

LCR700
LCR Meter

AUDAC

PROFESSIONAL AUDIO EQUIPMENT

LCR Meter LCR700




User Manual & Installation Guide

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Introduction

Dear customer,

With the LRC Meter you have acquired a high-quality and state-of-the-art measurement appliance.

The device is essential to sound engineers because of its many possibilities. Users can carry out measurements for induction, capacitance and impedance. During this action you can get a read-out on the D factor (dissipation factor) on a second display. All measurements can be carried out on two different frequencies: 120 and 1.000 Hz. This allows a measurement of great accuracy.

The LCR700 has an Auto-Power OFF function, which helps conserve the lifespan of the battery, and a fuse detection function to inform that a fuse is open or damaged. The use of a DC adapter can also serve to disable the Auto Power OFF function. The RS232 port enables you to communicate with a computer.

Environment

Do not place the unit in environments which contain high levels of dust, heat, moisture or vibration.

Do not use the unit near water or other liquids. Make sure no water or other liquids can be spilled, dripped or splashed on the unit.

This unit is developed for indoor use only. Do not use it outdoors.

Do not place objects on top of the unit.

Place the unit on a stable base.

Safety Requirements

(Read the safety requirements before using the meter)

Warning:

Before taking any measurements, please isolate the DUT from the power supply.

You should remove the test leads from the meter before replacing the batteries in order to avoid an electric shock. Make sure the circuit switch is disconnected before taking any measurements.


Do not use the meter if test leads look damaged. Please check regularly.

Caution:

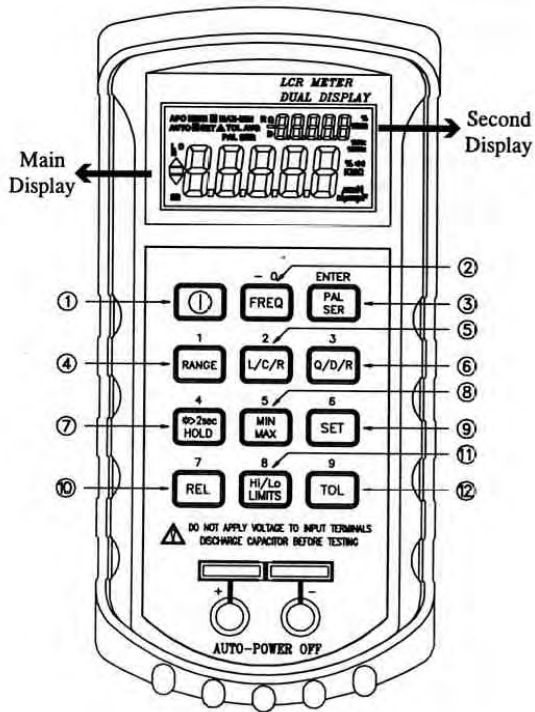
When you can't turn on the meter...

1. When you have turned off the meter a few seconds ago, it is perfectly normal. Please wait a moment to turn it on again.
2. When you can't operate the meter properly, please turn it off and restart later.
3. When the segments are fading away gradually, please wait 10 seconds to restart the meter.
4. When you can't turn on the meter normally, please press the power key for 10 seconds and the meter will restart.

General information

Display	L\C\R-4 ½ digits, max. reading of 19999. Q\D\R-4 digits, max.. reading of 9999 (Auto range)
Measurement parameters	Ls + (Q, D, Rs), Lp + (Q, D, Rp). Cs + (Q, D, Rs), Cp + (Q, D, Rp).
Basic accuracy	0.5% for Impedance 0.7% for Inductance, Capacitance
Measuring range control	Auto & manual
Overload indication	“OL” display.
Test frequency	1KHz & 120 Hz
Low battery indication	The  indicator is displayed when the battery voltage drops below the operating level and it cancels all the memorized values to store into EEPROM (included SET values).
Measurement speed	once per second, nominal.
Operating environment	0°C to 50 °C at < 80% RH..
Storage environment	-20°C to 60°C at 0 to 80% RH. With battery removed from meter.
Power	Single standard 9 Volt battery (NEDA 1604, IEC 6F22 006P)
External power	Adaptor 12 Volt min to 15 Volt max/50mA (optional)
Auto power	Auto power of if unused for 10 minutes
FUSE warning	Indicates when a fuse is open or damaged.
Protective Fuse	0.1 A fast-blow 250V AC.
Dimensions	19.2 cm (Height), 9.1 cm (width), and 5.25 cm (thickness).
Weights	365g (battery and holster included).
Accessories	A pair of test leads, instruction manual, Software, Optical data cable (9V battery and spare fuse in the meter).

Overview panel



APO	Auto power off
RS232	Communication indicator
R	Recording mode indicator
MAX	Maximum reading indicator
MIN	Minimum reading indicator
AVG	Average reading indicator
AUTO	Autoranging indicator
H	Data hold indicator
SET	Set mode indicator
△	Relative mode indicator
TOL	Tolerance mode indicator
PAL	Parallel mode indicator
SER	Series mode indicator
D	Dissipation factor indicator
Q	Quality factor indicator

R	Parallel or Series Resistance indicator
%	Tolerance indicator (percentage)
1 KHz	Frequency indicator
120 Hz	Frequency indicator
LRC	L, C or R function indicator
▲	High limit and tolerance indicator
▼	Low limit and tolerance indicator
🔋	Low battery indicator
🔊	Beep tone indicator for tolerance mode
MKΩ	Impedance (Ohm) indicator
umH	Inductance (Henry) indicator
mμpF	Capacitance (Farad) indicator

Specifications

CAPACITANCE:**Test Frequency 120 Hz**

Range	Min.	Max.	Cx	DF	Note
20mF	1μF	10.000mF	+/- (5.0%rdg + 5counts) DF<0.1	+/- (10%rdg + 100/Cx + 5counts) DF< 0.1	After short cal.
2000μF	100nF	1999.9μ	+/- (1.0%rdg + 5 counts) DF<0.1	+/- (2.0%rdg + 100/Cx + 5counts) DF<0.1	After short cal.
200μF	10nF	199.99μF	+/- (0.7%rdg + 3 counts) DF<0.5	+/- (0.7%rdg + 100/Cx + 5 counts) DF<0.5	-
20μF	1nF	19.999μF	+/- (0.7%rdg + 3counts) DF<0.5	+/- (0.7%rdg + 100/Cx + 5counts) DF<0.5	-
2000nF	100pF	1999.9nF	+/- (0.7%rdg + 3counts) DF<0.5	+/- (0.7%rdg + 100/Cx + 5counts) DF<0.5	-
200nF	10 pF	199.99nF	+/- (0.7%rdg + 5 counts) DF<0.5	+/- (0.7%rdg + 100/Cx + 5counts) DF<0.5	After open cal.
20nF	1pF	19.999nF	+/- (1.0%rdg + 5counts) DF<0.1	+/- (2.0%rdg + 100/Cx + 5 counts) DF<0.1	After open cal.

Test Frequency 1 KHz

Range	Min.	Max.	Cx	DF	Note
2000 μ F	100nF	1000.0 μ F	+/- (5.0%rdg + 5counts) DF<0.1	+/- (10%rdg + 100/Cx + 5 counts) DF<0.1	After short cal.
200 μ F	10nF	199.99 μ F	+/- (1.0%rdg+ 3counts) DF<0.5	+/- (2.0%rdg + 100/Cx +5counts) DF<0.5	After short cal.
20 μ F	1nF	19.999 μ F	+/- (0.7%rdg +3counts) DF<0.5	+/- (0.7%rdg + 100/Cx + 5counts) DF<0.5	-
2000nF	100pF	1999.9nF	+/- (0.7%rdg +3counts) DF<0.5)	+/- (0.7%rdg + 100/Cx + 5counts) DF<0.5	-
200nF	10pF	199.99nF	+/- (0.7%rdg +5counts) DF<0.1	+/- (0.7%rdg + 100/Cx + 5counts) DF<0.5	-
20nF	1pF	19.999nF	+/- (0.7%rdg + 100/Cx +5counts) DF<0.1	+/- (0.7%rdg + 100/Cx + 5counts) DF<0.1	After open cal.
2000pF	0.1pF	1999.9pF	+/- (1.0% rdg+5counts)	+/- (2.0%rdg+ 100/Cx + 5counts) DF<0.1	After open cal.

INDUCTANCE:**Test Frequency 120Hz**

Range	Min.	Max.	L_x (DF<0.5)	DF (DF<0.5)	Note
20000H	1H	10000H	Not specified	Not specified	-
2000H	100mH	1999.9H	$\pm (1.0\% \text{rdg} + L_x/10000 + 5\text{counts})$	$\pm (2.0\% \text{rdg} + 100/L_x + 5\text{counts})$	After open cal.
200H	10mH	199.99H	$\pm (0.7\% \text{rdg} + L_x/10000 + 5\text{counts})$	$\pm (1.2\% \text{rdg} + 100/L_x + 5\text{counts})$	-
20H	1mH	19.999H	$\pm (0.7\% \text{rdg} + L_x/10000 + 5\text{counts})$	$\pm (1.2\% \text{rdg} + 100/L_x + 5\text{counts})$	-
2000mH	100 μ H	1999.9mH	$\pm (0.7\% \text{rdg} + L_x/10000 + 5\text{counts})$	$\pm (1.2\% \text{rdg} + 100/L_x + 5\text{counts})$	-
200mH	10 μ H	199.99mH	$\pm (1.0\% \text{rdg} + L_x/10000 + 5\text{counts})$	$\pm (3.0\% \text{rdg} + 100/L_x + 5\text{counts})$	After short cal.
20mH	1 μ H	19.999mH	$\pm (2.0\% \text{rdg} + L_x/10000 + 5\text{counts})$	$\pm (10\% \text{rdg} + 100/L_x + 5\text{counts})$	After short cal.

Test Frequency 1KHz

Range	Min.	Max.	L _x (DF<0.5)	DF (DF<0.5)	Note
2000H	100mH	1000.0H	Not specified	Not specified	-
200H	10mH	199.99H	+/- (1.0% rdg + L _x /10000+5counts)	+/- (1.2%rdg + 100/L _x + 5counts)	After open cal.
20H	1mH	19.999H	+/- (0.7% rdg + L _x /10000+5counts)	+/- (1.2%rdg + 100/L _x + 5counts)	-
2000mH	100μH	1999.9mH	+/- (0.7% rdg + L _x /10000+5counts)	+/- (1.2%rdg + 100/L _x + 5counts)	-
200mH	10μH	199.99mH	+/- (0.7% rdg + L _x /10000+5counts)	+/- (1.2%rdg + 100/L _x + 5counts)	-
20mH	1μH	19.999mH	+/- (1.2% rdg + L _x /10000+5counts)	+/- (5.0%rdg + 100/L _x + 5counts)	After short cal.
2000μH	0.1μH	1999.μH	+/- (2.0% rdg + L _x /10000+5counts)	+/- (10% rdg + 100/L _x + 5counts)	After shore cal.

IMPEDANCE:

Range	Min.	Max.	Test Freq. 120 Hz	Test Freq. 1 kHz	Note
10MΩ	1kΩ	10.000MΩ	+/- (2.0%rdg + 8counts)	+/- (2.0%rdg + 8counts)	After open cal.
2MΩ	100Ω	1.9999MΩ	+/- (0.5%rdg + 5counts)	+/- (0.5%rdg + 5counts)	After open cal.
200kΩ	10Ω	199.99kΩ	+/- (0.5%rdg + 3counts)	+/- (0.5%rdg + 3counts)	-
20kΩ	1Ω	19.999kΩ	+/- (0.5%rdg + 3counts)	+/- (0.5%rdg + 3counts)	-
2kΩ	100mΩ	1.9999kΩ	+/- 0.5%rdg + 3counts)	+/- (0.5%rdg + 3counts)	-
200Ω	10mΩ	199.99Ω	+/- (0.8%rdg + 5counts)	+/- (0.8%rdg + 5counts)	After short cal.
20Ω	1mΩ	19.999Ω	+/- (1.2%rdg + 8counts)	+/- (1.2%rdg + 8counts)	After short cal.

Remarks

1. Q value is the reciprocal of DF
2. The specification is based on the testing sockets (clips) performed on the meter.
3. L(C) x indicates the readings of inductance (capacitance) on the display.
E.g. inductance (capacitance) = 18.888 H (F) then L(C) x=18888.

Getting started

1. Auto Power-down

If unused for about 10 minutes, the meter will power-down automatically. Press the **⏻** button to resume the power-on mode. When the power is down, press the **⏻** button to turn on the meter. The meter will return to its last operation before the power was turned off. In the MIN-MAX record mode, the RS-232 communication mode or while using the DC power-adaptor function, the auto-power down function is disabled automatically.

Continuous Measurement

In the power down mode, push the **⏻** button 2 seconds until the APO OFF indicator appears. It will put the meter into the continuous measurement mode.

Power switch

The **⏻** button turns the meter on or off.

2. Frequency select

Set the “FREQ” button switch to 120 Hz or 1 KHz according to the specimen that is to be tested. Generally, the electrolytic capacitor is set to 120 Hz. Others are set to 1 kHz in general.

3. Parallel/Series Mode

Press the “PAL SER” key to select either parallel (PAL) or series (SER) equivalent circuit. Generally, high impedances are measured in the parallel mode and low impedances are measured in the series mode.

4. Range Button

Press the (RANGE) key to select the Manual Range mode and to turn off the “AUTO” indicator. Every time you press the (RANGE) button, the measuring range will be increased by the power of ten, visible in the decimal point moving to the right and in the measuring unit changing. To exit the Manual Range mode and return to autoranging, press the (RANGE) button for 2 seconds. The “AUTO” indicator turns back on.

5. L/C/R Function Button (only Main display)

The L/C/R key switches the measurement parameters in sequence L – C – R – L This is indicated on the LCD. When the meter is turned on, it is set to the measurement parameter that was used last before the meter was turned off.

6. Q/D/R Function Button (only Second display)

The Q/D/R key switches the measurement parameter in sequence Q – D – R – Q . . . This is indicated on the LCD. When the meter is turned on, it is set to the measurement parameter that was used last before the meter was turned off.

7. HOLD. * >2sec.

Press the “HOLD” key to enter the data hold mode, the “HOLD” indicator is displayed. When the Hold mode is selected, the last readings will “freeze” in the display. Press “HOLD” for 2 seconds to start the backlight function, press this key for 2 seconds to exit the backlit function or wait 1 minute for it to automatically disable.

8. Min/Max button

Press “Min/Max” to enter the Min/Max/Avg mode. The meter will begin recording the minimum, maximum and average measured values. When this mode is entered, the auto power off and the function keys are disabled. After the first 6 measurements there will be an acoustic signal (beep) . When a new Max or Min value is recorded, there will be a signal (beep – beep). If you want to read the recorded MIN and MAX values, the difference between MAX and MIN values, and the average value AVG, you must press the button “MIN MAX” alternately. The Average Value’s display, displays the true average value. It can save up to 3000 values. The “Avg” indicator will flash when recording times reach 2991 to 3000 times. If the 3000 limit is exceeded, the Avg indicator stops recording and no further averaging will take place. The Max/Min values will continue to update. Under the Max/Min function, press “HOLD” key to stop recording temporarily and to store the former recording values. Press “HOLD” again to continue recording. You should press the Max/Min function for 2 seconds to stop the Max/Min function and delete the recordings.

9. SET

1. The “SET” function can only be activated if no other function is active.
2. Press “SET” to enter the SET mode, and change to manual range mode automatically.
3. While in the SET function, the main display is cleared, the second display shows “SET” indicators. The LCD shows the following flashing indicators: Δ , TOL, \blacktriangle and \blacktriangledown . The 5 keys that are now active are: “Power”, “SET”, “REL”, “Hi/Lo” and “TOL” .

4. OPEN, SHORT calibration:

For the open calibration, press the “SET” button once. In the large digital display, “OPEN” appears, in the small digital display “CAL” appears. Press the “PAL SER” button for confirmation (ENTER). If the calibration was successful, the measuring instrument would leave the set mode immediately and return to the normal mode. For the short calibration, short circuit the measuring leads and press the “SET” button twice. The large display will show “SHrt”, in the small display, “CAL” will be displayed. Press the “PAL SER” button for confirmation. After a relatively short time, the frequency display will change from 1 kHz to 120 Hz. After a successful calibration, the measuring instrument would leave the set mode immediately and will return to normal mode. If “out” appears in the small display and “UAL” in the large display, the calibration was not successful.

5. Hi/Lo Limits setting:

For setting a high and low limit (Hi) and (Lo), press the “RANGE” button before you enter the set mode to set the desired measuring range for the high and low limit. Then press the “SET” button to reach the set mode and then the "Hi/Lo" button. The arrow symbol “ \blacktriangle ” will flash, and on its right 4 1/2 digits for setting the value. When the half digit flashes, only the numbers “1” or “0” (=blank) can be set. For the other four digits, the numbers from 0 to 9 are possible. After entering the number, the next digit will flash. When the setting of the high limit is done, press the “ENTER” button (PAL SER) to confirm the lower limit. (Arrow symbol “ \blacktriangledown ”). Proceed in the same way as for setting the high limit. Make sure that the set value is below the upper limit, otherwise “Err” for error will be displayed and the measuring instrument will switch to the upper limit. When the setting of the lower limit is done, press the "ENTER" button for confirmation and the LCR meter will return to the normal mode automatically.

6. TOL Hi/Lo Limits setting:

Press the “RANGE” button to select the desired range. Press the “SET” button to enter the set mode and then the “TOL” button. The “TOL” symbol above the large display will flash and beneath it, the left digit of the 4 1/2 digits will flash also for setting the value. This value will be needed for measuring tolerance (described in detail below) without tolerance standards (in [%]). When the setting is done, press the “ENTER” button (PAL SER). The arrow symbol “ \blacktriangle ” and on its right the 4 1/2 digits will flash for setting the value. When the half digit flashes, only the numbers “1” or “0” (=blank) can be set. For the other four digits, the numbers from 0 to 9 are possible. After entering the number, the next digit will flash. When the setting of the high limit is done, press the "ENTER" button (PAL SER) to confirm the lower limit. (Arrow symbol “ \blacktriangle ”). Proceed in the same way as for setting the high limit. Make sure that the set value is below the upper limit, otherwise “Err” for error will be displayed and the measuring instrument will switch to the upper limit. When the setting of the lower limit is done, press the “ENTER” button for confirmation and the meter will return to the normal mode automatically.

7. REL setting:

Press the "RANGE" button to select the desired range. Press the "SET" button to enter the set mode and then the "REL" button. The "△" symbol and the left digit of the 4 1/2 digits will now flash for setting a reference value. After entering a number the next digit will flash. When the reference value is set, press "ENTER" to return to the normal mode.

10. REL Relative mode (only Main display)

Press the "REL" key to enter the Relative mode. The displayed reading is stored as a reference value and the display will indicate zero or a value close to zero (since the measured value and the reference value are the same at this point). Indicator "△" is displayed. Press the "REL" key again to exit the Relative mode.

For example: the displayed reading is 100.0, then press REL to store as a reference value and the display indicates zero. If you have set 100.0 as a reference value and if the input signal is 99.5, the relative mode will be -0.5. (99.5-100.0).

11. Hi/Lo Limits

Press "Hi/Lo LIMITS" to enter the "Hi/Lo LIMITS" mode, and change to manual range mode. The original "Hi/Lo LIMITS" values and indicators "▲" and "▼" appear individually and at the same time. When the input exceeds Hi Limit, the "▲" indicator is blinking and emits a continuous tone. When the input is lower than the Lo Limit, the "▼" indicator is blinking and a beep tone is heard. Press "Hi/Lo LIMITS" again to exit this mode. In addition, the meter ignores and does not record if an overload ("OL") situation occurs in the comparative processes or in the capacitance range ≤ 50 counts.


12. TOL

Press "TOL" to enter the tolerance mode, and change to manual range mode automatically. The original preset standard value and the "TOL" indicator appear individually and at the same time. When you enter the TOL mode, the Main display indicates the reference value and the second display indicates the tolerance value. There are 4 preset values in the TOL mode: just press TOL again to step through 1 %, 5 %, 10 % and 20%. The meter will emit an audible tone and blink the upper "▲" or lower "▼" indicator if the measured value is outside the limits. Standard values can be set by the "SET" function. In addition, the meter ignores and does not record if an overload ("OL") situation occurs in the comparative processes or in the capacitance range ≤ 50 counts. Press "TOL" for 2 seconds to exit this function.

Maintenance

Warning: Remove test leads before replacing battery or fuses.

Battery replacement

Power is supplied by a 9 volt “transistor” battery. (NEDA 1604, IEC 6 F22). The indicator  appears on the LCD display when replacement is needed. Remove the two screws on the back of the meter and lift off the battery case. Remove the battery from battery contacts.

Fuse Replacement

The LCD displays the symbol “FUSE” and an audible beep will sound. Replace the fuse only with the original type 100mA/250V, fast acting fuse.

Cleaning

Wipe the case with a damp cloth and detergent. Repeat regularly. Do not use abrasives or solvents.

Additional information RS-232 Command Table

Use IR as the interface of Data transmission and use an external computer to start RS-232 functions.

RS-232 Interface Parameters:

Baud rate: 1200

Parity check: EVEN

Data bits: 7

Stop bits: 1

(1) Setup Selections

a. Command S: Meter will enter the Setup mode and return "SETUP READY..x".

(x:firmware version)

b. Command

[E(L/C/R)(Q/D/R)(P/S)(A/B)(A/M)(0-6)]:

Main functions change

(L/C/R): L, C or R test function

(Q/D/R): Q, D or R

(P/S): P-PAL / S-SER

(A/B): A - 1 KHz / B-120 Hz

(A/M): A - AUTO / M – Manual

(0-6): Manual range

c. Command [A-AAAAA]: Default change

S	0	1	2	3	4	5	6	7	8
A	[U	+/-	1	9	9	9	9]
	Start Code	Data Format	Setting Value						Stop code

[U+/-19999]: REL SET setting value
 [V+/-19999]: Limits Hi setting value
 [W+/-19999]: Limits Lo setting value
 [X+/-19999]: TOL SET setting value
 [Y+/-19999]: TOL SET Hi setting value
 [Z+/-19999]: TOL SET Lo setting value

d.Command [BXXXXXX]: Exit the SETUP mode

(2) Read Data

Command N: Read Meter current data and status.

Data format: There are 39 ASCII code.

1. L/C/R
2. Q/D/R
3. A(1KHz) / B(120Hz)
4. P(PAL) / S(SER)
5. A(AUTO) / M(MENU)
6. 0/1: Main Display MSD, 8: while changing range, 9: OL
7. 6-10: Main Display Data
- 8.
- 9.
10. LSD
11. Main Display Range
12. MSD
13. 12-15: Second Display Data
- 14.
15. LSD
16. Second Display Range, 9: OL
17. Sequence 0-9 cycling
18. MSD
19. 18-21: D value
- 20.
21. LSD
22. Range for D value, 9: OL
23. MSD
24. 23-26: Q value
- 25.
26. LSD
27. Range for Q value, 9: OL
28. S(SET) / _(normal)
29. F(FUSE) / _(normal)
30. H(HOLD) / _(normal)
31. R(Present value) / M(Maximum value) / I(Minimum value) / X(Max-Min value) / A(Average

- value) / _(normal)
- 32. R(REL) / S(REL SET) / _(normal)
- 33. L(LIMITS) / _(normal)
- 34. T(TOL) / S(TOL SET) / _(normal)
- 35. B(Backlight) / _(normal)
- 36. A(Adapter insert) / _(normal)
- 37. B(Low Battery) / _normal
- 38. CR (ASCII : 0DH)
- 39. nl (LF) (ASCII: 0AH)

(3) RS-232 Output Chart for Main Display

Range	Rs	R	L		Rs	C	
		1KHz/120Hz	1 KHz	120 Hz		1KHz	120 Hz
0	100Ω	20.000Ω	2000.0μH	20.000mH	100KΩ	2000.0pF	20.000nF
1	100Ω	200.00Ω	20.000mH	200.00mH	100KΩ	20.000nF	200.00nF
2	100Ω	2000.0Ω	200.00mH	2000.0mH	10KΩ	200.00nF	2000.0nF
3	1KΩ	20.000KΩ	2000.0mH	20.000H	1KΩ	2000.0nF	20.000μF
4	10KΩ	200.00KΩ	20.000H	200.00H	100Ω	20.000μF	200.00μF
5	100KΩ	2000.0KΩ	200.00H	2000.0H	100Ω	200.00μF	2000.0μF
6	100KΩ	10.000MΩ	1000.0H	10000H	100Ω	2000.0μF	20.000mF

(4) RS-232 Output Chart for Second Display

Range	Q/D	R (Rs=100Ω)	R (Rs=1KΩ, 10KΩ)	R (Rs=100KΩ)
1	999.9	99.99Ω	99.99Ω	X
2	99.99	999.9Ω	999.9Ω	999.9Ω
3	9.999	9.999KΩ	9.999KΩ	9.999KΩ
4	9999	99.99KΩ	99.99KΩ	99.99KΩ
5	X	X	999.9KΩ	999.9KΩ

(5) FORMULA

$$R_p = R_s (1+Q^2)$$

$$C_p = C_s [1/(1+D^2)]$$

$$C_s = C_p (1+D^2)$$

$$L_p = L_s [1+(1/Q^2)]$$

$$L_s = L_p [Q^2/(1+Q^2)]$$

Personal notes