

User's Manual



SPA3000/2000/1000
Digital Power Meter

Version 2.00.00



Please read this manual before starting to use the equipment
Please keep this manual with the equipment

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The operating principle of this manual is applicable to any model in the following list. The hardware usage method of different models may vary. Please pay attention to the difference between different models.



SPA3000

Digital Power Meter

- Power accuracy: $\pm (0.1\% \text{ of reading} + 0.05\% \text{ of range})$
- Bandwidth: DC, 0.1Hz~100KHz
- Sampling rate: 100kS/s
- Simultaneous measurement of all parameters



SPA2000/1000

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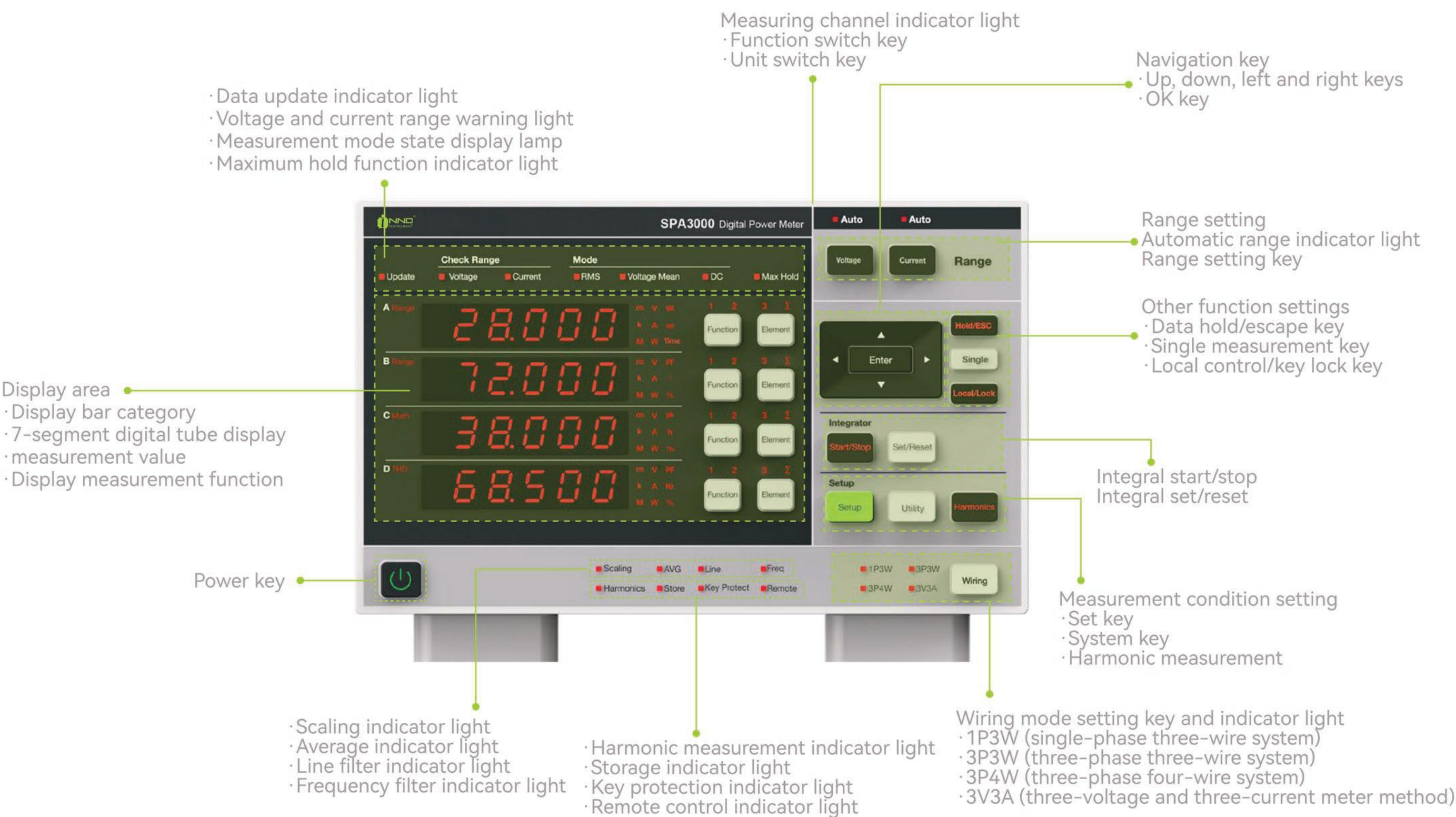
Chapter I

Name and Use of Components

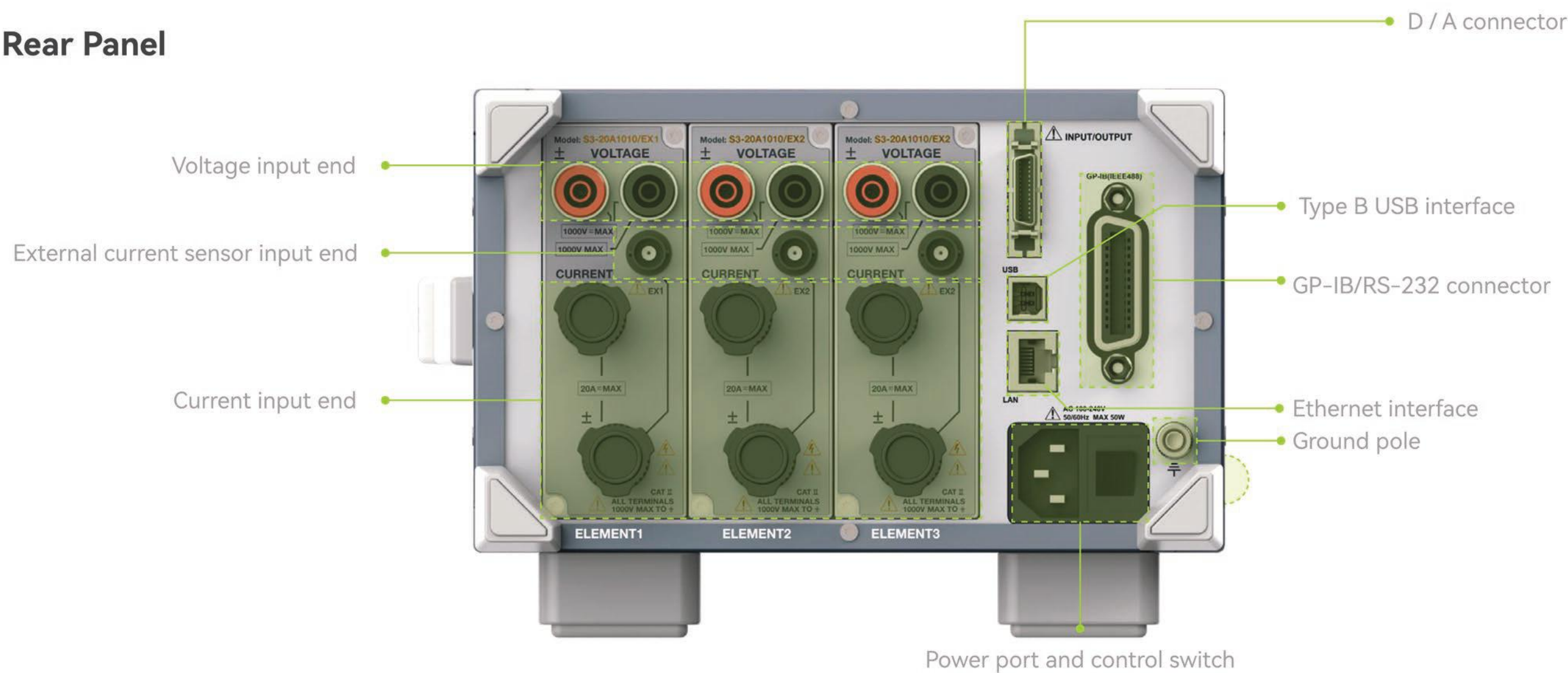
1.1 Schematic diagram of panel

SPA3000

Front Panel

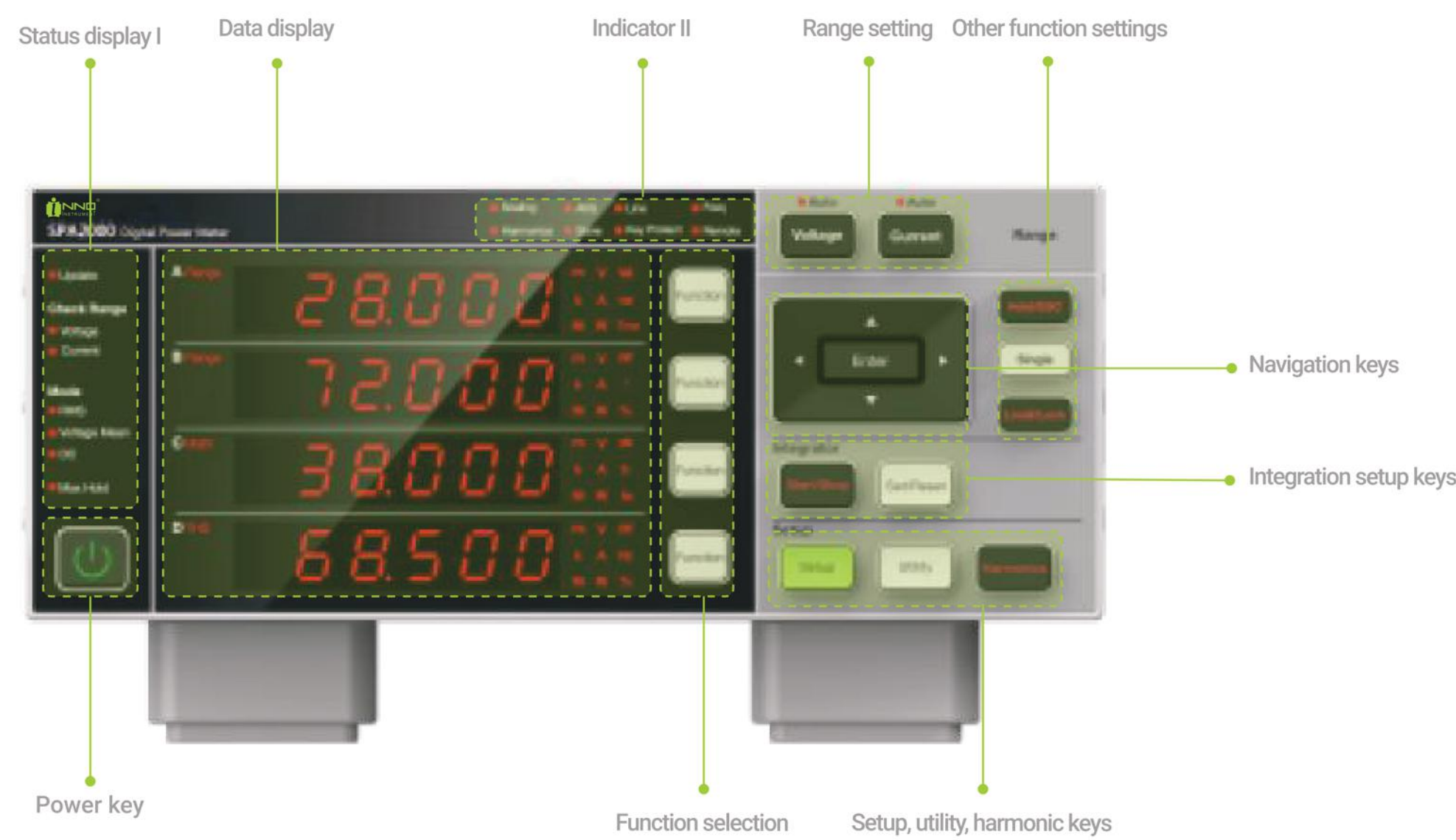


Rear Panel

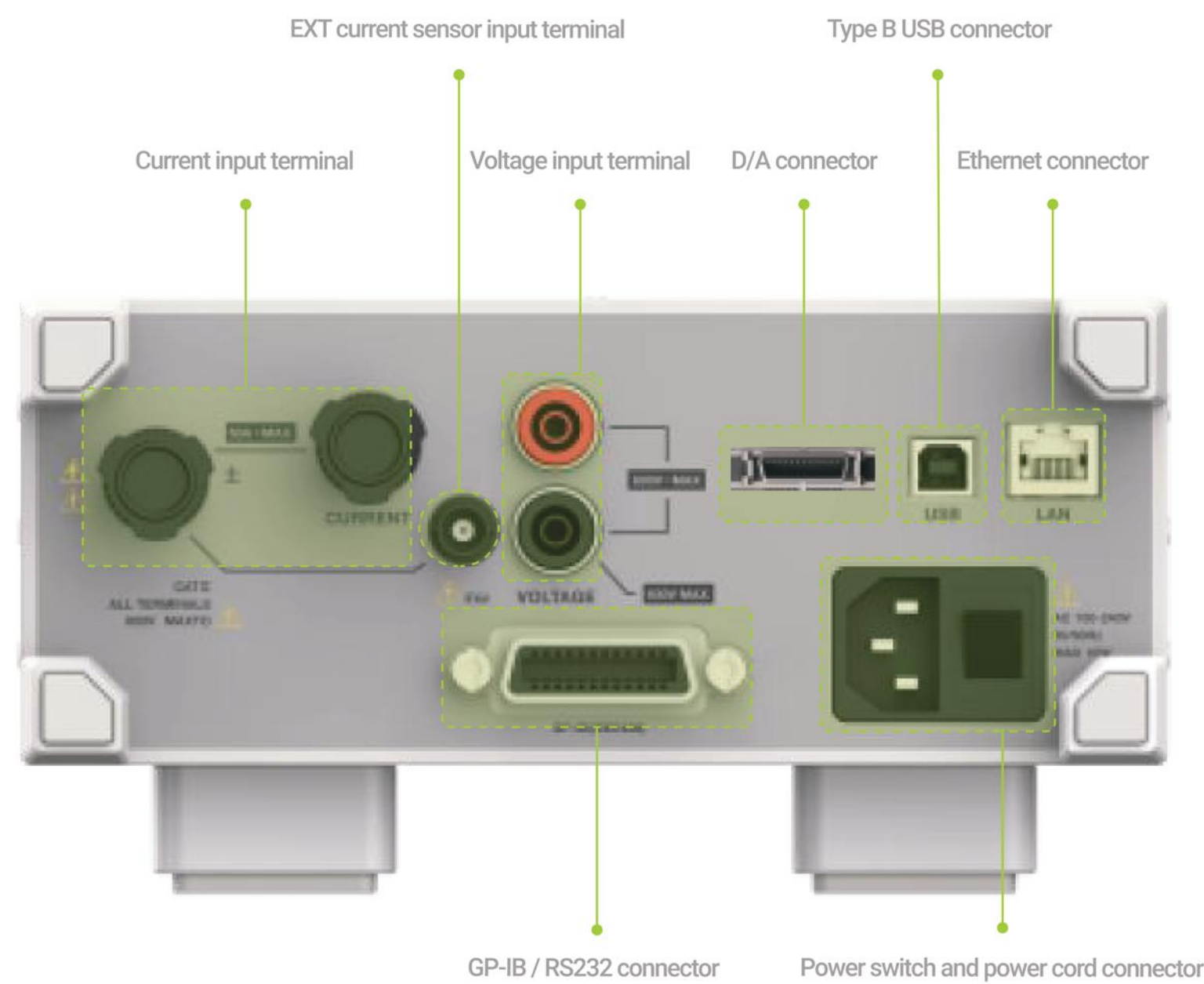


SPA2000/1000

Front Panel



Rear Panel



1.2 Brief introduction of key function

Power key - control the start/close of the instrument

It forms the instrument start combination key together with the rocker switch on the rear panel, and the power state indicator light has three effects:
The first state is that both the rocker switch and the power key are disconnected, and the power key light is not on, which is equivalent to the uncharged state.
The second state is that the ship switch is closed, the power key is disconnected, and the instrument is charged, thus it can run in the standby state.
The third state is that both switches are closed and the instrument is in normal operation state.

Function key - switch display function

Every time Function is pressed, the indicator light on the right side of each display area switches and displays in a certain sequence, indicating that the current display area displays different measurement functions. In the conventional measurement mode and harmonic measurement mode, the switching sequence is different. (See Section 1.4 of this volume for details)

Element key - switch input unit

It is used to select the input unit to be displayed, and the indicator light of the selected unit is on. Every time Element is pressed, the instrument will be switched cyclically in the sequence of 1→2→3→Σ→1.

Voltage key - select voltage range

When pressing this key, Display Bar A displays "VOLT", Display Bar B displays "Range", Display Bar C displays voltage range options, default to Auto, and the voltage range is selected through navigation (up and down) key; when the range is set to "Auto", the voltage "Auto" indicator light is on.

Current key - select current range

When pressing this key, Display Bar A displays "CURR", Display Bar B displays "Range", Display Bar C displays current range options, default to Auto, and the current range is selected through navigation (up and down) key; when the range is set to "Auto", the current "Auto" indicator light is on.

Wiring key - select the wiring mode

According to the wiring of the measuring circuit actually connected, the corresponding wiring mode is selected; when the set wiring modes are 1P3W (single-phase three-wire system), 3P3W (three-phase three-wire system), 3P4W (three-phase four-wire system) and 3V3A (three-voltage three-current meter method), the corresponding indicator light is on; when the wiring mode indicator lights are not on, the wiring mode is 1P2W (single-phase two-wire system).

Hold / ESC key - data hold/escape function

When pressing the Hold/ESC key in the measurement value display interface, its indicator light will be on, the data will stop updating and will remain displayed.
When pressing Hold/ESC again, its indicator light goes out, with the updated value displayed again.
In the setting interface, the function of Hold/ESC key is equivalent to ESC key. Pressing it can exit the setting interface.

Single key - perform a single measurement

When the measurement data is in the held state, pressing this key can perform the measurement once according to the specified update period. After the measurement data is updated, it will remain displayed again. Every time you press the Single key, the update rate indicator light is on once.

Navigation key

Key name	Function specifications	Remarks
Up and down keys	(1) Switch setting options (2) When setting a value, pressing the up key can increase the value, while pressing the down key can decrease the value	
Right key	(1) Move the setting bit of a value to the right (or return to the leftmost from the rightmost) (2) Switch setting items to the right in the menu, such as DA/SET menu	

Left key	(1) Move the setting bit of a value to the left (or return to the leftmost from the rightmost) (2) Switch setting items to the left in the menu, such as DA/SET menu	No decimal point
	(3) Move decimal point position (The decimal point moves from left to right, or from the rightmost to the leftmost.)	With decimal point
OK key	Determine options or perform actions	

Local / Lock combination key - lock/forcibly disconnect remote connection

Function 1: When there is no remote connection, pressing the Local/Lock key for a long time can lock or unlock the key. (Same as Section 9.4)
Function 2: When there is remote connection, the remote connection is forcibly disconnected.
Pressing the Local/Lock combination key for a long time can only disconnect the remote control function, not lock or unlock the function.

Start / Stop key - integral measurement execution key

Pressing this key can control the start and stop of key.

Set / Reset key - integral setting key

When the integral does not run or is running, it can call up the setting menu of integral mode, integral timer and rated integral time. When the integral stops, it can reset the integral value and time.

Setup key - setting key

Pressing this key can call up the following setting menus: measurement mode, scaling function, sensor input scaling, synchronization source, line filter, frequency filter, data update rate, average function, operation function, maximum hold function, saving configuration file and loading configuration file, etc.

Utility key - system setting key

Pressing this key can call up the following setting menus: display system information (model information, suffix code, instrument serial number and firmware version), initialization setting, display digit setting, peak factor setting, storage setting, D/A output setting, zero level compensation setting, zero setting, communication setting and self-test.

Harmonics key - harmonic setting key

Pressing this key can enter harmonic settings, which can set whether harmonic display is turned on, harmonic number, PLL source and THD formula. When the harmonic display is turned on, the Harmonics key and the lower harmonic display indicator light are on at the same time; when the harmonic display is turned off, the key and indicator light go out at the same time.

1.3 Character display


This instrument uses 7 segments of LED display, and numbers, letters and arithmetic symbols are displayed in character strings composed of the following special symbols. The list of contents corresponding to the 7-segment digital tube display is as follows:

0 → 0	A → A	K → K	U → U	^ (Index) → ^
1 → 1	B → b	L → L	V → V	
2 → 2	C → C	M → M	W → W	
3 → 3	D → d	N → n	X → X	
4 → 4	E → E	O → o	Y → Y	
5 → 5	F → F	P → P	Z → Z	
6 → 6	G → G	Q → q	+ → +	
7 → 7	H → H	R → r	- → -	
8 → 8	I → i	S → S	x → x	
9 → 9	J → J	T → t	÷ → ÷	


1.4 Measurement function display

Measurement function displayed by each indicator light during routine measurement display

Column A indicator light	Display measurement function	Remarks
V	Display the measured value U of the voltage	When pressing the "Function" key, the sequence of measurement functions displayed in Column A is V→A→W→VA→Var→TIME→V, which is displayed cyclically in turn.
A	Display the measured value I of the current	
W	Display the measured value P of active power	
VA	Display the measured value S of the apparent power	
var	Display the measured value Q of reactive power	
TIME	Displays the cumulative value TIME of the integral time in the format "---.---.---"	

 **Note:**
· "m, k and M" in the first column displayed by the indicator light respectively indicate the quantity level of unit, "m" for milli, "k" for thousand, and "M" megabyte.

Column B indicator light	Display measurement function and description	Remarks
A	Display the measured value I of the current	When pressing the "Function" key, the sequence of measurement functions displayed in Column B is A→W→PF→°→V→A, which is displayed cyclically in turn.
W	Display the measured value P of active power	
PF	Display the measured value λ of power factor	
°	Display the measured value Φ of phase angle	
V	Display the measured value U of the voltage	

 **Note:**
· "m, k and M" in the first column displayed by the indicator light respectively indicate the quantity level of unit, "m" for milli, "k" for thousand, and "M" megabyte.

Column C indicator light	Display measurement function and description	Remarks
V	Display the measured value of the voltage	When pressing the "Function" key, the sequence of measurement functions displayed in Column C is W→Vpk(+)→Vpk(-)→Apk(+)→Apk(-)→Wpk(+)→Wpk(-)→WH→WH±(+)→WH±(-)→AH→AH±(+)→AH±(-)→MAT H→V→A→W, which is displayed cyclically in turn.
A	Display the measured value of the current	
W	Display the measured value of the current	
Vpk	Display the maximum value of the voltage	
Vpk	Display the minimum value of the voltage	
Apk	Display the maximum value of current	
Apk	Display the minimum value of current	
Wpk	Display the maximum value of power	
Wpk	Display the minimum value of power	
WH	Display the sum of positive and negative watt-hour integrals	
WH±	Display positive watt-hour integral value	
WH±	Display negative watt-hour integral value	

AH	Display the sum of positive and negative ampere-hour integrals	
AH±	Display positive ampere-hour integral value	
AH±	Display negative ampere-hour integral value	
MATH	Display the measurement items corresponding to the operation function	

⚠ **Note:**

- "m, k and M" in the first column displayed by the indicator light respectively indicate the quantity level of unit, "m" for milli, "k" for thousand, and "M" megabyte.
- V pk, A pk, W pk, WH ±, and AH ± are displayed twice, with positive measurements displayed in the first time and negative measurements displayed in the second time.
- MATH is displayed on the left side of the 7-segment LED display.

Column D indicator light	Display measurement function and description	Remarks
V	Display the measured value of the voltage	When pressing the "Function" key, the sequence of measurement functions displayed in Column D is PF→V HZ→A HZ→V→A→W→PF, which is displayed cyclically in turn
A	Display the measured value of the current	
W	Display the measured value of active power	
PF	Display the measured value of power factor	
VHZ	Display the frequency of the voltage signal	
AHZ	Display the frequency of the current signal	

⚠ **Note:**

- "m, k and M" in the first column displayed by the indicator light respectively indicate the quantity level of unit, "m" for milli, "k" for thousand, and "M" megabyte.
- THD is displayed on the left side of the 7-segment LED display.

Measurement function displayed by each indicator light during harmonic measurement display

Column A indicator light	Display measurement function and description	Remarks
V	Display the total voltage effective value U of harmonics 1~50	When pressing the "Function" key, the sequence of measurement functions displayed in Column A is V→A→W→harmonic number→V, which is displayed cyclically in turn.
A	Display the total current effective value I of harmonics 1~50	
W	Display the total active power effective value P for harmonics 1~50	
No indicator light on	Display harmonic number	

⚠ **Note:**

- "m, k and M" in the first column displayed by the indicator light respectively indicate the quantity level of unit, "m" for milli, "k" for thousand, and "M" megabyte.

Column B indicator light	Display measurement function and description	Remarks
V	Display the voltage measurement U (K) for the harmonic number shown in Column A	When pressing the "Function" key, the sequence of measurement functions displayed in Column is B V→A→W→V and %→A and %→W and %→V and °→A and °→V, which is displayed cyclically in turn.
A	Display the current measurement I (K) for the harmonic number shown in Column A	
W	Display the active power measurement P (K) for the harmonic number shown in Column A	
V%	Display the voltage distortion factor UHDF (K) for the harmonic number shown in Column A	
A%	Display the current distortion factor IHDF (K) for the harmonic number shown in Column A	
W%	Display the active power distortion factor PHDF (K) for the harmonic number shown in Column A	

V°	<ul style="list-style-type: none"> When the harmonic number displayed in Column A is 1 (fundamental): the phase angle Φ (K) of the fundamental current relative to the fundamental voltage is displayed When the harmonic number displayed in Column A is 2~50: the phase angle ΦU (k) of the harmonic voltage of the current number relative to the fundamental voltage is displayed. 	When pressing the "Function" key, the sequence of measurement functions displayed in Column is B $V \rightarrow A \rightarrow W \rightarrow V$ and $\% \rightarrow A$ and $\% \rightarrow W$ and $\% \rightarrow V$ and $^{\circ} \rightarrow A$ and $^{\circ} \rightarrow V$, w
A°	<ul style="list-style-type: none"> When the harmonic number displayed in Column A is 1 (fundamental): the phase angle Φ (K) of the fundamental current relative to the fundamental voltage is displayed When the harmonic number displayed in Column A is 2~50: the phase angle ΦU (k) of the harmonic current of the current number relative to the fundamental current is displayed. 	

⚠ Note:

- "m, k and M" in the first column displayed by the indicator light respectively indicate the quantity level of unit, "m" for milli, "k" for thousand, and "M" megabyte.

Column C indicator light	Display measurement function and description	Remarks
V	Display the total voltage effective value U of harmonics 1~50	When pressing the "Function" key, the sequence of measurement functions displayed in Column C is $V \rightarrow A \rightarrow W \rightarrow V$, which is displayed cyclically in turn.
A	Display the total current effective value I of harmonics 1~50	
W	Display the total active power effective value P for harmonics 1~50	

⚠ Note:

- "m, k and M" in the first column displayed by the indicator light respectively indicate the quantity level of unit, "m" for milli, "k" for thousand, and "M" megabyte.

Column D indicator light	Display measurement function and description	Remarks
V	Display the total voltage effective value U of harmonics 1~50	When pressing the "Function" key, the sequence of measurement functions displayed in Column D is $V \rightarrow A \rightarrow W \rightarrow PF \rightarrow V$ and $HZ \rightarrow A$ and $HZ \rightarrow THD, V$ and $\% \rightarrow THD, A$ and $\% \rightarrow V$, which is displayed cyclically in turn.
A	Display the total current effective value I of harmonics 1~50	
W	Display the total active power effective value P for harmonics 1~50	
PF	Display the power factor of the fundamental harmonic (1st harmonic)	
VHz	Display voltage frequency FU	
AHz	Display current frequency FI	
THD V%	Display voltage distortion factor Uthd (Display is related to THD formula set by instrument)	
THD A%	Display current distortion factor Ithd (Display is related to THD formula set by instrument)	

⚠ Note:

- "m, k and M" in the first column displayed by the indicator light respectively indicate the quantity level of unit, "m" for milli, "k" for thousand, and "M" megabyte.
- THD is displayed on the left side of the 7-segment LED display.

1.5 Abnormal display of instrument

Data overflow display

If the operation value cannot be displayed in the specified decimal point and unit, "--inf--" will be displayed.

State description of voltage and current range warning light

Color	Description
Orange	Urms or Irms value exceeds 140% of the currently set range
Yellow	Urms or Irms value is between 130% and 140% of the currently set range

Green	Urms or Irms value is between 110% and 130% of the currently set range
Blue	Urms or Irms value is less than 30% of the currently set range
Not on	If Urms or Irms value is between 30% and 110% of the currently set range, it is normal measurement, and the warning light will not be on The currently set range is already in the lowest gear, even if Urms or Irms value is lower than 30% of the range, the warning light will not be on

Display of measured value being too small

When the measured voltage value or current value $\leq 0.5\%$ of the rated range (CF6, $\leq 1\%$): (see Section 9.7 of this manual for details)

- Voltage, current or other measured values related thereto will be displayed as "0.000" or "0.0000";
- The phase angle and power factor will be displayed as "error".

Overrange display

When the voltage or current measurements exceed 140% of the range:

- U, I and P will be displayed as "--OL--", indicating range overflow;
- S, Q, Φ , λ , CFU and CFI are displayed as “”--OF--“” under current or voltage overrange.

 **Note:**

There is no overrange display for harmonic measurement.

Display of non-existent measurement items

If the measurement item does not exist, and the wiring group is not formed, the relevant measurement item of the wiring group will be displayed as "----".

Chapter II

Before Starting Measurement

2.1 Instructions for Use

Safety Instructions

- To ensure that you use this instrument safely and correctly, you shall read the following safety warnings carefully.
- If the instrument is not operated in the correct way, it may cause damage to the instrument.
- The Company shall not be liable for any damage caused by operating instruments without observing the following safety warnings.

Correct operation

- In order to prevent electric shock or fire, you shall use the power line provided by the Company. The power plug must be connected to the power socket with protective grounding.
- It is necessary to ensure that the connected supply voltage is consistent with the rated voltage of the instrument, and the supply voltage cannot exceed the maximum rated voltage of the power line.

Check grounding protection

- Before connecting, it is necessary to check whether the protective grounding terminals and fuses inside and outside the instrument are in good condition. If any abnormality is found, you shall not use the instrument, otherwise it will be dangerous.
- Before starting up, it is necessary to check whether all protective grounding is connected in good condition, and confirm it again and again before starting up normally for use.
- It is not allowed to directly touch the connecting circuit with hands. If necessary, you shall cut off the power supply and wear safety gloves for operation.
- It is not allowed to disassemble the machine shell except the maintenance personnel of the Company, so as to prevent the danger of internal high-voltage electric shock.

Security environment confirmation

- In order to ensure the personal safety of operators, it is not allowed to use this instrument in the environment containing flammable and explosive gases or liquids, otherwise there will be danger.
- In order to ensure accurate measurement, it is necessary to ensure that this instrument is used in a suitable working environment (temperature: 5°C~40°C; Humidity: 20% RH ~ 80% RH).

2.2 Connect the power supply

Check before connecting

Please carefully check the following contents before safely connecting the power supply :

- 1) Check that the outside of the equipment is in good condition and there are no assembly defects, such as loose and falling screws, etc.;
- 2) Check whether the randomly matched power line is intact or not;
- 3) Check whether the type, model and quantity of random accessories are complete;

Please contact the Sales Department of the Company directly if the above inspection is inconsistent with the description of the purchase contract.

Connect the power line

- 1) Confirm that the power switch of this instrument is in a closed state.
- 2) After confirming that the supply voltage is within the rated voltage range of this instrument, the randomly distributed power line is connected to the power input port of the instrument.
- 3) Instrument power interface parameters are as follows

Item	Specification
Nominal supply voltage	AC100 ~ 240V
Allowable voltage fluctuation range	AC90 ~ 264V

Rated power supply frequency	50/60Hz
Allowable frequency fluctuation range	48Hz~ 63Hz
Maximum power consumption	50VA

2.3 Turn the power on/off

Operation when turning on the power

- As shown in the schematic diagram of the front panel in Section 1.1, the front power switch key and the rocker switch on the back of the instrument together form a power double switch design.
- When the rocker switch on the back is not closed, and the indicator light of the power key is not on, the instrument is not charged.
- After the rocker switch on the back is closed, the instrument is powered on, the indicator light of the power key is red, and the instrument is in standby state. At this time of pressing the power switch key, the instrument starts, the indicator light of the power key is green, and the instrument enters the running state.
- When the instrument is running, the power switch key is pressed for up to 2 seconds, the instrument stops running and enters the standby state, the digital tube is turned off, and the indicator light of the power key turns red at the same time.

Precautions when making accurate measurements

- The power switch is turned on to enable the instrument preheat for more than 30 minutes.
- Please set it to zero after preheating.

Operation when turning off power

- Please turn off the power switch first and then the rocker switch when the instrument needs to be turned off after use. When the instrument is completely uncharged, it is regarded as normal shutdown.
- If the instrument is abnormally powered off and shut down, the instrument starts automatically when it is powered on again. Please try to use the normal shutdown process to close the equipment. Please wait for more than 2S to power on and start the instrument again in case of abnormal shutdown.

2.4 Measurement circuit connecting direct input

The measurement cable from the measurement circuit is connected directly to the voltage or current input terminal.

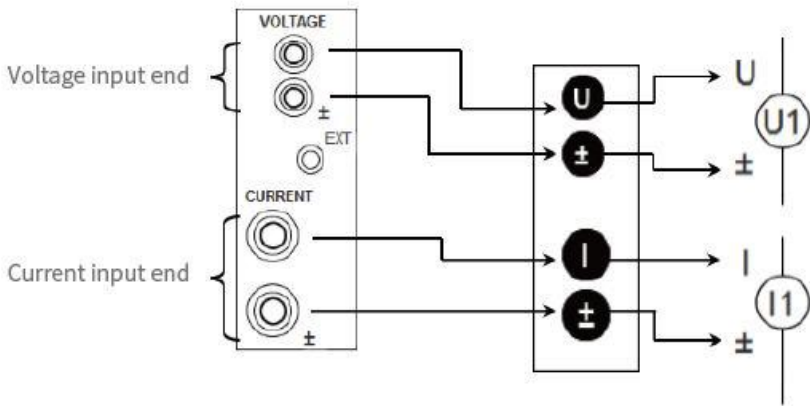
- Connect voltage input terminal

For a safety banana jack with a terminal of 4mm, the safety connector (the wire is not exposed) is inserted into the voltage input terminal.
- Connect current input terminal

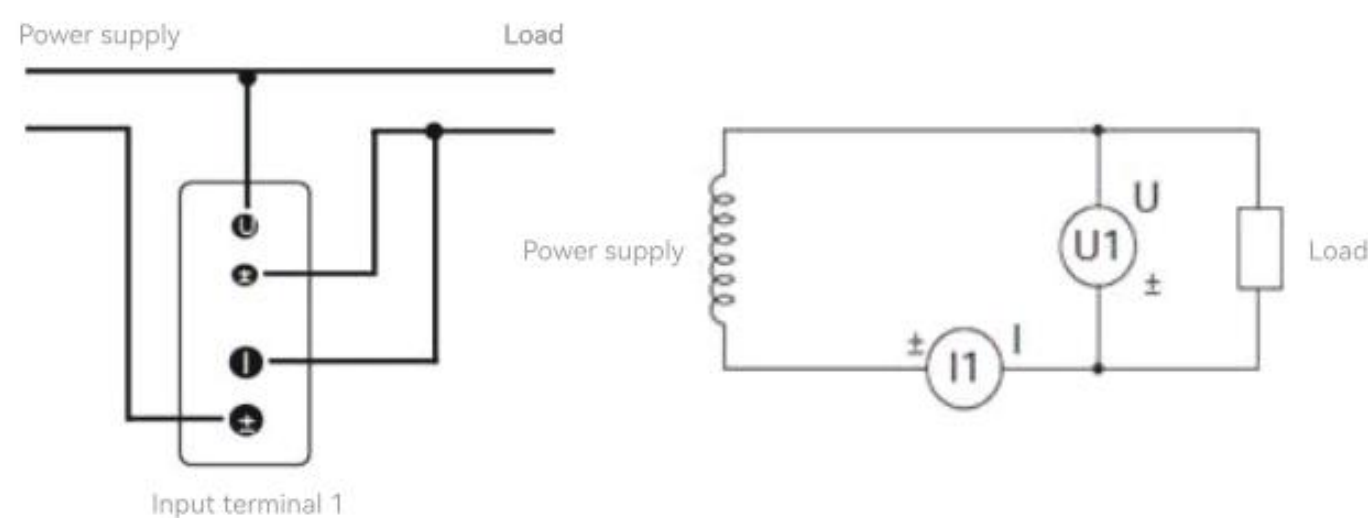
It is not allowed to touch the current sensor input interface when introducing the voltage of the measurement circuit into the current input terminal. Because these ports are electrically connected internally, they are very dangerous.

⚠ Note:

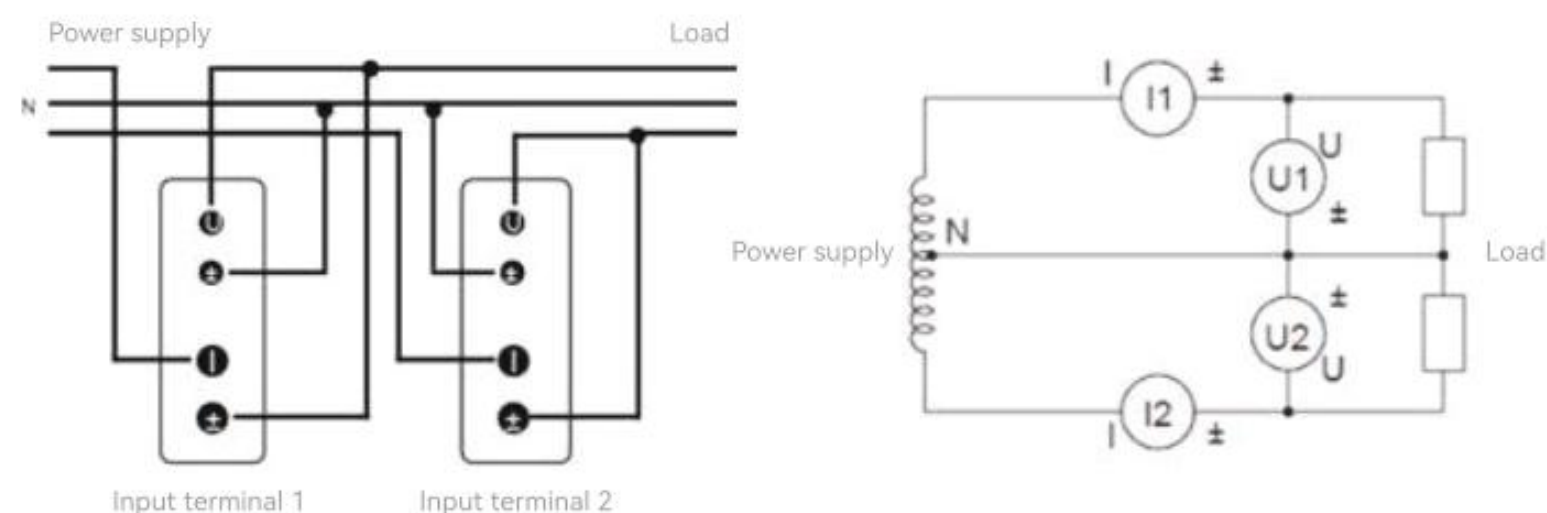
- Please make sure that there is no foreign matter on the contact surface between the current input terminal and the crimp terminal when connecting.
- It is necessary to regularly check whether the knob of the current input terminal is loose, and whether there is foreign matter on the contact surface between the current input terminal and the crimp terminal.



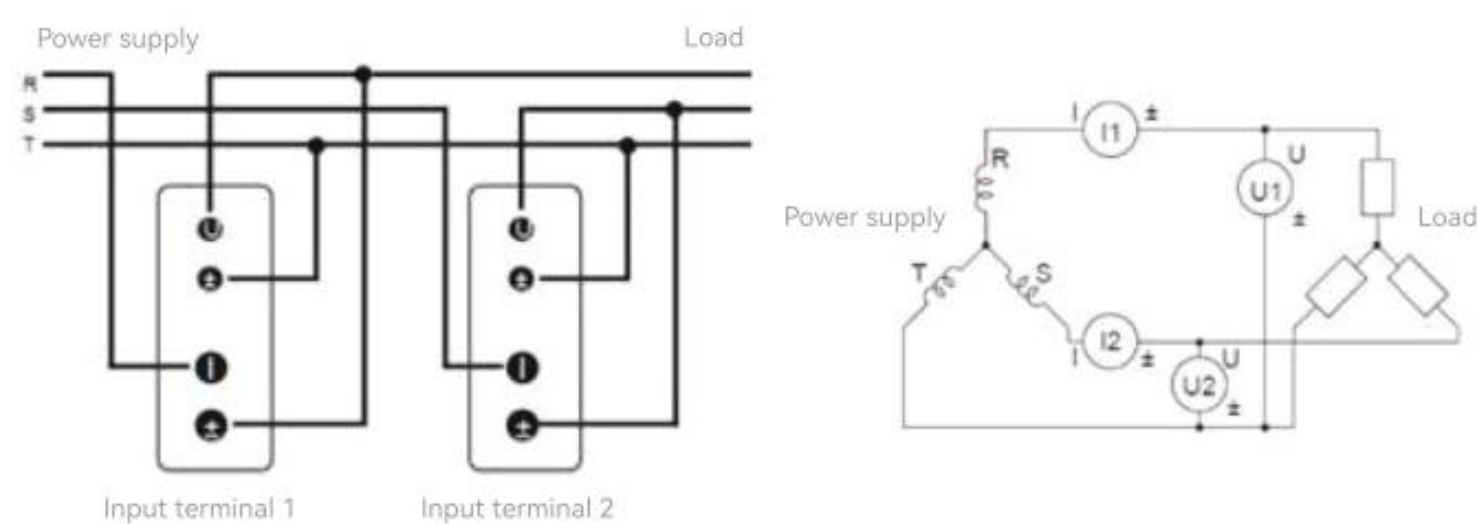
Single-phase two-wire system (1P2W), directly input wiring example



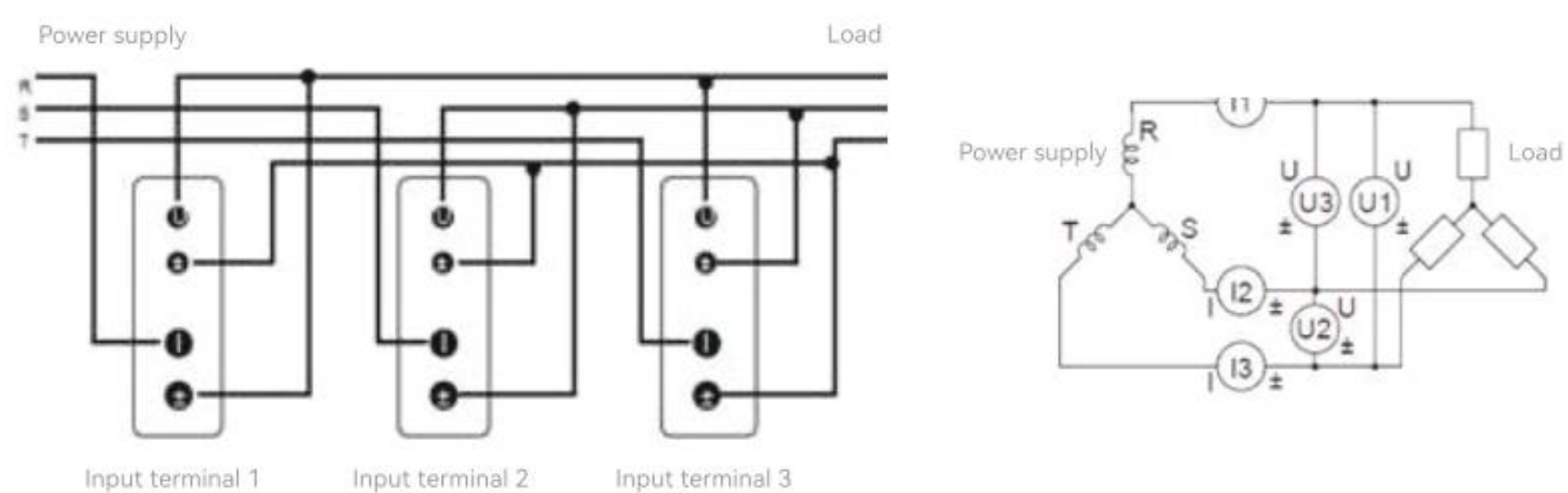
Single-phase three-wire system (1P3W), directly input wiring example



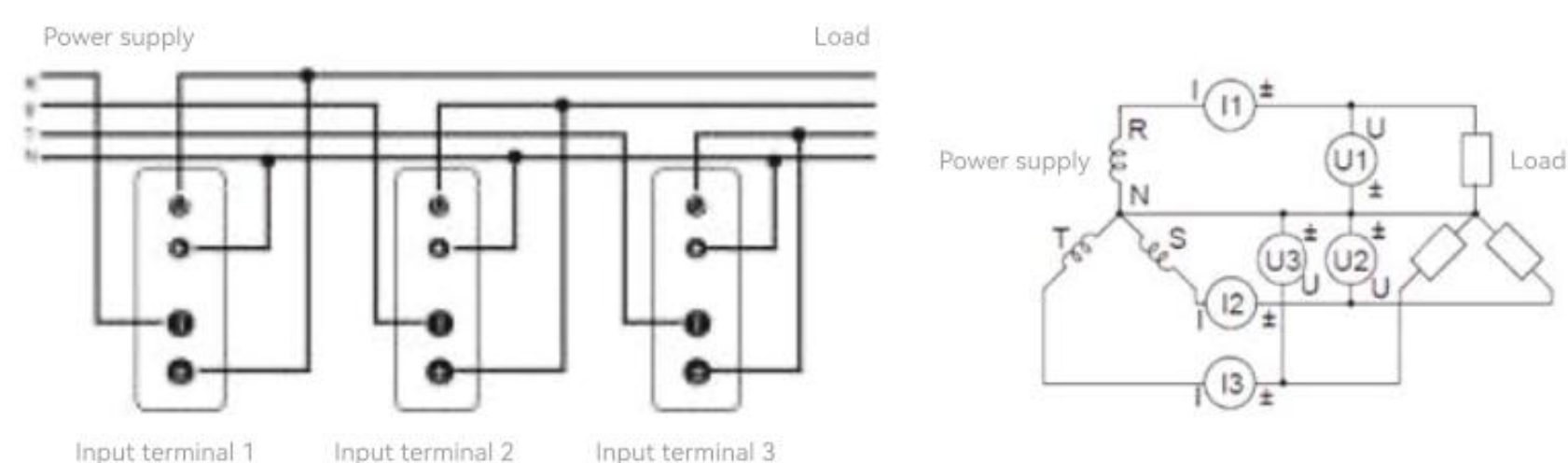
Three-phase three-wire system (3P3W), directly input wiring example



Three-phase three-wire (three-voltage three-current) system 3P3W (3V3A), directly input wiring example

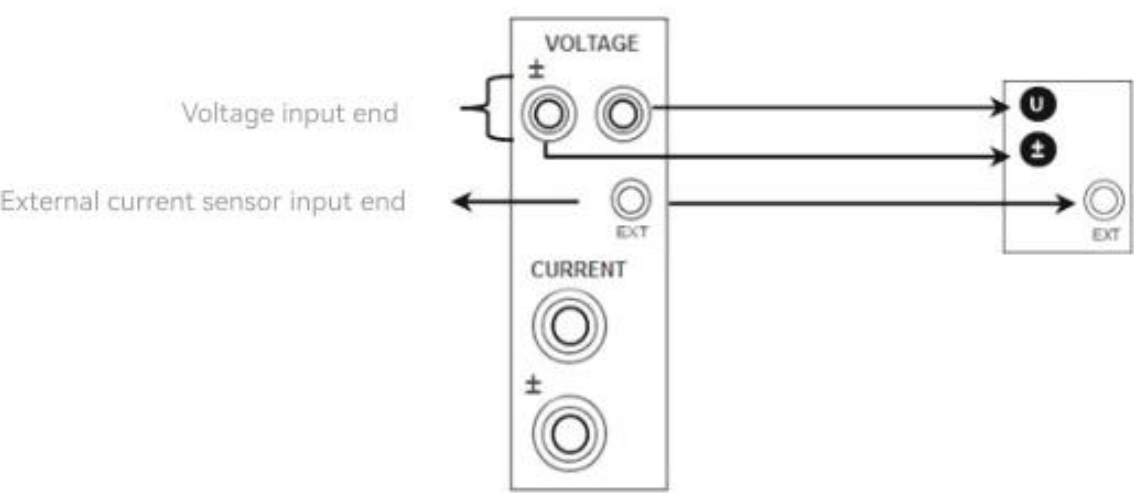


Three-phase four-wire (3P4W), directly input wiring example



2.5 Measurement circuit connecting external sensor input

When the maximum current of the measurement circuit exceeds the maximum range of the input unit (as described below), an external current sensor can be connected to the current sensor input interface to measure the current. The simplified connection mode of the input unit, voltage input terminal and external current sensor input connector of the digital power meter is shown in the figure.

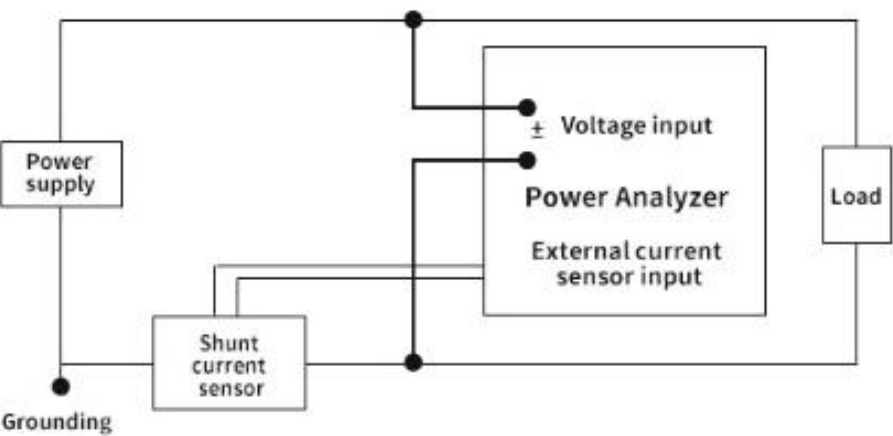


Output type of current sensor

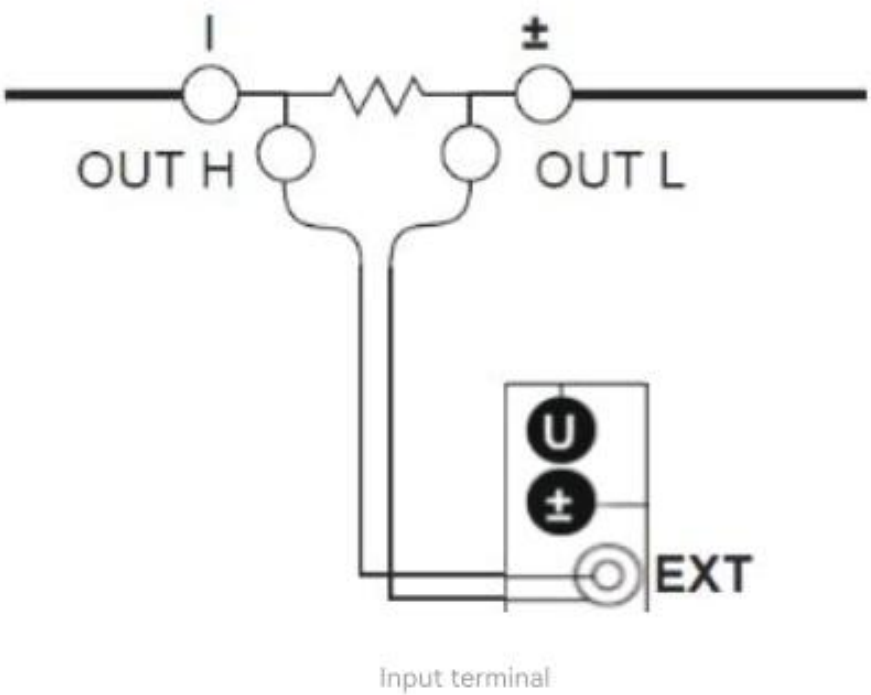
External current sensors can be divided into shunt current sensor and voltage output clamp current sensor.

2.5.1 Connection mode of current sensor

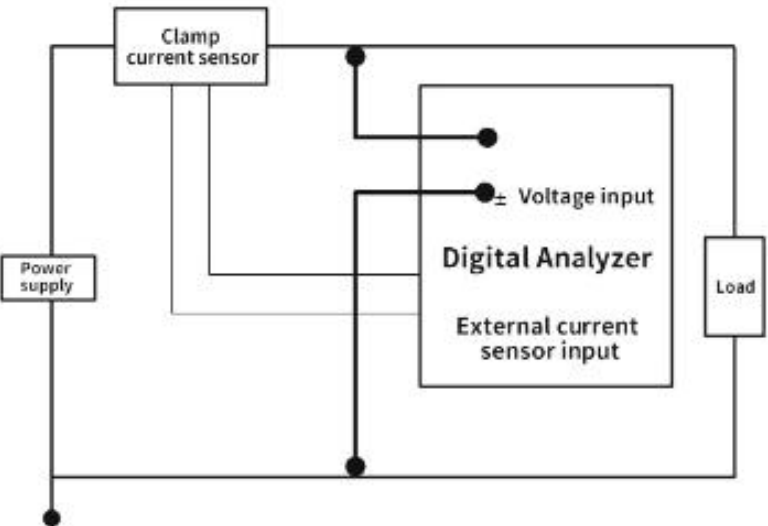
The shunt current sensor is connected to power ground. If the sensor must be connected to a non-ground terminal, it is necessary to use wire with conducting layer between the sensor and the instrument to reduce the influence of common-mode voltage. Attention shall be paid to electricity safety when connecting external current sensor cables.



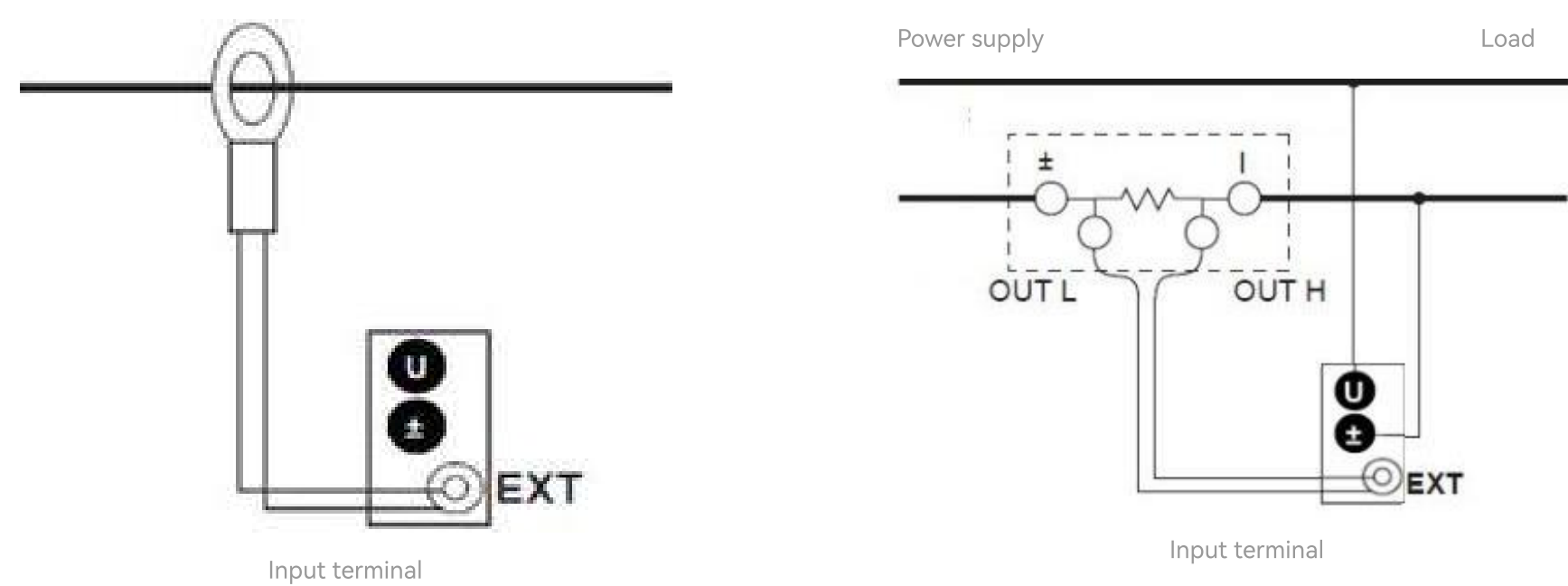
The connection of shunt current sensor is shown in the figure :



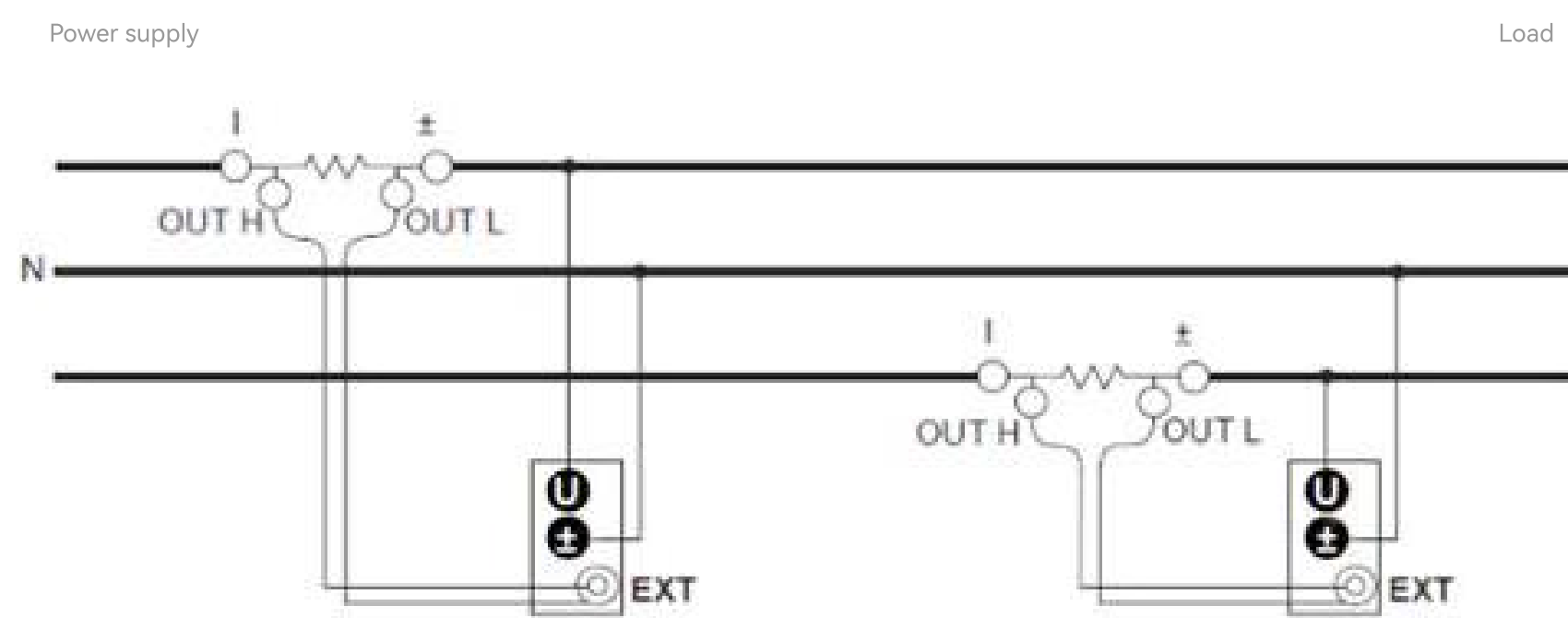
When the tested circuit is not grounded, the signal frequency is high or the power is high, the influence of the inductance of the shunt current sensor cable becomes greater. In this case, the measurement is performed using an isolated sensing (CT, DC-CT, or clamp type).



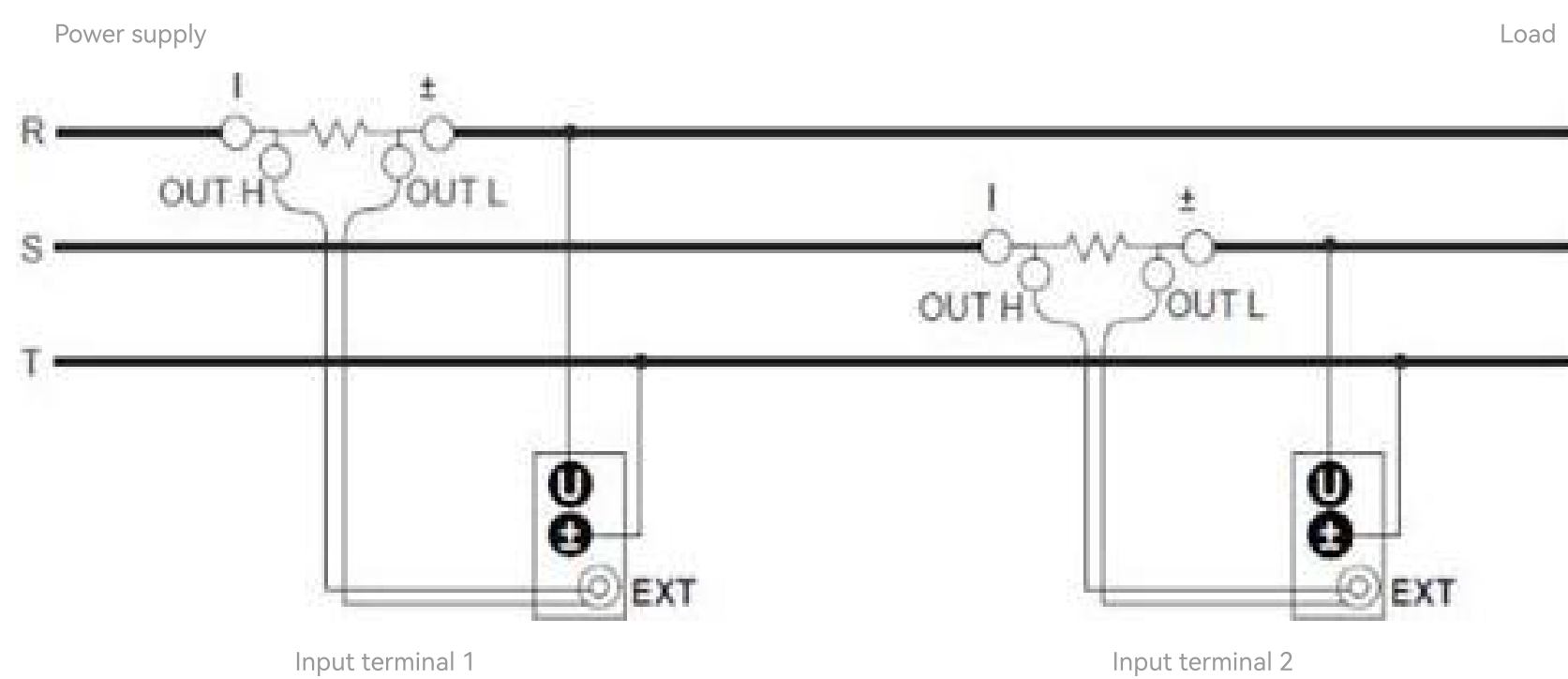
The connection of voltage output clamp current sensor is shown in the figure :



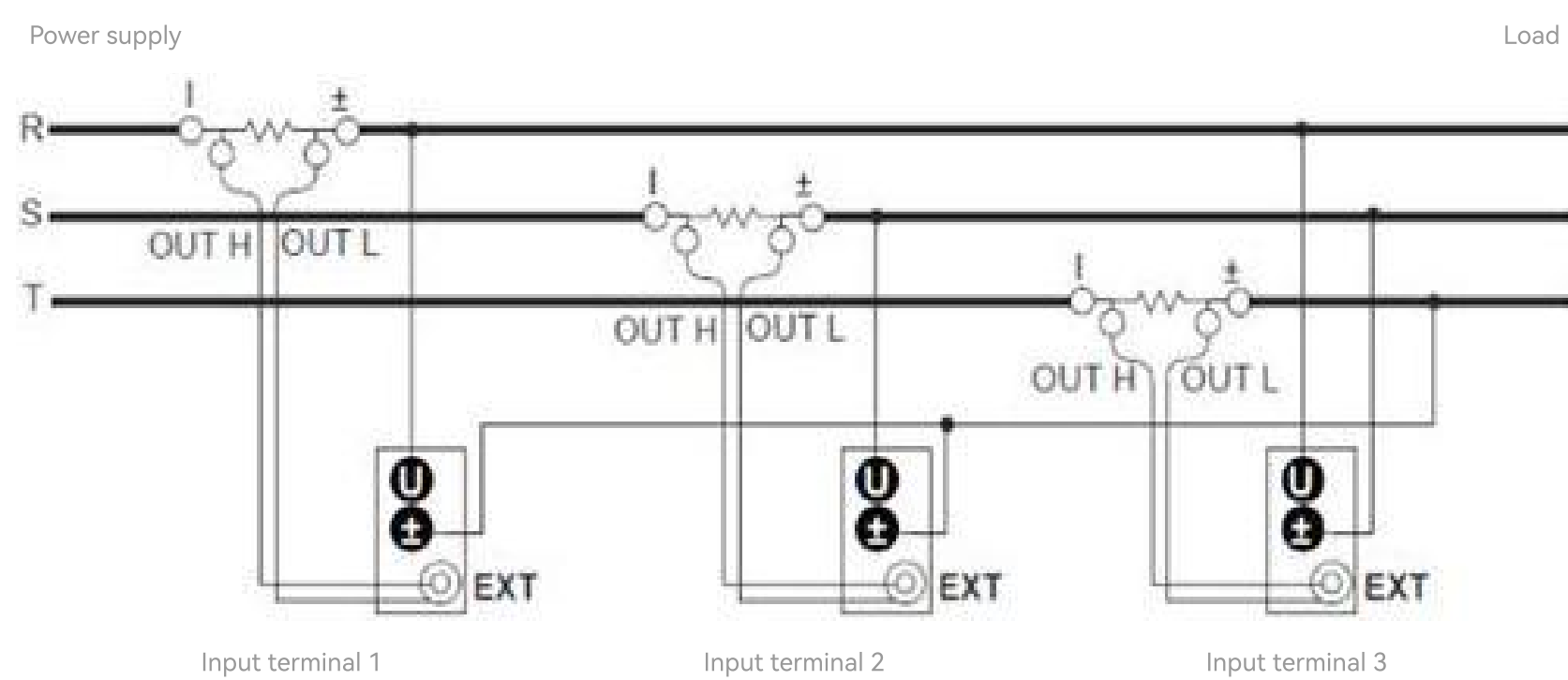
Single-phase three-wire system (1P3W), example of wiring by using shunt current sensor



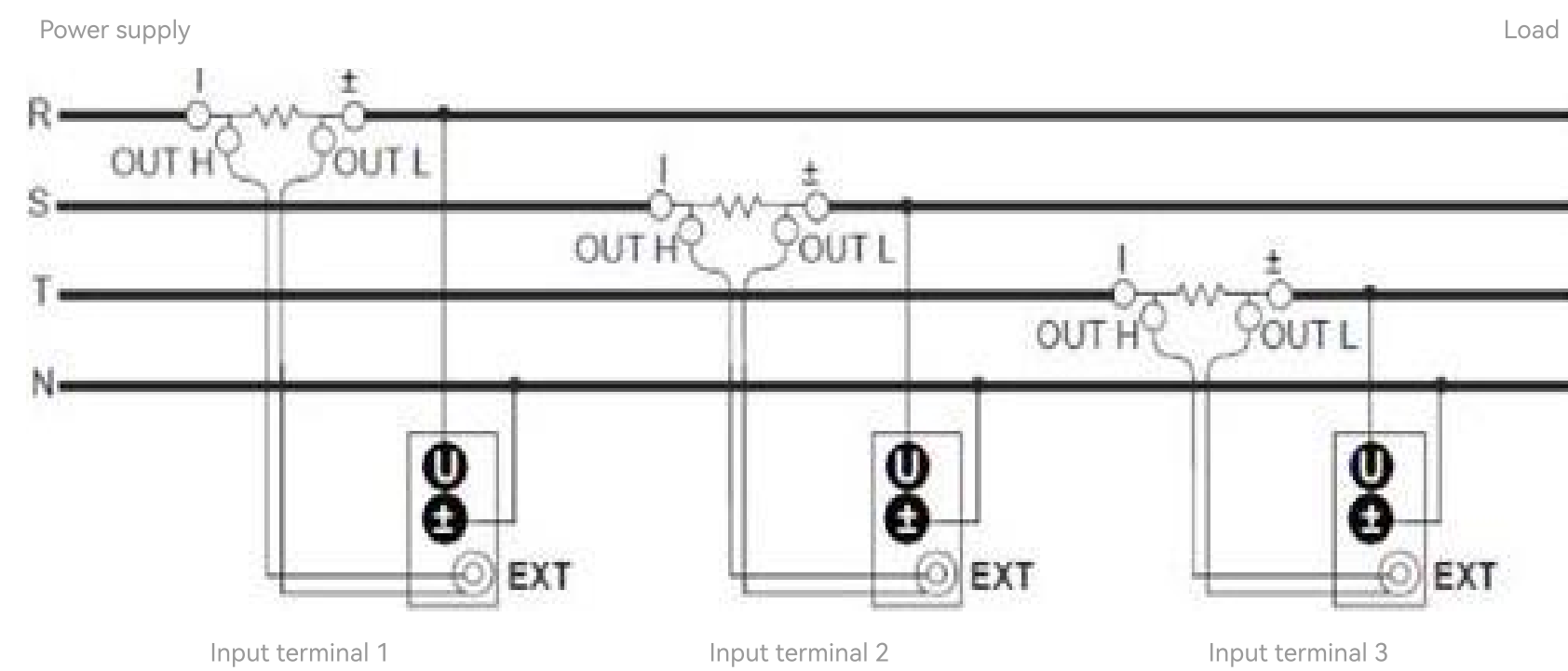
Three-phase three-wire system (3P3W), example of wiring by using shunt current sensor



Three-phase three-wire (three-voltage three-current) system 3P3W (3V3A), example of wiring by using shunt current sensor



Three-phase four-wire system (3P4W), example of wiring by using shunt current sensor

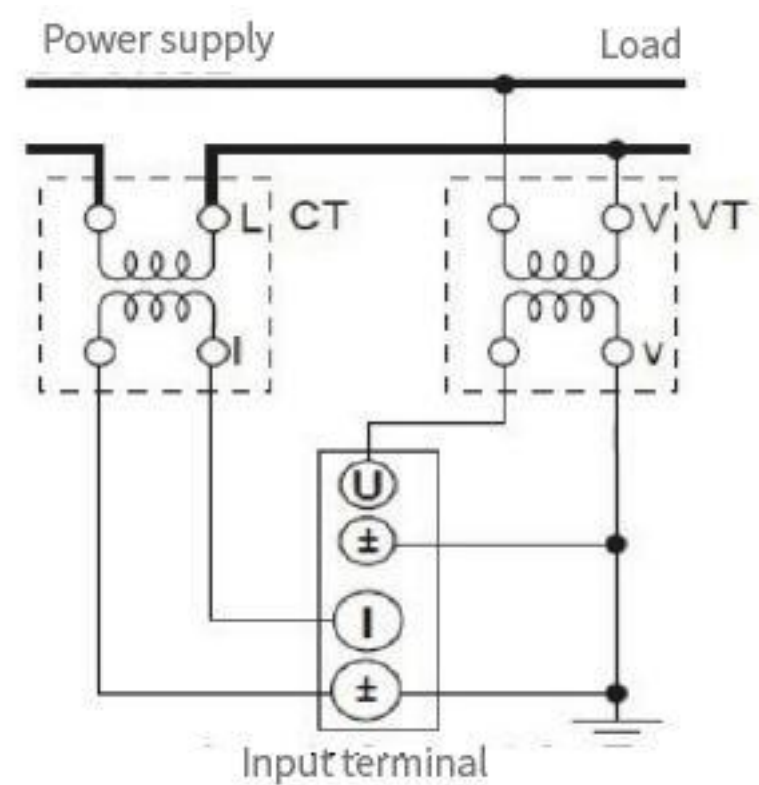


2.5.2 Connection mode of voltage and current transformers (VT/CT)

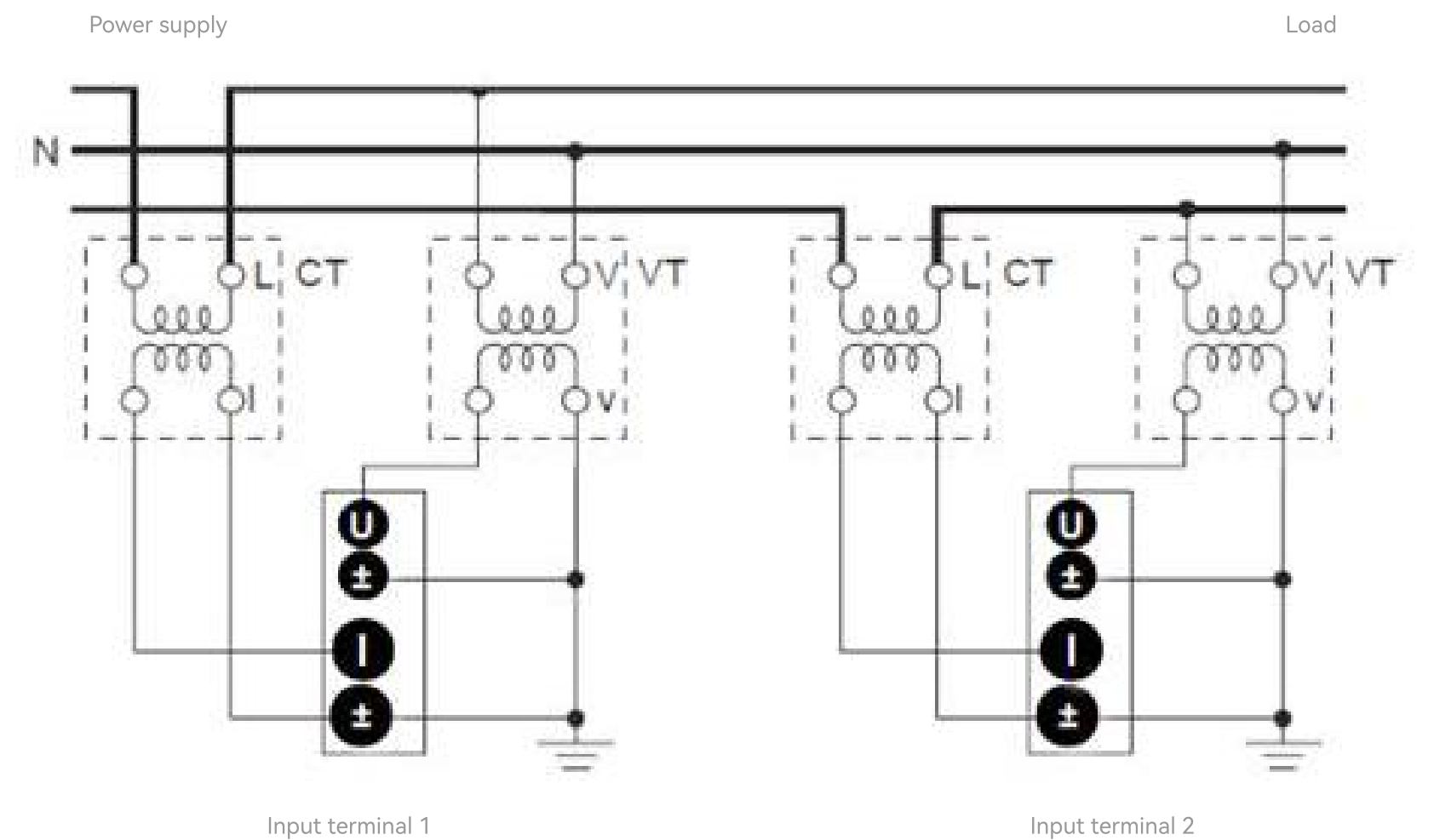
When the current exceeds the range, a current output sensor or CT (Current Transformer) can be connected to expand the range. When it is connected through the sensor, the current input terminal shall be connected.

When the voltage exceeds the range, a voltage sensor or VT (Voltage Transformer) can be connected to expand the range. When it is connected through the sensor, the voltage input terminal shall be connected.

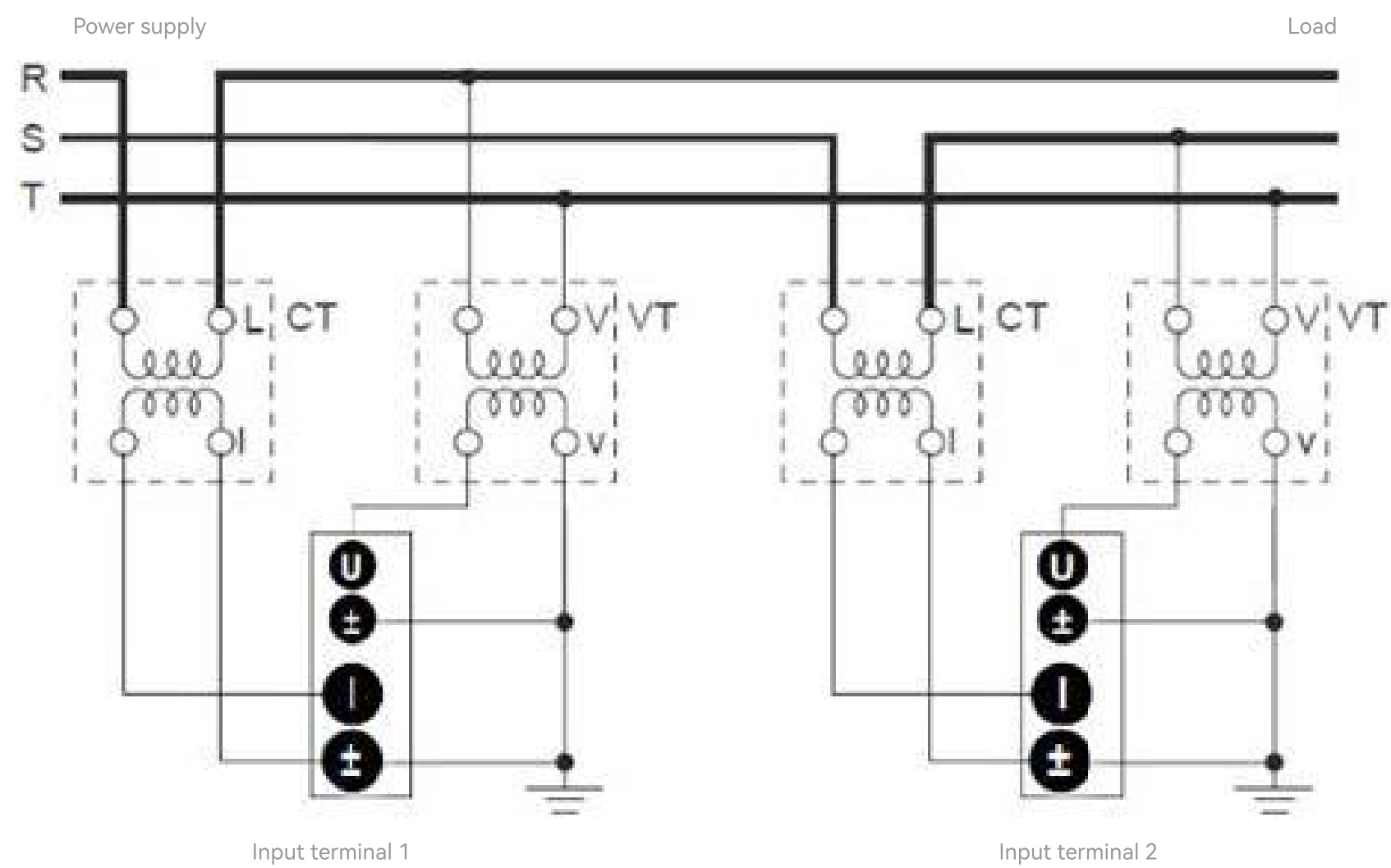
Single-phase two-wire system (1P2W), example of wiring by using transformer (VT/CT)



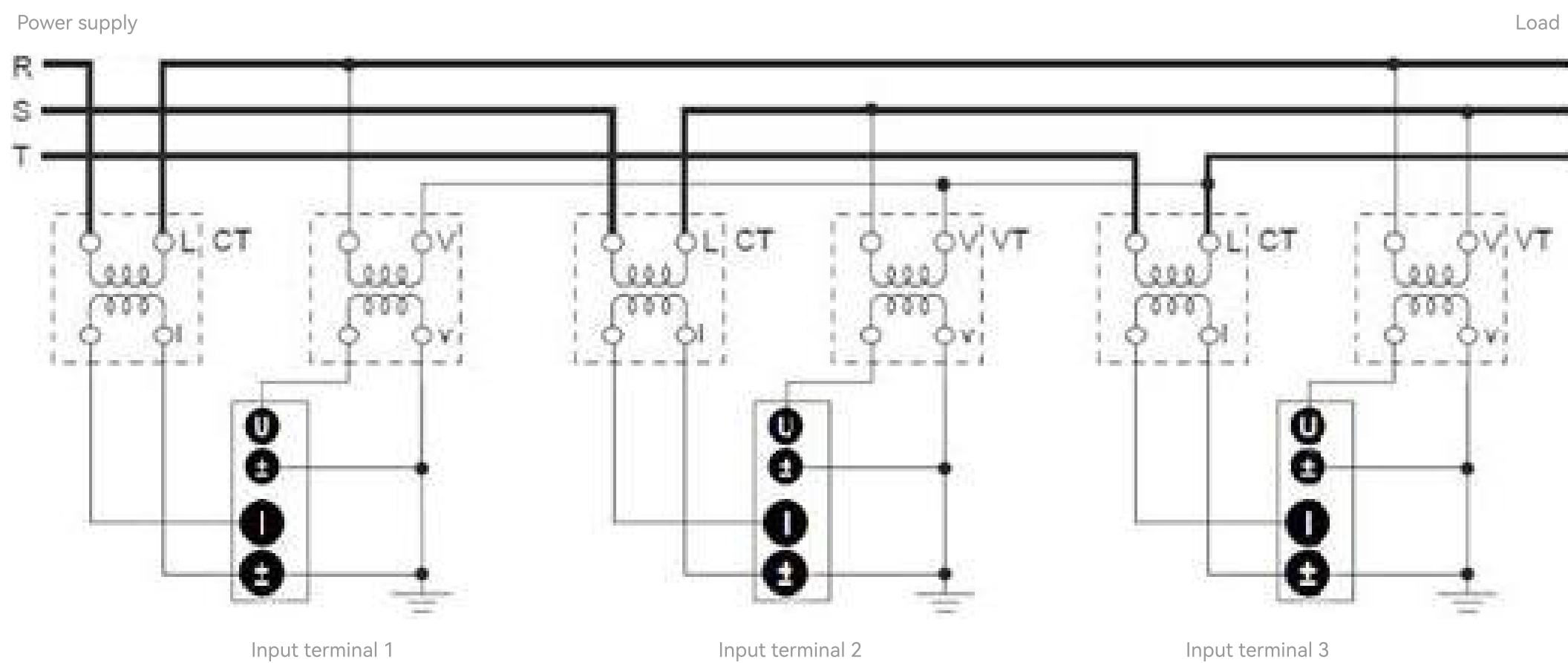
Single-phase three-wire system (1P3W), example of wiring by using transformer (VT/CT)



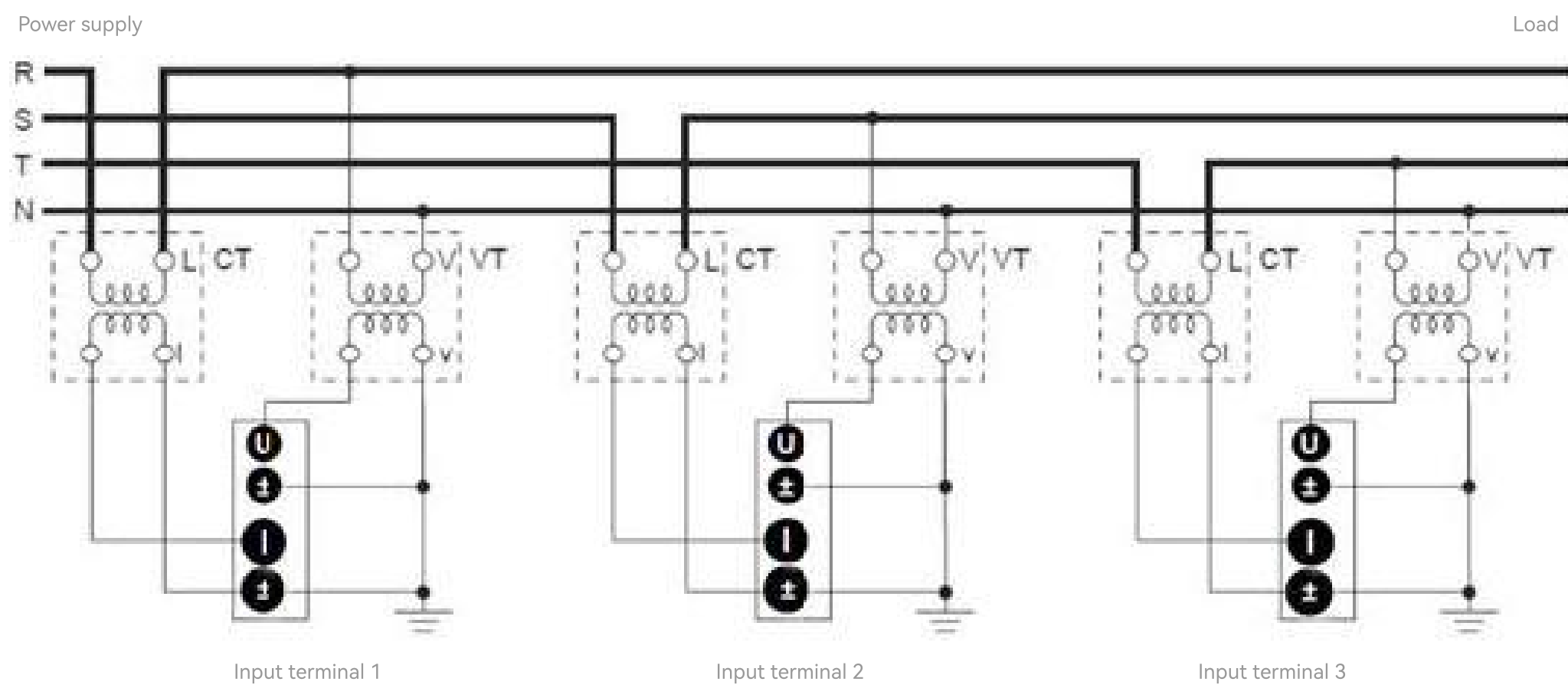
Three-phase three-wire system (3P3W), example of wiring by using transformer (VT/CT)



Three-phase three-wire (three-voltage three-current) system 3P3W (3V3A), example of wiring by using transformer (VT/CT)



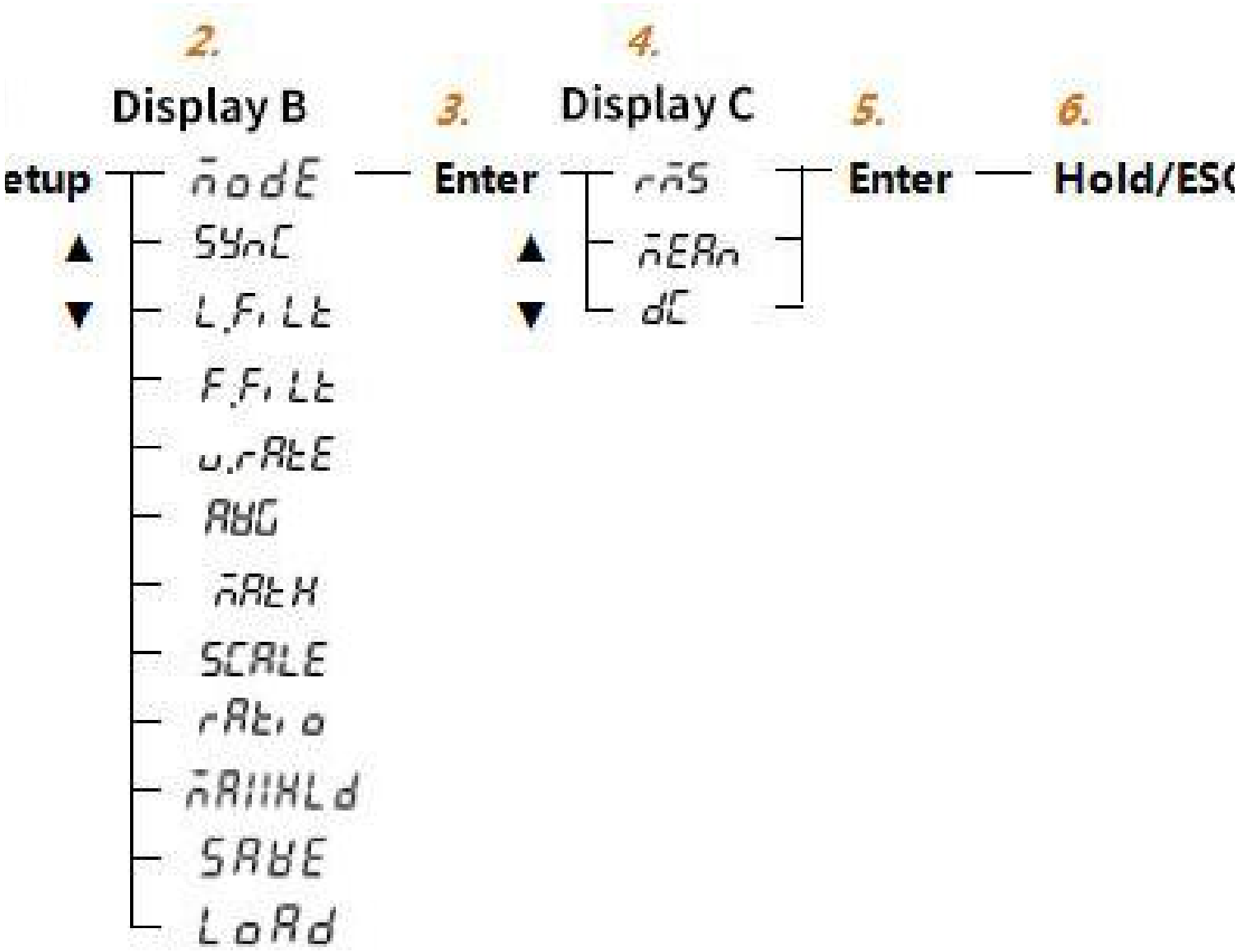
Three-phase four-wire system (3P4W), example of wiring by using transformer (VT/CT)



Setting of Measurement Conditions

3.1 Measurement mode setting

Operating steps



1. Press the Setup key;
2. Select the "Mode" menu;
3. Confirm;
4. Select setting options;
5. Confirm;
6. Exit and close the setting menu.

The above operating steps are displayed. The measurement mode options are displayed in Column C. The options are switched through the navigation (up and down) key. When the measurement mode options to be set appear, the "Enter" key is clicked to complete the setting. The indicator light of the corresponding setting item on the panel is on. The instrument returns to the superior menu for display. Pressing the "Hold/ESC" key can exit the setting interface.

Description of measurement mode

One of the following measurement modes can be selected for voltage and current measurement, and the default setting is RMS.

Indicator light	Voltage	Current
RMS	True RMS	True RMS
VOLTAGE MEAN	Rectified average calibrated to RMS	Rectified average calibrated to RMS
DC	Simple average	Simple average

When RMS mode is set, the true RMS of voltage and current are displayed, and the apparent power (S), reactive power (Q), power factor (λ) and phase angle (Φ) are calculated and displayed in $U_{rms} \cdot I_{rms}$.

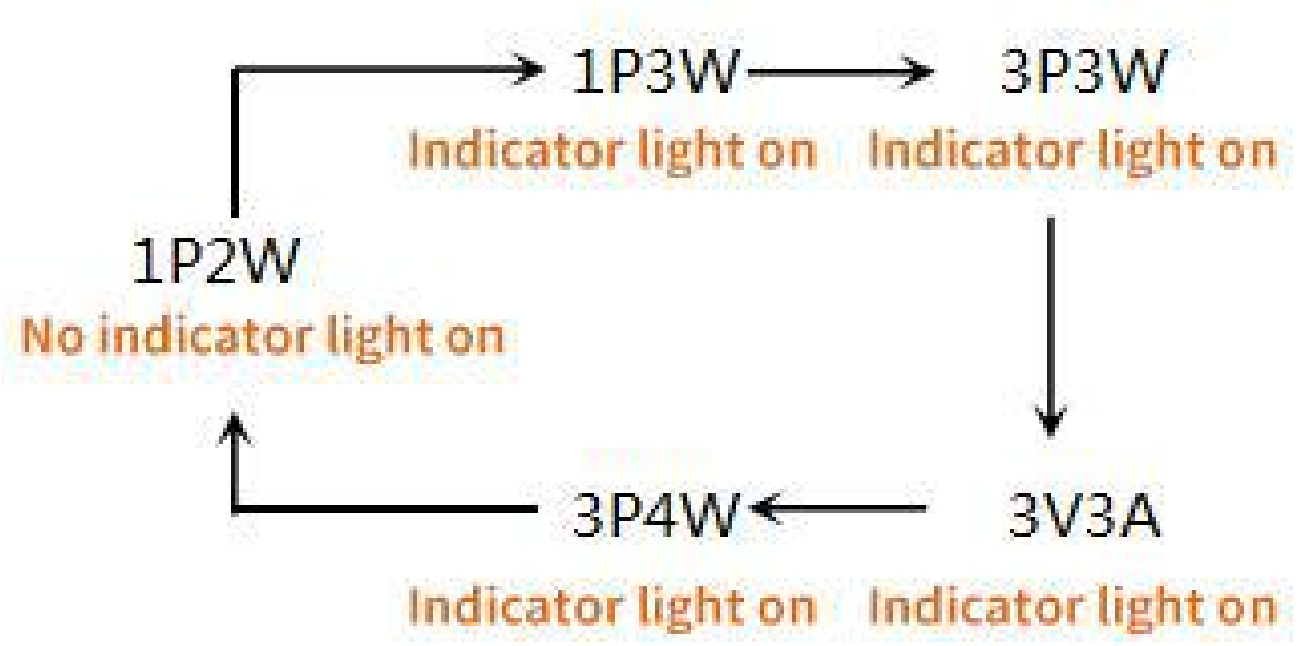
When the Voltage Mean mode is set, the rectified average value of the voltage and current RMS is displayed, and the apparent power (S), reactive power (Q), power factor (λ) and phase angle (Φ) are calculated and displayed in $U_{mean} \cdot I_{rms}$.

When DC mode is set, DC voltage and current are displayed, and apparent power (S), reactive power (Q), power factor (λ) and phase angle (Φ) are calculated and displayed in $U_{dc} \cdot I_{dc}$.

3.2 Wiring mode setting

This instrument can be equipped with 1P2W (single-phase two-wire system), 1P3W (single-phase three-wire system), 3P3W (three-phase three-wire system), 3V3A (three-voltage three-current meter method), and 3P4W (three-phase four-wire system) wiring modes.

Operating steps



- 1. Press the Wiring key.
- 2. Press the key repeatedly to select the connection mode.

The default wiring mode of the instrument is 1P2W, and the wiring status indicator light is not on. Every time you press it, the wiring mode will be switched cyclically in the sequence of 1P3W→3P3W→3V3A→3P4W→1P2W→1P3W.

Description

When the indicator light "1P3W" is on, it indicates that the wiring mode is set to single-phase three-wire system;
When the indicator light "3P3W" is on, it indicates that the wiring mode is set to three-phase three-wire system;
When the indicator light "3V3A" is on, it indicates that the wiring mode is set to three-voltage three-current meter method;
When the indicator light "3P4W" is on, it indicates that the wiring mode is set to three-phase four-wire system;
When the indicator light is not on, it indicates that the wiring mode is set to single-phase two-wire system.

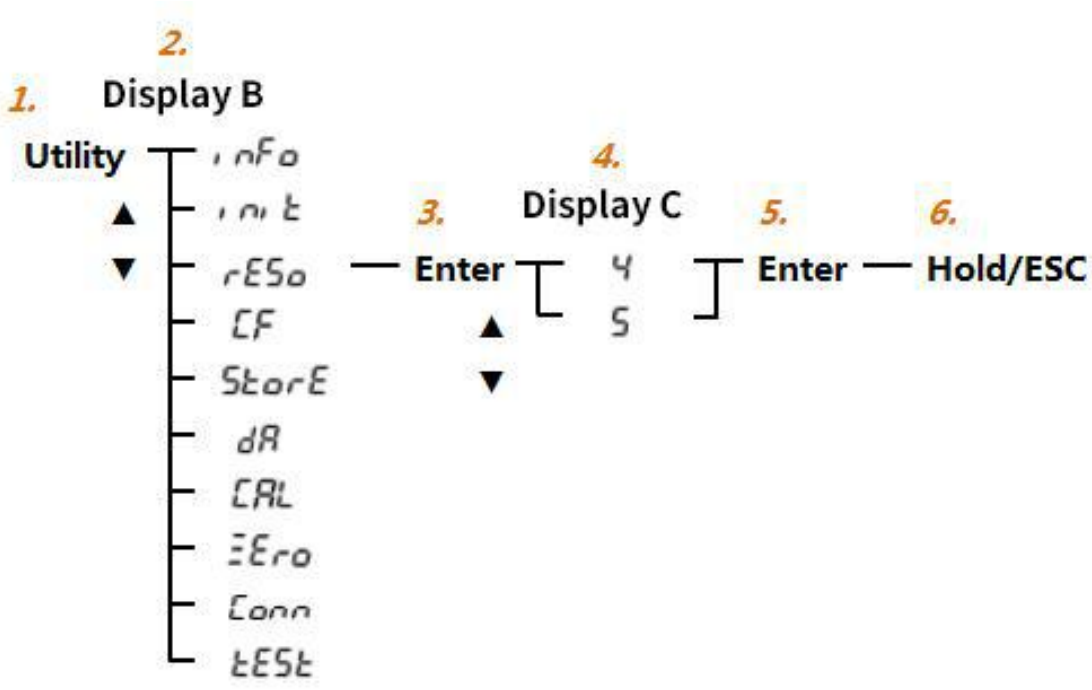
Limitations

When the integral or storage is running, pressing the Wiring key can display the error message "Error" in Column D. At this time, the wiring mode cannot be set.

3.3 Set the number of display digits of numeric values

The display digits of measured values can be selected for this instrument.

Operating steps



- 1. Press Utility key;
- 2. Select the "reso" menu;
- 3. Confirm;
- 4. Set the number of display digits;
- 5. Confirm;
- 6. Exit and close the setting menu.

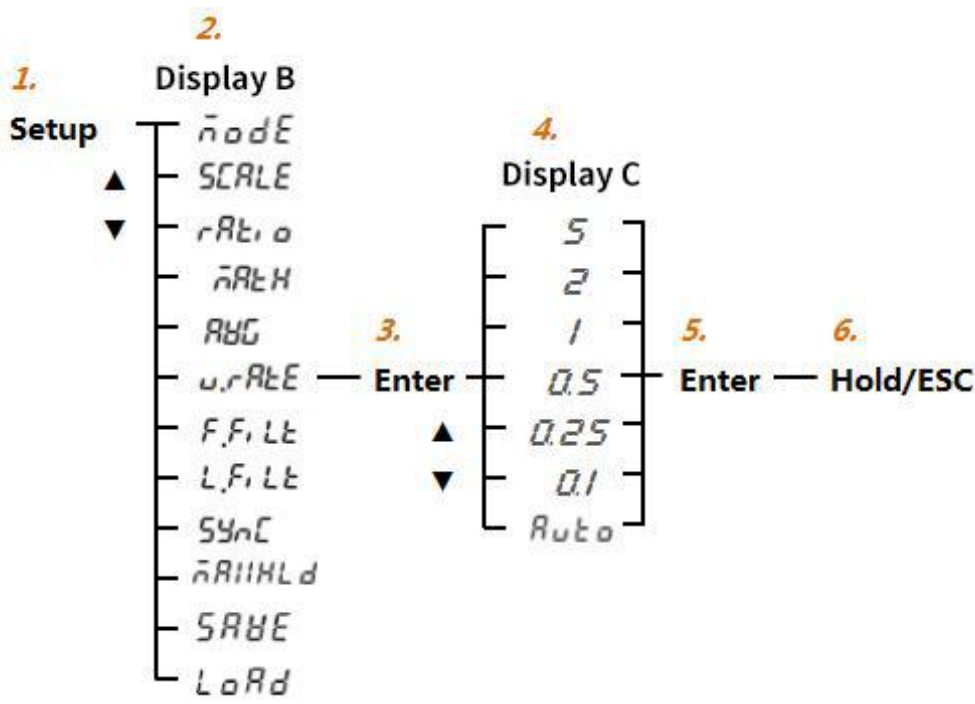
According to the above steps, the switch option "4" or "5" is pressed through navigation (up and down) in the Display Bar C, and "Enter" key is pressed to confirm and complete the setting. The instrument returns to the superior menu to display, and pressing the "Hold/ESC" key can exit the setting interface.

Description

If the number of display digits is set to 4, the data will be displayed up to 4 digits; if the number of display digits is set to 5, the data will be displayed up to 5 digits. If the measured value is 100V, and the number of digits is 4, the displayed value is 100.0 V; when the number of digits is 5, the display value is 100.00 V. The integral value and time are not affected by the display digit setting.

3.4 Data update rate setting

Operating steps



- 1. Press the Setup key;
- 2. Select the "u.rate" menu;
- 3. Confirm;
- 4. Set update rate options;
- 5. Confirm;
- 6. Exit and close the setting menu.

It is operated according to the above steps to enter the data update rate setting interface. The update rate option is located in Display Bar C. The update rate options can be switched through the navigation (up and down) key, and the "Enter" key is pressed to complete the setting. The instrument returns to the superior menu to display, and pressing the "Hold/ESC" key can exit the setting interface.

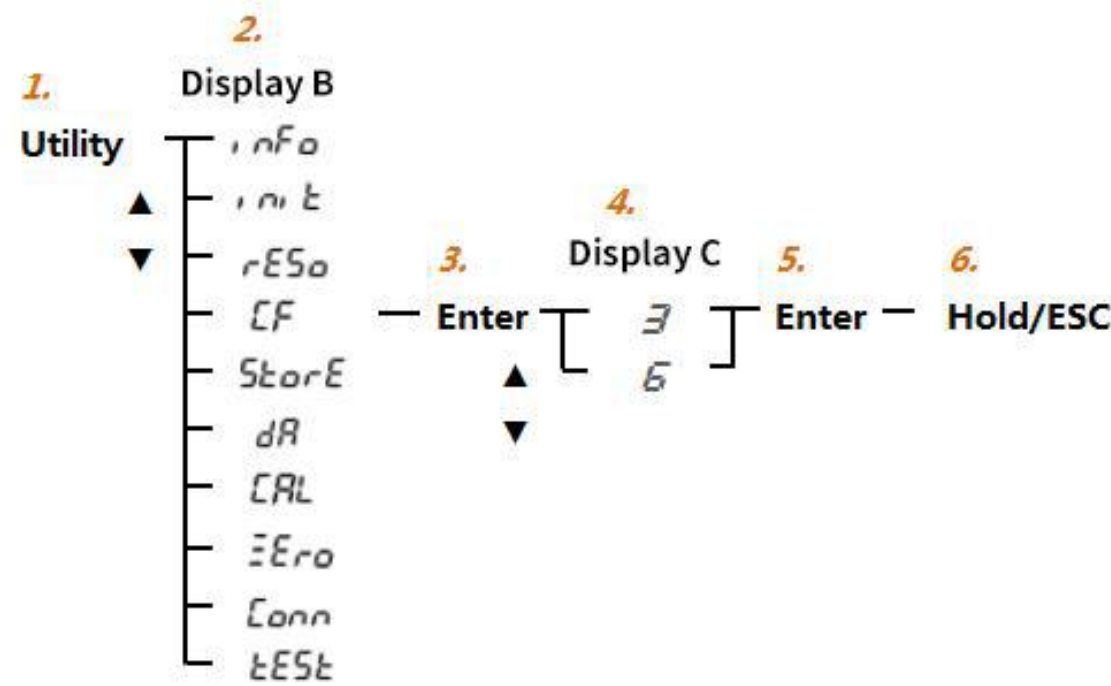
Description

The data update rate options supported by the instrument are 0.1 s, 0.25 s, 0.5 s, 1 s, 2 s, 5 s and Auto. After the update rate is set, the "Update" indicator light on the panel will flash according to the set update period. When the "Auto" option is selected, the instrument automatically selects the matching update rate according to the frequency of the input signal, and the "Update" indicator light flashes according to the self-matching update period. When the frequency of the input signal cannot be detected, the automatic update rate is updated by default according to the time-out period.

3.5 Peak factor setting

Under different peak factors, the measurement range options of corresponding voltage, current and external current sensors are different.

Operating steps



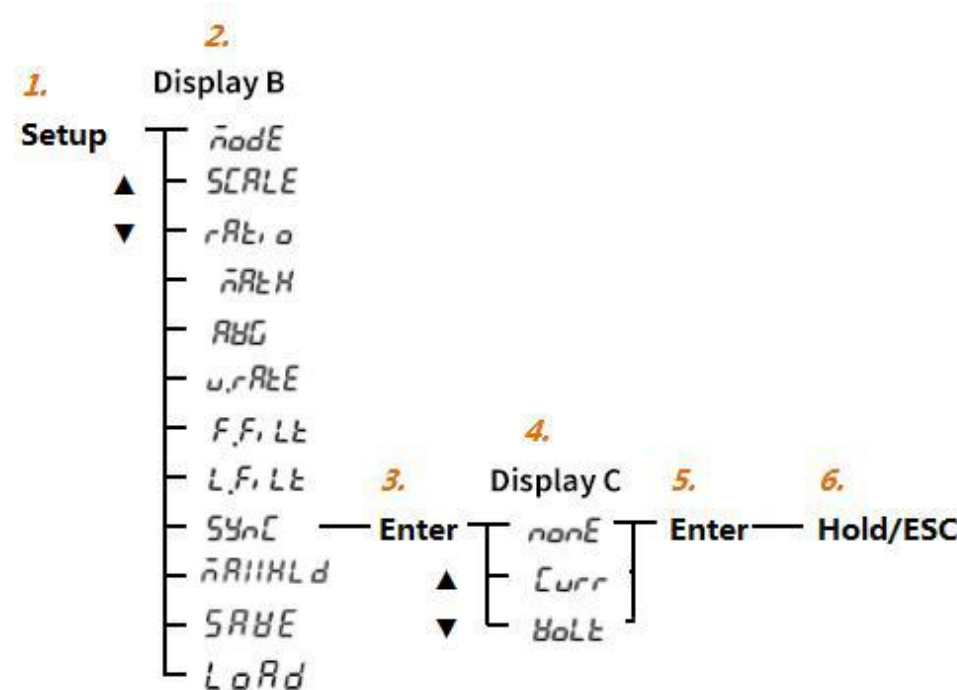
1. Press Utility key;
2. Select the "cf" setting menu;
3. Confirm;
4. Select peak factor;
5. Confirm;
6. Exit and close the setting menu.

It is operated according to the above steps, and the peak factor setting options are located in Display Bar C. The peak factors 3 and 6 can be switched by navigation (up and down) key, and pressing the "Enter" key can complete the setting. The instrument returns to the superior menu to display, and pressing the "Hold/ESC" key can exit the setting interface.

3.6 Synchronization source (measurement interval) setting

The measurement interval is determined by the reference input signal (synchronization source). The interval from the initial point of the rising slope (or the falling slope) passing through the zero point (the intermediate value of the amplitude) to the last point of the rising slope (or the falling slope) passing through the zero point (the intermediate value of the amplitude) in the data update period is defined as the measurement interval. The period of the input signal is detected from voltage and current signals, thus the synchronization source can be set as a Voltage or Current signal.

Operating steps



1. Press the Setup key;
2. Select the "sync" setting menu;
3. Confirm;
4. Select the synchronization source options;
5. Confirm;
6. Exit and close the setting menu.

It is operated according to the above steps to enter the synchronization source setting interface. The synchronization source options are located in Display Bar C. The synchronization source options can be switched through the navigation (up and down) key, and the "Enter" key is pressed to complete the setting. The instrument returns to the superior menu to display, and pressing the "Hold/ESC" key can exit the setting interface.

Description of Synchronization Source Options

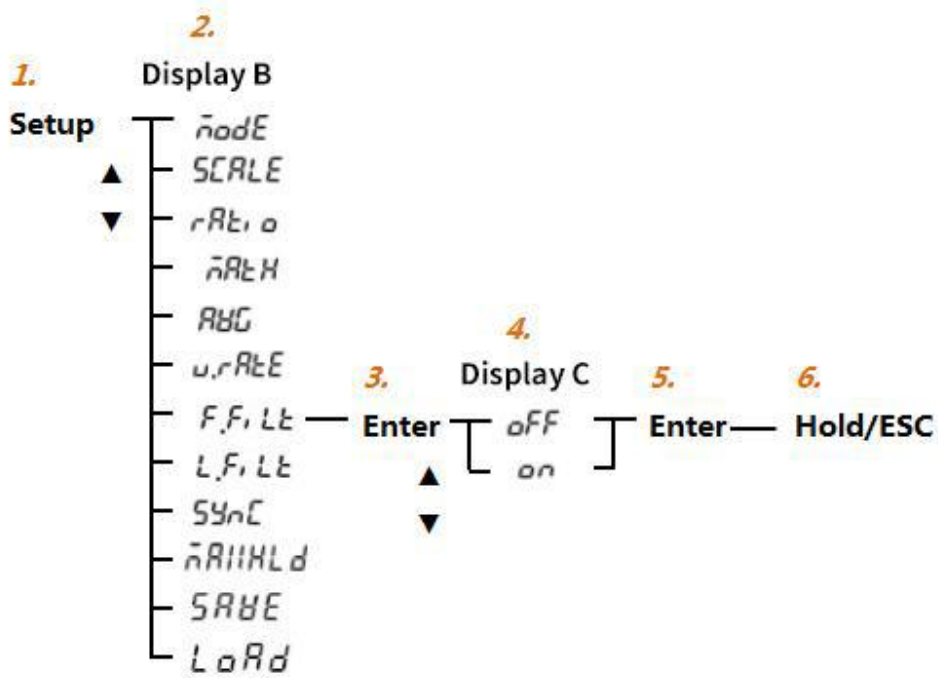
Item	Description
VOLT	The period of the voltage signal is preferentially detected, and the voltage signal is used as a synchronization source. The voltage signal of each unit is used as the synchronization source of the respective unit. When the period of the voltage signal cannot be detected, the current signal is used as the synchronization source. If the period of the current signal cannot be detected, the measurement interval will be set to the whole data update period.
CURR	The period of the current signal is preferentially detected, and the current signal is used as a synchronization source. The current signal of each unit is used as the synchronization source of the respective unit. When the period of the current signal cannot be detected, the voltage signal is used as the synchronization source. If the period of the voltage signal cannot be detected, the measurement interval will be set to the whole data update period.
NONE	The measurement is not performed synchronously with the voltage or current signal, and the whole data update period is selected as the measurement interval

 **Note:** The measurement interval for calculating peak voltage or current is always the whole data update period.

3.7 Frequency filter setting

The frequency filter is inserted in the frequency measurement circuit, which affects not only the frequency measurement, but also the voltage, current and power measurement. Therefore, it is also used to accurately detect zero crossing. Since the filter is not inserted in the voltage and current measurement circuit, even if it is turned on, the measured value will contain high frequency components.

Operating steps



1. Press the Setup key;
2. Select the "f.filt" setting menu;
3. Confirm;
4. Set the frequency filter switch;
5. Confirm;
6. Exit and close the setting menu.

It is operated according to the above steps to enter the switch setting interface of the frequency filter. The switch options of the frequency filter are located in Display Bar C. The switch option "OFF" or "ON" can be switched through the navigation (up and down) key, and pressing the "Enter" key can complete the setting. The instrument returns to the superior menu to display, and pressing the "Hold/ESC" key can exit the setting interface.

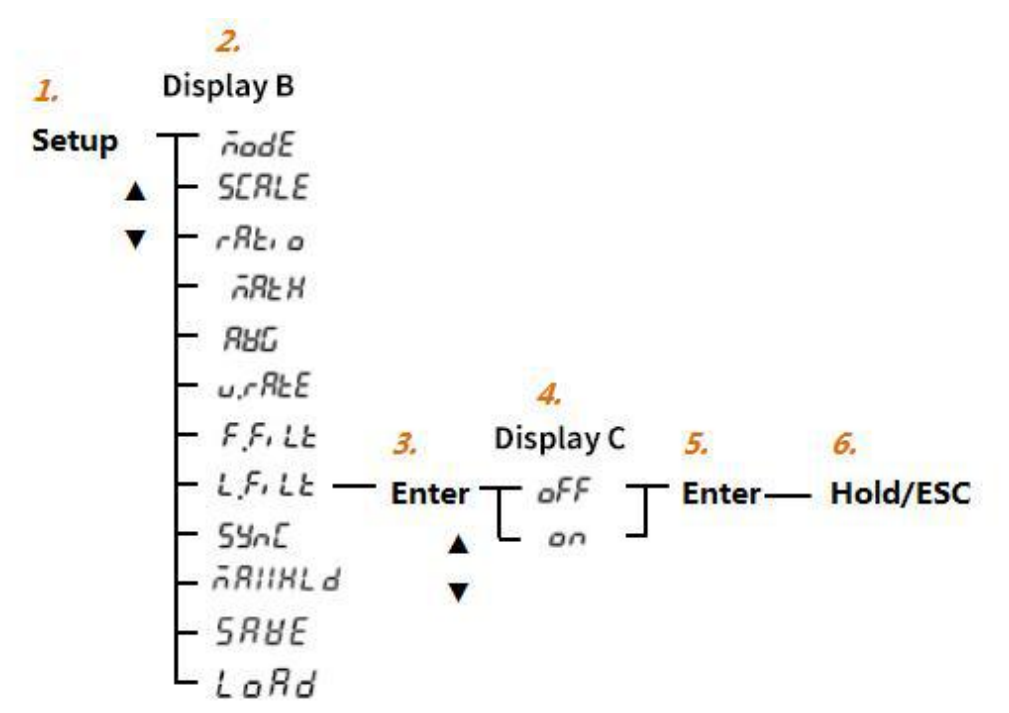
Description

ON is set to turn on the frequency filter. When it is turned on, the default cutoff frequency is 500Hz, and the "Freq" indicator light on the panel is on. Setting OFF indicates that the frequency filter is disabled, and the indicator light is off.

3.8 Line filter setting

The line filter is inserted in the voltage and current measurement circuit, thus it will directly affect the measurement of voltage, current and power. When the line filter is turned on, the measured value does not contain high frequency components, thus the noise from the frequency converter or distorted waveform can be removed to measure the voltage, current and power.

Operating steps



- 1. Press the Setup key;
- 2. Select the "I.filt" setting menu;
- 3. Confirm;
- 4. Setting the line filter switch;
- 5. Confirm;
- 6. Exit and close the setting menu.

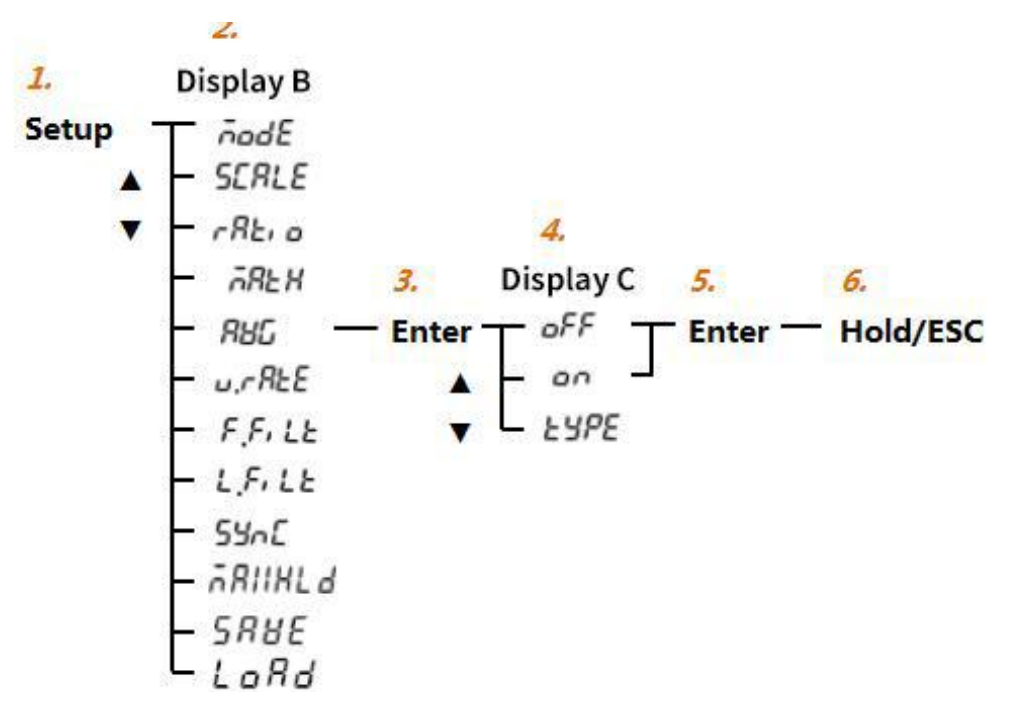
Description

ON is set to turn on the line filter. When it is turned on, the default cutoff frequency is 500Hz, and the "Line" indicator light on the panel is on. Setting OFF indicates that the line filter is disabled, and the indicator light is off.

3.9 Average function setting

3.9.1 Set average function on/off

Operating steps



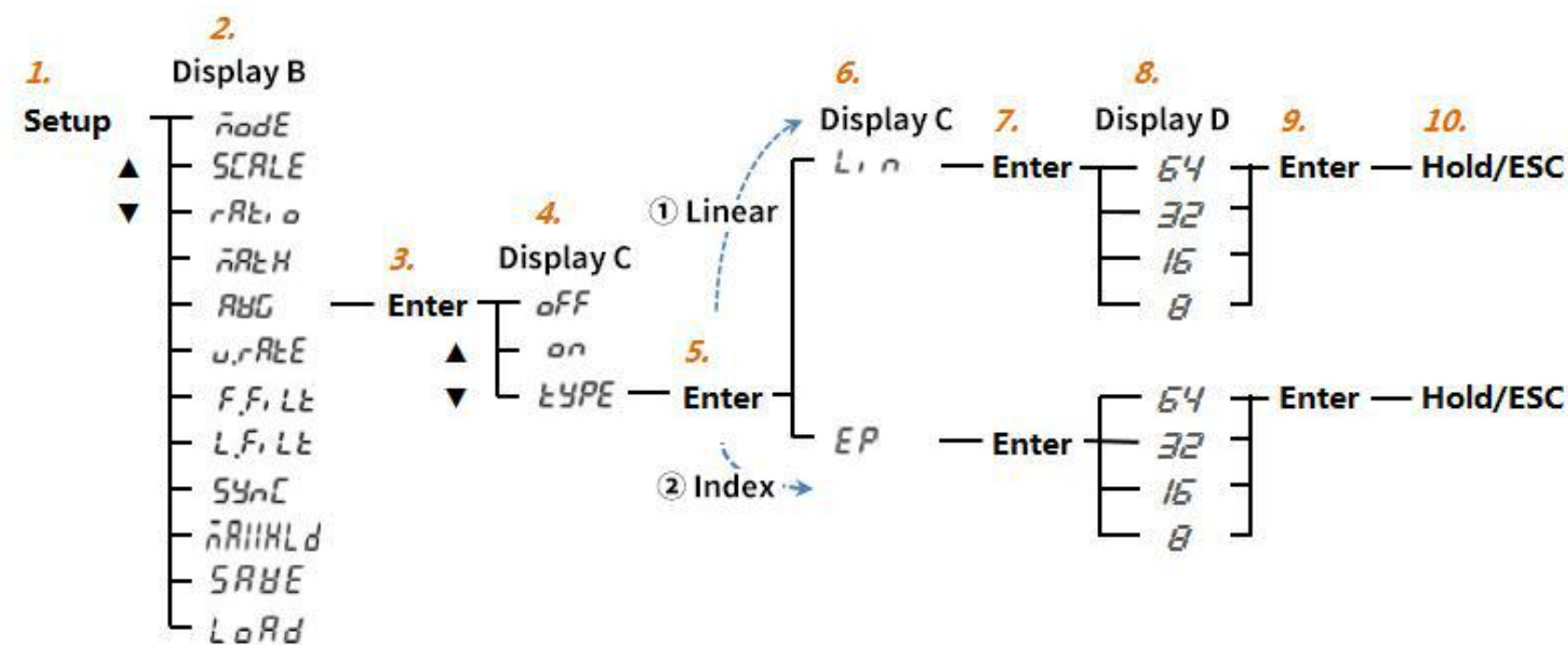
- 1. Press the Setup key;
- 2. Select the "avg" setting menu;
- 3. Confirm;
- 4. Select average function on/off;
- 5. Confirm;
- 6. Exit and close the setting menu.

It is operated according to the above steps, the average setting switch options are located in Display Bar C. Through the navigation (up and down) key, ON or OFF of the average display can be switched, and "ON" or "OFF" option is selected. Pressing the "ENTER" key can complete the switch setting. After the average function is turned on, the "AVG" indicator light on the panel will be on. The instrument returns to the superior menu to display, and pressing the "Hold/ESC" key can exit the setting interface.

3.9.2 Average type setting

Average type: Exponential average and linear average can be used. Attenuation constant needs to be set for exponential average, and average number needs to be set for linear average.

Operating steps



1. Press the Setup key;
2. Select the "avg" setting menu;
3. Confirm;
4. Select the average type;
5. Confirm;
6. Select the average type (exponential or linear);
7. Confirm;
8. Set the number of linear averages (8, 16, 32, 64) or the attenuation constant of exponential averages (8, 16, 32, 64);
9. Confirm;
10. Exit and close the setting menu.

It is operated according to the above steps to select and set the average type option "TYPE" in Display Bar C, and the average type option "EP" or "LIN" is displayed in Display Bar C. It is operated in sequence according to the above two paths to set the attenuation constant at exponential average and the average number at linear average respectively. The attenuation constant and the average number are displayed in Display Bar D.

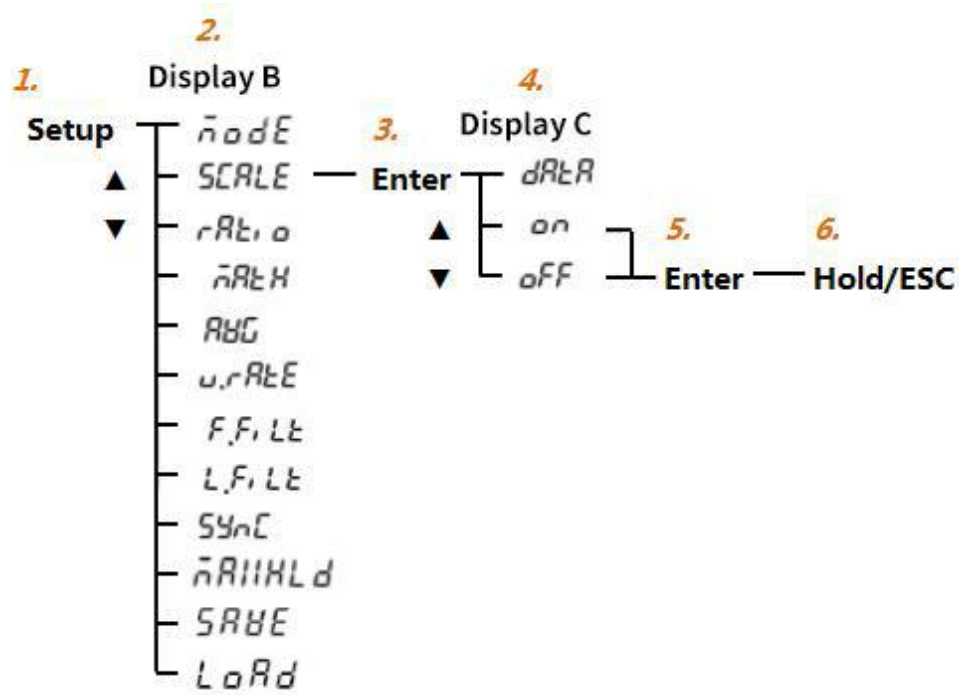
Description and limitations of average function

The averaging function is not available when the integral starts. Even if average is turned on, average will be automatically turned off after the integral starts. In harmonic measurement, only exponential average takes effect .

3.10 Scaling function setting

3.10.1 Turn scaling function on/off

Operating steps

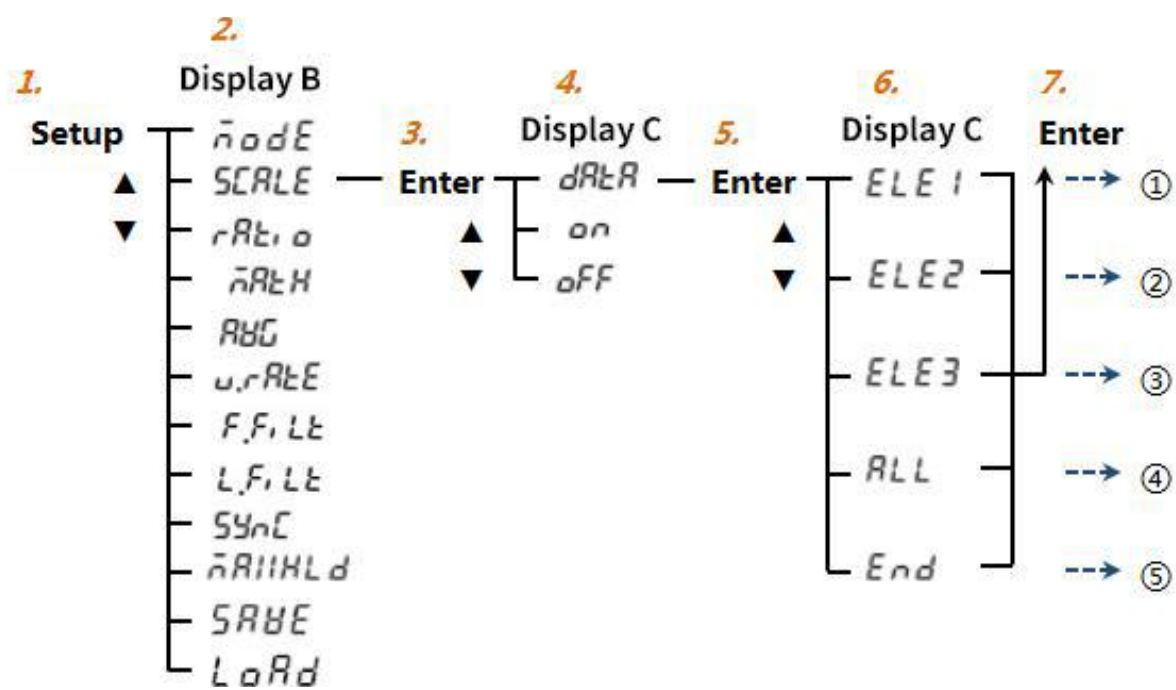


1. Press the Setup key;
2. Select the "scale" menu;
3. Confirm;
4. Set the scaling function on/off;
5. Confirm;
6. Exit and close the setting menu.

It is operated according to the above steps, the scaling setting switch options are located in Display Bar C. Through navigation (up and down) key, ON or OFF of the display scaling can be switched. "ON" or "OFF" option is selected, and the "Enter" key is pressed for confirmation. After the scaling function is turned on, the "Scaling" indicator light on the panel will be on, and the instrument will return to the superior menu for display. Pressing the "Hold/ESC" key can exit the setting interface.

3.10.2 Set independent unit or select all

Operating steps



1. Press the Setup key;
2. Select the "scale" menu;
3. Confirm;
4. Select the ratio setting;
5. Confirm;
6. Select the setting unit (select all or independent unit);
7. Confirm.

Description

- ①→Enter the scale factor interface of the separate setting unit 1;
- ②→Enter the scale factor interface of the separate setting unit 2;
- ③→Enter the scale factor interface of the separate setting unit 3;
- ④→Enter the scale factor interface for setting all units at the same time;
- ⑤→Exit the scaling setting interface and return to the superior display menu.

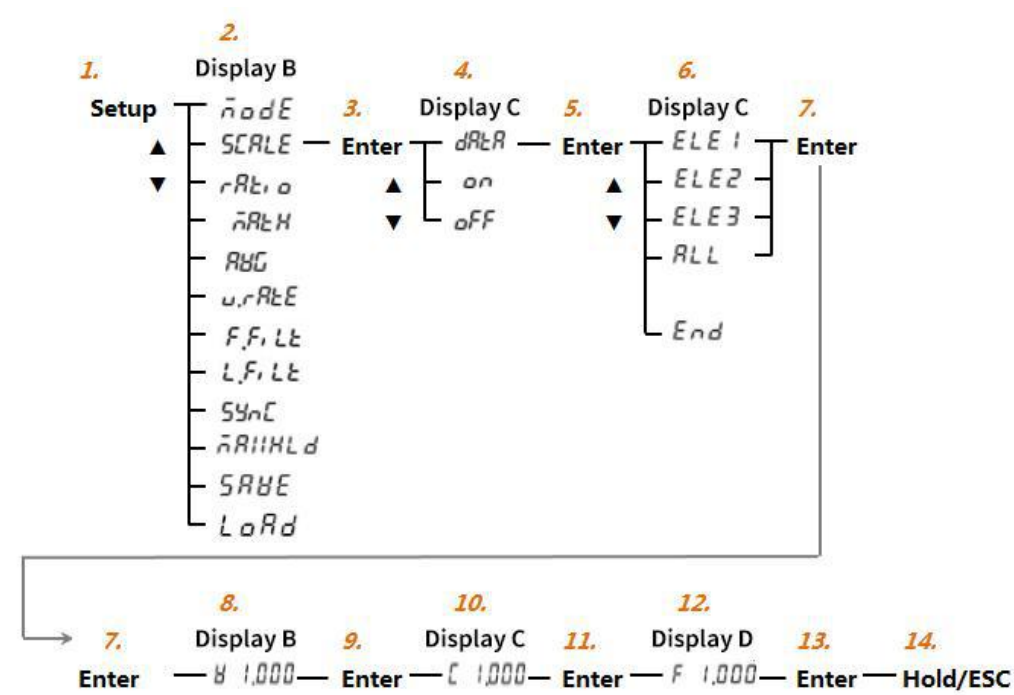
By taking Unit 1 as an example, when "ELE1" is selected in Step 6, it will enter the interface for setting the scale factor of Unit 1 separately. As shown in the figure, Display Bar A displays "ELE1", indicating that the scale factor of Unit 1 is currently being set. VT factor, CT factor and SF factor are set in Display Bars B, C and D respectively.

The setting interfaces of Unit 2, Unit 3 and Select All are the same as those of Unit 1, and only display in Display Bar A is changed to "ELE2", "ELE3" and "ALL" respectively.

3.10.3 Scale factor setting

By taking the scale setting of Unit 1 as an example, the scale factor operation methods of Unit 2 are the same as those of Unit 3.

Operating steps



- 1~7. Same as the operation steps in the previous section;
- 8. Set VT ratio (display B);
- 9. Confirm;
- 10. Set CT ratio (display C);
- 11. Confirm;
- 12. Set SF ratio (display D);
- 13. Confirm;
- 14. Exit and close the setting menu.

It is operated according to the above steps 1 to 7. After entering the scaling setting interface, Display Bar A is used to display the currently set input unit, Display Bar B is used to set VT ratio, Display Bar C is used to set CT ratio, and Display Bar D is used to set power factor.

Description of scaling function

VT ratio :

When the secondary output of VT is connected to the voltage input terminal, the VT ratio is set. The voltage range is then set based on the maximum value of the VT output. The setting range is 0.001 ~ 9999.

CT ratio :

When the secondary output of the CT or the output of the current sensor is connected to the current input terminal, the CT ratio (or the conversion ratio of the current output type current sensor) is set. Then, the current range is set according to the maximum value of CT or current sensor output. The setting range is 0.001 ~ 9999.

Power factor

By setting the power factor (SF), the active, apparent, and reactive power measurements multiplied by the factor can be displayed. The setting range is 0.001 ~ 9999.

Setting method

The set factor value can be added and subtracted by operating the navigation (up and down) key. The number of digits is set to move to the right by one digit by operating the navigation right key, and the value of adjacent digits on the right is set. The decimal point position of the value is moved by operating the navigation left key. The decimal point moves to the right by one digit in each press. After the numerical value setting is completed, the "Enter" key is pressed for confirmation, and the skip flash cursor will move to the next display bar until the VT ratio, VT ratio and SF ratio are all set.

⚠ Note:

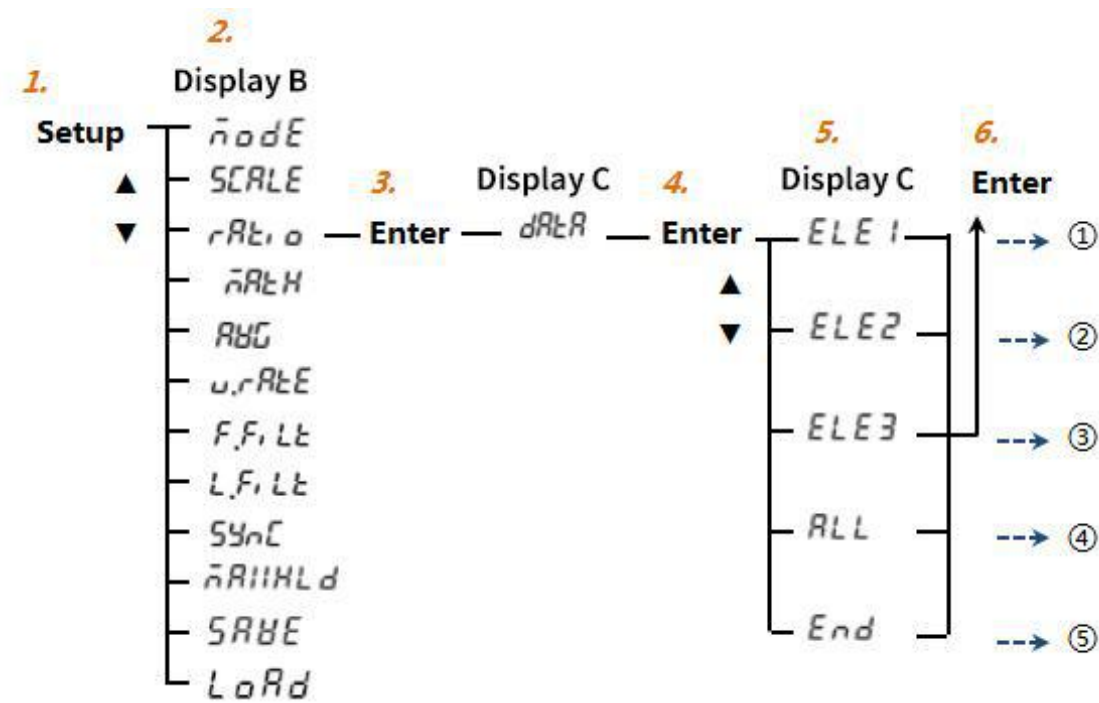
If VT, CT and SF of Channel 1 are all set to 10, the current, voltage and power of Channel 1 are amplified by 10 times, 10 times and 1,000 times respectively (VT*CT*SF).

The scale is set, and the current and voltage range will not change.

3.11 Sensor conversion ratio setting

3.11.1 Set independent unit or select all

Operating steps



1. Press the Setup key;
2. Select the "ratio" setting menu;
3. Confirm;
4. Confirm;
5. Select the setting unit (select all or independent unit);
6. Confirm the unit.

Description

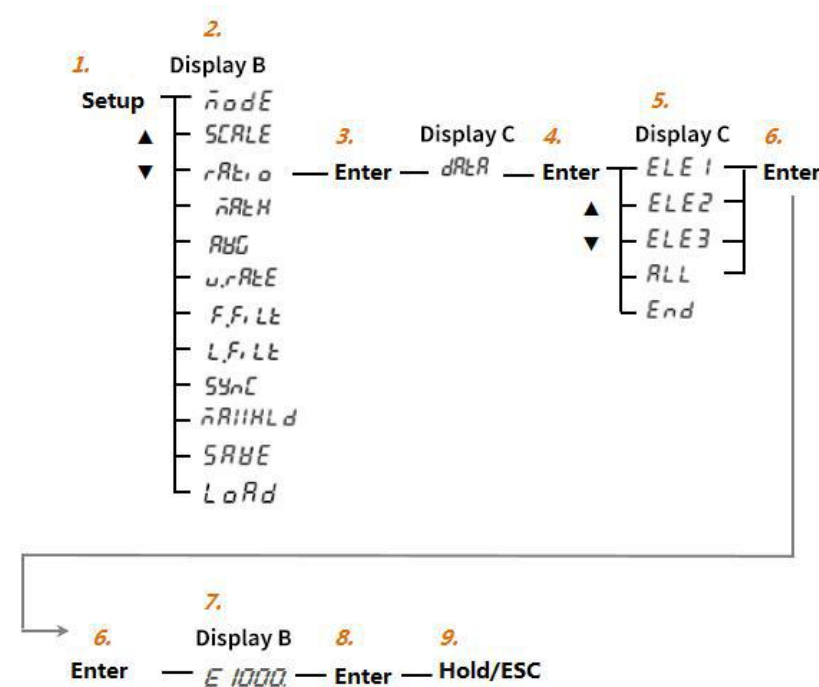
- ①→Enter a separately set interface of the sensor conversion ratio of Unit 1;
- ②→Enter a separately set interface of the sensor conversion ratio of Unit 2;
- ③→Enter a separately set interface of the sensor conversion ratio of Unit 3;
- ④→Enter a separately set interface of the sensor conversion ratio of Unit 4;
- ⑤→Exit the sensor conversion ratio setting interface and return to the superior display menu.

It is operated according to the above steps, "Data" will be displayed in Display Bar C, and the "Enter" key is pressed to enter the selection interface of the unit. The input unit number is displayed in Display Bar C, and the options can be switched by navigation (up and down) key.

3.11.2 Sensor conversion ratio setting

By taking the sensor conversion ratio setting of Unit 3 as an example, the operation method of other units is the same.

Operating steps



- 1~6. Same as the operation steps in the previous section;
7. Set the conversion ratio of external sensors;
8. Confirm;
9. Exit and close the setting menu.

After entering the sensor conversion ratio setting interface according to the above steps 1 to 6, Display Bar B is used to display the currently set input unit, and Display Bar C is used to set the sensor conversion ratio.

When the "Math" function indicator light is on on the left side of Display Bar C, it indicates that the value of the set operation function is displayed in Display Bar C at this time. When displaying the Math function value, the "Element" key operation is invalid, with no unit indication.

3.12.2 Description of operation function

Efficiency

Definition : The active power P2 measured by Unit 2 is taken as the active power input on the primary side of the converter, and the active powers P1 and P3 measured by Units 1 and 3 are taken as the power consumed on the secondary side of the converter to calculate the efficiency.
Efficiency formula: $\text{Efficiency} = (P1+P3) / P2 \times 100\%$

 **Note:**

If the denominator in the formula is less than or equal to 0.0001% of the rated range, the efficiency is displayed as "ERROR".

Peak factor

Symbols : CF U1, CF U2, CF U3, CF I1, CF I2, CF I3.
Definition: Represent the ratio operation results of peak value and RMSof signals U1/U2/U3/I1/I2/I3, respectively.

 **Note:**

When the RMS falls to 0.5% or less (peak factor 6 falls to 1% or less), the peak factor will be displayed as "Error" (see Section 9.7 of this book for details). The peak factor can be calculated even if the measurement mode is MEAN or DC.

Arithmetic operation

Symbol expression : A+B, A-B, A*B, A/B, A 2 /B, A/B 2
The values of Display Bar A and Display Bar B are taken as operation items, with the operation results displayed in Display Bar C. During operation, Display Bar C only displays the numerical value and the quantity level of units, and the data in Display Bar A and Display Bar B need to be operated according to units. If the operation formula is set to A+B, 100mA is displayed in Display Bar A, and 1V is displayed in Display Bar B, the operation result in Display Bar C is 1.1.

 **Note:**

When the function displayed in Display Bar A is integral elapsed time (TIME), the calculation result will be displayed as "----", with no data. When dividing, the operation value is displayed as "Error" if the value of the display function in Display Bar B is equal to 0 or no data is displayed,.

Integral average active power

Symbols : AV P1/ AV P2/ AV P3/ AV P4
Definition : AV P1: Display the result of the division of watt-hour (WP1) of Unit 1 by the integral time.
AV P2 : display the result of the division of watt-hour (WP2) of unit 2 and integral time.
AV P3 : display the result of the division of watt-hour (WP3) of unit 3 and integral time.
AV P4 : display the result of the division of watt-hour (WPΣ) of unit Σ and integral time.

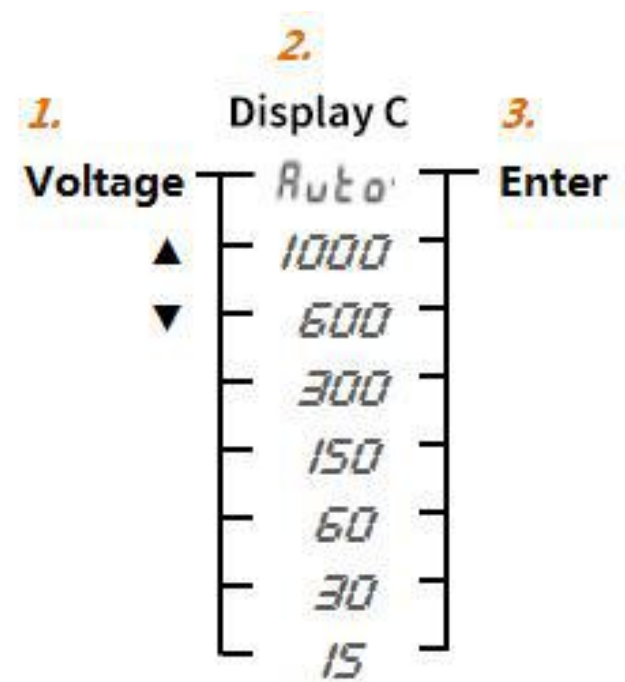
 **Note:**

The value of watt-hour WPΣ depends on the wiring mode. This operation function is only useful during integral period (integral operation or integral pause). If the integral is reset, the values of watt-hour and integral time will become zero, and the result shows "-----" without any data.

Range Settings

4.1 Setting of voltage range

Operating steps



- 1. Press the Voltage key;
- 2. Select the voltage range;
- 3. Confirm.

After pressing the Voltage key, the range options are displayed in Display Bar C and can be switched with navigation (up and down) keys. In the process of setting the voltage range, the "V" function indicator light on the right side of Display Bar C is on.

Fixed voltage range

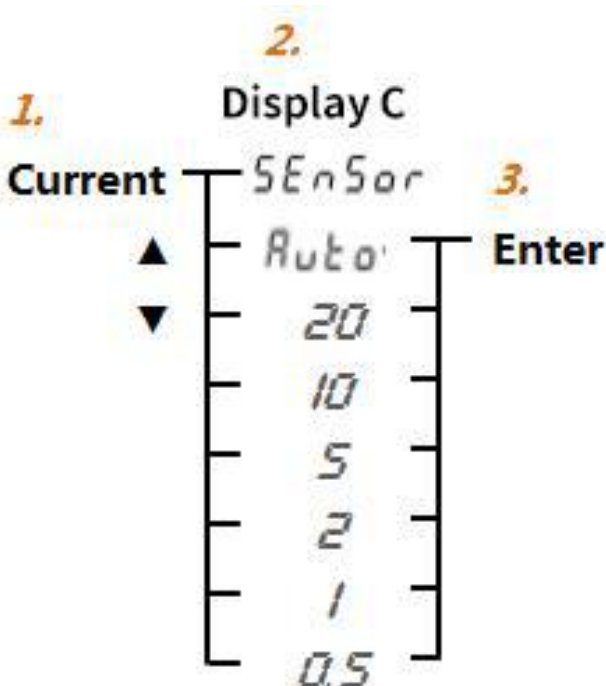
When the peak factor is set to 3, the optional voltage range includes 15V, 30V, 60V, 150V, 300V, 600V and 1000V.
When the peak factor is set to 6, the optional voltage range includes 7.5V, 15V, 30V, 75V, 150V, 300V and 500V.

Automatic voltage range

The instrument supports automatic voltage range mode, and the automatic range options are consistent with the fixed range options. The operation method is the same as that of above fixed range settings. When switching in Display Bar C, select "Auto" option and press "Enter" key to confirm. At this time, the voltage has been set to automatic range mode, and the voltage "Auto" indicator light on the main panel is on.

4.2 Setting of voltage range

Operating steps



- 1. Press the Current key;
- 2. Select the current range;
- 3. Confirm.

After pressing the Current key, the range options are displayed in Display Bar C and can be switched with navigation (up and down) keys. In the process of setting the current range, the "A" function indicator light on the right side of Display Bar C is on.

Fixed current range

When the peak factor is set to 3, the optional current range includes 0.5A, 1A, 2A, 5A, 10A and 20A.
When the peak factor is set to 6, the optional current range includes 0.25A, 0.5A, 1A, 2.5A, 5A and 10A.

Automatic current range

The instrument supports automatic current range, and the automatic range options are consistent with the fixed range options. The operation method is the same as that of above fixed range settings. When switching in Display Bar C, select "Auto" option and press "Enter" key to confirm. At this time, the current has been set to automatic range mode, and the current "Auto" indicator light on the panel is on.

4.3 Power range

The measuring range of active power (power range) is determined by the wiring mode, voltage range and current range. The details are as follows.

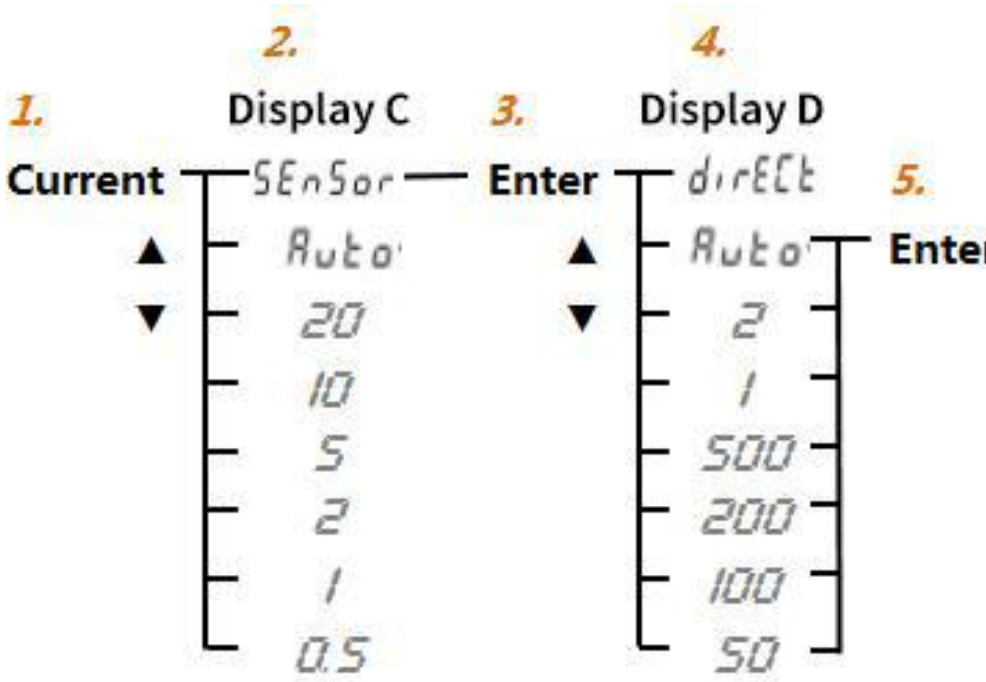
Wiring mode	Power range calculation
1P2W	Voltage range*current range
1P3W	Voltage range*current range*2
3P3W	
3V3A	
3P4W	Voltage range*current range*3

⚠ Note:

When the result of voltage range × current range reaches or exceeds 1,000W, the display unit becomes "kW". When it exceeds 1,000kW, the unit becomes "MW".

4.4 Setting of the range for external current sensor

Operating steps



- 1. Press the Current key;
- 2. Select the current sensor option;
- 3. Confirm;
- 4. Set the range of external sensor;
- 5. Confirm.

After pressing the Current key, select the "Sensor" option in Display Bar C, and the range options of external current sensor are displayed in Display Bar D and can be switched with navigation (up and down) keys. In the process of setting the range of external current sensor, the "V" function indicator light behind Display Bar D is on.

Fixed range of external current sensor

When the instrument is connected with an external current sensor, it can support both low-range board card and high-range board card.

When the instrument is equipped with a low-range board card :

When the peak factor is set to 3, the optional range includes 50mV, 100mV, 200mV, 500mv, 1V and 2V;

When the peak factor is set to 6, the optional range includes 25mV, 50mV, 100mV, 250mV, 0.5V and 1V.

When the instrument is equipped with a high-range board card :

When the peak factor is set to 3, 2.5V, 5V and 10V are optional,

When the peak factor is set to 6, 1.25V, 2.5V and 5V are optional.

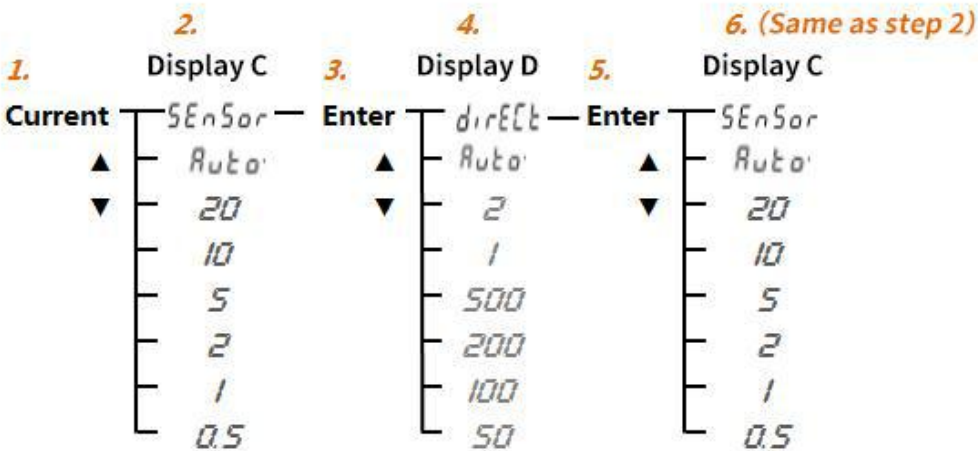
Automatic range of external current sensor

The automatic range options of external current sensor are consistent with the fixed range options of external current sensor. According to the above instructions, when switching in Display Bar D, select "Auto" option and press "Enter" key to confirm. At this time, the external current sensor has been set to automatic range mode, and the current "Auto" indicator light on the panel is on.

4.5 Setting interface direct switching function

The instrument can realize the function of switching from the range setting interface of external current sensor to the current range setting interface of direct input. The operation method is the same as the above steps. When switching in Display Bar D, select "Direct" option and press "Enter" key to confirm, and then the setting interface will switch to the current range setting interface during direct input.

Operating steps



1. Press the Current key;
2. Select the current sensor option;
3. Confirm;
4. Select the direct switching option;
5. Confirm;
6. The same as step 2, you can enter the current range setting interface during direct input.

Description

Switch the range options in Display Bar C with navigation (up and down) keys, and set the current range during direct input. The "A" function indicator light behind Display C is on, which is consistent with the content in Section 4.2. When the user does not set the current range of direct input, but exits the setting interface, the setting cursor returns to Display Bar D to display the current range of external current sensor.

4.6 Automatic range switching

Turn on the automatic range mode, in which the range will be automatically switched according to the following rules.

Range upshift condition – the range upshift occurs when any one of the following conditions is met :

- Urms or Irms exceeds 110% of the currently set range
- The Upk or lpk value of input signal exceeds 330% of the currently set range (660% when the peak factor is 6)

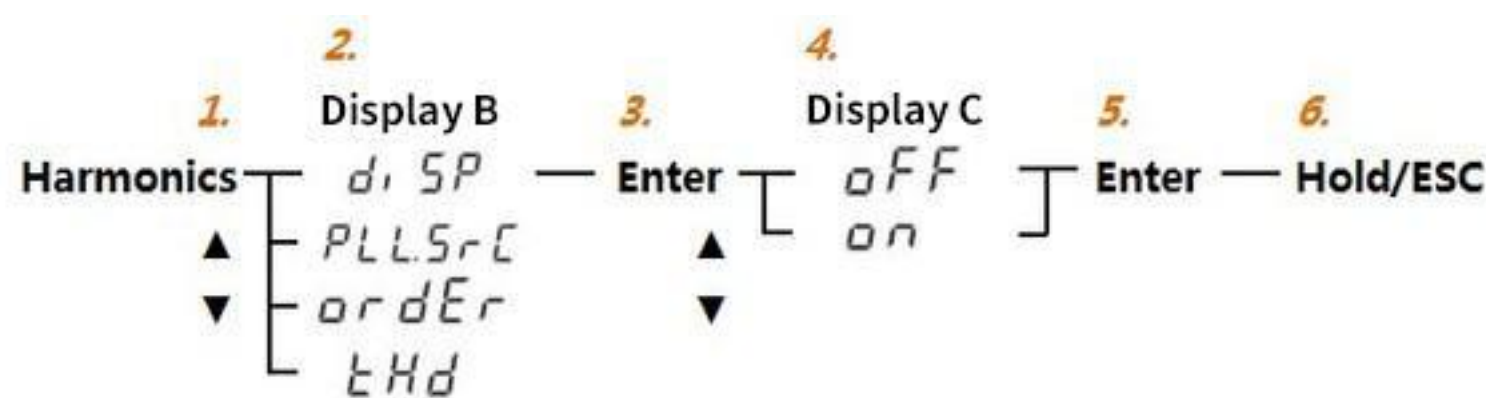
Range downshift condition – the range downshift occurs when all of the following conditions are met :

- Urms or Irms is less than or equal to 30% of the currently set range
- The Upk or lpk value of input signal is less than 300% of the lower range (600% when the peak factor is 6)

Harmonic Measurement Settings

5.1 Turn on/off the harmonic measurement display

Operating steps



- 1. Press the Harmonics key;
- 2. Select the display option;
- 3. Confirm;
- 4. Set to turn on or off the harmonic display function;
- 5. Confirm;
- 6. Exit and close the setting menu.

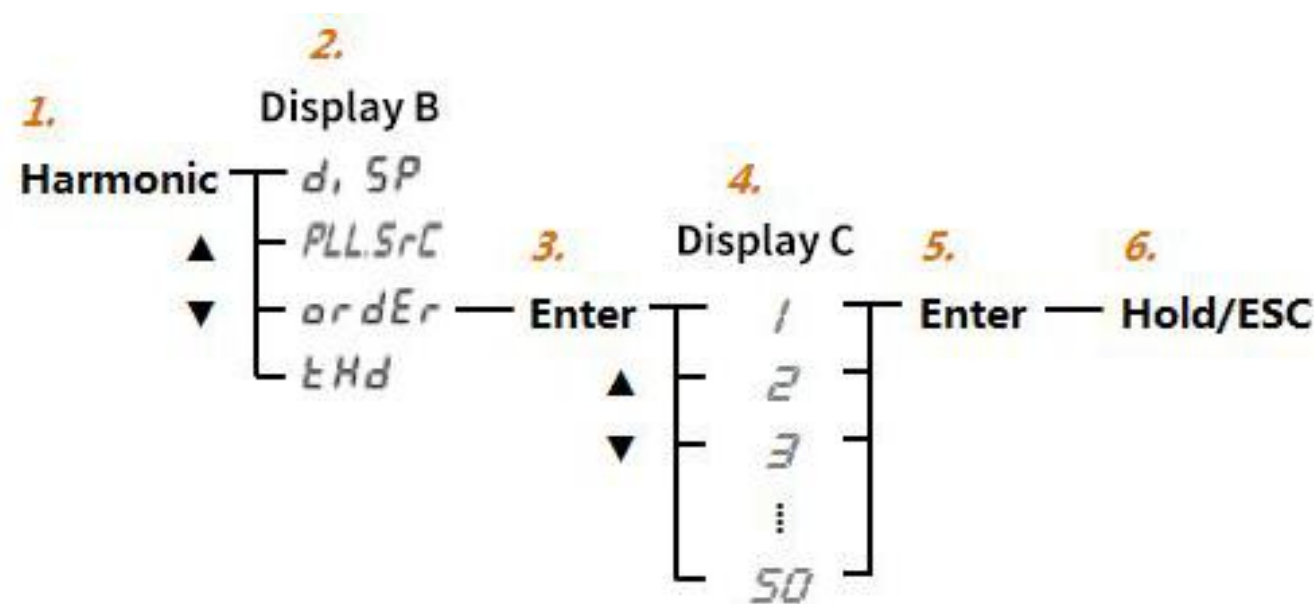
Following the above steps 1~3, the ON/OFF options of harmonics measured value display will be displayed in Display Bar C. You can switch between the two options of "OFF" or "ON", and then press "Enter" key to complete the setting. The instrument returns to the previous menu to display. After setting to turn on the harmonic measurement display, the "Harmonics" indicator light on the panel is on.

Harmonics measured value display

After turning on the harmonic measurement data display, return to the main interface to display harmonic measurement value, and switch the display function by pressing the "Function" key. (See Section 1.4 of this volume for related operating instructions)

5.2 Setting of harmonic number

Operating steps



- 1. Press the Harmonics key;
- 2. Select the harmonic number setting menu;
- 3. Confirm;
- 4. Set the number of harmonic measurement;
- 5. Confirm;
- 6. Exit and close the setting menu.

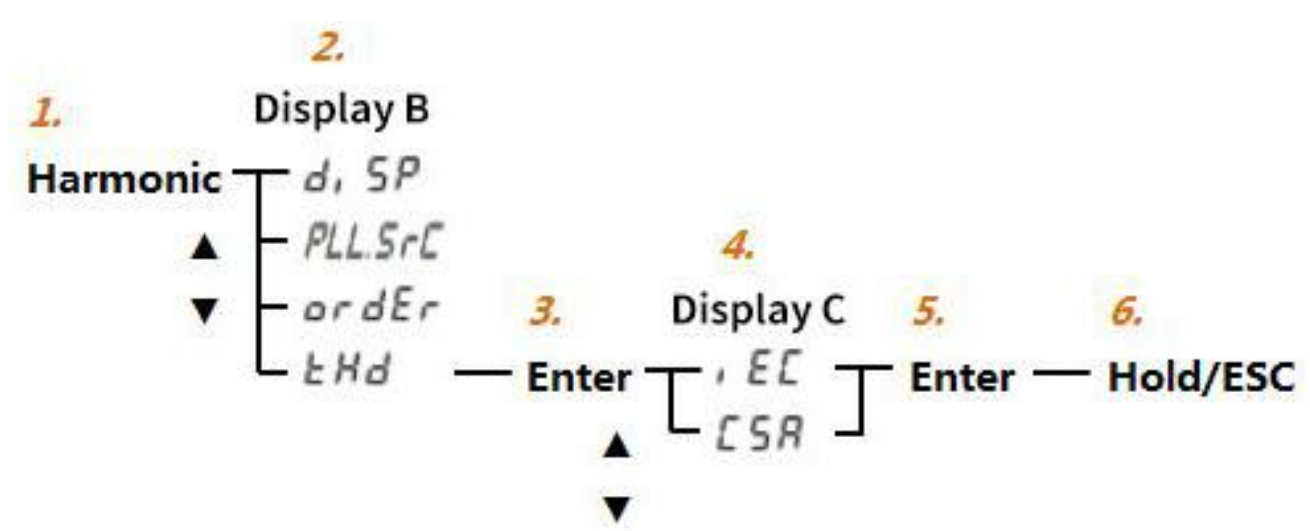
Following the above steps 1~3, the number of harmonic measurement will be displayed in Display Bar C. You can set the harmonic number with navigation (up, down, left and right) keys, and then press "Enter" key to complete the setting. The instrument returns to the superior menu to display, and pressing the "Hold/ESC" key can exit the setting interface.

Description

The number of harmonic measurement can be set to 1~50, but the actual maximum number of harmonic analysis depends on the magnitude of fundamental frequency. When the harmonic number exceeds the specified upper limit, the symbol "-----" is displayed in Display Bar B.

5.3 Setting of THD formula

Operating steps



- 1. Press the Harmonics key;
- 2. Select the "THD" formula setting menu;
- 3. Confirm;
- 4. Set the THD formula type;
- 5. Confirm;
- 6. Exit and close the setting menu.

Following the above steps 1~3, the THD formula options will be displayed in Display Bar C. You can switch between the two formula standards "IEC" or "CSA", and then press "Enter" key to complete the setting. The instrument returns to the superior menu to display, and pressing the "Hold/ESC" key can exit the setting interface.

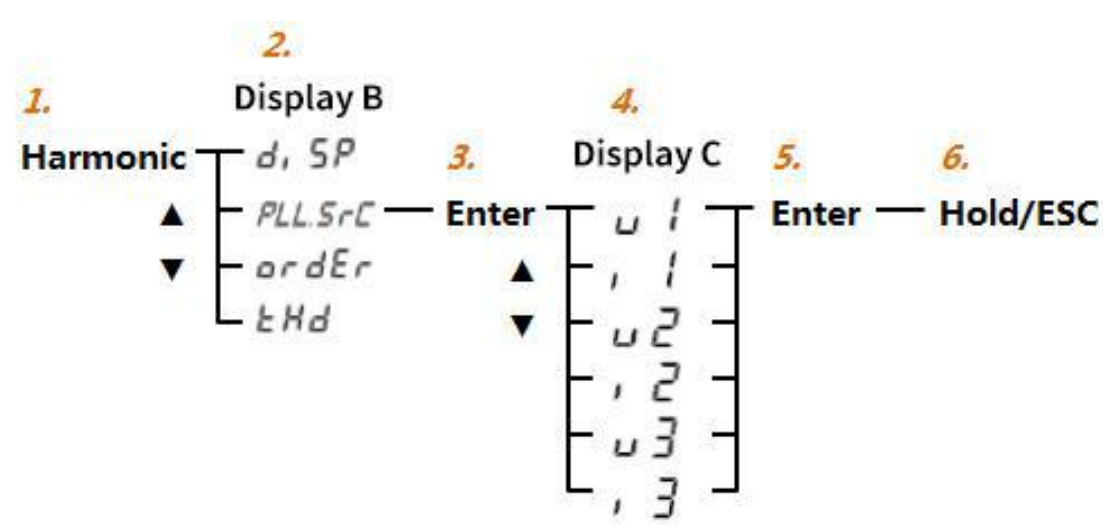
Description

IEC: Calculate the ratio between the effective value of 2~50 number of harmonics and that of fundamental wave (1 time).
CSA: Calculate the ratio between the effective value of 2~50 number of harmonics and that of 1~50 number of harmonics.
⚠ NOTE: When the upper limit of harmonic number is less than 50, only the upper limit reaching the number will be calculated.

5.4 Setting of PLL source

Set the PLL (Phase Locked Loop) for determining the fundamental frequency; frequency synchronization source, and the fundamental frequency is the reference for the number of harmonic measurements. Selecting the input signal with less distortion or fluctuation as PLL source can make harmonic measurement more stable.

Operating steps



- 1. Press the Harmonics key;
- 2. Select the "PLL.src" setting menu;

- 3. Confirm;
- 4. Set the PLL source signal;
- 5. Confirm;
- 6. Exit and close the setting menu.

Following the above steps 1~3, the PLL source setting options will be displayed in Display Bar C. You can switch between the PLL source options with navigation (up and down) keys, and then press "Enter" key to complete the setting. The instrument returns to the superior menu to display, and pressing the "Hold/ESC" key can exit the setting interface.

Description

PLL source	Description	PLL source	Description
U1	Set PLL source to voltage of unit 1	I1	Set PLL source to current of unit 1
U2	Set PLL source to voltage of unit 2	I2	Set PLL source to current of unit 2
U3	Set PLL source to voltage of unit 3	I3	Set PLL source to current of unit 3

 **Note:** Set PLL source to current of unit 3

Integral Settings

6.1 Integral start & stop

Integral start and integral indicator light display

Press the Start/Stop key, it flashes and the integral starts. The integral value or average active power (operation function) during integral is displayed in Display Bar C, and the integral time is displayed in Display Bar A.

When integral is in progress, press this key again, the key light will stay on, the integral will be paused, and the displayed integral value and integral time will be held.

Set/Reset: press the key when integral is paused to reset it. The Start/Stop light will be off and the integral display item will be cleared.

Conditions of integral stop

- 1) It reaches the integral time specified by integral timer during normal integral.
- 2) The integral time reaches the maximum.
- 3) The integral value reaches the maximum or minimum display value.

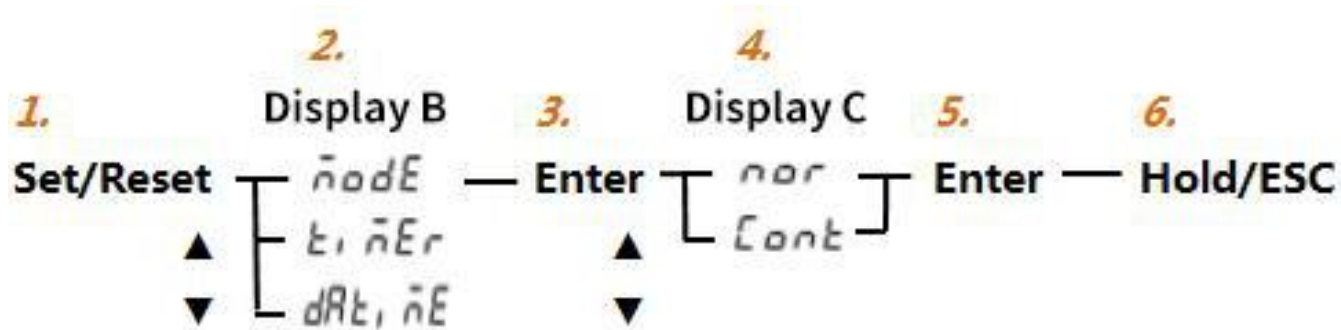
Integral display function

Press the Function key of Display Bar A or Display Bar C to display Time (integral time), WH/WH± (integral power), AH/AH± (current) or Math (average active power during integral). The display functions are switched in a certain order every time the Function is pressed.

(See Section 1.4 of this volume for details)

6.2 Setting of integral mode

Operating steps



- 1. Press the Set/Reset key;
- 2. Select the integral mode setting menu;
- 3. Confirm;
- 4. Select the integral mode;
- 5. Confirm;
- 6. Exit and close the setting menu.

Following the above steps, the integral mode setting option will be displayed in Display Bar C. You can switch between the two modes of "NOR" or "CONT", and then press "Enter" key to confirm and complete the setting. At this time, the flashing cursor returns to Display Bar B, and you can press "Hold/ESC" key to exit the setting interface.

Integral mode

NOR mode :

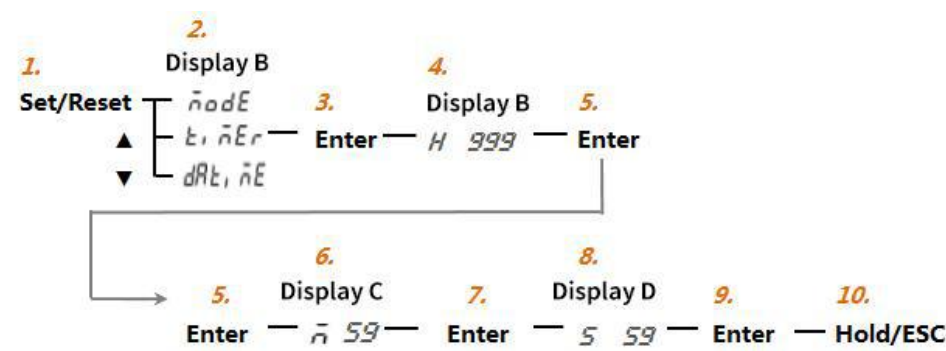
In normal integral mode, the integral starts after Start key is pressed and stops until the specified stop time is reached or the stop key is pressed, and the integral time and integral value will be held.

CONT mode :

Cyclic integral mode, in which the integral starts after Start key is pressed. When it reaches the time specified by the timer, the integral will reset and restart automatically, and the cycle will continue.

6.3 Setting of integral timer

Operating steps



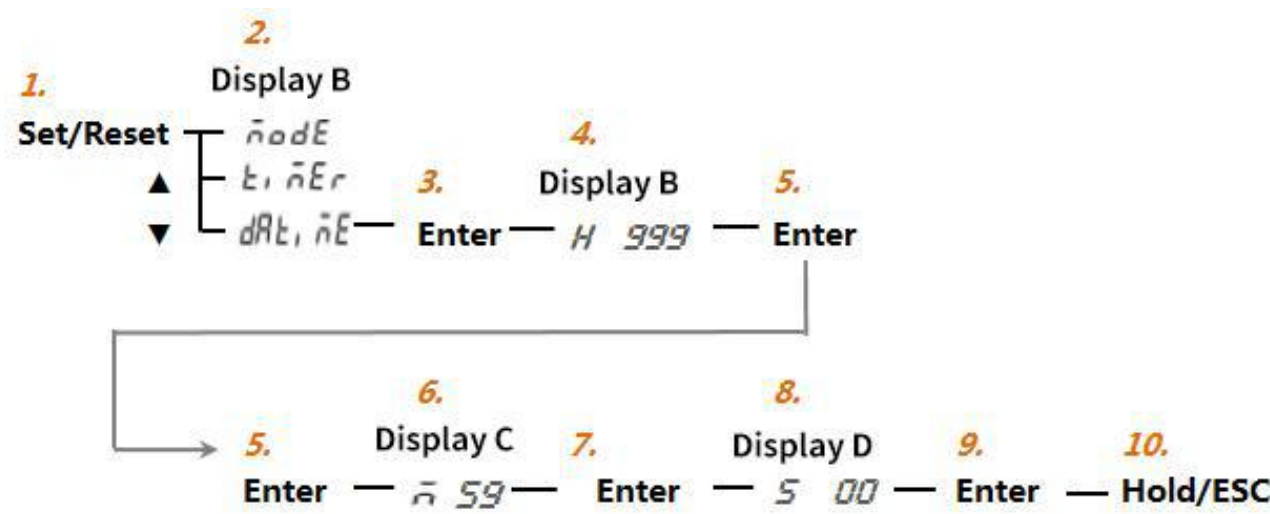
1. Press the Set/Reset key;
2. Select the integral timer setting menu;
3. Confirm;
4. Set the hour (Display B);
5. Confirm;
6. Set the minute (Display C);
7. Confirm;
8. Set the second (Display D);
9. Confirm;
10. Exit and close the setting menu.

Follow the above steps 1~3 to enter the timer setting interface, and the setting cursor will be displayed in Display Bar B. When setting with navigation keys, press "Enter" to confirm, switch the setting cursor to Display Bar C to set the minute, confirm it again, and then switch the setting cursor to Display Bar D to set the second. After the hour, minute and second are set, press "Enter" again. The instrument returns to the previous menu to display, and press "Hold/ESC" key to exit the setting interface.

Setting range of integral timer: 00:00:00~10000:00:00. The setting time of the actual integral timer is related to the data update rate, and must be greater than or equal to the update rate cycle, otherwise the setting is invalid.

6.4 Setting of integral D/A timer

Operating steps



1. Press the Set/Reset key;
2. Select the integral D/A timer setting menu;
3. Confirm;
4. Set the hour (Display B);
5. Confirm;
6. Set the minute (Display C);
7. Confirm;
8. Set the second (Display D);
9. Confirm;
10. Exit and close the setting menu.

Follow the above steps 1~3 to enter the DA timer setting interface, and the setting cursor will be displayed in Display Bar B. When setting with navigation keys, press "Enter" to confirm, switch the setting cursor to Display Bar C to set the minute, confirm it again, and then switch the setting cursor to Display Bar D to set the second. After the hour, minute and second are set, press "Enter" again. The instrument returns to the previous menu to display, and press "Hold/ESC" key to exit the setting interface.

Setting range of integral D/A timer: 00:00:00~10000:00:00.

6.5 Integral function limitations

When the integral is in progress

The following settings cannot be made:

Measurement mode, wiring mode, measurement range, peak factor, synchronous source setting, input filter, data update rate, number of harmonic measurement, operational formula of harmonic measurement distortion rate, PLL source setting, integral mode, integral timer setting, integral start action and integral reset.

Functions cannot be executed:

Proportion function setting, average function setting, BIT operation, Math operation function, zero level compensation function, configuration file saving and loading function.

When the integral is paused

The following settings cannot be made:

Measurement mode, wiring mode, measurement range, peak factor, synchronous source setting, input filter, data update rate, number of harmonic measurement, operational formula of harmonic measurement distortion rate, PLL source setting, integral mode, integral timer setting and integral stop action.

Functions cannot be executed:

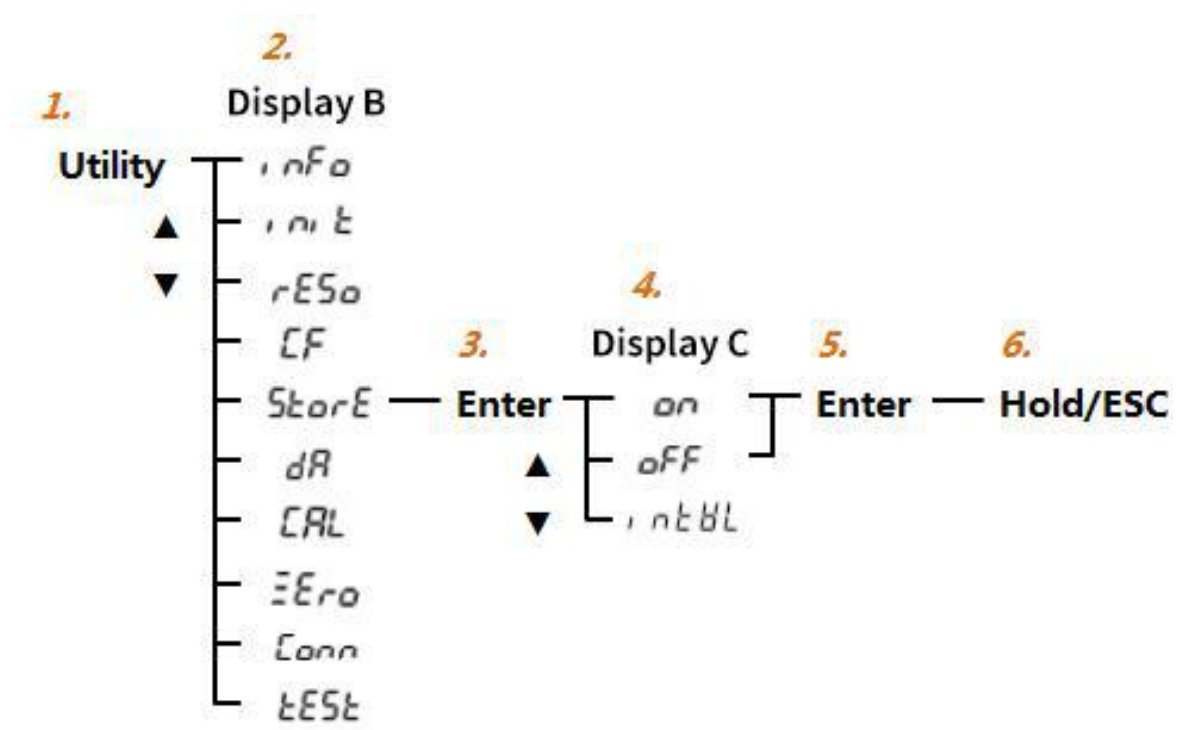
Proportion function setting, average function setting, BIT operation, Math operation function, zero level compensation function, configuration file saving and loading function.

Storage of Measurement Data

7.1 Turn on/off the storage function

Measurement data can be stored. The stored data cannot be called out directly in the display frame of instrument, but can be analyzed by a computer or a connected upper computer through the communication function.

Operating steps



- 1. Press Utility key;
- 2. Select the "store" setting menu;
- 3. Confirm;
- 4. Set the storage function ON/OFF;
- 5. Confirm;
- 6. Exit and close the setting menu.

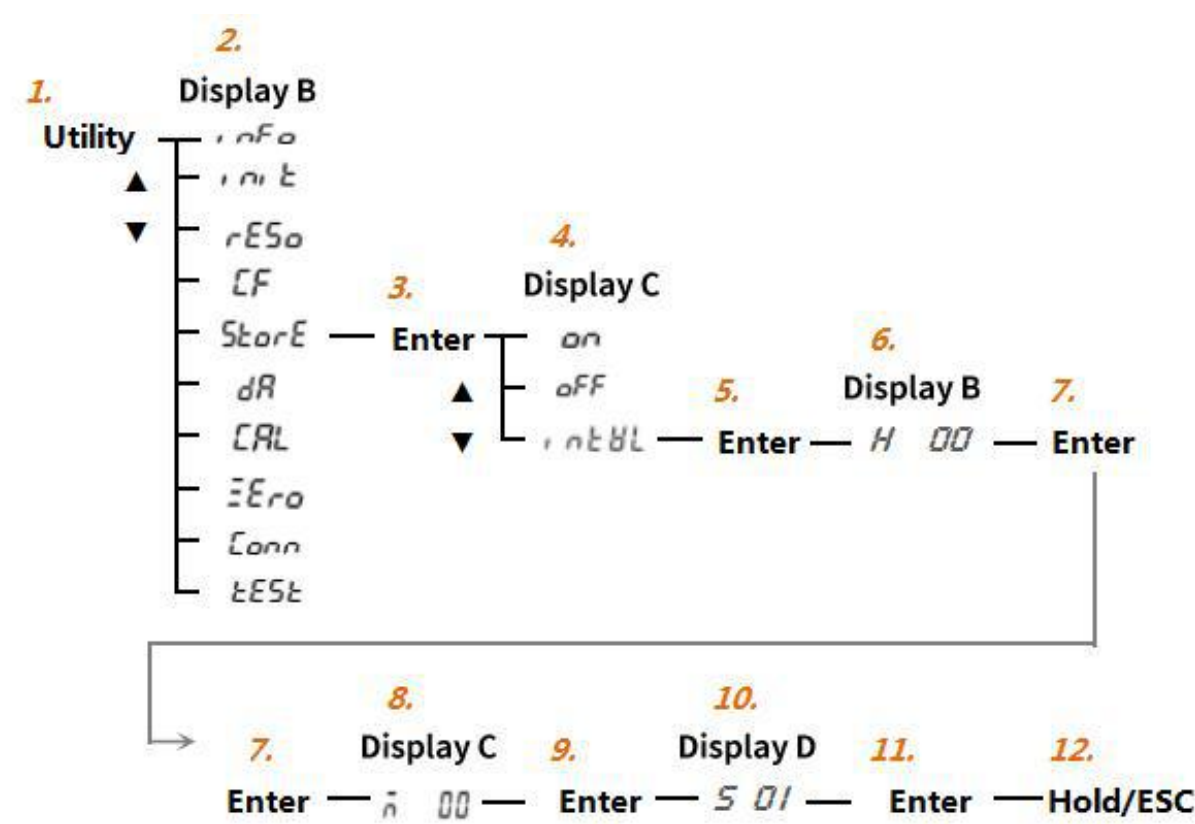
Follow the above steps 1~3 to enter the storage setting interface. Switch options "ON", "OFF" and "INTVAL" in Display Bar C, and select "ON" or "OFF" setting to turn on or off the storage function.

ON: turn on the storage function, the Store indicator light on the panel is on, and the setting interface returns to the previous menu.

OFF: turn off the storage function, the Store indicator light on the panel is off, and the setting interface returns to the previous menu.

7.2 Setting of storage interval

Operating steps



1. Press Utility key;
2. Select the "store" setting menu;
3. Confirm;
4. Set the storage time interval;
5. Confirm;
6. Set the hour (Display B);
7. Confirm;
8. Set the minute (Display C);
9. Confirm;
10. Set the second (Display D);
11. Confirm;
12. Exit and close the setting menu.

Follow the above steps 1~5 to enter the setting interface of storage time interval. Display Bar A displays "Time" fixedly, and Display Bars B, C and D are used for setting the hour, minute and second of storage time interval respectively. Set the hour, minute and second in turn with navigation (up and down) keys. After pressing "Enter" key to confirm, the setting cursor jumps to the next bar.

Setting range of storage interval is 00:00:00~99:59:59. In addition, the storage time interval is affected by the data update rate, and the set time interval must be greater than or equal to the update rate, otherwise the setting is invalid. If the set storage time interval is less than the update rate, the storage time interval will automatically become the current update rate time. When the storage interval is set to 0:0:0, the storage interval is the same as the specified data update interval.

7.3 Description of storage function

Storage items

Storage items include all conventional measurement data, harmonic measurement data (when the harmonic measurement data display is turned on), operation data, integral data and frequency (voltage and current). When the harmonic data display is turned off, the harmonic data will not be stored.

When the maximum hold function is turned on, the display values of U (voltage), I (current), P (active power), S (apparent power), Q (reactive power), U+pk/U-pk (voltage peak), I+pk/I-pk (current peak) and P+pk/P-pk (power peak) will hold the maximum values. The stored measurement data also holds the maximum value.

When the storage is running, if the "Hold" key is pressed to hold the display, the measurement operation and the storage interval time count will be held (paused), and the data storage will also be held (paused). Press the Hold key again to keep the storage running.

Storage limitations

When the storage is being executed, the following settings cannot be made: measurement mode, wiring mode, measurement range, peak factor, synchronous source setting, input filter, data update rate, number of harmonic measurement, operational formula of harmonic measurement distortion rate, PLL source setting, storage time interval setting and zero setting.

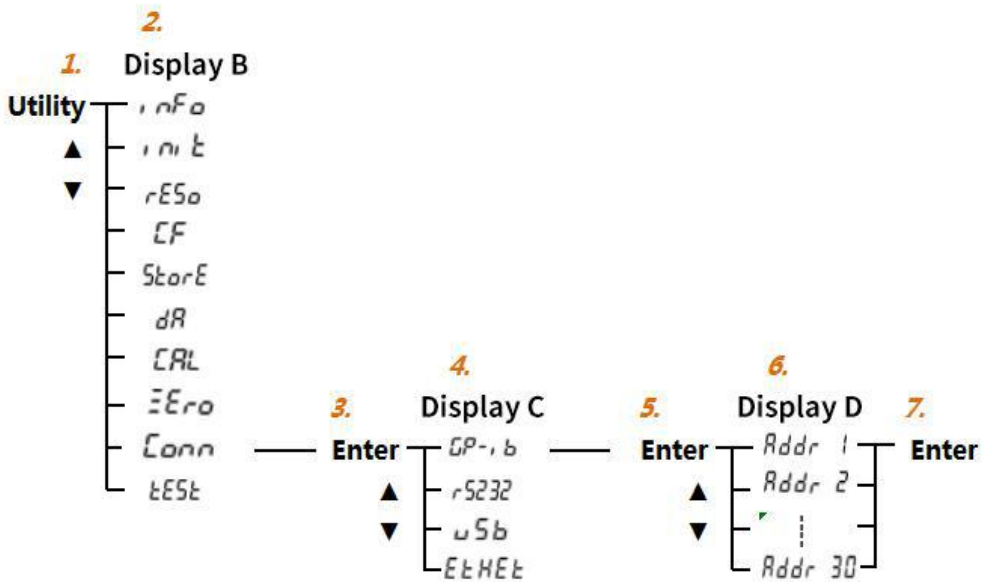
Functions cannot be executed: proportion function setting, average function setting, BIT operation, Math operation function, zero level compensation function, configuration file saving and loading function.

Network Communication Settings

8.1 Setting of GP-IB bus

The remote control function of the instrument can be realized through GP-IB bus communication. When connecting to PC, it is required to set the address of the instrument in GP-IB system, which is unique and can be set between 1~30.

Operating steps



- 1. Press Utility key;
- 2. Select the "Conn" setting menu;
- 3. Confirm;
- 4. Select the GP-IB communication mode;
- 5. Confirm;
- 6. Set the address of GP-IB (1~30);
- 7. Confirm.

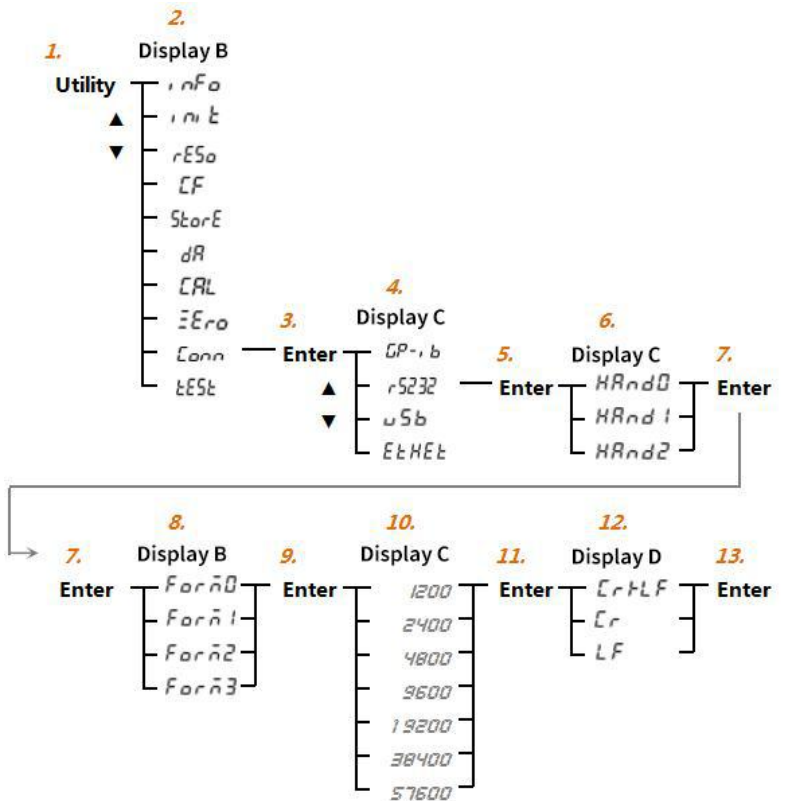
Follow the above steps 1~5 to enter the setting interface of GP-IB. Display Bars A, B and C fixedly display the characters "UTIL", "CONN" and "GP-IB" respectively, Display Bar D is used to set the address bit, in which the address can be switched with navigation (up and down) keys. After the setting is completed by pressing the "Enter" key, the display returns to the main interface to display the measured value. Select either GP-IB or RS-232.

⚠ Note:

The instrument does not support setting the same GPIB address in GPIB cascade mode.

8.2 Setting of RS-232 interface

Operating steps



1. Press Utility key;
2. Select the "Conn" setting menu;
3. Confirm;
4. Select the RS232 communication mode;
5. Confirm;
6. Set the handshake mode of RS232 communication;
7. Confirm;
8. Set the data format of RS232 communication;
9. Confirm;
10. Set the baud rate of RS232 communication;
11. Confirm;
12. Set the terminal mode of RS232 communication;
13. Confirm and complete the setting.

Follow the above steps 1~5 to enter the setting interface of RS-232 interface. Display Bars A, B, C and D display the parameters to be set respectively. In the process of setting, press "Enter" key in turn to jump directly to the setting of the next parameter item until the parameters in Display Bar D are set. After confirmation, the display returns to the main interface to display the measured value.

Display Bar A is used to set the handshake mode, and the options can be switched between "Hand0, Hand1 and Hand2";

Display Bar B is used to set the data format, and the options can be switched between "Form0, Form1, Form2 and Form3";

Display Bar C is used to set the baud rate, and the options can be switched between "1200, 2400, 4800, 9600, 19200, 38400 and 57600";

Display Bar D is used to set the terminal mode, and the options can be switched between "Cr+Lf, Cr and Lf".

Configuration description Handshake mode

To use RS-232 interface to communicate with PC, the equipment of both sides must negotiate a set of rules to ensure the correct transmission of data. Such negotiation is called a handshake. Since there are many handshake modes between the instrument and PC, it must be ensured that both the instrument and PC shall select the same method.

Options of handshake mode are as below

Handshake mode	Data transmission control (transmit data to PC)			Data receiving control (receive data from PC)		
	Software handshake	Hardware handshake	No handshake	Software handshake	Hardwar handshake	No handshake
	Stop sending when X-OFF is received, and resume sending when X-ON is received	Stop sending when CB (CTS) is wrong; resume sending when it is correct		Send X-OFF when the receive buffer is 3/4 full; send X-ON when it is full.	Set CA (RTS) to false when the receive buffer is 3/4; set CA (RTS) to 1/4 full.	
Hand0			.			.
Hand1	.			.		
Hand2		.			.	

Data format

Data format includes the format of start bit, data bit, parity bit and stop bit. The instrument allocates four formats for the data format.

Data format	Start bit	Data bit	Parity bit	Stop bit
Form0	1	8	NONE	1
Form1	1	7	ODD	1
Form2	1	7	EVEN	1
Form3	1	7	NONE	2

Baud rate

Baud rate refers to the data transmission rate sent from one device to another. In unit of bits per second, the baud rate can be set by the instrument includes 1200, 2400, 4800, 9600, 19200, 38400 and 57600.

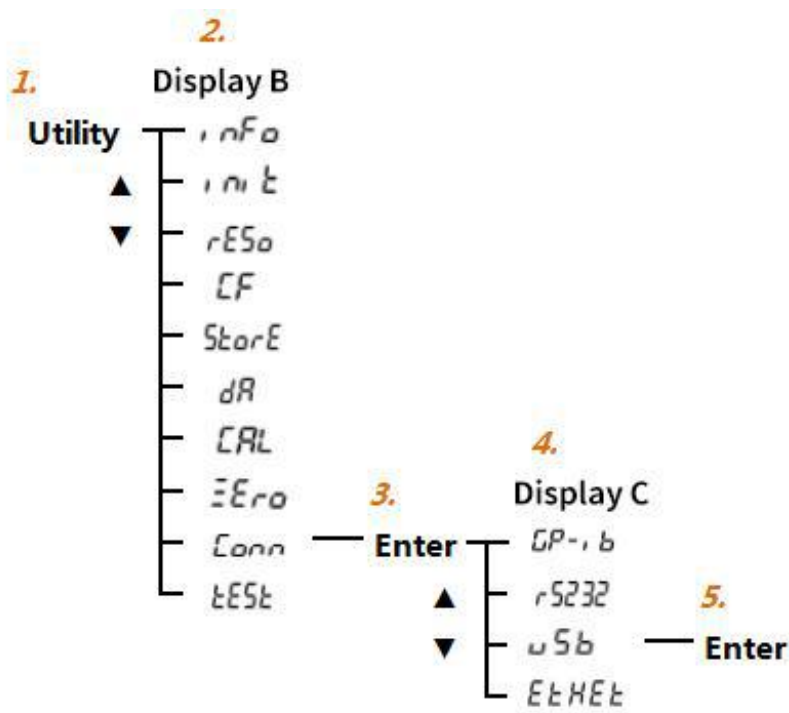
Terminal mode

Terminal mode refers to the terminal characters used at the end of sending data. When sending data from the instrument, "CR", "LF" and "CR+LF" can be used as terminators. When sending data to the instrument, "LF" and "CR+LF" can be used as terminators.

8.3 Setting of USB bus

Connect the instrument to PC through USB bus to realize remote control between the instrument and PC.

Operating steps



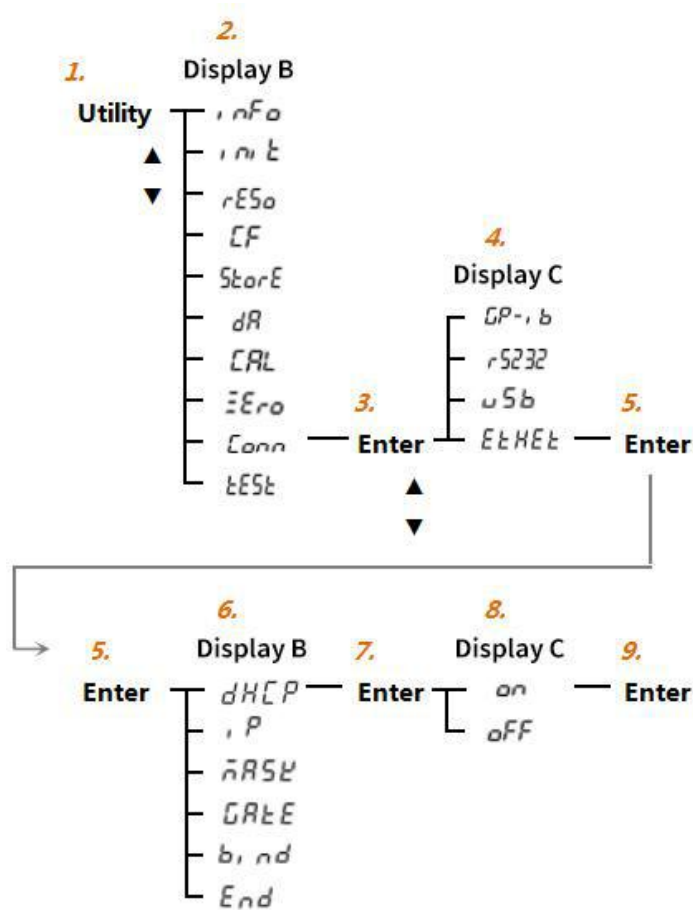
- 1. Press Utility key;
- 2. Select the "Conn" setting menu;
- 3. Confirm;
- 4. Select the USB communication mode;
- 5. Confirm.

Follow the above steps and select "USB" in step 4. Press "Enter" key to confirm, and the instrument returns to the previous menu to display.

8.4 Setting of Ethernet

8.4.1 Turn on/off the DHCP

Operating steps

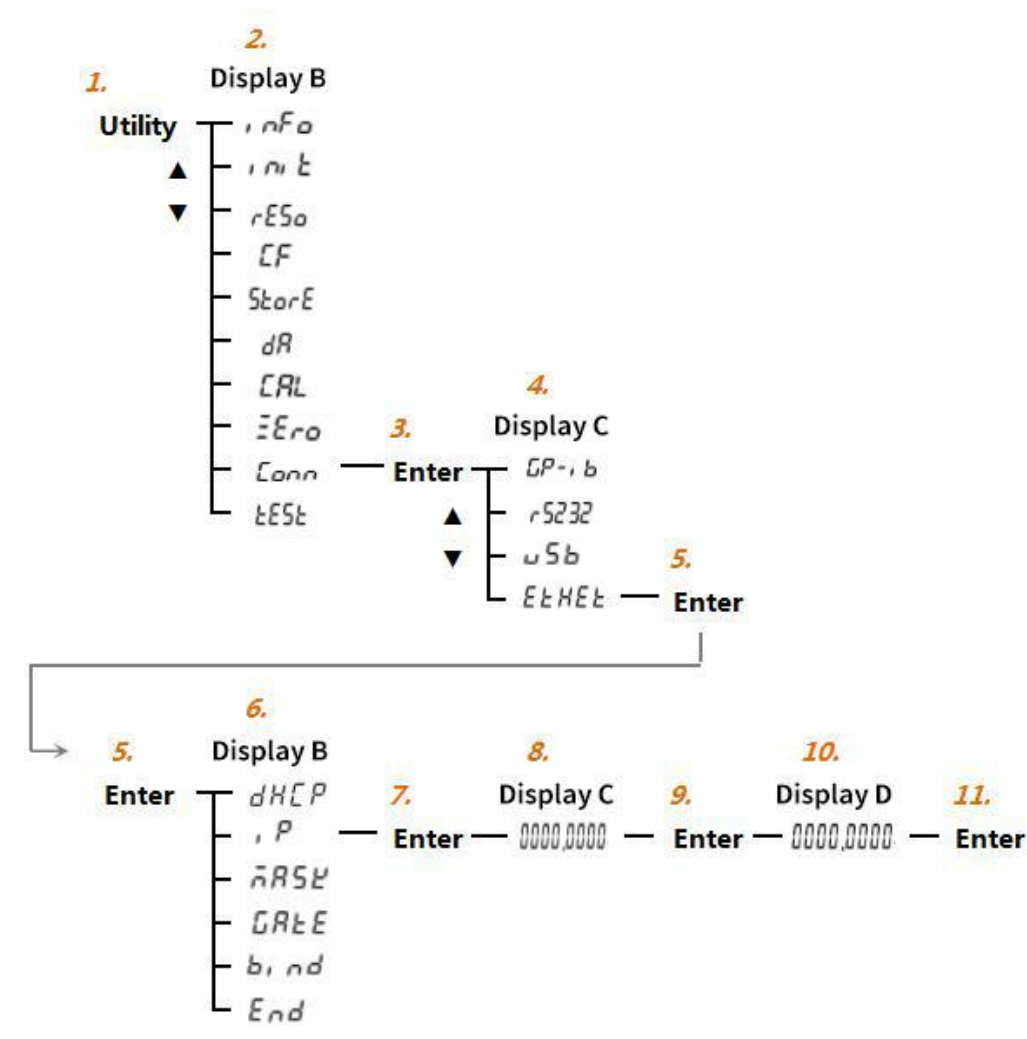


1. Press Utility key;
2. Select the "Conn" setting menu;
3. Confirm;
4. Select the Ethernet communication mode;
5. Confirm;
6. Enter to the Ethernet DHCP setting;
7. Confirm;
8. Set the DHCP switch;
9. Confirm.

Follow the above steps 1~7 to enter the setting interface of Ethernet DHCP switch. Select the ON/OFF state with navigation (up, down, left and right) keys. After the setting is completed, the instrument returns to the previous menu to display.

8.4.2 Setting of Ethernet IP

Operating steps



1. Press Utility key;
2. Select the "Conn" setting menu;
3. Confirm;
4. Select the Ethernet communication mode;
5. Confirm;
6. Enter to the Ethernet IP address setting;
7. Confirm;
8. Set the first two segments of IP address (Display C);
9. Confirm;
10. Set the last two segments of IP address (Display D);
11. Confirm.

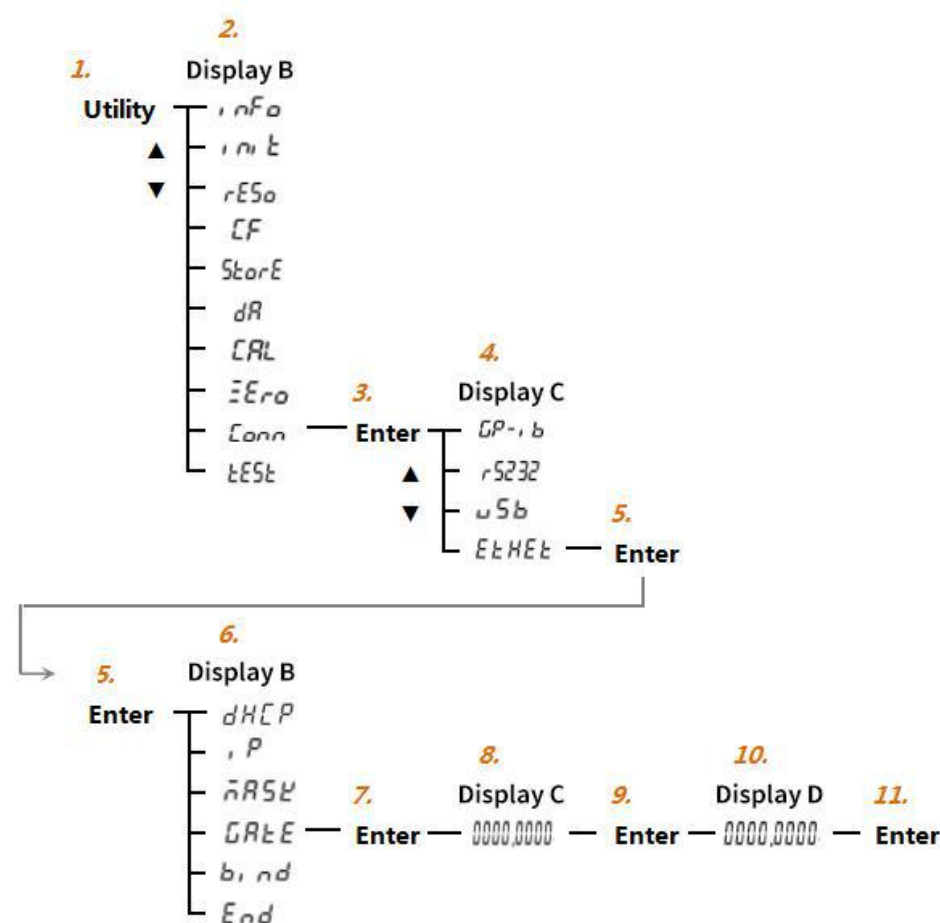
Follow the above steps 1~7 to enter the setting interface of Ethernet IP address. Display Bars C and D are used to set the first 2 segments and the last 2 segments of IP address respectively. Set the IP address with navigation (up, down, left and right) keys. After setting the Display Bar C, press "Enter" key to enter the column D. After the setting is completed, the instrument returns to the previous menu to display.

Description

The default IP address of the instrument is 000.000.000.000, and the setting range is 000.000.000.000~255.255.255.255. Initialization settings do not reset the IP address.

8.4.3 Setting of gateway

Operating steps



1. Press Utility key;
2. Select the "Conn" setting menu;
3. Confirm;
4. Select the Ethernet communication mode;
5. Confirm;
6. Enter to the Ethernet gateway address setting;
7. Confirm;
8. Set the first two segments of gateway address (Display C);
9. Confirm;
10. Set the last two segments of gateway address (Display D);
11. Confirm.

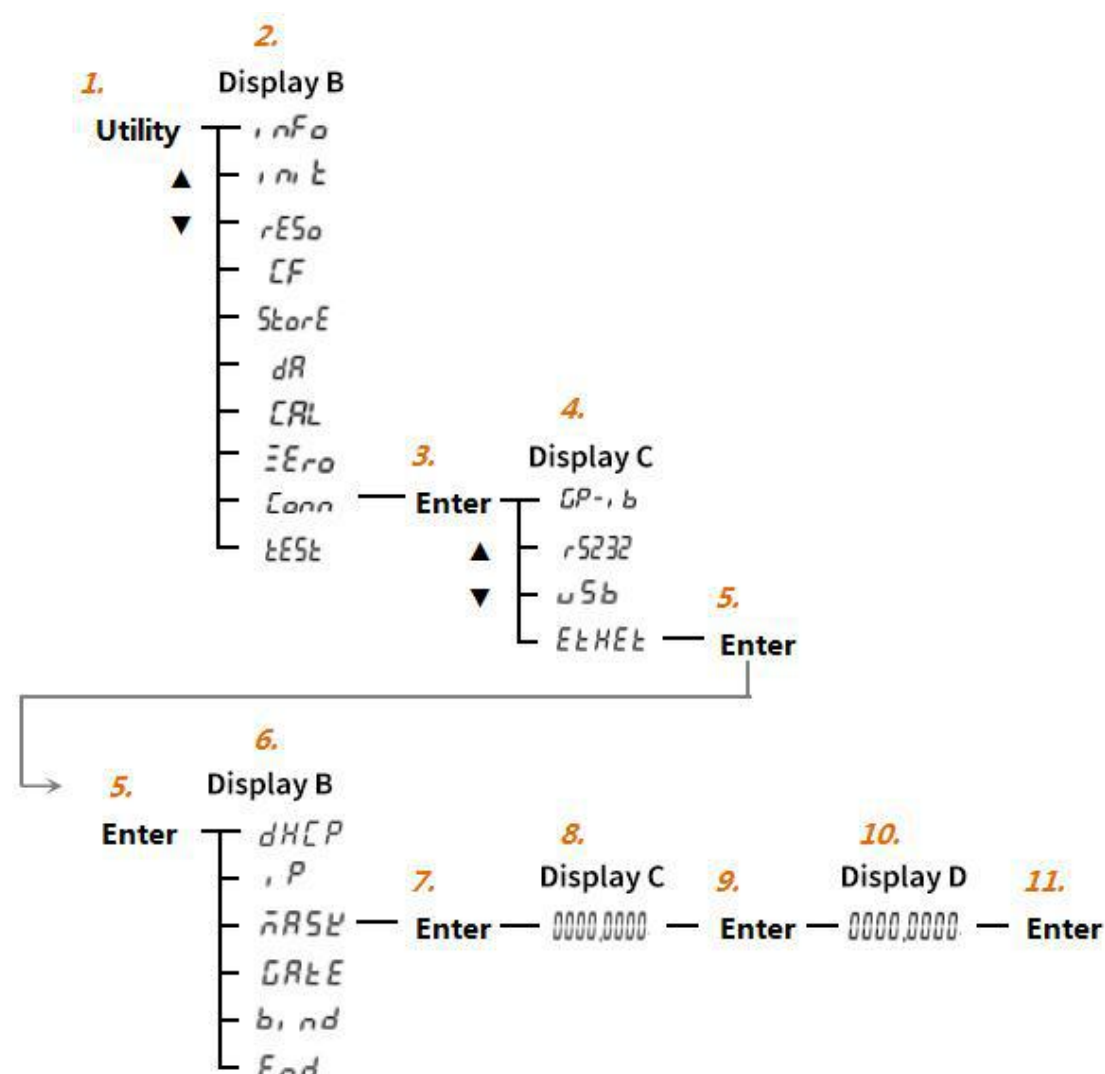
Follow the above steps 1~7 to enter the setting interface of Ethernet gateway address. Display Bars C and D are used to set the first 2 segments and the last 2 segments of gateway address respectively. Set the gateway address with navigation (up, down, left and right) keys. After setting the Display Bar C, press "Enter" key to enter the column D. After the setting is completed, the instrument returns to the previous menu to display.

Description

The default gateway address of the instrument is 000.000.000.000, and the setting range is 000.000.000.000~255.255.255.255. Initialization settings do not reset the gateway address.

8.4.4 Setting of subnet mask

Operating steps



1. Press Utility key;
2. Select the "Conn" setting menu;
3. Confirm;
4. Select the Ethernet communication mode;
5. Confirm;
6. Enter to the Ethernet subnet mask setting;
7. Confirm;
8. Set the first two segments of subnet mask (Display C);
9. Confirm;
10. Set the last two segments of subnet mask (Display D);
11. Confirm.

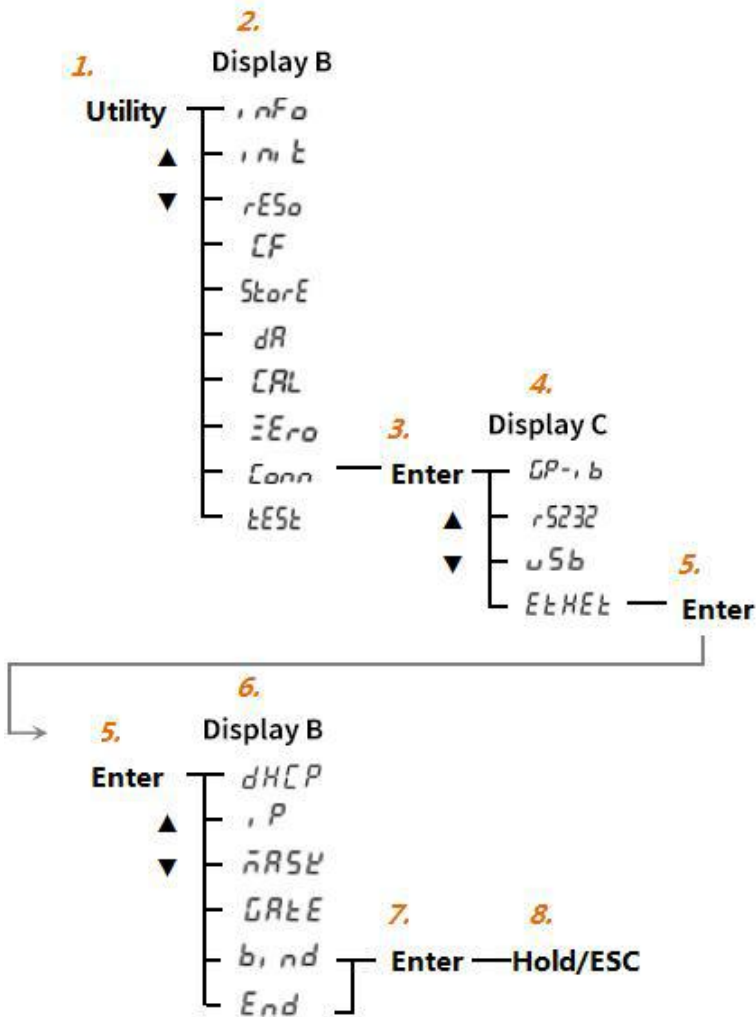
Follow the above steps 1~7 to enter the setting interface of Ethernet subnet mask address. Display Bars C and D are used to set the first 2 segments and the last 2 segments of subnet mask address respectively. Set the subnet mask address with navigation (up, down, left and right) keys. After setting the Display Bar C, press "Enter" key to enter the column D. After the setting is completed, the instrument returns to the previous menu to display.

Description

The default subnet mask address of the instrument is 000.000.000.000, and the setting range is 000.000.000.000~255.255.2 55.255. Initialization settings do not reset the subnet mask address.

8.4.5 Execution and end of Ethernet

Operating steps



1. Press Utility key;
2. Select the "coon" setting menu;
3. Confirm;
4. Select the Ethernet communication mode;
5. Confirm;
6. Select execution of network communication or end of network communication;
7. Confirm;
8. Exit and close the Ethernet setting menu.

Follow the above steps 1~5 to enter the Ethernet setting menu. When "BIND" is selected in step 6, it enters the execution interface, and Display Bar C displays "EXEC". Press "Enter" key to confirm the execution of network communication function, and the interface jumps to "END" display. When "BIND" is directly selected in step 6, the system ends the Ethernet setting. After the setting is completed, the instrument returns to the previous menu to display.

Description

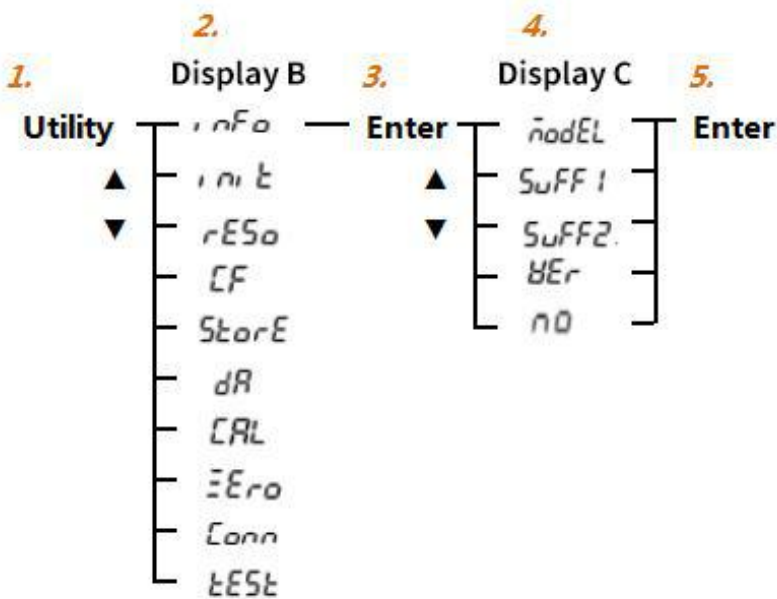
Only after execution, the IP address, gateway address and subnet mask set above will take effect, otherwise the settings will not take effect.

Chapter IX

Other Functions

9.1 View system information

OperatingViewing steps steps



1. Press Utility key;

2. Select the "info" menu;

3. Confirm;

4. Select the information to be viewed;

5. Confirm.

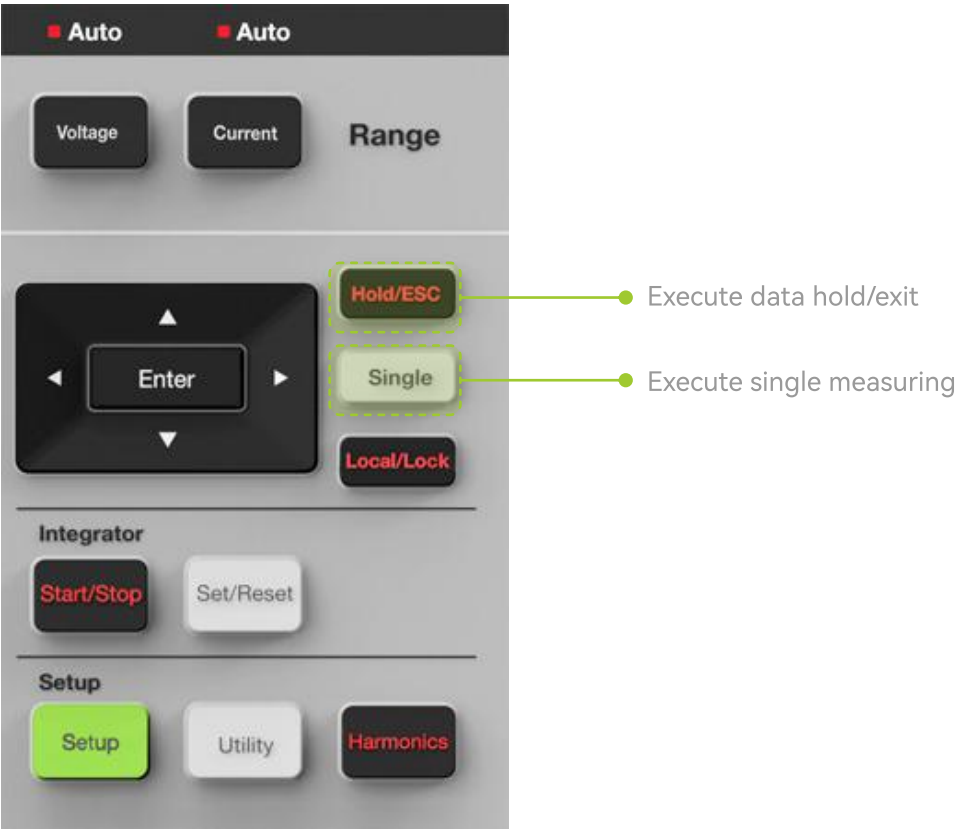
Follow the above operating steps to enter the information query display interface. Display Bar A displays "INFO" fixedly, Display Bar B displays the information item names, such as "VER", "NO.", "MODEL", "SUFF.1", "SUFF.2" or "CA.DATE", and Display Bar C displays the values of the items shown in B. In the information viewing interface, press "Enter" key to return to the main interface to display the measured value.

Meaning of information

VER	Display the software version of the instrument
NO.	Display the number of the instrument
MODEL	Display the model of the instrument
UFF.1	Display the suffix code 1 of the instrument
SUFF.2	Display the suffix code 2 of the instrument
CA.DATE	Calibration date of the current instrument

9.2 Holding measured values and executing a single measurement

Description of data hold



Description of data hold

In the main interface (measured value is displayed), press the "Hold/ESC" key, the "Hold/ESC" key indicator light is on, and the current measured value is held. When the data is held, the data update stops, and the "Update" indicator light on the panel is off. When the measured value is in the hold state, press the "Hold/ESC" key again, the Hold/ESC" key indicator light is off, and the hold state is released. The measuring display value continues to update, and the "Update" indicator light on the panel is on again.

When the integral is held, press the "Hold/ESC" key, the integral display will not update, but the integral continues to execute inside the instrument. The Update indicator light will flash as the internal data is updated. When the holding of display value is released, the integral results (integral value and integral time) at the release time point will be displayed.

When storing data, if the "Hold/ESC" key is pressed to hold the display, the measurement operation and the storage interval time count will be held (paused), and the data storage will also be held (paused). Press the "Hold/ESC" key again to release the holding, and the storage will continue.

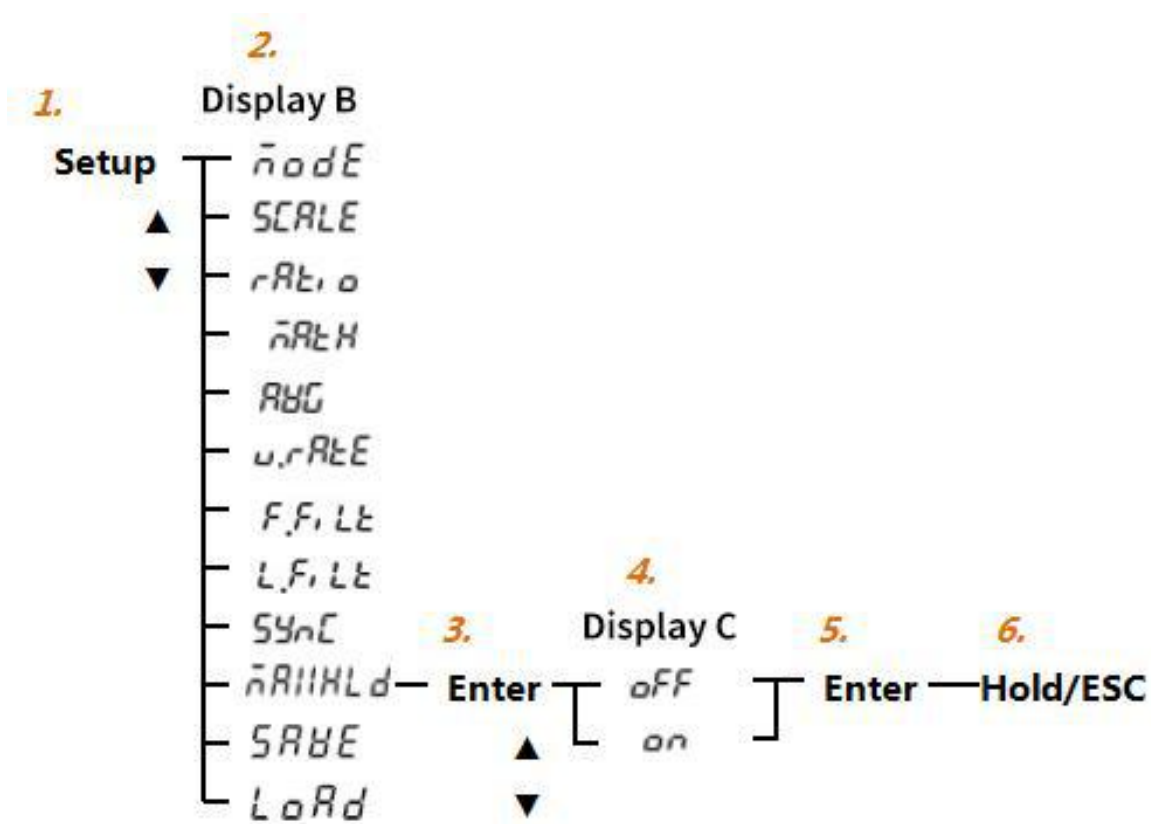
Description of executing single measuring

When the measured value is in the hold state, press the "Single" key, the measurement will be executed once at the current data update rate and the display data will be updated, and then it returns to the data hold state again. The "Update" indicator light is lit once every time the data measurement is executed. When there is no hold state, press the "Single" key and then start the measurement again from this point.

9.3 Maximum hold function

The instrument has the function of holding the maximum value. When the function is enabled, the maximum value of measurement will be held. If the measured value is larger than the current holding value, the larger value will be held. Measurement functions that can hold the maximum values include: U (voltage), I (current), P (active power), S (apparent power), Q (reactive power), U+pk/U-pk (peak voltage), I+pk/I-pk (peak current) and P+pk/P-pk (peak power).

Operating steps

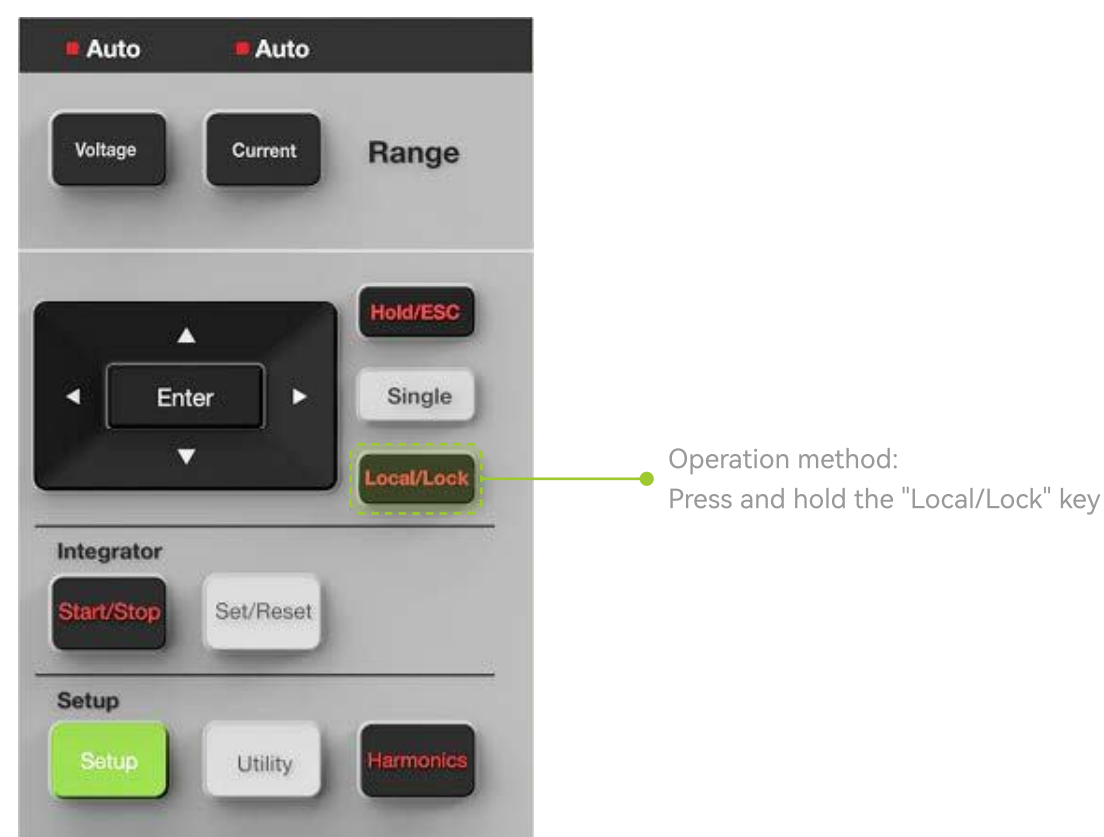


- 1. Press the Setup key;
- 2. Select the "maxhld" function menu;
- 3. Confirm;
- 4. Sets to turn on or off the maximum hold function;
- 5. Confirm;
- 6. Exit and close the setting menu.

Follow the above steps to set whether to turn on the maximum hold function. When the Display Bar C is confirmed as "ON", it means that the maximum hold function is enabled, and the Max hold indicator light on the panel is on. When the Display Bar C is confirmed as "OFF", it means that the maximum hold function is disabled, and the Max hold indicator light is off.

9.4 Key lock / unlock function

Operation method



Function specifications

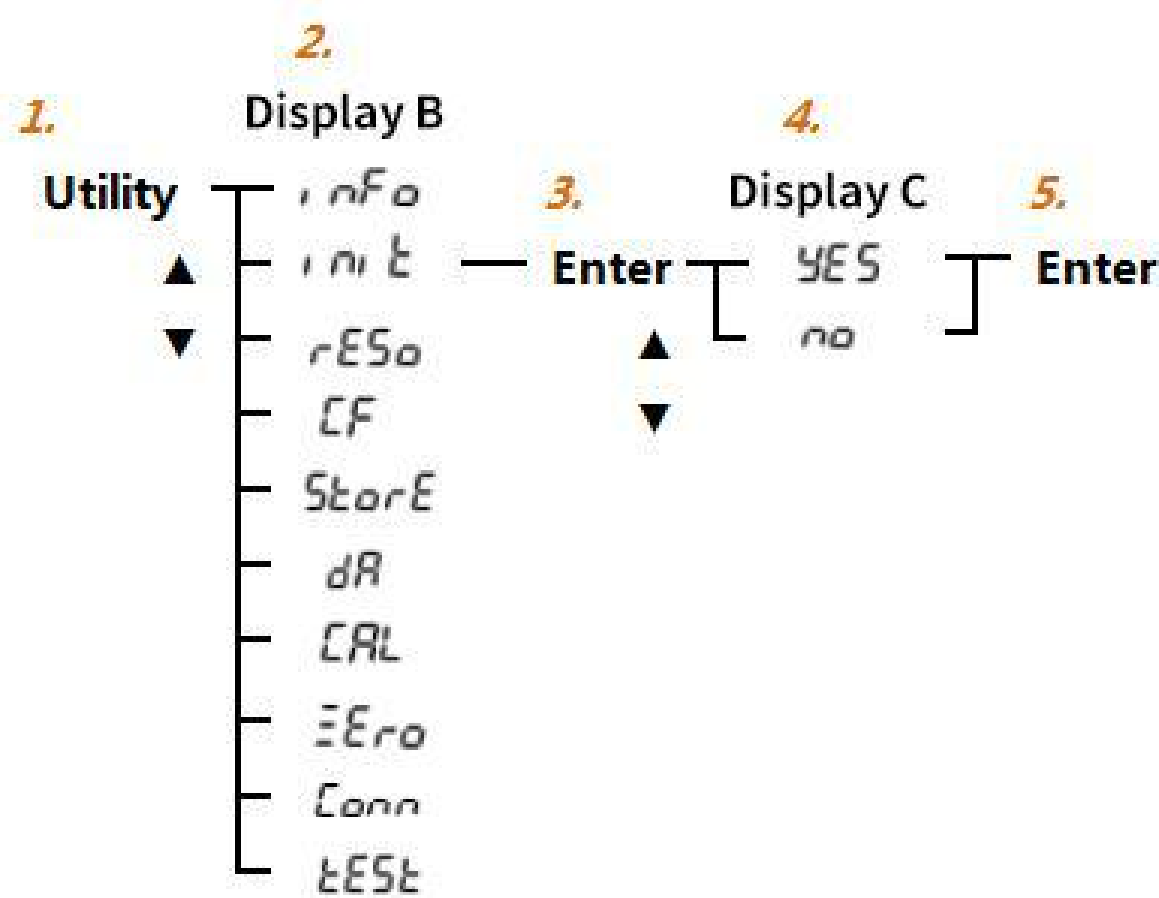
Key locking :
After pressing and holding the "Local/Lock" key, the indicator light of the "Local/Lock" key is on. At this time, the key has been locked, and the "Key Protect" indicator light on the panel is on. At this time, except for the power switch and "Local/Lock" key, other key operations are invalid.

Key unlocking :
In the key locking state, press and hold the "Local/Lock" key to unlock the key locking state. At this time, the "Local/Lock" key indicator light and the "Key Protect" indicator light are off at the same time. After the key is unlocked, all key operations resume to take effect.

9.5 Initialization settings

The instrument can initialize the setting parameters to return to the factory default.

Operating steps



1. Press Utility key;
2. Select the "init" function menu;
3. Confirm;
4. Select whether to execute the initialization operation;
5. Confirm the operation.

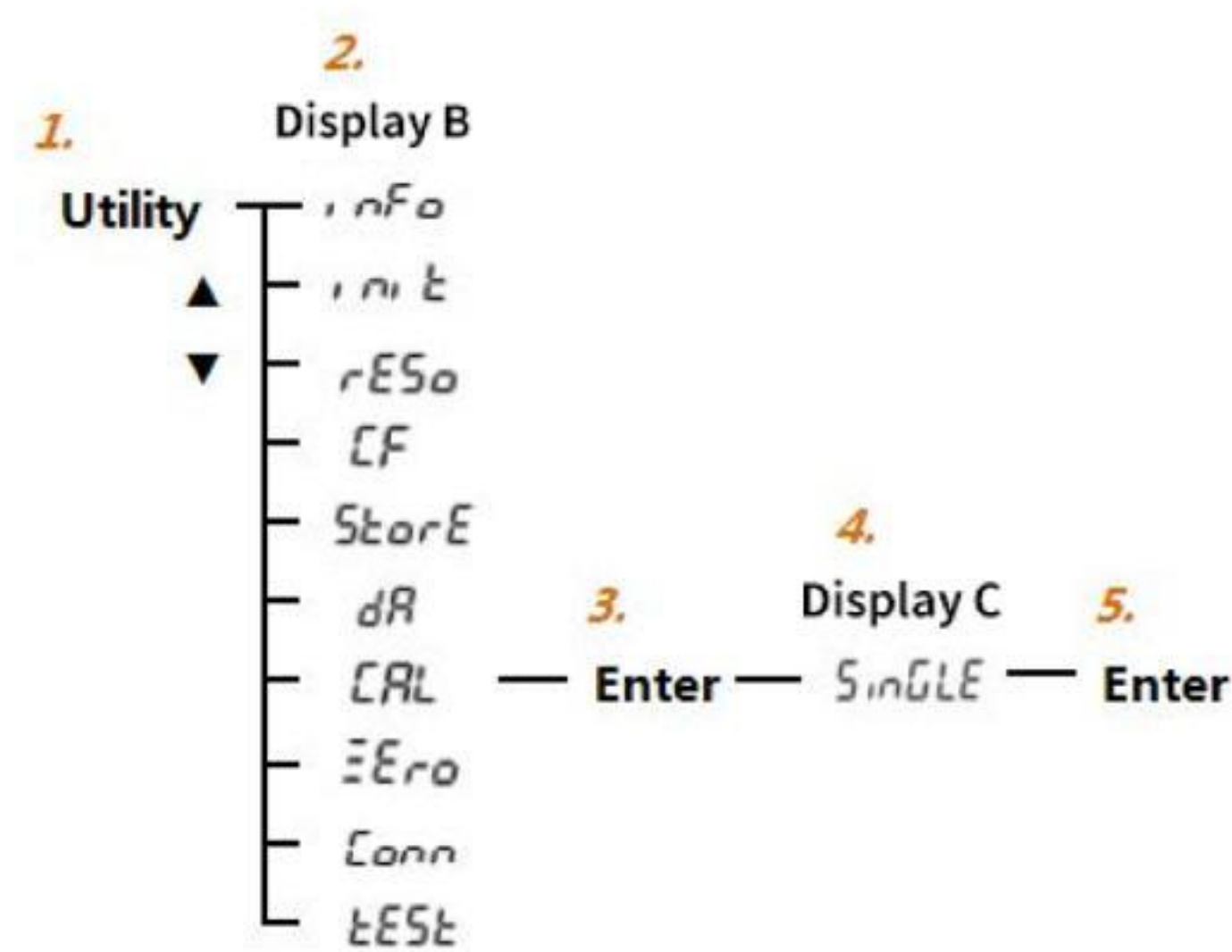
Follow the above steps to execute initialization, and the instrument immediately returns to the main interface and display the default state after the initialization is completed.

Initialization limitations

The network settings could not be initialized.
Initialization does not delete the saved configuration files.
When the storage is running, initialization can be executed, the storage is stopped, and the stored data files are deleted.
When the integral is running, initialization can be executed and the integral is directly reset.

9.6 Calibration function

Operating steps



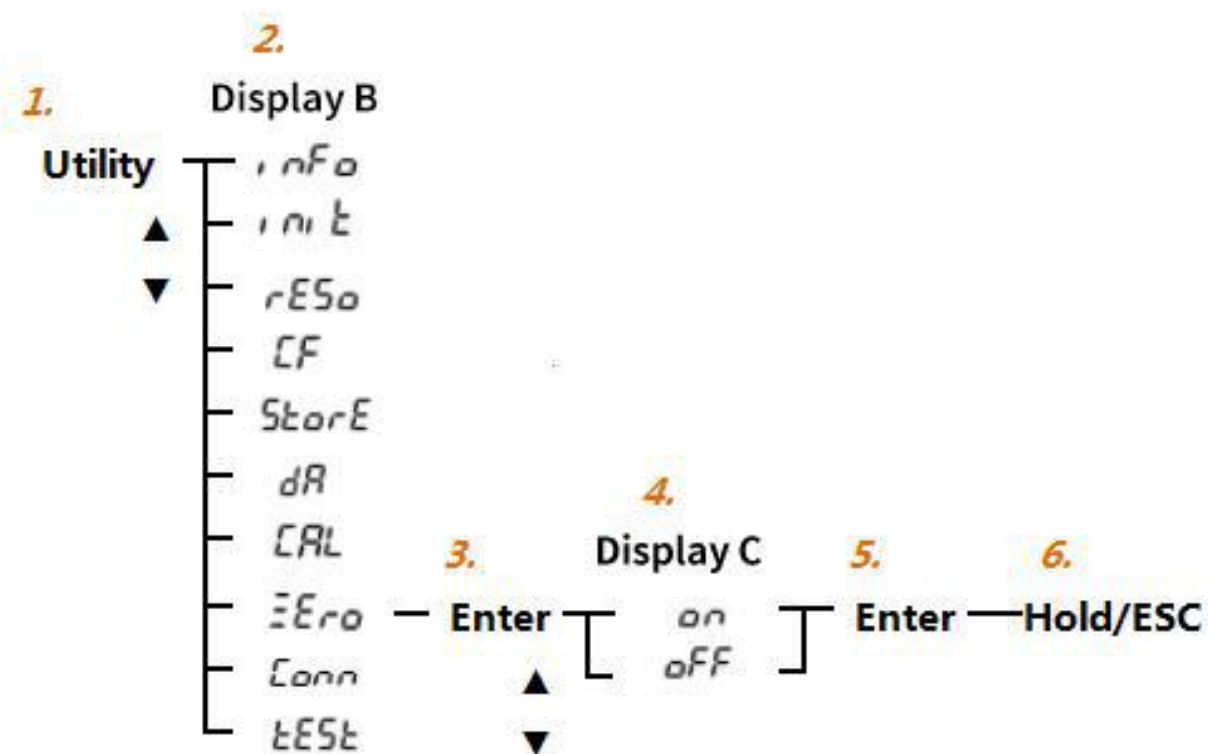
- 1. Press Utility key;
- 2. Select the "cal" function menu;
- 3. Confirm;
- 4. Perform a Calibration setting;
- 5. Confirm the operation.

Description of Calibration setting function

Manual calibration setting :
Follow the above operating steps to execute calibration setting manually.
Automatic calibration setting :
Turn on the instrument, and when the range is changed or initialized manually, the instrument will execute calibration setting automatically.

9.7 Zero function

Operating steps



1. Press Utility key;
2. Choose “Zero” setting menu;
3. Confirm;
4. Set zero switch;
5. Confirm;
6. Exit and close the setting menu.

Follow the steps above, zero setting is located at C display column, then zero switch can be switched by navigation keys (UP, DOWN); press “Enter” key to complete the setting, the instrument returns to the previous menu, and press “Hold/ESC” key to exit the setting interface.

Function specifications

Zero switch is turned on, and too small voltage and current measurement is displayed

CF=3, measurement $\leq 0.5\%$ of rated range (CF=6, $\leq 1\%$):

Voltage, current or other measured values related thereto will be displayed as "0.000" or "0.0000";

The phase angle and power factor will be displayed as "Error";

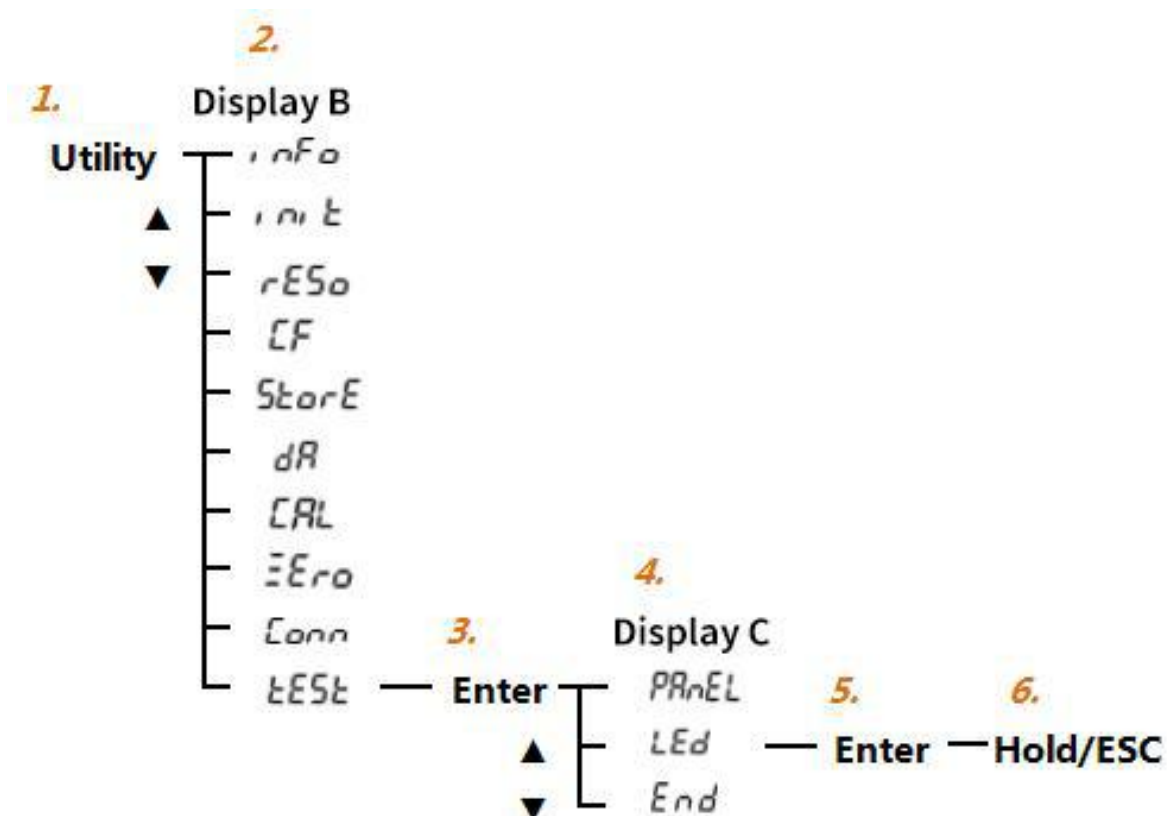
Zero switch is turned off, zero is not implemented for the measurement, and actual test value is displayed.

9.8 BIT function

The system BIT function includes panel key self-check and indicator light self-check.

9.8.1 LED BIT

Operating steps



1. Press Utility key;
2. Select the "test" function menu;
3. Confirm;
4. Select LED BIT;

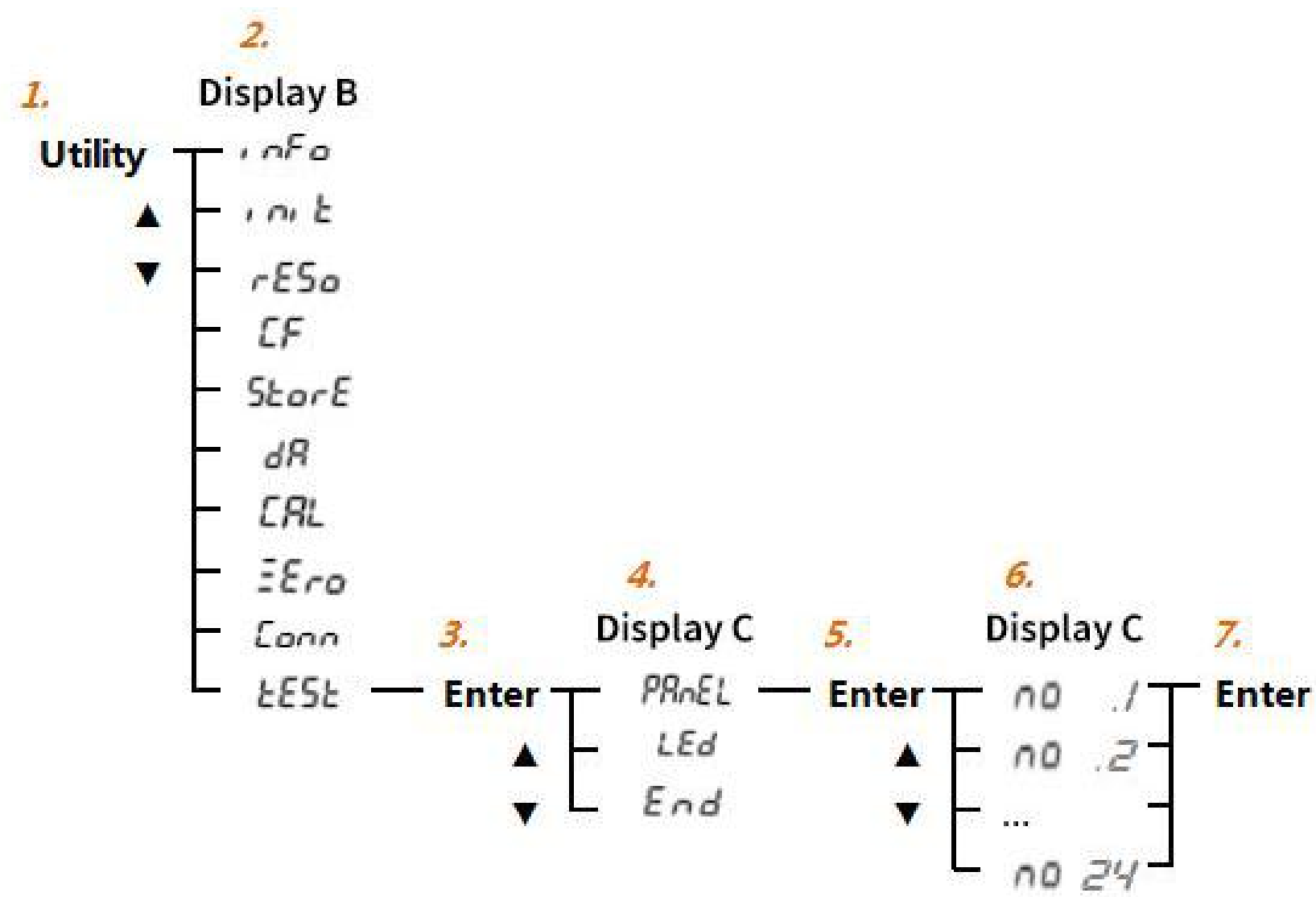
- 5. Confirm (all indicator lights on the panel are lit regularly);
- 6. Exit the LED BIT mode.

Description of LED BIT

After entering the LED BIT state, all key lights and status lights except the power lights are off, and there is no focus in the key test environment. Switch the display status of LED lights one by one with navigation (up and down) keys.

9.8.2 Key BIT

Operating steps



- 1. Press Utility key;
- 2. Select the "test" function menu;
- 3. Confirm;
- 4. Select the key BIT;
- 5. Confirm;
- 6. Operate each entity key one by one, and Display C displays the number corresponding to the key in turn;
- 7. Press "Enter" key twice continuously to exit the BIT mode.

Description of key BIT

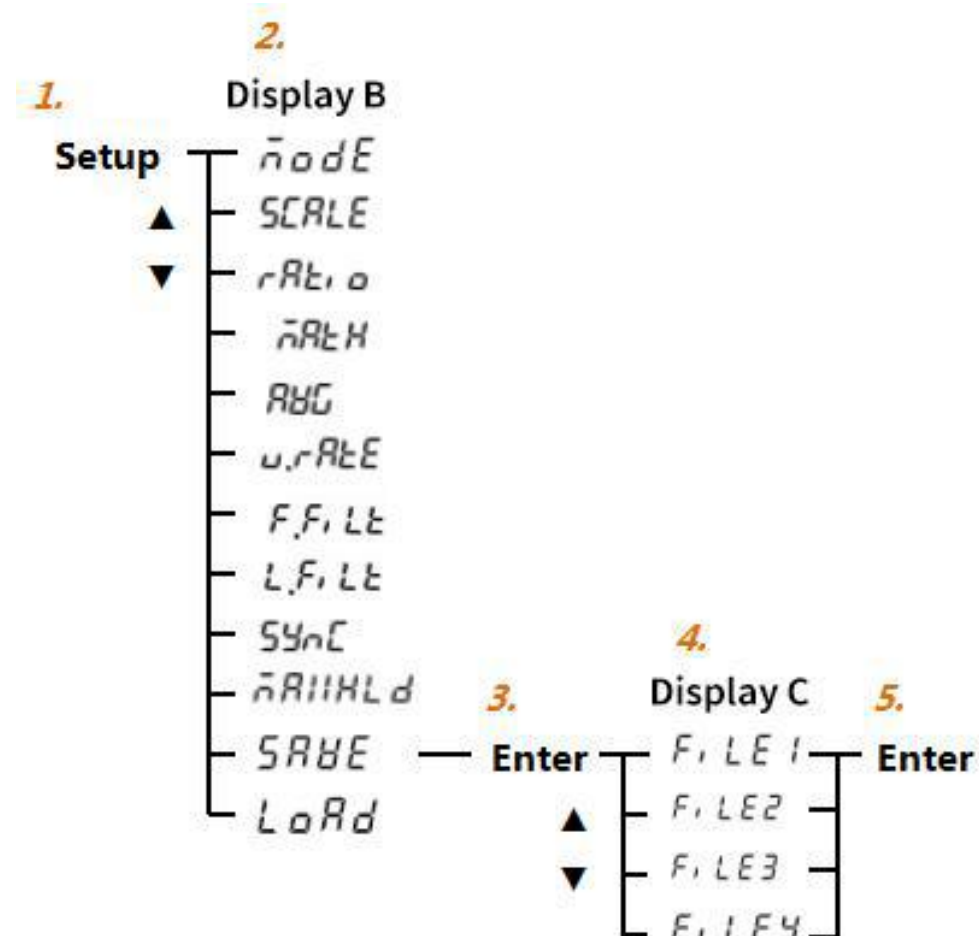
A corresponding number will be assigned to all keys respectively (except the power switch key) inside the instrument. After entering the key BIT state, press any key, and Display Bar D will display the number information of the key to confirm effective operation of the key. Press "Enter" key twice continuously to exit the key BIT mode.

9.9 Saving and loading of configuration file

The parameter setting file of the instrument can be saved in the internal memory of the instrument. A total of four sets of parameter configurations can be saved, and File1, File2, File3 and File4 are used respectively to represent the storage destination of the configuration file. The configuration file shall be saved, so that the configuration will be loaded quickly when encountering similar measurement environment in the later period, and the time for users to set the parameters again shall be reduced.

9.9.1 Saving of configuration file

Operating steps



1. Press the Setup key;
2. Select the "save" function menu;
3. Confirm;
4. Select the directory folder (File1~File4) where the files will be saved;
5. Confirm;
6. Exit and close the setting menu.

Follow the above steps to enter the configuration file saving interface. Display Bar C can be switched to display "File1, File2, File3 and File4", and Display Bar D displays the saving status of the configuration file: "Free" or "Saved". Press "Enter" key to save the current configuration, and the instrument returns to the previous menu to display.

Description of information in Display Bar D

If "Saved" is displayed, it means that the configuration parameters have been saved in the file. If the saving operation is executed again, the system will overwrite the previous parameters. If "Free" is displayed, it means that the configuration parameters have not been saved in the file.

Description of configuration file

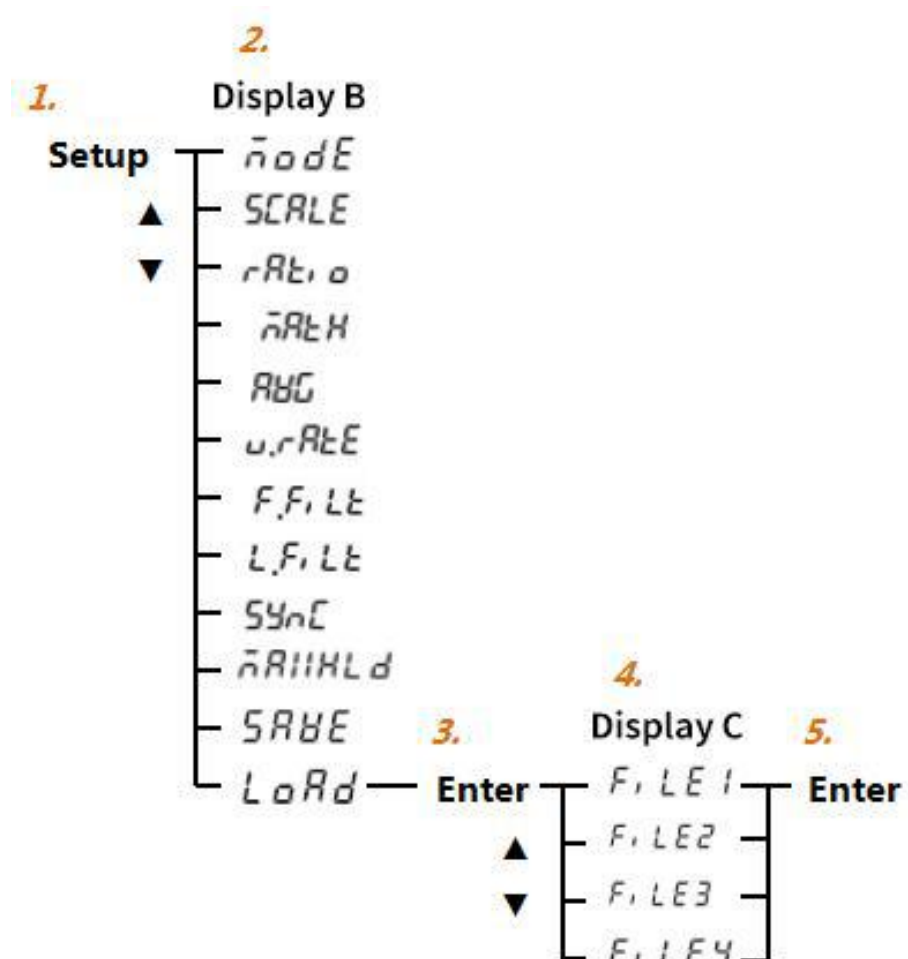
The saved setting parameters include current and voltage range, all settings in the Utility menu, all settings in the Setup menu, display settings in Display Bar A, B, C and D, holding, wiring settings, harmonic settings, integral settings, etc.

When integral and storage are in progress, an error prompt will appear when saving the configuration file.

After initialization, the configuration file will not be deleted.

9.9.2 Loading of configuration file

Operating steps



- 1. Press the Setup key;
- 2. Select the "load" function menu;
- 3. Confirm;
- 4. Select the directory folder (File1~File4) to be loaded;
- 5. Confirm;
- 6. Exit and close the setting menu.

Follow the above steps to enter the configuration parameter loading interface. Display Bar C can be switched to display "File1, File2, File3 and File4", and Display Bar D displays the status of configuration file in the file: "Free" or "Saved". Press "Enter" key to select the configuration file to be loaded, and the instrument returns to the previous menu to display.

⚠ Note:

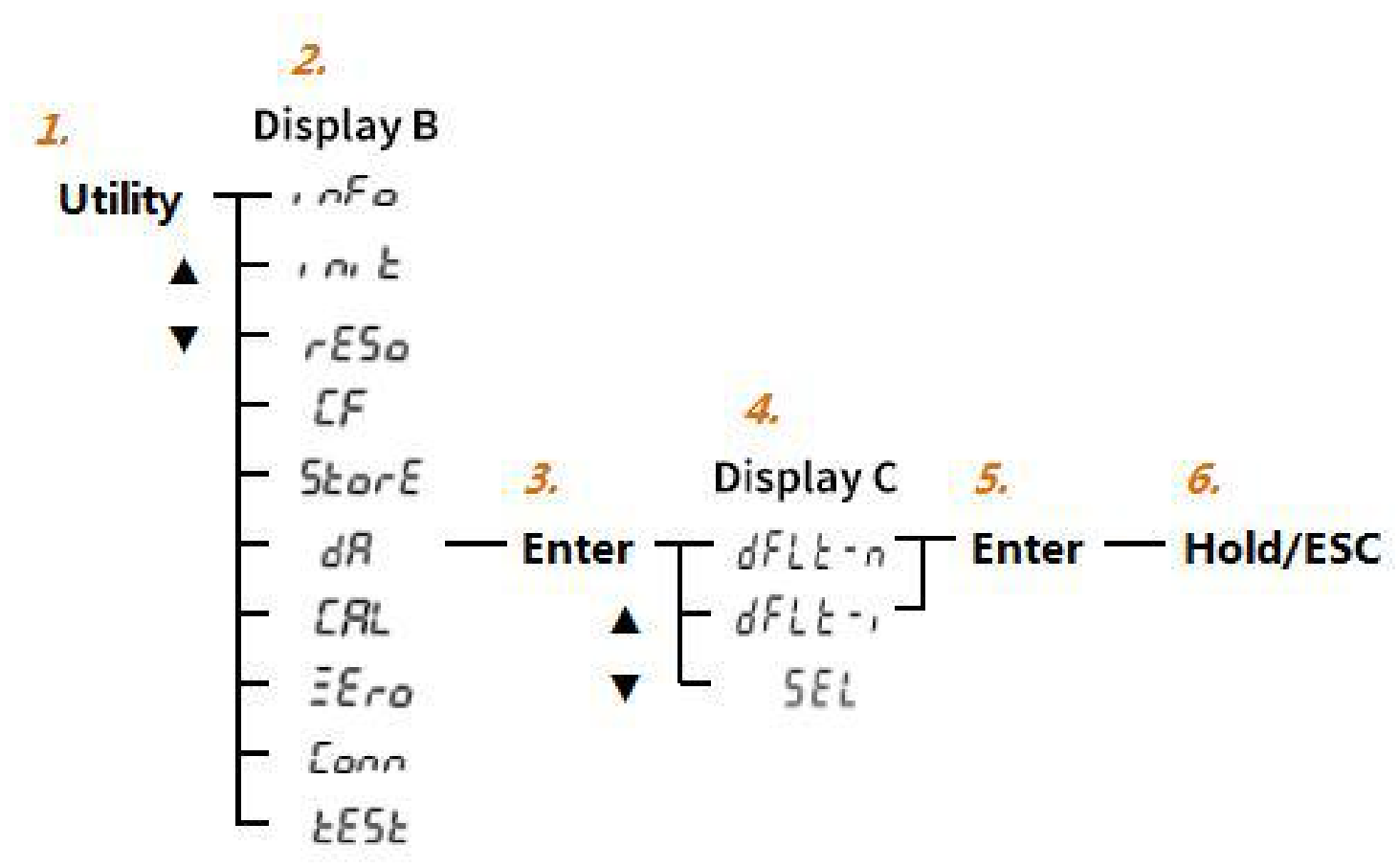
If "Saved" is displayed in Display Bar D, it means that the configuration parameters have been saved in the file, and the "Enter" key can be directly pressed to execute loading.
If "Free" is displayed in Display Bar D, it means that the configuration parameters have not been saved in the file, and an error prompt will appear when loading the file.

9.10 Setting of D/A output

The instrument can output voltage, current, active power, apparent power, reactive power, power factor, phase angle, frequency, voltage peak, current peak and integral value with DC analog voltage of ±5VFS. The system allocates 12 item channels for the output items, and each channel can select to output different measured values.

9.10.1 Selection of fixed output mode

Operating steps



Follow the above steps to enter the DA output setting interface, and the instrument has configured two fixed modes for DA output items. In addition, the user can also select custom output items.
The characters "DFIL-N", "DFLT-I" and "SEL" are displayed in the Display Frame C respectively. When "DFIL-N" and "DFLT-I" are selected, it enters the data mode of fixed output; when "SEL" is selected, it enters the data mode of D/A custom output.

D/A output mode

1) DFLT-N is the preset conventional measured value, and the output item of each channel is fixed as follows

Channel	Item
CH1	U1
CH2	U2
CH3	U3
CH4	U4

Channel	Item
CH5	I1
CH6	I2
CH7	I3
CH8	I4

Channel	Item
CH9	P1
CH10	P2
CH11	P3
CH12	P4

⚠ **Note:** Among them, U4, I4 and P4 represent the measured values of the wiring group.

2) DFLT-I is the preset integral measured value, and the output item of each channel is fixed as follows

Channel	Item
CH1	P1
CH2	P2
CH3	P3
CH4	P4

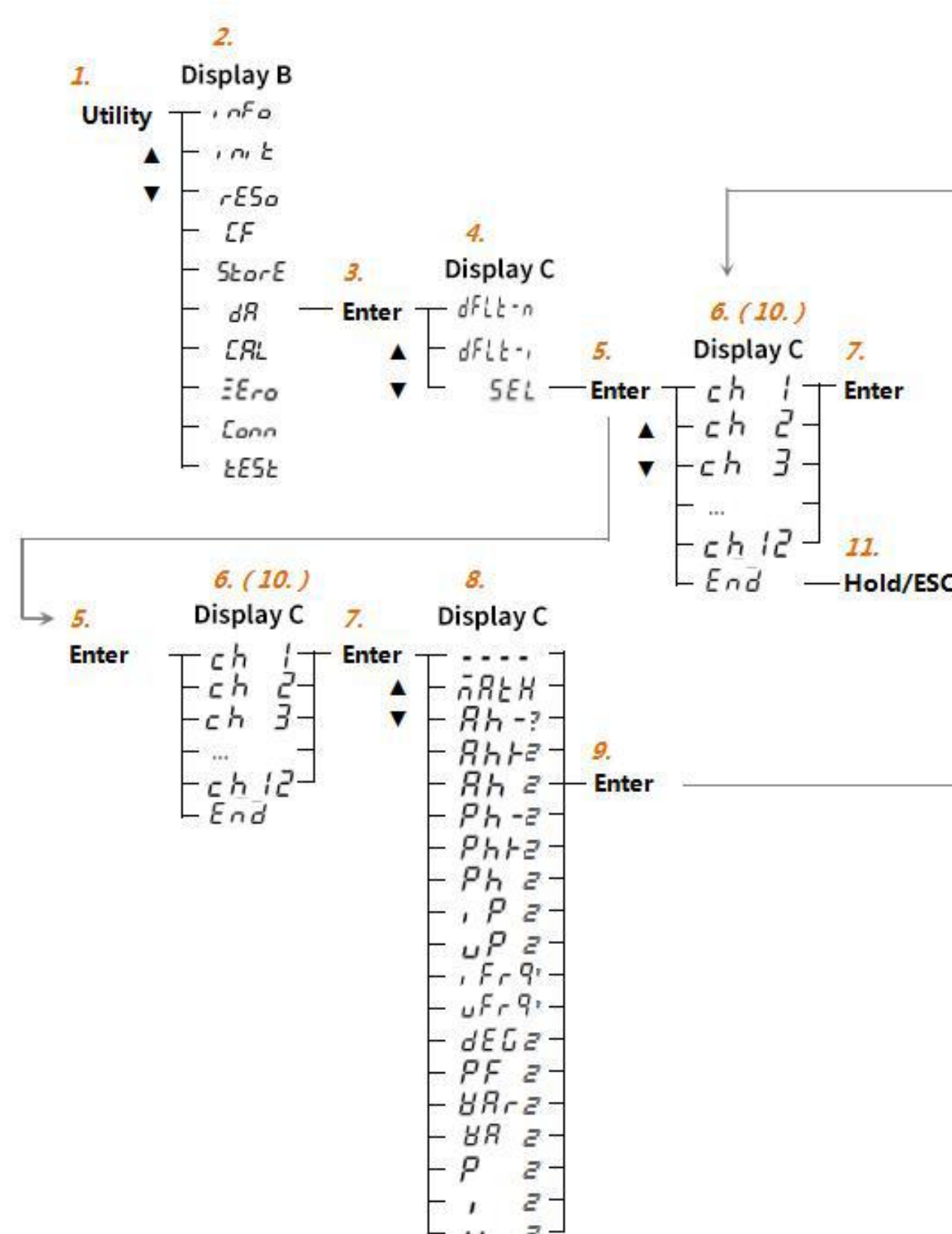
Channel	Item
CH5	WP1
CH6	WP2
CH7	WP3
CH8	WP4

Channel	Item
CH9	q1
CH10	q2
CH11	q3
CH12	q4

⚠ **Note:** Among them, P4, WP4 and q4 represent the measured values of the wiring group.

9.10.2 Setting of custom output mode

Operating steps



1. Press Utility key;
2. Select the "DA" function menu;
3. Confirm;
4. Select the custom mode of DA output;
5. Confirm;
6. Select the DA output channel
7. Confirm;
8. Set the measurement function of the selected channel;
9. Confirm;
10. Select the output channel again, which is the same as step 6;
11. Until the measurement function values displayed in channels 1~12 are set, finally select END to end the custom setting and exit.

When setting the data mode of D/A custom output, select "SEL" in the above step 4 to enter the custom setting interface. It is required to set output item (including output function and unit number) for each output channel in turn.

Follow the above steps to enter the setting interface of channel items. The current channel number is displayed in Display Bar B and "CH1~CH12" can be switched with navigation (up and down) keys, and the output item of the channel can be displayed in Display Bar D. The setting of output items includes two parts: the measurement function of the item can be set in Area A on the left, the unit number of the item can be set in Area B on the right, and both areas can be switched by using navigation (left and right) keys.

Output item

The output items can be set to U (voltage U), I (current I), P (active power P), VA (apparent power S), Var (reactive power Q), PF (power factor λ), Deg (phase angle Φ), UFrq (voltage frequency fU), IFrq (current frequency fI), UP (voltage peak Upk), IP (current peak Ipk), PH (sum of watt-hours Wp), PH+ (positive watt-hours Wp+), PH- (negative watt-hours Wp-), AH (sum of ampere-hours q), AH+ (positive ampere-hours*q+), AH- (negative ampere-hours*q-), Math (operation), and ----(0V D/A output; cell-free setting).

Appendix

Appendix I Symbols and Definitions of Measurement Function

Conventional measurement

The panel indicator indicates the unit of measured value and the item being measured. It is on the left or right side of the 7-segment LED screen used for displaying measurement data.

Voltage

Measurement function (symbol)	Panel indicator lights up	Meaning	Input unit support	Wiring group support
U(RMS)	V	True effective value of voltage	Yes	Yes
U(Mean)	V	Rectified average calibrated to RMS of voltage	Yes	Yes
U(DC)	V	Simple average of voltage	Yes	Yes
U+PK	Vpk+	Maximum value of voltage	Yes	No
U-PK	Vpk-	Minimum value of voltage	Yes	No
CF U	MATH	Peak factor of voltage	Yes	No

 **Note** : The CFU function can be set through the MATH function.

Current

Measurement function (symbol)	Panel indicator lights up	Meaning	Input unit support	Wiring group support
I(RMS))	A	True effective value of current	Yes	Yes
I(DC)	A	Simple average of current	Yes	Yes
I+PK	Apk+	Maximum value of current	Yes	No
I-PK	Apk-	Minimum value of current	Yes	No
CF I	MATH	Peak factor of current	Yes	No

 **Note** : The CFI function can be set through the MATH function.

Power

Measurement function (symbol)	Panel indicator lights up	Meaning	Input unit support	Wiring group support
P	W	Active power	Yes	Yes
S	VA	Apparent power	Yes	Yes
Q	var	Reactive power	Yes	Yes
λ	PF	Power factor	Yes	Yes
φ	°	Phase difference	Yes	Yes
P+PK	Wpk+	Maximum value of power	Yes	No
P-PK	Wpk-	Minimum value of power	Yes	No

Frequency

Measurement function (symbol)	Panel indicator lights up	Meaning	Input unit support	Wiring group support
FU	VHz	Voltage frequency	Yes	No
FI	AHz	Current frequency	Yes	No

Integral power (watt-hour)

Measurement function (symbol)	Panel indicator lights up	Meaning	Input unit support	Wiring group support
TIME	TIME	Integral time	Yes	Yes
WP	WH	Sum of positive and negative watt-hours	Yes	Yes
WP±	WH±	Positive or negative watt-hours	Yes	Yes
q	AH	Sum of positive and negative ampere-hours	Yes	Yes
q±	AH±	Positive or negative ampere-hours	Yes	Yes
AV P	MATH	Average active power during integral	Yes	Yes

⚠ **Note** : The AV P function can be set through the MATH function.

Efficiency

Measurement function (symbol)	Panel indicator lights up	Meaning
EFFI	MATH	Efficiency

⚠ **Note** : The EFFI function can be set through the MATH function.

Arithmetic operation

Measurement function (symbol)	Panel indicator lights up	Meaning
A+B	MATH	A+B
A-B	MATH	A-B
A×B	MATH	A×B
A÷B	MATH	A÷B
A÷B^2	MATH	A÷B^2
A^2÷B	MATH	A^2÷B

⚠ **Note** : It can be set through the MATH function.

Harmonic measurement

Harmonic measurement function

Measurement function (symbol)	Panel indicator lights up	Meaning
U(K)	V	Effective value of K number of harmonic voltage
I(K)	A	Effective value of K number of harmonic current

Measurement function (symbol)	Panel indicator lights up	Meaning
P(K)	W	Active power of K number of harmonics
$\lambda(K)$	PF	Power factor of one harmonics
$\Phi(K)$	V° or A°	Phase difference between fundamental voltage and fundamental current
UTHD	V%	Total harmonic voltage distortion
ITHD	A%	Total harmonic current distortion
UHDF(K)	V%	Harmonic distortion factor of K number of harmonic voltage
IHDF(K)	A%	Harmonic distortion factor of K number of harmonic current
PHDF(K)	W%	Harmonic distortion factor of K number of harmonic power
$\Phi U(K)$	V°	Phase difference between K number of harmonic voltage and fundamental voltage
$\Phi I(K)$	A°	Phase difference between K number of harmonic current and fundamental current

 **Note** : K represents harmonic number, which is displayed in display A.

Number of harmonic measurement function

The harmonic number that can be specified is shown in the following table.

Measurement function (symbol)	Panel indicator lights up	Total value (total effective value)	1 (fundamental wave)	Harmonic wave
U(K)	V	Yes	Yes	2~50
I(K)	A	Yes	Yes	2~50
P(K)	W	Yes	Yes	2~50
$\lambda(K)$	PF	No	Yes	No
$\Phi(K)$	V° or A°	No	Yes	No
UTHD	THD V%	Yes	No	No
ITHD	THD A%	Yes	No	No
UHDF(K)	V%	No	Yes	2~50
IHDF(K)	A%	No	Yes	2~50
PHDF(K)	W%	No	Yes	2~50
$\Phi U(K)$	V°	No	No	2~50
$\Phi I(K)$	A°	No	No	2~50

 **Note** : TK represents harmonic number.

Appendix II Initialization Configuration List

Item	Content
Display A	Display function: V, input unit: 1
Display B	Display function: A, input unit: 1
Display C	Display function: W, input unit: 1
Display D	Display function: PF, input unit: 1
Display bits	5
Data update cycle	0.5s
Zero	ON
Line filter	OFF
Frequency filter	OFF
Measuring synchronous source	Volt (voltage)
Current range	Auto
Voltage range	Auto
Current sensing range	2V/10V
Measuring mode	RMS
Wiring mode	1P2W
Hold	OFF
Maximum hold	OFF
Ratio	Ratio switch: OFF VT: 1.000 CT: 1.000 SF: 1.000
External sensor conversion ratio	Sensor conversion ratio switch:OFF ALL: 1000 Ele1: 1000 Ele2: 1000 Ele3: 1000
Average	Average switch: OFF Type: Ep (exponential average) Average coefficient: 8
Peak factor	3
MATH formula	Efficiency EFFI
Frequency	Voltage frequency and current frequency of input unit 1
Integral	Integral mode: nor Integral timer: 10000:00:00 Integral DA timer: 10000:00:00
Harmonic measurement	Harmonic display: OFF THD formula: IEC Maximum harmonic number of measurement: 50 PLL source: U1
Storage	Storage function switch: OFF Interval: 00:00:01

D/A output item	Item dflt-n
GP-IB address	addr 1
RS-232	Handshake mode: hand0 Data format: form0 Baud rate: 19200 Terminator: Cr+Lf