UTE9811+ Smart Digital Power Meter

SCPI Programming Manual

REV 00
2023.2

UNI-T®

Copyright

2023 Uni-Trend Technology (China) Co., Ltd.

Brand Information

UNI-T is the registered trademark of Uni-Trend Technology (China) Co., Ltd.

Software Version

00.00.01

Software upgrade may have some change and add more function, please subscribe **UNI-T** website to get the new version or contact **UNI-T**.

Statement

- **UNI-T** products are protected by patents (including obtained and pending) in China and other countries and regions.
- **UNI-T** reserves the right to change specifications and prices.
- The information provided in this manual supersedes all previous publications.
- The information provided in this manual is subject to change without notice.
- **UNI-T** shall not be liable for any errors that may be contained in this manual. For any incidental or consequential damages arising out of the use or the information and deductive functions provided in this manual.
- No part of this manual shall be photocopied, reproduced or adapted without the prior written permission of **UNI-T**.

Product Certification

UNI-T has certified that the product conforms to China national product standard and industry product standard as well as ISO9001:2008 standard and ISO14001:2004 standard. UNI-T will go further to certificate product to meet the standard of other member of the international standards organization.

Chapter 1 SCPI

SCPI（Standard Commands for Programmable Instruments）is a standardized instrument programming language that builds on existing standards IEEE 488.1 and IEEE 488.2 and follows the floating point rules of IEEE 754 standard, ISO 646 message exchange 7-bit encoding notation (equivalent to ASCII programming) and many other standards.

This section introduces the format, symbols, parameters, and abbreviations of the SCPI command.

Instruction Format

Command is consisting of a keyword, separator, parameter domain and end mark. Take the following command as an example.

:VOLTage:RANGe 150

VOLTage, RANGe is keyword, ":" and blank is separator, "150" is parameter (some commands have multiple parameters and separated by ","), the line separator or carriage return after the command is the end mark.

For the convenience of description, the following conventions are adopted for subsequent symbols.

• Square Brackets "[ ]"
The contents in square brackets (command keywords) can be omitted.

• Braces "{ }"
It represents the parameter in command string.

• Angle Braces "< >"
The parameter enclosed in the angle brackets must be a numerical parameter.

• Vertical Bar "|"
It is used to separate multiple parameters.

•End Mark: line separator <LF>（0x0A）or carriage return <CR>（0x0D）

Parameter Description

The data type of programming parameters include numeric, character and Boolean type. Regardless of the type, it is expressed as an ASCII. For details, see the following table.

Symbol	Meaning	Example
<NR1>	Integer	123, 0123
<NR2>	Fixed Floating point number	123., 12.3, 0.123, .123
<NR3>	Floating point number	123, 12.3, 123E+3
<NRF>	It may be <NR1>, <NR2> or <NR3>	
<Boolean>	Boolean data	0|1|ON|OFF

All the commands are case-insensitive. The commands can be all input in uppercase letters or in lowercase letters. For abbreviations, it should enter all the uppercase letters that exist in the command syntax.

Chapter 2 Communication Interface and Setting

The detailed description can refer to "Chapter 6 Communication Setting" and "Chapter 8 Communication Interface in UTE9811+ User's Manual.

Chapter 3 Instruction

3.1 Instruction List

Notes：The instruction ":VOLTage:RANGe" , ":VOLTage:AUTo" , ":CURRent:RANGe" , ":CURRent:AUTo" and ":MANual:FREQuency" can only be used when set the user's grade to High. The specific step can refer to section 7.3 user's grade in UTE9811+ User's Manaul.

Instruction	Function
*IDN?	Query the instrument information.
*RST	Restore to the factory setting.
*STB?	Query status byte register.
*SAV	Save the current setting into nonvolatile memory for next time use.
:DISPlay:MODe	Set measurement mode
:DISPlay:SELect	Select window 4 to display power factor or frequency
:HOLD	Turn on or off hold mode.
:VOLTage:RANGe	Set the voltage range.
:VOLTage:AUTo	Turn on or off auto range of voltage.
:CURRent:RANGe	Set the current range.
:CURRent:AUTo	Turn on or off auto range of current.
:RATe	Set update rate.
:AVERaging	Set the average switch state and average count.
:MUTe	Turn on or off mute key.
:ALARm:FLAG?	Query the alarm state.
:ALARm:CURRent:HIGH	Set the upper limit of current alarm.
:ALARm:CURRent:LOW	Set the lower limit of current alarm.
:ALARm:POWer:HIGH	Set the upper limit of power alarm.
:ALARm:POWer:LOW	Set the lower limit of power alarm.

:ALARm:TIMe	Set alarm delay.
:UPDAte:COUNt?	Query the current update count.
:MEASure:DATa:TYPe	Query the type of measurement data
:MEASure:FREQuency:VOLTage?	Query the measured frequency of voltage.
:MEASure:VOLTage?	Query the currently measured value of voltage.
:MEASure:CURRent?	Query the currently measured value of current.
:MEASure:POWer:ACTive?	Query the currently measured value of power.
:MEASure:PFACtor?	Query the currently measured value of power factor.
:MEASure:VOLTage:THD?	Query voltage total harmonic distortion.
:MEASure:CURRent:THD?	Query current total harmonic distortion.
:MEASure:VOLTage:HARMonic:ARRay?	Query voltage distortion of 1-50 times.
:MEASure:CURRent:HARMonic:ARRay?	Query current distortion of 1-50 times.
:MEASure:VOLTage:CF?	Query the measured value of voltage crest factor.
:MEASure:CURRent:CF?	Query the measured value of current crest factor.
:MEASure:VOLTage:HARMonic:RMS?	Query total RMS voltage of 1-50 times.
:MEASure:CURRent:HARMonic:RMS?	Query total RMS current of 1-50 times.
:MEASure:POWer:HARMonic:RMS?	Query total RMS active power of 1-50 times.
:SYSTem:ERRor?	Query error information.
:SYSTem:LEVel	Set the user's grade.
:LOCK	Set the lock key state on the front panel.

3.2 Instruction Parsing

*IDN?

Function   Query the instrument information.

Syntax   *IDN?

Example   *IDN?

-> UNI-T,UTE9811+,012345678,F1.02

Description

The return format of instrument information is <manufacturer>,<model>,<serial number>,< firmware version>.

*RST

Function   Restore to the factory setting.

Syntax   *RST

Example   *RST

Description

Except communication configuration parameter（instruction type, baud rate, address）, other configuration parameter will restore to the factory setting.

*STB?

Function   Query status byte register.

Syntax   *STB?

Example   *STB?   -> 4

Description

If returned value is 4, it represents the status byte register set to 00000100; it means the error queue is not empty, which also means an error has been generated.

*SAV

Function   Save the current setting into nonvolatile memory for next time use.

Syntax   *SAV   {<NR1>}

Example   *SAV 0

:DISPlay:MODe

Function   Set the current display interface.

Syntax   :DISPlay:MODe {<Mode>}

          :DISPlay:MODe?

          Mode = RMS | CF | HARM_RMS | THD_VALUE | THD_PERCENT

    ・RMS = TRMS

    ・CF   = Crest factor

    ・HARM_RMS = Total RMS harmonic

    ・THD_VALUE = Measured value of harmonic

    ・THD_PERCENT = Harmonic distortion factor

Example   :DISPlay:MODe THD_VALUE

         :DISPlay:MODe? -> THD_VALUE

:DISPlay:SELect

Function   Select window 4 to display power factor or frequency.

Syntax   :DISPlay:SELect {<Type>}

        :DISPlay:SELect?

        <Type> = PF | HZ

    ・PF = Display power factor

    ・HZ = Display measurement frequency

Example   :DISPlay:SELect HZ

        :DISPlay:SELect? -> HZ

:HOLD

Function   Turn on/off hold mode.

Syntax   :HOLD   {<Boolean>}

       :HOLD?

Example   :HOLD OFF

       :HOLD?   -> 0

:VOLTage:RANGe

Function   Set the voltage range.

Syntax   :VOLTage:RANGe   {<Voltage>}

       :VOLTage:RANGe?

       <Voltage> = 75,150,300,600

Example   :VOLTage:RANGe 150

       :VOLTage:RANGe?   -> 150

:VOLTage:AUTo

Function   Turn on or off auto range of voltage.

Syntax   :VOLTage:AUTo   {<Boolean>}

       :VOLTage:AUTo?

Example   :VOLTage:AUTo 1

       :VOLTage:AUTo?   -> 1

Notes: This instruction can only be used when set the user's grade to High.

:CURRent:RANGe

Function   Set the current range.

Syntax   :CURRent:RANGe   {<Current>}

       :CURRent:RANGe?

       <Current> = 0.2, 1, 4, 20

Example   :CURRent:RANGe 1

       :CURRent:RANGe?   -> 1

Notes: This instruction can only be used when set the user's grade to High.

:CURRent:AUTo

Function   Turn on or off auto range of current.

Syntax   :CURRent:AUTo   {<Boolean>}

       :CURRent:AUTo?

Example   :CURRent:AUTo 1

       :CURRent:AUTo?   -> 1

Notes: This instruction can only be used when set the user's grade to High.

:MANual:FREQuency

Function   Set the input signal frequency of user defined.

Syntax   :MANual:FREQuency   {<NRf>}

   :MANual:FREQuency?

   <NRf> = 0 or 40~70;<NRf>= 0 represents this function (input signal frequency of user defined) is
      disabled.

Example   :MANual:FREQuency   50.1

   :MANual:FREQuency?   ->   50.1

Notes: This instruction can only be used when set the user's grade to High.

:RATe

Function   Set update rate.

Syntax   :RATe   {<Time>}

   :RATe?

   <Time> = 0.1,0.25,0.5,1,2,5

Example   :RATe 0.25

   :RATe?   -> 0.25

:AVERaging

Function   Set the average switch state and average count.

Syntax   :AVERaging   {<Average>}

   :AVERaging?

   <Average> = OFF,8,16,32,64

   · OFF = Average is turned off

   · 8,16,32,64 = Average is turned on and it represents the average count.

Example   :AVERaging 16

   :AVERaging?   -> 16

:MUTe

Function   Turn on or off mute key.

Syntax   :MUTe   {<Boolean>}

   :MUTe?

Example   :MUTe 1

   :MUTe?   ->1

:ALARm:FLAG?

Function　　Query the alarm state.

Syntax　　:ALARm:FLAG?　{<Type>,<State>}

　　　　　<Type> = CURRENT,POWER

　　　　　CURRENT = current; POWER = power

　　　　　<State> = DISABLE, WAITING, RUNNING, OK, LOW, HIGH

　　　　　　・DISABLE = the test is forbidden;

　　　　　　・WAITING = wait for connect to the load;

　　　　　　・RUNNING = testing;

　　　　　　・OK = the test is completed, the test result within the lower and upper limit;

　　　　　　・LOW = the test is completed, the test result is below the lower limit;

　　　　　　・HIGH = the test is completed, the test result is higher than theupper limit.

Example　　:ALARm:FLAG? CURRENT　-> RUNNING

:ALARm:CURRent:HIGH

Function　　Set the upper limit of current alarm.

Syntax　　　:ALARm:CURRent:HIGH　{<NRf>}

　　　　　　:ALARm:CURRent:HIGH?

Example　　:ALARm:CURRent:HIGH 10.1

　　　　　　:ALARm:CURRent:HIGH? -> 10.1

:ALARm:CURRent:LOW

Function　　Set the lower limit of current alarm.

Syntax　　:ALARm:CURRent:LOW　{<NRf>}

　　　　　　:ALARm:CURRent:LOW?

Example　　:ALARm:CURRent:LOW　1.1

　　　　　　:ALARm:CURRent:LOW?　-> 1.1

:ALARm:POWer:HIGH

Function　　Set the upper limit of power alarm.

Syntax　　　:ALARm:POWer:HIGH　{<NRf>}

　　　　　　:ALARm:POWer:HIGH?

Example　　:ALARm:POWer:HIGH 1000.1

　　　　　　:ALARm:POWer:HIGH?　-> 1000.1

:ALARm:POWer:LOW

Function　　Set the lower limit of power alarm.

Syntax　　:ALARm:POWer:LOW　{<NRf>}

:ALARm:POWer:LOW?

Example   :ALARm:POWer:LOW 10.1

:ALARm:POWer:LOW   -> 10.1

:ALARm:TIMe

Function   Set alarm delay.

Syntax   :ALARm:TIMe   {<NRf>}

:ALARm:TIMe?

Example   :ALARm:TIMe 20.2

:ALARm:TIMe?   -> 20.2

:UPDAte:COUNt?

Function   Query the current update count.

Syntax   :UPDAte:COUNt?

Example   :UPDAte:COUNt?   ->   763

Description

Each time the data is updated, the number of updates will be increased by one. By detecting the difference in the number of updates before and after, it can determine whether the data update event occurs, so as to obtain the latest updated data.

:MEASure:DATa:TYPe

Function   Set the type of measurement data

Syntax   :MEASure:DATa:TYPe {<Type>}

:MEASure:DATa:TYPe?

Type = ACTUAL | LAST

・ ACTUAL = Real-time measured data

・ LAST = Recently update valid measured data

Example   :MEASure:DATa:TYPe ACTUAL

:MEASure:DATa:TYPe -> ACTUAL

Description

・ Set the type of measurement data to " ACTUAL " , query measurement data command (such as:MEASure:VOLTage?") , the obtained value truly reflects the current measuring state of the instrument. The measured value is invalid when the instrument is in configuration measurement function or switching ranges, the obtained value is "NaN" .When the instrument exits configuration measurement function or switching ranges, the value obtained by the command is valid measurement data.

・ Set the type of measurement data to " LAST" , the value obtained by the query measurement data command is recently update valid measured data.

:MEASure:FREQuency:VOLTage

Function   Query the measured frequency of voltage.

Syntax   :MEASure:FREQuency:VOLTage?

Example   :MEASure:FREQuency:VOLTage?   ->   50.00

:MEASure:VOLTage?

Function   Query the currently measured value of voltage.

Syntax   :MEASure:VOLTage?

Example   :MEASure:VOLTage?   ->   110.36

:MEASure:CURRent?

Function   Query the currently measured value of current.

Syntax   :MEASure:CURRent?

Example   :MEASure:CURRent?   ->   10.23

:MEASure:POWer:ACTive?

Function   Query the currently measured value of power.

Syntax   :MEASure:POWer:ACTive?

Example   :MEASure:POWer:ACTive?   ->   30.5

:MEASure:PFACtor?

Function   Query the currently measured value of power factor.

Syntax   :MEASure:PFACtor?

Example   :MEASure:PFACtor?   ->   0.519

:MEASure:VOLTage:THD?

Function   Query voltage total harmonic distortion.

Syntax   :MEASure:VOLTage:THD?   {VALUE|PERCENT}

              VALUE = Return the measured value of voltage total harmonic distortion, the unit is V.

              PERCENT = Return voltage total distortion, the unit is %.

Example   :MEASure:VOLTage:THD? VALUE   ->   5.00

:MEASure:CURRent:THD?

Function   Query current total harmonic distortion.

Syntax   :MEASure:CURRent:THD?   {VALUE|PERCENT}

              VALUE = Return the measured value of current total harmonic distortion, the unit is A.

              PERCENT = Return curent total distortion,the unit is %.

Example   :MEASure:CURRent:THD?   VALUE   ->   1.000

:MEASure:VOLTage:HARMonic:ARRay?

Function   Query voltage distortion of 1-50 times.

Syntax   :MEASure:VOLTage:HARMonic:ARRay?   {VALUE|PERCENT}

　　　　 -> <Data1>,<Data2> ⋯ <Data50>

　　　　 VALUE = Return the measured voltage distortion value of1-50 times, the unit is V.

　　　　 PERCENT = Return voltage distortion of 1-50 times, the unit is %.

Example   :MEASure:VOLTage:HARMonic:ARRay? VALUE

　　　　 -> 10.00, 1.00 ⋯ 2.00

:MEASure:CURRent:HARMonic:ARRay?

Function   Query current distortion of 1-50 times.

Syntax   :MEASure:CURRent:HARMonic:ARRay? {VALUE|PERCENT}

　　　　 -> <Data1>, <Data2> ⋯ <Data50>

　　　　 VALUE = Return the measured current distortion value of1-50 times, the unit is A.

　　　　 PERCENT = Return current distortion of 1-50 times, the unit is %.

Example   :MEASure:CURRent:HARMonic:ARRay? VALUE

　　　　 -> 5.012,1.031 ⋯ 0.101

:MEASure:VOLTage:CF?

Function   Query the measured value of voltage crest factor.

Syntax   :MEASure:VOLTage:CF?

Example   :MEASure:VOLTage:CF?   ->   1.420

:MEASure:CURRent:CF?

Function   Query the measured value of current crest factor.

Syntax   :MEASure:CURRent:CF?

Example   :MEASure:CURRent:CF?   ->   6.125

:MEASure:VOLTage:HARMonic:RMS?

Function   Query total RMS voltage of 1-50 times.

Syntax   :MEASure:VOLTage:HARMonic:RMS?

Example   :MEASure:VOLTage:HARMonic:RMS?   ->   110.23

:MEASure:CURRent:HARMonic:RMS?

Function   Query total RMS current of 1-50 times.

Syntax   :MEASure:CURRent:HARMonic:RMS?

Example   :MEASure:CURRent:HARMonic:RMS?   ->   1.236

:MEASure:POWer:HARMonic:RMS?

Function   Query total RMS active power of 1-50 times.

Syntax   :MEASure:POWer:HARMonic:RMS?

Example   :MEASure:POWer:HARMonic:RMS? -> 120.23

:SYSTem:ERRor?

Function   Query the last error code and information.

Syntax   :SYSTem:ERRor?

Example   :SYSTem:ERRor? -> -113,"Undefined header"

Description

If there is no error, then it return 0,"No error"

:SYSTem:LEVel

Function   Set the user's grade.

Syntax   :SYSTem:LEVel {<LEVEL>,<NR1>}

       :SYSTem:LEVel?

       <LEVEL> = NORMAL | HIGH

       <NR1> = Secret code

Example   :SYSTem:LEVel HIGH,*****(secret code)

       :SYSTem:LEVel? -> HIGH

:LOCK

Function   Set the lock key state on the front panel.

Syntax   :LOCK {<Boolean>}

       :LOCK?

Example   :LOCK 1

       :LOCK? -> 1

Chapter 4 Acquire Newest Measurement Data

The measurement data will in breaks when in auto range or UTE9811+ is reconfigured, the acquired data is "nan" via ":MEASure:###:###?". If user want to acquire the newest measurement data,it need to exit break state and then to acquire the data. By detecting the difference in the number of updates before and after, it can determine whether the data update event occurs, so as to obtain the latest updated data. The specific method as follows.

:UPDAte:COUNt? -> 101

:UPDAte:COUNt? -> 101

```
...
:UPDAte:COUNt?    -> 102    # data update event occurs
:MEASure:VOLTage?    -> 110.36
:MEASure:CURRent?    -> 10.23
...
```