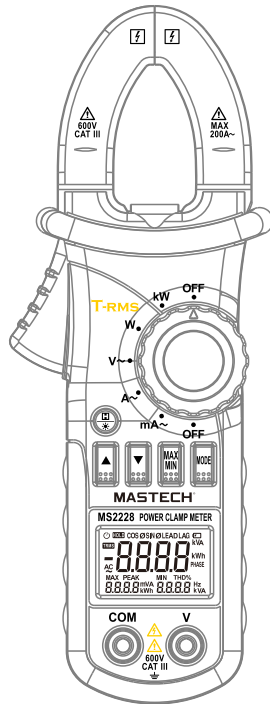


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MS2228

Digital Clamp Meter Operation Manual



CAT III
600V

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Safety Instructions

Please carefully read the instruction manual before using the tester, and pay special attention to “Warning” content. Please follow instructions under “Warning”.






1. Please be very careful when test voltage is higher than AC 30 V, and do keep in mind that your finger shall not exceed the hand-shielding part of the test probe.
2. Do not measure voltage which is higher than the allowed input limit.
3. Before use, please check the meter and test probe; do not carry out testing in case the test probe is naked, tester housing is damaged, or there is no LCD display, etc..
4. It meets requirements of safety standards only when the meter is used together with the supplied test probes. In case the test probe is damaged and needs replacement, it is required to replace it with a test probe of the same model and identical electrical specifications.
5. Please never carry out any voltage measurement whenever the test probe is inserted in any current outlet.
6. Please do not expose the meter to strong light, high temperature, or dampness.

Before use, please carefully read this instruction manual. Especially safety contents!

The digital power meter is designed and manufactured in accordance with international standard, IEC61010-1, and international safety specification, IEC1010-2-032, and the meter strictly follows the safety standard of double-insulation AC 600 V CAT III.

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Safety Sign

	Note-Important safety information, refer to the instruction manual.
	Application around and removal from UNINSULATED HAZARDOUS LIVE conductors is permitted.
	Earth (ground) TERMINAL
	Equipment protected throughout by double insulation or reinforced insulation.
	Battery low Indicator

General Description

The digital power meter is a hand-held intelligent harmonic power tester, with both functions of digital current testing and power testing. The tester is comprised of three channels including voltage, current, and power as well as a micro single chip system, and it is equipped with a powerful software for measurement and data processing functions; it can measure, calculate, and display voltage, current, power factor, apparent power, passive power, frequency, harmonic parameters, with stable performance and operation convenience. The meter is especially suitable for the measurement and examination of on-site power equipment and power-supplying circuits; with hand-held clamp structure, small volume, and light weight, it can be easily carried by the user, which makes it easy and fast for doing measurement. For measurement of sing-phase power, The meter is your ideal choice.

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Features

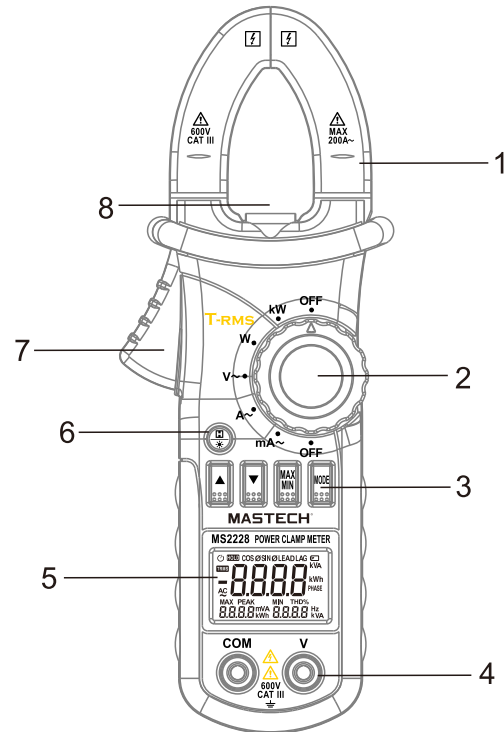
1. The meter can be used for testing power, voltage, current, peak value, phase, frequency, power factor, phase angle, and reaction factor, etc. of single-/three-phase circuit; automatic phase sequence testing is possible for 3-phase measurement.
2. True effective value measurement: accurate measurement is possible even with serious distortion in current waveform.
3. Low-consumption high-speed single-chip microprocessor is employed and sophisticated algorithm is applied, as a result, results can be obtained rapidly and precisely, and up to 20 harmonics and distortion value thereof can be measured.

Hand-held, clamp-type structure, with light weight, convenient for carry-on.

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Appearance





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1. Current clamp size: $\Phi 26\text{mm}$
2. Function-switching knob :Rotation knob for selecting different measuring function
3. Function-selection button: Button for operating the measuring functions
4. Input terminal

Terminal	Function
V	Input terminal for measuring the first phase; use yellow test probe for connection
COM	Input terminal for measuring the 2nd phase; use black test probe for connection. Common terminal: ground input terminal (earthing) for all measuring functions; use black test probe for connection.

5. LCD display :4-digit digital display; 7-section LCD for displaying measurement operation function, test result, and unit sign.
6. H/  HOLD button :DATA HOLD button; press down HOLD button, and the last reading will be held and displayed on the display, and "HOLD" symbol will be shown; press HOLD button again, and the meter will switch back to normal measurement mode.
7. Trigger :Press down the trigger, and the clamp will open; release it, and the clamp will close.
8. LED Lamp
In power and current mode ,press  button open or close Lamp

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Knob Switch Operations

The function-switching knob is used for powering-on and for switching to any measurement function in the following table.

Knob position description

Sign	Knob position	Functions
OFF	Powering-off position	For powering-off
KW	Active power position	For measuring active power, etc.
W	power position	For measuring active power, etc.
V~	AC-Voltage harmonics test position	For measuring AC-voltage harmonics, etc.
A~	AC-Current harmonics test position	For measuring AC-current harmonics, etc.
mA~	AC-Current harmonics test position	For measuring AC-Current harmonics, etc.

Note:

When the meter is automatically powered off, be sure to switch the knob to "OFF" position; turn on the meter after 5 seconds.

Button Switch Operations

Button descriptions

SN	Function-selection button
1	MODE :Test-mode switching button
2	▲ :Reverse-search button
3	▼ :Forward-search button
4	MIN/MAX :MAX/MIN Value
5	H/☉ :HOLD/LIGHT

The following functions can be realized through button operations:

1. MODE:

Under KW/W test mode, you can press **MODE** button to switch the display of active power and passive power; under A/V~ test mode, you can switch the display among total harmonic distortion rate F, r, and harmonic percentage.

2. ▲:

press ▲ button to change view MAX value, MIN value, measuring time; During testing harmonics, you can change the times of harmonics. press ▲ button to search backward the stored data and show it on LCD. With every press of the button, the searching cursor will move one step backward to the previous data.

3. ▼:

press ▼ button to change view MAX value, MIN value, measuring time; During testing harmonics, you can

change the times of harmonics. press ▼ button to search forward the stored data and show it on LCD. With every press of the button, the searching cursor will move one step forward to the previous data.

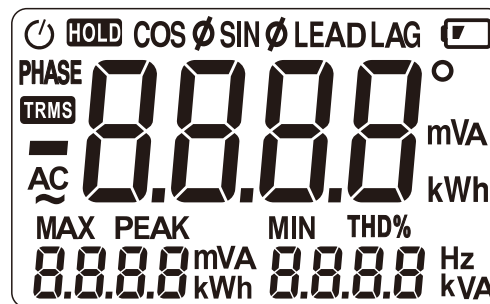
4. MAX/MIN:

In test mode, press MAX/MIN button to view the max /min Power, current, voltage.

5. HOLD/☉:

After measurement, press this button to hold this data on LCD; after powering-off, data will display Press this button longer than 1S, Open or close the back light.

LCD Display

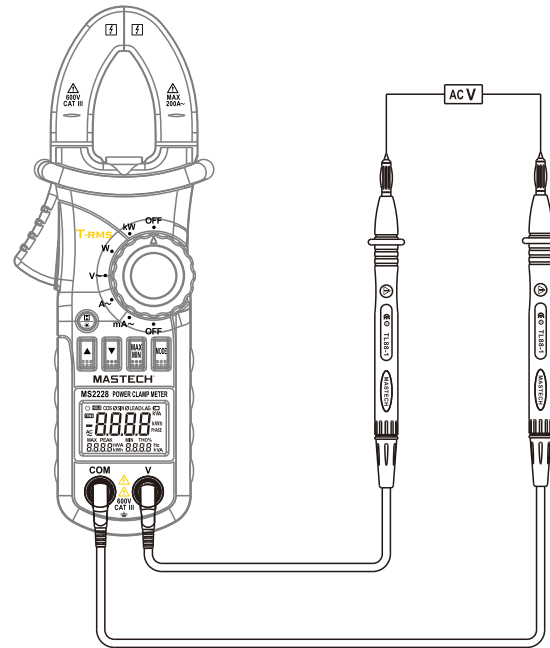


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LCD symbol	Description	LCD symbol	Description
	AutoPower Off	HOLD	Hold
LAG	Phase angle lag	LEAD	Phase angle lead
	Low Battery indication	0	Phase angle (degree)
SINΦ	Phase angle (degree)	COSΦ	Power factor
	AC symbol	PEAK	Peak value
Hz	Frequency		Negative symbol
MIN	Minimum value	MAX	Maximum value
W	watt	A	current
VA _r	Passive power	VA	Apparent power
PHASE	phase	TRMS	TRMS
%	Harmonic percentage	V	Voltage
%THD	Total harmonics distortion ratio		
H01F	Total harmonics distortion ratio F (relative to base wave)		
H01r	Total harmonics distortion ratio r (relative to real effective value)		

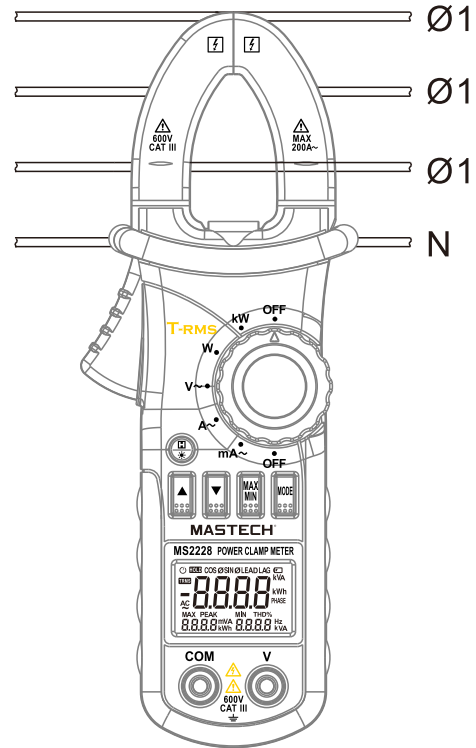
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Instruction Manual AC voltage (V) measurement



1. According to the connection mode as above Table , switch the function switching knob to V~, select corresponding sockets from V, COM terminal, and insert the test wire.
2. Connect the two test probes V1, COM to the power source or load to be tested. The meter will automatically test and display the result, and the present harmonics percentage will be shown on the following line.
3. Under voltage test mode, press MAX/MIN button to view Max or Min value
4. Press MODE button to show harmonics percentage on LCD, and the total harmonic distortion ratio F and R will be cyclically displayed. Press ▲/▼ button to display value of each measurement of the harmonic.

AC CURRENT measurement



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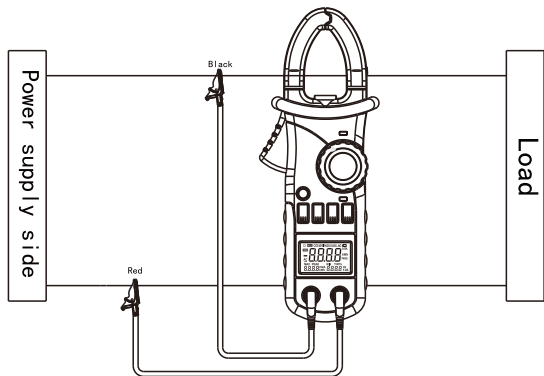
1. Switch the function knob to A~ position;
Pull the trigger to open the clamp, and then clip a wire which is to be tested; the measured current value will be automatically shown on LCD.
2. Press MODE button to show harmonics percentage on LCD, and the total harmonic distortion ratio F and r will be cyclically displayed.
3. Press▲/▼button to display value of each measurement of the harmonic.
4. press MAX/MIN button to view Max or Min value

Test of single-phase circuit

1. Clip the clamp on the test wire of the power supply or load. If the user needs to measure a certain phase of the 3-phase circuit, then the clamp should clip on the wire of the same phase.
2. switch the function switching knob to KW/Wposition, select corresponding input sockets from V1 or COM terminal and insert the test wire.
3. After it is correctly connected, you can measure single-phase power (active power, power factor, apparent power, passive power, voltage, current, phase angle, peak value of voltage and current, and frequency):
4. The meter will carry out automatic measurement and display active power, and voltage/current value of the load being tested will be displayed on the bottom line of LCD; press down MODE button, Var value of passive power will be displayed on LCD; press MODE button to display apparent power and power factor ($\cos \Phi$); negative power factor signifies that the load being tested is a load with capacitor characteristics.

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5. The maximum measurement range of active power kW is 120 kW; if this range is exceeded, "OL" symbol will be displayed beyond this range. If voltage being tested is greater than 600 V, or current being tested greater than 200 A, "OL" symbol will be displayed on LCD.
6. The min. input voltage is 10 V and the min. input current is 10mA; if active power value is smaller than this limit, "0.00 kW" will be displayed in stead of active power value.
7. Press Max/Min value to view Max/Min Value
8. Passive power is a value not directly measured; equation for kVar is $kVar_2 = kVA_2 - kW_2$; its value is calculated by software based on the measured voltage, current and active power, and displayed on LCD.

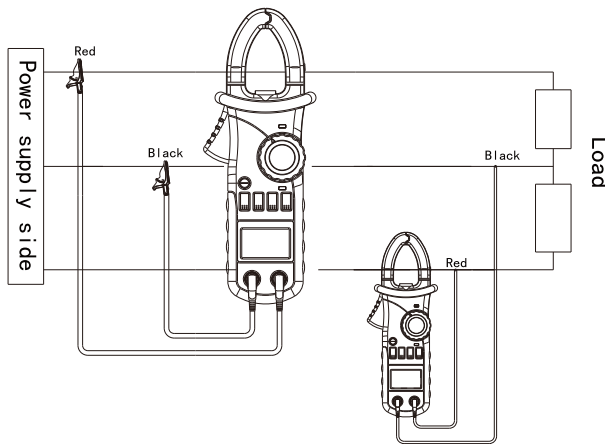


$\cos\Phi$ /phase angle

1. Switch the function-switch knob to KW/W position, and the test wire is inserted to V1/COM input terminals.
2. The meter will automatically measure and display power factor, voltage value and current value.
3. Press **MODE** button to display phase angle, power factor ($\cos \Phi$);
4. Press MAX/MIN Button to view Max value, Min value, measuring time.

Single-phase three-line circuit


the process for measuring power and power factor for single-phase three-line circuit is the same as that for single-phase two-line circuit, where the black clip is connected to the middle wire, and the red clip and clamp-type sensor are simultaneously connected to all test wires.




Input Voltage and Current

During power measurement, if input voltage is over 600 V (RMS) or current over 200 A (RMS), "O L" symbol will be displayed and bar symbol shown in full scale.

Backlight

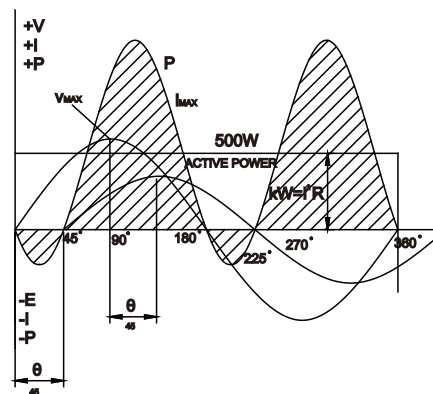
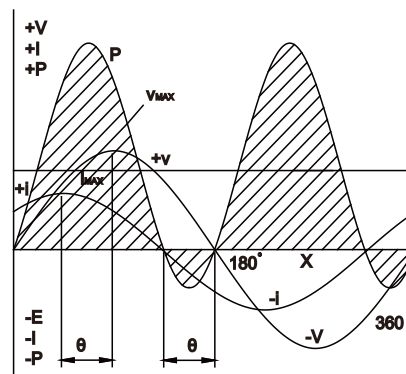
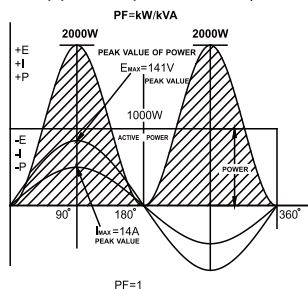
Press  button longer than 1s, the backlight will be lit up, and it will then be automatically turned off after about 20 seconds.

Auto Power Off

1. If there is no function change or button press for 10 minutes, the meter will automatically turn power off. When the meter is automatically powered off, be sure to switch the knob to "OFF" position; turn on the meter after 5 seconds.
2. Holding the button  down while turning the meter on, Disables automatic power -off

Power curve diagram

(Active power = apparent power × PF)




REPLACING THE BATTERIES

 **WARNING**

To avoid electric shock, make sure that the test leads have been clearly move away from the circuit under measurement before opening the battery cover.

 **WARNING**

Do not mix old and new batteries. Do not mix alkaline, standard (carbon-zinc), or rechargeable (ni-cad, ni-mh, etc) batteries.

1. If the symbol " appears, it means that the batteries should be replaced.
2. Loosen the screw of the battery cover and remove it.
3. Replace the used batteries with new ones.
4. Return the battery cover and tighten the screw.

NOTE:

Do not reverse the polarity of the batteries.

REPLACING TEST LEADS

Replace test leads if leads become damaged or worn.

 **WARNING**

Use meet EN 61010-031 standard, rated CAT III 600V, or better test leads.

 **WARNING**

To avoid electric shock, make sure the probes are disconnected from the measured circuit before removing the rear cover. Make sure the rear cover is tightly screwed before using the instrument.

General specification

Complies with IEC/EN 61010-1, 600 V CAT III

1. Max. common-mode voltage: 600V AC RMS
2. Mode of display: LCD display; Max. reading: 6000
3. Range selection: Fully automatic range selection
4. Frequency detection: automatic (when harmonic is serious, it is better to use manual settings for testing frequency so as to assure the reading stability)
5. Over-range display: "OL"
6. Data holding: "HOLD" is shown on LCD
7. Power supply: 3 batteries of 1.5 V, AAA
8. Power consumption: 250 mW
9. Storage temperature: - 20 °C ~ 70 °C
10. Operating temperature: 0 °C ~ 40 °C
11. Temperature Coefficient: 0.05% (specified accuracy) per °C
12. Electromagnetic Compatibility: In an RF field of 3V/M, accuracy = specified accuracy, Otherwise accuracy is unspecified.
13. Operating Altitude: ≤ 2000m CAT III 600V ; ≤ 3000m CAT II 600V
14. Store Altitude: 12000m
15. Dimensions: 208mm×78mm×35mm
16. Weight: approximate 350 g (with battery)

Technical specification

Accuracy: ±(% read + graduation #) ambient temperature: 18°C ~ 28°C, Humidity 80%, frequency for voltage, current: 45 Hz ~ 65 Hz

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AC Voltage RMS

Range	Accuracy	Resolution	Input impedance
10V-600V	±(1.0%+5)	0.1V	1 MΩ //10 pF

Max. allowed overload voltage: 750 V (RMS)

AC Current RMS

Range	Accuracy	Resolution
10mA-3999mA	± (2%+5)	0.01mA
4A-200A	± (2%+5)	0.01A

Max. allowed overload current: 200 A

Single-phase active power (W)

Range	Accuracy	Resolution
0.01W-120KW	± (3%+5)	0.01W

Min. test current: 10mA; Min. test voltage: 10V

Power factor

Range	Accuracy	Resolution
0.3~1 Capacitive	± (0.02+2)	0.001
0.3~1 Inductive	± (0.02+2)	0.001

Min. test current: 10mA; Min. test voltage: 10V

Passive power (VAr) $2=(VA) 2+W 2$

Range	Accuracy	Resolution
0.01W-120KW	± (3%+5)	0.01VAr

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Min. test current: 10mA; Min. test voltage: 10V
Passive power Var is calculated according to the measured V, A, and kW value.

Frequency (Hz)

Range	Accuracy	Resolution
30Hz~1kHz	0.5%+1	0.1Hz

Min. test current: 10mA; Min. test voltage: 10V

Harmonic test

Harmonic number	Precision of harmonic voltage
1	± (3.0%+10)
2-6	± (3.5%+10)
7-8	± (4.5%+10)
9-10	± (5.0%+10)
11-15	± (7%+10)
16-20	± (10%+10)

Min. test current: 20mA; Min. test voltage: 20V

Accessories

Item	Quantity
User Manual	×1
Battery	1.5V AA A Battery×3
Test Leads	×1
Test clip	×2 (Red,Black)
Package box	×1

Quality Assurance

Thank you for using the product of our company; this product has a warranty period of one year starting from purchasing date.

This product has passed the strict quality test of our company. Our company will exert our efforts to do after-sales service for you in accordance with the

Warranty instructions.

In case there is any problem occurred during warranty period, which is resulted from product quality problem, please fill in the warranty card and mail it in together with the product, and the service department of our company will repair it or replace it free of charge, while the user himself/herself shall not take the meter apart. When warranty period is over, the repairing will be charged.

Free service does not apply to the following cases:

Problems and damages due to improper use or use under environment which is not stipulated for this product, including overloading.

Problems and damages due to unauthorized dismantling or refitting and misuse.

Problems and damages due to user reasons.

Problems and damages due to natural disasters.

