

Autoranging True RMS Multimeter User Manual



**Please read this manual before switching the unit on.
Important safety information inside.**

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1. Safety Information

The following safety information must be observed to insure maximum personal safety during the operation at this meter:

- Do not use the meter if the meter or test leads look damaged, or if you suspect that the meter is not operating properly.
- Never ground yourself when taking electrical measurements. Do not touch exposed metal pipes, outlets, fixtures, etc., which might be at ground potential. Keep your body isolated from ground by using dry clothing, rubber shoes, rubber mats, or any approved insulating material.
- Turn off power to the circuit under test before cutting, unsoldering, or breaking the circuit. Small amounts of current can be dangerous.
- Use caution when working above 60V dc or 30V ac rms. such voltages pose a shock hazard.
- When using the probes, keep your fingers behind the finger guards on the probes.
- Measuring voltage which exceeds the limits of the multimeter may damage the meter and expose the operator to a shock hazard. Always recognize the meter voltage limits as stated on the front of the meter.
- Never apply voltage or current to the meter that exceeds the specified maximum:

| Input Limits | |
|---|--|
| Function | Maximum Input |
| V DC or V AC | 600VDC, 600V AC |
| mA DC/AC | 400mA DC/AC |
| A DC/AC | 10A DC/AC (30 seconds max every 15 minutes) |
| Frequency, Resistance, Capacitance, Duty Cycle, Diode test, Continuity | 250V DC/AC |
| Temperature | 250V DC/AC |

2. Safety Symbols



- This symbol adjacent to another symbol, terminal or operating device indicates that the operator must refer to an explanation in the Operating Instructions to avoid personal injury or damage to the meter.

WARNING

- This **WARNING** symbol indicates a potentially hazardous situation, which if not avoided, could result in death or serious injury.

CAUTION

- This **CAUTION** symbol indicates a potentially hazardous situation, which if not avoided, may result damage to the product.



- This symbol advises the user that the terminal(s) so marked must not be connected to a circuit point at which the voltage with respect to earth ground exceeds (in this case) 500 VAC or VDC.



- This symbol adjacent to one or more terminals identifies them as being associated with ranges that may, in normal use, be subjected to particularly hazardous voltages. For maximum safety, the meter and its test leads should not be handled when these terminals are energized.

3. Controls And Jacks

- 1-4000 count Liquid Crystal Display with symbolic signs
- 2-Function switch
- 3-10A (positive) input jack for 10A DC or AC measurements
- 4-COM (negative) input jack
- 5-Positive input jack
- 6-MODE pushbutton
- 7-Range pushbutton
- 8-Data Hold/Back Light pushbutton
- 9-Relative pushbutton
- 10-Battery Cover



4. Symbols And Annunciators

-)) Continuity
- BAT Low Battery
- + Diode
- DATA HOLD Data Hold
- AUTO AutoRanging
- AC Alternating Current or Voltage
- DC Direct Current or Voltage

5. Specifications

| | |
|--------------------------------------|--|
| The instrument complies with: | EN61010-1. |
| Insulation: | Class2, Double insulation. |
| Overvoltage category: | CATIII 600V. |
| Display: | 4000 counts LCD display with function indication. |
| Polarity: | Automatic, (-) negative polarity indication. |
| Overrange: | "OL" mark indication. |
| Low battery indication: | The "BAT" is displayed when the battery voltage drops below the operating level. |
| Measurement rate: | 2 times per second, nominal. |
| Auto power off: | Meter automatically shuts down after approx. 30 minutes of inactivity. |
| Operating environment: | 0 °C to 50 °C (32 °F to 122 °F) at < 70 % relative humidity. |
| Storage temperature: | -20 °C to 60 °C (-4 °F to 140 °F) at < 80 % relative humidity. |
| For inside use, max height: | 2000m |
| Pollution degree: | 2 |
| Power: | One 9V battery , NEDA 1604, IEC 6F22. |
| Dimensions: | 138 (H) x 68 (W) x 37 (D) mm |
| Weight: Approx.: | 210g. |

Accuracy is given at 18 °C to 28 °C (65 °F to 83 °F), less than 70 % RH

DC Voltage (Auto-ranging)

| Range | Resolution | Accuracy |
|---------|------------|---------------------------------|
| 400.0mV | 0.1mV | $\pm 0.5\%$ of rdg ± 2 dgts |
| 4.000V | 1mV | $\pm 1.2\%$ of rdg ± 2 dgts |
| 40.00V | 10mV | |
| 400.0V | 100mV | |
| 600V | 1V | $\pm 1.5\%$ of rdg ± 2 dgts |

Input Impedance: 7.8M Ω .

Maximum Input: 600V dc or 600V ac rms.

AC Voltage (Auto-ranging except 400mV)

| Range | Resolution | Accuracy |
|--|------------|----------------------------------|
| 400.0mV | 0.1mV | $\pm 1.5\%$ of rdg ± 40 dgts |
| 4.000V | 1mV | $\pm 1.2\%$ of rdg ± 8 dgts |
| 40.00V | 10mV | $\pm 1.5\%$ of rdg ± 8 dgts |
| 400.0V | 100mV | |
| 600V | 1V | $\pm 2.0\%$ of rdg ± 8 dgts |
| All AC Voltage ranges are specified from | | 5% of range to 100% of range |

Input Impedance: 7.8M Ω .

Frequency Range: 50 to 400Hz

Maximum Input: 600V dc or 600V ac rms.

DC Current (Auto-ranging for μ A and mA)

| Range | Resolution | Accuracy |
|---------------|-------------|---------------------------------|
| 400.0 μ A | 0.1 μ A | $\pm 1.0\%$ of rdg ± 3 dgts |
| 4000 μ A | 1 μ A | $\pm 1.5\%$ of rdg ± 3 dgts |
| 40.00mA | 10 μ A | |
| 400.0mA | 100 μ A | |
| 10A | 10mA | $\pm 2.5\%$ of rdg ± 5 dgts |

Overload Protection: 0.5A / 250V and 10A / 250V Fuse.

Maximum Input: 400mA dc or 400mA ac rms on μ A / mA ranges, 10A dc or ac rms on 10A range.

AC Current (Auto-ranging for uA and mA)

| Range | Resolution | Accuracy |
|---|------------|---------------------------------|
| 400.0uA | 0.1uA | $\pm 1.5\%$ of rdg ± 8 dgts |
| 4000uA | 1uA | $\pm 1.8\%$ of rdg ± 8 dgts |
| 40.00mA | 10uA | |
| 400.0mA | 100uA | |
| 10A | 10mA | $\pm 3.0\%$ of rdg ± 7 dgts |
| All AC Voltage ranges are specified from 5% of range to 100% of range | | |

Overload Protection: 0.5A / 250V and 10A / 250V Fuse.

Frequency Range: 50 to 400 Hz

Maximum Input: 400mA dc or 400mA ac rms on uA / mA ranges, 10A dc or ac rms on 10A range.

Resistance (Auto-ranging)

| Range | Resolution | Accuracy |
|-----------------|--------------|---------------------------------|
| 400.0 Ω | 0.1 Ω | $\pm 1.2\%$ of rdg ± 4 dgts |
| 4.000k Ω | 1 Ω | $\pm 1.0\%$ of rdg ± 2 dgts |
| 40.00k Ω | 10 Ω | $\pm 1.2\%$ of rdg ± 2 dgts |
| 400.0k Ω | 100 Ω | |
| 4.000M Ω | 1k Ω | |
| 40.00M Ω | 10k Ω | $\pm 2.0\%$ of rdg ± 3 dgts |

Input Protection: 250V dc or 250V ac rms.

Capacitance (Auto-ranging)

| Range | Resolution | Accuracy |
|---------|------------|---------------------------------|
| 40.00nF | 10pF | $\pm 5.0\%$ of rdg ± 7 dgts |
| 400.0nF | 0.1nF | $\pm 3.0\%$ of rdg ± 5 dgts |
| 4.000uF | 1nF | |
| 40.00uF | 10nF | |
| 100.0uF | 0.1uF | $\pm 5.0\%$ of rdg ± 5 dgts |

Input Protection: 250V dc or 250V ac rms.

Frequency (Auto-ranging)

| Range | Resolution | Accuracy |
|----------|------------|-----------------------|
| 5.000Hz | 0.001Hz | ±1.5% of rdg ± 5 dgts |
| 50.00Hz | 0.01Hz | |
| 500.0Hz | 0.1Hz | ±1.2% of rdg ± 3 dgts |
| 5.000kHz | 1Hz | |
| 50.00kHz | 10Hz | |
| 500.0kHz | 100Hz | |
| 5.000MHz | 1kHz | ±1.5% of rdg ± 4 dgts |
| 10MHz | 10kHz | |

Sensitivity: >8V RMS

Overload protection: 250V dc or ac rms.

Duty Cycle

| Range | Resolution | Accuracy |
|------------|------------|-----------------------|
| 0.1%~99.9% | 0.1% | ±1.2% of rdg ± 2 dgts |

Pulse width: >100us, <100ms;

Frequency width: 5Hz – 150kHz

Sensitivity: >8V RMS

Overload protection: 250V dc or ac rms.

Temperature

| Range | Resolution | Accuracy |
|--------------|------------|------------|
| -20°C~+760°C | 1°C | ±3% of rdg |
| -4°F~+1400°F | 1°F | ±5°C/9°F |

Sensor: Type K Thermocouple

Overload protection: 250V dc or ac rms..

Diode Test

| Test current | Resolution | Accuracy |
|---------------|------------|--------------------------------|
| 0.3mA typical | 1 mV | $\pm 10\%$ of rdg ± 5 dgts |

Open circuit voltage: 1.5V dc typical

Overload protection: 250V dc or ac rms.

Audible continuity

Audible threshold: Less than 150 Ω Test current: <0.3mA

Overload protection: 250V dc or ac rms.

6. Operation

WARNING: Risk of electrocution. High-voltage circuits, both AC and DC, are very dangerous and should be measured with great care.

- ALWAYS turn the function switch to the OFF position when the meter is not in use. This meter has Auto OFF that automatically shuts the meter OFF if 30minutes elapse between uses.
- If "OL" appears in the display during a measurement, the value exceeds the range you have selected. Change to a higher range.

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

MODE BUTTON

To select Ohm/Diode/Continuity/Cap , DC/AC, Hz/%Duty

RANGE BUTTON

When the meter is first turned on, it automatically goes into AutoRanging. This automatically selects the best range for the measurements being made and is generally the best mode for most measurements. For measurement situations requiring that a range be manually selected, perform the following:

- Press the RANGE button. The "AUTO" display indicator will turn off.
- Press the RANGE button to step through the available ranges until you select the range you want.


- Press and hold the RANGE button for 2 seconds to exit the ManualRanging mode and return to AutoRanging.

DATA HOLD BUTTON

The Data Hold function allows the meter to "freeze" a measurement for later reference.

- Press the DATA HOLD button to "freeze" the reading on the indicator. The indicator "HOLD" will be appear in the display.
- Press the DATA HOLD button to return to normal operation.

BACKLIGHT

Press and hold the HOLD  key for >1 second to turn on or off the display backlight function.

Note: The HOLD feature will activate when the Backlight is turned on. Press the HOLD key again to exit Hold.

RELATIVE BUTTON

The relative measurement feature allows you to make measurements relative to a stored reference value. A reference voltage, current, etc. can be stored and measurements made in comparison to that value. The displayed value is the difference between the reference value and the measured value.

- Perform any measurement as described in the operating instructions.
- Press the RELATIVE button to store the reading in the display and the "REL" indicator will appear on the display.
- The display will now indicate the difference between the stored value and the measured value.
- Press the RELATIVE button to return to normal operation.

6-1. Non-Contact AC Voltage Measurements

WARNING: Risk of Electrocution. Before use, always test the Voltage Detector on a known live circuit to verify proper operation

- Touch the probe tip to the hot conductor or insert into the hot side of the electrical outlet.
- If AC voltage is present, the detector light will illuminate.

NOTE: The conductors in electrical cord sets are often twisted. For best results, rub the probe tip along a length of the cord to assure placing the tip in close proximity to the live conductor.

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

6-2. DC Voltage Measurements

CAUTION: Do not measure DC voltages if a motor on the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

- Set the function switch to the V DC position .
- Insert the black test lead banana plug into the negative (COM) jack and the red test lead banana plug into the positive (V) jack.
- Touch the test probe tips to the circuit under test. Be sure to observe the correct polarity (red lead to positive, black lead to negative).
- Read the voltage in the display. The display will indicate the proper decimal point and value. If the polarity is reversed, the display will show (-) minus before the value.

6-3. AC Voltage Measurements

WARNING: Risk of Electrocution. The probe tips may not be long enough to contact the live parts inside some 240V outlets for appliances because the contacts are recessed deep in the outlets. As a result, the reading may show 0 volts when the outlet actually has voltage on it. Make sure the probe tips are touching the metal contacts inside the outlet before assuming that no voltage is present.

CAUTION: Do not measure AC voltages if a motor on the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

- Set the function switch to the V AC position.
- Insert the black test lead banana plug into the negative (COM) jack and the red test lead banana plug into the positive (V) jack.
- Touch the test probe tips to the circuit under test.
- Read the voltage in the display. The display will indicate the proper decimal point, value and symbol (AC, V, etc.).

6-4. DC Current Measurements

CAUTION: Do not make current measurements on the 10A scale for longer than 30 seconds. Exceeding 30 seconds may cause damage to the meter and/or the test leads.

- Insert the black test lead banana plug into the negative (COM) jack.
- For current measurements up to 4000 μ A DC, set the function switch to the μ A position and insert the red test lead banana plug into the (μ A) jack.
- For current measurements up to 400mA DC, set the function switch to the mA range and insert the red test lead banana plug into the (mA) jack.
- For current measurements up to 10A DC, set the function switch to the A position and insert the red test lead banana plug into the 10A jack.
- Press the AC/DC button until "DC" appears in the display.
- Remove power from the circuit under test, then open up the circuit at the point where you wish to measure current.
- Touch the black test probe tip to the negative side of the circuit. Touch the red test probe tip to the positive side of the circuit.
- Apply power to the circuit.
- Read the current in the display. The display will indicate the proper decimal point, value and symbol.

6-5. AC Current Measurements

WARNING: To avoid electric shock, do not measure AC current on any circuit whose voltage exceeds 250V AC.

CAUTION: Do not make current measurements on the 10A scale for longer than 30 seconds. Exceeding 30 seconds may cause damage to the meter and/or the test leads.

- Insert the black test lead banana plug into the negative (COM) jack.
- For current measurements up to 4000uA AC, set the function switch to the uA position and insert the red test lead banana plug into the (uA) jack.
- For current measurements up to 400mA AC, set the function switch to the mA range and insert the red test lead banana plug into the (mA) jack.
- For current measurements up to 10A AC, set the function switch to the A position and insert the red test lead banana plug into the 10A jack.
- Press the AC/DC button until “AC” appears in the display.
- Remove power from the circuit under test, then open up the circuit at the point where you wish to measure current.
- Touch the black test probe tip to the negative side of the circuit. And touch the red test probe tip to the positive side of the circuit.
- Apply power to the circuit.
- Read the current in the display. The display will indicate the proper decimal point, value and symbol.

6-6. Resistance Measurements

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

- Set the function switch to the Ω \rightarrow \rightarrow \rightarrow cap position.
- Insert the black test lead banana plug into the negative (COM) jack and the red test lead banana plug into the positive Ω jack.
- Touch the test probe tips across the circuit or part under test. It is best to disconnect one side of the part under test so the rest of the circuit will not interfere with the resistance reading.
- Read the resistance in the display. The display will indicate the proper decimal point, value and symbol.

6-7. Continuity Check

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

- Set the function switch to the $\Omega \rightarrow \text{+} \rightarrow \text{)}\text{)$ cap position.
- Insert the black lead banana plug into the negative (-) jack (COM) and the red test lead banana plug into the positive (+) jack (Ω).
- Press the MODE button until the $\text{)}\text{)$ symbol appears in the display.
- Touch the test probe tips to the circuit or wire you wish to check.
- If the resistance is less than approximately 150Ω , the audible signal will sound. The display will also show the actual resistance.

6-8. Diode Test

WARNING: To avoid electric shock, do not test any diode that has voltage on it.

- Set the function switch to $\Omega \rightarrow \text{+} \rightarrow \text{)}\text{)$ cap position.
- Press the MODE button until the $\rightarrow \text{+}$ symbol appears in the display.
- Insert the black test lead banana plug into the negative (-) jack (COM) and the red test lead banana plug into the positive (+) jack (Ω).
- Touch the test probe tips to the diode or semiconductor junction you wish to test. Note the meter reading
- Reverse the probe polarity by switching probe position. Note this reading.
- The diode or junction can be evaluated as follows:
 - A. If one reading shows a value and the other reading shows OL, the diode is good.
 - B. If both readings show OL, the device is open.
 - C. If both readings are very small or 0, the device is shorted.

NOTE: The value indicated in the display during the diode check is the forward voltage.

6-9. Frequency Measurement

- Set the function switch to the FREQ position.
- Insert the black test lead banana plug into the negative (-) jack (COM) and the red test lead banana plug into the positive (+) jack (F).
- Touch the test probe tips to the circuit under test.
- Read the frequency in the display. The digital reading will indicate the proper decimal point, symbols (Hz, kHz) and value.

6-10. Capacitance Measurements

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

- Set the function switch to the $\Omega \rightarrow \text{CAP}$ position. ("nF" and a small value will appear in the display).
- Insert the black test lead banana plug into the negative (-) jack (COM) and the red test lead banana plug into the positive (+) jack (CAP).
- Touch the test leads to the capacitor to be tested. The display will indicate the proper decimal point, value and symbol.

6-11. Temperature Measurements

WARNING: To avoid electric shock, disconnect both test probes from any source of voltage before making a temperature measurement.

- Set the function switch to TEMP.
- Insert the type K thermocouple probe black test lead banana plug into the negative COM jack and the red test lead banana plug into the positive Temp jack.
- Touch the Temperature Probe head to the part whose temperature you wish to measure. Keep the probe touching the part under test until the reading stabilizes (about 30 seconds).
- Read the temperature in the display. The digital reading will indicate the proper decimal point and value.
- When setting "Celsius" or "Fahrenheit" into initial state, please remove the battery cover and slip the "°C/°F" switch to the corresponding position.

WARNING: To avoid electric shock, be sure the thermocouple has been removed before changing to another measurement function.

7. Replacing The Battery

WARNING: To avoid electric shock, disconnect the test leads from any source of voltage before removing the battery door.

- When the batteries become exhausted or drop below the operating voltage, "BAT" will appear in the right-hand side of the LCD display. The battery should be replaced.
- Follow instructions for installing battery. See the Battery Installation section of this manual.

- Dispose of the old battery properly.

WARNING: To avoid electric shock, do not operate your meter until the battery door is in place and fastened securely.

8. Battery Installation

WARNING: To avoid electric shock, disconnect the test leads from any source of voltage before removing the battery door.

- Disconnect the test leads from the meter.
- Open the battery door by loosening the screw using a Phillips head screwdriver.
- Insert the battery into battery holder, observing the correct polarity.
- Put the battery door back in place. Secure with the two screws.

WARNING: To avoid electric shock, do not operate the meter until the battery door is in place and fastened securely.

NOTE: If your meter does not work properly, check the fuses and battery to make sure that they are still good and that they are properly inserted.

9. Replacing The Fuses

WARNING: To avoid electric shock, disconnect the test leads from any source of voltage before removing the fuse door.

- Disconnect the test leads from the meter and any item under test.
- Open the fuse door by loosening the screw on the door using a Phillips head screwdriver.
- Remove the old fuse from its holder by gently pulling it out.
- Install the new fuse into the holder.
- Always use a fuse of the proper size and value (0.5A/250V fast blow for the 400mA range, 10A/250V fast blow for the 10A range).
- Put the fuse door back in place. Insert the screw and tighten it securely.

WARNING: To avoid electric shock, do not operate your meter until the fuse door is in place and fastened securely.

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