OWH9800 Series Digital Power Meter User Manual

For product support, visit:www.owon.com.hk/download

※：The illustrations, interface, icons and characters in the user manual may be slightly different from the actual product. Please refer to the actual product.

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General Warranty

We warrant that the product will be free from defects in materials and workmanship for a period of 2 years from the date of purchase of the product by the original purchaser from our company. The warranty period for accessories such as probes, battery is 12 months. This warranty only applies to the original purchaser and is not transferable to a third party.

If the product proves defective during the warranty period, we will either repair the defective product without charge for parts and labour, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by our company for warranty work may be new or reconditioned like new. All replaced parts, modules and products become the property of our company.

In order to obtain service under this warranty, the customer must notify our company of the defect before the expiration of the warranty period. Customer shall be responsible for packaging and shipping the defective product to the designated service centre, a copy of the customers proof of purchase is also required.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. We shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than our company representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of not our supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

Please contact the nearest Sales and Service Offices for services.

Excepting the after-sales services provided in this summary or the applicable warranty statements, we will not offer any guarantee for maintenance definitely declared or hinted, including but not limited to the implied guarantee for marketability and special-purpose acceptability. We should not take any responsibilities for any indirect, special or consequent damages.

Table of Contents

1. General Safety Requirement

Before any operations, please read the following safety precautions to avoid any possible bodily injury and prevent this product or any other products connected from damage. In order to avoid any contingent danger, this product is only used within the range specified.

Only the qualified technicians can implement the maintenance.

To avoid Fire or Personal Injury:

- **Use Proper Power Cord.** Use only the power cord supplied with the product and certified to use in your country.
- **Product Grounded.** This instrument is grounded through the power cord grounding conductor. To avoid electric shock, the grounding conductor must be grounded. The product must be grounded properly before any connection with its input or output terminal.
- **Limit operation to the specified measurement category, voltage, or amperage ratings.**
- **Check all Terminal Ratings.** To avoid fire or shock hazard, check all ratings and markers on the instrument. Refer to the user's manual for more information about ratings before connecting the instrument. Do not exceed any of ratings defined in the following section.
- **Do not operate without covers**. Do not operate the instrument with covers or panels removed.
- **Use Proper Fuse.** Use only the specified type and rating fuse for this instrument.
- **Avoid exposed circuit**. Do not touch exposed junctions and components when the instrument is powered.
- **Do not operate if in any doubt.** If you suspect damage occurs to the instrument, have it inspected by qualified service personnel before further operations.
- **Use your instrument in a well-ventilated area.** Inadequate ventilation may cause an increasing of temperature or damages to the instrument. Please keep the instrument well ventilated, and inspect the air outlet and the fan regularly.
- **Do not operate in wet conditions.** To avoid short circuit inside the instrument or electric shock, never operate the instrument in a humid environment.
- **Do not operate in an explosive atmosphere.**In order to avoid damages to the device or personal injuries, it is important to operate the device away from an explosive atmosphere.
- **Keep instrument surfaces clean and dry.** To avoid the influence of dust or moisture in air, please keep the surface of device clean and dry.

2. Safety Terms and Symbols

Safety Terms

Terms in this Manual. The following terms may appear in this manual:

Warning: Warning indicates the conditions or practices that could result in injury or loss of life.

Caution: Caution indicates the conditions or practices that could result in damage to this product or other property.

Terms on the Product. The following terms may appear on this product:

Danger: It indicates an injury or hazard may immediately happen.

Warning: It indicates an injury or hazard may be accessible potentially.

Caution: It indicates a potential damage to the instrument or other property might occur.

Safety Symbols

Symbols on the Product. The following symbol may appear on the product:

	Hazardous Voltage		Refer to Manual
	Protective Earth Terminal		Chassis Ground
	Public Ground		

3. Quick Start

3.1 Product Overview

The power meter adopts a dual-channel design. The rear panel (CH1) serves as the AC main input, AC supporting a maximum AC voltage and current of 600V/20ARMS. The front panel (CH2) supports both AC and DC sampling without harmonic analysis capability, optimized for DC sampling applications, and extends the DC input range up to 1000V/20A. With the dual-channel design, users can easily measure and calculate parameters such as voltage, current, power, frequency, crest factor, harmonics, integration, and efficiency.

Power Meter comes standard with RS232/RS485 communication interfaces, enabling remote control of the meter, and also features a USB host interface for saving measurement parameters directly to external storage devices, supporting long-term data recording. It offers 0.5% accuracy for voltage, current, and power measurements and includes extensive active power integration and energy accumulation functions. The power meter is widely used in testing household appliances, UPS systems, photovoltaic and wind power, charging stations, and energy storage applications.

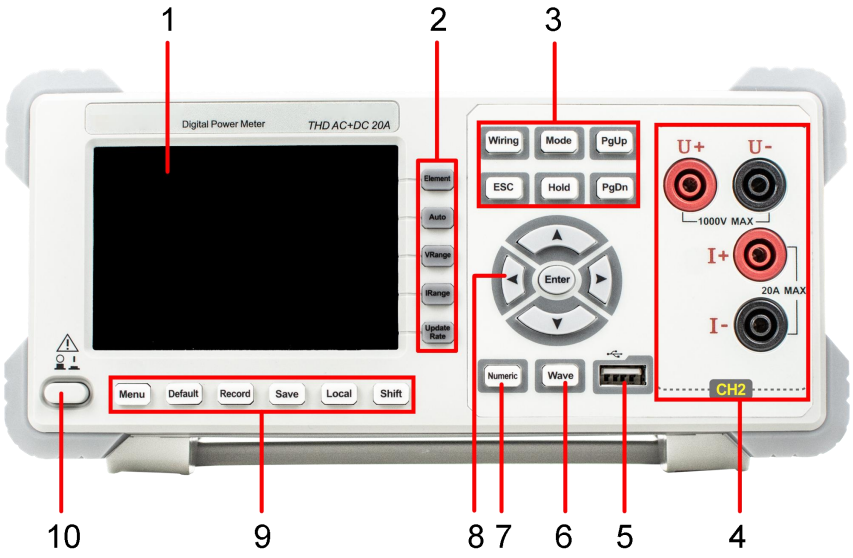
Key Features:

1. Dual-channel design (front/rear panels), AC supports single-phase/three-phase (CH1: A/B/C) measurements:
   1) Rear panel CH1 supports AC input, 3–600V/20A RMS, with ±0.5% accuracy.
   2) Front panel CH2 supports up to 0–1000V/0–20A AC+DC input, with ±0.5% accuracy.
2. High-resolution 3.95-inch TFT color screen display
3. Simultaneous measurement of voltage, current, power, efficiency, and harmonics.
4. Integration and harmonic analysis up to the 63rd order.
5. Manual/auto range setting.
6. Customizable efficiency calculation support.
7. Multiple display modes: numeric, waveform, and bar graph.

8. USB support for screenshots and long-term data recording.
9. Standard digital communication interfaces RS232/485, supporting SCPI commands and Modbus protocol.

3.2 Panel Introduction

3.2.1 Front panel



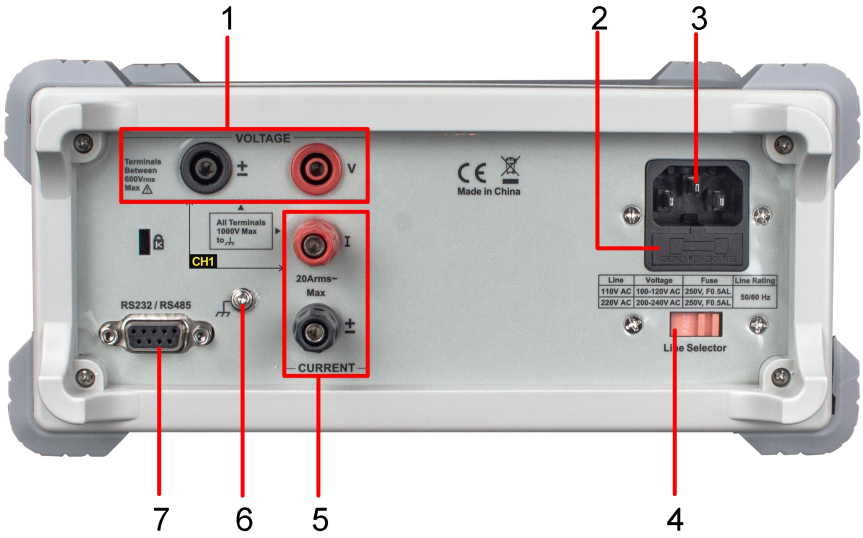
The components of the front panel are defined as follows:

1	**Display Screen**	TFT color screen displays.
2	**Menu select area**	**Element:** Channel switch key. **Auto:** Automatic range setting. **VRange:** Voltage range setting. **Irange:** Current range setting. **Update Rate:** Data update cycle.
3	**Function key area 1**	**Wiring:** Wiring and efficiency settings. **Mode:** Working mode settings. **PgUp:** Page up to previous page. **ESC:** Exit editing mode and return to the previous page. **Hold:** Page hold key or pause. **PgDn:** Page down to next page.
4	**CH2 connection area**	**CH2 voltage terminal:** Connect CH2 to the voltage to be measured. **CH2 current terminal:** Connect CH2 to the measured

		current.
5	**USB interface**	USB data interface.
6	**Wave key**	Waveform display page switch key.
7	**Numeric key**	Digital display page switch key.
8	**Direction key, Enter key**	↑ ↓ ← →**:** Move the cursor up, down, left, and right. **Enter:** Confirm parameter key.
9	**Function key area 2**	**Menu:** Enter Menu. **Default:** Go back to the main page setup **Record:** Data recording with USB disk for a long time (effective when U disk is inserted). **Save:** Save waveform screenshots to USB disk. **Local:** Remote communication connection or short press Local to realize keyboard lock function; long press “Local” key to unlock the panel.. **Shift:** Reuse function.
10	**Power button**	ON/OFF Switch.

3.2.2 Rear Panel

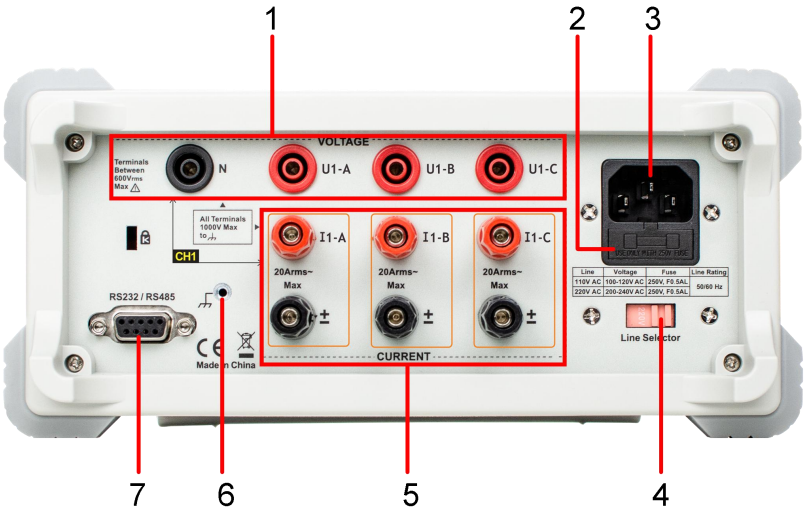
OWH9811 rear panel overview



1	**CH1 voltage terminal**	The red V and black ± are the CH1 voltage sampling terminals.
2	**Fuse**	Power supply fuse.
3	**AC power**	The power cord inputs AC power from this

	terminal	connection terminal to the input terminal.
4	**Line switcher**	110V/220V AC voltage selection switch
5	**CH1 current terminal**	The red I and black ± are the CH1 current terminals.
6	**Ground**	Protective grounding.
7	**RS232/485 interface**	The computer can be connected via the RS232/485 port.

OWH9830 rear panel overview



The components of the rear panel are defined as follows：

1	**CH1 voltage terminal**	The red V and black ± are the CH1 voltage sampling terminals, and the three-phase voltage terminals are in a common N structure.
2	**Fuse**	Power supply fuse.
3	**AC power terminal**	The power cord inputs AC power from this connection terminal to the input terminal.
4	**Line switcher**	110V/220V AC voltage selection switch
5	**CH1 current terminal**	The red I and black ± are the CH1 current terminals, and the red V and red I are the in-phase terminals.
6	**Ground**	Protective grounding.

7	**RS232/485 interface**	The computer can be connected via the RS232/485 port.

3.3 General Inspection

When you get a new digital power meter, it is recommended that you check the instrument according to the following steps.

1. Inspect the instrument for damage caused by shipping.

If the packaging carton or foam padding is severely damaged, please retain it until the instrument and accessories have passed electrical and mechanical tests.

2. Inspect the accessories.

A detailed list of supplied accessories is provided in "Appendix A: Accessories" of this manual. Refer to this information to check for missing accessories. If any accessories are missing or damaged, please contact your authorized distributor or local office.

3. Inspect the instrument.

If the instrument is damaged, malfunctions, or fails performance testing, please contact your authorized distributor or local office. If the instrument is damaged during shipping, please retain the packaging. Notify the shipping department and your authorized distributor. We will arrange for a repair or replacement.

3.4 Power-on inspection

Before operating the power meter, please ensure you understand the general safety precautions.

1. Before turning on the power, make sure the power supply voltage matches the supply voltage; otherwise, the instrument may be damaged.
2. Please make sure that the main power plug is connected to a power socket with protective grounding. Do not use a power strip without

protective grounding. Before operating the instrument, you should first ensure that the instrument is well grounded.

3. Please pay attention to the positive and negative pole markings and the maximum voltage and current limits before connecting the instrument, otherwise the instrument will be burned.

Press the power button on the front panel. The startup screen will appear.

Select **Menu** to enter the system settings interface. Press the **System** Information button to access the system information interface, which displays information such as the product model, serial number, and software version number.

3.5 Connection circuit

The power meters can measure voltage, current, power, and other energy factors for various electrical products. This section describes typical circuit connection methods for practical applications of power meters.

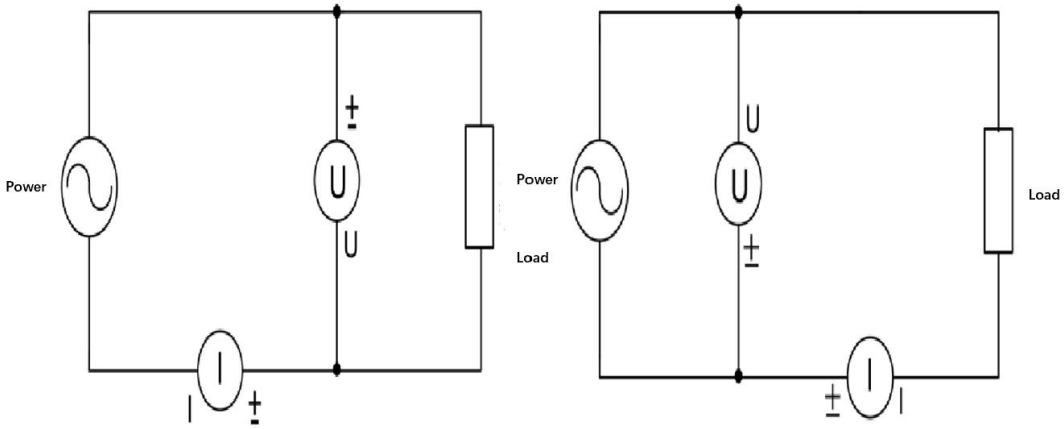
3.5.1 Precautions before connection

1. When connecting a measurement circuit, always disconnect the power supply to the circuit to avoid the risk of electric shock during connection.
2. Always connect the main power plug to a power outlet with a protective ground. Do not use a terminal block without a protective ground. Before connecting the circuit, ensure that the electronic load is properly grounded.
3. Never connect a current circuit to a voltage input terminal, or vice versa.
4. When insulating the measurement cable, ensure that the bare wires connected to the input terminal do not protrude from the terminal. Also, secure the screws of the input terminal to prevent the cable from becoming detached.
5. When connecting to the voltage input terminal, use a measurement cable with a safety rubber plug that does not expose bare wires. Ensure that the input terminal is securely fastened to prevent the cable from becoming detached.
6. Use a measurement cable that meets the rated voltage and current requirements and has a high voltage resistance and sufficient current capacity for the voltage and current being measured. When measuring a 20A current, use a copper wire with a cross-sectional area greater than

4mm^2.

3.5.2 Connection Method

To achieve accurate measurements, consider the following when connecting the voltage and current input terminals. When measuring larger currents, connect the voltage input terminals closer to the load. When measuring smaller currents, connect the current input terminals closer to the load. The circuit diagram is shown below.



Measuring larger currents **Measuring small currents**

Voltage Input Terminals

The voltage terminals are safety rubber sockets. Insert the safety plug (without exposed wires) into the voltage input terminals.

Current Input Terminals

The current input terminals are binding posts. First, wrap the wire around the screw or insert the crimp terminal through the screw shaft, then hold the terminal knob and tighten the screw.

4. Measurement conditions

4.1 Setting the Crest Factor and Measurement Range

For the power meter, crest factor (CF) is defined as the ratio of the waveform peak value to the rated RMS value. CH1 has two ranges: CF = 3 and CF = 6. For example, when CF = 3 and the voltage range is 600V, the voltage peak that CH1 can measure is 600V * 3 = 1800V. The voltage range, current range, effective input range, and measurement accuracy depend on the crest factor setting.

Therefore, to perform accurate measurements, it is necessary to set the appropriate crest factor and voltage and current measurement ranges. The selected range is effective for different measurement modes. The voltage and current ranges of the power meter are shown in the table below.

Model	Voltage Range	Current Range
OWH9811	CH1: CF=3:75V/150V/300V/600V/Auto CF=6:37.5/75V/150V/300V/Auto CH2: 50V/100V/500V/1000V/Auto	CH1: CF=3:0.2A/1A/4A/20A/Auto CF=6:0.1A/0.5A/2A/10A/Auto CH2: 0.2A/1A/4A/20A/Auto
OWH9830	CH1: CF=3:75V/150V/300V/600V/Auto CF=6:37.5/75V/150V/300V/Auto CH2:50V/100V/500V/1000V/Auto	CH1: CF=3:0.2A/1A/4A/20A/Auto CF=6:0.1A/0.5A/2A/10A/Auto CH2: 0.2A/1A/4A/20A/Auto

Voltage and Current Ranges

The measurement range is set based on the levels of RMS value (CH1) and peak value (CH2). When inputting voltage or current signals into the input element, fixed range and auto range are available.

Fixed Range

Select the desired range from multiple options. Once selected, the range will not change regardless of variations in the input signal level.

For example, voltage range for CH1 on the OWH9811 model:

- **Crest factor(CF) of 3:** The maximum option is "600V", and the minimum option is "75V".
- **Crest factor(CF) of 6:** The maximum option is "300V", and the minimum option is "37.5V".

The ranges for other models will differ, please refer to the display of the specific model.

Auto-ranging Setting

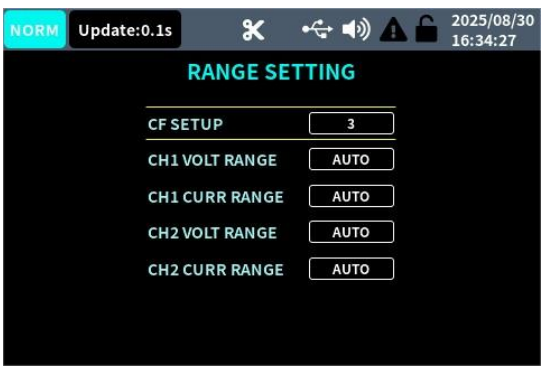
Automatically switches range according to the magnitude of the input signal. The available ranges are the same as those for fixed ranges.

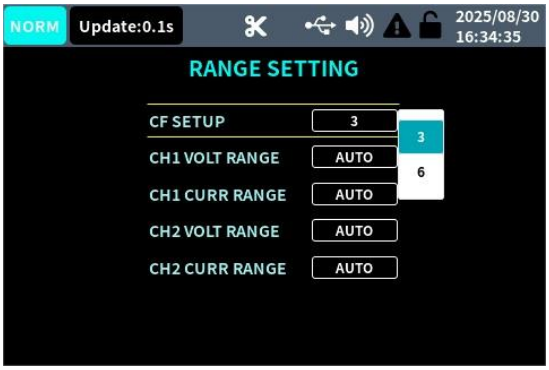
1. **CH1 automatic range upshift principle: The range is upshifted when any of the following conditions are met.**
   1) Urms or Irms exceeds 110% of the currently set range.
   2) CF= 3: The Upk or Ipk value of the input signal exceeds 330% of the currently set range.
   3) CF= 6: The Upk or Ipk value of the input signal exceeds 660% of the currently set range.
2. **CH1 automatic range downshift principle: The range is downshifted when all of the following conditions are met.**
   1) Urms or Irms is less than or equal to 70% of the lower range.
   2) CF= 3: The Upk or Ipk value of the input signal is less than 300% of the lower range.
   3) CF= 6: The Upk or Ipk value of the input signal is less than 600% of the lower range.
3. **CH2 automatic range upshift principle: The range is upshifted when the following conditions are met.**
   1) Upk or Ipk exceeds 110% of the currently set range.
4. **CH2 automatic range downshift principle: The range is downshifted when the following conditions are met.**
   1) Upk or Ipk is less than or equal to 70% of the lower range.

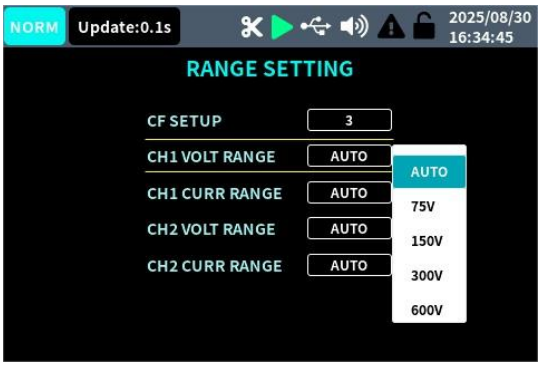
Note: When auto-ranging is selected, the range may change if the input waveform is a pulse waveform with an irregular period. In this case, select a fixed range.

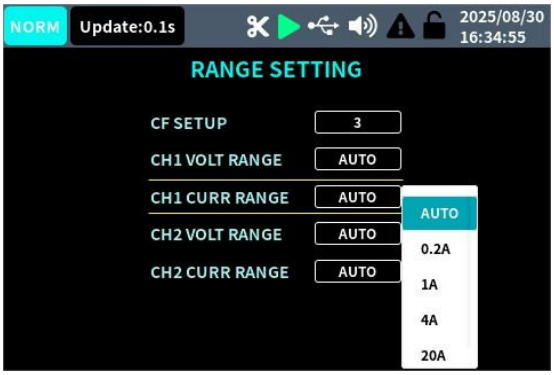
Method 1: Operating Steps

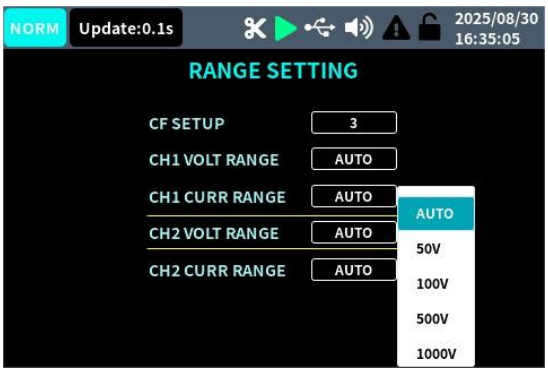
1. Select **Menu** to enter the **Range Setting** interface.
2. In the **CF Setting** dropdown box, set the Crest Factor (CF). Two options are available: CF = 3 or CF = 6 (default is CF = 3).
3. After setting the CF, use the cursor keys to select the voltage range or current range channel. The same operation can be applied to configure voltage and current ranges for different channels.

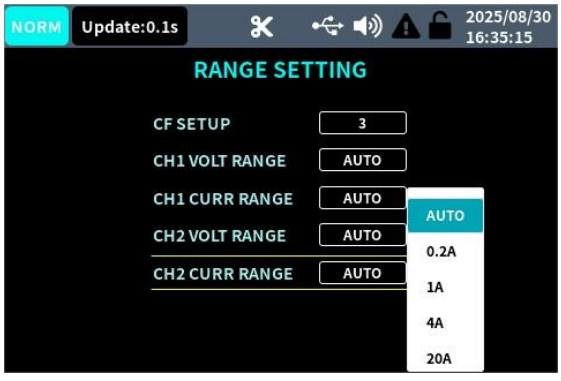












Method 2: Operating Steps

1. On the main numeric display interface, if the user needs to set the voltage range, press the **VRange** key to open the voltage range dropdown box, or press the **Auto** key for quick automatic range setting. The **Element** key can be used to switch between different channels for voltage range configuration.

2. If the user needs to set the current range, press the **IRange** key to open the current range dropdown box, or press the **Auto** key for quick automatic range setting. The **Element** key can be used to switch between different channels for current range configuration.

When CF=3，Display digits and power range of CH1

Voltage Range	Current Range			
(V)	0.200A	1.000A	4.000A	20.000A
75.00	15.00W	75.00W	300.0W	1500W
150.0	30.00W	150.0W	600.0W	3000W
300.0	60.00W	300.0W	1200W	6000W
600.0	120.0W	600.0W	2400W	12000W

When CF=6，Display digits and power range of CH1

Voltage Range	Current Range			
(V)	0.100A	0.500A	2.000A	10.000A
37.50	3.75W	18.75W	70.00W	375.0W
75.00	7.50W	37.50W	150.0W	750.0W
150.0	15.00W	75.00W	300.0W	1500W
300.0	30.00W	150.0W	600.0W	3000W

Display digits and power range of CH2

Voltage Range	Current Range			
(V)	0.200A	1.000A	4.000A	20.000A
50.00	10.00W	50.00W	200.0W	1000W
100.0	20.00W	100.0W	400.0W	2000W
500.0	100.0W	500.0W	2000W	10000W
1000.0	200.0W	1000W	4000W	20000W

4.2 Setting the Data Update Rate

During measurement, the measurement interval determines the sampling data range. For the power meter, the measurement interval is defined by both the data update rate and the synchronization source. Each channel of the power meter uses its own voltage signal as the synchronization source. The synchronization source provides a reference signal for measurement, while

the data update rate determines the update cycle of the sampled data.

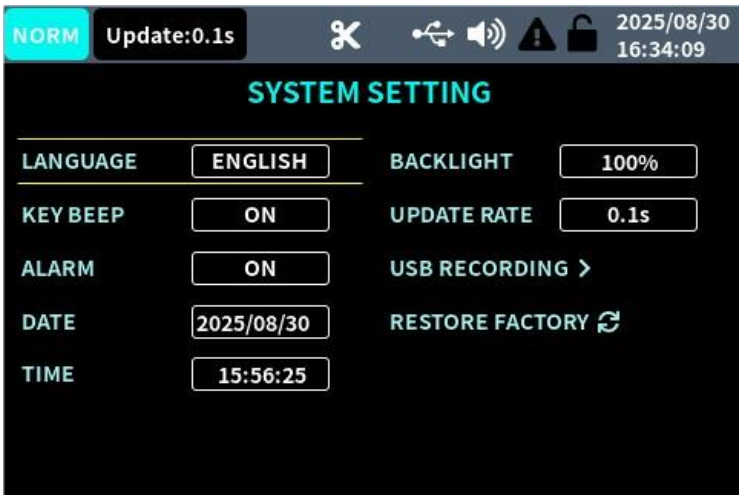
The power meter use the frequency measurement circuit to detect the period of the input signal, and the measurement interval is set as an integer multiple of the detected period. The power meter calculates the measurement values by averaging the sampled data within the measurement interval. However, for functions that measure the maximum values of voltage and current (Ipk+, Ipk-, Upk+, Upk-, Ucf, Icf), the measurement interval is based on the data update cycle. If the rising slope or falling slope appears only once or not at all within the data update cycle, the data update cycle itself is taken as the measurement interval.

Note:

1. Data Update Rate: The time interval for each data update of the power meter. Available settings: 0.1 s, 0.2 s, 0.5 s, 1 s, 2 s, 5 s.
2. Data Update Cycle: The period of sampling data used for measurement functions, equal to the set data update rate.

Operating Steps

- Method 1: Press the **Update Rate** key on the panel. The data update rate can be set cyclically among 0.1 s, 0.2 s, 0.5 s, 1 s, 2 s, and 5 s.
- Method 2: Enter the System Settings via the **Menu**. In the Data **UPDATE RATE** dropdown box, select the desired update rate.



Note: The data update rate is only effective in Normal Mode. When the input signal frequency is relatively low, the numeric display may become unstable and difficult to read. In this case, setting a larger data update rate allows averaging over a longer period to obtain more stable measurement data.

4.3 Valid Input Range and Abnormal Data Handling

For the power meters:

- Channel 1 and Channel 2 rated voltages are 600 Vrms and 1000 Vpk, supporting continuous input of 700 Vrms and 1100 Vpk, with maximum rated peak voltages of 1800 V (at CF=3) and 1100 V.
- The rated current is 20 Arms and 20 Apk, supporting continuous input of 24 Arms and 24 A, with maximum rated peak currents of 60 A (at CF=3) and 30 A.

Abnormal Data Handling:

- When voltage **Urms** or current **Irms** is zero, related parameters including active power **P**, apparent power **S**, reactive power **Q**, power factor **λ**, phase angle **φ**, voltage frequency **fU**, voltage peak **Upk**, current peak **Ipk**, voltage crest factor **CfU**, and current crest factor **CfI** are not calculated, and "----" is displayed.
- When voltage Urms or current Irms exceeds 1.2 times the current range, "OVER" is displayed, indicating overrange. In this case, P, S, and Q also display "OVER".
- For DC input, if no frequency is detected, the panel displays "----". For AC input, if fU frequency is outside the 38–72 Hz range, the panel displays "ERR".
- When |U1pk+| or |U1pk-| exceeds CF × current voltage range, the panel displays "OVER".
- When |I1pk+| or |I1pk-| exceeds CF × current current range, the panel displays "OVER".
- When |U2pk+| or |U2pk-| exceeds 1.1 times the current voltage range, the panel displays "OVER".
- When |I2pk+| or |I2pk-| exceeds 1.2 times the current current range, the panel displays "OVER".
- When active power values used for efficiency calculations (η1, η2) overflow, the panel displays "OVER".
- The range of THD (Total Harmonic Distortion) is [0, 400%]. If the value exceeds this range, the panel displays "ERR".

5. General Measurement Functions

5.1 General Information

The power meters provide a comprehensive set of basic electrical measurement functions, accurately measuring voltage, current, power, power factor, harmonics, frequency, and distortion factor. The reliable data serves as a scientific basis for analyzing the energy quality and performance of equipment.

The variable naming convention of the digital power meter is: parameter type + channel number + description. For example, U1rms and U2rms represent the RMS voltage of Channel 1 and Channel 2, respectively.

For three-phase power meter, the channel numbers for the three-phase inputs and the ∑ (sum) channel are represented as 1A, 1B, 1C, 1∑. For instance, U1Arms, U1Brms, U1Crms, U1∑rms represent the RMS voltages of phases A, B, C, and the total ∑ of the three-phase input, respectively.

General Measurement Parameters

Symbol	Description	Symbol	Description	Symbol	Description
P	Active Power [W]	Irms	RMS Current [A]	Urms	RMS Voltage [V]
Q	Reactive Power [var]	S	Apparent Power [VA]	λ	Power Factor
Upk+	Positive Voltage Peak [V]	Ipk+	Positive Current Peak [A]	CfU	Voltage Crest Factor
Upk-	Negative Voltage Peak [V]	Ipk-	Negative Current Peak [A]	CfI	Current Crest Facto
ф	Phase Angle between Voltage and Current	fU	Voltage Frequency [Hz]	η	Efficiency

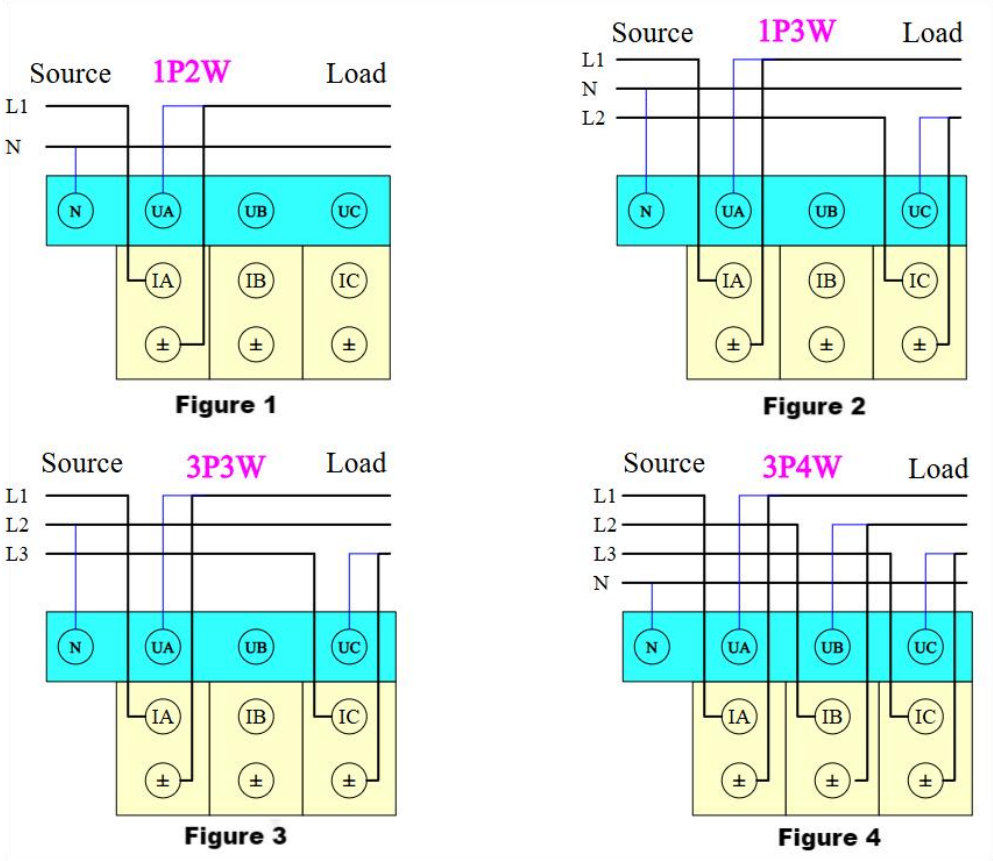
Formulas for General Measurement Parameters：

Measurement function[unit]	Formula
Urms [V]	$\sqrt{\mathrm{AVG}\left(\mathrm{u}\left(n\right)^{2}\right)}$
Irms [A]	$\sqrt{\mathrm{AVG}\left(\mathrm{i}\left(n\right)^{2}\right)}$
P[W]	$\mathrm{AVG}\left(\mathrm{u}\left(n\right)\cdot\mathrm{i}\left(n\right)\right)$
S [VA]	$\mathrm{U}\cdot\mathrm{I}$
Q [var]	$s\cdot\sqrt{\mathrm{S}^{2}\text{-}\mathrm{P}^{2}}$ s is -1 for a lead phase and 1 for a lag phase
λ	P/S
ф [°]	$\cos^{-1}\left(\mathrm{P}/\mathrm{S}\right)$
Upk+ [V]	The maximum u(n) for every data update u(n)
Upk- [V]	The minimum u(n) for every data update u(n)
Ipk+ [V]	The maximum u(n) for every data update i(n)
Ipk- [V]	The minimum u(n) for every data update i(n)
CfU	CfU=MAX(|Upk+|,|Upk-|)/Urms
CfI	CfI=MAX(|Ipk+|,|Ipk-|)/Irms

5.2 Wiring Methods

The power meter supports the following wiring configurations: 1P2W, 1P3W, 3P3W, and 3P4W. The single-phase power meter supports the 1P2W wiring configuration.

The detailed wiring diagrams for 1P2W, 1P3W, 3P3W, and 3P4W are shown in the figure below.



Note: In the 3P3W wiring method, two line voltages and two phase currents are used. Phase B is connected to the common connection point N of the two line voltages, and the **UB** terminal is left floating.

- **When the wiring mode is set to 1P2W**, the user should connect **UA, N** to CH1 for single-phase voltage input, and **IA, ±** to CH1 for single-phase current input.

  In this case, the measurement channel is **CH1A**.

  - **U1A** represents the phase voltage between L and N.
  - **I1A** represents the phase current between L and N.

- **When the wiring mode is set to 1P3W**, the user should connect **UA, UC, N** to CH1 for two-phase voltage inputs, and **IA, IC** with their corresponding ± to CH1 for two-phase current inputs.

  In this case, the measurement channels are **CH1A and CH1C**.

  - **U1A** represents the phase voltage between L1 and N.
  - **U1C represents the phase voltage between L2 and N.**
  - **I1A represents the phase current between L1 and N.**
  - **I1C** represents the phase current between L2 and N.

- **When the wiring mode is set to 3P3W**, the user should connect **UA, UC, N** to CH1 for three-phase voltage inputs, and **IA, IC** with their

corresponding ± to CH1 for A and C phase current inputs.

In this case, the measurement channels are **CH1A and CH1C**.

- U1A represents the line voltage UAB.
- U1C represents the line voltage UCB.
- I1A and I1C represent the phase currents of A and C, respectively.

- **When the wiring mode is set to 3P4W**, the user should connect **UA, UB, UC, N** to CH1 for three-phase voltage inputs, and **IA, IB, IC** with their corresponding ± to CH1 for three-phase current inputs.

  In this case, the measurement channels are **CH1A, CH1B, and CH1C**.

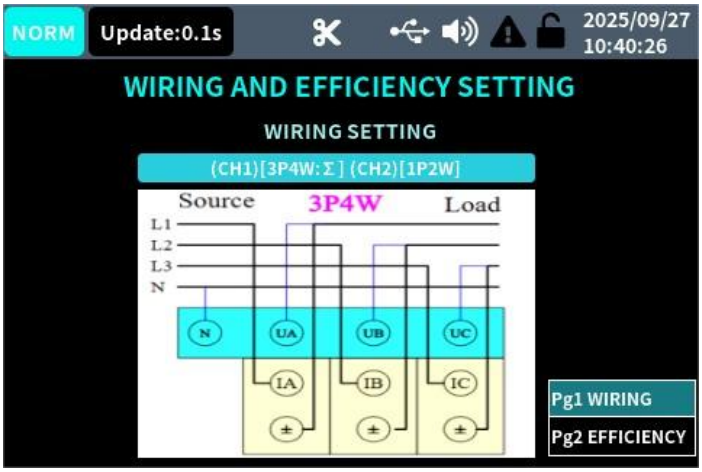
  - **U1A, U1B, U1C** represent the phase voltages of A, B, and C, respectively.
  - **I1A, I1B, I1C** represent the phase currents of A, B, and C, respectively.

When the wiring mode is **1P3W, 3P3W, or 3P4W**, the digital power meter three-phase power meter can further calculate the **total (∑) measurement parameters**. The specific calculation formulas are shown in the following table:

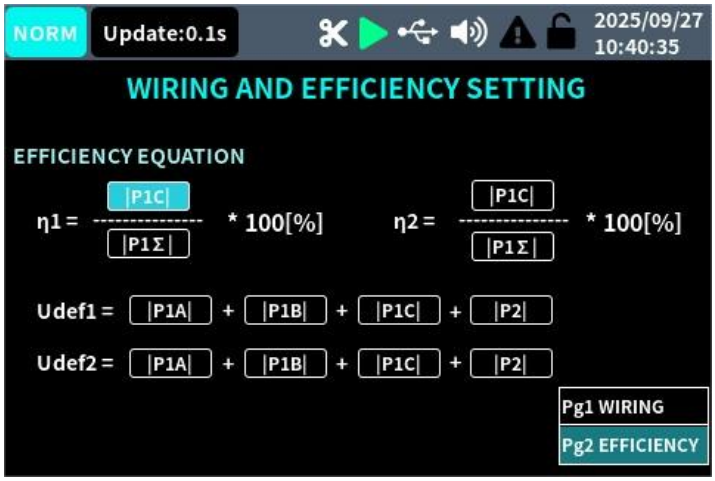
Wiring system	**1P3W**	**3P3W**	**3P4W**
U1Σrms[V]	(U1A + U1C) / 2		(U1A + U1B + U1C) / 3
I1Σrms[A]	(I1A + I2C) / 2		(I1 + I2 + I3) / 3
P1Σ [W]	P1A + P1C		P1A + P1B + P1C
S1Σ [VA]	S1A+S1C	$\frac{\sqrt{3}}{2}(S1A+S1C)$	S1A +S1B +S1C
Q1Σ [var]	$s\cdot\sqrt{S1\Sigma^2-P1\Sigma^2}$, (Lead: s=-1; Lag: s=1)		
λ1Σ	P1Σ/S1Σ		
ϕ1Σ	$s\cdot\cos^{-1}\left(P1\Sigma/S1\Sigma\right)$, (Lead: s=-1; Lag: s=1)		

Operating Steps:

1. The user can press the **Wiring** button to enter the wiring mode and efficiency setting interface. In the wiring mode dropdown menu, the user can select from **3P4W, 3P3W, 1P3W,** or **1P2W** wiring modes. For the **OWH9830** unit, the default wiring mode of **CH1** is **3P4W**. For the **OWH9811** unit, **CH1** only supports the **1P2W** wiring mode.



2. The **OWH9830** allows the user to press the **PgDn** key to switch to the efficiency formula setting interface. By selecting **Efficiency**, the user can flexibly choose the calculation formulas for **η1** and **η2** from the option boxes. For example: **η1 = P1∑/P2**, **η1 = P1A/P2**, or **η1 = P2/P1∑**, etc.



5.3 Setting Measurement Functions

During general measurements, the power meters offer **three numeric display styles** and **one graphical display style**, with each style supporting up to **9 pages**.

1. To highlight several important measurement parameters, the display can be switched to **4ITEM** or **8ITEM** modes.
2. To view all parameters on a single interface, switch to **16ITEM** mode.
3. To observe channel waveforms, switch to the **Waveform Display** mode.
4. The following example uses the **8ITEM** mode. The interface is configured to display: **U1rms, I1rms, P1, λ, U2rms, I2rms, P2, η1**. The specific operation steps are as follows:

For general measurements, the power meters provide **three numerical display styles** and **one graphical display style**, with up to **nine pages** available for each style.

When it is necessary to highlight certain key measurement parameters, the display can be switched to the **4-ITEM** or **8-ITEM** style.

When all parameters need to be viewed on a single screen, the display can be switched to the **16-ITEM** mode.

When waveform observation of the channels is required, the display can be switched to the **waveform display mode**.

For the **OWH9811 model**, the default parameters displayed in the **4-ITEM, 8-ITEM, and 16-ITEM** display modes are shown in the table below.

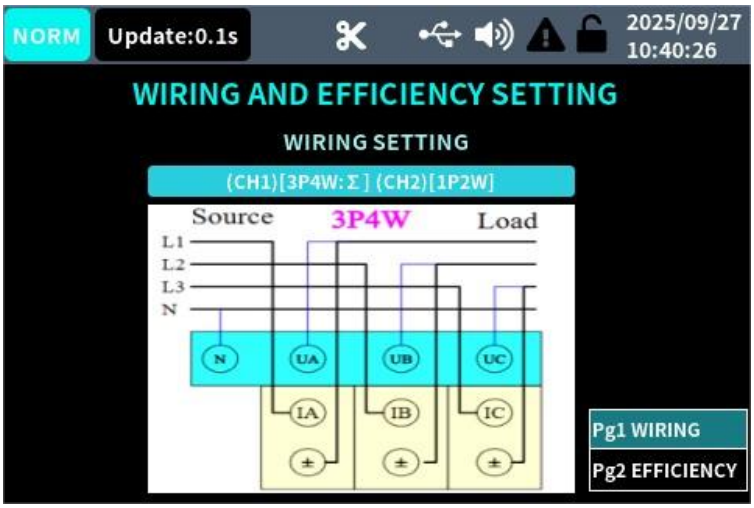
4ITEM						
1	2	3	4	5	6	7
U1rms	Q1	U1pk+	CfU1	U2rms	U2rms	U2pk+
I1rms	λ1	U1pk-	CfI1	I2rms	λ2	U2pk-
P1	φ1	I1pk+	η1	P2	--	I2pk+
S1	fU1	I1pk-	--	S2	fU2	I2pk-

16ITEM					
1	2	3	4	5	6
U1rms	U2rms	---	---	---	---
I1rms	I2rms	---	---	---	---
P1	P2	---	---	---	---
S1	S2	---	---	---	---
Q1	---	---	---	---	---
λ1	λ2	---	---	---	---
φ1	η1	---	---	---	---
---	---	---	---	---	---
fU1	---	---	---	---	---
U1pk+	U2pk+	---	---	---	---
U1pk-	U2pk-	---	---	---	---
I1pk+	I2pk+	---	---	---	---
I1pk-	I2pk-	---	---	---	---
CfU1	---	---	---	---	---

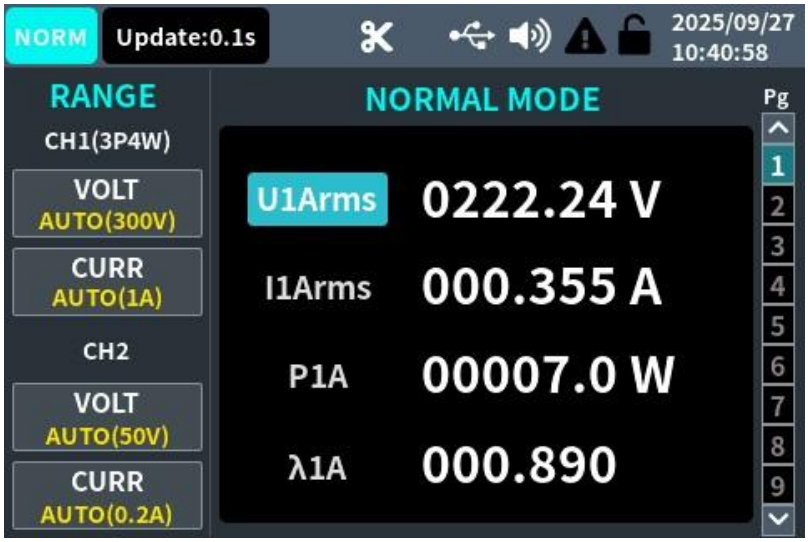
Cfl1	---	---	---	---	---
---	---	---	---	---	---

Operating Steps

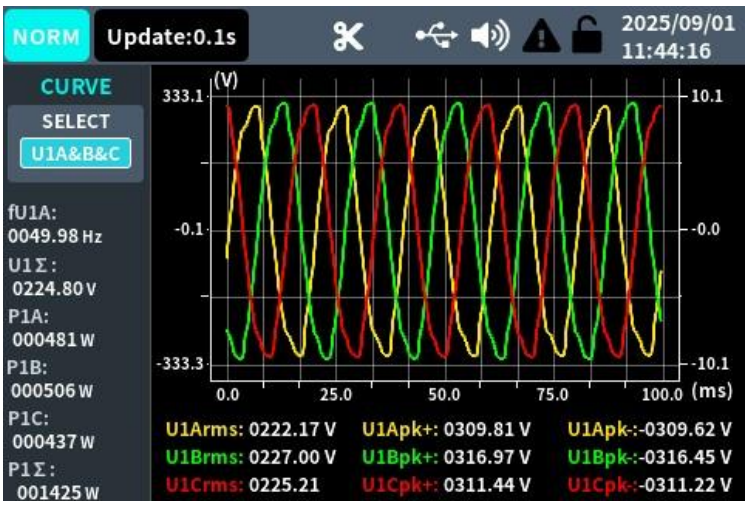
1. Press the **Mode** button or access it from the **Menu** to enter the mode settings, enabling the power meter to operate in normal measurement mode. By pressing the **Mode** button continuously, the power meter can cycle through **Normal Mode**, **Harmonic Mode**, and **Integration Mode**.
2. Press the **Wiring** button or access it from the **Menu** to enter the wiring mode and efficiency formula settings. Select the appropriate wiring configuration and set the efficiency formula. The user must follow the wiring diagram displayed on the screen to avoid circuit damage and ensure accurate measurement results.



3. Press the **Esc** key to return to the main numerical display page of normal measurement. At this point, the configured wiring mode is shown below the **CH1 range** on the left side. The user can press the **Numeric** button to switch between numerical display interfaces. By pressing this button repeatedly, the display will cycle through different styles: **4-ITEM, 8-ITEM, and 16-ITEM**.

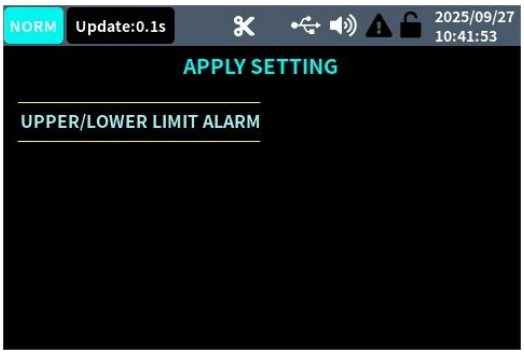


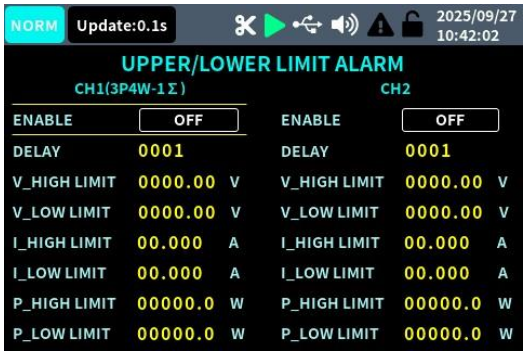
4. To modify display items, the user can move the cursor using the **Up/Down arrow keys** to the target position (e.g., the second row to display **P2**), then press **Enter** to enter edit mode. At this point, **P2** can be directly selected from the dropdown menu and confirmed with **Enter**. Alternatively, the user may select the same parameter type from another channel (e.g., **P1**), then press the **Element** key to switch the channel to **P2**. This method is mainly used in the **OWH9830 series**.
5. Repeat the above step to complete the configuration of all parameters to be displayed.
6. If additional display variables are needed, press the **PgUp** / **PgDn** keys to switch to different display pages. The power meters support up to **nine pages**. Parameters on different pages can be viewed by toggling with the **PgUp** / **PgDn** keys.
7. To view voltage and current waveforms, press the **Wave** button to switch to the waveform display interface. From the dropdown menu, different display contents can be selected. For the **OWH9830**, users can view **CH1 three-phase voltages, three-phase currents, phase A voltage/current, phase B voltage/current, phase C voltage/current**, as well as **CH2 voltage/current**. For the **OWH9811**, users can view the **voltage and current of CH1 or CH2**.



5.4 Alarm Setting Function

In certain automated testing scenarios, the power meters provide **upper and lower limit** alarm functions for voltage, current, and power parameters. Users can configure these alarm limits through the Application Settings menu.





Users can enable or disable the alarm function by switching the **Alarm On/Off** setting. To reduce false alarms caused by sampling noise, the **alarm delay count** can be set. An alarm will only be triggered if the monitored parameter exceeds the set limit continuously for the number of times specified by the alarm delay count.

For example, if **CH1** is set with an alarm delay count of 5, and the voltage of CH1 exceeds the upper limit for **5 consecutive data update cycles**, a pop-up will indicate an upper voltage limit alarm, and the alarm indicator in the status bar will turn red. **Pop-up alarm messages** must be manually cleared by the user. **Status bar alarm indicators** update in real time according to the current measurement. If the sampled value returns to the normal range, the status bar will revert to black.

For **3P4W, 3P3W, and 1P3W multi-phase wiring modes**, the **CH1 voltage, current, and power alarm information** is determined based on **|U1∑rms|, |I1∑rms|, and |P1∑|**. In this case, the maximum alarm thresholds for voltage, current, and power are **660 V, 22 A, and 13.2 kW × N phases**, respectively.

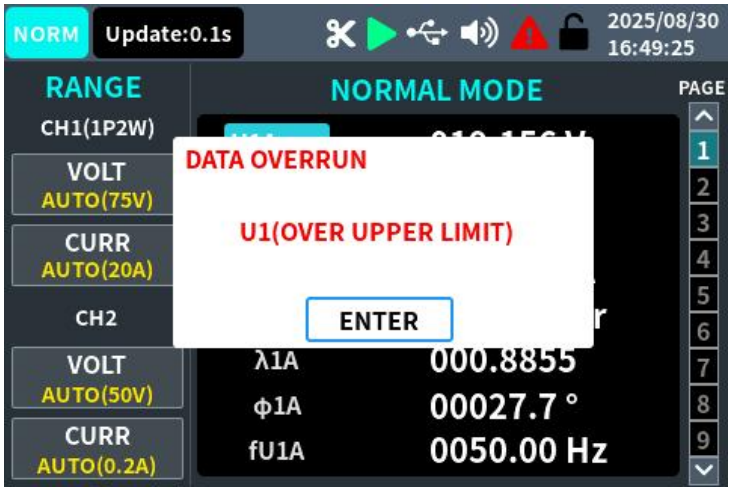
For the **1P2W single-phase wiring mode**, the **CH1 voltage, current, and power alarm information** is determined based on **|U1Arms|, |I1Arms|, and |P1A|**. In this case, the maximum alarm thresholds for voltage, current, and power are **660 V, 22 A, and 13.2 kW**, with the minimum value being **0**.

For **CH2**, the maximum alarm thresholds for **voltage |U2rms|, current |I2Arms|, and power |P2|** are **1100 V, 22 A, and 22 kW**, respectively, with the minimum value being **0**.

When both the upper and lower limits are set to zero, it indicates that the parameter is not subject to alarm monitoring.

Operating Steps

1. Press the **Menu** key to enter the **Alarm Settings** interface.
2. The user can independently configure the alarm information for **CH1** and **CH2**. When a specific parameter needs to be monitored, its corresponding upper and lower alarm limits must be set to a **non-zero value** by using the **Up/Down/Left/Right arrow keys**, along with the **Enter** and **Esc** keys.
3. To monitor a specific parameter, use the **cursor keys (Up/Down/Left/Right), Enter,** and **Esc** to set the corresponding upper and lower alarm limits to non-zero values.
4. After setting the limits, turn on the **Alarm Switch** to start monitoring voltage, current, and power limits.



5.5 Screenshot and Data Logging Functions

The **power meters** provide **screenshot saving** and **USB flash drive data logging** functions, enabling users to conveniently store test data. The key information for USB data logging is as follows:

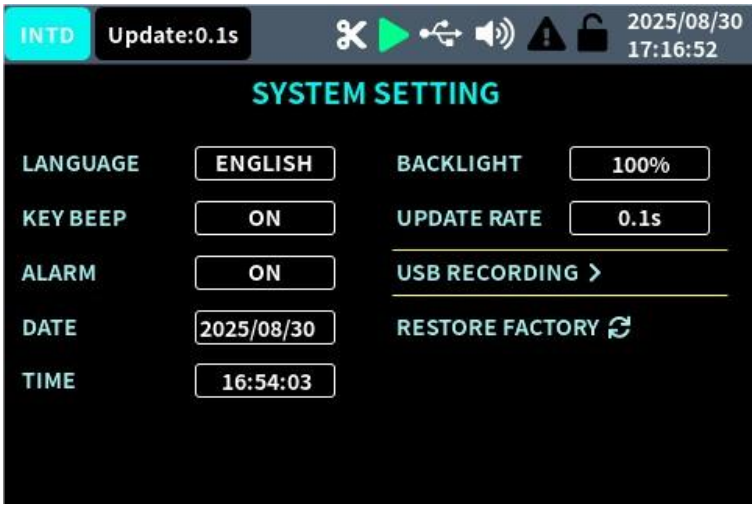
- **USB flash drive requirements:** FAT32 format, capacity ≤ 32 GB
- **Status indicators:** Gray (not connected) → White (recognized) → Flashing (read/write in progress)
- Logging steps: Insert USB drive → System Settings → USB Logging → Set Length → Start Logging
- **Logging status:** Status bar displays "T00:00:00" + USB flashing
- **Termination conditions:** Manual stop / Reaching set duration / Automatic stop after 72 hours / Insufficient space / USB removed
- **File storage:** Named as PA_DATA_<time>.csv. When data exceeds **1 million records**, a new file is automatically created.
- **Data format:** Includes timestamp + parameters of the current page

Screenshot Saving Steps:

1. Insert the USB flash drive and ensure it is successfully recognized.
2. During operation, press the **Hold** button to pause screen updates.
3. Press the **Save** button to capture and save a screenshot.

Data Logging Steps:

1. Insert the USB flash drive and ensure it is successfully recognized.
2. Press the **Menu** button to enter the **USB Logging Settings** interface.
3. Use the edit function to select the parameters to be recorded and set the recording duration. After saving the settings, exit to the main screen.
4. Press the **Record** button to start logging. Press the **Record** button again to stop logging.


INTD
Update:0.1s
2025/08/30
17:16:52
SYSTEM SETTING
LANGUAGE
ENGLISH
KEY BEEP
ON
ALARM
ON
DATE
2025/08/30
TIME
16:54:03
BACKLIGHT
100%
UPDATE RATE
0.1s
USB RECORDING
RESTORE FACTORY


INTD
T 00:00:03
2025/08/30
17:17:17
USB RECORDING SETTING
RECORDING LENGTH
001 Hour
LOGGING INTHERVAL
00.1 s
STORAGE PARAMETERS
U1Arms
I1Arms
P1A
S1A
Q1A
λ1A
ϕ1A
fU1A
STOP

6. Harmonics Measurement Function

This chapter describes the harmonics measurement features and operation of the power meters.

6.1 Basic Concepts

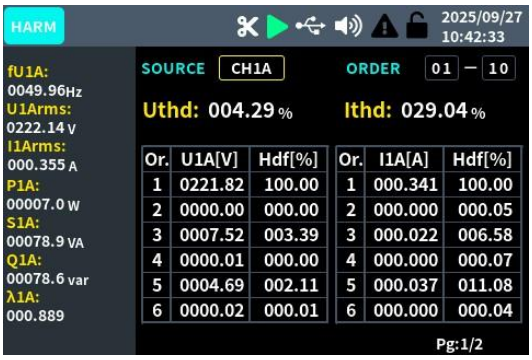
The CH1 channel of the digital power meter supports harmonics analysis. Its full-bandwidth passband is **2.8 kHz**, the measurable fundamental frequency range is **45–66 Hz**, and the maximum number of measurable harmonics is **63**. Harmonics measurement error is **1%**.

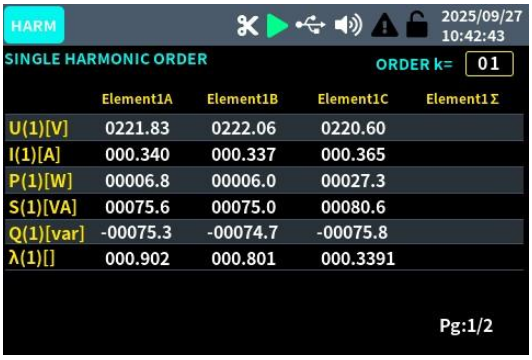
The meter can measure **active power, reactive power, power factor, and total harmonic distortion (THD)** for voltage, current, and each harmonic order. Harmonic parameters can be displayed in **lists** or **bar charts**, allowing intuitive analysis of the measurement results.

6.2 Harmonics Measurement Operation

The harmonics measurement mode provides **three main display interfaces**: **list, numeric, and bar chart**.

1. Use **list mode** to view multiple harmonic orders simultaneously.
2. Use **numeric mode** to focus on specific harmonic values of voltage, current, or power.
3. Use **bar chart mode** for a visual representation of harmonic orders.

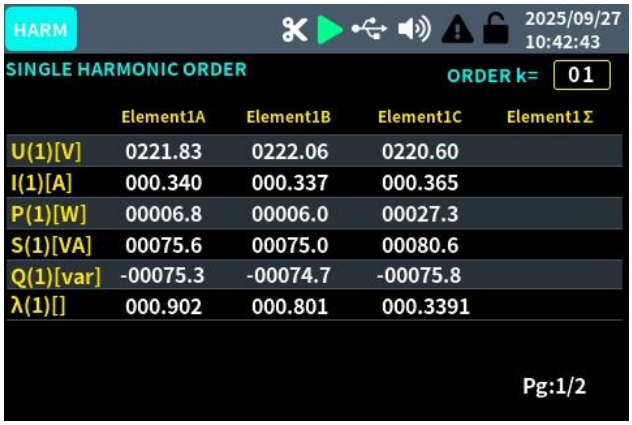




Operating Steps

1. Press the **Mode** key to set the power meter to **Harmonics Mode**.
2. Press the **Numeric** key to switch between **list** and **numeric** displays. Repeatedly pressing this key cycles between the two display styles.
   1) **List Display:** *(diagram or table of multiple harmonic orders)*
   2) **Single Harmonic Numeric Display:** *(diagram showing single harmonic value)*

3. Use the **Up/Down arrow keys** to move the cursor to the desired setting position. For example, to select the channel for **CH1**, press **Enter** to enter edit mode. At this point, other channel options can be selected from the dropdown menu and confirmed by pressing **Enter**. Alternatively, to set the number of harmonics to read, press **Enter** to enter edit mode, then use the **Up/Down keys** to set the harmonic count from **1 to 63**. Press **Enter** to confirm and exit the harmonic count setting.
4. Press the **Numeric** button to switch to the **single-harmonic numerical display interface**. When the cursor is on the harmonic count setting, press **Enter** to confirm and set the single-harmonic count from **1 to 63**. After setting, press **Enter** to confirm and exit the single-harmonic count setting.



5. If the user wants to view the **voltage or current harmonic waveforms**, press the **Wave** button to switch to the **harmonic mode display interface**. By selecting the parameters, the user can switch between voltage and current to view individual harmonic displays.

6. To return to the numeric display interface, press the Numeric key again to switch back to the previous numeric display screen.

7. Integration Measurement Function

This chapter describes the integration measurement features and operation methods of the power meters.

7.1 Basic Concepts

Both CH1 and CH2 channels of the power meter can perform:

1. **Active power integration (Wh)**
2. **Current integration (Ah)**

Integration supports **automatic or fixed range settings**. During integration, the display can show **Wh (WP), Ah (q), and integration time (Time)**, as well as measurement and calculated values from normal or harmonics measurement modes.

Integration formulas:

$$WP = \left[\frac{1}{N} \sum_{n=1}^{N} u(n) i(n) \right] \cdot Time$$

$$q = \left[\frac{1}{N} \sum_{n=1}^{N} I(n) \right] \cdot Time$$

Current integration uses RMS calculation mode.

Maximum/minimum display values:

Active power (WP): ±999,999 MWh

Current (q): ±999,999 MAh

Time: 10,000 hours

The maximum display resolution is **999,999**. When the integration value reaches 1,000,000 counts, the decimal point automatically moves. For example, **999.999 mWh + 0.001 mWh = 1.00000 Wh**.

For **three-phase power meters**, the cumulative integration for **CH1∑** depends on wiring configuration:

Wiring Method	1P3W	3P3W	3P4W
WP1Σ	WP1A+WP1C		WP1A+WP1B+WP1C
q1Σ	q1A+q1C		q1A+q1B+q1C

Integration Overflow Display

Integration stops and retains the current integration value and time when:

1. Integration time reaches the maximum (10,000 hours)
2. WP or q reaches the maximum/minimum display value

Integration with Measurement Limits

If instantaneous voltage or current exceeds the AD circuit range, these values are treated as the upper/lower limit of the range.

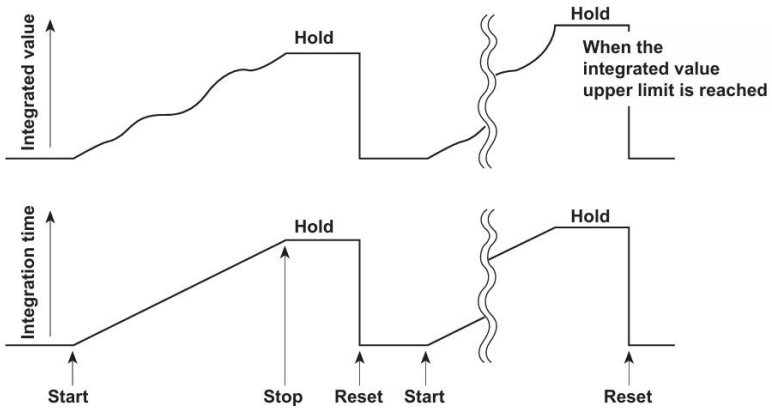
7.2 Integration Modes

The power meter supports **Manual Integration Mode** and **Standard Integration Mode**.

7.2.1 Manual Integration Mode

Integration continues from start to stop. However, integration stops automatically if:

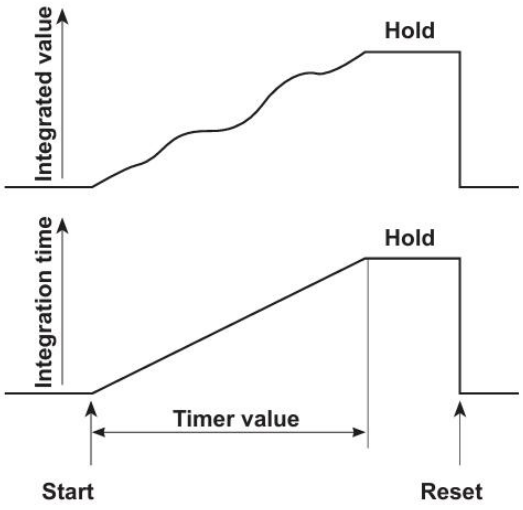
1. Maximum integration time (10,000 hours) is reached
2. Integration value reaches maximum/minimum display value



7.2.2 Standard Integration Mode

Integration time is set via a relative timer. Integration stops when:

1. The set time expires
2. Maximum/minimum display value is reached before the timer ends



7.3 Integration Operation

7.3.1 Start, Stop, Hold, Reset

Users can start, stop, reset, or hold integration via front panel keys or communication commands to control the CH1 and CH2 together.

1. **Start:** Shift + Wiring or panel Start key
2. **Stop:** Shift + Hold or panel Stop key
3. **Reset:** Shift + Esc or panel Reset key
4. **Hold:** Hold key (locks the display while integration continues)

7.3.2 Integration Main Interface

The main interface includes:

Parameter Setting Area:

- Mode: Manual or Standard integration
- Set Time: max 9999:59:59 (10,000 hours)

Display Control Area:

- Status: Run, Stop, Hold, Reset
- Test Time: 9999:59:59 (current integration duration)
- Wh Integration: max 999,999 MWh
- Ah Integration: max 999,999 MAh

7.3.3 Basic Operations

1. Set voltage/current range via **Mode** key or **Menu** to enter integration mode.
2. Enter integration mode via **Mode** key or Menu.
3. During integration, normal and harmonic measurements can be displayed. Status bar shows integration running symbol.
4. Hold Function: Press **Hold** to freeze the display while integration continues.
5. Run Function: Press **Shift**+**Wiring** or panel Start key to begin integration.

6. Stop Function: Press **Shift**+**Hold** or panel Stop key to pause integration.

7. Reset Function: Press **Shift**+**Esc** or panel Reset key to clear integration values.

7.3.4 Manual Integration Operation

1. Set **Mode** via key or Menu to enter integration mode.
2. Select **Manual** from the mode dropdown (time setting disabled).
3. Press **Shift**+**Wiring** or panel Start key to begin integration.
4. Stop integration via **Shift**+**Hold** or panel Stop key.

7.3.5 Standard Integration Operation

1. Set **Mode** via key or Menu to enter integration mode.
2. Select **Normal** mode from the dropdown.
3. Set the timer (max 9999:59:59).

4. Start integration via **Shift**+**Wiring** or panel Start key.
5. Stop integration manually if needed via **Shift**+**Hold** or panel Stop key.

8. Troubleshooting

If the instrument remains black with no display after pressing the power switch, please proceed as follows:

1. Check whether the power connector is properly connected.
2. Check whether the fuse below the power input socket is correctly selected and intact (use a flat-head screwdriver to open if necessary).
3. After completing the above checks, restart the instrument.
4. If the problem persists, please contact our company for service assistance.

9. Technical Specifications

The instrument must be operated continuously for more than 30 minutes at the specified operating temperature to meet the following specifications.

Model	OWH9811		OWH9830	
Display	TFT 3.95 inch Screen		TFT 3.95 inch Screen	
Update rate	0.1s、0.2s、0.5s、1s、2s、5s		0.1s、0.2s、0.5s、1s、2s、5s	
Measurement items	V, A, W, VA, var, λ, fU, CfU, CfI, Upk, Ipk, THD		V, A, W, VA, var, λ, fU, CfU, CfI, Upk, Ipk, THD	
Measurement method	CH1 1ph-AC	CH2 1ph-AC+DC	CH1 3ph-AC	CH2 1ph-AC+DC
Voltage measurement range	3.0V-600Vrms	0V-1000Vpk*1	3.0V-600Vrms	0V-1000Vpk*1
Voltage range	CF=3: 75V/150V/300V/600V CF=6: 37.5/75V/150V/300V	50V/100V/500V/1000V	CF=3: 75V/150V/300V/600V CF=6: 37.5/75V/150V/300V	50V/100V/500V/1000V
Voltage accuracy	±(0.4% of reading + 0.1% of range + 1 digit)		±(0.4% of reading + 0.1% of range + 1 digit)	
Voltage resolution	0.01V/0.1V		0.01V/0.1V	
Current measurement range	0~20.0Arms	0-20Apk*1	0~20.0Arms	0-20Apk*1
Current range	CF=3: 0.2A/1A/4A/20A CF=6: 0.1A/0.5A/2A/10A	0.2A/1A/4A/20A	CF=3: 0.2A/1A/4A/20A CF=6: 0.1A/0.5A/2A/10A	0.2A/1A/4A/20A
Current accuracy	±(0.4% of reading + 0.1% of range + 1 digit)		±(0.4% of reading + 0.1% of range + 1 digit)	
Current resolution	0.001A		0.001A	
Range Switching	Auto/Manual		Auto/Manual	
Power Range	0~12kW	0~20kW	0~36kW	0~20kW
Power accuracy	±(0.4% of reading + 0.1% of range + 1 digit)		±(0.4% of reading + 0.1% of range + 1 digit)	
Power Resolution	0.01W/0.1W/1W		0.01W/0.1W/1W	
Power Factor Range	-1.000~1.000		-1.000~1.000	
Power Factor Accuracy	±(0.4% of reading + 0.1% of range + 1 digit)	----	±(0.4% of reading + 0.1% of range + 1 digit)	----
Operating Frequency	40Hz~70Hz	DC+40Hz-70Hz	40Hz~70Hz	DC+40Hz-70Hz
Frequency Accuracy	±(0.1% of reading + 1 digit)	----	±(0.1% of reading + 1 digit)	----
Harmonic Analysis	2.8 kHz bandwidth, up to 63rd order	----	2.8 kHz bandwidth, up to 63rd order	----
Integration	Watt-hour (Wh), Ampere-hour (Ah)		Watt-hour (Wh), Ampere-hour (Ah)	

Function				
Warm-up Time	>30 min		>30 min	
Peak Current	60A	30A	60A	30A
Maximum Continuous Input	Vrms=700V; Irms=24A	Vpk=1100V; Ipk=24A	Vrms=700V; Irms=24A	Vpk=1100V; Ipk=24A
Interface	RS232/RS485			
Communication Protocol	Standard SCPI ， Modbus protocal			
Baud Rate (bps)	4800、9600(default)、19200、38400、57600，115200,			
Display Hold	YES		YES	
Mute	YES		YES	
Key Lock	YES		YES	
Power Supply	AC 100V~240V, 50/60Hz			
Operation environment	18 ℃ ~ 28 ℃, 30% ~ 75% RH (When operating temp. is outside 18 ℃ ~ 28 ℃, add temp. coefficient: 0.05% of reading / ℃)			
Storage Environment	-10 ℃ ~ 50 ℃, ≤ 80% RH (non-condensing)			
Operating Altitude	≤2000 meters			
Weight	1.3kg		1.3kg	
Dimensions	235mm(L) × 110mm(H) × 295mm(W)		235mm(L) × 110mm(H) × 295mm(W)	

***1: DC peak maximum value.**

Adjustment Interval: A calibration interval of one year is recommended.

10. Appendix

10.1 Appendix A: Accessories

(Images for reference only, subject to the actual product.)

Standard Accessories:

Power cord

User manual

Banana plug to crocodile clip test leads

Optional Accessories:

Banana head

RS232 Cable

Terminal Box Accessories

10.2 Appendix B: Maintenance and Cleaning

General Maintenance

Do not store or place the instrument in locations where the LCD display is exposed to direct sunlight for extended periods.

Caution: Do not allow sprays, liquids, or solvents to come into contact with the instrument to avoid damage.

Cleaning

Inspect the instrument regularly depending on usage. Clean the exterior of the instrument following the steps below:

1. **Wipe off surface dust with a soft cloth. When cleaning the LCD** display, take care not to scratch the transparent LCD protective cover.
2. Wipe the instrument with a damp but not dripping soft cloth. Ensure the power is disconnected before cleaning. Mild detergent or clean water may be used. Do not use any abrasive chemical cleaners, which may damage the instrument

Warning:

Before reconnecting power and operating the instrument, make sure it is completely dry to prevent electrical short circuits or personal injury caused by residual moisture.