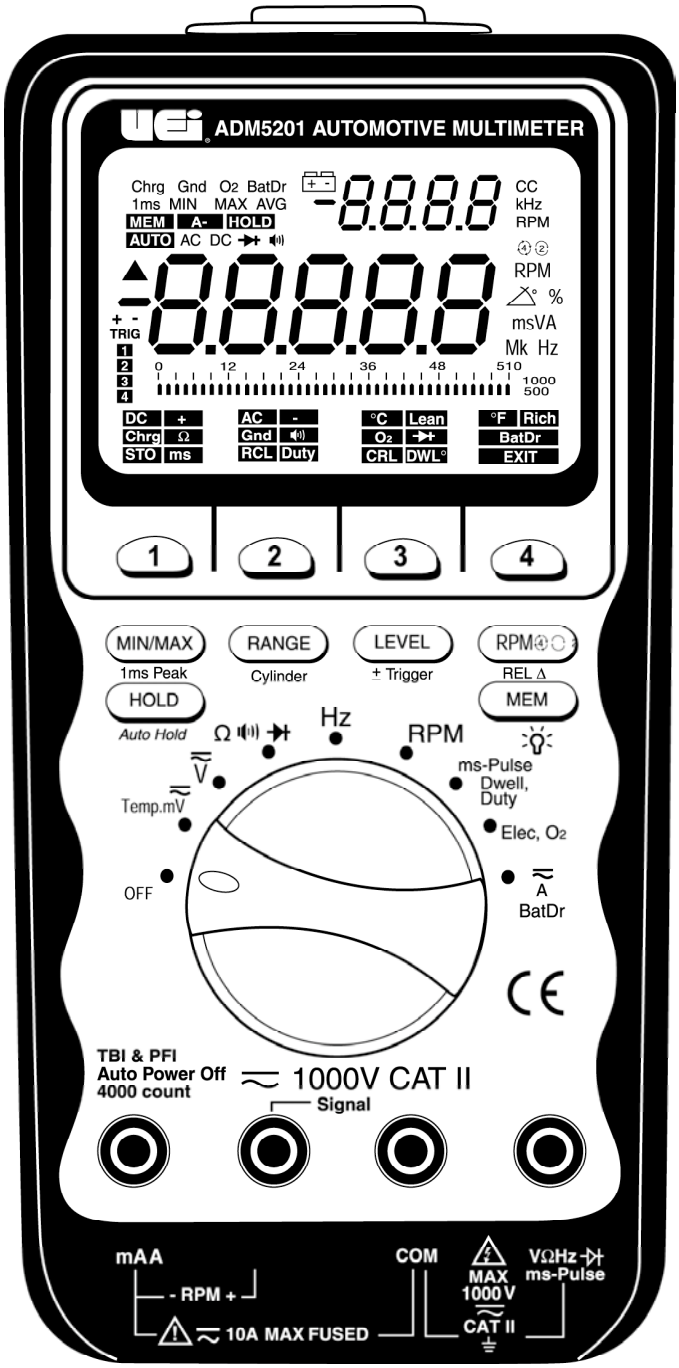
UEi Automotive

INSTRUCTION MANUAL

ADM5201

Digital Multimeter



1-800-547-5740 • Fax: (503) 643-6322

www.ueiautomotive.com • email: info@ueitest.com

Introduction

The ADM5201 advanced handheld automotive multimeter combines all the features of a full function multimeter and integrates the functions of an O2 Sensor tester, PFI & TBI Fuel Injection testers. The ADM5201 provides a quick and accurate diagnosis of the complete O2 circuit. It is also capable of sending a Rich/Lean signal to the ECM, and displaying crossing-per-second (CC) and O2 voltage simultaneously, when secondary display shows test results. This professional grade multimeter provides efficient trouble shooting solutions to the most difficult problems encountered in today's sophisticated automotive electronic systems.

The ADM5201 has a bright LED backlight. A battery access door allows users to replace the battery and fuse without breaking calibration seals! High impact over-molded case absorbs shock over more of the case than a conventional rubber boot design. Convenient closed case calibration allows adjustments to be made directly through the Optically-Isolated RS232 serial port.

Features include

- Testing functions include: O2 Sensor Test, Ground Test, Battery and Alternator Charging System Test, and Battery Drain Test
- Accurate RPM measurements for 2 and 4 stroke automotive engines with 1 to 12 cylinders using the inductive pickup
- ms-Pulse Width function to test on-time of both PFI type and TBI type fuel injectors
- Duty Cycle and direct DWELL reading
- 4 step adjustable triggers on 1 to 12 cylinders
- Temperature measurement up to 2,372˚F or 1,300˚C
- 4-4/5 digit, 50,000 count primary and 9,999 count secondary dual display with bar-graph (Frequency range: 99,999 counts)
- Backlit display
- RS-232C optically isolated serial port
- Memory store and recall (20 locations)
- Auto hold. 50ms high speed MIN/MAX/Avg, & relative mode
- 1ms Peak Mode
- Auto-power off
- High impact over-molded case

Safety Notes

Before using this meter, read all safety information carefully. In this manual the word **"WARNING"** is used to indicate conditions or actions that may pose physical hazards to the user. The word **"CAUTION"** is used to indicate conditions or actions that may damage this instrument.

WARNING!

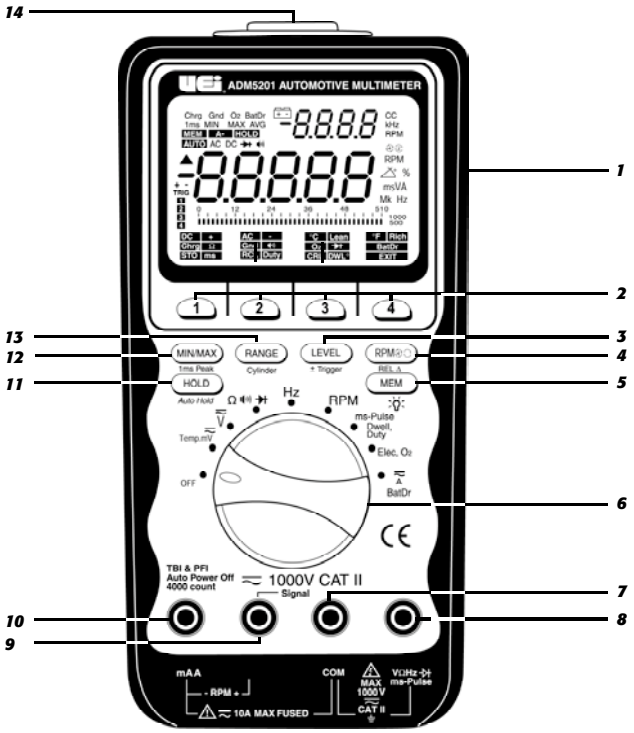
Exceeding the specified limits of this meter is dangerous and can expose the user to serious or possibly fatal injury.

- **DO NOT** attempt to measure any voltage that exceeds 600 volts with this meter - UEi offers numerous alternatives for measuring high voltage and current
- Voltages above 600 volts DC or 25 volts AC may constitute a serious shock hazard
- **DO NOT** attempt to use this meter if either the meter or the test leads have been damaged. Send unit in for repair by a qualified repair facility
- Test leads must be fully inserted prior to taking measurements
- Never attempt a voltage measurement with the test leads inserted into the "**A**" terminal and the "**COM**" terminal - The "**A**" terminal is protected by a fuse. You might be injured or damage the meter
- Always disconnect the live test lead before disconnecting the common test lead from a circuit
- Turn the engine off before connecting or disconnecting inductive pickup to avoid a shock.
- Disconnect the test leads from the test points before changing functions to avoid damaging the meter when testing above 350V AC
- Choose the proper range and function for the measurement - Always set the meter to the highest range and work downward for an unknown value if you are using manual ranging mode
- Do not try voltage or current measurements that may exceed the ratings marked on the input limit for switch or terminal
- Use current probes to measure circuits exceeding 10A
- Disconnect the "**LIVE**" test lead before disconnecting the "**COMMON**" test lead
- Do not test a recently recharged lead-acid battery
- Disconnect the power and discharge all high-voltage capacitors before testing in the resistance, continuity, and diode functions
- If the engine has been running, do not place the meter and its accessories near the engine or the exhaust manifold which might be hot and can damage the meter
- If any of the following indications occur during testing, turn off the power source to the circuit under test:
    - Arcing
    - Flame
    - Smoke
    - Extreme Heat
    - Smell of Burning Materials
    - Discoloration or Melting of Components
- Read the safety precautions associated with the equipment being tested and seek assistance or advice when performing unfamiliar tasks.
- Keep your fingers away from the test lead metal probe contacts and bus-bars when making measurements. Always grip the instrument and test-leads behind the hand guards (molded into the probes).
- In the event of electrical shock, ALWAYS bring the victim to the emergency room for evaluation, regardless of the victim's apparent recovery. Electrical shock can cause an unstable heart rhythm that may need medical attention.

International Symbols

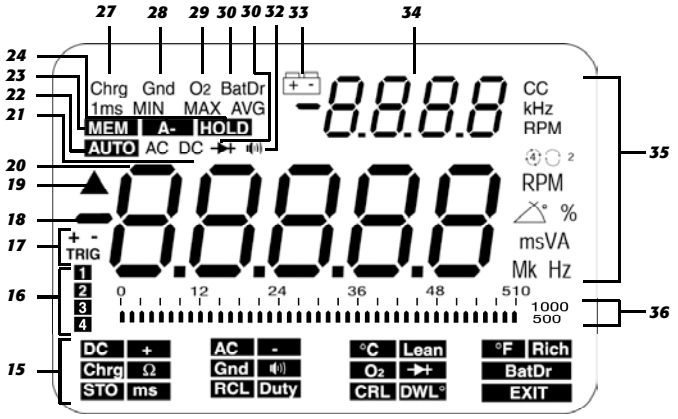
Dangerous Voltage	Ground
AC Alternating Current	Warning or Caution
DC Direct Current	Double Insulation (Protection Class II)
Either AC or DC	Fuse
Not Applicable to Identified Model	Battery

Controls and Indicators



1. **LCD Display:** 4-4/5 digit, 50000 count (primary) and 9999 count (secondary) dual display with bar-graph.
2. (1) (2) (3) (4) **:** On screen menu selection push-buttons.
3. (LEVEL) **:** Press this push-button momentarily select levels. **±Trigger** Press again for more than 1 second to toggle between positive and negative trigger slopes.
4. (RPM 4 2) **:** Press this push-button momentarily to toggle between **RPM** (4) and **RPM** (2) in **RPM** function. Press again for more than 1 second to select Relative Zero.
   REL Δ
5. (MEM) **:** Press this push-button momentarily to select Memory mode. Press again for more than 1 second to turn the LCD backlight on.
6. **Selector:** Turn the power ON or OFF and select a function.
7. **COM:** Common (ground reference) input terminal for all functions except **RPM** function.
8. **VΩ Hz ms Elec Temp:** Input terminal for all functions except **Current** and **RPM** functions.
9. **PRM +/Signal:** Input terminal (+) for **RPM** function. **Output** terminal for sending out a **Rich** command or a **Lean** command for 5 seconds in **O_2** Sensor test mode.
10. **A/RPM:** Input terminal (+) for current function. Ground reference (-) input terminal for RPM function.
11. (HOLD) **:** Press this push-button momentarily to activate **HOLD** for simply freezing a reading. Press again for more than 1 second to activate Auto Hold for automatically capturing a stable reading, beeping to acknowledge, and holding it on the LCD.
    Auto Hold
12. (MIN/MAX) **:** Press this push-button momentarily to activate Record function. Press this push-button for more than 1 second to activate 1 ms Peak function.
    1ms Peak
13. (RANGE) **:** Press this push-button momentarily to select ranges in the manual ranging mode of most functions or number of cylinders on Dwell function. Press this push-button momentarily to toggle between the PFI mode and the TBI mode when measuring on-time of fuel injectors.
    Cylinder PFI/TBI
14. **RS-232 Optical interface**

LCD Display Functional Description



15. **Menu on screen**
16. (1) (2) (3) (4) **:** These annunciators indicate trigger level status.
17. **+ - Trig:** These annunciators indicate that positive (+) or negative (-) Trigger Slope is selected.
18. ▬ **:** This symbol indicates Negative Polarity.
19. ▲ **:** This symbol indicates the Relative function is activated.
20. **DATA:** Primary digital readings of data being measured.
21. (AUTO) **:** This annunciator indicates Autoranging.
22. **AC DC:** AC annunciator indicates alternating current is selected. DC annunciator indicates direct current is selected.
23. (MEM) **:** This annunciator indicates the Memory function is activated.
24. (A-) (HOLD) **:** "**HOLD**" annunciator indicates the HOLD function is selected and "**A-**" and "**HOLD**" annunciators indicate the Auto Hold function is selected.
25. **1 ms MIN/MAX:** These annunciators indicate 1 ms MAX (+) Peak, or 1 ms MIN (-) Peak reading is being displayed.
26. **MIN/MAX/AVG:** These annunciators indicate MIN (Minimum, MAX (Maximum), or AVG (Average) reading is being displayed.
27. **Chrg:** This annunciator indicates the Charging system test function is selected.

28. **Gnd:** This annunciator indicates the Ground test function is selected.
29. **O_2:** This annunciator indicates the O_2 Sensor test function is selected.
30. **BatDr:** This annunciator indicates the Battery Drain test function is selected.
31. **:** This symbol indicates the Diode test function is selected.
32. **:** This symbol indicates the Continuity test function is selected.
33. **:** Low Battery alert. Replace the battery as soon as possible to ensure accuracy.
34. **DATA:** Secondary display for Dual Display data.
35. **CC... :** These annunciators indicate the function being selected and/or the appropriate measurement units.
36. **:** Analog bar-graph with scale.

Operating Instructions

Making Measurements and Tests

All measurements and tests are made by first setting the rotary selector switch to a function setting (so that the meter is put in the default measurement function) and then selecting a measurement from the menu keys. Note that not all function knob settings have corresponding menu key settings.

For example, the steps below show how to make an AC voltage measurement.

1. Set the rotary selector switch to $\tilde{\overline{V}}$ position for voltage measurements. Then, the meter is set to the default DC voltage measurement mode.
2. Select the menu key 2 for AC voltage measurement (Fig 1).
3. Connect the test leads to the measurement points.

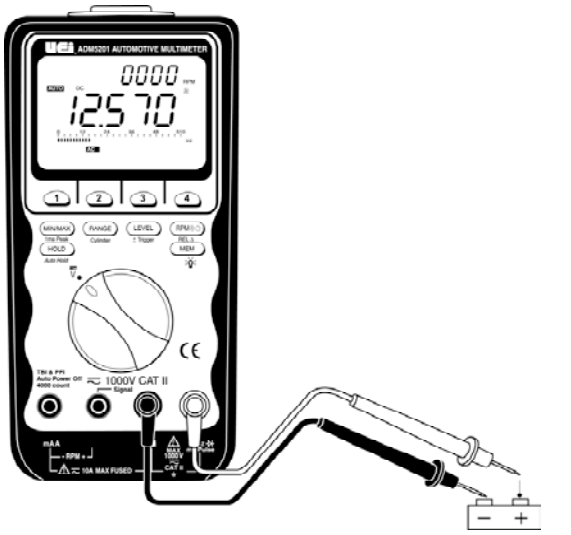
(Fig 1)

Voltage (V)

1. Set rotary selector to $\tilde{\overline{V}}$ position. The meter defaults at DC.
2. Press menu key 2 momentarily to select AC, and press RPM 4 2 twice to select Hz in the secondary display, if required.
3. Insert red lead into "**V**" terminal and black lead into "**COM**" terminal.
4. Touch black probe to ground or negative side of the circuit and touch red probe to positive side of the circuit coming from the power source (Fig 2).
5. Set rotary selector to m$\tilde{\overline{V}}$ position for voltage application below 0.4 V with similar operation procedures.
6. Refer to **Dual Display RPM** function.

   NOTE: *Voltage must be measured in parellel (red probe measuring circuit from power source).*

The analog bar graph is easier to read when the data causes the digital display to rapidly change. It is also useful for trend setting or directional data.



Parallel Connection

(Fig 2)

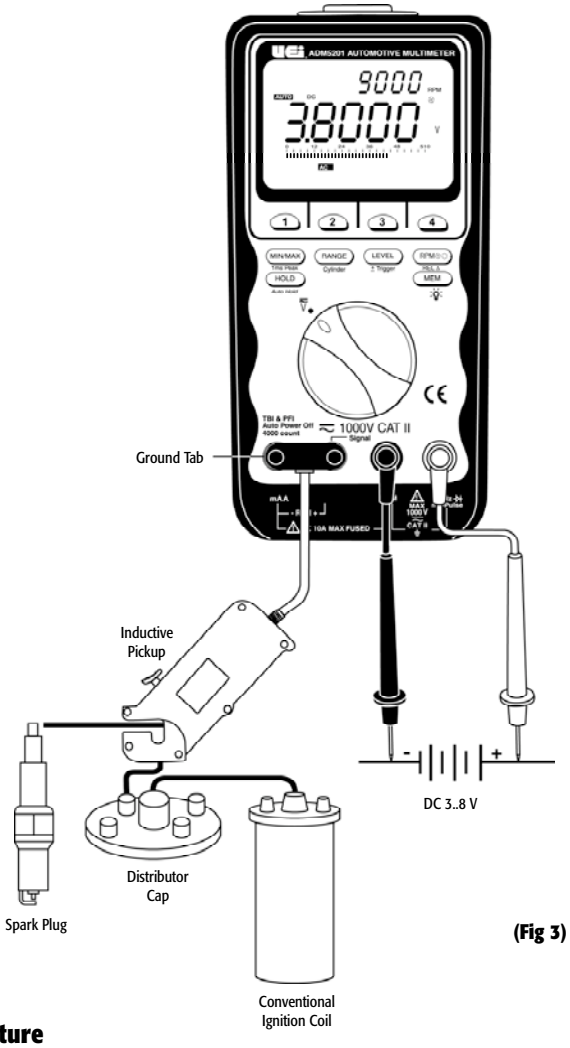
Dual Display RPM

This function is available for the primary functions; DC, mV, AC mV, DC V, AC V, Dwell, ms-Pulse, and Duty Cycle. The trigger level selection is not available for this function, but available for the primary display RPM function.

1. Set the meter to the corresponding primary function.
2. Press RPM 4 2 button to toggle between RPM 4 (for 4-stroke engine) and RPM 2 (for 2-stroke or DIS engine).
3. Insert the Dual Banana Connector into the **RPM** - and the **RPM** + input terminals as shown. Ensure the plug with the Ground Tab goes into the **RPM** - terminal.
4. Clamp the inductive pickup to a spark plug wire with the arrow sign facing the spark plug as shown. Ensure the pickup jaws are completely closed (Fig 3).

5. Read RPM in the secondary display.

   NOTE: *Position the pickup as far away from the distributor and the exhaust manifold as possible. Position the pickup within 6 inches of the spark plug or move it to another plug wire if no reading or an erratic reading is received.*



(Fig 3)

Temperature

1. Set rotary selector to "Temp. m$\overline{\overline{V}}$" position.
2. Press menu key 3 (or 4) to select temperature function. The primary display will show "OFL." and the secondary display will always show the meter's internal temperature in ˚F or ˚C alternatively matching with the selected primary display mode of ˚F or ˚C.
3. Insert banana plug K-type temperature bead probe with correct +/- polarities. You can also use a thermocouple probe adapter (optional accessory) to adapt other standard K-type temperature probes (Fig 4).
4. Touch the end of the thermocouple probe to the measurement surface and read the primary digital display with ˚F (or ˚C). We can easily recognize the temperature unit of the primary display from the secondary display.

   NOTE: *The measured temperature is displayed with 0.1 ˚F (or 0.1 ˚F) resolution. For example, 98˚F is displayed as 0098.0 and 98˚C is displayed 0098.0.*

(Fig 4)

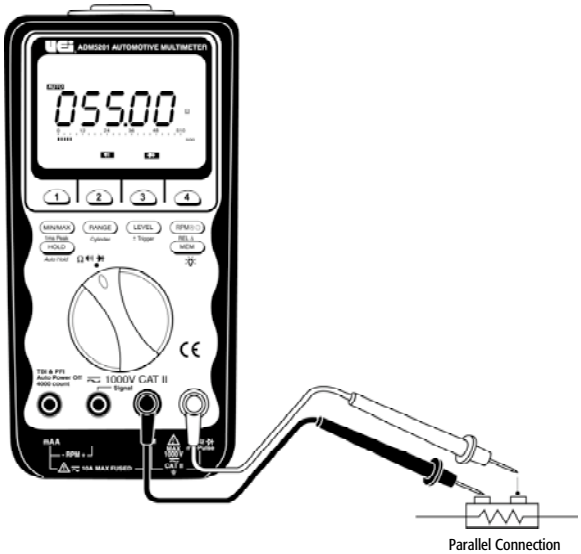
Resistance (Ω)

CAUTION!

Turn off power and discharge all capacitors on circuit to be tested before attempting in circuit resistance measurements. Accurate measurement is not possible if external or residual voltage is present.

1. Set rotary selector to "Ω •)) ⊣ " position. The meter defaults at "**Ω**" function. "OFL." is displayed in the primary display.
2. Insert black lead into "**COM**" terminal and red lead into "**Ω**" terminal (Fig 5).
3. Touch the test lead probes across the resistance or circuit to be tested.

   NOTE: *The resistance in the test leads can affect accuracy in the 500Ω range. Short the leads together and press the "**REL Δ**" button to automatically subtract the test lead resistance from the measured resistance.*



(Fig 5)

Continuity (•)))

CAUTION!

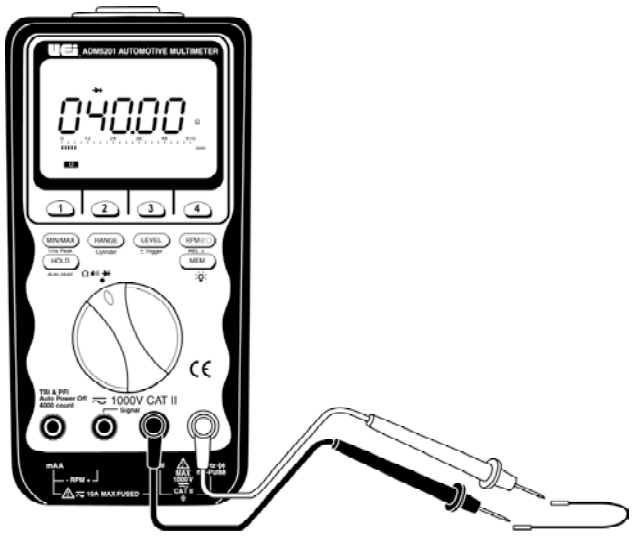
Turn off power OFF on the test circuit. A beeper tone does not necessarily mean zero resistance.

1. Set rotary selector to "Ω •)) →|← " position.
2. Press menu key 2 to select "Continuity" function. "OFL." is displayed in the primary display.
3. Insert black lead into "**COM**" terminal and red lead into "**Ω**" terminal (Fig 6).
4. Touch the test lead proves across the device being tested.

If the resistance of the device is below 70Ω, there is a continuous beep tone.

If the resistance of the device is more than 70Ω, there is no beep tone.

This is useful for checking wiring connections and operation of switches.



(Fig 6)

Diode (→|←) Test

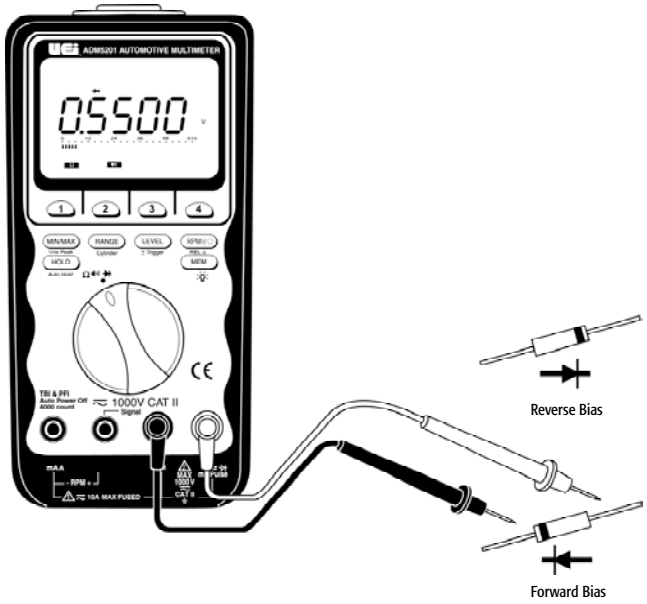
CAUTION!

Turn the power OFF on the test circuit.

1. Set rotary selector to "Ω •)) →|← " position.
2. Press menu key 3 to select "**Diode Test**" function. "OFL." is displayed in the primary display.
3. Connect the test leads as shown and observe the digital display. Normal forward voltage drop (forward biased) for a good silicon diode is between 0.4 V to 0.9 V. A reading higher than that indicates a leaky diode (defective). A zero reading indicates a shorted diode (defective). An "OFL." indicates an open diode (defective) (Fig 7).
4. Reverse the test leads connections (reverse biased) across the diode.
5. The primary display shows "OFL." if the diode is good. Any other readings indicate the diode is resistive or shorted (defective).

Use the table below to determine if the diode is good or bad.

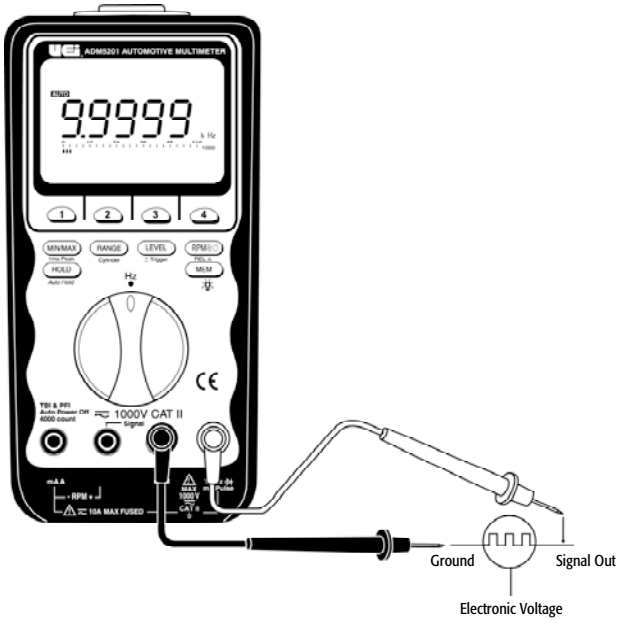
Diode	Forward Bias (→|←)	Reverse Bias (→|←)
Good	0.4 to 0.9 V	OFL
	OFL	0.4 to 0.9 V
Bad	OFL	1.0 to 3.0 V
	1.0 to 3.0 V	OFL
	0.4 to 0.9 V	0.4 to 0.9 V
	OFL	OFL
	0.0000 V	0.0000 V



(Fig 7)

Frequency

1. Set rotary selector to "**Hz**" position.
2. Insert black lead into "**COM**" terminal and read lead into "**Hz**" terminal.
3. Touch black probe to ground and touch red probe to the "**Signal out**" wire on the sensor (Fig 8).



(Fig 8)

RPM (primary display)

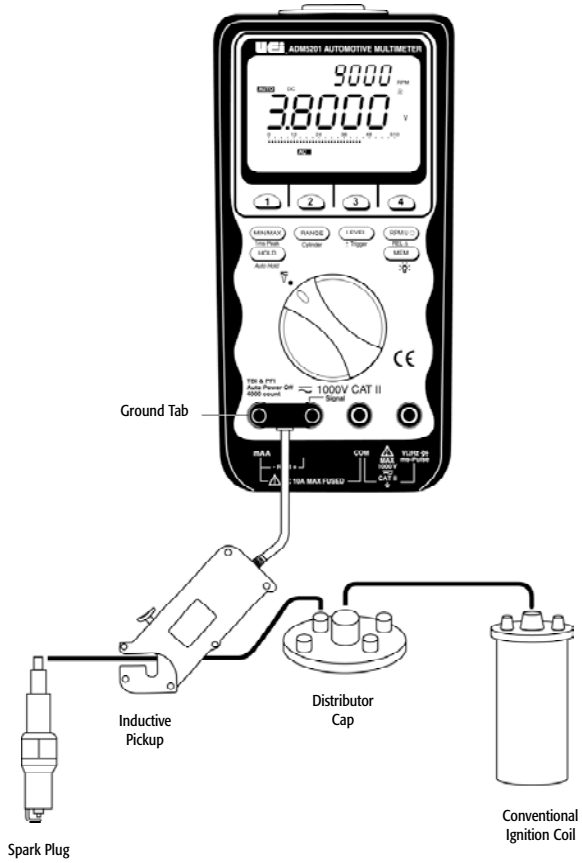
WARNING!

Be sure the inductive pickup is in the terminals marked "- RPM +" when measuring RPM's. If the pickup is in the wrong terminal, personal injury or meter damage may occur.

The ignition system can generate a potential shock hazard. Ensure that the engine is off before connecting or removing the inductive pickup.

1. Set rotary selector to "**RPM**" position. The meter defaults at "**TRIG** 1 2 3 4 " (trigger) level.
2. Press " RPM 4 2 " push-button to toggle between RPM 4 for 4-stroke engine and RPM 2 for 2-stroke and DIS engine.
3. Insert the Dual Banana Connector into the "**RPM -**" and the "**RPM +**" input terminals as shown. Ensure the plug with the Ground Tab goes into the "**RPM -**" terminal (Fig 9).
4. Clamp the inductive pickup to a spark plug wire with the arrow sign facing the spark plug as shown. Ensure the pickup jaws are completely closed.
5. Read RPM in the primary display.

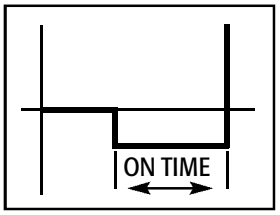
   NOTE: *4 trigger levels (TRIG 1 2 3 → TRIG 1 2 → TRIG 1 → TRIG 1 2 3 4) are selectable by pressing LEVEL button momentarily in this function.*



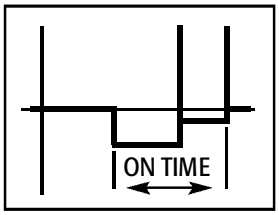
(Fig 9)

Fuel Injection On Time

This function applies to both Port Fuel Injectors (PFI) which operate with a single On Time pulse and Throttle Body Injectors (TBI) which operate with twin pulses.



Port Fuel Injection Waveform



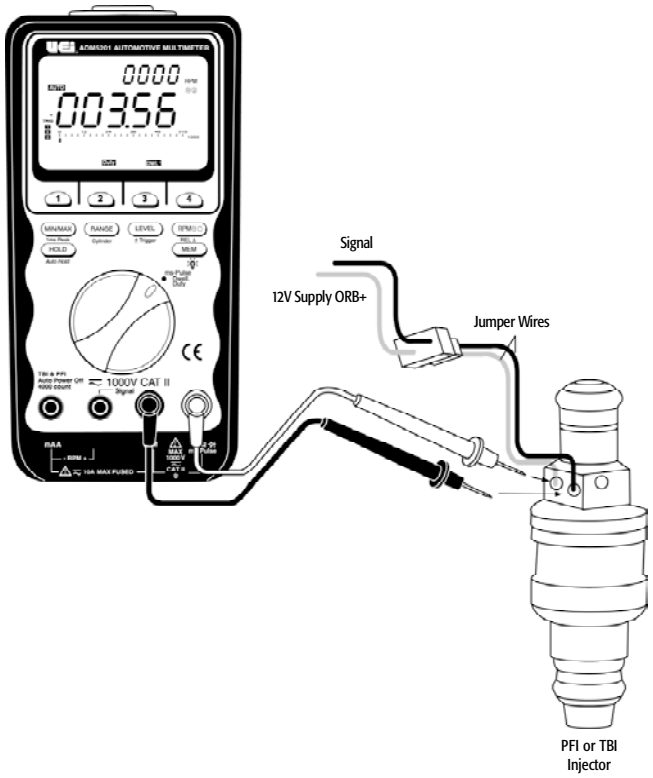
Port Body Injection Waveform

1. Set rotary selector to "**ms-Pulse**, **Dwell**, **Duty**" position.

   The meter defaults at "**ms-Pulse**" with - TRIG 1 2 3 level in the PFI mode. ("PF 1" appears in the secondary display for 1 second).

   Press " RANGE PFI/TBI " push-button to toggle between the PFI mode and the TBI mode. ("tB 1" appears in the secondary display for 1 second).

   4 trigger levels (-TRIG 1 2 3 → -TRIG 1 2 → -TRIG 1 → -TRIG 1 2 3 4) are selectable by pressing " LEVEL " push-button momentarily in this function.
2. Insert black lead into "**COM**" terminal and red lead into "**ms(-Pulse)**" terminal.
3. Connect the test leads as shown and read On Time in the primary display (Fig 10).
4. The fuel injection frequency can be displayed in the second display by pressing the " RPM 4 2 " push-button momentarily twice.



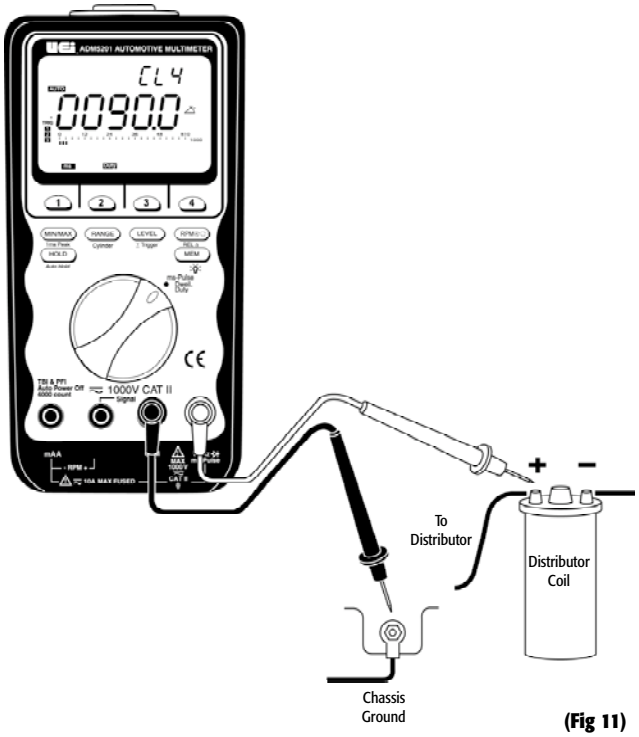
(Fig 10)

Dwell

1. Set rotary selector to "**ms-Pulse**, **Dwell**, **Duty**" position.
2. Press the menu key 3 to select "**Dwell**" function. The meter defaults at 4 cylinders (CL4).

   Press "(RANGE)" (Cylinder) push-button momentarily and repeatedly to select the required number of cylinder and display the cylinder setting in the second display.
3. Insert black lead into "**COM**" terminal and red lead into "**ms(-Pulse)**" terminal.
4. Connect the test leads as shown and read Dwell angle in the primary display. Adjust trigger levels by pressing "(LEVEL)" push-button momentarily, if necessary (Fig 11).
5. Press the menu key 2 momentarily to display Dwell readings in terms of percentage if required.
6. The frequency of the same signal source can be displayed in the second display by pressing the "(RPM 4 2)" push-button momentarily twice.
7. Adjust the Dwell angle according to the procedures outlined in your vehicle service manual.

   NOTE: *Recheck the timing whenever the Dwell able has been adjusted.*



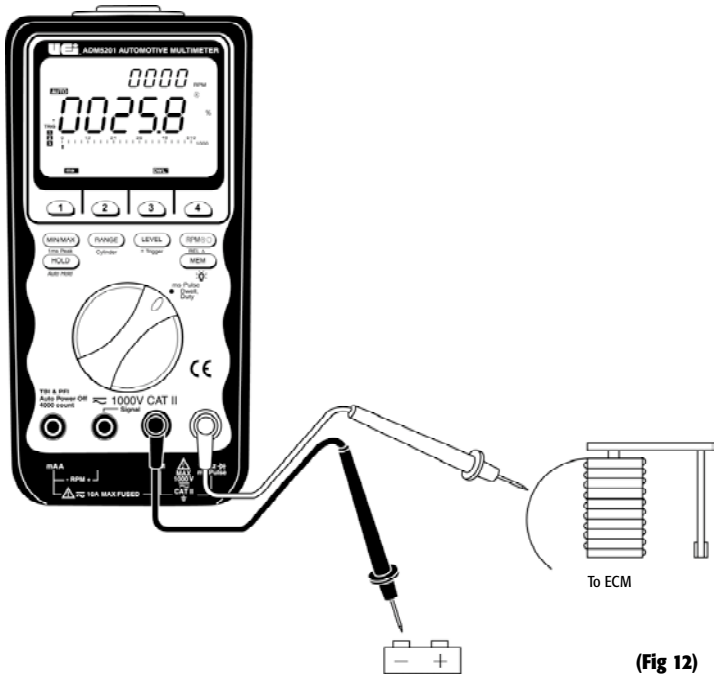
(Fig 11)

Duty Cycle

1. Set rotary selector to "**ms-Pulse**, **Dwell**, **Duty**" position.
2. Press menu key 2 to select "Duty" function.
3. Insert black lead into "**COM**" terminal and red lead into "**ms(-Pulse)**" terminal.
4. Connect the test leads as shown and read the Duty Cycle percentage in the primary display. Adjust trigger levels by pressing "(LEVEL)" push-button momentarily, if necessary (Fig 12).
5. Press menu key 1 or 3 momentarily to display Duty Cycle reading in terms of ms (Pulse Width) or (Dwell) angle if required.
6. The frequency of the same signal source can be displayed in the second display by pressing the "(RPM 4 2)" push-button momentarily twice.

In most applications, the negative trigger slope is assigned to display the percentage of time that the plunger is in the closed position (low duty cycle) during one duty cycle. The positive slop is assigned to display the percentage of time that the plunger is in the open position. Refer to the car's service manual to verify slope assigned to position for each component.

Press the "(LEVEL)" (±Trigger) push-button for more than 1 second to toggle between the negative (-) slope and the positive (+) slope, if required.



(Fig 12)

Changing System Test

Charging system problems often are identified with a No-Start complaint. The battery will have discharged and the starter won't crank the engine. To properly check the charging system, the battery must be fully charged.

WARNING!

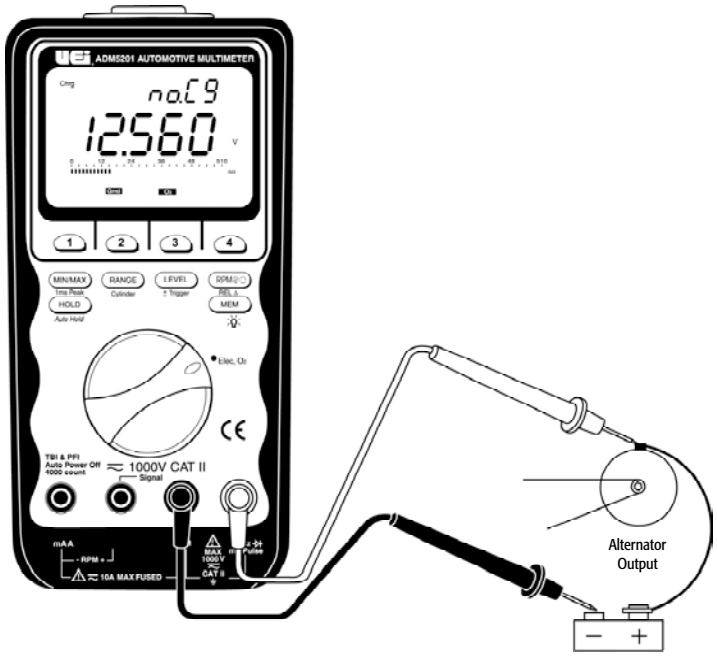
Be sure the battery to alternator connection and lead connections are all secure, or damage may result.

1. Set rotary selector to "**Elec**" position. The meter defaults at Charge System Test function.
2. Insert black lead into "**COM**" terminal and red lead into "**ms(-Pulse)**" terminal (Fig 13).

Battery Condition Test

1. Connect red lead probe to the alternator output.
2. Connect black lead probe to ground.
3. With engine Off, turn the headlights On low.
4. Read the secondary display to check the condition of the battery. Use the table below.

Secondary Display (Battery Condition)	Primary Display
LBAT (Low Battery)	< 11.399 V
noCG (No Charge)	11.400 ~ 13.299 V
GOOD (Good)	13.300 ~ 15.599



(Fig 13)

- "noCG" not displayed : Check wiring and battery leads.
- "noCG" displayed : Good battery, proceed.
- "noCG" and "LBAT" displayed : Low battery, correct before proceeding.

Alternator Charging Test

1. Connect red lead probe to the alternator output.
2. Connect black lead probe to ground.
3. Start engine and run at 1000 - 2000 rpm.
4. Turn the headlights On low.
5. Allow the secondary display to stabilize.
6. Read the secondary display to check the alternator charging conditions. A display "ALT" or "noCG" in the secondary display together with beep sound indicates that the alternator charging system is in bad condition (Fig 14).

(Fig 14)

- No display in the secondary display : System normal.
- "noCG" displayed : Suspect open field (current) or regular.
- "noCG" and "LBAT" displayed alternatively : Suspect bridge rectifier or grounded stator winding.
- "NALI" displayed : Suspect bridge rectifier or open stator winding.

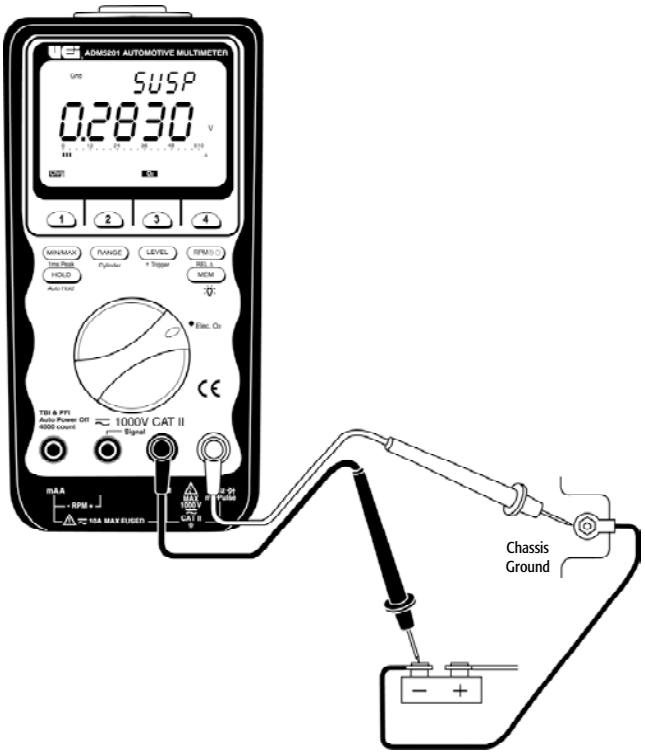
NOTE: *When the alternator and the associated rectifier diodes are in good condition, the ripple voltage of the alternator output signal should be less than 0.49 V AC (typical).*

Ground Test

This function is designed to locate bad grounds, voltage drops, intermittent connections, or any source of high resistance in automotive electrical circuits and grounds.

If provides a very efficient check of a vehicle's electrical system condition. This test works by measuring the voltage drop across any cable to which it is connected. The amount of voltage drop is displayed as "9000", "SUSP", "BAD", and "OPEN" annunciators in the secondary display.

1. Set rotary selector to "**Elec**" position.
2. Press the menu key 2 to select "**Ground Test**" function. "OFL" is displayed in the primary display and "OPEN" is displayed in the secondary display.
3. Insert black lead into "**COM**" terminal and red lead into "**Elec**" terminal (Fig 15).
4. Connect the two probes to the cable being tested. A good connection is indicated by the display of "9000" in the secondary display.
5. Apply power to the vehicle. The condition of the cable between the two probes is indicated by either "9000", "SUSP", or "BAD" in the secondary display.



(Fig 15)

Secondary Display	Primary Display (Amount of Voltage Drop)
9000 (Good)	< 0.1999 V
SUSP (Suspect)	0.2000 ~ 0.3999 V
BAD (Bad)	0.4000 ~ 1.9999
OPEN (Open)	> 2.0000 V

If either "SUSP" or "BAD" is displayed, check the cable closely for poor connections between the two test leads. Make certain all connectors are clean and secure.

NOTE: *When checking ground connections, always clean or scrape off the area of the chassis where the ground lead is being connected. Dirt, grease, and paint are insulators and will prevent the unit from making a good connection. If a ground connection is suspect, connect the unit to the chassis as close as possible. When testing charging or starting circuits from the battery, always make the first connection to the battery post, and not the battery connector. Corrosion on the battery post and connector surfaces can be the source of the problem very frequently.*

O_2 Sensor

This is a very efficient method to check and simulate O_2 Sensors.

This test hooks in parallel with the O_2.

Sensor circuit. The primary display will show O_2 Sensor voltage, while the secondary display will show Cross Counts (CC).

Cross Counts are the number of times the reading crosses 0.45 V DC per second.

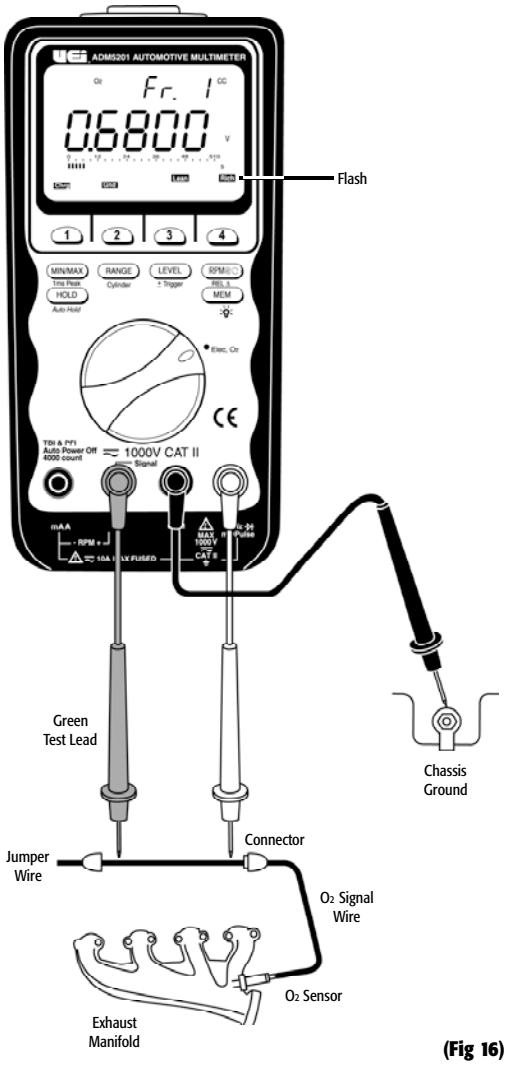
Nominal CC is 1 to 3 for a good O_2 Sensor.

During this test, the secondary display will indicate Full Lean, Lean, Rich, and Full Rich respectively, according to the measuring value of the O_2 Sensor output, together with the corresponding Cross Counts (.X).

Primary Display	Secondary Displayed
< 0.29999 V	FL. X (Full Lean)
0.3000 ~ 0.4499 V	FL. X (Lean)
0.4500 ~ 0.5999 V	FL. X (Rich)
≥ 0.6000 V	FL. X (Full Rich)

Also during this test the menu key 3 (Lean) or menu key 4 (Rich) might be pressed to send out a rich command or a lean command for 5 seconds, which will make the "**Lean**" or "**Rich**" annunciator or menu screen flash depending upon which was commended. During this time the primary display will show the signal level that is at the O_2 sensor to see that the condition is being compensated for. The green lead is required to be connected between the "**Signal**" terminal and the O_2 connector on the ECM side.

NOTE: *Signal out and CC may not function properly on some Toyota O_2 Sensors.*



(Fig 16)

1. Set rotary selector to "**Elec**" position.
2. Press the menu key 3 to select "**O_2**" Sensor function. "**Lean**" and "**Rich**" annunciators will be displayed on menu screen.
3. Insert black lead into "**COM**" terminal and red lead into "**Elec**" terminal and green lead into "**Signal**" terminal (Fig 16).
4. Unplug the "**O_2**" Sensor connector.
5. Connect a jumper wire between the connector halves.
6. Connect red lead probe to the "**O_2**" Sensor side of the jumper wire.
7. Connect black lead probe to ground.
8. Connect green lead probe to the ECM side of the jumper wire.
9. Press menu key 3 (Lean) or 4 (Rich) to send out a Lean or Rich signal for 5 seconds.

AC or DC Current ($\overline{\overline{A}}$)

WARNING!

Do not measure any circuit that draws more than the current rating of the installed fuse. Replace the defective fuse with a proper fuse only. Failure to do this may result in injury or damage to the meter. Do not attempt current measurements where the open circuit voltage is above 600 V.

For measuring circuits of more than 10 A, use voltage output current clamp adapters compatible with the meter voltage functions.

1. Set rotary selector to "**$\overline{\overline{A}}$ BatDr**" position. The meter defaults at DC current.
2. Press the menu key 2 to select AC.
3. Insert black lead into "**COM**" terminal and red lead into "**A**" terminal (Fig 17).
4. Connect the red lead probe to the side of the circuit closest to the power source.
5. Connect the black lead probe to the side of the circuit closest to ground.
6. Turn the power ON and test. **DO NOT** crank the engine.

(Fig 17)

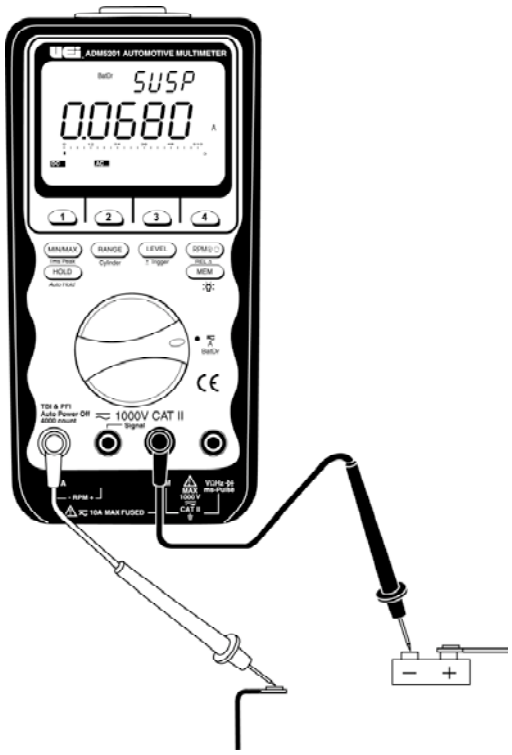
Battery Drain Test

This function measures the car's battery current when it is turned off. This test will run continuously so the Auto-Power-Off feature will be automatically disabled in this mode.

1. Set rotary selector to "**A BatDr**" position. The meter defaults at DC current.
2. Press the menu key 4 to select BatDr test function.
3. Insert black lead into "**COM**" terminal and red lead into "**A**" terminal (Fig 18).
4. Turn the ignition and accessories off.
5. Disconnect the negative battery cable.
6. Touch red lead probe to the cable.
7. Touch black lead probe to the negative battery post.
8. Observe the secondary display (allowing up to 30 minutes).

Secondary Display	Primary Displayed
Good (Low Drain)	< 0.0199 A
SUSP (Marginal Drain)	0.0200 ~ 0.0799 A
bAd (High Drain)	≥ 0.0800 A

If a "SUSP" or "bAd" is displayed, check fused and non-fused circuit form malfunction.



(Fig 18)

MIN/MAX Mode

Press the "MIN/MAX" push-button momentarily to activate MIN/MAX (Record) mode with LCD annunciators "MAX, MIN, AVG" turned on. Press this button momentarily to read throughout the Maximum (MAX), Minimum (MIN), and Average (AVG) readings in the primary display. Press the button for more than 1 second to exit MIN/MAX (Record) mode.

With the Autoranging MIN/MAX (Record) mode, you can easily track intermittent signals, capture turn on/ turn off surges, and monitor line voltage changes over a much wider dynamic range with the best resolution. It surpasses manual ranging recording which is apt to be overflowed or to have insufficient resolution. The meter features a fast sampling speed of 50 ms for MAX, MIN and AVG readings. The faster the sampling speed, the more accurate the measurements will be. The true average (AVG) feature calculates all readings continually taken over time. The Auto-Power-Off feature will be automatically disabled in this mode.

1mS Peak Mode

Press the "MIN/MAX" (1 ms Peak) push-button for more than 1 second to activate 1 ms Peak mode with LCD annunciators 1 ms MIN/MAX turned on. The meter defaults at 1 ms MAX (positive peak value reading) mode.

Press the menu key 2 momentarily to select 1 ms MIN (negative peak value reading) mode.

Press the menu key 4 (EXIT on menu screen) to exit 1 ms Peak mode.

With 1 ms Peak mode, transient signal peak voltage as short as 1 ms can be captured.

Manual and Auto Ranging

Press the " (RANGE) " push-button momentarily to select manual ranging, and the meter will remain in the range it was with LCD annunciator " AUTO " turned off. Press the button momentarily again to step through the ranges. Press the button for more than 1 second to resume autoranging.

In Dwell ( ) function, press this " (RANGE) " (Cylinder) button momentarily to display the cylinder setting on the secondary display. Default it "CL4" (4 Cylinder). Press this button momentarily again to select the number of cylinders from 1 through 12 (1, 2, 3, 4, 5, 6, 8, 10 and 12 cylinders) to match the engine under test.

NOTE: *The secondary display defaults at "0000 rpm" in the $\widetilde{mV}$, $\widetilde{V}$, and Hz function. The selected cylinder setting or RPM ④ ② setting is maintained until the meter is turned off.*

Trigger Level and +/- Trigger Slope Selection

This feature is available for RPM, Dwell, ms-Pulse, or Duty measurement function. The meter is set at selected trigger level as power up default in individual function as follows:

Function	Default Trigger Level
RPM	+ TRIG 1 2 3
Dwell, ms-Pulse, Duty	- TRIG 1 2 3

However, car signal levels under test may vary due to aging of components, abnormal conditions, and each car manufacturer's different design. Therefore, positive and/or negative 4 selectable trigger levels, which are carefully designed and tested to cover all the extreme conditions, are available in these functions to provide more flexibility to cope with your applications.

If your reading is unstable, select lower sensitivities (higher trigger level number) by pressing the " (LEVEL) " push-button momentarily. If your reading shows zero, select higher sensitivities (lower trigger level number).

The 4 selectable trigger levels are cycled through as follows:

• RPM: → +TRIG 1 2 3 → +TRIG 1 2 → +TRIG 1 → +TRIG 1 2 3 4 →

• Dwell, ms-Pulse, Duty:

→ -TRIG 1 2 3 → -TRIG 1 2 → -TRIG 1 → -TRIG 1 2 3 4 →

In some cases, positive trigger levels may be required for measuring Dwell, ms-Pulse, or Duty. Press the " (LEVEL) " (±Trigger) push-button for more than 1 second to toggle between positive (+) and negative (-) trigger level for the selected trigger level.

NOTE: *Positive (+) trigger or negative (-) trigger is to identify whether the On or Off portion of the signal under test is of measuring interest. For example, if you get a reading of 10% Duty Cycle in the Positive (+) Trigger (On portion), you then will get a reading of 90% Duty Cycle in the negative (-) trigger (off portion).*

RPM ④ ② Selection

In the RPM function, the meter defaults to "**RPM ④**" for conventional 4-stroke engine. Press the " (RPM ④ ②) " push-button momentarily to toggle to "**RPM ②** " for 2-stroke or DIS engine. And also the $\widetilde{mV}$, $\widetilde{V}$, or Hz function, press the " (RPM ④ ②) " push-button momentarily to toggle between "**RPM ④**" and "**RPM ②**" setting for the dual display RPM function.

Relative Δ Mode

Press the " (RPM ④ ②) " (RELΔ) push-button for more than 1 second to select the Relative Zero (Δ) mode with LCD annunciator "**Δ**" turned on. This feature allows the user to offset the measured value with a relative reference value.

Press the " (RPM ④ ②) " (RELΔ) push-button for more than 1 second to exit relative mode and resume normal measurements.

Hold or Auto Hold

Press the " (HOLD) " push-button momentarily to activate the Hold function with LCD annunciator " HOLD " turned on. Press the button momentarily again to exit Hold function. This feature freezes the display for later view.

Press the " (HOLD) " (Auto Hold) push-button for more than 1 second to activate the Auto Hold function with LCD annunciators " A- HOLD " turned on. This feature automatically freezes the display and the meter beeps when the measurement reading is stabilized. The displayed value will be updated when a new measurement value is stabilized. This mode is very useful when it is impossible for you to press the " (HOLD) " push-button or see the meter display while probing and taking measurements. Press the " (HOLD) " (Auto Hold) push-button for more than 1 second to exit Auto Hold function.

Memory (Data Store, Recall, & Clear) Mode

Press the " (MEM) " push-button momentarily to activate the Memory mode with LCD annunciators " MEM " and " HOLD " turned on. The menu screen shows four menu selections: " STO " (Store), " RCL " (Recall), " CLR " (Clear), and " EXIT " (Exit).

Store: Press the menu key 1 to store the displaying data. The available memory location number momentarily shows in the secondary display and "SAVE" momentarily shows in the primary display. If no memory location is available, "FULL" and "DATA" momentarily show in the primary display and in the secondary display respectively and nothing is stored, when you must clear all the memory locations be pressing the "**Clear**" menu key to secure memory locations. You can store up to 20 data. You can exit the store mode by pressing either the "**EXIT**" menu key or the " (MEM) " push-button momentarily.

Recall: Select "**Recall**" to review the stored data by pressing the menu key 2. When you press the menu key 2. When you press the menu key 2, the last memory location number used in the previous memory operation will momentarily show in the secondary display with four menu selections; "+", "-", "CLR", and "EXIT" turned on in the menu screen. The required memory location can be selected by using the menu key 1 and the menu key 2, when the data stored at the selected memory location will show in the primary display. In the "**Recall**" mode, when you press the "**Clear**" menu key, the data stored at the recalled memory location only is erased. If no stored data is available in the "**Recall**" mode, when you press the "**Recall**" menu key, "dAtA" and "no" momentarily show in the primary display and in the secondary display respectively and nothing is retrieved. You can exit the "**Recall**" mode by pressing either the "**EXIT**" menu key or the "MEM" push-button momentarily.

Clear: Select "**Clear**" to clear all stored data in the "**Store**" mode or only the data stored at the selected memory location in the "**Recall**" mode. In the "**Store**" mode, when you press the "Clear" menu key, "SUrE" and "YoU" continuously show in the primary display and in the secondary display respectively with two menu selections; "EXIT" (ALL CLEAR) and "AC" turned on in the menu screen. When you press the menu key 2, "donE" momentarily shows in the primary display and all the stored data are erased. Press the "**EXIT**" menu key to exit the memory mode without erasing any stored data.

EXIT: Select "**EXIT**" to exit memory mode. You can also exit memory mode by pressing the "MEM" push-button momentarily or turning the rotary selector.

Backlight

Press the "MEM" (☼) push-button for more than 1 second to toggle the backlight On and Off. The backlight will also automatically be Off 30 seconds after each activation to extend the battery life.

Auto Power Off

The meter automatically turns off after approximately 30 minutes of no activities to extended battery life.

You can enable or disable the Auto-Power-Off mode. Turn the meter on while pressing the menu key 4 to activate this feature, when the meter shows "AtP" in the Secondary display, and "EnAL" (or "diSA") in the primary display with three menu selections; "+", "-", and "EXIT" turned on in the menu screen. You can toggle "EnAL/diSA" by pressing the "+" and "-" menu keys. Press the "EXIT" menu key to get into the next setup.

The meter will display "**MIN**" annunciator at the upper left corner of the LCD, "AtP" in the secondary display, and a two digit number in the primary display with three menu selections; "+", "-", and "EXIT" turned on in the menu selection. You can set up a new auto-power-off time by using the "+" and "-" menu keys. Press the "EXIT" menu key to save the newly customized default values during the entire setup cycle. The meter will resume normal operation just after "SAVE" is displayed in the primary display.

NOTE: *The newly customized default values in any Setup can be saved only when the entire Setup cycle is ended. The meter displays "SAVE" at the end of the entire Setup cycle only.*

RS-232C Interface

The meter provides an optically isolated interface port at the top for the data communication. The RS70 optical adapter cable and the WS716 software disc are required to connect the meter to the PC computer. These accessories are provided to the end users as optional items.

Maintenance

Periodic service

WARNING!

Repair and service of this instrument is to be performed by qualified personnel only. Improper repair or service could result in physical degradation of the meter. This could alter the protection from electrical shock and personal injury this meter provides to the operator. Perform only those maintenance tasks that you are qualified to do.

These guidelines will help you attain long and reliable service from your meter:

1. Calibrate your meter annually to ensure it meets original performance specifications.
2. Keep your meter dry. If it gets wet, wipe it dry immediately. Liquids damage electronic circuits.
3. Whenever practical, keep the meter away from dust and dirt, which can cause premature wear.
4. Although your meter is built to withstand the rigors of daily use, it can be damaged by severe impacts. Use reasonable caution when using and storing the meter.

NOTE: *When servicing the meter, use only the replacement parts specified.*

Battery: 9V, NEDA 1604, JIS006P or IEC 6F 22
Fuse: 600V / 15 A IR 100 kA fast acting fuse for A input

Cleaning and Decontamination

Periodically clean your meter's case using a damp cloth. **DO NOT** use abrasives, cleaning solvents or strong detergents, as they may damage the finish or affect the reliability of the structural components.

Battery Replacement

Always use a fresh replacement battery of the specified size and type. Immediately remove the old or weak battery from the meter and dispose of it in accordance with your local disposal regulations. Old or defective batteries can leak chemicals that corrode electronic circuits.

WARNING!

To avoid electric shock, be sure to turn off the meter's power and disconnect both test leads from any equipment before you remove or install batteries.

To install a new battery, follow these procedures:

1. Remove the screw from the battery compartment cover on the back (lower half) of the meter and lift the cover.
2. Remove and discard the old battery. Always dispose of old batteries promptly in a manner consistent with local disposal regulations.

WARNING!

*Under **NO** circumstance should you expose batteries to extreme heat or fire as they may explode and cause injury.*

3. Place a fresh 9V battery in the compartment.

***NOTE:** If you do not plan to use the meter for a month or more, remove the battery and store it in an area that won't be damaged by a leaking battery.*

4. Reattach the battery compartment cover to the meter and reinstall the screw.

Specifications

Safety & Compliance

Maximum voltage between any terminal and earth ground	600V DC/AC (but, 1000V DC/AC peak for mV and V functions)
Compliance	Complies with UL&cUL standard UL 3111-1, CSA C22.2 No. 1010.1-92, ANSI/ISA-S82, 01-94 to 1000V Overvoltage Category II
Certifications	CE-marking certificated
Surge Protection	6.5 kV peak per IEC 1010.1-92
Fuse Protection for A input	600V / 15 A IR 100 kA fast fuse

Physical Specifications

Display (LCD)	Digital - 50000 count primary display / 9999 count secondary display; updates 4/seconds nominal Analog - 25 segments, updates 40/seconds
Operating Temperature	32˚F to 122˚F (0˚C to 50˚C)
Storage Temperature	-4˚F to 140˚F (-20˚C to 60˚C)
Temperature Coefficient	Nominal 0.15 x (specified accuracy)/˚C @ (0˚C to 18˚C or 28˚C to 50˚C), or otherwise specified
Relative Humidity	0% to 80% @ (32˚F to 95˚F) 0% to 70% @ (94˚F to 122˚F)
Altitude	Operating - up to 2000 m Storage - 10000 m
Battery Type	Single 9V battery - NEDA 1604, JIS 006P or IEC 6F 22
Battery Life	150 hrs. typical (with backlight off)
Shock Vibration	Per MIL-T-PRF 28800 for a Style D, Class III Instrument
Pollution Degree	2
E.M.C.	Meets En 61326 : 1997 A_1
Size (H x W x D)	6.77 x 3.62 x 1.59" (172 x 92 x 40.5mm)
Weight	without mounted accessory Approx. 655g (1.45 lbs.)
Warranty	3 years
Calibration Interval	1 year

Feature Summary

Backlight	For clear readings in poorly lighted areas
Fast Autoranging	Meter automatically selects the best range momentarily
AUTO HOLD	Automatically holds readings on display for later view
Continuity/Open test	Beeper sounds
Bar Graph	25 segments for peaking an nulling
Memory Locations	20
Dual Display	PLus individual RPM input & display
MIN/MAX Mode	Record maximum, minimum, and average values
1 ms Peak Mode	Captures peaks to 1 millisecond
Relative	Relative zero
Level	4 selectable trigger levels
±Trigger	Selectable Positive & Negative trigger slope
Cylinder	9 selectable number of cylinders in Dwell
RPM 4	For 4-stroke engine application
RPM 2	For DIS & 2-stroke engine application
ms-Pulse/Duty Cycle	Measure the time signal is ON or OFF in milliseconds or in %
Close-Case calibration	No internal adjustments needed
Battery/Fuse Access Door	Battery or fuse replaceable without voiding calibration
High-Impact Overmolded Case	Protective holster features

Electrical Specifications

Accuracy is given as ±([% of reading] + [number of digits]), or otherwise specified, at 23˚C ±5˚C and less than 80% RH for a period of one year after calibration.

DC Voltage

Range	Resolution	Accuracy
500.0 mV	0.01 mV	0.1% + 2 d
5.0000 V	0.1 mV	
50.000 V	1 mV	
500.00 V	0.01 V	
1000 V	0.1 V	

NMRR: > 60 dB @ 50/60 Hz
CMRR: > 120 dB @ DC 50/60 Hz, RS = 1 KΩ
Input Impedance: 10 MΩ, 30 pF nominal
(50 MΩ, 100 pF nominal for 500 mV range)

AC Voltage

Range	Resolution	Accuracy	
		40 ~ 400 Hz	400 Hz ~ 2 kHz
500.00 mV	0.01 mV	0.5% + 10 d	1.0% + 10 d
5.0000 V	0.1 mV		
50.000 V	1 mV		
500.00 V	0.01 V		
1000.0 V	0.1 V		

CMRR: > 60 dB @ DC to 60 Hz, RS = 1 KΩ
Input Impedance: 10 MΩ, 30 pF nominal
(50 MΩ, 100 pF nominal for 500 mV range)

DC Current

Range	Resolution	Accuracy
5.0000 A	100 µA	0.5% + 10 d
10.000 A	1 mA	1.5% + 20 d

AC Current (40 - 1 kHz)

Range	Resolution	Accuracy
5.0000 A	100 µA	0.75% + 10 d
10.000 A	1 mA	1.0% + 20 d

Burden Voltage: 0.03 V/A

Ohms

Range	Resolution	Accuracy
500.00 Ω*	0.01 Ω	0.1% + 5 d
5.0000 kΩ	0.1 Ω	0.1% + 2 d
50.000 kΩ	1 Ω	0.1% + 2 d
500.00 kΩ	0.01 kΩ	0.1% + 2 d
5.0000 MΩ	0.1 kΩ	0.3% + 5 d
50.00 MΩ	10 kΩ	0.75% + 10 d

Open Circuit Voltage: 1.3 V DC
*Using Relative mode.

Diode Tester

Range	Resolution	Accuracy
2.0000 V	2.0% + 1 d	<3.0 V DC

Temperature

Range	Resolution	Accuracy*
-50˚C to 0˚C	0.1˚C	±3.0˚C
0˚C to 100˚C	0.1˚C	±1.0˚C
100˚C to 1300˚C	0.1˚C	±3.0˚C
-58.0˚F to 32˚F	0.1˚F	±5.0˚F
32˚F to 212˚F	0.1˚F	±2.0˚F
212˚F to 2372˚F	0.1˚F	±5.0˚F

*With k-type thermocouple.

Frequency

Range	Resolution	Accuracy
99.999 Hz	0.001 Hz	0.005% + 3 d
999.99 Hz	0.01 Hz	
9.9999 kHz	0.1 Hz	
99.999 kHz	1 Hz	
999.99 kHz	0.01 kHz	

Minimum frequency 0.5 Hz, sensitivity 250 mV.
•Minimum frequency 1 Hz in the Secondary display.

RPM (Primary Display)

Range	Resolution	Accuracy
4-stroke	120 - 20000 RPM	2 RPM
2-stroke	60 - 10000 RPM	

4 Selectable trigger levels.

RPM (Secondary Display)

Range	Resolution	Accuracy
4-stroke	240 - 9999 RPM	2 RPM
2-stroke	120 - 9999 RPM	

Dwell

Range*	Resolution	Accuracy
0.0˚ - 356.4˚	0.1˚	1.2/krpm + 2 d

*Selectable trigger levels and ± trigger slopes.
*Selectable cylinders 1, 2, 3, 4, 5, 6, 8.
*Specified ranges depend on ± trigger slopes, engine RPM.

ms-Pulse and Duty Cycle

Mode	Resolution*	Accuracy
Multi-Point-Injection	0.50 ms - 250.00 ms	0.5 ms + 1 d
	0.0% - 100.0%	0.04%/krpm + 2 d
Single-Point-Injection	0.50 ms - 250.00 ms	0.05 ms + 1 d
	0.0% - 100.0%	0.04%/krpm/cyl + 2 d

Fuel Injection Detector (Both TBI & PFI).
4 Selectable trigger levels and ±trigger slopes.
*Specified ranges depend on ± trigger slopes, engine RPM and number of cylinders.

Audible Continuity Test

Application
For quick open-short test.
Threshold
The beeper turns on when the measured resistance is lower than 10Ω, and turns off when greater than 70Ω. Response time < 200 µS.

O_2 Sensor Test

Application
For quick and accurate method to diagnose and simulate oxygen sensors.

Ground Test

Application
Designed to locate bad grounds, voltage drops, intermittent connections, or any source of high resistance in an automotive electrical circuits and grounds.

Charging System Test

Application
Designed to diagnose the battery and the alternator.

Battery Drain Tester

Application
Measures the car's battery current when it is turned off.

ADM5201
Digital Multimeter

Limited Warranty

The ADM5201 is warranted to be free from defects in materials and workmanship for a period of three years from the date of purchase. If within the warranty period your instrument should become inoperative from such defects, the unit will be repaired or replaced at UEi's option. This warranty covers normal use and does not cover damage which occurs in shipment or failure which results from alteration, tampering, accident, misuse, abuse, neglect or improper maintenance. Batteries and consequential damage resulting from failed batteries are not covered by warranty.

Any implied warranties, including but not limited to implied warranties of merchantability and fitness for a particular purpose, are limited to the express warranty. UEi shall not be liable for loss of use of the instrument or other incidental or consequential damages, expenses, or economic loss, or for any claim or claims for such damage, expenses or economic loss. A purchase receipt or other proof of original purchase date will be required before warranty repairs will be rendered. Instruments out of warranty will be repaired (when repairable) for a service charge. Return the unit postage paid and insured to:

1-800-547-5740 • FAX: (503) 643-6322
www.ueiautomotive.com • Email: info@ueitest.com

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

PLEASE
RECYCLE