**ET44、ET45 Benchtop LCR Meter**

**SCPI Communication Protocol**

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**1 SCPI** Command Syntax

* 1. Grammar practice

Take the following two commands as examples to explain all the symbols meanings in the SCPI command

：

[SOURce[1|2]:]VOLTage:UNIT {VPP|VRMS|DBM}

[SOURce[1|2]:]FREQuency:CENTer {<frequency>|MINimum|MAXimum|DEFault}

According to command syntax, most commands (and some arguments) are represented in a mixture of upper and lower case letters.For shorter program lines, you can send commands in abbreviated form.To achieve better program readability, you can send long format commands.For example, in the above syntax, the VOLT and VOLTAGE are both acceptable formats.You can use uppercase or lowercase letters.Therefore, VOLTAGE, volt and volt are all acceptable formats.Other formats, such as VOL and VOLTAG, are invalid and produce errors.

The curly braces ({}) contain the parameter options for the given command string.Braces are not sent with the command string.

A vertical bar (|) separates multiple parameter selections for a given command string.For example, in the above command, {VPP|VRMS|DBM} indicates that you can specify a parameter in "VPP," "VRMS," or "DBM."Bars are not sent with the command string.

The Angle brackets (< >) in the second example indicate that a value must be specified for the parameter within the brackets.For example, in the syntax statement above, the parameter in Angle brackets is < frequency >.Angle brackets are not sent with the command string.You must specify a value for the parameter (for example, "FREQ:CENT 1000") unless you select any other option shown in the syntax (for example, "FREQ:CENT MIN").

Some syntax elements, such as nodes and parameters, are enclosed in square brackets ([]).This means that the element is optional and can be omitted.Angle brackets are not sent with the command string.If no value is specified for the optional parameter, the instrument selects the default value.In the example above, "SOURce[1|2]" means that you can refer to SOURce channel 1 through "SOURce" or "SOURce1", or "SOUR1" or "SOUR".In addition, since the entire SOURce node is optional (in square brackets), you can also refer to channel 1 by omitting the SOURce node entirely.This is because channel 1 is the default channel for the SOURce node.On the other hand, to refer to channel 2, you can only use "SOURce2" or "SOUR2" on the program line.

* 1. Command separator

The colon (:) is used to separate the command keyword from the keyword at the next level.Spaces must be inserted to separate arguments from command keywords.If a command requires more than one argument, the adjacent arguments must be separated by commas, as shown below:

APPL: SIN e3 455, 1.15, 0.0

In this example, the APPLy command specifies a sine wave with a frequency of 455 KHz, an amplitude of 1.15v, and a DC offset of 0.0v.

The semicolon (;)Use to separate multiple commands in the same subsystem and minimize typing.For example, send the following command string:

TRIG: SOUR EXT.The COUNT ten

The same as sending the following two commands:

TRIG: SOUR EXT

TRIG: the COUNT of 10

**2 ET44 Command Set**

The section titled "description" describes the use of a command or the operations it performs.

The section "arguments" under the heading describes the parameters necessary to send a command.When the parameter is a value or string type within <>, the definition of the parameter, allowable value range, default (factory setting) value, and so on are given, and when the parameter is a selection type within {}, the description of each selection is given.

The section titled "command syntax" indicates that the command does not need to be answered, and the instrument only needs to perform the corresponding action according to the command.The part with "query syntax" as the title indicates that the command needs to be answered and the instrument needs to return data to the upper computer. For the specific answer content, please refer to "query return".Both command syntax and query syntax are grammars that are sent from the external controller to ET43.

This communication agreement provides that:

NR1: integer, e.g. 123

NR2: a decimal (fixed-point number), as in 12.3

NR3: floating point number, e.g., 12.3E+5

NRf: NR1, NR2 or NR3

NL: carriage return, integer 10

* 1. **IEEE488.2 Mandatory Order**

**\*IDN?**

The description command is used to query the instrument information

Query syntax \*IDN?

The query returns <manufacturer>,<model>,<firmware>,<hardware>,<SN><NL>

Note: <manufacturer>, that is, ZC; <model>, that is, ET43; <firmware>, that is, software version number; <hardware>, that is, hardware version number; and <SN>, that is, serial number.

* 1. **SCPI** Instrument order
		1. **SYSTem** Subsystem command set

**:VERSion?**

The description command is to search the SCPI version number to conform to the instrument

Query syntax SYSTem: VERSion?

The query returns 1999.0<NL>

* 1. **ET44 Command Set**

**2.3.1 APERture** Subsystem command set

The APERture subsystem commands are mainly used to set the speed mode for measurement.You can query the current measured speed mode.

APERture command syntax {FAST|MEDium|SLOW}

Parameter

|  |  |
| --- | --- |
|  | Description |
| FAST | Set the mode of Measuring speed as FAST |
| MEDium（Preset Value） | Set the mode of Measuring speed as MEDium |
| SLOW | Set the mode of Measuring speed as SLOW |

Query grammar APERture?

The query returns {FAST|MEDium|SLOW}<NL>

**2.3.2 BIAS** Subsystem command set

**:VOLTage[:LEVel]**

Set dc bias voltage, character?Query the current dc bias voltage.

Command syntax BIAS:VOLTage[:LEVel] <numeric>

Parameter

|  |  |
| --- | --- |
|  | < numeric > |
| Range  | 0～1500 |
| Preset Value | 0 |
| Unit | mV |

Query grammar BIAS:VOLTage[:LEVel]?

The query returns <NR3><NL>

For example: Make BIas to 1500mv

 BIAS:VOLTage 1500 (Notice the Spaces in between)；

The query ：BIAS:VOLTage:LEVel?

 Returns ：1500

**2.3.3 COMParator** Subsystem command set

COMParator subsystem commands are used to set COMParator functions, including COMParator switch Settings, tolerances and nominal Settings.

**[:STATe]**

Description setting the comparator function on or off to query the current comparator function status.

Command syntax COMParator[:STATe] {ON|OFF|1|0}

Parameter

|  |  |
| --- | --- |
|  | Description  |
| ON or 1 | Turn on the comparator function 。 |
| OFF or 0（Preset Value） | Turn off the comparator function 。 |

Query Grammar : COMParator[:STATe]?

Query Return : <NR1><NL>

**:TOLerance:BIN？**

Describes the tap position of the current comparator BIN, which is only valid when the comparator is opened.

Query syntax COMParator:TOLerance:BIN?

The query returns <NR1><NL>

**:TOLerance:NOMinal （The following instructions are only valid on the comparator Settings screen）**

Describes the nominal value that sets the comparator function.

The nominal value of the current tolerance mode can be queried.

Command syntax COMParator: how: NOMinal < numeric >

Parameter

|  |  |
| --- | --- |
|  | <numeric> |
| Preset Value | 0 |

Query grammar COMParator:TOLerance:NOMinal?

Query Return <NR3><NL>

**:** **TOLerance:RANGe:CH**

Describes the tolerance range of the setting comparator

Command syntax COMParator: how: RANGe: CH < value >

Parameter

|  |  |  |
| --- | --- | --- |
| Channel  | CH | CH |
| Range | 1L、1H、2L、2H、3L、3H | 2ndL、2ndH |
| Unit | / | / |
|  | <value> | <value> |
| Range | -50~+50 | / |
| Unit | % | / |
| Default  | +1% | Current measuring value |

Query Grammar COMParator:TOLerance:RANGe:CH?

Query Return <value><NL >

**2.4.4 CORRection** Subsystem command set

CORRection subsystem command set is used to set open circuit correction and short circuit correction

**:OPEN[:EXECute]**

Describes an open circuit correction for all frequency points.

Syntax CORRection:OPEN[:EXECute]

The query returns <NR1><NL>

**:SHORt[:EXECute]**

Describes an open circuit correction for all frequency points.

Syntax CORRection:OPEN[:EXECute]

The query returns <NR1><NL>

**2.4.5 DISPlay** Subsystem command set

DISPlay subsystem command set is mainly used to set the display interface

**:PAGE**

Description of the page to display, characters?You can query the current page

DISPlay:PAGE{MEASurement| COMPset |SYSTem}

Parameter

|  |  |
| --- | --- |
|  | Dexcription  |
| MEASurement（Preset Value） | Set the display page to< MEAS DISPLAY> |
| COMPset  | Set the comparator interface to< COMP set > |
| SYSTem | Set the display page to<SYSTEM INFO> |

Query Grammar DISPlay:PAGE?

Query Return {MEASurement| COMPset |SYSTem}<NL>

**2.4.6 FETCh ORDER**

Description query the measuring result

Query Grammar FETCh?

Query Return <NR3>,<NR3><NL>

**2.4.7 VOLTage** Subsystem command set

The VOLTage subsystem is mainly used to set the measuring VOLTage of the device. If the CURRent[:LEVel] signal is set, the query command returns the error number -230.Characters?The current measurement level voltage can be queried.

The command syntax VOLTage[:LEVel] is <numeric>

Parameter

|  |  |
| --- | --- |
|  | <numeric>  |
| Range  | 10~2000 |
| Preset Value  | 1000mV |
| Unit  | mV |

Query Grammar VOLTage[:LEVel]?

Query Return <NR3><NL>

**2.4.8 FREQuency** Subsystem command set

The FREQuency subsystem command set is mainly used to set the measurement FREQuency of the instrument.You can query the current measurement frequency

Command syntax FREQuency[:CW] <numeric>

Parameter

|  |  |
| --- | --- |
|  | <numeric>  |
| Range  | 10～100000  |
| Preset Value | 1000 |
| Unit  | Hz |
| Resolution rate  | Depends on the setting frequency 。 |

Query Grammar FREQuency[:CW]?

Query Return <NR3><NL>

**2.4.9 FUNCtion** Subsystem command set

The FUNCtion subsystem command is mainly used to set "FUNCtion", range, current and voltage monitoring switch, deviation display mode and nominal setting, etc.

**:DEV:MODE**

Describes setting relative measurement mode, character?The current deviation measurement pattern state can be queried.

FUNCtion: DEV:MODE {ON|OFF}

Parameter

|  |  |
| --- | --- |
|  | Description  |
| ON | Turn on relative measurement mode |
| OFF（Preset Value） | Turn off relative measurement mode |

Query Grammar FUNCtion:DEV:MODE?

Query Return {ON|OFF}<NL>

**:IMPedance:A**

Describes setting the main parameters of a measurement, character?The state of the current range can be queried.

Command syntax FUNCtion: IMPedance: A {AUTO | | Z | R | | C L DCR | ECAP

Paramter

|  |  |
| --- | --- |
|  | Description  |
| AUTO | main parameter automatic |
| R | Resistance  |
| C | Capacitance  |
| L | Inductance |
| Z | Impedance |
| DCR | Dc resistance |
| ECAP | Electrolytic capacitor |

Query Grammar FUNCtion:IMPedance:A?

Query Return {AUTO|R|C|L|Z|DCR|ECAP}<NL>

**:IMPedance:B**

Describe setting of measurement parameters, character?The state of the current range can be queried.

Command syntax FUNCtion: IMPedance: B {X | D | | Q THR | ESR}

Parameter

|  |  |
| --- | --- |
|  | Description  |
| X | reactance |
| D | Dissipation factor |
| Q | Quality factor  |
| THR | Angle |
| ESR | Equivalent series resistance |

Query Grammar FUNCtion:IMPedance:B?

Query Return {X|D|Q|THR|ESR}<NL>

**:IMPedance:EUUivalent**

Describe setting the serial and parallel properties of measurement parameters, character?The state of the current range can be queried.

Command syntax FUNCtion: IMPedance: EQUivalent

Parameter

|  |  |
| --- | --- |
|  | Description  |
| SERial | In series |
| PALlel | In parallel |

Query Grammar FUNCtion:IMPedance: EQUivalent?

Query Return {SERial|PALlel}<NL>

**:IMPedance:RANGe:AUTO**

Describes the automatic range conversion function for starting impedance measurements, character?The state of the current range can be queried.

Command syntax FUNCtion: IMPedance: RANGe: AUTO {ON | OFF | 1 | 0}

Parameter

|  |  |
| --- | --- |
|  | Description |
| ON or 1（Preset Value ） | Automatic conversion range open |
| OFF or 0 | Auto convert range off |

Query Grammar FUNCtion:IMPedance:RANGe:AUTO?

Query Return <NR1><NL>

**:IMPedance:RANGe[:VALue]**

Describes the characters used to set the instrument range.Can query current range parameters.This command turns off automatic range conversion.

Command syntax FUNCtion: IMPedance: RANGe VALue] [: < numeric >

Parameter

|  |  |
| --- | --- |
|  | <numeric> |
| Range  | 30|100|300|1000|3000|10000|30000|100000 |
| Preset Value | Automatic  |
| Unit  | Ω |

Query grammar FUNCtion:IMPedance:RANGe[:VALue]?

Query return <Numeric><NL>

**2.4.10 SYSTem Subsystem Command Set**

**:BEEPer[:IMMediate]**

Describe the sound of the prompt.The beeping sound can be emitted even if it is disabled by the :SYSTem:BEEPer:STATe command.

SYSTem: BEEPer[:IMMediate]

**:BEEPer:STATe**

Describes setting the prompt sound on or off.

SYSTem: BEEPer:STATe {ON|OFF|1|0}

Parameter

|  |  |
| --- | --- |
|  | Descriotion  |
| ON or1 | Turn on the prompt tone  |
| OFF or 0（Preset Value ） | Disable the prompt tone |

Query Grammar SYSTem:BEEPer:STATe?

Query Return <NR1><NL>

**:LOCal**

Describes placing ET44 in the local operation state.(the program command to set the instrument to local or remote operation state and the switch of the power button of the instrument are mutually affected)

Command syntax SYSTem:LOCal

**:REMote**

Describes setting ET44 to the remote operation state.

Command syntax SYSTem:REMote