

# Owner's Manual & Safety Instructions

**Save This Manual** Keep this manual for the safety warnings and precautions, assembly, operating, inspection, maintenance and cleaning procedures. Write the product's serial number in the back of the manual near the assembly diagram (or month and year of purchase if product has no number). Keep this manual and the receipt in a safe and dry place for future reference.

18k

# AMES<sup>TM</sup>

I N S T R U M E N T S

64021

## PROFESSIONAL, COMMERCIAL & RESIDENTIAL DIGITAL MULTIMETER



Visit our website at: <http://www.harborfreight.com>  
Email our technical support at: [productsupport@harborfreight.com](mailto:productsupport@harborfreight.com)

When unpacking, make sure that the product is intact and undamaged. If any parts are missing or broken, please call 1-888-866-5797 as soon as possible.

Copyright © 2018 by Harbor Freight Tools®. All rights reserved.

No portion of this manual or any artwork contained herein may be reproduced in any shape or form without the express written consent of Harbor Freight Tools. Diagrams within this manual may not be drawn proportionally. Due to continuing improvements, actual product may differ slightly from the product described herein. Tools required for assembly and service may not be included.

### **⚠ WARNING**

Read this material before using this product.  
Failure to do so can result in serious injury.  
**SAVE THIS MANUAL.**

# Table of Contents

Safety .....	2	Operation .....	8
Specifications .....	5	Maintenance .....	15
Setup .....	6	Warranty .....	16



## WARNING SYMBOLS AND DEFINITIONS

	This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.
	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
	Addresses practices not related to personal injury.

# IMPORTANT SAFETY INFORMATION

## Safety Warnings and Precautions

### **⚠ WARNING**

**Read all safety warnings and all instructions.**

*Failure to follow the warnings and instructions may result in electric shock, fire and/or serious injury.*

**Save all warnings and instructions for future reference.**

1. Electrical shock can cause death or injury! NEVER TOUCH exposed conductors of electricity.
2. **Test cable voltages with care.**
3. Inspect the Multimeter before use. In addition to a general inspection, look specifically for:
  - a. Pay special attention to the insulation protecting the connectors.
  - b. Check the leads for exposed metal, damaged insulation, and continuity.
  - c. Replace damaged test lead immediately, before use.
4. Do not use the Multimeter if:
  - a. Either of the test leads are damaged in any way.
  - b. Test leads are dirty or have residue on them.
  - c. The battery is low.
  - d. Near any explosive gasses or fumes.
  - e. Any abnormal operation is detected.  
(If in doubt about the condition of the Meter, have it serviced before use.)
  - f. The battery cover is open.
5. Power this Meter using only the battery(ies) referenced in the Specifications Chart.
6. Use caution when working near voltages above 30 VAC rms, 42 VAC peak, or 60 VDC. Voltages this high present a risk of electric shock.
7. Disconnect the circuit's power before connecting the Meter in series, when measuring current.
8. Connect the common (COM) test lead first and disconnect it last.
9. Hold the probes with fingers behind guards.
10. Avoid electrical shock. Use extreme caution when working near uninsulated conductors or bus bars. Prevent body contact with grounded surfaces such as pipes, radiators, ranges, and cabinet enclosures when testing voltages.
11. Observe work area conditions. Do not test voltages in damp or wet locations. Don't expose to rain. Keep work area clean and well lit.
12. Keep children away. Children must never be allowed in the work area.
13. Stay alert. Watch what you are doing, use common sense. Do not operate any meter when you are tired.
14. Do not operate meter if under the influence of alcohol or drugs. Read warning labels on prescriptions to determine if your judgment or reflexes are impaired while taking drugs. If there is any doubt, do not operate the meter.

15. People with pacemakers should consult their physician(s) before use. Electromagnetic fields in close proximity to heart pacemaker could cause pacemaker interference or pacemaker failure.

16. Do not test voltage on circuits higher than 1000 volts.

17. Do not test current on circuits higher than 10 amps.

18. Dress properly. Protective, electrically nonconductive clothes and nonskid footwear are recommended when working.

19. Wear ANSI-approved safety goggles during use.

20. Only use accessories intended for use with this meter.

21. Avoid damaging meter. Use only as specified in this manual.

22. Prior to testing resistance, diodes, or continuity; disconnect all power to the circuit and discharge all high-voltage capacitors.

23. Performance of this meter may vary depending on battery condition.

24. Use the proper settings, terminals, techniques, and range for the tests performed. Start with the range stated in the instructions.

25. Do not apply voltage to the Test Leads when the Multimeter is in the Ohms testing setting. Damage can occur to the Meter.

26. Do not switch between testing modes with the multimeter connected to a circuit.

27. Do not use the meter at a setting marked as blank on the scale.

28. Have the Multimeter calibrated by a qualified technician every year to maintain accurate results.

29. Do not disassemble charger; take it to a qualified technician when service or repair is required. Incorrect reassembly may result in a risk of electric shock or fire.

30. The warnings, cautions, and instructions discussed in this instruction manual cannot cover all possible conditions and situations that may occur. It must be understood by the operator that common sense and caution are factors which cannot be built into this product, but must be supplied by the operator.



**SAVE THESE INSTRUCTIONS.**

# Specifications

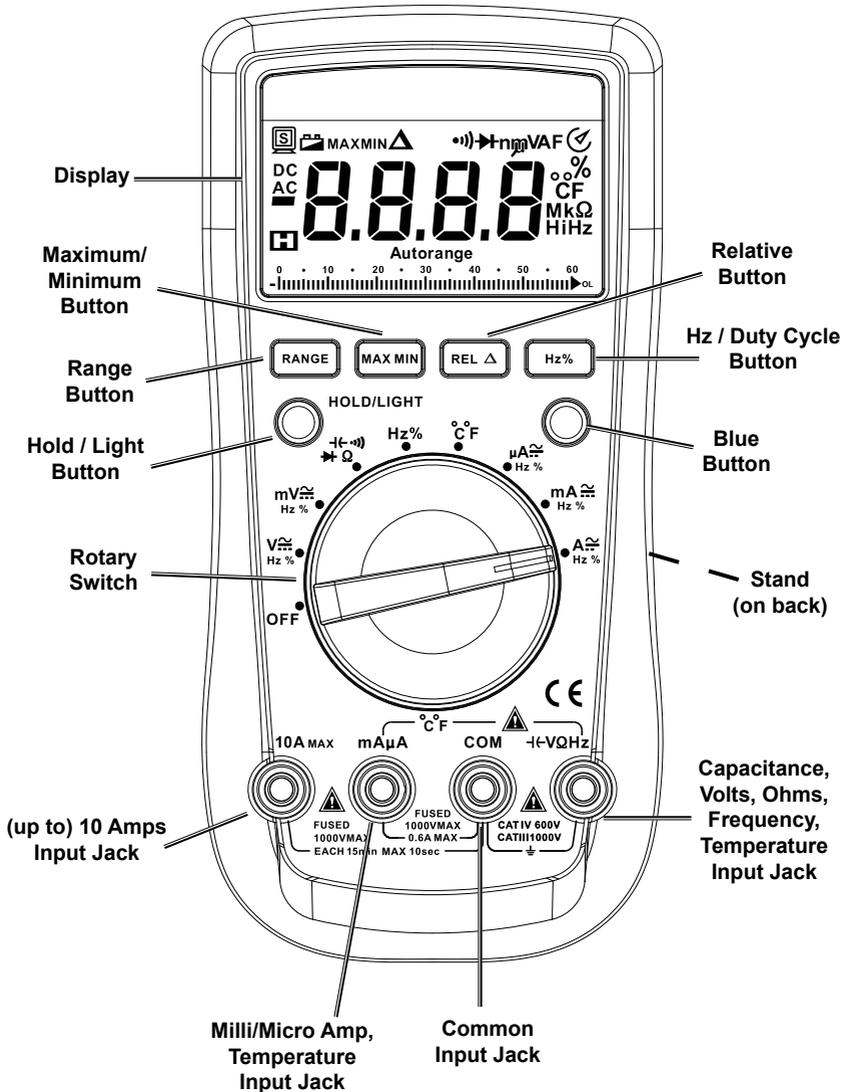
DC Voltage	Ranges: 60mV / 600mV / 6V / 60V / 600V / 1000V
DC Voltage Accuracy	(@60mV - 600mV) $\pm$ 0.8% of rdg + 3D (@6V - 600V) $\pm$ 0.5 of rdg + 1D (@1000V) $\pm$ 1.0% of rdg + 3D
DC Current	Ranges: 600 $\mu$ A / 6000 $\mu$ A / 60mA / 600mA / 6A / 10A
DC Current Accuracy	(@600 $\mu$ A - 600mA) $\pm$ 1.0% of rdg + 3D (@6A - 10A) $\pm$ 1.2% of rdg + 5D
AC Voltage	Ranges: 60mV / 600mV / 6V / 60V / 600V / 750V Frequency Range: 45Hz ~ 1kHz
AC Voltage Accuracy	(@60mV - 600mV) $\pm$ 1.2% of rdg + 5D (@6V - 600V) $\pm$ 1.0% of rdg + 3D (@750V) $\pm$ 1.2% of rdg + 5D
AC Current	Ranges: 600 $\mu$ A / 6000 $\mu$ A / 60mA / 600mA / 6A / 10A Frequency Range: 45Hz ~ 1KHz
AC Current Accuracy	(@600 $\mu$ A - 6000 $\mu$ A) $\pm$ 1.2% of rdg + 5D (@60mA - 600mA) $\pm$ 1.5% of rdg + 5D (@6A - 10A) $\pm$ 2.0% of rdg + 5D
Resistance	Ranges: 600 $\Omega$ / 6k $\Omega$ / 60k $\Omega$ / 600k $\Omega$ / 6M $\Omega$ / 60M $\Omega$
Resistance Accuracy	(@600 $\Omega$ ) $\pm$ 1.2% of rdg + 2D (@6k - 600k $\Omega$ ) $\pm$ 1.0% of rdg + 2D (@6M $\Omega$ ) $\pm$ 1.2% of rdg + 2D (@60M $\Omega$ ) $\pm$ 1.5% of rdg + 2D
Capacitance	Ranges: 40nF / 400nF / 4 $\mu$ F / 40 $\mu$ F / 400 $\mu$ F / 4000 $\mu$ F
Capacitance Accuracy	(@40nF - 40 $\mu$ F) $\pm$ 3.0% of rdg + 5D (@400 $\mu$ F) $\pm$ 4.0% of rdg + 5D
Diode	Open circuit voltage ~2.8V
Continuity	Meter beeps at < 10 $\Omega$
Frequency	Range: 10Hz - 10MHz
Frequency Accuracy	(@10Hz to - 10MHz) $\pm$ 0.1% + 4D
Temperature	Range: -40°F - 1832°F (-40°C - 1000°C)
Temperature Accuracy	(@ -40°F - 4°F) -8% of rdg + 6D (@>4°F - 32°F) $\pm$ 1.2% of rdg + 5D (@>32°F - 212°F) $\pm$ 1.2% of rdg + 4D (@>212°F - 1832°F) $\pm$ 2.5% of rdg + 3D
Duty Cycle	1% - 99%
Operating Temperature	Range: 32°F - 104°F
Overload Protection	(mA $\mu$ A Jack) 600mA/1000V $\varnothing$ 6.35 $\times$ 31.8mm fuse (F1) (10A Jack) 10A/1000V $\varnothing$ 10.3 $\times$ 38mm fuse (F2)
Display	LCD
Battery	9V (included)

# Setup - Before Use:

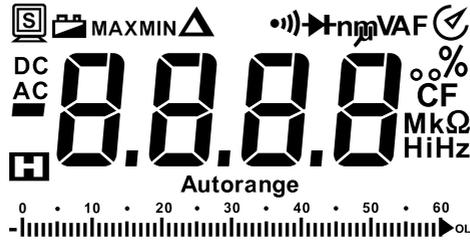


Read the **ENTIRE IMPORTANT SAFETY INFORMATION** section at the beginning of this manual including all text under subheadings therein before set up or use of this product.

## Functions



# Display



Symbol	Description
AC, ~	Alternating current
DC, —	Direct current
	Indicates that display data is being held
	Auto Power-Off
<b>Autorange, AUTO</b>	Auto range mode (Meter selects the range with the best resolution)
<b>MANU</b>	Manual range selection mode
•• )	Continuity
→	Diode test
<b>REL, Δ</b>	Relative measurement mode
<b>MAX</b>	The maximum value is being measured
<b>MIN</b>	The minimum value is being measured
	Battery low
%	Percent (Duty cycle)
°C, °F	Celsius / Fahrenheit (Temperature)
kΩ, Ω	Kilohms, Ohms (Resistance)
mF, F, †	Millifarads, Farads (Capacitance)
mV, V	Millivolts, Volts (Voltage)
mA, A	Milliamperes, Amperes (Current)
kHz, Hz	Kilohertz, Hertz (Frequency)
n, μ, m	Unit of measurement: Nano, Micro, Milli
k, M	Unit of measurement: Kilo, Mega
	Sleep mode
<b>OL</b>	Value too large for the selected range
-	Negative reading
	Bar graph

SAFETY

SETUP

OPERATION

MAINTENANCE

# Operating Instructions



Read the **ENTIRE IMPORTANT SAFETY INFORMATION** section at the beginning of this manual including all text under subheadings therein before set up or use of this product.

Electrical shock can cause death or injury! NEVER TOUCH exposed conductors of electricity.

## General Operation

---

### RANGE Button

---

The **RANGE** Button enables manual selection of available ranges for the selected function. The Meter's default is **Autorange (AUTO)** where the Meter selects for you.

1. To select manual ranging mode, hold down **RANGE** Button until the Meter beeps. The Meter is in manual mode when **MANU** is seen on the Display.
2. Each press of the **RANGE** Button steps through the ranges available for the selected function.
3. To return to Autorange, hold down the **RANGE** Button for about 2 seconds or until the Meter beeps. The Meter is in Autorange when **AUTO** is seen on the Display.

### MAX MIN Button

---

The **MAX MIN** Button allows you to record, temporarily store and view signal events as you monitor them. You may record while in any range or mode except Hz% (frequency/duty cycle).

1. Press the **MAX MIN** (maximum/minimum) Button to begin recording. Note that the Meter automatically resets to manual range mode when measuring minimum / maximum values.
2. When you are finished recording, press the **MAX MIN** Button to scroll through the high (maximum) and low (minimum) recorded readings. The readings will be seen on the Display.
3. To return to normal operating mode, hold down the **MAX MIN** Button for about 2 seconds.

### REL $\Delta$ Button

---

The **REL** (relative mode) Button can be used in all modes except Hz% (frequency/duty cycle). Relative mode subtracts a stored value from the present measurement and displays the result. For example, if the stored value is 20.0V and the present measurement is 22.0V then the Meter will display 2.0V.

1. To enter relative mode, press the **REL  $\Delta$**  Button. The present measurement will lock and the Meter will display "0".
2. Take a new measurement and the Meter will display the relative value.
3. Press the **REL  $\Delta$**  Button again to reset the stored value and exit relative mode.

## Hz% Button

---

The **Hz%** (frequency/duty cycle) Button allows you to measure the frequency and duty cycle (the ratio of time a load or circuit is on versus off) of a signal.

1. To measure the frequency/duty cycle, press the **Hz%** Button. Frequency (Hz) is the default measurement mode.
2. To measure **Duty Cycle**, press the **Hz%** Button again to select % measurement.
3. To exit the frequency/duty cycle measuring mode, press the **Hz%** Button.

## HOLD / LIGHT Button

---

The **HOLD/LIGHT** Button has two functions: To hold the present reading on the Display and to turn on the Display's backlight.

1. To activate **HOLD**, hold down the **HOLD/LIGHT** Button until the meter beeps and the  symbol appears on the Display.
2. When in **HOLD** mode, the present reading will be held on the Display.
3. To exit **HOLD**, hold down the **HOLD/LIGHT** Button until the meter beeps and the  symbol disappears from the Display.
4. To turn on the Display's backlight, hold down the **HOLD/LIGHT** Button for about 2 seconds.
5. The backlight will automatically turn off after about 10 seconds.

**Note:** The Hold mode will not capture unstable or noisy readings.

**Note:** Frequent use of the backlight shortens the life of the battery(ies). Only use the backlight when necessary.

## Blue Button

---

The Blue Button is used to enable available modes for a selection on the Rotary Switch.

### Auto Power-Off and Sleep Mode

---

If the Meter is not used for approximately 15 minutes, it automatically turns itself off to conserve battery power. The Meter's default is enabled **Auto Power-Off** which is indicated by  appearing on the Display.

1. **Sleep Mode** is active when  is seen on the display.
2. To turn the Meter back on after auto power-off, press any Button or turn the Rotary Switch.
3. To disable **Auto Power-Off**, hold down the **Blue** Button while turning on the Meter. The  symbol will not display when Auto Power-Off is disabled.

## Bar Graph

---

The bar graph updates faster than the digital display. This can be used for monitoring changes in measurements at a higher sampling rate. The bar graph indicates polarity (-) and overload ( **OL**).

# Measurement Operation

---

**Note:** Remove plugs from ends of Test Leads (included) before connecting to Meter.

**Note:** Test Lead probes have removable covers for overvoltage protection. With covers in place, Test Leads are rated for use with CAT III and CAT IV circuits. Exposed probes are rated for use with CAT II circuits.

## AC/DC Voltage Measurement

---

Measure AC conductors carrying up to 750 VAC, 45Hz ~ 1kHz.

Measure DC conductors carrying up to 1000 VDC.

**WARNING!** Use caution when working near voltages above 30 VAC rms, 42 VAC peak, or 60 VDC. Voltages this high present a risk of electric shock.

1. Plug black test lead into **COM** Jack. Plug red test lead into **⚡-VΩHz Input** Jack.
2. Turn Rotary Switch to the  $V_{\text{Hz}}^{\approx}$  or  $mV_{\text{Hz}}^{\approx}$  position, as appropriate.
3. Press **Blue** Button to choose AC or DC voltage.
4. Carefully touch exposed conductors with tips of probes.
5. Read measured voltage on the Display.
6. Press **Hz%** to obtain frequency and duty cycle value.
7. When testing is complete, turn Rotary Switch to **OFF**, remove Test Leads and store with Meter.

## Frequency/Duty Cycle Measurement

---

Measure a signal's duty cycle and frequency from 10Hz to 10MHz.

1. Plug black test lead into **COM** Jack. Plug red test lead into **⚡-VΩHz Input** Jack.
2. Turn the Rotary Switch to the **Hz%** position. Frequency (Hz) is the default measurement mode.
3. Connect the Test Leads across the circuit to be measured.
4. Read measured frequency on the Display.
5. To measure **Duty Cycle**, press the **Hz%** Button to select % measurement.
6. When testing is complete, turn Rotary Switch to **OFF**, remove Test Leads and store with Meter.

## Temperature Measurement

Measure temperature from -40°F to 1832°F (-40°C to 1000°C).

1. Connect red (+) end of Thermocouple (included) to the **VΩHz Input** Jack and the black (-) end to the **mAμA Input** Jack.
2. Turn Rotary Switch to the **°C°F** position. The Display will show the current ambient temperature.
3. Press **Blue** Button to switch between Celsius and Fahrenheit.
4. Touch the tip of the Thermocouple to the object being tested.
5. After a few seconds the measured temperature will display.
6. When testing is complete, turn Rotary Switch to **OFF**, remove Thermocouple and store with Meter.

**Note:** To avoid measurement errors at very low temperatures, the operating temperature must not exceed 10~28°F.

**WARNING!** To prevent electric shock, remove Thermocouple before switching between testing modes.

## Resistance Measurement

Measure resistance up to 60M Ohms.

**WARNING!** To prevent electric shock, turn off all power and fully discharge capacitors in the circuit under test before measuring.

**Note:** When measuring Ohms, start with the lowest range if the resistance is unknown.

1. Plug black test lead into **COM** Jack. Plug red test lead into **VΩHz Input** Jack.
2. Turn the Rotary Switch to the **Ω** position.
3. Press Blue Button until the Display indicates Ohms **Ω** is being measured.
4. Carefully touch exposed conductors with tips of probes.
5. Read measured resistance on the Display.
6. When testing is complete, turn Rotary Switch to **OFF**, remove Test Leads and store with Meter.

**Note:** Sometimes the resistor value and measured resistance differ. This is due to the Meter's output test current going through all possible paths between leads.

- Keep test leads as short as possible.
- Resistors should be measured out of circuit.

**Note:** For resistance measurements above 1MΩ, allow a few seconds to get a steady reading.

**Note:** When leads are disconnected or measurement is out of range, **OL** is displayed.

## Continuity Measurement

---

Test continuity between two points in a circuit.

**WARNING!** To prevent electric shock, turn off all power and fully discharge capacitors in the circuit under test before measuring.

1. Plug black test lead into **COM** Jack.  
Plug red test lead into **1kVΩHz Input** Jack.
2. Turn the Rotary Switch to the  position.
3. Press **Blue** Button until  is displayed.

4. Connect the test leads across the circuit to be measured.
5. Read measured resistance on the Display. If the measured resistance is less than 10Ω, Meter will beep.
6. When testing is complete, turn Rotary Switch to **OFF**, remove Test Leads and store with Meter.

**Note:** If Test Leads are open or the resistance is out of range, **OL** is displayed. The buzzer does not sound if the resistance is greater than 100Ω.

## Diode Measurement

---

Test voltage drop in diodes.

**WARNING!** To prevent electric shock, turn off all power and fully discharge capacitors in the circuit under test before measuring.

1. Plug black test lead into **COM** Jack.  
Plug red test lead into **1kVΩHz Input** Jack.
2. Turn the Rotary Switch to the  position.
3. Press **Blue** Button until  is displayed.

4. Connect red probe to diode's anode and black probe to the cathode.
5. Read measured forward-biased voltage drop on the Display.

**Note:** In a circuit, a good diode will produce a forward voltage drop of 0.5V to 0.8V.

**Note:** **OL** is displayed if the Test Leads are reversed, the diode is open, or the measurement is out of range.

6. When testing is complete, turn Rotary Switch to **OFF**, remove Test Leads and store with Meter.

## Capacitance Measurements

---

Measure capacitors up to 4000 $\mu$ F.

**WARNING!** To prevent electric shock, turn off all power and fully discharge capacitors in the circuit under test before measuring.

1. Plug black test lead into **COM** Jack. Plug red test lead into **V $\Omega$ Hz Input** Jack.
2. Turn the Rotary Switch to the **Ω** position.
3. Press **Blue** Button until **nF** is displayed.
4. Press the **REL** button to zero out reading as necessary.
5. Carefully touch capacitor leads with tips of probes.
6. Read measured capacitance on the Display.
7. When testing is complete, turn Rotary Switch to **OFF**, remove and store capacitor and Meter.

**Note:** If the measurement is out of range, **OL** is displayed.

# Current Measurement

Measure AC and DC circuits and conductors carrying up to 10 amperes.

**Note:** Amperage is always tested in series with circuit under test.

**Note:** When using manual range mode, always start with the highest range if the amperage is unknown.

**NOTICE: To prevent damage to the meter, use the correct input jacks.**

1. Turn the Rotary Switch to the appropriate position, depending on the amperage of the circuit under test.
  - Selections are:
    - $\mu\text{A}$   $\text{Hz}\%$  microamperes,
    - $\text{mA}$   $\text{Hz}\%$  milliamperes,
    - $\text{A}$   $\text{Hz}\%$  Amperes.
2. Always start with the highest range if the amperage is unknown.
3. **Turn off power to the circuit and allow capacitors to discharge.**
4. Press **Blue** Button to select AC or DC current. The Meter default is DC current measurement.
5. Break the circuit and connect the Test Leads in series with the circuit being measured. Connect the black lead on the lower voltage side.
  - Plug black test lead into **COM** Jack.
  - If amperage is < 600mA, plug red test lead into **mA $\mu$ A** Jack.
  - If amperage is > 600mA, plug red test lead into **10A** Jack.
6. Power on the circuit and read measurement.
  - Switch to lower ranges, as necessary, to get the most accurate reading.
  - If "OL" is displayed the measurement exceeds the current range. Switch to a higher range.
7. Press **Hz%** to obtain frequency and duty cycle value.

**WARNING! Measure for a maximum of 10 seconds and allow 15 minutes to pass between measurements.**
8. When testing is complete, reconnect the circuit, turn Rotary Switch to **OFF**, remove Test Leads and store with Meter.

# Maintenance and Servicing



Procedures not specifically explained in this manual must be performed only by a qualified technician.

## Cleaning, Maintenance, and Lubrication

---

1. Wipe unit with a dry, lint-free cloth. Do not use solvents or abrasives.
2. Remove battery if not in use for long periods.
3. Store unit in a dry location.
4. Other than the battery and fuses, there are no replaceable parts in this unit. **Repairs should be done by a qualified technician.**

## Battery/Fuse Replacement

---

If the  sign appears on the Display, the battery should be replaced.

1. Remove Test Leads from the Meter.
2. Power off Meter and turn it over.
3. Remove screw(s). Remove tilt stand and battery cover.
4. Replace **Battery**.
  - a. Remove battery from the battery compartment.
  - b. Replace battery with the same type and rating.
5. Replace **Fuse(s)**.
  - a. Remove screw(s) from case bottom and separate case top from bottom.
  - b. Carefully remove fuses one at a time. Gently pry one end loose and remove from its bracket. **Make note of its rating.**
  - c. Replace with new fuse of the same type and rating.
6. Rejoin the tilt stand, battery cover and case bottom. Reinstall and tighten screw(s).

**Note:** Do not reverse the polarity of the battery.

## Calibration

---

Have the Meter calibrated by a qualified technician every year.

## Limited 90 Day Warranty

Harbor Freight Tools Co. makes every effort to assure that its products meet high quality and durability standards, and warrants to the original purchaser that this product is free from defects in materials and workmanship for the period of 90 days from the date of purchase. This warranty does not apply to damage due directly or indirectly, to misuse, abuse, negligence or accidents, repairs or alterations outside our facilities, criminal activity, improper installation, normal wear and tear, or to lack of maintenance. We shall in no event be liable for death, injuries to persons or property, or for incidental, contingent, special or consequential damages arising from the use of our product. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation of exclusion may not apply to you. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS.

To take advantage of this warranty, the product or part must be returned to us with transportation charges prepaid. Proof of purchase date and an explanation of the complaint must accompany the merchandise. If our inspection verifies the defect, we will either repair or replace the product at our election or we may elect to refund the purchase price if we cannot readily and quickly provide you with a replacement. We will return repaired products at our expense, but if we determine there is no defect, or that the defect resulted from causes not within the scope of our warranty, then you must bear the cost of returning the product.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

**Record Serial Number Here:** \_\_\_\_\_

**Note:** If product has no serial number, record month and year of purchase instead.

