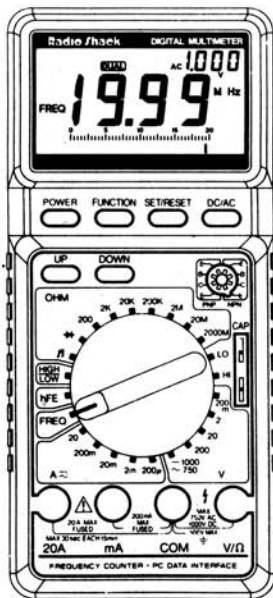


OWNER'S MANUAL

MANUAL DUAL-DISPLAY DIGITAL MULTIMETER

Please read before using this equipment.

w/PC Interface



Cat. No. 22-168A

Radio Shack[®]

INTRODUCTION

Your Radio Shack LCD Digital Multimeter is a portable, 3½ digit, compact test instrument ideally suited for use in the field, lab, shop, and home. Here are some of the professional features of your new digital meter.

Computer Interface and Software — includes both MS-DOS and Microsoft Windows software to let you interface the meter with your PC-compatible computer to log and graph measurements.

Memory Recording — stores ten measurements which you can download to a computer.

Frequency Check Function — measures frequencies up to 20 MHz.

Transistor-Check Function — measures the gain (hFE) of small-signal, bipolar transistors.

Capacitor-Check Function — measures the capacitance of low-voltage capacitors.

Dual-Measurement Function — shows both the AC voltage and frequency for AC measurements or the logic level and ripple frequency for logic measurements.

Analog Bargraph Display — indicates the magnitude of the input compared to the full-scale value of the measurement range.

MAX/MIN Hold Function — displays the maximum or minimum measured value on the secondary display.

Data Hold Function — freezes the secondary display so you can keep the measured value there even after you disconnect the probes.

Relative Offset — stores a value in memory and displays the difference between the stored value and subsequent readings.

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Radio Shack is a registered trademark used by Tandy Corporation.

Windows is a trademark and MS-DOS is a registered trademark of Microsoft Corporation.

Continuity Function – makes it easy to check fuses, alarm wiring, cables, and connections.

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

Diode-Check Function – safely checks semiconductor junctions for open, short, or normal.

Combined (Function and Range) Selector Switch – makes the meter easy to use.

Latest IC and Display Technology – ensures reliability, accuracy, stability, and ease of operation.

Auto Power Shut-Off – turns off after 10 minutes of non-use to help conserve battery power.

Beeper – sounds tones for overload warning, continuity function, and range selection.

Logic Test Function – checks logic levels without extra logic probes.

Overload and Transient Protection – helps protect the meter from accidental overload on most ranges.

Low-Battery Indicator – appears when you need to replace the batteries.

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

Cautions:

- Completely read this manual before you use the meter.
- If you are not familiar with meters and testing procedures, we suggest you read “Using Your Meter” (Radio Shack Cat. No. 62-2039).

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A WORD ABOUT SAFETY

This meter has been manufactured and tested in accordance with IEC 348 and DIN57411/VDE 0411 Part 1 : Safety Requirements for Electronic Measuring Apparatus, Safety Class II.

We have taken every precaution in designing and manufacturing this meter to ensure that it is as safe as we can make it. But safe operation depends on you, the operator. We recommend that you follow these simple safety rules:

- Never apply voltages to the meter that exceed the limits given in the specifications. Never apply more than 1000 V DC or 750 V AC between any terminals or between any input jack and ground.
- Use extreme caution when working with voltages above 30 V AC or 60 V DC. Always disconnect power from the circuit you are measuring before you connect the test probes to high-voltage points.

- Never connect the test probes to a source of voltage when you select diode, resistance, continuity, current measurement, capacitance, or hFE functions.
- Always turn off the meter's power and disconnect the test probes before you replace the battery or fuse.
- Never operate the meter unless the back cover is in place and fully closed.
- Because some AC/DC sets have a hot chassis, be sure the top of your work bench and the floor underneath it are made of nonconductive materials.

The meter is fully calibrated and tested. Under normal use, no further adjustment should be necessary. If the meter should require repair, do not try to adjust it yourself. Take it to your local Radio Shack store. Service by unauthorized personnel voids the warranty.

WARNING: USE EXTREME CAUTION IN THE USE OF 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.

SPECIFICATIONS

DC VOLTS (Maximum Measurement = 1000 V)

200 mV - 2 - 20 - 200 - 1000 V	$\pm 0.8\%$ of Reading and $\pm 0.3\%$ of Full Scale ± 1 in Last Digit
--------------------------------------	--

AC VOLTS (Maximum Measurement = 750 V)

200 mV - 2 - 20 - 200 V	$\pm 1.2\%$ of Reading and $\pm 0.8\%$ of Full Scale ± 3 in Last Digit
750 V	$\pm 1.5\%$ of Reading and $\pm 1.2\%$ of Full Scale ± 3 in Last Digit

DC CURRENT (Maximum Measurement = 20 A)

200 μ A - 2 mA	$\pm 1.0\%$ of Reading and $\pm 0.5\%$ of Full Scale ± 1 in Last Digit
20 mA - 200 mA	$\pm 1.5\%$ of Reading and $\pm 1.2\%$ of Full Scale ± 1 in Last Digit
20 A	$\pm 2.5\%$ of Reading and $\pm 2.0\%$ of Full Scale ± 5 in Last Digit

AC CURRENT (Maximum Measurement = 20 A)

200 μ A - 2 mA	$\pm 1.5\%$ of Reading and $\pm 1.0\%$ of Full Scale ± 3 in Last Digit
20 mA - 200 mA	$\pm 2.3\%$ of Reading and $\pm 1.8\%$ of Full Scale ± 5 in Last Digit
20 A	$\pm 3.5\%$ of Reading and $\pm 3.0\%$ of Full Scale ± 7 in Last Digit

CAPACITANCE

200 pF - 200 nF	$\pm 2.5\%$ of Reading and $\pm 2.0\%$ of Full Scale ± 3 in Last Digit
20 μ F - 200 μ F	$\pm 4.5\%$ of Reading and $\pm 4.0\%$ of Full Scale ± 5 in Last Digit

RESISTANCE

200 Ohm	$\pm 1\%$ of Reading and $\pm 0.5\%$ of Full Scale ± 3 in Last Digit
---------------	--

2 kohm - 20k - 200k - 2 Mohm	$\pm 1\%$ of Reading and $\pm 0.5\%$ of Full Scale ± 1 in Last Digit
20 Mohm	$\pm 1.5\%$ of Reading and $\pm 1.0\%$ of Full Scale ± 2 in Last Digit
2000 Mohm	$\pm 5.5\%$ of Reading and $\pm 5.0\%$ of Full Scale ± 5 in Last Digit

FREQUENCY

2 kHz - 20 MHz	$\pm 2.5\%$ of Reading and $\pm 2.0\%$ of Full Scale ± 3 in Last Digit
----------------------	--

DIODE CHECK FUNCTION For checking semiconductors for open, short, or normal

CONTINUITY TEST Continuity buzzer sounds at less than 40 ohms

hFE MEASUREMENT 0-1000 hFE values for either PNP or NPN transistor.
Base DC Current about $10 \mu\text{A}$
 V_{CE} about 3.0V

COMMUNICATION	Transmission Rate: 1200 baud Character Coding: 7-Bit ASCII Parity Bit: None Stop Bit: 2 RS-232 Serial Interface
INPUT IMPEDANCE	10 Mohm (DCV/ACV all ranges)
RANGE SELECTION	Manual (rotary-type switch)
POWER SOURCE	9 V battery (such as Radio Shack Cat. No. 23-553, not supplied)
POWER CONSUMPTION	70 mW typical
LOW BATTERY INDICATION	A battery symbol on the right of the display indicates when battery voltage drops below 6.5 V - 7.5 V
POLARITY	Automatic polarity selection
OVERRANGE INDICATION	OL appears, and the bargraph flashes


OPERATING TEMPERATURE	32 to 104°F (0 to 40°C)
STORAGE TEMPERATURE	14 to 122°F (-10 to 50°C)
WEIGHT	12.35 oz (350 grams)
SIZE	7¼×3¼×1⅞ Inches (187×87×34 mm) (HWD)
ACCESSORIES (included)	Fuse 2A/250V (Fast-Acting Type) Shrouded Banana-Type Probes RS-232C Cable, 3½-Inch Disk

SPECIAL PANEL MARKINGS

We have placed the following special markings on the panel to remind you of the measurement limitations and safety.

20A MAX FUSED The maximum current that you can measure at this terminal is 20 amps DC/AC. This terminal is fuse protected. For your safety during continuous measurements, keep the duty cycle as 30 seconds in use and 15 minutes in rest.

200mA MAX FUSED The maximum current that you can measure at this terminal is 200 mA DC/AC. This terminal is limited to 2 amps by a fuse.

500V MAX  To avoid electrical shock or instrument damage, do not connect the common input terminal (COM) to any source of more than 500 V with respect to earth/ground.

MAX 750V AC 1000V DC The maximum voltage this meter can measure is 1000V DC or 750V AC.



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



Refer to the complete operating instructions.

PREPARATION

INSTALLING/REPLACING THE BATTERY

Your meter requires a 9V battery (not supplied) for power. For reliable operation, we recommend an alkaline battery, such as Radio Shack Cat. No. 23-553.

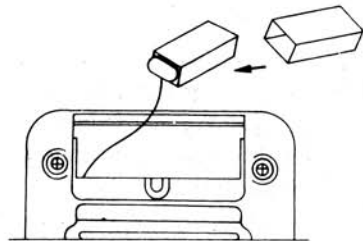
Warning: TO AVOID ELECTRIC SHOCK, DISCONNECT BOTH LEADS FROM ANY EQUIPMENT BEFORE YOU REMOVE OR INSTALL THE BATTERY.

Follow these steps to install the battery:

1. Turn off power and disconnect the two test probes.
2. Loosen the battery compartment cover screw and slide off the cover. Remove the old battery, if necessary.



3. Place the battery into the supplied insulation capsule and snap it onto the contacts.



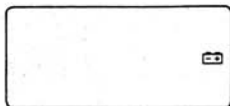
Warning: Do not discard the provided battery insulation capsule. If you do not use this insulation capsule properly, damage or injury might result.

4. Replace the battery compartment cover and secure it with the screw.

WARNING: DO NOT OPERATE THE METER UNTIL YOU REPLACE THE BATTERY AND CLOSE THE BATTERY COMPARTMENT COVER.

Notes:

- When the battery indicator appears, replace the battery.



- Never leave a weak or dead battery in your meter. Even a *leakproof* battery can leak damaging chemicals. When you are not going to use your meter for a week or more, remove the battery.

USING THE TEST PROBES

Use only the type of test probes supplied with your meter. These test probes are rated for 1200 volts. You can purchase replacement probes from your local Radio Shack store.

Cautions:

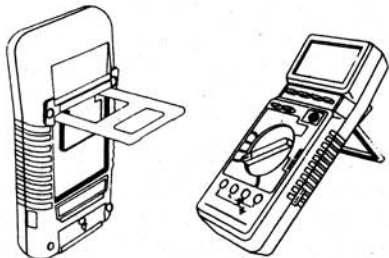
- Although the test probes are rated for 1200 volts, the maximum rating of your meter is 1000 volts DC and 750 volts AC. If you try to measure DC voltages above 1000 volts or AC voltages above 750 volts, you might damage your meter and expose yourself to a serious shock hazard. Use extreme care when you measure high voltages.
- Never connect the probe you plug into the **COM** terminal to a source of voltage greater than 500 volts with respect to earth ground. This creates a serious shock hazard.

USING THE STAND

Use your meter's stand to prop up or hang the meter.

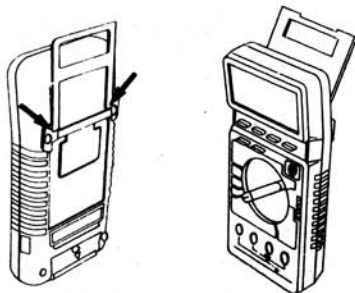
Propping Up the Meter

If you prop up your meter on a benchtop, the stand helps provide a better viewing angle. To use the stand as a prop, just open it away from the meter and set it on a flat surface.



Hanging the Meter

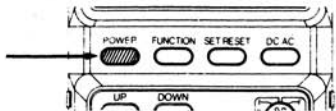
To hang the meter, remove the stand by pressing the lower parts of the stand together. Then insert the stand into the top two holes as shown.



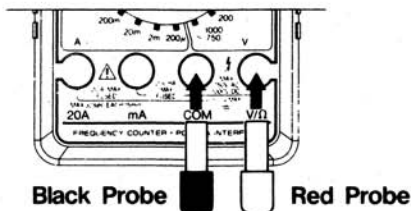
PRE-OPERATION CHECK

To ensure correct operation and familiarize yourself with the meter, follow these steps before you use it.

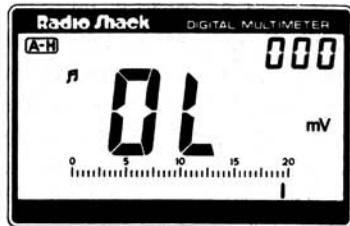
1. Press **POWER** to turn on the meter. The meter beeps once.



2. Plug the black probe into the meter's **COM** terminal and the red probe into the meter's **V/ Ω** terminal.



3. Rotate the function selector to . Your meter displays OL and the analog bargraph flashes.



4. Touch the probe tips together. Your meter sounds a tone.
5. Rotate the function selector to one of the other **OHM** positions. Your meter displays a value of less than 1 ohm when you touch the probe tips together.

MAKING MEASUREMENTS

UNDERSTANDING PHANTOM READINGS

In some DC and AC voltage ranges, when the probes are not connected to any circuit, the display might show a *phantom* reading. This is normal. The meter's high input sensitivity produces a wandering effect. When you connect the probes to a circuit, accurate readings appear.

MEASURING HIGH-VOLTAGE CIRCUITS

When you use the meter to check a high-voltage circuit, do not try to position both probes at once. Instead, clamp one probe to the neutral or ground lead of the circuit (usually a bare, green, or white wire in AC wiring circuits) using insulated Slip-On Alligator Clips (Cat. No. 270-354). Then probe for voltages with the other probe. This helps prevent you from accidentally touching a hot wire because you need to concentrate on only one test probe.

Warning: Never clamp onto a hot wire, (usually red, black, or blue in AC wiring circuits.) If you clamp onto a hot wire and touch the other probe, you could receive a shock.

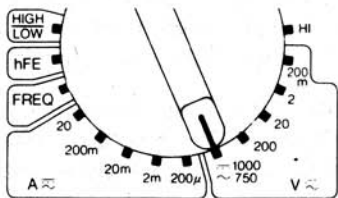
AC/DC VOLTAGE MEASUREMENT

WARNING: DO NOT TRY TO MEASURE A VOLTAGE GREATER THAN 1000 VOLTS DC OR 750 VOLTS AC. YOU MIGHT DAMAGE YOUR METER AND EXPOSE YOURSELF TO A SEVERE SHOCK HAZARD.

Note: All the figures on the display blink when more than the maximum voltage (DC 1000/AC 750 VOLTS) is supplied. If this happens, DISCONNECT THE PROBES IMMEDIATELY.

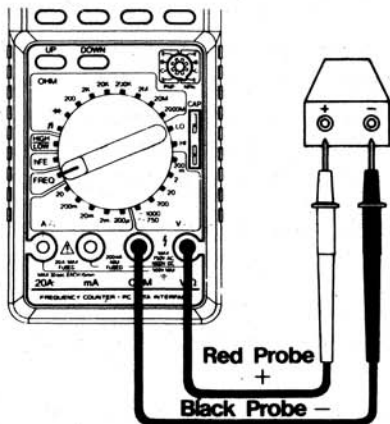
Follow these steps to measure AC/DC voltage.

1. Rotate the function selector to the desired position.



Select the range as required for the voltage level to be measured. If you do not know the voltage level, start with the range switch set to the highest voltage position and reduce the setting as needed to get a reading.

2. Press **DC/AC** to toggle between DC and AC voltage. **AC** appears for AC measurements.
3. Plug the black probe into the meter's **COM** terminal and the red probe into the V/ Ω terminal.
4. Connect the probes to the AC/DC voltage source you want to measure.



Notes:

- If polarity is negative, – appears on the left of display.
- For the most accurate measurement, select the lowest possible voltage range without getting an overload reading.

Measuring an AC Voltage on a DC Bias

To measure an AC voltage superimposed on a DC voltage source bias, follow the steps for measuring AC voltage.

Caution: Never try to measure an AC voltage that is riding on a DC voltage level where the peak AC voltage exceeds 1000V with respect to earth ground.

MEASURING 3-PHASE AC VOLTAGES

We designed this meter to measure household AC voltage. It is not intended for commercial or industrial use. If you want to measure 3-phase, line-to-line voltages, please note the following.

Warning: Because of the dangers inherent in measuring three-phase circuits, we strongly recommend that you do not use this meter for such applications.

-
- If you choose to make the measurements, use extreme care. The actual voltage can be greater than the circuit's rated voltage (line-to-ground).
 - To determine the line-to-line voltage, multiply the rated line-to-ground voltage by 1.732.

For example, if the rated line-to-ground voltage is 462 volts, the line-to-line voltage is:

$$462 \text{ Volts} \times 1.732 = 800 \text{ Volts}$$

This voltage exceeds the meter's rating and you should not connect the meter to this circuit. See "Measuring High-Voltage Circuits."

MEASURING AC/DC CURRENT

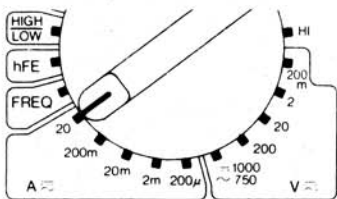
WARNINGS:

- DO NOT APPLY VOLTAGE DIRECTLY ACROSS TERMINALS. YOU MUST CONNECT THE METER IN SERIES WITH THE CIRCUIT.
- THE 20A TERMINAL IS FUSED. A SEVERE FIRE HAZARD AND SHORT CIRCUIT DANGER EXISTS IF YOU APPLY A VOLTAGE WITH HIGH-CURRENT CAPABILITY TO THIS TERMINAL. THE METER CAN BE DESTROYED UNDER SUCH CONDITIONS.

To measure current, break the circuit and connect the probes to two circuit connection points. Never connect the probes across a voltage source in parallel. Doing so can blow the fuse or damage the circuit under test.

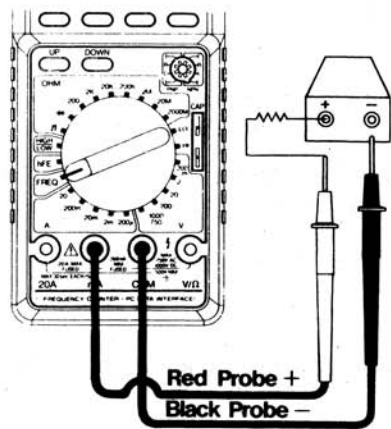
Note: The maximum input current is 200 mA or 20 A depending on the terminal used. In these ranges excessive current blows the fuses, which you must replace.

1. Rotate the function selector to the desired **A** range. If you do not know the current level, set it to the highest position and reduce the setting as needed to get a reading.



2. Press **DC/AC** to toggle between DC and AC amps.
3. Plug the black probe into your meter's **COM** terminal and the red probe into your meter's **mA** or **20A** terminal.
4. Remove power from the circuit under test and then break the circuit at the appropriate point.

5. Connect the probes in series with the circuit.



6. Apply power and read the current. Your meter displays the current value.

Note: If you set the meter for DC current, **-** appears or disappears. This indicates the polarity of the measured current.

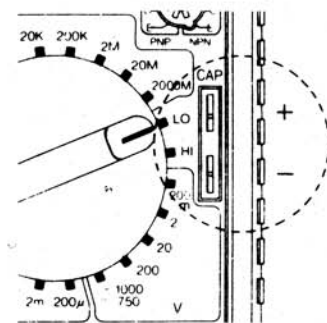
MEASURING CAPACITANCE

Follow these steps to measure normal capacitance.

1. Before testing, discharge each capacitor by shorting its leads together. Use caution when handling some capacitors, as they can be charged with considerable electricity.

Caution: If you attempt to measure the capacitance of a charged capacitor, you might damage your meter.

2. Rotate the function selector to the desired **CAP** range (**LO** for low-value capacitors and **HI** for high-value capacitors). If you do not know the approximate capacitance value, set the range to **HI** and reduce to **LO** to get a valid reading.
3. Insert the discharged capacitor into the **CAP** connectors. Your meter displays the capacitance value.



Note: For polarized capacitors, be sure to insert the negative lead in the **-clip**.

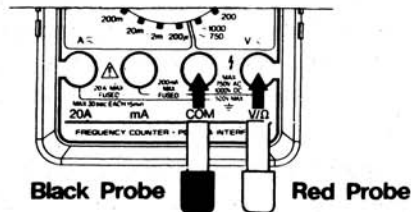
MEASURING RESISTANCE

WARNINGS:

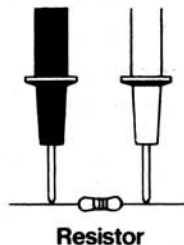
- NEVER CONNECT THE TEST PROBES TO A SOURCE OF VOLTAGE WHEN YOU HAVE SELECTED THE OHMS FUNCTION AND PLUGGED THE PROBES INTO THE V/ Ω TERMINAL.
- BE SURE THAT THE CIRCUIT UNDER TEST HAS ALL POWER REMOVED AND THAT ANY ASSOCIATED CAPACITORS ARE FULLY DISCHARGED BEFORE YOU MAKE A RESISTANCE MEASUREMENT.

The resistance measuring circuit compares the voltage gained through a known resistance (internal) with the voltage developed across the unknown resistance. So, when you check in-circuit resistance, be sure the circuit under test has all power removed (all capacitors are fully discharged).

1. Plug the black probe into your meter's **COM** terminal and the red probe into your meter's **V/ Ω** terminal.



2. Rotate the function selector to the desired **OHM** range.
3. Connect the probes to the device you want to measure.



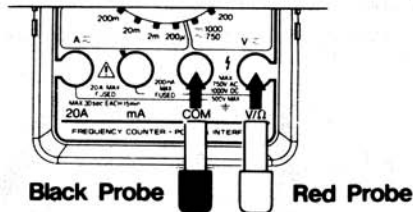
Notes:

- If the measured resistance value exceeds the maximum value of the range selected, OL appears and the bargraph flashes. This indicates an overload. Select a higher range. In this mode, the beeper does not sound.
- When you short the test probes in the 200 OHM range, your meter displays a small value (no more than 0.3 ohms). This value is due to your meter's and test lead's internal resistance. Make a note of this value and subtract it from small resistance measurements for better accuracy.
- For resistance of about 1 Megohm and above, the display might take a few seconds to stabilize. This is normal for high-resistance readings.

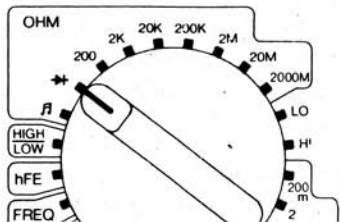
CHECKING DIODES

This function lets you check diodes and other semiconductors for opens and shorts. It also lets you determine the forward voltage for diodes. You can use this function when you need to match diodes.

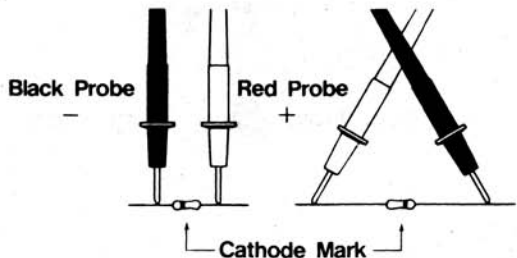
1. Plug the black probe into your meter's **COM** terminal and the red probe into your meter's **V/ Ω** terminal.



2. Rotate the function selector to the diode position.



3. Connect the probes to the diode you want to check and note the meter reading.



- If the display shows a value, for example 0.2 for a germanium diode or 0.5 for a silicon diode, reverse the diode. If the meter indicates an overrange, the diode is good. The displayed number is the diode's actual forward voltage (up to 2.0 volts).
- If the display indicates an overrange condition, reverse the polarity of the connection. If the display shows a value, the device is good. The displayed value is the component's actual forward voltage (up to 2.0 volts). If the display still indicates an overrange condition, the device is open.
- If the display shows a value both before and after you reverse the polarity, the device is shorted.

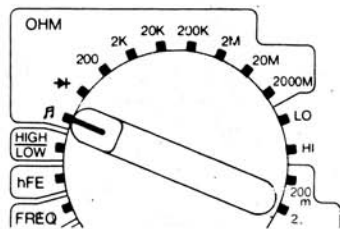
When you connect the diode to the meter and the meter displays the device's forward voltage, the red test probe or socket is connected to the diode's anode, and the black probe or socket

is connected to the diode's cathode. This meter supplies enough forward voltage to light most LEDs. However, if the LED's forward voltage is greater than 2.0 volts, the meter incorrectly indicates that the device is open.

CHECKING CONTINUITY

Follow these steps to check a circuit's continuity.

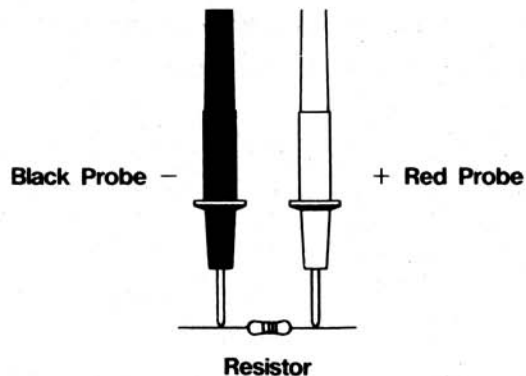
1. Rotate the function selector to .



2. Plug the black probe into your meter's **COM** terminal and the red probe into your meter's **V/ Ω** terminal.
3. Remove power from the circuit.

Warning: Never perform a continuity measurement on a circuit that has power connected.

4. Connect the probes to the circuit.

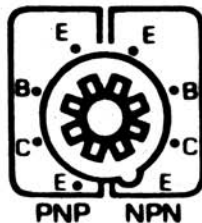


Note: The buzzer sounds if the measured resistance is below 40 ohms.

CHECKING TRANSISTORS

Follow these steps to determine a transistor's base gain.

1. Rotate the function selector to the hFE position.
2. Insert the transistor you want to measure into the appropriate transistor socket. Your meter displays the transistor's hFE value.



Notes:

- Insert the base, collector, and emitter pins in the correct sockets, as marked.

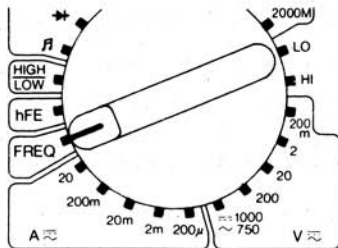
-
- Do not take the hFE reading as an absolute measurement, but rather as an indication that the transistor is operating. The true gain of a transistor depends on its operating current. This meter applies 500 to 1000 μA to the emitter and collector and measures the base current to calculate the base gain.
 - Even though the meter turns off the test probes during the hFE measurement, a voltage connection might affect the hFE reading. Do not connect the test probes to a voltage source during this measurement.
 - You cannot measure the hFE of a transistor that is connected in a circuit.
 - You cannot measure the hFE of an FET or other non-bipolar transistor.
 - Some power Darlington transistors contain an internal base-to-emitter resistor. Because the meter uses two current readings to calculate hFE, any internal transistor resistance causes undependable readings.
 - High-voltage junctions in power transistors prevent correct readings. Also, the larger leads of the power transistor can damage the test socket.
 - Do not try to determine hFE for power transistors with this meter.
 - hFE is affected by temperature. Try not to warm the transistor with your hand when you install the device in the socket. If the hFE reading is not stable when you first measure it, let the transistor's temperature stabilize.
- Warning:** The transistor socket is not protected against overload. You can damage the meter and void your warranty if you build and use external leads for the transistor socket.

MEASURING FREQUENCY

WARNING: IF YOU TRY TO MEASURE THE FREQUENCY OF A SIGNAL THAT EXCEEDS 250 VOLTS AC RMS, YOU MIGHT DAMAGE YOUR METER AND EXPOSE YOURSELF TO A SEVERE SHOCK HAZARD.

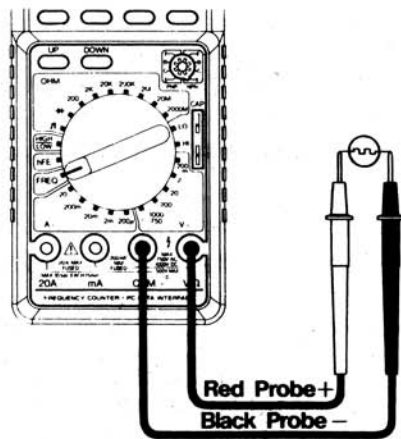
Follow these steps to measure the frequency of a signal.

1. Rotate the function selector to **FREQ.**



2. Plug the black probe into your meter's **COM** terminal and the red probe into your meter's **V/Ω** terminal.

3. Connect the probe to the frequency source.



Notes:

- Input limit voltage: AC 20 V max.
- Input sensitivity:
1 Hz up to 1 MHz – 150 mV rms.
1 MHz up to 20 MHz – 300mV rms.

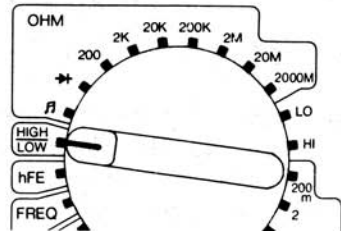
Warning: When you connect the test probes to an AC outlet, do not turn the function selector switch to another range. It could damage the meter's internal components or injure you.

LOGIC TEST

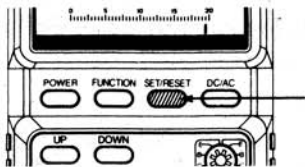
The logic function lets you easily check digital circuits to determine the logic state of different parts of the circuit. Rather than display an absolute voltage, this function displays **HI**, **LO**, or --- to indicate logic high, logic low, or undetermined, respectively.

Follow these steps to perform a logic test.

1. Rotate the function selector to the **HIGH/LOW** logic range.



2. Plug the black probe into your meter's **COM** terminal and the red probe into your meter's **V/ Ω** terminal.
3. Connect the black probe to the ground point (**GND**) of the test circuit and the red probe to the supplying voltage point (**V+**). While keeping the test probes firmly connected to each point, press **SET/RESET**.



4. While keeping a connection between the black probe and the circuit's **GND** point, move the red probe to the other desired points. The meter immediately displays one of the three indications.

- If the measured value exceeds 70% of the stored (**V+**) value, **Hi** (**HIGH**) appears.
- If the measured value falls below 30% of the stored (**V+**) value, **Lo** (**LOW**) appears.
- If the measured value is between 30% and 70% of the stored (**V+**) value, **---** appears.

Notes:

- In this mode, the Data-Hold and Max/Min-Hold functions do not work (see "Using the Advanced Functions").
- The logic level is limited to a voltage range of 0.5 V to 19.9 V.

USING THE ADVANCED FUNCTIONS

USING THE AUTO-HOLD FEATURE



When you first turn on the meter, **A-H** appears in the upper left corner of the display to indicate that the auto-hold feature is turned on. When this feature is turned on, the secondary display shows the reading taken 4 seconds earlier. To turn off this feature, press **FUNCTION** to select one of the other advanced functions.

USING THE DATA HOLD FEATURE



The data hold feature lets you hold a reading on the display.

To turn on the data hold feature, press **FUNCTION** until **D-H** appears at the top of the display. Both the main and secondary displays show the current reading. To hold a reading on the secondary display, press **SET/RESET**. The main display continues to track the current measurement. Press **SET/RESET** to release the measurement and return to the auto-hold function. Or, press **FUNCTION** to select another advanced feature.

USING THE MINIMUM FEATURE



The minimum feature lets you measure the minimum value of a changing reading. To turn on the minimum reading feature, repeatedly press **FUNCTION** until **MIN** appears at the top of the display. Both the main and secondary displays show the current reading. Press **SET/RESET** to activate the minimum feature. The secondary display only updates when the current reading is lower than the previously held reading. The main display continues to track the current measurement. Press **SET/RESET** to release the measurement and return to the auto-hold function. Or, press **FUNCTION** to select another advanced feature.

USING THE MAXIMUM FEATURE



The maximum feature lets you measure the maximum value of a changing reading. To turn on the maximum reading feature, repeatedly press **FUNCTION** until **MAX** appears at the top of the display. Both the main and secondary displays show the current reading. Press **SET/RESET** to activate the maximum feature. The secondary display only updates when the current reading is higher than the previously held reading. The main display continues to track the current measurement. Press **SET/RESET** to release the measurement and return to the auto-hold function. Or, press **FUNCTION** to select another advanced feature.

USING THE RELATIVE MEASUREMENT FEATURE



The relative measurement feature lets you measure values relative to a reference value that you set. For example, you can set a reference voltage and then measure the difference between the actual voltage and the reference voltage. Follow these steps to set a reference value.

1. Repeatedly press **FUNCTION** until **REL** appears at the top of the display.
2. Press **UP** or **DOWN** to set the reference value's polarity. (– appears for negative values.) Press **SET/RESET**.

3. Press **UP** or **DOWN** to set the reference value's first digit. Press **SET/RESET**.

Note: The first digit can be either **1** or nothing. **0** does not appear on the display for the first digit.

Repeat Step 3 for the other three digits. After you enter the last digit, the meter begins making relative measurements. The main display shows the actual measurement. The secondary display shows the difference between the measured value and the reference value.

USING THE COMMUNICATION FEATURE

If you repeatedly press **FUNCTION**, **COM** appears as one of the options on your meter's display. This mode was designed to interface the meter with a computer. However, the software supplied with your meter is able to automatically interface with the meter without using this mode. There is no need to ever select the **COM** mode.

STORING MEASUREMENTS IN MEMORY



Follow these steps to store up to ten measured values in memory for later recall.

1. Select the measurement type and range with the rotary selector.
2. Repeatedly press **FUNCTION** until **MEM** appears at the top of the display.
3. Repeatedly press **UP** or **DOWN** until the secondary display shows the number of the memory you want to store a value in.
4. While making a measurement, press **SET/RESET** to store the current measurement.

RECALLING STORED MEASUREMENTS



Follow these steps to recall a measured value from one of the ten memories.

1. Repeatedly press **FUNCTION** until **RCL** appears at the top of the display.
2. Repeatedly press **UP** or **DOWN** until the memory you want to recall appears in the secondary display.
3. Press **SET/RESET**. The stored value appears in the secondary display.

USING THE COMPARE FUNCTION



The comparison function lets you rapidly compare a voltage measurement to stored high and low reference values. If the measured value is between the reference values, the meter's secondary display shows **PASS**. If the measured value is above (the upper reference) voltage or below the lower reference value, the meter displays **HIGH** or **LOW** respectively.

Follow these steps to set the reference values and begin comparison measurements.

1. Repeatedly press **FUNCTION** until the meter displays **CMP**.

2. Press **UP** or **DOWN** to set the minimum reference value's polarity (– appears for negative values). Then press **SET/RESET**.
3. Press **UP** or **DOWN** to set the minimum reference value's first digit. Then press **SET/RESET**.
Repeat this step for the rest of the minimum reference value's digits.
4. Repeat step 3 to set the maximum reference value.

After you set both reference values, the meter displays the current measurements in the main display and the comparison result (**LO**, **PASS**, or **HIGH**) in the secondary display.

USING THE DUAL MEASUREMENT FEATURE



Your meter can measure and display two different types of measurements at the same time. To set the dual mode, repeatedly press **FUNCTION** until **DUAL** appears at the top of the display.

The meter displays the following dual measurements:

Input Range Selection	Main Display	Secondary Display
AC Voltage	AC Voltage	Frequency
Frequency	Frequency	AC Voltage

Notes:

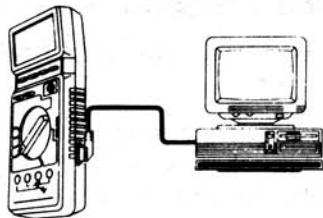
- The meter indicates a frequency measurement on the secondary display when you select the DC/AC A, resistance, diode, or hFE modes and turn on the dual function. This measurement is not valid.
- When you select dual measurement while measuring frequency, the meter selects the 20V AC range for the secondary display. To measure both the voltage and frequency, when the voltage is greater than 20V AC, select AC voltage as the primary measurement.

USING THE METER WITH A COMPUTER

INTERFACING THE METER WITH A COMPUTER

Follow these steps to connect the meter to a computer.

1. Connect the supplied RS-232C cable between the meter's and the computer's serial port, as shown.



2. Press **POWER** to turn on the meter.
3. Turn on the computer.

USING THE SUPPLIED SOFTWARE

We have included two programs to log and display data collected with your meter. The MS-DOS program is called RS, and is in the *GRAPHIC* subdirectory on the supplied diskette. The Windows program is called Scopeview, and is in the *SCOPE* directory on the supplied diskette.

Note: You can not log frequencies on the computer if the voltage exceeds 20V AC.

Using the DOS Software

Follow these steps to install and run the MS-DOS software.

Note: The following steps assume a basic knowledge of MS-DOS commands, and also assume you have a hard disk. Refer to your computer's MS-DOS User's Guide for information about MS-DOS commands. This software requires a VGA monitor.

-
1. Insert the supplied diskette in your computer's 3½-inch drive.
 2. Create a directory on your hard disk for the software. For example, to make a directory called METER for the software, type:

```
cd \<ENTER>  
md METER <ENTER>
```

3. Make the directory you created the current directory. For example, if the directory is METER, type:

```
cd \METER <ENTER>
```

4. Copy the files from the GRAPHIC subdirectory on the floppy drive to your hard disk. For example, type:

```
copy a:\GRAPHIC c:
```

5. To run the program, type RS **<ENTER>**. Follow the on-screen help for specific operating instructions.

Notes:

- If you do not have a hard disk, you can still run the program from the supplied floppy diskette. Change to the GRAPHIC subdirectory on the diskette, and type RS **<ENTER>**.
- To stop the program or to escape from a device I/O error, press **<CTRL+BREAK>**.

Using the Windows Software

Follow these steps to install and run the Windows software.

Note: The following steps assume a basic knowledge of Microsoft Windows. Refer to your computer's Windows User's Guide for information about using Windows. This software requires Microsoft Windows, Version 3.1 or later and a VGA or EGA display.

1. Start your computer and run Windows.
2. Insert the supplied diskette in your computer's 3½-inch drive.

-
3. From the Windows Program Manager, pull down the FILE menu and select the RUN option.
 4. At the prompt, type:
a: \scope\setup <ENTER> (If you placed the diskette in Drive A)
or
b: \scope\setup <ENTER> (If you placed the diskette in Drive B)
 5. Follow the on-screen prompts to complete the installation.
 6. To run the program, double-click the SCOPE-VIEW icon. Follow the on-screen help for specific operating instructions.

Also, refer to the **README** file in the diskette's **SCOPE** subdirectory for operation hints.

TECHNICAL INFORMATION

You need the following information if you are writing your own interface software.

Communication parameters

- Transmission rate: 1200 baud
- Character coding: 7-bit ASCII
- Parity: None
- Stop Bits: 2

Data Format

The data format consists of a frame of 14 bytes. The frames are set as follows:

BYTE)	1	2	3	4	5	6	7	8	9	A	B	C	D	E
Example 1)	D	C	-	1	.	9	9	9	V					CR
Example 2)					1	.	9	9	9	M	o	h	m	CR

HINTS FOR WRITING YOUR OWN SOFTWARE

If you write your own program, the host computer must give the meter the D command to activate data transmission.

The following program is an example of a BASIC program that gets a single reading from the meter:

```
10 OPEN "COM1 : 1200, N, 7, 2, RS, CS,  
    DS, CD" AS #2  
20 A$ = "D"  
30 PRINT #2, A$  
40 IN$ = INPUT$(14, #2)  
50 PRINT IN$  
60 CLOSE #2  
70 END
```

REPLACING THE FUSE

WARNING: TO AVOID ELECTRIC SHOCK, DISCONNECT THE TEST PROBES BEFORE REMOVING THE BATTERY OR THE FUSE. REPLACE ONLY WITH THE SAME TYPE OF BATTERY OR FUSE. SERVICE SHOULD BE PERFORMED ONLY BY QUALIFIED PERSONNEL.

CAUTION: For continued protection against fire or other hazard, replace only with a fuse of the specified voltage and current ratings.

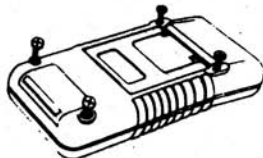
F 1—Radio Shack Cat. No. 270—1052

F 2—Radio Shack Cat. No. 270—1041

Follow these steps to replace the fuse.

1. Turn off the meter and disconnect the test probes.

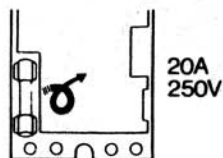
2. Remove the cover by unscrewing the four screws and pulling off the meter's cover.



3. Remove the blown fuse.



F 1



F 2

4. Install the new fuse in the fuse compartment.
5. Replace the cover and secure it with the screws.

WARNING: DO NOT OPERATE YOUR METER UNTIL THE BACK COVER IS IN PLACE AND FULLY CLOSED.

CARE AND MAINTENANCE

Your Radio Shack LCD Digital Multimeter is an example of superior design and craftsmanship. The following suggestions will help you care for your meter so you can enjoy it for years.



Keep your meter dry. If it gets wet, wipe it dry immediately. Liquids might contain minerals that can corrode the electronic circuits.



Use and store your meter only in normal temperature environments. Extreme temperatures can shorten the life of electronic devices, damage batteries, and distort or melt plastic parts.



Handle your meter gently and carefully. Dropping it can damage circuit boards and cases and can cause the meter to work improperly.



Keep your meter away from dust and dirt, which can cause premature wear of parts.



Wipe your meter with a damp cloth occasionally to keep it looking new. Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the meter.



Use only a fresh battery of the recommended size and type. Always remove an old or weak battery. It can leak chemicals that destroy electronic circuits.

Modifying or tampering with your meter's internal components can cause a malfunction and might invalidate its warranty and void your FCC authorization to operate it. If your meter is not performing as it should, take it to your local Radio Shack store for assistance.

FCC STATEMENT

This meter complies with the limits for a Class B digital device as specified in Part 15 of *FCC Rules*. These limits provide reasonable protection against radio and TV interference in a residential area. However, your meter might cause TV or radio interference even when it is operating properly. To eliminate interference, increase the distance between the meter and the radio or TV.

Consult your local Radio Shack store or an experienced radio/TV technician if the problem still exists.

RADIO SHACK LIMITED WARRANTY

This product is warranted against defects for 90 days from date of purchase from Radio Shack company-owned stores and authorized Radio Shack franchisees and dealers. Within this period, we will repair it without charge for parts and labor. Simply **bring your Radio Shack sales slip** as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover a product subjected to misuse or accidental damage.

EXCEPT AS PROVIDED HEREIN, RADIO SHACK MAKES NO EXPRESS WARRANTIES AND ANY IMPLIED WARRANTIES ARE LIMITED IN DURATION TO THE DURATION OF THE WRITTEN LIMITED WARRANTIES CONTAINED HEREIN. Some states do not permit limitation or exclusion of implied warranties; therefore, the aforesaid limitation(s) or exclusion(s) may not apply to the purchaser.

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

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