INSTRUCTION MANUAL

5000 SERIES LCR METER

Contents

Introduction

1-1. Precautions

Check the instrument immediately after unpacking for any damage that may have occurred during transit. If switches, connectors, panel or housing are found broken or marred, please notify the dealer of the instrument.

Befor connecting power to the instrument, make sure that your line voltage meets the voltage indication on the rear panel. The power cable ,fuse and power transformer primary winding of the instrument have been factory-adjusted for the locally available power source. If the voltage indication on the rear panel doesn't match the available power source, please contact the nearby supplier.

The LCR METER rated for 100-130V is equipped with 0.5 Amp fast blow fuse, and other rated for 200-260V is provided with a 0.3 Amp fuse. The bias fuse rated at 0.25 Amp fast blow. Replacement fuses must be of correct type voltage and current rating.

The LCR METER is provided with a three-wire electrical cord containing a three terminal polarity plug for line voltage and safety ground connection. The plug's ground terminal is connected directly to the frame of the unit. For adequate protection against electrical shock hazard, this plug must be inserted into a mating outlet containing a safety ground contact.

Measurement precautions:

1. THe instrument should be powered on for at least 10 minutes prior to measurement for best accuracy.
2. DC bias should be changed only after removal of the capacitor from the test fixture to prevent capacitive discharge that may blow the 250mA bias protection fuse.
3. If the equipment is used near noise generating equipment, be aware that the display may indicate large errors.
4. Aviod using the LCR METER in places with rapid temperature variations.
5. Charged capacitors can be dangerous, even lethal. Never handle its terminals if it has been charged to more than 60 V. Routine discharging procedures may not be perfectly dependable.

! This is a warning mark. It indicates precautions which must be observed to protect the instrument from damage.

1-2. General Description

The LCR METER is a powerful general purpose meter for passive component testing. The meter embodies use of microprocessor and LSI circuits to provide excellent performance at low cost and provides highly accurate, stable, reliable and fast responding readings.

The LCR METER provides 0.2% basic accuracy of measured resistance, capactance and inductance. 100Hz,120Hz,1KHz, 10KHz(model 5030,5040 only) test frequencies, 500mV test signal level and external bias up to 60V.

Features:

1. Self test
   Automatic functional test verifies proper operation of both analog and digital circuits and system calibration values at power on. Any detected abnormal operation will cause the LCR METER to display an error message code.
2. High Accuracy
   Basic measurement accuracy is 0.2% . Major contriburtor is a 5 terminal Kelvin connection measurement technique, which automatically compensates for residuals caused by parasitic elements in the test setup.
3. Wide measurement range
   5 terminal measurement technique can measure impedance over 8 decades of range.
4. Variable test frequency
   Frequency : 100Hz,120Hz,1KHZ,10KHz(model 5030,5040 only).
5. Test signal level and external DC bias
   Level :500mV RMS
   External DC bias : 0 to 60V.
6. Equivalent circuit mode
   Series mode or Parallel mode can be selected for the approriate representation of the DUT.
7. Display
   4 large LEDs is used to present clear and complete numeric results and to display selection type and error messages for each mode of operation.
8. Full Kelvin Connection to DUT
   The Kelvin connection provide automatic correction for losses occurring in the measurement leads or test fixture.
9. Fully automatic setup
   Appropriate range is selected automatically for best accuracy.
10. Hi-Lo limit comparison (model 5020,5040 only)

1-3. Specification

Parament Tested : L(Q,ESR,EPR)
C(D,ESR,EPR)
R(Q,CP,Cs,ESR,EPR)

Display : 4 digits large scale LEDs.

Equivalent Circuit : series or parallel selectable.

Test frequency : 4 selectable test frequencies,100Hz,120Hz,1KHz,10KHz (model 5030,5040 only)

Tolerance is +/− 0.1% or 2Hz.

Signal Level : 500mV RMS, accuracy: +/− 10%.

External DC Bias: Supplied thru terminals on the front panel. Maximum voltage is 60V and corect polarity must be observed. Maximum current is fuse-protected to 250mA. Caution must be observed as capacitors remain charged after removal.

Display Range :

L: .001uH to 9999H
C: .001pF to 9999mF
R: .001 ohm to 9999MΩ
D: .0001 to 9999
Q: .0001 to 9999

Measuring Range :
Automatically selects the appropriate range for the DUT.

Range	Impedance range
1	below 5 ohm
2	5 − 50 ohm
3	50 − 500 ohm
4	500 − 5K ohm
5	5K − 50K ohm
6	above 50K

Accuracy : LCR : +/−0.2% in basic ranges, refer to the figure 1−1.

$$D,Q:\pm \frac{0.0005(1\pm(D,Q)^2)}{1\mp 0.0005\ D,Q} \pm 0.001$$

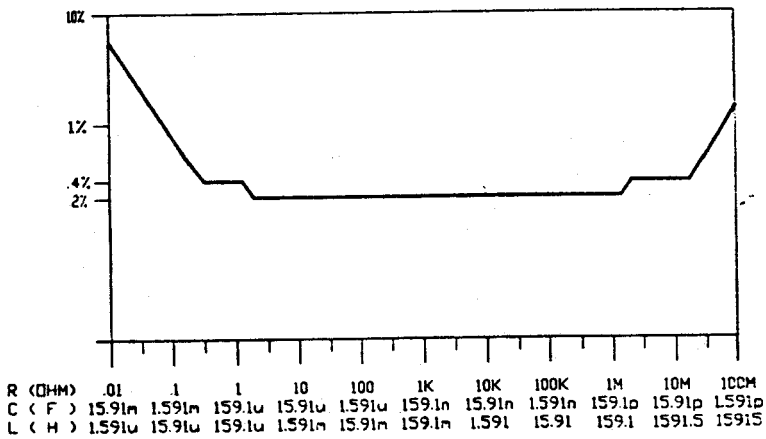
This refers to the amount the D or Q reading may be in error. The following formula gives the percentage the DUT reading for L, C or R may be in error for a selected frequency of 1KHz and a signal level of 250mV.

$$Z_{ERROR} = 0.025\%\left(\frac{Z^2+3Z\times 10^N+2\times 10^{2N}}{Z\times 10^N}\right)(1+F)$$

Where:
Z is the DUT impedance in ohms.
N is the range number minus 1.
F is dependent on the DUT type: DUT type L use 1/Q.
DUT type C use D.
DUT type R use Q.
Option: Model 5020,5040 contain switch programmable Hi,Lo limit comparators

ACCURACY FIGURE

TEST CONDITIONS:
1.LEVEL 500mV
DC BIAS 0V
2.FREQ: 1 KHZ
3.DUT TYPE:R,Q «1
DUT TYPE:L,Q »1
DUT TYPE:C,D «1



R (OHM)	.01	.1	1	10	100	1K	10K	100K	1M	10M	100M
C (F)	15.91m	1.591m	159.1u	15.91u	1.591u	159.1n	15.91n	1.591n	159.1p	15.91p	1.591p
L (H)	1.591u	15.91u	159.1u	1.591m	15.91m	159.1m	1.591	15.91	159.1	1591.5	15915

Figure 1-1. LCR METER ACCURACY CURVE

Measured Mode : 1) auto start: Test is initiated automatically.
2) manual start: Push "START" to initiate one test cycle.

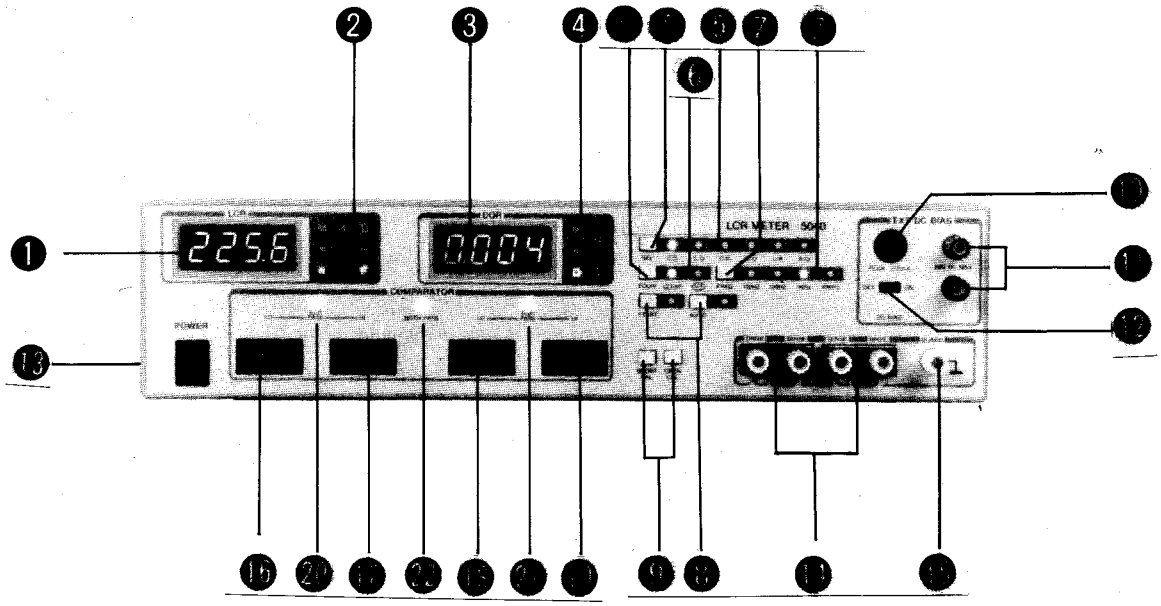
Test Time : A single test takes approx. 0.5 second at 1KHz.

Power : 100-130 V or 200-260 V AC.
50/60 Hz. 45 watts maximum.
Environment : Temperature : 0° to 50°c operating.
-20° to 60°c storage.
Humidity : 0 to 85% R.H. operating.
Dimension : 300 (W) X 402(L) X 105(H) mm.
WEIGHT : 5 KG.
Accessories :
*1.Kelvin clip lead set.
2.Shorting bar:For use in short calibration.
3.AC power cord.
4.Instruction manual.
*1.Axial component adaptor.
*6.External test fixture.

*:Option.

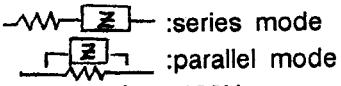
1-4. Panel Function

Fiqure 1-2 shows the panel functions of the instrument. Table 1 identifies them with descriptions and functions. Similarly,figure 1-3 shows the controls on the rear panel. Table 2 identifies them.



Fiqure 1-2 Front Panel

Table 1 : Front panel functilons

REF NO	NAME	DESCRIPTION
1	Display screen For L,C,R	Shows the LCR primary measured value. Display in 4 digits.
2	Unit indicators For D,Q,R	uH,mH,H for L measurement. pF,nF,mF for C measurement. m ohm,ohm,K ohm for R measurement.
3	Display screen for D,Q,R	Shows the D,Q,R primary measured value. Display in 4 digits.
4	Unit indicators	D is Disspation Factor. It indicates total loss of the capacitor.
5	Function SELect	Selects DUT type. There are 6 LEDs indicating C/D,C/Q,C/R,L/Q,L/R, or R/Q measurement.The left symbol is displayed on the LCR screen,the right is displayed on the DQR screen.
6	EQUIValent	Either the equivalent SERIES or PARALLEL LCR circuit represention may be selected.  :series mode :parallel mode
7	FREQuency	4 fixed frequencies from 100Hz, 120Hz,1Khz 10KHz(model 5030,5040 only) may be selected.
8	Measure mode key	Auto or manual selection. start of test is initiated by the "START" key in manual mode. Auto mode initiates start at test automatically.
9	Zeroing key	"SHORT" and "OPEN" calibration key the impedance at the DUT test fixture. For best accuracy , repeat the zeroing procedure on a daily basis and with any change to the test fixture.
10	External bias fuse	Current limited at 250 mA for bias Circuit protection.
11	External bias connector	Receives cable for external bias supply. Observe the voltage, current limits and polarity.

REF NO	NAME	DESCRIPTION
12	External bias switch	Slide switch for external bias. ON,OFF. External bias up to 60VDC can be applied to capacitors under test.
13	Power switch	Rocker switch for main POWER ON,OFF.
14	Test unit	A 4 terminal test unit,receives components with radial leads. Kelvin lead set is also available.
15	Guard	Shields against noise and improves accuracy in the test fixture and Kelvin clip lead set.

As follows,for model 5020,5040 only,if the values(L,C,R,D,Q) are not in the set range,the "Hi","Lo" indicators will light. Pass conditions will turn on the "PASS" indicators.

16	Lo limit setup for L.C.R.	
17	Hi limit setup for L.C.R.	
18	Lo limit setup for D.Q.R.	
19	Hi limit setup for D.Q.R.	
20	L.C.R. comparator indicators	LO: under the Lo limit. HI: over the Hi limit. PASS: within range.
21	D.Q.R. comparator indicators	LO: under the Lo limit. HI: over the Hi limit. PASS: within range.
22	BOTH PASS indicator	Both "L.C.R." and "D.Q.R." PASS.

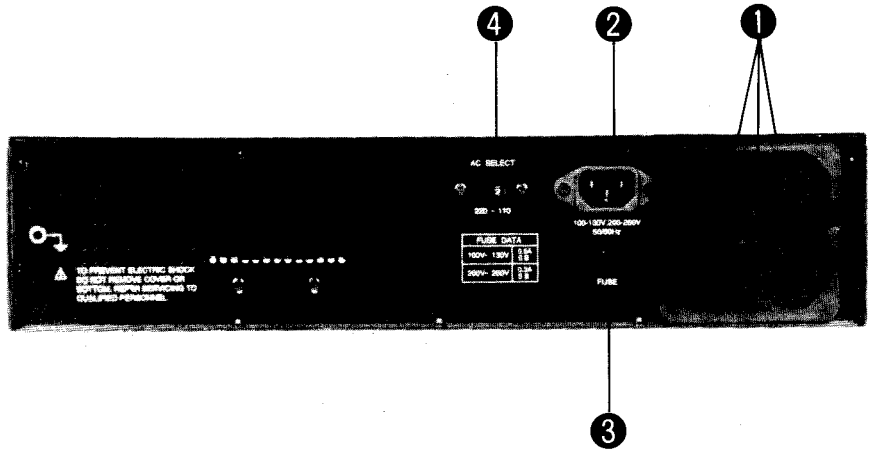


Figure 1-3:Rear panel

Table 2:Rear panel

Ref.No	Name	Description
1	Fan	Low noise fan with air filter
2	Power Socket	AC power input
3	Power fuse	Short circuit protection with slow-blow fuse
4	Line voltage selector	Select AC range 110V or 220V

1—5 Assessories

We supply several accessories that enhance the usefulness of this meter.

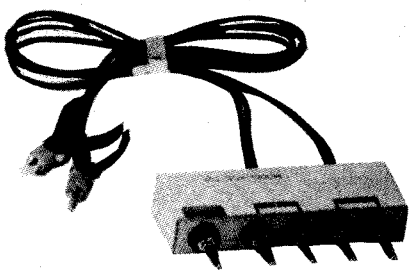
1.Kelvin clip lead set:provides full kelvin connection to large components. Refer to figure 1-4a (model ACS-009)

2.Short bar:Provided for short calibration use. Refer to figure 1-4b.

*3.Axial component adaptor:Provides 4-terminal connection to components with axial-leads. Refer to figure 1-4c. (model ACS-007)

*4.External test fixture set: (model ACS-012)

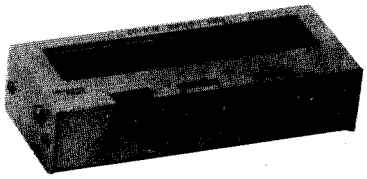
*Options.



a.Kelvin clip set.

b.Short bar.

c.Axial component adaptor



d.External test fixture set

Figure 1-4 : Accessories

2-1 Getting Started

The LCR METER has been designed to operate from a single-phase power source with one of the current-carrying conductors at ground potential. It's provided with a three-wire electrical cord containing a three-terminal polarized plug for line voltage and safety ground connection. The plug's ground terminal is connected directly to the frame of the unit. For adequate protection against electrical shock, this plug must be inserted into a mating outlet containing a safety ground contact.

Prior to powering up the instrument, make sure that the line voltage for your area corresponds to the line voltage value appearing on the rear panel of the LCR METER. The LCR METER has been designed to operate from 100-130 V or 200-260 V nominal power source at 48 to 62 Hz. If the line voltage appearing on the label of the rear panel differs from that in your area, please contact your supplier.

At power up ,an automatic functional test verifies proper operation. A dash"-" runs thru the 7-seg. displays. Refer to figure 2-1 If any abnormal operation is detected in the LCR METER, an error message code will be displayed.
Please contact your supplier.

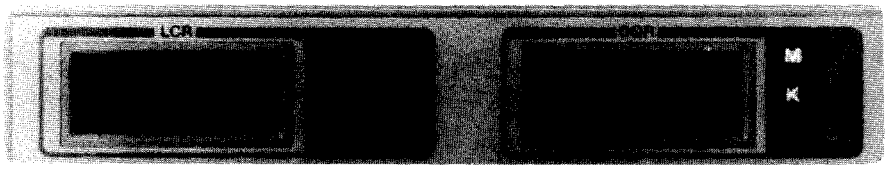
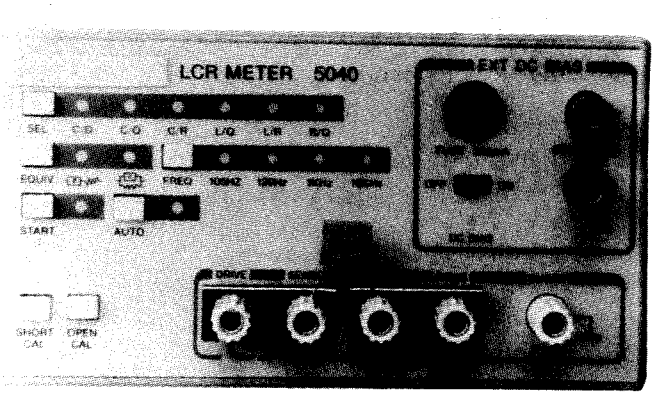


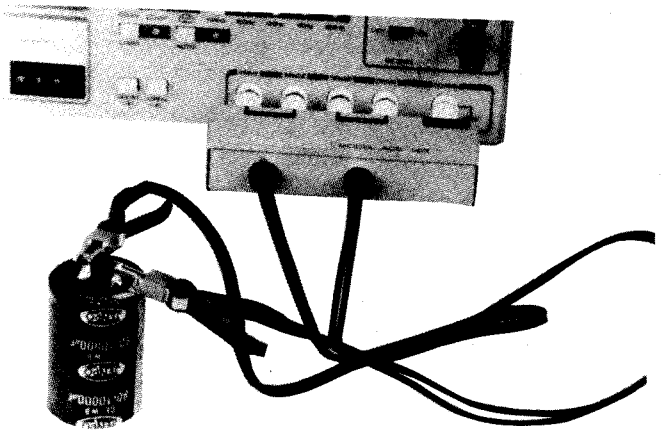
Figure 2-1 : Self test message

Connecting the DUT.

1.Test unit for radial packaged components. Refer to figure 2-2a.
2.Kelvin clip lead set for large components such as inductors or electrolytic capacitors. Refer to figure 2-2b
3.Axial component adaptor for axial components. Refer to figure 2-2c.
4.External test fixture



a.



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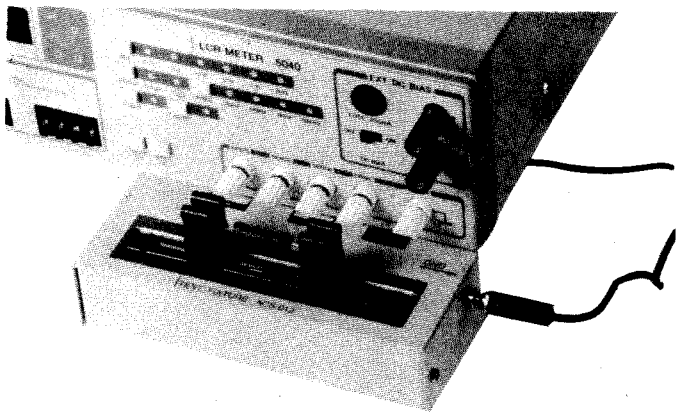
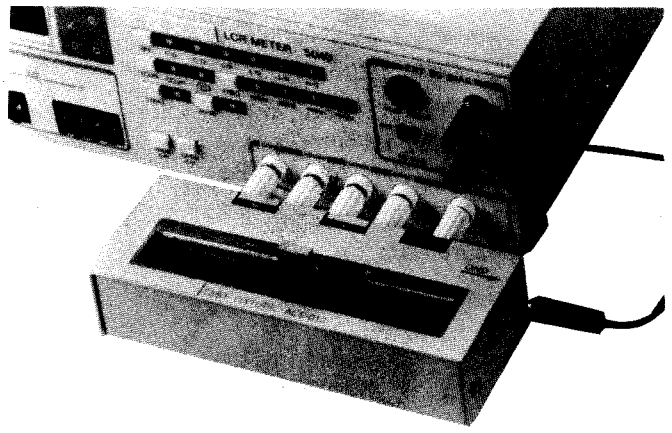


c.



d.

Figure 2-2 : Connecting the DUT

2-2 Zeroing

Before measurement,zero the LCR METER as follows. In this process, the LCR METER automatically measures stray parameters and retains the data which is used to correct measurements so that results represent parameters of the DUT alone, without test fixture or adaptor offsets.

Open calibration :

Open the test unit and press the "OPEN CAL" key. The LCR screen will display the "L--1" message, as shown figure 2-3. A dash "-" will run thru the 7-seg. display on the DQR screen. At completion,it will flash "1111" on the DQR screen and then return to the normal measurement mode. The message "P--3" will appear,if the test fixture is not opened.

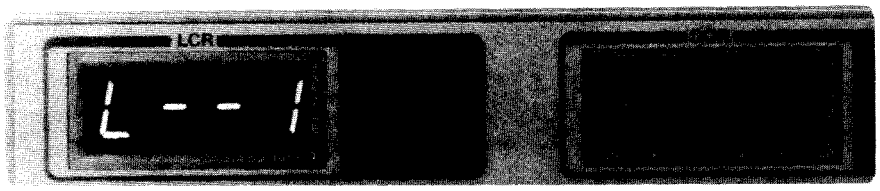


Figure 2-3. Open Calibration

Short Calibration :

Short the test unit and press the "SHORT CAL" key. The LCR screen will display the "L--2" message, as shown in figure 2-4. A dash"-" will run thru the 7-seggemt display on the DQR screen. At completion, it will flash "2222" on the DQR screen and then return to the normal measurement mode. The message "P--4" will appear, if the test unit is not shorted.

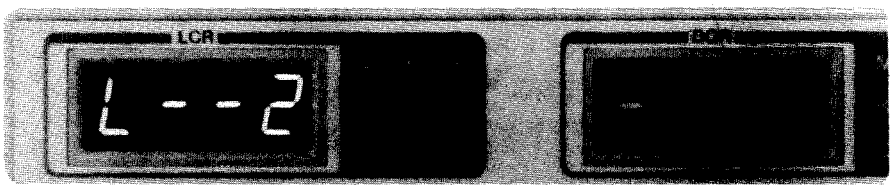


Figure 2-4: Short Calibration

For best accuracy,repeat the zeroing procedure every day and after any change to the test fixture adaptors.

2-3 Routine Measurement

1.Verify or select measurment mode "AUTO" using the "MODE" select key. The indicator LED is on to represent the "AUTO" measurement mode, off indicates manual measurement.

2.Put the component into the test unit. The display shows the measured values as shown in figure 2-5 . If an incorrect component type is selected, the LCR screen will display "SEL" ; choose the right type by pushing the SEL key.

3.When the AUTO mode LED is off, it represents the manual measurement mode. Place the component into the test unit and press the "START" key. The display screen will show the measured value each time the "START" key is pressed.

This procedurce is basic,there are many alternatives described later where the user can select other parameters, equivalent circuit, test conditions etc.

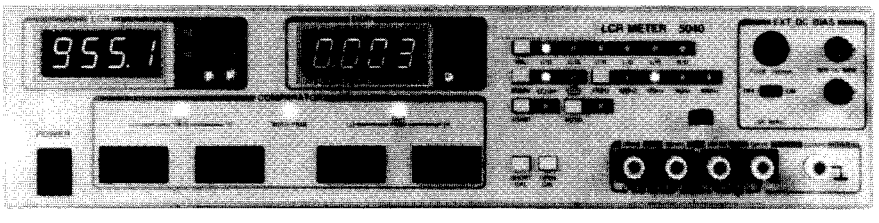
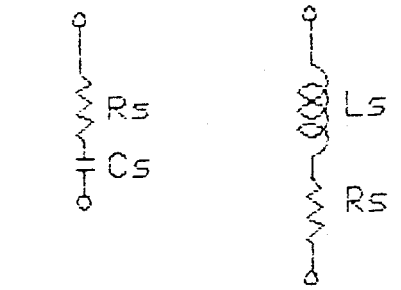


figure 2-5 : Measurement Result

2-4. Measurement Parameters

An impedance that is neither pure reactance nor a pure resistance can be represented at any specific frequency by either a series or a parallel combination of resistance and reactance. The value of resistance and reactance used in the equivlent circuit is dependent upon the series or parallel combination used to represent it. For each type of the principal measurement L,C or R equivalent series or parallel circuits can be selected to represent it . This instrument defaults to C/D DUT type, equivalent series circuit and 1 kHz signal freqvency, Of course, the default condition can be easily changed by pressing the SEL, EQUIV or FREQ keys.

The series equivalent circuits for capacitance and inductance are as follows with their respective equations:



$Z = Rs + 1/jWCs$

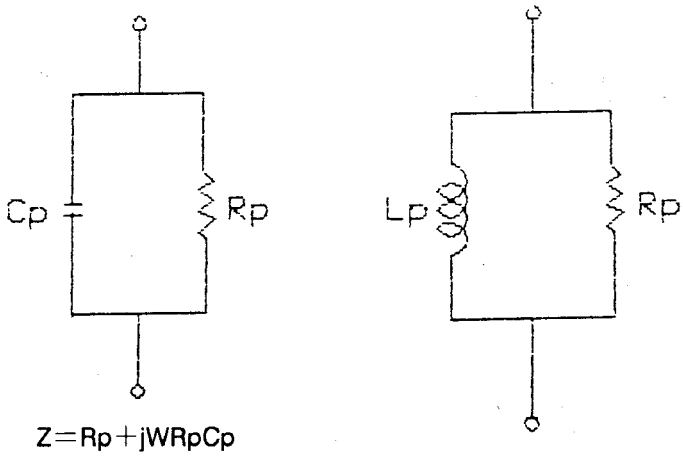
$D = 1/Q = WRsCs$

$Z = Rs + jWLs$

$Q = WLs/Rs$

Figure 2-6 Series Equivalent Circuit

The Parallel equivalent circuits and their respective equations are as figure 2-7.



$Z = Rp + jWRpCp$

$D = 1/WRpCp = 1/Q$

$Z = jWLpRp/(jWLp + Rp)$

$Q = Rp/WLp$

Figure 2-7. Parallel Equivalent Circuit

2-5. Test condition

2-5-1 Test frequency :

There are several available frequencies:100,120,1K,10KHz(model 5030, 5040 only). Press the "FREQ" key to change test frequency.

The C and L testing range is dependent upon the test frequency. as detailed below.

Figure 1-1 shows the accuraccy of the measurement range at a test frequency of 1KHz

The L Measurement range is 754uH/n -- 75.4H/n.
The C measurement range is 33.6uF/n -- 336pF/n.
Where n is the frequency in KHz.

2-5-2 Test signal level :

Power-up test signal level is 250mV RMS. The actual voltage across the DUT can get up to 500mV RMS, it is dependent upon the ratio between the DUT impedance and the precision reference resistance selected within the LCR METER.

2-5-3 DC bias for DUT

External DC bias of up to 60VDC can be applied for capacitor measurement, current limit is fuse protected to 250mA. For a charged capacitor, the LCR METER is internally protected up to 1 joule at 60V peak. Connect the external bias voltage supply from the front panel terminals and push the "DC BIAS" switch to on. OBSERVE the polarity marking on the panel and connect the supply accordingly. Refer to figure 2-8.

There are two factors that affect stability the DUT : voltage and capacitance. Besides changing to a "final"voltage, there is also the stabilization of the capacitance value itself. For example, some electrolytic capacitors respond slowly to a change in applied voltage, therefore the DUT capacitance can be settling long after the voltage is essentially stable.

Before connecting the DUT of an unknown capacitor, check the polarity of the test fixture, as described below.

1.Test unit:Positive on the upper terminal as the label mark indicates on the front panel.
2.Kelvin clip lead set:Positive to the clip with the red hinged handle.
3.External test fixture:Positive on the right side as the label mark indicates.

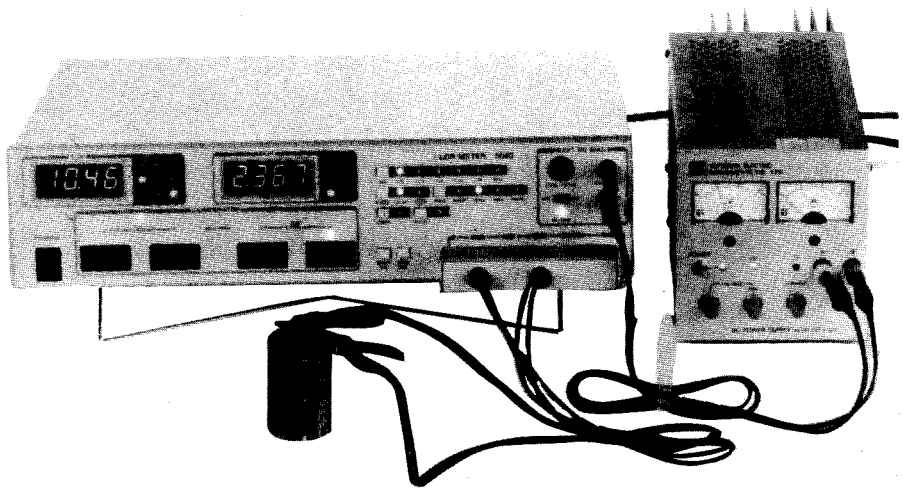


Figure 2-8. Connecting External Bias

! Warning:

1.Capacitor remains charged after measurement.
2.To minimize electrical shock hazard, limit bias to 60 V.
3.Do not leave instrument unattended with bias applied.
4.Be sure that the bias supply is floating. Don't connect either lead to ground.
5.Generally the external circuit must include switching for both application of bias after each DUT is in the test fixture and dischange before it is removed.
6.A well-filtered supply is recommended. Bias-supply hum can affect measurement, particularly if the test frequency is the same as the power frequency.

2-5-4 Measurement Range

This instrument features automatic range selection. It will auto select the appropriate range to attain the best accuracy. The following table gives the measurement range:

Range	Impendance range
1	below 5 ohms
2	5 - 50 ohms
3	50 - 500 ohms
4	500 - 5K ohms
5	5K - 50K ohms
6	above 50K ohms

2-6. LCR Accuracy

The following equation gives the percentage the DUT reading may be in error.

$$Z_{ERROR} = 0.025\%\left(\frac{Z^2+3Z\times10^N+2\times10^{2N}}{Z\times10^N}\right)(1+F)\ K$$

Where : Z is the DUT impedance in ohm.
N is the range number minus one. Use the table shown in 2-5-4.
F is the dependent upon the DUT type:Dut type L use 1/Q.
Dut type C use D.
Dut type R use Q.
K is found in the table below

FREQUENCY	K
100 Hz	4
120 Hz	4
1K Hz	2
10K Hz	4

LIMIT of ERROR for D and Q :

$$D,Q:\pm\frac{0.0005(1\pm(D,Q)^2)}{1\mp0.0005(D,Q)}\ \pm0.001$$

This refers to the amount the D or Q reading may be in error.

Figure 2-9 gives a graphical repesentation of the L,C,R accuracy.

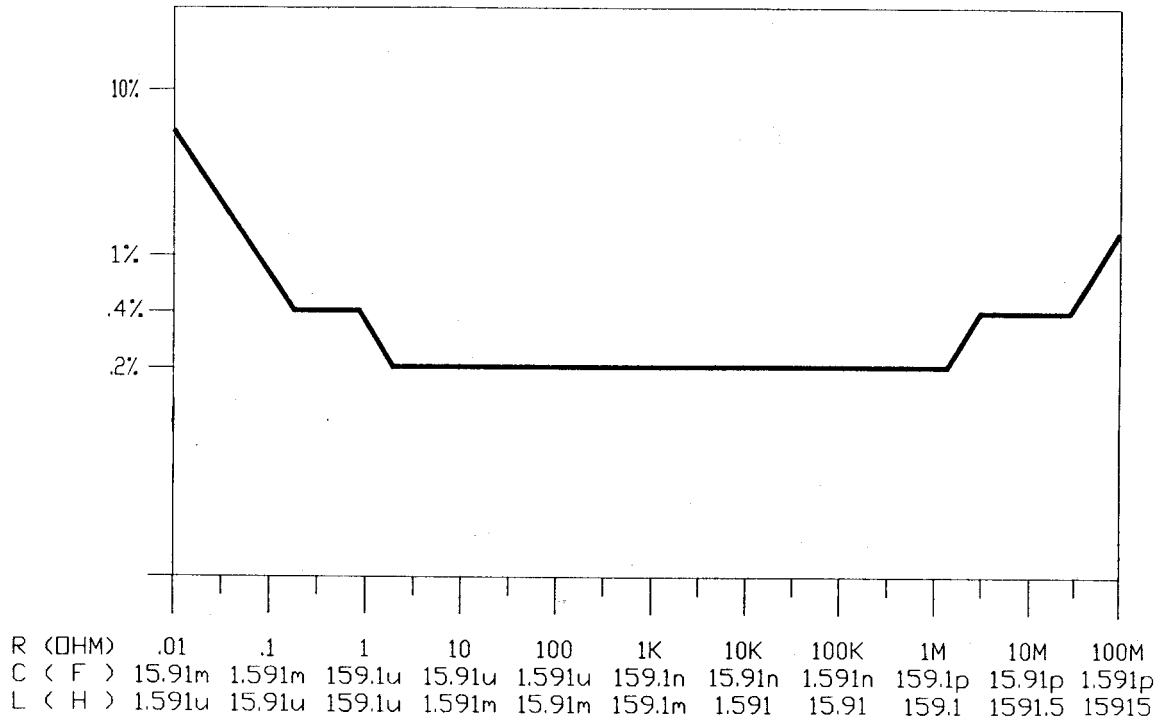


Figure 2-9 LCR Accuracy curve

3-1 Capacitance Measurement

1.Use the "SEL" key to select C/D,C/Q, or C/R.
2.Connect the capacitor.
3.Set up the required test condition (equivalent circuit, frequency, or external bias.)
4.Select "AUTO" measurement mode. The LCR screen displays the numerical value of the capacitor, the DQR screen displays the Disspation factor (D) or the Quality factor (Q). The applied unit of measure is highlighted.
5.Disconnect the capacitor.

Loss Resistance.
The D factor indicates the loss resistance of the capacitor. This parameter is usually desired, so in most cases DUT type C/D would be selected. Other applications might be more interested in the Q or the selected equivalent (series or parallel) resistance associated with the capacitor.

Measuring small-value capacitors:
For best accuracy when measuring small-value capacitors, it is necessary to use higher test frequencies Open calibration : The open calibration compensates parallel residual capacitance. For best accuracy, repeat OPEN CAL after any change in test fixture adaptors.

Measurement of electrolytic capacitors:
The procedure for applying bias to capacitors during measurement is described in 2-5-3. The polarity is marked below the test fixture. The corresponding positive extension cable is identified by the red hinge on the clip. Electrolytic Capacitors are nomally measured at 100 or 120 Hz, in series equivalent circuit mode

! warning

> 1.Capacitor remains charged after measurement.
> 2.To minimize electrical shock hazard, limit bias to 60 Volts.
> 3.Ensure the bias voltage supply is floating.

3-2 Inductance Measurement

1.Use the "SEL" key to select L/Q or L/R.
2.Connect the inductor.
3.Set up the desired test condition(equivalent, circuit ,frequency,bias).

4.Push "START" or set to "AUTO" mode to get the measured result.
5.Disconnect the inductor.

Loss Resistance.
The Q factor indicates the quality of the inductor. High Q factors indicate a low loss resistance, To measure the equivalent (series or parallel) resistance of the inductor, select DUT type L/R.

Measuring small-value inductors:
For best accuracy when measuring small-value inductors, it is necessary that "SHORT CAL" has been recently and accurately performed.

Short calibration : The short calibration compensates series residual resistance. For best accuracy, repeat SHORT CAL after any change of test fixture adaptors.

Measuring iron-cored inductors:
The test signal frequency and current level applied to iron-cored inductors greatly affects the resulting measured effectire value. Under ideal conditions the inductor should be measured with the same DC and AC current level that the inductor will fine in use. Excessive current levels can damage the core by causing permanent magnetization. Check beforehand that the test signal applied is within safe limits.

The AC RMS signal level can be up to twice that across the DUT at peak condition. The exact level is dependent upon the voltage divider between the DUT and the standard range resistor. The LCR METER is capable of supplying up to approximately 200mA peak current. If a DC current is required, it is recommended that an external floating DC supply with current limiting be used. External bias terminals is provided on the front panel. The maximum current applied to the DUT(AC RMS DC combined) is fuse protected to 250mA. Higher current levels to the inductor can be achieved by passing a DC current directly to the inductor itself and preventing it from entering the instrument. The bias switch should be in the OFF mode. Connect the current source to the inductor as follows:

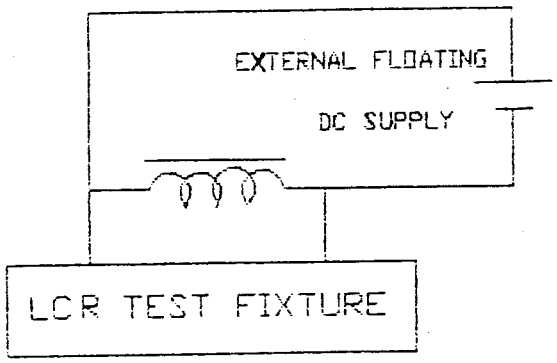


Figure 3-1 Inductors passing DC current.

3-3 Resistance Measurement

1.Use the "SEL" key to select C/R,L/R or R/Q, and set up the required testing condition (FREQUENCY, EQUIVALENT CIRCUIT)
2.The choice of selecting either series equivalent or parallel equivalent is usually depensent on the resistance value.

Generally,

For resistors more than 1K ohm, select parallel equivalent.
For resistors less than 1K ohm, select series equivalent.

3.Connect the resistor.
4.Push "START" or set to "AUTO" to get the measured result.
5.Disconnect the resistor.

It is not unusual for small changes to occur in the measured value of a resistor when the test frequency is changed. The effect can be caused by small reactive terms or by skin effect. Their effect is minimal at test frequency of 100/120 Hz. The high resolution of the instrument may also show up variations in resistance due to temperature changes.

3-4 Comparator Set-up

Models 5020 and 5040 contain limit comparators for the primary and secondary values, Measurement values that fall out side the range of the Lo or Hi switch settings will be indicated by a red Lo or Hi Fail light, whichever is closest in proximity. Since the range can cross over decade divisions, the Hi switch setting is always assumed to be greater than the Lo Switch Setting.

4-1 Introduction

This instrument measures and derives various parameters of the device under test through the use of ration-matic measurements applied to the DUT and to the precision standard resistors within the instrument. The microprocessor controls the sequence and applies corrective offsets using the software contained in ROM memory. The measured values as well as the input parameters are displayed in an easy-to-read format on the CRT screen.

4-2 BLOCK DIAGRAM

The figure 4-1 block diagram is a simple representation of the instrument.

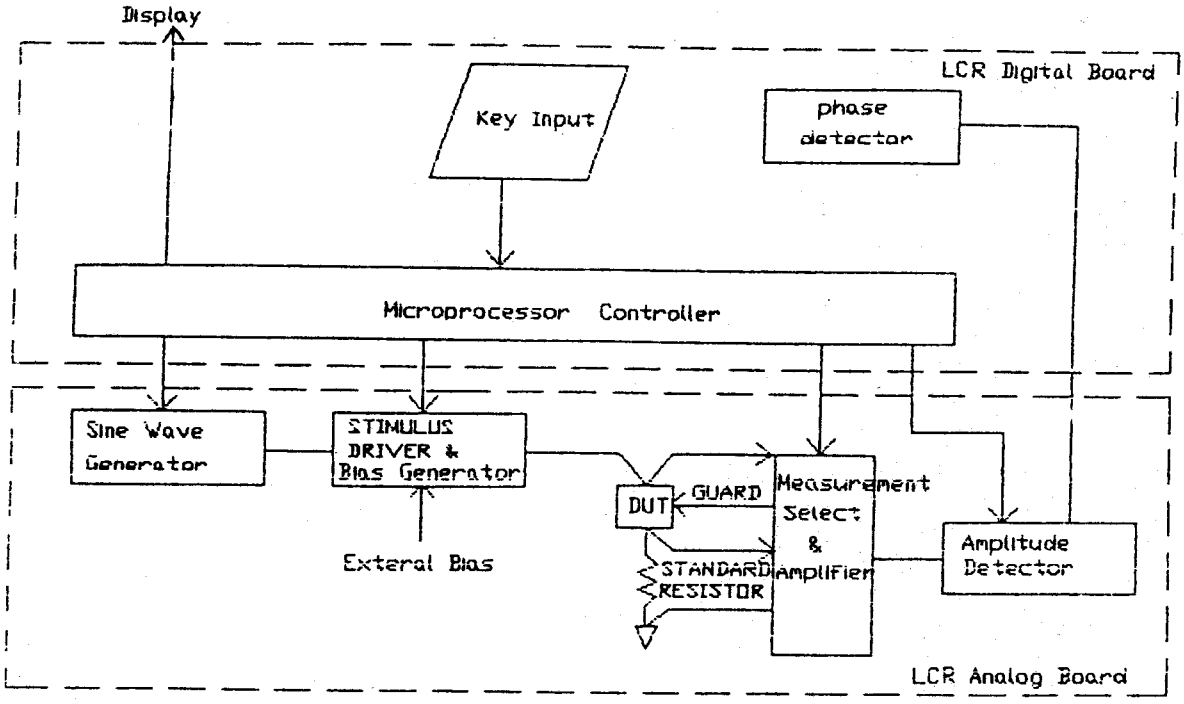


Figure 4-1 Block Diagram of LCR METER

Not shown in the diagram are a number of control registers with which the microprocessor can access.

4-3 Principal Function

SINEWAVE GENERATOR

The stimulus signal is generated in the following manner. The crystal oscillator frequency is divided down to 256 times the selected frequency indicated on the front panel. This signal drives the address lines of a sine table ROM which in turn controls a 8-bit D/A converter. The output is a finely stepped sinusiodal waveform that is then smoothed by filtering.

STIMULUS DRIVER & BIAS GENERATOR

An external bias of up to 60 volts can be applied to the DUT. The instrument can safely handle the correct polarity insertion of a charged capactitor with a potential of up to 60 v and an energy level of up to 1 joule. Incorrect polarity insertion is protected by a 250 mA fuse. The stimulus driver provides a output signal 500mV RMS which is applied across the DUT and the selected standard resistor connected in series with it. The voltage across the DUT is determined by the voltge divider between the DUT and the standard resistor.

MEASUREMENT SELECTION & AMPLIFICATION

The response signal can be selected across the DUT or across the standard precision resistor. Relays switch in one of six possible standards that are connected to the DUT and analong ground. The response signal is then amplified to an optimum level and filtered to remove noise.

AMPLITUDE DETECTOR

The level of the response signals are detected by the microprocessor that controls a 12-bit DAC and monitors the comparator output. The amplitude ratio between the DUT and standard is used by the microprocessor to calculate the DUT value.

PHASE DETECTOR

The phase difference of the DUT and reference standard is converted to a digital number by clocking a 12 bit counter with a 24 MHz clock. The microprocessor then converts the phase count into a phase angle for equivalent circuit parameter calculation.

KEY INPUT

All key-board switches are routinely polled by the microprocessor to control menu selection and calibration.

MICROPROCESSOR

To determine the values of the desired parameters (L and Q, C and D, or R and Q), the microprocessor calculates the ratios between the two separate measurements. One measurement is performed across the precision standard resistor and the second is performed across the DUT. High accuracy is achieved in that only tne ratio between the standard and the DUT determines the value of the selected parameters. Fixture offset errors are automatically subtracted out at calibration. Highest accuracy is achieved in AUTO RANGE mode where algorithms in ROM optimizes the ratio between the DUT and the standard through selection of the best possible standard precision resistor, as well as sensitive signal amplification. There are a total of six standard precision resisitors corresponding to the six ranges. The mode selection of series equivalent and parallel equivalent circuit representations are implemented in software, the measurements are performed identically in hardware.

The microprocessor runs off of programs contained in ROM momery and stores data into RAM memory. Calibration data is also held in RAM memory and is retained through the use of an on-board long life battary when the unit is powered down.

The reset circuitry allows for dependable power-up and power-down operation. A self-test if performed at power-up and any detected abnormal condition will cause a error message code to be displayed on the display screen.

4-4 Self Test and Codes Messages.

Every time the instrument is switched ON or the line voltage reappears after an interruption, the LCR METER keeps itself busy for a short time going through an automatic self-test routine. Detected abnormal conditions are displayed to the screen as code messages.

WARNING CODES(displayed on DQR LED Segment Display):

P - - n

where n=

1:Invalid Cal Table (calibration table memory has been disturbed)
2:Incomplete or No calibration done yet
3:trying to do a User Open Cal but DUT is not "open"
4:trying to do a User Short Cal but DUT is not "shorted"
5:trying to do a Range Cal but DUT is not a Standard Cal Resistor
6:System Open Cal has not been done yet
7:System short Cal has not been done yet

ERROR CODES (displayed on DQR LED Segment Display):

E--n

where n=

1:Comparator Offset Error on Self Test performed at power-up
2:Noise Amplitude Error on Self Test
3:Fine Gain Test Error on Self Test
4:Response Level Test Error on Self Test
5:Response Side x10 Gain Test Error on Self Test
6:Stimulus Level Test Error on Self Test
7:Phase Detector & Frequency Test Error on Self Test
8:Bias Fuse Test Error on any Short Cal proedure-the unit has to be powered off, problem fixed, and powered back on.

AUTOCAL Display CODES(displayed on either LCR or DQR LED Segment Display):

L--m(displayed on the LCR LED SEgment Display)

where m =

1:Open Cal procedure is going on
2:Short Cal Procedure is going on
3:Range Cal procedure is going on

n n n n (displayed on the DQR LED Segment Display)

where n =

1:end of an Open Cal procedure
2:end of an Short Cal procedure
3:end of an Range Cal procedure

RUNTIME CODE:

SEL

On the LCR LED Segment Display means that the "Display Selection" does not match the DUT that is being measured; e.g., when the DUT is an L and the Display Selection is in C

NOTE:

Most of the display codes described above pauses until the User pushes the START key. unless otherwise specified.