

# User Manual



## MM870

### Industrial TRMS Digital Multimeter





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## 1. Introduction

- Professional True RMS Industrial Digital Multimeter with 6000/60000 count LCD display.
- This Multimeter measures AC/DC Voltage, AC/DC Current, Resistance, Diode Test, Continuity, Capacitance, Frequency (Electrical & Electronic), Duty Cycle and Thermocouple Temperature.
- It features a waterproof, rugged design for heavy duty use.
- Proper use and care of this meter will provide many years of reliable service.

## 2. Safety

### 2-1. Safety Symbols



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.



**MAX** 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.

## 2-2. Per IEC1010 Measurement Installation Category

### Measurement Category I

Equipment of **Measurement 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.

### Measurement Category II

Equipment of **Measurement Category II** is energy-consuming equipment to be supplied from the fixed installation.

**Note:** Examples include household, office, and laboratory appliances.

### Measurement Category III

Equipment of **Measurement 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.

### Measurement Category IV

Equipment of **Measurement Category IV** is for use at the origin of the installation.

**Note:** Examples include electricity meters and primary over-current protection equipment.

## 2-3. 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.

- Never apply voltage or current to the meter that exceeds the specified maximum.
- Use extreme caution when working with high voltages.
- Do not measure voltage if the voltage on the "COM" input jack exceeds 1000V above earth ground.
- 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.
- Always discharge filter capacitors in power supplies and disconnect the power when making resistance or diode tests.
- Always turn off the power and disconnect the test leads before opening the covers to replace the fuse or batteries.
- 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.
- The tool is intended for indoor use only.
- Measure the known voltage to confirm the equipment is normal.

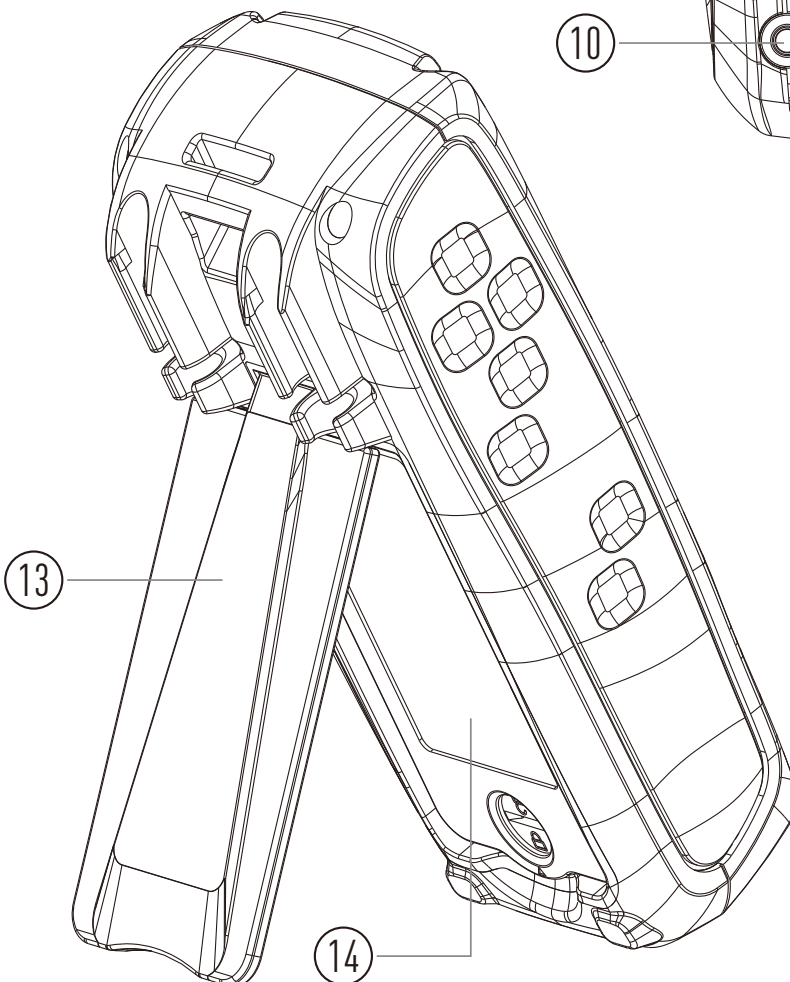
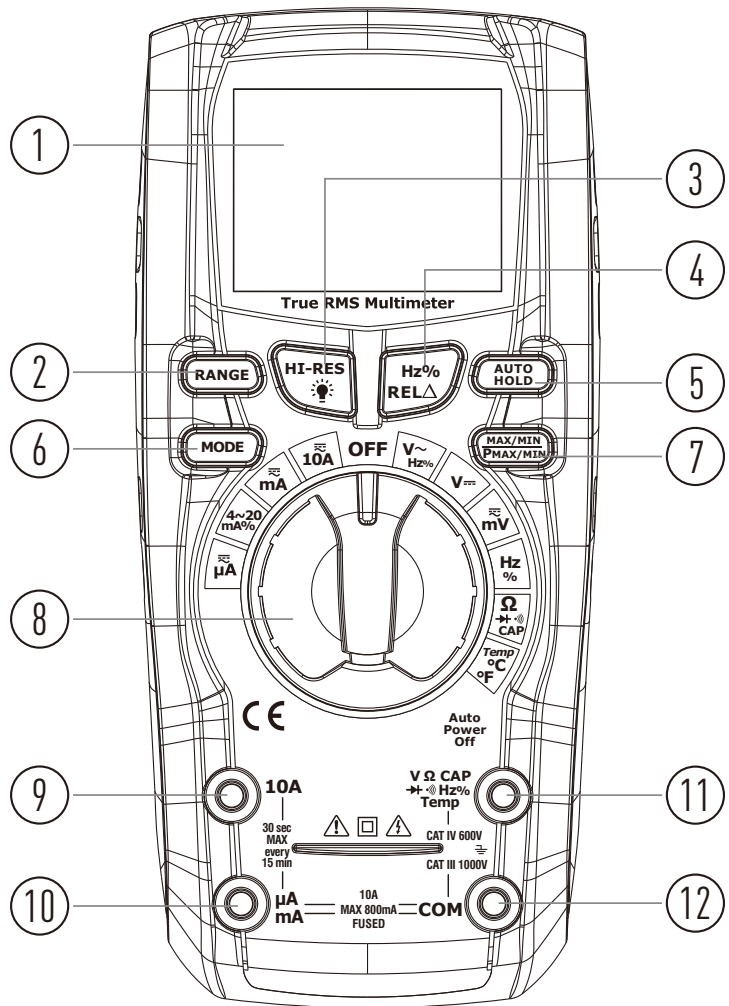
#### 2-4. Input Protection Limits

Function	Maximum Input
V DC or V AC	1000V DC/AC rms
mA DC/AC	800mA/1000V fast acting fuse
A DC/AC	10A/1000V fast acting fuse (10A for 30 seconds max every 15 minutes)
Frequency, Resistance, Capacitance, Diode Test, Continuity, Temperature	600V DC/AC rms
Surge Protection: 8kV peak per IEC 61010	

### 3.Description

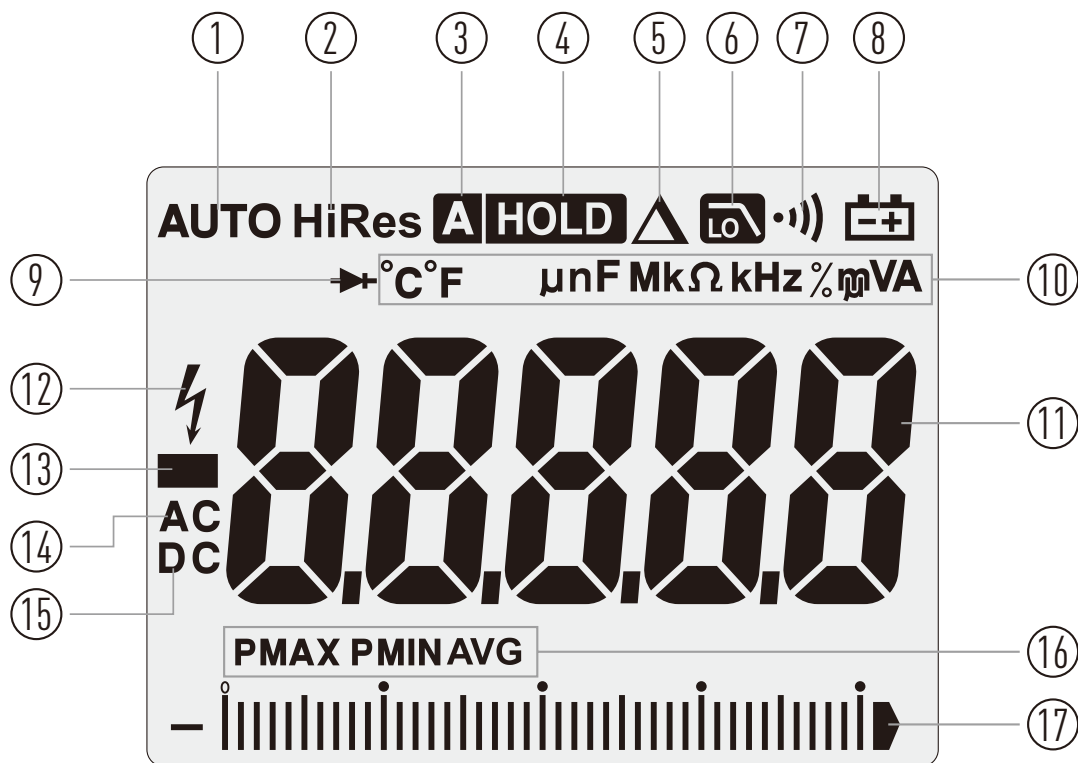
#### 3-1.Meter Description

- 1-LCD Display
- 2-RANGE Button
- 3-HIRES/Backlight Button
- 4-Hz/%/Relative Button
- 5-HOLD/AUTO HOLD Button
- 6-MODE Button
- 7-MAX/MIN/Peak Hold Button
- 8-Function Switch
- 9-10A Input Jack
- 10- $\mu$ A/mA Input Jack
- 11-Positive Input Jack
- 12-COM Input Jack
- 13-Tilt Stand
- 14-Battery Cover



### 3-2.Symbols Used on LCD Display

- |   |                                      |
|---|--------------------------------------|
| 1-Auto Ranging                              | 10-Units of Measure List             |
| 2-High Resolution (HiRes), 4-1/2 Digit Mode | 11-Measurement Reading               |
| 3-Auto HOLD Mode                            | 12-Hazardous Voltages                |
| 4-Display Hold                              | 13-Minus Sign                        |
| 5-Relative Mode                             | 17-Alternating Current               |
| 6-Low Pass Filter                           | 15-Direct Current                    |
| 7-Continuity                                | 16-Maximum/Minimum/Average/Peak Hold |
| 8-Battery Status                            | 17-Analog Bargraph                   |



## 4.Function

### 4-1.Auto/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** Button, the “**AUTO**” display indicator will turn off.
  - 2.Press the **RANGE** Button 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 and hold the **RANGE** Button for 2 seconds.

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

### 4-2.High Resolution (HiRes), 4-1/2 Digit Mode

- Press the **HIRES/Backlight** Button for 2 second causes the meter to enter the High-Resolution (**HiRes**) 4-1/2 digit mode, readings are displayed at 10 times the normal resolution with a maximum display of 59,999 counts.
- The HiRes mode works in all modes except Capacitance, Frequency, Temperature functions and the Peak MIN/MAX modes.
- To return to the 3-1/2 digit mode, press the **HIRES/Backlight** Button again for 2 second.

### 4-3.Display Backlight

- Press the **HIRES/Backlight** Button to turn the backlight on, press the **HIRES/Backlight** Button again to turn the backlight off.
- Change function switch will turn the backlight on.

### 4-4.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.
  - 1.Perform the measurement as described in the operating instructions.
  - 2.Press and hold the **Hz%/Relative** Button for 2 seconds to store the reading in the display and the “**△**” indicator will appear on the display, the display will now indicate the difference between the stored value and the measured value.

3. Press and hold the **Hz/%/Relative** Button for 2 seconds to exit the relative mode.

**Note:** Relative mode does not operate in the 4-20mA function.

#### 4-5. Display Hold & Auto Hold Mode

- The hold function freezes the reading in the display, press the **HOLD/AUTO** Button momentarily to activate or to exit the HOLD function, the “**HOLD**” indicator will appear on the display.
- The Auto HOLD mode captures the present reading on the display, when a new, stable reading is detected, the meter beeps and displays the new reading.
- Press the **HOLD/AUTO** Button for 2 second to enter or exit Auto HOLD mode, the “**A**” indicator will appear on the display.

#### 4-6. MODE Selection

- Press the **MODE** Button to select AC Voltage or Low Pass filter measurement in VAC Position, AC or DC in mV Position.
- Press the **MODE** Button to select Resistance, Continuity, Diode Test or Capacitance measurement.
- Press the **MODE** Button to select °C or °F in Temp Position.

#### 4-7. MAX/MIN/AVG Mode

1. Press the **MAX/MIN/Peak Hold** Button to activate the MAX/MIN/AVG recording mode, the display icon “**MAX**” will appear, the meter will display and hold the maximum reading and will update only when a new “**MAX**” occurs.
2. Press the **MAX/MIN/Peak Hold** Button again and the display icon “**MIN**” will appear, the meter will display and hold the minimum reading and will update only when a new “**MIN**” occurs.
3. Press the **MAX/MIN/Peak Hold** Button again and the display icon “**AVG**” will appear, the meter will display the average reading.
4. To exit MAX/MIN/AVG mode press and hold the **MAX/MIN/Peak Hold** Button for 2 seconds.

#### 4-8. PEAK HOLD Mode

1. The Peak Hold function captures the peak AC voltage or current, the meter can capture negative or positive peaks as fast as 1 millisecond in duration.
2. Momentarily press the **MAX/MIN/Peak Hold** Button, the “**PMAX**” will display, the meter will update the display each time a higher positive peak occurs.
3. Press the **MAX/MIN/Peak Hold** Button again, the “**PMIN**” will display, the meter will update the display each time a lower negative peak occurs.
4. Press and hold the **MAX/MIN/Peak Hold** Button for more than 1 second to exit PEAK Hold mode.

**Note:** Auto Power Off feature will be disabled automatically in this mode.

#### 4-9. Bar Graph

- The analog bar graph functions like the needle on an analog meter, but without the overshoot.
- The graph is not shown for Capacitance, Frequency, Temperature, Peak MAX/MIN or REL functions, range 6000.

#### 4-10. Auto Power Off

- The auto off feature will turn the meter off after 15 minutes.
- To disable the auto power off feature, hold down the **MODE** Button and turn the meter on, “**OFF**” will appear in the display.
- Turn the meter off and then on again to re-enable the auto power off feature.

#### 4-11. Low Battery Indication

- The “” icon will appear in the display when the battery voltage becomes low.
- Replace the battery when this appears.

## 5. Operating Instructions

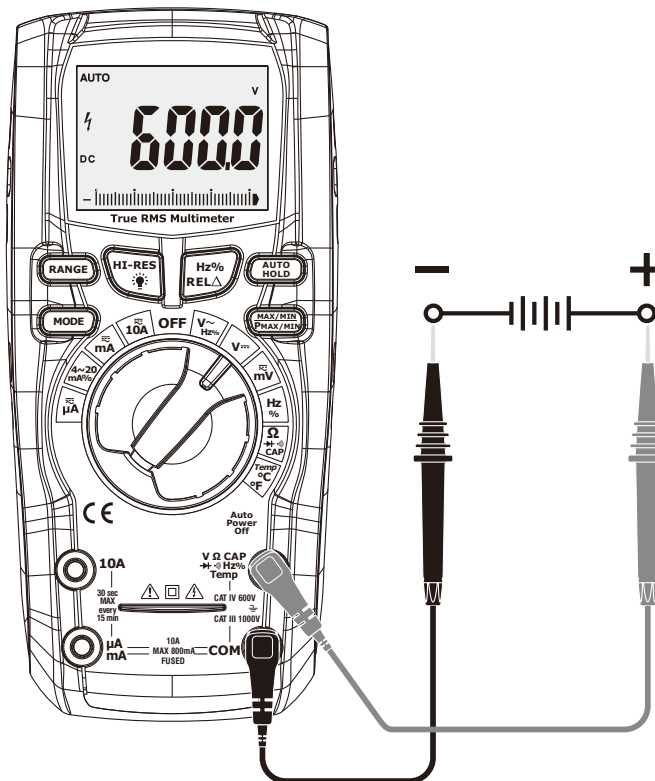
**WARNING:** Risk of electrocution. High-voltage circuits, both AC and DC, are very dangerous and should be measured with great care.

- Always turn the function switch to the **OFF** Position when the meter is not in use.
- If “**OL**” appears in the display during a measurement, the value exceeds the range you have selected, change to a higher range.

### 5-1. DC Voltage Measurement

**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 **VDC** Position.
2. Insert the black test lead into the **COM** Input Jack and the red test lead into the **Positive** Input 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.

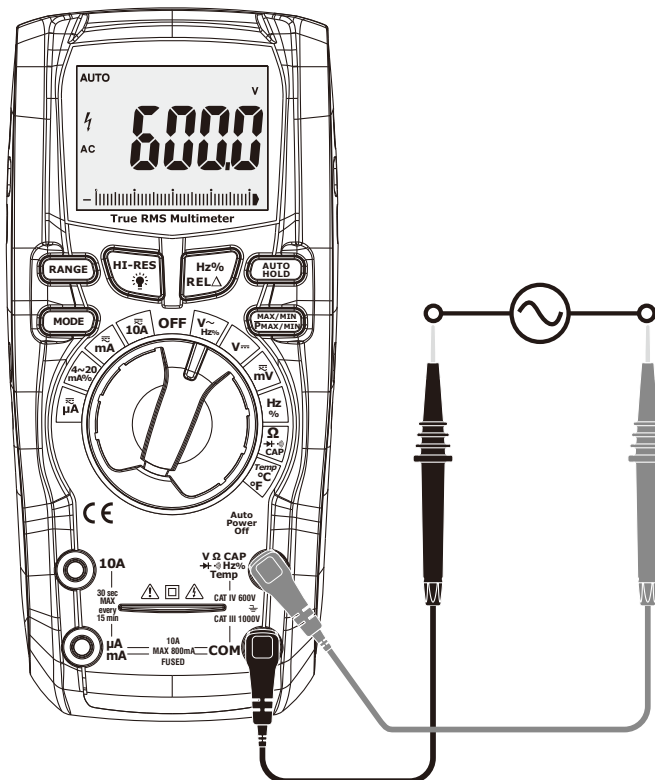


## 5-2.AC Voltage (Frequency, Duty Cycle)/Low Pass Voltage Measurement

**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.

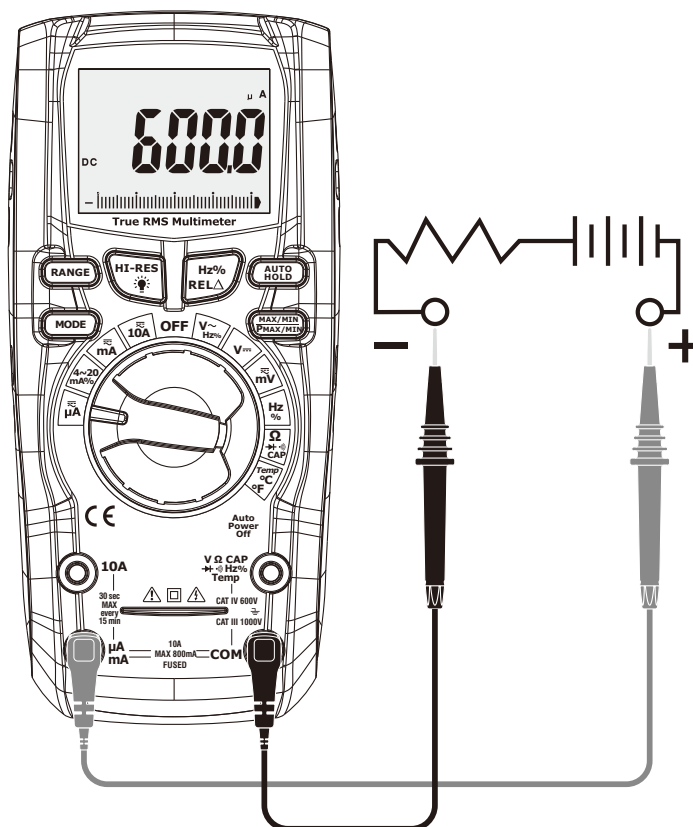
1. Set the function switch to the **VAC/Hz/%** Position.
2. Insert the black test lead into the **COM** Input Jack and the red test lead into the **Positive** Input Jack.
3. Touch the black test probe tip to the neutral side of the circuit; Touch the red test probe tip to the “hot” side of the circuit.
4. Read the Voltage in the display.
5. Press the **Hz/%** Button to indicate “Hz” or “%”, read the Frequency or % of Duty Cycle in the display.
6. Press the **MODE** Button to indicate “”, read the Low Pass Voltage in the display.



### 5-3.DC/AC Current (Frequency, Duty Cycle) Measurement

**CAUTION:** Do not make 10A 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 **COM** Input Jack.
  - For current measurement up to **6000 $\mu$ A DC**, set the function switch to the  **$\mu$ A AC/DC** Position and insert the red test lead banana plug into the  **$\mu$ A/mA** Input Jack.
  - For current measurement up to **600mA DC**, set the function switch to the **mA AC/DC** Position and insert the red test lead banana plug into the  **$\mu$ A/mA** Input Jack.
  - For current measurement up to **10A DC**, set the function switch to the **10A AC/DC** Position and insert the red test lead banana plug into the **10A** Input Jack.
2. Press the **MODE** Button to indicate “DC” or “AC” on the display.
3. Remove power from the circuit under test, then open up the circuit at the point where you wish to measure current.
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. Apply power to the circuit, read the Current in the display.
6. When measuring AC current, press the **Hz/%** Button to indicate “Hz” or “%”, read the Frequency or % of Duty Cycle in the display.
7. Press the **Hz/%** Button to return to Current measurement.



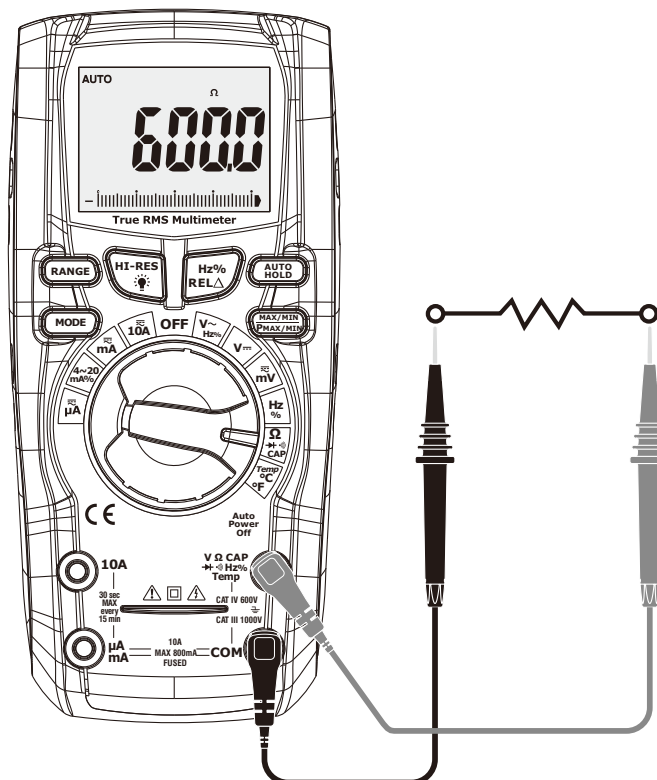
### 5-4. %4-20mA Measurement

1. Set up and connect as described for DC mA measurement.
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=3-100% and 24mA =125%.

### 5-5. Resistance Measurement

**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.

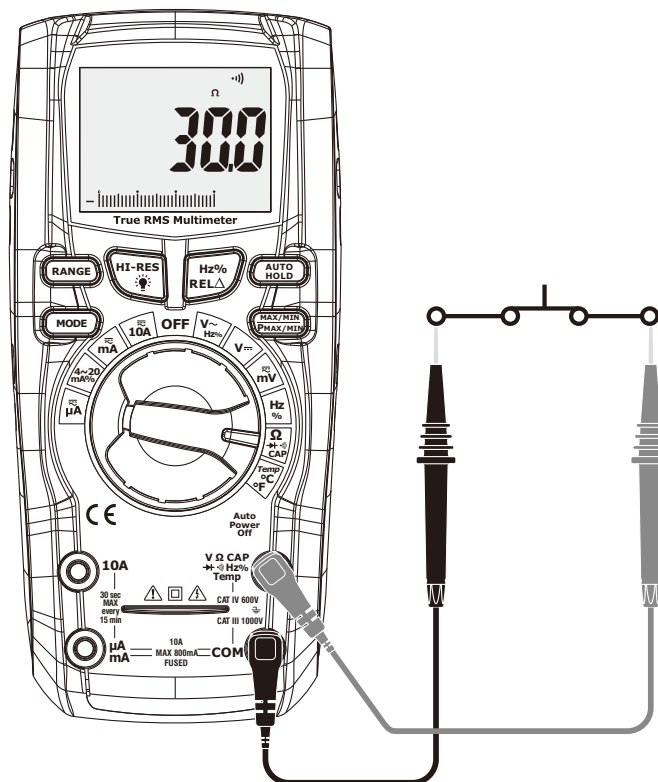
1. Set the function switch to the  $\Omega$   $\rightarrow$  CAP Position.
2. Insert the black test lead into the **COM** Input Jack and the red test lead into the **Positive** Input Jack.
3. Press the **MODE** Button to indicate “ $\Omega$ ” on the display.
4. Touch the test probe tips across the circuit 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.



## 5-6. Continuity Check

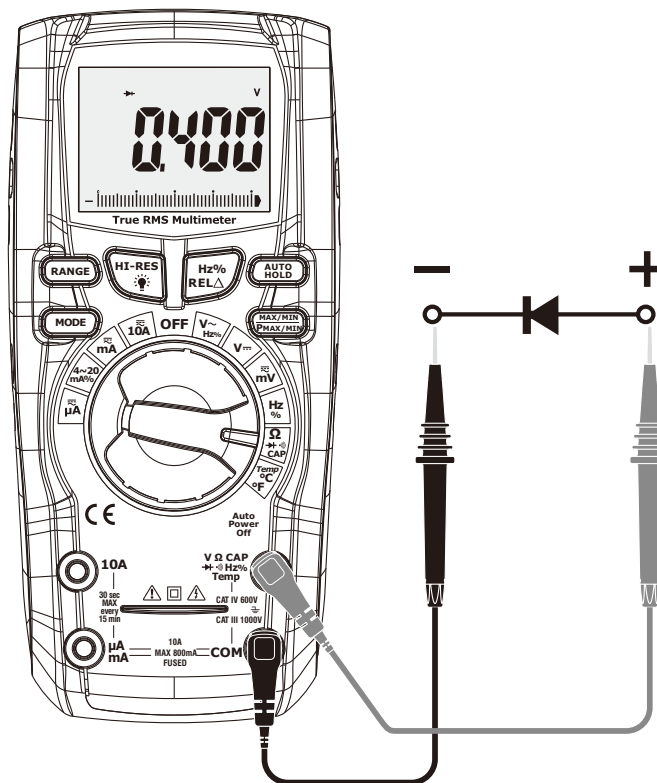
**WARNING:** To avoid electric shock, never measure continuity on circuits or wires that have voltage on them.

1. Set the function switch to the  $\Omega$  •)))  $\rightarrow$  CAP Position.
2. Insert the black test lead into the **COM** Input Jack and the red test lead into the **Positive** Input Jack.
3. Press the **MODE** Button to indicate “ $\Omega$ ” and “•)))” 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  $30\ \Omega$ , the audible signal will sound; if the circuit is open, the display will indicate “OL”.



## 5-7. Diode Test

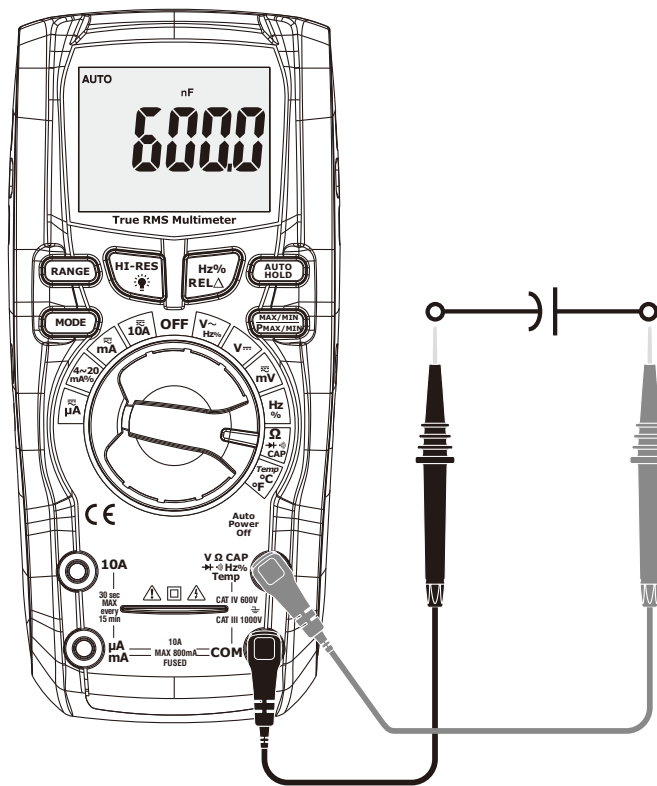
1. Set the function switch to the  $\Omega \cdot \text{CAP}$   $\rightarrow$   $\rightarrow$  CAP Position.
2. Insert the black test lead into the **COM** Input Jack and the red test lead into the **Positive** Input Jacks.
3. Press the **MODE** Button to indicate “V” and “ $\rightarrow$ ” on the display.
4. Touch the test probes to the diode under test.
5. 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.



## 5-8.Capacitance Measurement

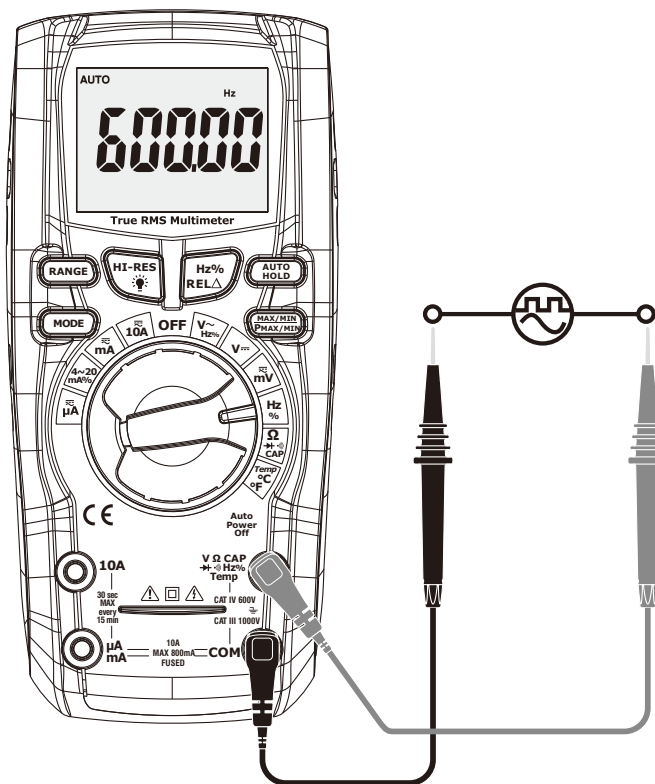
**WARNING:** To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any capacitance measurements. Remove the batteries and unplug the line cords.

- 1.Set the function switch to the  $\Omega \cdot \text{CAP}$  Position.
- 2.Insert the black test lead into the **COM** Input Jack and the red test lead into the **Positive** Input Jacks.
- 3.Press the **MODE** Button to indicate “F” on the display.
- 4.Touch the test leads to the capacitor to be tested, the test may take up to 3 minutes or more for large capacitors to charge, wait until the readings settle before ending the test.
- 5.Read the Capacitance value in the display.



## 5-9.Frequency/Duty Cycle Measurement (Electronic)

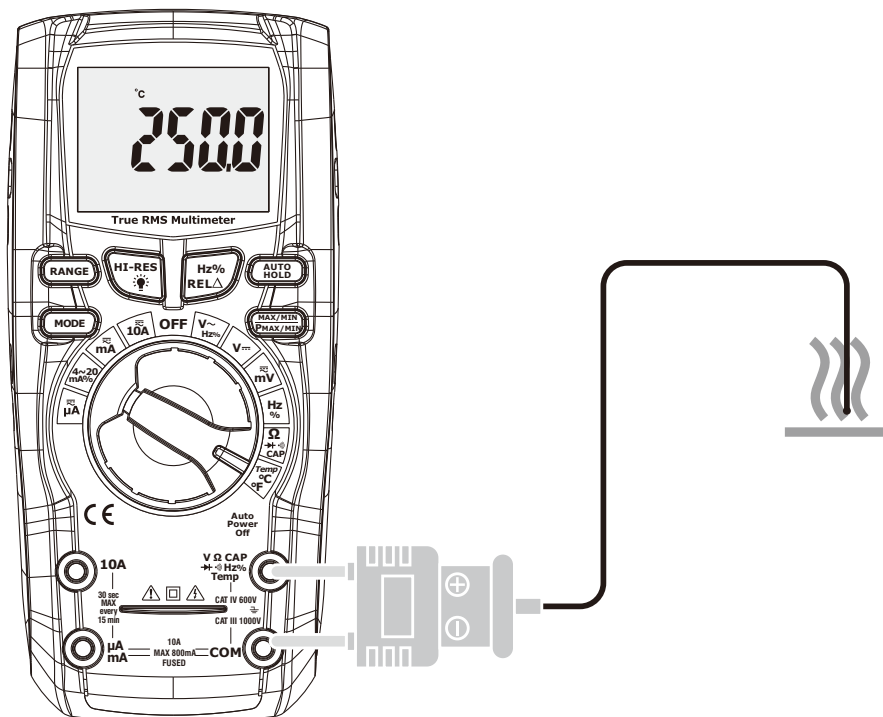
- 1.Set the function switch to the **Hz%** Position.
- 2.Insert the black test lead into the **COM** Input Jack and the red test lead into the **Positive** Input Jacks.
- 3.Touch the test probe tips to the circuit under test, read the Frequency on the display.
- 4.Press the **Hz/%** Button to indicate “%” on the display, read the % of Duty Cycle on the display.



## 5-10. Temperature Measurement

1. Set the function switch to the **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 **°C** or **°F**.
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.



## 6.Replacing the Batteries

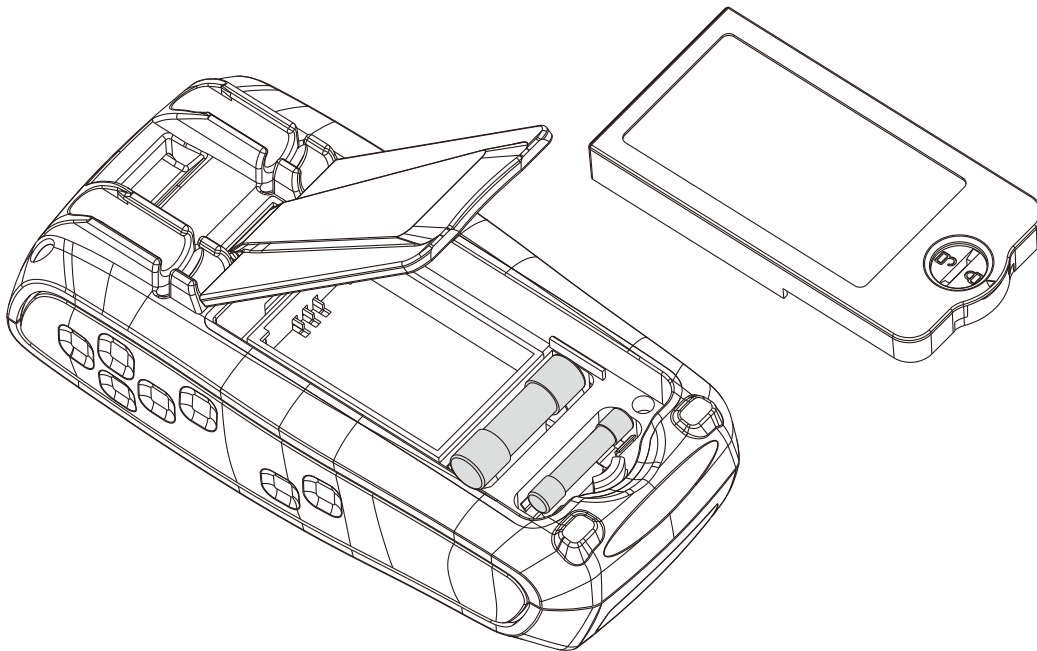
Refer to figure and replace the batteries as follows:

- 1.Turn the meter off and remove the test leads form the terminals.
- 2.Remove the battery door assembly by using a standard blade screwdriver to turn the battery door screw one-half turn counterclockwise.
- 3.Replace the batteries with 4x1.5V AAA.
- 4.Reinstall the battery door assembly and secure it turning the screw on-half turn clockwise.

## 7.Replacing the Fuses

Referring the figure, examine or replace the meter's fuses as follows:

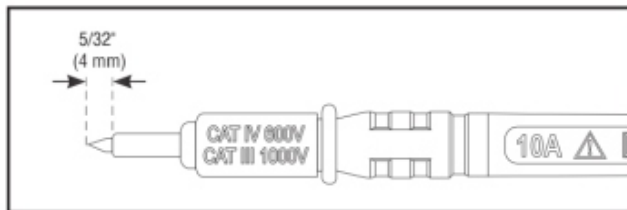
- 1.Turn the meter off and remove the test leads form the terminals.
- 2.Remove the battery door assembly by using a standard blade screwdriver to turn the battery door screw one-half turn counterclockwise.
- 3.Remove the fuse by gently prying one end loose, then sliding the fuse out of it's bracket.
- 4.Install only specified replacement fuses.
- 5.Reinstall the battery door assembly and secure it by turning the screw one-half turn clockwise.



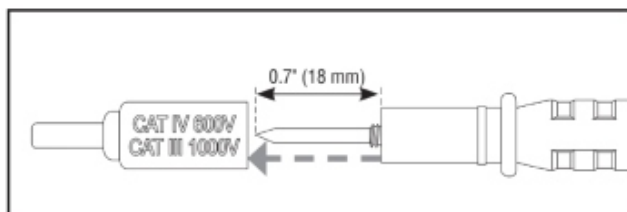
## 8. Test Lead

**WARNING:** Do not test if leads are improperly seated, results could cause intermittent display readings. To ensure proper connection, firmly press leads into the input jack completely.

- Test lead Conform to: EN61010-031:2015 standard to CAT IV 600V/CAT III 1000V , 10A MAX or higher security level.
- Testing in CAT III/CAT IV measurement locations, ensure the test lead shield is pressed firmly in place, failure to use the CAT III/CAT IV shield increases arc-flash risk.



- Testing in CAT II measurement locations, CAT III/CAT IV shields may be removed for CAT II locations, this will allow testing on recessed conductors such as standard wall outlets.



- Take care not to lose the shields.

## 9. Specifications

### 9-1. Technical Specifications

- 6000 Counts: Accuracy calculated as [% reading+(num. digits\*resolution)] at 18 to 28°C; <75%RH.
- 60000 Counts: Accuracy calculated as [% reading+(10\*num. digits\*resolution)] at 18 to 28°C; <75%RH.

Function	Range	Resolution	Accuracy
DC Voltage	600mV	0.1mV	±(0.1% + 2 digits)
	6V	0.001V	±(0.05% + 2 digits)
	60V	0.01V	
	600V	0.1V	
	1000V	1V	

AC Voltage	600mV	0.1mV	50 to 1000Hz ±(1.0% + 4 digits)	1k to 5kHz ±(2.0% + 5 digits)
	6V	0.001V		
	60V	0.01V		
	600V	0.1V		
	1000V	1V	Unspecified	

All AC Voltage ranges are specified from 5% of range to 100% of range.  
Low pass filter: Range 1000V (50 to 60Hz), ±(1.0+20); >3kHz (-3dB).

DC Current	600µA	0.1µA	±(0.2% + 5 digits)
	6000µA	1µA	±(0.2% + 3 digits)
	60mA	0.01mA	±(0.2% + 5 digits)
	600mA	0.1mA	±(0.2% + 3 digits)
	10A	0.01A	

10A: 30sec max with reduced accuracy

AC Current	600µA	0.1µA	50 to 1000Hz ±(1.0% + 3 digits)	1k to 5kHz ±(3.0% + 5 digits)
	6000µA	1µA		
	60mA	0.01mA		
	600mA	0.1mA		
	10A	0.01A	Unspecified	

10A: 30sec max with reduced accuracy

All AC Current ranges are specified from 5% of range to 100% of range

Function	Range	Resolution	Accuracy
4-20mA%	-25 to 125%	0.1%	±20 digits

0mA=-25%, 4mA=0%, 20mA=100%, 24mA=125%

Resistance	600Ω	0.1Ω	±(0.2% + 5 digits)
	6kΩ	0.001kΩ	±(0.2% + 3 digits)
	60kΩ	0.01kΩ	
	600kΩ	0.1kΩ	
	6MΩ	0.001MΩ	±(1.0% + 8 digits)
	60MΩ	0.01MΩ	±(2.0% + 8 digits)

Capacitance	60nF	0.01nF	±(3.5% + 10 digits)
	600nF	0.1nF	
	6μF	0.001μF	±(2.5% + 10 digits)
	60μF	0.01μF	
	600μF	0.1μF	
	6000μF	1μF	±(3.5% + 10 digits)

Frequency (Electronic)	60Hz	0.001Hz	±(0.5% + 2 digits)
	600Hz	0.01Hz	
	6kHz	0.0001kHz	
	60kHz	0.001kHz	
	600kHz	0.01kHz	
	6MHz	0.0001MHz	
	10MHz	0.001MHz	

Sensitivity: 0.8V rms min at 20% to 80% Duty Cycle and <100kHz; 5Vrms min at 20% to 80% Duty Cycle and >100kHz.

Frequency (Electrical)	40.00-10kHz	0.01Hz	±(0.5% reading)
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Sensitivity: 15Vrms

Duty Cycle	0.1 to 99.90%	0.1%	±(1.2% + 2 digits)
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Pulse width: 100μs-100ms; Frequency: 5Hz to 100kHz

Function	Range	Resolution	Accuracy
Temp (Type-K)	-50 to 1000°C	0.1°C	±(1.2% + 3°C)
	-58 to 1832°F	0.1°F	±(1.2% + 5°F)


Probe accuracy not included

**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.

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

## 9-2.General Specifications

Enclosure	Double molded, Waterproof
Shock (Drop Test)	2 meters (6.5 feet)
Diode Test	Test current of 1.5mA maximum, open circuit voltage 3.0V DC typical
Continuity Check	Audible signal will sound if the resistance is less than 35 Ω (approx.), Test current <0.35mA
PEAK	Captures peaks >1ms
Temperature Sensor	Requires type K thermocouple
Input Impedance	>10M Ω VDC
AC Response	True RMS
AC True RMS	The term stands for “Root-Mean-Square” which represents the method of calculation of the voltage or current value. Average responding multimeter 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.
ACV Bandwidth	50Hz to 5000Hz
Display	6000/60,000 count backlit liquid crystal with bargraph
Overrange indication	“OL” is displayed
Auto Power Off	15 minutes (approximately) with disable feature
Polarity	Automatic (no indication for positive); Minus (-) sign for negative
Measurement Rate	3 times per second, Nominal
Low Battery Indication	“  +” is displayed if battery voltage drops below operating voltage
Battery	4x1.5V (NEDA 1604) battery

Fuses	mA/uA ranges: 0.8A/1000V ceramic fast blow, range breaking capacity: 10kA/1000V AC/DC A ranges: 10A/1000V ceramic fast blow, range breaking capacity: 30kA/1000V AC/DC
Operating Temperature	5 to 40°C (41 to 104°F)
Storage Temperature	-20 to 60°C (-4 to 140°F )
Operating Humidity	Max 80% up to 31°C (87°F) decreasing linearly to 50% at 40°C (104°F)
Storage Humidity	<80%RH
Operating Altitude	2000meters (7000ft.) maximum
Safety	Complies with EN61010-1:2010/A1:2019, EN IEC 61010-2-033:2021/A11:2021 for measurement Category IV 600V and Category III 1000V, Pollution Degree 2. Standards: Conforms to: UL STD 61010-1, 61010-2-033. Certified to: CSA STD C22.2 # 61010-1, 61010-2-033. EC EN 61010-1, 61010-2-033, 61326-1.



## **WARRANTY STATEMENT**

Triplett Test Equipment offers a one-year warranty to the original purchaser of its products. We guarantee that our products will be free from defects in workmanship and materials for one (1) year from the purchase date.

### **This warranty does not cover:**

- Products purchased from unauthorized distributors.
- Items that have been repaired or altered by unauthorized individuals.
- Damage from misuse, abuse, misapplication, negligence, or accidents.
- Products with altered, defaced, or removed serial numbers.
- Accessories, including batteries.

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