

BENCHTOP LCR METER

LCR Meter
Programming Manual



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1. Overview

This manual provides users with guidelines in writing commands for remote control of the LCR meter. It is considered that readers of this manual have carefully read the User Operation Manual of this product and are familiar with operation methods this product.

The LCR meter communicates with PC via RS232, USB or GPIB interface. For details of communication methods, please refer to different chapters of this manual. After the LCR meter is reliably connected to PC, user can control the LCR meter via programming commands. The LCR meter supports SCPI commands and part of GPIB Common commands

2. Description to GPIB Common Commands

***RST**

Function: Reset the instrument to factory setup.

***IDN?**

Function: Query the instrument ID and return a string (unique identification code of the instrument).

Return: Company name, Instrument model number, Version number

***TRG**

Function: Trigger the instrument externally.

FETC?

Function: Perform with ***TRG** command. Query measurement data manually. If the data automatic transmission function is turned on, no need to use this command.

***SAV**

Function: Save files.

Command: <numeric_value>,[string]

Description: <numeric_value> is internal file numbers 1 to 105.

[string] is file name, max.10 strings.

Example: *SAV 1, "AB"

Remarks: When sending this command, if the existing file is covered, there is no notification about it.

***RCL**

Function: Upload the existing files.

Commands: <numeric_value>

Description: <numeric_value> is internal file numbers 1 to 105.

Example: *RCL 1

3. Introduction to SCPI Commands

SCPI (Standard Commands for Programmable Instrument) is standard commands for programmable instruments based on IEEE 488.2 common commands. SCPI commands include two parts: IEEE 488.2 Common Commands and Control Commands defined for SCPI instruments.

Common Commands, as defined by IEEE 488.2, are supported by the instrument. Syntax and semantics of common commands must follow the rules of IEEE 488.2. Common commands are generally used to control reset, self-test and status operations in stead of measurement. For more details, please refer to chapter [IEEE 488.2 Common Commands](#).

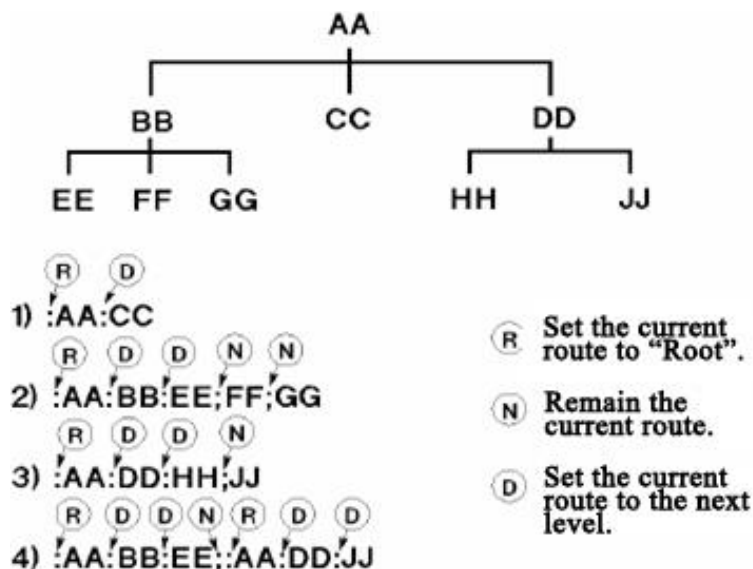
Control Commands defined for SCPI instruments are used to measure, read data, switch ON/OFF a function or a mode and so on. This chapter includes the following contents:

3.1 Command Structure

The SCPI is in a tree structure. The command on the top is called “root command” or called “root” in short. To reach command of the lowest level, user must follow its route.

Command terminator	It is a symbol to end the command. For example: NL (Line break symbol, as 10 in ASCII code).
Colon (:)	It means a command level, going to the next level.
Semicolon (;)	It means multiple levels of commands.
Question mark (?)	It means query.
Comma (,)	It is a break between multiple parameters.
Space ()	It is a break between commands and parameters. A symbol  is used to represents space In description of commands.
Quotation mark (“”)	It means contents of the original citation, which will not be processed by command analysis programm.
Asterisk (*)	Commands follow an asterisk are common commands.

The following figure shows how to reach command of the lowest level by using colon and semicolon.



If sending command: AA:BB:EE;FF;GG

It means the same to send below three commands:

:AA:BB:EE

:AA:BB:FF

:AA:BB:GG

3.2 Parameter

Character data and string data

Character data is consisted of ASCII characters. String data is consisted of ASCII characters with quotation mark ("").

Numerical data

Numerical data includes integer number (NR1), Fixed point number (NR2), and Floating point number (NR3). The numerical data range is $\pm 9.9E37$.

Examples of NR1:

123

+123

-123

Examples of NR2:

12.3

+1.234

-123.4

Examples of NR3:

12.3E+5

123.4E-56

3.3 Command System

3.3.1 SPEED

Function: Query or set test speed.

Parameter: FAST | MEDIUM | SLOW

Return: FAST | MEDIUM | SLOW

3.3.2 DISPLAY

:DISPLAY:PAGE

Function: Query or set display page.

Parameter: MEASUREMENT (Measurement display)

BNUMBER (Comparator function)

MSETUP (Measurement setup)

SYSTEM (System setup)

Return: < MEAS DISP > | < BIN DISP > | < MEAS SETUP > | < SYSTEM SETUP > | < ABOUT > |
< INTER FILE LIST >

:DISPLAY:RFONT

Function: Query or set font size. Query or set display ON/OFF.

Parameter: LARGE (Large font size)

TINY (Small font size)

OFF (Measurement data display off)

ON (Measurement data display on)

Return: OFF | LARGE | TINY

:DISPlay

Function: Query or set measurement data display mode.

Parameter: DIReCt (Direct reading)
PERcent (Percentage deviation)
ABSolute (Absolute deviation)

Return: DIRECT | PERCENT | ABSOLUTE

3.3.3 FREQuency

: FREQuency

Function: Query or set test frequency.

Parameter: 50 | 60 | 100 | 120 | 1k | 10k (for LCR-7010)
100 | 120 | 1k | 10k | 20k | 30 (for LCR-7030)
40 | 50 | 60 | 75 | 100 | 120 | 150 | 200 | 250 | 300 | 400 | 500 | 600 | 750 | 800 | 1k | 1.5k | 2k | 2.5 | 3k |
4k | 5k | 6k | 7.5k | 10k | 12k | 15k | 15.7k | 16.2k | 20k | 25k | 30k | 40k | 50k | 60k | 66.6k | 75k |
100k | 120k | 150k | 200k (for LCR-7030)

Return: 50 | 60 | 100 | 120 | 1k | 10k (for LCR-7010)
100 | 120 | 1k | 10k | 20k | 30 (for LCR-7030)
40 | 50 | 60 | 75 | 100 | 120 | 150 | 200 | 250 | 300 | 400 | 500 | 600 | 750 | 800 | 1k | 1.5k | 2k | 2.5 | 3k |
4k | 5k | 6k | 7.5k | 10k | 12k | 15k | 15.7k | 16.2k | 20k | 25k | 30k | 40k | 50k | 60k | 66.6k | 75k |
100k | 120k | 150k | 200k (for LCR-7030)

3.3.4 LEVel

: LEVel

Function: Query or set test level.

Parameter: 0.1V | 0.3V | 1.0V

Return: 0.1V | 0.3V | 1.0V

3.3.5 PARAMeter

: PARAMeter

Function: Query or set test parameters.

Parameter: cd | lq | rq | rd | rx | zd | zr

Return: cd | lq | rq | rd | rx | zd | zr

3.3.6 EQUivalent

: EQUivalent

Function: Query or set equivalent shift of test parameters.

Parameter: SERial | PARallel

Return: SERIAL | PARALLEL

3.3.7 SRESistor

: SRESistor

Function: Query or set source resistance.

Parameter: 30 | 100

Return: 30 | 100

3.3.8 RANGe

: RANGe

Function: Query or set range.
Parameter: AUTO | HOLD | 0 | 1 | 2 | 3 | 4 | 5
Return: AUTO-<n> | HOLD-<n>
<n> is number 0~5.

3.3.9 TRIGger

: TRIGger

Function: Query or set trigger mode. Or immediately trigger for one time.
Parameter: INTERNAL (Internal trigger)
EXTERNAL (External trigger)
IMMEDIATE (Immediately trigger for one time)
Return: INTERNAL | EXTERNAL

: TRIGger:DELaY

Function: Query or set trigger delay time.
Parameter: 0~6000 (ms)
Return: 0~6000

3.3.10 CORRection

: CORRection

Function: Clear data.
Parameter: OPEN (Single point open circuit clearing)
OPEN_ALL (All points open circuit clearing)
SHORT (Single point short circuit clearing)
SHORT_ALL (All points short circuit clearing)

3.3.11 COMParator

: COMParator[:STATe]

Function: Query or set comparator status.
Parameter: ON | OFF | 1 | 0
Return: 1 | 0

: COMParator:Auxiliary BIN

Function: Query or set auxiliary status.
Parameter: ON | OFF | 1 | 0
Return: 1 | 0

: COMParator:BIN CLear

Function: Clear all upper and lower limits.
Parameter: ON | OFF | 1 | 0
Return: 1 | 0

: COMParator:COUNT[:STATe]

Function: Query or set counter status.

Parameter: ON | OFF | 1 | 0

Return: 1 | 0

: COMParator:COUNT:DATA?

Function: Query counter number of each range.

Return: <count numbers of fail range>,<counter number of range 1>,<counter number of range 2>,<counter number of range 3>,<counter number of auxiliary range>

: COMParator:COUNT:CLEAr

Function: Clear counter number of ll ranges.

3.3.12 LIMit

: LIMit:NOMinal

Function: Query or set nominal value.

Parameter: <value>

Return: <value>

<value> is NR3 format.

: LIMit:BIN<n> <HIGH>,<LOW>

Function: Query or set high and low limits of each range.

Parameter: n (1~3, in NR1 format.)

high, low (-100~100, in NR3 format.)

Return: <HIGH>,<LOW>

Note: If there is no setting for high and low limits, the return value will be "9.9999e+37".

: LIMit:SECondary <HIGH>,<LOW>

Function: Query or set high and low limits of secondary parameters.

Parameter: high, low (in NR3 format.)

Return: <HIGH>,<LOW>

Note: If there is no setting for high and low limits, the return value will be "9.9999e+37".

3.3.14 HANDLER

:HANDler:MODE

Function: Query or set comparator output mode.

Parameter: CLEAR | HOLD | PULSE

Return: CLEAR | HOLD | PULSE

: HANDler:PULSe

Function: Query or set pulse width.

Parameter: <numeric_value> | MIN | MAX

Return: <numeric_value>

Note: <numeric_value> is 1~9999. Unit is default at ms.

:HANDler:EDGE

Function: Query or set trigger edge.

Parameter: RISing | FALLing

Return: RISING | FALLING

3.3.15 CALCULATE

:CALCulate:AVERage

Function: Query or set average time numbers.

Parameter: 1~255

Return: 1~255

:CALCulate:LIMit:BEEPer:SOURce

Function: Query or set beeper source.

Parameter: MASTr | EARPHone | ALL

Return: MASTER | EARPHONE | ALL

:CALCulate:LIMit:BEEPer:PASS

Function: Query or set beeper for comparator pass.

Parameter: OFF | LONG | SHORT | TwoSHORT

Return: OFF | LONG | SHORT | TWOSHORT

:CALCulate:LIMit:BEEPer:FAIL

Function: Query or set beeper for comparator fail.

Parameter: OFF | LONG | SHORT | TwoSHORT

Return: OFF | LONG | SHORT | TWOSHORT

3.3.16 SYSTem

:SYSTem:BEEPer[:STATe]

Function: Query or set touch tone.

Parameter: OFF | 0

ON | 1

Return: 0 | 1

:SYSTem:SAVE

Function: Save file.

Parameter: <numeric_value>, [string]

Note: <numeric_value> is internal file number 1~105.

[string] is file name, with max.10 strings. When file name is omitted, the file is named automatically with file numbers.

:SYSTem:LOAD

Function: Load from existing files.

Parameter: <numeric_value>

Note: <numeric_value> is internal file number 1~105.

Example: SYST:LOAD 1

:SYSTem:RESet

Function: Reset system.

3.3.17 PRINt

:PRINt

Function: Query or set automatic data transmission function.

Parameter: OFF | 0
ON | 1

Return: 0 | 1

Note: When automatic data transmission is activated, the instrument automatically transmits measurement data in the following format.

<A>,,<COMP>

<A>: Measurement data of main parameters.

: Measurement data of secondary parameters.

<COMP>: Measurement data of comparator results 0~5.

3.3.18 COMP

: COMPArator: COMP:STATe

Function: Query or set comparator on/off.

Parameter: ON | OFF | 1 | 0

Return: 1 | 0

: COMPArator: COMP: MODE

Function: Query or set comparator mode.

Parameter: 1 | 0

Return: 1 | 0

Note: 1: Δ ABS mode.

: COMPArator: COMP: LIMit:NOMinal

Function: Query or set nominal value of main parameters.

Parameter: < numeric_value > (NR3 format)

Return: < numeric_value > (NR3 format)

: COMPArator: COMP: LIMit:A□<HIGH>,<LOW>

Function: Query or set high or low value of main parameters.

Parameter: <HIGH>,<LOW>

Return: < numeric_value > (HIGH), < numeric_value > (LOW)

Note: If there is no high or low limits, the returned value will be "9.9999e+37".
In comparator mode $\Delta\%$, the returned value range is -100~100.

: COMPArator: COMP: LIMit:B□<HIGH>,<LOW>

Function: Query or set high or low value of secondary parameters.

Parameter: <HIGH>,<LOW> (NR3 format)

Return: < numeric_value > (HIGH), < numeric_value > (LOW)

Note: If there is no high or low limits, the returned value will be "9.9999e+37".

4. Format Commands

4.1 Data Output Format

When writing commands, the “Symbol” in below table must be expressed in the way of ASCII code.

Character Sequence	Application	Symbol	Description			
1	Initial word recognition	{	No special meaning			
2	Indication for main/secondary parameters.	0, 1, 2, 3, 4		Main parameter	Secondary parameter	
			0	L: Inductance	Q: Quality factor	
			1	C: Capacitance	D: Dissipation	
			2	R: Resistance	Q: Quality factor	
			3	R: Resistance	D: Dissipation	
			4	Other		
3	Frequency	0, 1, 2, 3, 4, 5	0: 10kHz 1: 1kHz 2: 120Hz 3: 100Hz 4: 60Hz 5: 50Hz			
4	Level	0, 1, 2	0: 1V 1: 0.3V 2: 0. 1V			
5	Display mode	0, 1, 2	0: % deviation 1: Direct reading 2: ABS deviation			
6	Range	0, 1	0: HOLD 1: AUTO			
7	Speed	0, 1, 2	0: FAST 1: SLOW 2: MEDIUM			
8	Clear	0, 1, 2, 3	0: Short circuit clear 1: Open circuit clear 2: All clear 3: Not clear			
9	Beeper	0, 1	0: ON 1: OFF			
10	Operation mode	0, 1	0: Continuous 1: Single			
11	Equivalent form	0, 1	0: Series 1: Parallel			
12	Serial port	0, 1	0: OFF 1: ON			
13	Comparator mode	0, 1, 2	0: OFF 1: ON		0: Comparator P 1: Comparator P3 2: Comparator OFF	
14	Internal resistance	0, 1	0:30Ω 1:100Ω			
15~20	Main parameter	0~9, “.”, “-”	From high to low			
21~26	Secondary parameter	0~9, “.”, “-”	From high to low			
27	Unit of main parameter, or %	0, 1, 2, %		L	C	R/Z
			0	uH	pF	Ω
			1	mH	nF	kΩ
			2	H	uF	MΩ
			%	Percentage deviation		
28	Comparator output	0, 1, 2, 3, 4, 5			Comparator P3	Comparator P1
			0	NG	NG	D/QNG: bad secondary parameter
			1	Grade 1	Grade 1 of P1	PASS
			2	Grade 2	Grade 1 of P2	HI: Exceeding HIGH limit
			3	Grade 3	Grade 1 of P3	LO: Exceeding LOW limit
			4	AUX fail		D/QNG&HI
			5	No comparator		D/QNG&LO
29	The current range	0, 1, 2, 3, 4, 5	0: 100kΩ 1: 10kΩ 2: 1kΩ 3: 100Ω 4: 31.6Ω 5: 10Ω			
30	Stop bit	}	No special meaning			

4.2 String Format

When writing commands, the “Command Code” in below table must be expressed in the way of ASCII code. For example, command string {A0} in ASCII code is 7B41307D. Only one of the following command can in contained in one string. Each command must be started with { and ended with }.

No.	Command Code	Numbers of Characters	Control Function
1	A0	2	Measure parameters, series and parallel: L-Q
2 ^P	A1	2	Measure parameters, series and parallel: C-D
3	A2	2	Measure parameters, series and parallel: R-Q
4	A3	2	Measure parameters, series and parallel: Z-r
5	B0	2	Measure frequency: 10kHz
6	B1	2	Measure frequency: 1kHz
7	B2	2	Measure frequency: 120Hz
8	B3	2	Measure frequency: 100Hz
9	B4	2	Measure frequency: 60Hz
10	B5	2	Measure frequency: 50Hz
11	C0	2	Measure level: 1V
12	C1	2	Measure level: 0.3V
13	C2	2	Measure level: 0.1V
14	D0	2	Display mode: $\Delta\%$
15	D1	2	Display mode: Direct reading
16	D2	2	Display mode: ABS deviation
17	E0	2	Hold in the current range.
18	E1	2	Auto ranging.
19	E2	2	Hold in 0 range 100k Ω .
20	E3	2	Hold in 1 range 10k Ω .
21	E4	2	Hold in 2 range 1k Ω .
22	E5	2	Hold in 3 range 100 Ω .
23	E6	2	Hold in 4 range 31.6 Ω .
24	E7	2	Hold in 5 range 10 Ω .
25	F0	2	Measurement speed: FAST.
26	F1	2	Measurement speed: SLOW.
27	F2	2	Measurement speed: MEDIUM.
28	G0	2	Short circuit clear.
29	G1	2	Open circuit clear.
30	G2	2	Fixed point frequency short circuit clear.
31	G3	2	Fixed point frequency open circuit clear.
32	H0	2	Beeper: MASTER.
33	H1	2	Beeper: EARPHONE.
34	I0	2	Trigger: (OFF) Continuous.
35	I1	2	Trigger: (ON) Single.
36	J0	2	Equivalent format: (SER) series.
37	J1	2	Equivalent format: (PER) parallel.
38	K0	2	RS232 interface: (OFF) only receive data (single direction).
39	K1	2	RS232 interface: (ON) Allow to send data (Bi-direction).
40	L0	2	Comparator mode: P1
41	L1	2	Comparator mode: P3
42	L2	2	Comparator OFF
43	L3	2	Comparator ON
44	M0	2	Source resistance: 30 Ω
45	M1	2	Source resistance: 100 Ω

No.	Command Code	Numbers of Characters	Control Function																
46	NX=XB _{1B} XB _{2B} XB _{3B} XB _{4B} XB _{5B} XB _{6B} XB _{7B}	≤10	NX: it is relative setting parameters. Parameter's value and unit follows symbol “=”. Rules: N1: Nominal value N2: Q/D limits N3: High limit of grade 1 N4: Low limit of grade 1 N5: High limit of grade 2 N6: Low limit of grade 2 N7: High limit of grade 3 N8: Low limit of grade 3 N9: High limit of secondary parameter N0: Low limit of secondary parameter After receiving data, the instrument will automatically adjusted data into below format: 1) X1_B: ASCII code of 0~9. X2~XB_{6B}: ASCII codes of 0~9 and decimal points. XB_{7B}: ASCII code of 0~2. Here XB_{7B} is defined as below: <table border="1"> <tr> <th>ASCII code of XB_{7B}</th><th>C</th><th>L</th><th>Z, Q</th></tr> <tr> <td>30H</td><td>pF</td><td>μH</td><td>Ω</td></tr> <tr> <td>31H</td><td>nF</td><td>mH</td><td>KΩ</td></tr> <tr> <td>32H</td><td>μF</td><td>H</td><td>MΩ</td></tr> </table> 2) N3~N8 XB_{1B}: ASCII codes of “+” and “-”. X₂: ASCII codes of 0~9. X₃~X₆: ASCII codes of 0~9 and decimal points. X₇: ASCII code of % (N2, N9). 3) N0, N9 XB_{1B}: ASCII codes of “+” and “-”. X₂~X₆: ASCII codes of 0~9 and decimal points. X₇: ASCII code of 0~2. 4) N2 X₁~X₆: ASCII codes of 0~9 and decimal points. Note: N2 is only valid for secondary parameters D/Q. D with high limit and without low limit. Q with low limit and without high limit.	ASCII code of XB _{7B}	C	L	Z, Q	30H	pF	μH	Ω	31H	nF	mH	KΩ	32H	μF	H	MΩ
ASCII code of XB _{7B}	C	L	Z, Q																
30H	pF	μH	Ω																
31H	nF	mH	KΩ																
32H	μF	H	MΩ																
47	NX=?P	4	Query setting values of the instrument. When the instrument receives this command, it sends corresponding command to the computer for one time in below format: { NX=XB_{1B}XB_{2B}XB_{3B}XB_{4B}XB_{5B}XB_{6B}XB_{7B} } According to command 46, the data is adjusted automatically by the instrument as X2~XB_{6B}:999999																
48	P0	2	Trigger, same as pressing TRIGGER key on front panel.																