RadioShack®
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15-Range Digital Multimeter

Owner's Manual
Please read before using this equipment.

❒ Contents

❒ *Features*

Your RadioShack 15-Range Digital Multimeter is a portable, compact multimeter that is ideal for field, shop, and home applications. Its $3^1/_2$-digit digital display can display 0–1,999 units. It measures AC and DC voltage up to 500V, and resistance up to 2MΩ.

Your meter's modern semiconductor technology brings "big meter" performance to a pocket-sized instrument.

Diode Check Function — lets you safely check semiconductors for open, shorted, or normal junctions.

Low Battery Indicator — lets you quickly see when you need to replace the battery.

Auto Power Off — the meter conserves battery power.

Full Auto-Polarity Operation — protects your meter and gives valid measurements even when you connect the leads in reverse polarity.

UL Listed — passes the stringent safety tests required by Underwriters Laboratories.

Note: Your meter requires one 12V battery (Cat. No. 23-144, not supplied).

Important:

- Completely read this manual before using the meter.
- If you are not familiar with multimeters and testing procedures, we suggest you read *Using Your Meter* (available at your local RadioShack store) before using the meter.

A WORD ABOUT SAFETY

We have taken every precaution in designing this meter to ensure that it is safe. Safe operation depends on you, the operator. We recommend that you follow these simple safety rules.

- This equipment is rated for installation category II (max. 3600 VA).

- Never apply voltages to the meter that exceed the limits given in the specifications. Never apply more than 500V between the test leads and ground.

- Use extreme caution when working with voltages above 100V. Always disconnect power from the circuit you are measuring before you connect test leads to high-voltage points.

- Never connect to a voltage source when you select the diode check resistance measurement.

- Always discharge any capacitors of the circuit under test before you attach test leads.

- Always turn off power and disconnect the test leads from the circuit before replacing the meter's battery.
- Never operate the meter unless its back panel is fully closed with the screw fully tightened.
- Because many AC/DC sets have a potentially hot chassis, be sure the top of your workbench and the floor underneath it are made of non-conductive materials.
- This meter is fully calibrated and tested. Under normal use, no further adjustment should be necessary. If the meter requires repair, do not try to adjust it yourself. Take it to your local RadioShack store.

WARNINGS:

- **Use extreme caution when using this device. Improper use of this device can result in injury or death. Follow all safeguards suggested in this owner's manual in addition to normal safety precautions in dealing with electrical circuits. Do not use this device if you are unfamiliar with electrical circuits and testing procedures. not for commercial or industrial use.**

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

- **For indoor use only.**

WARNING: To reduce the risk of fire or shock hazard, do not expose this product to rain or moisture.

CAUTION

RISK OF ELECTRIC SHOCK. DO NOT OPEN.

CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT REMOVE COVER OR BACK. NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED PERSONNEL.

This symbol is intended to alert you to the presence of uninsulated dangerous voltage within the product's enclosure that might be of sufficient magnitude to constitute a risk of electric shock. Do not open the product's case.

This symbol is intended to inform you that important operating and maintenance instructions are included in the literature accompanying this product.

SPECIAL PANEL MARKINGS

For your safety, we have added special markings to the meter's panel to remind you of the measurement limitations.

500 V MAX 

The maximum voltage that can be measured is 500 volts RMS AC or 500 volts DC. Refer to the complete operating instructions.
To avoid electrical shock or instrument damage, do not connect the test leads to any source that exceeds 500 volts.

Caution: Risk of electric shock! Refer to the complete operating instructions.

Caution: Be extra careful when making high-voltage measurements. DO NOT TOUCH TERMINALS OR PROBE ENDS.

❒ *Specifications*

Display ..... LCD 3 $^{1}/_{2}$ -digit digital display

DC VOLTS
(2–20–200–500 V) ..... ± 0.8% of full scale, ± 1 in last digit

AC VOLTS (200–500 V)
(at 50/60 Hz) ..... ± 1.5% of full scale, ± 5 in last digit

DC CURRENT
(2–20–200mA) ..... ± 2.0% of full scale, ± 1 in last digit

RESISTANCE
(200–2K–20K–200K–2M) ..... ± 2.0%
of full scale, ± 3 in last digit

Range Control ..... Manual Range

Low Battery Indicator .....

Input Impedance ..... 1 M OHM (DC)

Polarity ..... Automatic

Overrange Indication ..... OL
(decimal point floating)

Warning: The maximum input limit for voltage measurement is 500V. To avoid electrical shock and damage to the meter, never try to measure a DC voltage above 500 volts.

Over Voltage
Protection (DCV/ACV) ..... 600 V MAX

Operating Temperature ..... 32 to 109°F
(0 to 43°C)

Storage Temperature ..... – 4 to 140°F
(–20 to 60°C)

Relative Humidity ..... 80% (maximum)

Power Source ..... One 12V battery (Cat. No. 23-144)

Power Consumption ..... 30 mW (Typical)

Dimensions (HWD) ..... $4\frac{5}{8} \times 3\frac{1}{8} \times \frac{11}{16}$ in. ($118 \times 80 \times 18$ mm)

Weight (with batteries) ..... 3.5 oz (100 g)

❒ *Preparation*

INSTALLING THE BATTERY

Your meter requires one 12V battery (Cat. No. 23-144, not supplied), available at your local RadioShack store.

Warnings:

- To avoid electrical shock, disconnect both of the meter's test leads

from any equipment before you install or remove the battery.

- Do not operate your meter until the battery is properly installed and the back panel is in place and secured.

Caution: Use only a fresh battery of the required size and recommended type.

1. Set the selector to **OFF**.
2. Use a Phillips screwdriver to loosen the screws in the case's back cover, then grasp and lift off the meter from the case.
3. Place the battery in the battery compartment as indicated by the polarity symbols (+ and –) marked inside the battery compartment.

4. Replace the back panel and secure it with the screws.

When appears on the display or the meter does not measure accurately, replace the battery. If the battery power is extremely low, does not appear.

Warning: Dispose of old batteries promptly and properly. Do not burn or bury them.

Caution: If you do not plan to use the multimeter for a few weeks, remove the battery. Batteries can leak chemicals that can destroy electronic parts.

AUTOMATIC/MANUAL POWER OFF

Your meter conserves power by automatically turning off about 30 minutes after the last time you changed a setting (even if you are making measurements).

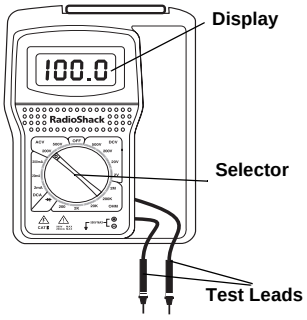
To turn the meter back on, rotate the selector to any other range except **OFF**.

To manually turn off the meter before it automatically turns off, rotate the selector to **OFF**.

❒ *Using the Meter*

Note: Always rotate the selector to **OFF** when the meter is not in use.

1. With the meter open, unwind the test leads from inside the cover.



Caution:

- The test leads are permanently attached to the meter. Do not try to remove them.

2. Rotate the selector to the desired function and range. For example, **DCV** includes four ranges: 2, 20, 200 and 500.

3. Connect the test leads to the circuit to measure. To measure different circuits, see “Measurements” on Page 22.

   Caution: If **OL** appears when you are measuring voltage, the value you are measuring exceeds the meter’s maximum range. Immediately disconnect the probes from the circuit or your meter might be damaged.

4. Read the range in volts, ohms, or the current reading as indicated by the position of the decimal point.

Selector Setting	Range	Display
DCV 2V	2 V	d.ddd
DCV 20V	20V	dd.dd
DCV 200V	200V	ddd.d
DCV 500V	500V	ddd
ACV 200V	200V	ddd.d
ACV 500V	500V	ddd
OHM 200	200Ω	ddd.d
OHM 2K	2KΩ	d.ddd
OHM 20K	20KΩ	dd.dd
OHM 200K	200KΩ	ddd.d
OHM 2M	2MΩ	d.ddd

Selector Setting	Range	Display
Diode	Diode	d.ddd
DCA 2mA	2mA	d.ddd
DCA 20mA	20mA	dd.dd
DCA 200mA	200mA	ddd.d

5. Rotate the selector to **OFF** when you finish using the meter.
6. Replace the test leads inside the compartment.
7. Close the cover.

❒ *Measurements*

MEASURING AC/DC VOLTAGE

Warning: The maximum input limit for voltage measurement is 500V DC and 500V AC (RMS). To avoid electrical shock and damage to the meter, never try to measure a DC voltage above 500 volts or an AC voltage above 500 volts RMS.

1. Set the selector to **DCV 2V**, **DCV 20V**, **DCV 200V**, or **DCV 500V** to measure DC voltage, or **ACV 200V** or **ACV 500V** to measure AC voltage.

2. Connect the test leads to the circuit you want to test.

3. Set the selector to the highest range for the type of voltage (AC or DC) you are measuring, then reduce it as necessary until the correct voltage appears.

Note: When measuring DC voltage, if the measured voltage's polarity is negative, **–** appears before the value.

Measuring AC Voltage Riding on a DC Source Bias

Warning: To avoid injury to yourself or damage to your meter, never try to measure an AC voltage that is riding on a DC source bias where the peak voltage exceeds 500V (with respect to earth ground).

Caution: Never try to measure any voltage more than 30V AC on a DC source bias.

To measure an AC voltage superimposed on a DC voltage source bias, you must first measure the DC and AC voltages separately, then compute the peak voltage using this formula:

$$\text{Peak voltage} = \text{DC voltage} + \frac{\text{AC voltage}}{.707}$$

Note: This formula provides an exact value for sine waves. It provides an approximate value for other wave types.

1. Set the selector to **DCV 20V** or **DCV 200V**.

2. Connect the test leads to the circuit to test. The DC voltage appears on the display.

3. Disconnect the test leads from the circuit.

4. Set the selector to **ACV 200V** or **ACV 500V**.

5. Connect the meter's test leads to the same circuit you tested in Step 2. The AC voltage appears on the display.

6. Compute the peak voltage using the formula:

$$\text{Peak voltage} = \text{DC voltage} + \frac{\text{AC voltage}}{.707}$$

MEASURING DC CURRENT

To measure current, you must break the circuit and connect the red probe and the black probe to two circuit connection

points. The connection must be in series with the circuit under test.

Caution: Never connect the red probe and black probe across a voltage source while the setting is set to **2mA**, **20mA**, or **200mA**. Doing so can blow the fuse in the meter and damage the circuit under test. The maximum input limit for DC current measurement is 200mA.

1. Rotate the selector to **DCA 2mA**, **DCA 20mA**, or **DCA 200mA** to measure DC current.

2. Remove power from the circuit under test and discharge all capacitors.

3. Break the circuit at the appropriate point, then connect the meter's red probe and black probe in series with the circuit.

Caution: Do not apply voltage to the red probe and black probe while the function switch is set to **DCA 2mA**, **DCA 20mA**, or **DCA 200mA**. The connection must be in series with the current.

4. Apply power and read the current.

Notes:

- When measuring DC current, if the measured current's polarity is negative, **–** appears before the value.
- The DC mA range is fuse-protected. If the meter does not show a reading in this range, check the fuse.

MEASURING RESISTANCE

The resistance measuring circuit in your meter compares the voltage gained through a known internal resistance with the voltage developed across an unknown resistance.

Warning: Be sure the circuit under test has all power removed and any associated capacitors are fully discharged before making a resistance measurement.

Caution: Your meter has a circuit to protect the resistance range from over-voltage. However, to ensure a correct measurement and to avoid accidentally exceeding the protection circuit's rating, never connect the test leads to a source of voltage while the selector is set to **OHM 200**, **OHM 2K**, **OHM 20K**, **OHM 200K**, or **OHM 2M**.

Note: If there is no resistance connected across the test leads or the measured value exceeds the range you set, **OL** appears when you set the selector to **OHM 200**, **OHM 2K**, **OHM 20K**, **OHM 200K**, or **OHM 2M**. This is normal.

1. Set the selector to **OHM 200**, **OHM 2K**, **OHM 20K**, **OHM 200K**, or **OHM 2M**.

2. Connect the test leads across the circuit to measure. Or, remove one of the component's leads from its circuit and connect the test leads across the component. The meter displays the reading in the chosen range.

CHECKING DIODES

This meter is for checking standard diodes. It is not to be used for checking specialty diodes, such as zener diodes.

You can also check transistors and other semiconductors for opens, shorts, and normal operation, as well as determine the forward voltage for diodes. (This is handy when you need to match a diode).

Caution: Do not connect the test leads to a source of voltage when you set the selector to diode. This could damage the meter or circuit being tested.

1. Rotate the selector to ⊳| .
2. Remove power from the circuit under test.
3. Connect the test leads across the circuit to measure, or remove one of the component's leads from its circuit and connect the test leads across the component. Note the first reading.

4. Reverse the test leads and note the second reading. Check the unit you tested for opens, shorts, and normal operation, and determine the forward voltage for the diode.

Note: The values that appear during the diode check show the actual forward voltage (max. 3.3V).

❒ *Care*

Use and store the meter only in normal temperature environments. Handle the meter carefully; do not drop it. Keep the meter away from dust and dirt, and wipe it with a damp cloth occasionally to keep it looking new.

Modifying or tampering with the meter's internal components can cause a mal-

function. If your meter is not performing as it should, take it to your local RadioShack store for assistance.

Warnings:

- Do not let any water drip inside the meter while cleaning it.
- Make sure that the meter is completely dry before using it.

REPLACING THE FUSE

If the meter does not work for the current in the DCA 2mA, 20mA, or 200mA range, replace the fuse with another ceramic 315 mA, 250 V fuse (not supplied, available at your local RadioShack store).

Caution: Do not use a fuse with ratings other than those specified. Doing so might damage your meter.

Warning: To avoid electric shock, disconnect the test leads before you remove the meter from the case.

1. Set the selector to **OFF**.
2. Use a Phillips screwdriver to loosen the screws in the case's back cover, then grasp the meter and lift it from the case.
3. To remove the fuse, pull the red ribbon. The fuse pops out.
4. If the fuse is blown, discard it and save the red ribbon. Then wrap the ribbon around the replacement fuse

and insert the fuse into the fuse holder.

5. Replace the back panel and secure it with the screws.

Limited Ninety-Day Warranty

This product is warranted by RadioShack against manufacturing defects in material and workmanship under normal use for ninety (90) days from the date of purchase from RadioShack company-owned stores and authorized RadioShack franchisees and dealers. EXCEPT AS PROVIDED HEREIN, RadioShack MAKES NO EXPRESS WARRANTIES AND ANY IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE DURATION OF THE WRITTEN LIMITED WARRANTIES CONTAINED HEREIN. EXCEPT AS PROVIDED HEREIN, RadioShack SHALL HAVE NO LIABILITY OR RESPONSIBILITY TO CUSTOMER OR ANY OTHER PERSON OR ENTITY WITH RESPECT TO ANY LIABILITY, LOSS OR DAMAGE CAUSED DIRECTLY OR INDIRECTLY BY USE OR PERFORMANCE OF THE PRODUCT OR ARISING OUT OF ANY BREACH OF THIS WARRANTY, INCLUDING, BUT NOT LIMITED TO, ANY DAMAGES RESULTING FROM INCONVENIENCE, LOSS OF TIME, DATA, PROPERTY, REVENUE, OR PROFIT OR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, EVEN IF RadioShack HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. *(continued)*

(continued)

In the event of a product defect during the warranty period, take the product and the RadioShack sales receipt as proof of purchase date to any RadioShack store. RadioShack will, at its option, unless otherwise provided by law: (a) correct the defect by product repair without charge for parts and labor; (b) replace the product with one of the same or similar design; or (c) refund the purchase price. All replaced parts and products, and products on which a refund is made, become the property of RadioShack. New or reconditioned parts and products may be used in the performance of warranty service. Repaired or replaced parts and products are warranted for the remainder of the original warranty period. You will be charged for repair or replacement of the product made after the expiration of the warranty period.

This warranty does not cover: (a) damage or failure caused by or attributable to acts of God, abuse, accident, misuse, improper or abnormal usage, failure to follow instructions, improper installation or maintenance, alteration, lightning or other incidence of excess voltage or current; (b) any repairs other than those provided by a RadioShack Authorized Service Facility; (c) consumables such as fuses or batteries; (d) cosmetic damage; (e) transportation, shipping or insurance costs; or (f) costs of product removal, installation, set-up service adjustment or reinstallation.

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

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22-810
07A01
Printed in China

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