

2. DIAGNOSIS

INTRODUCTION

Diagnosing the electronic fuel injection and engine management system is fairly straightforward if you use a sound diagnostic procedure.

The first and foremost order of importance, for diagnosing a problem with any type of system, is to understand how that system is supposed to normally operate. Whether it is an automotive system, a heating system for a building, or even a human biological system like your heart or lungs, before attempts are made to repair a problem, it is crucial to understand what is normal and what is not normal.

In other words, to be effective in diagnosing and repairing problems with the electronic fuel injection and engine management system, it is important that you possess a good working knowledge of the system.

Having the proper diagnostic tools and reference materials available, and attendance at training schools is a good method for planning to succeed when diagnosing problems or malfunctions with the engine management system.

This manual has a section specifically written to help in understanding how the system normally operates. The first section of this manual, Section "1", titled "General Description and System Operation," is a good place to begin your understanding of normal system and component operation. Make sure you take the time to read the material contained at least once.

The Importance of Mechanical Systems

Don't forget, underneath all the wiring, electronics, sensors, and actuators is a basic internal combustion engine. The fuel injection and engine management system assumes that all of the engine's mechanical systems are functioning properly. As a reminder, here are a few "basic engine" items that might cause conditions that could be blamed incorrectly on the "electronics," the engine management system:

- Low compression
- Vacuum leaks
- Exhaust system restrictions
- Incorrect valve timing caused by worn parts or incorrect assembly
- Poor quality fuel
- Ignored regular maintenance intervals

The Importance of Having the Special Diagnostic Tools

There are certain special diagnostic tools that are called out in the diagnostic procedures and charts. These tools are designed for specific diagnostic uses, and the service manual procedures and charts that call for their use are written to require having these tools available. If the special diagnostic tools are not used where indicated, most efforts to accurately diagnose problems with the engine management system will be extremely difficult, if not impossible. These special diagnostic tools have been carefully designed and selected, and are available as a diagnostic tool kit through Kent-Moore SPX Corporation. Address, FAX, and phone numbers are supplied in Section 6 - "Special Tools," of this manual.

As to special tools, it is important to remember that none of the special diagnostic tools will make you into a diagnostic genius. No tool will ever replace human intellect. Tools can't perform a diagnosis for you, and they don't eliminate the need for diagnostic charts and service procedures. All of the special diagnostic tools are just that—tools.

Tools are used to help perform various tasks. Some tools, such as the Tech 1 diagnostic tool or the digital volt-ohm-amp multimeter, allow us a way to examine what is happening in an electrical or electronic circuit. The Tech 1 diagnostic tool is by itself a small handheld computer, and communicates with the electronic control module. The Tech 1 allows us a way of "seeing" what the electronic control module is interpreting from its various input signals, and a "window" to observe what commands are being sent to the various devices that are controlled and operated by the electronic control module.

Knowledge required

It is *NOT* required that you fully understand how electronics and computers operate. What is required is a basic working knowledge of applied electrical theory, such as voltage, current, resistance, and what happens in an "open" circuit, and what happens in a "shorted" circuit. You should also be familiar with interpreting a simple wiring diagram. Also, you should be familiar with how to use a digital volt-ohm-amp multimeter in various situations. Of course, it is assumed that you have a good understanding of how a basic automotive engine operates.

2-2 ENGINE MANAGEMENT SYSTEMS 1.7L THROTTLE BODY INJECTION

The engine used in this vehicle has controls to reduce exhaust emissions while maintaining good driveability and fuel economy.

An electronic control module is the heart of this control system and has sensors used to get information about engine operation and about the various systems it controls. Details of basic operation are covered in Section "1", "General Description and System Operation."

The electronic control module has the ability to do some diagnosis of the engine management. When it finds a problem, it turns "ON" a "CHECK ENGINE" light on the instrument panel, and a trouble code will be stored in the electronic control module memory. *This does not mean that the engine should be stopped right away, but that the cause of the light coming "ON" should be checked as soon as reasonably possible.*

DIAGNOSIS PROCEDURE

This portion of Section "2", "Diagnosis" of the manual is divided into 5 parts. They are:

INTRODUCTION. This contains general information about how to use this section.

"A" SECTION AND "A-" CHARTS. This is where all diagnostic procedures begin. It contains: the all-important "DIAGNOSTIC CIRCUIT CHECK"; charts about the "Check Engine" light; what to do if the engine will not run; and other general charts.

TROUBLE CODE CHARTS. If the DIAGNOSTIC CIRCUIT CHECK reveals a trouble code set in the electronic control module's memory, this is where the individual trouble codes are diagnosed. If more than one trouble code is stored, always start with the lowest number before going to the next higher trouble code.

"B" SECTION, DRIVEABILITY SYMPTOMS. If no trouble code is stored, or a code is stored but proves to be only an intermittent condition, this part will help the mechanic to find the problem. Again, all diagnostic procedures must begin with the DIAGNOSTIC CIRCUIT CHECK.

"C" SECTION AND "C-" CHARTS (Component Systems). This part contains general remove and replace information about the individual components in the engine control system. It also contains service information about those components. This is where you would look to find information on: the ignition system; intake manifold electric heater system; the fuel injector; the air conditioning electrical control system; and so on.

2.1 DIAGNOSTIC PRECAUTIONS

The following requirements must be observed when working on vehicles:

1. Before removing any electronic control module system component, disconnect the battery ground cable.
2. Never start the engine without the battery being solidly connected.
3. Never separate the battery from the on board electrical system while the engine is running.
4. When charging the battery, disconnect it from the vehicle's electrical system.
5. Never subject the electronic control module to temperatures above 80°C, i.e. paint oven. Always remove control unit first if this temperature is to be exceeded.
6. Ensure that all cable harness plugs are connected solidly and that battery terminals are thoroughly clean.
7. The engine management system harness connectors are designed to fit only one way; there are indexing tabs and slots on both halves of the connector. Forcing the connector into place is not necessary if it is installed with the proper orientation. Failure to match the indexing tabs and slots on the connector can cause damage to the connector, the module, or other vehicle components or systems.
8. Never connect or disconnect the electronic control module connectors when the ignition is switched "ON."
9. Before attempting any electric arc welding on the vehicle, disconnect the battery leads and the electronic control module connectors.
10. When steam cleaning engines, do not direct the steam cleaning nozzle at electronic control module system components. If this happens, corrosion of the terminals can take place.
11. Use only the test equipment specified in the diagnostic charts; other test equipment may give incorrect results or damage good components.
12. Make all voltage measurements using a digital voltmeter with an internal impedance rating of at least 10 million ohms per volt (10 MΩ/volt).
13. When a test light is specified, a "low-power" test light must be used. Do not use a high-wattage test light (i.e.: Headlight). While a particular brand of test light is not suggested, a simple check on any test light will ensure it is safe for electronic control module circuit testing. Connect an accurate ammeter (such as the high-impedance digital multimeter) in series with the test light, and power the test light-ammeter circuit with the vehicle battery.

If the ammeter indicates **less** than 1/4 amp current flow (.25 A or 250 ma), the test light is **SAFE** to use.

If the ammeter indicates **more** than 1/4 amp current flow (.25 A or 250 ma), the test light is **NOT SAFE** to use.



14. Electronic components used in control systems are often designed to carry very low voltage, and are very susceptible to damage from electrostatic discharge. It is possible for less than 100 volts of static electricity to cause damage to some electronic components. By comparison, it takes as much as 4,000 volts for a person to even feel the zap of a static discharge.

There are several ways for a person to become statically charged. The most common methods of charging are by friction and by induction. An example of charging by friction is a person sliding across a car seat, in which a charge of as much as 25,000 volts can build up. Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off, leaving the person highly charged with the opposite polarity. Static charges of either type can cause damage, therefore, it is important to use care when handling and testing electronic components.

NOTICE: To prevent possible Electrostatic Discharge damage:

- Do Not touch the electronic control module connector pins or soldered components on the electronic control module circuit board. Never disassemble the electronic engine control module metal case, except for the calibrator cover.
- When handling an engine calibrator, do not remove the integrated circuit from carrier.

2-4 ENGINE MANAGEMENT SYSTEMS 1.7L THROTTLE BODY INJECTION

2.2 DIAGNOSTIC GENERAL DESCRIPTION

The diagnostic charts and functional checks in this manual are designed to locate a faulty circuit or component through logic based on the process of elimination. The charts assume the vehicle functioned correctly at the time of assembly and there are no multiple failures.

The electronic control module performs a continual self-diagnosis on certain control functions. This diagnostic capability is aided by the diagnostic procedures in this manual. The electronic control module's language for communicating the source of a malfunction is a system of diagnostic codes. The codes are two digit numbers that range from 12 to 55. When a malfunction is detected by the electronic control module, a code is stored/logged and the "Check Engine" light is turned "ON."

"CHECK ENGINE" LIGHT

The light is in the instrument panel and does the following:

- It tells the driver a problem has occurred and the vehicle should be taken for service as soon as reasonably possible. *It does NOT mean the engine should be stopped.*
- It displays diagnostic "Codes" stored by the electronic control module which help the technician diagnose system problems.

As a bulb and system check, the light will come "ON" with the ignition "ON," and the engine not running. When the engine is started, the light will turn "OFF." If the light remains "ON," the self-diagnostic

system has detected a problem. If the problem goes away, the light will turn "OFF" in most cases after 10 seconds, but a diagnostic code will be stored in the electronic control module's memory.

When the light remains "ON" while the engine is running, or when a malfunction is suspected due to a driveability or emissions problem, a "Diagnostic Circuit Check" must be performed. The procedures for these checks are given in "Diagnostic Charts," Section "2.9A". These checks will expose malfunctions which may not be detected if other diagnostics are performed out of order.

INTERMITTENT "CHECK ENGINE" LIGHT

In the case of an "intermittent" problem, the "Check Engine" light will turn "ON" for at least ten (10) seconds and then will turn "OFF." However, the matching code will be stored in the memory of the electronic control module until the battery voltage to the electronic control module has been removed or the Tech 1 diagnostic tool has been used to "clear codes." When unexpected codes appear during the code reading process, one can assume these codes were set by an intermittent malfunction and could be helpful in diagnosing the system.

An intermittent code may or may not re-set. If it is an intermittent failure, a Diagnostic Code Chart is not used. Consult the "Diagnostic Aids" on the page facing the diagnostic chart corresponding to the intermittent diagnostic code. "Symptom Charts," Section "2.9B" also covers the topic of "Intermittents." A physical inspection of the sub-system often will reveal the problem.

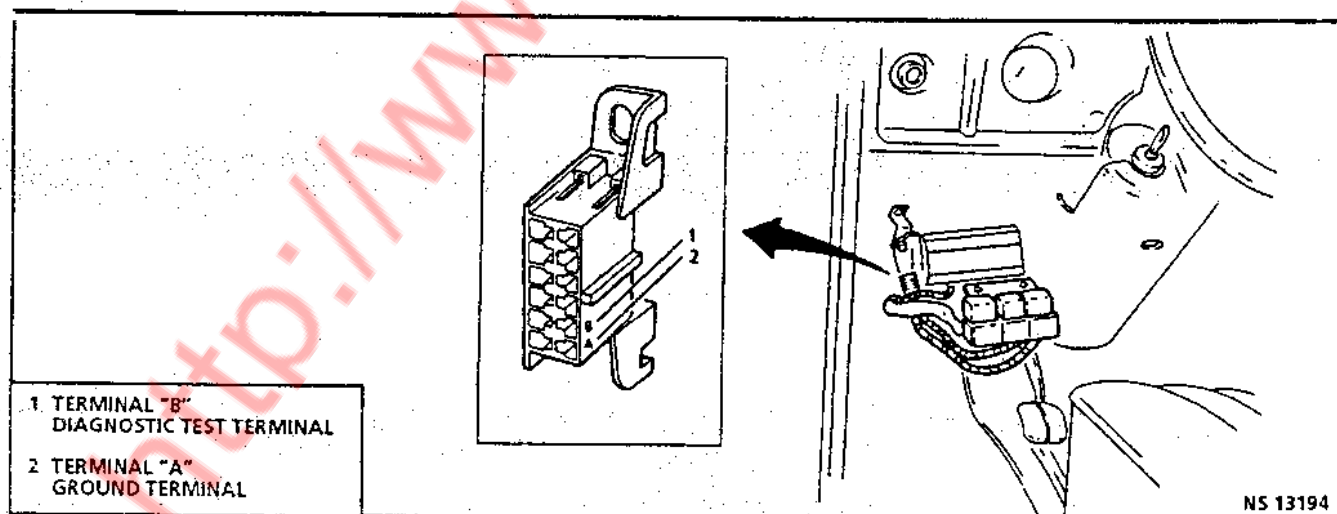


Figure 2.2-1 Assembly Line Data Link Location View

READING CODES

The provision for communicating with the electronic control module is the assembly line data link connector (see Figure 2.2-1). The assembly line data link connector is used by the assembly plant to receive electronic control module information, and to check the engine before the vehicle leaves the plant. The code(s) stored in the electronic control module's memory can be read either through a Tech 1 (a handheld diagnostic tool plugged into the assembly line data link connector), or by counting the number of flashes of the "Check Engine" light when the diagnostic "test" terminal "B" of the assembly line data link connector is grounded. The assembly line data link connector terminal "B" (diagnostic "test" terminal) is the second terminal from the right of the assembly line data link connector's top row. The terminal is most easily grounded by connecting it to terminal "A" (connected to engine ground), the terminal to the right of terminal "B" on the top row of the assembly line data link connector.

Once terminals "A" and "B" have been connected, the ignition switch must be moved to the "ON" position, with the engine **NOT RUNNING**. At this point, the "Check Engine" light should flash Code 12 three times consecutively. This would be the following flash sequence: "flash, pause, flash-flash, long pause, flash, pause, flash-flash, long pause, flash, pause, flash-flash." Code 12 is not a trouble code. Code 12 merely indicates that the electronic control module's diagnostic system is operating. If Code 12 is NOT indicated, a problem is present within the diagnostic system itself, and should be addressed by consulting the "Diagnostic Circuit Check" chart in "Diagnostic Charts," Section "2.9A".

Following the flashing of Code 12, the "Check Engine" light will flash any trouble codes three times if any diagnostic trouble codes are present, or it will simply continue to flash Code 12. If more than one diagnostic trouble code has been stored in the electronic control module's memory, the codes will flash from the lowest to the highest, with each code displayed three times.

CLEARING CODES

To clear the codes from the memory of the electronic control module, either to see if the malfunction will occur again or because repair has been completed, there are two methods. Either the electronic control module

power feed must be disconnected for at least ten (10) seconds, or the Tech 1 diagnostic tool also has the ability to "erase" the diagnostic trouble codes from the electronic control module's memory without disconnecting the battery or any fuses. The electronic control module power feed can be disconnected by removing the negative battery terminal. (When the battery terminal is disconnected, other on-board memory data, such as preset electronic radio tuning, is also lost.)

NOTICE: To prevent electronic control module damage, the ignition must be "OFF" when disconnecting or reconnecting electronic control module power.

DIAGNOSTIC DISPLAY MODE

When the diagnostic "test" terminal is grounded (assembly line data link terminal "B" connected to "A") with the ignition "ON" and the ENGINE "STOPPED," the system will enter what is called the "Diagnostic Display" mode. (This can also be done by using the Tech 1 tool in the "F1: Field Service" mode, but with the engine *not running*.) In this mode the electronic control module will:

1. Display a Code 12 by flashing the "Check Engine" light (indicating the system is operating correctly).
2. Display any stored codes by flashing the "Check Engine" light. Each code will be flashed three times, then Code 12 will be flashed again. If no other codes are in the electronic control module's memory, Code 12 will continue to flash as long as the diagnostic display mode is active.
3. Energize the intake manifold heater relay, air conditioning clutch control relay and evaporative canister purge solenoid. This allows checking circuits which may be difficult to energize without driving the vehicle and being under particular operating conditions. These relays and solenoids will remain energized as long as the electronic control module is in the "Diagnostic Display" mode, including the intake manifold electric heater relay, which causes a high electrical load due to the manifold heater operating current.
4. Command the idle air control valve to fully extend to its zero-step position, shutting the idle air passage in the throttle body.

FIELD SERVICE MODE

If the diagnostic "test" terminal is grounded, or "Field Service" mode is selected from Tech 1 with the **ENGINE RUNNING**, the system will enter the "Field Service" mode. In this mode:

1. The "Check Engine" light will not flash malfunction codes. It will flash in a different manner, telling the technician if the fuel control system is operating in the "Open Loop" or "Closed Loop" mode. If in the "Closed Loop" mode, the flashing of the light will indicate if the exhaust is too rich, too lean, or in control. The explanation of each of the 4 possibilities follow.
 - 1A. Flashing "Open Loop" - The "Check Engine" light will flash "ON" and "OFF" 2.5 times per second (5 times every 2 seconds).
 - 1B. Flashing "Closed Loop" with fuel system operating normally - The "Check Engine" light will flash "ON" and "OFF" at a rate of once per second.
 - 1C. Flashing "Closed Loop" but oxygen sensor input indicates a lean exhaust - The "Check Engine" light will be "OFF" most or all of the time.
 - 1D. Flashing "Closed Loop" but oxygen sensor input indicates a rich exhaust - The "Check Engine" light will be "ON" most or all of the time.
2. The electronic spark timing is fixed at 10° before top dead center when engine revolutions per minute is less than 2,000.
3. The idle air control valve is commanded to a fixed number of steps.
4. Prevent any new diagnostic trouble codes from storing into memory.

See Sections "1.1" or "2.3" for additional information on electronic control module modes of operation.

ELECTRONIC CONTROL MODULE ADAPTIVE LEARNING ABILITY

The electronic control module has a "learning" ability which allows it to make corrections for minor variations in the engine management system to improve drivability. If the battery is disconnected to clear diagnostic codes or for other repair, the "learning" process resets and begins again. A change may be noted in the vehicle's performance. To "teach" the vehicle, ensure that the engine is at operating temperature. The vehicle should be driven at part throttle, with moderate acceleration and idle conditions until normal performance returns.

All diagnostic procedures must always begin with the "DIAGNOSTIC CIRCUIT CHECK."

Diagnostic procedures must begin with the "Diagnostic Circuit Check," which represents an organized approach for identifying system problems.

The "DIAGNOSTIC CIRCUIT CHECK" makes an initial check of the system, and then will direct the mechanic to other charts in the book. It must be used as a starting point for all procedures. The entire book is set up in a specific order, that is, the "DIAGNOSTIC CIRCUIT CHECK" will lead the mechanic to other charts, and those charts may lead to still other charts. **THE SEQUENCE MUST BE FOLLOWED.** The engine control system uses many input signals and controls many output functions. If the correct diagnostic sequence is not followed, incorrect diagnosis and replacement of good parts may happen.

Diagnostic charts incorporate diagnosis procedures using a Tech 1 "Scan" tool where possible. This Tech 1 "Scan" tool is a small hand-held computer in itself. Its job is to give information to a mechanic about what is happening in the engine management system.

The assembly line data link connector is used by the assembly plant to perform end of line tests. This connector can also be used by mechanics to monitor certain inputs and outputs as seen by the electronic control module. The Tech 1 "Scan" tool reads and displays the information (serial data) supplied to the assembly line data link connector from the electronic control module.

DIAGNOSIS PROCEDURE

In response to the "Check Engine" light or an owner complaint relating to engine performance.

ALL FAULT FINDING SHOULD FOLLOW THE
DIAGNOSIS CHARTS,

BEGINNING WITH THE

DIAGNOSTIC CIRCUIT CHECK!

DIAGNOSTIC CIRCUIT CHECK

After the visual/physical underhood inspection, the "Diagnostic Circuit Check" in Section "2.9A" is the starting point for all diagnostic procedures or finding the cause of an emissions test failure.

The correct procedure to diagnose a problem is to follow three basic steps.

1. **Are the on-vehicle diagnostics working?** This is determined by performing the "Diagnostic Circuit Check." Since this is the starting point for the diagnostic procedures or finding the cause of an emissions test failure, *always begin here.*

If the on-vehicle diagnostics aren't working, the "Diagnostic Circuit Check" will lead to a diagnostic chart. If the on-vehicle diagnostics are working correctly, the next step is:

2. **Is there a code stored?** If a code is stored, go directly to the numbered code chart. This will determine if the fault is still present. If no code is stored, then:
3. **Observe Serial Data information transmitted by the electronic control module.** This involves reading the information available on the assembly line data link/Serial Data Stream with a Tech 1 "Scan" tool. Information on this tool and the meaning of the various displays can be found in the succeeding paragraphs. Typical data readings under a particular operating condition can be found in: Section "2.9A", "Diagnostic Charts" - Tech 1 "Scan" Tool Typical Data Values.

2.3 TECH 1 "SCAN" TOOL DESCRIPTION

TECH 1 "SCAN" TOOL

The electronic control module can communicate a variety of information through assembly line data link connector terminal "M". This data is transmitted at a high frequency which requires a Tech 1 "Scan" tool for interpretation.

TECH 1 "SCAN" TOOL EXPLANATION

To explain how the "Scan" tool works, let's think for a minute about how a television works. A television is an electronic device that receives and processes information, and sends out information in a form that can be understood by the person watching it. The television receives a signal (from a transmitting station) that is not usable to the person. The television processes it, then sends the signal to a screen. The person can then see the information that the television transmitting station sent out. The "Scan" tool is like the television because it also processes information, sent to it by the electronic control module. The information is sent out of the electronic control module to the assembly line data link connector terminal "M". The "Scan" tool plugs into the assembly line data link connector, and the information is sent to the tool on its cable. The "Scan" tool processes the information, and "sends" the signal to a display screen on the tool. Just like a television, you can select which "station" that you want to see. The difference is instead of seeing the picture on a television, you "see" the display screen, and the "stations" that you can select on a "Scan" tool are the different input and output signals that are being processed by the electronic control module.

TECH 1 "SCAN" TOOL USES

The "Scan" tool is a useful and quick way of comparing operating parameters of a poorly operating engine with a known good one. For example, a sensor may shift its value but not set a code. Comparison with a known good vehicle may uncover this problem.

The "Scan" tool allows a quick check of sensors and switches which are inputs to the electronic control module. The electronic control module in the vehicle sends out information to the "Scan" tool at a very fast rate, and the display on the tool can update quicker than a digital voltmeter. The "Scan" tool allows a mechanic to manipulate wiring harnesses or components under the hood while observing the "Scan" readout. This can help in locating intermittent connections.

TECH 1 "SCAN" TOOL USE WITH INTERMITTENTS

The Tech 1 "Scan" tool allows manipulation of wiring harnesses or components under the hood with the engine not running, while observing the Tech 1 "Scan" tool readout.

The Tech 1 "Scan" tool can be plugged in and observed while driving the vehicle under the condition when the "Check Engine" light turns "ON" momentarily or when the engine driveability is momentarily poor. If the problem seems to be related to certain parameters that can be checked on the Tech 1 "Scan" tool, they should be checked while driving the vehicle. If there does not seem to be any connection between the problem and any specific circuit, the Tech 1 "Scan" tool can be used to monitor each parameter, watching for a period of time to see if there is any change in the readings that indicates intermittent operation.

The Tech 1 "Scan" tool can capture and store data when the problem occurs, so it can be played back at a slower rate to determine what happened to the system. This is called the "SNAPSHOT" mode.

The Tech 1 "Scan" tool is an easy way to compare the operating parameters of a poorly operating engine with those of a known good one. For example, a sensor may shift in value but not set a diagnostic code. Comparing the sensor's readings with those of a known good vehicle may uncover the problem.

The Tech 1 "Scan" tool saves time in diagnosis and helps to prevent the replacement of good parts. The key to using the Tech 1 "Scan" tool successfully is the technician's ability to understand the system being diagnosed, as well as understanding the Tech 1 "Scan" tool operation and limitations. The technician should read the Tech 1 operating manual to become familiar with the Tech 1 operation.

ADDITIONAL TECH 1 FUNCTIONS: "SNAPSHOT"

The Tech 1 tool has the ability to capture and store data parameters as they occur. This data can then be replayed and studied to help you locate current and intermittent problems.

"MISCELLANEOUS TESTS"

The Tech 1 "Scan" tool also has the ability to send signals to the electronic control module, instructing the electronic control module to perform various functions or tasks.

This provides a quick way to determine if a device is operational or not. Also included is a command to erase all stored diagnostic trouble codes from the electronic control module's memory.

Briefly stated, one of the Tech 1 menu selections is called "MISCELLANEOUS TESTS." After making that selection, other menu selections can be chosen. Each one is described below.

OUTPUT TESTS

- **Intake manifold heater relay "ON" and "OFF" control.** Recommend to observe "SYSTEM VOLTAGE" while commanding the manifold heater to cycle "ON" and "OFF." System voltage should decrease slightly when the manifold heater is "ON," due to large current draw.
- **Air conditioning compressor clutch control relay "ON" and "OFF" command** can be initiated. Listen for the compressor clutch engagement with the engine at idle and air conditioning controls in the "ON" position.
- **"Check Engine" lamp "ON" and "OFF" control.**
- **Evaporative Emissions storage canister solenoid "ON" and "OFF" control.** Recommended to operate engine until fully warm, then observe "CLOSED LOOP FUEL ADJUSTMENT" as "EVAP SOLENOID" is cycled "ON" and "OFF." Percentage of fuel adjustment (XX%) should quickly change as canister is purged of fuel vapors.

IDLE SYSTEM

- **Idle control:** To exercise the Idle air control motor, by changing the "desired idle speed" up or down. The idle air control valve should track this command, and engine speed should follow up or down if the idle air control valve is functioning properly.
- **Idle reset:** To reset the idle air control valve. Should cause the idle air control valve to fully extend to the zero (0) step, fully shut position, then retract to a known position.

OCTANE ADJUST

- This function instructs the electronic control module to "read, store, and use" the current value of the octane adjustment potentiometer input signal. This adjustment is usually set at the factory to allow using high octane fuel. An adjustment would be performed if the customer desires to use low octane fuel. When the Tech 1 is not commanding this function, the octane adjustment input signal from the

potentiometer is only used to determine if the circuit is good or faulty. Refer to CHART C-15, "Octane Adjustment," for further information.

CLEAR CODES

- This function will erase all stored diagnostic trouble codes from the electronic control module's memory, without the need to either disconnect the battery or remove power from the electronic control module.

CRANK TEST

This is a special test that monitors and records the engine cranking speed (revolutions per minute), battery voltage while cranking, and could be useful in diagnosing a "hard start" engine that might be due to low engine cranking speed.

TECH 1 "SCAN" TOOL LIMITATIONS

The Tech 1 "Scan" tool must receive the signal from the electronic control module in order to display any usable information. If the electronic control module sends no signals to the assembly line data link diagnostic connector, or the connection to the Tech 1 is defective, the Tech 1 "Scan" tool will only display, "NO DATA. RESELECT OR TURN "OFF" AND CHECK ASSEMBLY LINE DATA LINK CONNECTOR." The "DIAGNOSTIC CIRCUIT CHECK" instructs the mechanic what to do if this happens.

The Tech 1 "Scan" tool has a few limitations. If the Tech 1 "Scan" tool is displaying an electronic control module "output" function, it displays only the *command* given by the electronic control module. That does not mean that the desired action took place. This is similar to the dashboard gearshift indicator on a vehicle with an automatic transmission. Just because the gearshift pointer indicates the transmission is in "drive" gear does not mean that the transmission is actually in that gear. To be sure, you must check the linkage and adjustment at the transmission. When using the Tech 1 "Scan" tool to observe one of the electronic control module "output" functions, such as intake manifold heater, idle air control valve, or canister purge, the mechanic must not assume the *indicated* is the same as the *actual*. If the Tech 1 "Scan" tool is displaying manifold heater as being "ON," but the manifold heater relay is disconnected or defective, or if the heater element is burnt out, the electronic control module has no way of knowing it. The display may indicate the command is "ON," but the device may not be operating!

2-10 ENGINE MANAGEMENT SYSTEMS 1.7L THROTTLE BODY INJECTION

The Tech 1 "Scan" tool saves time in diagnosis and helps to prevent the replacement of good parts. *The key to using the "Scan" tool successfully for diagnosis is the technician's ability to understand the system being diagnosed, as well as an understanding of the Tech 1 "Scan" tool's limitations.*

The following information will describe all of the Tech 1 "Scan" tool mode F0 data list displays, and how they help in diagnosis.

With an understanding of the data the Tech 1 "Scan" tool displays, and knowledge of the circuits involved, the Tech 1 "Scan" tool is useful in getting information which is difficult or impossible to get with other methods.

The Tech 1 "Scan" tool does NOT make using diagnostic charts unnecessary, nor can it tell you exactly where a problem is in a circuit. Most diagnostic charts incorporate diagnosis procedures that require the use of a Tech 1 "Scan" tool.

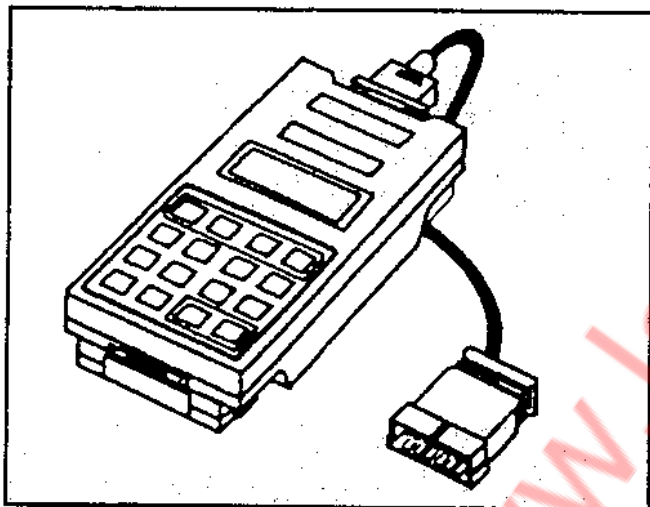


Figure 2.3-1 Tech 1 "Scan" Tool

DIAGNOSTIC MODES

The electronic control module and the Tech 1 tool have various modes for communicating information between themselves. The following describes system operation in the different modes.

DIAGNOSTIC DISPLAY MODE

1. Ignition "ON," engine not running.
2. Tech 1 in the "F1: Field Service" mode, but with the *engine not running*. (This can also be done without the Tech 1 by using a jumper wire to connect the assembly line data link connector terminals "A" and "B" together.)

When in the diagnostic display mode, these actions take place:

- "Check Engine" light flashes codes.
- Certain solenoids and relays are energized.
- Idle air control valve moves to its fully extended position, closing the idle air passage in the throttle body injection unit.
- Diagnostic trouble codes cannot be stored.

FIELD SERVICE MODE

Similar to "Diagnostic Display" mode, except with the *engine running*.

1. Engine running.
2. Tech 1 in the "F1: Field Service" mode. (This can also be done without the Tech 1 by using a jumper wire to connect the assembly line data link connector terminals "A" and "B" together.)

When in the "Field Service" mode, these actions take place:

- Electronic spark timing will be fixed at 10° before top dead center when engine revolutions per minute are less than 2,000.
- Idle air control valve will be commanded to a fixed position.
- In the "Field Service" mode, the "Check Engine" light will flash in a different manner. Refer to "Field Service" mode explanation on Page 2-6 for information about how the "Check Engine" light will flash in this mode.

TECH 1 "F0: DATA LIST" PARAMETERS

TECH 1 "F0: DATA LIST"

When the Tech 1 tool is connected and the F0 data list mode is selected, the data parameters are displayed in pairs.

The Tech 1 has preprogrammed data pairs. If custom data pairs are desired, any individual parameter can be paired with any other parameter. Refer to the Tech 1 owner's manual for further information about selecting customized data parameter pairs.

ENGINE SPEED

Displays the electronic control module's interpretation of actual engine revolutions per minute, as received from the crankshaft reference input signal.

Often useful to detect if extra reference pulses are suspected. A sudden high engine speed indication while at a steady throttle would indicate electrical interference in the crankshaft reference input signal circuit. This interference is usually caused by electronic control module wires too close to ignition secondary wires or an open crankshaft reference low Circuit 58 wire.

DESIRED IDLE

While the engine is idling the electronic control module is controlling idle speed. Desired idle is the closed throttle engine speed that is commanded by the electronic control module.

COOLANT TEMPERATURE

Displays the electronic control module's interpretation of coolant temperature in the engine. The coolant temperature sensor is mounted in the engine and is wired to the electronic control module. The electronic control module monitors the difference in voltage between two terminals, and then converts the voltage to a temperature shown in degrees Celsius. The reading should read close to the air temperature when the engine is cold, and rise as the coolant temperature rises. After engine is started the temperature should rise steadily to about 85°C-95°C then stabilize as the thermostat opens.

INTAKE AIR TEMPERATURE

Displays intake air temperature as interpreted by the electronic control module. The intake air temperature sensor is a thermistor and is mounted in the air cleaner.

THROTTLE POSITION

Displays the throttle position sensor signal input to the electronic control module. Values will be in voltage from which the electronic control module calculates the throttle opening.

The display is the electronic control module's interpretation of the throttle position sensor input voltage. With the throttle fully closed the voltage should be within 0.25-1.25 volts and go up to about 4.5 volts at wide open throttle.

THROTTLE ANGLE

Displays the electronic control module computed throttle angle as a function of the throttle position sensor input voltage (see above). 0% refers to a completely closed throttle while 100% is wide open.

MANIFOLD ABSOLUTE PRESSURE

Displays the electronic control module's interpretation of the intake manifold absolute pressure. Manifold absolute pressure sensor output voltage range is from zero to five volts, but the normal operating range is from about 0.30 to 4.90 volts. This value on the Tech 1 "Scan" tool cannot change until the engine is started, even though the actual manifold absolute pressure sensor output voltage can change. With the engine running, the voltage will be about 1-2 volts at idle. As engine load increases, this voltage also increases.

BAROMETRIC PRESSURE

This parameter represents calculated barometric air pressure, based on the signal from the absolute pressure sensor when the ignition is first switched "ON" before the engine starts. The electronic control module can update its baro pressure calculation when the engine is operating with the throttle nearly wide open at low engine speed. Because barometric air pressure depends on altitude, it may vary from 105 kPa (at or below sea level) to 60 kPa (4300 meters above sea level). On the Tech 1, the calculated barometric pressure is displayed.

OXYGEN SENSOR VOLTAGE

Displays oxygen sensor voltage in millivolts. When the sensor is cold this voltage will be close to 450 mV. As the sensor's electric heater begins to heat up the oxygen sensor, the voltage will fluctuate between 100-900 mV when the engine is running. If the engine isn't running but the ignition is "ON," the oxygen sensor voltage will slowly decrease to less than 200 mV.

EXHAUST GASES (RICH/LEAN)

This display will indicate if the electronic control module is interpreting a "rich" or "lean" exhaust signal from the oxygen sensor.

OXYGEN SENSOR READY (YES/NO)

This display will indicate whether or not the oxygen sensor is in the "ready" state. "Ready" can also be interpreted as "up to temperature."

"OPEN/CLOSED LOOP" FUEL CONTROL

Displays either "Open Loop" or "Closed Loop" depending on the state of the fuel control system. Time since start up, oxygen sensor ready status and coolant temperature all contribute to the change from "Open" to "Closed Loop."

"CLOSED LOOP" FUEL ADJUSTMENT

This will display corrections made to the fuel injector pulse width based on the rich/lean indication from the oxygen sensor signal. As with memory fuel adjustment, the scale will be -99% to +99%.

MEMORY FUEL ADJUSTMENT

Indicates what "state" the fuel correction is in. 0% is the middle with no fuel being reduced from or added to the injector pulse width calculations. If fuel is being added to the system the display will read between +1% and +99%. If fuel is being reduced the display will read between -1% and -99%.

MEMORY FUEL ADJUSTMENT CELL

This display will indicate which memory fuel cell is currently being used.

AIR FUEL RATIO

The amount of air compared to the amount of fuel in the air-fuel mixture commanded by the electronic control module. See "Stoichiometric Ratio" in glossary.

POWER ENRICHMENT MODE ACTIVE? (YES/NO)

The display will indicate whether or not the fuel control system is in the power enrichment mode.

DECEL FUEL CUT MODE IN EFFECT? (YES/NO)

Display indicates when decel fuel cut off mode is in effect.

EVAPORATIVE EMISSION CANISTER PURGE CYCLE

Displays the pulse width modulation command (0-100%) of the canister purge solenoid.

FUEL INJECTOR PULSE WIDTH

The injector pulse width is the length of time (in milliseconds) the electronic control module is commanding the fuel injector on. Injector "ON" time is how electronic fuel injection systems control fuel mixture (air/fuel ratio). A longer "ON" time yields more fuel delivered, and a richer mixture.

SPARK ADVANCE

Displays the final total spark advance delivered to the spark plug.

OCTANE ADJUST

This will display the voltage that the electronic control module is interpreting from the octane adjust potentiometer. This also displays the value of ignition timing retard as it relates to the voltage mentioned above.

IDLE AIR CONTROL POSITION (0-255)

Displays the numbers that indicate what position the electronic control module has commanded the idle air control valve to be at. The electronic control module moves the idle air control in steps and these steps are what is displayed on the Tech 1 "Scan" tool. The number of "steps" or "counts" indicate how far open or shut the idle air passageway in the throttle body is. Larger numbers mean a larger opening in the idle air passageway, and a higher idle speed should occur. After the engine starts, the numbers should decrease as the engine warms to normal operating temperature. With the engine idling in "neutral" and the air conditioning not "ON," the numbers should be between 5 and 50 steps. Anything that makes the engine work harder at idle will cause this number to increase. Remember, this position shows the electronic control module command. There is no way to verify that the actual idle air control position is equal to the command.

VEHICLE SPEED

Displays the electronic control module's interpretation of vehicle speed, as received from the vehicle speed sensor. If this position indicates no vehicle speed (zero), but the speedometer shows otherwise, then a Code 24 will eventually set. Also useful in checking speedometer accuracy.

RADIATOR FAN

This will display "NOT USED" on NIVA vehicles.

INTAKE MANIFOLD HEATER ("ON/OFF") RELAY

This will display the ("ON/OFF") status of the electronic control module control of this output.

SYSTEM VOLTAGE

This will display the voltage of the battery, as interpreted by the electronic control module from the terminal which is connected to "Switched + 12V" from the ignition switch.

AIR CONDITIONING REQUEST (YES/NO)

Displays when the operator has requested air conditioning. The display is the electronic control module's interpretation of the air conditioning request input signal to the electronic control module. The display will show "YES" if the electronic control module has 12 volts on this terminal, indicating that the electronic control module has been requested to turn "ON" the air conditioning compressor clutch. The display will show "NO" if the request signal is not received. The signal is a 12 volt signal from the air conditioning control switches.

Before the signal is received at the electronic control module, it must pass through the air conditioning high-side high-pressure switch, and the air conditioning cycling switch. If the switches are open the Tech 1 will display "NO" even though the air conditioning request switch is closed.

AIR CONDITIONING ("ON/OFF") CLUTCH

The display will show the electronic control module's command to the air conditioning compressor control relay. It will show "ON" if the electronic control module has commanded the relay to operate the compressor, and "OFF" if the electronic control module has not commanded the relay to operate the compressor. Remember that the electronic control module command to the control relay is just that, a command. Do not assume that the compressor is running just because the command says "ON."

FUEL PUMP CIRCUIT ("ON/OFF")

Indicates whether or not the fuel pump circuit is energized. This is a valuable display when diagnosing a suspected fuel pump circuit failure.

CALIBRATION IDENTIFICATION

The programmable read only memory is located inside the electronic control module and has information on the vehicle's weight, engine transmission, axle ratio and other items specific to each vehicle. This identification is used to determine if the engine calibrator is the correct one for a particular vehicle.

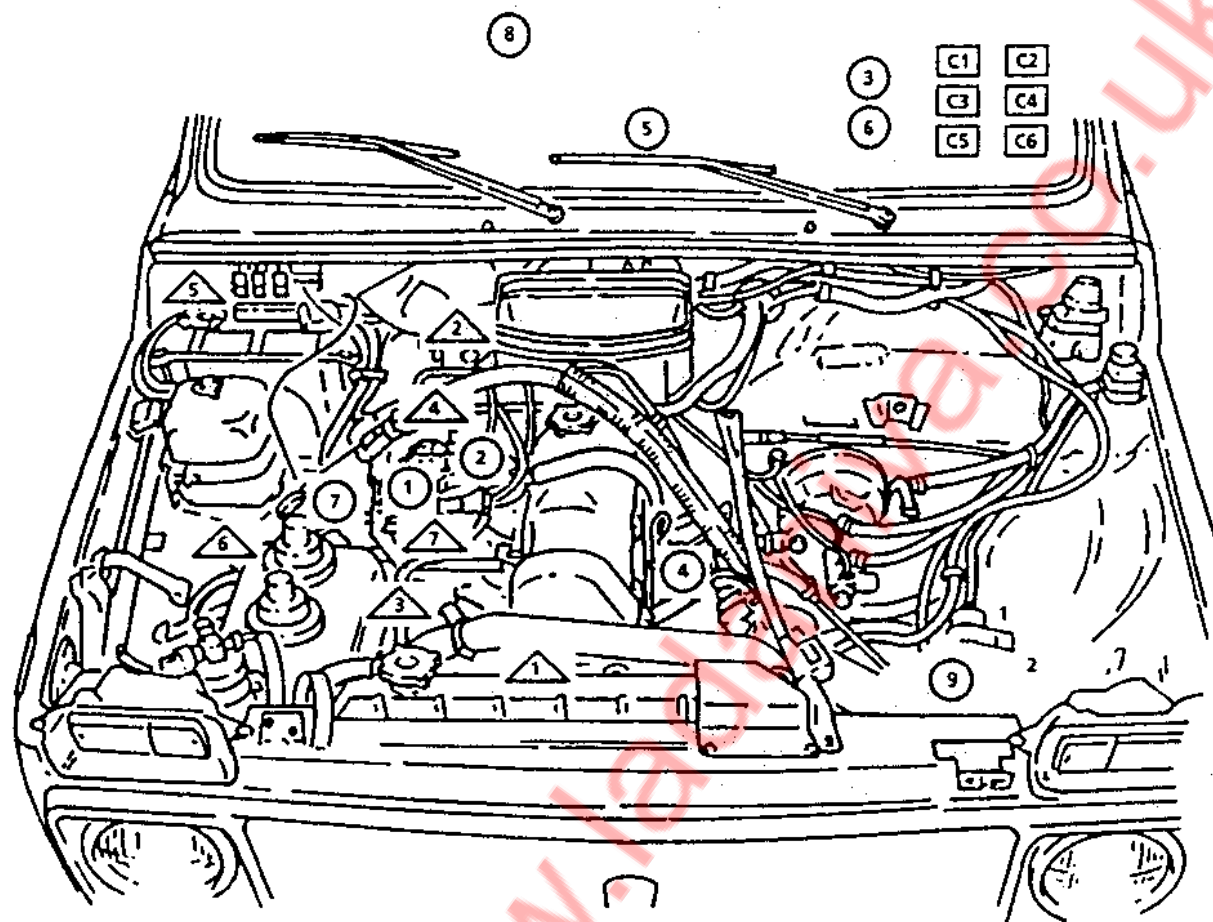
TIME FROM START

Time from start is available and is a measure of how long the engine has been running. If the engine stops, time from start will reset to 0:00:00.

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2.4 UNDERHOOD LOCATION VIEW

1.7L THROTTLE BODY INJECTION



□ COMPUTER HARNESS

- C1 Electronic Control Module
- C2 Assembly Line Data Link*
- C3 Fuse/Relay Block*
- C4 Cross Car Harness Connector*
- C5 Fuel Pump to Electronic Control Module Connector*
- C6 Maxi-Fuse*

MISCELLANEOUS

- 1 Fuel Filter
- 2 Fuel Pressure Tap*

○ CONTROLLED DEVICES

- 1 Fuel Injector
- 2 Idle Air Control Valve
- 3 Fuel Pump Relay*
- 4 Ignition System Coils
- 5 Check Engine Light
- 6 Intake Manifold Heater Relay
- 7 Intake Manifold Heater (Under Throttle Body Injection Unit)
- 8 Fuel Pump (Under Access Panel in Storage Area)
- 9 Evaporative Emission Canister (mounted inside of the Engine Compartment near the radiator)

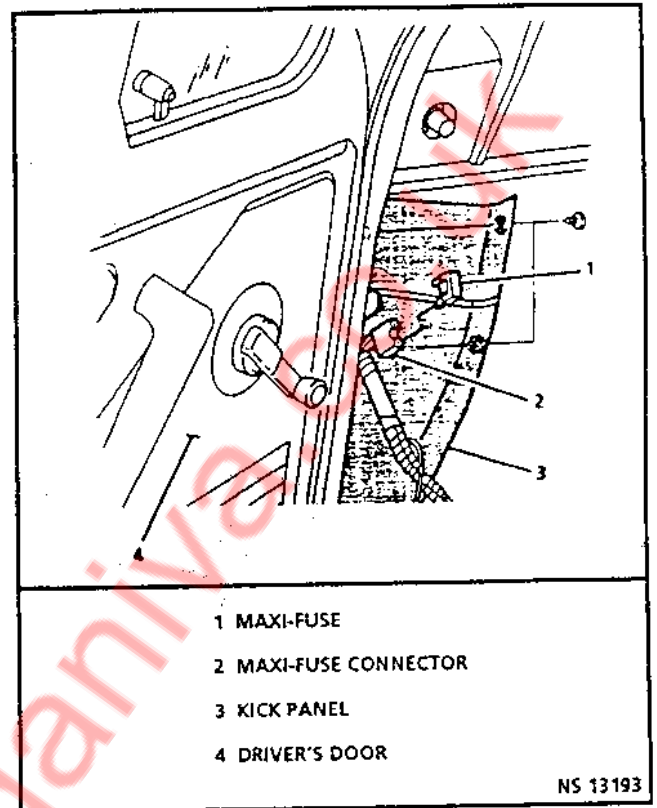
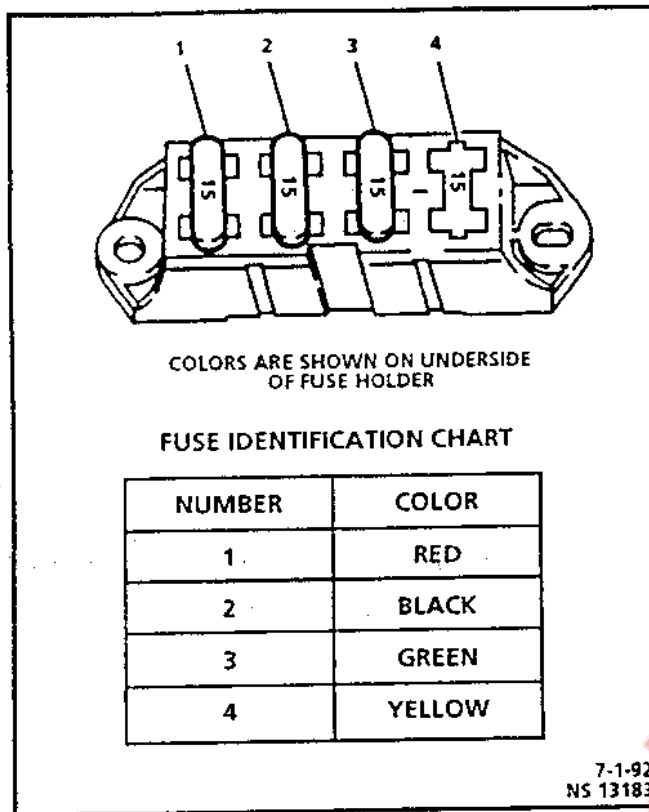
△ INFORMATION SENSORS

- 1 Crankshaft Position Sensor (Front of Engine, near end of Crankshaft)
- 2 Manifold Absolute Pressure Sensor
- 3 Coolant Temperature Sensor
- 4 Throttle Position Sensor
- 5 Octane Adjust Potentiometer
- 6 Oxygen Sensor (mounted in Exhaust Manifold below Throttle Body Injection Unit)
- 7 Intake Air Temperature Sensor (mounted in Air Cleaner - not shown)
- 8 Vehicle Speed Sensor (mounted under Vehicle to Transmission - not shown)

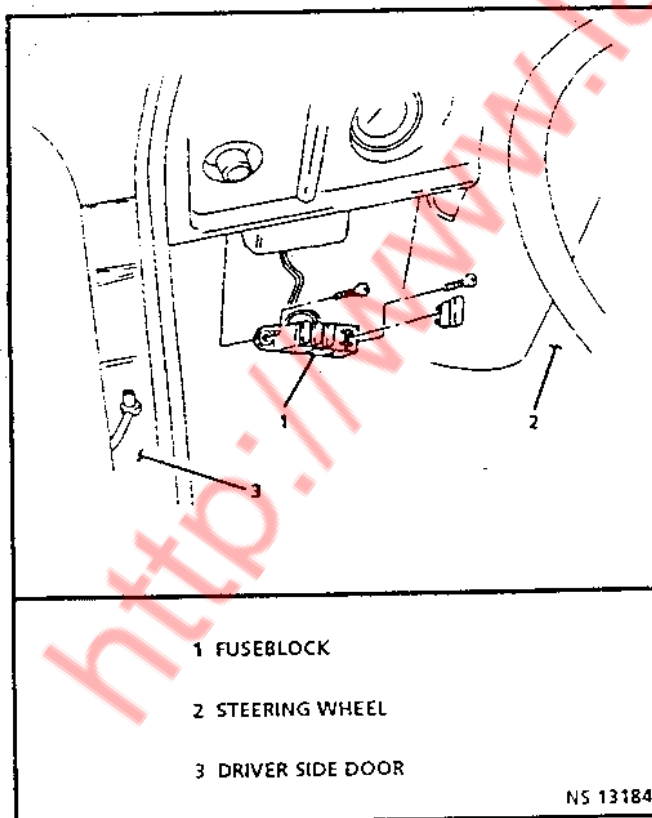
* Actual location may vary.

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2.5 FUSEBLOCK VIEWS

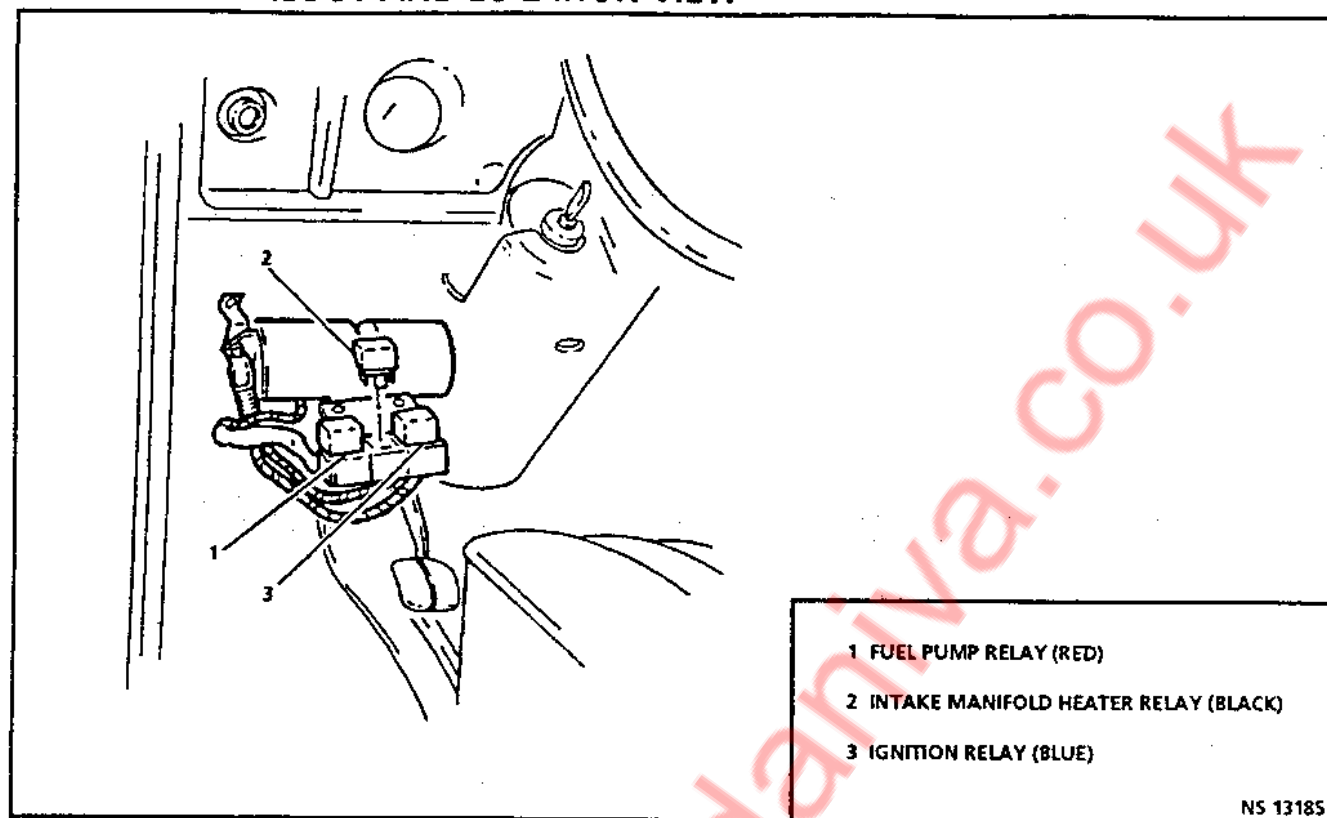


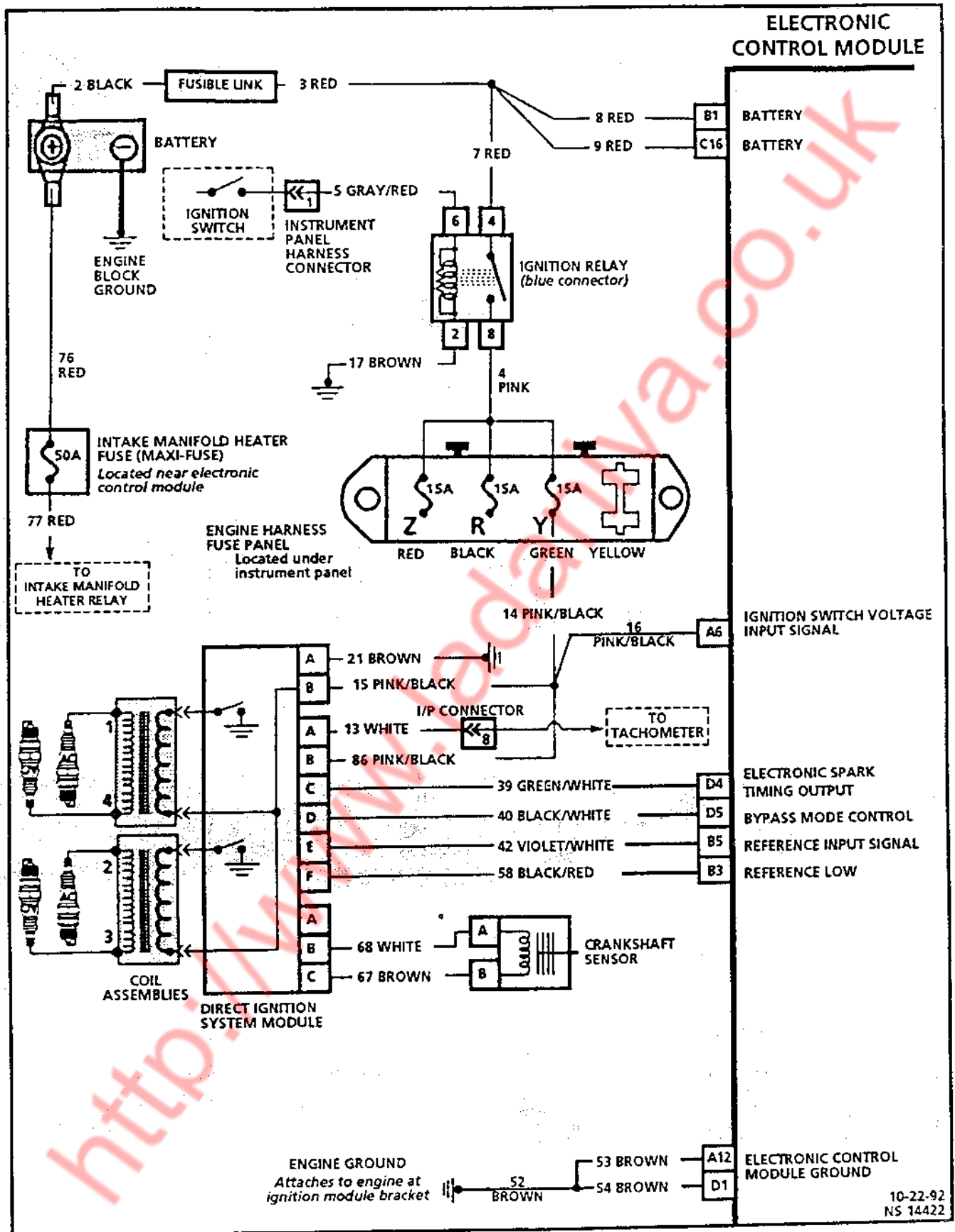
Maxi-Fuse Location View



Fuse Block Location View

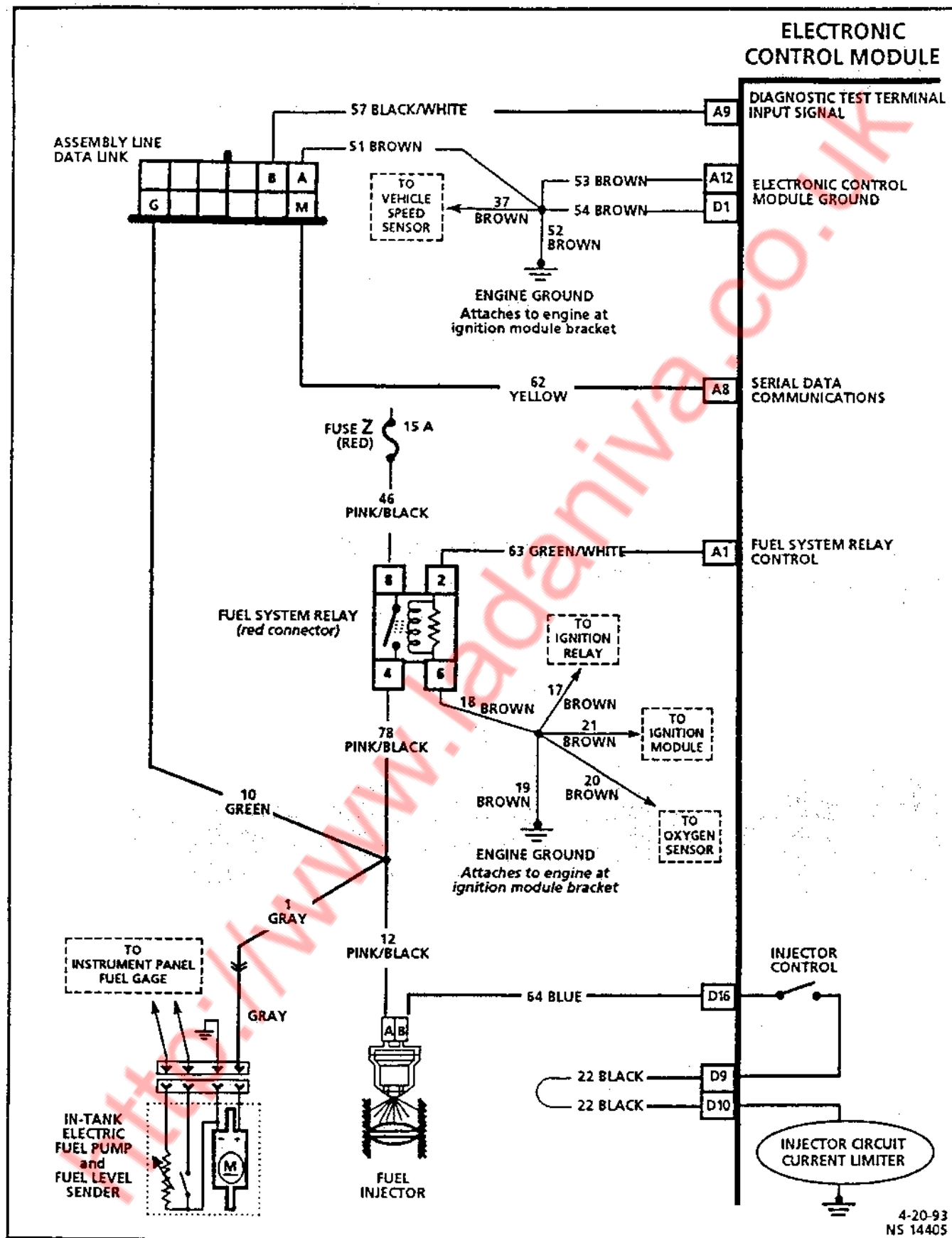
2.6 RELAY CALLOUT AND LOCATION VIEW



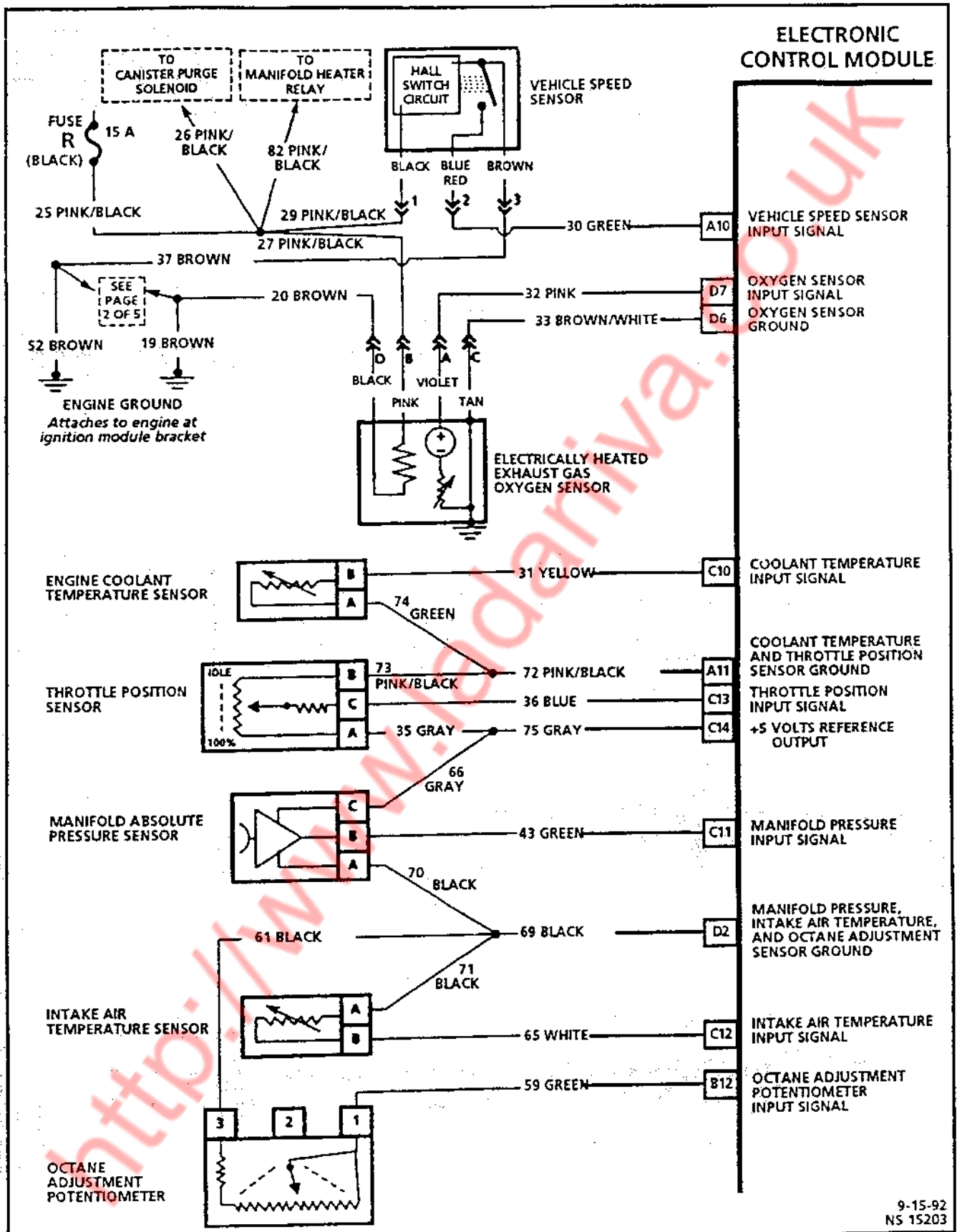


Engine Management System Wiring Diagram 1.7L Throttle Body Injection NIVA (1 of 5)

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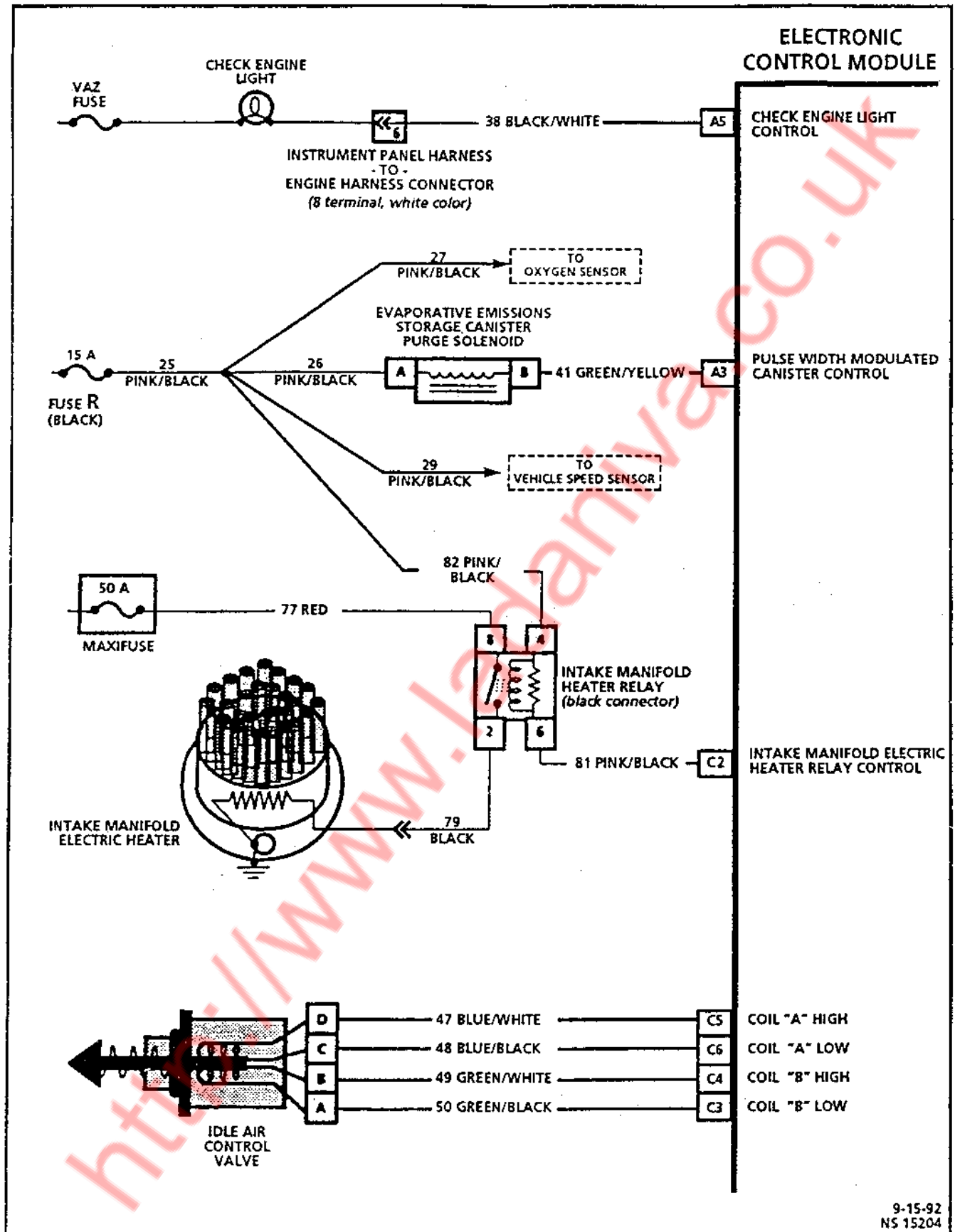
Engine Management System Wiring Diagram 1.7L Throttle Body Injection NIVA (2 of 5)



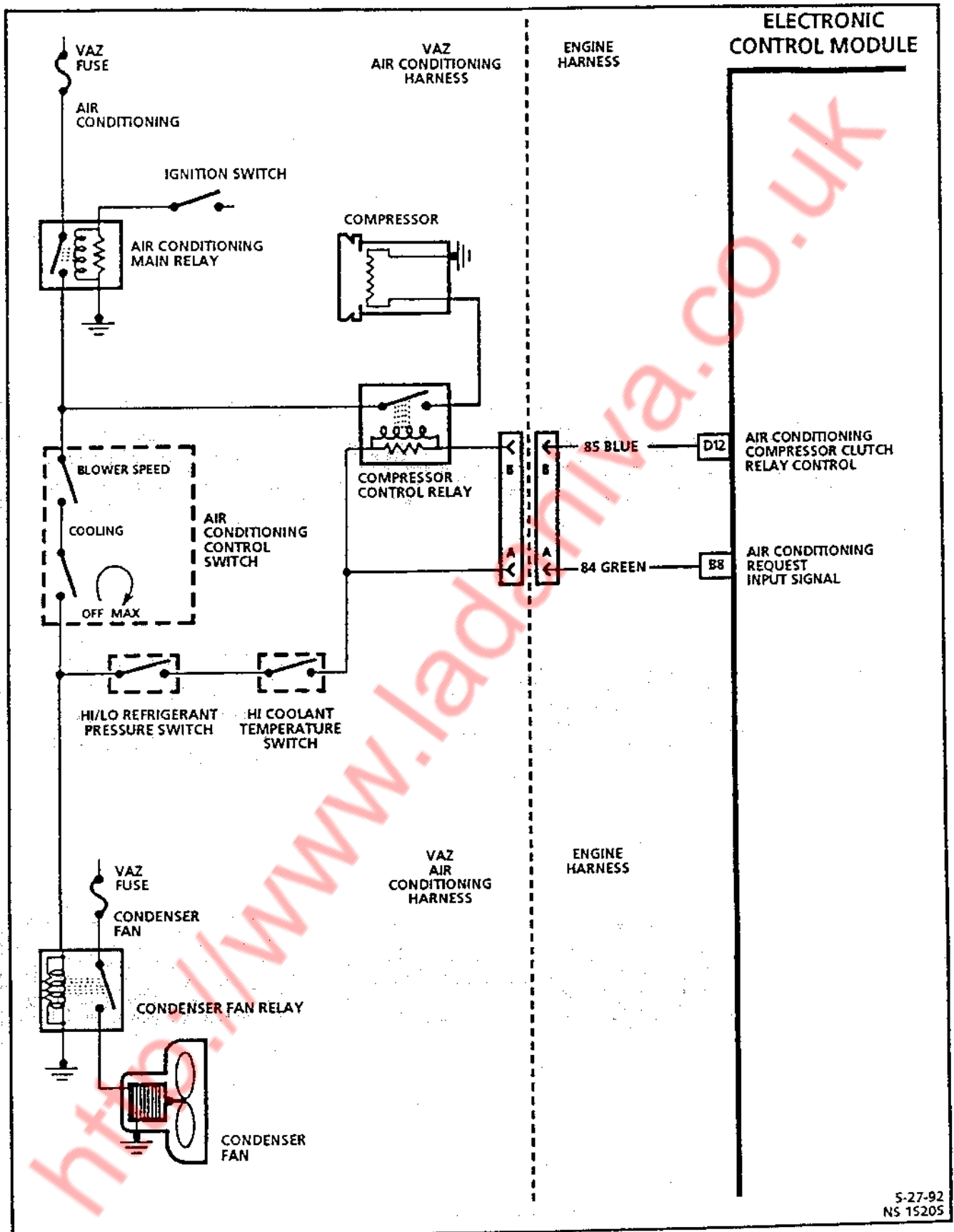
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Engine Management System Wiring Diagram 1.7L Throttle Body Injection NIVA (3 of 5)

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Engine Management System Wiring Diagram 1.7L Throttle Body Injection (4 of 5)



Engine Management System Wiring Diagram 1.7L Throttle Body Injection NIVA (5 of 5)

2.7 ELECTRONIC CONTROL MODULE CONNECTOR IDENTIFICATION CHARTS

TBI ELECTRONIC CONTROL MODULE CONNECTOR IDENTIFICATION

This electronic control module voltage chart is for use with a digital voltmeter to further aid in diagnosis. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING

- Engine at operating temperature
- Engine idling (For "Engine Run" column)
- Diagnostic "test" terminal not grounded
- Tech 1 "Scan" tool not installed
- Air conditioning "OFF"
- Digital voltmeter "-" (negative) lead connected to a good clean ground point.

DC VOLTAGE

IGN "ON"	ENG. RUN	CIRCUIT	PIN	WIRE COLOR
0**	B+	FUEL SYSTEM RELAY CONTROL	A1	GREEN/ WHITE
		NO CONNECTION	A2	
B+	VARIES ⑧	PULSE WIDTH MODULATED CANISTER CONTROL	A3	GREEN/ YELLOW
		NO CONNECTION	A4	
0*	B+	CHECK ENGINE LIGHT CONTROL	A5	BLACK/ WHITE
B+	B+	IGNITION SWITCH VOLTAGE INPUT SIGNAL	A6	PINK/ BLACK
		NO CONNECTION	A7	
2-5 VARYING	2-5 VARYING	SERIAL DATA COMMUNICATIONS	A8	ORANGE
5	5	DIAGNOSTIC "TEST" TERMINAL INPUT SIGNAL	A9	BLACK/ WHITE
VARIES	VARIES	VEHICLE SPEED INPUT SIGNAL	A10	GREEN
0**	0**	COOLANT TEMPERATURE SENSOR & THROTTLE POSITION SENSOR GROUND	A11	PINK/ BLACK
0**	0**	ELECTRONIC CONTROL MODULE GROUND	A12	BROWN

24-PIN A-B CONNECTOR



BACK VIEW OF CONNECTOR

- 1 Battery voltage for first two seconds, after ignition is turned "ON" without cranking the engine.
 - 2 When vehicle is stopped, voltage will be either less than 1 volt or more than 10 volts; depending upon position of drive wheels. When vehicle is moving, voltage will vary depending upon vehicle speed.
 - 3 Varies with temperature.
 - 4 Varies. With ignition "ON," reads barometric pressure. With engine running, reads engine load.
 - 5 Voltage will vary with engine revolutions per minute.
 - 6 Depending on octane adjustment potentiometer trim.
 - 7 Battery voltage (B +) with engine warm. Less than 0.5 volts on cold engine.
 - 8 Varies between battery voltage down to less than 1 volt, depending on 0%-100% duty cycle of pulse width modulated control signal.
- * Less than 0.50 volt.
** Less than 0.10 volt.
B + Should equal battery voltage

DC VOLTAGE

IGN "ON"	ENG. RUN	CIRCUIT	PIN	WIRE COLOR
B+	B+	BATTERY + (POWER SUPPLY)	B1	RED
		NO CONNECTION	B2	
0**	0**	CRANKSHAFT REFERENCE LOW	B3	BLACK/ RED
		NO CONNECTION	B4	
0*	⑤	CRANKSHAFT REFERENCE INPUT SIGNAL	B5	PURPLE/ WHITE
		NO CONNECTION	B6	
		NO CONNECTION	B7	
0*	0*	AIR CONDITIONING REQUEST INPUT SIGNAL	B8	GREEN
0*	B+	NO CONNECTION	B9	
		NO CONNECTION	B10	
		NO CONNECTION	B11	
⑥ 1-5 VOLT	1-5 VOLT	OCTANE ADJUSTMENT INPUT SIGNAL	B12	GREEN

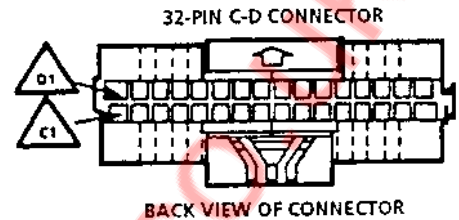
ENGINE 1.7L Throttle Body
Injection/NIVA

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Figure 2.7-1 ECM Connector Terminal End View 1.7L Throttle Body Injection NIVA (1 of 2)

DC VOLTAGE

IGN "ON"	ENG. RUN	CIRCUIT	PIN	WIRE COLOR
		NO CONNECTION	C1	
B+	B+	INTAKE MANIFOLD ELECTRIC HEATER RELAY CONTROL	C2	PINK/ BLACK
NOT	USEABLE	IDLE AIR CONTROL COIL "B" LOW	C3	GREEN BLACK
NOT	USEABLE	IDLE AIR CONTROL COIL "B" HIGH	C4	GREEN/ WHITE
NOT	USEABLE	IDLE AIR CONTROL COIL "A" LOW	C5	BLUE/ BLACK
NOT	USEABLE	IDLE AIR CONTROL COIL "A" HIGH	C6	BLUE/ WHITE
		NO CONNECTION	C7	
		NO CONNECTION	C8	
		NO CONNECTION	C9	
③ 1-2	1-2	COOLANT TEMPERATURE INPUT SIGNAL	C10	YELLOW
④ 3.5 - 5.0	0.9 - 1.5	MANIFOLD ABSOLUTE PRESSURE INPUT SIGNAL	C11	GREEN
③		INTAKE AIR TEMPERATURE INPUT SIGNAL	C12	WHITE
3 - 7	.3 - .7	THROTTLE POSITION INPUT SIGNAL	C13	BLUE
5	5	+5 VOLT REFERENCE OUTPUT	C14	GRAY
		NO CONNECTION	C15	
B+	B+	BATTERY +	C16	RED



- 1 Battery voltage for first two seconds, after ignition is turned "ON" without cranking the engine.
 - 2 When vehicle is stopped, voltage will be either less than 1 volt or more than 10 volts; depending upon position of drive wheels. When vehicle is moving, voltage will vary depending upon vehicle speed.
 - 3 Varies with temperature.
 - 4 Varies. With ignition "ON," reads barometric pressure. With engine running, reads engine load.
 - 5 Voltage will vary with engine revolutions per minute.
 - 6 Depending on octane adjustment potentiometer trim.
 - 7 Battery voltage (B +) with engine warm. Less than 0.5 volts on cold engine.
 - 8 Varies between battery voltage down to less than 1 volt, depending on 0%-100% duty cycle of pulse width modulated control signal.
- * Less than 0.50 volt.
** Less than 0.10 volt.
B + Should equal battery voltage

DC VOLTAGE

IGN "ON"	ENG. RUN	CIRCUIT	PIN	WIRE COLOR
0**	0**	ELECTRONIC CONTROL MODULE GROUND	D1	BROWN
0**	0**	OCTANE ADJUST POTENTIOMETER, MANIFOLD ABSOLUTE PRESSURE SENSOR, AND INTAKE AIR TEMPERATURE SENSOR GROUND	D2	BLACK
		NO CONNECTION	D3	
0*	1.2	ELECTRONIC SPARK TIMING OUTPUT	D4	GREEN/ WHITE
0	4.6	IGNITION MODULE BYPASS MODE CONTROL	D5	BLACK/ WHITE
0**	0*	OXYGEN SENSOR GROUND	D6	BROWN
0.1-0.2	VARIES	OXYGEN SENSOR INPUT SIGNAL	D7	PINK
		NO CONNECTION	D8	
0**	0**	INJECTOR CIRCUIT CURRENT LIMITER JUMPER	D9	BLACK
0**	0**	INJECTOR CIRCUIT CURRENT LIMITER JUMPER	D10	BLACK
		NO CONNECTION	D11	
0*	B+ A/C "OFF", 0* A/C "ON"	AIR CONDITIONING COMPRESSOR CLUTCH RELAY CONTROL	D12	BLUE
		NO CONNECTION	D13	
		NO CONNECTION	D14	
		NO CONNECTION	D15	
B+	B+	INJECTOR CONTROL	D16	BLUE

ENGINE 1.7L Throttle Body
Injection/NIVA

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Figure 2.7-2 ECM Connector Terminal End View 1.7L Throttle Body Injection NIVA (2 of 2)

2.8 ELECTRONIC CONTROL MODULE TERMINALS DEFINED

ELECTRONIC CONTROL MODULE
CONNECTOR VOLTAGES WITH EXPLANATIONS

- A1 FUEL SYSTEM RELAY CONTROL** - Turning the ignition "ON" signals the electronic control module to energize (+12V) the fuel system relay. If no crankshaft reference input pulses are received, the electronic control module turns "OFF" the relay. When the electronic control module receives crankshaft reference input (terminal "B5") the electronic control module turns the fuel pump relay back "ON."
- A2 NO CONNECTION**
- A3 PULSE WIDTH MODULATED CANISTER CONTROL** - The electronic control module supplies the ground circuit to energize the evaporative emission storage canister control solenoid. With the engine stopped this terminals should equal the battery voltage. With the engine running, the voltage will be between battery voltage and zero. The voltage level will depend on the 0%-100% pulse width modulated control signal sent to the canister solenoid.
- A4 NO CONNECTION**
- A5 CHECK ENGINE LIGHT CONTROL** - The electronic control module supplies the ground to turn the "Check Engine" light "ON". With the ignition "ON" and the engine not running, the "Check Engine" light should be "ON," terminal "A5" voltage is close to zero. With the "Check Engine" light not "ON," the voltage at terminal "A5" is battery voltage.
- A6 IGNITION SWITCH VOLTAGE INPUT SIGNAL** - This is the "turn on" signal to the electronic control module from the ignition switch circuit. It is *not* the "power supply" to the electronic control module; it signals the electronic control module the ignition is "ON." The voltage equals battery voltage when the ignition switch is in either the 'run' or 'crank' position.
- A7 NO CONNECTION**
- A8 SERIAL DATA COMMUNICATIONS** - From terminal "A8" the electronic control module sends out information (data) about its inputs and outputs to the assembly line data link terminal "M". This data is sent as a string of rapidly changing voltage signals pulsed from high (+5 volts) to low (0 volts). The Tech 1 "Scan" tool, when connected, interprets the varying square-wave signal and displays the data. The data is sent in a serial fashion; that is, one piece after the other until all the information has been sent—then the process begins again. Voltage, when measured with a digital voltmeter, will rapidly change between 1 and 5 volts.
- A9 DIAGNOSTIC "TEST" TERMINAL INPUT SIGNAL** - This terminal is connected to the assembly line data link diagnostic "test" terminal "B". When the diagnostic "test" terminal is not grounded, this terminal will have 5 volts on it. When the assembly line data link diagnostic "test" terminal is grounded, the resulting zero voltage at the electronic control module causes it to operate in the Diagnostic Mode or the Field Service Mode, depending if the engine is stopped or running.
- A10 VEHICLE SPEED INPUT SIGNAL** - The electronic control module sends a +12V signal voltage to the vehicle speed sensor. The vehicle speed sensor pulses the signal to ground, these pulses vary in frequency with the speed of the car.
- A11 COOLANT TEMPERATURE AND THROTTLE POSITION SENSOR GROUND** - This terminal should be nearly zero volts. It is connected through the electronic control module circuitry to engine ground.
- A12 ELECTRONIC CONTROL MODULE GROUND** - This terminal has nearly zero volts. It is connected directly to the engine at the direct ignition system mounting bracket.

- B1 BATTERY + (Power Supply)** - This terminal "B1" supplies the electronic control module with full-time +12 volts. It is hot even when the ignition is turned "OFF." It receives voltage through the fusible link. This electronic control module terminal could be called the power supply and "MEMORY" terminal, along with terminal "C16".
- B2 NO CONNECTION**
- B3 CRANKSHAFT REFERENCE LOW** - This terminal is always nearly zero volts. It is connected through the ignition module to engine ground.
- B4 NO CONNECTION**
- B5 CRANKSHAFT REFERENCE INPUT SIGNAL** - This terminal could be called the "tach" input. It provides the electronic control module with revolutions per minute and crankshaft position information. With ignition "ON," but the engine not running, the voltage is less than 1 volt. As the crankshaft turns, the voltage increases with revolutions per minute.
- B6 NO CONNECTION**
- B7 NO CONNECTION**
- B8 AIR CONDITIONING REQUEST INPUT SIGNAL** - When the instrument panel air conditioning switch is "OFF," the voltage at this terminal is near zero. When the switch is "ON," a +12 volt signal is sent to the electronic control module.
- B9 NO CONNECTION**
- B10 NO CONNECTION**
- B11 NO CONNECTION**
- B12 OCTANE ADJUSTMENT INPUT SIGNAL** - The octane adjust potentiometer output voltage, which depends on the potentiometer voltage adjustment, is variable from 1-5 volts. By monitoring this output voltage, the electronic control module makes small changes in the total spark advance to allow for low octane fuel.
- C1 NO CONNECTION**
- C2 INTAKE MANIFOLD ELECTRIC HEATER RELAY CONTROL** - This terminal has battery voltage until the electronic control module energizes the relay by supplying the ground, then the voltage is close to zero. The input that causes the electronic control module to energize the relay is C10 - COOLANT TEMPERATURE SENSOR. The electronic control module also energizes the relay in the Diagnostic Mode - ignition "ON," the engine not running with the assembly line data link diagnostic "test" terminal "B" jumpered to "A".
- C3, C4, C5, C6 IDLE AIR CONTROL COILS** - These terminals are connected to the idle air control valve, located on the throttle body. It is difficult to predict what the voltage will be, and the measurement is not usable for service procedures.
- C7 NO CONNECTION**
- C8 NO CONNECTION**
- C9 NO CONNECTION**
- C10 COOLANT TEMPERATURE INPUT SIGNAL** - The electronic control module sends a 5 volt signal to the coolant temperature sensor—a temperature-variable-resistor, called a thermistor. The sensor, also connected to ground, varies the voltage based on engine coolant temperature. As the engine coolant temperature increases, the voltage on terminal "C10" decreases. At 0°C engine coolant temperature, the voltage is above 4 volts. At normal operating temperature (85°C to 100°C) the voltage is less than 2 volts.

C11 MANIFOLD ABSOLUTE PRESSURE INPUT SIGNAL

The voltage on terminal "C11" varies with intake manifold pressure. The sensor monitors intake manifold pressure by a small hose connected to the sensor from the throttle body. With the ignition "ON" and the engine not running (high manifold pressure) the voltage is above 4 volts. This is the barometric pressure measurement, and this voltage changes with both barometric pressure and altitude. When the engine is running at idle, the manifold pressure is quite low due to engine vacuum; therefore, the voltage is also low -1 to 2 volts. The voltage is variable, mostly from engine intake manifold pressure changes, but it can change with barometric pressure or altitude changes. This is typically called the "engine load" input.

C12 INTAKE AIR TEMPERATURE INPUT SIGNAL

The electronic control module sends a 5 volt signal to the air temperature sensor—a temperature-variable-resistor, called a thermistor. The sensor, also connected to ground, varies the voltage based on intake air temperature. As the intake air temperature increases, the voltage on terminal "C12" decreases. At 0°C intake air temperature, the voltage is above 4 volts. At normal operating temperature (85°C to 100°C) the voltage is less than 2 volts.

C13 THROTTLE POSITION INPUT SIGNAL

The throttle position sensor input voltage, which follows actual throttle changes, is variable from 0 to 5 volts. Typically the voltage is less than 1 volt at idle, and 4 to 5 volts at wide-open throttle.

C14 + 5 VOLTS REFERENCE - This voltage is always nearly 5 volts with the ignition "ON." It is a regulated voltage output from the electronic control module, and supplies 5 volts to the manifold absolute pressure and throttle position sensors.

C15 NO CONNECTION

C16 BATTERY + (POWER SUPPLY) - See terminal "B1".

D1 ELECTRONIC CONTROL MODULE GROUND - This terminal has nearly zero volts, it is connected directly to the engine at the direct ignition system mounting bracket.

D2 OCTANE ADJUST, MANIFOLD ABSOLUTE PRESSURE, AND INTAKE AIR TEMPERATURE SENSOR GROUND - This terminal is nearly zero volts, it is connected through the electronic control module to engine ground.

D4 ELECTRONIC SPARK TIMING OUTPUT - This terminal has very low voltage with the ignition "ON," but the engine not running. With the engine running at idle, the voltage is slightly more than 1 volt. As the engine revolutions per minute goes up, this voltage increases.

D5 IGNITION MODULE BYPASS MODE CONTROL - With ignition "ON" and the engine not running this terminal has very low voltage. When the electronic control module measures more than 500 revolutions per minute (engine "RUN" threshold) on B5 - CRANKSHAFT REFERENCE INPUT SIGNAL, the electronic control module turns on 5 volts to D5 - IGNITION MODULE BYPASS MODE CONTROL CIRCUIT.

D6 OXYGEN SENSOR GROUND CIRCUIT - This terminal should have zero volts. It is connected directly to the engine block at the ignition module bracket. This terminal grounds the electronic control module circuitry for the oxygen sensor voltage monitor inside the electronic control module.

D7 OXYGEN SENSOR INPUT SIGNAL- With ignition "ON" and engine not running, the voltage should drop from a starting point of approximately 0.450 volt to less than 0.200 volts. The oxygen sensor is electrically heated. When the engine is not running and the sensor is hot an abundance of oxygen in the exhaust manifold will be sensed and the sensor's output voltage would be less than 0.200 volts. If the sensor's electric heater is malfunctioning, the only voltage seen here with the engine stopped would be the "reference" voltage coming from the electronic control module. This reference voltage is a steady 400-500 mV (0.400-0.500 volt). With the engine running and after the oxygen sensor is hot, the voltage should be rapidly changing, somewhere between 10-1000 millivolts (0.010-1.00 volts).

D8 NO CONNECTION

D9, D10

INJECTOR CIRCUIT, CURRENT LIMITER JUMPER - The electronic control module's injector control circuit uses this jumper to complete its path to ground through an internal current limiter. If this jumper circuit is open or missing, the vehicle will not start. If the circuit is shorted to ground the vehicle may run, but with reduced performance and poor driveability and would eventually cause the fuel injector to not operate.

D11 NO CONNECTION

D12 AIR CONDITIONING COMPRESSOR CLUTCH RELAY CONTROL - The electronic control module supplies the ground path on this terminal to energize the air conditioning compressor clutch control relay. The voltage is less than 1 volt when the electronic control module energizes the relay, but the voltage is also less than 1 volt if the electronic control module does not receive the "Air Conditioning Request" input voltage at terminal "B8".

D13 NO CONNECTION

D14 NO CONNECTION

D15 NO CONNECTION

D16 FUEL INJECTOR CONTROL - The voltage at this terminal comes through the injector which is connected to +12 volts. With the ignition "ON," and the engine not running, the voltage is equal to battery voltage. With the engine at idle, the charging system increases this battery voltage slightly. With higher engine revolutions per minute or more engine load, the increased injector pulse frequency and injector pulse width causes the voltage to be slightly less than at idle.

BLANK

SECTION 2.9A

DIAGNOSTIC CHARTS

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2.9 DIAGNOSTIC CHARTS DEFINED

INTRODUCTION

The diagnostic charts are designed to provide fast and efficient fault location for the fuel system, electronic spark timing system and all other engine functions associated with the electronic control module. Each diagnostic chart uses 2 pages; a "trouble tree chart" on the right side page, and a "facing page" on the left side page. The left side "facing page" contains pertinent information, including malfunction code setting parameters and circuit diagrams. The trouble tree boxes with circled numbers are explained by the corresponding numbered paragraph on the left side facing page.

It is essential that the charts be used correctly. *When diagnosing any problem, ALWAYS BEGIN WITH THE DIAGNOSTIC CIRCUIT CHECK!* The Diagnostic Circuit Check will lead you into the other charts. **DO NOT GO DIRECTLY TO A SPECIFIC CHART** or false diagnosis and replacement of "good" parts could result.

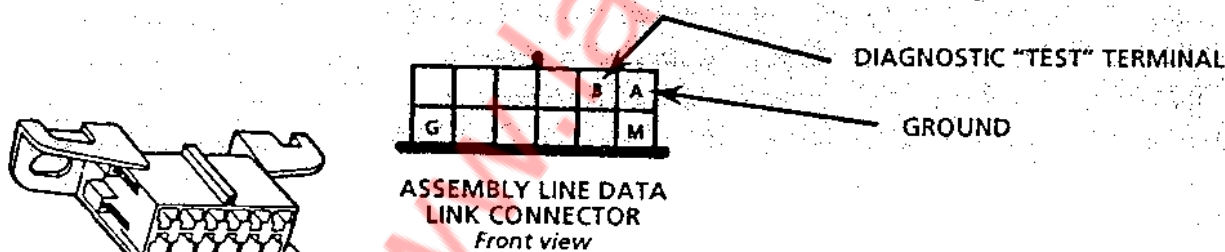
After a fault is corrected and all codes have been cleared, it is advisable to repeat the Diagnostic Circuit Check to ensure that proper repairs have been made.

When the electronic control module is operating in the DIAGNOSTIC MODE, the "Check Engine" light will flash stored malfunction codes.

Each code displayed consists of a number of flashes representing the first digit followed by a short pause, then a number of flashes representing the second digit, followed by a longer pause indicating the end of the code.

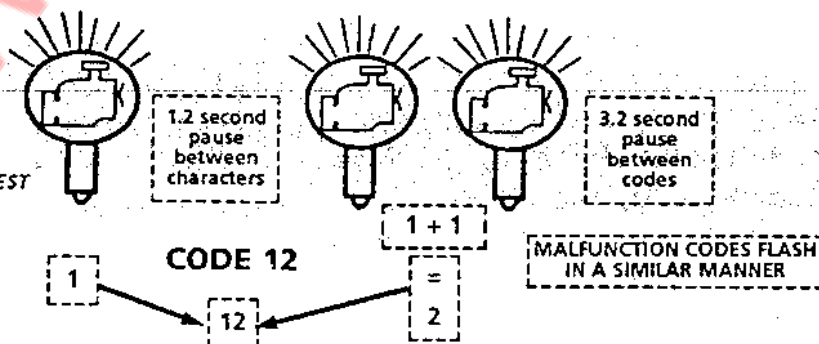
Each stored code is displayed three times before proceeding to the next code. After all codes stored in memory have been displayed, the entire flashing sequence is repeated.

Assembly Line Data Link Connector is located above the Electronic Control Module, which is mounted behind the left front kick panel.



DIAGNOSTIC DISPLAY MODE:

- IGNITION ON
- ENGINE NOT RUNNING
- ASSEMBLY LINE DATA LINK 'DIAGNOSTIC TEST TERMINAL' GROUNDED



"CHECK ENGINE" LIGHT FLASHES CODE 12 TO INDICATE ELECTRONIC CONTROL MODULE SELF-DIAGNOSTIC ABILITY IS OK.
IF MALFUNCTION CODES ARE PRESENT, THOSE CODES WILL FLASH AFTER CODE 12 FLASHES THREE TIMES
EACH CODE FLASHES THREE TIMES

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FLASHING "CHECK ENGINE" LIGHT → DIAGNOSTIC DISPLAY MODE

2.9A DIAGNOSTIC CHARTS

TECH 1 "SCAN" TOOL TYPICAL DATA VALUE

The Tech 1 "Scan" Data listed in the table may be used for comparison, after completing the Diagnostic Circuit Check and finding the on-board diagnostics functioning properly and no diagnostic codes displayed.

A TECH 1 "SCAN" TOOL THAT DISPLAYS FAULTY DATA SHOULD NOT BE USED, AND THE PROBLEM SHOULD BE REPORTED TO THE MANUFACTURER. THE USE OF A FAULTY TECH 1 "SCAN" TOOL CAN RESULT IN MISDIAGNOSIS AND UNNECESSARY PARTS REPLACEMENT.

Only the parameters listed are used in this manual for diagnosing. For more description on the typical data values, to diagnosis electronic control module inputs, refer to the "General Description and System Operation," Section "1". If all data values are within the ranges illustrated, refer to "2-B" "Symptom Charts."

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. The "Scan" position refers to the Tech 1 "F0: DATA LIST" display pairs that are displayed in order, if the "YES" button is pressed. After "Time From Start" parameter is displayed, by pressing the "YES" button, the display pairs will start on the top of list again.
2. "Units Displayed" are the available ways of displaying what each parameter is currently operating in, or a value that is being sensed or being outputted.
3. "Typical Data Value" is separated into two parts. These displayed values are typical of a normally operating vehicle. The ignition "ON" comparison should be performed first as this may lead to a quick identification of a failure. The Engine Running data should be compared to the ignition "ON" data as a diagnostic check to make sure the component or system is operating properly.
4. Ignition "ON" values are the typical values that should be seen on the Tech 1 "Scan" tool with the ignition "ON," and engine not running. Temperature sensors should be compared to the actual temperatures by letting the sensor sit overnight and then comparing their values. A difference of +5°C from the actual temperature may indicate a problem with the sensor. Use the diagnostic aids chart for that sensor to compare the resistance to temperature values.

Some "ON" or "OFF" switches may display an abnormal state. If the chart states this position is abnormal, then this may be caused by an open or short to ground, depending upon the normal state of the switch. Refer to "General Description and Operation" Section "1" for more information.
5. "ENGINE RUNNING" typical data values are an average of display values recorded from normally operating vehicles, and are intended to represent what a normally functioning system would typically display.

TECH 1 "SCAN" DATA				
① "SCAN" POSITION	② UNITS DISPLAYED	③ TYPICAL DATA VALUE, A/C "OFF", ENGINE WARM		REFER TO SECTION
		④ IGNITION "ON"	⑤ ENGINE IDLING	
ENGINE SPEED	REVOLUTIONS PER MINUTE	0	± 50 FROM DESIRED IDLE	1.2
DESIRED IDLE	REVOLUTIONS PER MINUTE	VARIES	ELECTRONIC CONTROL MODULE IDLE COMMAND (VARIES WITH TEMPERATURE)	1.2
COOLANT TEMPERATURE	°C	SHOULD EQUAL ACTUAL TEMP.	85° - 110°C	1.1
INTAKE AIR TEMPERATURE	°C		VARIES WITH AMBIENT AND UNDERHOOD AIR TEMPERATURE	1.1
MANIFOLD ABSOLUTE PRESSURE	KPA/VOLTS	75 TO 105 KPA 3.5 TO 5.0 VOLTS	DEPENDS ON BAROMETRIC PRESSURE AND ENGINE LOAD	1.1
BAROMETRIC PRESSURE	KPA	VARIES WITH ALTITUDE	DEPENDS ON BAROMETRIC PRESSURE	1.1
THROTTLE POSITION	VOLTS	.35 - .70	.35 - .70	1.1
THROTTLE ANGLE	0-100%	0%	0%	1.1
VEHICLE SPEED	KILOMETERS PER HOUR	0	0	1.1
SYSTEM VOLTAGE	VOLTS	11.5 - 14.0	12.0 - 15.0	1.2
OXYGEN SENSOR VOLTAGE	MILLIVOLTS	LESS THAN 200 mV	95mV to 950mV	1.1
OPEN/CLOSED LOOP FUEL CONTROL	OPEN/CLOSED	OPEN	"CLOSED LOOP" WITHIN 5 MINUTES AFTER STARTING ENGINE	1.2
POWER ENRICHMENT MODE ACTIVE	YES/NO	NO	NO	1.2
OXYGEN SENSOR READY	YES/NO	YES	SHOULD REMAIN "YES" AFTER STARTING ENGINE	1.1
EXHAUST GASES	RICH/LEAN	LEAN	VARIES WITH OXYGEN SENSOR'S INTERPRETATION OF EXHAUST GASES	1.1
DECEL FUEL CUT MODE IN EFFECT	YES/NO	NO	NO	1.2

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TECH 1 "SCAN" DATA				
① "SCAN" POSITION	② UNITS DISPLAYED	③ TYPICAL DATA VALUE, A/C "OFF" ENGINE WARM		REFER TO SECTION
		④ IGNITION "ON"	⑤ ENGINE IDLING	
ADAPTIVE MEMORY FUEL ADJUSTMENT	- 100% - + 100%	0%	FLUCTUATES WITH CHANGE IN MEMORY FUEL ADJUSTMENT NORMALLY BETWEEN -10% AND + 10%	1.2
FUEL MEMORY CELL	0-35		35	1.2
"CLOSED LOOP" FUEL ADJUSTMENT	- 100% - + 100%	0%	FLUCTUATES WITH CHANGE IN "CLOSED LOOP" FUEL ADJUSTMENT NORMALLY BETWEEN -20% AND +20% WHEN OPERATING IN "CLOSED LOOP"	1.2
SPARK ADVANCE	0 BEFORE TOP DEAD CENTER TO 60 BEFORE TOP DEAD CENTER	NOT USEABLE	VARIES	1.4
FUEL INJECTOR PULSE WIDTH	MILLISECONDS	3.9 OR HIGHER	.8 TO 1.5	1.2
AIR FUEL RATIO		NOT USEABLE	13.5 - 14.7	1
CALIBRATION IDENTIFICATION	VARIES	VARIES	VARIES	1.1
ENGINE RUNNING TIME SINCE LAST START UP	HOURS/MINUTES/ SECONDS	NOT USEABLE	VARIES WITH TIME	2.3
IDLE AIR CONTROL POSITION	COUNTS	135	5-50	1.2
AIR CONDITIONING REQUEST SIGNAL	YES/NO	NO	CHANGES WITH REQUEST FOR AIR CONDITIONING	1.1
AIR CONDITIONING COMPRESSOR CONTROL RELAY	ON/OFF	OFF	CHANGES WITH COMPRESSOR STATUS	1.1
OCTANE ADJUSTMENT	VOLTS DEGREES	0.00 VOLT 0° TO -8°	1.0 VOLT TO 4.7 VOLT 0° TO -8°	1.1
EVAPORATIVE EMISSION CANISTER PURGE DUTY CYCLE	0 - 100%	0%	0%	1.3
INTAKE MANIFOLD HEATER CONTROL RELAY	OFF/ON	OFF	"ON" OR "OFF" DEPENDING ON COOLANT TEMPERATURE AND INTAKE AIR TEMPERATURE	1.9
FUEL PUMP CIRCUIT	ON/OFF	"ON" MOMENTARILY THEN "OFF"	"ON"	1.2
RADIATOR FAN	NOT USED	NOT USED		1.2

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ELECTRONIC CONTROL MODULE DIAGNOSTIC CODES

CODE	DESCRIPTION	TURN ON CHECK ENGINE LIGHT?
13	NO OXYGEN SENSOR SIGNAL	YES
14	COOLANT TEMPERATURE - Signal voltage too low	YES
15	COOLANT TEMPERATURE - Signal voltage too high	YES
21	THROTTLE POSITION - Signal voltage too high	YES
22	THROTTLE POSITION - Signal voltage too low	YES
23	INTAKE AIR TEMPERATURE - Signal voltage too high	YES
24	NO VEHICLE SPEED SIGNAL	YES
25	INTAKE AIR TEMPERATURE - Signal voltage too low	YES
33	MANIFOLD ABSOLUTE PRESSURE - Signal voltage too high	YES
34	MANIFOLD ABSOLUTE PRESSURE - Signal voltage too low	YES
35	IDLE SPEED ERROR	YES
42	ELECTRONIC SPARK TIMING - Control Circuit problem	YES
44	LEAN EXHAUST INDICATION	YES
45	RICH EXHAUST INDICATION	YES
51	CALIBRATOR ERROR	YES
53	SYSTEM VOLTAGE TOO HIGH	YES
54	OCTANE ADJUSTMENT CIRCUITS - Signal voltage too high or too low	YES
55	ELECTRONIC CONTROL MODULE ERROR	YES

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2-36 ENGINE MANAGEMENT SYSTEMS 1.7L THROTTLE BODY INJECTION

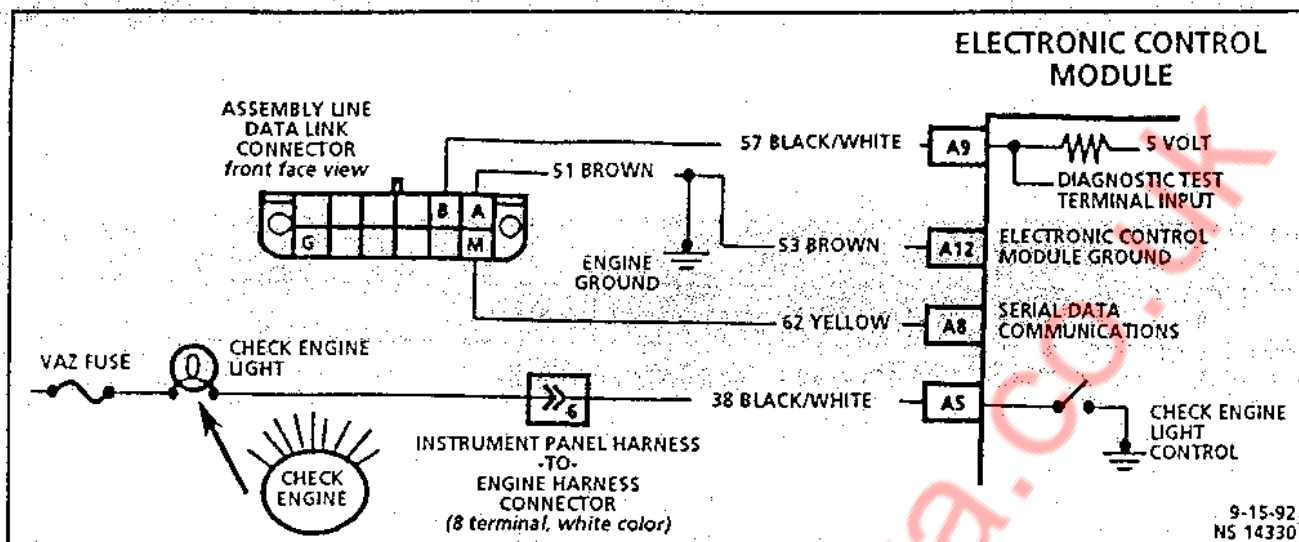


CHART A DIAGNOSTIC CIRCUIT CHECK 1,7L THROTTLE BODY INJECTION NIVA

Circuit Description:

The diagnostic circuit check is an organized approach to identifying a problem created by an electronic engine control system malfunction. It must be the starting point for any driveability complaint diagnosis, because it directs the service technician to the next logical step in diagnosing the complaint. Understanding the chart and using it correctly will reduce diagnosis time and prevent the unnecessary replacement of good parts.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. This check is to see if the bulb is OK.
2. If the "Check Engine" light is "OFF," CHART A-1 will check for both ignition feed and constant battery power to the electronic control module and the electronic control module grounds.
3. This check is done to see if the electronic control module has the capability to control the "Check Engine" light. With the assembly line data link diagnostic "test" terminal "B" grounded, the "Check Engine" light will flash Code 12 at least three times followed by any diagnostic codes stored in memory. Code 12 means there is no crankshaft reference signal coming to the electronic control module, this is normal because the engine is not running.
4. This check is used to see if the electronic control module can supply serial data for Tech 1 "Scan" tool use. If an engine calibrator error is present, the electronic control module may have the ability to flash a Code 12 but not enable serial data.
5. This test is used to see if "Cranks But Will Not Run" symptom is caused by an electronic control module problem or the vehicle electrical system.
6. This check is to see if the electronic control module has any codes stored in its memory to aid in diagnosing the customer complaint.
7. Look at all the parameters to determine if one is not in a normal state with just the ignition "ON" and engine not running. In particular, look at the barometric pressure reading from the manifold absolute pressure sensor voltage and kPa values. Are they normal for your altitude, use CHART C1-D. Look at the coolant temperature sensor value to see if the value is reasonable or if it is shifted above or below where it should be.
8. If the actual data is not within the typical values established, the charts in Section "2-C" "Component Systems Charts" will provide a functional check of the suspect component or system.

Diagnostic Aids:

If assembly line data link serial data output circuit (Yellow, wire from electronic control module terminal "A8" to assembly line data link terminal "M") is shorted to +12V, there will be no serial data output. See CHART A-2.

CHART A **DIAGNOSTIC CIRCUIT CHECK** **1,7L THROTTLE BODY INJECTION NIVA**

- IGNITION "ON," ENGINE NOT RUNNING.
- NOTE CHECK ENGINE LIGHT.

1 STEADY LIGHT

2 NO LIGHT

FLASHING CODE 12

- 3
- JUMPER ASSEMBLY LINE DATA LINK TERMINAL "B" TO "A". DOES CHECK ENGINE LIGHT FLASH CODE 12 AT LEAST 3 TIMES?

USE CHART A-1

CHECK FOR GROUNDED DIAGNOSTIC TEST INPUT CIRCUIT (BLACK/WHITE WIRE) TO ELECTRONIC CONTROL MODULE TERMINAL "A9". USE WIRING DIAGRAM ON CHART A.

4 YES

NO
USE CHART A-2

5 YES

WILL ENGINE START AND RUN?

NO

USE CHART A-2

YES

NO

USE CHART A-3

- 6
- ON TECH 1 TOOL, USE "EXIT" KEY AND RETURN TO SCREEN TITLED "SELECT MODE ↑ ↓". NEXT, SELECT F2: TROUBLE CODE. ARE ANY TROUBLE CODES DISPLAYED?

YES

REFER TO APPLICABLE CODE CHART. IF MORE THAN ONE CODE IS DISPLAYED, START WITH LOWEST CODE NUMBER.

NO

- 7
- ON TECH 1 TOOL, PRESS "EXIT" KEY ONCE, THEN SELECT F0: DATA LIST.
 - COMPARE EACH TECH 1 PARAMETER WITH TYPICAL DATA VALUES SHOWN ON PREVIOUS 4 PAGES. ARE VALUES NORMAL AND/OR WITHIN TYPICAL RANGES?

YES

REFER TO: "SYMPTOM CHARTS," SECTION 2.

NO

- 8
- REFER TO: "COMPONENT SYSTEMS CHARTS," SECTION 2.

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2-38 ENGINE MANAGEMENT SYSTEMS 1.7L THROTTLE BODY INJECTION

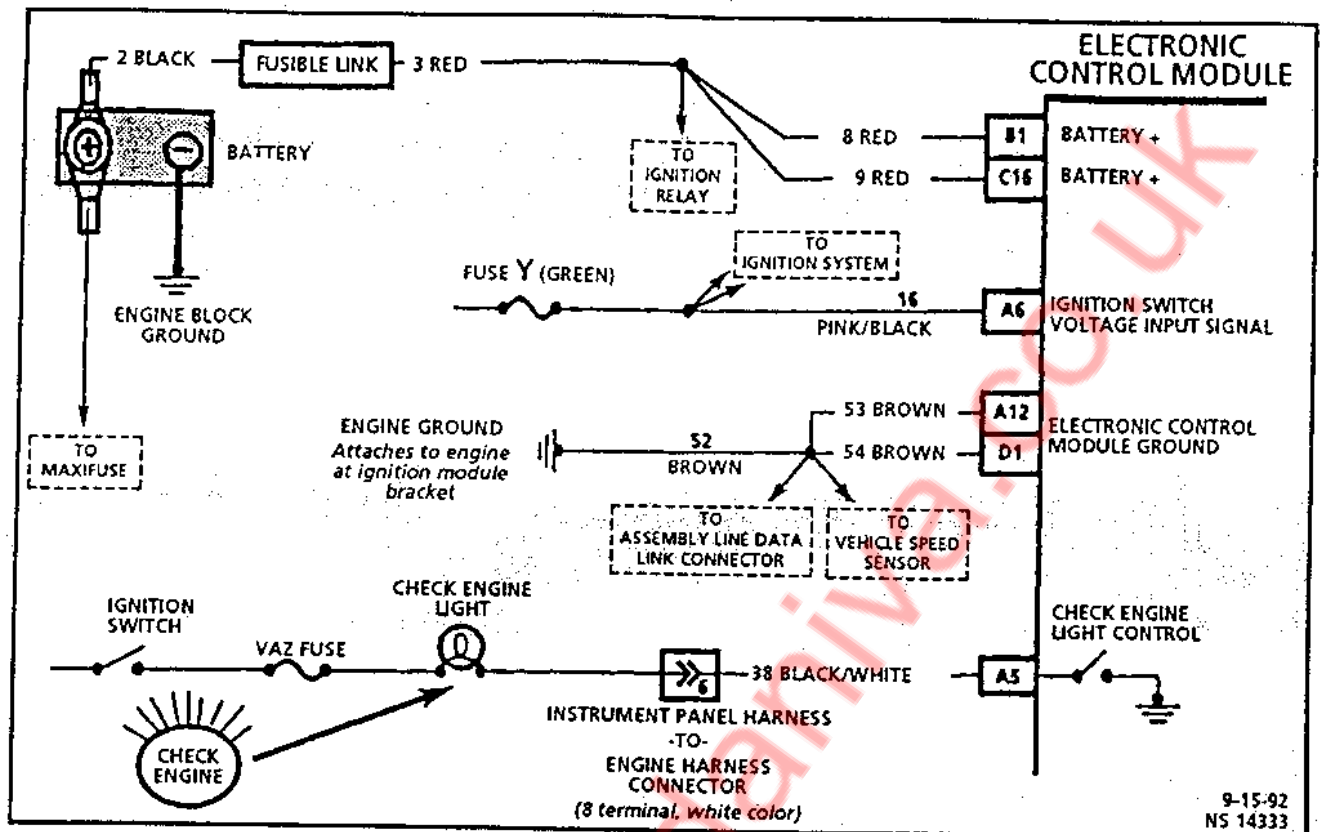


CHART A-1
NO "CHECK ENGINE" LIGHT
1.7L THROTTLE BODY INJECTION NIVA

Circuit Description:

There should always be a steady "Check Engine" light, when the ignition is "ON" and the engine is not running. Switched ignition voltage is supplied from VAZ fuse directly to the light bulb. The electronic control module will control the light and turn it "ON" by providing a ground path through the Black/White wire to electronic control module terminal "A5".

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

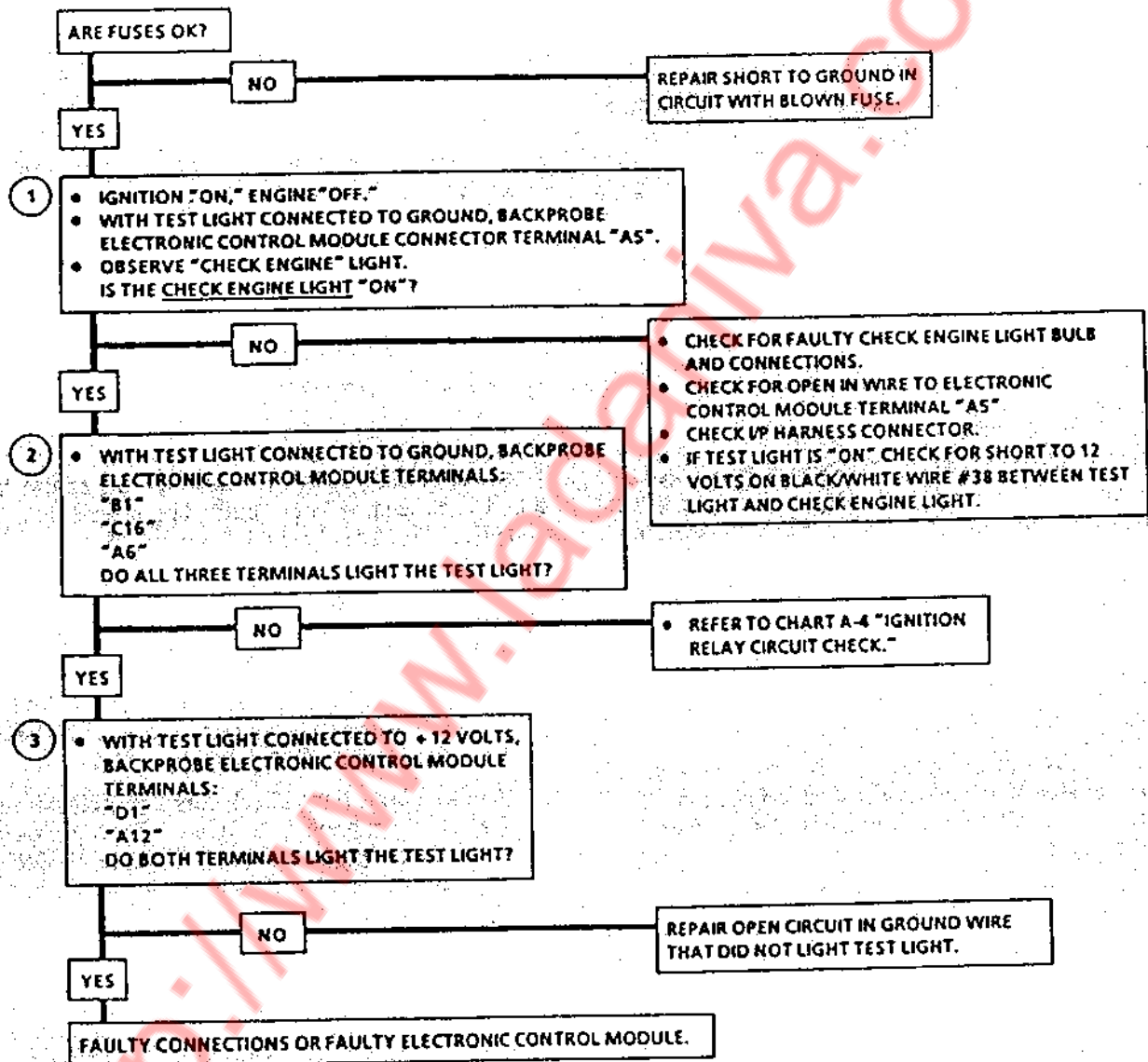
1. Step 1 checks the operation of the control circuit wire to the electronic control module connector terminal "A5".
2. This step checks the electronic control module is receiving power on its three power supply terminals: "B1", "C16", and "A6".
3. This step checks the electronic control module-to-engine block ground circuits on electronic control module connector terminals "A12" and "D1".

Diagnostic Aids:

If ignition switch voltage input circuit (electronic control module Pink/Black wire from electronic control module terminal "A6" to Fuse "Y") is shorted to voltage the engine will not stop running and/or the dash lights will be "ON."

If the "Check Engine" light is "OFF" and the test light is "ON" in Step 1, there may be a short to 12 volts between "A5" and the "Check Engine" light. Check for open wires, bad connections or a bad bulb before assuming that there is a short to 12 volts.

CHART A-1 **NO "CHECK ENGINE" LIGHT** **1.7L THROTTLE BODY INJECTION NIVA**



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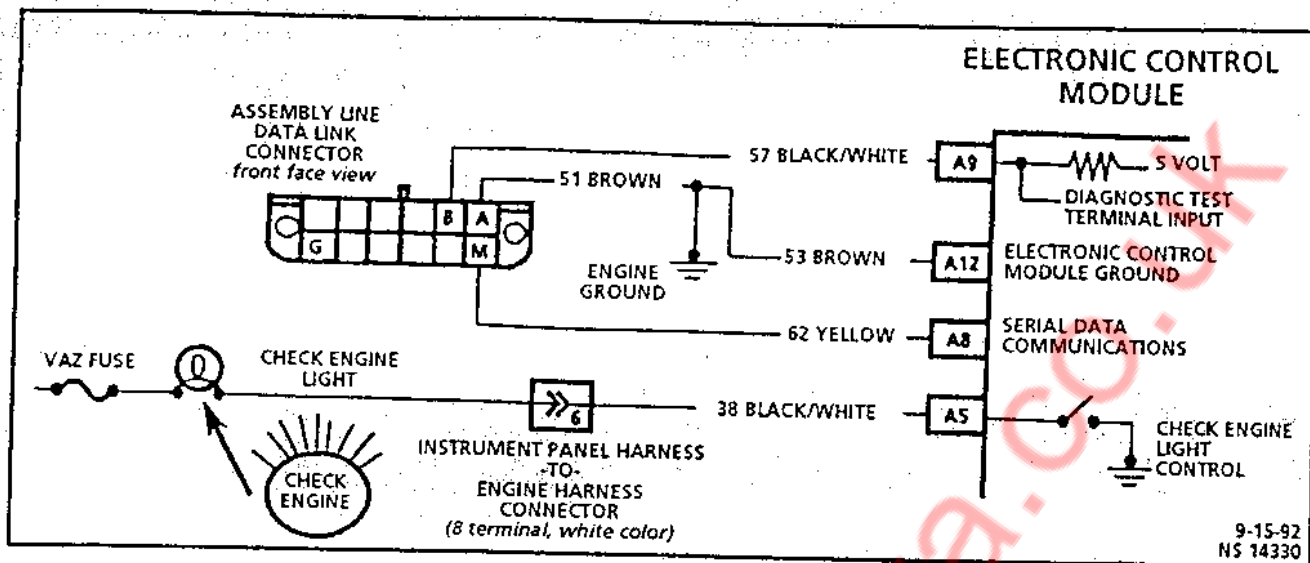


CHART A-2

NO ASSEMBLY LINE DATA LINK SERIAL DATA OR WILL NOT FLASH CODE 12 ("CHECK ENGINE" LIGHT "ON" STEADY) 1.7L THROTTLE BODY INJECTION NIVA

Circuit Description:

There should always be a steady "Check Engine" light when the ignition switch is "ON" and the engine is not running. Switched ignition voltage is supplied directly to the "Check Engine" light bulb. The electronic control module will turn the light "ON" by supplying the ground path on electronic control module terminal "A5".

When the electronic control module's diagnostic "test" terminal "A9" is grounded, the electronic control module commands the "Check Engine" light to flash a Code 12, followed by any code(s) stored in memory. The Tech 1 "Scan" tool, when the "F1: Field Service" key is pressed, supplies a ground for assembly line data link terminal "B".

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

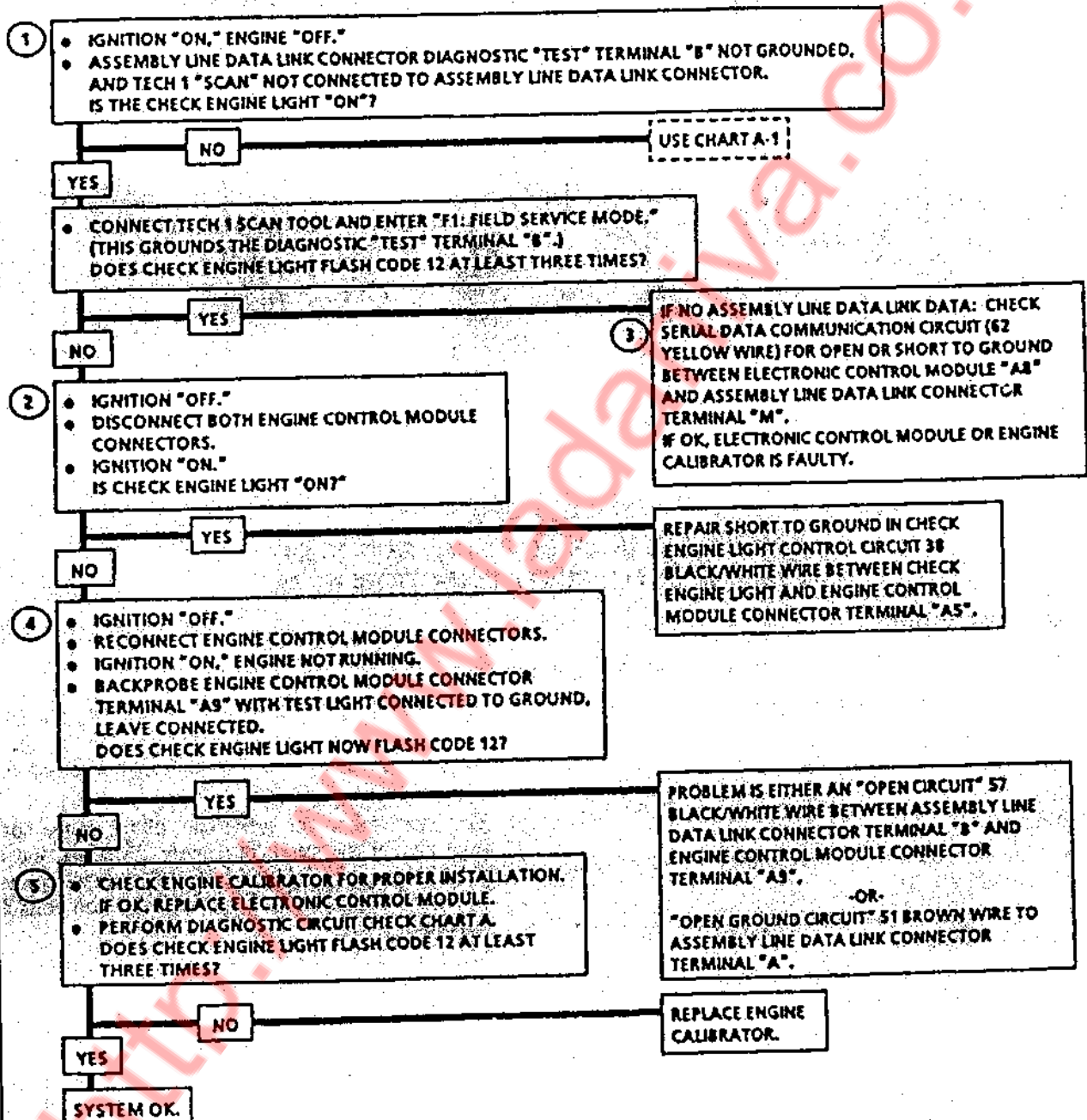
1. If "Check Engine" light is "ON," but very dim and the engine will not start, check connections "D1" and "A12" for proper tightness. Also, ensure that they are clean.
2. If the "Check Engine" light goes "OFF" when the electronic control module connectors are disconnected, then the "Check Engine" light control circuit 38 (Black/White wire) to electronic control module terminal "A5" is not shorted to ground.
3. The electronic control module can flash a Code 12 but may not be able to output serial data to the assembly line data link connector terminal "M". If the Tech 1 "Scan" tool does not display serial data AND the "Check Engine" light is flashing Code 12, THEN check the Tech 1 "Scan" tool on a good vehicle. If the Tech 1 "Scan" tool and the serial data output circuit are OK, then the connections, the electronic control module, or the engine calibrator may be faulty.
4. This step checks for an open circuit between assembly line data link connector terminal "B" and electronic control module terminal "A9".
5. At this point, the "Check Engine" light wiring is OK. The problem is a faulty electronic control module or engine calibrator. If Code 12 does not flash after replacing the electronic control module, then replace the engine calibrator also.

Diagnostic Aids:

A steady light suggests a short to ground in the "Check Engine" light control circuit, or an open in the diagnostic test terminal input circuit to the electronic control module.

CHART A-2

NO ASSEMBLY LINE DATA LINK SERIAL DATA OR WILL NOT FLASH CODE 12 ("CHECK ENGINE" LIGHT "ON" STEADY) 1.7L THROTTLE BODY INJECTION NIVA

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2-42 ENGINE MANAGEMENT SYSTEMS 1.7L THROTTLE BODY INJECTION

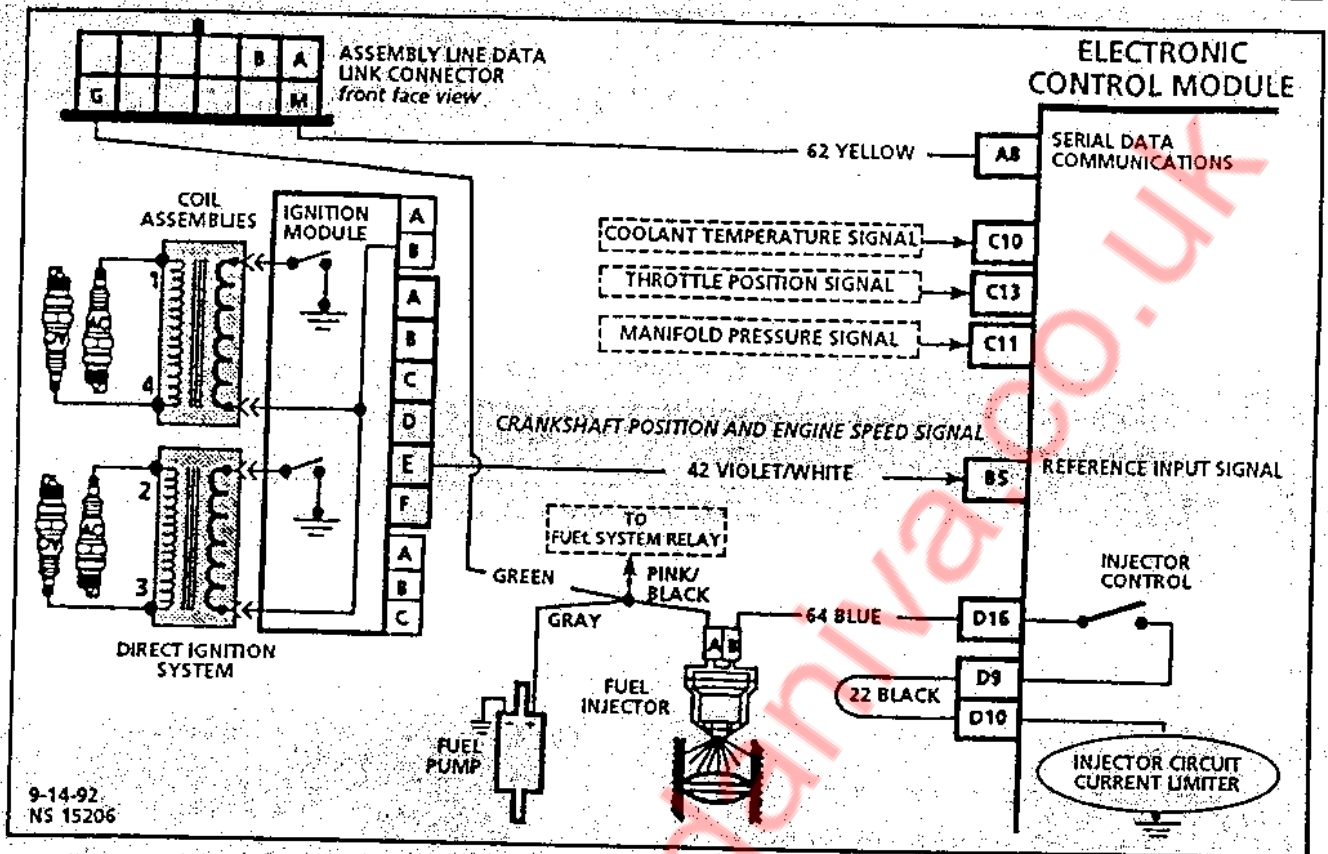


CHART A-3

(Page 1 of 3)

ENGINE CRANKS BUT WILL NOT RUN 1.7L THROTTLE BODY INJECTION NIVA

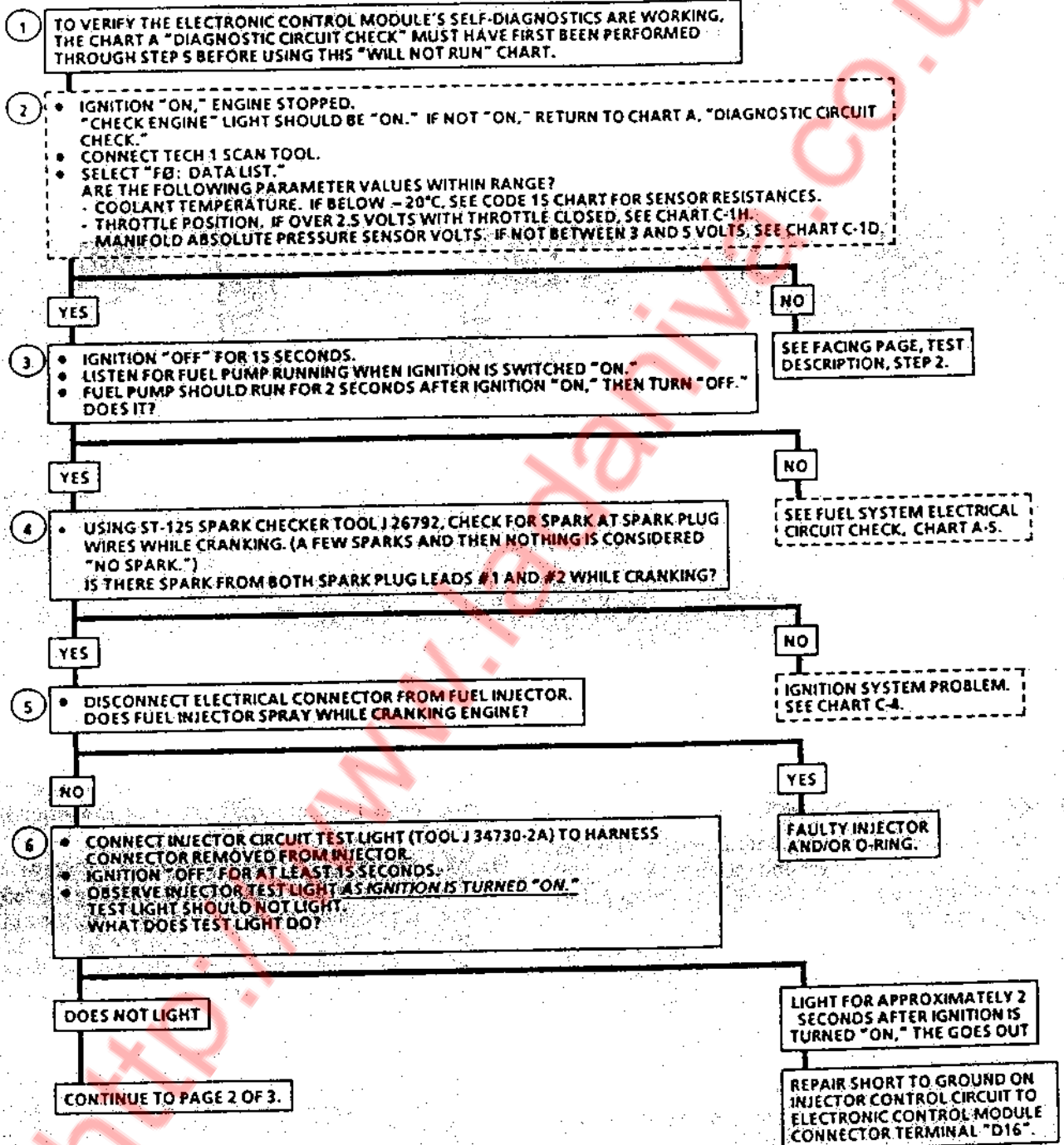
Circuit Description:

Before using this chart check: battery condition, engine cranking speed, fuel quantity and quality.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. It is essential that CHART A, "Diagnostic Circuit Check" be performed first. CHART A will determine if:
 - Electronic control module power and ground circuits are OK.
 - Electronic control module self diagnostic ability is operating.
 - Tech 1 "Scan" tool can communicate with the electronic control module.
2. If incorrect, these sensor input signals to the electronic control module can cause a no-start.
3. Any time the electronic control module has been "OFF" for at least 15 seconds, it energizes the fuel pump relay for 2 seconds after the ignition switch is seconds. Have an assistant listen for fuel pump running at the rear of vehicle.
4. This step checks for sufficient voltage at the spark plug end of the spark plug wire. Wire #1 and #2 must be tested individually. Wire #1 and #2 connect to different ignition coils, so both ignition coils are checked.
5. With the fuel injector electrically disconnected, there should be NO fuel delivered.
6. This step checks for a short to ground on the injector control circuit. If this occurs, the engine would be "flooded" because the injector would spray fuel continuously, without electronic control module control.

CHART A-3 (Page 1 of 3) **ENGINE CRANKS BUT WILL NOT RUN** **1.7L THROTTLE BODY INJECTION NIVA**



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Circuit Description:

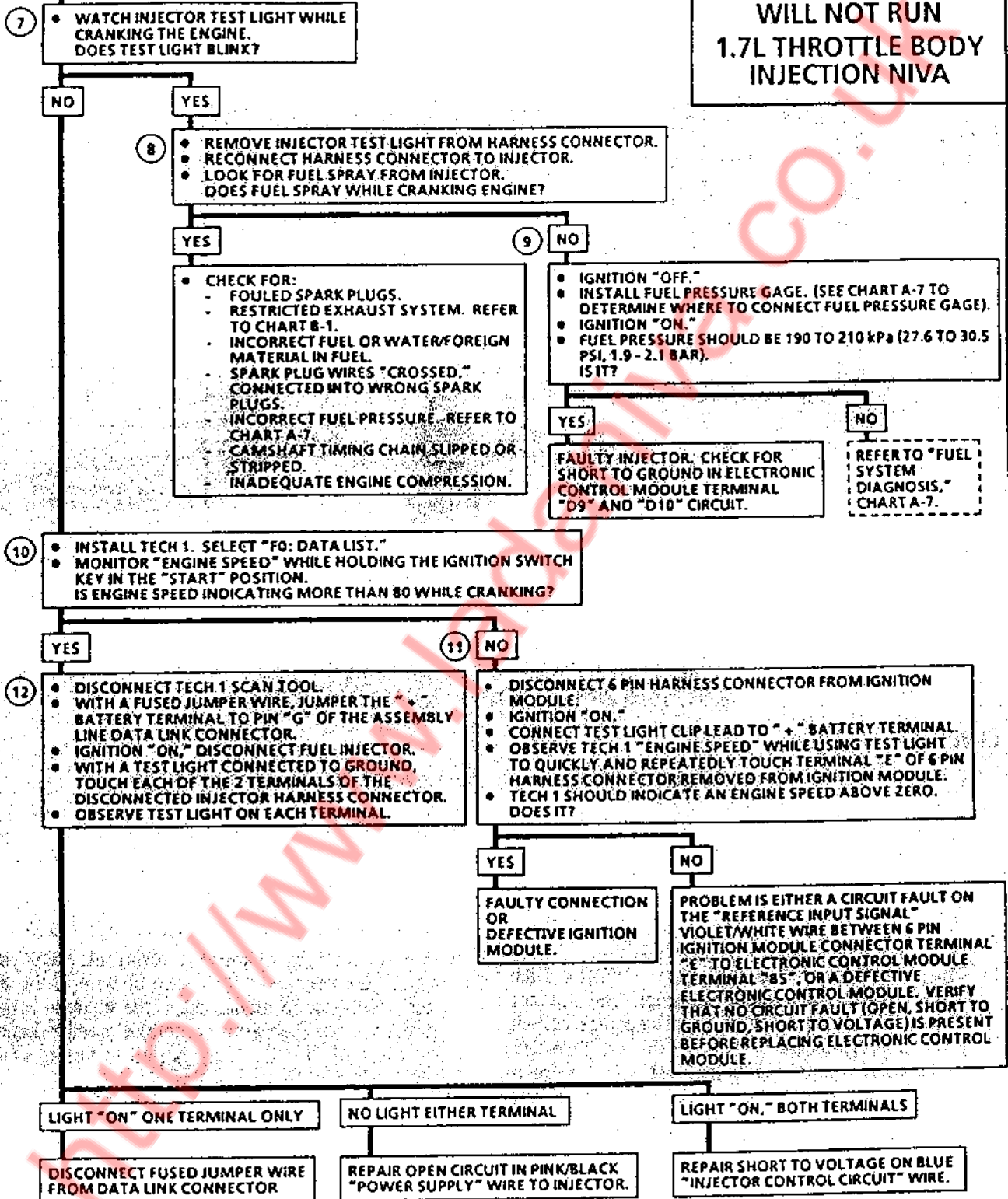
Test Description: Numbers (s) below refer to circled number(s) on the diagnostic chart.

- NOTICE:** If engine speed is indicated but less than 80, check for and repair cause of low cranking speed.

- VAZ SERVICE MANUAL THROTTLE BODY INJECTION NIVA

CHART A-3 (Page 2 of 3) **ENGINE CRANKS BUT WILL NOT RUN** **1.7L THROTTLE BODY INJECTION NIVA**

CONTINUED FROM PAGE 1 OF 3

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2-46 ENGINE MANAGEMENT SYSTEMS 1.7L THROTTLE BODY INJECTION

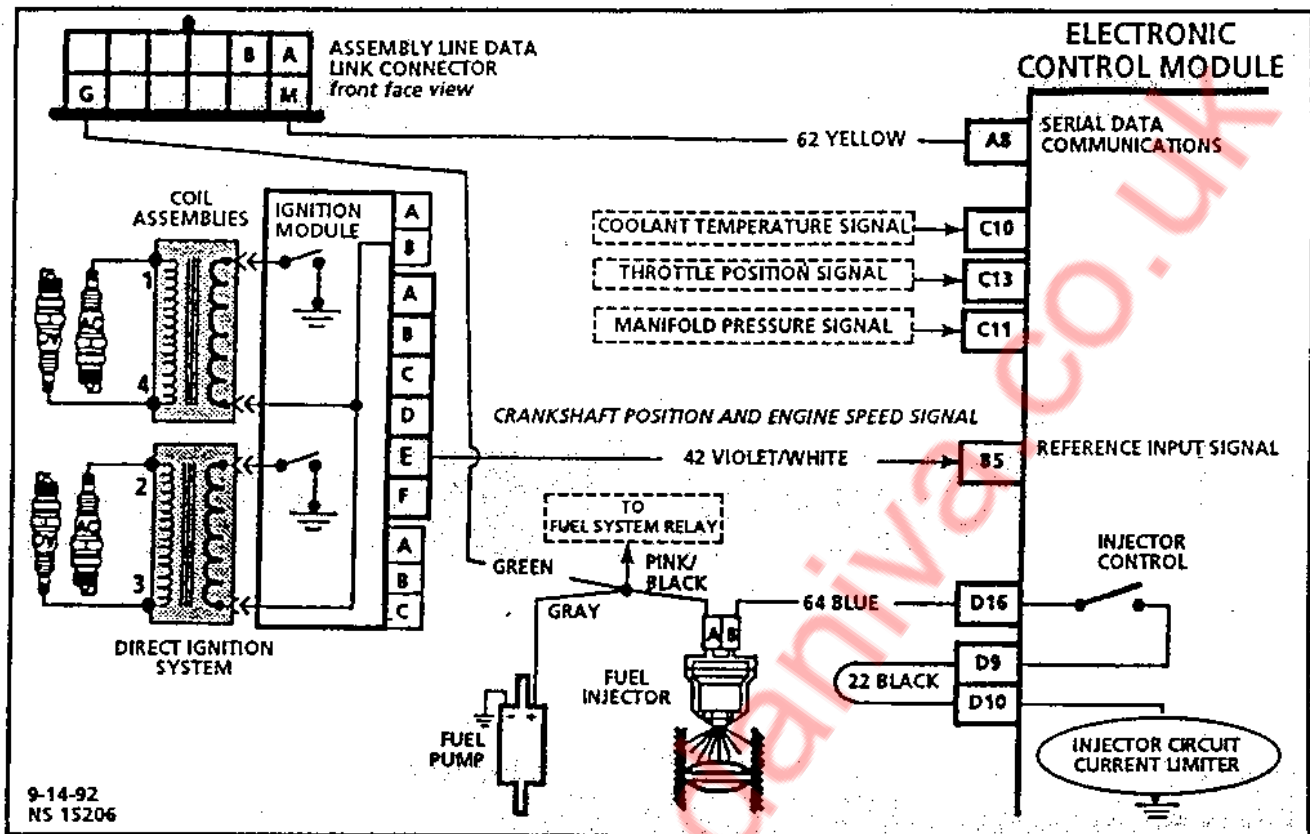


CHART A-3

(Page 3 of 3)

ENGINE CRANKS BUT WILL NOT RUN 1.7L THROTTLE BODY INJECTION NIVA

Circuit Description:

Before using this chart check: battery condition, engine cranking speed, fuel quantity and quality.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

13. If the engine is too cold or too hot to properly test the fuel injector, the test results would be invalid. It is imperative for accurate test results that the injector temperature is between 10°C and 35°C.
14. This test uses the fuel injector tester J 39021 and the digital voltmeter J 39689 together. The injector tester supplies one of three fixed amperage current values throughout the duration of the test. Selection of the correct supply amperage value of 4 amps is based on the injector coil's specified resistance when the push-to-test button is depressed. The tester energizes the injector solenoid coil for 5 seconds.

The condition of the injector solenoid coil is determined by the voltage displayed on the digital voltmeter while the injector is energized. The voltage reading displayed during the first second of the five second test should be ignored.

15. This step checks that the injector control circuit (Blue #64 wire) is a complete circuit to the electronic control module. With the injector connected, the voltage from the Pink/Blue injector wire goes through the injector, and through the Blue #64 wire to the electronic control module terminal "D16".
16. Electronic control module terminals "D9" and "D10" are connected by a loop of wire in the harness. If this loop breaks open, the injector control circuits inside the electronic control module damage could result. If circuit is shorted to voltage (+12 volts), the engine will not start.

CHART A-3

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ENGINE CRANKS BUT
WILL NOT RUN
1.7L THROTTLE BODY
INJECTION NIVA

FROM CHART A-3
PAGE 2 OF 3

FUEL INJECTOR TEST TO BE PERFORMED NEXT, WITH ENGINE TEMPERATURE BETWEEN 10°C AND 35°C FOR ACCURATE INJECTOR TEST.

- 13
- IGNITION "ON".
 - CONNECT TECH 1. SELECT "F0: DATA LIST". OBSERVE COOLANT TEMPERATURE.
 - IS COOLANT TEMPERATURE BETWEEN 10°C AND 35°C?

YES

NO

INJECTOR MUST BE TESTED AT TEMPERATURES BETWEEN 10°C AND 35°C. ALLOW THE ENGINE TO WARM OR COOL AS NEEDED.

- IGNITION "OFF".
- CONNECT FUEL INJECTOR TESTER J-39021 POWER CABLE TO VEHICLE BATTERY. SET THE TESTER ROTARY SWITCH TO THE "INJECTOR COIL TEST, 4 AMP" POSITION.
- PLUG DIGITAL VOLTMETER J-39689 TEST LEADS (+/-) INTO FUEL INJECTOR TESTER. SET THE DIGITAL VOLTMETER TO MEASURE "DC VOLTS."
- DISCONNECT HARNESS CONNECTOR FROM FUEL INJECTOR. USING TESTER ADAPTOR J-39021-30, CONNECT FUEL INJECTOR TESTER CABLE TO FUEL INJECTOR.
- FUEL INJECTOR TESTER "LOW VEHICLE BATTERY" INDICATOR SHOULD NOT BE "ON". IS IT?

YES

CHARGE VEHICLE BATTERY BEFORE PROCEEDING.

NO

- 14
- OBSERVE VOLTMETER. AS INJECTOR TESTER "START TEST" BUTTON IS PUSHED ONCE. (INJECTOR WILL AUTOMATICALLY BE TESTED FOR 5 SECONDS. DO NOT TEST MORE OFTEN THAN ONCE PER MINUTE)
 - VOLTAGE DISPLAYED SHOULD STAY BETWEEN 5.4 AND 8.5 VOLTS DC. (DISREGARD FIRST SECOND OF THE 5-SECOND TEST.) DOES VOLTAGE STAY BETWEEN 5.4 AND 8.5 VOLTS?

NO

FAULTY FUEL INJECTOR.

YES

- 15
- DISCONNECT TESTERS, AND RECONNECT HARNESS TO FUEL INJECTOR.
 - DISCONNECT ELECTRONIC CONTROL MODULE CONNECTORS.
 - WITH A FUSED JUMPER WIRE, JUMPER THE "+" BATTERY TERMINAL TO PIN "G" OF THE DATA LINK CONNECTOR.
 - BACKPROBE ELECTRONIC CONTROL MODULE HARNESS CONNECTOR "D16" WITH TEST LIGHT CONNECTED TO GROUND. IS TEST LIGHT "ON"?

NO

REPAIR OPEN CIRCUIT ON BLUE "INJECTOR CONTROL CIRCUIT" WIRE, BETWEEN INJECTOR HARNESS CONNECTOR AND ELECTRONIC CONTROL MODULE TERMINAL "D16".

YES

- 16
- REMOVE FUSED JUMPER WIRE FROM DATA LINK CONNECTOR.
 - USING A DIGITAL MULTIMETER J 39689, CHECK THE RESISTANCE BETWEEN THE ELECTRONIC CONTROL MODULE HARNESS CONNECTOR TERMINALS "D9" AND "D10". RESISTANCE SHOULD BE LESS THAN 1 OHM. IS IT?

YES

FAULTY CONNECTIONS, OR FAULTY ELECTRONIC CONTROL MODULE.

NO

REPAIR OPEN CIRCUIT IN THE WIRE LOOP, BETWEEN ELECTRONIC CONTROL MODULE HARNESS CONNECTOR TERMINAL "D9" TO "D10".

2-8-93
NS 15803

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Circuit Description:

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

- (These are gray/red wire and the Red wire terminals.) If power is available at both terminals, the testlight should light when touched to each of the two relay terminals.

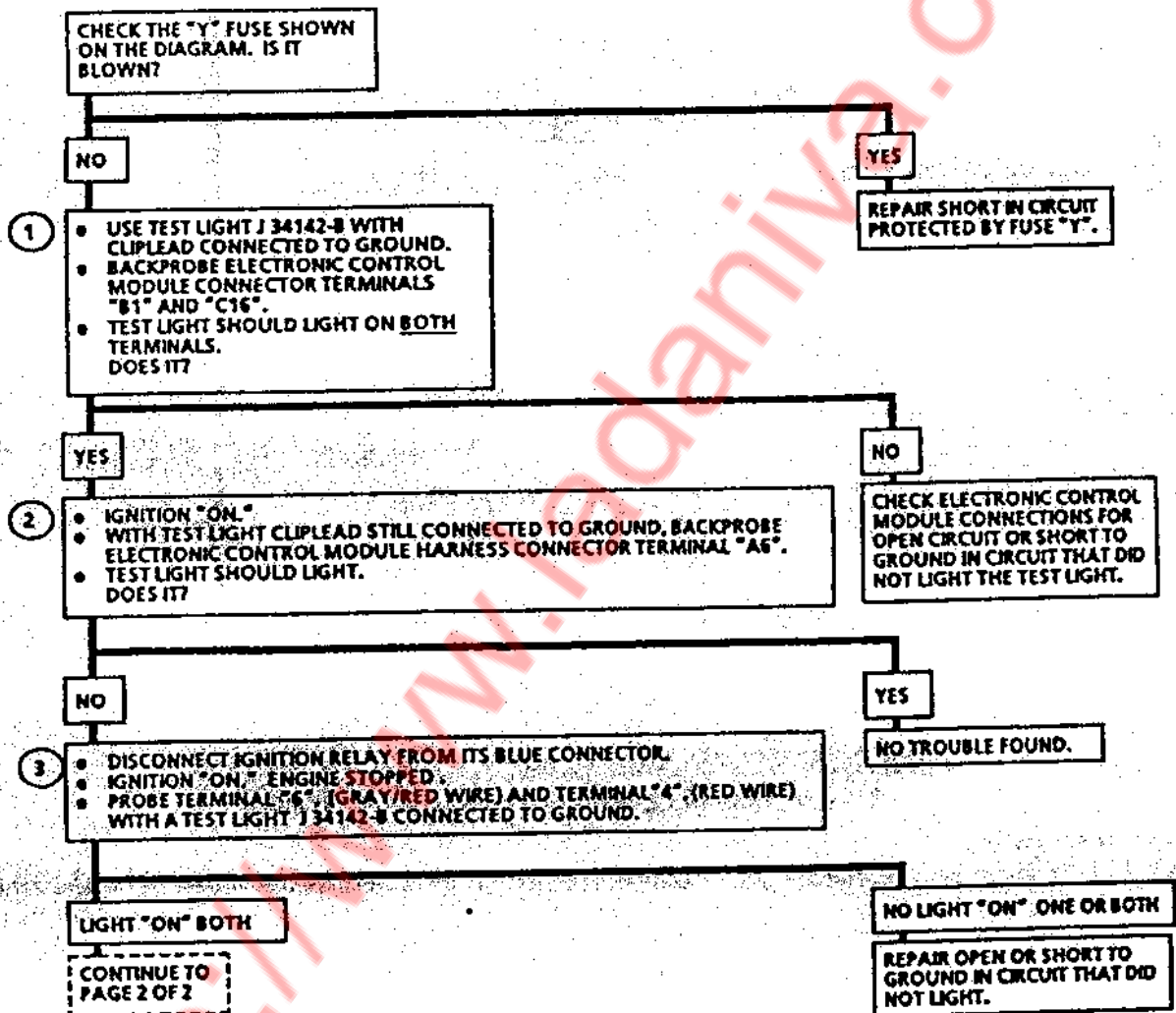
The intake manifold heater relay is the same as the ignition relay. If the ignition relay fails the intake manifold heater relay can be used to operate the vehicle until a replacement relay can be obtained.

CHART A-4

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IGNITION RELAY AND POWER CIRCUITS CHECK

1.7L THROTTLE BODY
INJECTION NIVA



9-22-92
NS 15802

2-50 ENGINE MANAGEMENT SYSTEMS 1.7L THROTTLE BODY INJECTION

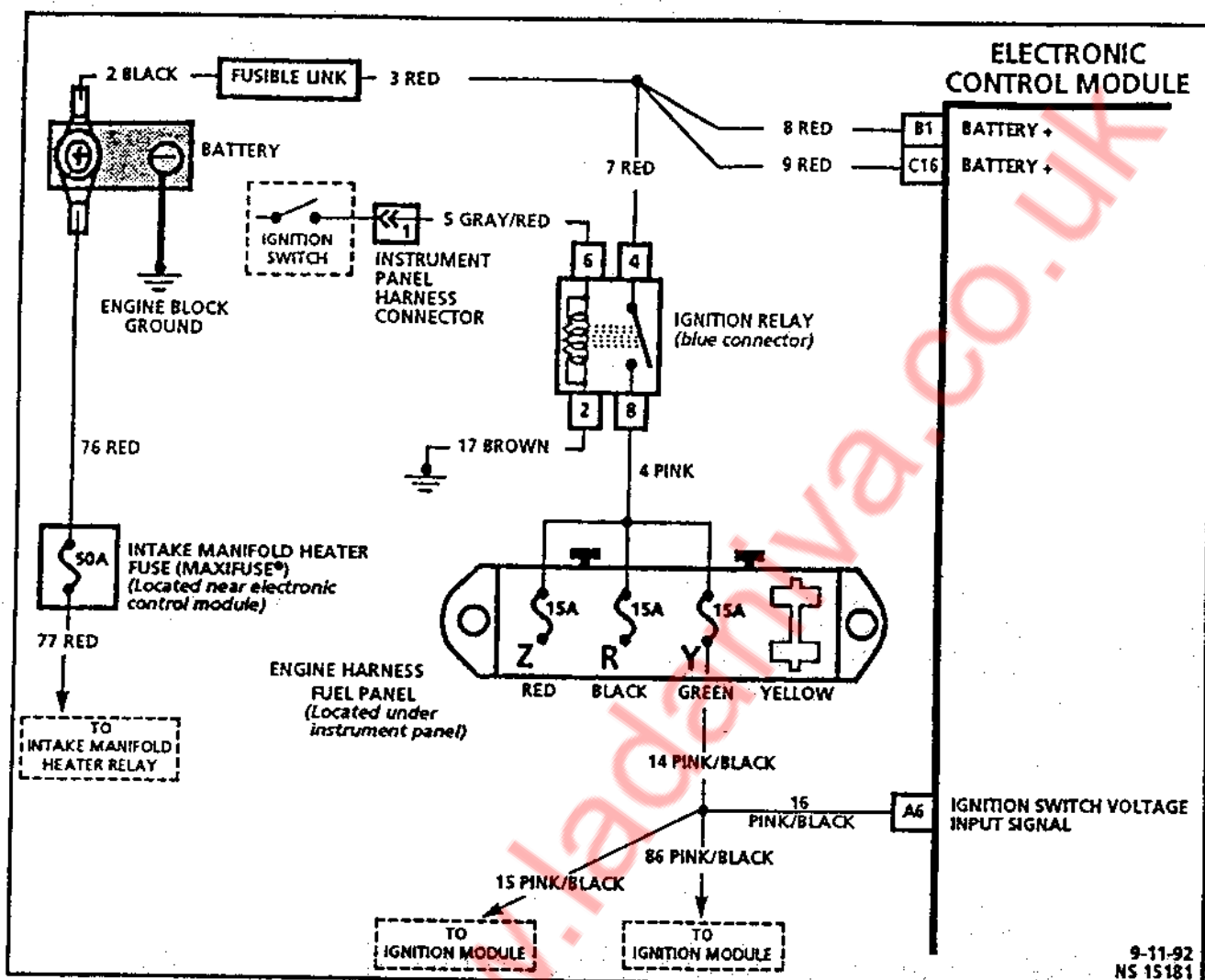


CHART A-4

(Page 2 of 2)

IGNITION RELAY AND POWER CIRCUITS CHECK 1.7L THROTTLE BODY INJECTION NIVA

Circuit Description:

When the ignition switch is turned "ON," it activates the ignition relay and supplies voltage to the electronic control module. The electronic control module will operate as long as voltage is applied to electronic control module terminal "A6" ignition switch voltage input signal during cranking or running. The electronic control module terminals "B1" and "C16" receive power directly from the battery, through a fusible link.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

- A previous test proved that power was available at the relay connector, terminal "6" (Gray/Red wire). This test will check if the Brown wire to relay terminal "2" is a good ground circuit.
- This test checks the switch portion of the relay. The Tech 1 "Scan" tool displays "system voltage" from the electronic control module's interpretation of the voltage level at terminal "A6".

- This checks the Pink wire, from the ignition relay blue connector to the fuse block.

Diagnostic Aids:

The intake manifold heater relay is the same as the ignition relay. If the ignition relay fails, the intake manifold heater relay can be used to operate the vehicle until a replacement relay can be obtained.