

True RMS 200A AC/DC Open Jaw Clamp Meter

Model MA160

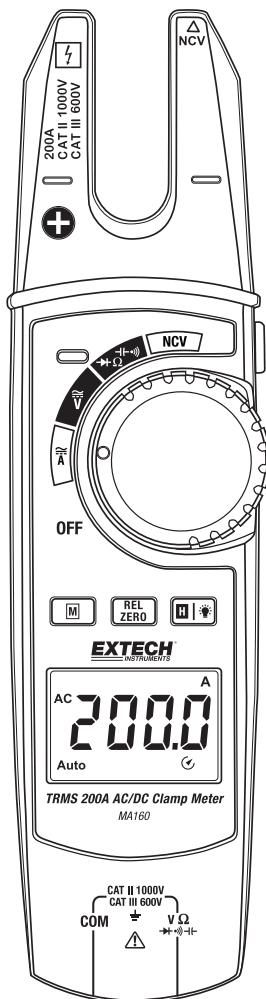


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1. Introduction

Thank you for selecting the Extech MA160 Clamp Meter.

The MA160 is a feature-packed Open Jaw True RMS digital Clamp meter.

Measure AC/DC voltage, AC current, DC current, Resistance, Diode, Continuity, and Capacitance. The MA160 also includes a Non-Contact Voltage Detection feature.

Other functions include Data Hold, Relative mode, Work light, Backlight, and Auto power-off.

This device is shipped fully tested and calibrated and, with proper use, will provide years of reliable service. Please visit our website (www.extech.com) to check for the latest version of this User Guide, Product Updates, Product Registration, and Customer Support.

Features

- 6000 count digital display
- Large backlit LED display
- True RMS AC measurements
- 0.8% DCV accuracy
- Data Hold
- Relative mode
- Auto Power OFF (APO)
- 200A AC current measurements
- 200A DC Current Measurements
- Non-Contact Voltage Detector
- Visual and audible continuity measurement alert
- Low battery indicator
- CAT III 600V / CAT II 1000V

2. Safety Information

To ensure the safe operation and service of the meter, follow these instructions closely. Failure to observe warnings can result in severe injury.



WARNINGS

WARNINGS identify hazardous conditions and actions that could cause BODILY HARM or DEATH.

- When handling test leads or probes, keep hands and fingers behind the finger guards at all times. To avoid electrical shock do not touch exposed electrical wire, connectors, unused input terminals, or circuits under test.
- Remove test leads from the meter before opening the battery compartment or meter housing.
- Use the meter only as specified in this User Guide or accompanying Quick Start to avoid compromising the protections provided by the meter.
- Be sure to use the proper terminals, switch positions, and ranges when taking measurements.
- Verify the meter's operation by measuring a known voltage. Have the meter serviced if the meter responds unusually or if there are questions regarding the meter's functional integrity.
- Do not apply more than the rated voltage, as marked on the meter, between terminals or between any terminal and earth ground.
- Do not measure voltages above 1000VDC or 600V AC between terminal and ground to prevent electrical shock and damage to the Clamp meter.
- Use caution working with voltages above 30 VAC RMS, 42 VAC peak, or 60 VDC. These voltages pose a shock hazard.
- To avoid misleading readings that could lead to electric shock and injury, replace the batteries as soon as the low battery indicator is displayed.
- Disconnect power to the circuit under test and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.
- Do not use the meter in the presence of explosive gas or vapor.
- To reduce risk of fire or electric shock, do not use the meter if it is wet and do not expose the meter to moisture.
- Individual protective equipment should be used if HAZARDOUS LIVE parts in the installation where measurements are to be carried out could be accessible.



CAUTIONS

CAUTIONS identify conditions and actions that could cause DAMAGE to the meter or equipment under test. Do not expose the meter to extremes in temperature or high humidity.

- Disconnect the test leads from the test points before changing the position of the function (rotary) switch.
- Do not expose the meter to extremes in temperature or to high humidity.
- Never set the meter to the resistance, diode, capacitance, micro-amp, or amp functions when measuring the voltage of a power supply circuit; this could result in meter damage and damage to the equipment under test.

Safety Symbols that are typically marked on meters and instructions

	This symbol, adjacent to another symbol, indicates the user must refer to the manual or user guide for further information.
	Risk of electrical shock
	Equipment protected by double or reinforced insulation
	Low Battery symbol
	Conforms to EU directives
	Do not discard this product in household trash.
	AC measurement
	DC measurement
	Earth ground

PER IEC1010 OVERVOLTAGE INSTALLATION CATEGORY

OVERVOLTAGE CATEGORY I

Equipment of OVERVOLTAGE CATEGORY I is equipment for connection to circuits in which measures are taken to limit the transient over-voltages to an appropriate low level.

Note – Examples include protected electronic circuits.

OVERVOLTAGE CATEGORY II

Equipment of OVERVOLTAGE CATEGORY II is energy-consuming equipment to be supplied from the fixed installation.

Note – Examples include household, office, and laboratory appliances.

OVERVOLTAGE CATEGORY III

Equipment of OVERVOLTAGE CATEGORY III is equipment in fixed installations.

Note – Examples include switches in the fixed installation and some equipment for industrial use with permanent connection to the fixed installation.

OVERVOLTAGE CATEGORY IV

Equipment of OVERVOLTAGE CATEGORY IV is for use at the origin of the installation.

Note – Examples include electricity meters and primary over-current protection equipment

3. Descriptions

Meter Description

1. Non-Contact Voltage Detector
2. Open jaw
3. Work Light
4. NCV alert LED lamp
5. Work Light switch
6. Rotary function switch
7. Mode (M) button
8. Relative Δ , DCA Zero button
9. HOLD and Backlight button
10. Display
11. Test lead jacks

Note: Battery compartment on back of meter

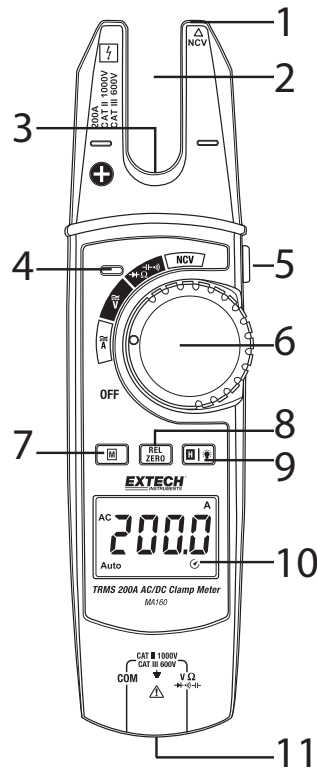


Fig 3-1 METER DESCRIPTION

Display Icon Descriptions for MA160

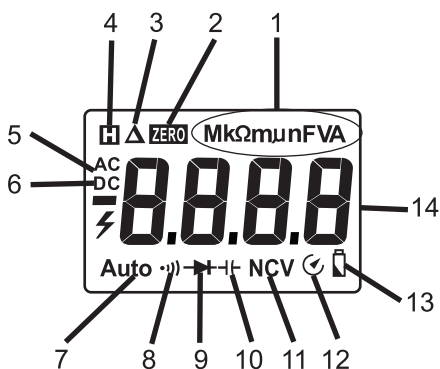


Fig 3-2 MA160 METER DISPLAY

1. Units of measure
2. DCA Zero
3. Relative mode
4. Data hold
5. Alternating Current
6. Direct Current
7. Automatic range
8. Continuity
9. Diode
10. Capacitance
11. Non-Contact Voltage Detector
12. Auto power off
13. Battery status
14. LCD display

Push-Button Descriptions



Momentary presses of the Mode (**M**) button perform the functions shown in the table below.

Fig. 3-4 Mode (M) Button Function Table

Switch Position	Mode (M) Button Function
	AC → DC
	AC ↔ DC
	Ω → → →



Momentarily press to access/exit the Relative mode. This mode of operation is only available for AC/DC voltage, AC Current, and Capacitance.

In DCA mode, press to zero the display; press and hold to exit the zero.



Press and hold this button to activate/deactivate the LCD backlight. Momentary presses switch DATA HOLD ON or OFF.

Function Switch Description

- 1. Meter POWER OFF position
- 2. AC/DC Current mode (use **M** button to choose AC or DC)
- 3. AC/DC Voltage mode (use **M** button to choose AC or DC)
- 4. Capacitance, Continuity, Diode, Resistance modes (use **M** button to choose mode)
- 5. Non-Contact Voltage Detect position with alert LED

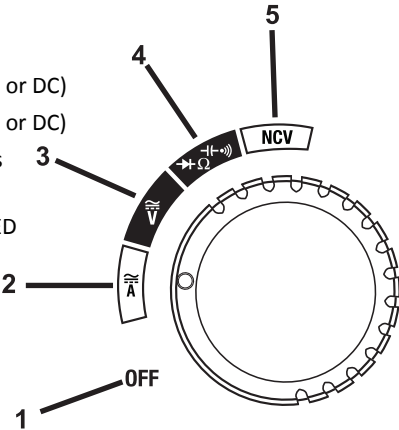


Fig 3-3 MA160 Function Switch

4. Operation



CAUTION: Read and understand all of the Safety statements listed in the safety section of this manual prior to use.

Powering the Meter

1. Turn the rotary function switch to any position to power the meter. Check the batteries if the unit fails to power ON. Refer to the Maintenance section for battery replacement.
2. Turn the function switch to the OFF position to power OFF the meter.
3. The meter has an Auto Power OFF feature (APO) where the meter switches OFF after 15 minutes of inactivity. When APO is enabled, the APO icon will show on the display when the meter is powered ON,

The low battery symbol  appears on the display when the battery voltage weakens below the threshold.

Display Backlight

With the meter powered ON, press and hold the backlight button  to switch the backlight ON or OFF. Note that excessive use of the backlight will shorten the battery life.

Work Light

With the meter powered ON, press the Work Light button on the right side of the meter. A momentary press will switch the Work Light off. The Work Light lamp is located on the back of the unit toward the bottom of the clamp jaw. Note that excessive use of the backlight will shorten the battery life.

Data Hold

To freeze the LCD meter reading, press the Data Hold (H) button. While data hold is active, the  display icon appears on the LCD. Press the (H) button to return to normal operation. The  icon will switch OFF.

Test Lead Considerations

Test lead probe covers can be removed for CAT II 1000V installations. Use the test lead probe covers for CAT III 1000V installations. Do not measure voltages > 1000V DC or 600V AC. Remove the storage caps from the meter end of test leads before connecting leads to the meter.

Voltage Measurements



WARNING:

Remove the test lead probe covers for CAT II 1000V installations. Use the test lead probe covers for CAT III 600V installations.

Do not measure voltages greater than 600VAC or 1000VDC.



CAUTION: When connecting the test leads to the circuit or device under test, connect the black lead before the red; when removing the test leads, remove the red before the black lead.

Disconnect probes and circuit under test after all measurements are completed.

AC Voltage Measurements

1. Insert the black test lead banana plug into the negative (COM) jack and the red test lead banana plug into the positive (V/ Ω) jack.
2. Turn the function switch to the  position. Use the **M** button to select AC.
3. Read the Warning and Caution statements above to determine whether or not to use the test lead probe covers.
4. Touch the test probe tips to the circuit under test.
5. Read the digital value shown on the display. The meter is Auto Ranging and therefore selects the proper decimal point position. The meter also displays the measurement type, unit symbols, and other relevant multifunction icons.
6. The meter is capable of detecting AC voltages to 600V.

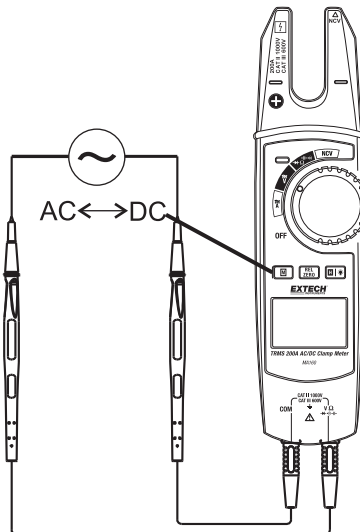


Fig 4-1 AC VOLTAGE MEASUREMENTS

DC Voltage Measurements

1. Insert the black test lead banana plug into the negative (COM) jack and the red test lead banana plug into the positive (V/ Ω) jack.
2. Move the Function Switch to the $\overline{V}$ position.
3. Use the **M** button to select **DC**.
4. Read the Warning and Caution statements at the beginning of the Voltage Measurement section to determine whether or not to use the test lead probe covers.
5. Touch the test probe tips to the circuit under test. Be sure to observe the correct polarity (red lead to positive, black lead to negative).
6. Read the digital value of the measurement in the display. The display will also indicate the proper decimal point (Auto Range) and measurement type/units symbols. If the polarity is reversed, the display will show (-) minus before the value.
7. The meter is capable of detecting DC voltages to 1000V.

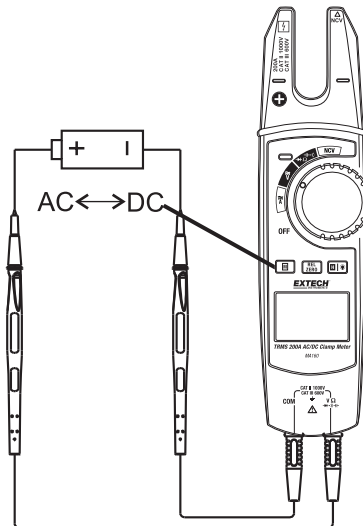


Fig 4-2 DC VOLTAGE MEASUREMENTS

Current Measurements Using the Clamp



WARNING: Do not measure the current on a circuit when the voltage increases to more than 750V AC or 1000V DC. This can cause damage to the instrument and can cause injury to persons.

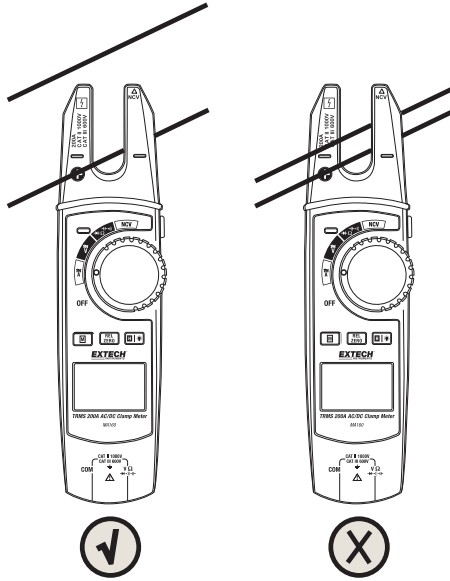


Fig. 4-3 Correct and Incorrect Clamping

1. Ensure that the probe leads are disconnected from the meter.
2. Set the function switch to the **A** position.
3. Use the **M** button to select **AC** or **DC**. For DC press **ZERO** to remove any residual magnetism and to null the display before clamping onto a conductor.
4. Place the meter so only one conductor is located at the base of the jaws. For optimum results, center the conductor in the jaws.
5. Read the current measurement in the display. The display will indicate the proper decimal point and value. In DC, when the polarity is reversed, the display will show (-) minus before the value.

Non-Contact Voltage Detector



WARNING: It is possible for voltage to be present in a circuit even if the meter does not beep or flash the NCV LED lamp. Always verify meter operation on a known live AC current circuit and verify that the batteries are fresh before use.

When the meter senses an AC Voltage or electromagnetic field > 100VAC, the following occurs:

- The audible beeper sounds ON and OFF
- The LED lamp flashes ON and OFF
- The display shows 1, 2, 3, or 4 dashes

The greater the electrical field strength, the faster the rate of the audible beeper, the flashing of the LED lamp, and the number of dashes displayed. If the meter does not emit a tone or flash the LED in this mode, there is still the possibility that voltage is present; **please use caution.**

1. Turn the function switch to the **NCV** position to select Non-Contact Voltage Detect mode.
2. Note that **EF** is displayed when in this mode. If the **EF** does not display when the function switch is turned to the NCV position, check the batteries and do not use the meter until **EF** is displayed.
3. To test, place the meter near a source of electrical energy. Note that the tip of the meter offers the highest sensitivity.
4. Note the audible beeping, the flashing LED, and the displayed dashes when a source of electrical energy is detected.

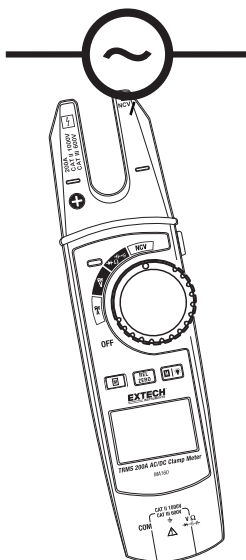


Fig 4-4 NON-CONTACT VOLTAGE DETECTOR

Resistance Measurements



CAUTION: Switch OFF power to the device under test before measuring. Do not test on circuits or devices where 60VDC or 30VAC is present.

1. Insert the black test lead banana plug into the negative (COM) jack. Insert the red test lead banana plug into the positive (V/ Ω) jack.
2. Turn the Function Switch to the Ω position.
3. Use the **M** button to select the Ω icon on the display indicating resistance only (without the continuity/diode/capacitance icons showing).
4. Touch the test probe tips across the circuit or part under test. It is best to disconnect one side of the part under test so the rest of the circuit will not interfere with the resistance reading.
5. Read the resistance value in the display. The display will indicate the proper decimal point and value. If the reading is out of range, the **OL** display icon will appear.

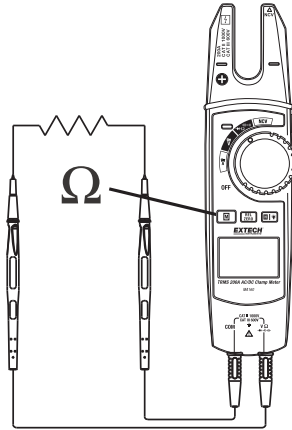


Fig 4-5 RESISTANCE MEASUREMENTS



Resistance Measurement Notes:

- The display will show “OL” when an open circuit is detected or if the resistance > maximum range.
- The test leads introduce an error of approx. $0.1\Omega \sim 0.2\Omega$ for low resistance measurements. Use the Relative mode to obtain accurate readings. Short the test leads together, press the REL button, and then measure a low resistance. The meter subtracts the short-circuit value from the reading.
- If the test lead resistance of probe is > 0.5Ω when shorted, inspect the test leads and the connection.
- It may take several seconds for the reading to stabilize when measuring resistance > $1M\Omega$. This is normal operation.
- For personal safety, do not measure a circuit with voltages > 30V DC or AC.

Continuity Measurements

1. Insert the black test lead into the negative **COM** terminal and the red test lead into the positive terminal.
2. Set the function switch to the  position.
3. Use the **M** button to select the Continuity mode. Look for the Continuity icon  on the display.
4. Touch the test probe tips across the wire or circuit under test.
5. If the resistance is $< 10\Omega$, the beeper will sound continuously. If the resistance is between 10 and 100Ω the beeper may or may not sound. For an open circuit condition the meter will display **OL**.

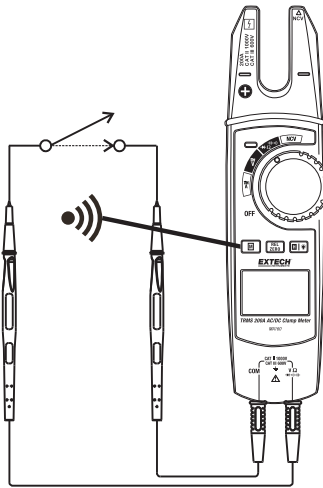


Fig 4-6 CONTINUITY MEASUREMENTS



Continuity Measurement Notes:

- Turn off power to the circuit under test and discharge capacitors before measuring continuity.
- Open-circuit voltage is approx. -3.5V
- Disconnect test leads and circuit measured after measurements are completed.

Capacitance Measurements



WARNING: To avoid electric shock, remove power to the circuit under test and discharge the capacitor under test before measuring. Do not test on circuits or devices where 60VDC or 30VAC is present.

1. Set the function switch to the  capacitance position.
2. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive  jack.
3. Press the **M** button to select the unit of measure symbol **F**.
4. Touch the test probe tips across the part under test.
5. For small capacitance values, use the Relative mode  to remove test lead and probe capacitance.
6. Read the capacitance value in the display.
7. The display will indicate the proper decimal point and value.

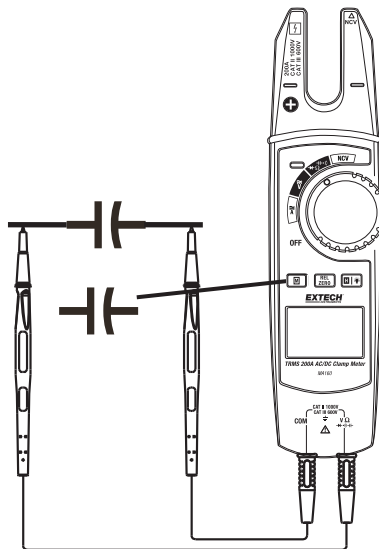


Fig 4-7 CAPACITANCE MEASUREMENTS



Capacitance Measurement Notes:

- The display will show “OL” if a capacitor is short circuited or if the measured capacitance > maximum range of the instrument.
- Capacitance measurements > 600 μ F may require several seconds to obtain a stable reading.
- In order to ensure measurement accuracy, discharge residual charges before measuring capacitance; Use maximum safety when working with high voltage capacitors to prevent damage to the instrument and risk to personal safety.
- Disconnect test leads and circuit under test after measurements are completed.

Diode Test

1. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the **→** positive jack.
2. Turn the function switch to **→** position. Use the **M** button to select the diode function, the diode and voltage symbols will appear on the LCD when in Diode test mode.
3. Touch the test probe tips to the diode or semiconductor junction under test. Note the meter reading.
4. Reverse the test lead polarity by reversing the red and black leads. Note this reading.
5. The diode or junction can be evaluated as follows:
 - If one reading displays a value (typically 0.400V to 0.900V) and reverse reading displays **OL**, the diode is good.
 - If both readings display **OL** the device is open.
 - If both readings are very small or '0', the device is shorted.

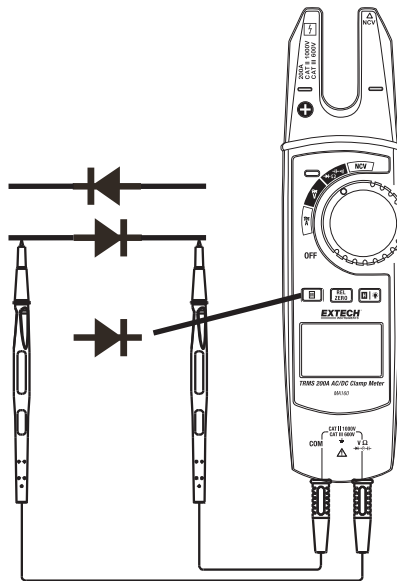


Fig 4-8 DIODE TESTING

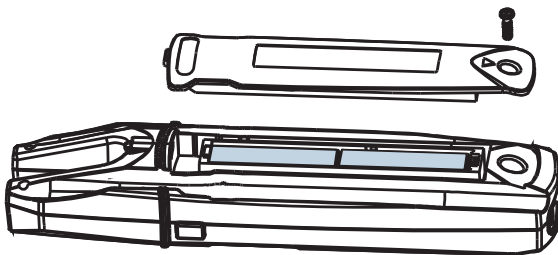
5. Maintenance



WARNING: To avoid electrical shock, remove the test leads, disconnect the meter from any circuit and turn OFF the meter before opening the case. Do not operate with an open case.

Battery Replacement

1. Remove the test leads from the meter.
2. Remove the Phillips head screw that secures the battery compartment cover on the back of the meter.
3. Open the battery compartment and replace the two AA batteries, observing correct polarity. Re-assemble the meter before use



Battery Safety Notes: Please dispose of batteries responsibly; never dispose of batteries in a fire, batteries may explode or leak. If the meter is not to be used for 60 days or more, remove the battery and store separately. Do not mix battery types or freshness levels; please use batteries of the same type and of the same freshness level.



Never dispose of used batteries or rechargeable batteries in household waste. As consumers, users are legally required to take used batteries to appropriate collection sites, the retail store where the batteries were purchased, or wherever batteries are sold.

Disposal: Do not dispose of this instrument in household waste. The user is obligated to take end-of-life devices to a designated collection point for the disposal of electrical and electronic equipment.

Cleaning and Storage

Periodically wipe the case with a damp cloth and mild detergent; do not use abrasives or solvents. Please remove the batteries if the meter is stored for a long period of time.

6. Specifications

ELECTRICAL SPECIFICATIONS

Accuracy is given as $\pm$ (% of reading + least significant digits) at 23 °C $\pm$ 5 °C with relative humidity <80%. Accuracy is specified for a period of one year after calibration.

Function	Range	Resolution	Accuracy (reading)	‘OL’ Protection
AC Current	200.0 A	0.1A	± (2.5% + 5 digits)	200A
	TRMS, Frequency Response 50 to 60Hz			
DC Current	200.0A	0.1A	± (2.5% + 5 digits)	200A
	DC Zero function in use			
AC Voltage	6.000V	0.001V	± (1.2% + 5 digits)	1000V DC 750V AC
	60.00V	0.01V	± (1.2% + 3 digits)	
	600.0V	0.1V		
	750V	1V	± (1.5% + 5 digits)	
	True RMS voltage applicable to 10%~100% of the range Input Impedance: ≥ 10MΩ; Frequency response 40~400Hz			
DC Voltage	6.000V	0.001V	± (0.8% + 3 digits)	1000V DC 750V AC
	60.00V	0.01V		
	600.0V	0.1V		
	1000V	1V	± (1.0% + 5 digits)	
	Input Impedance: ≥ 10MΩ			
Resistance	600.0Ω	0.1Ω	± (1.2% + 2 digits)	1000V DC 750V AC
	6.000kΩ	0.001kΩ	± (1.0% + 2 digits)	
	60.00kΩ	0.01kΩ		
	600.0kΩ	0.1kΩ		
	6.000MΩ	0.001MΩ	± (1.2% + 2 digits)	
	60.00MΩ	0.01MΩ	± (1.5% + 5 digits)	
Continuity	600.0Ω	0.1Ω	-----	1000V DC; 750V AC
	Less than 10Ω beeper sounds. 10Ω to 100Ω undetermined. Greater than 100Ω beeper off (OL displayed). Open circuit voltage approx. 1.2V			
Diode	6.000V	0.001V	0.5 to0.8V	1000V DC; 750V AC
	Open Circuit Voltage : Approx. 3.3V			

Function	Range	Resolution	Accuracy (reading)	‘OL’ Protection
Capacitance	60.00nF	0.01nF	± (4.0% + 20 digits)	1000V DC 750V AC
	600.0nF	0.1nF		
	6.000µF	0.001µF		
	60.00µF	0.01µF		
	600.0µF	0.1µF		
	6.000mF	0.001mF	± (10%)	
	60.00mF	0.01mF	For reference only	
Non-Contact Voltage Detector (NCV)	≥100Vrms; ≤10mm (LED/Buzzer indication)			

GENERAL SPECIFCATIONS

Display	6000-count Multi-Function LCD
Display rate	3 times / second
Polarity	Automatic display of positive and negative polarity
Over-range indication	“OL” or “-OL” is displayed
Clamp Sensor Type	Open Jaw Hall Effect
Jaw Opening	14.7 mm (0.57”) diameter
Electromagnetic field influence	Unstable or inaccurate readings may be displayed if there is an electromagnetic field disturbance in the measurement environment
Maximum Voltage	600VAC RMS or 1000V DC maximum applied to any terminal
Low battery indication	 is displayed if battery voltage is less than 2.4V
Auto Power OFF	After 15 minutes
Operating Temperature and Humidity	0~30°C (32~86°F); 80%RH maximum 30~40°C (86~104°F); 75%RH maximum 40~50°C (104~122°F); 45%RH maximum
Storage Temperature and Humidity	-20~60°C (-4~140°F); 80%RH maximum (with battery removed)
Operating Altitude	2000m (6562’)
Battery power	2 x 1.5V ‘AA’ alkaline batteries
Weight	163.7g (5.7 oz.)Including battery
Dimensions (W x H x D)	210 x 53 x 35mm (8.27x 2.1 x 0.67”)
Safety Standards	Complies with EN61010-1, EN61010-2-032, and EN61010-2-033 CAT II 1000V, CAT III 600V; Pollution Degree 2
Drop Protection	1m (approx. 3’) drop onto hardwood on concrete flooring
For Indoor Use	

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