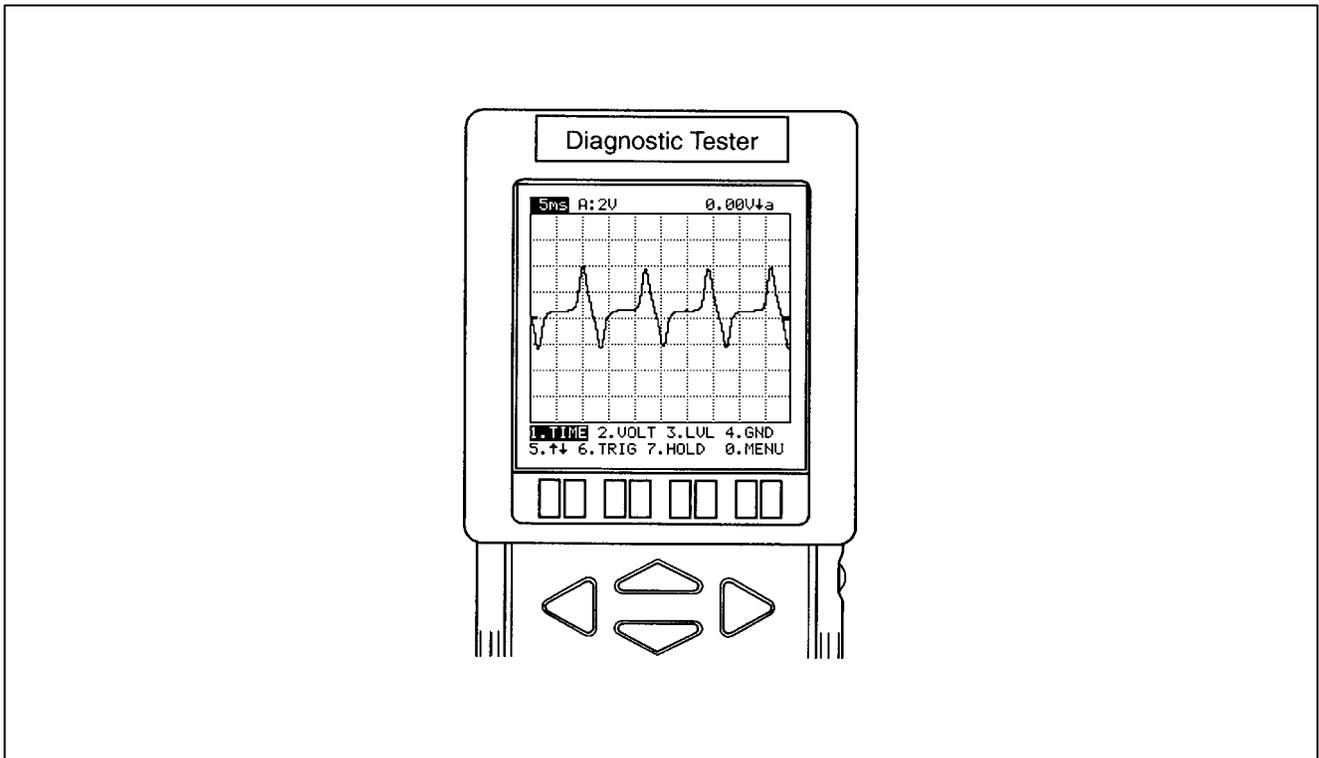


Section 6

Diagnostic Tester



- Lesson Objectives**
1. Describe the various functions the diagnostic tester is capable of performing.
 2. Use the diagnostic tester to:
 - a. select and display specific automatic transmission serial data.
 - b. display line graph of voltage signals.
 - c. monitor voltage signals using the oscilloscope.
 3. Use the diagnostic tester and printer to print out a strip chart monitoring five voltage signals.
 4. Use the diagnostic tester and breakout box to display voltage signals.



Notes

A large grid area for taking notes, consisting of a 30x30 grid of small squares.

Diagnostic Tester Usage

The Diagnostic Tester is a very useful tool when diagnosing electronic control transmission problems. It can be used for more than pulling codes. It can be used to:

- Display and monitor sensor and actuator data and switch inputs.
- Display data graphically.
- Laboratory oscilloscope analysis.
- Active actuator function tests.
- Record and recall data using the snapshot feature.
- Print data lists, graphs, scope displays and test results.

Use and Limitations

The diagnostic tester provides access to large quantities of information from a conveniently located diagnostic connector rather than performing tedious pin checks with a DVOM.

- A diagnostic tester allows a “quick check” of sensors, actuators, and ECM calculated data. For example, when checking for sensor signals which may be shifted out of normal range, scan data allows you to quickly compare selected data to repair manual specifications or known good vehicle data.
- When checking for intermittent fault conditions, it provides an easy way to monitor input signals while wiring or components are manipulated, heated or cooled.

Some important limitations to consider when attempting to diagnose certain types of problems using serial data.

- Serial data is processed information rather than a live signal. It represents what the ECM “thinks” it is seeing rather than the actual signal which would be measured at the ECM terminal. Serial data can also reflect a signal value the ECM has defaulted to, rather than the actual signal.

Serial Data

Serial data is electronically coded information which is transmitted by one computer and received and displayed by another computer. The transmitting computer digitizes the data sensors, actuators and other calculated information and is received and displays it as an analog voltage, temperature, speed, time or other familiar unit of measurement.

There are three different types of serial data which can be received and displayed by the Diagnostic Tester, depending on the application. These are OBD, OBD II, and V-BoB. In all three cases, data is digitized by the transmitting computer and displayed by the Diagnostic Tester.

Serial Data

Scan tool allows a "quick check" of sensors actuators, and ECM calculated data.

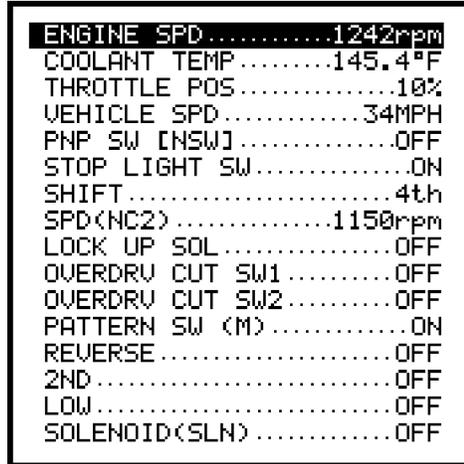


Fig. 6-01
T273i243

Line Graph Mode

The line graph mode displays the voltage signal of two data parameters simultaneously over time. It can be selected from any data list display with the active key (F4). The time line can be changed to scales of 5, 10, 15, 30, 60, 100, 200, and 300 seconds by pressing the left and right arrow keys.

The data parameters are displayed at the top of the screen. They can be replaced by highlighting the one you want to change using the up and down arrow keys. By pressing the YES key the next parameter on the data list is selected and pressing the NO key, the previous parameter is selected. The entire data list can be scanned one item at a time until the desired parameter is found. Each time the YES or NO key is pressed the new parameter is displayed on the screen. Press the ENTER key to freeze the display and # and SEND to print what's on the screen.

Line Graph Mode

The Data parameters are displayed at the top of the screen.

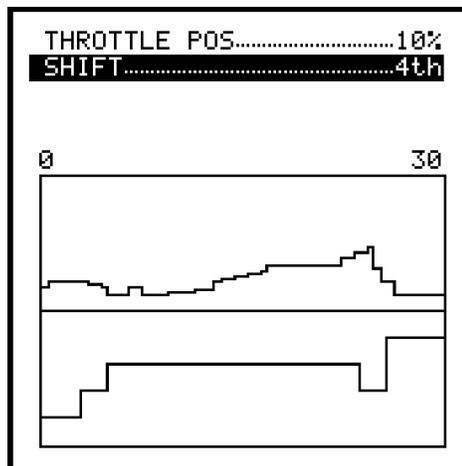
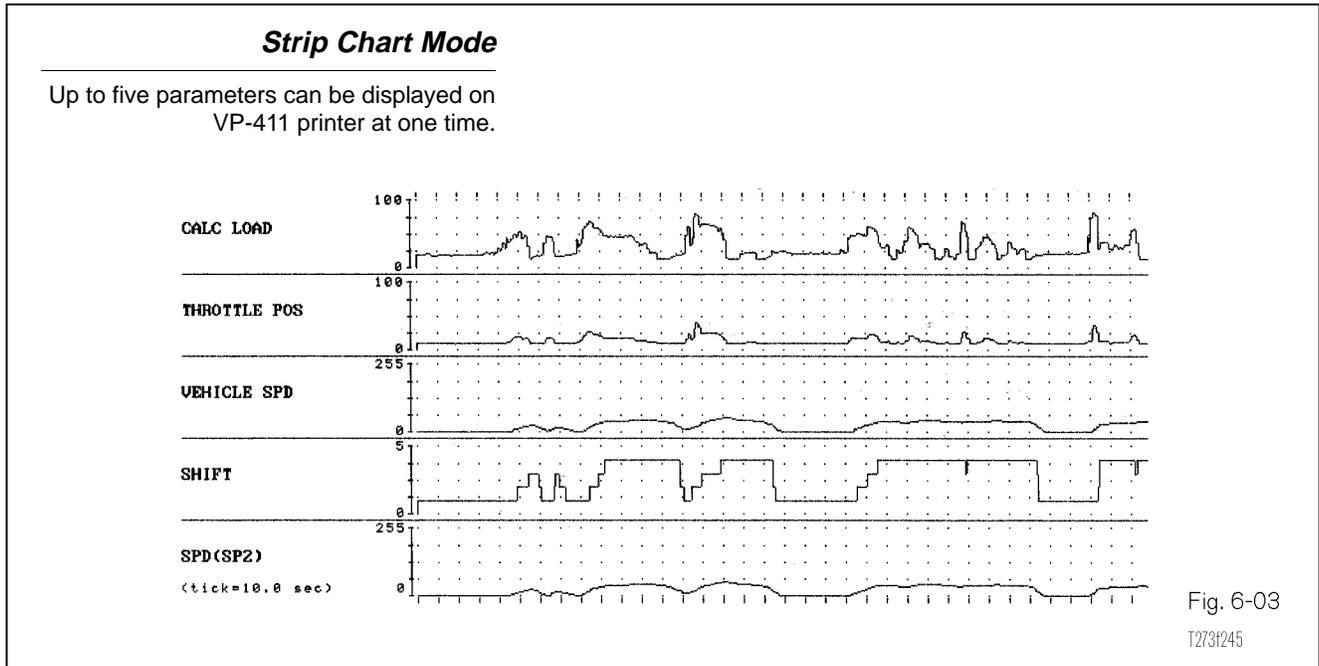


Fig. 6-02
T273i244

Strip Chart Mode The strip chart mode can be selected from any Data List display by pressing the F6 key. It will only work if the VP-411 printer is connected to the diagnostic tester. Up to five parameters can be displayed on the printer at one time allowing you to map five events simultaneously for future reference. The diagnostic tester screen displays the sensor data parameters and not the actual strip chart. These parameters can be changed by highlighting the parameter you wish to replace and pressing the YES or NO keys to move to the next parameter or the previous one similar to the Line Graph mode. To move through the selection process quicker, use the Star key and YES or NO to select the next parameter not currently displayed.

To start strip chart, press the # and F8 at the same time. Press # and F9 to stop strip chart.



Snapshot Features The snapshot feature allows you to record data before and after a fault occurs. This provides for careful examination of all data parameters in the seconds just before and after the vehicle exhibits a driveability condition, or sets a diagnostic trouble code.

The snapshot feature allows you to record up to four events which can be stored for replay at a later time. Triggering the snapshot function can be done manually, or set automatically when a code is set. The trigger point can be adjusted allowing you to examine the data before, after, or on either side of the trigger point.

To change the trigger point, select TRIGGER POINT from the Current Data Menu. Use the left and right arrows to move the trigger point between Start and End. Pressing the ENTER key, triggers the snapshot. The time you have selected for the snapshot will count down on the display screen.

Automatic Trigger To set the snapshot to trigger automatically, select Codes Snapshot from the Current Data menu. Select the data list similar to the manual trigger (All Data, User List or Custom Data) for the snapshot capture. The Codes Snapshot function captures a snapshot of data after a trouble code is received. When the trigger occurs, "Trigger" is displayed on the screen while data is being saved.

Replay Snapshot After completing the data capture, the snapshot can be saved for later review. The screen prompts you to either save the snapshot or quit. Pressing YES will save the data set and pressing NO will continue without saving. Selecting NO will allow you to review the last snapshot by putting the screen in Data Display phase.

Snapshot Save

Pressing YES will save the data set and pressing NO will continue without saving.

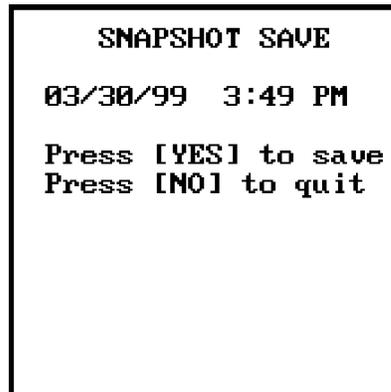


Fig. 6-06

T2731250

To view stored data, select Replay Snapshot from the Current Data Menu. Each snapshot is time and date stamped . Using the up/down arrows, highlight the snapshot you wish to display. Pressing ENTER will display the snapshot data.

Data captured in the Snapshot mode can be displayed in the following modes:

- Data List mode (F1 key)
- LED List mode (F2 key)
- Bar Graph mode (F3 key)
- Line Graph mode (F4 key)

Using the left and right arrow, the snapshot time can be scanned to observe component value changes. The left and right arrow keys will sequence through the data samples displayed. Press SEND to print the data list. To delete the snapshot, press * and ENTER simultaneously.

Snapshot Display Options

The snapshot can be in either Data List, LED List, Bar Graph, or line graph mode.

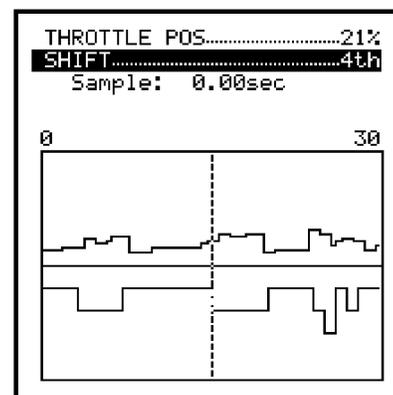
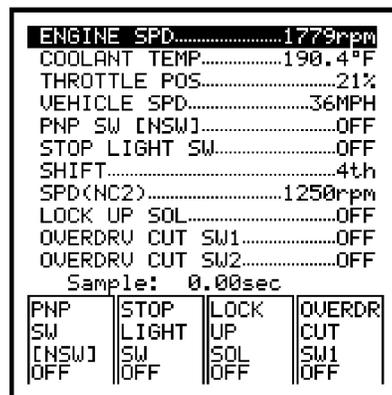
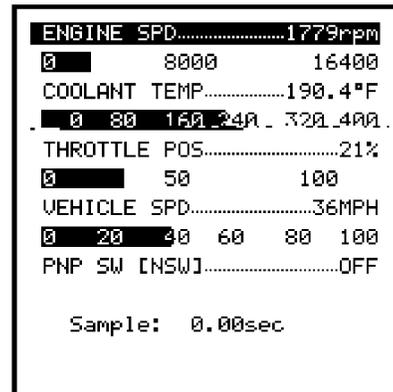
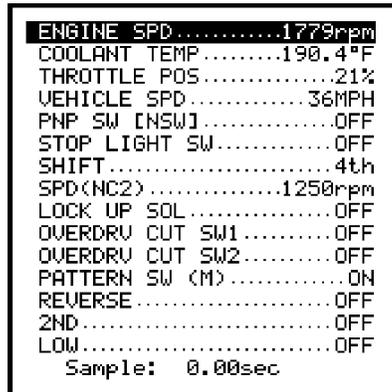


Fig. 6-07
T273f246/T273f252
T273f253/T273f254

Oscilloscope The oscilloscope feature of the diagnostic tester gives you the ability to accurately display electronic signals which are difficult or impossible to read using a digital multimeter.

An oscilloscope is an electronic measurement instrument which is capable of plotting rapid changes in electrical signals on a graphic display. The vertical scale of the scope display represents signal voltage. The horizontal scale represents time. The scope can be adjusted so that each division on the grid represents specific increments of voltage and time. The diagnostic tester oscilloscope can display voltages ranging from less than 100 mv to 20 volts and times ranging from less than 1 ms to more than 3 minutes.

Oscilloscope Display

An Oscilloscope allows you to plot changing electrical signals on a graphic display. Voltage is displayed on the vertical scale time on the horizontal scale.

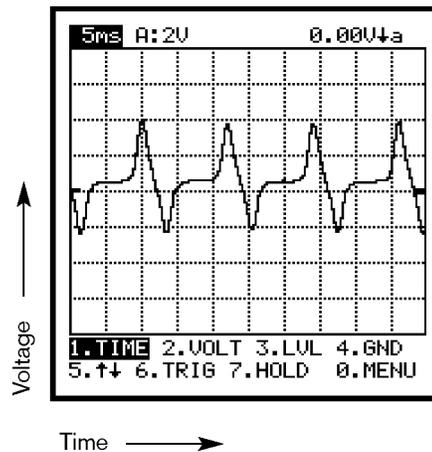


Fig. 6-08

T273f255

The rate at which the scope trace moves horizontally across the display is referred to as the sweep rate and is determined by the trigger. The trigger is usually the input signal so that the scope trace can be synchronized to the signal event. The input signal can come from either the autoprobe or directly from the V-BoB. This is similar to a timing light. The trigger is the inductive pickup hooked around the #1 plug wire. This synchronizes the light to the signal. The diagnostic tester also has an automatic trigger feature which drives the sweep independently of the input signal. Automatic trigger is used for displaying analog signals which cannot trigger the sweep.

Autoprobe The Autoprobe is used to manually probe specific terminals to monitor the circuit. The Autoprobe is connected to the Instrument Port (I/P) connector at the bottom of the diagnostic tester. It provides the following test capabilities: voltage, frequency and oscilloscope functions.

For more accurate readings, it is recommended that the autoprobe be calibrated before measuring voltage or using the oscilloscope. Select Calibrate from the Autoprobe Menu and ground the autoprobe at the battery negative terminal or body ground. Press and hold the switch on the Autoprobe. The tester screen confirms that the calibration is complete.

Refer to the Tester Operator's Manual to check the internal circuits of the autoprobe.

Autoprobe

The autoprobe is connected to the I/P connector at the bottom of the diagnostic tester and monitors individual terminals.

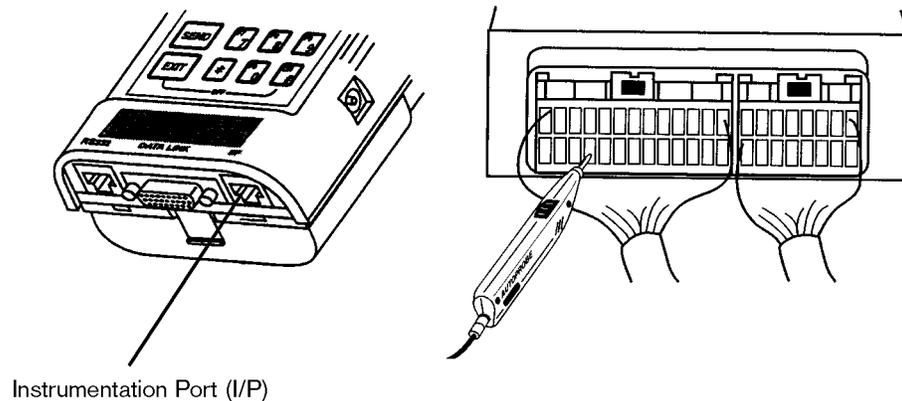


Fig. 6-09

T2731256/T2731257

Oscilloscope Features The oscilloscope's Display Control Menu at the bottom of the display window has many features used to change the oscilloscope settings and trigger control:

- manual adjustment of voltage and time scales.
- adjustment of the voltage trigger level.
- selection of the leading or trailing edge of the signal.
- selection of the GND level.
- vary the cursor display.
- vary the background grid.

The screen captures displayed on the following pages represent the transmission speed sensor at approximate 30 miles per hour.

Input Signal and Trigger

The scope trace is typically triggered by the input signal to synchronize the sweep with the signal. This prevents the signal from walking across the display.

The signal can also be triggered independent of the input signal by selecting the automatic trigger feature.

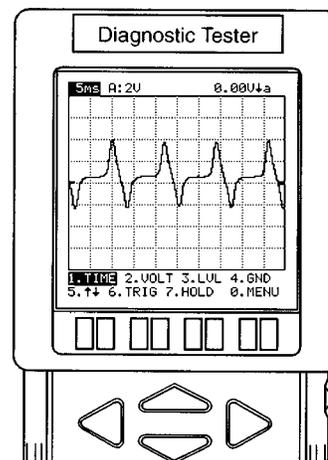
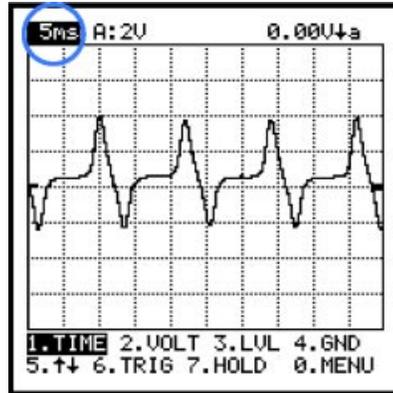


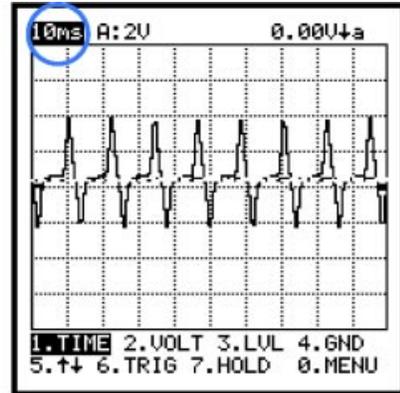
Fig. 6-10
T2731258

Time Scale

Selecting 1.TIME allows adjustment of time per division by pressing the up and down keys. Each division can be adjusted to represent from .2ms to 20 seconds.



5 Milliseconds



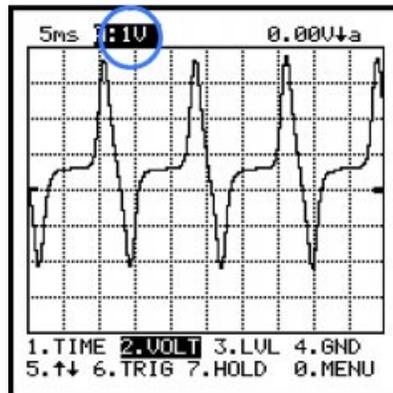
10 Milliseconds

Fig. 6-11

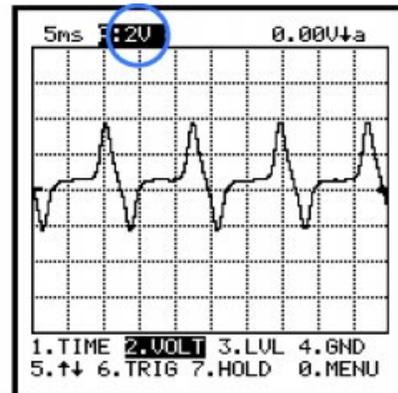
T2731255/T2731260

Voltage Scale

Selecting 2.VOLT, allows adjustment of volts per division by pressing the up and down arrow keys. Each division can be adjusted to represent from 0.1 to 5 volts.



1 Volt



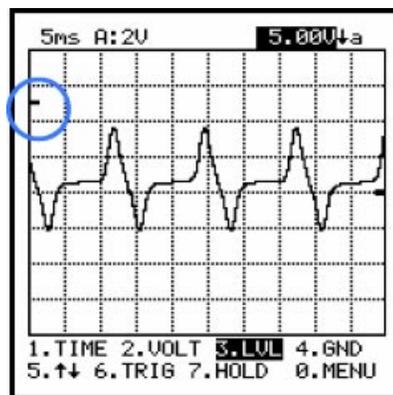
2 Volts

Fig. 6-12

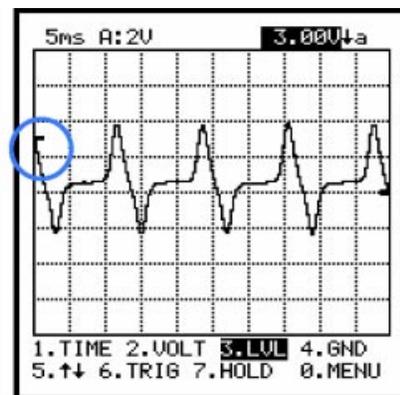
T2731261/T2731262

Trigger Level Adjustment

Selecting 3.LVL allows adjustment of trigger level by pressing the up and down keys. This is the voltage above or below which the signal must go to trigger the sweep. Trigger level is set in 1/2 division increments.



Trigger voltage set higher than peak voltage. Waveform walks across the screen



Trigger voltage set lower than peak voltage. Waveform is steady.

Fig. 6-13

T2731263/T2731264

GND Level Adjustment

Selecting 4.GND allows adjustment of the GRD level by pressing the up and down keys. The trigger level indicator moves along with the GND level.

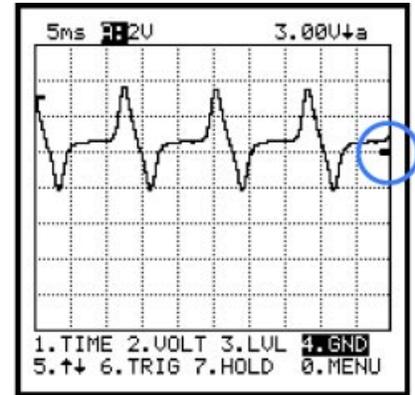
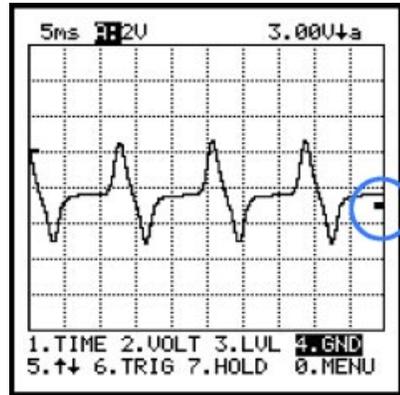


Fig. 6-14

T2731265/T2731268

Shifting the Pattern Display

Selecting 5.↑↓ allows you to select the leading or trailing edge of the signal as the trigger point. The trigger slope is indicated on the top right of the screen. An up arrow indicates a trigger on the rising edge (upslope). A down arrow indicates a trigger on the falling edge (downslope).

Toggling the "5" key would start the slope at either the signal's maximum voltage (downslope) or minimum voltage level (upslope).

This feature has more significance when monitoring DC signals.

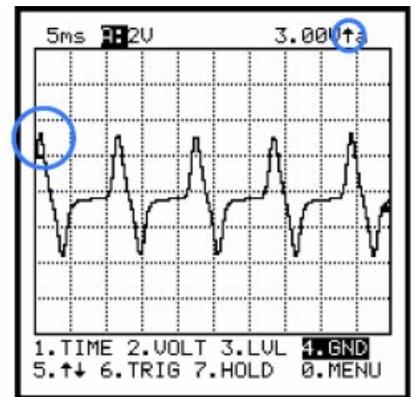
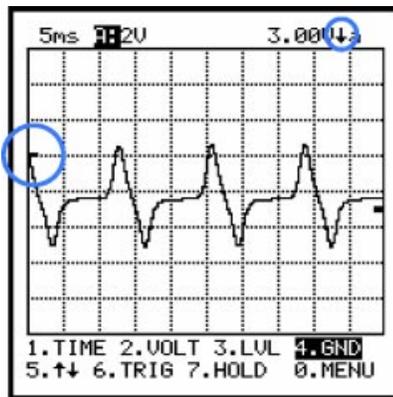


Fig. 6-15

T2731265/T2731268

Trigger Option Selecting 6.TRIG allows you to select three different types of trigger options by toggling the “6” key. The trigger mode selected (n, a, or s) is displayed in the upper right corner of the display.

- The normal trigger (n) uses the input signal to trigger and synchronize the display. If there is no signal past the trigger, there will be no trace on the screen.
- The automatic trigger (a) uses an internal trigger built into the Diagnostic Tester to drive the scope sweep. If a trigger does not occur for 250 ms, a trigger is forced to occur. This makes it a greater place to start and then further adjustments can be made.
- The single shot trigger (s) uses the input signal to trigger the sweep, however, the pattern display freezes after a single trigger signal is sensed. Pressing the ENTER key or the button on the autoprobe resets the trigger. The trigger is only activated when the signal crosses the trigger level, or the ENTER key is pressed. While waiting for the trigger the single shot indicator shows an upper case “S.”

Trigger Options

Selecting 6.TRIG allows you to select from three different types of trigger options:

normal trigger (n),
automatic trigger (a), and
single shot trigger (s).

Trigger level is set in 1/2
division increments

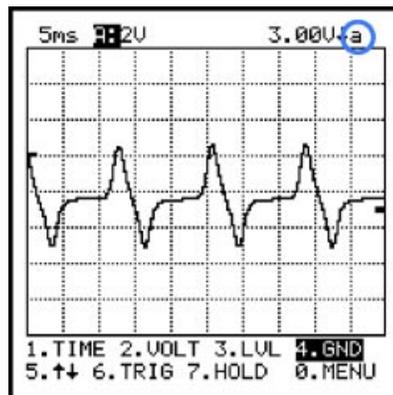


Fig. 6-16

T273R265

Hold Option Pressing 7.HOLD causes the current display to freeze so that the waveform can be analyzed. When the hold mode is active, the red LED on the right side of the tester is turned ON.

Waveform Freeze

Selecting 7.HOLD allows you to freeze the current display so the waveform can be analyzed.

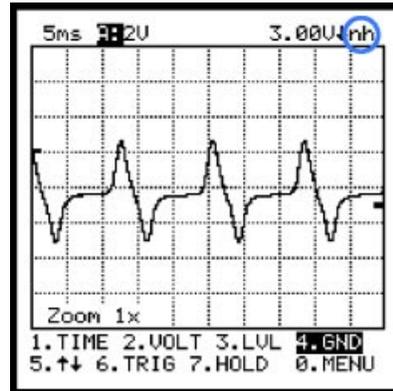


Fig. 6-17

T2731270

Pop-Up Menu When 0.MENU is selected, a menu will “pop-up” on the screen. This menu allows selection of additional display controls. The additional functions available are: Auto Setup, Cursor, Grid Display, Zoom and Waveform.

Selecting 1.AUTO from the pop-up menu, the Tester automatically sets the Time Scale, Volt Scale, and Trigger Level based on the signal measured. Further manual adjustments may be made to configure displayed waveforms in the most useful format.

The waveform can be saved, recalled or deleted by selecting 5.WAVEFORM from the “pop-up” menu.

Pop-Up Menu

Pressing 0.MENU provides for a selection of additional display controls. Additionally, this menu allows for saving and recalling stored wave forms.

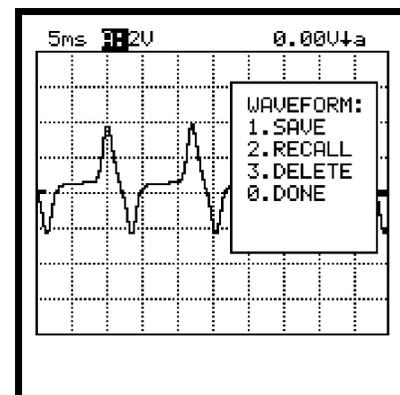
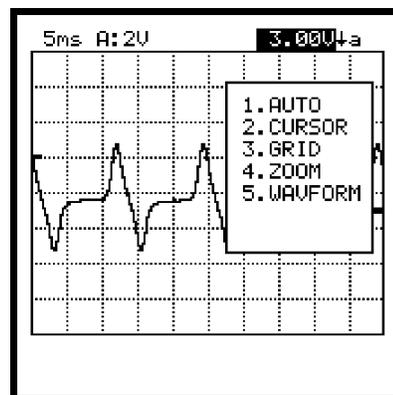


Fig. 6-18

T2731271/T2731272

Vehicle Break-Out Box

The Vehicle Break-out Box allows you to observe serial data using the Diagnostic Tester, even though the vehicle does not have a serial data line. Depending on the diagnostic need, the V-BoB may be used instead of serial data accessed through the DLC because of the wide variety of data signals available and the high speed data transmission.

By connecting V-BoB in series with the ECT or ECM, you can perform any of the tester functions that can be performed on vehicles with a serial data stream except active test and clear codes. Data can be displayed in list form or graphically.

The Break-out Box Kit comes with a number of ECU interface boxes. Accessing the break-out Box function and identifying the vehicle, engine, transmission, and system, the tester screen identifies the ECU interface box. The interface box may have more connectors than are needed to attach the vehicle harness and interface box. In this event, each connector is labeled with a letter, which corresponds with those identified on the tester screen.

Break-out Box Components

The V-BoB is connected in series with the ECM and the vehicle harness to provide serial data.

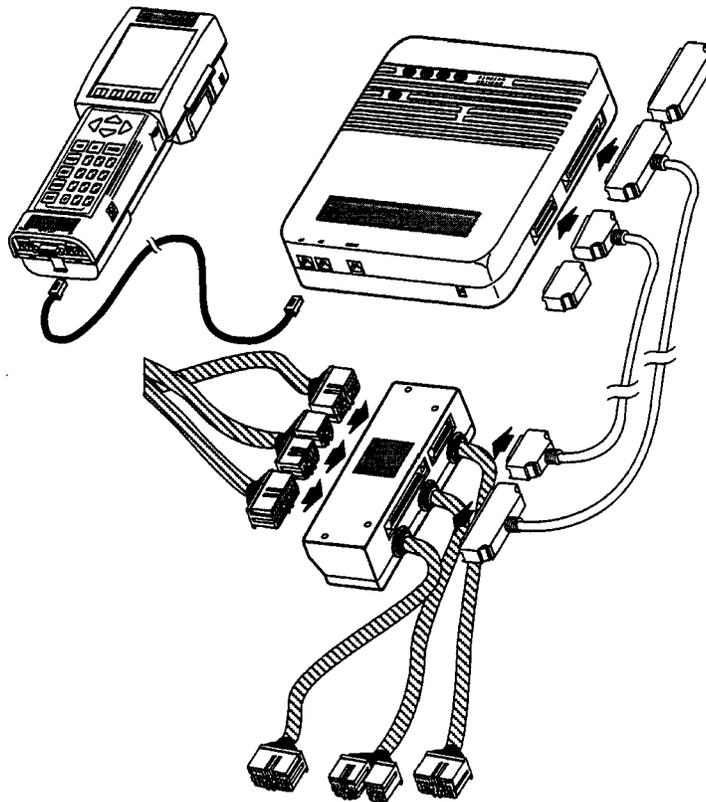


Fig. 6-19
T27342273

The Diagnostic Tester and Break-out Box are connected via an I/P cable and each is powered by the DC Power Cable from the cigarette lighter. The interface box and the Break-out Box are connected using the 50 and 80 pin data cables.

Interface Box Identification

The tester identifies the ECU interface box and connectors.

```

*Verify Connections*

Interface Box # 3
(GREEN)

Connectors A B C E

[YES] to continue

```

Fig. 6-20

T2731274

V-BoB Data Display With the break-out box connected, the diagnostic tester is ready to display data from the vehicle ECM. The diagnostic tester features are essentially the same receiving data from the vehicle Break-out Box, as when receiving data from DLC1, 2 and 3. Data lists can be displayed in the following ways:

- Data List Mode.
- Custom Data List Mode.
- LED/Switch Status List Mode.
- Bar Graph Mode.
- Line Graph Mode.

Data List Mode The Data List Mode displays the entire pre-selected data list stacked vertically on the screen. If there is more data than fits on the screen, it can be accessed by scrolling with the up and down arrow key commands.

Custom Data List Mode The Custom Data List allows you to select from all possible data words available (every live pin on the ECM) to create your own custom list. This feature is useful when specific data is not conveniently located on the pre-programmed data list. Scroll commands are the same as the Data List Mode. Use the YES or NO keys to select or deselect items from the list.

LED/Switch Status List Mode The LED/Switch Status List Mode displays the status of four user selectable switches with LEDs. These switches can be selected by moving the cursor with the up and down arrow keys to the desired location, then using the YES/NO keys to scroll through the various switch inputs.

Bar Graph Mode The Bar Graph List displays data and a bar graph for any six user selectable items. Data can be rearranged by moving the cursor to the desired location using the up and down arrow keys, then scroll through the data choices using the YES/NO keys.

Line Graph Mode The Line Graph List displays two user selectable data items as line graphs plotted against each other. Data can be rearranged by moving the cursor to the desired location using the up and down arrow keys, then scrolling through the data choices using the YES/NO keys.

Snapshot Display Options

The snapshot can be displayed in either Data List, LED List, Bar Graph or Line Graph mode.

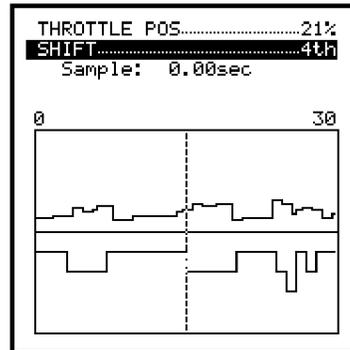
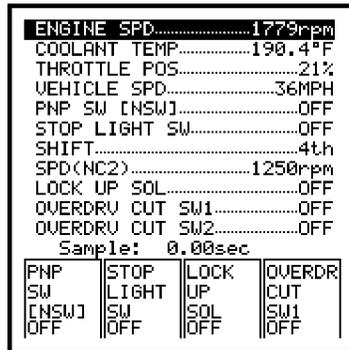
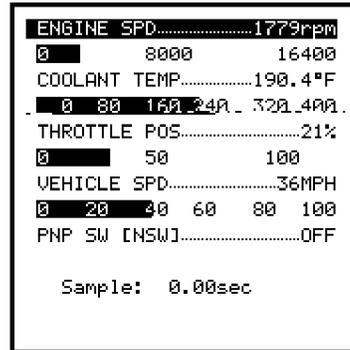
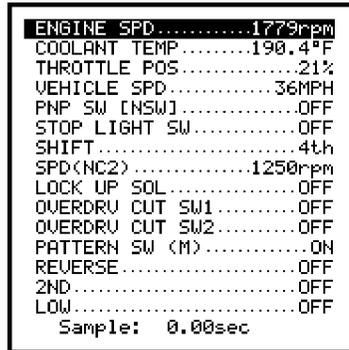


Fig. 6-21
T2731246/T2731252
T2731253/T2731254

Any wire connected to the ECM can be displayed on the Diagnostic tester oscilloscope when interfaced to the vehicle through Vehicle Break-out Box. To select a signal for oscilloscope display, select OSCILLOSCOPE from the Break-out Box Menu to gain access to the Signal Select Menu. The Signal Select Menu allows you to choose and display any ECM pin on the oscilloscope. V-BoB allows two signals to be displayed at a time.

To select the desired signal, scroll the cursor to the desired location using the up and down keys. To select the signal for display, press the YES key. The selected item will flash rapidly when selected. Once the desired signal has been selected, press the ENTER key to display the live signal on the oscilloscope grid. To deselect the signal, exit to the signal select menu and press the NO key.

Displaying V-BoB Parameters on the Oscilloscope

Any ECM terminal can easily be displayed on the diagnostic tester oscilloscope.

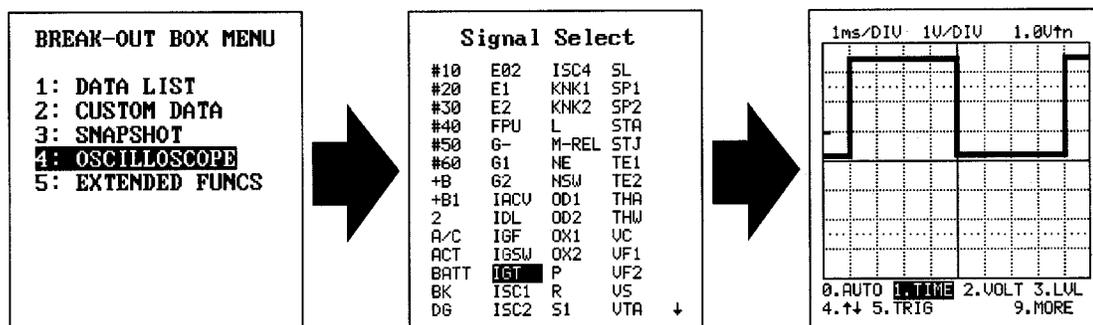


Fig. 6-22

T2731279



Notes

A large grid area for taking notes, consisting of a 30x30 grid of small squares.