actron®

ACTRON MANUFACTURING CO.
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Cleveland, Ohio 44102

FULL THREE (3) YEAR WARRANTY

Actron Manufacturing Company, 9999 Walford Avenue, Cleveland, Ohio 44102, warrants to the user that this unit will be free from defects in materials and workmanship for a period of three (3) years from the date of original purchase. Any unit that fails within this period will be repaired or replaced at Actron's option and without charge when returned to the Factory. Actron requests that a copy of the original, dated sales receipt be returned with the unit to determine if the warranty period is still in effect. This warranty does not apply to damages caused by accident, alterations, or improper or unreasonable use. Expendable items, such as batteries, fuses, lamp bulbs, flash tubes are also excluded from this warranty.
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2-2208

AUTORANGING

ENGINE ANALYZER

Contents

Table of Contents

Table of Contents

Introduction

Safety!

- Do not use this product to measure voltages that are over 1000 VDC or 750 VAC between any terminal and ground.
- Internal combustion engines produce carbon monoxide which can slow reaction time and can lead to serious injury. Keep the service area well ventilated or attach an exhaust extraction system.
- Set the parking brake and block the wheels when doing testing.
- Do not operate the vehicle while taking measurements with the meter. Use two people for testing that requires vehicle operation.
- Use eye protection when working on vehicles. Always check the condition of belts and hoses that can cause injury to technicians working near rotating or hot components.
- Do not use damaged or frayed test leads that have poor insulation.
- Automotive service areas have safety hazards that technicians must understand and observe while using this product. This list of safety items cannot be complete because of the number of possibilities and should not be considered as a complete list.

Introduction

Introduction

The meter is an advanced electronic tester that has all the functions of an advanced multimeter and automotive tester in one compact unit. The automotive features include frequency, temperature, RPM, and dwell measurement.

The advanced multimeter functions include maximum and minimum measurements for capturing and displaying changes in signal level. The meter has a 3 3/4 digit display with a range of 0 to 3999 for standard measurements and 9,999 for frequency. It also has a 42 segment graphic bargraph which updates 20 times per second for a faster response than the digital display. This manual will help technicians understand the use and capabilities of the meter.

How to use this manual

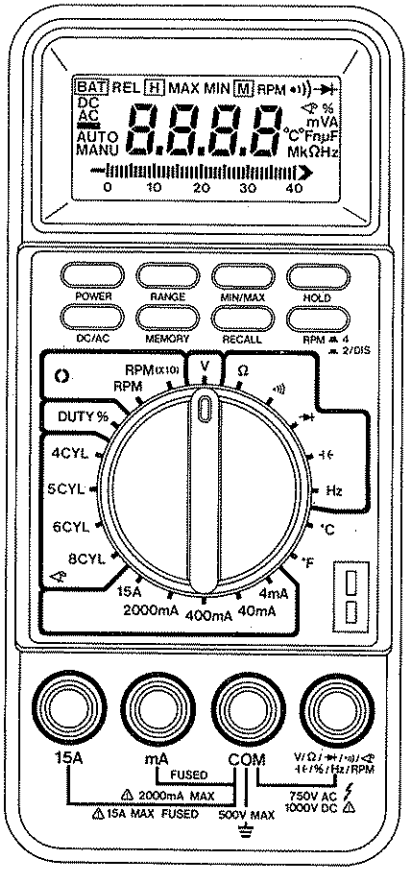
The layout is by meter functions. Included in each chapter are specifications, ranges, special measurement options, and typical use for each function on the rotary switch. Use the chapter for the function you are using in order to learn the complete capability of this product. Meter controls and the display layout are in the first section with meter functions following.

Introduction

Getting Started

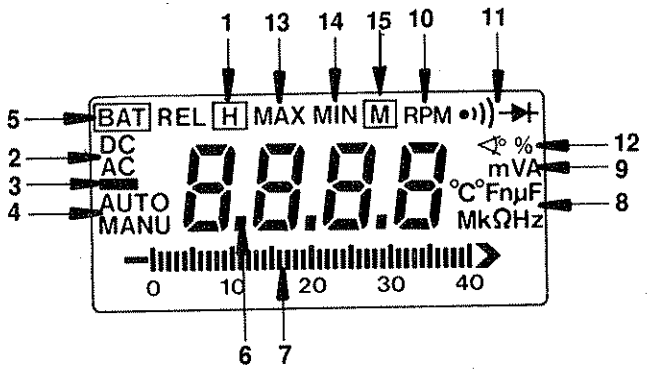
The meter is an advanced design incorporating a wide range of automotive and multimeter functions. This section will help you get started but is not intended to explain every function in detail.

Overview :



Introduction

3 3/4 digit meter display



Display With All Functions Shown

1. Hold-Displayed when hold button is pressed
2. DC/AC-Shows type of voltage measurement selected
3. Negative sign-Negative polarity indicator
4. AUTO, MANU-Automatic or manual ranging is selected
5. Battery low-Change the battery when this symbol is displayed
6. Decimal-Shows decimal point location for the range selected
7. 42 segment bar graph-For fast analog signal indication
8. Ω, temperature, frequency, capacitance indicators
9. Millivolt, volt & amp indicators
10. RPM indicator
11. Diode, continuity test indicators
12. Duty cycle percent, dwell indicators
13. Maximum value indicator
14. Minimum value indicator
15. Memory indicator

Meter Functions

Special Measurement Features

These buttons are used to select operating modes and power ON/OFF. When a button is pushed the beeper sounds (unless the beeper has been turned off). An annunciator is displayed to show which mode or option has been selected.

① MANUAL RANGING

Press the RANGE button to select the manual range mode and turn off the auto annunciator (the meter remains in the range it was in when manual ranging was selected). In the manual range mode, each time you press the RANGE button, the range increments, and a new value is displayed. If you are already in the highest range the meter "WRAPS AROUND" to the lowest range. To exit the manual range mode and switch to auto ranging, press and hold down the RANGE button for 2 seconds, the "AUTO" annunciator will again be displayed.

② MIN/MAX

Press the MIN/MAX button to record the minimum or maximum value of a signal. Signals lasting 100 ms or 1onger will be recorded and displayed.

After the MIN/MAX button is depressed the first time, the MIN and H symbols will be displayed. Each time the signal value is smaller than the previously stored value, the old value will be replaced with the new, smaller one.

After the MIN/MAX button is depressed the second time, the MAX and H symbols will be displayed. Each time the signal value is greater than the previously stored value, the old value will be replaced with the new, greater one.

Meter Functions

Pressing the MIN/MAX button the third time returns the meter to normal operating mode.

③ Hold :

Press the HOLD button to capture and freeze the present reading. Pressing the HOLD button a second time will release the hold function.

Note : HOLD is sometimes pressed by accident. If the reading appears to be frozen, check if the HOLD symbol is displayed.

④ DC/AC

Press the DC/AC push button to select between DC or AC when the rotary switch is set to voltage or current.

⑤ MEMORY

Press the MEMORY button to enter the memory mode. In the Memory mode the "M" annunciator is displayed and the displayed reading is stored.

⑥ RECALL

Press the RECALL button to enter the memory read mode. The "H" annunciator is displayed and the "M" annunciator is flashing.

The value shown on the LCD is always the stored memory value. Pressing "HOLD" when you are in the read mode causes you to exit the read mode and enter the memory mode.

⑦ RPM 4 2/DIS

Press the RPM 4 2/DIS button to toggle between RPM for 2-cycle/ distributorless ignition system or RPM for 4-cycle engines.

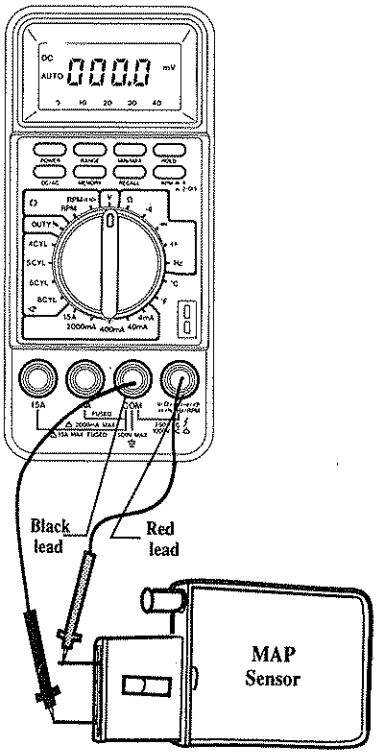
Meter Functions

1-Voltage Measurements

1. Set up the meter as shown in the diagram.
2. Plug the meter leads in as shown.
3. Connect the leads to the circuit to be measured.
4. Observe voltage readings.

Special measurement options are included in this section.
Examples of automotive applications are shown in section 12.

Meter Set-Up For Volts



Meter Functions

Voltage Selection

Two types of voltage measurements are possible.

1. DC voltage always has the same polarity. Batteries, solar cells, and computer power supplies are examples of DC voltage sources.
2. AC voltage continuously changes polarity at regular intervals. Rotating generators, alternators, and signal generators such as magnetic pick ups and speed sensors are examples.

Advanced testing options are included in this section. These test options will increase the range of special tests that can be performed by utilizing the advanced capabilities of the meter.

Selector Switch Position

Set the rotary selector switch to the V position on the rotary dial. The meter will automatically select the best range.

DC & AC Voltage Selection :

When the meter is powered on or voltage is selected with the rotary function switch, the meter will display AC or DC.
To change this selection press the AC/DC button.

Range Selection :

There are two modes of range selection when measuring voltage.

1. Auto ranging is the default mode when the VOLTAGE function is selected or when the meter is powered on.
   Auto ranging automatically selects the best measurement range.
2. Manual ranging is selected when the RANGE button is pressed.
   Each time the RANGE button is pressed, the next higher range is selected.
   Manual ranging allows the operator to choose the desired measurement range.

Meter Functions

Note:Pressing the RANGE button for 2 seconds or longer will release the manual range mode and restore the auto range mode.

Manual Voltage Ranges :

The voltage ranges that can be selected with the front panel button in the manual mode are :

000.0mV to 399.9mV

0.000V to 3.999V	00.00V to 39.99V
000.0V to 399.9V	0000V to 1000VDC or 750VAC

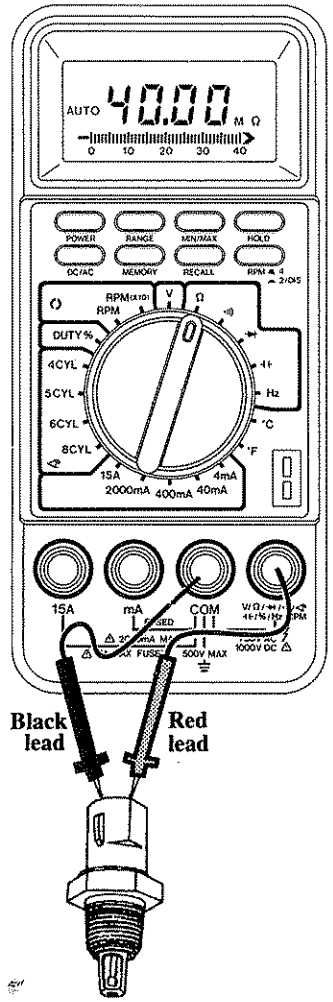
Meter Functions

2-Ohms Measurements

1. Set up the meter as shown in the diagram.
2. Plug the meter leads in as shown.
3. Connect the leads to the circuit to be measured.
4. Observe resistance readings.

The example shown here is for testing a resistive type temperature sensor.

Meter Set-Up For Ohms



Air Temperature Sensor

Test Lead Connection

The red lead plugs into the V-Ω receptacle on the lower right of the front panel. The black lead plugs into the COM receptacle on the lower right of the front panel.

Selector Switch Position :

Set the selector switch to the OHMS position on the rotary switch. The meter will automatically select the best range for the circuit being measured.

Range Selection :

There are two modes of range selection when measuring resistance.

1. Auto ranging is the default mode when the OHMS function is selected or when the meter is powered on. Auto ranging automatically selects the best measurement range.
2. Manual ranging is selected when the RANGE button is pressed. Each time the RANGE button is pressed, the next higher range is selected.
   Manual ranging allows the operator to choose the appropriate measurement range.

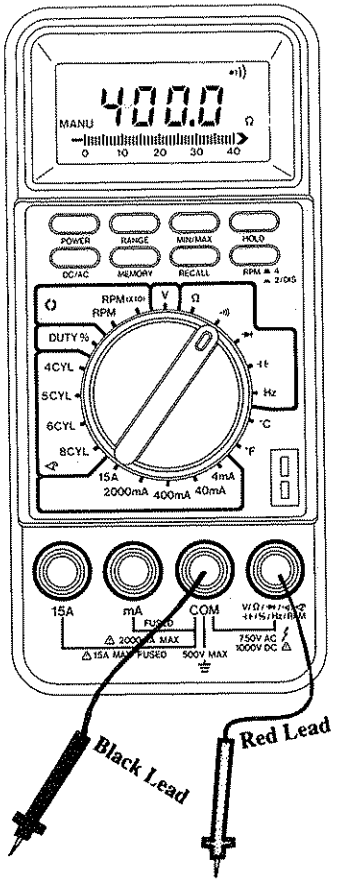
Manual Ohms Ranges :

The resistance ranges that may be selected with the front panel button in the manual mode are :

1. 000.0 Ω to 399.9 Ω
2. 0.000KΩ to 3.999KΩ
3. 00.00KΩ to 39.99KΩ
4. 000.0KΩ to 399.9KΩ
5. 0000KΩ to 3999KΩ
6. 00.00MΩ to 39.99MΩ

3- Audible Continuity Test

It is difficult to watch the meter when testing for an open or a shorted wire in a complex wiring harness especially when it is in a tight place or under the dash. The audible continuity feature produces an audible tone when the resistance being measured is under 35Ω.
If the resistance is greater than 35Ω, the tone will not be produced.
Finding opens and shorts is made easy by listening for the tone instead of looking at the meter.



Typical Uses For Audible Continuity

Test for open circuit :

1. Disconnect both ends of the circuit.
2. Place a jumper wire to ground at one end of the circuit. This allows testing to ground with the meter, since it may not be easy to connect the meter to both ends of the circuit.
3. Connect the red lead to the circuit to be tested and the black lead to ground.

If the tone does not sound, the circuit is open. Remove the ground jumper from the circuit and connect it to an easy access point closer to the meter. The tone will sound when the ground completes the circuit. The open will be between the point where the tone sounds and the last point was tested.

Short Circuit Testing (Short to ground) :

1. Disconnect both ends of the circuit.
2. The meter should show an open circuit when connected to ground and one end of the circuit. If not, disconnect the vehicle wire harness connectors until the short disappears. The short is in wiring that was disconnected when the tone stopped sounding.

4- Diode Test

The diode test applies a 3 volt signal to the diode under test and tests the ability of the diode to pass and block the current.

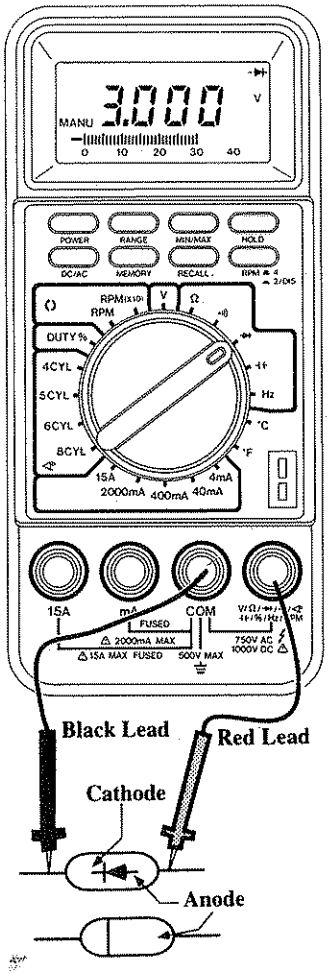
Note : Be sure that no power is applied to the diode under test. Preferably remove the diode from the circuit.

1. Set up the meter as shown in the diagram.
2. Plug the meter leads in as shown in the diagram.
3. Connect the leads to the diode for conduction or blocking action.

Conduction test-The red lead connects to the anode and the black lead to the cathode for forward conduction, which results in a low voltage reading.

Blocking test-Reversing the leads will cause a good diode to block current flow, which results in a higher voltage reading.

Meter Set-Up For Diode Test



Normal test results :

Red lead to anode 0.4 to 0.7 volts.
Black lead to anode approximately 3 volts or so depending on the battery condition.

Shorted diodes will have a low voltage reading for both conduction and blocking tests.
Open diodes will read approximately 3.000V for both the blocking and conduction test.

Test Lead Connection

The red lead plugs into the V-Ω receptacle on the lower right of the front panel. The black lead plugs into the COM receptacle on the lower right of the front panel.

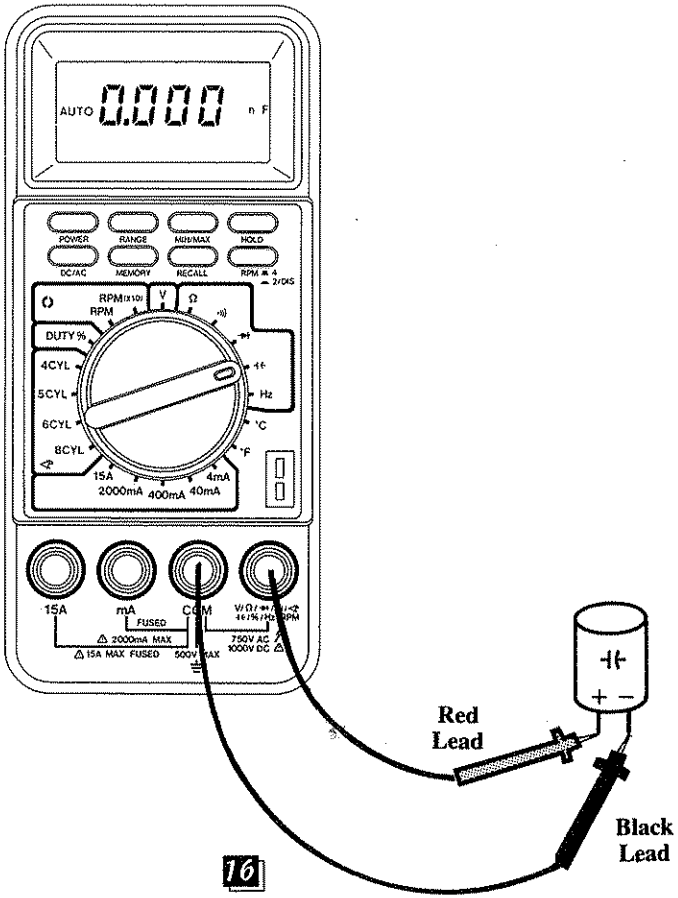
Selector Switch Position :

Set the selector switch to the DIODE position.
The display reads the voltage present across the test leads.
The test uses a fixed voltage and does not require range selection or auto ranging.

5- Capacitance Measurement

1. Set up the meter as shown in the diagram.
2. Plug the meter leads in as shown.
3. Connect the leads to the circuit to be measured.
4. Observe capacitance reading.

Note :
To prevent measuring errors and for safety discharge the capacitor to ground first.



Test Lead Connection

Plug the red lead into the V-Ω receptacle on the lower right of the front panel. The black lead plugs into the COM receptacle on the right lower front panel.

Selector Switch Position

Set the selector switch to the ⊣⊢ position on the rotary dial.

Range Selection

The meter will automatically select a suitable range when a capacitor is connected to the test leads.
Manual ranging is selected when the RANGE button is pressed.
Each time the RANGE button is pressed, the next higher range is selected.

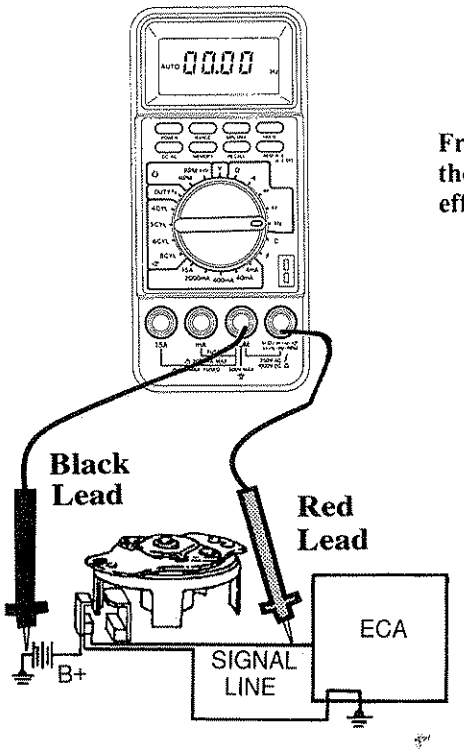
Manual Range :

The capacitance ranges that can be selected with the RANGE button in the manual mode are :
0 to 4nF
0 to 40nF
0 to 400nF
0 to 4μF
0 to 40μF

6- Frequency Measurements

1. Set up meter as shown in the diagram.
2. Plug the meter leads in as shown.
3. Connect the leads to the circuit to be measured.
4. Observe frequency readings.

Meter Set-Up For Frequency



Frequency measurement of the output signal from a hall effect pick up in a distributor.

Test Lead Connection :

The red lead plugs into the V-Ω receptacle on the lower right of the front panel. The black lead plugs into the COM receptacle on the lower front panel.

Selector Switch Position :

Set the selector switch to the Hz position on the rotary dial. The meter will automatically select the best frequency range.

Input Sensitivity Selection :

The input sensitivity can be set for frequency measurements. The default input sensitivity level when power is turned on or the frequency function is selected is 10mV.
The input sensitivity ranges are : 10mV, 0.1V, and 1V. They can be changed by pressing the RANGE button. The input sensitivity is displayed for 0.5 sec after the RANGE button is pressed.

7- Temperature Measurements

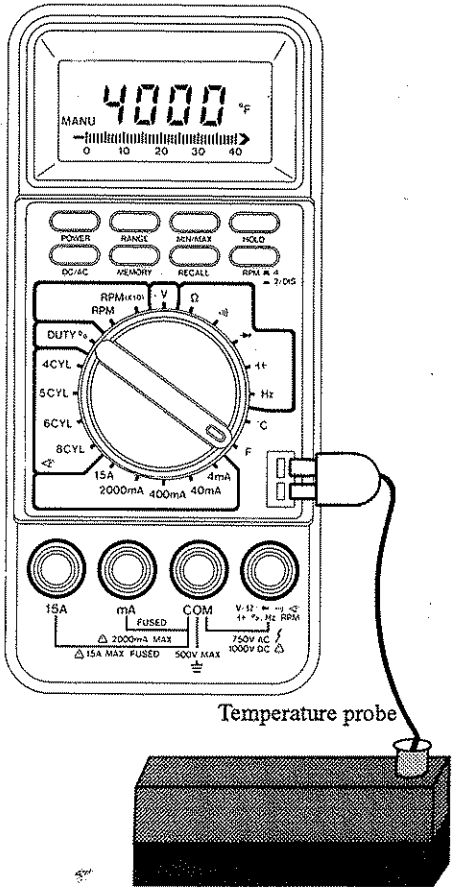
1. Set the selector switch to temperature (℃ or ℉).

2. Plug the special temperature probe into the yellow socket on the front panel.

3. Place the probe tip on the surface where temperature is being measured.

4. Allow temperature readings to stabilize before reading.

Meter Set-Up For Temperature



Temperature Measurement Range :

Centigrade range is -20℃ to 1370℃, Fahrenheit range is 0℉ to 2000℉

ex) :
Temperature measurement

8- Amps Measurements

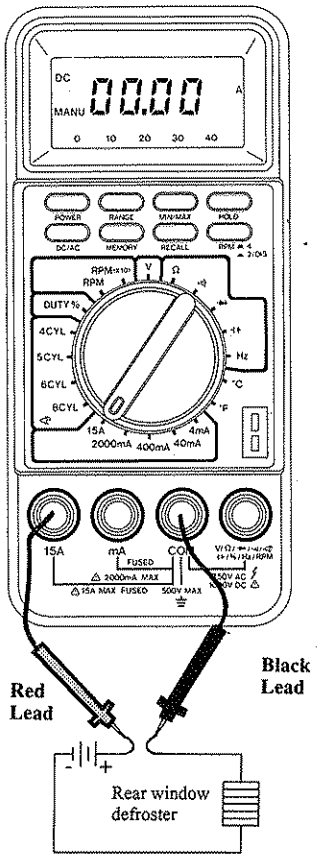
Note : An ammeter is a short circuit to other circuits.
Never connect it across a power source even if the selector switch is set to a different function.
The function switch does not disconnect the internal ammeter circuit.

1. Turn the power off and open the circuit. Connect the leads in series as shown in the diagram.
2. Plug the red test lead into the 15A or mA receptacle and the black lead into the COM receptacle.

Note: Always start with the 15A scale if there is any doubt about the expected current.
The circuits are protected with fuses to prevent damage to the meter. If the meter does not appear to work even when testing a good circuit, it is possible the fuse is blown.

4. Select AC or DC amps by using the AC/DC button.
5. Observe amps reading.

Meter-Set Up For Amps



" Rear window defroster"

Test Lead Connection :

Plug the red lead into the 15A or mA receptacle on the lower left of the front panel.
Plug the black lead into the COM receptacle on the lower right front panel.

Range Selection :

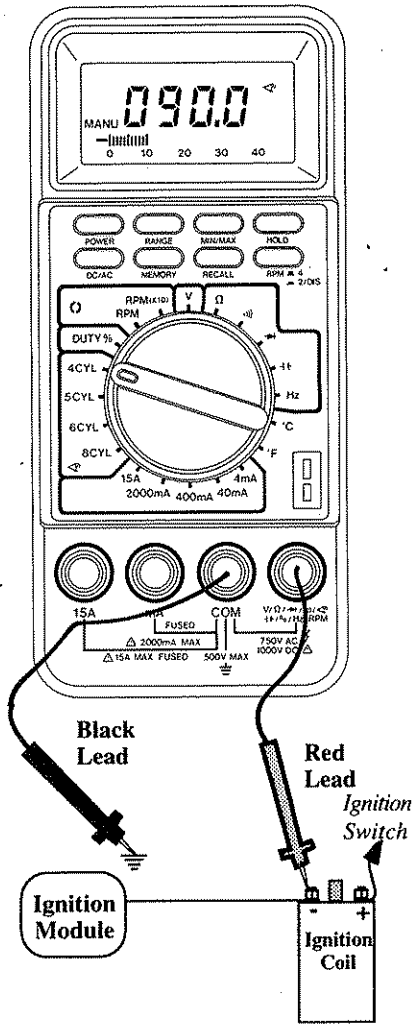
Set the selector switch to the 15A or 4, 40, 400, 2000mA position of the rotary dial.

Note : To select AC current, press the DC/AC front panel button and use the same procedure as for DC current.

9- Dwell Measurements

1. Set selector switch to DWELL (4CYL, 5CYL, 6CYL, 8CYL)
2. Plug the leads in as shown.
3. Connect the leads to the circuit under test.
4. Take dwell readings.

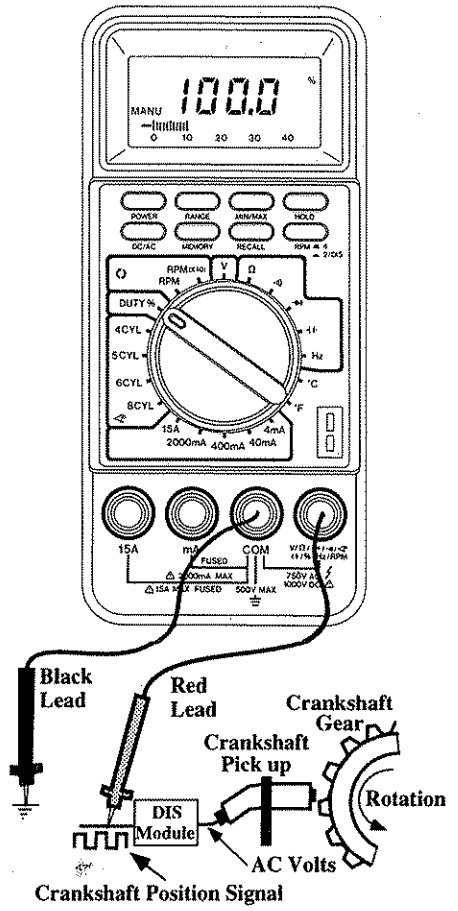
Meter Set-Up For Dwell



10- Duty Cycle Measurements

1. Set selector switch to DUTY CYCLE.
2. Plug the leads in as shown.
3. Connect the leads to the circuit under test.
4. Take duty cycle readings.

Meter Set-Up For Duty Cycle



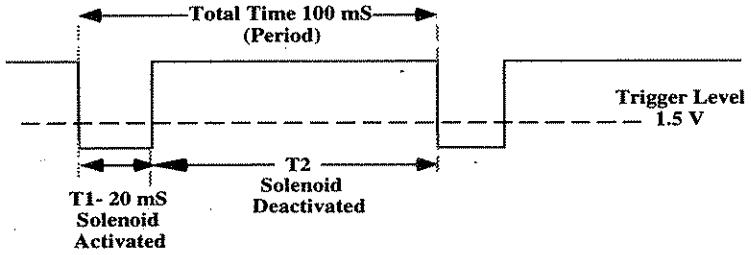
Selector Switch Position :

Set the selector switch to the DUTY CYCLE position on the rotary dial.

Duty Cycle Defined :

Duty cycle is the ratio of the amount of time a signal is doing work to the total time period, expressed as a percentage.

Example :
Total time of one cycle is 100mS. The solenoid is activated for 20mS.
% Duty Cycle = Activated time ÷ Total cycle time x 100%



Duty Cycle = 20ms ÷ 100ms x 100%= 20% in this example.

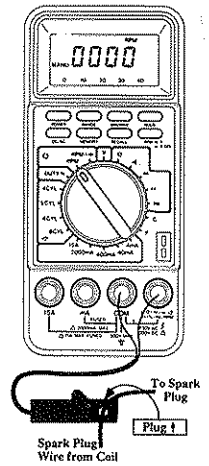
11- Engine RPM Measurements

1. Set up the meter as shown in the diagram.

2. Connect the inductive pick up. Point the arrow on the pick up toward the spark plug.

3. Use RPM4 2/DIS button to select 2 or 4 cycle mode.

Meter Set-Up For RPM



Note : Most distributor equipped systems are of a 4 stroke cycle type(4 cycle for short). A few car engines, some motorcycle engines, and small industrial motors are of a 2 stroke cycle type (2 cycle for short). DIS equipped vehicles use 4 stroke cycle engines, however, since the DIS ignition system fires spark plugs at twice the rate, the ignition pattern looks like a pattern for a 2 stroke cycle engine. Follow this simple rule when selecting the RPM mode for distributor equipped 4 cycle engines set the mode to RPM4, for 2 cycle and DIS engines set the mode to RPM2.

4. Observe engine RPM readings.

5. Some DIS ignition system readings will be 0000. If this happens remove the inductive pick-up and reverse it so the arrow points towards the coil.

Meter Functions

Test Lead Connection :

Plug in the special inductive pick up. The red lead plugs into the V- Ω receptacle on the lower right of the front panel. The black lead plugs into the COM receptacle on the lower right front panel.

Selector Switch Position :

Set the selector switch to the RPM or RPM(x10) position on the rotary dial.
RPM range is 0 to 3000 RPM ; RPM(x10) range is 0 to 9000 RPM.

Component Testing

12- Component Testing :

Introduction

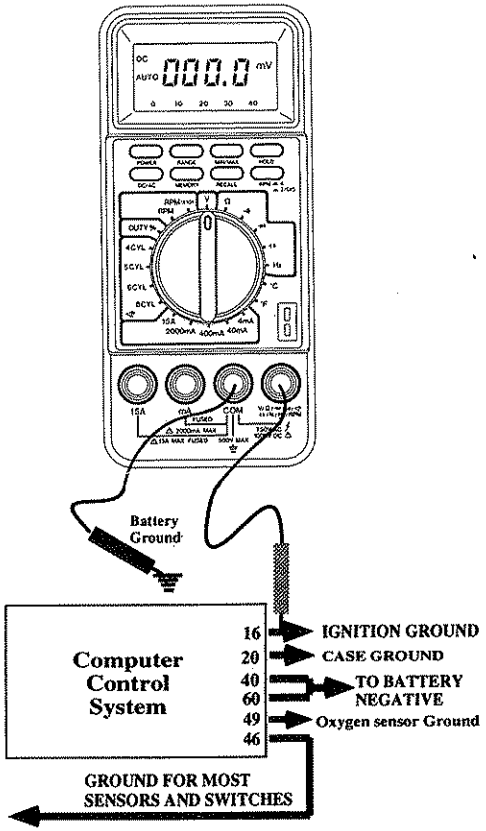
This section deals with the use of the meter on various automotive circuits including distributorless ignition systems (DIS) and computer control systems.

The following test procedures will show the best use of the advanced functions provided by the meter. If more information is needed about a test function, see the details in the Meter Functions section.
This section will deal with meter connections and circuit testing.

Computer Ground Noise Testing

Set-Up

1. Set meter rotary selector switch to VOLTS.
2. Connect black lead to chassis or battery ground.
3. Connect the red lead to the ground circuit of the computer control system (there are usually several grounds).
4. Start the engine and observe meter readings. The meter should read no greater than 100mV DC.

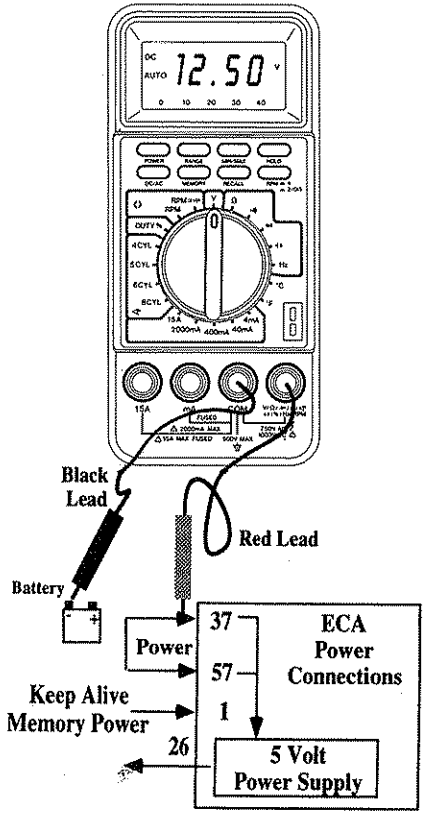


Computer Power Testing

To check for voltage drop and noise on the computer input power line the following procedure is given.

Test Set Up

1. Set meter rotary selector switch to VOLTS.
2. Connect the black lead to the chassis or battery ground.
3. Connect the red lead to the + terminal of the battery; note the reading.
4. Move the red lead to the power input line of the computer module. The reading should not be more than 0.1V below the reading obtained in step 3. Low readings indicate excessive voltage drop in the wiring to the computer power circuits.
5. Check for noise by pressing the MIN/MAX front panel button.



Throttle Position Sensor Testing

The throttle position sensor is an important sensor for computer controlled fuel systems. To verify that sensor is good three tests must be performed and the sensor must pass all of them.

Meter set-up

Use the same set-up as for the MIN/MAX capture for voltage.

Note : All of these tests are performed with the wire harness connected. Use a back-probe adaptor or other means to obtain the reading.

Test-1

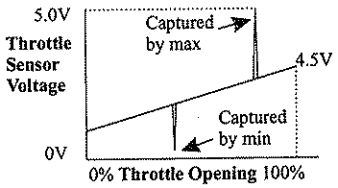
Connect the red lead to the throttle position signal line (input to the computer) and the black lead to a good ground. With the engine running, check the idle voltage reading against the specification.

Test-2

This test is performed with the ignition switch in the on position and the engine off. Connect the meter leads as in Test-1. Slowly open the throttle to wide open and watch for sudden changes on the bargraph display. Jumps or sudden changes in the voltage will be recorded in the MIN/MAX capture mode. This indicates a short or open in the sensor.

Test-3

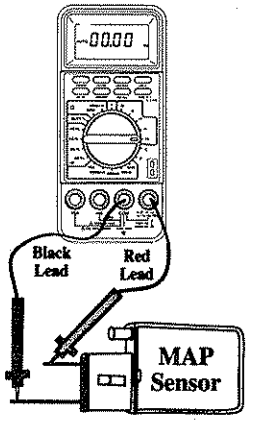
Connect the meter leads as in Test-2. Turn the ignition key to on position, but do not start the engine. Close the throttle and note the voltage reading.
Fully open the throttle and note the voltage reading. Compare the two readings to manufacturer's specification.



MAP Sensor Testing

Some MAP sensors produce a frequency that is proportional to manifold vacuum. The example shown is for a MAP sensor on a Ford vehicle but this procedure will also work for all sensors that have a frequency output signal.

MAP Sensor Testing



Test Procedure

1. Set meter to FREQUENCY.
2. Connect the meter as shown.
   This test is performed with the sensor in the vehicle and the connector plugged in.
   Use a back-probe adaptor or other means to obtain the signal.
3. Turn the ignition switch to the ***ignition-on, engine-off*** position.
4. Compare the frequency to ***engine-off*** specification.
5. Start and idle the engine and compare the frequency to the ***engine running*** specification.

Duty Cycle Testing

MAP sensor signals have duty cycle as well as frequency parameters that should be measured. The Ford MAP sensor usually has a 49 to 59% duty cycle. Service manuals or experience should be used when testing sensors.

Diagnostic Note:

Erratic signals may show a greater change in duty cycle than in the frequency reading. Both tests should be run on frequency generating sensors to do a complete test of the sensor.

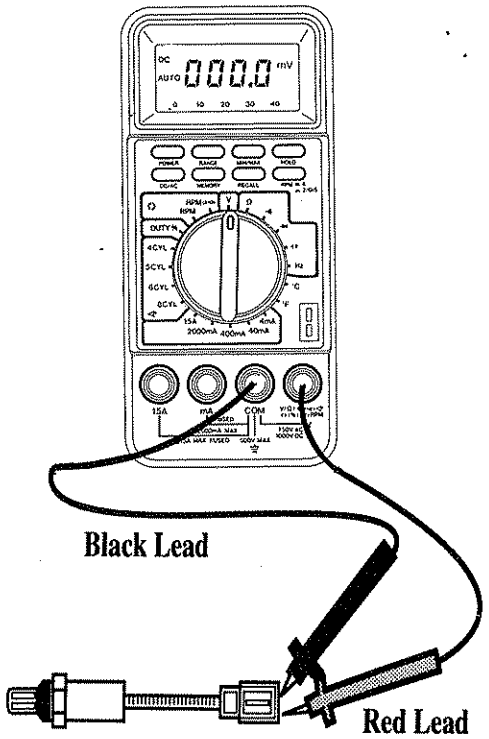
Component Testing

Oxygen Sensor Testing :

The oxygen sensor (O_2 Sensor) monitors the oxygen content in the exhaust stream and generates a voltage proportional to this.
The following test will check the oxygen sensor output voltage level. This test is performed with the oxygen sensor in the car and the sensor harness connected. Use a back-probe adapter or other means to obtain the signal.

Test set up

1. Rotate the function selector switch to VOLTS.
2. Connect the red lead to the output terminal of the 0_2 sensor and the black lead to the oxygen sensor ground.
3. Start engine. Idle at 2000 RPM for 2 minutes to warm up the sensor.
4. Press the MIN/MAX button to store the minimum (lean) value.
5. Maintain throttle partly open (2000 RPM idle), then quickly rev and release throttle completely several times.



Component Testing

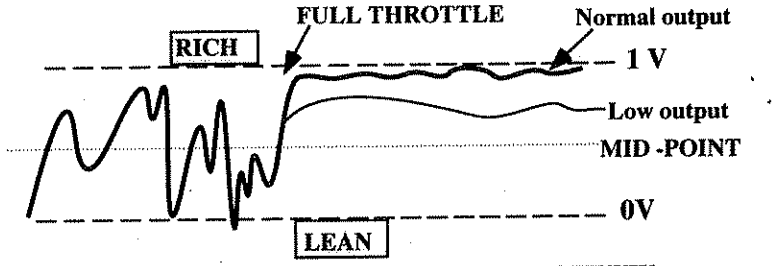
6. Compare the stored minimum value to specifications. It should be approximately 0.1V to 0.3V(100mV to 300mV).
7. Press the MIN/MAX button again to store the maximum (rich) value.
8. Repeat step 5.
9. Compare the stored maximum value to specifications. It should be approximately 0.7V to 0.9V.
10. Stop the engine.

A dymamic oxygen sensor test can be done during a test drive.

Component Testing

Dynamic Oxygen Sensor Testing :

The oxygen sensor must respond quickly and cover the voltage range from 0.1V to 0.9V. Using the MIN/MAX capture mode during a test drive will capture the complete range of operation without having to watch the meter.
The chart below shows the results of a typical wide open throttle test drive.



FULL THROTTLE OXYGEN SENSOR ACTIVITY

Note :
The oxygen sensor signal may not reach the full 0.9V level because of a fuel delivery problem such as dirty injectors or low fuel pressure. Additional testing can be done by selecting the MIN/MAX mode and injecting propane into the intake until the engine RPM drops slightly indicating a full rich mixture. The oxygen sensor is working if it can reach the full enrichment point of 0.9V. Check the fuel delivery system on the vehicle that failed the test drive but has an oxygen sensor that can cover the complete range.

Oxygen sensor response time should also be tested. Slow oxygen sensors can cover the entire operating range but have a delayed response to fuel mixture changes. Test this by measuring how quickly the sensor responds to a sudden enrichment. Use the bargraph to watch for an instant (0.1 sec) rich response to a quick burst of propane into the intake.

Specifications

13- General Specifications

- **Displays**
  3 3/4 digit(3999 count). 9999 count(Hz), 42 Segment analog bargraph and units sign annunciators.

- **Low battery indication**
  Battery graphic on display blinks when battery voltage is 6.9 to 7.5 volts.

- **Display test**
  All symbols are displayed at power up.

- **Display update rate**
  Digital display
  2 times per second.
  Note : The update rate in the capacitance mode is one time per second.

  Bar graph
  20 times per second.

- **Operating Environment :** 0°C to 40°C (32°F to 104°F) at <75% R.H

- **Storage Environment :** -10°C to 50°C (14°F to 122°F) at <75% R.H with battery removed.

- **Temperature Coefficient :** 0.1 x (Specified accuracy)/°C (<18°C or 28°C to 50°C)

- **Auto power off :** Approximately 30 minutes after rotary switch or mode change
  Note : If meter turns off you must push the power button two times to turn the meter back on.

Specifications

- **Power :** Single 9V battery

- **Battery Life :** 500 hours typical with alkaline battery

- **Fuse :** 15A/250V, 5.0 x 20mm ceramic type
  2A/250V, 5.0 x 20mm fast acting type

- **Size(H x W x L) :** 33mm x 84mm x 184mm

- **Weight :** Approx. 350g

14- Electrical Specifications

Accuracy is listed as ± % of reading and the number of least significant digits the measurement is allowed to vary from the calibration standard.

AC Voltage
Range : 4V, 40V, 400V, 750V
Resolution : 1mV to 1V
Accuracy : ±(1.2% + 5 dgt) 50 to 500Hz
Input Impedance : Greater than 10MΩ
Overload Protection : 750V rms

DC Voltage
Ranges : 400mV, 4V, 40V, 400V, 1000V
Resolution : 0.1mV to 1V
Accuracy : ±(0.5% + 2 dgt)
Input Impedance : Greater than 10MΩ
Overload Protection : 1000V DC

Specifications

DC Current
Ranges : 4mA, 40mA, 400mA, 2000mA, 15A
Resolution : 0.001mA to 0.01A
Accuracy : ±(1.5% + 2 dgt) 4mA to 2000mA
±(2.0% + 2 dgt)15A Range
Overload Protection : 4mA to 2000mA Range-2A 250V fuse
15A Range-15A 250V fuse

AC Current
Ranges : 4mA, 40mA, 400mA, 2000mA, 15A
Resolution : 0.001mA to 0.01A
Accuracy : ±(2.0% + 5 dgt)
Overload Protection : 4mA to 2000mA Range-2A 250V fuse
15A Range-15A 250V fuse

Resistance
Ranges : 400Ω, 4KΩ, 40KΩ, 400KΩ, 4MΩ, 40MΩ
Accuracy : ±(1.0% + 2 dgt) 400Ω Range
±(2.0% + 5 dgt) 40MΩ Range
±(0.75% + 2 dgt) all other Ranges
Overload Protection : 250V DC/AC Peak

Frequency
Ranges : 100Hz, 1000Hz, 10KHz, 100KHz, 500KHz
Resolution : 0.01 Hz to 100Hz
Accuracy : ±(0.1% + 10.0 dgt)
Overload Protection : 500V DC/AC Peak

Capacitance
Ranges : 4nF, 40nF, 400nF, 4μF, 40μF
Resolution : 0.001nF to 10nF

Specifications

Accuracy : ±(5.0% + 2 dgt)
Overload Protection : 250V DC/AC Peak

Diode Test
Resolution : 0.001V
Accuracy : ±(2% + 2 dgt)
Open Circuit Voltage : 3.0V typical
Overload Protection : 250V DC/AC Peak

RPM
Ranges : RPM, RPM(x 10)
Resolution : 1 RPM and 10 RPM
Accuracy : ±(2% + 10 dgt)
Overload Protection : 250V DC/AC Peak

Audible Continuity
Buzzer sounds at 35 Ohms or less.

Duty Cycle
Resolution : 0.1%
Accuracy : ±(2% + 5 dgt)
Overload Protection : 250V DC/AC Peak

Dwell Angle
Ranges : 4CYL, 5CYL, 6CYL, 8CYL
Resolution : 0.1°
Accuracy : ±(2% + 5 dgt)
Overload Protection : 250V DC/AC Peak

Specifications

Temperature
Ranges : °C, °F
Resolution : 1°F, 1°C
Accuracy : ±(3° + 1 dgt) up to 150°C
±3% rdg over 150°C
±(5°+ 2 dgt) up to 225°F
±3% rdg over 225°F

Battery
9V NEDA 1604A, JIS 006P, IES 6F22 carbon or alkaline battery

Maintenance

15- Maintenance :

To avoid electrical shock :

- **Remove the test leads before opening the meter case.**
- **Do not operate the meter while the back cover is removed.**

Battery Replacement :

Replace the battery according to the following steps :

1. Turn off the power to the meter.
2. Unscrew the four screws located in the rear case.
3. Gently lift the bottom case up and away from the top case.
4. Remove the old battery from the top case.
5. Gently unsnap the battery connector from the battery.
6. Snap the new battery into the battery connector.
7. Reinsert the battery into the top case. Position the battery wires so they will not be pinched between the bottom and top case.
8. Reinstall the bottom cover by snapping it into the top cover.
9. Tighten the four screws in the rear case.

Fuse Replacement :

1. Turn off the power to the meter.
2. Unscrew the four screws located in the rear case.
3. Gently lift the bottom case up and away from the top case.
4. Remove the open fuse by gently prying loose one end and sliding the fuse from the fuse holder.
5. Install a new fuse with the same size and rating.
6. Reinstall the bottom cover by snapping it into the top cover.
7. Tighten the four screws in the rear case.

Fuses :

1. mA Range : 2A 250V, 5.0 x 20mm fast acting type
2. 15A Range : 15A 250V, 5.0 x 20mm ceramic type