

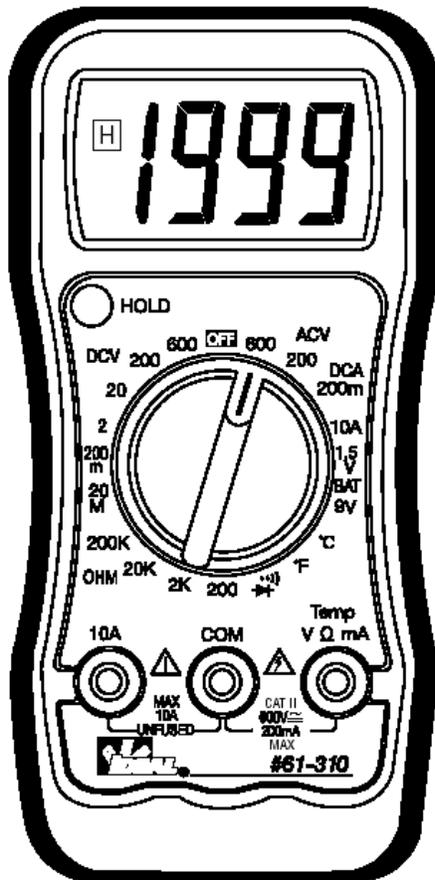
# IDEAL INDUSTRIES, INC.

## TECHNICAL MANUAL

### MODEL: 61-310

*This Service Manual provides the following information:*

- Precautions and safety information
- Specifications
- Basic maintenance (cleaning, replacing the battery and fuses)
- Performance test procedures
- Calibration and calibration adjustment procedures



Form Number: TM61310

Revision: 2. Date: August 2007

**TABLE OF CONTENTS**

	<b>Page</b>
Introduction	1
Precautions and Safety Information	1
Symbols	1
Safety	2
Specifications	3
General Specifications	3
Measurement Characteristics	4
Voltage Specifications	4
Current Specifications	4
Resistance Specifications	5
Diode Check, Continuity, Temperature Specifications	5
Auto Power Off, Data Hold Function, Battery Test	5
Physical and Environmental Characteristics	6
Certifications and Compliances	6
Required Equipment	7
Basic Maintenance	8
Opening the Meter Case	8
Replacing the Battery	8
Replacing Fuses	9
Fuse Replacement	9
Cleaning	9
Performance Tests	10
Testing the Voltage Function	10/11
Testing the DC Current Function	11
Testing the Resistance Function	11/12
Testing the Diode and Continuity Functions	12
Testing the Temperature Function	12
Calibration	13
Calibrating DCV, ACV Functions	13
Calibration DC Current, Temperature	13

## Introduction

### Warning

To avoid shock or injury, do not perform the verification tests or calibration procedures described in the manual unless you are qualified to do so.

The information provided in this document is for the use of qualified personnel only.

### Caution

The 61-310 series contain parts that can be damaged by static discharge.

Follow the standard practices for handling static sensitive devices.

For additional information about IDEAL INDUSTRIES, INC. and its products, and services, visit IDEAL INDUSTRIES, INC. web site at:

[www.idealindustries.com](http://www.idealindustries.com)

## Precautions and Safety Information

Use the meter only as described in the Service Manual. If you do not do so, the protection provided by the meter may be impaired. Read the "Safety Information" page before servicing this product.

In this manual, a **Warning** identifies conditions and actions that pose hazard (s) to the user; a **Caution** identifies conditions and actions that may damage the meter or the test instrument.

## The Symbols

The symbols used on the meter and in this manual are explained in Table A.

Table A. The Symbols

	Risk of electric shock
	Refer to the manual. Important information.
	DC measurement
	Equipment protected by double or reinforced insulation
	Battery
	Earth
	AC measurement
	Conforms to EU directives

## SAFETY

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use the product only as specified.

**For operating instructions, see the 61-310 Digital Multimeter Instruction Manual.**

**⚠CAUTION:** These statements identify conditions or practices that could result in damage to the equipment or other property.

**⚠WARNING:** These statements identify conditions or practices that could result in personal injury or loss of life.

### Specific precautions

**Use proper Fuse.** To avoid fire hazard, use only the fuse type and rating specified for this product.

**Do not operate without covers.** To avoid personal injury, do not apply any voltage or current to the product without covers in place.

**Electric overload.** Never apply a voltage to a connector on the product that is outside the range specified for that connector.

**Avoid electric shock.** To avoid injury or loss of life, do not connect or disconnect probes or test leads while they are connected to a voltage source.

**Do not operate in wet/damp conditions.** To avoid electric shock, do not operate this product in wet or damp conditions.

## SPECIFICATIONS

All specifications are warranted unless noted typical and apply to the 61-310.  
Stated accuracies are at 23°C±5°C at less than 70% relative humidity and without the battery indicator displayed.

### General specifications

Characteristics	Description
Display count	3 ½ digit liquid crystal display, 1999 count
Numeric update rate	3 times / sec
Polarity display	Automatic, positive implied
Over range display	"OL" is displayed
Low Battery indicator	 is indicated
Automatic power-off time	Automatic backlight off = 30 minutes
Power source	9V battery, NEDA 1604, JIS006P, IEC6F22
Maximum input voltage	600V CAT II between V and COM
Maximum floating voltage	600V CATII between any terminal and earth ground
Maximum mA input current, V/mA and COM	Fused 250mA at 250Vrms
Maximum A input current, 10A and COM	10A , not Fused, max time is no longer that 15 seconds
V connector	V ~, V  , Ω,  ,  ,  , mA, Temperature
Temperature Coefficient	0.1×(Spec. Accuracy) per °C, <18°C or >28°C
Battery Life	Alkaline 9V, approximately 200 hours

**Measurement Characteristics**

Accuracy is  $\pm$ (% reading + number of digits) at 23°C  $\pm$  5°C, less than 80% R.H.

**(1) DC Volts**

Range	Resolution	Accuracy	Over voltage protection
200.0mV	100 $\mu$ V	0.5% + 2	600V rms
2.000V	1mV		
20.00V	10mV		
200.0V	100mV		
600V	1V	0.8% + 2	

**Input Impedance:** 10M $\Omega$

**(2) AC Volts**

Range	Resolution	Accuracy	Over voltage protection
		40-400Hz	600V rms
200.0V	100mV	1.2% + 10	
600V	1V	1.2% + 10	

**Input Impedance:** 4.5M $\Omega$

**AC Conversion Type:** Average sensing rms indication calibrated to the sine wave input.

**(3) DC Current**

Range	Resolution	Accuracy	Overload protection
200.0 mA	0.1mA	1.5% + 2	250mA/250V Fast Blow Fuse
10.00A*	.01A	3.0% + 5	Not fused, 15 sec Max

\* **Caution:** Do not make high current measurements on the 10A scale for longer that 15 seconds. This should be followed by a 15 minute cool down period. Exceeding 15 seconds may cause damage to the meter and/or the test leads.

**(4) Resistance**

Range	Resolution	Accuracy	Over voltage protection
200.0Ω * <sup>1</sup>	0.1Ω	0.8% + 4	250V rms
2.000KΩ	1Ω	0.8% + 2	
20.00KΩ	10Ω		
200.0KΩ	100Ω		
2.000MΩ	1KΩ		
20.00MΩ * <sup>2</sup>	10KΩ	3.0% + 3	

**Open circuit Voltage:** -1.5V approx.

\*<sup>1</sup> < 5 digit of reading rolling.

\*<sup>2</sup> ± 2% of reading rolling.

**(5) Diode Check and Continuity**

Range	Resolution	Accuracy	Max. Test Current	Max. Open Circuit Voltage
→	1mV	Not specified *	1mA, approx.	2.8V, approx.

**Overload Protection:** Not specified

**Continuity:** Built-in buzzer sounds when resistance is less than approximately <30 Ω with a response time of approximately 100 msec.

**(6) Temperature: Type K thermocouple**

Range	Resolution	Accuracy	Overload protection
-20 to 16 °C	1°	2.5% + 10	Not Specified
17 to 400 °C	1°	1.0% + 5	
401 to 750 °C	1°	2.5% + 10	
-4 to 59 °F	1°	2.5% + 19	
60 to 750°F	1°	1.0% + 9	
751 to 1382°F	1°	2.5% + 19	

**(7) Auto Power Off (APO)**

If the meter idles for more than 15 minutes, the meter automatically turns the power off.

**(8) Data Hold**

Press the **HOLD** button to freeze the reading in the display, “H” will appear on LCD display.

Press the **HOLD** button again to release the data hold function.

**(9) Battery Test 1.5 and 9V**

**Test current** 1.5V is approximately 120mA

9.0V is approximately 9mA

**Physical and Environmental Characteristics**

<b>Characteristics</b>	<b>Description</b>
Dimensions (H×W×D)	150mm(H) ×76mm (W) ×38mm(D) (with holster) 5.9" (H) x 3.0"(W) x1.5"(D)
Weight (with battery& holster)	0.219Kg (7.1 oz.)
<b>Environmental characteristics</b>	<b>Description</b>
Temperature operating range	0 to +40°C
Non-Operating	-20 to +60°C <80% R.H.
Humidity (operating)	<75% R.H.
Altitude	6561.7 Ft. (2000m)
Indoor Use	Indoor Use

**Certifications and compliances**

Safety	Complies with UL 61010B-1
Input Safety Rating	V / Ω/Temp/mA, UL 61010B-1, UL 61010-B-2-031, EU 61010-1 EN61010-2-031, Cat II 600Volts
	CAT III: Distribution level mains, fixed installation.
	CAT II: Local level mains, appliances, portable equipment
	CAT I: Signal level, special equipment or parts of equipment, telecommunication, electronics.
Pollution Degree 2	Do not operate in environments where conductive Pollutants may be present.
EC Declaration of Conformity	Meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility and Low Voltage Directive 73/23/EEC for product safety. Compliance was demonstrated to the following specifications as listed in the official Journal of the European Communities: En 55011 Class A: Radiated and Conducted Emissions. En 50082-1 Immunity: IEC 801-2 Electrostatic Discharge IEC 801-3 RF Radiated En 61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use.

**Required Equipment**

Required equipment is listed in Table B. If the recommended models are not available, equipment with equivalent specifications may be used.

Repairs or servicing should be performed only by qualified personnel.

**Table B. Required Equipment**

Equipment	Required Characteristics	Recommended Model
Calibrator	<p><b>AC Voltage Range:</b> 0 ~ 750V AC  <b>Accuracy:</b> ±0.07% (Basic)</p> <p><b>Frequency Range:</b> 40 ~ 1KHz  <b>Accuracy:</b> ±2%</p> <p><b>DC Voltage Range:</b> 0 ~ 1000V DC  <b>Accuracy:</b> ±0.006% (Basic)</p> <p><b>Current Range:</b> 0 ~ 10A  <b>Accuracy:</b> AC (40Hz to 1KHz): ±0.08% (Basic)  DC: ±0.02% (Basic)</p> <p><b>Frequency Source:</b> 5.00Hz ~ 100MHz  <b>Accuracy:</b> ±0.001%</p> <p><b>Amplitude:</b> 0.5V p-p ~ 1.0V p-p (square wave)  <b>Accuracy:</b> ±5%</p> <p><b>Resistance Range:</b> 1Ω ~ 100MΩ  <b>Accuracy:</b> ±0.03% (Basic)</p> <p><b>Capacitance Range:</b> 1pF ~ 10mF  <b>Accuracy:</b> ±0.10% (Basic)</p>	Fluke 5500 or Wavetek 9100 Calibrator or equipment

## Basic Maintenance

### Warning

To avoid shock, remove the test leads and any input signals before opening the case or replacing the battery or fuses.

### Opening the Meter Case

### Caution

To avoid an unintentional short circuit, always place the uncovered meter assembly on a protective surface. When the case of the meter is open, circuit connections are exposed.

1. Disconnect test leads from any live source, turn the rotary switch to OFF, and remove the test leads from front terminals.
2. For battery replacement follow instructions under **Replacing the Battery** section
3. For Fuse replacement follow instructions in the **Fuse Replacement** section.

### Replacing the Battery

The 61-310 meter is powered by a 9V battery, types are, NEDA 1604, JIS006P, IEC 6F22

1. Remove the rubber holster.
2. Remove the two screws on the battery cover and open the battery cover.
3. Unsnap the old battery and snap in the new battery.
4. Return the battery cover and reinstall the two battery cover screws.
5. Replace the rubber boot.

### Battery and Fuse Replacement

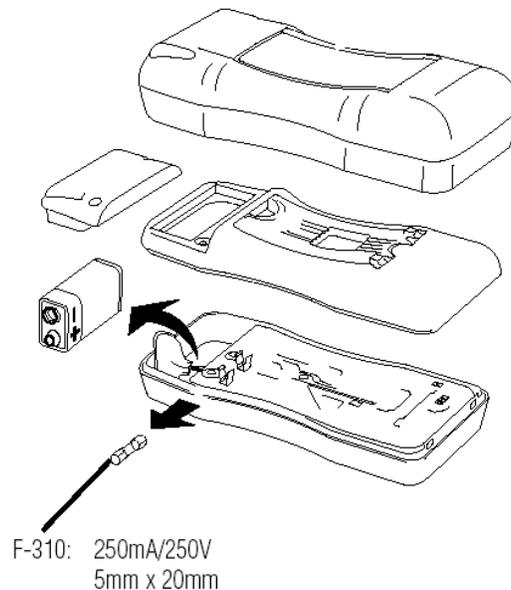


FIGURE 1

## Replacing Fuses

### Warning

To avoid electrical shock, remove the test leads and any input signals before replacing the battery or fuses.

To prevent damage or injury, INSTALL ONLY quick acting fuses with the following Amp/Volt current interrupt rating:

F-310 Fuse: 250mA 250V FAST BLOW Fuse

## Fuse Replacement

The 61-310 replacement fuse is part number: F-310

Fuse Rating is: 250mA 250V FAST BLOW

1. Remove the rubber holster.
2. Remove the two screws on the battery cover and open the battery cover.
3. Remove the two screws under the battery cover.
4. Lift up on the back case until the case unsnaps from the front case near display.
  - Replace the defective fuse with the standard rated fuse for this meter.
5. Return the back case cover, reinsert the case screws.
  - It is recommended to replace the old battery with a new battery.
6. Return the battery cover and reinstall the two battery cover screws.
7. Replace the rubber boot.

 **Caution** Use only a fuse with the amperage, interrupt voltage, and speed rating specified.

## Cleaning

### Warning

To avoid electrical shock or damage to the meter, never allow water inside the case. To avoid damaging the meter's housing, never apply solvents to the meter.

**Performance Tests**

The following performance tests verify the complete operability of the meter and check the accuracy of each meter function against the meter’s specifications.

Accuracy specifications are valid for a period of one year after calibration, when measured at an operating temperature of 18°C to 28°C and a maximum of 80% relative humidity.

To perform the following tests, it is not necessary to open the case, no adjustments are necessary, merely make the required connections, apply the designated inputs, determine if the reading on the meter display falls within the acceptable range indicated.

If the meter fails any of these tests, it needs calibration adjustment or repair.

**Testing the Voltage Function**

To verify accuracy in the AC and DC voltage ranges, do the following:

1. Turn the rotary switch to “**DCV**” function and range shown in Table 1.
2. Connect the calibrator to the **VΩ** and **COM** inputs on the meter.
3. Set the calibrator for the voltage from steps 1 to 7 in Table 1.
4. Compare the reading on the meter display with the display reading shown in Table 1.
5. If the display reading falls outside of the range shown in Table 1, the meter does not meet specification.

**Table 1: DC Voltage Test:**

Step	Range	Input	Reading
1	200mV	190.0mV	188.8 to 191.2
2	200mV	2.0mV	1.8 to 2.2
3	2V	1.900V	1.888 to 1.912
4	2V	-1.900V	-1.888 to -1.912
5	20V	19.00V	18.88 to 19.12
6	200V	190.0V	188.8 to 191.2
7	600V	600V	593 to 607

6. Turn the rotary switch to the “**ACV**” function and range shown in Table 2.
7. Set the calibrator for the voltage and frequency from step 1 to 6 in Table 2.
8. Compare the reading on the meter display with the display reading shown in Table 2.
9. If the display reading falls outside of the range shown in Table 2, the meter does not meet specification.

Table 2: AC Voltage Test:

Step	Range	Input	Frequency	Reading
1	200V	2.0V	60Hz	1.0 to 3.0
2	200V	2.0V	400Hz	1.0 to 3.0
3	200V	190.0V	60Hz	186.7 to 193.3
4	200V	190.0V	400Hz	186.7 to 193.3
5	600V	600V	60Hz	583.0 to 617.0
6	600V	600V	400Hz	583.0 to 617.0

### Testing the DC milliamps and DC amps Function

1. Turn the rotary switch to the **DCA** function and range shown in Table 3.
2. Apply the inputs for steps 1-3 in Table 3.
3. For each input, compare the reading on the meter display to the reading for your meter in Table 3.
4. If the display reading falls outside of the range shown in Table 3, the meter does not meet specification.

Table 3: DC Current Test:

Step	Range	Source	Reading
1	200 mA	2.00 mA	1.8 to 2.2
2	200 mA	190.0 mA	186.9 to 193.1
3	10 A	10.00 A	9.65 to 10.35

### Testing the Resistance Function

To verify the accuracy of the resistance function, do the following:

1. Connect the calibrator to **VΩ** and **COM** on the meter.
2. Turn the rotary switch to **OHM.** function and range shown in Table 4
3. Apply the inputs for steps 1-6 in Table 4.
4. Compare the meter display readings to the display readings in Table 4.
5. If the display reading falls outside of the range shown in Table 4, the meter does not meet specification.

Table 4:  $\Omega$  Resistance Test:

Step	Range	Source	Reading
1	*200 OHM	2.0 $\Omega$	1.6 to 2.4
2	*200 OHM	190.0 $\Omega$	188.3 to 191.7
3	2K OHM	1.900K $\Omega$	1.883 to 1.917
4	20K OHM	19.00K $\Omega$	18.83 to 19.17
5	200K OHM	190.0K $\Omega$	188.3 to 191.7
7	20M OHM	19.00M $\Omega$	18.40 to 19.60

\*Lead resistance on the 200 ohm range is not included in error.

### Checking the Diode Test Function

To check the diode test function, do the following:

1. Connect the calibrator to the **V $\Omega$**  and **COM** inputs on the meter.
2. Turn the rotary switch to .
3. Apply 1.500V DC. The meter display should read approx. 1.500V dc.
4. Apply a 20-ohm resistor to the meter, the built-in buzzer buzzes.

### Testing the Temperature Function

Before beginning this test allow 30 minutes for the meter and calibrator temperature adapter to reach ambient temperature.

To verify the accuracy of the Temperature function, perform the Following:

1. Apply the temperatures in steps 1 - 7 to the **V $\Omega$ Temp** and **COM** inputs using a temperature adapter to the meter.
2. Turn the rotary switch to  $^{\circ}\text{C}$  or  $^{\circ}\text{F}$  (Range is  $-20$  to  $750$   $^{\circ}\text{C}$  or  $-4$  to  $1382$   $^{\circ}\text{F}$ )
3. Compare the reading on the meter display to the reading in Table 4.

**Note** : Meter selects the proper range automatically. Each measurement takes a few seconds.

4. If the display reading falls outside of the range shown in steps 1–7 of Table 4, the meter does not meet specification.

Table 5: Temperature Test:

Step	Range	Source	Reading
1	$^{\circ}\text{C}$	$-20$ $^{\circ}\text{C}$	$-30$ to $-10$
2	$^{\circ}\text{C}$	$0$ $^{\circ}\text{C}$	$-10$ to $10$
3	$^{\circ}\text{C}$	$400$ $^{\circ}\text{C}$	$391$ to $409$
4	$^{\circ}\text{C}$	$750$ $^{\circ}\text{C}$	$721$ to $779$
5	$^{\circ}\text{F}$	$-4$ $^{\circ}\text{F}$	$-23$ to $15$
6	$^{\circ}\text{F}$	$32$ $^{\circ}\text{F}$	$13$ to $51$
7	$^{\circ}\text{F}$	$1382$ $^{\circ}\text{F}$	$1328$ to $1436$

## Calibration Procedure

To Recalibrate your meter: It is recommended that the Multimeter be calibrated once each year.

1. Perform calibration at an ambient temperature of  $23^{\circ}\text{C}\pm 2^{\circ}\text{C}$  and a relative humidity of  $<70\%$  Disconnect the test leads and turn the meter off. Remove the test leads from the front terminals.
2. Position the meter face down. Remove the battery cover screws and the 2 bottom case cover screws.
3. Lift the end of the bottom case cover until it gently unsnaps from the case top at the end nearest the LCD.

### (A) DCV and ACV Calibration (Adjust VR1)

1. Set the rotary switch to the "200mV DC" position.
2. Set the output of the DC calibrator for  $190.0\text{mV} \pm 0.02\%$  and connect to **V/ $\Omega$ /Temp** and **COM** input terminals on meter.
3. Using a small flat-tipped screwdriver to adjust VR1 until the display reads 198.9 to 190.1 mV.
4. Disconnect the DC calibrator from the meter.

### (B) DC A Calibration (Adjust VR5)

1. Set the rotary switch to the "10 A DC" position.
2. Set the output of the calibrator to 5A DC
3. Connect the calibrator current output to the **10A** and **COM** input terminals on meter.
4. Using a small flat-tipped screwdriver to adjust VR4 until the display reads 4.95 to 5.05 amps

### (C) $^{\circ}\text{C}$ Calibration (Adjust VR2)

1. Set the rotary switch to the " $^{\circ}\text{C}$ " position.
2. Set the output of the calibrator to  $0^{\circ}\text{C}$
3. Connect the calibrator Temperature output to the **V/ $\Omega$ /Temp** and **COM** input terminals
4. Using a small flat-tipped screwdriver, adjust VR2 for a  $0^{\circ}\text{C} \pm 1^{\circ}\text{C}$  (-1 to 1) display

### (D) $^{\circ}\text{F}$ Calibration (Adjust VR3)

1. Set the rotary switch to the " $^{\circ}\text{F}$ " position.
2. Set the output of the calibrator to  $32^{\circ}\text{F}$
3. Connect the calibrator Temperature output to the V/Temp and Com input
4. Using a small flat-tipped screwdriver adjust VR3 for a  $32^{\circ}\text{F} \pm 1^{\circ}\text{F}$  (31 to 33) display