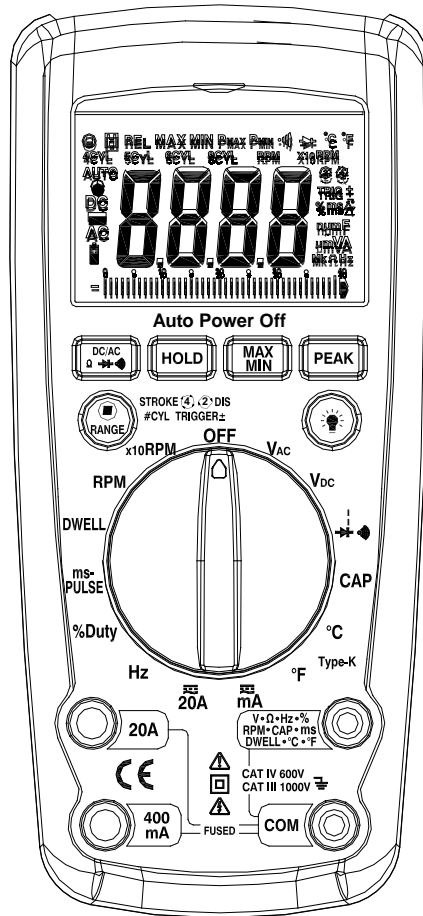


DM-930 AUTOMOTIVE MULTIMETER INSTRUCTION MANUAL



Safety

DANGER

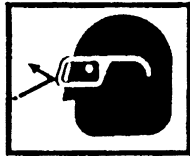
- Engines produce carbon monoxide which is odorless, can cause slower reaction time and can lead to serious injury. When the engine is operating, always keep service areas WELL VENTILATED or attach the vehicle exhaust system to the shop exhaust removal system.



- Set the parking brake and block the wheels before testing or repairing the vehicle. It is especially important to block the wheels on front-wheel drive vehicles; the parking brake does not hold the drive wheels.



- Wear an eye shield when testing or repairing vehicles.



Exceeding the limits of this meter is dangerous. This may expose you to serious or possibly fatal injury. Carefully read and understand the cautions and the specification limits of this meter.

- Voltage between any terminal and ground must not exceed 600V DC or 600V AC.
- Use caution when measuring voltage above 25VDC or 25VAC.
- Circuit tested must be protected by a 20A fuse or circuit breaker.
- Do not use the meter if it has been damaged.
- Do not use any test leads if the insulation is damaged or if metal is exposed.



Safety Cont'd...


Danger

- Avoid electrical shock: do not touch the test leads, tips or the circuit being tested.
- Do not try a voltage measurement with the test leads in the 20A or the mA terminal.
- When testing for the presence of voltage or current, make sure the meter is functioning correctly. Take a reading of a known voltage or current before accepting a zero reading.
- Choose the proper range and function for the measurement. Do not try voltage or current measurements that may exceed the ratings marked on the Function/Range switch or terminal.
- When measuring current, connect the meter in series with the load.
- Never connect more than one set of test leads to the meter.
- Disconnect the live test lead before disconnecting the common test lead.
- The mA and the 20A terminals are protected by fuses. To avoid possible injury or damage, use only on circuits limited to 400mA or 20A for 30 seconds.



Safety Cont'd...

IMPORTANT

- To maintain accuracy of the meter, replace the exhausted battery immediately when the battery symbol “” appears on the meter display.
- Avoid measuring error from outside interference. Keep the meter away from spark plugs or coil wires.
- Avoid damaging the meter when testing voltage. Disconnect the test leads from the test points before changing functions.
- Do not exceed the limits shown in the table below:

Function	Terminal	Input limit
DC/AC Volts, Ohm/Continuity /Diode,CAP. Adaptor, Type-K TEMP.,Hz,%Duty, mS Dwell, RPM	V- Ω -RPM	600Volts AC/ DC
AC/DC μ A mA	μ A / mA	400mA DC/AC
AC/DC20A	20A	*20A DC/AC

*20 Amp measurement for 30 seconds maximum.

Getting Started

This chapter will help you get started. It describes the basic functions of the Meter.

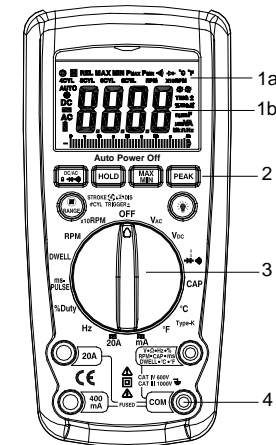
Meter Basics

1.Digital LCD display

Display features:

- Symbols to identify function
- Four character digital display

The digital display is best for stable input. The bar graph is best for rapidly changing input.



2.Function buttons

Press the button to select a function. A symbol will display to verify your choice.

3.Rotary Function Dial

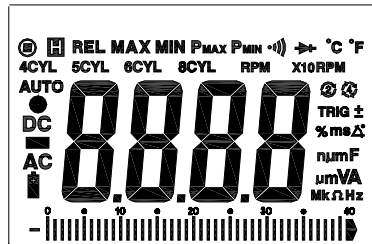
Turn this switch to select a function or turn the meter OFF.

4.Volts Terminal

The Red test lead is used to measure Amps, Volts, Ohms, TEMP, Hz, RPM, Cap, mS and Dwell.

The Black test lead is used in the Common (COM) terminal for all tests and measurements.

LCD DISPLAY SYMBOLS



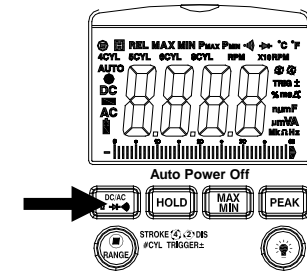
-8.8.8.8	LCD display reading
	Continuity
	Low Battery
	Diode
H	Data Hold
AUTO	AutoRanging
AC	Alternating Current or Voltage
DC	Direct Current or Voltage

n	nano (10^{-9}) (capacitance)
µ	micro (10^{-6}) (amps, cap)
m	milli (10^{-3}) (volts, amps) A Amps
k	kilo (10^3) (ohms) F Farads (capacitance)
M	mega (10^6) (ohms) Ω Ohms
Hz	Hertz (frequency) V Volts
%	Percent (duty ratio)
°F	Degrees Fahrenheit
°C	Degrees Centigrade

Function Buttons

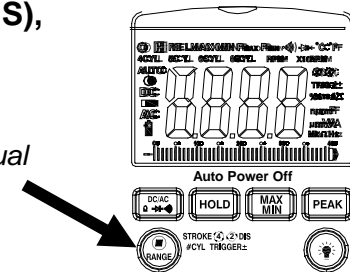
Mode Button

Press the mode pushbutton to select the following functions;
DC/AC Voltage, DC/AC Current
Resistance, Diode, Continuity & Capacitance



Manual Range & Stroke 4/2(DIS), Hz, %, ms ±, CYL Button

Press to this button to select;
STROKE 4, 2DIS, Hz, %, ms±,
CYL range & V/A Resistance manual Range



Manual Ranging

The meter turns on in the autoranging mode.

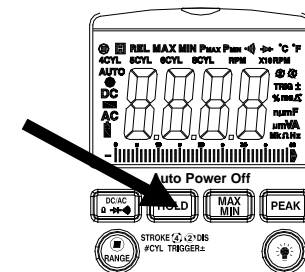
Press the **Range** button to go to manual ranging.

The display icon "○" will appear. Each press of the range button will step to the next range as indicated by the units and decimal point location. Press and hold the **Range** button for two seconds to return to autoranging.

Data Hold

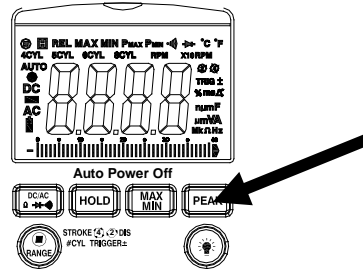
The Data Hold function allows the meter to "freeze" a measurement for later reference.

1. Press the **HOLD** button to "freeze" the reading on the display.
The HOLD indicator, "H", will appear in the upper left corner of the display.
2. Press the **HOLD** button again to return to normal operation.



Peak Hold

The Peak Hold function captures the peak AC or DC voltage or current. The meter can capture negative or positive peaks as fast as 1 millisecond in duration.



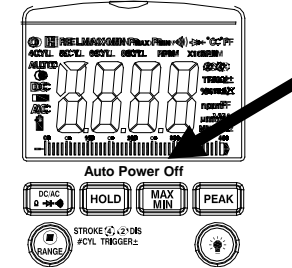
1. Turn the function dial to the A or V position.
2. Press and hold the **PEAK** button until “**CAL**” appears in the display. This procedure will zero the range selected & meter go to manual ranging.
3. Press the **PEAK** button, **Pmax** will display.
4. The display will update each time a higher positive peak occurs.
5. Press the **PEAK** button again, **Pmin** will display. The display will now update and indicate the lowest negative peak.
6. To return to normal operation, press and hold the **PEAK** button until the **Pmin** or **Pmax** indicator switches off.

Note: If the Function switch position is changed after a calibration the Peak Hold calibration must be repeated for the new function selected.

MAX/MIN

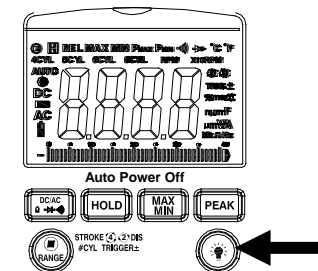
1. Press the **MAX/MIN** key to activate the MAX/MIN recording mode. The display icon “**MAX or MIN**” will appear. The meter will go to manual ranging & display and hold the maximum or minimum reading and will update only when a new “MAX or MIN” occurs.
2. Press the **MAX/MIN** key and a blinking “**MAX MIN**” will appear. The meter will display the present reading, but will continue to update and store the max and min readings.

To exit MAX/MIN mode press and hold the **MAX/MIN** key for 2 seconds.



Backlight Button

1. Press the BACKLIGHT button to turn the backlighting ON.
2. Press the BACKLIGHT button again to turn the backlighting OFF.



Meter Functions - Voltage (V)

- ⇒ Select the **Volts “V”** range with the rotary switch.
- ⇒ The meter will automatically select best voltage (V) range.
- ⇒ Select DCV or ACV with the function dial.

Insert:

- Black lead in **COM** terminal.
- Red lead in **V-Ω-RPM** terminal

Touch the Black probe to ground or to the negative (-) circuit

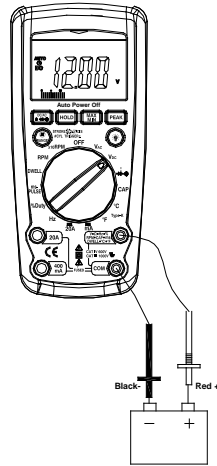
Touch the Red probe to the circuit coming from the power source

IMPORTANT: Voltage must be measuring in parallel (Red probe measuring circuit from power source).

WARNING



When measuring voltage, be sure the Red test lead is in the terminal marked “V”. If the test lead is in an Amp (A) or Milliampere (mA) terminal, you may damage your meter and could be injured.



Meter Functions – Resistance (Ω)

IMPORTANT: If you are testing an application that has capacitors in the circuit, be sure to turn the power OFF on the test circuit and discharge all capacitors. Accurate measurement is not possible if external or residual voltage is present.

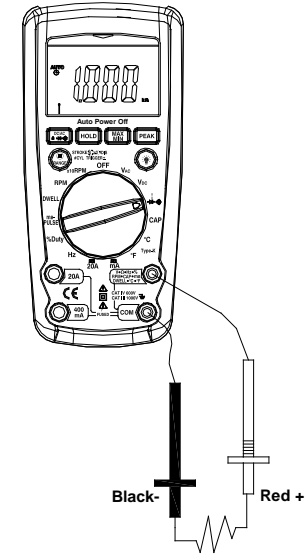
⇒ Select the **Resistance “Ω”** range with the function dial.

⇒ Select the **Resistance “Ω”** function with the Mode button. Please Note: the DM-930 defaults to resistance.

Insert:

- Black lead in **COM** terminal.
- Red lead in **V-Ω-RPM** terminal.

Touch the test lead probes across the resistor to be tested.



Meter Functions – Diode Check (\blacktriangleright)

IMPORTANT: Turn the power OFF to the test circuit

⇒ Select the **Diode Check** “ \blacktriangleright ” function with the function dial and mode button.

Insert:

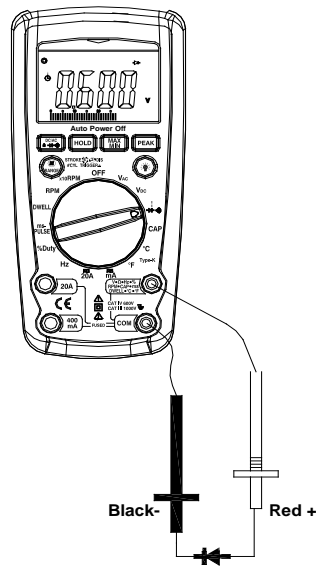
Black lead in **COM** terminal.
Red lead in **V- Ω -RPM** terminal.

Touch the Black test probe to the negative (-) side of the diode.
Touch the Red test probe to the positive (+) side of the diode. Reverse the probes: Black to the positive (+) side and Red to the negative (-) side.

Note:

A “good” diode will read low in one direction and high in the other direction when the probes are reversed (or vice versa).

A defective diode will have the same reading in both directions or read between 1.0 and 3.0 V in both directions.



Diode	- to +	Reverse Probes + to -
Good	.4 to .9V	OL
	OL	.4 to .9V
Bad	OL	1.0 to 3.0V
	1.0 to	OL
	.4 to .9V	.4 to .9V
	OL	OL
	.000V	.000V

Meter Functions – Capacitance (CAP)

IMPORTANT: Turn the power OFF to the test circuit before performing any work.

⇒ Select the Capacitance “ **CAP** ” function with the function dial and **MODE** button.

Insert:

Black lead in **COM** terminal.
Red lead in **V- Ω -RPM** terminal

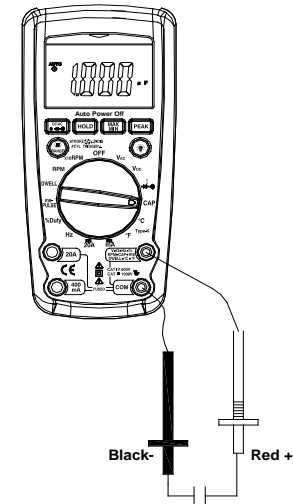
CAUTION: When checking in-circuit capacitance, be sure that the circuit has all power removed and all capacitors are fully discharged.

Touch the test lead probes across the capacitance circuit to be tested.

Read the measured value from the LCD display.

Note:

- The bar graph is disabled in capacitance measurement mode. However, since the measurement time of 4mF and 40mF modes is quite long (3.75s and 7.5s respectively) the bar graph is used to display the time remaining to complete the measurement.
- In order to obtain an accurate reading, a capacitor must be discharged before measurement begins. The meter has a built-in discharge mode to automatically discharge the capacitor. In discharge mode, the LCD displays “**DIS.C**”
- Discharging through the chip is quite slow. It is recommended to discharge the capacitor by other means when possible.



Meter Functions – Audible Continuity (•••))

IMPORTANT: Turn the power OFF on the test circuit

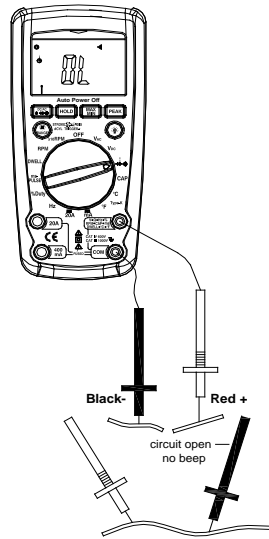
⇒ Select the **Audible Continuity** “•••) “ function with the function dial and **mode** button.

Insert:

- Black lead in **COM** terminal.
- Red lead in **V-Ω-RPM** terminal.

Touch one test probe to each end of the circuit to be tested.

- Circuit complete, the meter will beep continuously.
- Circuit open, there is no beep and the display shows to OL (over limit).



Meter Functions – AC or DC Current (A)

IMPORTANT: All current measured flows through the meter.

It is important that you:

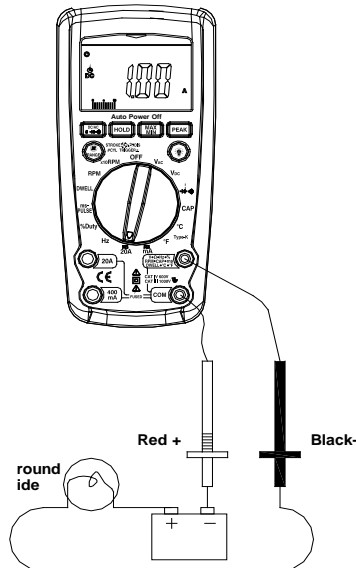
- Do Not Exceed 30 seconds when measuring continuous current between 1A-20A. Allow five minutes for cool down before continuing with any other measurements.

⇒ Select the “20A” or “mA” range with the function dial.

⇒ Press the **mode** button to select **AC** or **DC**.

Insert:

- Black lead in **COM** terminal.



- Red lead in the **20A** or **mA** terminal (select 20A if you are unsure of the current draw).

IMPORTANT: Turn OFF all power to the circuit or disconnect the circuit from the power source.

Connect:

- The Red probe to the side of the circuit closest to the power source.
- The Black probe to the side of the circuit to ground.
- Turn the power ON and test.

Note:

Current must always be measured with the meter test probes connected in series, as described.

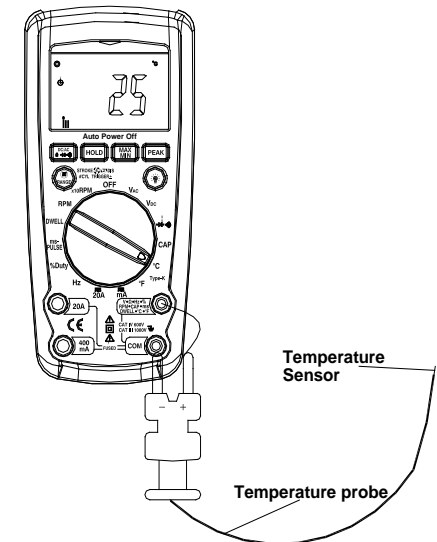
Meter Functions –Temperature (°C / °F)

IMPORTANT: To avoid heat damage to the meter, keep it away from sources of very high temperature. The life of the Temperature Probe is also reduced when subjected to very high temperatures. Probe operating range is **-58° to 482 °F**.

⇒ Select the **Temperature** “°C or °F” function with the function dial.

⇒ Insert the temperature probe connector into the K-type thermocouple adapter. Insert the adapter into the front of the meter as shown.

Touch the end of the temperature sensor to the area or surface of the object to be measured.



Meter Functions – Frequency(Hz)

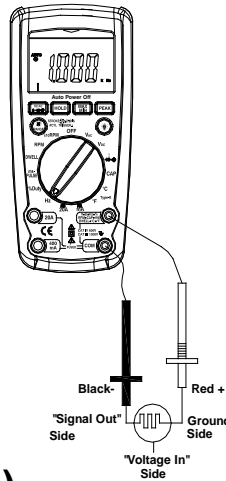
⇒ Select the “Hz” Frequency function with the function dial.

Insert:

- Black lead in **COM** terminal.
- Red lead in **V-Ω-RPM** terminal.

Connect the Black test probe to ground.

Connect the Red test probe to the “signal out” wire of the sensor to be tested.



Meter Functions-Dwell (Δ°)

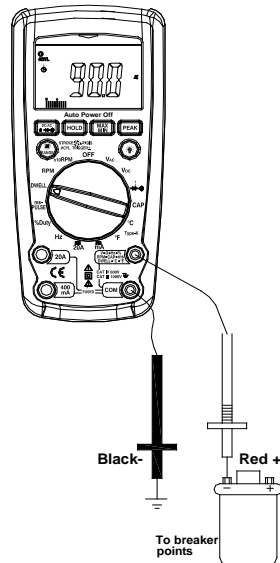
⇒ Select the “DWELL” function with the rotary switch.

Insert:

- Black lead in **COM** terminal.
- Red lead in **V-Ω-Hz-RPM** terminal.

Connect the Black test probe to ground.

Connect the Red test probe to the wire that connects to the breaker points (see illustration).



Meter Functions - Duty Cycle (%)

⇒ Select the “% Duty” Cycle function with the function dial.

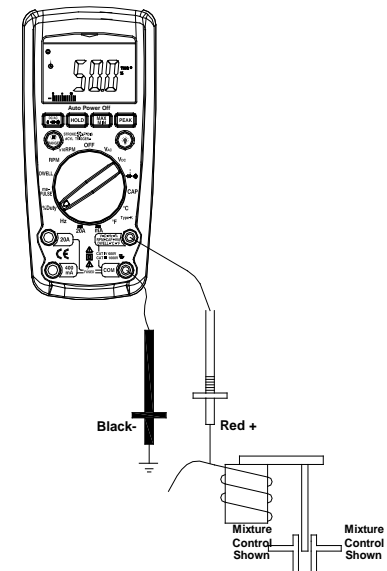
Insert:

- Black lead in **COM** terminal.
- Red lead in **V-Ω-%-RPM** terminal.

Connect the Black test probe to ground.

Connect the Red test probe to the signal wire circuit.

The illustration for a mixture control solenoid is shown with the metering rod in the closed position. The meter will display the percentage of time the plunger is in the closed position. (low duty cycle) during one duty cycle.



Meter Functions - ms-PULSE (Pulse Width) & ms-PERIOD (Period)

Pulse Width is the length of time an actuator is energized. For example, fuel injectors are activated by an electronic pulse from the Engine Control Module (ECM).

This pulse generates a magnetic field that pulls the injectors nozzle

valve open.

When the pulse ends, the injector nozzle is closed.

This open to close time is the Pulse Width and is measured in milliseconds (ms).

The most common automotive application for measuring pulse width is on fuel injectors.

You can also measure the pulse width of the fuel mixture control solenoid and the idle air control motor.

This exercise shows how to measure Pulse Width on Port Fuel injectors.

(continued on next page)

To measure pulse width (mS):

⇒ Select the “mS-Pulse” function with the function dial.

⇒ Press the ±TRIG button for 2 seconds until the negative (-) trigger slope is displayed on the upper left side of the display.

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

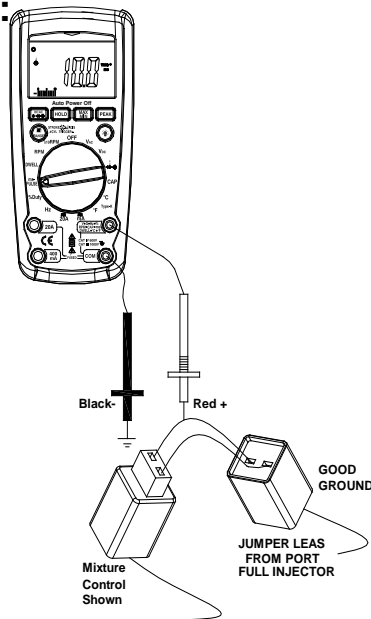
Insert:

Black lead in **COM** jack.

Red lead in **V-Ω-RPM** jack.

Connect:

Jumper wires between the fuel injector and the harness connector.



Connect black test probe to a good ground at the fuel injector or the negative (-) vehicle battery post.

Connect red test probe to the fuel injector solenoid driver input on the jumper cable.

Start the engine. A pulse width in milliseconds should be read.

Note: Initially, the unit will read “OL”, then readings will descend and stabilize to the actual pulse width. If “OL” remains, re-check your connections.

Meter Functions-RPM/×10RPM

⇒ Select the **RPM** range with the function dial.

OR

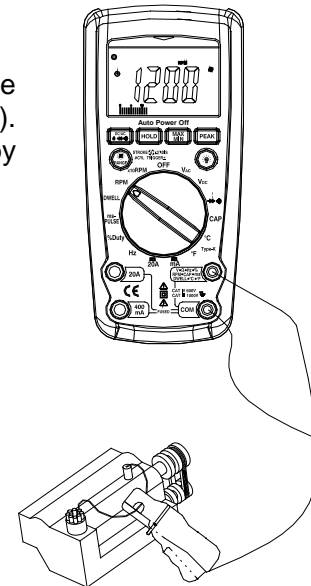
⇒ Select the **×10RPM** range with the function dial (1,000 to 12,000 RPM). Multiply the displayed reading by ten to get actual RPM.

⇒ Press **STROKE** (4) (2) / **DIS** button to select through **RPM** (4) for 4-stroke, **RPM** (2) for 2-stroke and **DIS** ignitions.

Connect the inductive pickup by connecting leads to the meter.

- Black lead in **COM** terminal.
- Red lead in **V-Ω-RPM** terminal.

Clamp 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 within six inches of the spark plug or move it to another plug wire if no reading or an erratic reading is received.

RPM 4 : For RPM of 4-stroke engines which have 1 ignition on every 4 engine strokes

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

PLEASE NOTE:

THE RPM PICK-UP HAS AN ADJUSTABLE SENSITIVITY SWITCH THAT CAN ALSO BE USED TO CORRECT AN UNSTABLE READING.

As you are measuring, keep the meter away from the engine to ensure a stable reading.

General Specifications

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

Insulation: Class2, Double insulation.

Overvoltage category: CATIII1000V/CATIV600V.

Display: 4000 counts LCD display with function indication.

Polarity: Automatic, (-) negative polarity indication.

Overrange: "OL" mark indication.

Low battery indication: The "  " 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: 167 (H) x 79 (W) x50 (D) mm

Weight: Approx.: 300g.

Accuracy and Resolution Specifications

*Accuracy is given as \pm [(X% of reading) \pm [number of least significant digits]] at 18°C to 28°C (65°F to 83°F), with relative humidity up to 70%.

RPM (Tach)

Range	Resolution	Accuracy
RPM 4	600~4000 RPM	1 RPM
	1000~12000 RPM (X10 RPM)	10 RPM
RPM 2/DIS	300~4000 RPM	1 RPM
	1000~6000 RPM (X10 RPM)	10 RPM

$\pm 2\%$ of rdg ± 4 dgts

Effect Reading: >600 RPM

DEWLL ANGLE

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

DC Voltage

Range	Resolution	Accuracy
400.0mV	0.1mV	$\pm 0.5\%$ of rdg ± 3 dgts
4.000V	1mV	$\pm 1.5\%$ of rdg ± 2 dgts
40.00V	10mV	
400.0V	100mV	$\pm 1.8\%$ of rdg ± 2 dgts
600V	1V	

Input Impedance: 10M Ω

AC Voltage

Range	Resolution	Accuracy
400.0mV	0.1mV	$\pm 1.5\%$ of rdg ± 5 dgts
4.000V	1mV	$\pm 1.0\%$ of rdg ± 3 dgts
40.00V	10mV	$\pm 1.5\%$ of rdg ± 3 dgts
400.0V	100mV	
600V	1V	$\pm 2.0\%$ of rdg ± 4 dgts

Input Impedance: 10M Ω .

Frequency Range: 50 to 60Hz

DC Current

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

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

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

AC Current

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

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

Frequency Range: 50 to 60 Hz

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

Resistance

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

Capacitance

Range	Resolution	Accuracy
4.000nF	1pF	$\pm 5.0\%$ of rdg ± 60 dgts
40.00nF	10pF	$\pm 5.0\%$ of rdg ± 7 dgts
400.0nF	0.1nF	
4.000uF	1nF	$\pm 3.0\%$ of rdg ± 5 dgts
40.00uF	10nF	
400.0uF	0.1uF	
4.000mF	0.001mF	$\pm 10\%$ of rdg ± 10 dgts
40.00mF	10.00mF	

Frequency

Range	Resolution	Sensitivity	Accuracy
4.000kHz	1Hz	>5V RMS	$\pm 1.5\%$ of rdg ± 3 dgts
40.00kHz	10Hz		
400.0kHz	100Hz		
4.000MHz	1000Hz		
40.00MHz	1kHz	>15V RMS	$\pm 2.0\%$ of rdg ± 4 dgts

Duty Cycle

Range	Resolution	Accuracy
0.5%~99.0 %	0.1%	$\pm 2\%$ of rdg ± 5 dgts

Pulse width: >100us, <100ms;

Frequency width: 5Hz – 100kHz

Sensitivity: >5V RMS

Pulse Width

Range	Resolution	Accuracy
1.0~ 20.0ms	0.1ms	$\pm 2\%$ of rdg ± 20 dgts

Type-K Temperature

Range	Resolution	Accuracy
-30 °C ~ 1000 °C	1 °C	$\pm 3\%$ of rdg ± 5 °C / 8 °F (Meter only, probe accuracy not included)
-22 °F ~ 1832 °F	1 °F	

Sensor: Type K Thermocouple

Diode Test

Test current	Resolution	Accuracy
1.0mA typical	1 mV	$\pm 5\%$ of rdg ± 15 dgts

Open circuit voltage: 3.0V dc typical


Audible Continuity

Audible threshold: Less than 35Ω Test current: <1 mA dc typical

Maintenance

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, “” will appear in the left-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.

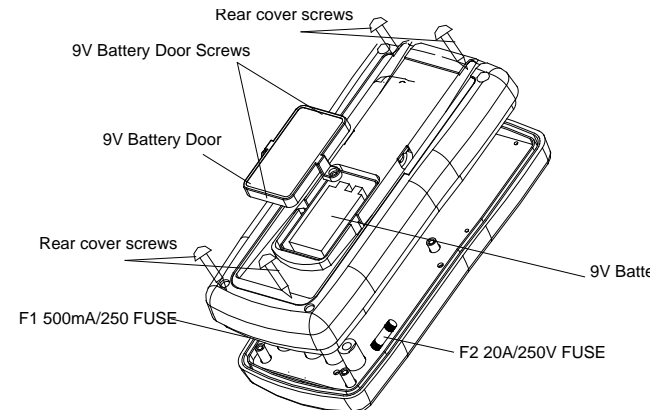
NOTE: If your meter does not work properly, check the fuses and battery to make sure that they are still good and that they are properly inserted.

REPLACING THE FUSES

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

1. Disconnect the test leads from the meter and any item under test.
2. Open the fuse door by loosening the screws on the rear cover 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 - ϕ 5 x 20 , fast blow for the 400mA range, 20A/250V – ϕ 6.3 x 32 fast blow for the 20A range).
5. 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.



Trouble Shooting

1. Meter will not turn ON.

- Check the battery contacts for a tight fit and correct polarity.
- Check for a minimum battery voltage of 8.0 volts.

2. Ampere reading is erratic or there is no reading at all.

- Disassemble the meter back cover as per the fuse replacement instructions on page 24 and test the fuses for continuity with another meter.

3. Meter reading is erratic.

- Printed circuit board damaged from handling with hands.
- Low battery.
- “Blown” fuse.
- Open circuit in a test lead (frayed or broken wire).

4. Meter readings do not change.

- “Hold” feature is still toggled ON.

Warranty

This PDI product is warranted to be free from defects in materials and workmanship for a period of two (2) years from the verified date of purchase. During this warranty period, PDI will either repair or replace the defective unit, at PDI's discretion. A purchase receipt or other acceptable form of proof of original purchase date will be required before any warranty processes begin. PDI warrants all authorized repairs with a six (6) month limited warranty. View full warranty details and register your PDI product at www.PDIimeters.com.

NOTE: Online product registration is required for all warranty claims. All warranty claims must have a Return Goods Authorization assigned from PDI, in order to begin processing. Contact PDI for more details.



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