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Quick Start Guide

UTE323 Series Digital Power Meter

UTE32320250712-V1.00

July 2025

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1. Product Overview

The UTE323 series digital power meters include six models: UTE323, UTE323G, UTE333H, UTE333HG, UTE333H-2K, and UTE333HG-2K. These are high-precision, high-performance, programmable three-phase digital power meters with a current measurement range of 5 mA to 50 A, suitable for applications ranging from production lines to R&D environments.

Typical applications include:

- Measurement of DC, 1P2W (Single-Phase Two-Wire), 1P3W (Single-Phase Three-Wire), 3P3W (Three-Phase Three-Wire), and 3P4W (Three-Phase Four-Wire)
- Power measurement of high-power household appliances such as air conditioners and induction cookers
- Power measurement of office equipment such as monitors and printers
- Power measurement of energy-related equipment such as LEDs, power supplies, and batteries
- Energy-saving performance evaluation of industrial equipment such as frequency converters and large-scale air conditioners
- Efficiency measurement of inverters

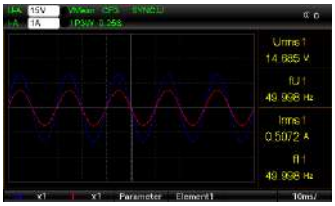
1.1 Functional Features

The main functional features of the UTE323 series digital power meters are as follows.

Intuitive Display Interface: Equipped with a 5-inch high-definition LCD screen for clear and intuitive data display.



Oscilloscope Function: Enables real-time observation of voltage, current, frequency, and waveform variations.





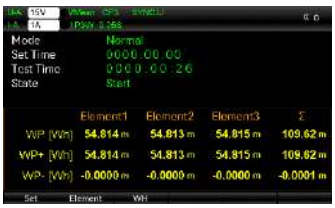
Simultaneous Multi-Unit Measurement: Enables simultaneous measurement of voltage, current, power, and power factor across three channels.



Harmonic Measurement (IEC 61000-4-7): Provides harmonic analysis of signals including voltage, current, power, and phase angle, with measurement results displayed up to the 50th order.



Mathematical Functions: Supports arithmetic operations (addition, subtraction, multiplication, division) on measured parameters of each channel.



Current and Power Integration: Supports integration of parameters including q, q+, q-, WP, WP+, WP-, with selectable standard integration mode or repetitive integration mode.



D/A Conversion Output: Equipped with 12 D/A output channels for proportional scaling and output of measured parameters such as voltage, current, and power.



Communication Interfaces: Provides USB, RS-232, GPIB, and Ethernet ports for remote control and data acquisition.

Auto Rang: Automatically switches to the appropriate range within the specified measurement range.

External Storage: Supports external USB storage devices for long-term data recording (voltage, current, power, and harmonics).

Built-in Filters: Includes line and frequency filtering functions.
Line filter cutoff frequency is selectable from 500 Hz to 100 kHz.
Frequency filtering suppresses noise and unneeded harmonics during carrier wave measurements.

PC Analysis Software: Dedicated software for remote control, configuration, data acquisition, display,

harmonic analysis, waveform analysis, and data storage.

Maximum Hold Function: Stores maximum values of RMS/peak voltage, RMS/peak current, active power (P), reactive power (Q), and apparent power (S).

Sampling Rate: 300 kSa/s

Bandwidth: DC, 0.1 Hz to 300 kHz

Low-Current Measurement: Minimum measurable current of 5 mA

Wide Current Sensor Input Range: 50 mV to 10 V, compatible with a broad range of sensors, ideal for measuring power consumption of intermittently operating equipment.

Data Update Rate: Up to 0.1 s at maximum speed, with selectable update intervals of 0.1 s, 0.25 s, 0.5 s, 1 s, 2 s, 5 s, 10 s, 20 s, or Auto to suit different signal frequencies.

1.2 Technical Specifications

f: Frequency (in error calculation formulas, the unit is kHz)

Rate: Data update interval

CF: Crest factor (peak factor)

rdg.: Reading

F.S.: Measurement range (full scale)

λ/PF: Power factor

ø: Phase difference

Ext: External current sensor input

S: Apparent power

Q: Reactive power

Model	UTE323, UTE323G		UTE333H, UTE333HG UTE333H-2K, UTE333HG-2K	
Bandwidth	DC, 0.1 Hz to 300 kHz		DC, 0.1 Hz to 300 kHz	
Sample Rate	300 kSa/s		300 kSa/s	
Voltage Range	CF = 3	CF=6 or 6 A	CF = 3	CF=6 or 6 A
	15 V	7.5 V	15 V	7.5 V
	30 V	15 V	30 V	15 V

<table>
<tr><th>Model</th><th colspan="2">UTE323, UTE323G</th><th colspan="2">UTE333H, UTE333HG
UTE333H-2K, UTE333HG-2K</th></tr>
<tr><td rowspan="8"></td><td>60 V</td><td>30 V</td><td>60 V</td><td>30 V</td></tr>
<tr><td>150 V</td><td>75 V</td><td>150 V</td><td>75 V</td></tr>
<tr><td>300 V</td><td>150 V</td><td>300 V</td><td>150 V</td></tr>
<tr><td>600 V</td><td>300 V</td><td>600 V</td><td>300 V</td></tr>
<tr><td>/</td><td>/</td><td>1000V</td><td>500V</td></tr>
<tr><td>/</td><td>/</td><td>2000V
pplicable only to UTE333H-2K and UTE333HG-2K)</td><td>1000V
(Applicable only to UTE333H-2K and UTE333HG-2K)</td></tr>
<tr><td colspan="4">Note:
The rated range of voltage is: 1% - 130% (the maximum display is 140%. 1000V range and 500V range,the maximum is 100%)
The maximum AC input for the 1000V range is 1000Vrms, and the maximum DC input is 1500Vdc
The maximum AC input for the 2000V range is 1100Vrms, and the maximum DC input is 2050Vdc</td></tr>
<tr><td>Voltage Resolution</td><td>0.001 V, 0.01 V</td><td>0.0001 V, 0.001 V, 0.01 V</td><td>0.001 V, 0.01 V, 0.1 V</td><td>0.0001 V, 0.001 V, 0.01 V</td></tr>
<tr><td rowspan="6">Voltage Accuracy</td><td colspan="2">DC, 0.1 Hz to 45 Hz: ±(0.1% rdg.+ 0.2% F.S.)</td><td colspan="2">DC, 0.1 Hz to 45 Hz: ±(0.1% rdg.+ 0.2% F.S.)</td></tr>
<tr><td colspan="2">45 Hz to 66 Hz: ±(0.1% rdg.+ 0.05% F.S.)</td><td colspan="2">45 Hz to 66 Hz: ±(0.1% rdg.+ 0.05% F.S.)</td></tr>
<tr><td colspan="2">66 Hz to 1 kHz: ±(0.1% rdg.+ 0.2% F.S.)</td><td colspan="2">66 Hz to 1 kHz: ±(0.1% rdg.+ 0.2% F.S.)</td></tr>
<tr><td colspan="2">1 kHz to 10 kHz: ±[(0.07 * f)% rdg.+ 0.3% F.S.]</td><td colspan="2">1 kHz to 10 kHz: ±[(0.07 * f)% rdg.+ 0.3% F.S.]</td></tr>
<tr><td colspan="2">10 kHz to 100 kHz:
±(0.5% rdg.+ 0.5% F.S.)±{0.04*(f-10)}% rdg.</td><td colspan="2">10 kHz to 100 kHz:
±(0.5% rdg.+ 0.5% F.S.)±{0.04*(f-10)}% rdg.</td></tr>
<tr><td colspan="4">Note: For input levels between 110% and 130% of the rated range, add 50% of the specified reading error to the above accuracy.</td></tr>
<tr><td rowspan="9">Current Range</td><td>CF = 3</td><td>CF=6 or 6 A</td><td>CF = 3</td><td>CF=6 or 6 A</td></tr>
<tr><td>500 mA</td><td>250 mA</td><td></td><td></td></tr>
<tr><td>1 A</td><td>0.5 A</td><td>1 A</td><td>0.5 A</td></tr>
<tr><td>2 A</td><td>1 A</td><td>2 A</td><td>1 A</td></tr>
<tr><td>5 A</td><td>2.5 A</td><td>5 A</td><td>2.5 A</td></tr>
<tr><td>10 A</td><td>5 A</td><td>10 A</td><td>5 A</td></tr>
<tr><td>20 A</td><td>10 A</td><td>20 A</td><td>10 A</td></tr>
<tr><td></td><td></td><td>50 A</td><td>25 A</td></tr>
<tr><td colspan="4">The rated range of the current is: 1% to 130% (the maximum display range is 140%, and for the 50A range, it is 100%)</td></tr>
</table>

Model	UTE323, UTE323G		UTE333H, UTE333HG UTE333H-2K, UTE333HG-2K	
Current Resolution	0.01 mA, 0.1 mA, 1 mA		0.1 mA, 1 mA	0.01 mA, 0.1 mA, 1 mA
Direct Input Current Accuracy	DC: ±(0.1% rdg.+ 0.2% F.S.)		DC: ±(0.2% rdg.+ 0.2% F.S.)	
	0.1 Hz to 45 Hz: ±(0.1% rdg.+ 0.2% F.S.)		0.1 Hz to 45 Hz: ±(0.1% rdg.+ 0.2% F.S.)	
	45 Hz to 66 Hz: ±(0.1% rdg.+ 0.05% F.S.)		45 Hz to 66 Hz: ±(0.1% rdg.+ 0.05% F.S.)	
	66 Hz to 1 kHz: ±(0.1% rdg.+ 0.2% F.S.)		66 Hz to 1 kHz: ±(0.1% rdg.+ 0.2% F.S.)	
	1 kHz to 10 kHz: ±[(0.07 * f)% rdg.+ 0.3% F.S.]		1 kHz to 10 kHz: ±[(.07 * f)% rdg.+ 0.3% F.S.]	
Direct Input Current Accuracy	10 kHz to 100 kHz: ±(0.5% rdg.+ 0.5% F.S.)±{0.04*(f-10)}% rdg.		10 kHz to 100 kHz: ±(0.5% rdg.+ 0.5% F.S.)±{0.04*(f-10)}% rdg	
	Note: For input levels between 110% and 130% of the rated range, add 50% of the specified reading error to the above accuracy.			
External Current Sensor Input (Ext1)	CF = 3	CF=6 or 6 A	CF = 3	CF=6 or 6 A
	2.5 V	1.25 V	2.5 V	1.25 V
	5 V	2.5 V	5 V	2.5 V
	10 V	5 V	10 V	5 V
External Current Sensor Input (Ext2)	50 mV	25 mV	50 mV	25 mV
	100 mV	50 mV	100 mV	50 mV
	200 mV	100 mV	200 mV	100 mV
	500 mV	250 mV	500 mV	250 mV
	1 V	0.5 V	1 V	0.5 V
	2 V	1 V	2 V	1 V
External Current Sensor Input Accuracy	DC, 0.1 Hz to 45 Hz: ±(0.1% rdg.+ 0.2% F.S.)		DC, 0.1 Hz to 45 Hz: ±(0.1% rdg.+ 0.2% F.S.)	
	45 Hz to 66 Hz: ±(0.1% rdg.+ 0.05% F.S.)		45 Hz to 66 Hz: ±(0.1% rdg.+ 0.05% F.S.)	
	66 Hz to 1 kHz: ±(0.1% rdg.+ 0.2% F.S.)		66 Hz to 1 kHz: ±(0.1% rdg.+ 0.2% F.S.)	
	1 kHz to 10 kHz: ±[(0.07 * f)% rdg.+ 0.3% F.S.]		1 kHz to 10 kHz: ±[(0.07 * f)% rdg.+ 0.3% F.S.]	
	10 kHz to 100 kHz: ±(0.5% rdg.+ 0.5% F.S.)±{0.04*(f-10)}% rdg.		10 kHz to 100 kHz: ±(0.5% rdg.+ 0.5% F.S.)±{0.04*(f-10)}% rdg.	
Line Filter (ON)	f < 45Hz: The voltage and current errors increase the reading by 1%. 45Hz ≤ f < 66Hz： The voltage and current errors increase the reading by 0.3%.			
Frequency Measuring Range	Data Update Interval	Measurement Range	Data Update Interval	Measurement Range
	0.1 s	20 Hz ≤ f ≤ 300 kHz	0.1 s	20 Hz ≤ f ≤ 300 kHz
	0.25 s	10 Hz ≤ f ≤ 300 kHz	0.25 s	10 Hz ≤ f ≤ 300 kHz
	0.5 s	5.0 Hz ≤ f ≤ 300 kHz	0.5 s	5.0 Hz ≤ f ≤ 300 kHz
	1 s	2.0 Hz ≤ f ≤ 300 kHz	1 s	2.0 Hz ≤ f ≤ 300 kHz

Model	UTE323, UTE323G		UTE333H, UTE333HG UTE333H-2K, UTE333HG-2K	
	2 s	1.0 Hz ≤ f ≤ 300 kHz	2 s	1.0 Hz ≤ f ≤ 300 kHz
	5 s	0.5 Hz ≤ f ≤ 300 kHz	5 s	0.5 Hz ≤ f ≤ 300 kHz
	10 s	0.2 Hz≤ f ≤ 300 kHz	10 s	0.2 Hz≤ f ≤ 300 kHz
	20 s	0.1 Hz ≤ f ≤ 300 kHz	20 s	0.1 Hz ≤ f ≤ 300 kHz
	Auto	0.1 Hz ≤ f ≤ 300 kHz	Auto	0.1 Hz ≤ f ≤ 300 kHz
Frequency accuracy	Accuracy: ±(0.06% of the reading) Note: When the crest factor is 3, the input signal level must be greater than or equal to 30% of the measurement range (for crest factors of 6 or 6A, it must be greater than or equal to 60%); furthermore, when the frequency of the measured voltage or current is less than or equal to 200Hz, the frequency filter must be turned on.			
Active Power Accuracy (Direct Input Current, PF = 1)	DC: ±(0.1% rdg.+ 0.2% F.S.)		DC: ±(0.3% rdg.+ 0.2% F.S.)	
	0.1 Hz to 45 Hz: ±(0.3% rdg.+ 0.2% F.S.)		0.1 Hz to 45 Hz: ±(0.3% rdg.+ 0.2% F.S.)	
	45 Hz to 66 Hz: ±(0.1% rdg.+ 0.05% F.S.)		45 Hz to 66 Hz: ±(0.1% rdg.+ 0.05% F.S.)	
	66 Hz to 1 kHz: ±(0.2% rdg.+ 0.2% F.S.)		66 Hz to 1 kHz: ±(0.2% rdg.+ 0.2% F.S.)	
	1 kHz to 10 kHz: ±(0.1% rdg.+ 0.3% F.S.)±{0.067*(f-1)}% rdg.		1 kHz to 10 kHz: ±[(0.13 * f)% rdg.+ 0.3% F.S.]	
	10 kHz to 100 kHz: ±(0.5% rdg.+ 0.5% F.S.)±{0.07*(f-10)}% rdg.		10 kHz to 100 kHz: ±(0.5% rdg.+ 0.5% F.S.)±{0.07*(f-10)}% rdg.	
Active Power Accuracy (External Current Sensor Input, PF = 1)	DC: ±(0.1% rdg.+ 0.2% F.S.)		DC: ±(0.1% rdg.+ 0.2% F.S.)	
	0.1 Hz to 45 Hz: ±(0.3% rdg.+ 0.2% F.S.)		0.1 Hz to 45 Hz: ±(0.3% rdg.+ 0.2% F.S.)	
	45 Hz to 66 Hz: ±(0.1% rdg.+ 0.05% F.S.)		45 Hz to 66 Hz: ±(0.1% rdg.+ 0.05% F.S.)	
	66 Hz to 1 kHz: ±(0.2% rdg.+ 0.2% F.S.)		66 Hz to 1 kHz: ±(0.2% rdg.+ 0.2% F.S.)	
	1 kHz to 10 kHz: ±(0.1% rdg.+ 0.3% F.S.)±{0.067*(f-1)}% rdg.		1 kHz to 10 kHz: ±(0.1% rdg.+ 0.3% F.S.)±{0.067*(f-1)}% rdg.	
	10 kHz to 100 kHz: ±(0.5% rdg.+ 0.5% F.S.)±{0.07*(f-10)}% rdg.		10 kHz to 100 kHz: ±(0.5% rdg.+ 0.5% F.S.)±{0.07*(f-10)}% rdg.	
Power Range	750 mW to 12000 W		15 W to 50 kW	
Influence of Power Factor	When λ=0: 45 Hz ≤ f ≤ 66 Hz: 0.2% of ± S When f up to 100 kHz: ± {(0.2+0.2 x f) % of S}, as reference value, the unit of f is kHz. When 0＜λ＜1: (Power reading) x [(Power reading error%) + (Power range error%) x $\left(\frac{\text{Power range}}{\text{Indicated apparent power value}}\right)$ + {tanø x (Influence of power factor when λ=0)%}]			

<table>
<tr><th>Model</th><th colspan="4">UTE323, UTE323G</th><th>UTE333H, UTE333HG
UTE333H-2K, UTE333HG-2K</th></tr>
<tr><td>Apparent Power (S) Accuracy</td><td colspan="5">Voltage accuracy + Current accuracy</td></tr>
<tr><td>Reactive Power (Q) Accuracy</td><td colspan="5">Apparent power accuracy + ($\sqrt{(1.0004-\lambda^2)}$ $-\sqrt{(1-\lambda^2)}$) x 100% of range</td></tr>
<tr><td>Power Factor (λ) Accuracy</td><td colspan="5">$\pm$ [$\left(\lambda-\frac{\lambda}{1.0002}\right)$ + |cosø-cos{ø+$sin^{-1}(Influence\ of\ power\ factor\ when\ \lambda=0)$%/100}|] ± 1 digit
At rated voltage and current, ø represents the phase difference between voltage and current.</td></tr>
<tr><td>Phase Difference (ø) Accuracy</td><td colspan="5">$\pm$ [|ø-$cos^{-1}\left(\frac{\lambda}{1.0002}\right)$| + sin^{-1}{(Influence of power factor when λ=0) %/100}]</td></tr>
<tr><td rowspan="6">Harmonic accuracy (when the line filter is turned off)</td><td>Frequency</td><td>Voltage</td><td>Current</td><td>Power</td><td></td></tr>
<tr><td>10Hz≤f＜45Hz</td><td>±(0.15% rdg.+0.35% F.S.)</td><td>±(0.15% rdg.+0.35% F.S.)</td><td>±(0.15% rdg.+0.50% F.S.)</td><td></td></tr>
<tr><td>45Hz≤f≤440Hz</td><td>±(0.15% rdg.+0.35% F.S.)</td><td>±(0.15% rdg.+0.35% F.S.)</td><td>±(0.25% rdg.+0.50% F.S.)</td><td></td></tr>
<tr><td>440Hz＜f≤1kHz</td><td>±(0.20% rdg.+0.35% F.S.)</td><td>±(0.20% rdg.+0.35% F.S.)</td><td>±(0.40% rdg.+0.50% F.S.)</td><td></td></tr>
<tr><td>1kHz＜f≤2.5kHz</td><td>±(0.80% rdg.+0.45% F.S.)</td><td>±(0.80% rdg.+0.45% F.S.)</td><td>±(1.56% rdg.+0.60% F.S.)</td><td></td></tr>
<tr><td>2.5kHz＜f≤5kHz</td><td>±(3.05% rdg.+0.45% F.S.)</td><td>±(3.05% rdg.+0.45% F.S.)</td><td>±(5.77% rdg.+0.60% F.S.)</td><td></td></tr>
<tr><td colspan="5">Note: The above accuracy is applicable when CF = 3 and PF = 1. The power above 1.2 kHz is the reference value.</td></tr>
<tr><td>Temperature coefficient</td><td colspan="5">Add ±0.03% of reading/°C within the range 5 to 18°C or 28 to 40°C</td></tr>
<tr><td>Waveform Display</td><td colspan="5">Voltage and current waveforms</td></tr>
<tr><td>Line Filter</td><td colspan="5">Standard</td></tr>
<tr><td>Frequency Filter</td><td colspan="5">Standard</td></tr>
<tr><td>Efficiency Measurement</td><td colspan="5">Support</td></tr>
<tr><td>Math Operation</td><td colspan="5">Standard</td></tr>
<tr><td>Harmonic Measurement</td><td colspan="5">Maximum 50th order</td></tr>
</table>

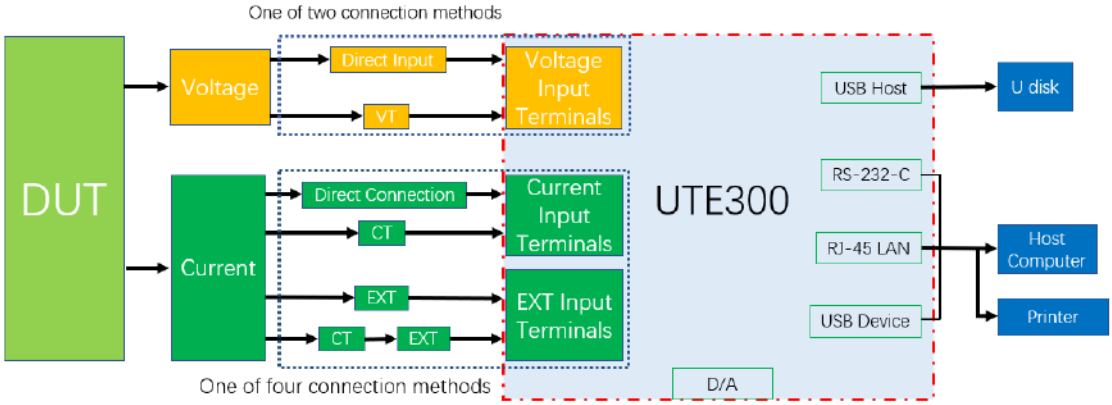
Model	UTE323, UTE323G	UTE333H, UTE333HG UTE333H-2K, UTE333HG-2K
Integration Function	Average active power integral, current integral	
D/A Output	12CH for digital-to-analog conversion	
Communication Interface	LAN, USB, RS-232 (Option: GPIB, When selecting GPIB, the models are UTE323G, UTE333HG or UTE333HG-2K.)	

Notes:

- The accuracy values for voltage, current, and power in the table are specified at CF = 3.
- For CF = 6 or 6 A, the range error is twice that at CF = 3.
- When measuring frequency, the RMS value of voltage or current must be greater than 30% of the measurement range.

1.3 Application System

The application system block diagram of the UTE323 series digital power meter is shown in the figure below.



1.4 Environmental Requirements

Operating Temperature	5°C to 40°C, 20% RH to 80% RH (non-condensing)
Accuracy Guarantee (Temperature/Humidity Range)	23°C ± 5°C, 30% to 75% RH
Storage Temperature	-10°C to 50°C, 20% RH to 80% RH (non-condensing)
Altitude	≤ 2000 meters

2. Getting Started Manual

2.1 General Inspection

Before using a new digital power meter, it is recommended to inspect the instrument as follows:

(1) Check for transportation damage

Inspect the packaging carton and expanded polyethylene protective padding for any significant damage.

(2) Check accessories

Verify the included accessories against the packing list. If any accessory is missing or damaged.

(3) Check the instrument

- Examine the instrument for physical damage, operational malfunctions, or performance issues.
- If it was damaged during transportation, retain the original packaging and notify the carrier.

Note: If any issues are found during these checks, please contact your UNI-T distributor for assistance.

2.2 Quick Function Check

Before using the digital power meter, perform a quick function check to ensure proper operation:

2.2.1 Button Check

Ensure that all buttons can be pressed and released normally.

2.2.2 Power-On Check

Connect the power meter to an AC 100 V–240 V, 50/60 Hz power source using the supplied power cord or another cord that meets your country's standards. Press the power switch to turn on the instrument.

Note: If any issues are found during these checks, please contact your UNI-T distributor for assistance.

3. Front Panel Overview

The front panel of the UTE323 series digital power meters is equipped with a USB port for connecting a USB flash drive, allowing measurement data to be saved directly to external storage. This section uses UTE323 as an example to describe the front panel layout and button functions.



UTE323 Front Panel

Note: The panel layout and functions of the UTE323, UTE323G, UTE333H, UTE333HG, UTE333H-2K, and UTE333HG-2K are identical, differing only in the model designation on the nameplate.

3.1 Button Functions on Front Panel

Button	Functional Description
	**Power On/Off Button:** "I" indicates power on, and "O" indicates power off. **Note:** The interval between powering off and on must be greater than 5 seconds.
	**General Function Button (F1–F6):** Perform functions depending on the parameters displayed on the screen. For ease of reference, these six buttons are referred to as F1 to F6 from left to right (not labeled on the actual panel).
	**Up/Down Selection Buttons:** Used to select the previous ▲, next ▼ item when setting parameters.

Button	Functional Description
	
	**Left/Right Selection Buttons:** Used to navigate left ◀ or right ▶ between items when setting parameters. Common functions include moving the editing cursor during value entry, enabling/disabling functions, and adjusting brightness.
	**Confirm Button (Enter):** Saves current settings and exits the setup menu.
	**Exit/Local Button:** Exits the current setup menu and returns to the previous screen. When in remote control mode, pressing this button switches back to local operation.
	**Wiring Mode Selection Button:** Selects wiring modes including 1P3W (Single-Phase Three-Wire), 3P3W (Three-Phase Three-Wire), 3P4W (Three-Phase Four-Wire), and 3V3A (Three-Voltage Three-Current)
	**Measurement Mode Button:** Press and release to select between RMS, VMean, and DC measurement modes. *Long press to capture the current screen.*
	**General Parameter Measurement Button:** Cycles through four different display modes. Each mode contains four display pages; pages can be changed using ▲ / ▼. Up to 24 parameters can be displayed simultaneously.
	**Harmonic Measurement Button:** Provides two display modes for harmonics: bar chart and list view.
	**Waveform Display Button:** Displays voltage and current waveforms, with four user-defined measurement parameters.
	**Integration Function Button:** Integrates average active power for each channel, current integration, as well as total power and current under different wiring modes.
	**Key Lock:** Disables all other key operations. Long-press (approx. 1s) to unlock.
	**Voltage Range Button:** Select the desired voltage range using ▲ / ▼, then press Enter to confirm and exit. Press Esc to exit without saving.
	**Current Range Button:** Select the desired current range using ▲ / ▼, then press Enter to confirm and exit. Press Esc to exit without saving.
	**Maximum Value Hold Button:** Holds the maximum measured value; updates automatically if a new maximum is detected.
	**Data Hold Button:** Holds the currently measured data from the input terminals.
	**Integration Start Button:** Press this button to start the integration process.

Button	Functional Description
	**Integration Stop Button:** Press this button to stop the ongoing integration.
	**Integration Reset Button:** When integration is stopped or an error occurs, press this button to reset both the integration results and the integration status.
	**Single Button** (Single Measurement Function): When the data hold function is enabled, press the **Single** button once to refresh and update the measurement data.
	**Setup Button** (Measurement-Related Function Setting)**:** Provides access to settings such as synchronization source, line filter, frequency filter, crest factor, data update interval, averaging filter, external current sensor, transformation ratio, range hopping, and D/A (Digital-to-Analog) conversion.
	**System Menu Button:** Opens submenus including system information, general settings, serial port settings/GPIB settings, network settings, and USB flash drive settings.
	**Zero Calibration Button:** Press this button to perform zero potential calibration.

4. Rear Panel Overview

The rear panel of the UTE323 Series digital power meters integrates multiple interfaces and terminals, including voltage, current, and sensor input terminals (for three measurement units), instrument power socket, D/A (Digital-to-Analog) output and control interfaces, RS-232/GPIB communication interfaces, USB communication interface, and Ethernet communication interface.

For illustration, the rear panel layout of the UTE323/UTE323G models is shown below.

The key differences are as follows:

Communication interface:

- UTE323G, UTE333HG and UT333HG-2K models are equipped with a GPIB interface.
- UTE323, UTE333H and UT333H-2K models are equipped with an RS-232 interface.

Measurement range:

The maximum allowable direct input for UTE323 / UTE323G is **600V / 20A**.

The maximum allowable direct input for UTE333H/UTE333HG is **1500V / 50A**.

The maximum allowable direct input for UTE333H-2K/UTE333HG-2K is **2000V / 50A**.



UTE323 Rear Panel



UTE323G Rear Panel

4.1 Functions on Real Panel

No.	Rotary/Interface	Functional Description
1		**Voltage Input Terminals (per unit):** UTE323/UTE323G: maximum measuring voltage 600 V UTE333H/UTE333HG: maximum measuring voltage 1500 V UTE333H-2K/UTE333HG-2K: maximum measuring voltage 2000 V
2		**Current Input Terminals (per unit):** UTE323/UTE323G: maximum allowable input current 20 A UTE333H/UTE333HG UTE333H-2K/UTE333HG-2K: maximum allowable input current 50 A
3		**External Current Sensor Input Interfaces (per unit):** Ext1: maximum allowable input voltage 10 V Ext2: maximum allowable input voltage 2 V
4		**RS-232 Communication Interface:** The UTE323, UTE333H and UTE333H-2K models are equipped with this interface.
5		**GPIB Communication Interface:** The UTE323G, UTE333HG and UTE333HG-2K models are equipped with this interface.
6		**D/A Output and Control Interfaces:** For analog signal output and instrument control signal transmission.
7		**USB Communication Interface:** Enables data transfer and basic remote operation with a computer.
8		**LAN (Ethernet) Communication Interface:** Supports remote control of the instrument via a local area network.
9		**3-Wire Power Input Socket:** For AC power supply connection (AC 100 V–240 V, 50/60 Hz).

5. User Interface

5.1 Display Contents

Display Contents	Description
U-R 15 V /30 V /150 V /300 V /600 V /1000 V /2000V	**U-R (Voltage Range):** Indicates that the voltage is set to a fixed range of 15 V, 30 V, 150 V, 300 V, 600 V, 1000 V, or 2000 V. (When CF = 6 or 6 A, each range is halved.)
U-A 15 V /30 V /150 V /300 V /600 V /1000 V	**U-A (Auto Voltage Range):** Indicates that the voltage is set to an auto range of 15 V, 30 V, 150 V, 300 V, 600 V, 1000 V, or 2000 V. (When CF = 6 or 6 A, each range is halved.)
I-R 500 mA /1 A /2 A /5 A /10 A /20 A /50 A	**I-R (Current Range):** Indicates that the current is set to a fixed range of 500 mA,1 A, 2 A, 5 A, 10 A, 20 A, or 50 A. (When CF = 6 or 6 A, each range is halved.)
I-A 500 mA /1 A /2 A /5 A /10 A /20 A /50 A	**Auto Current Range:** Indicates that the current is set to an auto range of 500 mA,1 A, 2 A, 5 A, 10 A, 20 A, or 50 A. (When CF = 6 or 6 A, each range is halved.)
EXT1	**EXT1 (External Current Sensor 1):** Indicates that the EXT1 sensor channel is used for current measurement input.
EXT2	**EXT2 (External Current Sensor 2):** Indicates that the EXT2 sensor channel is used for current measurement input.
I-RANGE 2.5 V /5 V /10 V	**I-RANGE (EXT1 Current Range):** Indicates that the current measurement (EXT1 channel) is set to a fixed range of 2.5 V, 5 V, or 10 V. (When CF = 6 or 6 A, each range is halved.)
I-AUTO 2.5 V /5 V /10 V	**I-AUTO (EXT1 Auto Current Range):** Indicates that the current measurement (EXT1 channel) is set to an auto range of 2.5 V, 5 V, or 10 V. (When CF = 6 or 6 A, each range is halved.)
I-R 50 mV /100 mV /200 mV /500 mV /1 V /2 V	**I-R (EXT2 Current Range):** Indicates that the current measurement (EXT2 channel) is set to a fixed of 50 mV, 100 mV, 200 mV, 500 mV, 1 V, or 2 V. (When CF = 6 or 6 A, each range is halved.)
I-A 50 mV /100 mV /200 mV /500 mV /1 V /2 V	**I-A (EXT2 Auto Current Range):** Indicates that the current measurement (EXT2 channel) is set to an auto range of 50 mV / 100 mV, 200 mV, 500 mV, 1 V, or 2 V. (When CF = 6 or 6A, each range is halved.)
SCALE	**SCALE (Transformation Ratio):** Indicates that the transformation ratio function is enabled.

Display Contents	Description
500 Hz /1 kHz /2 kHz /3 kHz /4 kHz /5 kHz /5.5 kHz /6 kHz /7 kHz /8 kHz /9 kHz /10 kHz /20 kHz /30 kHz /40 kHz /50 kHz /60 kHz /70 kHz /80 kHz /90 kHz /100 kHz	**Line Filter (ON):** Indicates that the line filter is enabled, with the cutoff frequency selectable from 500 Hz, 1 kHz, 2 kHz, 3 kHz, 4 kHz, 5 kHz, 5.5 kHz, 6 kHz, 7 kHz, 8 kHz, 9 kHz, 10 kHz, 20 kHz, 30 kHz, 40 kHz, 50 kHz, 60 kHz, 70 kHz, 80 kHz, 90 kHz, or 100 kHz.
F.F	**Frequency Filter (ON):** Indicates that the frequency filter is enabled.
RMS DC VMean	**RMS DC VMean (Measurement Mode):** Indicates the current measurement mode is RMS (Root Mean Square), DC (Direct Current), or VMean (Voltage Mean).
SYNC.OFF	**SYNC.OFF (Sync Source):** Indicates that no synchronization source is set.
SYNC.U	**SYNC.U (Sync Source: Voltage):** Indicates that voltage is selected as the synchronization source.
SYNC.I	**SYNC.I (Sync Source: Current):**Indicates that current is selected as the synchronization source.
1P3W /3P3W /3P4W /3V3A	**1P3W /3P3W /3P4W /3V3A (Wiring Method)**: Indicates the wiring mode 1P3W (Single-Phase Three-Wire), 3P3W (Three-Phase Three-Wire), 3P4W (Three-Phase Four-Wire), and 3V3A (Three-Voltage Three-Current).
P.V 1 2 3	**P.V 1 2 3 (Peak Voltage Over Range):** Indicates that the peak voltage has exceeded the measurement range for Channel 1, 2, or 3.
P.I 1 2 3	**P.V 1 2 3 (Peak Current Over Range):** Indicates that the peak current has exceeded the measurement range for Channel 1, 2, or 3.
fault.1	**Indicates a channel failure**
	**Key Sound (ON/OFF):** Indicates whether the key sound is enabled  or disabled .
	**Remote Control Mode:** Indicates that the instrument is operating in remote control mode.
	**USB Detection:** Indicates that a USB flash drive is inserted.

5.2 Measurement Interface

5.2.1 Simple Display Mode

The simple display mode shows the measurement results of four primary parameters on the screen. During measurement, users can cycle through different display modes by pressing the Meter button. This mode provides four display pages, which can be switched using the up ▲ or down ▼ keys.

Page 1: Channel 1 parameters U1 (Voltage 1), I1 (Current 1), P1 (Active Power 1), PF1 (Power Factor 1).

Page 2: Channel 2 parameters U2 (Voltage 2), I2 (Current 2), P2 (Active Power 2), PF2 (Power Factor 2).

Page 3: Channel 3 parameters U3 (Voltage 3), I3 (Current 3), P3 (Active Power 3), PF3 (Power Factor 3).

Page 4: Total parameters of all channels UΣ (Total Voltage), IΣ (Total Current), PΣ (Total Active Power), PFΣ (Total Power Factor).

The figure below shows the default display content of each page in simple display mode.



Page 1



Page 2



Page 3



Page 4

Parameter Settings

In addition to the default parameters, the display content on each page can be customized. The steps to set parameters are as follows.

1. On the desired display page, press the function key **F1** (labeled Parameter).

2. Use the up ▲ or down ▼ keys to move the cursor to the parameter position you want to change.
3. Press the function key F2 (labeled Element) to switch between channels.
4. Press the Enter key to open the list of selectable parameters, as shown in the figure below.



5. Use the arrow keys ▲ ▼ ◀ ▶ to navigate to the desired parameter, then press Enter again to confirm, as shown in the figure below.



6. Press the Esc button to exit cursor mode.

5.2.2 Standard Display Mode

The standard display mode shows the measurement results of two primary parameters and eight secondary parameters on the screen. During measurement, users can cycle through different display modes by pressing the Meter button. This mode provides four display pages, which can be switched using the up ▲ or down ▼ keys.

Page 1: Channel 1 parameters U1, I1, P1, PF1, S1, Q1, fU1, fI1, THDU1, THDI1.

Page 2: Channel 2 parameters U2, I2, P2, PF2, S2, Q2, fU2, fI2, THDU2, THDI2.

Page 3: Channel 3 parameters U3, I3, P3, PF3, S3, Q3, fU3, fI3, THDU2, THDI3.

Page 4: Total parameters of all channels UΣ, IΣ, PΣ, PFΣ, SΣ, QΣ, PHIΣ, P2, MATH, EFFi

The figure below shows the default display content of each page in standard display mode.



Page 1



Page 2



Page 3



Page 4

Parameter Settings

In addition to the default parameters, the display content on each page can be customized. The steps to set parameters are as follows.

1. On the desired display page, press the function button F1 (labeled Parameter).
2. Use the arrow keys ▲ ▼ ◀ ▶ to move the cursor to the parameter position you want to change.
3. Press the function button F2 (labeled Element) to switch between channels.
4. Press the Enter button to open the list of selectable parameters, as shown in the figure below.



5. Use the arrow keys ▲ ▼ ◀ ▶ to navigate to the desired parameter, then press Enter again to confirm, as shown in the figure below.



6. Press the Esc button to exit cursor mode.

5.2.3 Multi-Channel Display Mode

The multi-channel display mode shows the measurement results of three channels simultaneously, with each channel displaying eight parameters on the screen. During measurement, users can cycle through different display modes by pressing the Meter button. This mode provides four display pages, which can be switched using the up ▲ or down ▼ keys.

The figure below shows the default display content of each page in multi-channel display mode.



Page 1



Page 2



Page 3



Page 4

Parameter Settings

In addition to the default parameters, the display content on each page can be customized. The steps to set parameters are as follows.

1. On the desired display page, press the function button **F1**(Parameter).
2. Use the arrow keys ▲ ▼ ◀ ▶ to move the cursor to the parameter position you want to change.
3. Press the **Enter** button to open the list of selectable parameters, as shown in the figure below.



4. Use the arrow keys ▲ ▼ ◀ ▶ to navigate to the desired parameter, then press **Enter** again to confirm, as shown in the figure below.



5. Press the **Esc** button to exit cursor mode.

5.2.4 Sum Total Display Mode

The sum total display mode builds on the multi-channel display mode by adding an extra column to show the total sum of parameters across all units. Importantly, this total sum is not a simple arithmetic sum of the individual channel values; the calculation formula for **Σ**(sum) depends on the selected wiring mode.

The calculation formulas for different wiring modes are summarized in the table below.

Wiring Method	1P3W	3P3W	3V3A	3P4W
UΣ[V]	$\frac{U_1+U_3}{2}$	$\frac{U_1+U_3}{2}$	$\frac{U_1+U_2+U_3}{3}$	$\frac{U_1+U_2+U_3}{3}$
IΣ[V]	$\frac{I_1+I_3}{2}$	$\frac{I_1+I_3}{2}$	$\frac{I_1+I_2+I_3}{3}$	$\frac{I_1+I_2+I_3}{3}$

Wiring Method	1P3W	3P3W	3V3A	3P4W
PΣ[V]	$P_1 + P_3$	$P_1 + P_3$	$P_1 + P_3$	$P_1 + P_2 + P_3$
SΣ[V]	$S_1 + S_3$	$\frac{\sqrt{3}}{2}(S_1 + S_3)$	$\frac{\sqrt{3}}{2}(S_1 + S_2 + S_3)$	$S_1 + S_2 + S_3$
QΣ[V]	$Q_1 + Q_3$	$Q_1 + Q_3$	$Q_1 + Q_3$	$Q_1 + Q_2 + Q_3$
λΣ/ PF	$\frac{P\Sigma}{S\Sigma}$	$\frac{P\Sigma}{S\Sigma}$	$\frac{P\Sigma}{S\Sigma}$	$\frac{P\Sigma}{S\Sigma}$
ΦΣ/PHI[°]	$COS^{-1}(\frac{P\Sigma}{S\Sigma})$	$COS^{-1}(\frac{P\Sigma}{S\Sigma})$	$COS^{-1}(\frac{P\Sigma}{S\Sigma})$	$COS^{-1}(\frac{P\Sigma}{S\Sigma})$

Note: In all formulas, subscripts indicate the channel number. For example, U_2 represents the voltage of Channel 2.

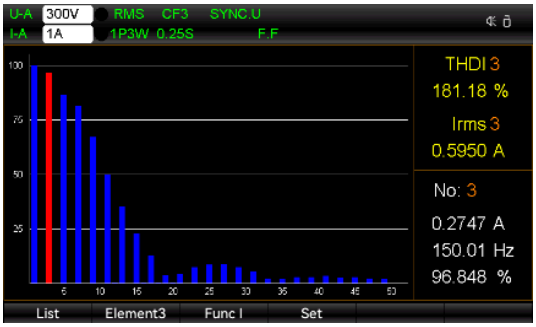
5.2.5 Harmonic Measurement Interface

The UTE323 series power meters provide a harmonic measurement function fully compliant with the international standard IEC 61000-4-7:2002. Based on the fundamental frequency, the instrument can measure up to the 50th harmonic for voltage, current, and power. Key measurements include total harmonic distortion (THD), carrier component, harmonic component of each order, phase difference, and harmonic distortion factor.

The synchronization source can be set to any of U1, U2, U3, I1, I2, or I3, depending on the measurement scenario. The upper limit of harmonic analysis orders can be freely configured between 1 and 50. For applications with specific THD calculation requirements, the power meter can perform calculations accordingly.

Notes: The IEC 61000-4-7:2002 standard specifies precise harmonic calculation methods (e.g., time window, synchronization, and window functions) and performance requirements for standard-compliant measuring instruments.

The power meter provides two display modes for harmonic measurement: histogram and list. The default mode is the histogram, as shown in the figure below.



Histogram Display Mode



List Display Mode

In list display mode, if there is no input signal or if harmonic measurement is abnormal (i.e., certain harmonic orders are unanalyzed), the corresponding harmonic values are displayed as ------.

For example, in IEC mode, harmonics from the 41st to 50th orders are shown as ------, while the values of other orders are displayed according to the actual measurement results.

5.2.6 Integration Interface

The power meter supports integration parameters: WP, WP+, WP-, q, q+, q-. Integration can be performed for all measurement units. When a numeric follows a parameter (e.g., WP1), it represents the integration value of the corresponding channel (e.g., WP1 = Channel 1 integration). When the symbol **Σ** follows a parameter (e.g., WPΣ), it represents the total integration value. The total integration value depends on the selected wiring mode.

The calculation methods for integration under different wiring modes are provided in the table below.

Wiring Method	1P3W	3P3W	3V3A	3P4W
WPΣ(Wh)	WP1 + WP3	WP1 + WP3	WP1 + WP3	WP1 + WP2 + WP3
WP+Σ(Wh)	WP+1 + WP+3	WP+1 + WP+3	WP+1 + WP+3	WP+1 + WP+2 + WP+3
WP-Σ(Wh)	WP-1 + WP-3	WP-1 + WP-3	WP-1 + WP-3	WP-1 + WP-2 + WP-3
qΣ(Ah)	q1 + q3	q1 + q3	q1 + q3	q1 + q2 + q3
q+Σ(Ah)	q+1 + q+3	q+1 + q+3	q+1 + q+3	q+1 + q+2 + q+3
q-Σ(Ah)	q-1 + q-3	q-1 + q-3	q-1 + q-3	q-1 + q-2 + q-3

The integration interface consists of five display pages: integration data of channel 1, integration data of channel 2, integration data of channel 3, total integration data (sum of all channels), and all integration parameters displayed simultaneously.

Switch between pages: Press the function button **F2** (labeled Element) cyclically while in the integration interface.

Switch displayed parameters (WP/q): Press the function button **F3** to toggle between WP and q.

The five display pages are illustrated in the figure below.



WP integration of Unit 1



q integration of Unit 2



q integration of Unit 3



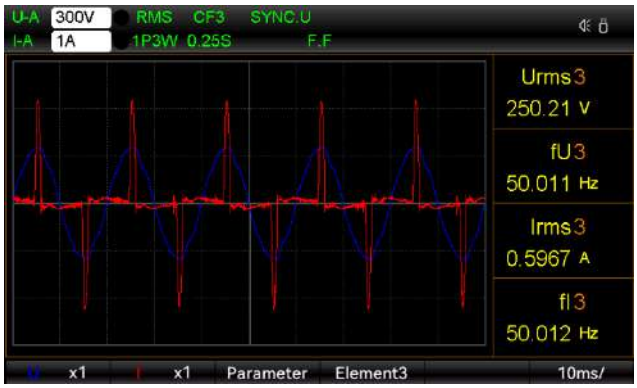
WP total integration



All integration parameters of q

5.2.7 Waveform Display

The power meter features a waveform display function, allowing visual representation of voltage and current waveforms. In this mode, key measurement parameters can also be displayed alongside the waveforms, as shown in the figure below.



6. General Measurement Configuration

6.1 Range Settings

6.1.1 Voltage Range Settings

Setting Steps

1. When the integration function is not enabled, press the Voltage button on any measurement interface to move the cursor to the voltage range position (highlighted in blue).
2. Press the up ▲ or down ▼ keys to select the desired voltage range.
3. Press the Enter button to save the selected voltage range, or press the Esc button to exit the setting.

Notes:

UTE323/UTE323G voltage range (CF = 3): Auto,15 V, 30 V, 60 V, 150 V, 300V, 600 V (CF = 3)

UTE333H/UTE333HG voltage range (CF = 3): Auto, 15 V, 30 V, 60 V, 150 V, 300 V, 600 V, 1000 V

UTE333H-2K/UTE333HG-2K voltage range (CF = 3): Auto, 15 V, 30 V, 60 V, 150 V, 300 V, 600 V, 1000 V, 2000 V

When CF = 6 or 6 A, all ranges are halved.

UTE323/UTE323G voltage range (CF = 6 or 6 A): Auto, 7.5 V, 15 V, 30 V, 75 V, 150 V, 300 V

UTE333H/UTE333HG voltage range (CF = 6 or 6 A): Auto, 7.5 V, 15 V, 30 V, 75 V, 150 V, 300V , 500 V

UTE333H-2K/UTE333HG-2K voltage range (CF = 6 or 6 A): Auto, 7.5 V, 15 V, 30 V, 75 V, 150 V, 300V , 500 V, 1000 V

Auto indicates the auto range mode.

Maximum display range (CF = 3): 0.5% to 140% of the range

When CF is set to 3, the crest factor of the 1000V range is 1.8, the maximum effective input is 1000V, and the maximum peak input is 1800V;

When CF is set to 6, the crest factor of the 500V range is 3, the maximum effective input is 500V, and the maximum peak input is 1800V;

The maximum effective input of the 1000 range of UTE333H/UTE333HG is 1000Vrms, and the maximum effective DC input supports 1500Vdc.

The maximum allowable AC input of the 2000V range of UTE333H-2K/UTE333HG-2K is 1100Vrms, and the maximum allowable DC input is 2050Vdc.

6.1.2 Current Range Settings

Setting Steps

1. When the integration function is not enabled, press the Current button on any measurement interface to move the cursor to the voltage range position (highlighted in blue).
2. Press the up ▲ or down ▼ keys to select the desired current range.
3. Press the Enter button to save the selected current range, or press the Esc button to exit the setting.

Notes:

UTE323/UTE323G current range (CF = 3): Auto, 500 mA, 1 A, 2 A, 5 A, 10 A, 20 A

UTE333H/UTE333HG/ UTE333H-2K/UTE333HG-2K current range (CF = 3): Auto, 1 A, 2 A, 5 A, 10 A, 20 A, 50 A

When CF = 6 or 6 A, all ranges are halved.

UTE323/UTE323G current range (CF = 6 or 6 A): Auto, 250 mA, 500 mA, 1 A, 2.5 A, 5 A, 10 A

UTE333H/UTE333HG/ UTE333H-2K/UTE333HG-2K current range (CF = 6 or 6 A): Auto, 500 mA, 1 A, 2.5 A, 5 A, 10 A, 25 A

Auto indicates the auto range mode.

Maximum current display range (CF = 3): 0.5% to 140% of the range. For the 50A range, it is 0.5% to 100%.

Current Range Setting for External Current Sensor Channels

When measuring with external current sensor channels (Ext1 / Ext2), the available current ranges vary depending on the channel type and CF setting.

Ext1 (CF = 3): Auto, 2.5 V, 5 V, 10 V

Ext2 (CF = 3): Auto, 50 mV, 100 mV, 200 mV, 500 mV, 1 V, 2 V

When CF = 6 or 6 A, all ranges are halved.

Ext1 (CF = 6 or 6 A): Auto, 1.25 V, 2.5 V, 5 V

Ext2 (CF = 6 or 6 A): Auto, 25 mV, 50 mV, 100 mV, 250 mV, 500 mV, 1 V

Auto indicates the auto range mode.

6.2 Measurement Mode

The UTE323 digital power meter provides three measurement modes, which can be configured according to the type of signal being measured or the values that need to be displayed.

In the display interface, the parameter positions for **U** (Voltage), **I** (Current), **S** (Apparent Power), and **Q** (Reactive Power) will update dynamically based on the selected measurement mode.

For example, in DC mode, U is displayed as **Udc** (DC Voltage); in RMS mode, U is displayed as **Urms** (Voltage RMS).

Setting Steps

1. Press and release the **Mode** button; the measurement mode changes each time the key is pressed.
2. Repeat step 1 to cycle through the three modes: RMS, DC, VMean.

Display Types

The display types for voltage and Current vary depending on the selected measurement mode, as provided in the table below.

Measurement Mode	Voltage	Current
RMS	True RMS value	True RMS value
DC	Linear average	Linear average
VMean	Rectified mean value calibrated to the RMS value	True RMS value

Calculation Formula

RMS: Select this mode to display the true RMS values 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: The period of input signal

DC: Select this mode, when the input voltage or current is DC. The input signal is linearly averaged, calculation formula is as follows.

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

f (t): Input signal

T: The period of input signal

VMean: Select this mode to display the voltage as a rectified mean value calibrated to the RMS value. The calculation formula is as follows.

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

f (t): Input signal

T: The period of input signal

6.3 Direct Input Current Measurement

The UTE323 series digital power meters support four wiring modes: 1P3W (Single-Phase Three-Wire), 3P3W (Three-Phase Three-Wire), 3P4W (Three-Phase Four-Wire), and 3V3A (Three-Voltage Three-Current). Refer to the following wiring diagrams to select the appropriate wiring mode and perform correct wiring.

Notes

1. The different colors shown in the wiring diagrams are only for distinguishing phase lines. Actual phase wire colors should comply with local standards and regulations.
2. Load current flows through the thicker wires shown in the diagrams. Ensure that these wires have sufficient current-carrying capacity to prevent overheating or damage.
3. Always turn off the power supply of both the load and the instrument before wiring at the load terminal to ensure operator safety and avoid damage caused by transient currents.
4. When measuring high current/voltage or signals containing high-frequency components, take precautions against mutual interference and noise. Use shielded cables or twisted pairs when necessary.
5. Keep test wires as short as possible to minimize the influence of stray capacitance on measurement accuracy.
6. To reduce distributed capacitance to ground, keep test wires and ground wires as far away from the instrument housing as possible.

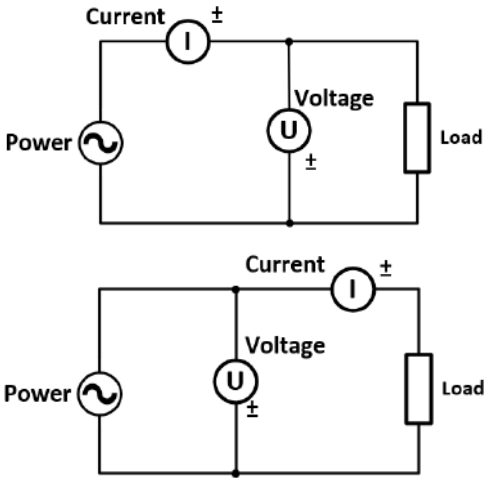
6.3.1 1P2W Wiring Connection

Single-phase two-wire (1P2W) systems are commonly used in DC applications, household lighting, and chargers, involving only the live (L) and neutral (N) wires.

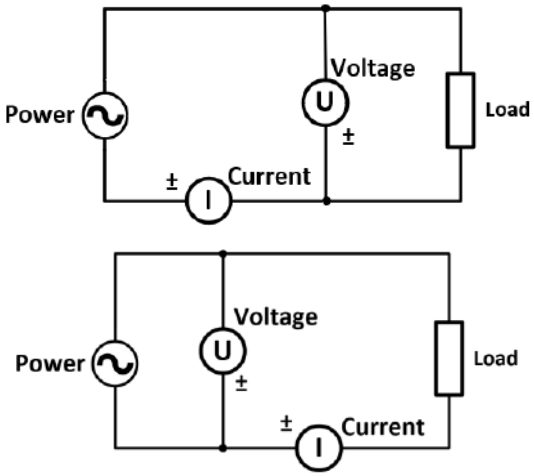
When measuring the power of a 1P2W device with the UTE323 digital power meter, select the 1P2W mode and connect any one measurement unit for wiring. To achieve more accurate measurements, the following factors should be considered during the measurement process: the position of the terminal connections, the influence of stray capacitance, and the magnitude of voltage and current.

(1) Impact of stray capacitance: When measuring 1P2W devices, connect the instrument's current input terminal to the side closer to the power supply ground. This reduces the effects of stray capacitance on measurement results. The wiring diagram is shown below.

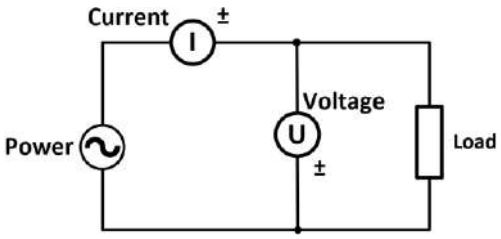
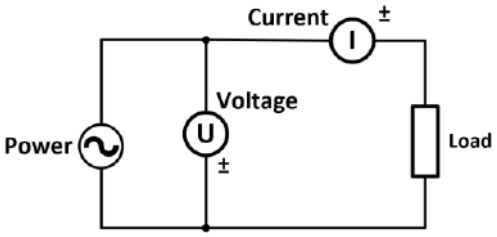
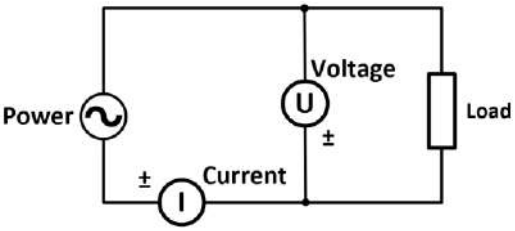
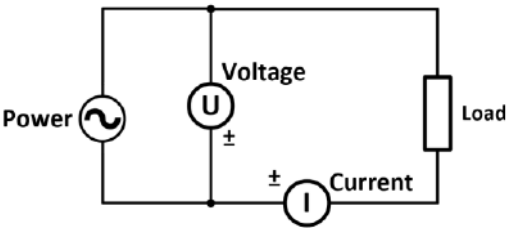
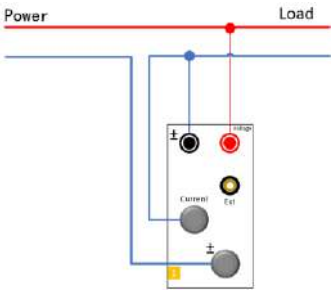
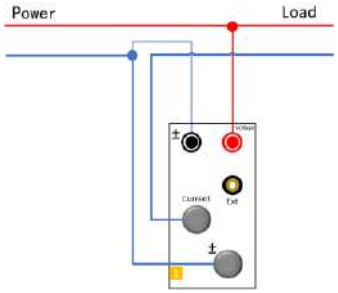
Easily Affected



Not Easily Affected



(2) Impact of the magnitude of current:

	High Current Wiring Method	Low Current Wiring Method
Easily Affected		
Not Easily Affected		
Wiring Diagram		

When using the high-current wiring method for measurement, the voltage is measured at the load end, ensuring accurate voltage measurement. However, due to the leakage current of the multi-measurement voltmeter, the measured load current may be higher than the actual value.

The power error introduced by this wiring method is:

$$P_{LOS}=\frac{U^2}{2000000\Omega}$$

U indicates the voltage measured by the voltmeter, expressed in volts (V).

When using the low-current wiring method for measurement, the voltage is measured at the power supply end, while the current measurement is accurate. However, due to the voltage division characteristic of the multi-measurement ammeter, the measured load voltage may be higher than the actual value.

The power error introduced by this wiring method is:

$$P_{LOS}=I^2 \times 0.002\Omega$$

I indicates the current measured by the ammeter, expressed in amperes (A).

6.3.2 1P3W Wiring Connection

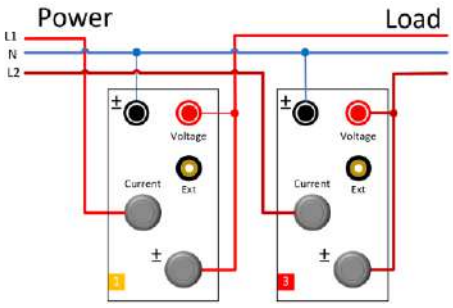
The single-phase three-wire (1P3W) system is commonly used in power supply systems with two live wires (L1, L2) and one neutral wire (N).

When measuring using the 1P3W wiring method:

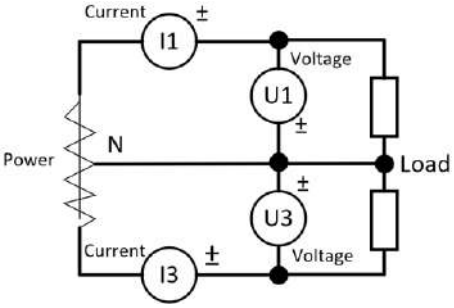
- Use Unit 1 of the power meter to measure the circuit between the L1 wire and the N wire.
- Use Unit 3 of the power meter to measure the circuit between the L2 wire and the N wire.

The wiring diagram is shown below.

Wiring Diagram



Schematic Diagram



6.3.3 3P3W Wiring Connection

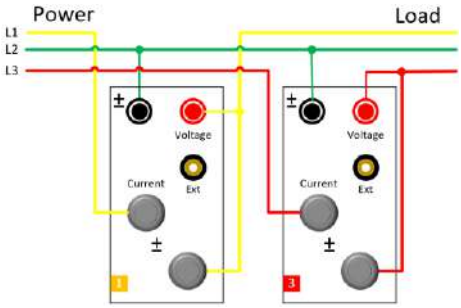
The three-phase three-wire (3P3W) system consists of three phase wires: L1 (yellow), L2 (green), and L3 (red). This system does not include a neutral (N) or protective earth (PE) wire and is suitable only for three-phase balanced loads, such as three-phase asynchronous motors (e.g., water pump motors, fan motors, compressors, conveyor belt motors), machine tool equipment, and air compressors.

When measuring using the 3P3W wiring method:

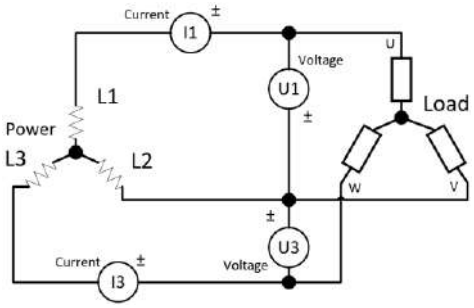
- Take the L2 wire as the reference phase.
- Use Unit 1 of the power meter to measure the circuit between the L1 wire and the L2 wire.
- Use Unit 3 of the power meter to measure the circuit between the L3 wire and the L2 wire.
- After wiring, connect the L1, L2, and L3 phases to the U, V, and W phases of the load, respectively.

The wiring diagram is shown below.

Wiring Diagram



Schematic Diagram



Warning

- Ensure that the three-phase load is balanced.
- Verify the phase sequence before applying power.
- This power supply system does not provide ground wire protection. To prevent electric shock caused by live equipment enclosures due to load leakage, properly ground the load casing. The grounding resistance must be ≤ 4 Ω.

6.3.4 3V3A Wiring Connection

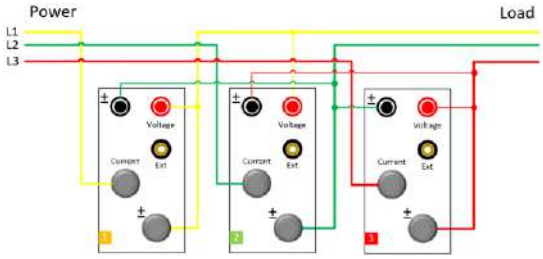
The three-voltmeter three-ammeter (3V3A) wiring method is suitable for three-phase power supply systems and is used when line voltages need to be measured phase by phase.

When using the 3V3A wiring method:

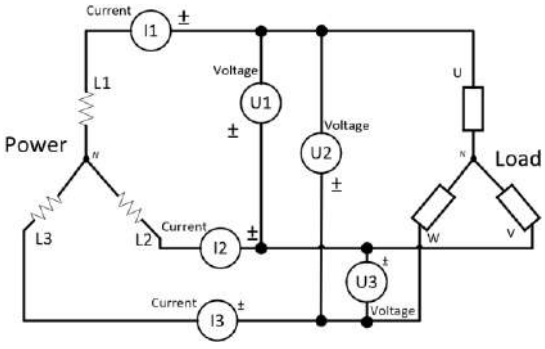
- Use Unit 1 of the power meter to measure the line voltage between L1 and L2.
- Use Unit 2 to measure the line voltage between L1 and L3.
- Use Unit 3 to measure the line voltage between L3 and L2.

The wiring diagram is shown below.

Wiring Diagram



Schematic Diagram



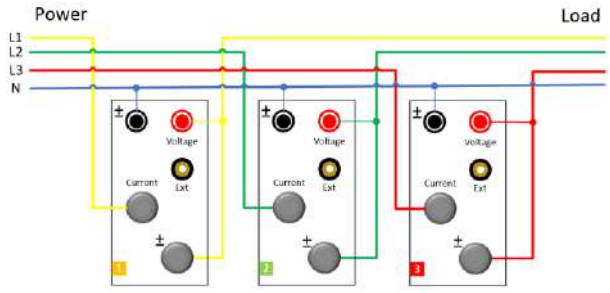
6.3.5 3P4W Wiring Connection

The three-phase four-wire system consists of three phase wires L1 (yellow), L2 (green), L3 (red), and one neutral wire N (light blue). It is used to measure the phase voltages of a three-phase four-wire power system. This configuration can simultaneously provide three-phase 380 V and single-phase 220 V outputs and is widely used in industrial, commercial, and residential power distribution.

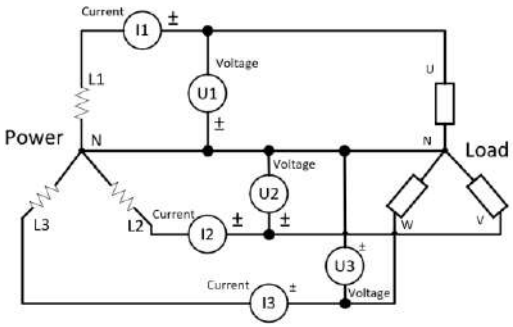
When the three phases are balanced, the current in the neutral wire is close to zero. If the three phases are unbalanced, the neutral wire carries the unbalanced current.

The wiring diagram is shown below.

Wiring Diagram



Schematic Diagram



Notes

- The instrument casing must be properly grounded during measurement.
- The grounding resistance must be ≤ 4 Ω.

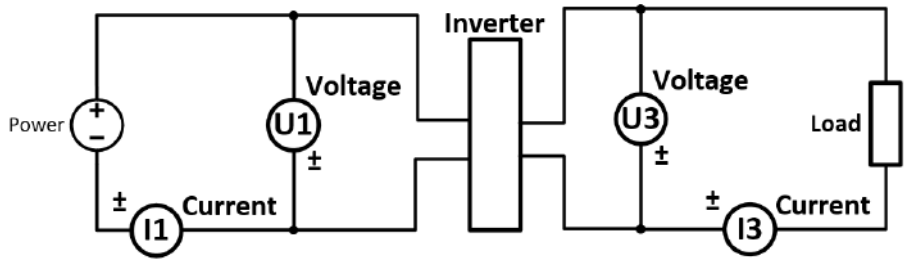
6.3.6 Wiring Connection for Single-Input Signle-Output Efficiency Measurement

When using the single-input single-output efficiency method:

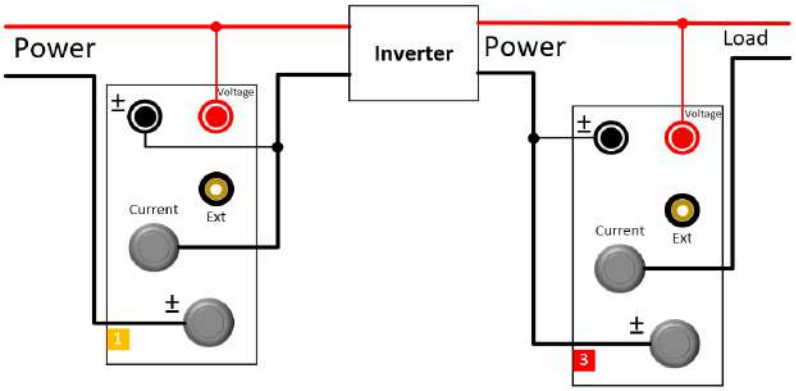
- Connect Unit 2 of the power meter to the DUT input to measure input power.
- Connect Unit 1 or Unit 3 of the power meter to the DUT output to measure output power.

When measuring efficiency using this method, for the first and third units, when using one unit, it is necessary to ensure that the other unit is not connected to any measuring equipment.

Wiring Diagram



Schematic Diagram

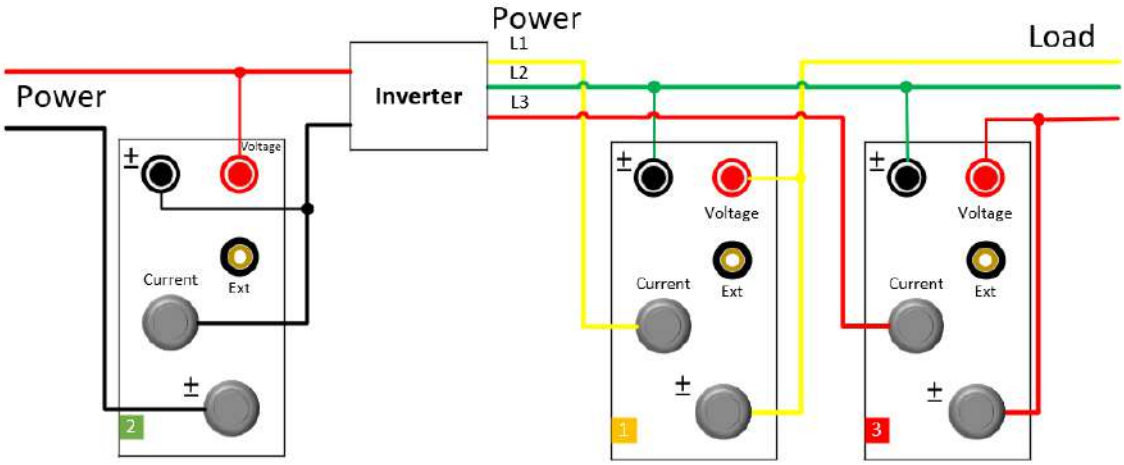


6.3.7 Wiring Connection for Single-Input Three-Output Efficiency Measurement

When using the single-input three-output efficiency method:

- Connect Unit 2 of the power meter to the DUT input to measure input power.
- Connect Unit 1 and Unit 3 of the power meter to the DUT output to measure output power.

The wiring diagram is shown below.



6.3.8 Power Supply Connection

1. Plug the power cord into the power socket on the rear panel of the instrument, ensuring that the supply voltage complies with the instrument's specifications.
2. Make sure the power socket is properly grounded to ensure electrical safety and measurement stability.
3. Verify that all wiring is correct, then turn on the instrument using the front-panel power switch. The instrument will enter the measurement state.

 Notes

- To ensure stable measurement data, allow the instrument to warm up for at least 30 minutes before starting measurements.
- After turning off the instrument, wait at least 5 seconds before turning it on again. Repeatedly switching the power on and off in a short period may shorten the instrument's service life and potentially damage internal circuits.
- After use, turn off the instrument and unplug the power cord to protect the instrument from potential lightning-induced voltage surges entering through the power grid.

 Warning

When using the direct current input terminals, do not connect any wires to the current sensor input terminals.

6.4 Wiring Connection for External Current Sensor Measurement

When the current in the measurement circuit exceeds the maximum allowable input current of the input unit (channel), an external current sensor can be connected to the current sensor input terminals to measure the current.

6.4.1 Wiring Method and Precautions

Before connecting the measurement cable from the external current sensor to the current sensor input terminals, unplug any cable connected to the current input terminals. The current sensor input interface and the current input port are internally connected. If both cables are connected simultaneously, this may cause

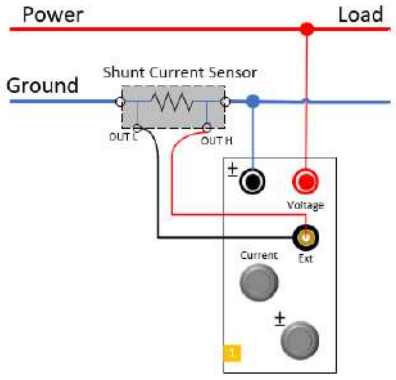
measurement errors (due to signal interference) or even instrument malfunction.

When applying voltage from the measurement circuit to the external current sensor input interface, do not touch the current input terminals. These terminals are electrically connected internally. Touching them under this condition may result in electric shock.

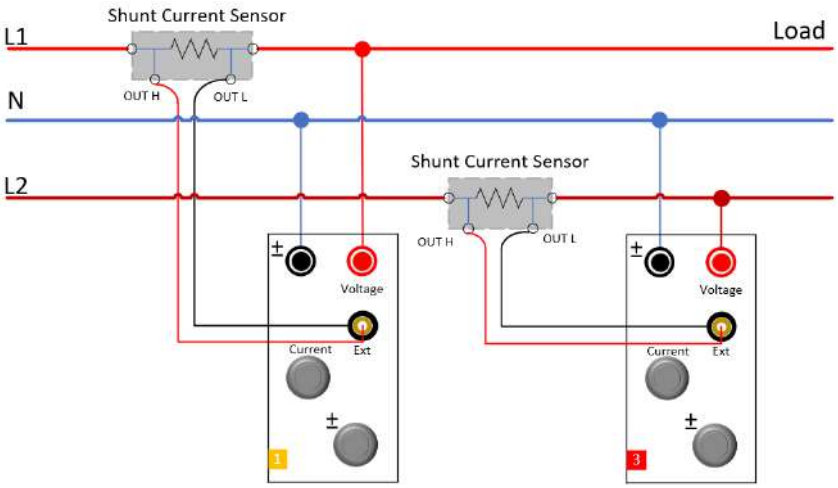
Warning

- **Do Not Use Exposed Sensors:** Using exposed sensors is extremely dangerous, as accidental contact may result in electric shock. Always ensure that the sensor is enclosed in a protective housing. The energized parts of the sensor must be insulated from the housing and have sufficient voltage rating to withstand the operating voltage of the measurement circuit.
- **Perform Wiring Only When Power Is Off:** Never wire a shunt or sensor while the measurement circuit is energized, this is highly hazardous. A shunt carries voltage when energized, so avoid touching it. Ensure the power supply of the measurement circuit is completely turned off before wiring.
- **Do Not Touch Cables During Measurement:** When using the external sensor input terminals, do not touch the current input terminals or any connected measurement cables with your hands. Once the measurement circuit is powered, voltage may be present on the current input terminals, posing a significant electric shock risk.
- **Use Safe Sensors and Connectors:** Connect external sensors to the instrument's input terminals using connectors with safe interface designs. If a connector accidentally detaches, exposed conductive parts may become energized, creating a hazard. Before using clamp-on current sensors, fully understand the voltage of the measurement circuit, as well as the specifications and operating instructions of the sensor. Verify that no hazards (such as electric shock risks) exist before proceeding with measurements.

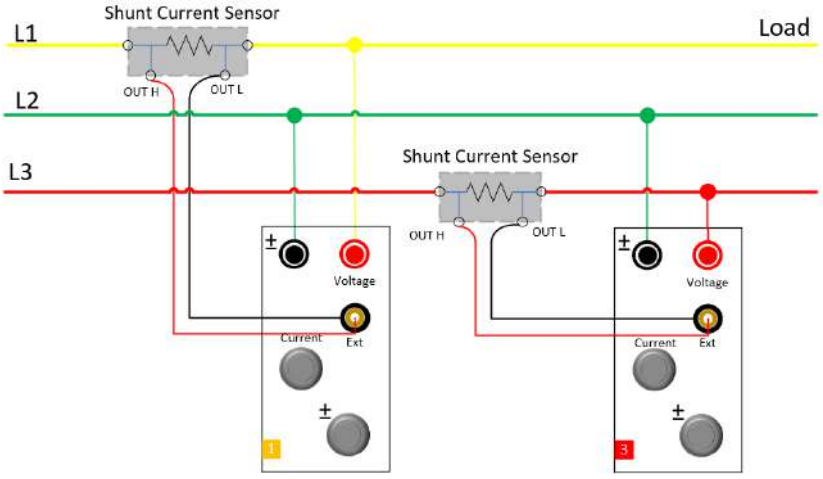
6.4.2 1P2W Wiring Connection Using Shunt-Type Sensors



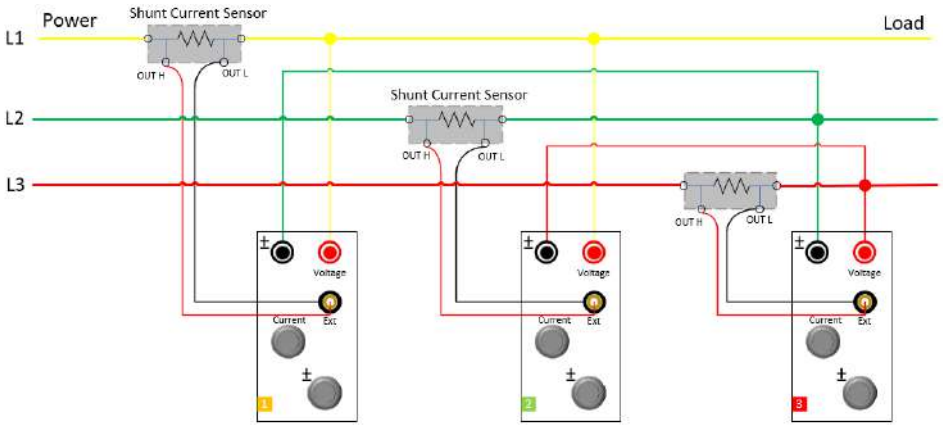
6.4.3 1P3W Wiring Connection Using Shunt-Type Sensors



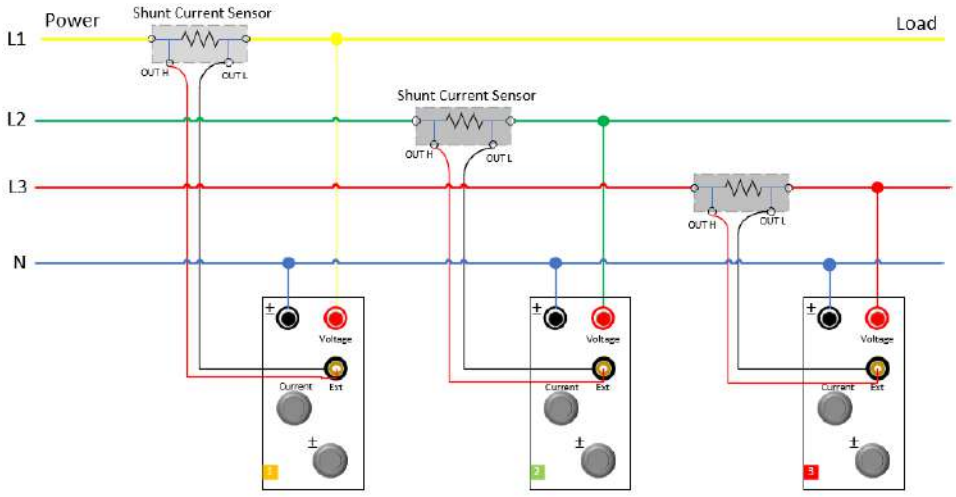
6.4.4 3P3W Wiring Connection Using Shunt-Type Sensors



6.4.5 3V3A Wiring Connection Using Shunt-Type Sensors



6.4.6 3P4W Wiring Connection Using Shunt-Type Sensors



6.5 Wiring Connection for VT/CT Measurement

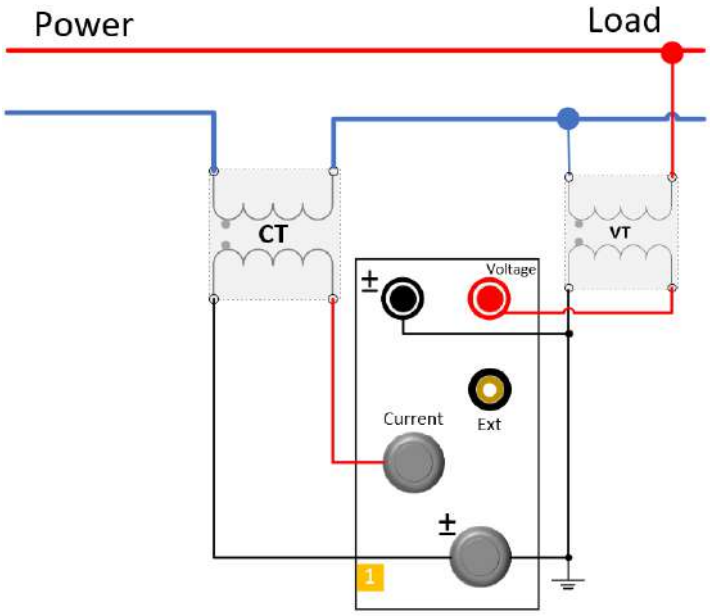
When the voltage or current of the DUT exceeds the power meter's maximum allowable input, a VT (Voltage Transformer) or CT (Current Transformer) can be used to step down the voltage or current to levels within the meter's input range.

Wiring Steps

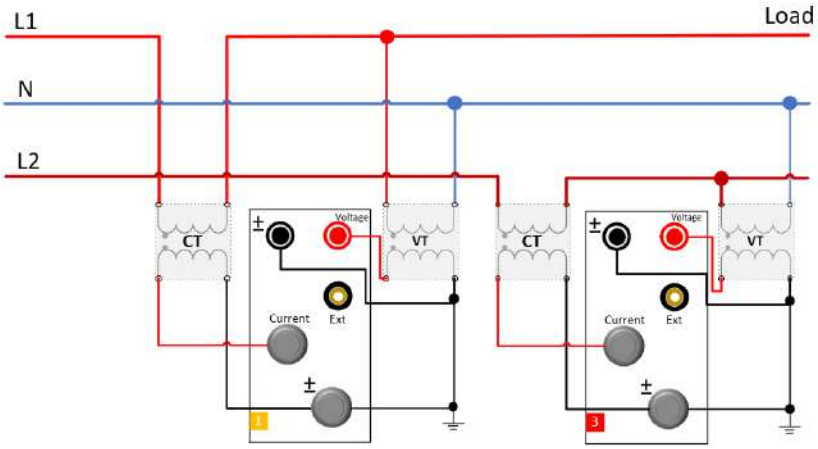
1. Connect the secondary side of the VT to the power meter's voltage input terminals.
2. Connect the secondary side of the CT to the power meter's current input terminals.
3. Enable the transformation ratio function on the power meter and set the correct VT/CT ratio. This ensures that the power meter calculates the actual voltage or current of the DUT by compensating for the transformation.

Note: Always ground the secondary side of the VT and/or CT.

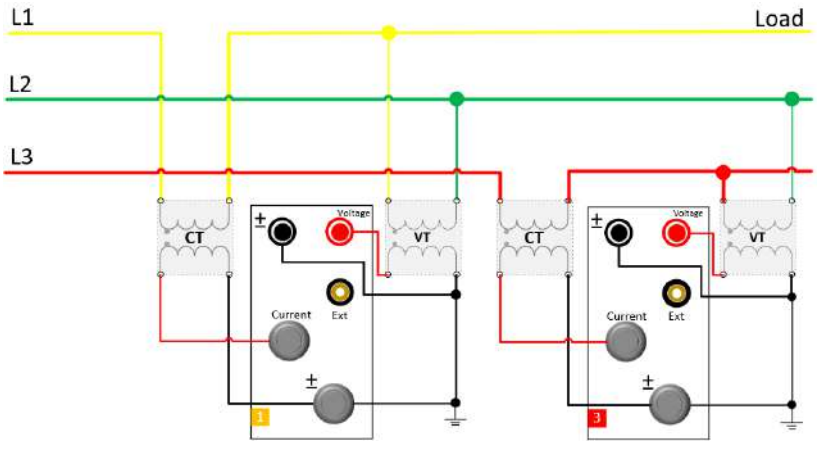
6.5.1 1P2W Wiring Connection Using VT/CT Measurement



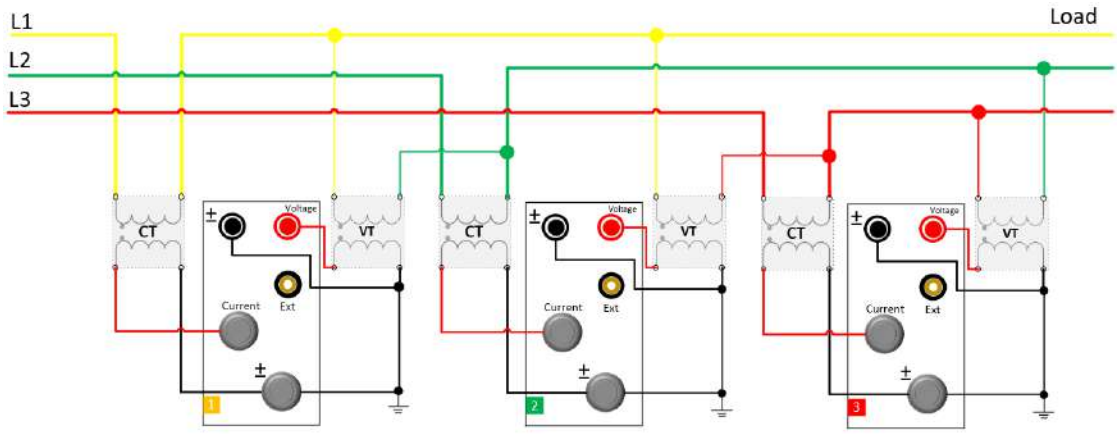
6.5.2 1P3W Wiring Connection Using VT/CT Measurement



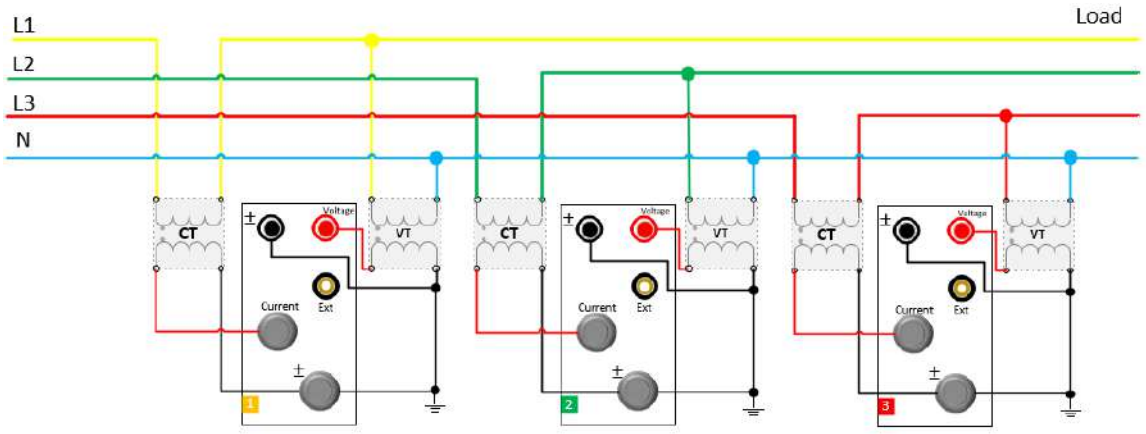
6.5.3 3P3W Wiring Connection Using VT/CT Measurement



6.5.4 3V3A Wiring Connection Using VT/CT Measurement



6.5.5 3P4W Wiring Connection Using VT/CT Measurement



7. Remote Control

The power meter supports remote control through multiple interfaces, including D/A, USB, LAN, and GPIB/RS-232. This chapter introduces the features and configuration procedures of these communication interfaces.

Note: When using the LAN interface, only local area network (LAN) control is supported.

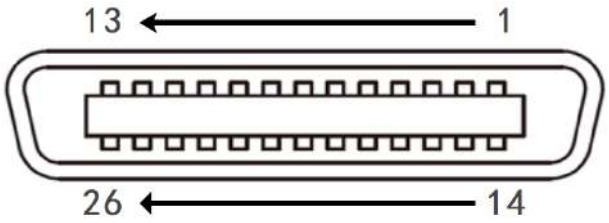
7.1 D/A Interface

The power meter series is equipped with a standard 12-channel D/A interface.

This section focuses on the electrical properties of the pins and the timing requirements for control signals.

7.1.1 D/A Interface Pin Definition

The D/A interface is located on the rear panel of the instrument and uses a 26-pin male SCSI connector. Users can connect to the instrument via a matching female SCSI cable. The pin arrangement of the D/A interface is shown in the figure below.



Pin Definition

Pin	Description	Pin	Description	Pin	Description
1	GND	10	CH 3 (Output)	19	CH 10 (Output)
2	EXTI HOLD (Input)	11	CH 1 (Output)	20	CH 8 (Output)
3	EXTI START (Input)	12	GND	21	CH 6 (Output)
4	EXTI RESET (Input)	13	GND	22	CH 4 (Output)
5	NC	14	EXTI TRIG (Input)	23	CH 2 (Output)
6	CH 11 (Output)	15	EXTI STOP (Input)	24	GND
7	CH 9 (Output)	16	INTEG BUSY(Output)	25	NC
8	CH 7 (Output)	17	NC	26	NC
9	CH 5 (Output)	18	CH 12 (Output)	/	/

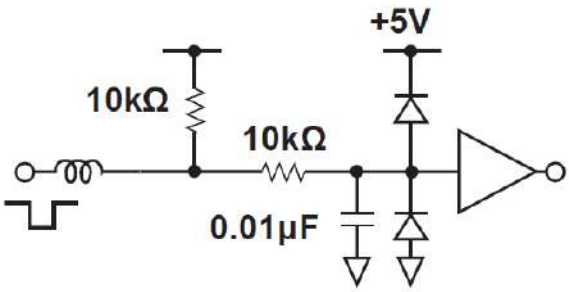
Notes

- **Avoid Short-Circuiting:** Do not short-circuit the D/A output pins or apply external voltages, as this may damage the instrument.
- **Correct Pin Connections:** Ensure correct pin connections when linking the D/A output to other devices. Misconnections can create abnormal current loops, potentially damaging both the power meter and the connected equipment.
- **Voltage Range Limit:** Do not apply voltages outside the 0–5 V range to the remote control pins, as this may damage the instrument.
- **Power Off Before Wiring:** Always turn off the instrument before connecting or disconnecting the D/A cable.

7.1.2 Remote Control Signals

In addition to outputting measurement data as ±5 V analog signals, the D/A interface of the power meter also supports remote control of the integration and data-hold functions via external signals. The figure below illustrates the DA12 remote control input and output circuit, showing the signal path and connection logic between the D/A interface and external control devices.

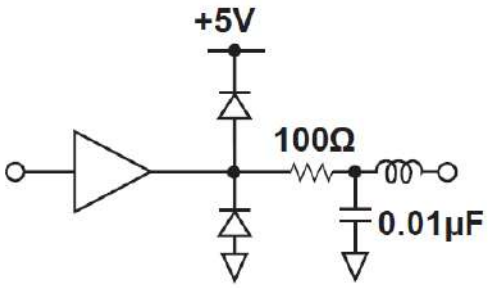
Input Circuit



Low Level: 0 V to 1 V

High Level: 4 V to 5 V

Output Circuit

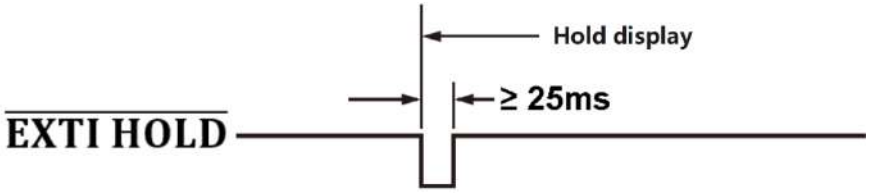


Low Level: 0 V to 1.5 V (8 mA)

High Level: 0 V to 1.5V (-8 mA)

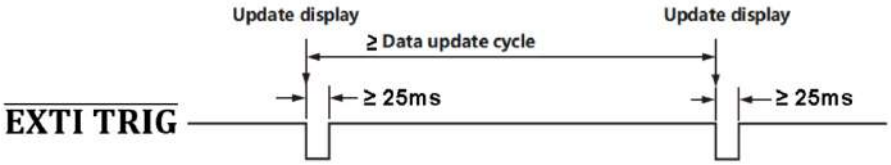
- $\overline{\text{EXTI HOLD}}$ (Hold Measurement Data Signal)

  As shown in the figure below, applying the $\overline{\text{EXTI HOLD}}$ signal remotely will hold the current measurement data.



- $\overline{\text{EXTI TRIG}}$ (Updated Held Display Data Signal)

  As shown in the figure below, applying the $\overline{\text{EXTI TRIG}}$ signal remotely updates the currently held measurement data.



- Remote Control Integration

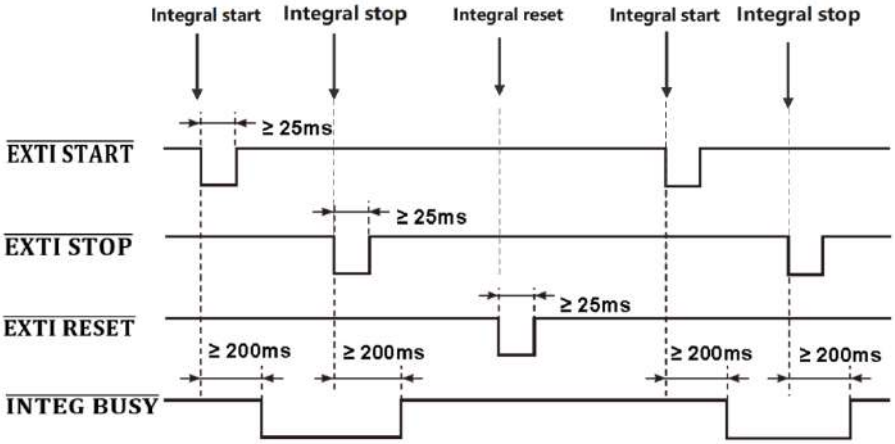
  $\overline{\text{EXTI START}}$ (Start integration)

  $\overline{\text{EXTI STOP}}$ (Stop integration)

  $\overline{\text{EXTI RESET}}$ (Reset integration)

  $\overline{\text{INTEG BUSY}}$ (Integral indicator: the instrument continuously outputs this signal while the integration process is in progress.)

The timing diagram for remote integration control is shown below.



Note:

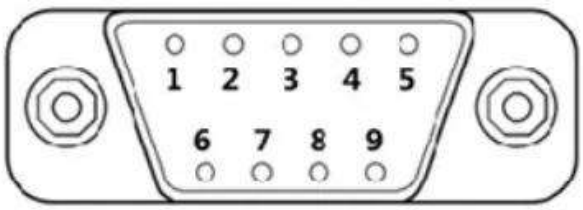
When integration starts, the **INTEG BUSY** signal is at a low level. In all other cases, the signal is at a high level. Users can monitor this signal directly to determine the status of the integration process.

7.2 RS-232 Interface

The RS-232 interface is a widely used serial communication standard, originally developed by the Electronic Industries Alliance (EIA) in 1962 to define the electrical and mechanical characteristics for serial binary data exchange between data communication devices.

The RS-232 standard supports connectors with either 25 or 9 pins. The power meter uses a 9-pin RS-232 connector. Users can remotely send SCPI or Modbus commands from a PC through this interface. Upon receiving the commands, the power meter executes the corresponding front-panel functions and can return measurement data, calculated values, parameter settings, control panel status bytes, error codes, and more.

The RS-232 communication interface is a DB9 male header, with pin definitions shown in the figure below.



9-pin Definition

1	NC (Not connection)
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:

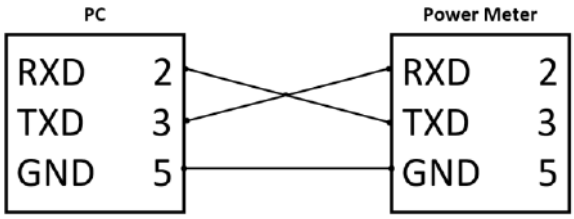
Before performing any communication operations, ensure that the power meter's parameters match those of the control host.

(1) Baud Rate: 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200 bps
(2) Data Bits: 7 or 8 bits
(3) Parity Bit: Odd, even, or none
(4) Stop Bits: 1 or 2 bits

7.2.1 RS-232 Interface Settings

Communication Protocol: Configure the communication protocol to either SCPI or Modbus according to the application requirements. When using Modbus, assign a unique device address to the power meter to distinguish it from other devices on the same communication bus and prevent command conflicts.
Baud Rate: Adjust the power meter's baud rate to match that of the control host.

7.2.2 PC Connecting to Power Meter Via RS-232



Notes

- **Ensure Stable Communication:** When using the RS-232 interface, do not use other communication interfaces simultaneously.
- **Pin Number Description:** In the block diagram, pins 2, 3, and 5 of the DB9 connector are used; all other pins are not required.
- **Standard Cable:** Use a cross-over serial cable when connecting the PC to the power meter.
- **Wiring Method:** This wiring method applies only to PCs with an RS-232 interface. If the PC lacks an RS-232 port, use a USB-to-RS-232 adapter cable to connect the PC to the power meter.

7.3 GPIB Interface

GPIB (General Purpose Interface Bus), also known as IEEE 488, is a standardized interface designed for connecting computers with programmable test and measurement instruments.
The GPIB bus supports the simultaneous connection of up to 15 devices on the same bus and enables

communication with a computer, making it particularly suitable for automated testing and data acquisition workflows.

For this power meter series, the GPIB interface is optional, only the UTE323G and UTE333G models are equipped with the GPIB interface.

When equipped with the GPIB option, the power meter can receive commands from the GPIB bus. After processing the commands, the instrument executes the corresponding front-panel functions and returns data to the connected computer, such as measurement data, calculated data, control panel settings, status bytes, and error codes.

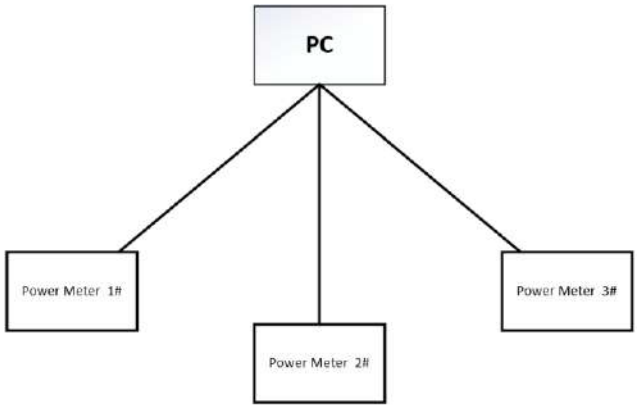
Compatible Models	PCI-GPIB or PCI-GPIB+, PCIe-GPIB or PCIe-GPIB+ PCMCIA-GPIB or PCMCIA-GPIB+ (not supported on Windows Vista or Windows 7) GPIB-USB-HS (requires NI-488.2M Ver. 2.8.1 or a later version)
Electrical and Mechanical Specifications	IEEE 488-1978 (JIS C 1901-1987)

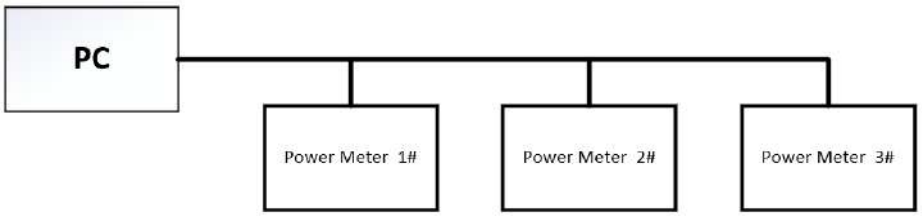
Notes

- **Ensure Stable Communication:** IEEE 488 specifies strict requirements for GPIB cable characteristics. Use only standard-compliant cables to maintain signal integrity and reliable communication.
- **Specified GPIB Address:** Each GPIB device must have a unique address to avoid conflicts on the bus. Before using the power meter's GPIB interface, configure its GPIB address to ensure proper identification and communication.

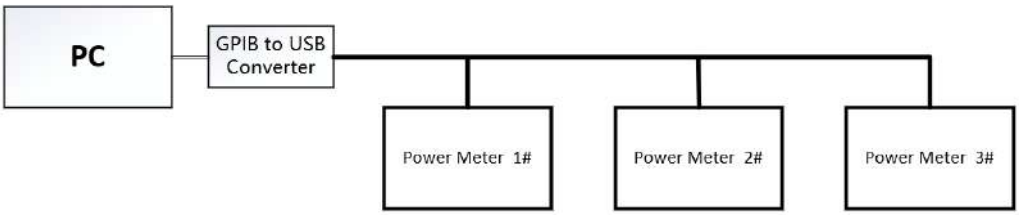
7.3.1 PC Connecting to Power Meter Via GPIB

When using the GPIB interface, use a standard GPIB communication cable. The cable length should be kept as short as possible to ensure reliable communication. The wiring connection is shown below.





Under normal conditions, PCs are not equipped with a built-in GPIB interface. To establish GPIB communication between a PC and the power meter, use a GPIB-to-USB adapter, as shown below.



Notes

- Ensure Stable Communication: When using the GPIB interface, do not use other communication interfaces simultaneously.
- Pin Number Description: The numbers in the above block diagram represent either the pin numbers of the PC's USB port or the standard 24-pin GPIB connector. Only the labeled pins are used for the connection; unlabeled pins remain unused.
- Standard GPIB Cables: Always use standard, IEEE 488-compliant GPIB cables. Non-standard or poor-quality cables may have inadequate shielding or incorrect wiring, which can cause interference, reduce communication stability, or prevent data exchange.

7.4 Ethernet Interface

The Ethernet interface is a standard physical connection used to link network devices to a Local Area Network (LAN). It typically adopts an RJ-45 connector, an 8-pin modular plug designed for twisted-pair cabling. Most devices with an Ethernet port include status indicators (LEDs) to display link connectivity and network activity.

Ethernet is one of the most widely used LAN technologies. It defines both the physical and electrical transmission characteristics of a LAN and the Media Access Control (MAC) method, which regulates how devices share network access.

The power meter is equipped with an Ethernet interface. It can receive commands from the Ethernet interface. After processing the commands, the instrument executes the corresponding front-panel functions and returns data to the connected computer, such as measurement data, calculated data, control panel settings, status bytes, and error codes.

Number of Ports	1
Connector Type	RJ-45 connector
Electrical and Mechanical Specifications	IEEE802.3
Transmission System	Ethernet (100BASE-TX, 10BASE-T)
Communication Protocol	TCP/IP
Baud Rate	Max. 100 Mbps
Supported Services	DHCP, remote control

7.4.1 Network Settings

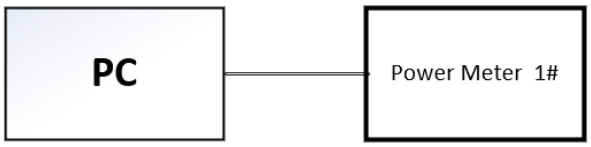
Communication Protocol: Configure the communication protocol to either SCPI or Modbus according to the application requirements.

IP Mode: Auto or manual

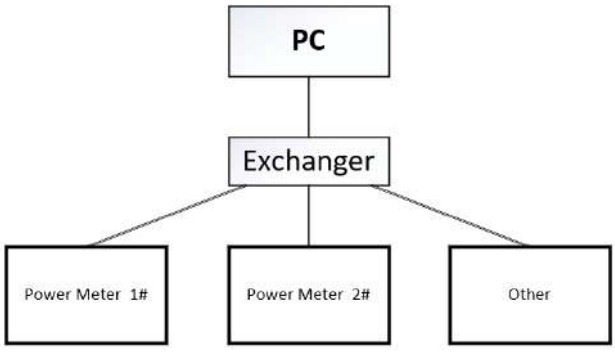
Note: When the power meter's IP mode is set to Manual, users must correctly configure the IP address, subnet mask, and gateway to ensure proper Ethernet communication.

7.4.2 PC Connecting to Power Meter Via Ethernet Interface

The power meter can be directly connected to a PC using an Ethernet cable. For this direct connection, a crossover Ethernet cable is required: one end wired according to the T568A standard and the other end according to the T568B standard.



A more common method is to connect via a network switch, which allows communication with multiple devices. Each power meter must have a specified IP address to ensure proper network communication, as shown in the figure below.



Note

Ensure Stable Communication: When using the Ethernet interface, do not use other communication interfaces simultaneously.

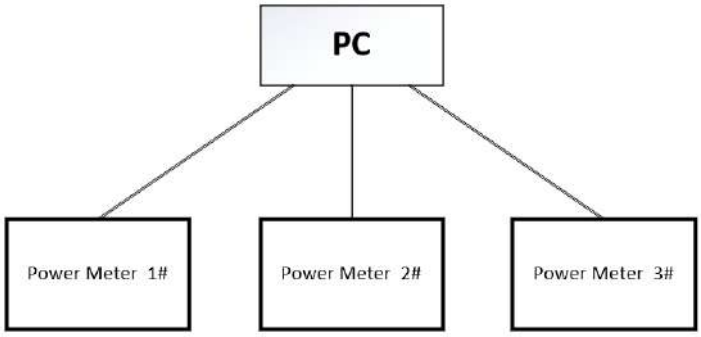
7.5 USB Interface

When communicating through the USB interface, there is no need to configure USB parameters on the instrument. The electrical specifications of the power meter's USB interface are shown in the table below.

Number of Ports	1
Connector Type	Type B USB connector (socket)
Electrical and Mechanical Specifications	USB 2.0
Transmission Rate	FS (full speed;12 Mbps)
Communication Protocol	User-defined
PC System	A PC with a USB port, running the English or Simplified Chinese version of Windows 7 (32-bit/64-bit), Windows Vista (32-bit/64-bit), or Windows XP (32-bit, SP2 or later)

7.5.1 PC Connecting to Power Meter Via USB

Multiple power meters can be connected simultaneously via the USB interface. Before connecting, ensure that the corresponding device driver is installed. The required driver for the power meter will be automatically installed when the power meter's upper computer software is installed.

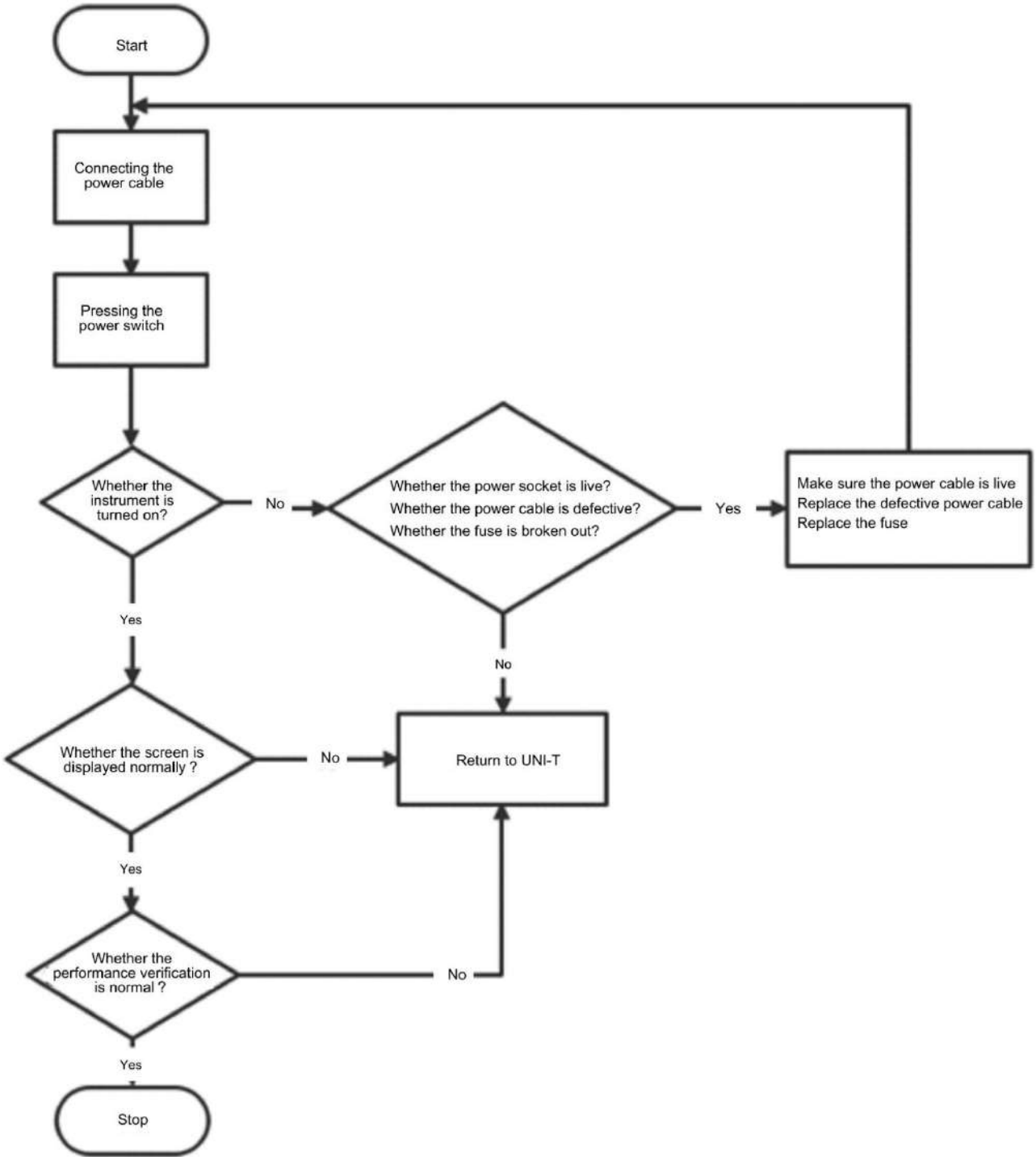


Notes

- **Ensure Stable Communication:** When using the USB interface, do not use other communication interfaces simultaneously.
- **Secure Connection:** The USB data cable must be firmly and reliably connected to both the instrument and the PC.
- **Multiple Devices:** If multiple devices are connected to the PC via USB, connect this power meter to the USB port closest to the PC.

8. Troubleshooting

If the power meter does not start up normally after pressing the power switch, follow the steps below to fix the issue.



P/N:1104011138 67X