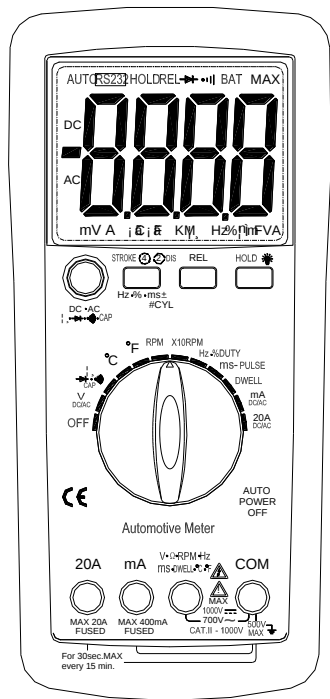


OPERATING INSTRUCTION

AUTOMOTIVE MULTIMETER



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	1000V DC, 700V AC
mA DC/AC	400mA DC/AC
A DC/AC	20A DC/AC (30 seconds max every 15 minutes)
Frequency, Resistance, Capacitance, Duty Cycle, Diode test, Continuity Temperature RPM,DWELL, Pulse width	250V DC/AC

SAFETY SYMBOLS



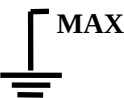
This symbol adjacent to another symbol, terminal or operating device indicates that the operator must refer to an explanation in the Operating Instructions to avoid personal injury or damage to the meter.



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



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



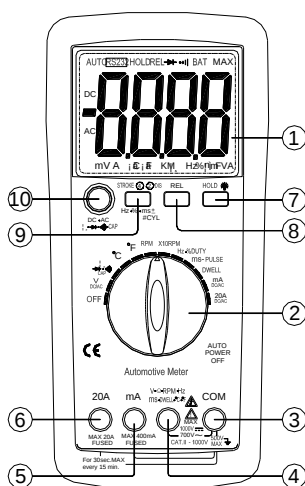
This symbol advises the user that the terminal(s) so marked must not be connected to a circuit point at which the voltage with respect to earth ground exceeds (in this case) 500 VAC



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.

CONTROLS AND JACKS



1. Large 4000 count Liquid Crystal Display with symbolic signs.
2. Function switch
3. Positive (+) input jack for DC/AC Voltage, current, Hz/ %duty cycle, Ohms, Diode, Continuity, Capacitance, Temperature (°C or °F) measurements ,RPM, DWELL, Pulse width
4. COM (negative) input jack.
5. (positive) input jack for DC/AC μ A/mA
6. 20A (positive) input jack for 20A DC or AC measurements.
7. Data Hold and backlight pushbutton .
8. Relative pushbutton.
9. RPM, DWELL, Hz/%, mS+/_ button.
10. Mode pushbutton..

SYMBOLS AND ANNUNCIATORS

-)) Continuity
- BAT Low Battery
- ➔ Diode

DATA HOLD Data Hold

- AUTO AutoRanging
- AC Alternating Current or Voltage
- DC Direct Current or Voltage

SPECIFICATIONS

The instrument complies with: IEC 1010-1
EN61010-1.

Insulation: Class2, Double insulation.

Overvoltage category: CATII 1000V.

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: 146 (H) x 66.2 (W) x 41.5 (D) mm

Weight: Approx.: 200g.

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

RPM (Tach)

Range		Resolution	Accuracy
RPM 4	600~4000 RPM	1 RPM	± 2 % of rdg ± 4 dgts
	600~12000 RPM (X10 RPM)	10 RPM	
RPM 2	300~4000 RPM	1 RPM	

	300~6000 RPM (X10 RPM)	10 RPM	
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Effect Reading: >600 RPM

Overload protection: 250V dc or ac rms.

DEWLL ANGLE

Cylinder	Range	Resolution	Accuracy
4CYL	0~90.0°	0.1°	±2.0% of rdg ± 4 dgts
5CYL	0~72.0°		
6CYL	0~60.0°		
8CYL	0~45.0°		

Overload protection: 250V dc or ac rms.

DC Voltage (Auto-ranging)

Range	Resolution	Accuracy
400.0mV	0.1mV	±0.5% of rdg ± 2 dgts
4.000V	1mV	±1.5% of rdg ± 2 dgts
40.00V	10mV	
400.0V	100mV	
1000V	1V	±1.8% of rdg ± 2 dgts

Input Impedance: 10MΩ.

Maximum Input: 1000V dc or 700V ac rms.

AC Voltage (Auto-ranging except 400mV)

Range	Resolution	Accuracy
400.0mV	0.1mV	±1.5% of rdg ± 30 dgts
4.000V	1mV	±1.0% of rdg ± 3 dgts
40.00V	10mV	±1.5% of rdg ± 3 dgts
400.0V	100mV	
700V	1V	±2.0% of rdg ± 4 dgts

Input Impedance: 10MΩ.

Frequency Range: 50 to 400Hz

Maximum Input: 1000V dc or 700V ac rms.

DC Current (Auto-ranging for mA and A)

Range	Resolution	Accuracy
40.00mA	10uA	±1.5% of rdg ± 3 dgts
400.0mA	100uA	
4A	1mA	±2.5% of rdg ± 5 dgts
20A	10mA	

Overload Protection: 0.5A / 250V and 20A / 250V

Fuse.

Maximum Input: 400mA dc or 400mA ac rms on mA ranges, 20A dc or ac rms on 20A range.

AC Current (Auto-ranging for mA and A)

Range	Resolution	Accuracy
40.00mA	10uA	±1.8% of rdg ± 5 dgts
400.0mA	100uA	
4A	1mA	±3.0% of rdg ± 7 dgts
20A	10mA	

Overload Protection: 0.5A / 250V and 20A / 250V

Fuse.

Frequency Range: 50 to 400 Hz

Maximum Input: 400mA dc or 400mA ac rms on mA ranges, 20A dc or ac rms on 20A range.

Resistance (Auto-ranging)

Range	Resolution	Accuracy
400.0Ω	0.1Ω	±1.2% of rdg ± 4 dgts
4.000kΩ	1Ω	±1.0% of rdg ± 2 dgts
40.00kΩ	10Ω	±1.2% of rdg ± 2 dgts
400.0kΩ	100Ω	
4.000MΩ	1kΩ	
40.00MΩ	10kΩ	±2.0% of rdg ± 3 dgts

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

Capacitance (Auto-ranging)

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

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

Frequency (Auto-ranging)

Range	Resolution	Accuracy
5Hz	0.001Hz	±1.5% of rdg ± 5 dgts
50Hz	0.01Hz	
500Hz	0.1Hz	±1.2% of rdg ± 3 dgts
5kHz	1Hz	
50kHz	10Hz	
500kHz	100Hz	
10MHz	1kHz	±1.5% of rdg ± 4 dgts

Sensitivity: <0.5V RMS while ≤1MHz ;

Sensitivity: >3V RMS while >1MHz ;

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: <0.5V RMS

Overload protection: 250V dc or ac rms.

Pulse Width

Range	Resolution	Accuracy
1.0~10.0ms	0.1ms	±3% of rdg ± 10 dgts

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	±3dgts (Meter only, probe accuracy not included)
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Sensor: Type K Thermocouple

Diode Test

Test current	Resolution	Accuracy
0.3mA typical	1 mV	±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 150Ω; Test current:
<0.3mA

Overload protection: 250V dc or ac rms.

OPERATION

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

1. 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 30 minutes elapse between uses.
2. 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 DC/AC Voltage, DC/AC Current, Resistance, Diode, continuity and Capacitance check.

STROKE 4/2(DIS) Hz.% ms CYL BUTTON

To select STROKE 4/2(DIS) Hz.% ms CYL range

DATA HOLD / BACKLIGHT BUTTON

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

1. Press the DATA HOLD button to "freeze" the reading on the indicator. The indicator "HOLD" will be appear in

the display.

2. Press the DATA HOLD button to return to normal operation.
3. If Press the BACKLIGHT button 2 seconds the display light ON
4. Press BACKLIGHT button 2 seconds again to exit the light mode.

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.

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

AC or DC Voltage Measurements

1. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive **V** jack.
2. Turn the rotary switch to the **VDC/AC** position.
3. Press the **MODE** button to select AC or DC Voltage
4. Touch the test probes to the circuit under test and read the voltage on the display.

Note: Pressing the **Hz/%** button while in the voltage function will switch the display to frequency or duty cycle

AC or DC Current Measurements

CAUTION: Do not make current measurements on the 20A scale for longer than 30 seconds every 15 minutes. Exceeding 30 seconds may cause damage to the meter and/or the test leads.

1. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the;
 - a. Positive **uA/mA** jack for currents to 400mA

- b. Positive **20A** jack for currents to 20A
2. Turn the rotary switch to the uA, mA or A position.
3. Press the **MODE** button to select AC or DC current
4. Touch the test probes in series with the circuit under test and read the current on the display.

Resistance or Diode or Continuity or Capacitance Measurements

WARNING: To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any resistance or capacitance measurements.

1. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive Ω   **CAP** jack.
2. Turn the rotary switch to the Ω   **CAP** position.
4. Press the **MODE** button to select Ω or  or  or **CAP**
5. connect the test probes to the two ends of the Resistance, Diode, Continuity and Capacitance or circuit to be measured.
6. Read the measured value from the LCD display
7. When on the continuity range, a beeping sound shall be heard if the resistance is lower than 150 Ω
8. When measuring the forward voltage across diode a normal diode will indicate 0.4V or 0.7V and the reverse voltage will indicate "OL" (same as on open condition). For a short-circuited diode, a value 0 mV will be display.

When checking in-circuit capacitance, be sure that the circuit has all power removed and all capacitor are fully discharged. The range control mode in capacitance measurement is auto- ranging.

Frequency or Duty Cycle Measurements

1. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive **HZ** jack.
 2. Turn the rotary switch to the **HZ %duty** position.
 3. Press the **HZ/%** button to select "**HZ**" or "%".
- Touch the test probes to the circuit or under test and read the frequency or duty cycle on the display.

Temperature Measurements

1. 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 + jack..
2. Turn the rotary switch to the select °C or °F.
3. Read the temperature on the display

Pulse Width Measurements

1. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive + jack.
2. Turn the rotary switch to the **Pulse Width** position.
3. Connect the back test probe to ground and connect the red test probe to the signal wire that connects to the component to be measured

Note : the applied time for most fuel injectors is displayed on the negative (-) slope

RPM (TACH) Measurements

1. Select the RPM range with the rotary switch
 2. Select the X10 RPM range with rotary switch (1,000 to 12,000 RPM). Multiply the displayed reading times by ten to get actual RPM
 3. Press STROKE 4/2 (DIS) button toward select through RPM 4 for 4-stroke, RPM 2 For 2-stroke and DIS
- The wire connection diagram please ref. Fig.4.
4. Insert the inductive pickup connecting terminal into the meter
 5. Ground lead in COM terminal.
 6. output lead in RPM terminal.
 7. connect the inductive pickup to a spark plug wire. If no reading is received ,unhook the clamp, turn it over and connect again.

Note:

- position the inductive pick-up as far away from the distributor and the exhaust manifold as possible.
- Position the inductive pick-up to within six inches of the spark plug or move it to another plug wire if no reading or an erratic reading is received

- **RPM4:** For RPM of 4-stroke engines which have 1 ignition on every 4 engine strokes
- **RPM2:** For RPM of DIS (Distributorless Ignition System) & 2-stroke engines which Have 1 ignition on every 2 engine strokes

DWELL ANGLE Measurement

1. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the positive + jack.
2. Turn the rotary switch to the corresponding position of **4CYL, 5CYL, 6CYL, 8CYL** on the “DWELL” range.
3. Connect red test probe into “**breaker points**” or “-” terminal of battery.
4. Crank engine. The display will show RPM reading.

REPLACING THE BATTERY

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

1. 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.
2. Follow instructions for installing battery. See the Battery Installation section of this manual.
3. 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.

BATTERY INSTALLATION

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

1. Disconnect the test leads from the meter.
2. Open the battery door by loosening the screw using a Phillips head screwdriver.
3. Insert the battery into battery holder, observing the correct polarity.
4. 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.

REPLACING THE FUSES

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

1. Disconnect the test leads from the meter and any item under test.
2. Open the fuse door by loosening the screw on the door using a Phillips head screwdriver.
3. Remove the old fuse from its holder by gently pulling it out.
3. Install the new fuse into the holder.
4. Always use a fuse of the proper size and value (0.5A/250V fast blow for the 400mA range, 20A/250V fast blow for the 20A range).
1. 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.