2882

INSTRUCTION MANUAL

DIGITAL AUTOMOTIVE MULTIMETER

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SAFETY GUIDELINES

TO PREVENT ACCIDENTS THAT COULD RESULT IN SERIOUS INJURY AND/OR DAMAGE TO YOUR VEHICLE OR TEST EQUIPMENT, CAREFULLY FOLLOW THESE SAFETY RULES AND TEST PROCEDURES.

SAFETY EQUIPMENT

Fire Extinguisher

Never work on your car without having a suitable fire extinguisher handy. A 5-lb. or larger CO_2 or dry chemical unit specified for gasoline/chemical/electrical fires is recommended.

Fireproof Container

Rags and flammable liquids should be stored only in fireproof, closed metal containers. A gasoline soaked rag should be allowed to dry thoroughly outdoors before being discarded.

Safety Goggles

We recommend wearing safety goggles when working on your car to protect your eyes from battery acid, gasoline, and dust and dirt flying off moving engine parts.

NOTE: Never look directly into the carburetor throat while the engine is cranking or running as sudden backfire can cause burns.

LOOSE CLOTHING AND LONG HAIR (MOVING PARTS)

Be very careful not to get your hands, hair, or clothes near any moving parts such as fan blades, belts, and pulleys or throttle and transmission linkages. Never wear neckties or loose clothing when working on your car.

JEWELRY

Never wear wrist watches, rings, or other jewelry when working on your car. You'll avoid the possibility of catching on moving parts or causing an electrical short circuit which could shock or burn you.

VENTILATION

The carbon monoxide in exhaust gas is highly toxic. To avoid asphyxiation, always operate vehicle in a well ventilated area. If vehicle is in an enclosed area, exhaust should be routed directly to the outside via leakproof exhaust hose.

SETTING THE BRAKE

Make sure that your car is in **park** or **neutral** and that the **parking brake is firmly set.**

NOTE: Some vehicles have an automatic release on the parking brake when the gear shift lever is removed from the **PARK** position. This feature must be disabled when it is necessary (for testing) to have the parking brake engaged when in the **DRIVE** position. Refer to your vehicle service manual for more information.

HOT SURFACES

Avoid contact with hot surfaces such as exhaust manifolds and pipes, mufflers (catalysts), the radiator, and hoses. Never remove the radiator cap while the engine is hot as escaping coolant under pressure may seriously burn you.

SMOKING AND OPEN FLAMES

Never smoke while working on your car. Gasoline vapor is highly flammable, and the gas formed in a charging battery is explosive.

BATTERY

Do not lay tools or equipment on the battery. Accidentally grounding the **"HOT"** battery terminal can shock or burn you and damage wiring, the battery or your tools and testers. Be careful of contact with battery acid. It can burn holes in your clothing and burn your skin or eyes.

When operating any test instrument from an auxiliary battery, connect a jumper wire between the negative terminal of the auxiliary battery and ground on the vehicle under test. When working in a garage or other enclosed area, auxiliary battery should be located at least 18 inches above the floor to minimize the possibility of igniting gasoline vapors.

HIGH VOLTAGE

High voltage—30,000-50,000 volts is present in the ignition coil, distributor cap, ignition wires, and spark plugs. When handling ignition wires while the engine is running, use insulated pliers to avoid a shock. While not lethal, a shock may cause you to jerk involuntarily and hurt yourself.

JACK

The jack supplied with the vehicle should be used only for changing wheels. Never crawl under car or run engine while vehicle is on a jack.

VEHICLE MANUAL, SOURCES FOR SERVICE INFORMATION.

The following is a list of publishers who have service manuals for your specific vehicle at nominal cost. Write to them for availability and prices, specifying the make, style, and model year of your vehicle.

American Motors Corporation
Myriad
8835 General Drive
Plymouth Township
Michigan 48170

Chrysler Corporation
Dyment Distribution Service
Service Publication
20026 Progress Drive
Strongsville, Ohio 44136

Ford Publication Department
Helm Incorporated
Post Office Box 07150
Detroit, Michigan 48207

Buick
Tuar Company
Post Office Box 354
Flint, Michigan 48501

Oldsmobile
Lansing Lithographers
Post Office Box 23188
Lansing, Michigan 48909

Cadillac, Chevrolet, Pontiac
Helm Incorporated
Post Office Box 07130
Detroit, Michigan 48207

OTHER SOURCES—Nonfactory

Domestic and Import Cars
Chilton Book Company
Chilton Way
Radnor, PA 19089

Cordura Publications
Mitchell Manuals, Inc.
Post Office Box 26260
San Diego, CA 92126

Motor's Auto Repair Manual
Hearst Company
250 W. 55th Street
New York, N.Y. 10019

IMPORTANT

CONSULT THE VEHICLE MANUAL FOR SPECIFIC TUNE-UP INFORMATION AND TEST PROCEDURES. ALWAYS FOLLOW THE MANUFACTURER'S SPECIFICATIONS AND TEST PROCEDURES FOR ADJUSTING DWELL ANGLE AND IDLE SPEED, ESPECIALLY ON VEHICLES WITH MODERN ELECTRONIC IGNITION AND EMISSION CONTROLS. DO NOT ATTEMPT TO SERVICE A VEHICLE WITHOUT THE MANUFACTURER'S INSTRUCTIONS AND SPECIFICATIONS.

DIGITAL ENGINE ANALYZER DESCRIPTION AND SPECIFICATIONS

DESCRIPTION: The digital engine analyzer is a compact, easy to use precision instrument which is compatible with all spark ignited engines used in passenger cars and trucks including today's computer controlled engines and distributorless ignition systems.

SPECIFICATIONS:

Display—3½ digit, .5 inch LCD (Liquid Crystal Display)

Alt Test LED—Red LED (Light Emitting Diode) indicates alternator condition. Note that the alternator condition LED obtains its input signal from the optional Hall effect (amps) clamp. Therefore, without this optional accessory, the alternator condition test is non-functional.

Automatic Polarity Sensing—Display shows a minus (–) sign on the DC Volts function when RED clip is connected to a voltage source which is negative (–) with respect to ground.

Zero Adjustment—Unit automatically zeroes on the Volts, Frequency, and RPM functions.

Overrange Indication—Left side of display shows either "1" or "–1" when range in a function is exceeded.

Operating Temperature—32° F to 100° F.

Internal Battery—The analyzer is powered by an internal nine (9) volt transistor radio battery. When replacement is necessary, the digital display will indicate "LO BAT." Replace the battery with an Eveready No. 216 general purpose, or a No. 522 alkaline battery or their equivalent. Note that the "LO BAT" indicator does **not** apply to the battery in the vehicle under test.

FUNCTIONS AND DISPLAY

The analyzer provides the following functions and displays them as indicated.

RPM—X10, 0—10000 RPM, 10 RPM resolution. Multiply the displayed reading by 10.

2 Cycle, D.I.S./4 Cycle switch—In the 4 cycle position, RPM is displayed for distributor equipped four (4) cycle engines. In the 2 cycle/D.I.S. position, RPM is displayed for distributorless ignition systems, two (2) cycle engines, and any engine which uses a waste spark type of ignition system.

DWELL—4, 6, and 8 cylinder capability.
4 cylinder, 0—90.0 degrees
6 cylinder, 0—60.0 degrees
8 cylinder, 0—45.0 degrees
.1 degree resolution

The display is read directly. The six (6) cylinder dwell scale is also used for the General Motors C-3 (Computer Command Control) system performance check.

DUTY CYCLE (%)—0-100%
The duty cycle position is used in those applications where a dwell or duty cycle measurement must be made and expressed in percentage.

DC VOLTS—0—2, 1 millivolt resolution
0—20, 10 millivolt resolution
0—200, 100 millivolt resolution.
All volts ranges have 10 Megohm input impedance making this analyzer compatible with the computer systems used on many modern vehicles.

AC VOLTS—0-200, 100 millivolt resolution.

ALT. TEST—(Alternator Test) Checks alternator condition, (Diodes and windings). **The digital display is shut off in this position.** As indicated above this test is non-functional without the optional Hall effect (amps) clamp.

OHMS—See the table below.

OHMMETER READINGS AND MULTIPLIER VALUES

SELECTOR	RANGE	MULTIPLIER	SMALLEST NUMBER READABLE
200 Ohms	.1Ω to 199.9Ω	1	.1Ω
A. Examples:			
	3.3 ohm resistor = 03.3 x 1 = 3.3Ω		
	25 ohm resistor = 25.0 x 1 = 25Ω		
	160 ohm resistor = 160.0 x 1 = 160Ω		
2 K-Ohms (K = Kilo or 1000)	1Ω to 1.999KΩ	1000	1Ω
B. Examples:			
	1800 ohm resistor = 1.800 x 1000 = 1800Ω		
or	1800 ohm resistor = 1.800 x 1KΩ = 1.8KΩ		
	330 ohm resistor = .330 x 1000 = 330Ω		
20 K-Ohms	10Ω to 19.99KΩ	1000	10Ω
C. Examples:			
	8200 ohm resistor = 8.20 x 1000 = 8200Ω		
or	8200 ohm resistor = 8.20 x 1KΩ = 8.2KΩ		
	15000 ohm resistor = 15.00 x 1000 = 15000Ω		
or	15000 ohm resistor = 15.00 x 1KΩ = 15KΩ		
200 K-Ohms	100Ω to 199.9KΩ	1000	100Ω
D. Examples:			
	20,000 ohm resistor = 20.0 x 1000 = 20,000Ω		
or	20,000 ohm resistor = 20.0 x 1KΩ = 20KΩ		
	150,000 ohm resistor = 150.0 x 1000 = 150,000Ω		
or	150,000 ohm resistor = 150.0 x 1KΩ = 150KΩ		
2 M-Ohms (M = Meg or Million)	1000Ω to 1.999MΩ	1000000	1000Ω
E. Examples:			
	750,000 ohm resistor = 750 x 1,000,000 = 750,000Ω		
or	750,000 ohm resistor = 750 x 1MΩ = 750KΩ		
	1,500,000 ohm resistor = 1.500 x 1,000,000 = 1,500,000Ω		
or	1,500,000 ohm resistor = 1.500 x 1MΩ = 1.5MΩ		

DIODE CHECK—Use this test to check for open or shorted diodes. A good diode will show a low reading with the test leads connected in one polarity, and a high reading with the test leads connected in the other polarity. The low reading will typically be some three digit number on the display (.673). The actual number is not critical. The high reading should be infinity (1.).

FREQ. (Hz)—Frequency measured in hertz.
X1, 0—1999 Hz, 1 Hz resolution
X10, 0—10 Khz, 10 Hz resolution
The digital display is read directly on the X1 range. Multiply the reading by 10 on the X10 range, (reading is in Hertz).

AUX.—Used in conjunction with the auxiliary input jacks on the analyzer for optional accessories which are available for the unit.

OFF—To preserve battery life always return the rotary switch to OFF when testing is complete.

LEAD CONNECTIONS

Test lead connections to the analyzer and vehicle are described and shown below.

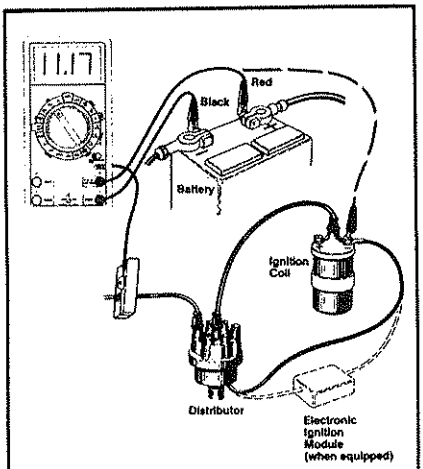
Connect the RED test lead banana plug to the positive (+) input jack on the analyzer.

Connect the BLACK test lead banana plug to the negative (–) input jack on the analyzer.

Plug the inductive pickup into the input jack on the side of the instrument.

See the instruction manuals supplied with the optional accessories for connection to the auxiliary input jacks and digital display indications.

Test connections to the vehicle are as follows:



Master Hookup Diagram
Figure 1

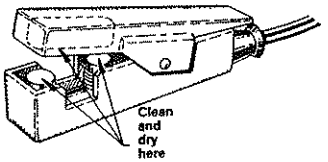
DC VOLTS—RED clip to the voltage source, such as the positive (+) battery terminal, lamp socket, oxygen sensor, throttle position sensor, or other connection as required by the test procedure. For safety reasons, always connect the RED clip first. BLACK clip to a clean secure ground such as the alternator bracket, or a ground strap. In the case of a component which is isolated from ground, connect the BLACK clip to the negative side of that component. For safety reasons do not use the negative (–) battery terminal or fuel system components as a ground connection. Explosive gasses or vapors may be present in these areas, and could be ignited by a sparking connection.

AC VOLTS—Connect the RED and BLACK clips across the voltage source to be measured.

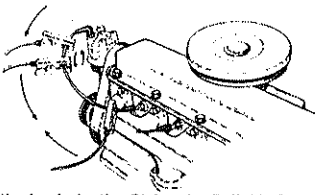
RPM—Clamp the inductive pickup around any spark plug wire. **Make sure that the clamp closes completely, and that the mating surfaces of the "U" core and "I" bar are clean as shown in Figure 2 below.** A defective ignition system may cause the tachometer to bounce around or show unsteady or intermittent readings. Low output spark voltage or defective ignition wires may be responsible. You may be able to steady the reading by sliding the inductive pickup along the ignition wire to a new location, or reversing the inductive pickup on the wire as shown in Figure 3. If erratic readings persist, move to another ignition wire in the event that the original one may be defective since the inductive pickup can be connected to any spark plug lead. Also, solid copper ignition wires radiate large amounts of radio frequency noise through the air which can interfere with the proper operation of the analyzer and other electronic equipment. Replace solid copper ignition wire with resistance wire if only for the tests described in this manual.

NOTE—INDUCTIVE PICKUP

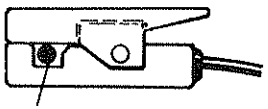
To maintain proper operation and accuracy of these pickups, clean and dry the inside mating surfaces with a soft cloth as shown in Figure 2. Avoid dropping these pickup assemblies as damage may result.



Cleaning Inductive Pickup
Figure 2



Positioning Inductive Pickup for Reliable Readings
Figure 3



CLAMP MUST BE COMPLETELY CLOSED
INDUCTIVE PICKUP CLOSURE
Figure 4

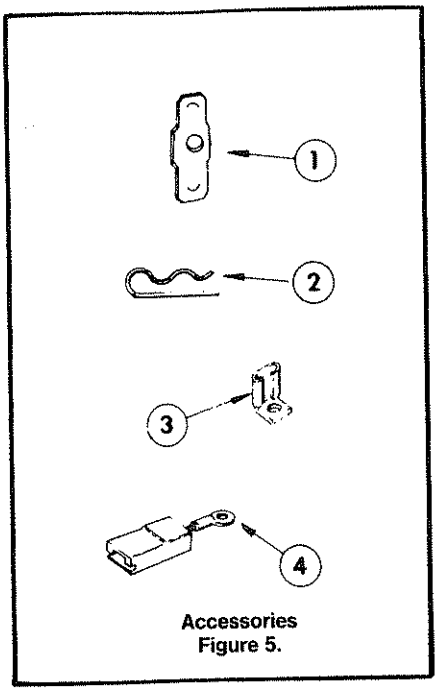
DWELL—BLACK clip to a clean secure ground as described above in DC VOLTS. RED clip to the negative (−) or tach terminal of the ignition coil. See Figure 1.

DUTY CYCLE—BLACK clip to a clean secure ground as described above in DC VOLTS. RED clip to the test point indicated by the service manual procedure.

OHMS/DIODE CHECK—Connect the RED and BLACK clips across the component to be tested. Note that when performing resistance or diode tests, the component under test must be electrically removed from the circuit to prevent false readings. Diodes must be checked in both polarities as described above in DIODE CHECK.

ACCESSORIES—The accessories shown are provided with the analyzer.

1. GM DIAGNOSTIC ADAPTER
   The GM DIAGNOSTIC ADAPTER is used for vehicles equipped with the large orange diagnostic connector and Toyota vehicles equipped with the IIA (Integrated Ignition Assembly).
2. FORD COIL CLIP
   The FORD COIL CLIP is used for vehicles that have ignition systems with booted connectors.



Accessories
Figure 5.

3. GM HEI ADAPTER
   The HEI ADAPTER is used to provide tach terminal connections on GM HEI systems.
4. ALTERNATOR ADAPTER
   The alternator adapter is used for full fielding some alternators.

ELECTRICAL SYSTEM—PRELIMINARY CHECKS

INTRODUCTION—Before performing any electrical system tests, carefully read the following information. These checks will help you identify the more common electrical system problems and will serve as a general guide for making electrical system tests.

VEHICLE CHECKS

A. CONSULT THE VEHICLE MANUAL OF THE VEHICLE BEING TESTED FOR SPECIFIC VOLTAGE AND CURRENT SPECIFICATIONS AND TEST PROCEDURES.

B. Check the fan belt; adjust the tension to manufacturer's specifications.

C. Check the generator or alternator pulley and mounting bolts. They should be tight. Make sure that the charging and cranking system wiring and the battery cables are in good condition and that connections are clean and tight. Make sure that the battery is clean and that the liquid level in each cell is above the plates on vent cap style batteries or that the green "eye" is visible on maintenance free batteries.

D. Check the "CCA" (Cold Cranking Amps) rating of the vehicle battery, often listed on the battery. This number should **equal or exceed** the specification given by the manufacturer for the vehicle's engine. If the battery capacity is too small, a cold engine may crank slowly or not at all on very cold days. If specifications are not available, the following method may be used to determine battery capacity.

8 CYLINDER ENGINES The cubic inch displacement (CID—not liters) equals the cold cranking amp requirement. For example, a 350 cubic inch displacement engine equals a 350 CCA minimum. For cold climates, add 20% of the cubic inch displacement to the CCA. Therefore 350 x .2 (20%) = 70. 350 + 70 = 420. A 420 CCA or greater rated battery should be used.

6 CYLINDER ENGINES Calculate the cubic inch displacement per cylinder and multiply by 8. For example, a 231 cubic inch displacement 6 cylinder engine = 38.5 cubic inch displacement per cylinder. Then, 38.5 x 8 = 308 CCA minimum. For cold climates add 20% of the adjusted cubic inch displacement to the CCA. Therefore 308 x .2 (20%) = 62. 308 + 62 = 370. A 370 CCA battery or greater should be used.

4 CYLINDER ENGINES Multiply the cubic inch displacement of the engine by 2. For example, a 151 cubic inch displacement 4 cylinder engine x 2 = 302 CCA. For cold climates add 20% to the CCA. Therefore 302 x .2 (20%) = 60. 302 + 60 = 362. A 362 CCA or greater rated battery should be used.

E. Check the alternator/generator output rating as listed on its color coded tag or stamped on the alternator/generator frame. For example, 60A or 100A indicates a 60 ampere or 100 ampere alternator/generator. This rating should equal or exceed the manufacturer's specification for the vehicle as equipped. An alternator/generator which is electrically too small for the vehicle cannot charge a battery when the vehicle is run under heavily electrically loaded conditions (lights, HI fan, air conditioning, etc.) The result could be a no CRANK/START condition after prolonged operation under heavy electrical load conditions.

F. Electrical specifications are generally given for an engine which is at normal operating temperature. If the engine is cold and will start, operate the engine for at least 10 minutes before making any tests or until it is fully warm (upper radiator hose is hot). If the engine will not start, and the cranking system tests must be made on a cold engine, cranking voltage may be slightly lower than specifications state.

CRANKING VOLTAGE AND BATTERY CONDITION

If the engine cranks slowly or not at all, the battery, starter motor, and associated wiring may be at fault. Check the cranking voltage as indicated below.

1. Connect the analyzer to the vehicle as shown in Figure 1 and described in LEAD CONNECTIONS on page 4.

2. Disable the engine from starting as explained in your vehicle service manual.

3. Function Selector—DC VOLTS, 20.

4. Crank the engine while observing the digital display.

5. Normal result—9.6 volts or more at 70° F. Voltage will drop slightly as temperature decreases.

6. If the results are significantly out of specification, consult your vehicle service manual for further diagnosis.

7. If battery voltage remains abnormally high (above approximately 10.5 volts) on a slow or no cranking engine, the problem may be loose or corroded connection(s) in the cranking circuit. Follow the procedure described below.

CRANKING CIRCUIT VOLTAGE LOSS TEST

The CRANKING CIRCUIT VOLTAGE LOSS TEST checks for voltage losses in the cranking system.

1. Perform the instructions listed under ELECTRICAL SYSTEM—PRELIMINARY CHECKS.

2. Disable the engine from starting as explained in your vehicle service manual.

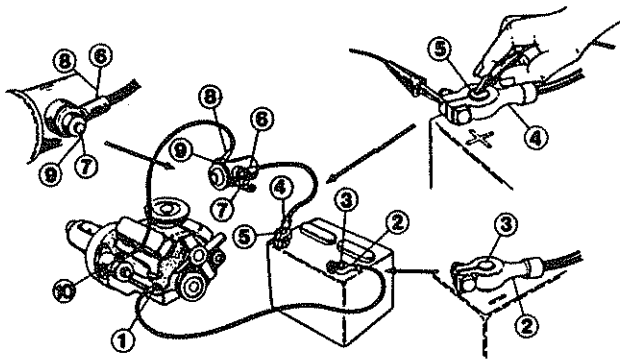
3. Function Selector—DC VOLTS, 2.

4. Use the RED and BLACK clips while referring to Figure 6. Connect the clips alternately between 1 and 2, 2 and 3, 4 and 5, 4 and 6, 6 and 7, 7 and 8, 7 and 9*, 8 and 9, and 8 and 10. Record the results at each point as read on the digital display with the engine cranking. Disregard the minus (−) sign if it appears in the display.

5. During this test no reading should be higher than .2 volts.*

6. If any reading is significantly higher than .2 volts,* check the cables or connections involved. Clean and tighten the connections. Replace broken, cracked, or corroded parts when necessary. To re-start the engine, reverse the "Disabling Procedure."

*The reading between 7 and 9, the starter solenoid voltage drop, may be a little higher than .2 volts and be satisfactory. Refer to your vehicle manual for specifications.



Cranking Circuit Voltage Loss, Typical Circuit
Figure 6

NOTE

This is a representative sample of one type of cranking circuit. Your vehicle may use a different circuit with different components or locations.

CHARGING SYSTEM VOLTAGE

It is the function of the charging system to keep the battery charged when the engine is running and to power the rest of the vehicle's electrical load requirement (ignition, lights, fan, etc.). If this system fails, the result will be a discharged, or possibly "dead" battery.

1. Connect the analyzer to the vehicle as shown in Figure 1, and described in LEAD CONNECTIONS, on page 4.

2. Function Selector—DC VOLTS, 20.

3. Start the engine and allow it to warm to normal operating temperature. Operate it at curb idle.

4. With all accessories off observe the digital display.

5. Normal result—13.2 to 15.2 volts or as specified in the vehicle service manual.

6. Function Selector—RPM X10

7. Select a step on the fast idle cam which will maintain engine speed between 1800 and 2800 RPM, or have an assistant hold engine speed in this range. Hold this speed through Step 11.

8. Function Selector—DC VOLTS, 20.

9. Observe the digital display. The voltage should not have changed from Step 5 more than about .5 volts.

10. Load the electrical system by turning on the lights, HI fan and wipers.

11. Observe the digital display. Voltage should not drop down below about 13.0 volts.

12. Shut off all accessories, return the engine to curb idle and shut it off.

13. If the results obtained in Steps 5, 9, or 11 are significantly different from those shown, or vehicle service manual values, further diagnosis may be required; see your vehicle service manual.

MISCELLANEOUS VOLTAGE TESTS

This analyzer can perform many of the voltage tests called out in the vehicle service manual, such as voltages at lamp sockets, motors, solenoids, relays, and vehicle on-board computer related devices such as MAP sensors, oxygen sensors, throttle position sensors, and various control solenoids. To measure DC voltages:

1. Connect the RED clip to the positive (+) side of the device under test, and the BLACK clip to the negative (—) side of the device under test.

2. Set the Function Selector to the appropriate 2, 20, or 200 volt range. If the approximate voltage is unknown, set the test selector to the 200 volt range and decrease to the 20 or 2 volt range as required.

IGNITION SYSTEM TESTS

1. **Primary Coil Voltage**

(a) If the engine cranks normally, but does not start, a low voltage (or no voltage) may be measured at the coil primary (+ terminal). Look for poor (or no) connection to the ignition switch, wiring harness, or firewall (bulkhead) connectors.

(b) If the engine starts, but dies immediately upon releasing the key, the ballast resistor may be open (or changed value). A full explanation for trouble-shooting this problem will be found in your vehicle service manual.

2. **Breaker Point Resistance Test**

(Breaker Point Systems Only). Visually check the breaker points and associated wiring and connections. Check to see that the lead from the distributor to the negative (—) terminal of the ignition coil is not damaged (nicked insulation etc.). Remove the distributor cap and inspect the breaker points. Properly adjusted breaker points become light gray in color in normal use. If they are blued, blackened, or pitted, they have exceeded their normal life.

(a) To prevent the engine from starting, disable the ignition system by grounding the coil tower wire as shown below.

(b) Connect the analyzer to the vehicle as shown in Figure 1, RED clip to the negative (—) side of the ignition coil.

(c) Function Selector—DC VOLTS, 2.

> **NOTE**
>
> When testing a vehicle with dual points, alternately block one set of points open with a piece of insulating material while the other set is being tested.

(d) Turn the ignition key to the ON position. If the digital display reads overrange, (1.), crank the engine a fraction of a revolution at a time until the display shows a voltage reading.

(e) The points are now closed. A reading of .200 or less on the display indicates that the breaker points and associated wiring are in good condition. The analyzer may indicate high point resistance on a new set of points until they have been run in the vehicle for a few miles and have been properly seated. This condition may be ignored as long as any defects discovered during the previous visual check have been corrected.

(f) A reading of more than .200 on the display may indicate defective points or any of the following faults may exist:

Poor distributor ground.

Poor connection on the primary lead from the distributor to the ignition coil.

Defective distributor pigtail lead.

Misaligned points.

Poor points/plate ground inside the distributor.

Correct the defect and repeat the test.

3. **Dwell Test and Adjustment**
(Breaker Point Systems only or Transistorized Systems which use Breaker Points). Before performing the Dwell Test and Adjustment procedure, read the vehicle emission control label or the vehicle service manual to determine what should be done with the vacuum hoses connected to the distributor and the various advance/retard solenoids. Most often, the vacuum hose must be disconnected from the distributor and the end plugged with a plastic golf "tee" or other suitable means.

(a) Connect the analyzer to the vehicle as shown in Figure 1, RED clip to the negative (—) side of the ignition coil.

(b) Function Selector—DWELL; 4, 6, or 8 cylinder to match the engine under test.

(c) Start the engine and allow it to warm up (upper radiator hose is hot). Operate the engine at curb idle or the RPM specified by the vehicle emission control label or the vehicle service manual for measuring dwell. Check the RPM by switching the Test Selector to the RPM X10 position. Return the Test Selector to the appropriate DWELL position and observe the digital display.

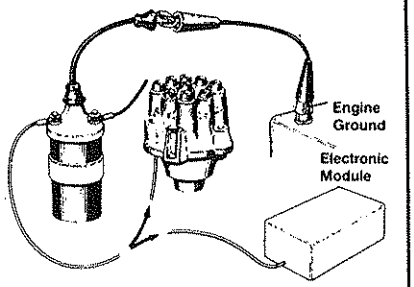
(d) If dwell is within specification, no adjustment is necessary.

NOTE:

There is a direct relationship between dwell and timing. However, it is only a one way relationship. If you change the dwell angle of the breaker points, you will automatically change the ignition timing. Changing the timing though, has no effect on the dwell angle. FOR THIS REASON, IT IS IMPORTANT TO RE-CHECK THE TIMING WHENEVER THE DWELL ANGLE HAS BEEN ADJUSTED.

DWELL ADJUSTMENT— CONVENTIONAL BREAKER POINT SYSTEMS

On GM distributors with a small metal slide cover, lift the cover and insert a ⅛" Allen wrench in the adjusting screw socket, and adjust the dwell by turning the wrench as shown in Figure 8.



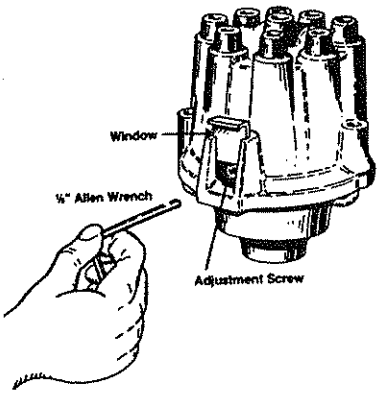
Disabling Procedure, Breaker Point Ignition System
Figure 7

On Ford, Chrysler, American Motors, and other distributors not equipped with a small metal access slide cover, perform the following steps while referring to Figure 9.

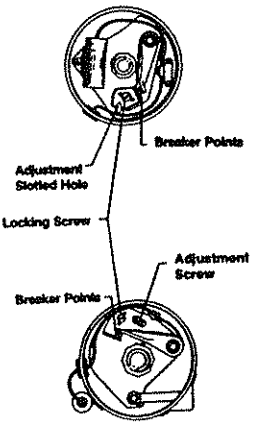
1. Remove the coil wire from the center tower of the distributor cap and ground the wire by connecting the loose end to the engine or frame. See Figure 7.

2. Remove the distributor cap and rotor.

3. Connect a remote starter switch to the vehicle or have an assistant crank the engine for you.



Dwell Adjustment, Dwell Reading, Typical Starting Engine
(Delco-Remy Sliding Window Distributors)
Figure 8



Dwell Adjustment
(All except Delco-Remy Sliding Window Distributors)
Figure 9

4. With the Test Selector set to the appropriate 4, 6, or 8 cylinder dwell position, turn the ignition key to the engine cranking position and observe the digital display.

5. To adjust dwell, loosen the locking screw slightly, and adjust the point gap with a feeler gauge according to the procedure outlined in the vehicle service manual. After adjustment, tighten the locking screw, and re-check dwell while cranking engine. Repeat procedure if necessary.

6. Reassemble distributor and recheck dwell reading with engine operating at idle speed. Repeat steps 5 and 6 if necessary.

DWELL VARIATION TEST

1. Follow the introductory paragraph and steps a. and b. of DWELL TEST AND ADJUSTMENT, page 9.

2. Start the engine and increase the engine speed from idle to about 1500 RPM and note the dwell angle. Return the engine speed to idle and again note the dwell angle. If the difference between the two dwell angle readings is more than 3 degrees, check for excessive wear in the breaker point plate and couplings or excessive wear in the distributor shaft gear and bushings.

FUEL SYSTEM TESTS

General Motors C-3 (Computer Command Control) Mixture Control Solenoid Dwell–

(Carburetor equipped vehicles only). The GM C-3 system controls air/fuel ratio with a mixture control solenoid in the carburetor. The basic system performance check of this system requires checking the duty cycle or "dwell" of the M/C solenoid. Note that regardless of the number of cylinders in the engine the Test Selector is always placed in the Dwell, **6 cylinder position.**

1. Connect the analyzer to the vehicle as shown in Figures 1 and 10. It will be necessary to switch the Function Selector between the RPM X10 and DWELL, 6 cylinder positions during the test procedure to observe the required reading.

2. Follow the test procedures as outlined in your vehicle service manual. Typically the dwell will vary from 10 degrees to 55 degrees when fully warmed at both curb idle and high speed (3000 RPM).

ENGINE RPM MEASUREMENT

1. Connect the analyzer to the vehicle as shown in Figure 1.

2. Function Selector—RPM X10

Carburetor Adjustments—There are several adjustments which should be checked as part of a performance tuneup. Those which require engine RPM monitoring are:

Curb idle
Base idle
Solenoid controlled idle
Fast idle

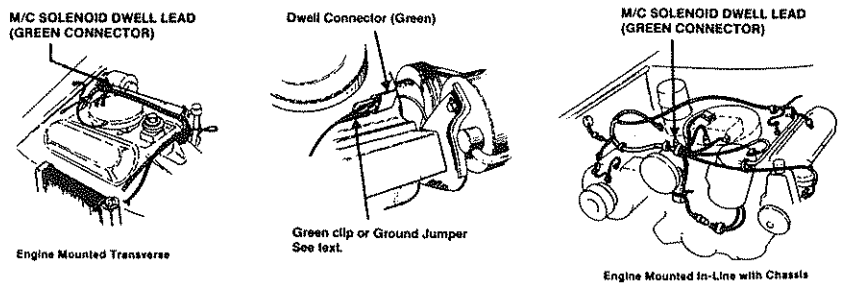
Your vehicle will likely have some combination of these adjustments. Proper adjustment of these settings is a requirement for good engine performance and drivability.

Fuel Injection Adjustments—Some fuel injection systems have a minimum and maximum authority adjustment which should be checked during routine performance tuneup or whenever idle problems are encountered. Consult your vehicle service manual for further information.

Miscellaneous Engine Tests—Many of the test procedures in your vehicle service manual require the engine to run at a specific RPM during the test. Your instrument provides excellent monitoring capabilities for this purpose.

OHMMETER TESTING

DIRECTIONS FOR USE—The OHMMETER is used to measure the electrical resistance of the various components of electrical systems. OHMMETER TESTS are always done in a circuit or on a component when NO power is applied to the circuit or component. Any attempt to use an ohmmeter in a live circuit will produce false results and may damage the instrument. In many cases the suspect component must be disconnected from the circuit to obtain an accurate reading. See the OHMMETER READINGS AND MULTIPLIER VALUES table for information on ranges and readings.



Typical GM C-3 Dwell Connector Locations
Figure 10

A. Low Resistance Measurements On the 200 Ohm scale this analyzer is capable of measuring very low resistance, down to .1 Ohm, (1/10th of an Ohm). Because the test leads have a small resistance to them, it is unlikely that the digital display will ever read 00.0 on the 200 Ohm scale of the analyzer with the test leads shorted together. The analyzer will read the resistance of the test leads themselves in such a case. With the leads shorted together the reading will likely be between 00.2 and 00.3. The actual lead resistance must be known before making any low resistance tests. The lead resistance must be subtracted from the reading obtained when using the 200 Ohm scale for testing purposes to obtain an accurate low resistance reading. For resistance above 10 Ohms, the lead resistance may be ignored. For example, to determine the resistance of a ballast resistor, follow these steps.

1. Short the ohmmeter test leads together on the 200 Ohm scale and record the reading (example: 00.3 Ohms) on the digital display.

2. Connect the ohmmeter leads across the ballast resistor and record the reading (example: 00.8 Ohms) on the digital display.

3. To obtain the actual resistance of the ballast resistor, subtract the ohmmeter lead resistance from the test result (00.8 Ohms—00.3 Ohms = 00.5 Ohms, the true ballast resistor resistance reading).

B. Short or Open Circuit Readings A short circuit (continuity) will be displayed as 000 on the digital display with the appropriate decimal point illuminated except as noted in the previous paragraph about "Low Resistance Meaurements." An open circuit (no continuity) or the overrange indication will be displayed as "1" on the digital display. If this indication is seen during resistance measurements move the Function Selector to a higher range one position at a time until a valid (multi-digit) reading is obtained. If the overrange indication is still present when the 2M Ohms position of the Function Selector is reached, the component or circuit being measured is either open or its resistance has exceeded the measuring capacity of this ohmmeter (2M Ohms). The majority of the electrical circuits/components found in the vehicle are of a relatively low resistance, and well within the measuring capability of this analyzer. Therefore an overrange indication on the 2M Ohms scale will be an open circuit (no continuity) in all but a few isolated cases. Consult your vehicle service manual for specific resistance values for components under test.

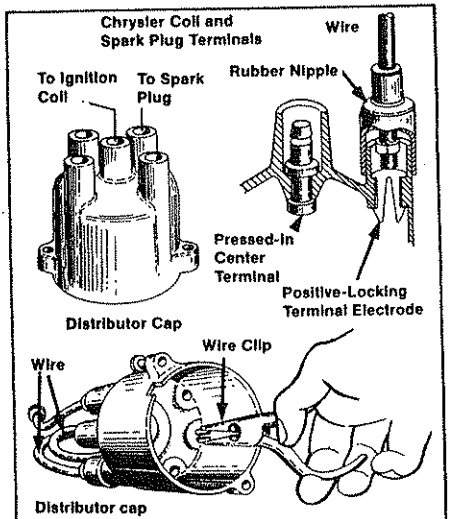
Spark Plug Wires—The spark plug wires in use today are refered to as resistance or suppression type wires. Unlike conventional conductor electrical wire which will provide a zero (0) Ohm reading on an ohmmeter, spark plug wires will show resistance when tested with an ohmmeter. Although designed to withstand extreme temperature conditions and high voltage, spark plug wires CANNOT withstand physical abuse. When removing these wires, grasp the wires only at the boots at both the spark plug end and the distributor or coil pack end. Twist the boots about a half a turn while pulling gently to remove them. The test procedure below will check these wires for open circuits, proper resistance, and intermittent opens.

CAUTION

Some Chrysler products use a "positive locking" terminal electrode spark plug wire. As shown by Figure 11, these plug wires can only be removed from inside the distributor cap. Damage may result to components if other means of removal are attempted.

NOTE

Some spark plug wires have sheel metal jackets with the following symbol —►◄—. This type of plug wire contains an "air gap" resistor. Wires of this type cannot be checked with an ohmmeter. An oscilloscope must be used.



CHRYSLER COIL AND SPARK PLUG TERMINALS
REMOVING CHRYSLER SPARK PLUG WIRES

Figure 11

Test Procedure:

1. Function Selector—OHMS, 200k

2. Connect the RED and BLACK clips to each end of the disconnected plug wire. It may be necessary to use a small screwdriver or nail to reach the recessed metal connectors inside the boots. Check for a tight connection. If more than one spark plug wire is removed for the test, clearly mark the wires and their locations on the engine to make re-installation easier.

3. While observing the digital display, gently flex the plug wire its full length. Then, gently flex each end of the spark plug wire between the wire and the boot. Defects most often occur where the wire meets the boot. The digital display should remain steady and not change its reading during this step.

> **NOTE**
>
> The far right digit (representing hundreds of ohms) on the digital display may change during the test procedure. This is acceptable.

4. Consult the vehicle service manual or the table below for proper results.

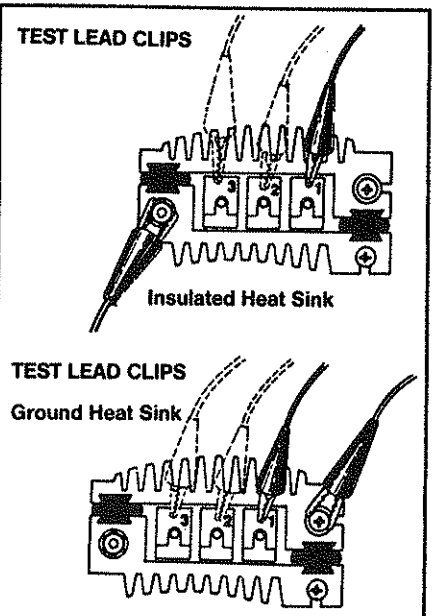
Alternator Diode Tests—The procedure below shows how to test diodes in a disassembled alternator. Although the procedure shown is for alternators, any diode is tested in the same manner as is shown, whether or not they are part of a "heat sink package," a diode trio, or handled one piece at a time.

Test Procedure:

1. Function Selector—Diode

Rectifier diodes:

2. See Figure 12 before beginning this test. Make all connections to a clean metal surface. Clean it if necessary. If the figure below does not match your alternator, refer to your vehicle service manual.



Rectifier Diode Assembly, Test Connections (GM AC Delco Shown)
Figure 12

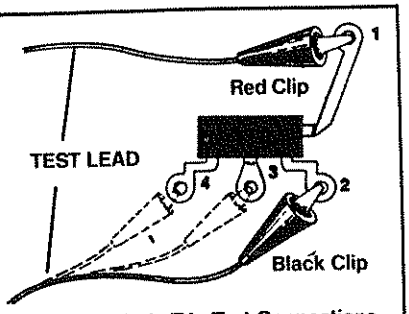
Manufacturer	Spark Plug Wire Resistance	Coil Tower Wire Resistance
Chrysler Corporation	Less than 50,000 ohms	Less than 15,000 ohms
Ford Motor Company	All wires less than 5000 ohms ohms per inch	
General Motors Corporation	0" to 15" wires-3000 ohms to 10,000 ohms 15" to 25" wires-4000 ohms to 15,000 ohms 25" to 35" wires-6000 ohms to 20,000 ohms	

3. Connect the BLACK clip to the insulated heat sink. In sequence, press the RED clip on the top spade terminal (not the threaded stud) at points 1, 2, and 3. (The insulated heat sink is connected to the alternator output terminal). Record each reading from the digital display.

4. Connect the RED clip to the insulated heat sink. In sequence, press the BLACK clip on the top spade terminal (not the threaded stud) at 1, 2, and 3. Record each reading from the digital display.

5. Connect the BLACK clip to the grounded heat sink. In sequence, press the RED clip on the top spade terminal at points 1, 2, 3. Record each reading from the digital display.

6. Connect the RED clip to the grounded heat sink. In sequence, press the BLACK clip on the top spade terminal (not the threaded stud) at points 1, 2, and 3. Record each reading from the digital display.



AC Delco Diode Trio Test Connections
Figure 13

Diode Trio (Delco-Remy AC Generators):

Delco-Remy uses a diode trio in their AC generators. This kind of diode package has four (4) terminals. See Figure 13 for test point connections.

1. Connect the RED clip to terminal 1, and the BLACK clip to terminal 2. Record the reading on the digital display. See Figure 13.

2. Reverse the clips and record the reading on the digital display. See Figure 13.

3. Repeat Steps 1 and 2 for points 1 and 3, and 1 and 4. See Figure 13.

Test Results: Rectifier Diodes and Diode Trio Tests.

Within specification:

Each diode should show one high and one low reading at each connection point. The high reading should be infinity (1.). The low reading will typically be some three digit number on the display (.524). The actual number is not critical.

NOTE—RECTIFIER DIODES ONLY

Three of the diodes tested will produce the low reading with the clips connected one way; the other three diodes will produce the low reading with the clips connected the opposite way.

1. Out of Specification

(a) Open Diode. Both readings at each connection point are infinity (1.).

(b) Shorted Diode. Either or both readings are (.000) at each connection point.

(c) Leaky Diode. One reading is higher than the other, but not infinity at each connection point.

ENGINE ANALYZER

Key No.	Part No.	Description
1	1000-248	Alternator Adaptor
2	1000-425	Accessories Kit (Primary Adaptors)
3	20-109	Nine (9) Volt Alkaline Battery
4	38-1393	Tach Pickup
5	38-976	Test Lead Set—Complete (w/o tach pickup)
6	400-1529	Analyzer Case Protective Boot
7	400-1533	Analyzer Case Stand
8	400-1531	Analyzer Case Battery Cover
8	400-1505	Carrying Case
10	2-200401	Instruction Manual