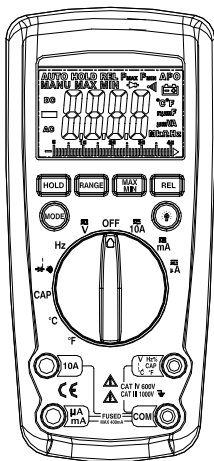




# True RMS Auto/Industrial Multimeter CATIII 1000V

## Model TMX-589 User Manual



member  
**AAIA**<sup>®</sup>  
Automotive Aftermarket  
Industry Association

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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, Frequency, Diode Test, Continuity and Thermocouple Temperature. Proper use and care of this meter will provide many years of reliable service.

## Safety Symbols

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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 in 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.

# 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	1000VDC/AC rms
mA AC/DC	500mA 1000V fast acting fuse
A AC/DC	10A 1000V fast acting fuse (10A for 30 seconds max every 15 minutes)
Frequency, Resistance, Capacitance, Duty Cycle, Diode Test, Continuity	1000VDC/AC rms
Temperature	1000VDC/AC rms

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.

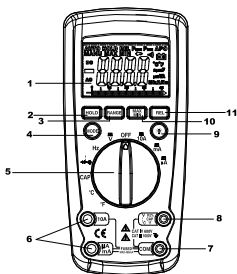
**NOTE:** Ghost Voltage - On some low AC and DC voltage ranges, with the test leads not connected to a device, the display may show a random, changing reading. This is normal and is caused by the high-input sensitivity. The reading will stabilize and give a proper measurement when connected to a circuit.


## **SPARE PARTS LIST**

#608	Replacement Test Leads CATIII 1000V
#637	Replacement Temperature Probe Bead Style
#671	Replacement Fuse 10A – 1000V
#672	Replacement Fuse 0.5A – 1000V

For other spare parts, please call 800-227-1603 or email your request to [info@esitest.com](mailto:info@esitest.com).

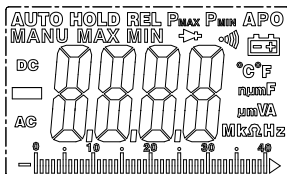
# **CONTROLS AND JACKS**



1. 4,000 count LCD display
2. HOLD button
3. RANGE button
4. MODE button
5. Function switch
6. mA/μA and 10A input jacks
7. COM input jack
8. Positive input jack
9.  Backlight button
10. MAX/MIN button
11. REL button

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

# LCD SYMBOLS



•))) 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)

REL Relative

V Volts

AC Alternating current

DC Direct current

$^{\circ}\text{F}$  Degrees Fahrenheit

$^{\circ}\text{C}$  Degrees Centigrade

MAX Maximum

MIN Minimum


AUTO Auto-Range

APO Auto Power-Off

HOLD Display hold

# **PUSH-BUTTON FUNCTIONS**

## **MODE BUTTON**

Selects AC or DC measurement when in Volts, Amps, mA or  $\mu\text{A}$  functions. Also used to select between  $\Omega$ ,  or  $\bullet$ )) when in the Ohm, Diode and Continuity function.

## **HOLD**

Press the HOLD button and the reading will freeze on the display. Press the button again and the frozen reading displayed will return to normal measurement status.

## **RANGE button**

When the meter is first turned on, it automatically goes into Auto-Ranging mode. This automatically selects the best range for the measurements being made and is generally the best mode for most measurements. For situations requiring the test range to be manually selected, perform the following:

Press the RANGE button. The "Auto Range" display indicator will turn off, The "Manual Range" display indicator will turn on.

Press the RANGE button to step through the available testing ranges until you select the test range desired.

Press and hold the RANGE button for 2 seconds to exit the Manual Ranging mode and return to Auto-Ranging.

## **MAX/MIN BUTTON**

The MAX/MIN function allows the meter to capture the highest or lowest measurement for later reference.

Press the MAX/MIN button to begin measurement. The indicator MAX or MIN will appear in the display. While in MAX mode, the meter high reading will be captured and held on the display. While in MIN mode, the low reading will be captured and held on the display.



If the MAX MIN message is flashing, the instrument is in MAX/MIN mode but not recording. Press the MAX/MIN button to select a mode.

To return to normal AUTO measurement mode, hold down the MAX/MIN button for 2 seconds.

### **PEAK BUTTON**

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.

Set the function switch to the Amps or Volts.

Press and Hold the PEAK button until "CAL" appears in the display. This procedure will zero the range selected & the meter will go into manual ranging mode.

Press the PEAK button, Pmax will display. The display will update each time a higher positive peak occurs.

Press the PEAK button again, Pmin will display. The display will now update and indicate the lowest negative peak.

To return to normal operation, press and hold the PEAK button until the Pmin or Pmax indicator switches off.

Note: If the Function switch position is changed after a calibration the Peak Hold calibration must be repeated for the new function selected.

The relative change feature allows you to make measurements relative to a stored reference value. A reference Voltage, Current, etc., is stored and measurements are made in comparison to that value. The displayed value is the difference between the reference value and the measured value.

### **BACKLIGHT BUTTON**

Press the BACKLIGHT button to turn on the display back lighting.

Press BACKLIGHT button again to exit the back light mode.

# 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.

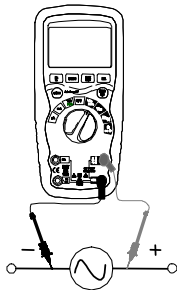
1. Set the function switch to the **V** position.
2. Insert the black test lead banana plug into the negative **COM** jack. Insert the red test lead banana plug into the positive **V** jack.
3. Touch the black test probe tip to the negative side of the circuit. Touch the red test probe tip to the positive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



## AC VOLTAGE MEASUREMENTS

**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 **V** position.
2. Press the **MODE** button to indicate “**AC**”.
3. Insert the black test lead banana plug into the negative **COM** jack.  
Insert red test lead banana plug into the positive **V** jack.
4. 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.
5. Read the voltage on the display



## Non-Contact AC Voltage Detection

**WARNING:** Risk of Electrocutation. Before use, always test the non-contact Voltage Detector on a known live circuit to verify proper operation.

2. Place the top end of the multimeter at the hot conductor or at the hot side/front of the electrical outlet.

If AC voltage is present, the detector light will illuminate.

**NOTE:** The conductors in electrical cord sets are often twisted. For best results, run the top end of the DMM along a length of the cord to assure that the sensor is in close proximity to the live conductor.

**NOTE:** The detector is designed with high sensitivity. Static electricity or other sources of energy may randomly trip the sensor. This is normal.

**WARNING:** In cases where the test results are not definite or you have any doubt, always assume that the AC Voltage is present.

## AC/DC CURRENT MEASUREMENTS


**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 negative **COM** jack.
2. For current measurements up to 4000 $\mu$ A AC/DC, set the function switch to the  **$\mu$ A** position and insert the red test lead banana plug into the  **$\mu$ A/mA** jack and press mode button to select AC or DC.
3. For current measurements up to 400mA AC/DC, set the function switch to the **mA** position and insert the red test lead banana plug into the  **$\mu$ A/mA** jack and press mode button to select AC or DC.
4. For current measurements up to 10A AC/DC, set the function switch to the **10A** position and insert the red test lead banana plug into the **10A** jack and press mode button to select AC or DC.
5. Remove power from the circuit under test, then open up the circuit at the point where you wish to measure current.
6. 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.
7. Apply power to the circuit.
8. Read the current on the display.

## 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  $\Omega$   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 on the display.



## CONTINUITY CHECK



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

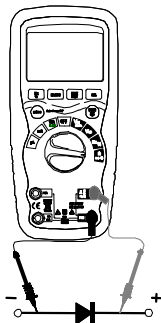
1. Set the function switch to the  $\Omega$   position.
2. Insert the black lead banana plug into the negative **COM** jack.  
Insert the red test lead banana plug into the positive  $\Omega$  jack.
3. Press the **MODE** button to indicate “” on the display.
4. Touch the test probe tips to the circuit 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  $\Omega \rightarrow \rightarrow \rightarrow$  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 “ $\rightarrow$ ” 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

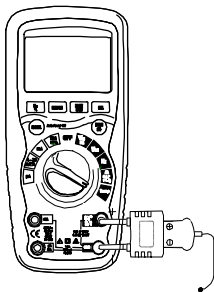


**WARNING:** To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any capacitance measurements. Remove the batteries and unplug the line cords.

1. Set the rotary function switch to the **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 **CAP** jack.
4. Touch the test leads to the capacitor to be tested.
5. Read the capacitance value on the display

## TEMPERATURE MEASUREMENTS

1. Set the function switch to the °C or °F position.
2. Insert the Temperature Probe into the positive °F & negative **Com** input jacks, making sure to observe the correct polarity.
3. Touch the Temperature Probe head to the surface you wish to measure.  
Keep the probe touching the surface under test until the reading stabilizes (about 30 seconds).
4. Read the temperature on 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 (Hz) MEASUREMENTS

1. Set the rotary function switch to the 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.



## Maintenance

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**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.** Extreme temperatures 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.

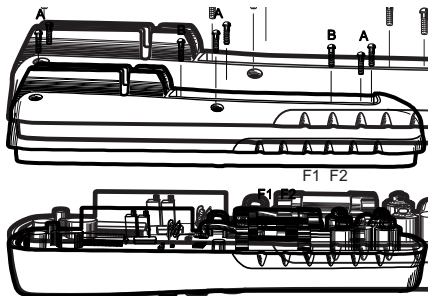
1. Turn power off and disconnect the test leads from the meter.
2. Open the rear battery cover by removing two screws (B) using a Phillips head screwdriver.
3. Insert the battery into battery holder, observing the correct polarity.
4. Put the battery cover back in place. Secure with the screws.



**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 rear cover (fuse door).

1. Disconnect the test leads from the meter and any item under test.
2. Remove rear cover by loosening the 6 screws (A) with a Phillips head screwdriver. Lift rear cover away from the front half. Battery cover does not need to be removed.
3. Remove the old fuse from its holder by gently pulling it out.
4. Install the new fuse into the holder.

Always use a fuse of the proper size and value (0.5A/1000V Ceramic fast blow for the 400mA range, 10A/1000V Ceramic fast blow for the 10A range).

5. Put the fuse door back in place. Insert the screw and tighten it securely.



**WARNING:** To avoid electric shock, do not operate your meter until the fuse door 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.

## SPECIFICATIONS

## DC VOLTAGE (AUTO-RANGING)

Range	Resolution	Accuracy
400.0mV	0.1mV	$\pm 1.2\%$ of rdg $\pm 2$ digits
4.000V	1mV	
40.00V	10mV	
400.0V	100mV	
1000V	1V	$\pm 1.5\%$ of rdg $\pm 2$ digits

Input Impedance: 10M $\Omega$ .

Maximum Input: 1000V dc or 1000V ac rms.

## AC VOLTAGE (AUTO-RANGING)

Range	Resolution	Accuracy
400.0mV	0.1mV	$\pm 1.5\%$ of rdg $\pm 8$ digits
4.000V	1mV	
40.00V	10mV	
400.0V	100mV	
1000V	1V	$\pm 1.5\%$ of rdg $\pm 8$ digits

All AC voltage ranges are specified from 5% of range to 100% of range. Input Impedance: 10M $\Omega$ .

AC Response: 50 Hz to 400Hz

Maximum Input: 1000V dc or 1000V ac rms.

## DC CURRENT (AUTO-RANGING)

Range	Resolution	Accuracy
400.0uA	0.1uA	$\pm 1.2\%$ of rdg $\pm 5$ digits
4000uA	1uA	
40.00mA	10uA	
400.0mA	100uA	
10A	10mA	$\pm 1.5\%$ of rdg $\pm 5$ digits

Overload Protection: FF500mA / 1000V and F10A / 1000V Fuse.

Maximum Input: 4000uA dc on uA range

400mA dc on mA range

10A dc on 10A range.

## AC CURRENT (AUTO-RANGING)

Range	Resolution	Accuracy
400.0uA	0.1uA	

4000uA	1uA	±1.5% of rdg ± 5 digits
40.00mA	10uA	
400.0mA	100uA	
10A	10mA	±1.8% of rdg ± 5 digits

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

Overload Protection: FF500mA/1000V and F10A/1000V Fuse.

AC Response: 50 Hz to 400 Hz

Maximum Input: 4000uA ac rms on uA

400mA ac rms on mA

10A ac rms on 10A range.

### **RESISTANCE [Ω] (AUTO-RANGING)**

Range	Resolution	Accuracy
400.0Ω	0.1Ω	±1.2% of rdg ± 5 digits
4.000kΩ	1Ω	±1.2% of rdg ± 2 digits
40.00kΩ	10Ω	
400.0kΩ	100Ω	
4.000MΩ	1kΩ	±2.5% of rdg ±8digits
40.00MΩ	10kΩ	

Input Protection: 1000V dc or 1000V ac rms.

### **CAPACITANCE (AUTO-RANGING)**

Range	Resolution	Accuracy
40.00nF	10pF	±5.0% of rdg ± 7 digits
400.0nF	0.1nF	±3.0% of rdg ± 5 digits
4.000uF	1nF	
40.00uF	10nF	
400.0uF	0.1uF	
4.000mF	1 uF	±5.0% of rdg ± 7 digits
40.00mF	10 uF	

Input Protection: 1000V dc or 1000V ac rms.

### **FREQUENCY (AUTO-RANGING)**

Range	Resolution	Accuracy
4.000Hz	0.001Hz	

40.00 Hz	0.01Hz	±1.0% of rdg ± 3 digits
400.0 Hz	0.1Hz	
4.000KHz	1 Hz	
40.00kHz	10Hz	
400.0kHz	100Hz	
10.00MHz	1kHz	±1.2% of rdg ± 4 digits

Sensitivity: >0.5V RMS while ≤1MHz ;

Sensitivity: >3V RMS while >1MHz ;

Input Protection: 1000V dc or 1000V ac rms.

## TEMPERATURE

Range	Resolution	Accuracy
-20 <sup>0</sup> C~+760 <sup>0</sup> C	1 <sup>0</sup> C	±3% of rdg ±5 digits
-4 <sup>0</sup> F~+1400 <sup>0</sup> F	1 <sup>0</sup> F	±3% of rdg ±8 digits

Sensor: Type K Thermocouple

Overload protection: 1000V dc or ac rms..

## DIODE TEST

Test current	Resolution	Accuracy
1Ma typical/Open MAX.3V	1 mV	±10% of rdg ± 5 digits

Open circuit voltage: MAX. 3V dc

Overload protection: 1000V dc or ac rms.

## AUDIBLE CONTINUITY

Audible threshold: Less than 35Ω Test current MAX. 1.5mA

Overload protection: 1000V dc or ac rms.

### Enclosure


### Shock (Drop Test)

### Diode Test

Double molded, waterproof

6.5 feet (2 meters)

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 $<0.35\text{mA}$
<b>Temperature Sensor</b>	Requires type K thermocouple
<b>Input Impedance</b>	$>10\text{M}\Omega$ VDC & $>9\text{M}\Omega$ 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 400Hz
<b>Crest Factor</b>	$\leq 3$ at full scale up to 500V, decreasing linearly to $\leq 1.5$ at 1000V
<b>Display</b>	4,000 count backlit liquid crystal with analog bar graph
<b>Overrange indication</b>	“OL” is displayed
<b>Auto Power Off</b>	30 minutes (approximately)
<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, $\mu\text{A}$ ranges; 0.5A/1000V ceramic fast blow. 10A 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>Weight</b>	0.753lb (342g) (includes holster).
<b>Size</b>	7.36" x 3.2" x 2.0" (187 x 81 x 50mm) (includes holster)
<b>Safety</b>	This meter is intended for origin of installation use and protected 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)

## **TROUBLE-SHOOTING**

### **1. METER WILL NOT TURN ON:**

- Check the battery contacts for a tight fit.
- Check for a minimum battery voltage of 8.0 volts.

### **2. AMPERE READING IS ERRATIC OR THERE IS NO READING AT ALL:**

- Disassemble the meter back cover as per the fuse replacement instructions on page 36 and test the fuses for continuity with another meter.

### **3. METER READING IS ERRATIC:**

- Printed circuit board damaged from handling with hands.
- Low battery.
- "Blown" fuse.
- Open circuit in a test lead (frayed or broken wire).

### **4. METER READINGS DO NOT CHANGE:**

- "Hold" feature is still toggled ON.

## **TECHNICAL HOTLINE: 800-227-1603**

For any technical assistance or possible service issues, please call the toll free number above. Especially if you feel the need to return your instrument. Please call us first and let us help you!

## **WARRANTY INFORMATION**

This product is warranted to be free of defects for one year. If this product fails during the first 12 months due to faulty material or workmanship, it will be replaced or repaired free of charge, at the discretion of the manufacturer.

NOTE: this one year warranty does not cover dead batteries and blown fuses.

For warranty service and coverage, please return this product to your supplier for processing and evaluation. OR, return it directly to:

**Electronic Specialties, Inc.**

**139 Elizabeth Ln.**

**Genoa City, WI 53128**

**262-279-1400**

Defective units being returned to your supplier or to the factory should include proof of purchase date.

Any testers that do not function due to misuse or abuse will be subject to “out of warranty service charges”.

For more product information go to: [www.esitest.com](http://www.esitest.com)