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Quick Guide

UTE310 Digital Power Meter

Copyright

Trademark

File Version

UTE31020230801-V1.00

Statements

1. Safety Instruction

This section contains information and warnings that must be followed to keep the instrument operating under safety conditions. In addition, user should also follow the common safety procedures.

Safety Precautions		
Warning	Please follow the following guidelines to avoid possible electric shock and risk to personal safety.	
	Users must follow the following conventional safety precautions in operation, service and maintenance of this device. UNI-T will not be liable for any personal safety and property loss caused by the user's failure to follow the following safety precautions. This device is designed for professional users and responsible organizations for measurement purposes. Do not use this device in any way not specified by the manufacturer. This device is only for indoor use unless otherwise specified in the product manual.	
Safety Statement		
Warning	"Warning" indicates the presence of a hazard. It reminds users to pay attention to a certain operation process, operation method or similar. Personal injury or death may occur if the rules in the "Warning" statement are not properly executed or observed. Do not proceed to the next step until you fully understand and meet the conditions stated in the "Warning" statement.	
Caution	"Caution" indicates the presence of a hazard. It reminds users to pay attention to a certain operation process, operation method or similar. Product damage or loss of important data may occur if the rules in the "Caution" statement are not properly executed or observed. Do not proceed to the next step until you fully understand and meet the conditions stated in the "Caution" statement.	
Note	"Note" indicates important information. It reminds users to pay attention to procedures, methods and conditions, etc. The contents of the "Note" should be highlighted if necessary.	
Safety Sign		
	Danger	It indicates possible danger of electric shock, which may cause personal injury or death.
	Warning	It indicates that you should be careful to avoid personal injury or product damage.
	Caution	It indicates possible danger, which may cause damage to this device or other equipment if you fail to follow a certain procedure or condition. If the "Caution" sign is present, all conditions must be met before you proceed to operation.
	Note	It indicates potential problems, which may cause failure of this device if you fail to follow a certain procedure or condition. If the

		“Note” sign is present, all conditions must be met before this device will function properly.
	AC	Alternating current of device. Please check the region’s voltage range.
	DC	Direct current device. Please check the region’s voltage range.
	Grounding	Frame and chassis grounding terminal
	Grounding	Protective grounding terminal
	Grounding	Measurement grounding terminal
CAT 0		This instrument is suitable for measurements on circuits that are not directly connected to the grid power supply and circuits that are specially protected to be powered from the (internal) grid. In the latter case, the transient stresses are different, and the instrument should be used for this type of measurement to ensure that the peak transient voltage is less than 3000 V.
CAT Ⅰ		Secondary electrical circuit connected to wall sockets through transformers or similar equipment, such as electronic instruments and electronic equipment; electronic equipment with protective measures, and any high-voltage and low-voltage circuits, such as the copier in the office.
CAT Ⅱ		Primary electrical circuit of the electrical equipment connected to the indoor socket via the power cord, such as mobile tools, home appliances, etc. Household appliances, portable tools (e.g. electric drill), household sockets, sockets more than 10 meters away from CAT III circuit or sockets more than 20 meters away from CAT IV circuit.
CAT Ⅲ		Primary circuit of large equipment directly connected to the distribution board and circuit between the distribution board and the socket (three-phase distributor circuit includes a single commercial lighting circuit). Fixed equipment, such as multi-phase motor and multi-phase fuse box; lighting equipment and lines inside large buildings; machine tools and power distribution boards at industrial sites (workshops).
CAT Ⅳ		Three-phase public power unit and outdoor power supply line equipment. Equipment designed to “initial connection”, such as power distribution system of power station, power instrument, front-end overload protection, and any outdoor transmission line.
	Certification	CE indicates a registered trademark of EU
	Certification	UKCA indicates a registered trademark of UK
	Waste	This product complies with the marking requirements of WEEE Directive (2002/96/EC). This additional label indicates that this

		electrical / electronic product must not be discarded in household waste.
	EFUP	This environment-friendly use period (EFUP) mark indicates that dangerous or toxic substances will not leak or cause damage within this indicated time period. The environment-friendly use period of this product is 40 years, during which it can be used safely. Upon expiration of this period, it should enter the recycling system.

Safety Requirements	
Warning	
Preparation before use	Please connect this device to AC power supply with the power cable provided. The AC input voltage of the line reaches the rated value of this device. See the product manual for specific rated value. The line voltage switch of this device matches the line voltage; The line voltage of the line fuse of this device is correct.
Check all terminal rated values	Please check all rated values and marking instructions on the product to avoid fire and impact of excessive current. Please consult the product manual for detailed rated values before connection.
Use the power cord properly	You can only use the special power cord for the instrument approved by the local and state standards. Please check whether the insulation layer of the cord is damaged or the cord is exposed, and test whether the cord is conductive. If the cord is damaged, please replace it before using the instrument.
Instrument Grounding	To avoid electric shock, the grounding conductor must be connected to the ground. This product is grounded through the grounding conductor of the power supply. Please be sure to ground this product before it is powered on.
AC power supply	Please use the AC power supply specified for this device. Please use the power cord approved by your country and confirm that the insulation layer is not damaged.
Electrostatic prevention	This device may be damaged by static electricity, so it should be tested in the anti-static area if possible. Before the power cable is connected to this device, the internal and external conductors should be grounded briefly to release static electricity. The protection grade of this device is 4 kV for contact discharge and 8 kV for air discharge.
Measurement accessories	Measurement accessories are of lower class, which are definitely not applicable to main power supply measurement, CAT II, CAT III or CAT IV circuit measurement.
Use the input / output port of this device properly	Please use the input / output ports provided by this device in a properly manner. Do not load any input signal at the output port of this device. Do not load any signal that does not reach the rated value at the input port of this device. The probe or other connection accessories should be effectively grounded to avoid product damage or abnormal function. Please refer to the product manual for the rated value of the input / output port of this device.

Power fuse	Please use power fuse of specified specification. If the fuse needs to be replaced, it must be replaced with another one that meets the specified specifications by the maintenance personnel authorized by UNI-T.
Disassembly and cleaning	There are no components available to operators inside. Do not remove the protective cover. Maintenance must be carried out by qualified personnel.
Service environment	This device should be used indoors in a clean and dry environment with ambient temperature from 0℃ to 40℃. Do not use this device in explosive, dusty or humid air.
Do not operate in humid environment	Do not use this device in a humid environment to avoid the risk of internal short circuit or electric shock.
Caution	
Abnormality	If this device may be faulty, please contact the authorized maintenance personnel of UNI-T for testing. Any maintenance, adjustment or parts replacement must be done by the relevant personnel of UNI-T.
Cooling	Do not block the ventilation holes at the side and back of this device; Do not allow any external objects to enter this device via ventilation holes; Please ensure adequate ventilation, and leave a gap of at least 15 cm on both sides, front and back of this device.
Safe transportation	Please transport this device safely to prevent it from sliding, which may damage the buttons, knobs or interfaces on the instrument panel.
Proper ventilation	Poor ventilation will cause the device temperature to rise, thus causing damage to this device. Please keep proper ventilation during use, and regularly check the vents and fans.
Keep clean and dry	Please take actions to avoid dust or moisture in the air affecting the performance of this device. Please keep the product surface clean and dry.
Note	
Calibration	The recommended calibration period is one year. Calibration should only be carried out by qualified personnel.

Warning

The UTE310 Digital Power Meter only supports measurement of power supplies under CAT II (600V) type overvoltage conditions, so please use the instrument strictly in accordance with this measurement environment.

2. Introduction

UTE310 is a high precision and high performance digital power meter. The current measurement range is 50uA～20A, which meets the requirement of production, test and R&D.

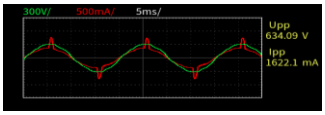
UTE310 digital power meter is suitable for the power measurement from production line to R&D field.

- The measurement of DC and single phase two-wire system;
- The measurement of the household appliances with high power, such as the air condition and the induction stave;
- The measurement of the office equipment, such as the display and the printer;
- The measurement of the energy equipment, such as LED, the power supply and the battery;
- The measurement of energy-saving performance of industrial equipment, such as the frequency converter and the large air condition.

2.1 Features

- **Oscillography**

  Observe the change of the measured signal in peak-to peak and waveform.

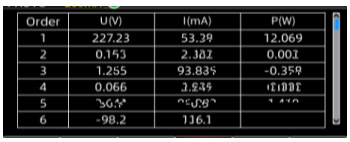


- **Basic power parameter measurement**

  Measure the basic power parameters of voltage, current, power factor, and support for measuring the AC and DC signals.

- **Harmonic measurement**

  Support the harmonic measurement of IEC61000-4-7, which can analysis the harmonic component in signal, such as voltage, current, power and phase angle. The maximum measured results of 50 harmonic can be displayed.

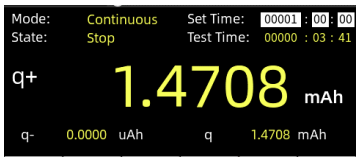


- **Mathematical operation**

  The measured parameters can be added, subtracted, multiplied, and divided.

- **Current integral and power integral**

  The integration of q, q+, q-, WP, WP+, WP-, which can be set to continuous integral or normal integral mode.



- **Multiple interfaces**

  The user can remote control the instrument via USB, RS-232/GPIB and LAN interfaces.

- **Automatic range**

This function can automatically select or change the range within the specified range.

- **Load and access the external memorizer**

  The instrument can connect the external memorizer to save the data of voltage, current, power and harmonic. And it can also export and import the configuration parameter of the instrument.

- **Built-in digital filter**

  The instrument has line filter and frequency filter function. The user can enable the line filter or frequency filter to restrain unwanted noise and harmonic components during fundamental measurements.

- **PC analysis software**
  The software is used to remote control and set the UTE 310 digital power meter, for acquiring, displaying, analyzing and saving the measured value, harmonic and waveform data.
- **Holding the maximum value**
  RMS/Peak of voltage and current, active power P, relative power Q and apparent power S.
- **Sampling frequency**
  The sampling frequency of the UTE310 is 1MHz.
- **Bandwidth**
  The bandwidth of the UTE310 is DC, 0.1Hz～300kHz.
- **25μA low current measurement**
  This function can accurately measure the stand-by power loss of the household appliance.
- **Input range of wide current sensor**
  50mV～10V, this sensor can be compatible with more sensors, and is very suitable for the power consumption measurement of intermittent operation equipment.
- **Input range of wide current**
  25uA～20A
- **The data update interval can up to 0.1s**
  UTE310 digital power meter can freely set the data update interval: 0.1s, 0.25s, 0.5s, 1s, 2s, 5s, 10s, 20s, Auto, to meet the measurement needs of different frequency signals.

2.2 Technical Index

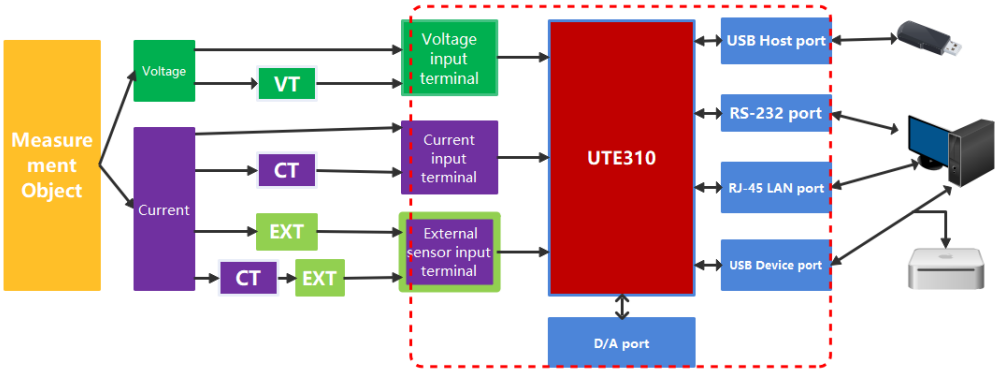
Model	UTE310	
Bandwidth	DC, 0.1Hz ~ 300kHz	
Sampling Rate	1MHz	
Voltage Range	CF=3	CF=6 or 6A
	15V	7.5V

	30V	15V
	60V	30V
	150V	75V
	300V	150V
	600V	300V
Voltage Resolution	0.001V/0.01V	
Current Range	CF=3	CF=6 or 6A
	5mA	2.5mA
	10mA	5mA
	20mA	10mA
	50mA	25mA
	100mA	50mA
	200mA	100mA
	500mA	250mA
	1A	0.5A
	2A	1A
	5A	2.5A
	10A	5A
	20A	10A
Current Resolution	0.0001mA/0.001mA/0.01mA/0.1mA/1mA	
Ext1 Sensor CH Range	CF=3	CF=6 or 6A
	50mV	25mV
	100mV	50mV
	200mV	100mV
	500mV	150mV
Ext1 Sensor CH Resolution	1uV/10uV/10uV	
Ext2 Sensor CH Range	CF=3	CF=6 or 6A
	1V	0.5V
	2V	1V
	2.5V	1.25V
	5V	2.5V
	10V	5V
Ext2 Sensor CH Resolution	100uV/1mV	
Frequency Measurement Range	Data Update Interval	Frequency
	0.1 S	20Hz≥f≤300kHz
	0.25 S	10Hz≥f≤300kHz
	0.5 S	5.0Hz≥f≤300kHz
	1 S	2.0Hz≥f≤300kHz
	2 S	1.0Hz≥f≤300kHz

	5 S	0.5Hz≥f≤300kHz
	10 S	0.2Hz≥f≤300kHz
	20 S	0.1Hz≥f≤300kHz
	Auto	0.1Hz≥f≤300kHz
Power Range	75mW ~ 12000W	
Waveform Display	Display the waveform of U/I	
Line Filter	√	
Frequency Filter	√	
Harmonic Measurement	1 ~ 50 times	
Integrating Function	Average active power integral, current integral	
Mathematical Operation	√	
DA Output and Control	√	
Communication Interface	RS-232/GPIB, LAN, USB	

2.3 Application System

The application system chart of the UTE310 digital power meter is shown in the following figure.



2.4 Environmental Condition

UTE310 digital power meter can only use indoors and non-condensing area, the general environmental requirements are shown as below table.

Environmental Condition	
Operating Environment	5℃ ~ 40℃， 20% ~ 80%RH （non-condensing）
Accuracy guaranteed temperature and humidity temperature	23℃±5℃， 30% ~ 75% R.H.
Storage temperature	-10℃ ~ 50℃ ，non-condensing below 80% R.H.
Operating altitude	≤2000 meters

3. Getting Start

This chapter is to introduce the precautions and preparation for using the UTE310 digital power meter for the first time.

3.1 General Inspection

Before using a new UTE310 digital power meter, it is recommended that you follow the following steps to check the instrument.

3.1.1 Check for damage caused by transportation

If you find that the packing carton or the protective foam panel is badly damaged, contact your UNI-T distributor for assistance.

3.1.2 Checking Accessories

Checking the packing list whether is damaged or missing. Contact your UNI-T distributor for assistance if has any damage or loss.

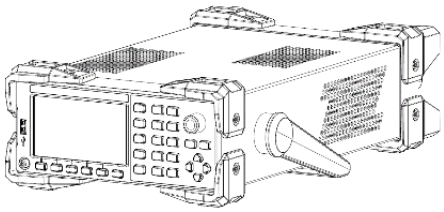
3.1.3 Check the Instrument

- Please contact your UNI-T distributor for assistance if you find the appearance of the instrument is broken, or the instrument does not work properly, or fails the performance test.
- If the instrument is damaged due to transportation, retain the packaging and notify the shipping department and contact your UNI-T distributor for assistance.

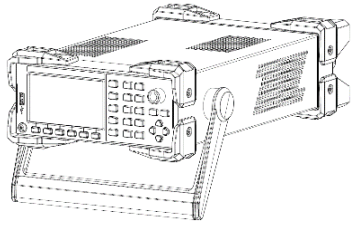
3.1.4 Checking the Handle

The instrument's handle can adjust to four positions by appropriate strengths. Hold the handle and pull to two sides to remove it. Adjusting the handle to the position as shown in the following figure.

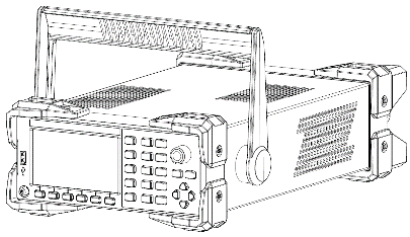
1. Original position



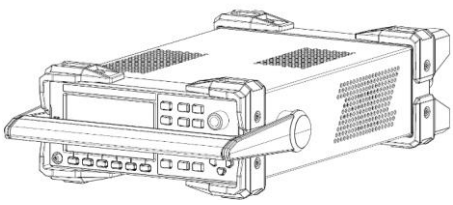
2. Testing position



3. Removal position



4. Lifting position



If the instrument's handle cannot adjust to four positions as above, please contact your UNI-T distributor for assistance.

3.2 Before Use

Before using the instrument, do a quick inspection to check that the instrument is operating properly. Please follow the following steps.

3.2.1 Key Inspection

Check whether the key can be pressed and popped up normally. If the key cannot operate functionally, contact your UNI-T distributor.

3.2.2 Boot-up Inspection

The power supply voltage of the power meter is 100V~240V and the frequency is 50/60Hz. Connect the power meter to the power supply by using the power cable in the accessory or other power cable that conform to the standard of your country. When the power switch is pressed, the instrument will turn on. If the instrument fails to power up properly, contact your UNI-T distributor for assistance.

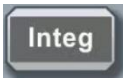
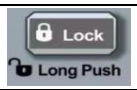
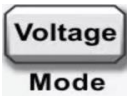
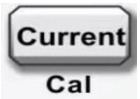
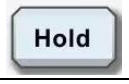
4. Front Panel

This chapter is to introduce the front panel and its key function of the UTE310 digital power meter, as shown in the following figure.

Front Panel of UTE310

4.1 Key Function on Front Panel

Key	Function
	The power switch ON/OFF: Press one time to turn on the instrument, press it again to shut down the instrument.
	Common function key This indicates the different functions according to the corresponding parameters of the display.

	**Up/Down selection key** Use the up/down key to select an item when setting the parameters. For the sake of simplicity, the up/down keys are indicated by the two buttons [▲][▼].
	**Left/Right selection key** Use the left/right key to select an item to the left or right when setting the parameters. It is usually used to move the editing bit in numerical editing. For the sake of simplicity, the left/right keys are indicated by the two buttons [◀][▶].
	**Enter key** Save the current settings and exit.
	**Esc key** Exit the current setting page; Return to the previous step
	**Encoder knob** When editing the numerical value, clockwise rotating the encoder knob to increasing the value, anticlockwise rotating the encoder knob to decreasing the value;
	**Second function auxiliary key** Press this key and press other key with the second function to enabling auxiliary function.
	**General parameter measurements** This function page includes three measurement/display styles, VEW-1, VEW-2 and VEW-3, measuring total of 24 parameters.
	**Harmonic measurements** Harmonic measurement and harmonic settings (including harmonic display and mode settings)
	**Waveform display** Display the waveform of voltage and current.
	**Integral key** The average active power and current can be integrated.
	**Lock key** Press this key to disable other keys, long press 1 second to unlock keys.
	**Voltage settings** Press this key to set the voltage, use "▲,▼" to select the range, and press the "Enter" key to save the selected range and exit (or wait for 10 seconds to automatically save the settings and exit); The second function of this key is measurement mode switching, which can switch to DC, RMS or MN.
	**Current settings** Press this key to set the current, use "▲,▼" to select the range, and press the "Enter" key to save the selected range and exit (or wait for 10 seconds to automatically save the settings and exit); The second function of this key is zero calibration.
	**Max hold** Hold the maximum value, the data is updated only when a measured value that is larger than the value that has been held.
	**Data hold** Hold the measured data that test by the input terminal.
	**Start key** Press this key to starting the integral.

Stop Reset	**Stop key** Press this key to pausing the integral. Press the Shift key with this key is to reset the integral or zeroing the integral.
Single	**Single measurement** In data hold, press the Single key to measure one time, the measured data is kept after the measurement is finished.
Setup	**Function settings** Press this key to set the synchronous source, line filter, frequency filter, crest factor, data update interval (SETUP), average filter (AVG), external current sensor input (EXT), VT/CT scale factor (SCALE), range jump (JUMP), D/A output and control.
System	**System settings** System information (INFO), SET, RS232, IP and USB.

4.2 Key Combination

[Shift + Mode]

Each time the **[Shift + Mode]** key is pressed, the measurement mode will be switched once, and there are three measurement modes, DC, RMS, and MN.

[Shift + Cal]

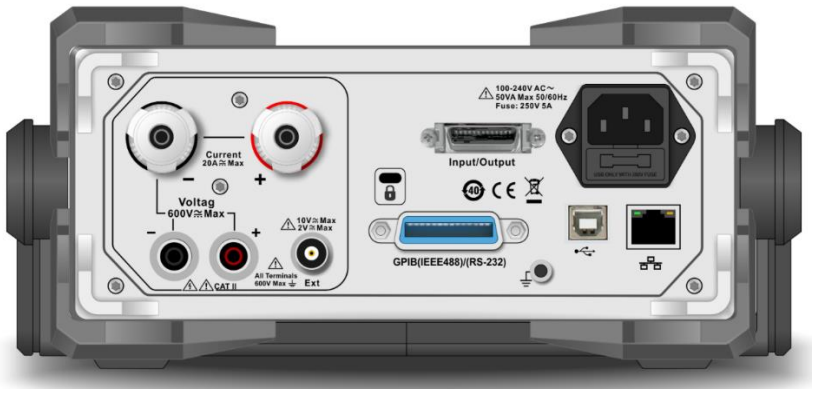
Zero calibration

[Shift +Reset]

Rest the integral

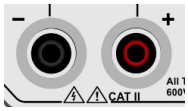
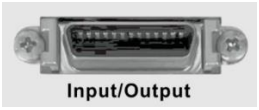
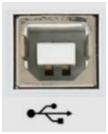
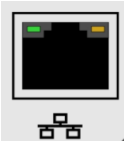
5. Rear Panel

Various interfaces such as voltage and current measurement input terminals, instrument power supply socket, D/A output and control interface, RS-232/GPIB communication interface, USB communication interface, LAN Ethernet communication interface, and safety grounding are integrated on the rear panel structure of the Digital Power Meter as shown below.



Rear Panel of UTE310

5.1 Rear Panel of UTE310

No.	Picture	Function Description
1		Voltage input terminal The maximum allowable input voltage is 600V.
2		Current input terminal The maximum allowable input current is 20A.
3		External current sensor input terminal The maximum allowable input voltage is 2V when EXT1 is selected. The maximum allowable input voltage is 10V when EXT2 is selected.
4		RS-232/GPIB communication interface The default interface is S-232.
5		D/A output and control interface
6		USB communication interface
7		LAN communication interface
8		Anti-theft lock hole
9		Three-wire power socket and fuse Fuse specification： AC 250V 5A.
11		Safety grounded M4 screw hole

6. User Interface

This chapter is to introduce the user interface and the parameter of UTE310 digital meter.

6.1 Description of Display Icon

Display Contents	Function Description
U-RANGE 15V /30V /150V /300V /600V	Indicates that the voltage is a fixed range of 15V /30V /150V /300V /600V respectively (each range is one-half of the current range when CF=6 or 6A).
U-AUTO 15V /30V /150V /300V /600V	Indicates that the voltage is an automatic range of 15V /30V /150V /300V /600V respectively (each range is one-half of the current range when CF=6 or 6A).
I-RANGE 5mA/10mA/20mA/50mA /100mA/200mA/500mA/1A/2A/5A/10A/20A	Indicates that the current is a fixed range of 5mA /10mA /20mA /50mA /100mA /200mA /500mA /1A /2A /5A /10A / 20A (each range is one-half of the current range when CF=6 or 6A).
I-AUTO 5mA/10mA/20mA/50mA /100mA/200mA/500mA/1A/2A/5A/10A/20A	Indicates that the current is an automatic range of 5mA/ 10mA /20mA /50mA /100mA /200mA /500mA /1A /2A /5A /10A / 20A respectively (each range is one-half of the current range when CF=6 or 6A).
EXT1	Indicates that the current selection is EXT1 (the external current sensor 1).
EXT2	Indicates that the current selection is is EXT2 (the external current sensor 2).
I-RANGE 2.5V/5V/10V	Indicates that the current is fixed range 2.5V /5V /10V of EXT1 respectively (each range is one-half of the current range when CF=6 or 6A).
I-AUTO 2.5V/5V/10V	Indicates that the current is automatic range 2.5V /5V /10V of EXT1 respectively 2.5V/ 5V/ 10V (each range is one-half of the current range when CF=6 or 6A).
I-RANGE 50mV/100mV/200mV/500mV/1V/2V	Indicates that the current is fixed range 50mV/ 100mV/ 200mV/ 500mV/ 1V/ 2V of EXT2 respectively. 50mV/100mV/200mV/500mV/1V/2V (each range is one-half of the current range when CF=6 or 6A).
I-AUTO 50mV/100mV/200mV/500mV/1V/2V	Indicates that the current is automatic range 50mV/ 100mV/ 200mV/ 500mV/ 1V/ 2V of EXT2 respectively. 50mV/100mV/200mV/500mV/1V/2V (each range is one-half of the current range when CF=6 or 6A).
SCALE	Indicates that the scaling transformation is enabled.
L.F	Indicates that the line filter is enabled.
F.F	Indicates that the frequency filter is enabled.
RMS/DC/MN	Indicates that the measurement mode is RMS/DC/MN.
SYNC.OFF	Indicates that the synchronous source is not set.

SYNC.U	Indicates that the voltage is set as a synchronous source.
SYNC.I	Indicates that the current is set as a synchronous source.
	Indicates that the measured voltage is lower than the rated range of 30%.
	Indicates that the measured voltage is at the rated range of 30% ~ 130% (not include 130%) when CF=3; Indicates that the measured voltage is at the rated range of 30% ~ 260% (not include 260%) when CF=6 or 6A.
	Indicates that the measured voltage is at the rated range of 130% ~ 140% (not include 140%) when CF=3; Indicates that the measured voltage is at the rated range of 260% ~ 280% (not include 280%) when CF=6 or 6A.
	Indicates that the measured voltage is at the rated range of 140% ~ 300% (not include 300%) when CF=3; Indicates that the measured voltage is at the rated range of 280% ~ 600% (not include 600%) when CF=6 or 6A.
	Indicates that the measured voltage is greater than or equal to the rated range of 300% when CF=3; Indicates that the measured voltage is greater than or equal to the rated range 600% when CF=6 or 6A.
	Indicates that the measured current is lower than the rated range of 30%.
	Indicates that the measured voltage is at the rated range of 30%～130% (not include 130%) when CF=3; Indicates that the measured voltage is at the rated range of 30%～260% (not include 260%) when CF=6 or 6A.
	Indicates that the measured voltage is at the rated range of 130% ~ 140% (not include 140%) when CF=3; Indicates that the measured voltage is at the rated range of 260% ~ 280% (not include 280%) when CF=6 or 6A.
	Indicates that the measured voltage is at the rated range of 140% ~ 300% (not include 300%) when CF=3; Indicates that the measured voltage is at the rated range of 280% ~ 600% (not include 600%) when CF=6 or 6A.
	Indicates that the measured current is greater than or equal to the rated range of 300% when CF=3; Indicates that the measured current is greater than or equal to the rated range 600% when CF=6 or 6A.

6.2 Measurement Interface

6.2.1 Common Measurement

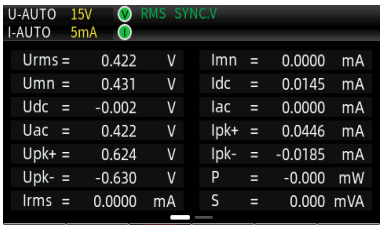
Pressing the [Meter] key to enter the common measurement interface. VIEW-1 has four test interfaces, the first interface displays the voltage (such as RMS voltage, voltage calibration average value, voltage AC component, voltage DC component, voltage positive peak value, voltage negative peak value); the second interface displays the current (such as RMS current, current calibration average value, current AC component, current DC component, current positive peak value, current negative peak value); the third interface displays the power (such as average active power, apparent power, reactive power, positive peak value of average active power, negative peak value of average active power, power factor); the fourth interface displays the frequency, crest factor, phase and synchronizing frequency of measurement parameter.

The four display interfaces can be switched by the [◀] or [▶] key, and each of the measurement interfaces can also set a parameter as the main display parameter (displayed in blue background with large font), which can be configured by the [CONFIG] key under the corresponding interface.

VIEW-2 can display multiple parameters at the same time.

Under VIEW-3 display style, mathematical operation can be carried out according to the user's demand, supporting the display of four areas A, B, C, D. Each area can be set and displayed independently, and the parameters displayed in A, B area can also be set to be displayed in the C area after arithmetic operation. The fourth measurement interfaces is shown in the following figure.

VIEW-1



VIEW-2

VIEW-3

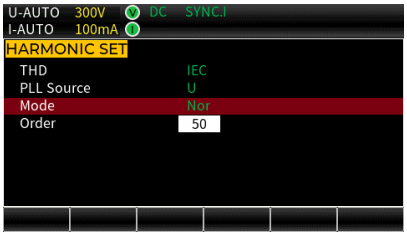
VIEW-1 and VIEW-2 displays the measurement parameter. VIEW-3 displays the measurement parameter and mathematical operation results.

6.2.2 Harmonic Measurement

Pressing the [Harmonic] key to enter the harmonic measurement interface. The harmonic measurement has two display modes, one is a bar graph (BAR) mode and the other is a list mode (LIST). It can measure the RMS value/inclusion rate of each harmonic component from 1~50, and can also measure the total harmonic distortion factor (THD). In the "SET" interface, the calculation formula of THD can be set to IEC or CSA, and PPL source, harmonic analysis mode (Nor or IEC) and maximum harmonic analysis order (Order) can also be set. The measurement interface is shown in the following figure.

BAR Mode

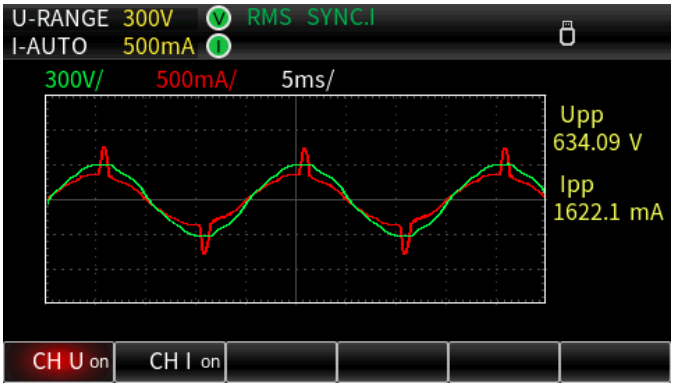
LIST Mode



SET (Harmonic Setting) Interface

6.2.3 Wave Display

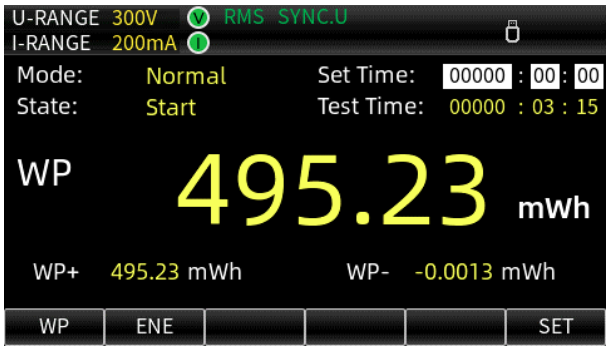
Pressing the **[Wave]** key to enter the wave display interface. UTE310 supports display the waveform of voltage and current at the same time or display one of them. Rotating the encoder knob to adjust the time axis, the vertical axis is automatically set according to the measured range. In the wave display interface, the peak-to-peak of voltage and current can be viewed, as shown in the following figure.



Wave Display Interface

6.2.4 Integration Interface

UTE310 supports the average active power integration and the current integration. Pressing the **[Integ]** key to enter the integration interface. The instrument has three integration modes, manual integration (set the integration timer to 00000: 00: 00 in the normal mode), standard integration (Normal) and continuous integration. The integration interface displays the integrated value and integration time and can set the integration time. The measurement interface is shown in the following figure.

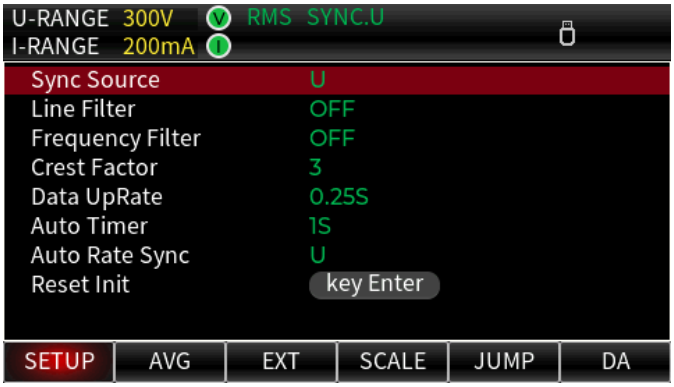


Average Active Power Integration

Current Integration

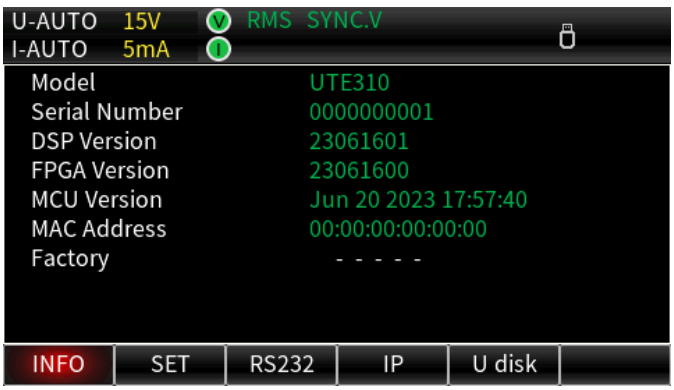
6.2.5 Setup Menu

Pressing the [SETUP] key to enter the Setup menu, to set the the parameter of data synchronization source, digital filter, crest factor, data update interval, automatic timeout, automatic data synchronization source, average filter (AVG), external current sensor input (EXT) and external proportional converter VT/CT/PT, JUMP (skipping range), D/A Output and Control, etc. The setting interface is shown in the following figure.



6.2.6 System Menu

Pressing the [System] key to enter the system settings, which includes the system information, display brightness, key sound, communication protocol, IP address and USB. The system interface is shown in the following figure.



7. Measurement Preparation

This chapter is to introduce the measurement range, measurement mode and wiring connection.

7.1 Range Settings

7.1.1 Voltage Range Settings

·Steps

1. In any interface, press the [Voltage] key to pop out the selection window of voltage range;
2. Press the [▲] or [▼] key to select the voltage range;
3. Press the [Enter] key to save the selected voltage range and exit the selection window or wait for 10s to automatically save and then exit.

·Explanations

Selection range: Auto, 15V, 30V, 60V, 150V, 300V, 600V (CF=3)

Auto represents the automatic range.

When CF=6 or 6A, all ranges will be reduced to half of the original, i.e. 7.5V, 15V, 30V, 75V, 150V, 300V.

7.1.2 Current Range Settings

·Steps

1. In any interface, press the [Current] key to pop out the selection window of current range;
2. Press the [▲] or [▼] key to select the current range;
3. Press the [Enter] key to save the selected current range and exit the selection window or wait for 10s to automatically save and then exit.

Common Measurement

Selection range: Auto, 5mA, 10mA, 20mA, 50mA, 100mA, 200mA, 500mA, 1A, 2A, 5A, 10A, 20A.

The display interface will synchronize the currently selected current range.

Auto represents the automatic range.

When CF=6 or 6A, all ranges will be reduced to half of the original, i.e. 2.5mA, 5mA, 10mA, 25mA, 50mA, 100mA, 250mA, 500mA, 1A, 2.5A, 5A, 10A.

When use EXT CH (the external current sensor) to measure

When using Ext1, the range can select to Auto, 2.5V, 5V, 10V

When using Ext2, the range can select to Auto, 50mV, 100mV, 200mV, 500mV, 1V, 2V.

The display interface will synchronize the currently selected current range.

Auto represents the automatic range.

When CF=6 or 6A, all ranges will be reduced to half of the original, i.e. Ext1: Auto, 1.25V, 2.5V, 5V. Ext2: Auto, 25mV, 50mV, 100mV, 250mV, 500mV, 1V.

7.2 Measurement Mode

UTE310 series has three measurement modes. The user can set the mode according to the signal type or the value to be displayed.

Setting Steps

1. Press the [Shift] key and then press the [Voltage/Mode] key to switch the measurement mode;
2. Repeat the first step can step through the measurement mode to RMS, DC or MN;
3. Press the [Enter] key to select the current option and save.

Explanations

Display value in different measurement mode

Measurement Mode	Voltage	Current
RMS	Display RMS	Display RMS
DC	Display the simple average value	Display the simple average value
MN	Display the voltage calibration average value	Display the voltage calibration average value

RMS mode: select this mode to display the RMS of voltage and current, the calculation formula is as follows.

$$\sqrt{\frac{1}{T}\int_0^T f(t)^2 \mathrm{dt}}$$

f(t): Input signal

T: Period of input signal

DC mode: select this mode when input DC voltage and current, calculating the simple average for the input signal. The calculation formula is as follows.

$$\frac{1}{T}\int_0^T f(t)\mathrm{dt}$$

f(t): Input signal

T: Period of input signal

MN: select this mode to display the rectified average value calibrated to the RMS value, calculated by the following formula.

$$\frac{\pi}{2\sqrt{2}} \times \frac{1}{T}\int_0^T |f(t)|\mathrm{dt}$$

f(t): Input signal

T: Period of input signal

7.3 Wire Connection

UTE310 digital power meter only supports a single two-wire power supply measurement. The measurement can be in accordance with the several wiring methods described in this subsection for wire connection, and to ensure that the measurement of the voltage and current is within the input range of the instrument. The UTE310 has two input methods for voltage measurement, four input methods for current measurement, and a total of eight input methods for power measurement. These are shown in the table below.

Current / Voltage	Direct Input	CT Transformer	EXT (External Current Sensor Input)	CT Transformer + EXT (External Current Sensor Input)
Direct Input	①	②	③	④
VT Transformer	⑤	⑥	⑦	⑧

Explanation

VT: voltage transformer

CT: output current type current sensor, such as current transformer, current output clamp current sensor

EXT: current sensor/shunt of output voltage type

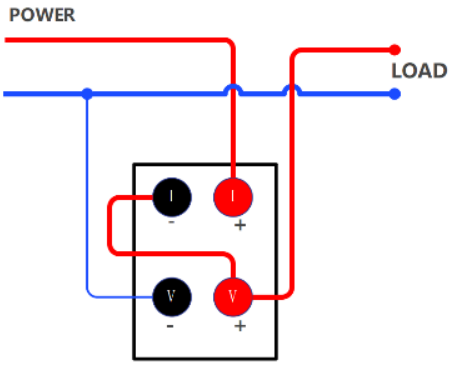
In this section, the shunt is mainly used to illustrate the wiring diagram, and the voltage output clamp current sensor is also used in the practical application.

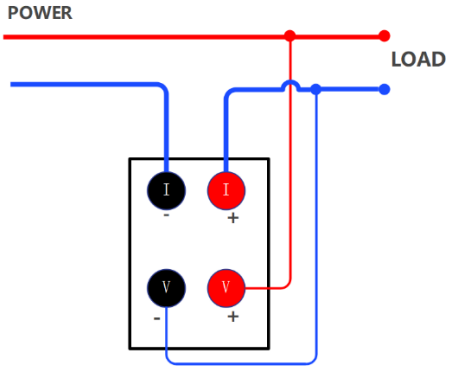
Notes

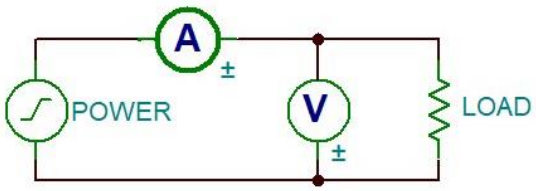
1. The load current flows along the thicker wires in the wiring diagram below, so that these wires need have a sufficiently large safe current-carrying capacity.
2. Turn off the power supply of the load and the instrument when the load end is wiring.
3. When measuring large currents/voltages or the current containing high frequency components, special attention should be paid to the possibility of mutual interference and noise problems when wiring.
4. To avoid stray capacitance affecting the measurement results, the test leads should be as short as possible.
5. In order to minimize the distributed capacitance to ground, the wire and grounding line should be as far away from the casing as possible.

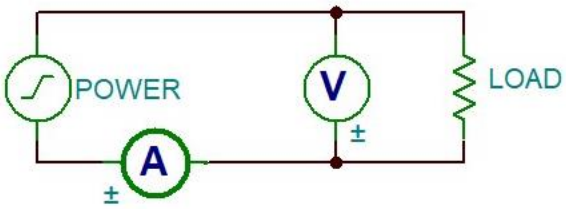
7.3.1 Wire Connection of Direct Input Voltage and Current (①)

- Wire connection schematic diagram when measuring the signal with large current

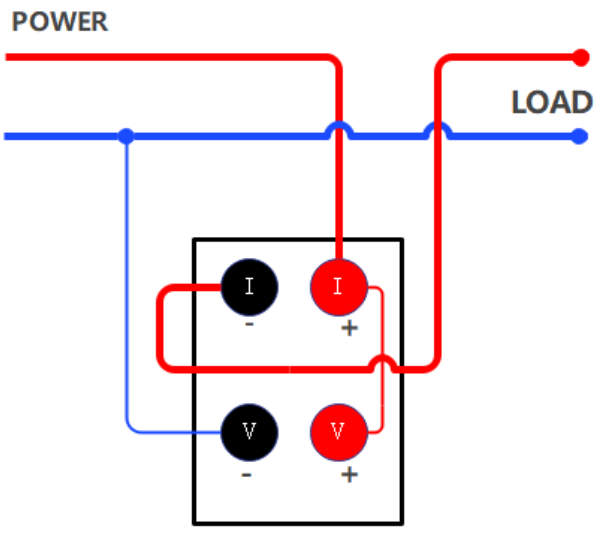


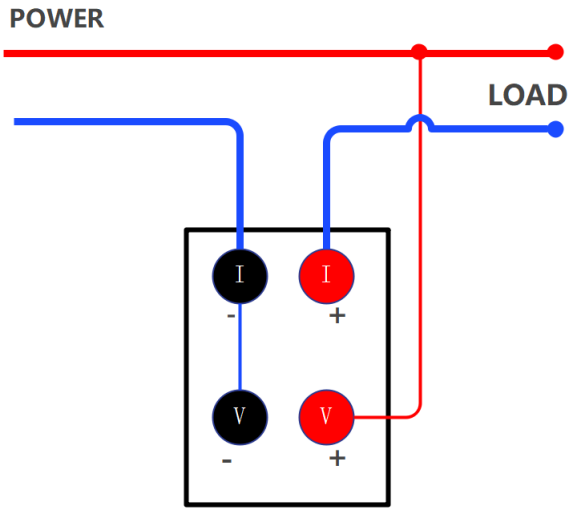


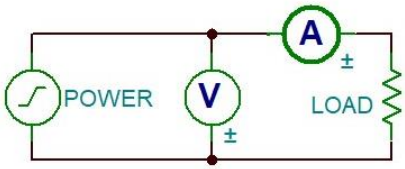


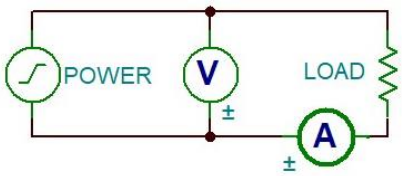


- Wire connection schematic diagram when measuring the signal with small current





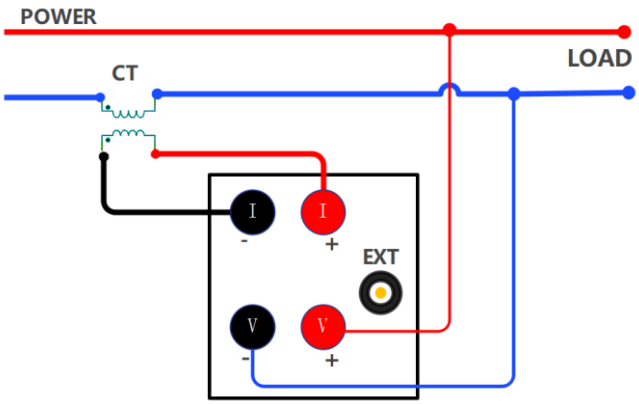




Explanation

In order to minimize the effect of stray capacitance on the measurement results, the measurement can be connected to the current input of the power meter as close as possible to the power supply ground, and use the thicker and shorter wires for the wire connection.

7.3.2 Wire Connection of Direct Input Voltage and of CT Transformer Input Current (②)

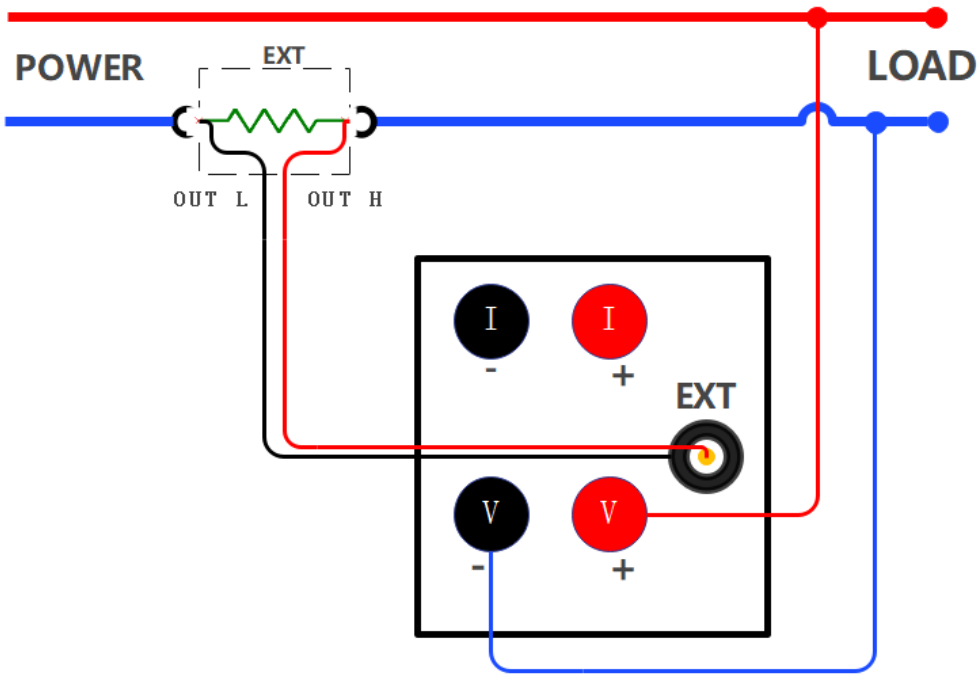


Danger

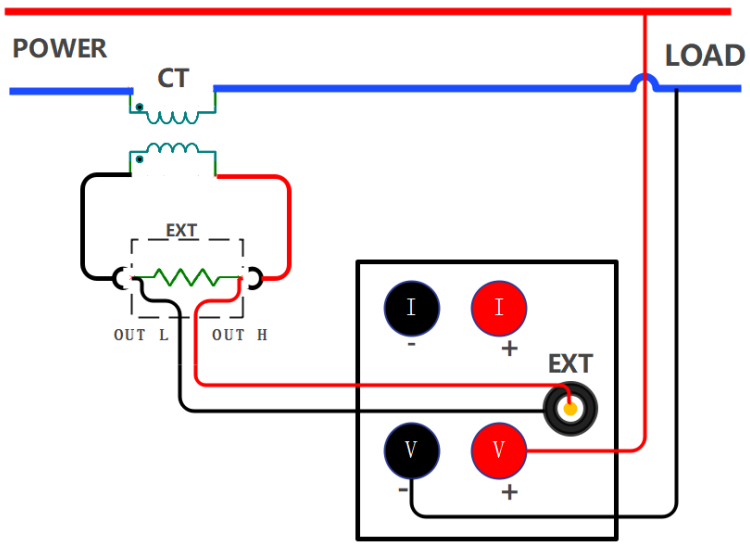
Do not use bare wire and sensor. It is important to avoid leaving the secondary side of a current transformer (CT) open-circuited, as it can cause high voltage transients and electric shock.

7.3.3 Wire Connection of Direct Input Voltage and EXT Input Current (③)

The current sensor of output voltage type must be selected when using EXT CH. The measurement circuit connecting method is shown in the following figure.



7.3.4 Wire Connection of Direct Input Voltage and (CT Transformer + EXT) Input Current (④)



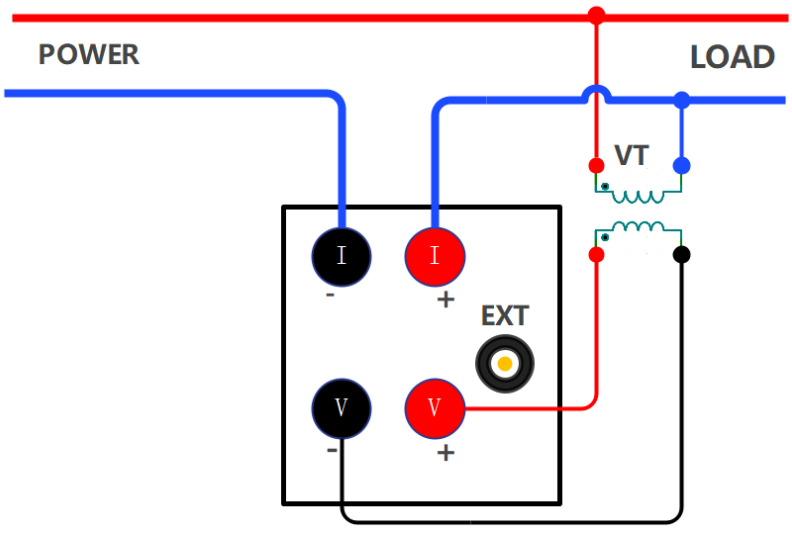
Warning

When using this wire connection for measurement, connecting the secondary side of CT to the input terminal of EXT, and then connecting the input terminal of EXT to the sensor input of the instrument, and finally connecting CT to the circuit to be tested.

Cautions

The measurement accuracy of this method is very rely on the accuracy of external sensor. If use this way to measure the equivalent accuracy of current sensor, the measured data error will be enlarged, so do not use this measurement method unless it is necessary.

7.3.5 Wire Connection of VT Transformer Input Voltage and Direct Input Current (⑤)

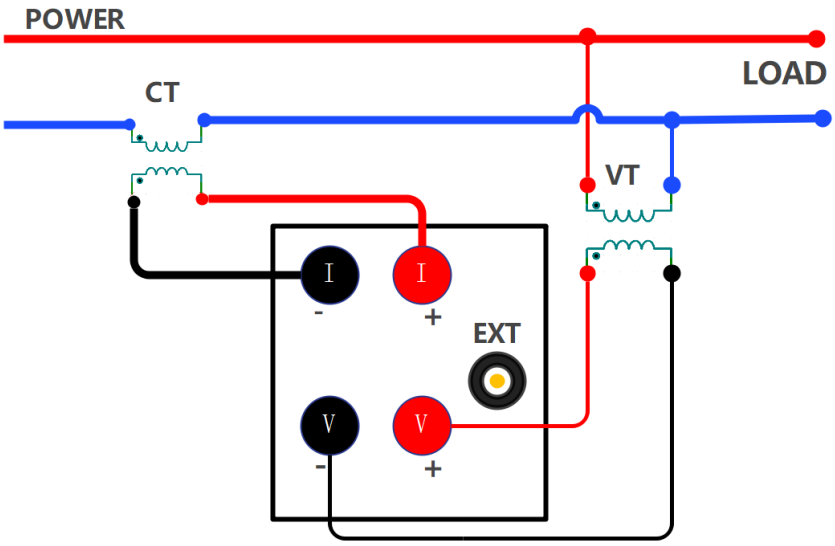


7.3.6 Wire Connection of VT Transformer Input Voltage and CT Transformer Input Current (⑥)

When the maximum current or voltage of the measuring object is over than the maximum measurement range of the instrument, it must use the CT and VT before measuring.

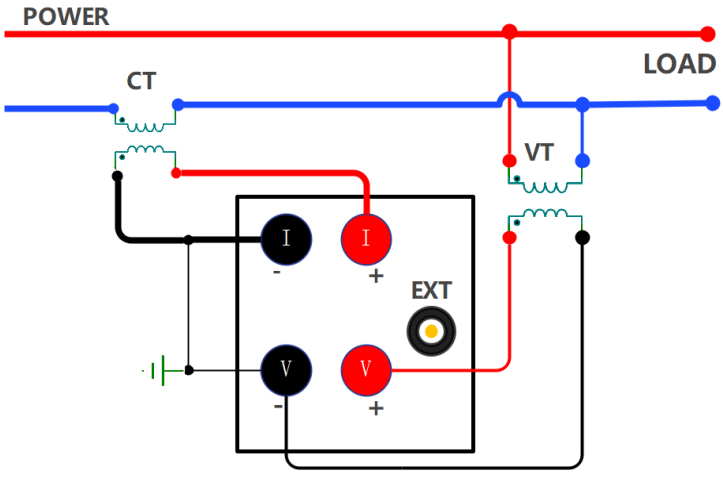
When using this wire connection for measurement, connecting the secondary side of CT to the current input terminal of power meter, and the secondary side of VT to the voltage input terminal of power meter, and finally connecting CT and VT to the circuit to be tested.

The wire connection example is shown in the following figure.

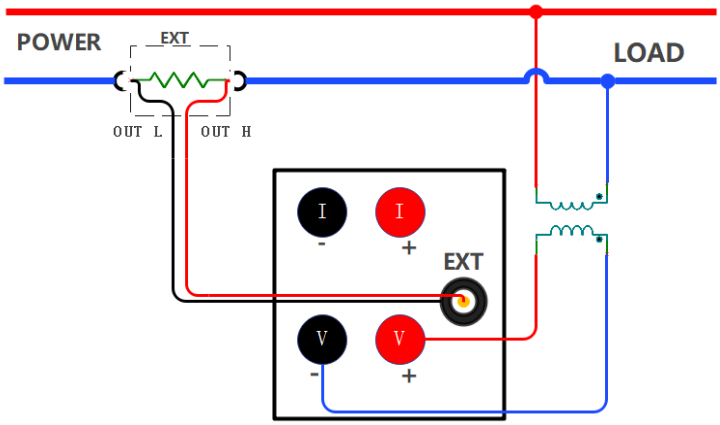


Warning

The secondary side of CT will product high voltage when using the CT. When the current is flowing on the primary side, please avoid the secondary side of CT is open-circuit, otherwise, it will be very dangerous. Connecting the common port (-) on the secondary side of VT/CT to ground to ensure security, as shown in the following figure.



7.3.7 Wire Connection of VT Transformer Input Voltage and EXT Transformer Input Current (⑦)



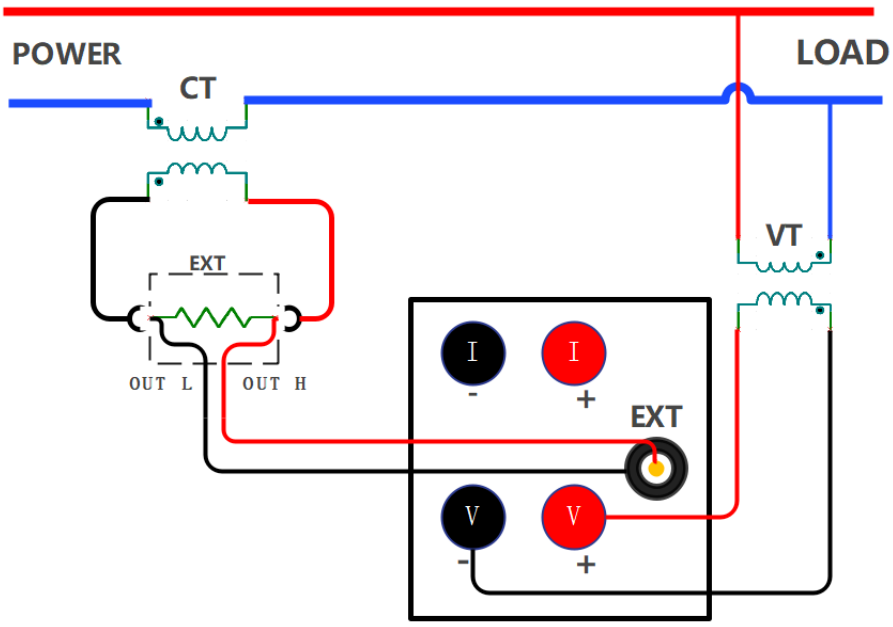
Warning

Do not use bare sensor, it may cause electric shock. Please make sure that the sensor is intact and the energized parts of the sensor are insulated from the box, and the sensor need have sufficient voltage-resistant for the voltage used in the measuring circuit.

When using EXT, do not wiring in the state of power-on. Do not touch the circuit, there is voltage on EXT when it is power on. The power of the measuring circuit must be disconnected when wiring.

7.3.8 Wire Connection of VT Transformer Input Voltage and (CT + EXT) Input Current (⑧)

The measurement accuracy of this method is very rely on the accuracy of external sensor. If use this way to measure the equivalent accuracy of current sensor, the error in the measured data will be larger than the error in using a single current sensor alone, so do not use this measurement method unless it is necessary.



Warning

When using the CT, be sure to fully understand the specification of voltage and clamp current sensor, the operating method and the dangerous factors (such as electric shock).

When using the EXT, do not touch the CT or connecting test cables. When the power of measuring circuit on EXT is enabled, the CT will produce the voltage, so it is dangerous.

Please use the connector that has safety design to connect the EXT of the instrument. In the event that a connector is dislodged, a voltage is generated at the conductive part, which is very dangerous.

8. Remote Control

UTE310 digital power meter can be remotely controlled by communicating with a computer via the USB, RS-232/GPIB interface, or RJ-45 Ethernet interface. For remote control, the user can use only one of the several communication interfaces for communication.

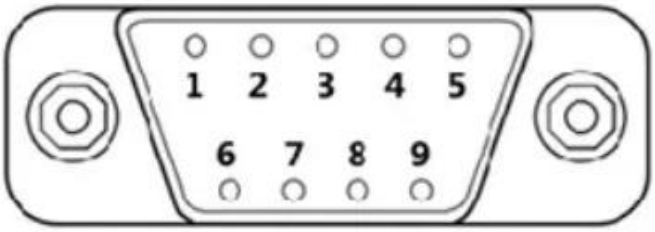
UTE310 digital power meter supports two remote control methods.

- User-defined programmed control based on SCPI and Modbus commands
- UTE310 host computer software

8.1 RS-232 Interface

UTE310 digital power meter has an RS-232 communication interface, which allows the user to remotely send SCPI commands to the power meter via the RS-232 interface. The power meter receives the relevant SCPI commands and executes the functions corresponding to the power meter's front panel keys, which can return measurement and calculation data, setup parameters and status bytes of control panel and error codes.

UTE310 communication interface is DB9 male head, and the definition of pin as shown in the following figure.



1	NC
2	RXD (RS-232 data input)
3	TXD (RS-232 data output)
4	NC

5	GND (RS-232 signal ground)
6	NC
7	NC
8	NC
9	NC

Notes

Before operating communication, UTE310 should match with the following parameters of the control host.

(1) Baud rate: 4800, 9600, 19200, 38400, 57600, 115200.

(2) Check bit: NONE (fixed value)

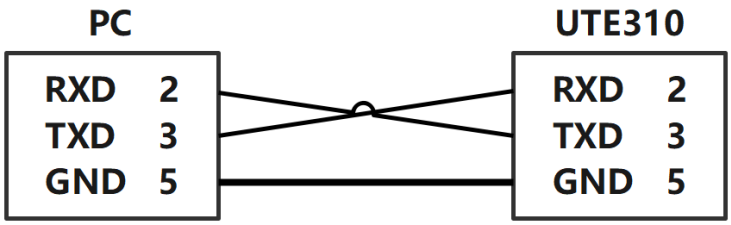
(3) Data bit: 8 (fixed value)

(4) Stop bit: 1 (fixed value)

8.1.1 RS-232 Settings

1. **Communication protocol**: set the communication protocol of power meter to SCPI, the setting method see subsection 7.2.3.
2. **Baud rate**: the baud rate of UTE310 and the control host should be the same, the setting method see subsection 7.3.1.

8.1.2 PC Connect to UTE310 via RS-232



Explanation

- In order to ensure stable communication, it is forbidden to use other interfaces for communication when using RS-232 interface.
- The number 2, 3, 5 mentioned in the above schematic indicates the pin numbers of DB9 interface, other pins not listed are not used.
- The above schematic is using a cross-serial cable, please use a cross-serial cable to connect the PC to the UTE310.

- The above wiring method only supports a PC with RS-232 interface. If the PC has no RS-232 interface, please use USB convert RS-232 serial line to connect a PC to UTE310.
- This wiring method only supports SCPI.

8.2 LAN Interface

UTE310 is equipped with a LAN port, so the user can send commands to the power meter by LAN port. When the power meter receives the command, the power meter will execute the function which corresponding to the key on the front panel and return the measured and calculated data, the setting parameters and state bytes of control panel and the error codes.

Port number	1
Interface type	RJ-45
Electrical and mechanical specifications	IEEE802.3
Transmission system	LAN (100BASE-TX, 10BASE-T)
Transmission rate	Maximum 100Mbps
Communication protocol	Modbus-TCP/IP
Support services	DHCP, Remote control (Modbus-TCP/IP)

8.2.1 LAN Settings

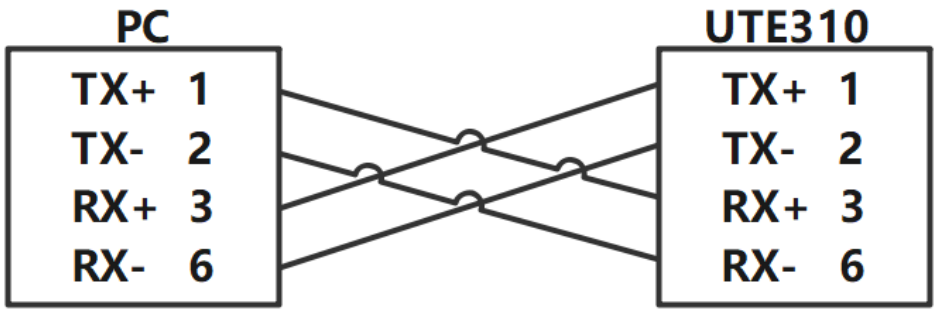
1. **Communication protocol**: set the communication protocol of power meter to Modbus, the setting method see subsection.
2. **Selecting IP mode**: DHCP (automatic acquire) or MANU (manually acquire).

Explanation

The user should correctly set the IP address, subnet mask and gateway for the power meter when the IP mode is MANU.

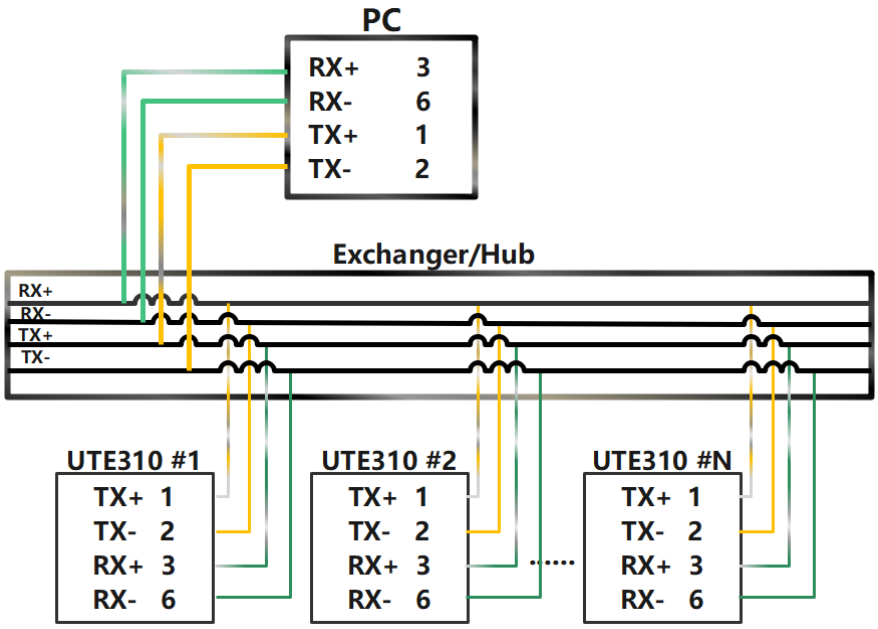
8.2.2 PC Connect to UTE310 via LAN

- **PC Connect to a Single UTE310**



- PC Connect to Multi-UTE310

  A PC connects to multiple UTE310 should through the concentrator or switch, as shown in the following figure.



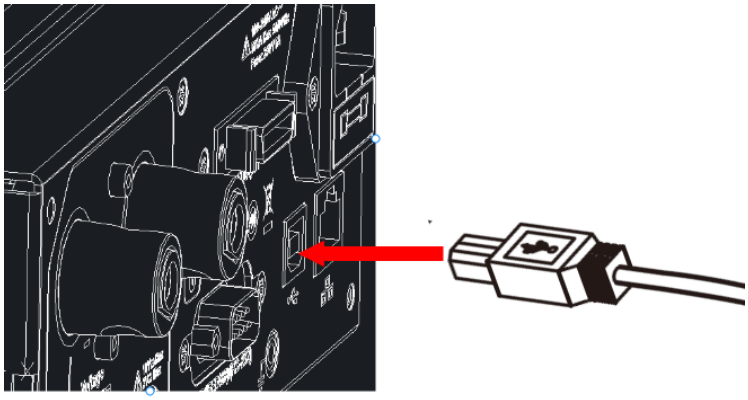
Explanation

- The above communication method only supports Modbus TCP/IP.
- In order to ensure stable communication, it is forbidden to use other interfaces for communication when using RJ-45 interface.
- The number mentioned in the above schematic indicates the pin numbers of RJ-45 interface, other pins not listed are not used.
- When a PC directly connect to a single UTE310, please use a cross-cable (one port is T586A and the other port is T586B).
- The above wiring represents the connection between the send end and the receive end of the data, and does not fully represent the actual physical connection.

8.3 USB Interface

When use USB interface to communication, it is not necessary to set USB parameters on the instrument.

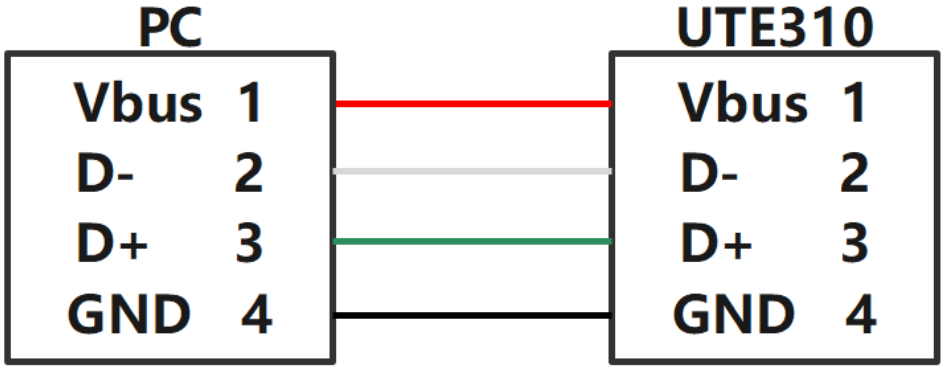
Port number	1
Interface type	B type USB (plug)
Electrical and mechanical specifications	USB 2.0
Transmission system	HS(high speed;480Mbps) and FS(full speed;12Mbps)
Transmission rate	User-defined
PC requirement	32-bit or 64-bit Windows 7 and higher systems with USB ports



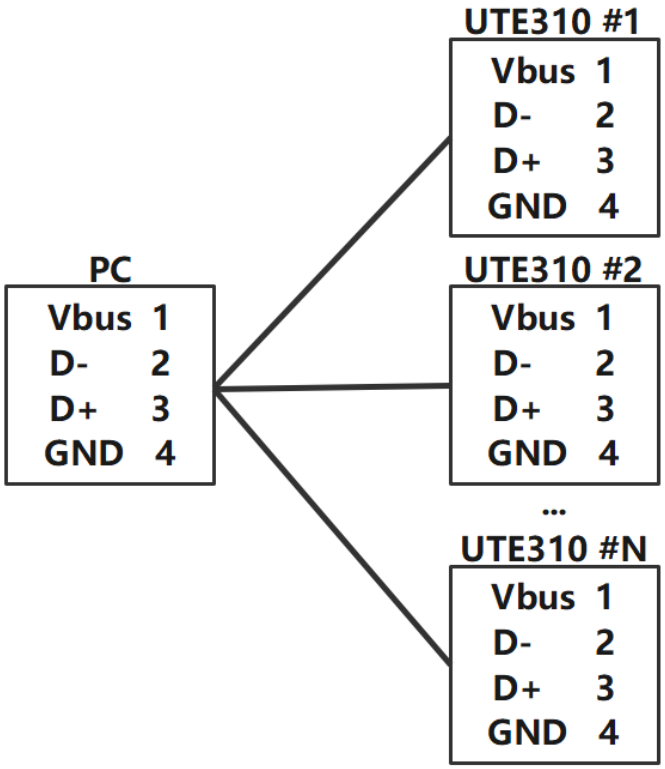
USB Connecting Figure

8.3.1 PC Connect to UTE310 via USB

- PC Connect to a Single UTE310



- PC Connect to Multi-UTE310



Cautions

- When use USB interface to communication, do not connect other interface to the PC.
- USB cable should reliably connect to the instrument and the PC.
- If the PC uses USB interface to connect multiple devices, the instrument should be connected to the USB interface closest to the PC side.

8.4 GPIB Interface (Optional)

UTE310's optional interface is GPIB. If the optional GPIB interface is selected, the RS-232 will not be equipped. When the optional GPIB interface is selected, the user can send the command to the power meter via GPIB, the power meter will execute the function which corresponding to the key on the front panel and return the measured and calculated data, the setting parameters and state bytes of control panel and the error codes.

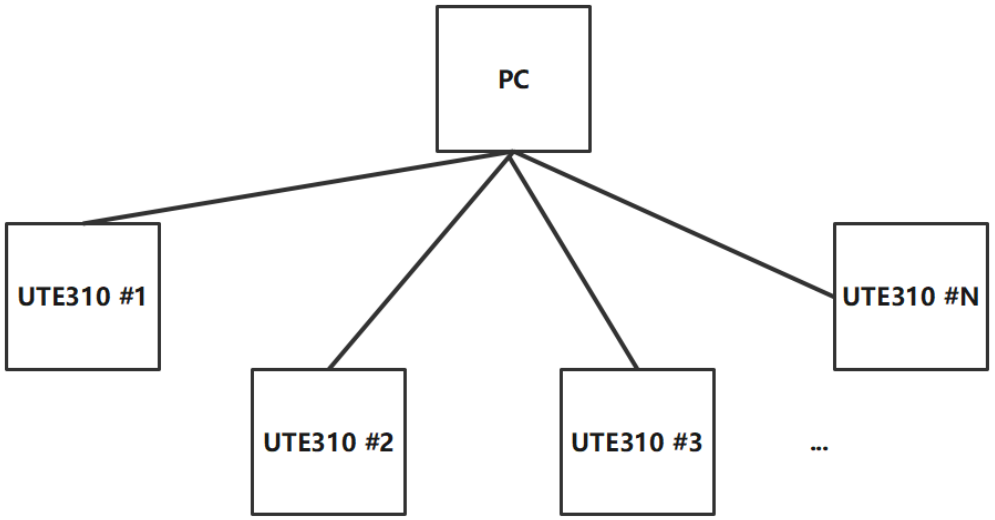
Applicable Equipment	American National Instrument PCI-GPIB or PCI-GPIB+, PCIe-GPIB or PCIe-GPIB+ PCMCIA-GPIB or PCMCIA-GPIB+ (Windows Vista or not support Windows 7) GPIB-USB-HS uses NI-488.2M Ver. 2.8.1 or update drive
Electrical and Mechanical Specifications	IEEE-488

Explanation

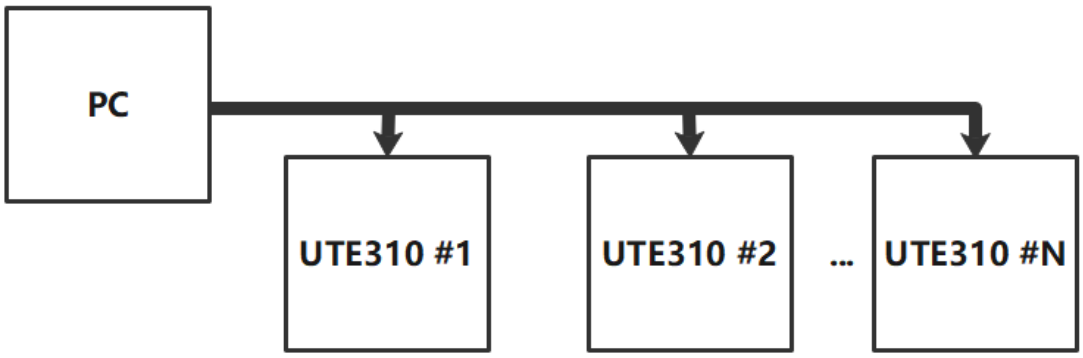
To ensure reliable and stable GPIB communication, please use genuine GPIB cables. Each GPIB device has a unique GPIB address, which is used to distinguish different GPIB devices. Therefore, when using the GPIB interface of the power meter, the user needs to set the GPIB address of the power meter first.

8.4.4 PC Connect to UTE310 via GPIB

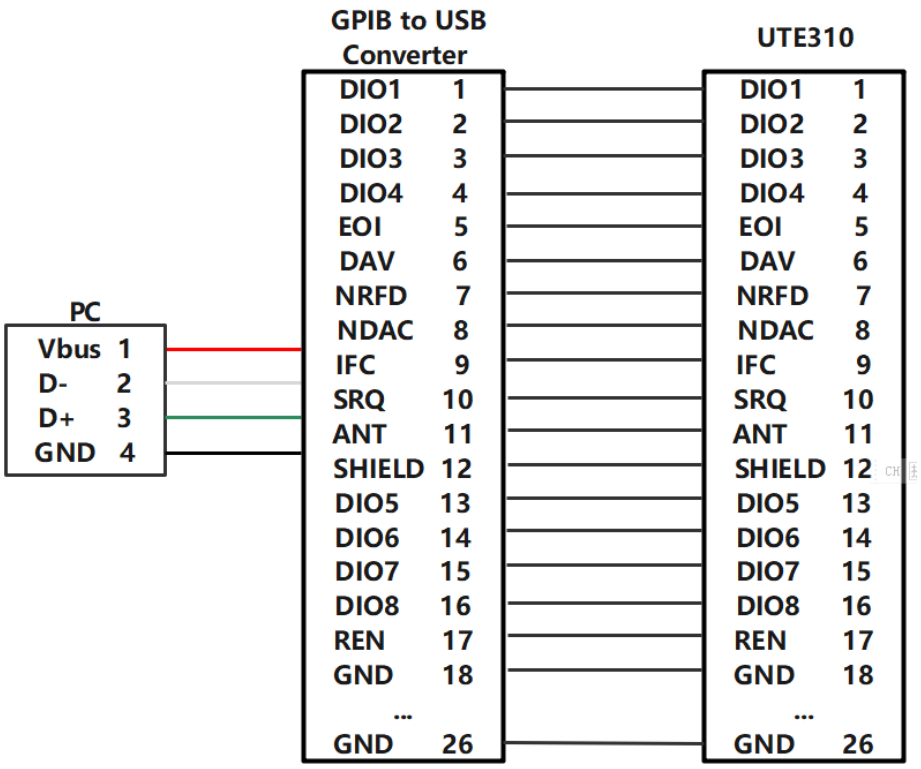
When using the GPIB interface for communication, please use genuine GPIB cable and do not use the longer wire. The connection is shown in the following figure.



or



In normal condition, PC has no GPIB interface, the user can connect through the GPIB to USB converter card, as shown in the following figure.

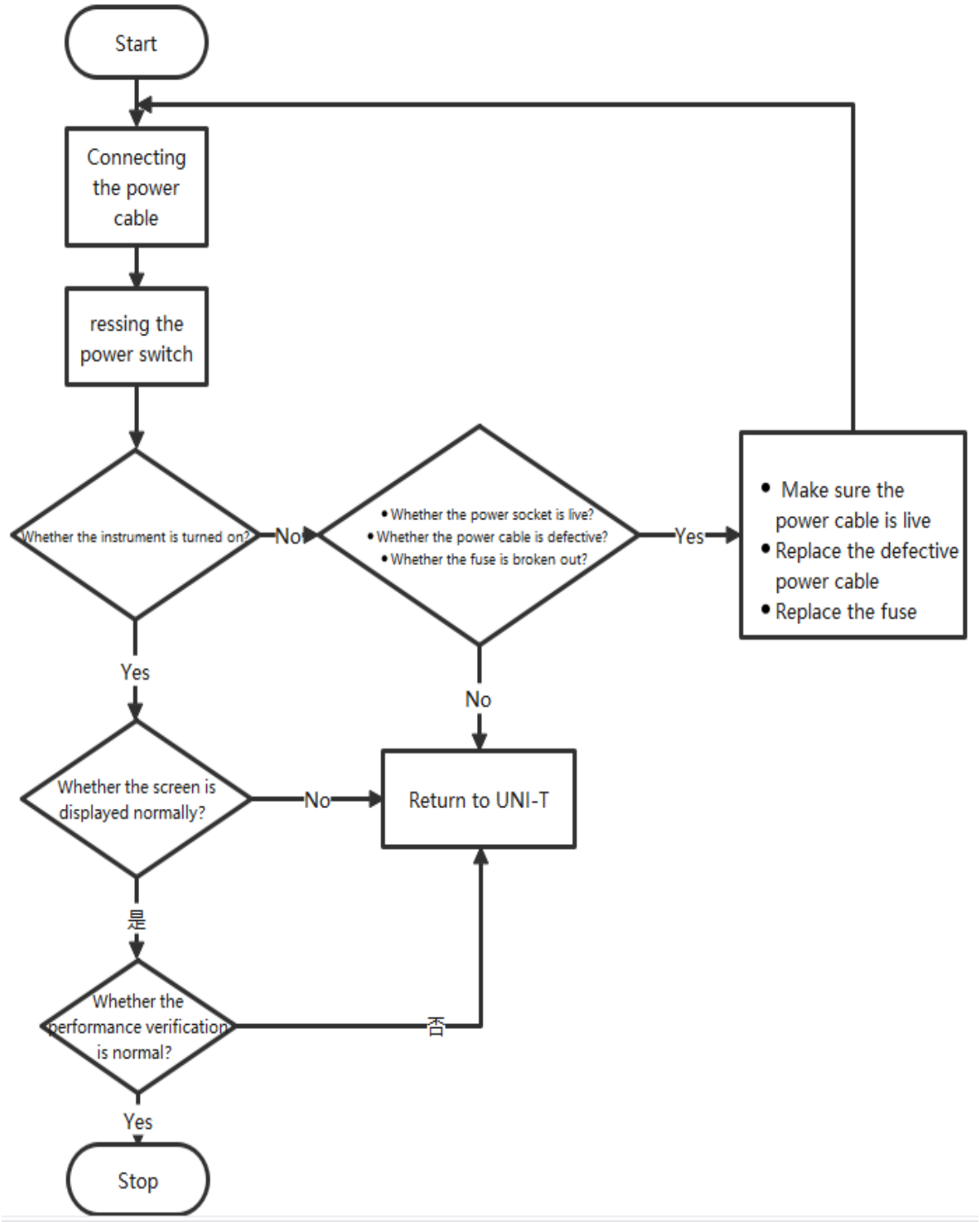


Explanation

- To ensure stable communication, when using the GPIB interface to communicate, other interface is forbidden.
- The number in the above block diagram indicates the pin numbers of the computer's USB or the pin numbers of the GPIB.
- When using the GPIB interface for communication, please use genuine GPIB cable.

9. Trouble-shooting

After pressing the power switch button, the power meter does not start normally. The fault can be handled according to the following process.



10. Contact Us

If the use of this product has caused any inconvenience, if you in mainland China you can contact UNI-T company directly.

Service support: 8am to 5.30pm (UTC+8), Monday to Friday or via email. Our email address is infosh@uni-trend.com.cn

For product support outside mainland China, please contact your local UNI-T distributor or sales center.

Many UNI-T products have the option of extending the warranty and calibration period, please contact your local UNI-T dealer or sales center.

To obtain the address list of our service centers, please visit our website at URL: http://www.uni-trend.com