ET44、ET45 Benchtop LCR Meter SCPI Communication Protocol

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1 SCPI Command Syntax

1.1 Grammar practice

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

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   :

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[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.

1.2 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

2.1　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.

2.2 SCPI　Instrument order

2.2.1　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>

2.3 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（预设值）	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
	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 子系统命令集

: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