

## Chapter 3 Service Tools



### Main Icons



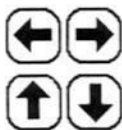
Press [F7] to see Lead Status Screen. Flashing icon indicates problem with one or more leads.



Press [F10] to display previous menu screen.



DIS Specs loaded.



Arrow Keys are active - press the appropriate arrow to scroll up or down a text screen, or change the scale on a meter screen.

The Service Tools Menu lists menus that contain system-related tests that allow you to test specific vehicle systems.

Many Service Tools Tests begin with a “live” screen allowing you to visually check the system without running the diagnostic routine. The “live” screen allows you to adjust the vehicle and see the effects of changes as you make them.

**Battery/Starting/Charging Menu** — Contains tests for the electrical system.

**Fuel System Menu** — Provides emission tests for carbureted and fuel-injected vehicles.

**Ignition Test Menu** — Provides diagnostic tools for checking the primary, secondary and timing systems on a vehicle.

**Cylinder Power Menu** — Provides cylinder speed and contribution tests.

**Multi-Analyzer Menu** — Provides multimeters, “Lab” scopes and recording scopes for digital and or analog waveform analysis.

### Hot Keys

[F6] - **Help** — Displays help screens.

[F7] - **Trigger Lead Status** — Displays *Trigger Lead Status* screen.

[F8] - **Kill** — Stops the engine.

[F9] - **Clear** — Clears data fields and displays.

[F10] - **Previous Menu** — Aborts the test in progress and returns to the previous menu or proceeds to the next test in a user test.

[F11] - **Form Feed** — Form feeds paper from the printer.

[F12] - **Print Reports** — Displays the *Print Reports* menu.

[Print Screen] — Prints a “screen dump” - an exact copy of what appears on the screen.

# Chapter 3 Service Tools

The Service Tools Manuals menus that contain system-related tests that allow you to test specific vehicle systems.

Many Service Tools Tests begin with a "live" screen allowing you to visually check the system without turning the diagnostic routine. The live screen allows you to adjust the vehicle and see the effects of changes as you make them.

Battery/Starting/Charging Menu -- Contains tests for the start & charge.

Fuel System Menu -- Provides emission tests for carbureted and fuel-injected vehicles.

Ignition Test Menu -- Provides diagnostic tests for checking the primary, secondary and timing systems on a vehicle.

Cylinder Power Menu -- Provides cylinder speed and combustion tests.

Multi-Analyzer Menu -- Provides multimeter, 2 air, scopes and recording scopes for up to 16 and or testing waveform analysis.

## Hot Keys

- [F5] - Help -- Displays help screens.
- [F7] - Trigger Lead Status -- Displays trigger lead status screen.
- [F8] - Kill -- Stops the engine.
- [F9] - Clear -- Clears data tests and displays.
- [F10] - Previous Menu -- Allows you to go back and forth in the previous menu.
- [F11] - Print Form -- Prints data paper from the printer.
- [F12] - Print Reports -- Displays the Print Reports menu.
- [Print Screen] -- Prints a "screen dump" - an exact copy of what appears on the screen.



Alvin Icons

Press [F7] to see last Status Screen, Loading Last Analyzed Problem with one or more tests.	
Press [F8] to display previous menu screen.	
Old Screen Loaded.	
Alvin Keys are active - press the appropriate key to activate or deactivate a test screen or change the scale of a waveform screen.	

# Battery / Charging / Starting Menu

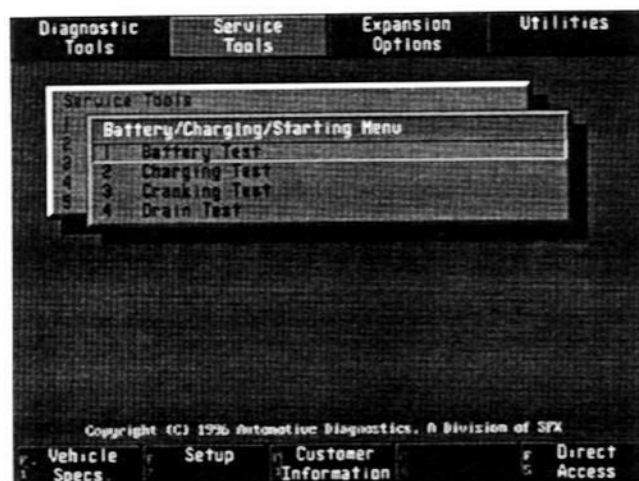


Figure 3-1

## Battery Test

### Overview

This routine is designed to test and report on the condition of any 12-volt automotive battery. The test reports the following data:

- **Available CCA**— (Cold Cranking Amps) from the battery.
- **Open Circuit Voltage** — measured at the battery positive and negative terminals.
- **Load Voltage** — measured at the battery positive and negative terminals while a load is placed on the battery.
- **Recovery voltage** — measured at the positive and negative terminals during a period of time after the load is removed from the battery.

### Required Lead Hookup:

- Battery Load Leads on battery terminals.

### Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

### Test Procedure

1. Highlight *Battery Test* from the *Service Tools* menu and press [ENTER]. Follow the screen prompt and type in the battery CCA rating. If you are not sure of the battery's rating, refer to a battery application manual, or enter the numbers per the chart below.

No. of Cylinders	CCA
4	400
6	500
8	575

Type in the CCA rating and press [ENTER]. To change the battery rating units, press [F5]. The *Battery Rating Units* screen will appear. Type the number which matches the rating units you will use. The available units are:

- CCA** — Cold Cranking Amps;
- DIN** — German Institute for Standardization units;
- IEC** — International Electrotechnical Commission units;
- A-HR** — Amp-Hours.

2. The test will run and the results screen will appear (see Figure 3-2).

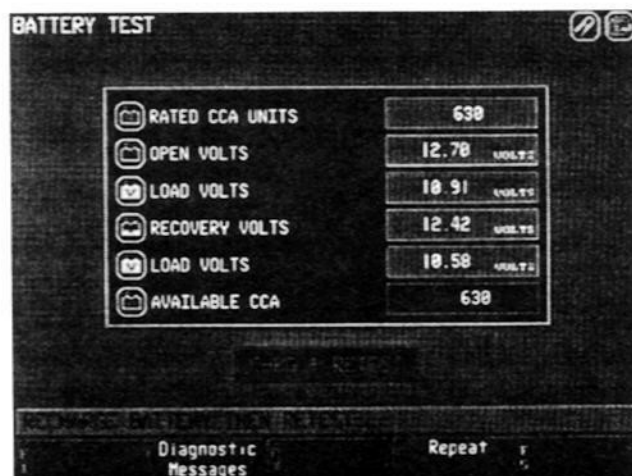


Figure 3-2



Results in green are within specification. Results in yellow are marginal - no diagnostics are available. Results in red are above or below acceptable established limits. Results in white have no diagnostics available because Vehicle Specifications were not entered.

Press:

- [F2] - to display the diagnostic messages;
- [F4] - to run the test again;
- [F10] - to return to the *Service Tools* menu;
- [F12] - to display the *Print Reports* menu.

## Charging Test

### Overview

The charging test allows you to measure the alternator output under a load condition. This test also provides you the tools necessary to check the diode condition.

### Conventional Ignitions

#### Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer
- Amp Probe

#### Recommended Lead Hookup:

- Complete hookup per Figure 1-27.

### Direct Ignition Systems (DIS)

#### Required Lead Hookup:

- Green #1 Lead
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer
- Secondary DIS High Tension Adapters
- Amp Probe
- Low Current Probe (required only if there is an inadequate secondary signal - connect the low current probe to the B+ ignition module.)



Place the transmission in "PARK" or, if manual, "NEUTRAL." Set the parking brake. Make sure the vehicle cannot roll. If necessary, chock the wheels.

### Charging Live Screen

The *Charging Live* screen (see Figure 3-3) appears when this test is selected. Use this screen to make sure that all leads and vehicle components are working correctly. If the "AMP" digital meter shows a high or negative reading, zero the amp probe.



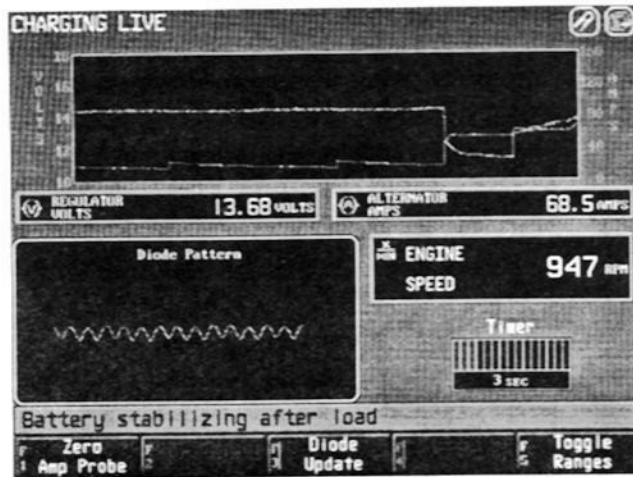


Figure 3-3

Press :

- [F1] – to zero the amp probe;
- [F2] – to run the diagnostic routine;
- [F3] – to update the diode pattern which appears on the screen;
- [F4] – to place a load on the battery;
- [F5] – to toggle the scales on the data display between a high and low scale.

**NOTE** The [F2] and [F4] keys are not available until the battery recovers from the load applied to it. When the timer reaches zero the keys will appear.

**NOTE** If it is necessary to zero the amp probe, remove the probe from the vehicle and completely close the probe jaws. When the analyzer completes the *Zero Amp Probe* procedure, replace the probe, making sure it is clamped around ALL negative battery leads! Check the arrow on the clamp carefully. The probe is clamped correctly around the negative terminal wires when the probe arrow points toward the battery.

### Diagnostic Test Procedure

1. From the "live" screen, press [F2]. Follow the screen prompt and run the engine at 2000 RPM. The green line on the graph represents voltage. The gray line represents alternator amps.

**NOTE** If the alternator amps are over 20, a timer will appear on the screen. The test may then take up to thirty seconds to complete.

The analyzer will then place a load on the battery and then allow the battery to stabilize.

2. Follow the next screen prompt and run the engine at idle. The analyzer will then apply a load to the battery.

The diode pattern will appear on the screen (see Figure 3-4).

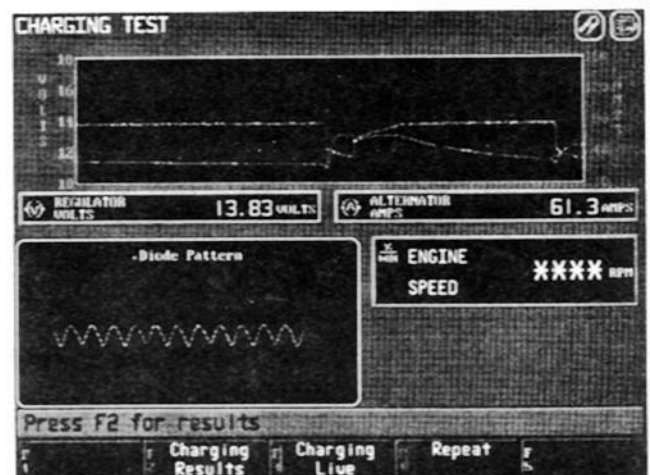


Figure 3-4

Press:

- [F2] – to display the *Charging Results* screen;
- [F3] – to display the *Charging Live* screen;
- [F4] – to repeat the test.

### Charging Results Screen

When you press [F2] the *Charging Results* screen appears (see Figure 3-5).

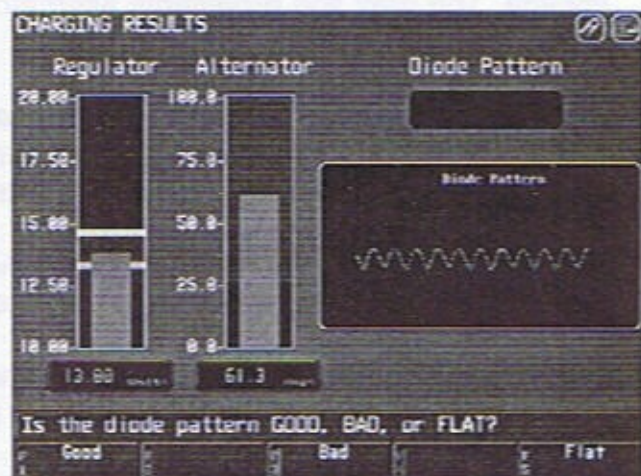


Figure 3-5

The gray bars represent the actual readings. The yellow bars on the "Regulator" graph represent marginal readings. For acceptable results, the gray bar should appear well inside the green area on both graphs. The digital readings shown below the graphs will also indicate whether the results are acceptable. Readings outside specified limits will appear in red.

The analyzer then prompts you to judge the diode pattern. Refer to Figure 3-6.

Press:

- [F1] – to indicate the diode pattern is good;
- [F3] – to indicate the diode pattern is bad;
- [F5] – to indicate the diode pattern is flat.

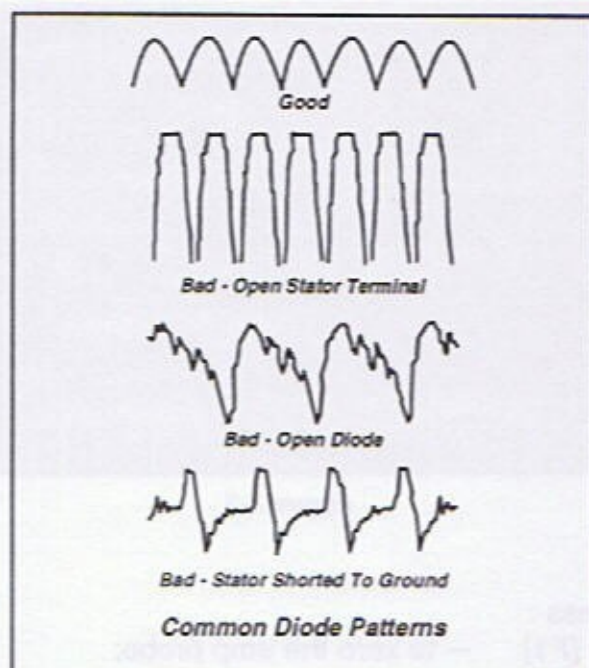


Figure 3-6

A good pattern will show regular, even waves, with some variation acceptable. A bad pattern has uneven or irregularly shaped waves. A flat pattern indicates the alternator is not working at all.

After you indicate the pattern condition, press:

- [F2] – to display the diagnostic messages;
- [F10] – to return to the *Service Tools* menu;
- [F12] – to print the test report.

## Cranking Test

### Conventional Ignitions



Place the transmission in "PARK" or, if manual, "NEUTRAL." Set the parking brake. Make sure the vehicle cannot roll. If necessary, chock the wheels.

#### Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer
- Amp Probe

#### Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

### Cranking Live Screen

The *Cranking Live* screen appears (see Figure 3-7) when the test is selected. Use this screen to make sure that all leads and vehicle components are working correctly. If the "AMP" digital meter shows a high or negative reading, zero the amp probe.



Figure 3-7

Press :

- [F1] – to zero the amp probe;
- [F2] – to run the diagnostic routine;
- [F3] – to toggle the ranges of the data displayed between high and low scales;
- [F4] – default is to "ON", which "kills" the ignition system (conventional ignitions only), press to remove inhibit and allow engine to start;
- [F5] – to freeze screen information.

### Diagnostic Procedure

1. If the engine is running when you press [F2], the analyzer will kill the engine. Follow the screen prompt (see Figure 3-8) and crank the engine until it starts.

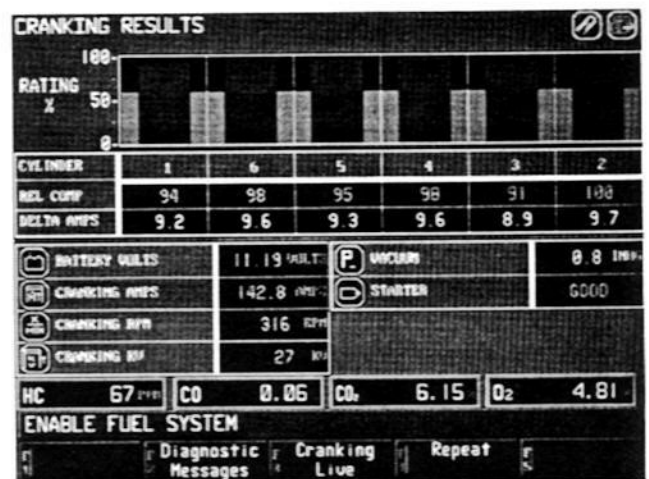


Figure 3-8

Press :

- [F2] – to display Diagnostic Messages, after the engine starts;
- [F3] – to display the *Cranking Live* screen;
- [F4] – to repeat the test.



### Direct Ignition Systems (DIS)



Place transmission in "PARK" or, if manual, "NEUTRAL." Set parking brake. Make sure vehicle cannot roll. If necessary, chock the wheels.

#### Required Lead Hookup:

- Green #1 Lead
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer
- Secondary DIS High Tension Adapters
- Low Current Probe
- Amp Probe

Follow the screen prompt and disable the fuel system as described below. Then crank the engine until it starts and press [F2] to access Diagnostics.

#### PFI (Ported Fuel Injection) Vehicles:

1. Turn the ignition key "ON."
2. After the ignition key is "ON," press the accelerator pedal all the way down. This will cause the computer on these vehicles to inhibit fuel flow because it is put in a "Clear Flood" mode.
3. Hold the accelerator pedal all the way down and crank the engine until the prompt "ENABLE FUEL SYSTEM - START ENGINE" appears. The analyzer then displays the results on the screen. Release the accelerator pedal and continue cranking to allow the engine to start.



If the engine starts before the "Re-enable Fuel" prompt appears, release the accelerator pedal, turn the ignition "OFF" and repeat the test.

### For GMTBI (Throttle Body Injection) Vehicles:

1. Remove the injector cable at the injector. These vehicles are not automatically disabled when the throttle is wide open. Remove the rubber or plastic airflow filter over the injector, and then unplug the cable connector at the injector.
2. Crank the engine until prompted to re-enable the fuel system. When the test results appear on the screen, stop cranking.
3. Follow the screen prompt and re-connect the injector and start the engine.

### For Ford, Chrysler / Mitsubishi, and Other Systems:

1. Disable the fuel system. Check the manufacturer's specifications for the correct procedure.
2. Crank the engine until prompted to enable the fuel system. Discontinue cranking when results appear on screen. Re-enable the fuel system, and start the engine.

### Ported Fuel Injection (PFI) with Clear Flood Mode, and Sequential Fuel Injection (SEFI) with Clear Flood Mode

1. Turn the ignition key to the RUN Position.
2. Depress the Accelerator all the way to WIDE OPEN THROTTLE.
3. Begin cranking the engine until prompted to enable fuel system.
4. Release the Accelerator and continue cranking until the engine starts.



If the engine starts during Step 3, immediately release the accelerator pedal and re-run the test.

#### **Ported Fuel Injection (PFI) without Clear Flood Mode, and Sequential Fuel Injection (SEFI) without Clear Flood Mode**

1. Disconnect Fuel Pump Relay or Inertia Switch.
2. Run the engine until all fuel is exhausted from the fuel system.
3. Follow the screen prompts.

#### **Throttle Body Injection (TBI) and Central Fuel Injection (CFI)**

1. Disconnect the fuel injector connector(s) at the fuel injector.
2. Run the engine until all fuel is exhausted from the fuel system.
3. Follow the screen prompts.

#### **Disabling Fuel Systems - Carburetor Carburetor with Electric Fuel Pump**

1. Disconnect fuel pump relay or wiring connector to fuel pump.
2. Run the engine until all fuel is exhausted from the carburetor bowl.
3. Follow the screen prompts.

#### **Carburetor with Mechanical Fuel Pump**

1. Crimp rubber fuel inlet hose with hose pliers.
2. Run the engine until all fuel is exhausted from the carburetor bowl.
3. Follow the screen prompts.

#### **Carburetor with Decel Valve**

1. Disconnect decel valve per manufacturer's recommendations.
2. Run the engine until all fuel is exhausted from the carburetor bowl.
3. Follow the screen prompts.

#### **Drain Test**

Use the Drain Test to determine the current drain cause by any vehicle component. Use the Low Current Probe to detect a current drain. For best results, do not connect the Low Current Probe around the battery leads.

#### **Required Leads:**

- System Ground (White)
- Low Current Probe

#### **Test Procedure**

1. Select the test from the menu. The *Drain Test* screen appears (see Figure 3-9).

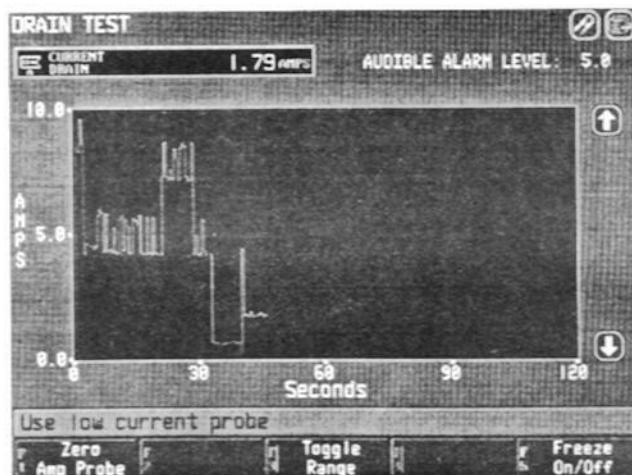


Figure 3-9



## Fuel System Menu

2. Press [F1] and follow the screen prompts to zero the Low Current Probe.

3. Set up the test.

Press:

**The arrow keys** – to change the audible alarm level.

[F1] – to zero the Low current probe;

[F3] – to toggle the meter scale on the display screen between 0-1 amp and 0-10 amps;

[F5] – to freeze the meter display, so that you can study the pattern more closely.

4. Clamp the Low Current Probe around the wire in the circuit that you want to test. Make sure that the probe is completely closed.
5. Make sure the remote is nearby. Press the Up or Down Arrow Keys to set the audible alarm limits. The light gray line in the meter on the display screen will move up or down as you press the Arrow Keys.
6. The meter displays amps over time. As the analyzer detects a current drain, it will draw the pattern on the screen. If the drain moves above the alarm level which you have set, the remote will beep.

**NOTE** For most accurate results, zero the amp probe often during extended testing.

### Menu Choices

Selecting the *Fuel System* menu allows you to display a menu of two tests. The *Four Gas Exhaust Test* displays exhaust gas readings for the vehicle at both idle and cruise RPM.



Figure 3-10

The *Fuel Injection Test* displays exhaust gas readings as well as electrical and fuel pressure data for fuel injected systems.



## Four Gas Exhaust Test

### Conventional Ignitions

#### Required Lead Hookup:

- Green #1 Lead
- System Ground Lead (White)
- Secondary Lead and Adapter
- Exhaust Probe

#### Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

### Direct Ignition Systems:

#### Required Lead Hookup:

- Green #1 Lead
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer
- Secondary DIS High Tension Adapters
- Low Current Probe
- Amp Probe
- Exhaust Probe

### Live Screen

The "live" screen (see Figure 3-11) will appear whenever the test is selected. The default analog meters (RPM and Vacuum) will always appear. Use the arrow keys to highlight either meter. Press the number of any highlighted digital meter to display that meter in the highlighted meter. Digital meters colored in gray are not available either because the leads are not connected or they are already displayed. Digital meters will be gray during bench warm-ups.



Figure 3-11

Press:

- [F1] – to turn the trace function "ON" or "OFF;"
- [F2] – to run the diagnostic test;
- [F3] – to toggle meter zero center function "ON" or "OFF."

### Diagnostic Procedure

1. Start the engine, if necessary. Follow the screen prompts and run the engine at cruise RPM. Watch the RPM box - red numbers indicate the RPM is too high, or too low. Green numbers indicate that the readings are within the test limits. When the analyzer detects a stable cruise RPM, the high speed portion of the test will run.
2. Follow the screen prompt and adjust the vehicle's engine to run at the manufacturer's idle RPM. When the analyzer detects the RPM within spec, the analyzer will read the RPM and dilution values, and will display the results on the screen, with a shadow function to show the acceptable range (see Figure 3-12).

Press:

- [F2] – to display diagnostics;
- [F3] – to display the *Live* screen;
- [F4] – to repeat the test.

The Engine Speed Meter on the left side will always be displayed.

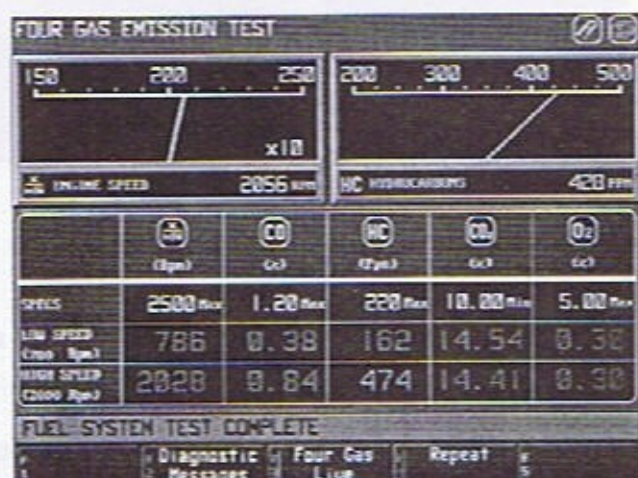


Figure 3-12

### Test Procedure



**COVER ALL FUEL SYSTEM TEST LEAD CONNECTIONS WITH A RAG TO PREVENT FUEL FROM SPRAYING OVER THE HOT ENGINE. WHEN BLEEDING THE SYSTEM, DRAIN THE BLEED FUEL INTO A PROPER CONTAINER.**

1. Install a drain hose on the end of the bleed adapter. Refer to Figure 3-13. Make sure the hose is long enough to reach a container to catch the excess fuel drained when you bleed the system.
2. Connect the Vacuum/Pressure Transducer to the fuel injection system (see Figure 3-13). Position the transducer so that it is lower than the connection at the fuel rail. Bleed all air from the transducer. Connect the proper adapter to the fuel line between the TBI unit and the fuel pump. In other systems, connect the adapter to the fuel rail, again, using the proper adapter. Adapter kits are available from various manufacturers.

### Fuel Injection Test

Use this test to diagnose problems with injector pulse, fuel pressure and related intake manifold vacuum problems in fuel injection systems.

#### Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Vacuum/Pressure Transducer
- Low Current Probe around the #1 cylinder injector wires.

#### Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

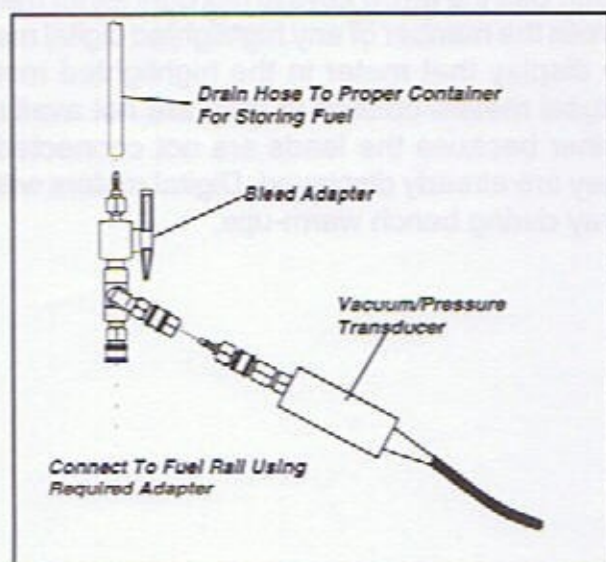


Figure 3-13



To read fuel pressure only, connect the vacuum transducer directly to the adapter.

To read fuel pressure changes (Delta Pressure), connect the bleed adapter to the fuel system adapter first. Connect the transducer to the bleed adapter so that the transducer is at the low point. This allows air to rise up out of the system.

Connect the low current probe to the #1 cylinder injector wires. This allows you to relate the #1 injector electrical pulses to the fuel pressure pulses shown on the screen.

3. Start the engine. Select the *Fuel Injection Test* from the *Fuel System* menu. The *Fuel Injection Test* screen appears (see Figure 3-14).

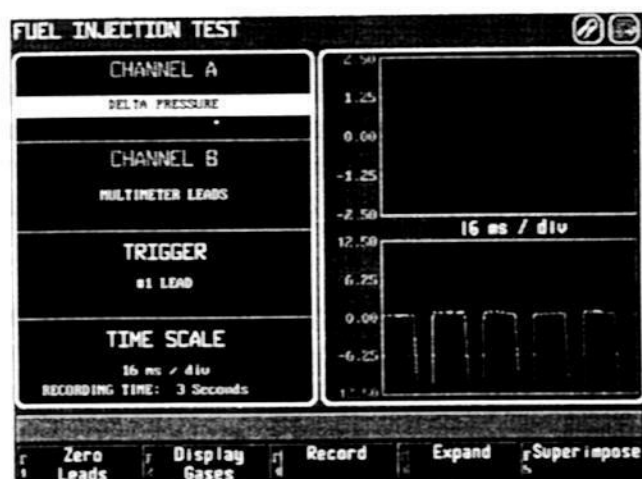


Figure 3-14

Press:

- [F1] – to zero all leads used in this test;
- [F2] – to display the analysis screen (see Figure 3-15);
- [F3] – to record patterns;
- [F4] – to expand the scope meters to full screen;
- [F5] – to superimpose both patterns in one meter screen.

4. The cursor will appear in the trigger box. Press [ENTER]. The trigger menu will pop out. Use the Arrow Keys to select a trigger and press [ENTER].

The pop-out menu will disappear. Press the up- or down-arrow key to move the cursor to the next block. Select the correct channels and time scales as needed.

Look at the patterns which appear in the meters. If the fuel pressure pattern looks smooth, or appears as a nearly straight line, bleed the air out of the fuel system. Drain any excess fuel into a proper container. Repeat the procedure until fuel pressure pattern looks well-defined, as shown in Figure 3-14.

5. Figure 3-15 shows the analysis screen.

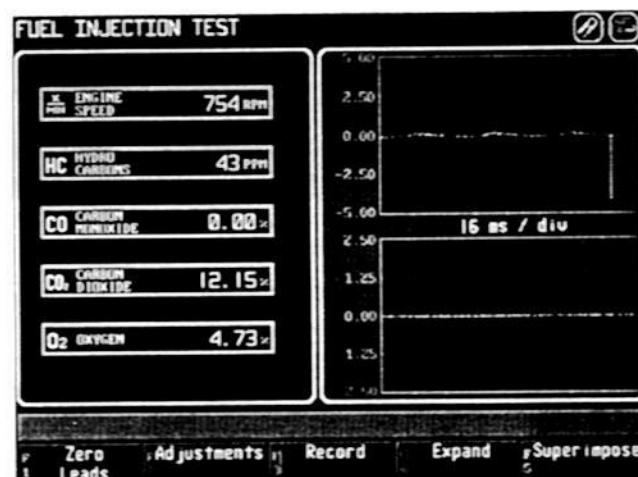


Figure 3-15



From the *Analysis* screen, press:

- [F1] – to zero all leads used in this test;
- [F2] – to display the *Adjustments* screen;
- [F3] – to record patterns;
- [F4] – to expand the scope meters to full screen;
- [F5] – to superimpose both patterns in one meter screen.

Figure 3-16 shows an example of the *Expanded* screen.



Figure 3-16

Press:

- [F2] – to return to the adjustments screen;
- [F3] – to freeze the display;
- [F5] – to superimpose both patterns in one meter screen.

Figure 3-17 shows an example of the *Freeze* screen. Press [F3] to unfreeze the display.

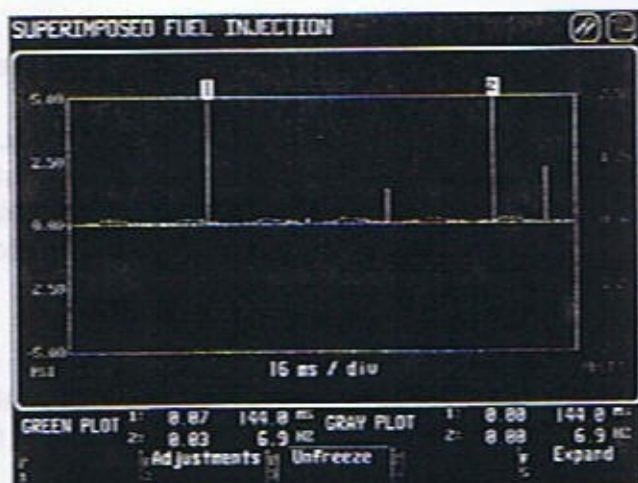


Figure 3-17

### Moving flags

Type the number of the flag to move. The number on the flag on the screen will grow larger to show that it is activated. Press the right- or left-arrow keys to move the flag from side to side. Note that the digital readouts under the meters will change as the flag moves. Flags move in the same manner in both expanded and superimposed modes.

Note the digital displays in the lower right corner of the screen, under the scope display. The readouts display the voltage, time in milliseconds and frequency in hertz at each test point marked by a flag.

6. To complete the test, turn the engine OFF. Cover the transducer assembly with a rag to catch any fuel spillage and remove the assembly from the fuel line.



**NEVER ATTEMPT TO REMOVE THE TRANSDUCER ASSEMBLY FROM THE ENGINE WHILE IT IS RUNNING!**

Reassemble the fuel line system.

# Ignition Test Menu

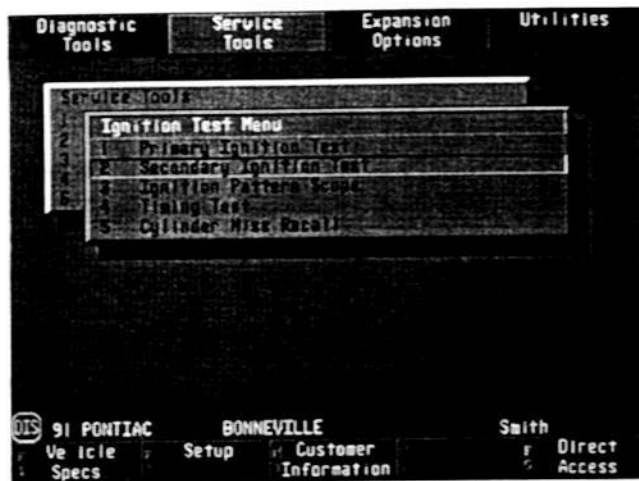


Figure 3-18

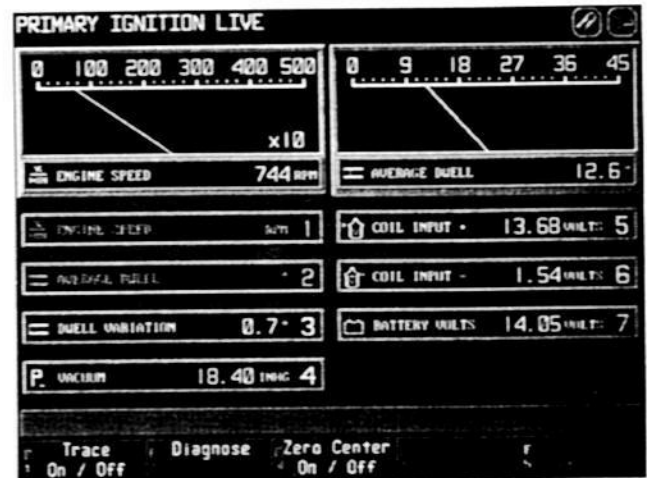


Figure 3-19

## Primary Ignition Test

The *Primary Ignition Live* test collects primary ignition data at idle speed.

### Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer

### Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

Press:

- [F1] – to turn meter trace (used to show trends) "On" or "Off";
- [F2] – to display primary ignition diagnostic information; after data is collected, the results screens are displayed;
- [F3] – to zero center the active meter; value changes are displayed as +/- either side of the zeroed reference point.

## Diagnostic Procedure

The test automatically runs once it is selected. The screen shown in Figure 3-20 appears.

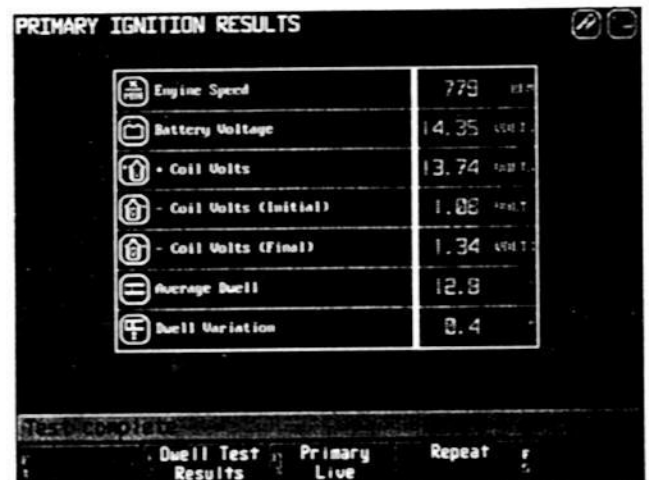


Figure 3-20

Press:

- [F2] – to display the *Dwell Test Results* screen;
- [F3] – to display the *Primary Live* screen;
- [F4] – to repeat the test.



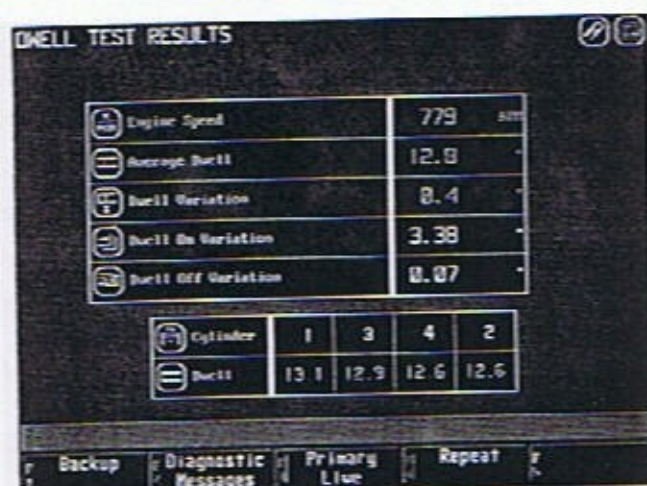


Figure 3-21

From the *Dwell Test Results* screen (see Figure 3-21), press:

- [F1] — to backup and review the *Primary Ignition Results* screen;
- [F2] — to read the Diagnostic Messages;
- [F3] — to display the *Primary Ignition Live* screen;
- [F4] — to repeat the test.

### Test Result Definitions

**Battery Volts** — The voltage measured at the battery positive and negative terminals.

**Coil Input +** — The voltage measured at the positive terminal of the ignition coil. This measurement is an average of several readings prior to the "Points Open / Transistor Off" portion of the primary pattern.

**- Coil Volts** — The voltage measured at the negative terminal of the ignition coil. This measurement is an average of several readings just after the "Points Close / Transistor On" portion of the primary pattern.

**- Coil Volts (Final)** — The voltage measured at the negative terminal of the ignition coil. This measurement is an average of several readings just before the points open / transistor off portion of the primary pattern.

**Average Dwell** — The average of each cylinders dwell over one distributor revolution. DWELL is the period of time measured in degrees or percent that current is flowing in the primary ignition circuit.

**Dwell Variation** — The *Maximum Cylinder Dwell* and *Minimum Cylinder Dwell* during one distributor revolution.



**Dwell Test Result Definitions**

**Average Dwell** — The average of each cylinder's dwell over one distributor revolution. DWELL is the period of time measured in degrees or percent that current is flowing in the primary ignition circuit.

**Dwell Variation** — The *Maximum Cylinder Dwell* and *Minimum Cylinder Dwell* during one distributor revolution.

**Dwell On Variation** — The variation in degrees or percent of the DWELL ON signal. This measurement relates to variations of when the points close or the electronic module turns on to provide power to the ignition coil.

**Dwell Off Variation** — The variation in degrees or percent of the DWELL OFF signal. This measurement relates to variations of when the points open or the electronic module turns off. This relates to when the spark plug fires in each cylinder.

**Cylinder** — When the actual firing order is used this relates to the actual cylinder number. When the actual firing order is not used this relates to the *Nth* cylinder in the firing order.

**Dwell** — The individual dwell of each cylinder during one revolution of the distributor.

**Secondary Ignition Test**

The *Secondary Ignition* test collects and displays KV readings for each cylinder and then reports individual spark plug burn times (milliseconds) and the KV readings listed below.

**Required Lead Hookup:**

- Green #1 Lead
- Conventional Secondary Lead
- System Ground Lead (White)

**Recommended Lead Hookup:**

- Connect all leads per Figure 1-27.

**Secondary Live Screen**

The *Secondary Ignition Live* screen appears when the test is selected (see Figure 3-22).

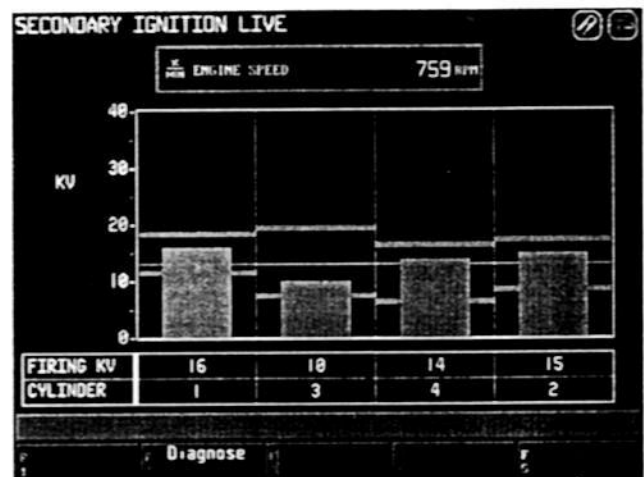


Figure 3-22

Gray bars represent the minimum and maximum KV's detected. The thin white line represents the average KV's detected. Press [F2] to run the diagnostic procedure.

**Diagnostic Procedure**

1. Start the engine. The analyzer samples the cylinder firings and calculates the test values.
2. Follow the screen prompt (run the engine at idle or cranking speeds) and "snap" the accelerator when prompted. The analyzer measures the burn time, various KV readings and circuit gap, and then displays the results for each cylinder on the chart on the screen shown in Figure 3-23.

Press:

- [F2] — to display diagnostic messages;
- [F3] — to display the *Secondary Live* screen;
- [F4] — to cancel the test while it is running, or to repeat the test after it has completed.

**Conventional Ignition**

SECONDARY IGNITION RESULTS								
CONVENTIONAL								
Cyl. Number	Average KV	Delta KV	Burn Time	Burn KV	Burn KV Slope	Coil Oscil.	Snap KV	Circuit Gap
1	14	5	1.4	1.6	0.2	4	19	9
3	14	5	1.4	1.6	0.2	4	17	7
4	15	5	1.4	1.6	0.3	4	20	11
2	14	5	1.4	1.7	0.3	4	18	9

Secondary Ignition test completed.

Diagnostic Messages Secondary Live Repeat

Figure 3-23

**KV Readings**

**Average KV** — The average KV required to initiate a spark. The amount for each cylinder's secondary circuit is stored and shown on the screen in the proper cylinder column.

**Delta KV** — The difference between the minimum and maximum KV.

**Burn Time** — The length of time in milliseconds that the spark plug is arcing.

**Burn KV** — The average KV required to maintain the spark. The amount for each cylinder's secondary circuit is stored and shown on the screen in the proper cylinder column.

**Burn KV Slope** — The change in Burn KV from the start of the spark line to the end of the spark line.

**Coil Oscillations** — The average number of secondary coil oscillations per cylinder.

After delta KV is displayed, the operator will be prompted to snap the throttle wide open and release it. This action is needed to obtain Snap KV and Circuit Gap values.

**Snap KV** — Secondary KV for each cylinder is sampled under load caused by engine acceleration. The highest value is stored and shown on the screen.

**Circuit Gap KV** — The voltage required to jump the largest air gap (except spark plug gap) in each cylinder secondary circuit is stored and shown on the screen.

Repeating this test may yield slightly different values. This is due to variations in mixture richness, turbulence, temperature, etc.



### Digital Secondary KV - DIS

The test for DIS vehicles runs the same way as conventional tests.

#### Required Lead Hookup:

- Green #1 Lead
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer
- Secondary DIS High Tension Adapters
- Low Current Probe
- Amp Probe

### DIS Secondary Live Screen

The *Secondary Ignition Live* screen appears when the test is selected (see Figure 3-24).

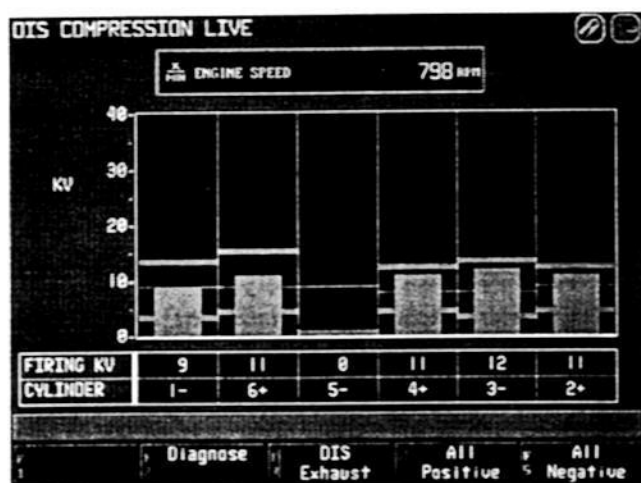


Figure 3-24

Gray bars represent the minimum and maximum KVs detected. The thin white line represents the average KVs detected.

Press:

- [F2] – to run the diagnostic procedure;
- [F3] – to toggle between *DIS Exhaust* and *Compression*, (note that the screen title will change) displays exhaust firings;
- [F4] – to display all positive firings;
- [F5] – to display all negative firings.

### Diagnostic Procedure

1. Start the engine. The analyzer samples the cylinder firings and calculates the test values.
2. Follow the screen prompt (run the engine at idle or cranking speeds) and “snap” the throttle. The analyzer measures the burn time, various KV readings and circuit gap, and then displays the results for each cylinder on the chart on the screen shown in Figure 3-25.

Press:

- [F2] – to display diagnostic messages;
- [F3] – to display the *Secondary Live* screen;
- [F4] – to repeat the test.

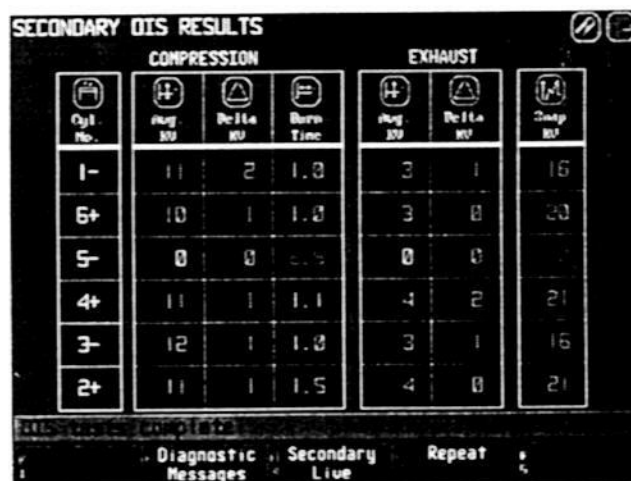


Figure 3-25

Secondary data is collected from the DIS system. After a few seconds, the display screen reports the following KV readings for the Compression Firings and Exhaust Firings of each cylinder (see Figure 3-25):

**"Average KV"** — The average KV required to initiate spark, averaged over a number of firings.

**"Delta KV"** — The difference between the minimum and maximum KV.

**"Burn Time"** — The length of time in milliseconds that the spark plug is arcing.

**"Snap KV"** — Secondary KV for each cylinder is sampled under load caused by engine acceleration. The highest value is stored and shown on the screen.

## NOTE

The "Average KV" values for compression should be several KV higher than the "Average KV" for exhaust. Compression increases cylinder resistance thus requiring higher voltage at the plug. High "Average KV" values for exhaust indicate high resistance.

Again, repeating this test may yield slightly different values, due to variations in mixture richness, turbulence, temperature, etc.

## Ignition Pattern Scope

### Parade Pattern

The parade pattern shows KV peaks of all active cylinders. The default ignition pattern is *Parade Secondary* (see Figure 3-26).



Figure 3-26

### Required Analyzer Hookup:

- Green #1 Lead
- Conventional Secondary Lead
- System Ground Lead (White)
- Exhaust Analyzer Probe

### Recommended Analyzer Hookup:

- Complete hookup per Figure 1-27.

Press:

**Up- and Down-Arrow Keys** — to adjust the KV range on the screen (when the arrows appear).

**[F1]** — to toggle between Parade Primary and Secondary patterns;

**[F2]** — to toggle between Raster Primary and Secondary patterns;

**[F3]** — to toggle between Sequential Primary and Secondary patterns;

**[F5]** — to "freeze" or "un-freeze" the display;



### DIS Vehicles

Parade patterns show the compression pattern for all cylinders (see Figure 3-27). Press [F1] to display either all negative or all positive firings. This will enable you to view compression and exhaust firings for all cylinders.

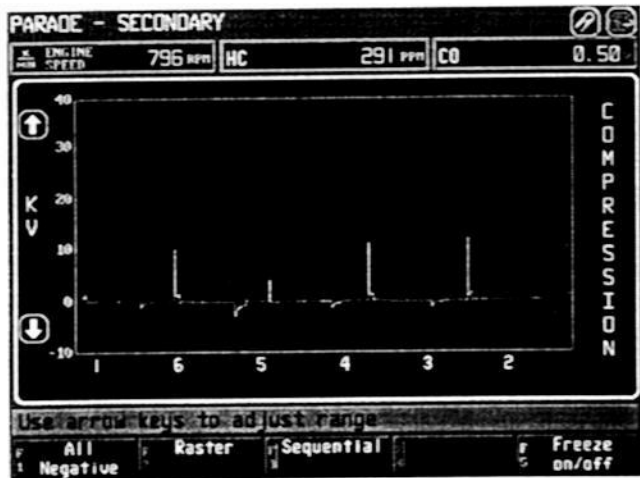


Figure 3-27

#### Required Analyzer Hookup:

- Green #1 Lead
- System Ground Lead (White)
- Secondary DIS Leads
- Exhaust Analyzer Probe

#### Recommended Analyzer Hookup:

- Complete hookup per Figure 1-27.

Press:

**Up- and Down-Arrow Keys** – to adjust the KV range on the screen (when the arrows appear).

**Right- and Left-Arrow Keys** – to adjust the time scale on the pattern meter.

[F1] – to toggle between “All Negative” cylinder firings and “All Positive” cylinder firings;

- [F2] – to display the *Raster Pattern* screen;
- [F3] – to display the *Sequential Pattern* screen;
- [F4] – to return to the *Compression* display after “All Positive” or “All Negative” cylinders were displayed;
- [F5] – to “freeze” or “un-freeze” the display;

### Raster Patterns

Raster patterns display the waveforms for all cylinders at one time (see Figure 3-28). The patterns are arranged in firing order from top to bottom.

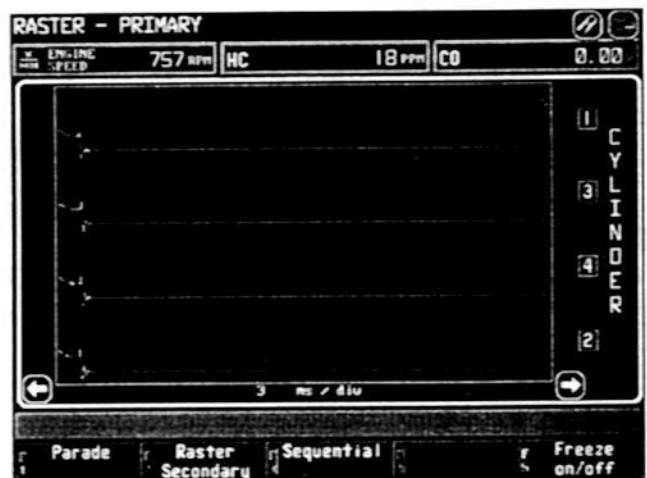


Figure 3-28

Press:

**Right- or Left-Arrow Keys** – to adjust the time scale on the pattern meter.

[F1] – to display the *Parade Pattern* screen;

[F2] – to toggle between the *Primary* and *Raster Secondary* screens;

[F3] – to display the *Sequential Pattern* screen;

[F5] – to “freeze” or “un-freeze” the display;

**Sequential Pattern**

Sequential patterns (see Figure 3-29) display a waveform for each cylinder, in firing order as entered through the *Setup* function at the *Main Menu*.

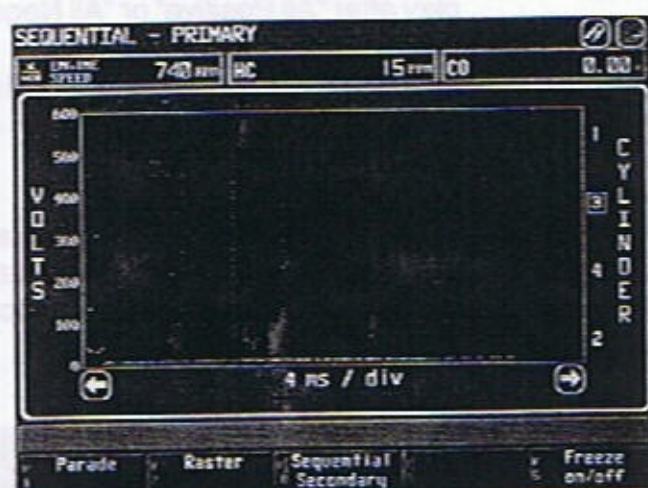


Figure 3-29

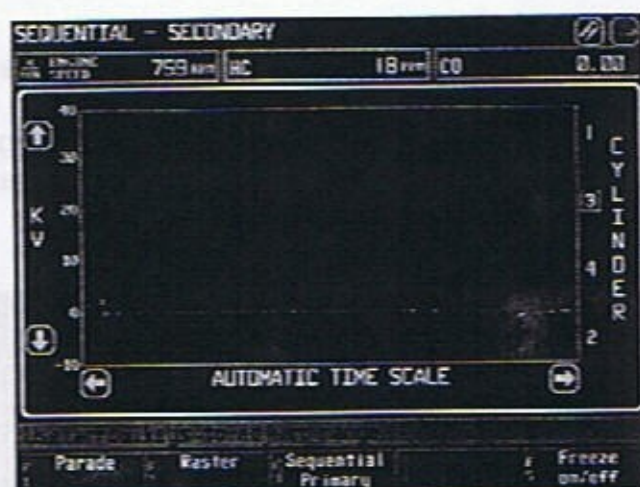


Figure 3-30

Press:

**Up- and Down-Arrow Keys** – to adjust the KV range on the screen (when the arrows appear).

**Right- or Left-Arrow Keys** – to adjust the time scale on the pattern meter.

[F1] – to toggle between *Primary* and *Secondary Parade* patterns;

[F2] – to display the *Raster Pattern* screen;

[F3] – to display the *Sequential Pattern* screen (see Figure 3-30);

[F5] – to “freeze” or “un-freeze” the display;



## Timing Test

### Timing Live Screen

The *Timing Live* screen (see Figure 3-31) appears when this test is selected. Use this screen to check the effects of any changes you make to the vehicle.



Figure 3-31

Use the right- or left-arrow keys to select either active meter. Press the number of the digital meter you wish to display in the analog meter box.

#### Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Vacuum/Pressure Transducer

#### Recommended Lead Hookup:

- Complete hookup per Figure 1-27.

Press:

- [F1] – to store the current reading in analyzer memory (data will be displayed in the boxes at the lower left corner of the screen);
- [F3] – to turn meter trace (used to show trends) “ON” and “OFF;”
- [F4] – to zero center the active meter.

The *Timing Diagnostic* test tests total advance, centrifugal advance, and base timing. Measured results are compared against the vehicle specification entered and then are highlighted on the *Results* screen to indicate the condition and generate diagnostics.

### Diagnostic Procedure

The sequence described below describes the timing test for a vehicle equipped with a “Standard Distributor” - one equipped with centrifugal weights and a vacuum advance unit. The timing test will change depending on the vehicle specification entered. For example, vehicles with computer-controlled timing will not perform the vacuum advance portion of the test.



**WARNING** Make sure the vehicle cannot roll! Place the transmission in PARK or NEUTRAL. If necessary, chock the wheels.

1. Press [F2]. The *Timing System Test* screen appears (see Figure 3-32). The analyzer will test the Total Advance Timing first.

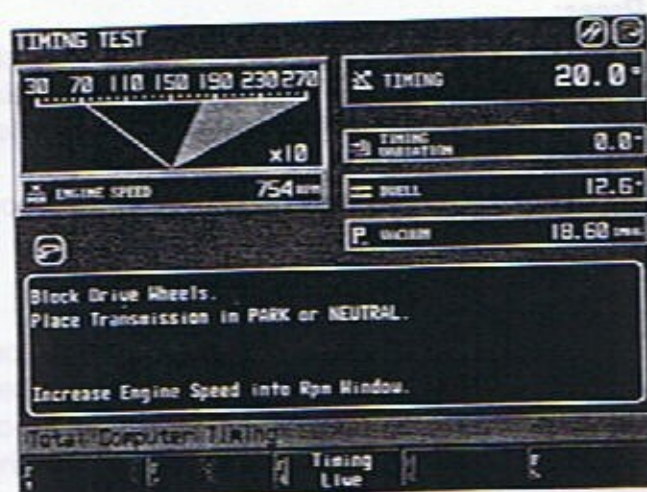


Figure 3-32

2. Start the engine if necessary, and increase the RPM into the green range shown in the RPM meter.

3. Press [ADVANCE] or [RETARD] on the timing light to align the timing marks.

## NOTE

Lightly tap the "Advance" or "Retard" buttons to advance or retard the timing 1/2 degree at a time. When the timing marks line up press [STORE] on the timing light. While maintaining the RPM at the specified level, use the timing light to move the timing mark to Top Dead Center (T.D.C.). Once the mark is at T.D.C. press [STORE].

4. The analyzer will now perform the *Centrifugal Advance* test. Remove the vacuum advance hose from the vacuum unit and plug the hose.

5. Increase the RPM into green range field. Use the timing light to align the timing mark to T.D.C. Press [STORE] on the timing light.

6. The analyzer will now perform the *Base Timing* test. Follow the instructions on the vehicle's emissions decal. Use the timing light and set the timing mark according to the decal instructions. Once the timing mark is set correctly, press [STORE] on the timing light.

From the *Base Timing* screen, press:

[F2] – to display the *Results* screen (see Figure 3-33);

[F3] – to display the *Timing Live* screen;

[F4] – to repeat the test.

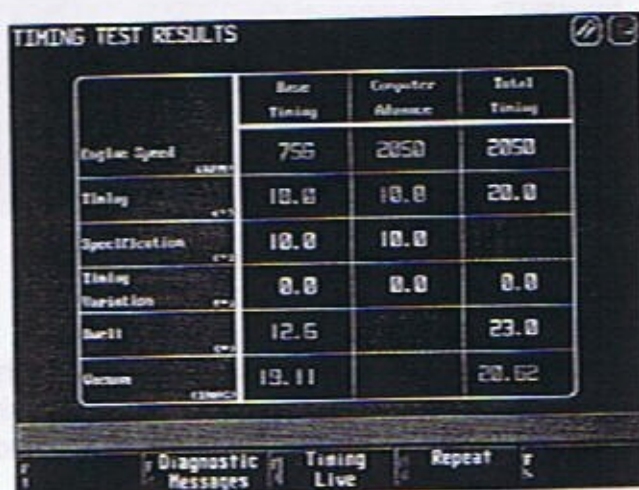


Figure 3-33

Press [F2] to display the diagnostic messages.

When finished, return the engine to its normal operating condition. For example, if you are testing a Ford equipped with an EEC system, reinstall the in-line spout connector that was removed before starting the test. If testing a GM vehicle, re-enable the Electronic Spark Timing Controls and clear codes.



## Cylinder Miss Recall

*Cylinder Miss Recall* helps pinpoint misfiring cylinders by recording the waveforms from each cylinder firing and playing them back for the operator to examine. Make sure that the correct spec is entered for the vehicle so that:

- the number of cylinders is entered correctly;
- the firing order is entered correctly;
- the analyzer is getting signals from the test leads.

### Required Lead Hookup:

- Green #1 Lead
- Conventional Secondary Lead
- System Ground Lead (White)

### Recommended Lead Hookup:

- Complete hookup per Figure 1-27.

When the test is selected, the *Cylinder Miss Recall* screen appears (see Figure 3-34).

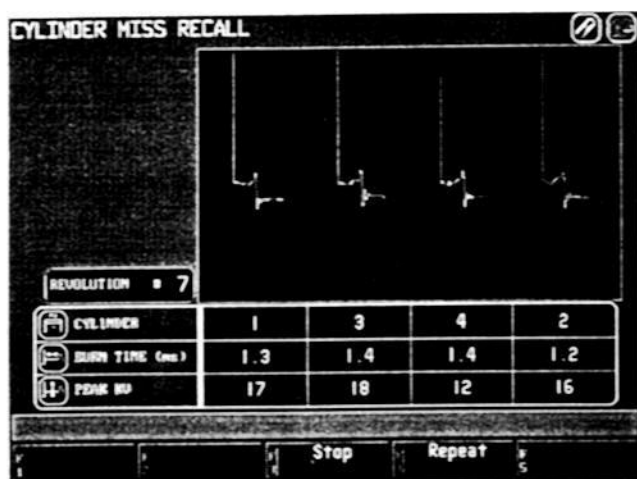


Figure 3-34

As the computer gathers the required information the prompt "COLLECTING IGNITION PATTERNS" appears.

Follow the screen prompts and press:

- [F3] – to begin displaying the information on the screen.

The *Cylinder Miss Recall* screen displays the following information for each revolution when playback is stopped by pressing [F3]:

- Revolution number
- Burn time per cylinder, measured in milliseconds
- Peak kilovolts, per cylinder.

The analyzer will play back each revolution recorded until the operator stops the playback.

Press:

- [F3] – to stop the playback on a particular revolution.  
[F4] – to repeat the test.

Watch the screen for the miss. When it appears, press [F3] to stop the playback. If you miss the "frame" that shows the misfire, press the up-arrow key to see the next revolution or press the down-arrow key to see the previous revolution. Press [F3] to resume the playback again.

# Cylinder Power Menu

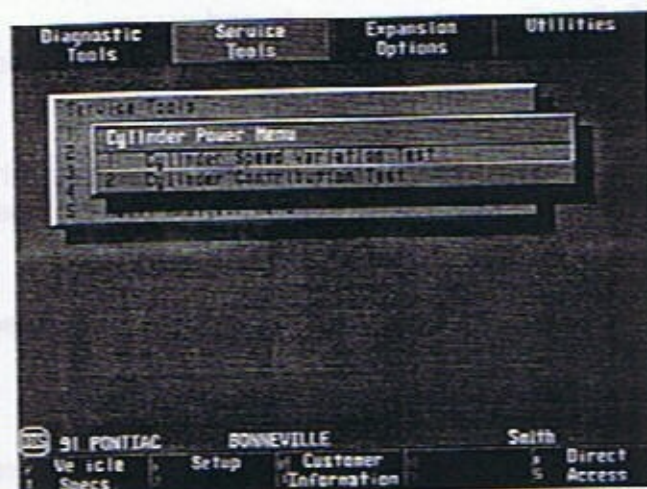


Figure 3-35

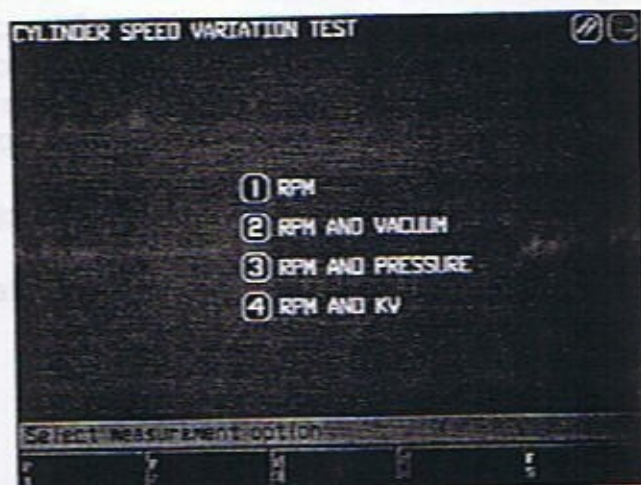


Figure 3-36

## Cylinder Speed Variation Test

The *Cylinder Speed Variation Test* plots engine RPM and either average vacuum or pressure over time. The test results are displayed in a window on the screen, and portions of the resulting plot can be magnified for closer inspection.

### Required Lead Hookup:

- Green #1 Lead
- Conventional Secondary Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)

### Recommended Lead Hookup:

- Complete hookup per Figure 1-27.

1. Select the *Cylinder Speed Variation Test* from the *Cylinder Power* menu. Follow the first screen prompt and press the number which matches the test configuration you wish to run (see Figure 3-36).

2. The *Data Collection* screen appears (see Figure 3-37). Follow the screen prompts and press:

- [F1] – to zero the vacuum/pressure lead, if you are running the RPM and Vacuum or Pressure test;
- [F2] – to run the test under acceleration;
- [F3] – to run the test under deceleration;
- [F4] – to run the test at idle.



Figure 3-37



- Follow the screen prompts and run the engine at the specified RPM. After the analyzer gathers the test data and processes the results, the "Cylinder Speed Variation Test" screen appears (see Figure 3-38).

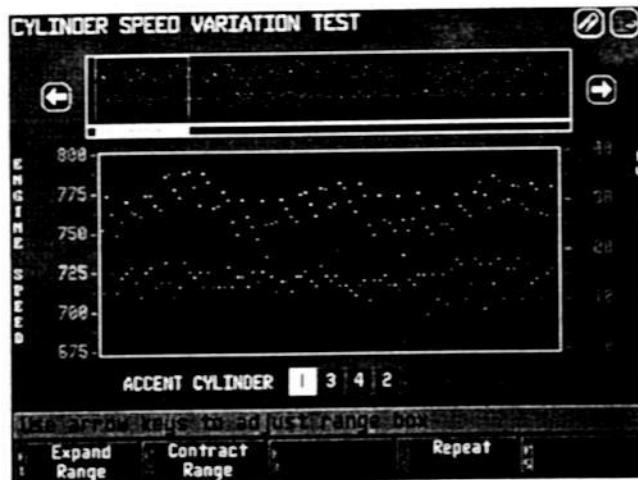


Figure 3-38

Press:

**Right- or Left-Arrow Keys** – to move the yellow range window right or left.

[F1] – to make the yellow range window in the upper full curve window larger;

[F2] – to make the yellow range window in the upper full curve window smaller;

[F4] – to repeat the test;

**The Number Key matching** the cylinder you want to highlight – The highlighted cylinder dot turns white on the screen.

### Interpreting the Curve

Generally, severe variations or RPM drops between cylinders indicates problems in engine performance.

To pinpoint a weak cylinder, find the cylinder that appears low on the curve. Because of engine dynamics, the weak cylinder is usually the one **BEFORE** the low cylinder on the curve. In larger V-8's, the weak cylinder may appear two or even three cylinders before the low cylinder on the curve under acceleration.

A good acceleration curve will show all cylinder firings within 50 RPM of each other, with only minor variations.

Consult the *Help* screens for detailed information.

## Cylinder Contribution Test

### Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer

### Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

When the test is selected, the *Cylinder Contribution* screen appears (see Figure 3-39). This screen displays the live RPM readings for each cylinder.

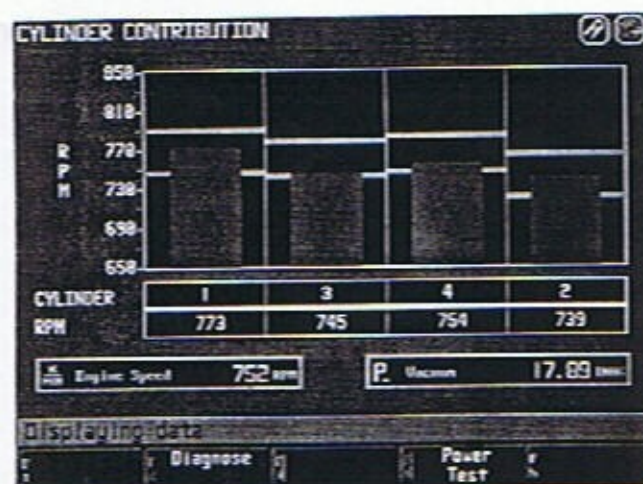


Figure 3-39

The gray bars represent the minimum and maximum readings for each cylinder.

Press:

- [F2] – to run the *Cylinder Efficiency* test;
- [F4] – to run the *Power* test;
- [F9] – to clear the display and begin displaying new information.

## Cylinder Efficiency (Conventional Ignitions)

The *Cylinder Efficiency* test measures the relative power contribution of each cylinder to overall engine performance. The test measures power lost when each cylinder is inhibited. Then the computer calculates the relative contribution of each cylinder and displays that information on the screen in the form of a bar graph.

The *Cylinder Efficiency* data screen appears when this test is selected (see Figure 3-40). The message "SHORTING CYLINDER #n" (where 'n' denotes the cylinder number) appears.

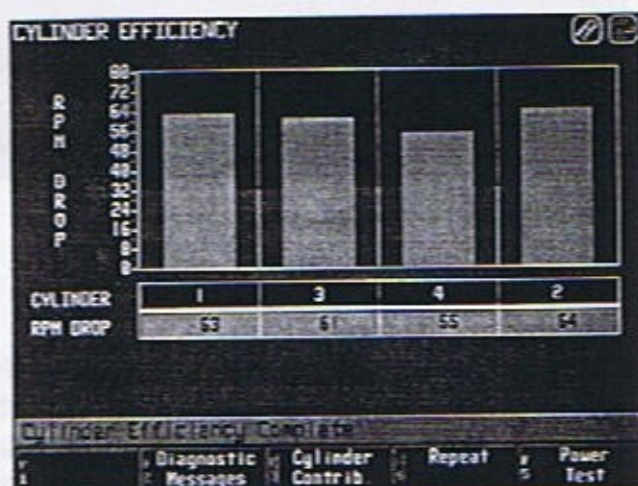


Figure 3-40

After the data has been collected, the computer calculates the results and displays the RPM Drop Values in the boxes under the graph.

Press:

- [F2] – display Diagnostics;
- [F3] – display the *Cylinder Contribution* screen (the "live" screen for this test);
- [F4] – repeat the test;
- [F5] – run the *Power* test.



The vertical bars represent the power LOST when a cylinder is "killed." The taller the bar, the greater the power loss. There is a bar for each cylinder, arranged in firing order.

The light blue box which appears behind the green bars represents the average RPM for the vehicle. Any bars which appear in red are below the average, and represent a weak cylinder.

### Cylinder Power Check

*Cylinder Power Check* allows the operator to "kill" cylinders and watch the resulting changes in engine RPM, HC, CO, CO<sub>2</sub> and O<sub>2</sub>. This information allows the operator to evaluate the performance of individual cylinders. This test will provide better results on older engines or on engines which are running roughly.

#### Required Lead Hookup:

- Green #1 Lead
- Coil Positive Lead (Yellow)
- Coil Negative Lead (Blue)
- System Ground Lead (White)
- Positive and Negative Battery Load Leads
- Vacuum/Pressure Transducer
- Exhaust Gas Analyzer Lead

#### Recommended Lead Hookup:

- Connect all leads per Figure 1-27.

NOTE

Power Check does NOT apply to DIS vehicles.

NOTE

Some computer-controlled fuel management systems attempt to compensate for RPM loss during *Power Check*. You can often disable this compensating feature according to the vehicle manufacturer's instructions. However, it may be easier to run a *Cylinder Efficiency* test, which will not trigger the computer compensation.

Even if the engine is computer controlled, you may want to run the *Power Check*. If the computer is working properly, you will see the RPM compensation as cylinders are inhibited. When finished, remember to re-connect any components disconnected from the vehicle.

The *Power Check* screen appears (see Figure 3-41).

CYLINDER POWER CHECK						
	(RPM)	(P)	(HC)	(CO)	(CO <sub>2</sub> )	(O <sub>2</sub> )
	756	18.30	2492	0.12	7.90	10.33
1	-14	16.85	1671	0.15	8.58	8.96
3	-68	17.75	1519	0.17	8.76	8.72
4	-30	17.48	1467	0.10	8.66	8.87
2	-30	17.14	1564	0.14	8.55	9.01
AUTOMATIC POWER TEST COMPLETE						
Automatic Test			Cylinder Contrib			Cylinder Efficiency

Figure 3-41

Follow the screen prompt or press:

- [F1] – to toggle between "Manual" and "Automatic" testing.
- [F3] – to return to the *Cylinder Contribution* screen.
- [F5] – to go to the *Cylinder Efficiency* screen.

**Automatic Testing**

The automatic sequence will inhibit each cylinder in firing order, one at a time.

**Manual Testing**

Make sure that the engine is running at a stable RPM. For manual testing, type in the cylinder number(s) to inhibit. The analyzer then inhibits the cylinder and displays the various readings on the chart on the screen. Type the number of an inhibited cylinder to release that cylinder.

**Cylinder Performance (DIS Vehicles)**

If you enter specifications for a DIS vehicle, the analyzer will automatically run the *Cylinder Performance* test. The computer calculates the relative contribution of each cylinder and displays that information on the screen in the form of a bar graph.

**Required Lead Hookup:**

- Green #1 Lead
- System Ground Lead (White)
- DIS Secondary Leads

**Recommended Lead Hookup:**

- Connect all leads per Figure 1-27.

1. Press [F2] (Diagnose) to start the *Cylinder Performance* test. The *Cylinder Performance* meter screen appears (see Figure 3-42). Adjust the vehicle's engine to provide a stable RPM reading, and then press [F2].
2. The *Cylinder Performance* data screen and the message "SETTING UP FOR CYLINDER PERFORMANCE" appears.



Figure 3-42

After the data has been collected, the computer calculates the results and displays the cylinder rating values in the boxes under the graph.

Press:

- [F2] – to display Diagnostics;
- [F3] – to display the *Cylinder Contribution* screen, the "live" screen for this test;
- [F4] – to repeat the test.



## Multi-Analyzer Menu

This menu provides a series of multimeters and lab scopes for displaying and analyzing “live” vehicle data.

From the *Service Tools* menu use the arrow keys or press [5] and [ENTER] to access the *Multi-Analyzer* menu.

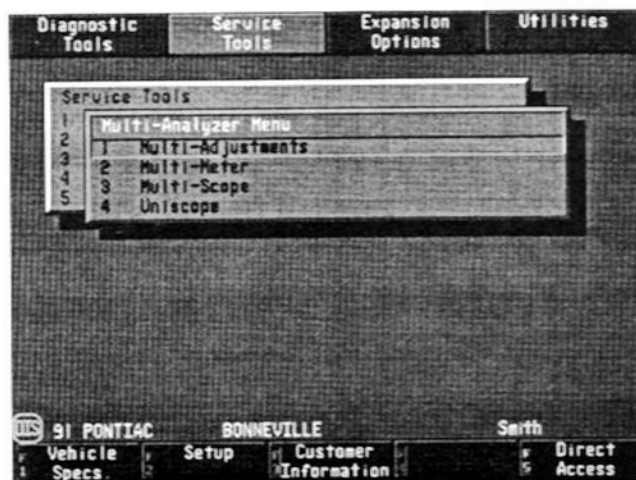


Figure 3-43

## Multi-Adjustments

The *Multi-Adjustments* screen allows the operator to see the “live” results of any adjustments made on the test vehicle.



Figure 3-44

The “default” meters (RPM and dwell) will always appear when *Multi-Adjustment* is selected. Use the right- and left-arrow keys to select an active meter in order to change it to another meter. Active meters are indicated by the yellow border around the meter. All of the digital meters except for the timer and temperature can be displayed as analog meters. Press the number of the digital meter to display that meter as an analog meter. Digital meters colored in gray are not available for meter display, either because they do not apply, or because they are turned “OFF.”

From the “Multi-Adjustment” screen, press:

- [F1] – to toggle the timer “ON” and “OFF;”
- [F2] – to toggle the trace function “ON” and “OFF;”
- [F3] – to *Zero Center* the analog meters. The *Zero Center Meter* icon appears in the lower left corner of the active analog meter.
- [F5] – toggle the timing light “ON” and “OFF.”

## Multi-Meter

The "default" meters (RPM and current) will always appear when *Multi-Meter* is selected.

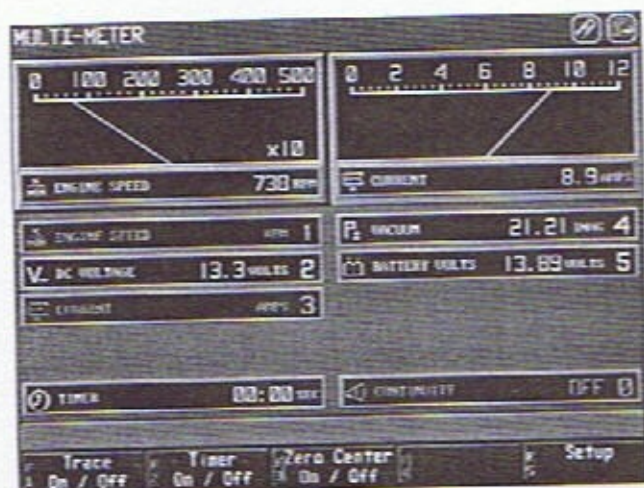


Figure 3-45

Use the right- and left-arrow keys to select an active meter in order to change it to another meter. Active meters are indicated by the yellow border around the meter. All of the digital meters except for the timer can be displayed as analog meters. Press the number of the digital meter to display that meter as an analog meter. Digital meters colored in gray are not available for meter display, either because they do not apply, or because they are turned "OFF."

From the *Multi-Meter* screen, press:

- [F1] – to toggle the trace function "ON" and "OFF."
- [F2] – to toggle the timer "ON" and "OFF."
- [F3] – to Zero Center the analog meters. The *Zero Center Meter* icon appears in the lower left corner of the active analog meter.
- [F5] – to display the *Multi-Meter Setup* screen (see Figure 3-46).
- [0] – to toggle the continuity tester function "ON" and "OFF."

## Changing the Multi-Meter Setup

Type the number of the leads configuration you wish to use. A check will appear in the box next to the list (see Figure 3-46).

Press:

- [F2] – to return to the *Multi-Meter* screen;
- [F3] – to zero the amp probe;
- [F4] – to zero the vacuum/pressure transducer.

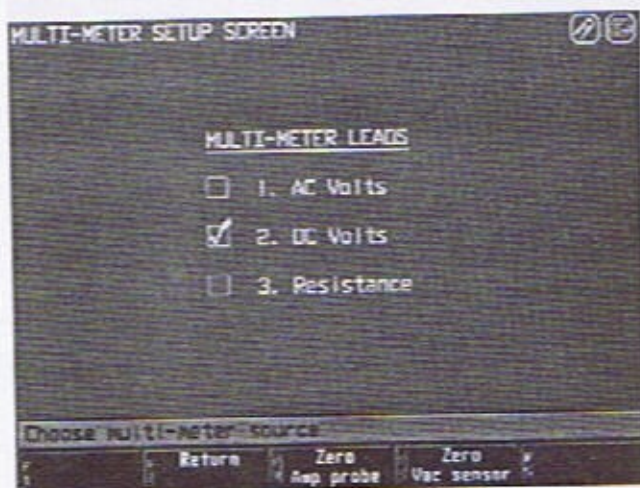


Figure 3-46

## Multi-Meter Ranges

1. AC Voltage:
  - 0 to 60 Volts AC RMS.
2. DC Voltage:
  - 0 to +/-50 Volts DC, high-impedance (10 megohm) meter.
3. Resistance:
  - 0 to 2 megohms.



## Multi-Scope

During this test the analyzer converts voltage readings from any electrical device into a waveform on the display screen. Display any electrical pattern ranging from +/- 25 volts, freeze it, and analyze it for voltage changes over millisecond time periods.

The *Dual Trace Scope* compares waveforms from two different components; for example, the Crank/Cam sensor and an injector. If you know what their respective waveforms look like, compare the two to see if the injector is firing at the wrong time because it is receiving a bad signal from the Crank/Cam sensor.

1. Select *Multi-Scope* from the *Multi-Analyzer Menu*.

### NOTE

If you have not previously selected a vehicle specification, the *VEHICLE SETUP/QUICK SPEC ENTRY* screen will appear. Make any changes necessary to the settings listed in this screen (refer to *Quick Spec Entry* in Chapter 1 for details). Press [F2] to continue.

2. The *DUAL TRACE SCOPE* screen will now appear (see Figure 3-47).

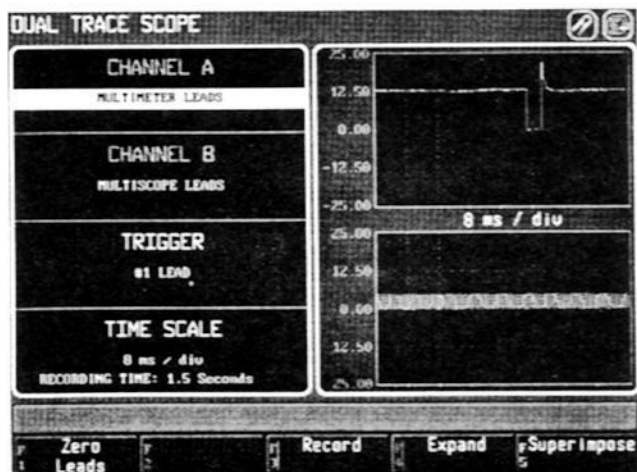


Figure 3-47

3. You may change the source leads for channels A and B, the trigger source, and the time scale as necessary. To change the source leads, use the up- or down-arrow keys to highlight the channel of your choice (A or B) and press [ENTER] (see Figure 3-48).

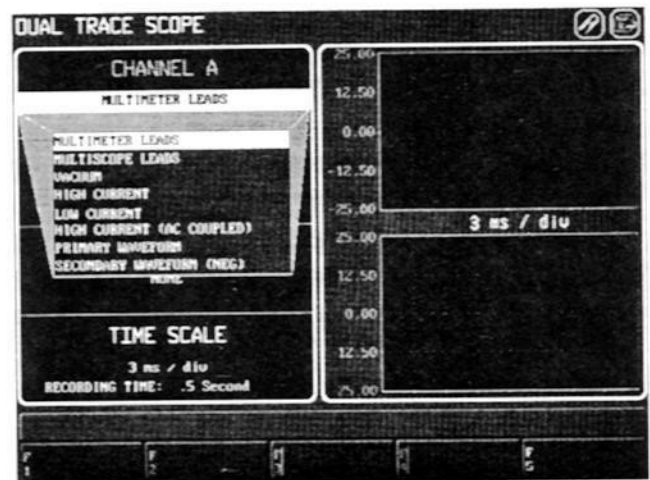


Figure 3-48

A drop-down menu will appear (see Figure 3-49). Highlight the correct source lead and press [ENTER].

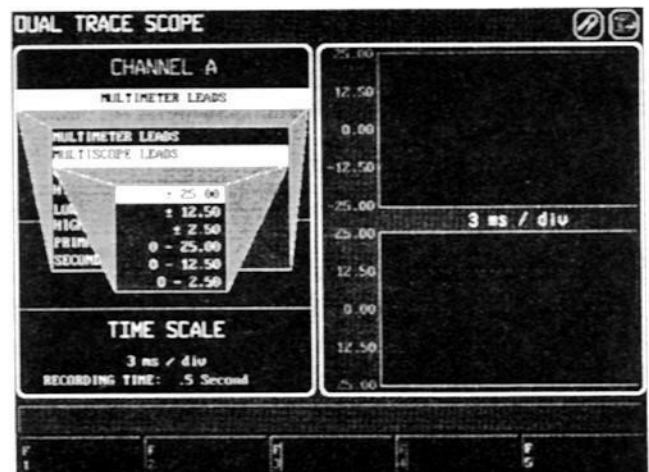


Figure 3-49

**Synchronizing the Pattern**

When a pattern is not synchronized, it will often be hard to read because its position on the screen is not controlled.

To stabilize the pattern on the screen, synchronize the pattern so that it is triggered by some event, such as the beginning of an injector pulse. When synchronized, the pattern begins at the left edge of the screen, where the triggering event occurs.

4. To change the trigger source, use the up- or down-arrow keys to highlight the **TRIGGER** source selection and press [ENTER]. A drop-down menu will appear (see Figure 3-50). Highlight the correct trigger source and press [ENTER].

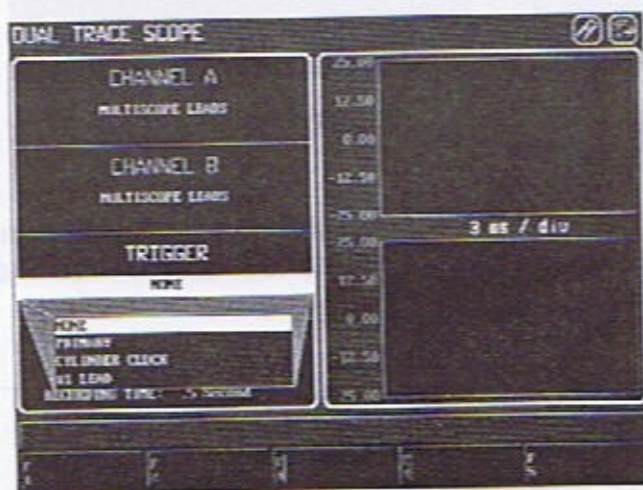


Figure 3-50

5. To change the time scale, use the up- or down-arrow keys to highlight the **TIME SCALE** selection and press [ENTER]. A drop-down menu will appear (see Figure 3-51). Highlight the correct time scale and press [ENTER].



Figure 3-51

6. Connect the trigger lead to any point that will serve as a trigger. The trigger lead can be connected to the same point as the source lead.

Start the engine. The waveforms will appear in the display halves of the boxes.

Press:

- [F1] - to zero all leads used in this test;
- [F3] - to record patterns;
- [F4] - to expand the scope meters to full screen (see Figure 3-52);
- [F5] - to superimpose both patterns in one meter screen (see Figure 3-53).



### Expanded Dual-Trace Scope

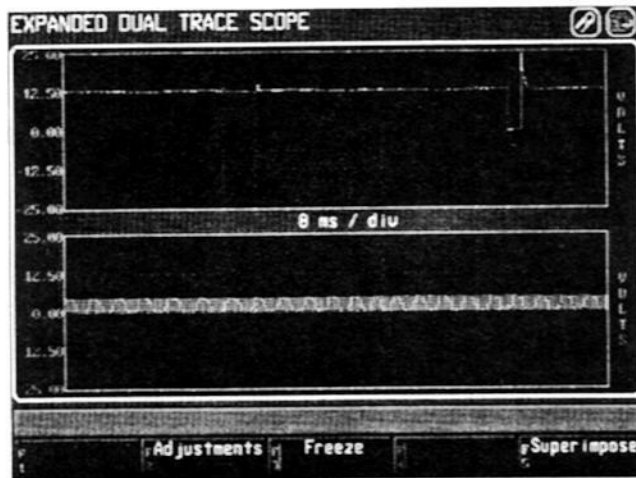


Figure 3-52

From the expanded screen, press:

- [F2] – to return to the *Dual Trace Scope* screen. This allows the operator to make any necessary adjustments to triggers, voltage or time scales.
- [F3] – to “freeze” the pattern on the screen. The analyzer then stops (freezes) the waveforms on the screen and displays time flags and voltage readings at particular times. The flags are spaced apart according to the time scale selected from the *Dual Trace Scope* screen. To “unfreeze” the patterns and resume play press [F3] again.
- [F5] – to toggle between expanded waveforms (see Figure 3-52) and superimposed waveforms (see Figure 3-53). This allows close comparison of both waveforms over time.

Note the digital displays in the lower left corner of the screen, under the scope display. The read-outs display the voltage time in milliseconds and frequency in hertz, at each test point marked by a flag, when *Freeze* is selected.

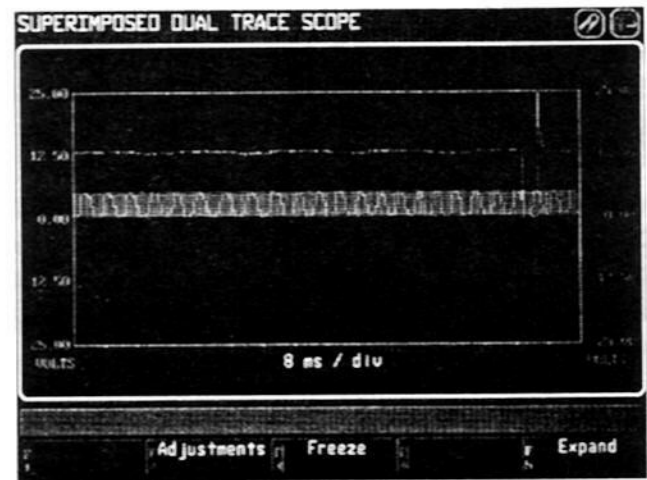


Figure 3-53

**High Current Probe:** Selecting this item allows you to use the light-grey high-amp probe as a DC-coupled trigger and display source. DC-coupling couples all frequency components of the trigger signal to the trigger and display circuitry. It is useful for most signals, but is especially useful for providing a stable display of signals with low frequencies or low repetition rates. It will display exactly and proportionally the signal and value being measured.

The typical use for this selection is for examining the average amperage values of a high current waveform, for example, starter motor draw. Highlight this item using the up and down arrow keys, then press [ENTER].

**High Current Probe (AC COUPLED):** This selection will use the light-grey high-amp probe as a trigger and display source, but the signals will be AC coupled into the analyzer. AC coupling capacitively couples the input signal to the vertical deflection circuitry of the oscilloscope screen. This method of coupling blocks the DC component of the signal input. Only the fluctuating, or changing, portion of the waveform will be displayed on-screen.

AC coupling is useful for viewing small AC waveforms having large DC offsets, such as per-cylinder changes in cranking or charging waveforms. Highlight this item using the up and down arrow keys, then press [ENTER].

Selecting this item will cause the *Voltage Scale* selection menu to pop out. Make your selection by highlighting the desired voltage scale using the up and down arrow keys, then press [ENTER].

### Printing Reports



This option is available only after pressing [F3] to freeze the waveforms.

Press [F3] to freeze the screen display. Adjust the flags as necessary and then press [F12] to print the *Dual Trace Scope* data report. The report lists the customer information and the values recorded at the flag locations on the screen.

### Moving Flags

Only one flag can be moved at a time. To select a flag, press the corresponding number. The number on the active flag will appear larger. Press the arrow keys to move the flags. This allows the operator to check and compare voltages at any particular time.

## Uniscope

The *Uniscope* allows the operator to examine a single waveform at various speeds and update rates with or without a trigger from the engine.

When the test is selected, the *Uniscope* screen appears (see Figure 3-54).

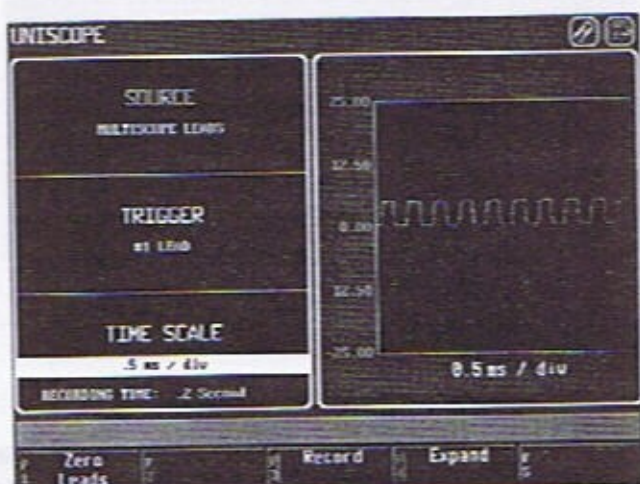


Figure 3-54

### Synchronizing the Pattern

When a pattern is not synchronized, it will often be hard to read because it will be scrolling across the screen.

To stabilize the pattern on the screen, synchronize the pattern so that it is triggered by some event, such as the beginning of an injector pulse. When synchronized, the pattern begins at the left edge of the screen, where the triggering event occurs.

The cursor will appear in the trigger box. Press [ENTER]. The trigger menu will pop out. Use the arrow keys to select a trigger and press [ENTER].



The pop-out menu will disappear. Press the arrow keys to move the cursor to the next block. Select the correct channels and time scales as needed.

Press:

- [F1] – to zero all leads used in this test;
- [F3] – to record patterns;
- [F4] – to expand the scope meters to full screen.

Connect the trigger lead to any point that will serve as a trigger. The trigger lead can be connected to the same point as the source lead.

Start the engine, if necessary. The waveforms will appear in the display halves of the boxes. Press:

- [F3] – to record the patterns;
- [F4] – to expand the pattern display to take up the entire screen (see Figure 3-55).

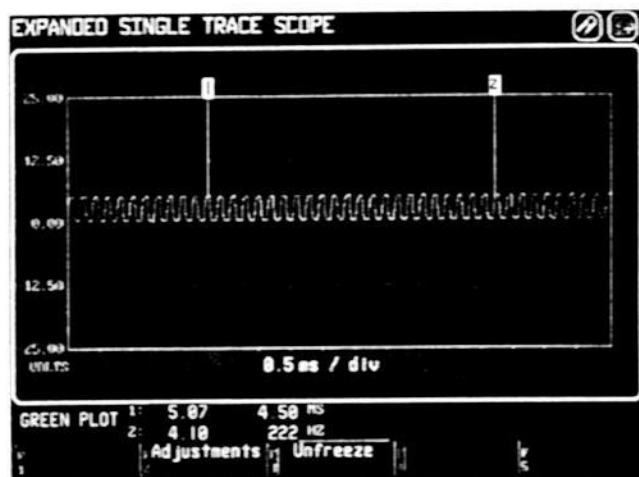


Figure 3-55

From the *Expanded* screen, press:

- [F2] – to return to the *Uniscope* screen. This allows the operator to make any necessary adjustments to triggers, voltage or time scales.
- [F3] – to “freeze” the pattern on the screen. The analyzer then stops (freezes) the waveforms on the screen and displays time flags and voltage readings at particular times. The flags are spaced apart according to the time scale selected from the *Uniscope* screen.

To “unfreeze” the patterns and resume playback, press [F3] again.

**High Current Probe:** Selecting this item allows you to use the light-grey high-amp probe as a DC-coupled trigger and display source. DC-coupling couples all frequency components of the trigger signal to the trigger and display circuitry. It is useful for most signals, but is especially useful for providing a stable display of signals with low frequencies or low repetition rates. It will display exactly and proportionally the signal and value being measured.

The typical use for this selection is for examining the average amperage values of a high current waveform, for example, starter motor draw. Highlight this item using the up and down arrow keys, then press [ENTER].

**High Current Probe (AC COUPLED):** This selection will use the light-grey high-amp probe as a trigger and display source, but the signals will be AC coupled into the analyzer. AC coupling capacitively couples the input signal to the vertical deflection circuitry of the oscilloscope screen. This method of coupling blocks the DC component of the signal input. Only the fluctuating, or changing, portion of the waveform will be displayed on-screen.

AC coupling is useful for viewing small AC waveforms having large DC offsets, such as per-cylinder changes in cranking or charging waveforms. Highlight this item using the up and down arrow keys, then press [ENTER].

Selecting this item will cause the *Voltage Scale* selection menu to pop out. Make your selection by highlighting the desired voltage scale using the up- and down-arrow keys, then press [ENTER].

### Printing Reports

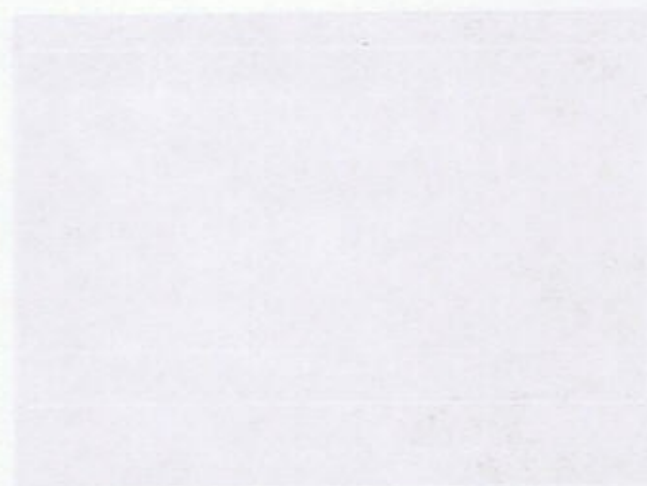
**NOTE** This option is available only after pressing [F3] to freeze the waveforms.

Press [F3] to freeze the screen display. Adjust the flags as necessary and then press [F12] to print the *Uniscope* data report. The report lists the customer information and the values recorded at the flag locations on the screen.

### Moving Flags

Only one flag can be moved at a time. To select a flag, press the corresponding number. The number on the active flag will appear larger. Press the right- and left-arrow keys to move the flags. This allows the operator to check and compare voltages at any particular time.

Note the digital displays in the lower left corner of the screen, under the scope display. The readouts display the voltage time in milliseconds and frequency in hertz, at each test point marked by a flag when *Freeze* is selected.





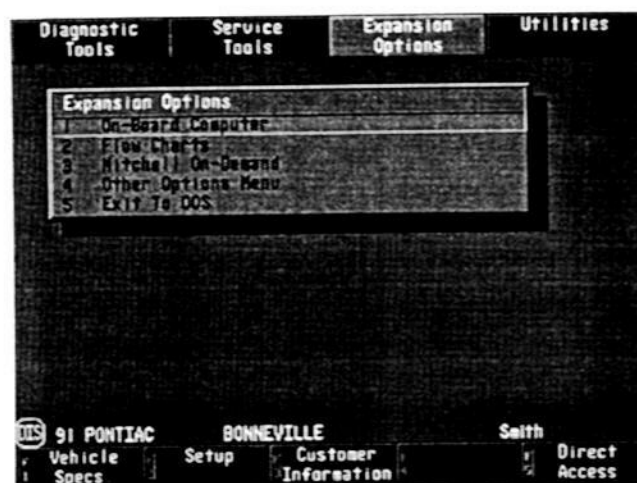






## Chapter 4

# Expansion Options



This menu provides access to optional modules that you may have installed on your analyzer. The following items may appear on the menu and some are described in more detail in the sections that follow.

**On-Board Computer** — This item allows access to on-board computer information from Chrysler, GM, Ford, and some import makes. The engine analyzer manipulates that information to allow you to read fault codes and system sensors, read data stream information and run manufacturer self-test procedures.


**Flow Charts Menu** — This item displays a menu of the optional Flow Chart procedures that apply to the current vehicle specifications. Flow Charts is a CD-ROM based module that allows you to diagnose engine operational problems in a step-by-step manner.

**Emission Certification** — This item will appear if Global Gas software has been installed on the unit. Global Gas provides exhaust gas measurements and international emission testing capabilities. This product is not part of the standard software kit. It is purchased separately.


**Mitchell On-Demand** — This item appears if the DOS version of Mitchell On-Demand is installed. Mitchell On-Demand is a CD-ROM based database of vehicle information and diagrams. Year/make/model pass-through software uses the current vehicle specifications to start Mitchell On-Demand at the appropriate location in their menuing system so that you will not have to re-select the vehicle.

**Other Options Menu** — This item displays a menu of options which you may customize for other commercially available software that you have installed on your unit. Items can easily be added to the menu by providing a title and the name and path for executing the program.


### Main Icons





Press [F7] to see Lead Status Screen. Flashing icon indicates problem with one or more leads.





Press [F10] to display previous menu screen.



DIS Specs Loaded.





Arrow Keys are active – press the appropriate arrow to scroll up or down a text screen, or move the highlight from one meter to another.

*Continued...*

**Exit To DOS**— This item allows you to exit the analyzer software and enter the DOS environment.

**Smoke Meter**— This item appears if the Smoke Meter software is installed on the unit. It provides diesel vehicle exhaust opacity testing. This product is not part of the standard software kit. It is purchased separately and includes additional test leads.

Other supported products may appear on the menu when they are installed on the unit. Generally, the modules do not appear on the menu unless they are installed, and, will appear ghosted if the current vehicle specification is not supported by the module.

### Hot Keys

- [F7] – **Trigger Lead Status** — Displays *Trigger Lead Status* screen.
- [F8] – **Kill** — Stops the engine.
- [F9] – **Clear** — Clears data fields and displays.
- [F10] – **Previous Menu** — Aborts the test in progress and returns to the previous menu or proceeds to the next test in a user test.
- [F11] – **Form Feed** — Form feeds paper from the printer.
- [F12] – **Print Reports** — Displays the "Print Reports" menu.
- [Print Screen] – Prints a "screen dump" - an exact copy of what appears on the screen.

### Task Switching

Using the Flow Charts program or the AD-Net Scan Tool with the 40-400 Professional Work Station provides you with "Task Switching" capability. Task Switching allows you to "leave" the 400 Engine Analyzer, Flow Charts, OBC Scan Tool, or certain other functions to retrieve data from another software module installed in the 400 unit.

When other available software modules are installed in the 400 unit, the [F1] key on the module main menu changes to "Select Module." For example, if you are in the OBC Scan Tool module, and Flow Charts is installed, the [F1] key on the OBC menu changes to "Select Module." If you are in Flow Charts, and OBC Scan Tool is installed, the [F1] on the main Flow Charts menu changes to "Get Measurement." Once you have obtained the desired measurement, you can then return to the original module and continue the programmed test where you left it.

To select another software module:

1. Return to the software module's main menu.
2. Press [F1].
3. Use the Arrow keys to select the desired module and press [ENTER].



# On-Board Computer (OBC)

## About the OBC Function

The On-Board Computer function allows access to on-board computer information from Chrysler, GM, Ford and some import makes. The engine analyzer manipulates that information to allow you to:

- read fault codes and system sensors
- read data stream information
- run manufacturer self-test procedures

**NOTE** This section provides a brief overview of the OBC function. For detailed instructions on the use of the OBC function, consult the **AD Net Scan Tool Operation and Maintenance Guide (P/N 520-05604)**.

This function interacts closely with manufacturer computers, and follows manufacturer test procedures. Each manufacturer has a number of different systems.

Many malfunctions that appear to be related to computer systems are actually the result of mechanical breakdown, poor electrical connections, or damaged vacuum hoses, rather than problems with computer system components themselves. For this reason, it is recommended that you always run a Quick Comprehensive Test after using the OBC Module to diagnose computer systems.

## Software Updates

If a software update is performed on the analyzer, there will be a software mismatch between the analyzer and the Scan Tool. This will require downloading the appropriate software from the analyzer to the Scan Tool. This is a completely automatic process, and only requires the operator to perform the following procedure:

1. Select *On-Board Computer* from the *Expansion Options* menu.
2. The "AD-OBC Initializing..." screen will appear. At this point, the analyzer communicates with the Scan Tool, detects the software mismatch, and displays a warning message (see Figure 4-1).



Figure 4-1

**NOTE** If you press [F4] to abort this process and exit the OBC function, the analyzer will still need to perform this operation before OBC can be used again.

## Flow Charts

- Press [F2] to perform the download. The process will take about 10 minutes. When it is finished, the analyzer will be ready to perform OBC functions.

## NOTE

If the warning message in Figure 4-1 appears when the operator accesses the OBC function on the analyzer and no software update has been performed recently, it is most likely the result of a corruption of the Scan Tool's downloadable memory. Press [F2] and the analyzer will correct the problem.

Flow Charts is a CD-ROM-based step-by-step diagnostic procedure for computer-equipped vehicles. It guides you through diagnosis of engine operation problems. The diagnosis is based on recommendations from vehicle manufacturer's service manuals.

The 400 Series Analyzer Software stores the Flow Chart information with the vehicle being tested in memory. Press [2] from the *Expansion Options* menu to access the *Flow Charts* program, (see Figure 4-2 and 4-3).

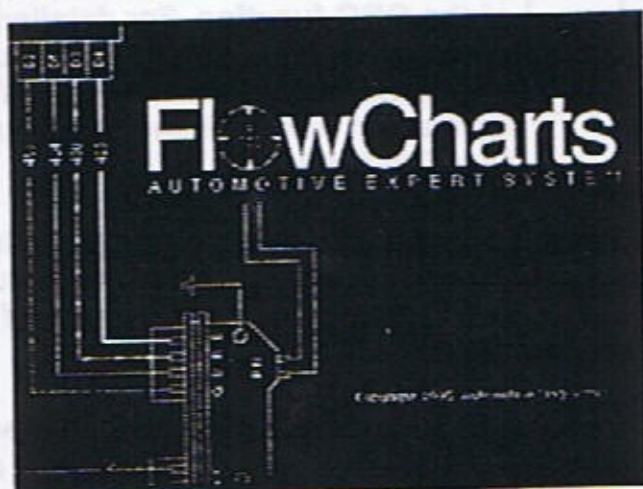


Figure 4-2

### Flowcharts Screen example.

#### Automotive Diagnostics Flowcharts

- The **DIAGNOSTIC CIRCUIT CHECK** is the correct starting point for diagnosis of all ECM and driveability problems. Trouble code charts should NOT be used unless trouble codes are currently present. The use of trouble code diagnostic charts when a code is intermittent may result in misdiagnosis and replacement of non-defective parts.

- To follow Structured diagnostic procedures, select **DIAGNOSTIC CIRCUIT CHECK** or **TROUBLE CODE MENU**.

**DIAGNOSTIC CIRCUIT CHECK**

**TROUBLE CODE MENU**

**MENU OF AVAILABLE GRAPHICS**

**MENU OF AVAILABLE TECHNICAL SERVICE BULLETINS**

**COMPONENT TESTING**

**COMPUTER PIN OUT INFORMATION**

F1 EXIT F2 PICTURE

Figure 4-3



## Mitchell On-Demand

**NOTE** Mitchell On-Demand is available in both Windows® and DOS versions. Only the DOS version of Mitchell On-Demand can be installed on to the 400 Series Professional Work Station.

**NOTE** If the year, make, and model of the vehicle testing specifications entered into the 400 Series match Mitchell database information, Mitchell-supportive 400 Series software will automatically start the Mitchell On-Demand program and supply the specifications to allow it to display the "Category" menu. Year, Make, and Model will show as [F1], [F2], and [F3] selections on the left side of the screen. You may review them as needed by pressing the appropriate key. If only one, or two, of the database items match, you will be required to enter the remaining items to reach the "Category" menu. You may then select any of the available items on the category list to access that function for the specified vehicle.

## Other Options Menu

The *Other Options Menu* contains a list of owner-installed options. You can install any number of popular retail software packages, as well as your choice of shop management packages.

When you install an application using the *Other Options Menu*, the analyzer computer will have almost the entire 640K of memory available for your programs.

To select the *Other Options Menu*, press the number key corresponding to the *Other Options Menu* position on the Expansion Options Menu listing. The menu (see Figure 4-4) appears. (You may also use the arrow keys to highlight the selection, then press [ENTER].)

**NOTE** The *Other Options* menu is not available if *Exit to DOS* is disabled.

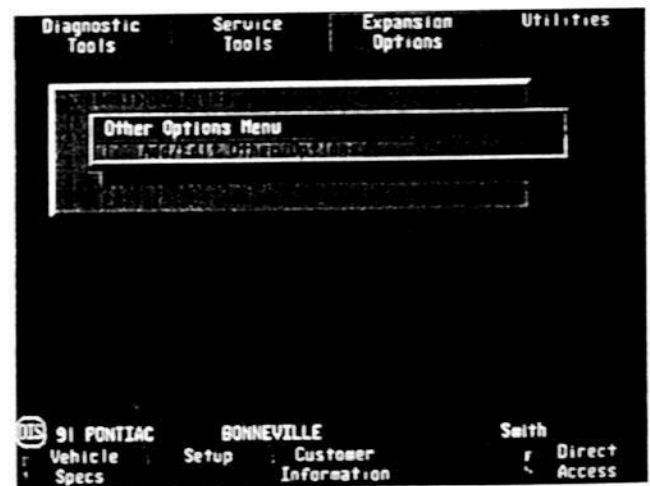


Figure 4-4

## Running an Optional Application

To run an optional application from the *Other Options* menu, use the Arrow Keys to highlight the item and press [ENTER], or type the item number.

The computer exits the analyzer software and starts the optional software application.

## Return to the Analyzer Software

1. Exit the optional application software (consult the application's User Manual for complete instructions). The cursor is then in the MS-DOS environment.
2. Change to the drive where the analyzer software is located.
3. Type `CD\400` and press [ENTER].
4. Type `400` and press [ENTER].

The analyzer software starts and the title screen appears. Press any key to continue. For more information on steps 2 through 4, consult an MS-DOS reference manual for a complete explanation.

## Adding New Options

Depending on the hard disk space available, up to nine (9) applications can be installed on the system. Adding an additional or larger hard drive to the analyzer computer can increase the number and/or size of the optional software applications installed.

### If No Options Are Currently Installed:

1. Press [1], *Add/Edit Other Options* to add a new software application to the analyzer. If no options are currently installed, the *Add/Edit Options* screen appears (see Figure 4-5).

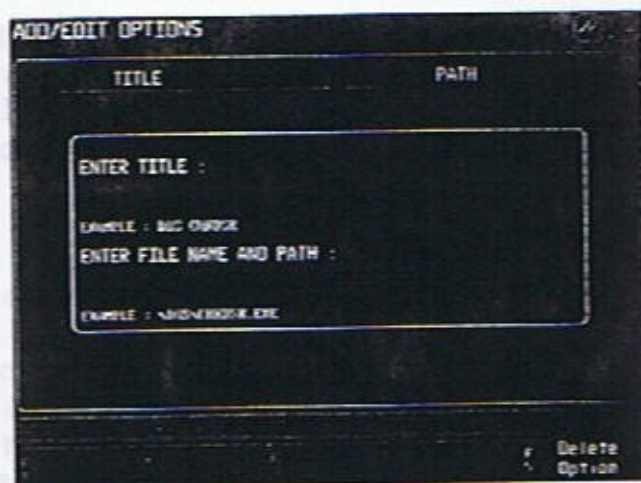


Figure 4-5

2. Enter the title of the optional software program and press [ENTER]. The cursor moves to the next field.
3. Enter the executable file name and path and press [ENTER].
4. Press [F10] to return to the *Other Options* menu. The newly installed optional software application appears in the menu.

*If other options are installed,*  
and you want to add another option:

1. From the *Expansion Options* menu, highlight *Other Options*, then press [ENTER].
2. Highlight *Add/Edit Other Options*, then press [ENTER]. A screen similar to the *Add Edit Options* screen in figure 4-6 appears. If you have multiple options installed, their names will be listed.
3. Use the arrow keys to scroll to a blank line, then press [ENTER]. Then, the *Add/Edit Options* screen 4-5 will be displayed.



Screen 4-5 is only displayed first if no other options are currently installed.

4. Enter the title of the optional software program and press [ENTER]. The cursor moves to the next field.
5. Enter the executable file name and path and press [ENTER].
6. Press [F10] to return to the *Other Options* menu. The newly installed optional software application appears in the menu.

### Editing an Optional Application Name or Path

1. Select *Add/Edit Other Options* from the *Other Options* menu and press [ENTER]. The *Add/Edit Options* screen will appear (see Figure 4-6).

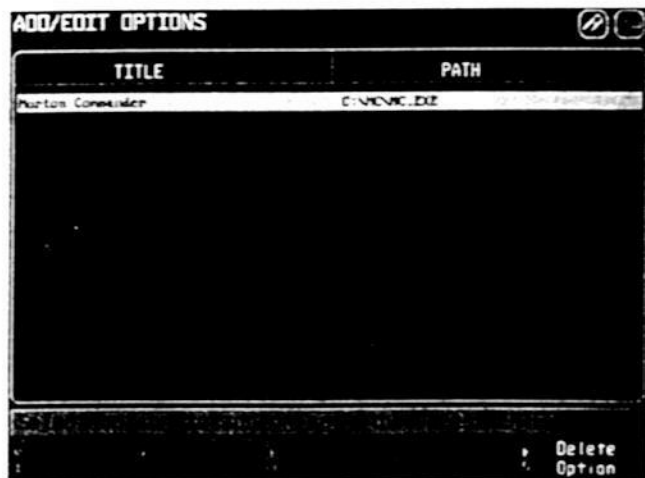


Figure 4-6

2. The cursor highlights the first option in the list. Use the up- or down-arrow keys to select the option you want to edit and press [ENTER].
3. The dialog box (see Figure 4-7) appears, containing screen prompts. The prompts guide you through the editing of commands that the computer uses to find and run the optional software package.

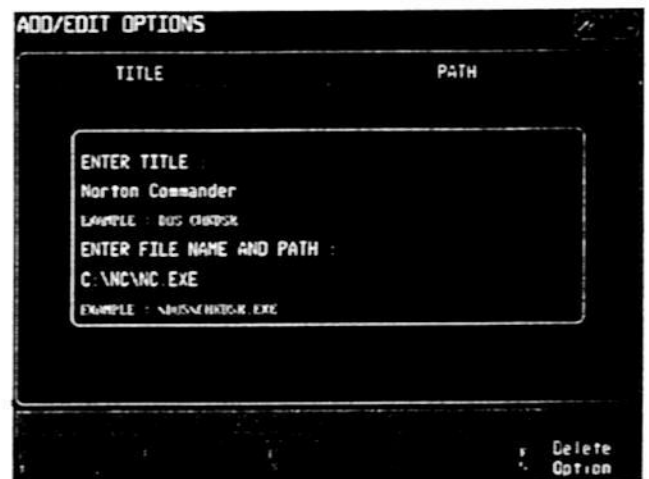


Figure 4-7

4. Type in the required information and press [ENTER]. When you are finished, the option will appear in the list in Figure 4-6.
5. Press [F10] to return to the *Other Options* menu. The edited item appears in the menu.

## Exit to DOS

### Deleting an Optional Application

1. Select *Add/Edit Other Options* from the *Other Options* menu and press [ENTER]. The *Add/Edit Options* screen appears, (see Figure 4-6).
2. Move the cursor to the optional application in the list that you want to delete.
3. Press [F5]. The analyzer deletes the item from the list.
4. Press [F10] to return to the *Other Options* menu. Note that the optional application is removed from the menu.

Select this menu item any time you wish to leave the analyzer program and go into the MS-DOS environment. Highlight the menu item or type the item number and press [ENTER]. The program will exit the analyzer software and enter MS-DOS.



Do NOT use this function unless you are very familiar with MS-DOS commands and their functions! "Tinkering" in MS-DOS can cause serious software problems, which will result in service call costs to your shop.

To return to the analyzer software from MS-DOS:

1. Change to the drive where the analyzer software is located.
2. Type `CD\400` and press [ENTER].
3. Type `400` and press [ENTER].

The analyzer software starts and the title screen appears. Press any key to continue.



*Notes:*

This image shows a single page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

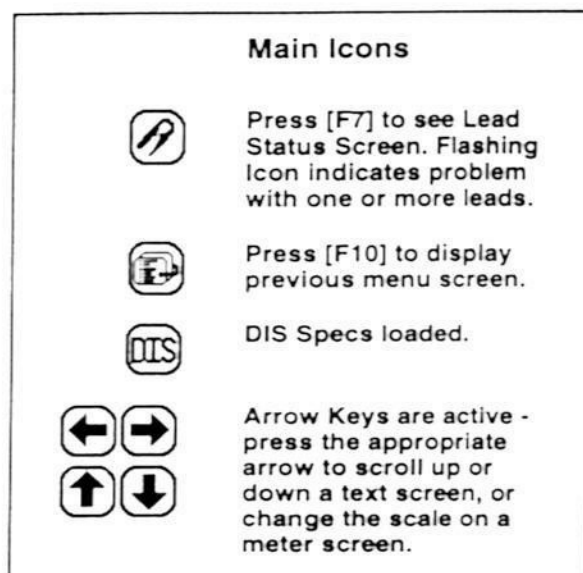
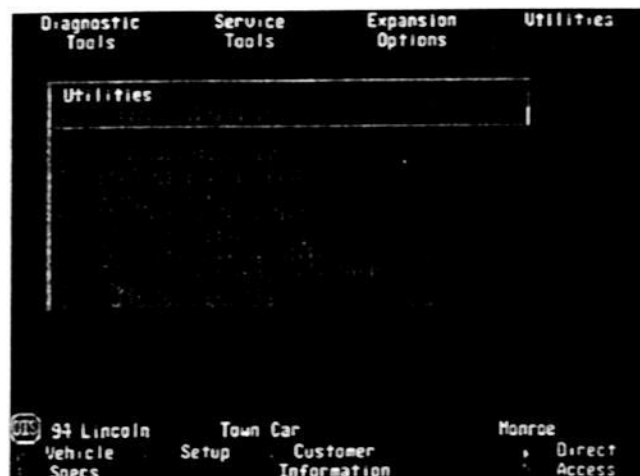
Notes:

Lined area for notes.



## Chapter 5

### Utilities



The "Utilities Menu" provides various administrative and calibration functions. These routines allow you to customize screen displays and report printouts according to your country, unit of measure, etc.

### Hot Keys

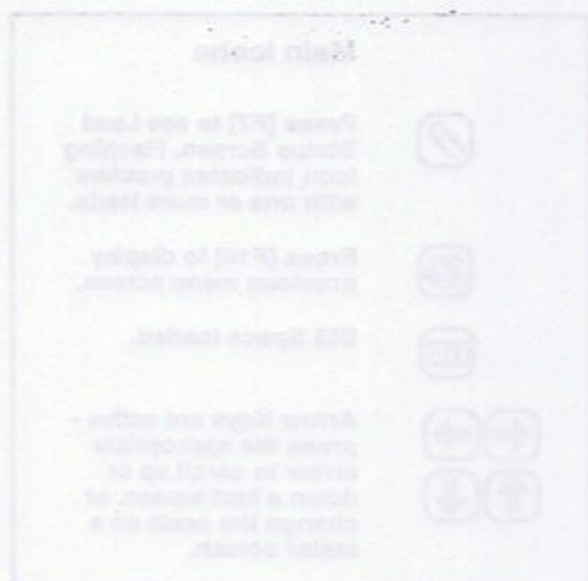
- [F6] – **Help** — Displays help screens.
- [F7] – **Trigger Lead Status** — Displays "Trigger Lead Status" screen.
- [F8] – **Kill** — Stops the engine.
- [F9] – **Clear** — Clears data fields and displays.
- [F10] – **Previous Menu** — Aborts the test in progress and returns to the previous menu or proceeds to the next test in a user test.
- [F11] – **Form Feed** — Form feeds paper from the printer.
- [F12] – **Print Reports** — Displays the "Print Reports" menu.
- [Print Screen] – Prints a "screen dump", an exact copy of what appears on the screen.

Chapter 5  
Utilities

The "Utilities Menu" provides various administrative and calibration functions. These functions allow you to customize screen displays and report printers according to your country, unit of measure, etc.

## Hot Keys

- [F1] -- Help -- Displays help screen.
- [F2] -- Trigger Lead Status -- Displays "Trigger Lead Status" screen.
- [F3] -- Kill -- Stops the engine.
- [F4] -- Clear -- Clears data fields and displays.
- [F10] -- Previous Menu -- Aborts the test in progress and returns to the previous menu or proceeds to the next test in a user test.
- [F11] -- Form Feed -- Form feeds paper from the printer.
- [F12] -- Print Report -- Displays the "Print Report" menu.
- [Print Screen] -- Prints a "screen dump", an exact copy of what appears on the screen.





## Dealer Information

The Dealer Information feature allows you to create custom report headers which will print out your shop name and address along with a sales message on the top of any printed report. The sales message can be up to three lines of 40 characters each in length.

Select "Dealer Information" from the "Utilities" menu. The "Dealer Information" screen appears (see Figure 5-1).

```

DEALER INFORMATION
NAME
Automotive Diagnostics
ADDRESS
8801 Angling Road
CITY, STATE, ZIP
Portage, MI 49802
PHONE NUMBER
616-329-7600
MESSAGE
Leader in Automotive Systems Diagnosis.
Research and Development
Manufacturer of Quality Products!
  
```

Figure 5-1

Type in the information and then press [ENTER]. The cursor moves to the next line.

If you need to change information entered previously, press [F9] to clear any highlighted field.

When finished, press [F10] to save the information in memory and return to the Previous Menu.

**NOTE** "Dealer Information" appears on the print-out only when it is selected in the *Engine Analyzer Configuration* function.

## Calibrate

The "Calibrate" menu item features a sub-menu of routines that calibrate various analyzer functions.

Select "Calibrate" from the "Utilities" menu and press [ENTER]. A sub-menu appears (see Figure 5-2).

Items 2 and 3 on the menu will appear in gray type and be ghosted if the Gas Analyzer is turned off in the "Engine Analyzer Configuration" screen (refer to Figure 5-19).

**NOTE** Items 2, 3, and 4 will not appear if Global Gas is installed on the unit. In that case, all gas calibration must be performed in Global Gas.

```

Automatic Tests | Manual Mode | Options | Special Functions
Calibration
1. Gas Calibration
2. Enter Gas Calibration Values
3. Gas Calibration Verification
Copyright (C) 1996 Automotive Diagnostics, A Division of TPA
Vehicle Specs | Setup | Customer Information | Direct Access
  
```

Figure 5-2

### Calibrating Leads

From the "Calibrate" submenu, press [1] and [ENTER]. The "Lead Calibration" screen appears. Follow the instructions on the screen and prepare the analyzer leads for calibration. When all the items listed on the screen have been completed, press [F2] to proceed to the next step.

## NOTE

"Lead Calibration" must be performed when the leads are disconnected and then reattached to the analyzer or when serviced.

The "Lead Connection" diagram appears (see Figure 5-3).

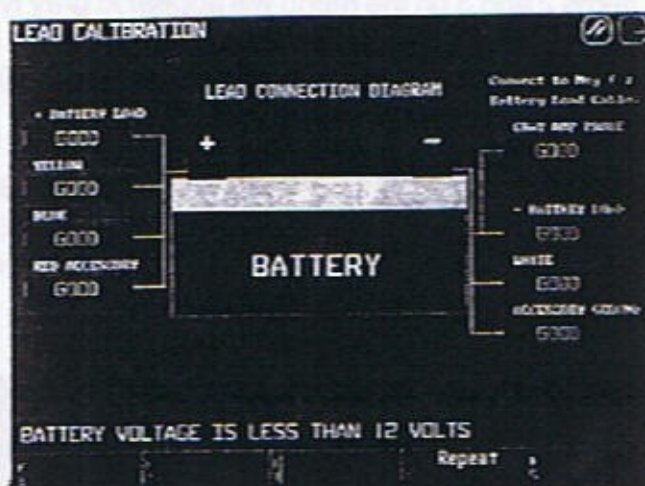


Figure 5-3

Make sure all the leads are connected correctly as shown in the diagram.



Make sure the gray amp probe is connected around the Negative Battery Load Lead - NOT the Negative Battery Cable! The arrow on the probe may point either toward or away from the battery.

Press [F2] to run the calibration routine. The calibration results appear in the boxes under the name of each lead on the screen. If a lead is indicated as "BAD," check the connections again and press [F4] to repeat the calibration routine.

Press [F10] to return to the "Calibrate" menu. Disconnect the leads before beginning the next task.

## Calibrate Gas Bench

The Gas Bench calibration is performed by the analyzer software. The analyzer requires a warm-up period before it completes a calibration.

The analyzer calibrates itself using specially formulated gases which are certified for concentration. These gases are stored in the bottle inside the lower left-hand cabinet.

## NOTE

Refer to "Enter Gas Calibration Values" later in this chapter and make sure the calibration values stored in analyzer memory match those listed on the gas bottle.

To run the calibration procedures, open the valve on the gas bottle and look at the pressure gauge. If the gauge reads less than 20 PSI, replace the bottle. Replacement bottles are available from any authorized service center.

## NOTE

Always close the gas bottle valve after each calibration.

1. Press [2] and [ENTER] from the Calibrate menu. At this point, the gas analyzer bench will autozero if the analyzer determines it is necessary.
2. Make sure the analyzer probe is removed from the tailpipe. If the sample hose is set up for dual exhaust testing, remove the dual exhaust assembly.
3. Follow the screen prompt and open the calibration gas bottle valve. Press [F2] to begin the test. Prompts appear describing what is happening inside the bench.



**Successful Gas Calibration**

1. Follow the screen prompts and cover the gas analyzer sample probe with the probe tip cap.
2. Press [F2] to run the leak check.
3. If the analyzer passes the leak check, remove the probe tip cap and press [F2] to return to the "Calibrate" menu.

**Failed Gas Calibration**

1. Follow the screen prompts and check the analyzer.
2. Make sure that the gas bottle valve is open (turn the valve counterclockwise.)
3. Check the "Calibration Gas Values" screen against the values printed on the calibration gas bottle. If the two sets of numbers do not match, see the "Enter Gas Calibration Values" section for details on how to enter the correct values into memory.
4. If the message shown in Figure 5-4 appears, run the gas calibration routine again.

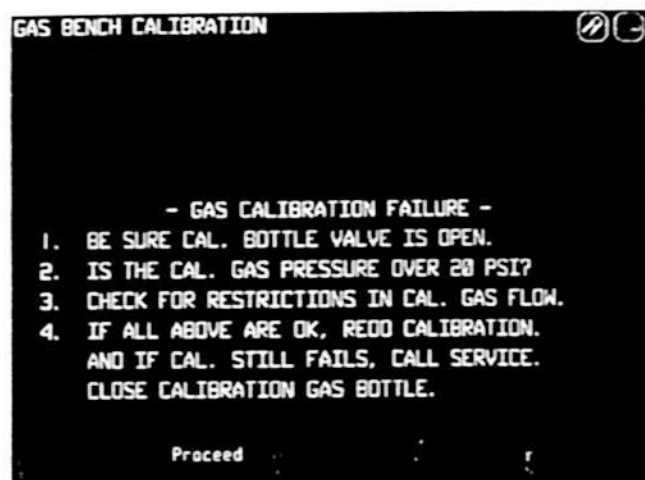


Figure 5-4

5. If the analyzer detects a leak again, remove the sample hose from the gas bench and seal the sample hose inlet fitting (refer to Figure 6-2). Run the routine again. If the analyzer passes the calibration routine, carefully check the sample hose and probe for leaks. If the analyzer fails again, check the following:

CHECK	FOR
Filter Housing	Cracks or chipped surfaces which might cause leaks.
Filter Housing O-ring	Cracks, tears or brittleness, which might cause leaks.
Clear Tubing Ends	Cracks
Probe Tip Cap	Cracks or tears
Sample Hose	Cracks or tears
Flexible Probe	Cracks

If you cannot find a leak and the analyzer will not pass the leak portion of the gas calibration routine, call an authorized service center for repairs.



**IF THE ANALYZER FAILS A GAS CALIBRATION, REMEMBER TO REMOVE THE PLASTIC CAP FROM THE PROBE END BEFORE RE-RUNNING THE CALIBRATION ROUTINE!**

**IF YOU DO NOT REMOVE THE PROBE TIP CAP YOU WILL FAIL ALL SUBSEQUENT GAS CALIBRATIONS!**

**REMEMBER TO REMOVE THE PLASTIC CAP FROM THE PROBE END BEFORE CONTINUING TO TEST VEHICLES!**

### Enter Gas Calibration Values

From the "Calibrate" menu press [3], "Enter Gas Calibration Values" and [ENTER]. The "Calibration Value Entry" screen appears (see Figure 5-5).

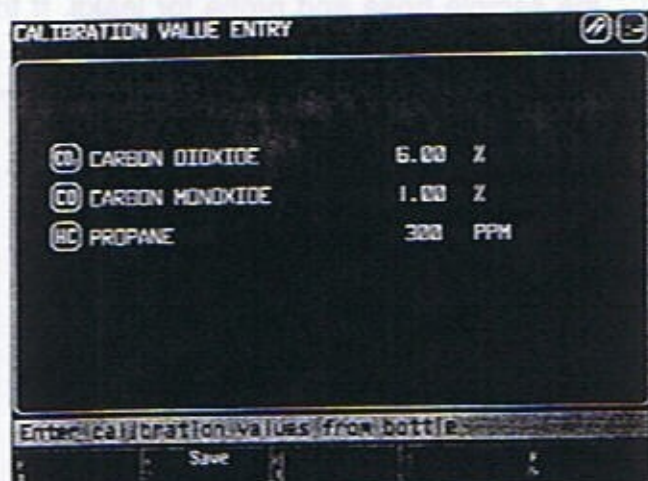


Figure 5-5

This screen displays the values currently saved in the analyzer's memory.

Compare the gas values printed on the calibration gas bottle to those shown on the screen. Change any values which do not match by using the Arrow Keys to move up and down the list. Type in the correct values and press [ENTER] for each item that needs to be changed.

**NOTE** To replace a value with a newer value containing fewer digits, first fill the field with zeroes (0's) and then type in the new number.

When finished, press [F2]. The new values will be saved in memory and the program will return to the "Calibrate" menu.

### Gas Calibration Verification

From the "Calibrate" menu press [4], "Gas Calibration Verification" and [ENTER]. Follow the screen prompt and open the calibration gas bottle valve. Press [F2] to perform the test.

When the analyzer detects stable readings, it will read the actual bench values and display the values on the screen. Figure 5-6 shows the completed screen.

	CALIBRATION GAS	ACTUAL READING
CO <sub>2</sub> .....	6.00	6.15
CO .....	1.00	1.05
HC(HEXANE) ....	154	156
HC(PROPANE) ...	300	305
O <sub>2</sub> .....	20.90	19.69
PEF .....	0.514	

Proceed

Figure 5-6

Compare the values in each column. If they do not match within a few points, run a Gas Calibration procedure and then run the Gas Calibration Verification routine again. If the values still do not match, call an authorized service technician.

If the values match, press [F2] to return to the "Calibrate" menu.



# Diskette Utilities

The 400 Series Analyzer Software comes with a utility designed to format diskettes.

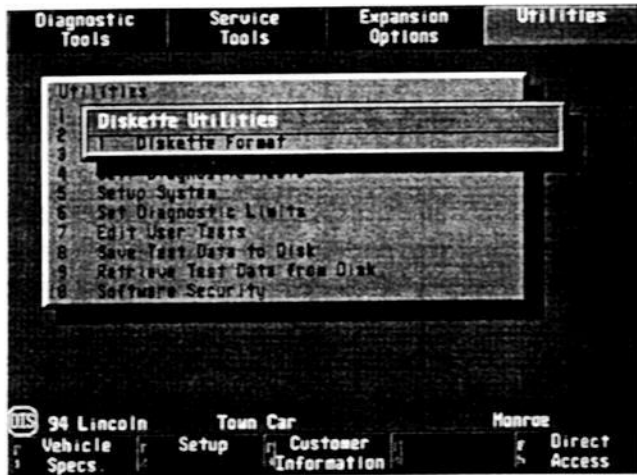


Figure 5-7

## Formatting Diskettes

Use this utility to format diskettes. Press [3] and [ENTER] from the Diskette Utilities submenu. The Diskette Format screen, Figure 5-8 appears.

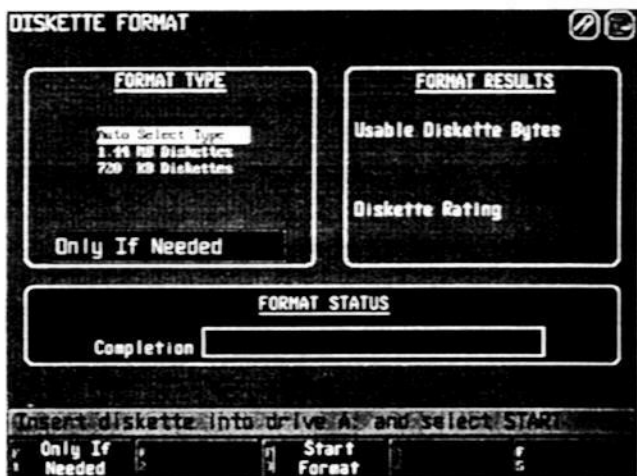


Figure 5-8

The "Format Type" box shows you the format choices available:

- "Auto Select Type" instructs the computer to automatically check the diskette to determine which type of format should be used. To use the "Auto Select" feature, insert a diskette in the drive and press [F3] to start formatting.
- "1.44 MB Diskettes" - formats 1.44 MB diskettes (also known as "High Density").
- "720 KB Diskettes" - formats 720 KB diskettes (also known as "Double Density").

1. Use the Arrow Keys to select the format type.
2. Insert a diskette into the floppy drive.  
Press:
  - [F1] – to instruct the computer to check the disk and format it only if necessary;
  - [F3] – to format the diskette according to the format type specified in the "Type" box.
3. Press [F10] to return to the previous menu.

## Self-Diagnostic Tests

Select "Self Diagnostic Tests" from the "Utilities" menu. The "Self Diagnostics" submenu appears (see Figure 5-9).



Figure 5-9

### Module Tests

From the Self-Diagnostics Tests submenu, move the cursor to highlight Module Tests and press [ENTER]. This routine displays the "Module Status Information" screen (see Figure 5-10).

MODULE	HARDWARE SERIAL NUMBER	SOFTWARE VERSION NUMBER
HIST SYSTEM	123456789	3.081
ENGINE ANALYZER	ABCDEF 123	V2.70 SBETA
GAS ANALYZER	ANDROS6230	E
VEHICLE ID		3.00
FLUORIMETERS		2.20
WBC SOON TOOL		0.02
GENERAL GAS		
CHIME METER		
BREAK OUT BOX	243E4RST6Y7U	1.10

Figure 5-10

The Module Status Information screen lists the version number information for all the accessory options installed on the analyzer.

### Update Module Status Information

1. Press [F1] to update the information on the screen after installing a new option or updating an option already on the system.
2. At the flashing cursor, type in the serial numbers of the Engine Analyzer and any other options installed. When you are finished typing, press either the Down Arrow Key or [ENTER] to scroll through the list. The analyzer program queries and displays the version information automatically.

#### NOTE

When calling an authorized service representative for help with any software problem it is recommended that you print out a copy of the diagnostic report. The service representative will ask you to read back some of the version information before attempting to diagnose a problem.

3. Press [F10] to return to the "Self Diagnostic Tests" submenu.



# Setup System

## Computer System Tests

From the Self-Diagnostics Tests submenu, move the cursor to highlight Computer System Tests and press [ENTER].

This data screen (see Figure 5-11) shows the computer configuration information.

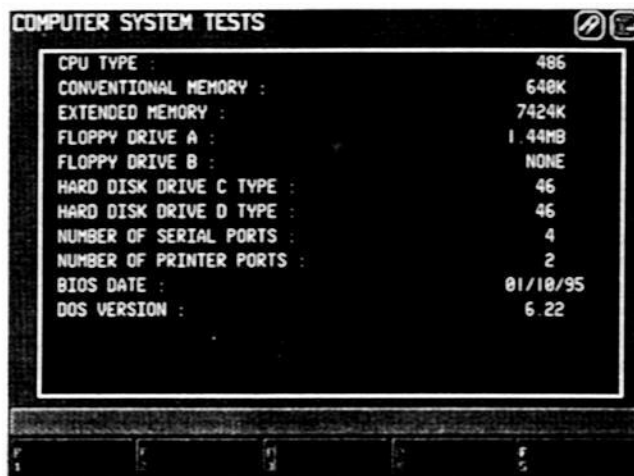


Figure 5-11

An authorized service representative may ask you to display this screen before attempting to diagnose a problem.

Press [F10] to return to the "Self Diagnostic Tests" submenu.

Selecting "Setup System" from the "Utilities" menu displays a Setup System sub-menu (see Figure 5-12).

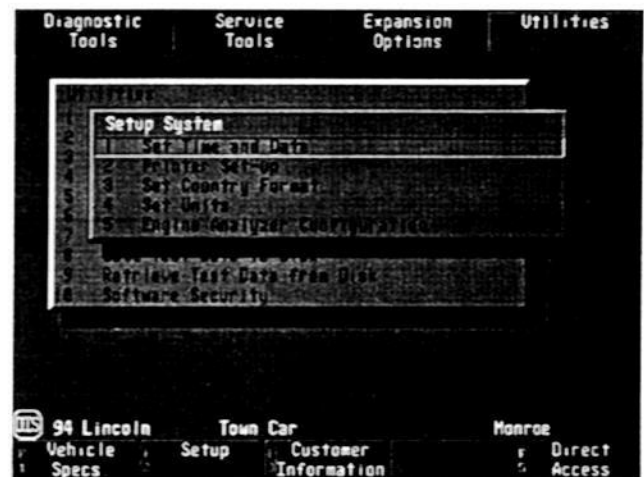


Figure 5-12

Use the Arrow Keys or type in the number of the setup function you wish to use and press [ENTER].

## Set Time and Date

This selection allows the operator to enter the correct time and date. The time and date are automatically printed on all customer and technical reports generated by the analyzer.

1. Select "Set Time and Date" from the "Setup System" menu.
2. The "Set Time and Date" screen appears (see Figure 5-13) with the current settings displayed.

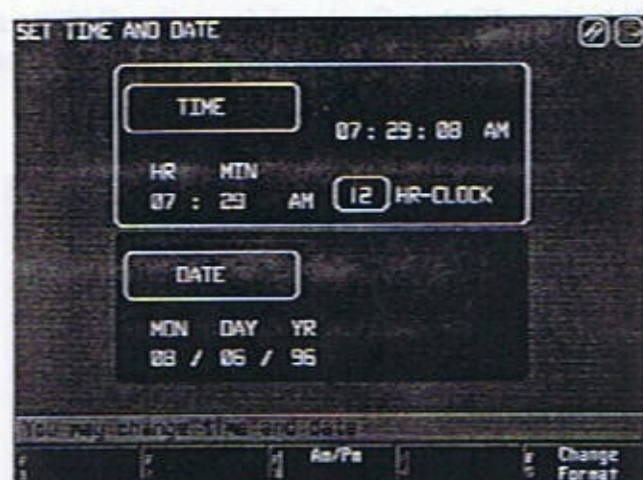


Figure 5-13

- Press the Up or Down Arrow Key to move the cursor to the setting that must be changed. The cursor will appear in one of the data fields. Type in the correct setting and press [ENTER]. Press [ENTER] to move the cursor from one field to the next.

Press:

- [F3] – to toggle between AM and PM;
- [F5] – to change the time format from AM/PM to 24 hr.

- When finished, press [F10] to save the data and return to the "Setup System" sub-menu.

**NOTE** The program does NOT automatically compensate for Daylight Savings Time.

## Printer Setup

This function allows you to select an optional printer and change the printer configuration in analyzer memory (see Figure 5-14).

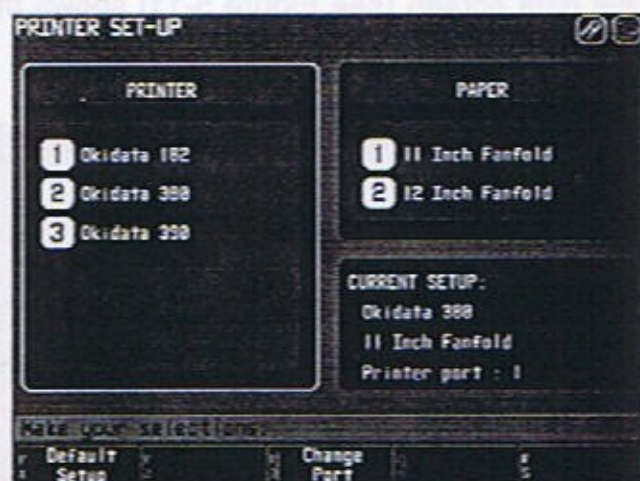


Figure 5-14

Press:

- Arrow Keys** – to toggle between the "Printer" and "Paper" dialog boxes;
- [1] or [2]** – to choose the type of printer to be configured in the printer dialog box or the size of the paper in the paper dialog box. Any changes made appear in the "Current Setup" box;
- [F1]** – to enter the default setup configuration into memory;
- [F3]** – to toggle between available printer ports. The port number will change in the "Current Setup" box.



## Set Country Format

This function allows you to change the display character format according to a particular country's requirements.

1. Select "Set Country Format" from the "Setup System" menu.
2. The "Set Country Format" screen appears (see Figure 5-15). The current settings are displayed on the screen.

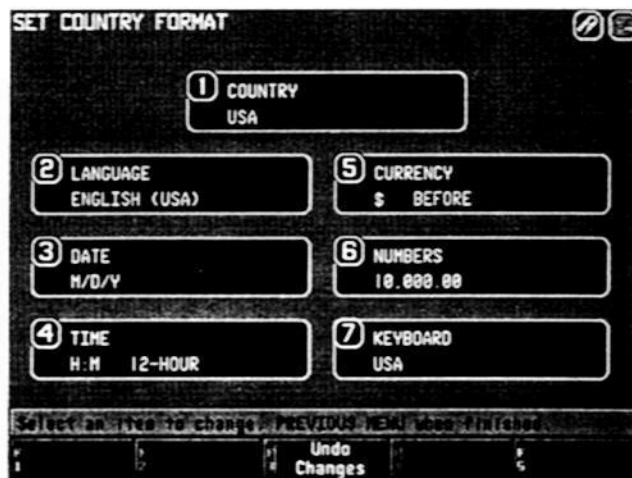


Figure 5-15

3. Press the number of the category to be changed. A dialog box will appear listing the available choices for that particular category (see Figure 5-16).

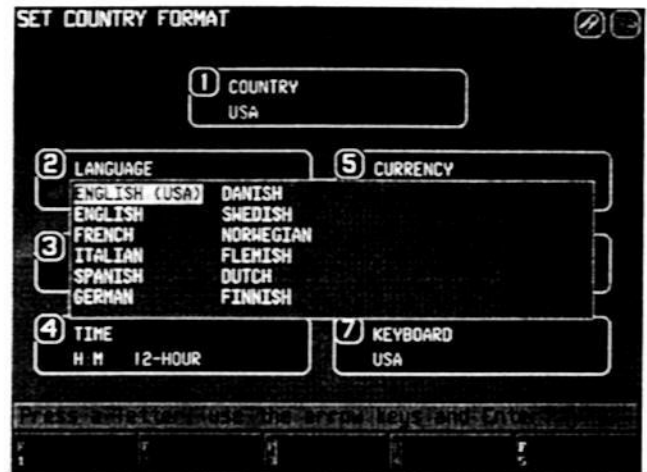


Figure 5-16

Use the Arrow Keys to move the cursor until the correct choice is highlighted or type in the letter or number of choice. Press [ENTER] to confirm the change. The dialog box will disappear and the new selection will be displayed in the "Set Country Format" screen.

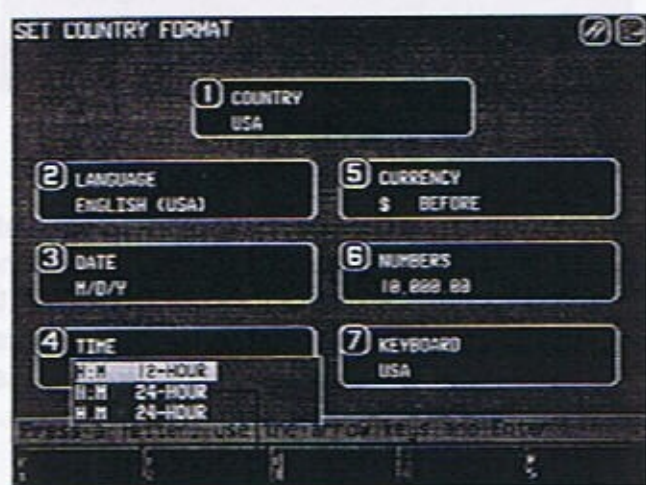
Press:

[F3] – to undo any changes made.

**Time**

The time can be displayed on the analyzer and in customer reports in a 12-hour style, a 24-hour style (1 p.m.), and a military style (13:00).

To change the clock style from a 24-hour style to a military style press [4]. Use the Arrow Keys and select style (A) from the dialog box, (see Figure 5-17). Press [ENTER].



**A**  
Figure 5-17

**Set Units**

Select this function from the "Setup System" sub-menu to change the measurement system. The "Set Units" screen (see Figure 5-18) provides the following choices for each measurement:

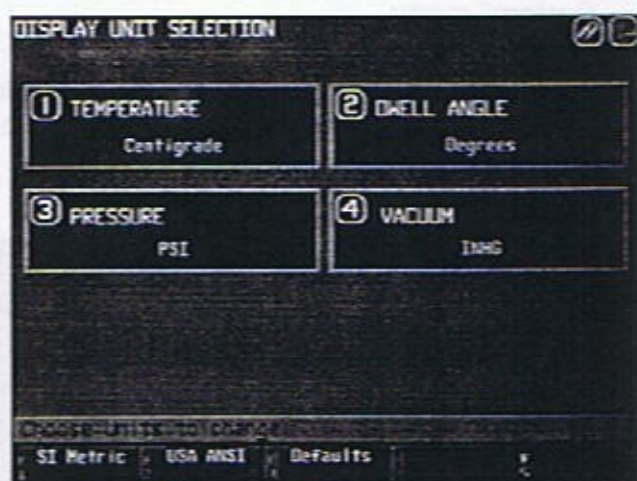


Figure 5-18

Press:

- [1] – to choose between Fahrenheit and Celsius temperature readings. Use the Arrow Keys to highlight the correct entry and press [ENTER] to confirm the choice.
- [2] – to choose between Degree and Percentage dwell readings. Use the Arrow Keys to highlight the correct entry and press [ENTER] to confirm the choice.
- [3] – or [4] to choose between the following Pressure and Vacuum units:
  - PSI - pounds per square inch
  - KPA - kilo pascals per
  - INHG - inches of mercury
  - Bars
  - Torr
- [F1] – to load SI (metric) units.
- [F2] – to load ANSI units. ANSI units are generally used for American/English defaults.
- [F3] – to load default units into memory. The default units are the same as the USA ANSI settings.



## Engine Analyzer Configuration

From the Setup System submenu, press [5] and [ENTER] to access the Engine Analyzer Configuration screen. The "Engine Analyzer Configuration" screen (see Figure 5-19) allows customization of the analyzer operation.

Use the Arrow Keys to move the cursor up and down the list. Press [ENTER] to toggle the particular function "ON" and "OFF."

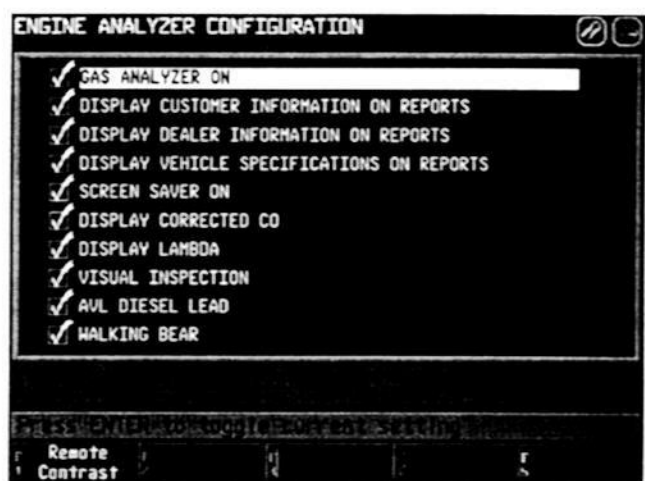


Figure 5-19

The "Gas Analyzer" is set to "ON" by default (box contains a check mark), displaying Gas Analyzer readings and messages in the event of problems with the exhaust analyzer.

The "Display Customer Information," "Display Dealer Information," and "Display Vehicle Specifications" settings customize the customer report format. It is recommended that specifications are printed on each report, to see where a vehicle tested out of spec, and to verify that the specification in memory is correct. If a specification for a vehicle isn't correct, modify it using "Vehicle Specifications," [F1], from any menu screen.

A "Screen Saver" is a moving pattern that appears on the display monitor after you have not used your computer for an amount of time. It provides less wear on, and longer life of, the monitor's Cathode-ray Tube. Other selections may appear for individual screen savers.

"Corrected CO" set to "ON," is displayed in the Four Gas Live screens.

"Display Lambda" set to "ON," is displayed in the Four Gas Live screens.

"Visual Inspection" set to "ON," appears as a step in the Quick Comprehensive Test.

"AVL Diesel Lead" set to "ON" indicates that an AVL Lead has been installed on the unit and should be used for diesel synchronization. Set to "OFF" indicates that the Green #1 Lead should be used.

The last option on the screen determines whether or not the "Walking Bear" will be displayed on the title screen.

Press:

- [F1] – to adjust the hand-held remote display contrast and brightness (see Figure 5-20). The default is set to 25. Use the Arrow Keys to set the contrast level from 1 to 50. Press [F10] to return to the previous menu screen. The contrast level is stored until the remote contrast is adjusted again.

## Set Diagnostic Limits

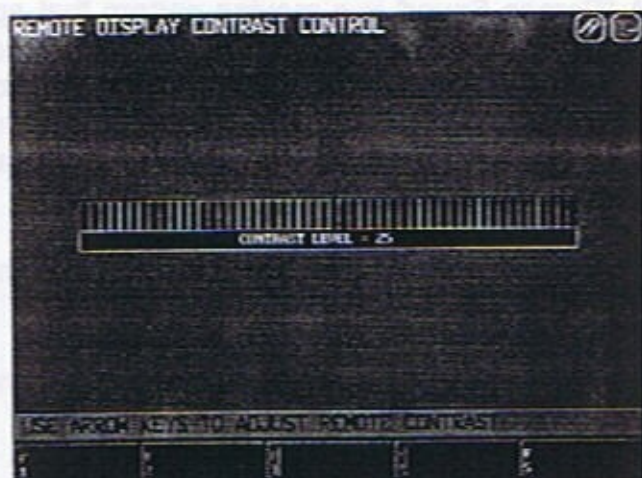


Figure 5-20

This function allows Gas Analyzer diagnostic limits to be set for various model-year vehicles. The analyzer compares emission readings to the values stored in memory and flags emission readings as good or bad, then generates diagnostic messages to assist in diagnosis and troubleshooting.

Select "Set Diagnostic Limits" from the "Utilities" menu. The "Set Diagnostic Limits" screen appears (see Figure 5-21).

YEAR RANGE	HC MAXIMUM	CO MAXIMUM
88-94	220	1.20
75-79	300	2.00
70-74	400	4.00
65-69	700	7.00
30-64	1000	8.00

Figure 5-21

Press:

- [F1] – to add an entry to the list. The cursor appears at the bottom of the list. Type in the required information in each column. Press [ENTER] to move the cursor to the next column.
- [F2] – to delete an entry from the list. The first entry in the list will be highlighted. Use the Arrow Keys to move the cursor up and down the list. Press [ENTER] to delete the highlighted entry.



## Edit User Tests

- [F3] – to edit an entry. The first entry in the list will be highlighted. Use the Arrow Keys to move the cursor up and down the list. Press [ENTER] to edit the highlighted entry. A red cursor will appear. Type in the new values and press [ENTER] to move the cursor to the next column.
- [F4] – Loads the default table (shown in Figure 5-21) into computer memory.

This menu item allows you to create a custom user test called a "Group Test." The Group Test can contain any sequence of options or tests in the "Test List."

For best test performance, always place the options "Specification Entry" and "Customer Information" in the number 1 and 2 positions, respectively in any group test.

Select "Edit User Tests" from the "Utilities" menu. The "Edit User Tests" screen appears (see Figure 5-22).

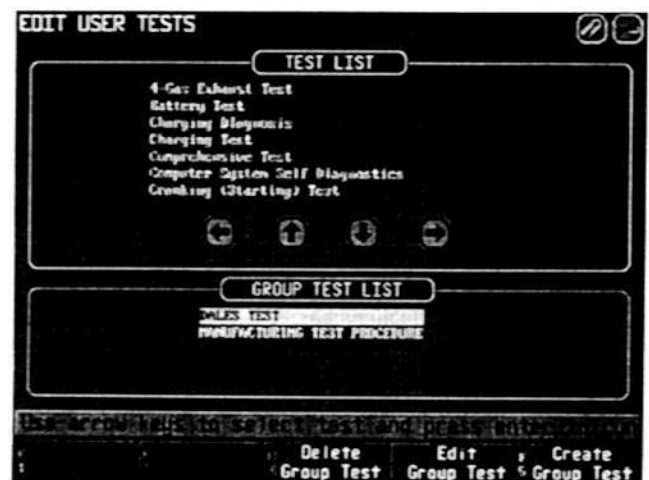


Figure 5-22

Press:

- [F3] – to delete a group test from the "User Test" menu;
- [F4] – to edit a group test from the "User Test" menu;
- [F5] – to create a new group test for the "User Test" menu.

### Deleting a Group Test

From the "Edit User Tests" screen, use the Arrow Keys to highlight the group test to be deleted. Press [F3] to delete the group test.

### Editing a Group Test

From the "Edit User Tests" screen, use the Arrow Keys to highlight the group test to be edited. Press [F4], the next "Edit Test" screen appears, (see Figure 5-23).

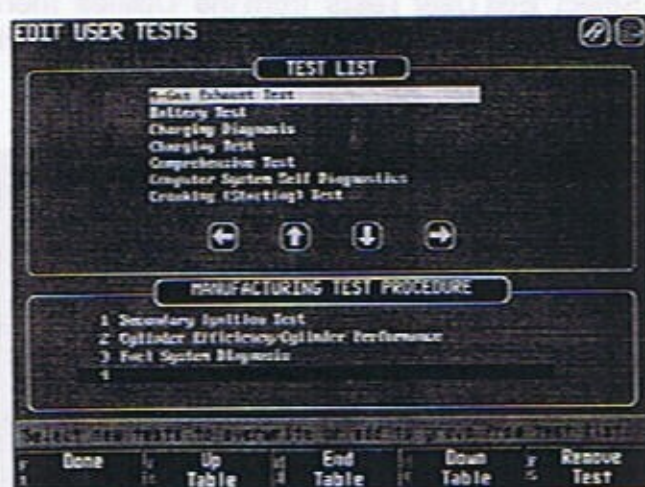


Figure 5-23

Press:

- [F1] – when finished editing the group test. The analyzer will prompt you to press [F1] again to save the changes or [F2] to return to the previous menu screen without saving any changes;
- [F2] – to move the group test cursor up the test list one line at a time;
- [F3] – to move the group test cursor to the end of the test list;
- [F4] – to move the group test cursor down the test list one line at a time;
- [F5] – remove an item from the group test list.

When finished, press [F10] to return to the "Utilities" menu.

### Adding an Item to a Group Test

1. To add an item to the group test, press [F3] to move the cursor to the last line in the group test list.
2. Use the Arrow Keys to move the cursor up and down the items in the test list. Press [ENTER] at an item that you want to add to the group test.
3. Press [F1] when finished. The screen in Figure 5-24 appears prompting you to save or not save the additions.

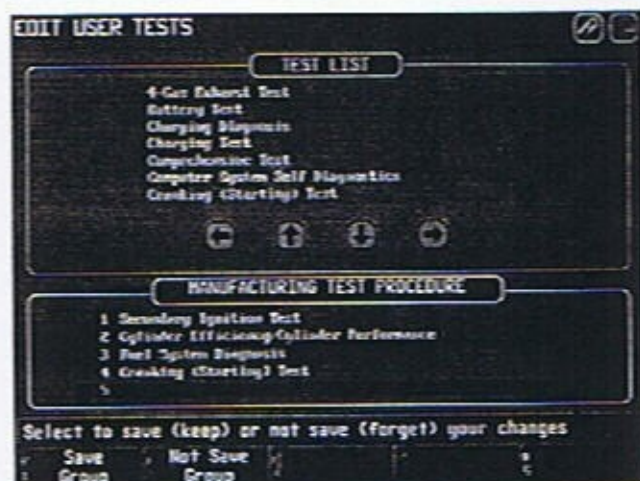


Figure 5-24

Press:

- [F1] – to save the group test;
- [F2] – to not save the changes made to the group test.



### Deleting an Item in a Group Test

1. Press [F2], [F3] or [F4] to move the cursor to the item line in the group test list that you want to delete.
2. Press [F5] to remove the test.
3. Press [F1] when finished. The screen in Figure 5-24 appears.

Press:

- [F1] – to save the group test;
- [F2] – to not save the changes made to the group test.

NOTE

The "Manufacturing Test Procedure" may be deleted, if desired.

### Creating a New Group Test

1. From the "Edit User Tests" screen, press [F5]. A dialog box appears (see Figure 5-25).

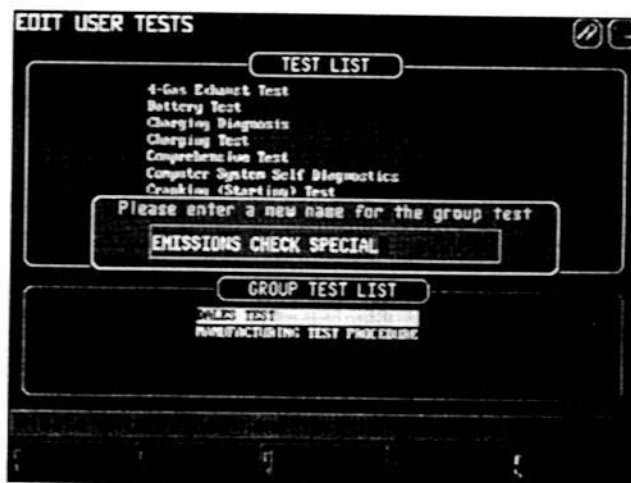


Figure 5-25

2. At the screen prompt type in the name of the new test and press [ENTER].
3. Use the Arrow Keys to move the test list cursor up and down the options in the test list. Press [ENTER] to add an item to the new group test.

NOTE

For best test performance, always place the options "Specification Entry" and "Customer Information" in the number 1 and 2 positions respectively, in any group test.

4. Add all test options for your custom test.
5. Press [F1] when finished. The screen in Figure 5-24 appears.

Press:

- [F1] – to save the group test;
- [F2] – to return to the previous menu screen without saving the group test.

6. Press [F10] to return to the previous screen.

## Save Test Data to Disk

Select this menu item to save the test results for the current customer to either a floppy disk drive or to the hard disk drive.

### Saving Test Data to Hard Disk Drive

The analyzer software allows up to 1 megabyte of test records to be saved on the C: drive.

1. Select "Save Test Data to Disk" from the Utilities Menu.
2. Make sure the file location is at "C:".
3. Press [F2] to continue.
4. A summary screen of the record is displayed on the screen (see Figure 5-26). Press any key to continue.



Figure 5-26

### Saving Test Data to a Floppy Disk

1. Insert a disk in Drive A: and select "Save Test Data to Disk" from the Utilities menu.
2. Press [F5] to change disk location if necessary, (see Figure 5-27).

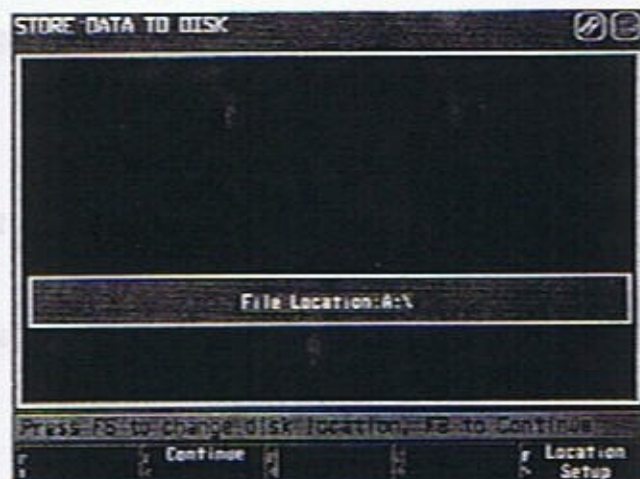


Figure 5-27

3. Follow the screen prompts and enter the correct drive and path for the records. Press [ENTER] to confirm the choices.
4. Press [F2] to copy the record to the diskette.
5. A summary screen of the record is displayed (see Figure 5-26). Press any key to continue.

**NOTE** For more information on disk drives and disk drive commands, consult an MS-DOS reference manual.



## Retrieve Test Data From Disk

Select this menu item from the Utilities Menu to retrieve a customer test record from the disk drive where it is stored.

The "Retrieve Data from Disk" screen will appear. The default drive to retrieve data records from is "A:" (the floppy drive).

1. If you wish to change to a different drive, press [F5]. The analyzer will prompt you to enter a path. Type in the path command and press [ENTER].
2. The disk is read by the system and a screen appears with saved files (see Figure 5-28). Move the cursor to the desired record and press [ENTER].

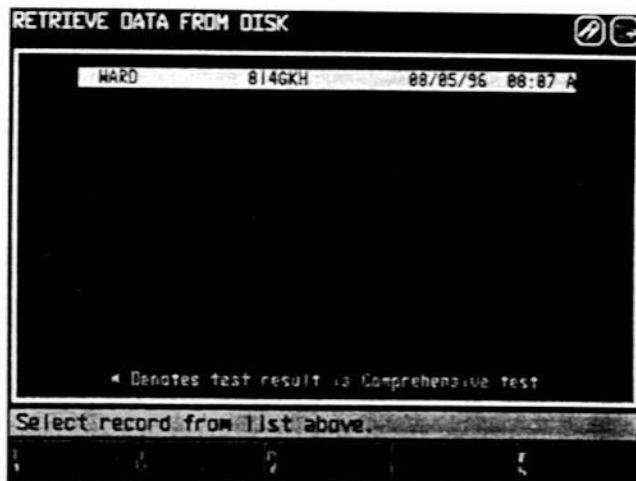


Figure 5-28

**NOTE**

If there are more than ten records on the disk, you will be asked to enter a customer name or vehicle license plate number (see Figure 5-29).

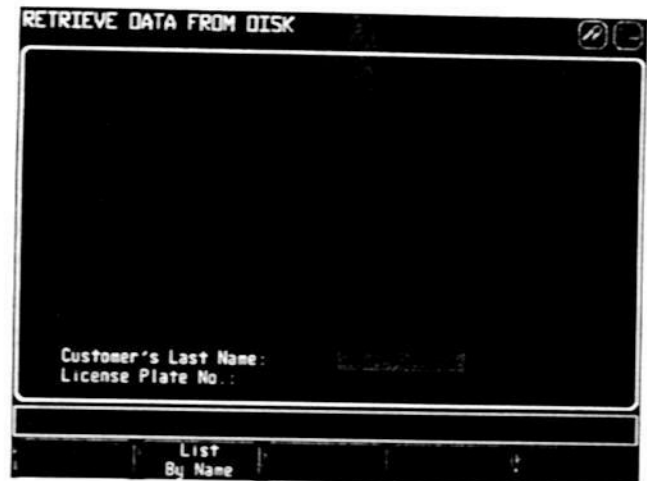


Figure 5-29

At this point, you may simply press [ENTER] and a list of customer names stored on the disk will be displayed (see Figure 5-30). The number to the right of each customer name denotes the number of test records stored on the disk under that name. Use the up- or down-arrow keys to highlight a customer name and press [ENTER].

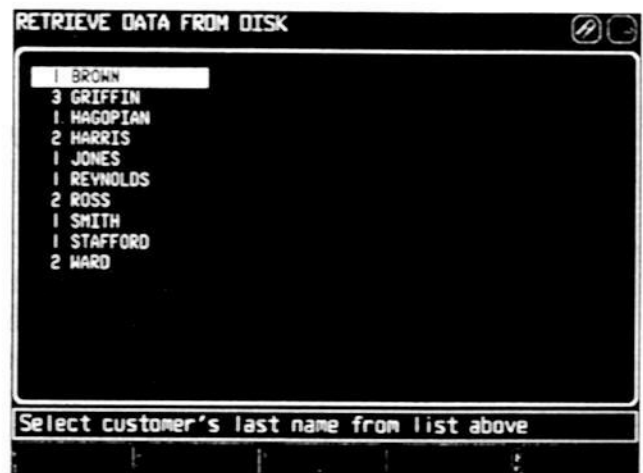


Figure 5-30

Alternatively, at the screen displayed in Figure 5-29, enter the customer's last name, or use the down-arrow key to highlight the license plate prompt and enter the vehicle's license plate number. Press [F2] to view a list of only those vehicle records associated with the customer name or vehicle license plate you selected (see Figure 5-31). Use the up- or down-arrow keys to highlight the test record you wish to retrieve and press [ENTER].

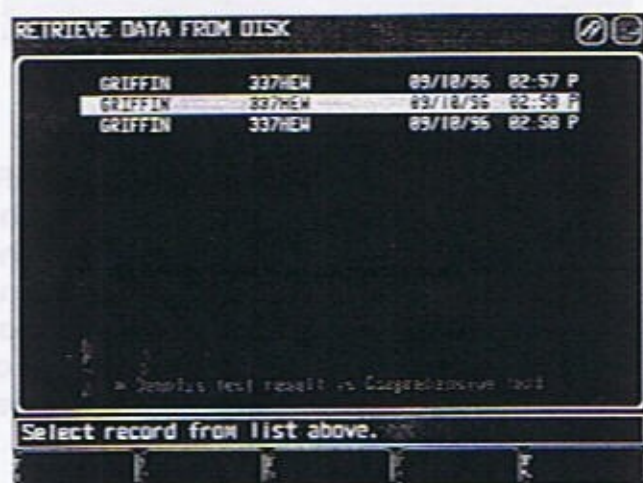


Figure 5-31

3. A summary screen of the record is displayed on the screen (see Figure 5-32).

Press:

- [F3] – to retrieve the record from the disk;
- [F4] – to delete the record from the disk;
- [F10] – to quit the screen without retrieving the file.

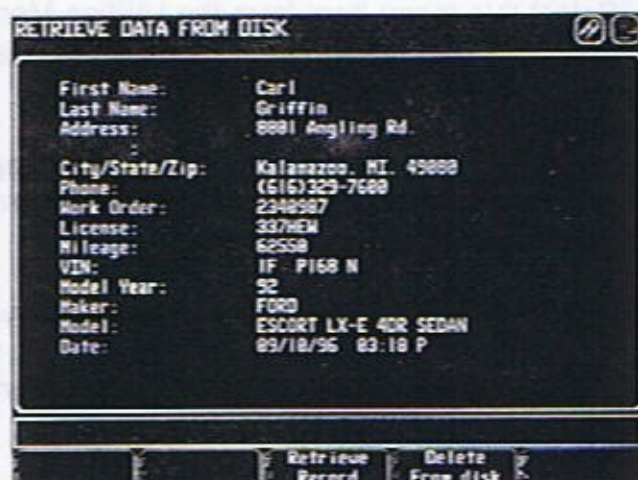


Figure 5-32

### Specification Message

A specification message (see Figure 5-33) appears when the retrieved customer was last tested using a previous version of the 400 Series system software. The analyzer requests that the customer information and vehicle specifications be re-entered into memory.



Figure 5-33

Press any key to clear the message. Re-enter specifications as required.



# Software Security

Select this menu item from the Utilities Menu to view the security status of the programs installed on the analyzer (see Figure 5-34).

PRODUCT SECURITY	
PRODUCT NAME	CURRENT STATUS
Vehicle Identification U 3.00	Permanent Authorization Present
<div> <div>HELP</div> <div>QUIT</div> <div>DISPLAY SECURITY</div> <div>PRINT</div> </div>	

Figure 5-34

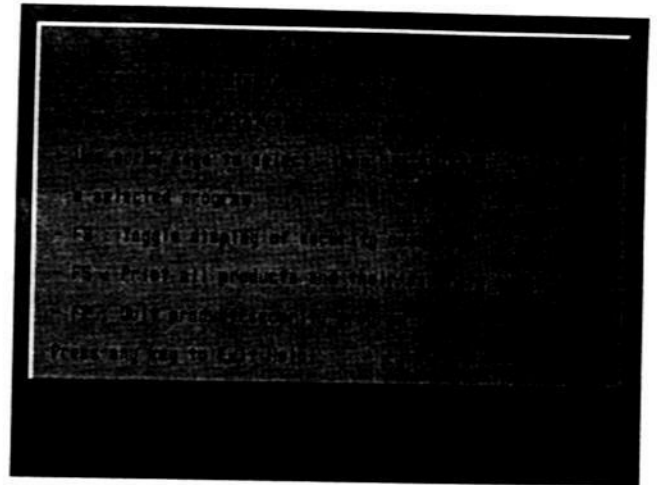


Figure 5-35

If you have only temporary authorization for a program module, a statement such as "56 More Authorized Runs Left" will be listed in the CURRENT STATUS column for that module.

Press:

- [F1] – for a help screen (see Figure 5-35);
- [F2] – to return to the menu system;
- [F3] – to display a security authorization request code;
- [F5] – to print a security authorization request form.

Notes: