

# User's Guide

## ET2144

### True RMS Industrial Multimeter



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## ***Introduction***

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This meter measures AC/DC Voltage, AC/DC Current, Resistance, Capacitance, Frequency (electrical & electronic), Duty Cycle, Diode Test, Insulation Test, and Continuity plus Thermocouple Temperature. It can store and recall data. It features a waterproof, rugged design for heavy duty use. Proper use and care of this meter will provide many years of reliable service.

## ***Safety***

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This symbol adjacent to another symbol, terminal or operating device indicates that the operator must refer to an explanation in the Operating Instructions to avoid personal injury or damage to the meter.

**WARNING**

This WARNING symbol indicates a potentially hazardous situation, which if not avoided, could result in death or serious injury.

**CAUTION**

This CAUTION symbol indicates a potentially hazardous situation, which if not avoided, may result damage to the product.



This symbol advises the user that the terminal(s) so marked must not be connected to a circuit point at which the voltage with respect to earth ground exceeds (in this case) 1000 VAC or VDC.



This symbol adjacent to one or more terminals identifies them as being associated with ranges that may, in normal use, be subjected to particularly hazardous voltages. For maximum safety, the meter and its test leads should not be handled when these terminals are energized.



This symbol indicates that a device is protected throughout by double insulation or reinforced insulation.

## **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 overvoltages 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

## SAFETY INSTRUCTIONS

This meter has been designed for safe use, but must be operated with caution. The rules listed below must be carefully followed for safe operation.

1. **NEVER** apply voltage or current to the meter that exceeds the specified maximum:

Input Protection Limits	
Function	Maximum Input
V DC or V AC	1000V DC/AC rms
mA AC/DC	500mA 1000V fast acting fuse
A AC/DC	10A 1000V fast acting fuse (20A for 30 seconds max every 15 minutes)
Frequency, Resistance, Capacitance, Duty Cycle, Diode Test, Continuity	1000V DC/AC rms
Temperature	1000V DC/AC rms
Surge Protection: 8kV peak per IEC 61010	


2. **USE EXTREME CAUTION** when working with high voltages.
3. **DO NOT** measure voltage if the voltage on the "COM" input jack exceeds 1000V above earth ground.
4. **NEVER** connect the meter leads across a voltage source while the function switch is in the current, resistance, or diode mode. Doing so can damage the meter.
5. **ALWAYS** discharge filter capacitors in power supplies and disconnect the power when making resistance or diode tests.

6. **ALWAYS** turn off the power and disconnect the test leads before opening the covers to replace the fuse or batteries.
7. **NEVER** operate the meter unless the back cover and the battery and fuse covers are in place and fastened securely.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

## Controls and Jacks



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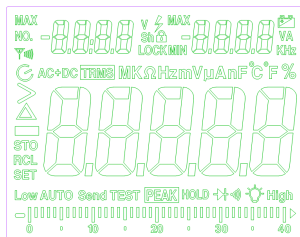
1. 40,000 count LCD display
2. MAX/MIN (-) button
3. STORE(<RECALL) button
4. RANGE(SETUP) button
5. INSULATION TEST button
6. MODE button
7. Function switch
8. mA,  $\mu$ A and 10A input jacks
9. REL(+) button
10. HOLD(PEAKHOLD>) button
11. EXIT(AC+DC) button
12.  Backlight button
13. Positive input jack
14. COM input jack



**Note:** Tilt stand and battery compartment are on rear of unit.

## Symbols and Annunciators

•)))	Continuity
	Diode test
	Battery status
n	nano ( $10^{-9}$ ) (capacitance)
$\mu$	micro ( $10^{-6}$ ) (amps, cap)
m	milli ( $10^{-3}$ ) (volts, amps)
A	Amps
k	kilo ( $10^3$ ) (ohms)
F	Farads (capacitance)
M	mega ( $10^6$ ) (ohms)
$\Omega$	Ohms
Hz	Hertz (frequency)
%	Percent (duty ratio)
AC	Alternating current
DC	Direct current
°F	Degrees Fahrenheit
MAX	Maximum
N0.	Serial number
S	second
	left auxiliary display
	right auxiliary display
SET	Set up parameter
AC +DC	Alternating current + D
TRMS	Ture RMS
STO	Store
RCL	Recall
AUTO	Auto Range
	Timing symbol
	Backlight
	bargraph



PEAK	Peak Hold
V	Volts
REL	Relative
AUTO	Autoranging
HOLD	Display hold
°C	Degrees Centigrade
MIN	Minimum

## Operating Instructions

**WARNING:** Risk of electrocution. High-voltage circuits, both AC and DC, are very dangerous and should be measured with great care.

1. ALWAYS turn the function switch to the **OFF** position when the meter is not in use.
2. If “OL” appears in the display during a measurement, the value exceeds the range you have selected. Change to a higher range.

## DC VOLTAGE MEASUREMENTS

**CAUTION:** Do not measure DC voltages if a motor on the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

1. Set the function switch to the green **VDC** position.
2. Insert the black test lead banana plug into the negative **COM** jack. Insert the red test lead banana plug into the positive **V** jack.
3. Touch the black test probe tip to the negative side of the circuit. Touch the red test probe tip to the positive side of the circuit.
4. Read the voltage in the display.



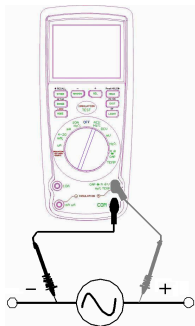


## AC VOLTAGE (FREQUENCY, DUTY CYCLE) MEASUREMENTS

**WARNING:** Risk of Electrocution. The probe tips may not be long enough to contact the live parts inside some 240V outlets for appliances because the contacts are recessed deep in the outlets. As a result, the reading may show 0 volts when the outlet actually has voltage on it. Make sure the probe tips are touching the metal contacts inside the outlet before assuming that no voltage is present.

**CAUTION:** Do not measure AC voltages if a motor on the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

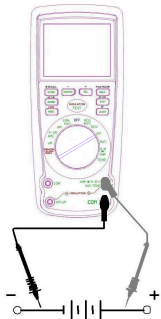
1. Set the function switch to the green **VAC/Hz/%** position.
2. Insert the black test lead banana plug into the negative **COM** jack. Insert red test lead banana plug into the positive **V** jack.
3. Touch the black test probe tip to the neutral side of the circuit. Touch the red test probe tip to the "hot" side of the circuit.
4. Read the voltage in the main display and the frequency in the right auxiliary display
5. Press and hold the **MODE** button 2 second to indicate "**Hz**".
6. Read the frequency in the main display.
7. Press the **MODE** button to indicate "%".
8. Read the % of duty cycle in the main display.
9. Press EXIT for 2 seconds into the function of AC+DC. Test DC and AC TURE Rms.



## MV VOLTAGE MEASUREMENTS

**CAUTION:** Do not measure mV voltages if a motor on the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

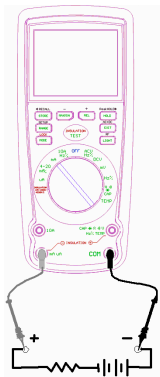
1. Set the function switch to the green mV position.
2. Press the **MODE** button to indicate “DC”. or “AC”, or in AC range press **EXIT** for two seconds and chose “AC+DC”
3. Insert the black test lead banana plug into the negative **COM** jack.  
Insert the red test lead banana plug into the positive **V** jack.
4. Touch the black test probe tip to the negative side of the circuit.  
Touch the red test probe tip to the positive side of the circuit.
5. Read the mV voltage in the display.



## DC CURRENT MEASUREMENTS

**CAUTION:** Do not make 20A current measurements for longer than 30 seconds. Exceeding 30 seconds may cause damage to the meter and/or the test leads.

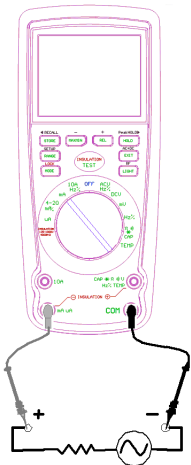
1. Insert the black test lead banana plug into the negative **COM** jack.
2. For current measurements up to  $4000\mu\text{A}$  DC, set the function switch to the yellow  **$\mu\text{A}$**  position and insert the red test lead banana plug into the  **$\mu\text{A}/\text{mA}$**  jack.
3. For current measurements up to  $400\text{mA}$  DC, set the function switch to the yellow **mA** position and insert the red test lead banana plug into the  **$\mu\text{A}/\text{mA}$**  jack.
4. For current measurements up to  $20\text{A}$  DC, set the function switch to the yellow **10A/HZ/%** position and insert the red test lead banana plug into the **10A** jack.
5. Press the **MODE** button to indicate "**DC**" on the display.
6. Remove power from the circuit under test, then open up the circuit at the point where you wish to measure current.
7. Touch the black test probe tip to the negative side of the circuit. Touch the red test probe tip to the positive side of the circuit.
8. Apply power to the circuit.
9. Read the current in the display.



## AC CURRENT (FREQUENCY, DUTY CYCLE) MEASUREMENTS

**CAUTION:** Do not make 20A current measurements for longer than 30 seconds. Exceeding 30 seconds may cause damage to the meter and/or the test leads.

1. Insert the black test lead banana plug into the negative **COM** jack.
2. For current measurements up to  $4000\mu\text{A}$  AC, set the function switch to the yellow  **$\mu\text{A}$**  position and insert the red test lead banana plug into the  **$\mu\text{A}/\text{mA}$**  jack.
3. For current measurements up to  $400\text{mA}$  AC, set the function switch to the yellow  **$\text{mA}$**  position and insert the red test lead banana plug into the  **$\mu\text{A}/\text{mA}$**  jack.
4. For current measurements up to 20A AC, set the function switch to the yellow **10A/HZ/%** position and insert the red test lead banana plug into the **10A** jack.
5. Press the **MODE** button to indicate “AC” on the display.
6. Remove power from the circuit under test, then open up the circuit at the point where you wish to measure current.
7. Touch the black test probe tip to the neutral side of the circuit. Touch the red test probe tip to the “hot” side of the circuit.
8. Apply power to the circuit.
9. Read the current in the display. In the 10AAC range, right auxiliary display frequency.
10. Press and hold the **MODE** button to indicate “Hz”.
11. Read the frequency in the display.
12. Momentarily press the **MODE** button again to indicate “%”.
13. Read the % duty cycle in the display.

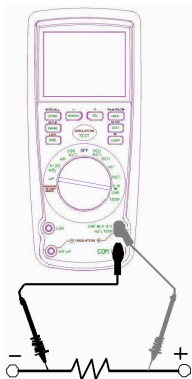


14. Press and hold the **MODE** button to return to current measurement.
15. Press EXIT for 2 seconds into the function of AC+DC. Test DC and AC TURE Rms.

## RESISTANCE MEASUREMENTS

**WARNING:** To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any resistance measurements. Remove the batteries and unplug the line cords.

1. Set the function switch to the green  **$\Omega$  CAP**  $\rightarrow \bullet \infty$  position.
2. Insert the black test lead banana plug into the negative **COM** jack. Insert the red test lead banana plug into the positive  **$\Omega$**  jack.
3. Press the **MODE** button to indicate “ **$\Omega$** ” on the display.
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 in the display.



## CONTINUITY CHECK

**WARNING:** To avoid electric shock, never measure continuity on circuits or wires that have voltage on them.

1. Set the function switch to the green  **$\Omega$  CAP**  $\rightarrow \bullet \rightarrow \infty$  position.
2. Insert the black lead banana plug into the negative **COM** jack.  
Insert the red test lead banana plug into the positive  **$\Omega$**  jack.
3. Press the **MODE** button to indicate "  $\bullet \rightarrow \infty$  " and " **$\Omega$** " on the display
4. Touch the test probe tips to the circuit or wire you wish to check.
5. If the resistance is less than approximately  $35\Omega$ , the audible signal will sound. If the circuit is open, the display will indicate "**OL**".




## DIODE TEST

1. Set the function switch to the green  **$\Omega$  CAP** position.
2. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive **V** jack.
3. Press the **MODE** button to indicate "  $\rightarrow \bullet$  " and "**V**" on the display.
4. Touch the test probes to the diode under test.  
Forward voltage will typically indicate 0.400 to 0.700V. Reverse voltage will indicate "**OL**".  
Shorted devices will indicate near 0V and an open device will indicate "**OL**" in both polarities.



## CAPACITANCE MEASUREMENTS

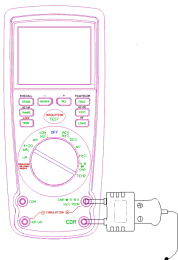
**WARNING:** To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any capacitance measurements. Remove the batteries and unplug the line cords.

1. Set the rotary function switch to the green **Ω CAP**  position.
2. Insert the black test lead banana plug into the negative **COM** jack.
3. Insert the red test lead banana plug into the positive **V** jack.
4. Press the **MODE** button to indicate “F”
5. Touch the test leads to the capacitor to be tested.  
Read the capacitance value in the Display



## TEMPERATURE MEASUREMENTS

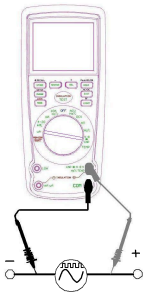
1. Set the function switch to the green Temp position.
2. Insert the Temperature Probe into the input jacks, making sure to observe the correct polarity.
3. Press the MODE button to indicate “°F” or “°C”
4. Touch the Temperature Probe head to the part whose temperature you wish to measure. Keep the probe touching the part under test until the reading stabilizes (about 30 seconds).
5. Read the temperature in the display.



**Note:** The temperature probe is fitted with a type K mini connector. A mini connector to banana connector adaptor is supplied for connection to the input banana jacks.

## FREQUENCY (DUTY CYCLE) MEASUREMENTS (ELECTRONIC)

1. Set the rotary function switch to the green **Hz/%** position.
2. Insert the black lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive **Hz** jack.
3. Touch the test probe tips to the circuit under test.
4. Read the frequency on the display.
5. Press the **MODE** button to indicate "%".
6. Read the % duty cycle in the display.



## % 4 – 20mA MEASUREMENTS

1. Set up and connect as described for DC mA measurements.
2. Set the rotary function switch to the **4-20mA%** position.
3. The meter will display loop current as a % with 0mA=-25%, 4mA=0%, 20mA=100%, and 24mA=125%.

## INSULATION RESISTANCE MEASUREMENTS

- a) Set the rotary function switch to the **INSULATION** position , and Press the **RANGE** button to chose one of the voltage which display on the top left corner.
- b) Connect two testing lines to the tested ;
- c) Push down and hold the "TEST" button /or press the " LOCK" keystoke first and then the "TEST" button, if the tested is electriferous and its voltage ( AC/DC) is over 30V, it will refuse work and no high-voltage testing occurs, simultaneity, it shows ">30V" on the LCD, the symbol " ⚡ " flashes, and the buzzer warns frequently. if the tested is diselectriferous or its voltage is lower than 30V, it will enter into the formal testing process and brings the high-voltage. on the primary display, the insulation resistance in MΩ is indicated in-



phase with analog bar; on the top right corner display, the tested insulation voltage in V (DC) is indicated, the symbol “ ⚡ ” flashes and the buzzer warns frequently

d) Being free from the “TEST” button or pushing down the “TEST” button in the “LOCK “ status can exit from the “LOCK” status and shutoff the high-voltage, synchronously, the resistance values is indicated in the primary display will be held, and the top right corner display still be in the status of monitoring the insulation voltage for the tested .

e) Subsequently, discharge the balance insulation voltage of the tested through the inner switch of the meter.

Turning the function switch or press the **EXIT** button can exit automatically from testing status during the process.

## **POWER TOOLS AND SMALL APPLIANCES**

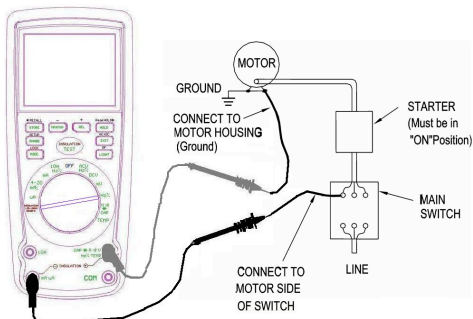
This test would also apply to other similar equipment that has a line cord. For double insulated power tools, the megohmmeter lead shown connected to the housing would be connected to some metal part if the tool(e.g chuck, blade).

Note: The switch of the device must be in the “ON” position and the main power should be disconnected.

## **MOTORS**

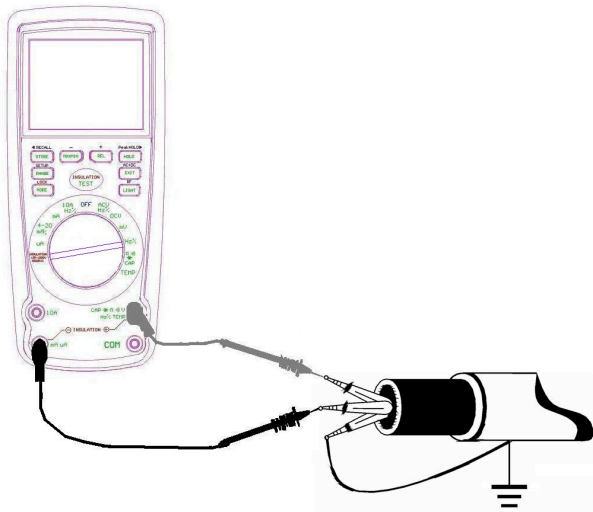
AC-Disconnect the motor from the line by disconnecting the wires at the motor terminals or by opening the main switch. If the main switch is used and the motor also has a starter then the starter must be held, by some means, in the “ON” position. In the latter case, the measured resistance will include the resistance of the motor, wire and all other components between the motor and the main switch. If a weakness is indicated, the motor and other components should be checked

individually. If the motor is disconnected at the motor terminals, connect one megohmmeter lead to the grounded motor housing and the other lead to One of the motor leads. DC-Disconnect the motor from the line. To test the brush rigging, field coils and armature connect one megohmmeter lead to the grounded motor housing and the other lead to the brush on the commutator. If the resistance measurement indicates a weakness, raise the brushes off the commutator and separately test the armature, field coils and brush rigging by connecting one megohmmeter lead to each of them individually, leaving the other connected to the grounded motor housing. The above also applies to DC Generators.



## CABLES

Disconnect the cable from the line. Also disconnect opposite end to avoid errors due to leakage from other equipment. Check each conductor to ground and /or lead sheath by connecting one megohmmeter lead to a ground and / or lead sheath and the other megohmmeter lead to each of the conductors in turn. Check insulation resistance between conductors by connecting megohmmeter leads to conductors in pairs.



## AUTORANGING/MANUAL RANGE SELECTION

When the meter is first turned on, it automatically goes into AutoRanging. This automatically selects the best range for the measurements being made and is generally the best mode for most measurements. For measurement situations requiring that a range be manually selected, perform the following:

1. Press the **RANGE** key. The "**AUTO**" display indicator will turn off.
2. Press the **RANGE** key to step through the available ranges until you select the range you want.
3. To exit the Manual Ranging mode and return to Autoranging, press **EXIT**

**Note:** Manual ranging does not apply for the Temperature functions.

## MAX/MIN

1. Press the **MAX/MIN** key to activate the MAX/MIN recording mode. The display icon "**MAX**" will appear. The meter left auxiliary display will display and hold the maximum reading and will update only when a new "max" occurs. The display icon "**MIN**" will appear. The right auxiliary display meter will display and hold the minimum reading and will update only when a new "min" occurs.
2. To exit MAX/MIN mode press **EXIT**

## RELATIVE MODE

The relative measurement feature allows you to make measurements relative to a stored reference value. A reference voltage, current, etc. can be stored and measurements made in comparison to that value. The displayed value is the difference between the reference value and the measured value. **Note:** Relative mode does not operate in the 4-20mA function.


1. Perform the measurement as described in the operating instructions.
2. Press the **REL** button to store the reading in the display and the "**REL**" indicator will appear on the display.

3. Left auxiliary display display the margin of initial value and the current value.

Right auxiliary display display the initial reading. Main display the reading after REL TEST.

4. Press the **EXIT** button to exit the relative mode.

## Display Backlight

Press the  key to turn the backlight on. The backlight will automatically turn off after SET time. Press the **EXIT** button to exit the **backlight on** mode.

## HOLD

The hold function freezes the reading in the display. Press the **HOLD** key momentarily to activate or to exit the **HOLD** function.

## PEAK HOLD

The Peak Hold function captures the peak AC or DC voltage or current. The meter can capture negative or positive peaks as fast as 1 millisecond in duration. Momentarily press the **PEAK** button, "**PEAK**" and "**MAX**" will display in **left auxiliary display**. **MIN**" will display in **right auxiliary display**. The meter will update the display each time a lower negative peak occurs. **Press the EXIT button to exit the PEAK HOLD mode.** Auto Power Off feature will be disabled automatically in this mode.

## Data record (STORE/RECALL )

### 1、 STORE function

In the current testing mode, press STORE button one time, enter into STORE function.

On the left upper corner of LCD shows NO XXXX, which states current storage serial number.

On the right upper corner of LCD shows XXXX which states how many current storage is used.

Press STORE button again, enter into recording interval time set up function.

On the left upper shows 0000 S ,which states recording interval time; using button + & - to select, the range is 0~255 seconds。

When the recording interval time is 0000 S, then press STORE button again to change into manual recording. Press the STORE button again to record once.

When the recording interval time is 1~255 S, then press STORE button again to start recording automatically from 0000. Recording times is showed on the left upper corner, data is showed on the right upper corner (Due to digitally limitation, there is only display preceding four numbers)

To finish above STORE function, press EXIT button shortly.

If you want to clean all the memory data, the steps are:

When power on, press the EXIT button long time, and then turn the switch from OFF to random, and release the EXIT button, the LCD will flash thrice and meantime buzzer thrice, which means all memory data have been cleaned.

## **2 RECALL function**

Press STORE button two seconds to enter into RECALL function.

On the left upper corner shows XXXX , which states current storage serial number. On the right upper corner shows XXXX , which states how many current storage is used.

Use button + & —to select serial number XXXX on the left upper corner and record data on the right upper corner.

To finish above RECALL function, press EXIT button.

## **Parameter setting up (SET)**

- 1 Press the RANGE button second seconds to enter into SET function. Then press shortly once, change on setting content. Setting content includes(in sequence) :

A: upper limit buzzer alarm

B: lower limit buzzer alarm

- C: auto power off time
- D: turn off phonating
- E: back lit time



Use ←, +, -, → buttons to select the parameter

- 2 Press SET button continuously to switch to setting content, till exiting set up to testing mode. So the updated setting content is saved. If press EXIT button in this period, all setting can't be saved.

### AC+DC

In all the measuring mode VAC, mV(AC), 10A(AC), mA(AC),  $\mu$ A(AC), press button EXIT for 2seconds to enters into AC+DC testing. The precision is the same as AC measure. LCD shows AC+DC signal. Press button EXIT to exit.

### LOW BATTERY INDICATION

When the  icon appears alone in the display  , the battery should be replaced.

### Maintenance

**WARNING:** To avoid electric shock, disconnect the test leads from any source of voltage before removing the back cover or the battery or fuse covers.

**WARNING:** To avoid electric shock, do not operate your meter until the battery and fuse covers are in place and fastened securely.

This Multimeter is designed to provide years of dependable service, if the following care instructions are performed:

1. **KEEP THE METER DRY.** If it gets wet, wipe it off.
2. **USE AND STORE THE METER IN NORMAL TEMPERATURES.** Temperature extremes can shorten the life of the electronic parts and distort or melt plastic parts.

3. **HANDLE THE METER GENTLY AND CAREFULLY.** Dropping it can damage the electronic parts or the case.
4. **KEEP THE METER CLEAN.** Wipe the case occasionally with a damp cloth. DO NOT use chemicals, cleaning solvents, or detergents.
5. **USE ONLY FRESH BATTERIES OF THE RECOMMENDED SIZE AND TYPE.** Remove old or weak batteries so they do not leak and damage the unit.
6. **IF THE METER IS TO BE STORED FOR A LONG PERIOD OF TIME,** the batteries should be removed to prevent damage to the unit.

## BATTERY INSTALLATION

**WARNING:** To avoid electric shock, disconnect the test leads from any source of voltage before removing the battery cover.

1. Turn power off and disconnect the test leads from the meter.
2. Open the rear battery cover by removing two screws (B) using a Phillips head screwdriver.
3. Insert the battery into battery holder, observing the correct polarity.
4. Put the battery cover back in place. Secure with the screws.

**WARNING:** To avoid electric shock, do not operate the meter until the battery cover is in place and fastened securely.

**NOTE:** If your meter does not work properly, check the fuses and batteries to make sure that they are still good and that they are properly inserted.



## REPLACING THE FUSES

**WARNING:** To avoid electric shock, disconnect the test leads from any source of voltage before removing the meter cover.

1. Disconnect the test leads from the meter.
2. Remove the protective rubber holster.
3. Remove the battery cover (two “B” screws) and the battery.
4. Remove the six “A” screws securing the rear cover.
5. Gently remove the old fuse and install the new fuse into the holder.
6. Always use a fuse of the proper size and value (0.5A/1000V fast blow for the 400mA range [SIBA 70-172-40], 10A/1000V fast blow for the 20A range [SIBA 50-199-06]).
7. Replace and secure the rear cover, battery and battery cover.

**WARNING:** To avoid electric shock, do not operate your meter until the fuse cover is in place and fastened securely.

## Specifications

Function	Range	Resolution	Accuracy
DC Voltage	400mV	0.01mV	± (0.06% reading + 4digits)
	4V	0.0001V	
	40V	0.001V	
	400V	0.01V	
	1000V	0.1V	± (0.1% reading + 5digits)
AC Voltage			50 to 1000Hz
	400mV	0.1mV	± (1.0% reading + 7digits)
	4V	0.001V	
	40V	0.01V	± (1.0% reading + 5 digits)
	400V	0.1V	
	1000V	1V	
AC+DCVoltage e	400mV	0.1mV	± (1.0% reading + 7digits) ( 50/60HZ )
	4V	0.001V	
	40V	0.01V	
	400V	0.1V	
	1000V	1V	
All AC voltage ranges are specified from 5% of range to 100% of range			
DC Current	400μA	0.01μA	± (1.0% reading + 3 digits)
	4000μA	0.1μA	
	40mA	0.001mA	
	400mA	0.01mA	
	10A	0.001A	

	(20A: 30 sec max with reduced accuracy)		
AC Current (AC+DC)			50 to 1000Hz
	400μA	0.1μA	± (1.5% reading + 7digits)
	4000μA	1μA	
	40mA	0.01mA	
	400mA	0.1mA	
	10A	0.01A	
AC+DCCurrent	400μA	0.1μA	± (1.5% reading + 7digits)
	4000μA	1μA	
	40mA	0.01mA	
	400mA	0.1mA	
	10A	0.01A	
	(20A: 30 sec max with reduced accuracy)		
	All AC current ranges are specified from 5% of range to 100% of range		

**NOTE:** Accuracy is stated at 65°F to 83°F (18°C to 28°C) and less than 75% RH.

AC switch according to the calibration of sine wave. It generally increase  $\pm$ (2% reading + 2% full scale) if non sine wave in the wave crest less than 3.0.

Function	Range	Resolution	Accuracy
Resistance	400Ω	0.01Ω	± (0.3% reading + 9 digits)
	4kΩ	0.0001kΩ	± (0.3% reading + 4 digits)
	40kΩ	0.001kΩ	
	400kΩ	0.01kΩ	
	4MΩ	0.001MΩ	
	40MΩ	0.001MΩ	± (2.0% reading + 10 digits)
Capacitance	40nF	0.001nF	± (3.5% reading + 40 digits)
	400nF	0.01nF	
	4μF	0.0001μF	± (3.5% reading + 10 digits)
	40μF	0.001μF	
	400μF	0.01μF	
	4000μF	0.1μF	± (5% reading + 10 digits)
	40mF	0.001mF	
Frequency (electronic)	40Hz	0.001Hz	± (0.1% reading + 1 digits)
	400Hz	0.01Hz	
	4kHz	0.0001kHz	
	40kHz	0.001kHz	
	400kHz	0.01kHz	
	4MHz	0.0001MHz	
	40MHz	0.001MHz	
	100MHz	0.01MHz	Not specified
	Sensitivity: 0.8V rms min. @ 20% to 80% duty cycle and <100kHz; 5Vrms min @ 20% to 80% duty cycle and > 100kHz.		
Frequency (electrical)	40.00Hz-10KHz	0.01Hz - 0.001KHz	± (0.5% reading)
	Sensitivity: 1Vrms		
Duty Cycle	0.1 to 99.90%	0.01%	± (1.2% reading + 2 digits)
	Pulse width: 100μs - 100ms, Frequency: 5Hz to 150kHz		
Temp	-50 to 1000°C	0.1°C	±(1.0% reading + 2.5°C)

(type-K)	-58 to 1832°F	0.1°F	±(1.0% reading +4.5°F) (probe accuracy not included)
4-20mA%	-25 to 125%	0.01%	±50 digits
	0mA=-25%, 4mA=0%, 20mA=100%, 24mA=125%		


## Meg OHMS

Terminal Voltage	Range	Resolution	Accuracy	Test Current	Short circuit current
125V(0%~+10%)	0.125~4.000 MΩ	0.001MΩ	$\pm(2\%+10)$	1mA	≤1mA
	4.001~40.00 MΩ	0.01MΩ	$\pm(2\%+10)$	@load	
	40.01~400.0 MΩ	0.1MΩ	$\pm(4\%+5)$	125kΩ	
	400.1~4000 MΩ	1MΩ	$\pm(5\%+5)$		
250V(0%~+10%)	0.250~4.000 MΩ	0.001MΩ	$\pm(2\%+10)$	1mA	≤1mA
	4.001~40.00 MΩ	0.01MΩ	$\pm(2\%+10)$	@load	
	40.01~400.0 MΩ	0.1MΩ	$\pm(3\%+5)$	250kΩ	
	400.1~4000 MΩ	1MΩ	$\pm(4\%+5)$		
500V(0%~+10%)	0.500~4.000 MΩ	0.001MΩ	$\pm(2\%+10)$	1mA	≤1mA
	4.001~40.00 MΩ	0.01MΩ	$\pm(2\%+10)$	@load	
	40.01~400.0 MΩ	0.1MΩ	$\pm(2\%+5)$	500kΩ	
	400.1~4000 MΩ	1MΩ	$\pm(4\%+5)$		
1000V(0%~+10%)	1.000~4.000 MΩ	0.001MΩ	$\pm(3\%+10)$	1mA	≤1mA
	4.001~40.00 MΩ	0.01MΩ	$\pm(2\%+10)$	@load	
	40.01~400.0 MΩ	0.1MΩ	$\pm(2\%+5)$	1MΩ	
	400.1~4000 MΩ	1MΩ	$\pm(4\%+5)$		

**Note:** Accuracy specifications consist of two elements:

- (% reading) – This is the accuracy of the measurement circuit.
- (+ digits) – This is the accuracy of the analog to digital converter.

Store capacitance	2000
<b>Enclosure</b>	Double molded, waterproof
<b>Shock (Drop Test)</b>	6.5 feet (2 meters)
<b>Diode Test</b>	Test current of 0.9mA maximum, open circuit voltage 2.8V DC typical
<b>Continuity Check</b>	Audible signal will sound if the resistance is less than 35 $\Omega$ (approx.), test current <0.35mA
<b>PEAK</b>	Captures peaks >1ms
<b>Temperature Sensor</b>	Requires type K thermocouple
<b>Input Impedance</b>	>10M $\Omega$ VDC & >9M $\Omega$ VAC
<b>AC Response</b>	True rms
<b>AC True RMS:</b>	The term stands for “Root-Mean-Square,” which represents the method of calculation of the voltage or current value. Average responding multimeters are calibrated to read correctly only on sine waves and they will read inaccurately on non-sine wave or distorted signals. True rms meters read accurately on either type of signal.
<b>ACV Bandwidth</b>	50Hz to 1000Hz
<b>Crest Factor</b>	$\leq 3$ at full scale up to 500V, decreasing linearly to $\leq 1.5$ at 1000V
<b>Display</b>	40,000 count backlit liquid crystal with bargraph
<b>Overrange indication</b>	“OL” is displayed
<b>Auto Power Off</b>	15 minutes (approximately) with disable feature

<b>Polarity</b>	Automatic (no indication for positive); Minus (-) sign for negative
<b>Measurement Rate</b>	2 times per second, nominal
<b>Low Battery Indication</b>	"  " is displayed if battery voltage drops below operating voltage
<b>Battery</b>	One 9 volt (NEDA 1604) battery
<b>Fuses</b>	mA, $\mu$ A ranges; 0.5A/1000V ceramic fast blow A range; 10A/1000V ceramic fast blow
<b>Operating Temperature</b>	41°F to 104°F (5°C to 40°C)
<b>Storage Temperature</b>	-4°F to 140°F (-20°C to 60°C)
<b>Operating Humidity</b>	Max 80% up to 87°F (31°C) decreasing linearly to 50% at 104°F (40°C)
<b>Storage Humidity</b>	<80%
<b>Operating Altitude</b>	7000ft. (2000meters) maximum.
<b>Safety</b>	This meter is intended for origin of installation use and protected, against the users, by double insulation per EN61010-1 and IEC61010-1 2 <sup>nd</sup> Edition (2001) to Category IV 600V and Category III 1000V; Pollution Degree 2. The meter also meets UL 61010-1, 2 <sup>nd</sup> Edition (2004), CAN/CSA C22.2 No. 61010-1 2 <sup>nd</sup> Edition (2004), and UL 61010B-2-031, 1 <sup>st</sup> Edition (2003)

