

TOOLSET DESCRIPTION OPERATOR'S MANUAL

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NOTE

Some Toyota/Lexus Diagnostic Toolset components are distributed under different trade names for North American and non-North American markets. Trade names for the two markets are listed in the following table.

	Name on Tool Label	Description in Repair Manuals	Description in Operator's Manual
USA and Canada	Diagnostic Tester	Hand-held Tester	Tester
	Vehicle Break-out Box	Break-out Box	Break-out Box
Worldwide (except USA and Canada)	Intelligent Tester	Hand-held Tester	Tester
	Intelligent Signal Processor	Break-out Box	Break-out Box

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1.0 DIAGNOSTIC CAPABILITIES

DIAGNOSTIC TOOLSET OVERVIEW

The Diagnostic Toolset consists of a hand-held Tester and attachments, which allows the use of one tool for many diagnostic applications. The Toolset is designed so that future diagnostic applications can easily be incorporated into the existing Toolset.

The diagnostic capabilities of the Toolset components are described in this section. A description of the hardware related to each component is included in the following sections.

THE TESTER

The Tester is used by professional technicians as an aid in diagnosing and repairing automotive electrical and electronic systems. It is designed to test Electronic Control Modules (ECMs) and Electronic Control Units (ECUs) for brake, body, and chassis systems, and their associated sensors, actuators, and cable harnesses.

Capable of operating either as a stand-alone tool or as the control unit for the Diagnostic Toolset, the Tester employs plug-in program cards or cartridges, and can be adapted to operate with virtually all electronic systems—from the simplest to the most complex.

The Tester supports diagnosis of electronic systems on many makes of vehicles in addition to Toyota and Lexus.

The Autoprobe supplied with the Tester Kit provides additional troubleshooting capabilities. The Autoprobe is used as a smart digital voltmeter (DVM) to monitor input/output signals between the ECM/ECU and sensors and actuators, in addition to utilization as a probe for the oscilloscope function.

When the program card is installed and the Tester is connected to a vehicle's Data Link Connector (DLC) the following diagnostic functions are available:

- Display ECM/ECU Data List parameters
- Display stored trouble codes and descriptions
- Display sensor operation data
- Display actuator control data
- Display ON/OFF status of switch signals
- Test feed-back systems such as the O2 sensor
- Command clearing of some ECM/ECU trouble codes
- Troubleshoot using the Autoprobe
- Troubleshoot intermittent problems with Snapshot mode
- Print test results to provide a permanent record

The Tester hardware components are described in Section 2.0 *Tester Kit Components* on page 5.

OBD AND OBD-II DIAGNOSTIC CAPABILITIES

The On Board Diagnostics (OBD and OBD-II) components provide diagnostics for the following electronic controllers:

- Engine Control Module (ECM)*
- Automatic Transmission (AT)*
- Air Bag Controller (AB)
- Anti-Lock Brake System (ABS)
- Cruise Control System (CCS)
- Air Suspension System (AS)
- Automatic Air Conditioning (A/C)
- Traction Control System (TRAC)

* OBD-II Support

The OBD and OBD-II functions access the following diagnostic data and signals on the vehicle:

- Data list and other OBD/OBD-II functions*
- Diagnostic Trouble Codes*
- Oxygen sensor signals
- Engine RPM data (IG-)

* OBD-II Support

DVM and Oscilloscope Capabilities: The Tester can be used with the Autoprobe to measure vehicle voltage, and signal frequencies.

- Volt meter
- Frequency counter (frequency, duty cycle)
- Oscilloscope

OBD and OBD-II hardware components are described in Section 3.0 *OBD and OBD II Components on page 17.*

NVH ANALYZER DIAGNOSTIC CAPABILITIES.

The Noise, Vibration and Harshness (NVH) Analyzer assists in isolating the cause of noise and vibration problems. The frequency of the noise or vibration is electronically matched with vehicle RPM and speed in order to help diagnose the source of the vibration or noise.

The NVH Analyzer should be used in a stable vibration and noise environment.

When connected to the Tester, the NVH Analyzer and related accelerometer and microphone can:

- Display Barchart graphs of vibration levels for wheels, engine and drivetrain.
- Display recorded vibrations over time in a "Raster" format (3-D).
- Display and store spectral analysis of vibration or noise data from 5 Hz to 500 Hz.
- Detect vibrations from .001G to 1G.
- Display and store dynamic vehicle data (RPM, vehicle speed) integrated with the corresponding spectral vibration data.
- Separate and classify vibration energy by source (Engine, Driveline, Wheels) and display in the Spectral, Raster, and Barchart display modes.

The NVH Analyzer diagnoses data received from the following sources:

- Vibration data using the accelerometer or microphone sensor inputs.
- The vehicle serial data stream or ignition signal.
- Vehicle data base information.
- Operator input.

CAUTION!



Two technicians are required when testing with the NVH Analyzer. One technician must actually drive the car, and the second technician will operate the NVH Analyzer. For safety reasons, one technician cannot perform all functions.

NVH Analyzer hardware components are described in Section 4.0 *NVH Analyzer Kit Components* on page 19.

BREAK-OUT BOX DIAGNOSTIC CAPABILITIES

The Break-out Box provides the capability of monitoring data on any combination of signal lines that connect the vehicle's electrical/electronic components to the ECU. The installation of the Break-out Box harness has no effect on the operation of the controller or the vehicle.

When used in conjunction with the Tester and the program card, the Break-out Box supports diagnosis of the following electronically controlled vehicle systems:

- Engine
- Automatic Transmission (AT)
- Anti-lock Brake System (ABS)
- Cruise Control System (CCS)
- Theft Deterrent System (TDS)

The Break-out Box can be used to support inspection of:

- Sensors
- Actuators
- Wiring harness shorts or opens
- Open grounds
- ECM/ECU operation

The Break-out Box contains 124 input channels: 120 for ECU inputs and four for external inputs (analog signals only). The Break-out Box can monitor signals between $\pm 40V$, with the following types of measurements:

- Analog
- Timing
 - Frequency
 - Pulse Interval
 - Pulse Width
 - Duty Cycle
- Signal Analysis
 - Oscilloscope

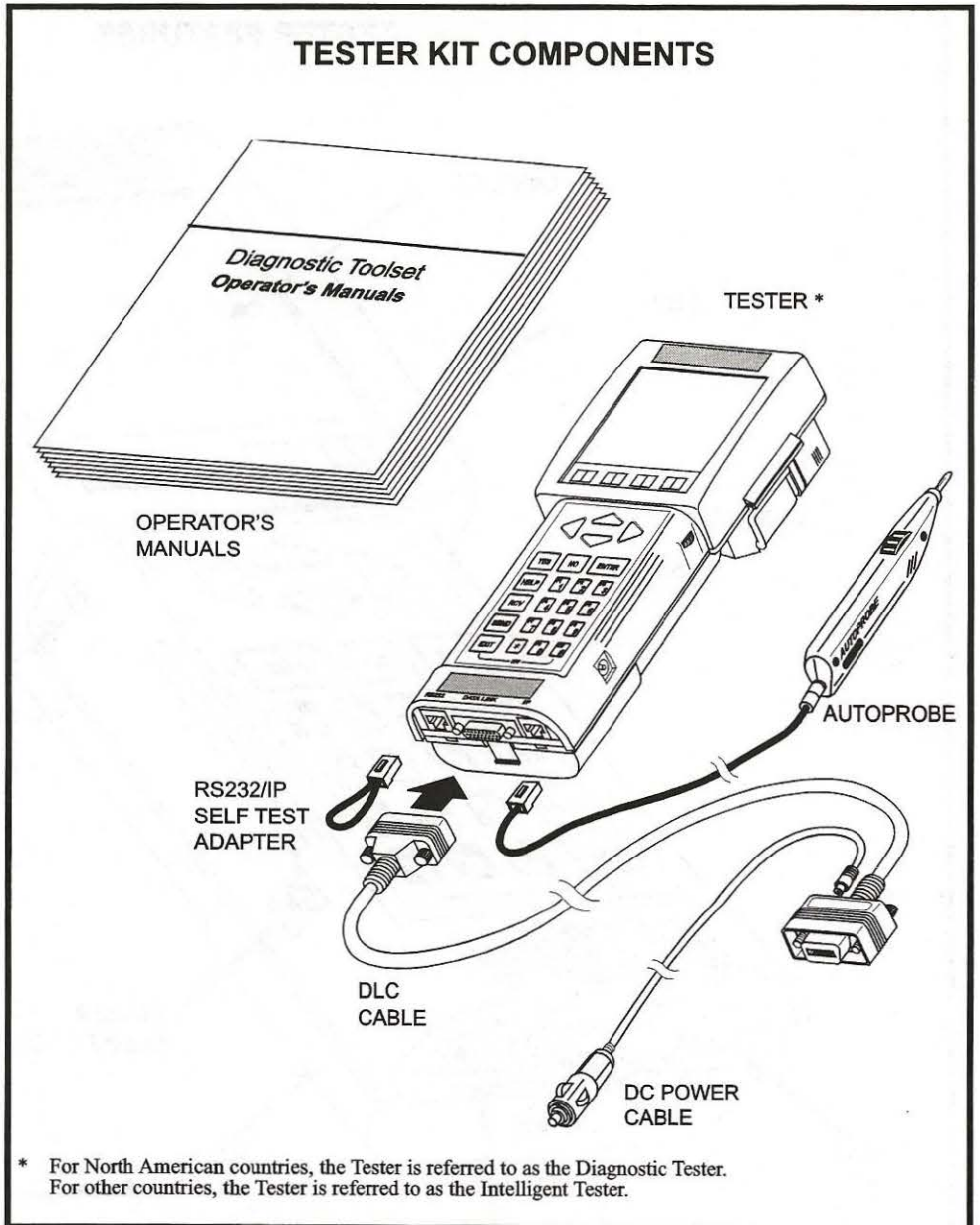
External Output Channels on the Break-out Box allow monitoring of up to four signals via an external source such as a volt meter or oscilloscope.

If a problem is detected in the operation of the Break-out Box or program card, you can perform a self test on the Break-out Box to help isolate the problem.

Break-out Box hardware components are described in Section 5.0 *Break-Out Box Kit Components* on page 21.

2.0 TESTER KIT COMPONENTS

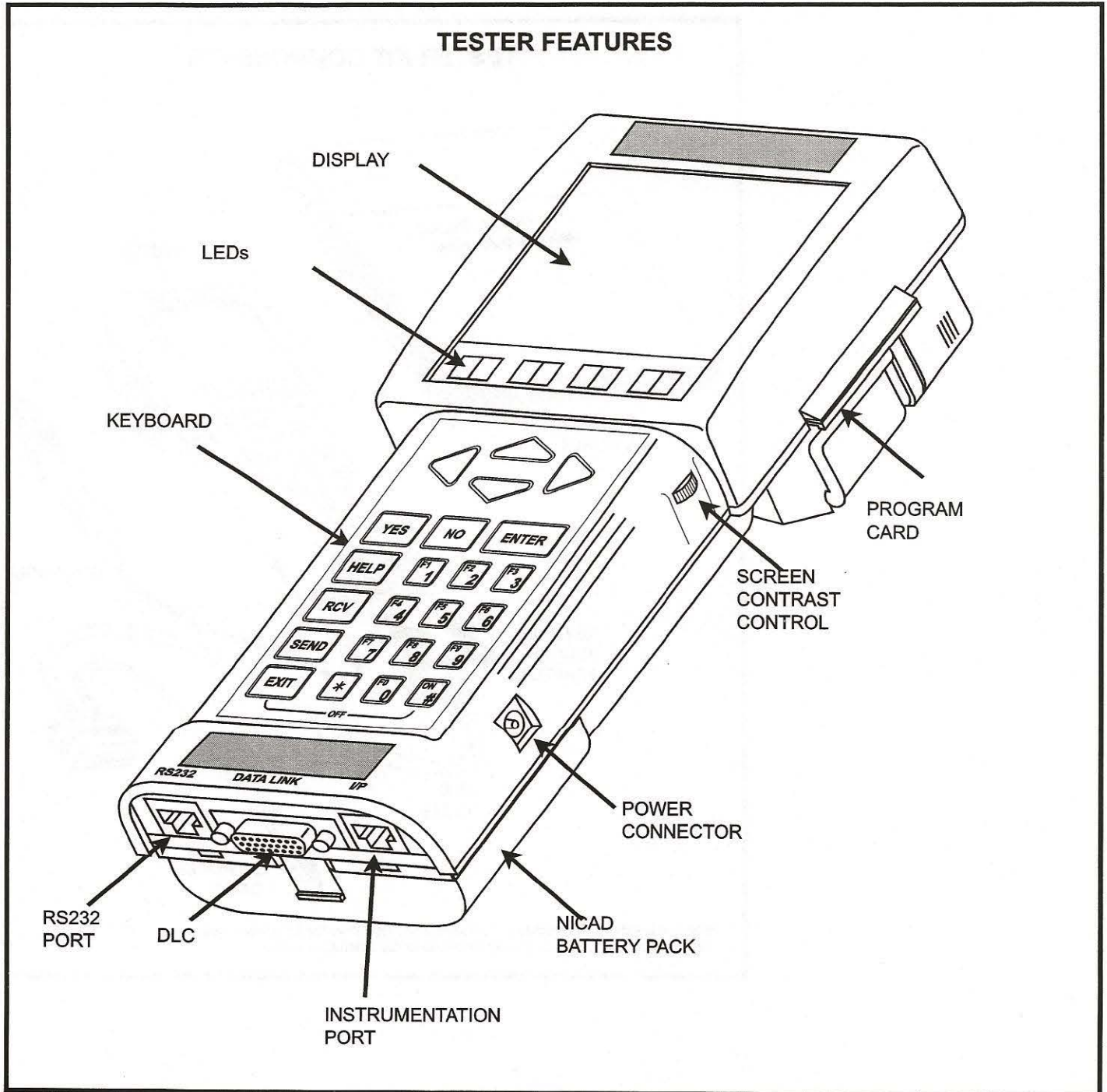
The Tester kit components consist of the hand-held Tester, Autoprobe, Data Link Connector (DLC) Cable, DC Power Cable, RS232/IP Self Test adapter, OBD and OBD-II adapter cables and the Diagnostic Toolset Operator's Manuals. The Tester and related components are described in detail in this section. Cables and adapters related to the OBD functions are illustrated and described in Section 3.0 *OBD and OBD II Components on page 17*



TESTER FEATURES

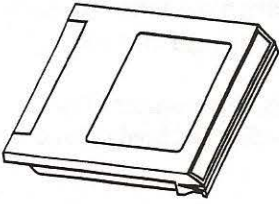
The Tester can be hand-held or placed on a flat surface. An adjustable hand strap on the back provides added security while holding the Tester.

A built-in support stand allows the Tester to be tilted to the most convenient viewing angle when it is not handheld.

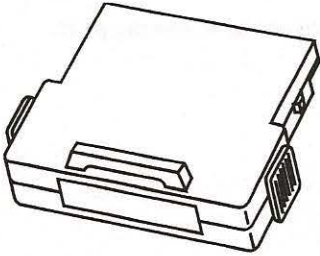


PROGRAM CARDS AND CARTRIDGES

PROGRAM CARD



I/O CARTRIDGE



The Tester uses plug-in program card and cartridge modules which contain the software programs for testing specific vehicles and systems. The modules are upgraded periodically to include new vehicles, model years, and systems. Specific operating instructions are provided for diagnostic test functions contained in the program card(s) or cartridge(s).

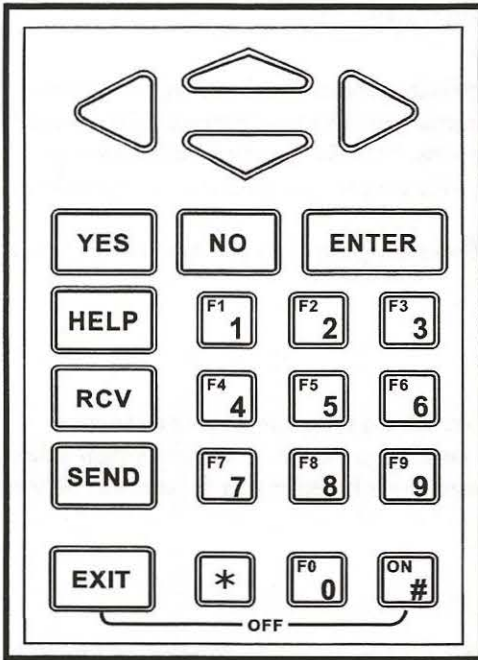
Two kinds of modules can be used with the Tester: program cards and Input/Output (I/O) Cartridges.

PROGRAM CARDS

Multiple Program Cards may be required to provide the complete diagnostic testing capabilities of the toolset. Program Cards are installed in the slot on the upper right side of the Tester (below the display). The program card slot is keyed so that the card can only be installed in the proper orientation.

I/O CARTRIDGES

I/O Cartridges such as the OBD-II Cartridge are used to expand the I/O (Input/Output) capability of the Tester. I/O cartridges plug into the slot at the top rear of the Tester. The OBD-II I/O Cartridge may be kept in the Tester when performing other functions.



TESTER KEYBOARD

KEYBOARD

The 23-key keyboard allows you to make menu selections or input information. Through the keyboard you can tell the Tester which data you want to see and in which format you want it displayed. While performing some tests you can even control the operation of certain component functions through the keyboard.

The ***** and **#** keys are used to modify other keys. For example, if the instructions say press **#****EXIT**, press the **#** key first and hold it down while pressing the **EXIT** key.

Some keys, such as the numeric (**0** - **9**) and **YES** and **NO** keys, have different functions depending on which test mode is in use. The **HELP** key displays a list of the active keys and their functions in the current test mode.


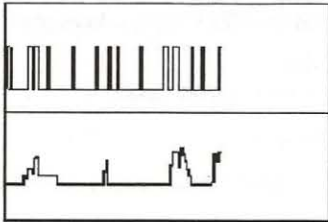
A chart of the keys and their functions is illustrated on the following page.

TESTER KEY FUNCTIONS

KEY	FUNCTION
* and #	Similar to the shift key on a typewriter, the * and # keys are used in conjunction with other keys as a modifier. Press the * or # key and hold it down while you press the second key. For example *HELP or #EXIT .
ON	Turn the Tester on.
#EXIT	Turn the Tester off.
△ ▽	Move the cursor (highlight) on the display up or down.
◀ ▶	Move the cursor (highlight) on the display left or right.
YES and NO	Answer questions asked on the Tester display. Display and select data parameters to monitor.
ENTER	Confirm information on the Tester display. Terminate a numeric entry. Move ahead in procedures. Select a highlighted menu entry.
HELP	Display a summary of the active keys.
*HELP	Display information about the highlighted item. (Not available in all modes.)
RCV	Receive input from an external device.
SEND	Send information (data only) to an external device such as a printer .
#SEND	Screen Print. Sends the current display to a printer.
EXIT	Return to a previous step in procedures. Return to normal operation after the HELP key has been pressed.
0 - 9	Used to select and control modes. Input data to the Tester and designate trouble codes.
F0 - F9	Used as "Hot Keys" in data displays.
F9	Change the size of characters displayed on the screen. (Not available in all modes.)
F0	Turn the cursor on and off in some modes.

DISPLAY

The 3.0 x 3.0 inch graphic display allows data to be viewed in several graphic modes and in large and small character sizes. The Tester can display real-time bar graphs, plots, and data for several parameters at the same time, giving an accurate account of current operating conditions. The display contrast can be adjusted by turning the thumb wheel on the right side of the Tester.

<pre>FCR LONG 12.850km/l FCR SHORT 12.850km/l FC LONG 0.129LTR FC SHORT 0.001LTR RPM LONG 2400RPM RPM SHORT 2400RPM DIST LONG 1.64km DIST SHORT 0.02km SPD LONG 68km/h SPD SHORT 68km/h INJECTOR 2.84msec THROTTLE 5°</pre>	<pre>INJECTOR 3.9ms IGNITION 8°C ISC STEP# 49 ENGINE SPD 2400rpm AIRFLOW 3.06U COOLANT 83°C THROTTLE 0% VEHICLE SPD 88km/h TARGET A/F L 1.25U</pre> <table border="1"> <tr> <td>A/F FB LEFT ON</td> <td>KNOCK FB OFF</td> <td>A/F FB RIGHT OFF</td> <td>STA SIGNAL OFF</td> </tr> </table>	A/F FB LEFT ON	KNOCK FB OFF	A/F FB RIGHT OFF	STA SIGNAL OFF
A/F FB LEFT ON	KNOCK FB OFF	A/F FB RIGHT OFF	STA SIGNAL OFF		
<p>DATA LIST (F1)</p>	 <p>LED/LIST (F2)</p>				
<pre>FCR LONG 12.01km/l 0 5 10 15 20 25 30 FCR SHORT 12.01km/l 0 5 10 15 20 25 30 FC LONG 0.47LTR 0 4 8 12 16 20 FC SHORT 0.02LTR 0 4 8 12 16 20 RPM LONG 2400RPM 0 2 4 6 8 10</pre>	<pre>OxL SIGNAL RICH IGNITION 45°C</pre> 				
<p>BAR GRAPH (F3)</p>	<p>LINE GRAPH (F4)</p>				
<pre>FCR LONG 12.850km/l FCR SHORT 12.850km/l FC LONG 0.129LTR FC SHORT 0.001LTR RPM LONG 2400RPM RPM SHORT 2400RPM DIST LONG 1.64km DIST SHORT 0.02km SPD LONG 68km/h SPD SHORT 68km/h INJECTOR 2.84msec THROTTLE 5°</pre>	<pre>INJECTOR 3.9ms IGNITION 8°C ISC STEP# 49 ENGINE SPD 2400rpm AIRFLOW METER 40.1ms COOLANT 83°C THROTTLE 0% VEHICLE SPD 68km/h TARGET A/F L 1.25U TARGET A/F R 2.50U A/F FB LEFT ON KNOCK FB OFF A/F FB RIGHT OFF STA SIGNAL OFF IDL SIGNAL OFF A/C SIGNAL OFF</pre>				
<p>LARGE CHARACTERS (F9)</p>	<p>COMPRESSED CHARACTERS (F9)</p>				

DATA LINK CONNECTOR AND CABLE

Communication between the Tester and the vehicle's electronic systems is through the heavy duty 14-pin to 26-pin Data Link Connector (DLC) cable that is connected to the bottom center of the Tester. Various adapters or adapter cables are used to connect the 14-pin end of the DLC cable to the vehicle's Check Connector, TDCL or DLC3 (M-OBD).

POWER SOURCES

The Tester is intended to be powered from the vehicle's battery via the cigarette lighter socket, or directly from the battery with the Battery Adapter Cable. The Tester may also be powered in the following ways:

- By the DLC1 (Check Connector) cable when the DLC1 cable is connected to the underhood DLC1.
- By the DLC3 (OBD-II Connector) cable when the DLC3 cable is connected to the DLC3 on the vehicle.
- By the AC/DC power supply.
- By the rechargeable battery pack. Powering the Tester with the battery pack is described below.

BATTERY BACKED OPERATION

A rechargeable NiCad Battery pack is provided to power the Tester under the following conditions:

- When the vehicle ignition is off
- While the engine is cranking
- Temporary off-vehicle "stand-alone" usage

Although the Tester will operate on the battery pack, it is recommended that the Tester is connected to the vehicle's 12-volt power supply during testing.

See Section 6.0 *Battery Charging and Replacement* in the Tester Operator's Manual for battery charging and replacement instructions.

BATTERY BACKED MEMORY

Tester configuration and data that has been captured during testing is retained in the Tester battery backed memory under power from an onboard Lithium battery. This battery should last up to 2 years from the time of purchase.

See Section 6.0 *Battery Charging and Replacement* in the Tester Operator's Manual for battery replacement instructions.

BEEPER

The Tester contains an audio output device which can be used for user prompts, test begin and end indications, and error indications.

LEDS

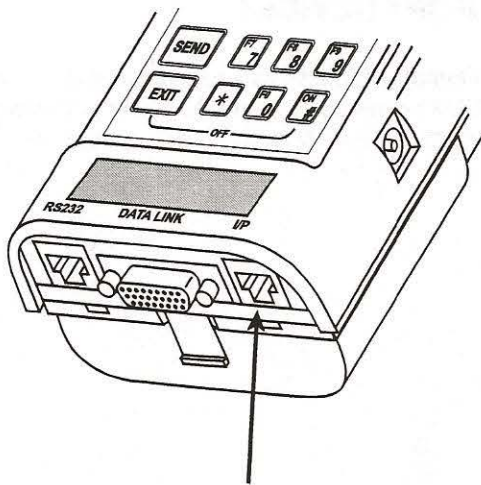
Eight Light Emitting Diodes (LEDs), four red and four green, are located immediately below the display and are visible only when activated. The green light on the right is lit when the Tester is in battery charge mode while the display is off.

In LED/LIST mode the status of four discrete parameters can be monitored at a time. In the display on the left, the green LED beneath KNOCK RETARD will be on when KNOCK RETARD is on and the red LED will be on when KNOCK RETARD is off.

For switched signals, such as A/C or Brake Switch, RED means OFF and GREEN means ON.

INJECTOR.....2.6ms			
IGNITION.....9°C A			
IAC STEP#.....49			
ENGINE SPD.....625rpm			
AIRFLOW METER 39.9ms			
ECT.....190°F			
THROTTLE.....0°			
VEHICLE SPD.....0MPH			
TARGET A/F L.....1.25V			
A/F	KNOCK	A/F	STA
FB	RETARD	FB	SIGNAL
LEFT		RIGHT	
ON	OFF	ON	OFF





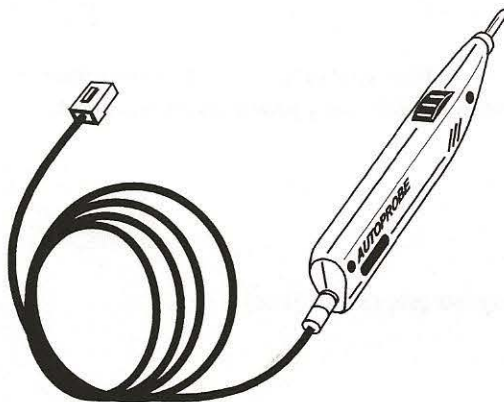
INSTRUMENTATION
PORT

INSTRUMENTATION PORT

INSTRUMENTATION PORT AND DEVICES

The Instrumentation Port (I/P) is used to connect the Tester to one or more instrumentation devices which are used to expand the diagnostic capability of the Tester. The I/P connector receives signals which provide a serial communication link from "smart" instrumentation devices. These devices contain microprocessors which can perform specific diagnostic functions and send information to the Tester.

The Instrumentation Port also contains circuits which can be used for making direct signal measurements. This capability is used to support instrumentation devices which may not require a microprocessor. The Autoprobe and NVH Analyzer are examples of this type of instrumentation devices.



AUTOPROBE

AUTOPROBE

The Autoprobe provides a convenient means of signal measurement and operates under control of the Tester.

In the signal measurement mode, the Autoprobe functions as a digital volt meter (DVM) and is used to passively monitor voltage signals from the ECU, sensors, actuators, harness and connectors.

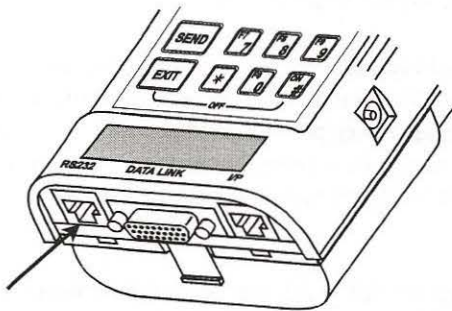
The Autoprobe is also used for signal input to the oscilloscope, as well as timing (frequency, duty cycle, pulse width) measurements on vehicle signals.

NOTE

The Autoprobe (DVM) provided in the Tester kit is only intended for automotive type signal measurement. It is not a lab-quality Digital Volt Ohm Meter (DVOM).

RS232 PORT AND RS232 PORT DEVICES

The Tester contains an RS232 Input/Output (I/O) serial data connection capable of supporting peripheral devices. The RS232 connection allows the Tester to transfer and receive data to and from other RS232 compatible devices such as a remote host computer or serial printer.



RS232 PORT

INSTRUMENTATION PORT

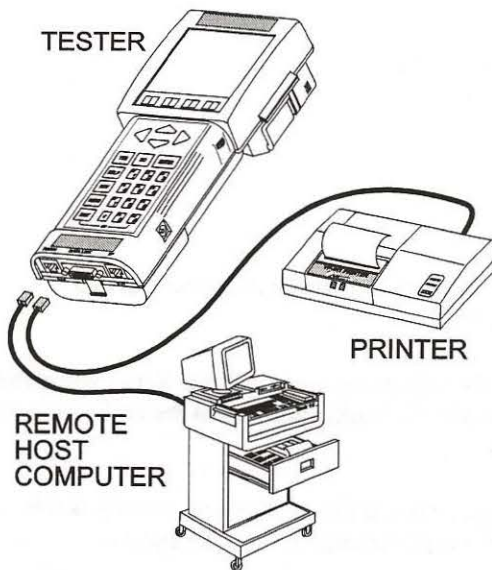
REMOTE HOST COMPUTER

Using the RS232 port, the Tester can transfer and receive data to and from remote host computers including personal computers, computer-based test equipment, and data base computer systems at data rates up to 115.2k baud.

PRINTER

When the Tester is connected to a compatible serial printer, such as the optional VP-411 or VP-414 via the RS232 port, the following functions are available:

- Print diagnostic parameters
- Print trouble codes
- Print test results
- Print display information (including bar graphs and plots)



RS232 PORT DEVICES

TESTER CHARACTERISTICS

ITEM	CHARACTERISTIC
SIZE	10.2 x 27.9 x 5.1 CM (4.0 x 11.0 x 2.0 INCHES)
WEIGHT	1.02 KG (2.25 LBS) WITH BATTERY PACK
POWER	3.0 WATTS @ 12 VDC
INPUT VOLTAGE	6.5 TO 24 VDC (PROTECTED AGAINST REVERSE POLARITY)
KEYBOARD	23 KEY MEMBRANE
GRAPHIC DISPLAY	160 x 160 DOT GRAPHIC LIQUID CRYSTAL DISPLAY WITH EL BACK-LIGHTING
LED DISPLAY	8 LED'S (4 RED; 4 GREEN)
AUDIO OUTPUT	VARIABLE FREQUENCY BEEPER (200 Hz TO 10 kHz)
POWER SOURCES	<ul style="list-style-type: none"> • 12-VOLT VEHICLE POWER • NICAD BATTERY PACK (APPROXIMATELY 2 HOUR OPERATION) • LITHIUM BATTERY FOR CLOCK/ CALENDER AND RAM (APPROXIMATELY 2 YEAR LIFE)
MODULES	<ul style="list-style-type: none"> • DIAGNOSTIC APPLICATION PROGRAM CARD • I/O CARTRIDGE
OPERATING TEMP.	0 °C TO 50 °C (32 °F TO 122 °F)
STORAGE TEMP.	-20 °C TO 60 °C (-4°F TO 140°F)

FUEL CONSUMPTION FUNCTION CHARACTERISTICS (OBD AND OBD II)

ITEM	CHARACTERISTIC
ACCURACY	<ol style="list-style-type: none"> 1. FUEL CONSUMPTION ± 10% (When Fuel, Fuel Pressure, and Injector are operating properly) 2. DISTANCE ± 10% 3. FUEL CONSUMPTION RATE ± 10% (When Fuel, Fuel Pressure, and Injector are operating properly) <p>NOTE: Long distance testing is recommended to obtain higher accuracy.</p>

AUTOPROBE CHARACTERISTICS

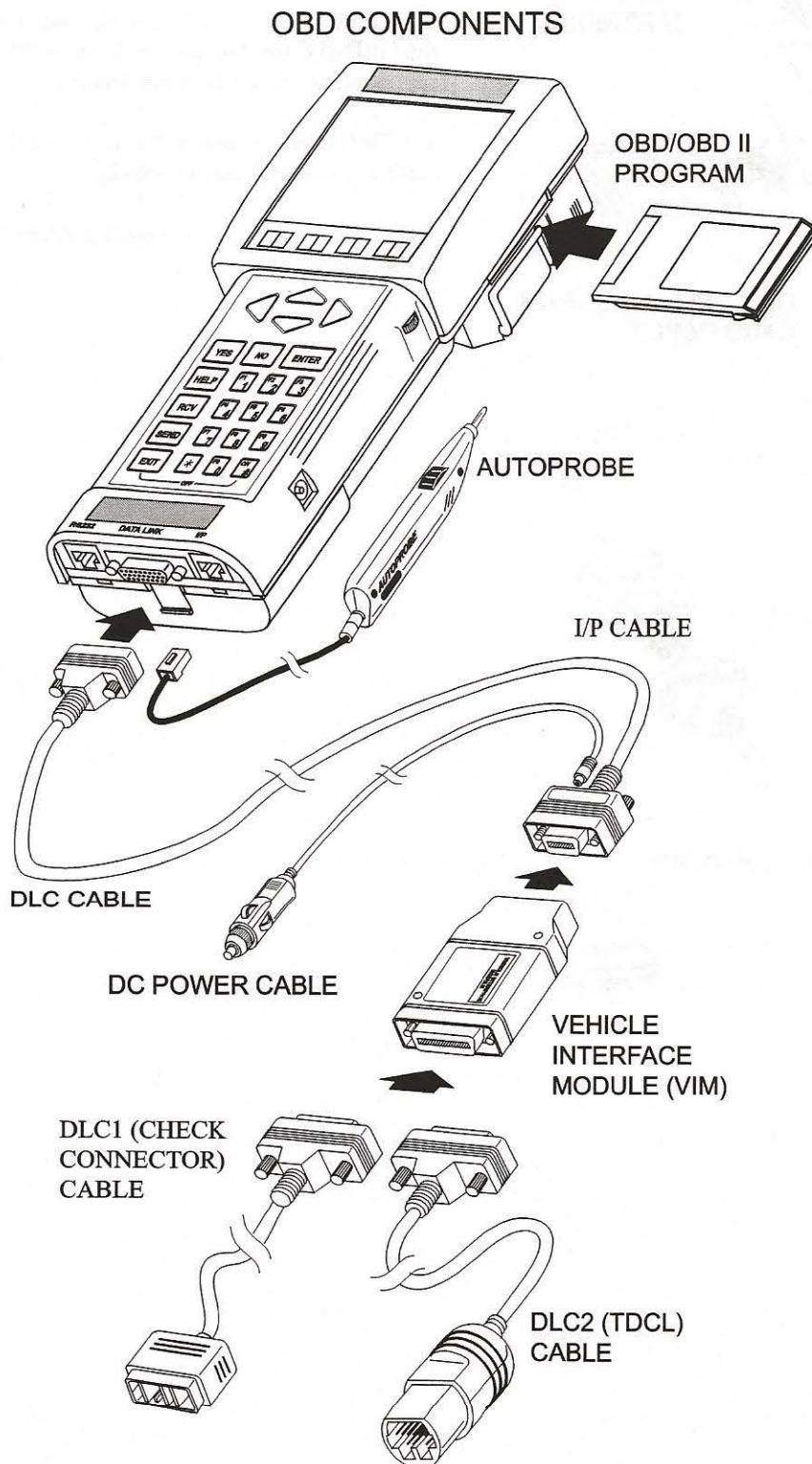
ITEM	CHARACTERISTIC
SIZE	12.7 X 1.8 CM (5.0 X 0.7 INCH)
WEIGHT	113 G (0.25 LB) WITH CABLE
CONNECTOR	10-PIN RJ45 MODULAR PHONE CONNECTOR (KEYED)
CABLE LENGTH	1.5 METER (5 FEET)
POWER SOURCE	5 VOLTS (SUPPLIED BY TESTER)
INPUT VOLTAGE	± 20 VOLTS/±5 VOLTS
INPUT IMPEDANCE	300KΩ
METER MODE	.1V/dv, .2V/dv, .5V/dv, 1V/dv — 1 MΩ
OSCILLOSCOPE MODE	2V/dv or 5V/dv — 300KΩ
PROBE MEASUREMENTS	-VOLTAGE RELATIVE TO VEHICLE GROUND (± 20V) - PULSE WIDTH - FREQUENCY(5 Hz - 10 kHz for Frequency range) (0 - 10 kHz for Oscilloscope range)
MEASUREMENT ACCURACY	VOLTAGE ±0.1V * FREQUENCY 1Hz PULSE WIDTH 2 μS
SAMPLE SWITCH	OPERATOR INPUT TO TESTER

* Voltage measurement accuracy is affected by any voltage offsets in the vehicle's ground circuit.

3.0 OBD AND OBD II COMPONENTS

OBD COMPONENTS

The OBD components consist of the Tester, Program Card, Vehicle Interface Module (VIM), DLC1 (Check Connector) cable and DLC2 (TDCL) cable.



The Program Card provides the software for operating the OBD test modes.

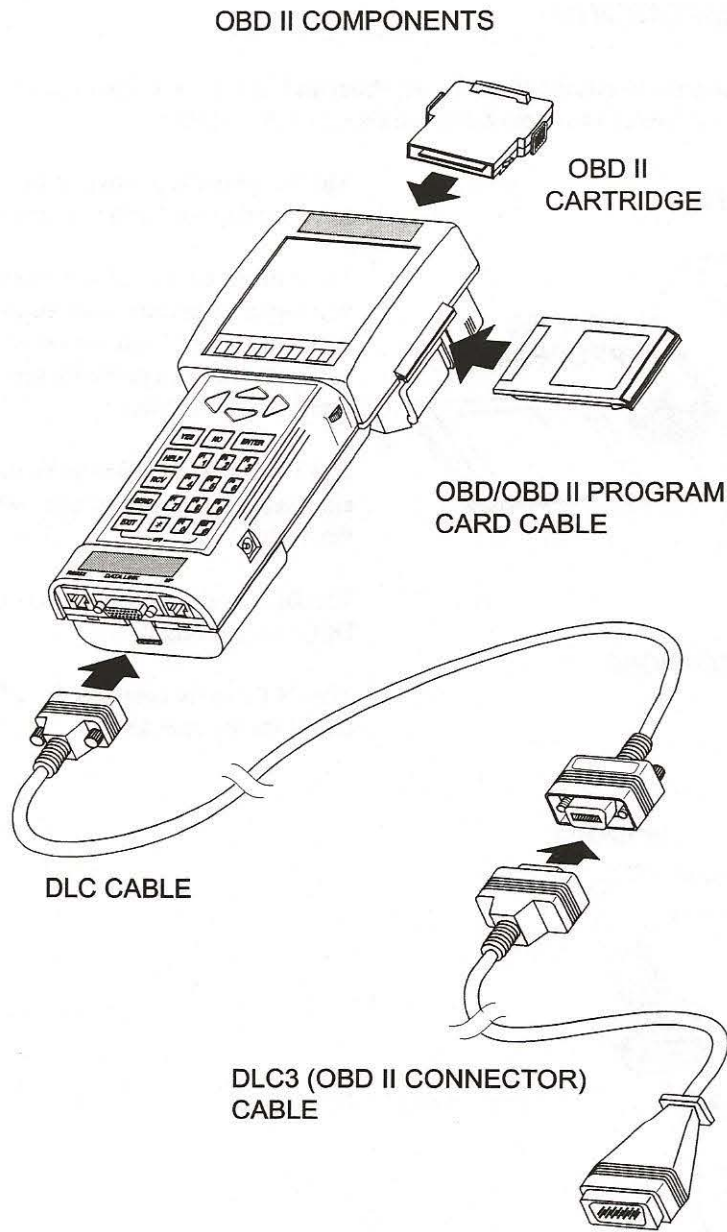
The Autoprobe is used as a smart digital volt meter to monitor input/output signals between the ECU and sensors and actuators, and as a probe for the oscilloscope function.

The VIM scales, buffers and conditions electronic signals between the vehicle and the Tester.

The DLC1 cable connects the VIM to the DLC1 on the vehicle.

The DLC2 cable connects the VIM to the DLC2 on the vehicle.

OBD II COMPONENTS



The OBD II components consist of the Tester, Program Card, OBD-II Cartridge, and the DLC3 (OBD-II Connector) cable. The vehicle must be equipped with a DLC3 in order to perform OBD-II tests.

The Program Card is used in conjunction with the OBD-II Cartridge to provide the software for operating the OBD-II test modes.

The DLC3 cable connects the Tester DLC cable to the DLC3 on the vehicle.

The OBD-II cartridge can be left permanently in the Tester.

4.0 NVH ANALYZER KIT COMPONENTS

The NVH Analyzer kit consists of a NVH Analyzer module, Program Card, I/P cable, and Accelerometer. A microphone is available as an option.

The NVH Analyzer components must be used in conjunction with the Tester, VIM, and related cables and adapter cables described in Section 3.0 *OBD and OBD II Components*.

The Program Card provides the software for operating the NVH Analyzer test modes.

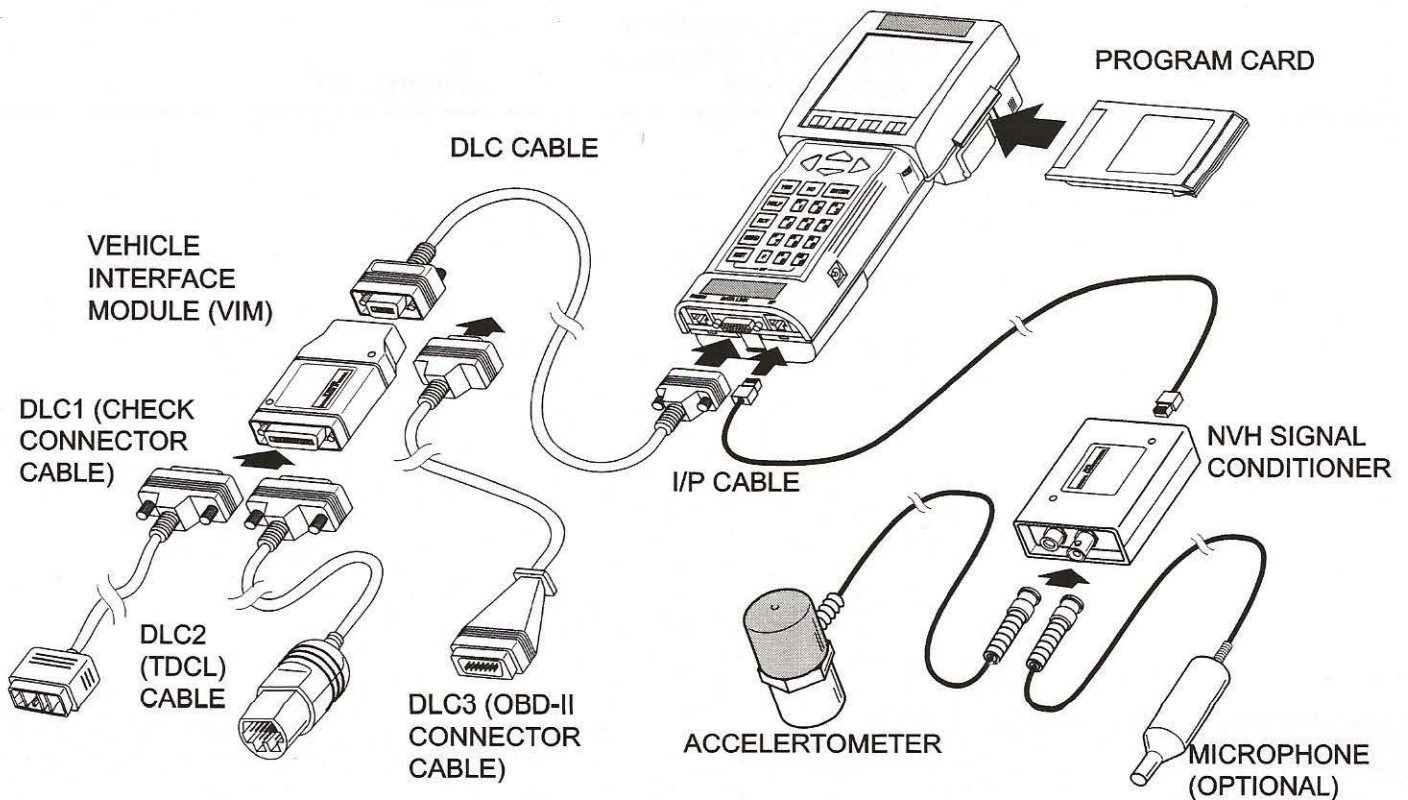
The NVH Analyzer module processes signals acquired from the Accelerometer or microphone for display on the Tester.

The I/P cable is used to connect the NVH Analyzer to the I/P port on the Tester.

The Accelerometer is used to detect vibration frequencies and amplitude during vehicle operation.

The optional microphone is used to record noise data during vehicle operation.

NVH ANALYZER COMPONENTS



NVH ANALYZER CHARACTERISTICS

ITEM	CHARACTERISTIC
SIZE	8.9 x 6.4 x 2.5 CM (3.5 x 2.5 x 1.0 INCHES)
WEIGHT	454 G (1 LB)
POWER	0.5 WATT
INPUT VOLTAGE	5.0 VOLTS
TESTER INTERFACE	INSTRUMENTATION PORT - CABLE LENGTH: 1.5 METER (5 FEET) - CONNECTOR: RJ45 10 PIN KEYED RIGHT
INPUTS/CONNECTORS - BNC - RCA	USED FOR ACCELEROMETER OR MICROPHONE INPUT USED FOR PHOTO SENSOR SIGNAL INPUT (FUTURE USE)
SENSORS ACCELEROMETER	LOW-IMPEDANCE PIEZOELECTRIC - SENSITIVITY: 0.01 G - RANGE: ±1.0 G - FREQUENCY RANGE: 5-62.5Hz 5-125Hz 5-250Hz 5-500Hz - FREQUENCY ACCURACY: ±1.0% - VIBRATION LEVEL ACCURACY: ±1.5 dBg - POWER: 2 mA CONSTANT CURRENT - CABLE LENGTH: 3 METER (10 FEET)
MICROPHONE (OPTIONAL)	CERAMIC NON-DIRECTIONAL - SENSITIVITY -64 dB - FREQUENCY RANGE: 5 - 62.5Hz 5 - 125Hz 5 - 250Hz 5 - 500Hz - FREQUENCY ACCURACY: ±1% - NOISE LEVEL ACCURACY: ±1.5 db - CABLE LENGTH: 1.8 METER (5 FEET)

5.0 BREAK-OUT BOX KIT COMPONENTS

The Break-out Box kit consists of the Break-out Box, Program Card, DC Power Cable, Y-Adapter Cable, I/P Cable, 80-pin and 50-pin Data Cables, 80-pin and 50-pin Self Test Adapters, ECU Interface Boxes, and Connector Exchange Wire Sets.

The Break-out Box must be used in conjunction with the Tester.

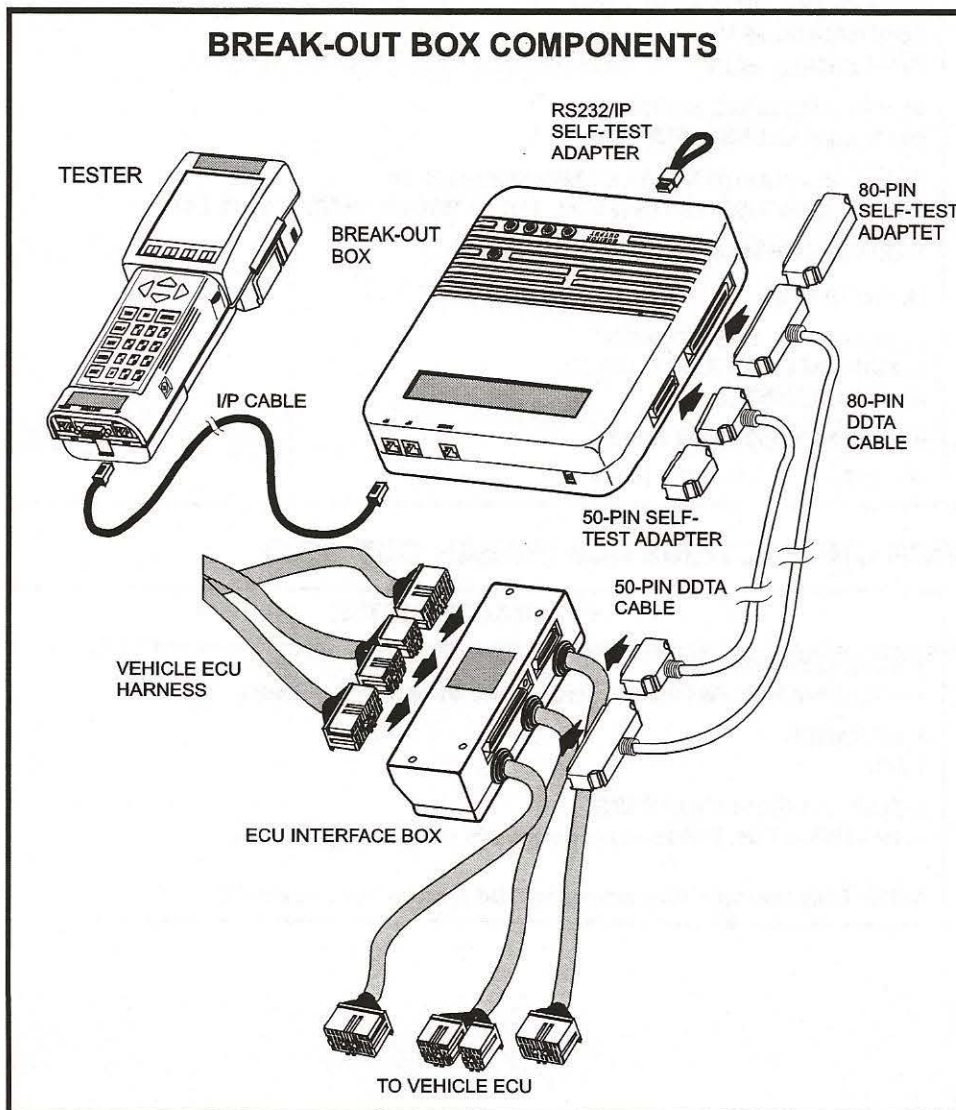
The Program Card provides software for operating the Break-out Box.

The DC Power Cable provides a means of powering the Break-out Box. A Y-Adapter Cable permits powering of both the Tester and Break-out Box from the vehicle cigarette lighter or battery adapter cable.

The I/P cable is used to connect the Break-out Box to the I/P port on the Tester.

The Break-out Box connects to the ECU Interface Box with the 50-pin and 80-pin Data Cables.

The ECU Interface Box is installed between one of the vehicle's ECUs and the vehicle wiring harness. A Connector Exchange Wire Set (not shown) is used to adapt the vehicle harness and ECU connectors for some ECUs (eg. CCS, TDS), if necessary.



BREAK-OUT BOX CHARACTERISTICS

ITEM	CHARACTERISTIC
SIZE	220 x 245 x 52 MILLIMETERS (8.7 x 9.7 x 2 INCHES)
WEIGHT	1.4 kg (3 LBS) WITH BATTERY PACK
PRIMARY POWER SOURCE	VEHICLE POWER VOLTAGE: 9 TO 24 VDC (PROTECTED AGAINST REVERSE POLARITY AND LOAD DUMP) CURRENT: 1 AMP
ALT. POWER SOURCE	REPLACEABLE NICAD BATTERY PACK
SERIAL INTERFACES	INSTRUMENTATION BUS (I/B) BAUD RATES:2400, 4800, 9600, 19.2K, 38.4K, 57.6K, 115.2K RS232 HARDWARE HANDSHAKING (1 INPUT, 1 OUTPUT) BAUD RATES:2400, 4800, 9600, 19.2K, 38.4K
INPUT SIGNALS:	ECU INPUTS: 120 CHANNELS EXTERNAL INPUTS: 4 CHANNELS
OUTPUT SIGNALS: TEST POINTS ANALOG OUTPUTS	4 BANANA JACKS 2 CHANNELS (CONNECTED TO I/P CONNECTOR)
INPUT SIGNAL LEVELS	2 SOFTWARE SELECTABLE INPUT RANGES LOW RANGE: ±5 V HIGH RANGE: ±40 V
INPUT IMPEDANCE	±5 V RANGE:10 MΩ MINIMUM ±40 V RANGE:1 MΩ MINIMUM
TYPES OF MEASUREMENT	BI-POLAR ANALOG VOLTAGE MEASUREMENTS TIMING MEASUREMENTS (FREQ., PULSE WIDTH, DUTY RATIO, ETC.)
SAMPLE RATE	VARIABLE UP TO 8,000 SAMPLES/SECOND
FREQUENCY RESPONSE	DC TO 10 KHZ
TIMING	RESOLUTION: 1 μS MINIMUM MAXIMUM FREQUENCY: 10 KHZ NO. OF CHANNELS: 6
OPERATING TEMP.	0 °C TO 50 °C (32 °F TO 122 °F)
STORAGE TEMP.	-20 °C TO 60 °C (-4 °F TO 140 °F)

FUEL CONSUMPTION FUNCTION CHARACTERISTICS (BREAK-OUT BOX)

ITEM	CHARACTERISTIC
ACCURACY	1. FUEL CONSUMPTION ± 10% (When Fuel, Fuel Pressure, and Injector are operating properly) 2. DISTANCE ± 10% 3. FUEL CONSUMPTION RATE ± 10% (When Fuel, Fuel Pressure, and Injector are operating properly) NOTE: Long distance testing is recommended to obtain higher accuracy.