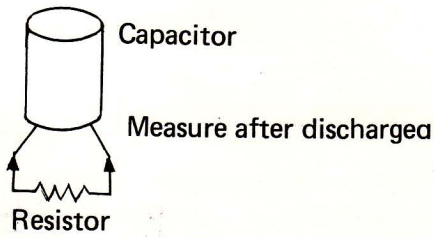
As the power transformer is provided with 100V and 120V series and parallel winding taps, this instrument can be used in 5 voltage ranges as shown in the following table by changing the tap wirings. Also, be careful on fuse ratings at this time.

3.2 Ambient Temperature

Accuracy of this instrument is guaranteed at an ambient temperature of 23 ± 5°C. When this instrument is used at 0°C ~ +40°C exceeding the above temperature range, measuring error may be increased. Therefore, for more accurate measurement, the ambient temperature must be carefully checked.

3.3 Do not apply excessive input to the measuring terminal

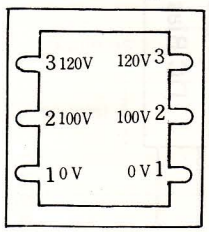
Do not apply external voltage to "UNKNOWN" measuring terminal. In measuring a capacitor, take a measurement only after the capacitor is discharged as the input circuit may be damaged if the capacitor is charged.

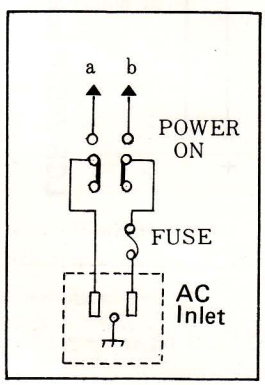


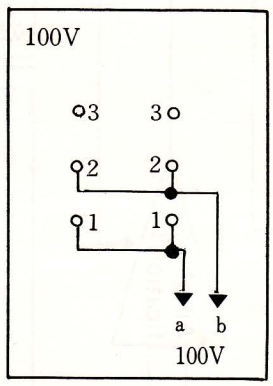
Reference Value	Working Voltage Range (± 10%)	Fuse Rating
100V 120V	90 ~ 110V 108 ~ 132V	0.8A Time lag
200V 220V 240V	180 ~ 220V 198 ~ 242V 216 ~ 264V	0.4A Time lag

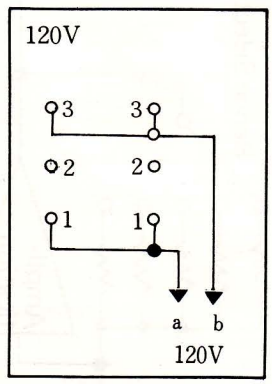
Voltage Connection Diagram

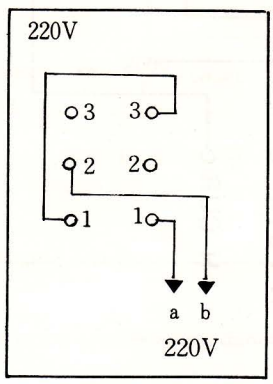
Terminal Arrangement

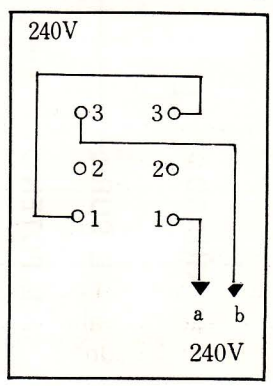




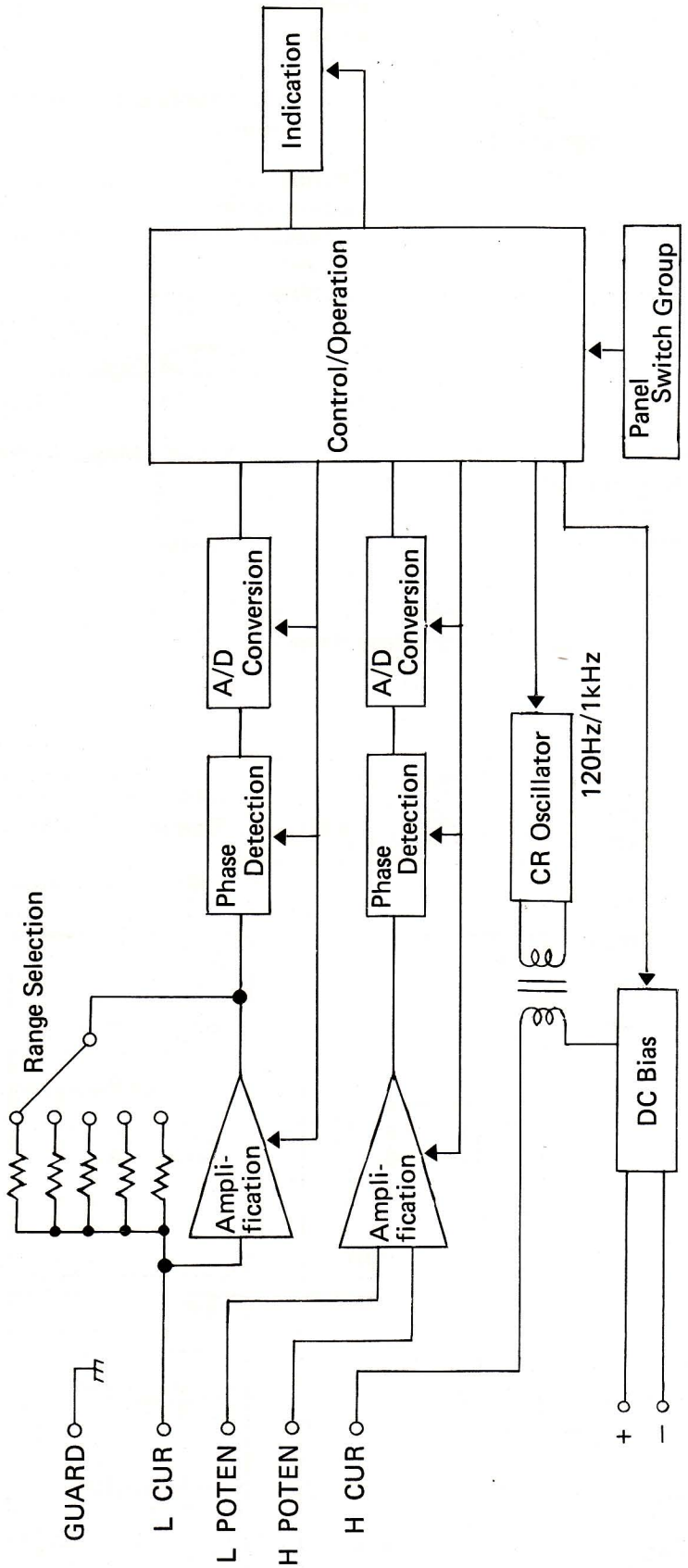








4. BLOCK DIAGRAM

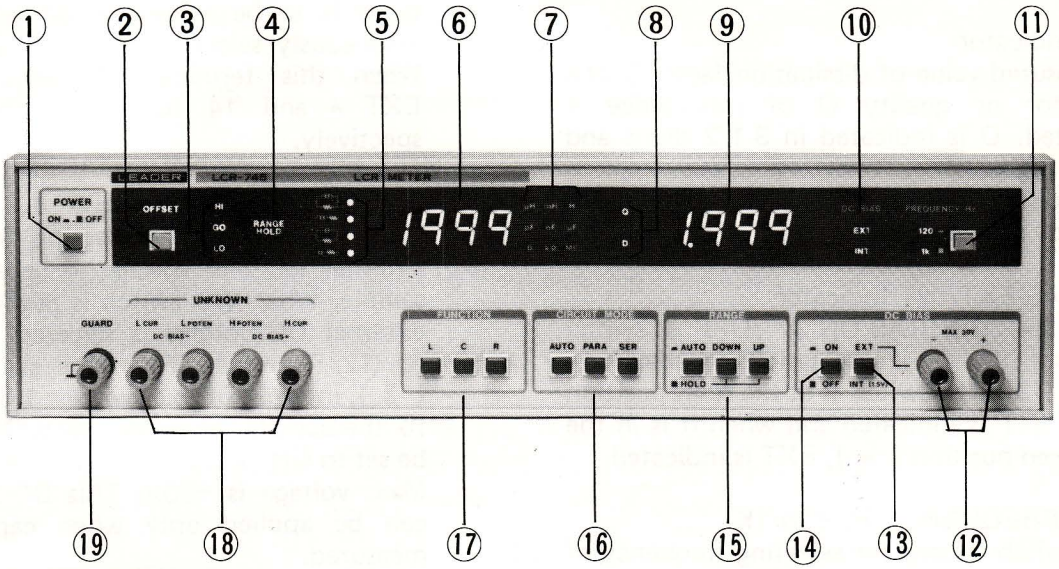


LCR-745 Block Diagram

5. CONTROLS AND CONNECTORS

Numbers enclosed with circles in this instruction manual denote control knobs and indicators.

5.1 Front Panel



① POWER ON ▬ /OFF ▮
This is the power switch. When this switch is pushed in, power is supplied. When the switch is pushed once more, it is reset and power is turned off.

② OFFSET
When this switch is pushed, the word OFFSET lights up and the automatic offset function is turned ON. For details of the automatic offset function, refer to the use of automatic offset function in 6.2.

③ HI, GO, LO
When ⑮ RANGE is set at HOLD position and a measured value is out of the specified measuring range, HI or LO lights up. When a measure value is higher than the specified measuring range, HI is lighted and when lower, LO is lighted.
When HI is ON, increase the measuring range until HI goes out by pushing the UP switch of ⑮ RANGE or push the AUTO switch to set the automatic range selection.
When LO is ON, in the similar manner, push the DOWN switch of ⑮ of RANGE or AUTO switch.
Further, in the automatic range selection, HI or LO lights up if a measured value exceeds the measuring range.
GO lights up when a measured range is within the specified measuring range with a separately available comparator used. If no comparator is used, GO does not light up.

④ RANGE HOLD indication
RANGE HOLD lights up when the AUTO/HOLD switch of ⑮ RANGE is kept at HOLD position (▬).

⑤ Circuit Mode Indication Lamp
This lamp indicates the circuit mode be under use for measurement. The circuit is selected by ⑰ FUNCTION and ⑯ CIRCUIT MODE switches according to the type of a sample to be measured.

⑥ LCR Indicator
Inductance, capacitance or resistance value with a decimal point is indicated. Indication is made in 3 1/2 digits and maximum indication is 1999.
If the measurement is not possible, no figure is indicated.

⑦ Unit Indicator
Unit for a measured value is indicated. A measured value is read by this unit together with a figure indicated on ⑥ LCR Indicator. This indicator also flashes to give a warning

when the manual measuring range is selected or when a measured value is over the measuring range.

⑧ D/Q Indicator
When ⑰ FUNCTION is set at L, Q is indicated and when it is at C, D is indicated. Measured values of Q and D are indicated on ⑨ D, Q Indicator.

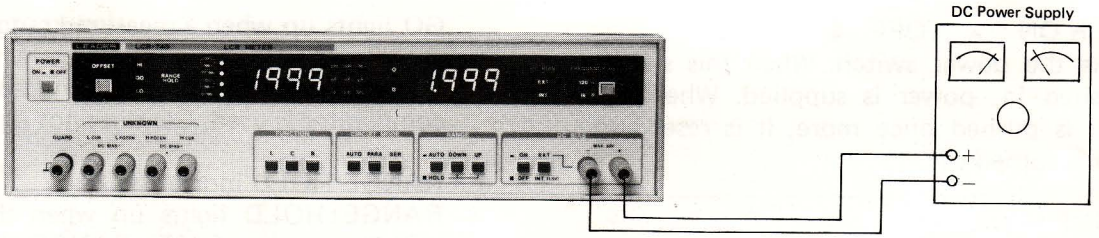
⑨ D, Q Indicator
A measured value of dissipation factor D of a capacitor or quality Q of inductance is indicated. D is indicated in 3 1/2 digits and Q in 3 digits.
No figure is shown when a measured value is out of the measuring range.

⑩ DC BIAS EXT/INT Indicator
When ⑭ DC BIAS ON ▬ /OFF ▮ switch is turned ON ▬ , an indication is made.
When ⑬ INT switch is at the reset position (▮), INT is indicated and when it is in the depressed position (▬), EXT is indicated.

⑪ TEST FREQUENCY Hz 120/1K
This switch is used for selecting frequency of the signal to be applied to the sample to be measured. When the switch is pushed in (▬), 120 Hz is selected and 120 is indicated. When the switch is reset (▮), 1k is selected and indicated.

⑫ DC BIAS Input Terminal
This terminal is used to apply 0 ~ +30V DC voltage externally to a sample when capacitance is to be measured. Be careful not to erroneously select polarity (+, —) of voltage. When this terminal is used, set ⑬ to EXT ▬ and ⑭ to ON ▬ positions, respectively.

⑬ DC BIAS EXT ▬ /INT 1.5V ▮
This switch is for selecting internal and external DC bias voltage to be applied to a sample. When this switch is pushed in (▬), external DC voltage is selected and applied to ⑫ Terminal. When the switch is reset (▮), internal DC bias voltage 1.5V is applied to the sample. However, switch ⑭ should be set to ON ▬ .
Max. voltage is +30V. This DC bias voltage can be applied only when capacitance is measured.



⑭ DC BIAS ON ▬ /OFF ▮
This switch is used to turn ON/OFF the DC bias function.
Set this switch to OFF (reset) when DC bias voltage is not applied to a sample and to ON ▬ (depress) when DC bias voltage is applied for measurement.
DC bias is automatically cut off when Inductance or Resistance is measured.

⑮ RANGE AUTO ▬ /HOLD ▮ , DOWN, UP
When the AUTO-HOLD switch is at AUTO ▬ , the measuring range is automatically selected. When this switch is at HOLD ▮ , the measuring range is fixed to that range which has been selected before this switch is reset and ④ RANGE HOLD is indicated. When the measurement is repeatedly performed in the same range, measuring time can be reduced.
Further, when this switch is set to HOLD ▮ , in the measurements of values other than resistance, the measuring range goes down by 1 digit when ⑪ TEST FREQUENCY is switched from 120 Hz to 1 kHz and goes up by 1 digit when it is switched from 1 kHz to 120 Hz. The DOWN switch is pushed to bring the range down when the range is in HOLD state. (Before the switch is pushed, LO of ③ is ON.) One push of the switch brings the range down by 1 digit.
The UP switch is pushed to bring the range up.

⑯ CIRCUIT MODE (Switching to Measuring Equivalent Circuit) AUTO, PARA, SER
This switch is used to select the equivalent circuit to be measured. The selected equivalent circuit is indicated on ⑤ Circuit Mode Indicating Lamp.

When the AUTO switch is pushed, a circuit fitted to a sample is automatically selected.
When the PARA switch is pushed, the parallel equivalent circuit mode is selected and when the SER switch is pushed, the series equivalent circuit mode is selected.

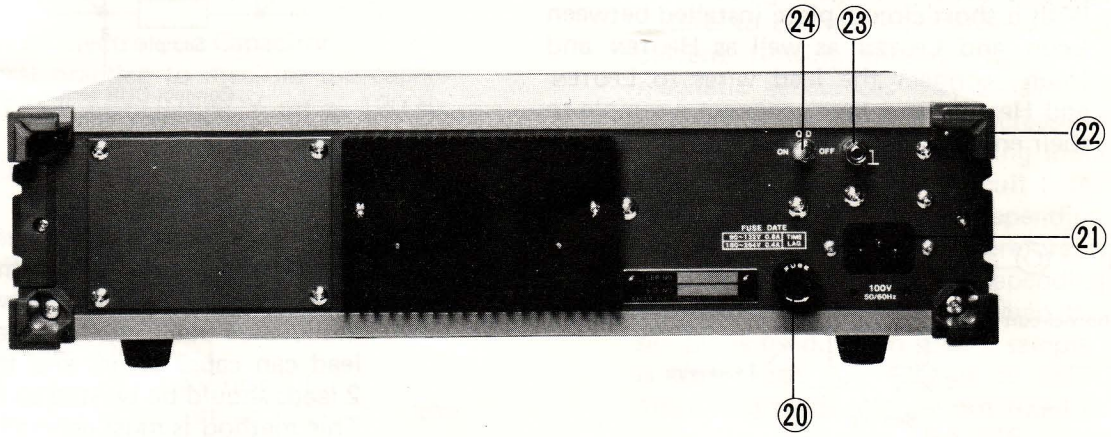
⑰ FUNCTION
Selects circuit parameters to be measured.

FUNCTION	PARAMETER TO BE MEASURED
L	Inductance and Q (Quality)
C	Capacitance and D (Dissipation Factor)
R	Resistance

⑱ UNKNOWN (Measuring Terminal)
This terminal consists of 4 terminals; high current (HCUR), high potential (HPOTEN), low current (LCUR) and low potential (LPOTEN) terminals.
It is possible to make this terminal a 5 terminal configuration by adding ⑲ GUARD Terminal.
Also, it is possible to make this terminal a 3 terminal configuration by connecting HCUR and HPOTEN, and LCUR and LPOTEN terminals.
When DC bias voltage is applied, + is applied to HCUR and HPOTEN terminals and − to LCUR and LPOTEN terminals.

⑲ GUARD (Guard Terminal)
This terminal is connected to the chassis ground of the LCR meter. This terminal is used to prevent measuring error being caused by external induction, etc.

5.2 Rear Panel



⑳ FUSE
When turned counterclockwise with a cross screwdriver, a fuse is removed together with the cap. Be careful of type and rating of fuses.

㉑ AC Inlet
Connect the power cord which is supplied with the instrument. Be careful of the specified voltage.

㉒ Power Cord Reel
Wind the power cord around this reel.

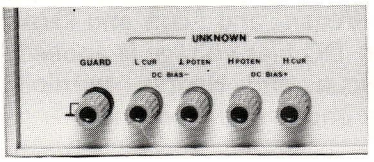
㉓ Earth Terminal
The earthing terminal.

㉔ Q, D Indicator ON-OFF Switch
When this switch is ON, a measured value of Q or D is indicated on ⑨ Q, D Indicator when L or C is measured.
When this switch is set to OFF, the indication on ⑨ goes out. Under this state, the measuring time is reduced to shorter than that when the switch is ON.
(Same measuring time as the measurement of resistance.)
CAUTION: Turn the switch ON or OFF after pulling the lever to this side under POWER off conditions.

6. BASIC OPERATION

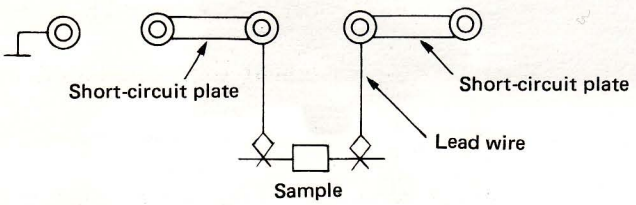
6.1 Connection of Sample

The UNKNOWN terminal of this meter consists of 5 terminals; HCUR, HPOTEN, LCUR, LPOTEN and GUARD terminals.



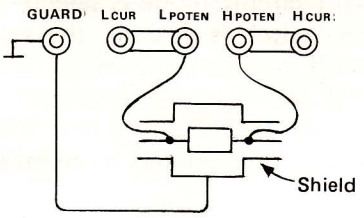
The following methods are available for connecting samples and the measuring method is selected according to kinds and values of samples. As each of these measuring methods tends to induce external noise if impedance of a sample is high, the lead wires should be as short as possible and if necessary, they should be shielded.

(1) 2 Terminal Measuring Method
With a short-circuit plate installed between LCUR and LPOTEN as well as HPOTEN and HCUR, connect the lead wires to LPOTEN and HPOTEN and then, connect a sample to their ends.

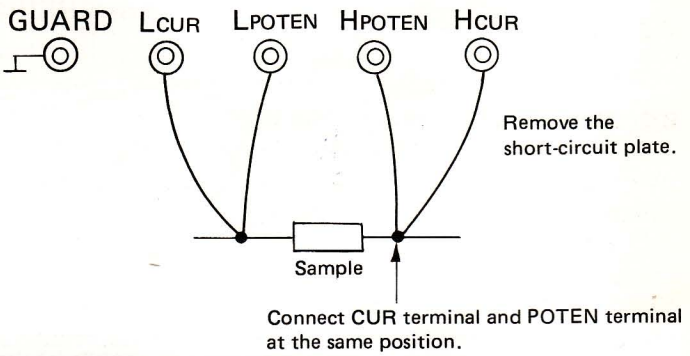


When these lead wires are used, however, resistance and inductance of the lead wires and capacitance between the lead wires can cause error. Further, in measuring high impedance, floating admittance can cause error.

(2) 3 Terminal Measuring Method
The measuring method with GUARD terminal added to the above 2 terminals measuring method. When this method is used, the effect of floating admittance in measuring high impedance can be eliminated. Other properties relative to error are the same as those of the 2 terminals measuring method.

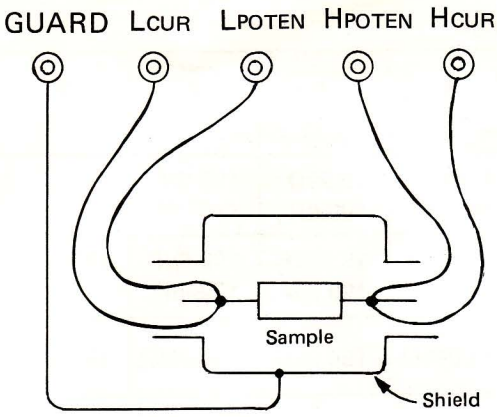


(3) 4 Terminal Measuring Method
With the short-circuit plate between LCUR and LPOTEN, and that between HPOTEN and HCUR removed, connect a sample as shown below.



This method is fitted to the measurement of low impedance. In the measurement of very low impedance, however, mutual inductance between CUR lead and POTEN lead can cause errors and therefore, these 2 leads should be twisted to each other.
This method is most generally used and the following fixtures are available for this instrument (separately available).
LF-2350 . . . . . Kelvin's clip type
LF-2351 . . . . . Inserting type

(4) 5-Terminal Measuring Method
This 5-terminal measuring method is the same as for the 4 terminal measuring method described in (3), above, with a GUARD terminal added. This method is a measuring method which has the features of both the 3 terminal and 4 terminal measuring methods.



In this case, also twist CUR lead and POTEN leads to each other for measuring low impedance.

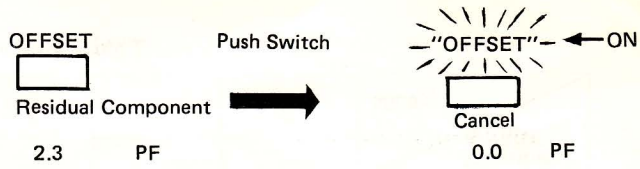
6.2 Use of Automatic Offset Function

The automatic offset function is used to automatically offset measured results of L, C and R to zero (0). When OFFSET switch (2) is pushed, the word OFFSET lights up and the automatic offset function is ON. When the switch is pushed again, this function is turned OFF and OFFSET goes out. Once the automatic offset function is ON, calculation is carried out and the result is displayed corresponding to respective ranges even when they are switched. When this function is used, the following measurements become possible.

6.2.1 Compensating measurement of residual components of measuring instrument

When low resistance, small capacitance or small inductance is measured, if measuring instruments have residual resistance, capacitance or inductance, measuring error is produced. The automatic offset function allows measurements with these residual components reduced to zero.

(1) Set (15) RANGE and (16) CIRCUIT MODE switches to the AUTO position, respectively.
(2) In measuring inductance or resistance, short circuit the measuring terminal, and in measuring capacitance, open the measuring terminal.
(3) At this time, residual components are displayed on (6) LCR indicator.
(4) After the indication has been stabilized, push (2) OFFSET switch.
(5) Confirm that the indication becomes 0.
(6) Setting (15) RANGE and (16) CIRCUIT MODE switches, respectively, starts the measurement.



When residual component is reduced as a result of change of measuring instruments, a minus symbol is lighted on the LCR indicator if a total measured value (residual component plus sample value or residual component only) is less than residual component at time of offset.

6.2.2 Measurement of deviation

Deviation from the reference value is measured as follows.

(1) Set (15) RANGE and (16) CIRCUIT MODE switches to AUTO position, respectively.
(2) Connect inductance, capacitance or resistance which is used as the reference.
(3) A sample value which is used as the reference is indicated on (6) LCR indicator at this time.
(4) When the indication has been stabilized, push (2) OFFSET switch.
(5) Confirm that the indication becomes zero (0).
(6) Setting (15) RANGE and (16) CIRCUIT MODE switches, respectively, starts the measurement.
(7) A difference between the measured value and the reference sample value is indicated on (6) LCR indicator.
A value to be indicated is calculated as follows:
Indicating value = (measured value − reference value) + 0 or 1 count
When a measured value is less than the reference value, − (minus) is indicated.
Note: A measured value of a sample connected is directly indicated on the D.Q indicator.

6.2.3 Release of automatic offset function

When it is desired to release an offset value set for change of measuring instruments, push (2) OFFSET switch. The word OFFSET goes out and the automatic offset function is released.
Further, the automatic offset function also can be released by operating (17) FUNCTION switch or (11) TEST FREQUENCY switch.

6.3 Measuring Range

The measuring range of this instrument is shown in Table 6-1.

Table 6-1 Measuring Range

Measuring Frequency \ Range		0	1	2	3	4	5	6	7
L	1kHz	199.9μH	1.999mH	19.99mH	199.9mH	1.999H	19.99H	199.9H	
	120Hz	1.999mH	19.99mH	199.9mH	1.999H	19.99H	199.9H		
C	1kHz	199.9pF	1.999nF	19.99nF	199.9nF	1.999μF	19.99μF	199.9μF	1999μF
	120Hz	1.999nF	19.99nF	199.9nF	1.999μF	19.99μF	199.9μF	1999μF	
R	1kHz 120Hz	1.999Ω	19.99Ω	199.9Ω	1.999kΩ	19.99kΩ	199.9kΩ	1.999MΩ	19.99MΩ

The measuring range can be changed over either manually or automatically.

(1) AUTO
When (15) AUTO-HOLD Switch is set at AUTO (▬), the automatic range selection is set and a range in which the maximum measured value can be indicated (indication error is minimized) is automatically selected.
Example: Measurement of 17 kΩ resistance Range 4 in Table 6 - 1 is selected and 17.00 kΩ is indicated.

(2) HOLD
When (15) AUTO-HOLD Switch is set at HOLD (▮), "RANGE HOLD" lights up and a range is fixed to that range before this switch is reset. To change the range, push the DOWN or UP switch. One push of the switch shift the range by 1 range.

DOWN ← Initial state → UP
No indication 17.00 kΩ 17.0 kΩ
(due to range over)

When (15) AUTO-HOLD Switch is set at HOLD if the measurements are repeatedly performed in the same range, the measuring time can be reduced.

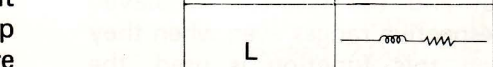
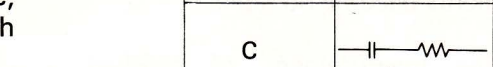
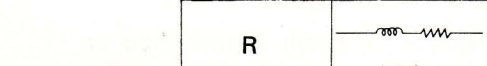
Note: In measuring values other than resistance, when (11) TEST FREQUENCY is changed from 120 Hz to 1 kHz, the measuring range decreases by 1 digit and when changed from 1 kHz to 120 Hz, the measuring range increases by 1 digit.

If a measured value exceeds the range or the measuring range set, no figure is indicated. If a measured value is higher than the range set at this time, HI on (3) lights up and if it is lower than the range set, LO lights up.

6.4 CIRCUIT MODE (Measuring Equivalent Circuit)

The measuring equivalent circuits can be manually or automatically selected by (17) FUNCTION Switch and (16) CIRCUIT MODE Switch. The relation is shown in Table 6-2.

Table 6-2 Equivalent Circuit Table

FUNCTION	CIRCUIT MODE	
	SER	PARA
L	 (Ls)	(Lp)
C	 (Cs)	(Cp)
R	 (Rs)	(Rp)

Ls: Series inductance measurement
Lp: Parallel inductance measurement
Cs: Series capacitance measurement
Cp: Parallel capacitance measurement
Rs: Series resistance measurement
Rp: Parallel resistance measurement

A selected equivalent circuit is indicated by (5) LED.
Further, the relation between the measuring range and equivalent circuit that can be set is as shown in Table 6-3.

Table 6-3 Relation between Measuring Range and Equivalent Circuit

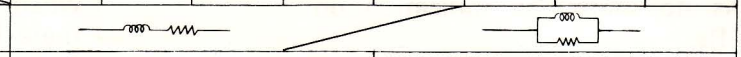
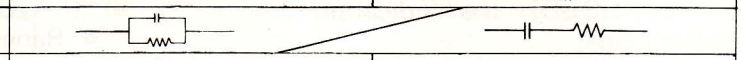
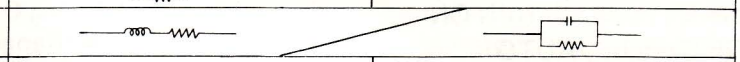
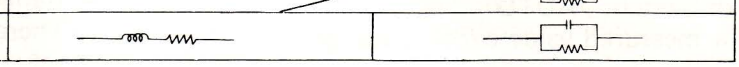
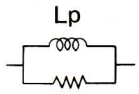
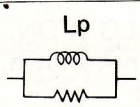
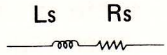
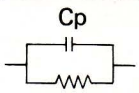
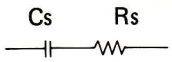
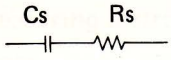
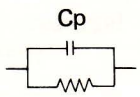
Mode Selection \ Range		0	1	2	3	4	5	6	7
L	PARA, SER								
	AUTO								
C	PARA, SER								
	AUTO								
R	PARA, SER								
	AUTO								

Table 6-4 Conversion Table of Equivalent Circuits

Measuring Circuit		Conversion Circuit	Conversion Formula
L			$Lp = (1+D^2)\,Ls$ $Rp = \frac{1}{(1+Q^2)\,Rs}$
			$Ls = \frac{1}{1+D^2}\,Lp$ $Rs = \frac{1}{(1+Q^2)\,Rp}$
C			$Cs = (1+D^2)\,Cp$ $Rs = \frac{1}{(1+Q^2)\,Rp}$
			$Cp = \frac{1}{1+D^2}\,Cs$ $Rp = \frac{1}{(1+Q^2)\,Rs}$

* D=1/Q

A value of circuit parameter measured in the parallel equivalent circuit is different from that measured in the series equivalent circuit. The conversion formulas are shown in Table 6-4.

6.5 LCR Indication

Measured results of the LCR are indicated on (6) LCR Indicator. Maximum indication is 1999. When the automatic offset function is OFF, the minus indication may be made for the measurement of L. This indicates that C component has been measured. In a similar manner, the minus indication in the measurement of C shows that L component has been measured.

6.6 When the measured value exceeds the measuring range

When a measured value exceeds the measuring range, HI or LO is ON and the indications on the LCR indicator and D,Q indicator go out.
The measuring range varies depending upon the circuit mode selected. The relation between the circuit mode and measured values in excess of the measuring range is as follows.

(1) Ls Cp Rs
- Overflow ..... HI is ON

1) RANGE Switch: AUTO
When measured values are such ones which bring the range above 5.

2) RANGE Switch: HOLD
When a measured value becomes above 2000 counts.

- There is no underflow indication on Ls Cp Rs.
When the range is no longer switched (Range 0 or HOLD), the indication including 0 is made.

(2) Lp Cs Rp

- Overflow ..... HI is ON

1) RANGE Switch: AUTO
When a measured value exceeds Range 7.

2) RANGE Switch: HOLD
When a measured value becomes above 2000 counts.

- Underflow ..... LO is ON

1) RANGE Switch: AUTO
When a measured value is below range 2 or when a measured value at range 3 is below 159 counts.

2) RANGE Switch: HOLD
When a measured value is below 159 counts.

(3) AUTO

- Overflow ..... HI is ON

1) RANGE Switch: AUTO
When a measured value exceeds range 7.

2) RANGE Switch: HOLD
When a measured value becomes above 2000 counts.

- Underflow ..... LO is ON (only at RANGE HOLD)

1) RANGE Switch: AUTO
When the range switch is at AUTO, there is no underflow. The indication including 0 is made.

2) RANGE Switch: HOLD

- Range 0 ~ 3
No underflow. The indication including 0 is made.
- Range 4 ~ 7
There is underflow when a measured value is below 159 counts.

(4) Overflow of Q, D

A. Q
The measuring range of Q is 0.5 ~ 99.9 independently of Range and Circuit Mode. If measured values exceed the measuring range, the indication is made as follows:

1) $Q \geqq 100.0$
HI is ON. L only is indicated and Q is not shown.

2) $Q < 0.5$
LO is ON. L only is indicated and Q is not shown.

B. D
The measuring range of D is 0.000 ~ 1.999 independently of Range and Circuit Mode. If measured values exceed 2,000, the indication is made as follows:
HI is ON. C only is indicated and D is not shown.

7. MEASURING METHODS

7.1 Resistance Measurement

Set the switches on the front panel as follows:

FUNCTION ..... R
CIRCUIT MODE ..... AUTO
RANGE ..... AUTO (▬)
DC BIAS ..... OFF (▮)
TEST FREQUENCY .... 120 Hz or 1 kHz

Select a connecting method from those described in section 6.1 according to resistance value to be measured, connect a sample and take a measurement.
Be careful of residual resistance of a measuring instrument in case of low resistance and effects by parallel capacitance in case of high resistance.
Generally, when resistance is higher, a measured value becomes different from that by DC.

7.2 Capacitance Measurement

Set the switches on the front panel as follows:

FUNCTION C
CIRCUIT MODE ..... AUTO
RANGE ..... AUTO (▬)
DC BIAS ..... OFF (▮)
TEST FREQUENCY .... 120 Hz or 1 kHz

Select a connecting method from those described in Section 6.1 according to the type of capacitance to be measured, connect a sample and take a measurement.
In case of the capacitance measurement, a value of capacitance and D (dissipation factor) are indicated. The measuring range of D is 0.001 ~ 1.999. If this range is exceeded, nothing is indicated. If D is above 2, it can be obtained from the following equation.

Measuring Circuit	Dissipation Factor
Cp, Rp	$D = \frac{1}{2\pi f Cp\ Rp}$
Cs, Rs	$D = 2\pi f\ Cs\ Rs$

f: Test frequency (120 Hz or 1 kHz)

When the dissipation factor is large, values of parallel capacitance and series capacitance are different from each other as can be seen from the equations in Table 6-4. If the dissipation factor is below 0.01, both values become nearly equal.

Caution: If a charged capacitor of rated voltage 50V or above is connected to the measuring terminal, the measuring circuit may be damaged. Capacitance should be measured only after discharging a capacitor in this case.
When the dissipation factor (D) is above 1, the indication may become unstable and it may become impossible to measure the capacitance.

- Measurement of Electrolytic Capacitor
  It is a general practice to measure the capacitance with TEST FREQUENCY set at 120 Hz. Electrolytic capacitor have generally a large dissipation factor and the larger the dissipation factor, the more the measured values will become unstable and fluctuate.
  When capacitance is measured with DC BIAS added, set the switches as follows:

  DC BIAS .... ON (⎓)
  INT/EXT .... INT 1.5V or EXT
  When set at EXT, 0 ~ 30V can be applied to the terminal of (12).

  Note that an indication has become unstable due to external induction when a test frequency is at 120 Hz.

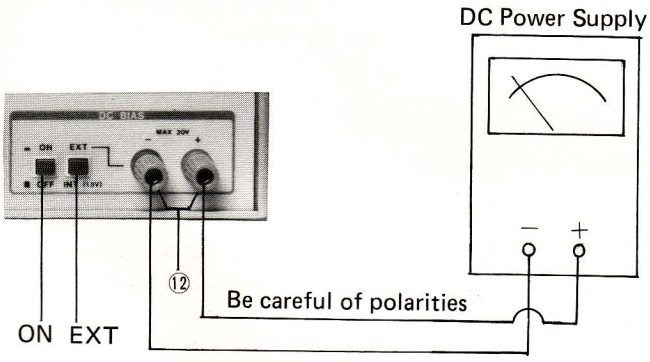


Fig. 7-1 Application of External DC BIAS

Note: When DC BIAS is applied, a certain time is required until an indication becomes stable.

7.3 Inductance Measurement

Set the switches on the front panel as follows.

FUNCTION L
CIRCUIT MODE ..... AUTO
RANGE ..... AUTO (⎓)
DC BIAS ..... OFF (▮)
TEST FREQUENCY ..... 120 Hz or 1 kHz

Select a connecting method from those described in Section 6.1 according to type of inductance to be measured, connect to sample and take a measurement.
In measuring inductance, inductance value and Q (quality) are indicated. Q is indicated in 3 digits and the measuring range is 0.5 ~ 99.9. When this range is exceeded, nothing is indicated.
The relation between Q and the dissipation factor D is as follows:

$$Q = \frac{1}{D}$$

In measuring large inductance, eliminate factors which may cause measuring error by providing shielding and other measures to prevent external induction.

Note: Coils using magnetic substances have the nature to change inductance according to current flowing through them. Further, magnetic substances may be saturated by measuring current and an increase in error may be resulted. In measuring inductance in the series equivalent circuit (-ꟷ-ꟷ-), current may be changed depending upon the measuring range and therefore, inductance measured may differ depending upon the measuring range even when the same sample is used. When such a sample as this is used with RANGE set at AUTO, the measuring range may be not fixed in some cases. In this case, RANGE should be reset to HOLD.

If Q is below 1, the indication may become unstable and inductance may not be measured.
Note that an indication has become unstable due to external induction when a test frequency is at 120 Hz.

7.4 To Determine GO/NO GO

When the quality of a sample is checked as a means for labor saving in production lines, use LEADER's Comparator for the LCR-745 together.

8. MAINTENANCE

This instrument has been manufactured and adjusted under the environment temperature of 23 ± 5°C to assure stable operation for a long time. If this instrument fails to operate properly, call a LEADER's serviceman as a special calibration system is necessary for its service and calibration.

How To Open Outer Case

Remove the cover by removing the 2 machine screws as shown in Fig. 8-1.

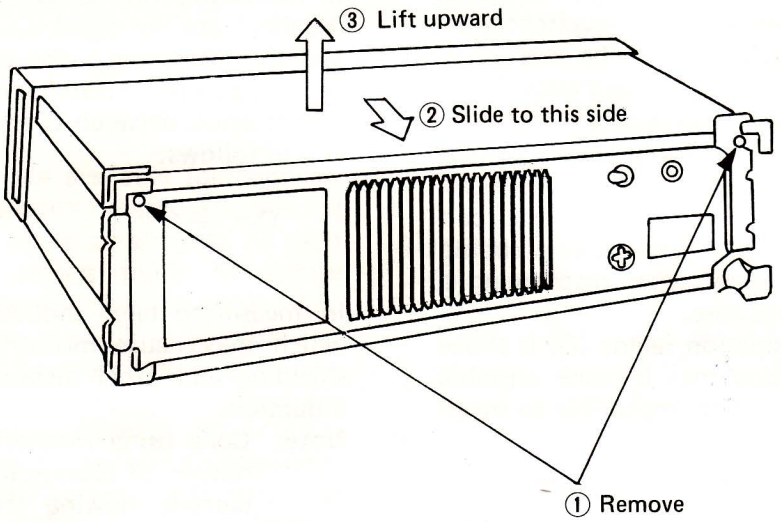


Fig. 8-1 How To Open Outer Case

LEADER TEST INSTRUMENTS

LEADER ELECTRONICS CORP.

2-6-33 TSUNASHIMA-HIGASHI, KOHOKU-KU,
YOKOHAMA, JAPAN.
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PHONE: (516) 231-6900
TELEX: 510-227-9669 LEADER HAUP

83010.5KM

Printed in Japan.

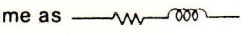
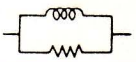
CORRECTION SHEET FOR LCR-745 LCR METER

Measurement range in specifications should be corrected as follows:

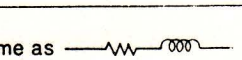
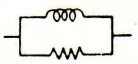
(1) Delete $(1+\frac{1}{Q})$ of L accuracy _____ x $(1+\frac{1}{Q})$

SPECIFICATIONS AFTER CORRECTION

1-1 Measuring Frequency: 1kHz

(2) L Accuracy		±(1%±3 counts)	±(0.35%±2 counts)	———
		———	±(0.5%±3 counts)	±(1%±3 counts)
	AUTO	Same as 		Same as 

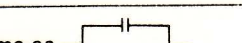
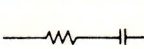
1-2 Measuring Frequency: 120 Hz

(2) L Accuracy		±(1.5%±3 counts)	±(0.4%±3 counts)	———
		———	±(0.5%±3 counts)	±(1.5%±3 counts)
	AUTO	Same as 		Same as 

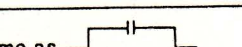
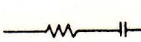
(2) Delete (1+D) of C accuracy _____ x (1+D)

SPECIFICATIONS AFTER CORRECTION

2-1 Measuring Frequency: 1kHz

(2) C Accuracy		±(1%±3 counts)	±(0.35%±2 counts)	———	
		———	±(0.5%±3 counts)	±(1%±3 counts)	±(2%±5 counts)
	AUTO	Same as 		Same as 	

2-2 Measuring Frequency: 120 Hz

(2) C Accuracy		±(0.5%±3counts)	±(0.4% ± 2 counts)	———	
		———	±(0.5%±3 counts)	±(1%±3 counts)	±(2%±5 counts)
	AUTO	Same as 		Same as 	

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