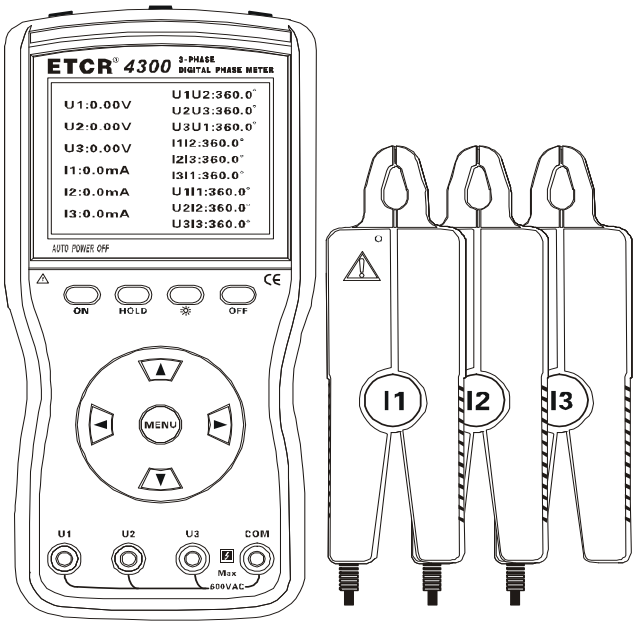
ETCR® THREE PHASE DIGITAL PHASE METER
三相数字相位伏安表

ETCR 4300
ETCR 4400



http://www.etcr.cc

MANUAL

Guangzhou ETCR Electronic Technology Co., Ltd.

广州市铱泰电子科技有限公司

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I. Safety Precautions And Procedures

This instrument was designed in compliance with IEC61010-1, IEC61010-031& IEC61326 safety guideline relative to electronic equipment.

For your own safety and to avoid damaging the instrument you are recommended to follow the procedures described in this manual and read carefully all instructions preceded by this symbol ⚠

Before and during measurements keep to the following instructions:

● Do not take the measurements in wet places

● Do not take the measurements in the presence of explosive gas and combustibles or in dusty places

● Avoid any contact with the circuit under test even though you are not taking any measurement

● Avoid any contact with exposed metal parts, unused measuring terminals, circuits etc. Do not take any measurement whenever anomalous conditions occur such as deformations, breaks, leakages, blind display etc

The herewith symbols are used in this manual and on the meter

 CAUTION: refer to the instruction manual. An improper use may damage the instrument or its components as well as endanger the user.

 High voltage danger: risk of electric shock

1. Preliminary Instructions

●This meter is designed for use in environments with pollution degree 2

● It can be used for voltage and current measurement on electrical installations with overvoltage CAT III 600V

● You are recommended to respect the usual safety regulations aimed at protecting you

against dangerous current and protecting the instrument against improper use

● Only the original accessories supplied along with the instrument guarantee compliance with the safety standards in force. They must be in a good conditions and, if necessary, replaced with identical ones

● Do not test nor connect to any circuit exceeding the specified overload protection

●Do not take measurements under environmental conditions exceeding the limits indicated in this manual

● Make sure that batteries are correctly installed

2. During Use

You are recommended to read the following instructions carefully:

CAUTION 
Failure to comply with warnings and instructions may damage the instrument and/or its components as well as injure the operator

● Do not measure under the conditions of external voltages. Although the instrument is self-protected, an excessive voltage may cause malfunction

● Do not press 2 or more buttons at the same time, otherwise all operations will be invalid.

● Avoid submitting the instrument to voltage while measuring (i.e. a test lead slipping off the measuring point accidentally touching an energized point)

CAUTION 
If the “low battery” symbol  is displayed during use interrupt testing, switch off the instrument and replace batteries. (Take note of the polarity when replace the battery.)

3. After Use

● Turn off the instrument pressing ON/OFF key after using it

● If you expect not to use the instrument for a long time remove batteries

II. Overview

ETCR4300 and ETCR4700 three-phase digital volt-ampere meter is a kind of digital, intelligent meter with multiply functions, which we developed specifically for field testing. It has the features of high precision, high stability, low power consumption and easy use, etc.

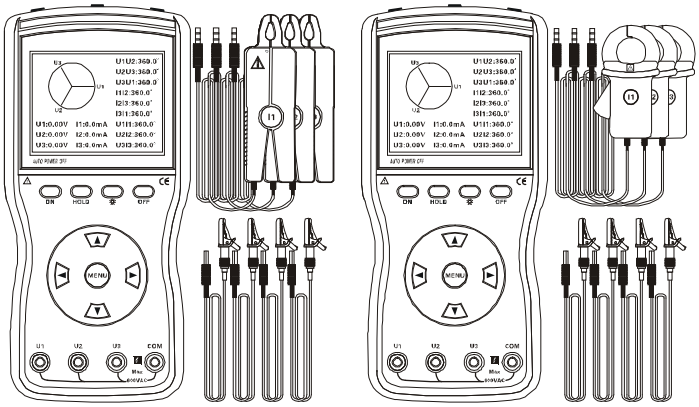
The meter is able to measure three-phase AC voltage, current，voltage between the phase between the current phase, the phase between voltage and current, frequency, phase sequence, active power, reactive power, apparent power, power factor, current vector sum simultaneously; judge the wiring type of transformer, inductive and capacitive circuits; also test the secondary circuit and bus differential protection system, read the phase relationship between the CT for differential protection; besides, it can be used to check whether the wiring of the watt-hour meter is correct or not, and check the line equipment, thus serving the electric inspector as a new type of safe, accurate and convenient electric meter.

ETCR4300, ETCR4700 three-phase digital phase meter is fitted with anti-vibration, anti-slip and high insulation jackets. With 240dots × 160dots LCD display, it is able to display dynamically, vector diameter is adopted to show a clear and exquisite luxurious appearance. Its current clamp varies in two sizes; the small tip clamp is applicable for cable intensive area; while the large circular one is for detection of coarse wires. Therefore, the meter can meet requirements of various occasions.

Three-phase digital phase meter is also known as intelligent three-phase digital phase meter, multipurpose three-phase digital phase meter and three-clamp digital phase meter or others, suitable for applications in electric power, petrochemical and metallurgical enterprises, railway, industrial and mining domain, research institutions, measuring departments, etc. It is particularly applicable for electric energy billing system and relay protection system.

Ⅲ. Model

Model	Dimensions of Clamp	Description
ETCR 4300	7.5mm×13mm	Small tip current clamp
ETCR 4700	35mm×40mm	Circular current clamp



IV. Electrical Symbols

	Extremely dangerous! The operator must strictly observe the safety guidelines; otherwise, there may be a risk of electric shock, injury or death.
	Danger！ The operator must strictly observe the safety guidelines; otherwise, there may be a risk of electric shock, injury or death.
	Warning! Strictly follow the safety guidelines, an improper use may damage the instrument or its components as well as endanger the user.
	Alternate current (AC) ∼
	Direct current (DC) ⎓
▣	Double insulation

V. Technical Specifications

1. ETCR4300 reference and working conditions

Influence quantity	Reference conditions	Working conditions	Remarks
Ambient temperature	23°C±1°C	-10°C ~ 40°C	----
Ambient humidity	40% ~ 60%	< 80%	----
Signal waveform	Sine wave	Sine wave	β=0.01
Signal frequency	50HZ±1HZ	45HZ～65HZ	----
Working voltage of meter	9V±0.1V	9V±1.5V	----
Current magnitude when measuring the phase sequence of phase frequency	1A±0.2A	2mA ~ 20A	----
Voltage magnitude when measuring the Phase sequence of phase frequency	100V±20V	10V~600V	----
Current magnitude when measuring the power factor	1A±0.2A	20mA~20A	----
Voltage magnitude when measuring the power factor	100V±20V	10V~600V	----
External electric field, magnetic field	To be avoided		
Location of the tested wire	The tested wire is arranged at the approximate geometrical center of the clamp		

2. ETCR4700 reference and working conditions

Influence quantity	Reference	Working	Remarks

	conditions	conditions	
Ambient temperature	23°C±1°C	-10°C ~ 40°C	----
Ambient humidity	40% ~ 60%	< 80%	----
Signal waveform	Sine wave	Sine wave	β=0.01
Signal frequency	50HZ±1HZ	45HZ～65HZ	----
Working voltage of meter	9V±0.1V	9V±1.5V	----
Voltage magnitude when measuring the phase-frequency phase sequence	1A±0.1A	0.1A ~ 400A	----
Voltage magnitude when measuring the phase-frequency phase sequence	200V±2V	30V ~ 600V	----
Voltage magnitude when measuring the power factor	1A±0.1A	0.1A ~ 400A	----
Voltage magnitude when measuring the power factor	200V±2V	30V ~ 600V	----
External electric field, magnetic field	To be avoided		
Location of the tested wire	The tested wire is arranged at the approximate geometrical center of the clamp		

3. General specifications

Model	ETCR4300	ETCR4700
Functions	It is able to measure three-phase AC voltage, current, phase between voltage, phase between current, the phase between voltage and current, frequency, phase sequence, active power, reactive power, apparent power, power factor, current vector sum simultaneously; judge the wiring type of transformer, inductive and capacitive circuits; also test secondary circuit and bus differential protection system, read the phase relationship between the CT for differential protection; besides, it can be used to check whether the wiring of the watt-hour meter is correct or not, and check the line equipment.	
Power supply	DC9V Alkaline batteries (1.5V LR6×6)	
Power consumption	The maximum power consumption can be 80mA if the backlight is turned on, and the battery can work continuously for 10 hours	
	The power consumption can be 50mA if the backlight is turned off, and the battery can work continuously for 16 hours	
Display modes	LCD display, 240dots×160dots	
Dimensions of meter	L×W×: 196mm×92mm×54mm	
Dimensions of Clamp	7.5mm×13mm	35mm×40mm
Voltage range	AC 0.00V~600V	
Current range	AC 0.0mA~20.0A	Current: AC 0mA~400A
Phase range	0.0°~360.0°	
Frequency range	45.00Hz~65.00Hz	
Active power	0.0W~12kW	0W~240kW

range		
Reactive power range	0.0W~12kVAR	0W~240kVAR
Apparent power range	0.0W~12kVA	0W~240kVA
Power factor range	-1~+1	
Current vector sum	0mA~60.0A	0A~1200A
Resolution	Voltage: AC 0.01V	
	Current: AC 0.1mA	
	Phase: 0.1°	
	Frequency: 0.01Hz	
	Active power: 0.1W	
	Reactive power: 0.1VAR	
	Apparent power: 0.1VA	
	Power factor: 0.001	
	Current vector sum: 1mA	Current vector sum: 0.1A
Phase sequence	Positive phase: U1, U2, U3 or I1, I2, I3 cursor flashes sequentially from left to right Negative phase: U1, U2, U3 or I1, I2, I3 cursor blinks sequentially from right to left	
Tested rate	About 2s/time	
Data retention	Press **HOLD during the test to keep the data, and the symbol "HD**" will be displayed.	
Data storage	500 sets	
RS232 interface	USB-RS232 interface; all data stored are uploaded to the computer, to provide the convenience for data analysis and management.	
Automatic shutdown	The meter automatically shuts down about 15 minutes after start-up, as to reduce the battery consumption.	

Backlight function	Available, suitable for use in dark places or at night	
Voltage detection	When the battery voltage is below 7.2V, low voltage sign will be displayed to remind the user of replacing the battery.	
Meter mass	Host: 550g (with battery)	
	Small tip current clamp: 170g×3	Circular current clamp: 185g×3
	Test line: 250g	
Length of test line	1.5m	
Length of current clamp wire	2m	
Working temperature and humidity	-10°C ~ 40°C; below 80%Rh	
Storage temperature and humidity	-10°C ~ 60°C; below 70%Rh	
Input impedance	Input impedance of test voltage: 2MΩ	
Withstand voltage	The withstand sine-wave AC voltage of 1000V/50Hz between the meter line and the shell can last for 1 minute.	
Insulation	The insulation resistance between the meter line and the jacket shell is ≥100MΩ	
Structure	Double insulation, with insulated vibration-proof jacket	
Applicable safety standards	IEC61010-1 CAT Ⅲ 600V, IEC61010-031, IEC61326 Pollution Degree 2	

4. ETCR4300 Intrinsic error and performance indicators under reference conditions

Category	Range	Resolution	Basic error

Voltage	AC 0.00V ~ 600V	0.01V	±(1.5%rdg+3dgt)
Current(AC)	0.0mA ~ 20.0A	0.1mA	±(1.5%rdg+3dgt)
Phase	0.0° ~ 360°	0.1°	±1°
Active power	0.0W ~ 12kW	0.1W	±(3%rdg+3dgt)
Reactive power	0.0VAR ~ 12kVAR	0.1VAR	±(3%rdg+3dgt)
Apparent power	0.0VA ~ 12kVA	0.1VA	±(3%rdg+3dgt)
Frequency	45HZ ~ 65HZ	0.01HZ	±(2%rdg+3dgt)
Power factor	-1 ~ +1	0.001	±0.03

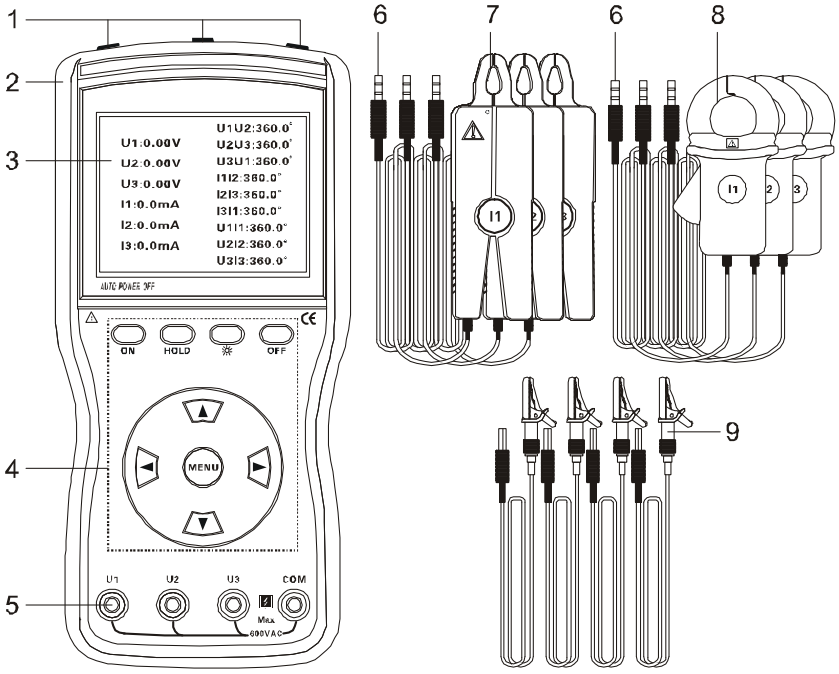
Note 1: Under working conditions, the phase error is ± 3 ° (the error is doubled in case that the current amplitude is less than 10mA).

5. ETCR4700 Intrinsic error and performance indicators under reference conditions

Category	Range	Resolution	Basic error
Voltage(AC)	0.00V ~ 600V	0.01V	±(1.5%rdg+5dgt)
Current(AC)	0Ma ~ 400A	1mA	±(1.5%rdg+5dgt)
Phase	0.0° ~ 360°	0.1°	±3°
Active power	0.0W ~ 240kW	0.1W	±(3%rdg+5dgt)
Reactive power	0.0VAR ~ 240kVAR	0.1VAR	±(3%rdg+5dgt)
Apparent power	0.0VA ~ 240kVA	0.1VA	±(3%rdg+5dgt)
Frequency	45HZ ~ 65HZ	0.01HZ	±(2%rdg+5dgt)
Power factor	-1 ~ +1	0.001	±0.03

Note 1: Under working conditions, the phase error is ±6°.

VI. Meter Structure



1. Three-phases current input interface 2. Vibration insulation jacket 3.LCD display
4. Function key area 5. Three-phase voltage input interface 6.Current clamp plug
7. Small tip current clamp (optical) 8. Circular current clamp (optical)
9. Voltage input test line

VII. Operating Methods

⚠	**Prior to use, check all parts of the meter carefully for any damage. Use them only if no damage is found.**
	Never use the meter in dangerous places.
	Install the batteries according to the Manual.
	Do not press 2 or more buttons at the same time, otherwise all operations will be invalid.

1. Startup & shutdown

Press the **ON** key to start up the meter and activate the LCD display. Press **OFF** to shut it down, and the meter will automatically shut down after 15 minutes of start-up.

2. Backlight control

After the meter is powered on, press the key to control the backlight, which is suitable for use in dark places or at night.

3. Data retention, cancellation and storage

In the test mode, press **HOLD** key to hold the displayed data, "**HD**" symbol will be displayed; press **HOLD** key again to cancel the retention. The meter will automatically number and store the currently held data while maintaining the data, group number of "**S**: 01" will be given. The meter can store up to 99 sets of data, if the memory is full, the "**FULL**" symbol will be displayed.

4. Data access and exit

In the test mode, press the **MENU** to enter the data access mode, the "**RD**" symbol will be displayed. Now it allows user to consult from "**R: 01**", press the "**Up Arrow**" to consult forwards with 1 increment each time, and press the "**Down Arrow**" to consult backward with 1 decrement each time, and press the "**Left Arrow**" to exit from the data access mode and return to the test mode.

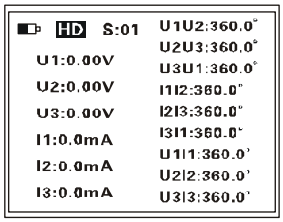
5. Data deletion

In the data access mode, press the "**Right Arrow**" key to enter the data delete option, then press the "**Left Arrow**" key or the "**Right Arrow**" key to move the cursor to "**YES**" or "**NO**", then press the "**MENU**" key to confirm the deletion or exit, and then return to the test mode.

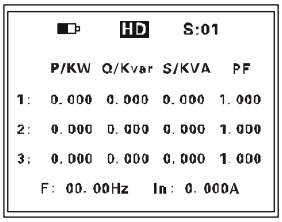
6. Test display mode switch

Once started, the meter will automatically enter the display mode of voltage, current, phase test (Figure A); press the "**Down Arrow**" key to enter the display

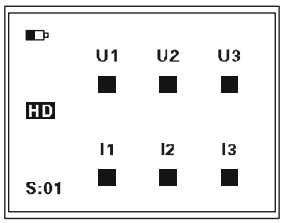
mode of active power, reactive power, apparent power, power factor, frequency, phase current vector test (Figure B); press the "**Right Arrow**" key to enter the phase sequence test display mode (Figure C); press the "**Left Arrow**" key to enter the vector diagram display mode (Figure D); press the "**Up Arrow**" key to return the display mode of voltage, current and phase test. The three-way powers, power factor shown in Figure B correspond to the power and power factor of U1I1, U2I2, and U3I3.



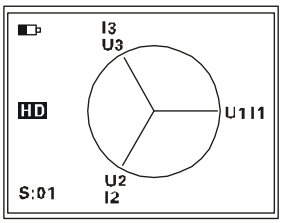
(A)



(B)



(C)



(D)

7. Testing

	Danger! Electric Shock Risk! It indicates the operations to be performed by the authorized qualified personnel subjected to special training, the operator must strictly observe the safety guidelines, and otherwise there may be risk of electric shock, personal injury or equipment damage.
	Danger! Do not use it to measure the line with a voltage exceeding 600 V, otherwise there may be risk of electric shock, personal injury or equipment damage.
	Dangerous! Do not use it to measure the line with current higher

	than 20A, which may cause damage to the equipment.

⚠	**Wire strictly in accordance with the manual, and make sure I1, I2, I3 are inserted correctly.**
	After testing, unplug the meter only after the test line is separated from the tested line.

	The phase test relationship of meter: for U1U2, U2U3, U3U1, I1I2, I2I3, I3I1, U1I1, U2I2, U3I3, the signal of the previous line advances that of the latter one.
⚠	**The voltage jack of U1, U2 and U3 have the homonymous ends with the red marked points on the corresponding current clamp.**
	During the phase test, the direction of the current input clamp should be consistent with that indicated by red marks on the clamp.

The meter can be used to test the three-phase AC voltage, current, phase between voltages, phase between currents, phase between voltage and current, frequency, active power, reactive power, apparent power, power factor, phase current vector sum; and judge the phase sequence, inductive, capacitive circuit.

Test wires are as follows:

Single-phase test: wire the L and N voltage lines to the **U1** yellow and **COM** black jack of the meter, and use the current clamp **I1** to clamp the L line to be tested. Connecting to **U2** green, **COM** black, **I2** or **U3** red, **COM** black, **I3** test lines are also feasible.

Three-phase four-wire test: wire the voltage lines of yellow UA, green UB, red UC, black N to the corresponding **U2** green, **U3** red, **COM** black jacks of the meter, and use the clamp I1, I2, I3 to clamp the line IA, IB, IC to be tested.

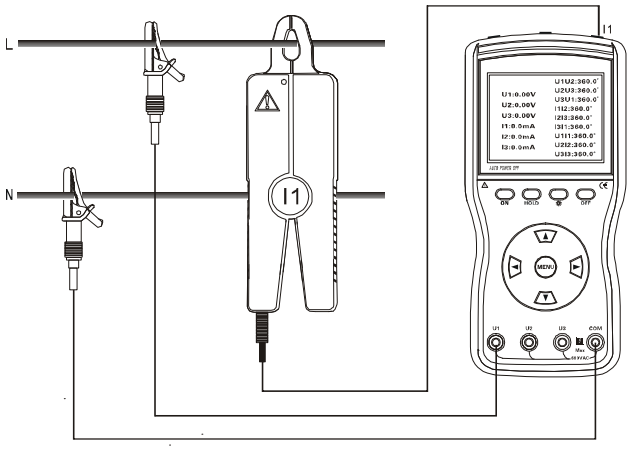
Three-phase three-wire test: wire the voltage lines of yellow UA, green UB , red UC and black N to be tested to the yellow U1, green U2, red U3 and black **COM** jacks of the meter, and use the clamp I1, I3 to clamp the IA, IC lines to be tested, as the following wiring diagram.

During the test, the inductive or capacitive load, phase sequence and polarity can be identified according to the phase relationships. If U1I1 phase is displayed in the range of 0^0 to 90^0, the tested load can be judged as inductive; if in the range of 270^0 ~ 360^0, the tested load is capacitive; If the displayed phases are all close to 120^0, then they are positive in phase sequence and have the same polarity; if the displayed phases are close to 120^0 and 300^0, then they are negative in phase sequence and have the opposite polarities (there is possibility that the current clamp or line are inversely wired); negative phase sequence is common in other cases (regardless of phase failure).

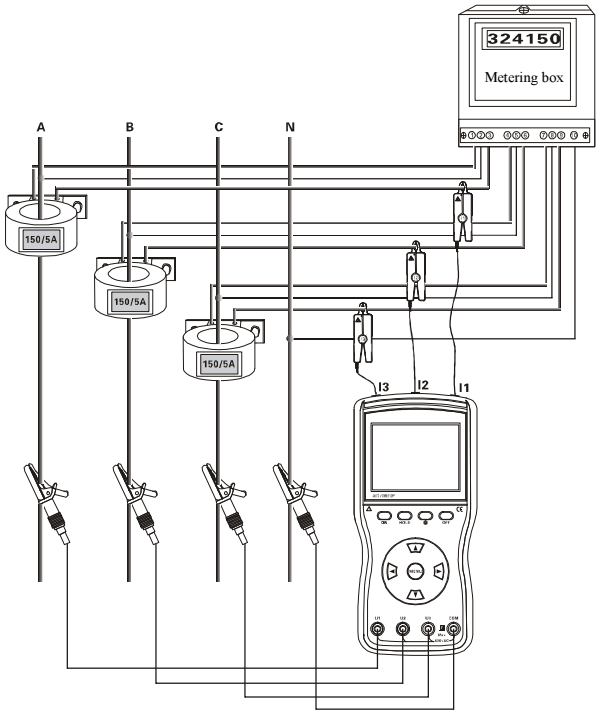
In the phase-sequence test display mode, when U1, U2, U3 or I1, I2, I3 are positive phase sequence, the cursor flashes sequentially from left to right; if negative for U1, U2, U3 or I1, I2, I3, the cursor flashes sequentially from right to left. If the corresponding cursor of U1, U2, U3 or I1, I2, I3 is not on, there might be phase failure or too low amplitude of the signal.

Reference wiring diagram:

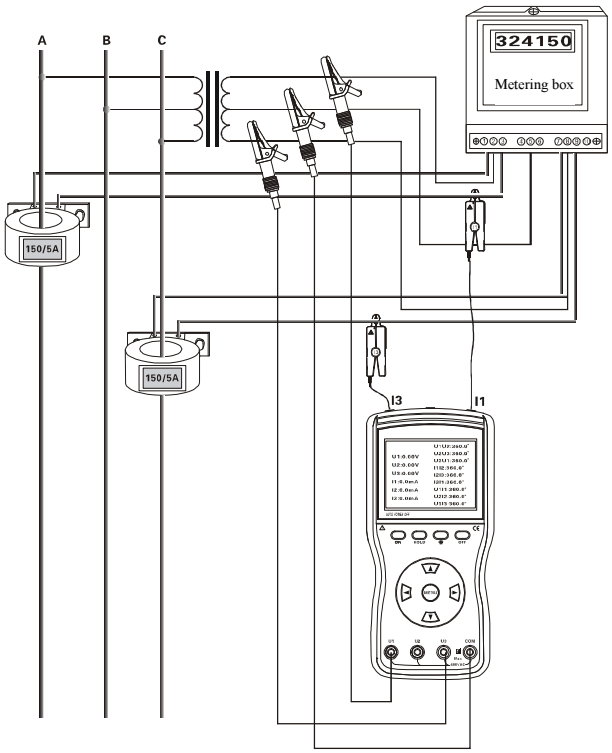
Test single-phase voltage, current, phase, frequency, power, etc.:



Test three-phase four-wire voltage, current, phase, phase sequence, frequency, power, power factor, etc.:



Test three-phase three-wire voltage, current, phase, phase sequence, frequency, power, power factor, etc.:



VIII. Battery replacement

⚠	**Please pay attention to the battery polarity, and make sure you install the batteries with correct polarity, otherwise damage to the meter will be caused.**
	Never replace batteries in dangerous spaces.
	Only use the qualified alkaline batteries (1.5V AA × 6).

	Do not use old and new batteries together.

1. When the meter supply voltage drops below 7.2V, the battery symbol will be displayed to indicate low battery. Please replace the battery timely, see the Figure below.

2. Press OFF button to turn off the meter.

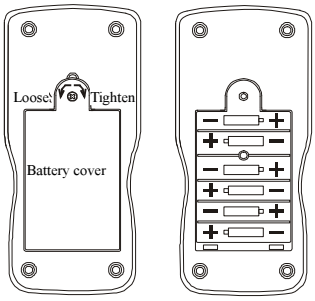
3. Use a cross head screw-driver to loosen one of the screws on the battery cover, as to open the battery cover.

4. Remove the old battery and install a new battery, please pay attention to the battery polarity.

5. Lid the battery cover and tighten the screws.

6. Press “ON” button to power on the meter, make sure the battery is replaced properly, otherwise, and repeat the operations from step 2.

7. Remove batteries if you do not expect to use the instrument for a long time remove batteries.



IX. Other Instructions and Attentions

1. Dedicated use of current clamp

The three current clamps of each meter are particularly dedicated to the specific meter. Do not install the clamps on any other meter for use purpose. Protect the current clamps against collision, and keep the jaw clean. It is more reliable after passing fully closed test.

2. Maintenance of current clamp

After use, remove the dust attached to the surface of current clamp immediately. Wiping with soft cloth dipping with lubricant is preferred other than

rough materials or corrosive agent. (e.g. WD-40 lubricant) for cleaning. Prior to test, clean it properly before use.

3. The meter is used for testing of the secondary circuit and low-voltage circuits, it is not suitable for measurement of current in high-voltage line, in order to prevent electric shock.

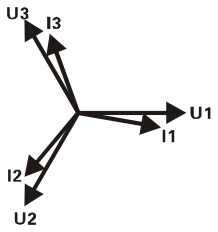
4. Three-phases four-wire (phase with three phase load balanced)

Phase relationship	**Phase value**	**Phase relationship**	**Phase value**
Ua-Ub	120°	Ia-Ib	120°
Ub-Uc	120°	Ib-Ic	120°
Uc-Ua	120°	Ic-Ia	120°

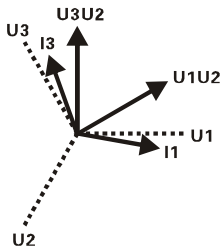
5. Three-phase three-wire (phase with three phase load balanced)

Phase relationship	**Phase value**	**Phase relationship**	**Phase value**
Uab-Ucb	300°	Ia-Ic	240°
Uab-Ia	30°	Ucb-Ic	330°

6. three-phase four-wire vector diagram and three-phase three-wire vector diagram



Three-phase four-wire vector diagram



Three-phase three-wire vector diagram

⚠	**Where the current clamp is inversely wired or the current lines are inversely wired, the difference of phase displayed will be 180°, which means increase of 180° based on the standard value.**

X. Configuration List

Host	1 set
Metering box	1pcs
Current clamp	3pcs
Test lines	4 (yellow, green, red, black line)
Battery	6 (Alkaline batteries: 1.5V AA)
Manual, Warranty card, Certificate of quality	1 copy for each

⚠ ***Manufactured by***

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