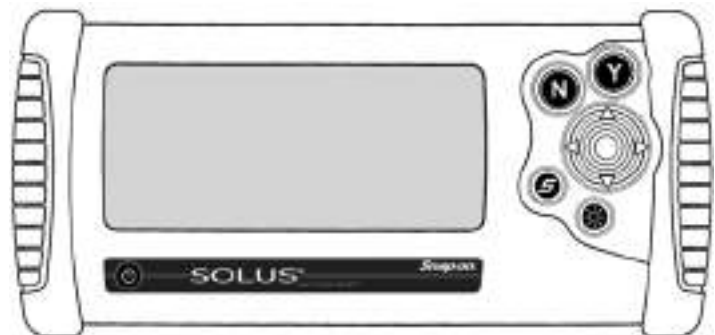
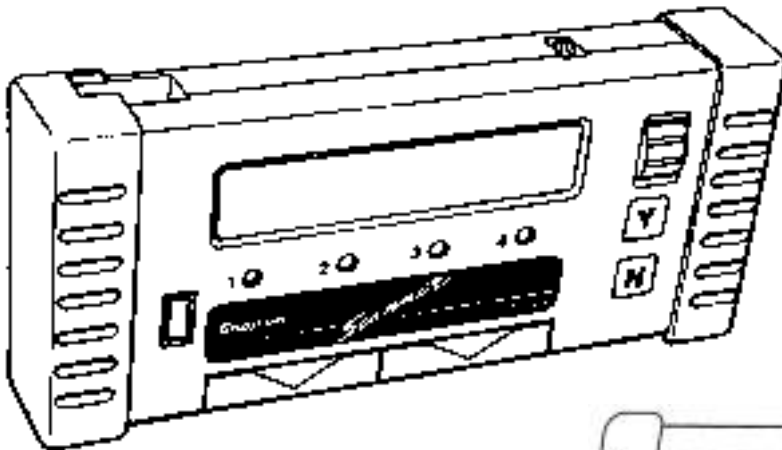
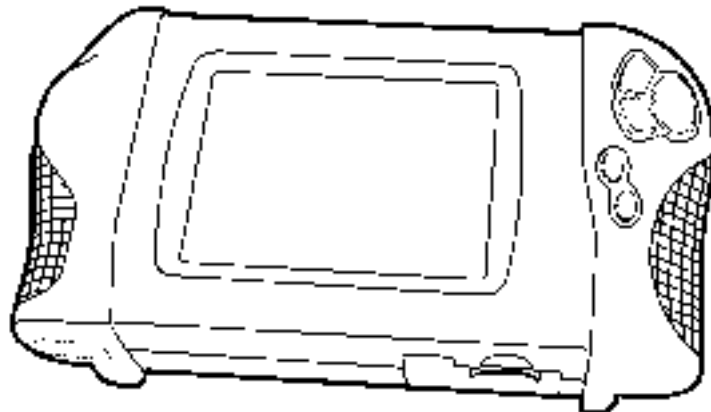

Fast-Track

Holden Engine Troubleshooter Reference Manual

Version 9.2 Software

February 2009



Snap-on[®]

Use in conjunction with the applicable Scanner User's Reference Manual
and Diagnostic Safety Manual.

Safety Warnings and Cautions

Refer to Diagnostic Safety Manual.

Holden Engine Troubleshooter Reference Manual

**Version 9.2
February 2009**

**BEFORE OPERATING THIS UNIT,
PLEASE READ THIS MANUAL
AND ANY APPLICABLE SCANNER
AND SAFETY MANUALS.**

Every effort has been made to ensure that the information in this manual and software is accurate. The right is reserved to change any part at any time without prior notice.

No responsibility is taken for any technical or printing errors that might occur in this manual or software.

Copyright © 2009 Snap-on Technologies Inc.

Snap-on[®]

Holden

Introduction

About the Fast-Track Troubleshooter System	2
Using Troubleshooter Effectively	3
Troubleshooting Trouble Codes	3
General Circuit Testing Information	4
Holden Reference Bulletins Index	7

CAUTION

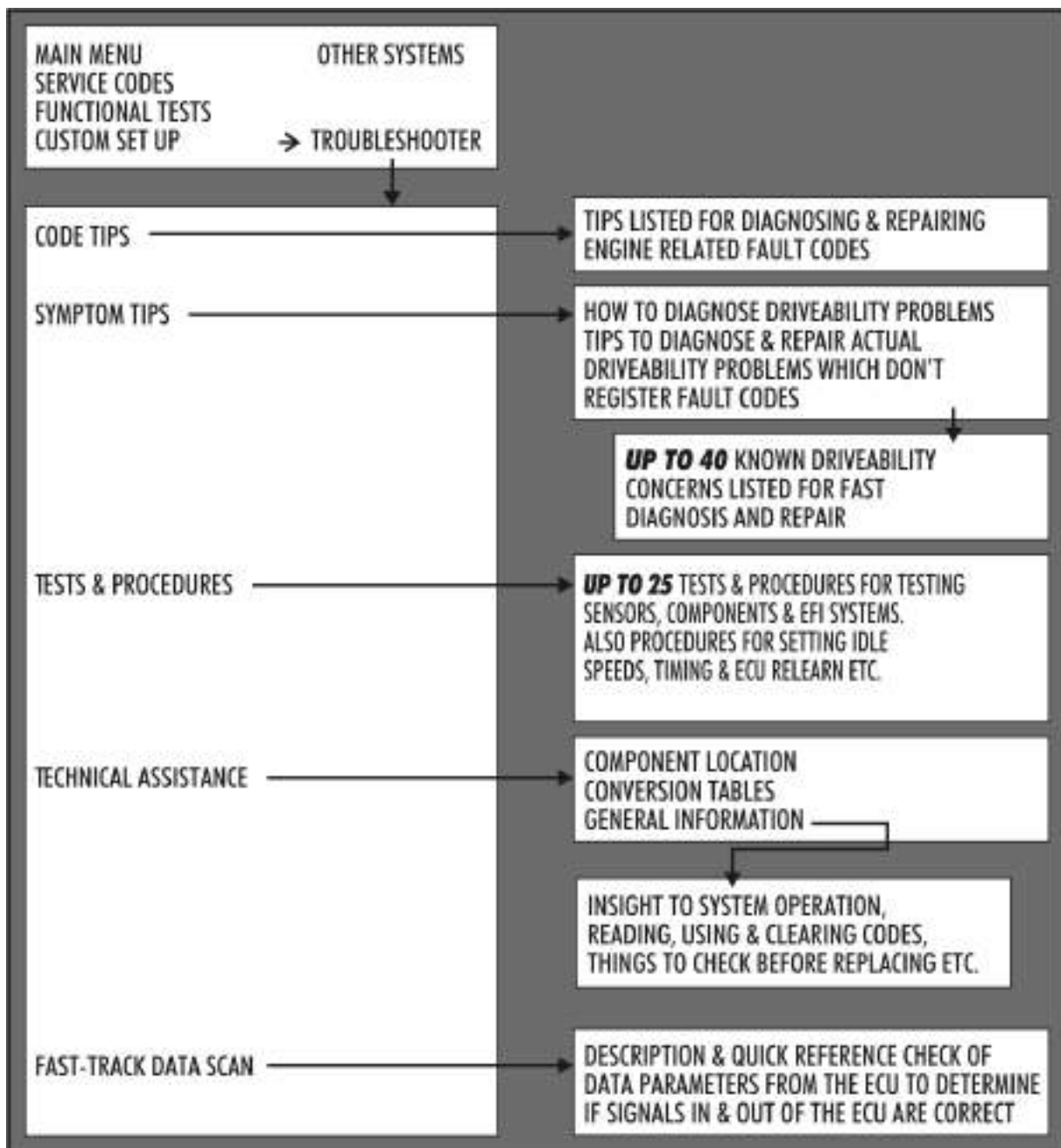
1. Always read Scanner and Safety Manuals first.
2. Ensure correct ID on Scanner and connections correct for vehicle.
3. Always check for fault codes first – checking KOEO, KOER and memory codes in Self Tests.

About the Fast-Track Troubleshooter System

Snap-on's *Fast-Track Troubleshooter* is a unique time saving diagnosis tool which compliments the Snap-on Scanner. They are used in unison to diagnose and repair EFI related problems. The *Troubleshooter* incorporates known faults & repair tips, component testing & technical assistance to reduce the down time of diagnosis, therefore saving you time and money. This product is researched and made in Australia for Australian Vehicles. Information is researched from throughout Australia from a large network of technical sources with vast knowledge of product.

The Reference Manual supplied in this kit contains additional information to support many *Troubleshooter* tips when special instructions, specifications, pinouts and wiring diagrams are needed as indicated by the Scanner.

IMPORTANT: The *Fast-Track Troubleshooter* system contains information on the most common code problems and driveability complaints on the above vehicles. It does not, however, contain information for every possible code and every possible problem that could occur in all vehicles.



Using *Troubleshooter* Effectively

The checks in each *Troubleshooter* tip begin with the most likely cause of a problem or with the tests that should be made first. The checks then progress through other possible causes and tests. All checks in a tip are common causes of a problem or important basic tests, and the most important are listed first. For the most effective use of the *Troubleshooter* tips, follow the checks in the order in which they are given.

Many checks in the *Troubleshooter* tips with refer you to references in this *Troubleshooter* Manual. Consult the references as directed by the tips on the *Troubleshooter*. Trying to use the references by themselves may cause you to miss important information or to perform some test or adjustment out of sequence.

CAUTION

During procedures in the *Troubleshooter* the vehicle's ignition switch will be required to be switched OFF (eg: for disconnecting connectors etc). This will cause the communication between the Scanner and vehicle to drop out. Sometimes the Scanner will read 'No Communication' or drop completely out and sometimes it will still show *Troubleshooter* information. Note if *Troubleshooter* information remains on screen, any data parameters shown will be those prior to switching ignition off and will not change due to no ignition power. Ensure ignition is on and vehicle's PCM is communicating whenever checking any data parameters.

Begin with the basics

The *Fast-Track Troubleshooter* tips deal with automatic transmission electronic systems and controls. Many tips also contain directions to check fuel, ignition, and other electrical components. As a general rule, basic fuel system, ignition, and electrical tests, as well as a thorough inspection, should be made before performing pinpoint tests on electronic components.

Always ensure that the following systems and components are in proper operating condition:

- Battery condition
- Electrical connectors and wiring harnesses
- Vacuum lines and connectors
- General engine mechanical condition
- Brakes and differential assemblies

Troubleshooting Trouble Codes

Trouble codes should be diagnosed and serviced in a basic order: First, hard codes for currently present problems; followed by soft, or memory, codes for intermittent problems.

GM vehicles transmit codes in numerical order from the lowest to the highest. This is basically the order in which they should be serviced, with current codes being diagnosed before history codes. Code 51 and some other 50-series codes are the exceptions to this general rule. Code 51 for many GM vehicles indicates a PROM fault and should be serviced before other codes. Other 50-series codes that relate to PROM or PCM problems also should be diagnosed before other codes.

To distinguish between a current (hard) code and an intermittent (soft) code on most GM vehicles, clear the codes from PCM memory. Then drive the vehicle and watch for the code to reappear. If it reappears immediately or soon, the code usually indicates a hard fault. If the code does not reappear quickly, it was probably a soft code, indicating an intermittent problem. Some late-model GM cars also have a code history section which shows up to the last four fault codes logged with a history of when they occurred. Refer to 'Reading, using and clearing codes' in the *Troubleshooter* Technical Assistance General Information section.

General Reference

General circuit testing (voltage drop testing)

In most cases, measuring the voltage at various points in a circuit will tell you more about the circuit integrity than measuring the circuit resistance (ohms). A good circuit consists of the supply voltage, a load, and a ground. The load should be activated when current passes through it. A load is any electrical component, such as a lamp, a motor, a solenoid, or a relay. Most electrical circuits also include a fuse on the supply side to protect the load in the event of a short or power surge. Typically, mechanically-switched circuits, such as headlamps and wiper motors, have a switch on the supply side of the load. Electronically-switched circuits such as a TCC solenoid or an EGR solenoid, are usually ground-side switched. Remember, many switches actually energize a relay which, in turn, activates a circuit.

To determine if a circuit is good, check the supply voltage to the load, and check the ground. Figure 1 shows you how to test the supply voltage. Connect the positive (+) DVOM lead to pin A of the load, and the negative (-) DVOM lead to chassis ground. With the switch closed, the DVOM indicates a good supply voltage (13.00 volts) at pin A of the load. This typically indicates that the supply side of the circuit is good. It also indicates that the fuse is not blown. If the fuse was blown, the DVOM would indicate zero volts on the supply side of the circuit.

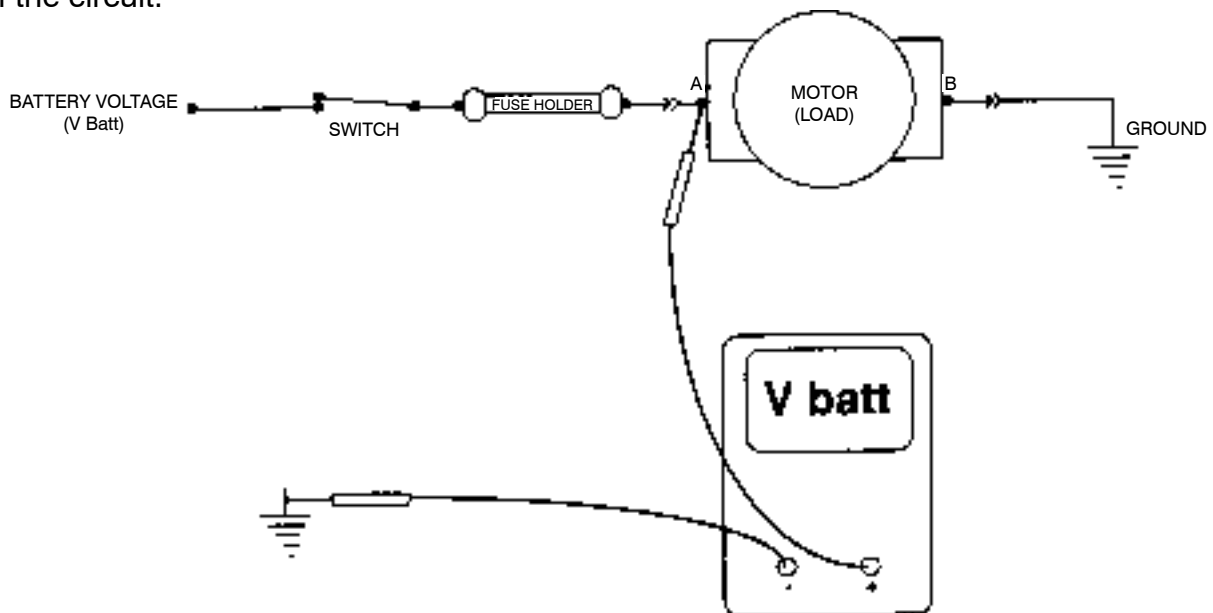
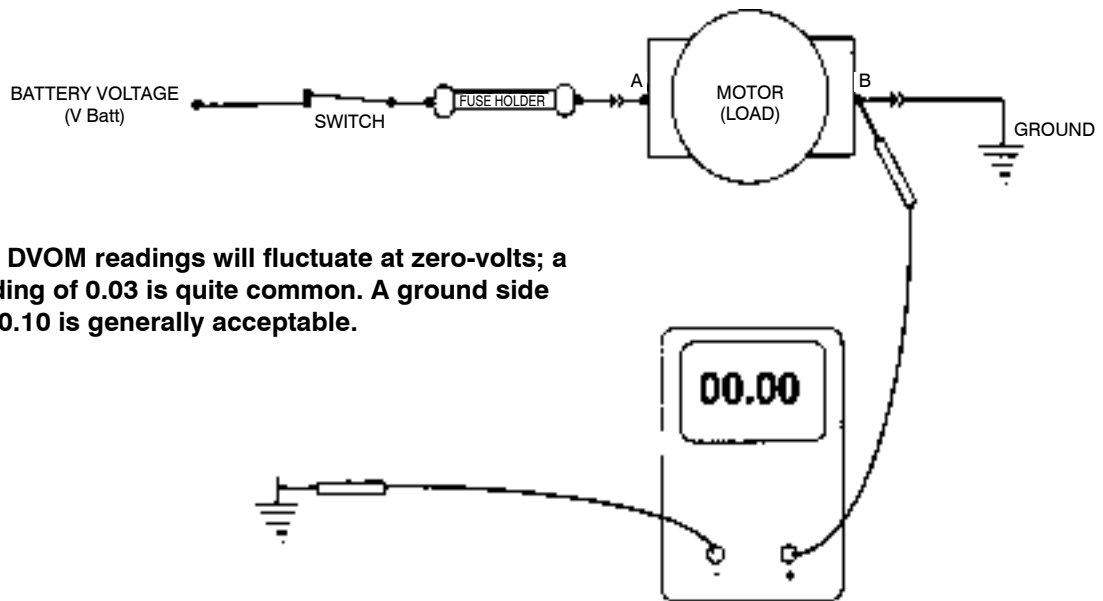


Figure 1. Good supply voltage.

Figure 2 on the next page shows you how to test the ground side of the circuit. The DVOM indicates a good ground (0.00 volts) at pin B of the load, with the switch closed. This typically indicates that the ground side of the circuit is good. (Most DVOM readings will fluctuate at zero volts; a DVOM reading of 0.03 is quite common. A ground side reading of 0.10 is an accepted reading.)

Usually, the fastest and easiest way to check a circuit is to start at the load. In general, there are only six basic types of electrical problems that can affect automotive electrical circuits:

- No supply voltage
- A voltage drop on the supply voltage side
- A voltage drop on the ground side
- An open ground
- A shorted lead
- An open load



Note: Most DVOM readings will fluctuate at zero-volts; a DVOM reading of 0.03 is quite common. A ground side reading of 0.10 is generally acceptable.

Figure 2. Good ground.

Voltage Drop Across The Load

In some cases it may be preferable to actually measure the voltage directly across a load. This may be because you suspect a poor connection, corroded terminals, or a specific open or shorted component, or simply because a known good ground is not near the portion of the circuit you are testing. Resistance can be high in long thin wires, in poor connections, and in corroded terminals. Therefore, wires, poor connections, and corroded terminals can sometimes “load” a circuit.

To measure the voltage drop across a load, connect the positive (+) DVOM lead to the supply side of the load, and the negative (-) DVOM lead to the ground side of the load, figure 3. In a normally operating circuit, most of the supplied voltage is dropped across the load. If there are two or more loads in a circuit, the voltage drop is divided in proportion to the resistance of each load. That is, the voltage drop across each component should add up to the total supply voltage.

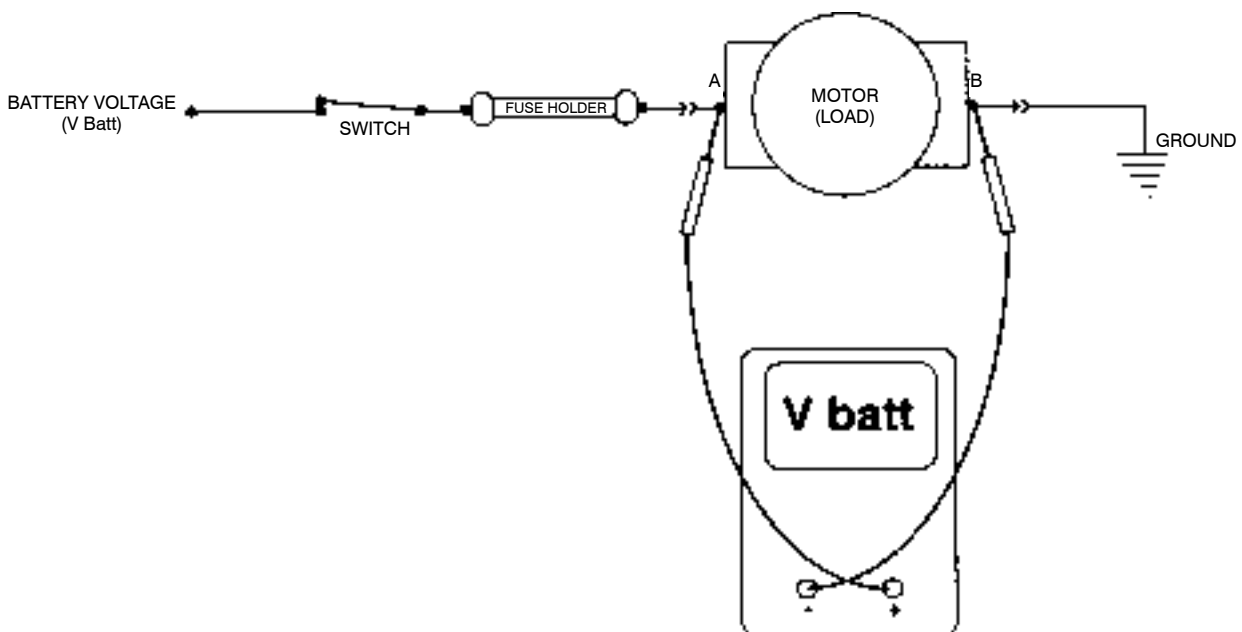


Figure 3. Voltage drop across the load.

Diagnosing Circuit Problems

Table 1 describes the symptoms, probable causes, and likely solutions for a circuit that is switched ON, but not operating properly. For a circuit that is switched OFF, but is still running, use a DVOM to probe between the load and the switch. Always start as close to the switch as possible. After isolating the problem to a specific segment of the circuit, unhook the circuit at that point to confirm that the circuit stops running. Always test the entire circuit (supply side and ground side) after fixing a problem.

Table 1. Circuit switched ON, but not operating properly. (All DVOM readings are referenced to battery ground, or a good chassis ground, separate from the circuit being tested.)

Supply Side	Ground Side	Probable Cause	Likely Solution
V batt	0.00-volts	Bad device or connections to device	Check for loose or corroded connector; if OK, replace component. Always test the entire circuit (supply side and ground side) after fixing a problem.
V batt	V batt	Open ground circuit	Use DVOM to probe circuit between ground side of component and ground source. Open circuit is located between adjacent test points having different readings. Always test the entire circuit (supply side and ground side) after fixing a problem.
0.00-volts	0.00-volts	Open supply circuit	Use DVOM to backprobe circuit between supply side of circuit and the supply source. Open circuit is located between adjacent test points having different readings. If fuse is open, check for a short to ground in section of circuit between load side of fuse and supply side of load. Always test the entire circuit (supply side and ground side) after fixing a problem.
V batt	Greater than 0.00-volts, less than V batt	High resistance ground connection	Use DVOM to probe circuit between ground side of component and ground source. High resistance circuit is located between adjacent test points having different readings. Always test the entire circuit (supply side and ground side) after fixing a problem.
Less than V batt, greater than 0.00-volts	0.00-volts	High resistance power connection	Use DVOM to backprobe circuit between supply side of circuit and supply source. High resistance circuit is located between adjacent test points having different readings. Always test the entire circuit (supply side and ground side) after fixing a problem.

Note: Most DVOM readings will fluctuate at zero-volts; a DVOM reading of 0.03 is quite common. A ground side circuit reading of 0.10 volts is acceptable.

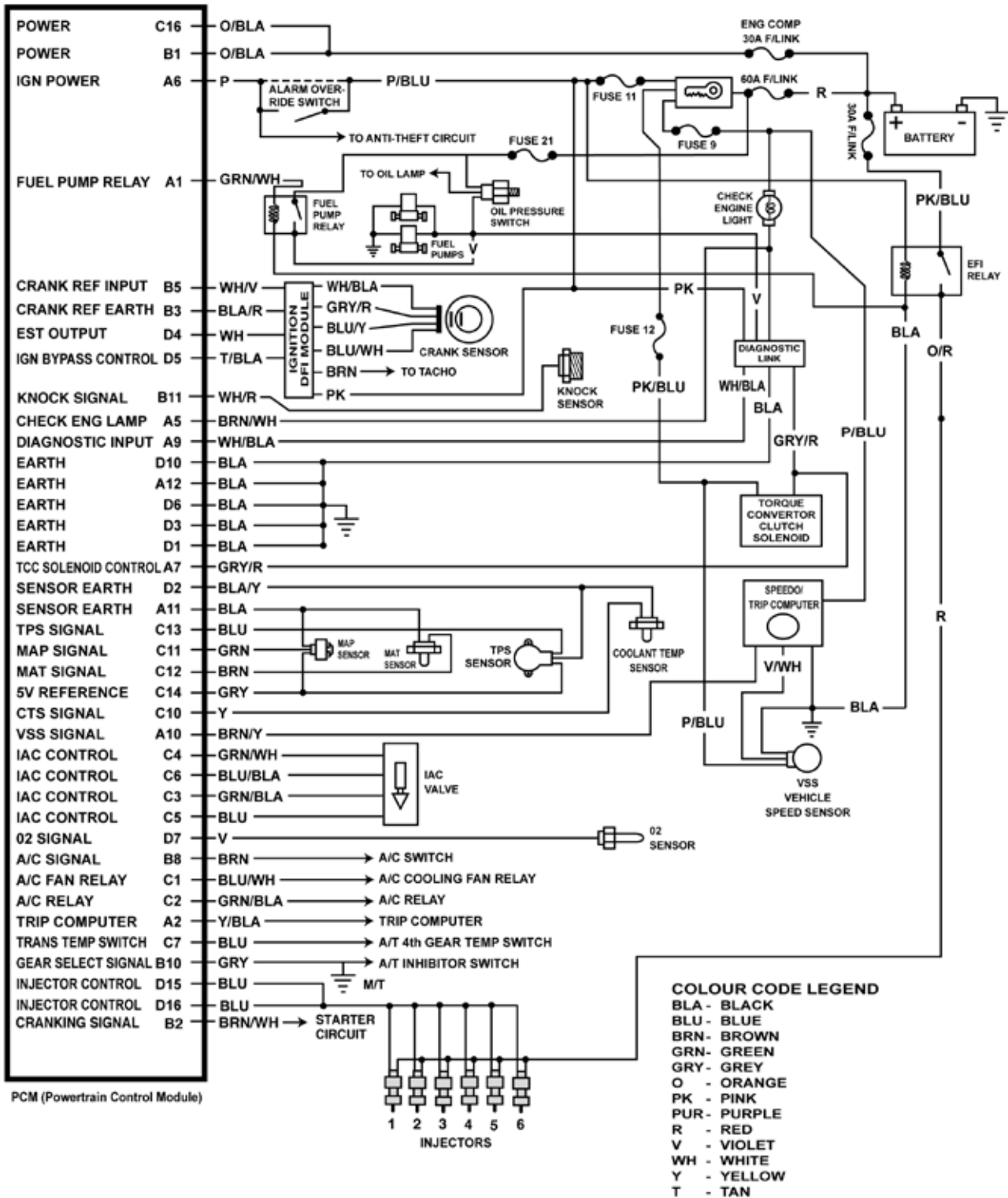
Holden Reference Bulletins

Ref. No.	Page	Subject
H001	9	VN Model (to Oct 1989) V6 wiring diagram and connectors
H002	11	VN Model (from Oct 1989) & VP Model V6 wiring diagram and connectors
H003	13	VN Model (to Oct 1989) V8 wiring diagram and connectors
H004	15	VN Model (from Oct 1989) & VP Model V8 wiring diagram and connectors
H005	17	VR Manual Model V6 wiring diagram and connectors
H006	19	VR Automatic Model V6 wiring diagram and connectors
H007	21	VR & VS Manual Model V8 wiring diagram and connectors
H008	23	VR & VS Automatic Model V8 wiring diagram and connectors
H009	25	VS Model V6 wiring diagram and connectors
H010	27	VT Model V6 wiring diagram and connectors
H011	29	VT Model V8 wiring diagram and connectors
H012	31	VX Model V6 connector diagram
H013	32	VY Model V6 connector diagram
H014	33	V6 Direct Fire Injection (DFI) Power Balance Testing
H015	34	Fuel System Diagnosis Using Fuel Pump Current
H016	35	V6 Crankshaft Sensor Testing
H017	37	Integrator and Block Learn Functions
H018	39	Short Term and Long Term Fuel Trim Functions
H019	41	3.8 Litre V6 Ignition Test
H020	43	Intake Air and Manifold Air Temperature Sensor Resistance Values
H021	44	Knock Sensor Test
H022	45	Quad Driver Circuit Test
H023	46	5.0 Litre V8 Coil Resistance Check
H024	46	3.8 Litre V6 Coil Resistance Check
H025	47	VN (pre Oct 89) 5.0 Litre V8 Ignition Test
H026	48	VN (post Oct 89) to VS 5.0 Litre V8 Ignition Test
H027	49	VT 5.0 Litre V8 Ignition Test
H028	50	VR Model V6 Manual Transmission EST Check
H029	51	VR Model V6 Automatic Transmission EST Check
H030	52	VS & VT Model V6 EST Check
H031	53	VN, VP V8 Model & VR, VS (manual only) V8 Model EST Check
H032	54	VR & VS V8 (auto only) Model EST Check
H033	55	VT 5.0 Litre V8 Model EST Check
H034	56	VX & VY V6 Model EST Check
H035	57	Coolant Temperature Sensor Resistance Check

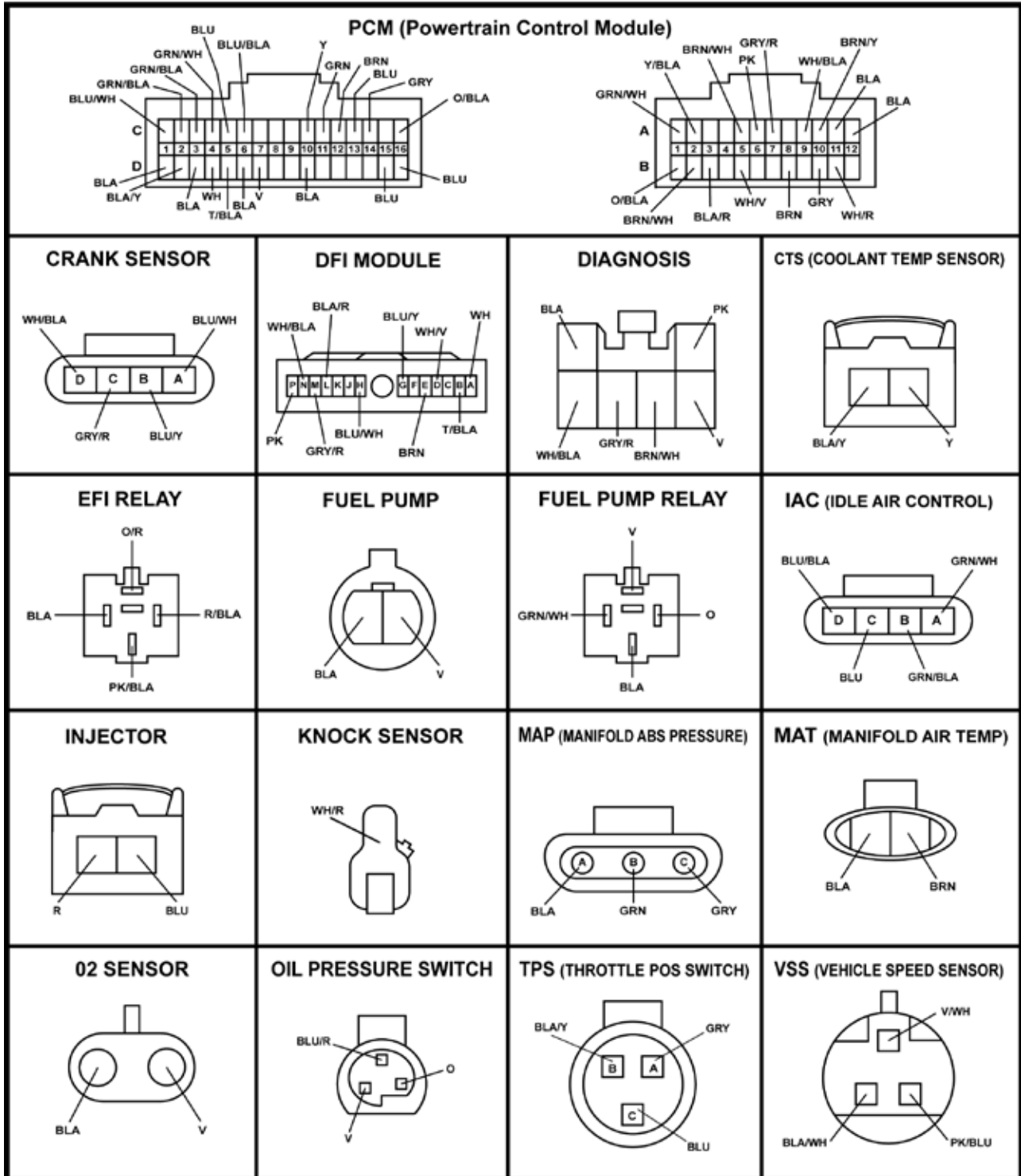
PLEASE NOTE WIRING DIAGRAM WIRE COLOURS ARE GIVEN AT THE PCM AND MAY NOT ALWAYS BE CORRECT DUE TO MANUFACTURING CHANGES IN PRODUCTION. ALSO WIRE COLOURS AT COMPONENTS AND SENSORS MAY NOT BE THE SAME AS AT THE PCM.

ALL CONNECTORS ARE VIEWED LOOKING INTO FACE OF CONNECTION.

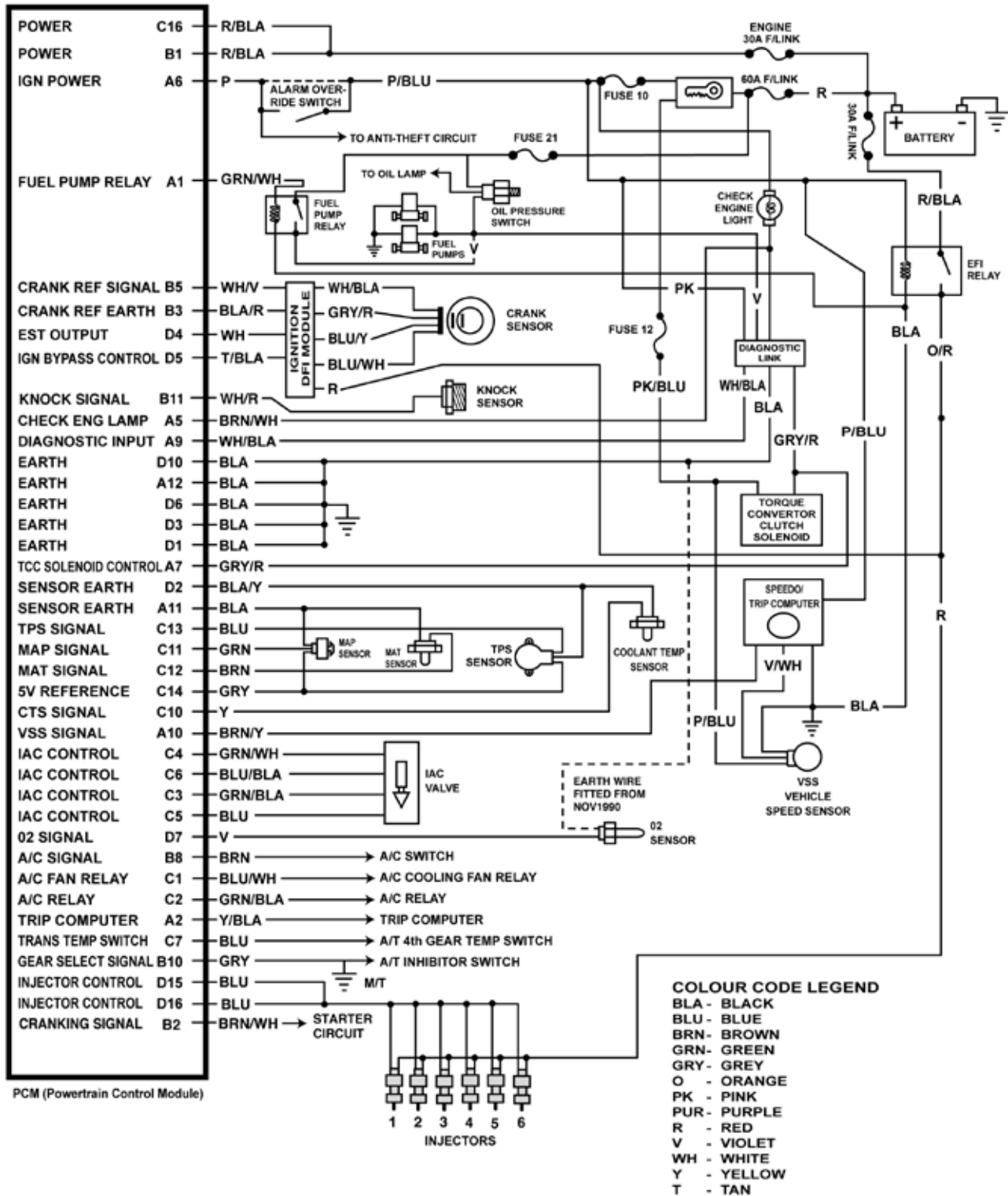
H001 VN Model (to Oct 1989) V6 Wiring Diagram



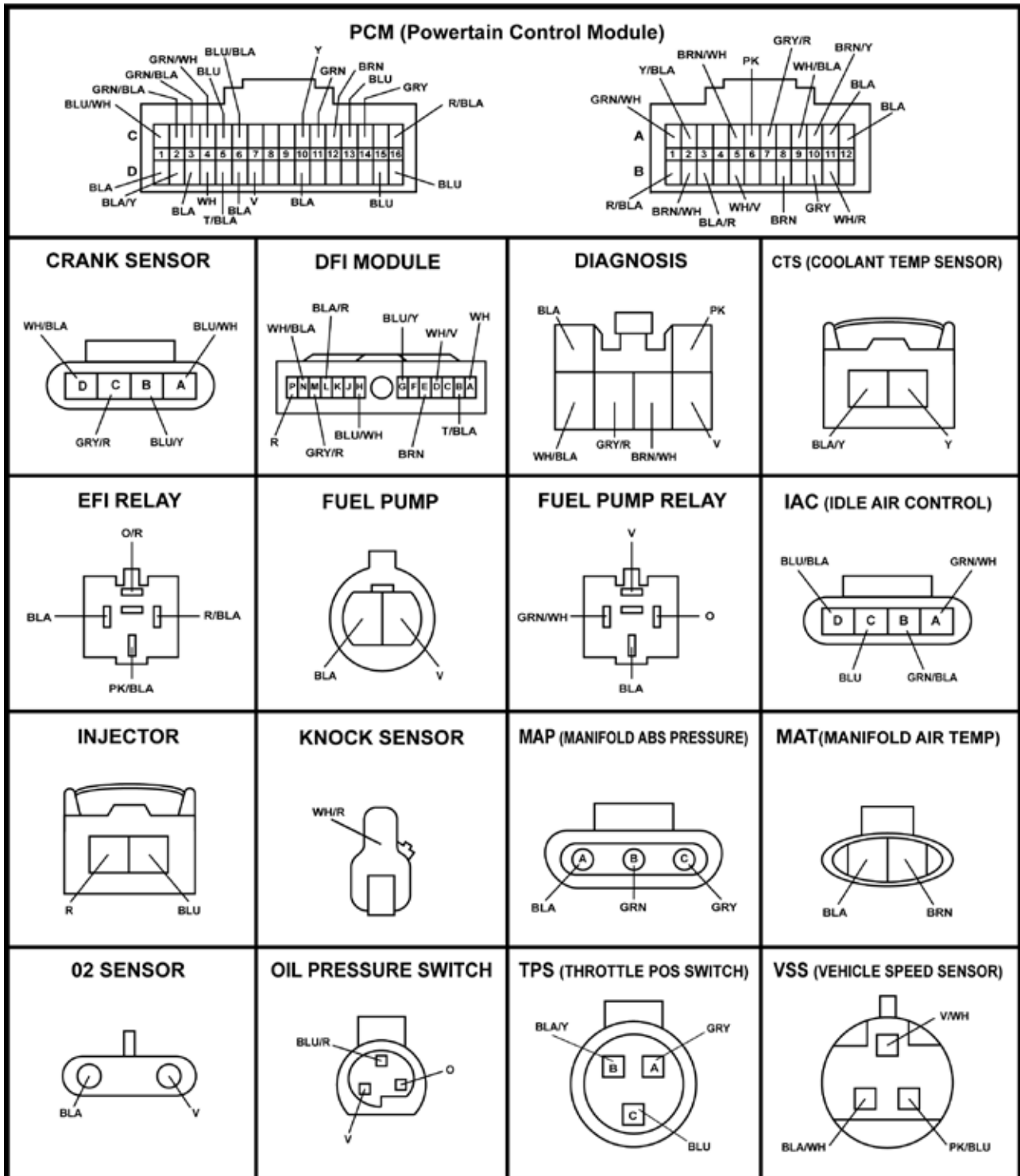
H001 VN Model (to Oct 1989) V6 Connectors



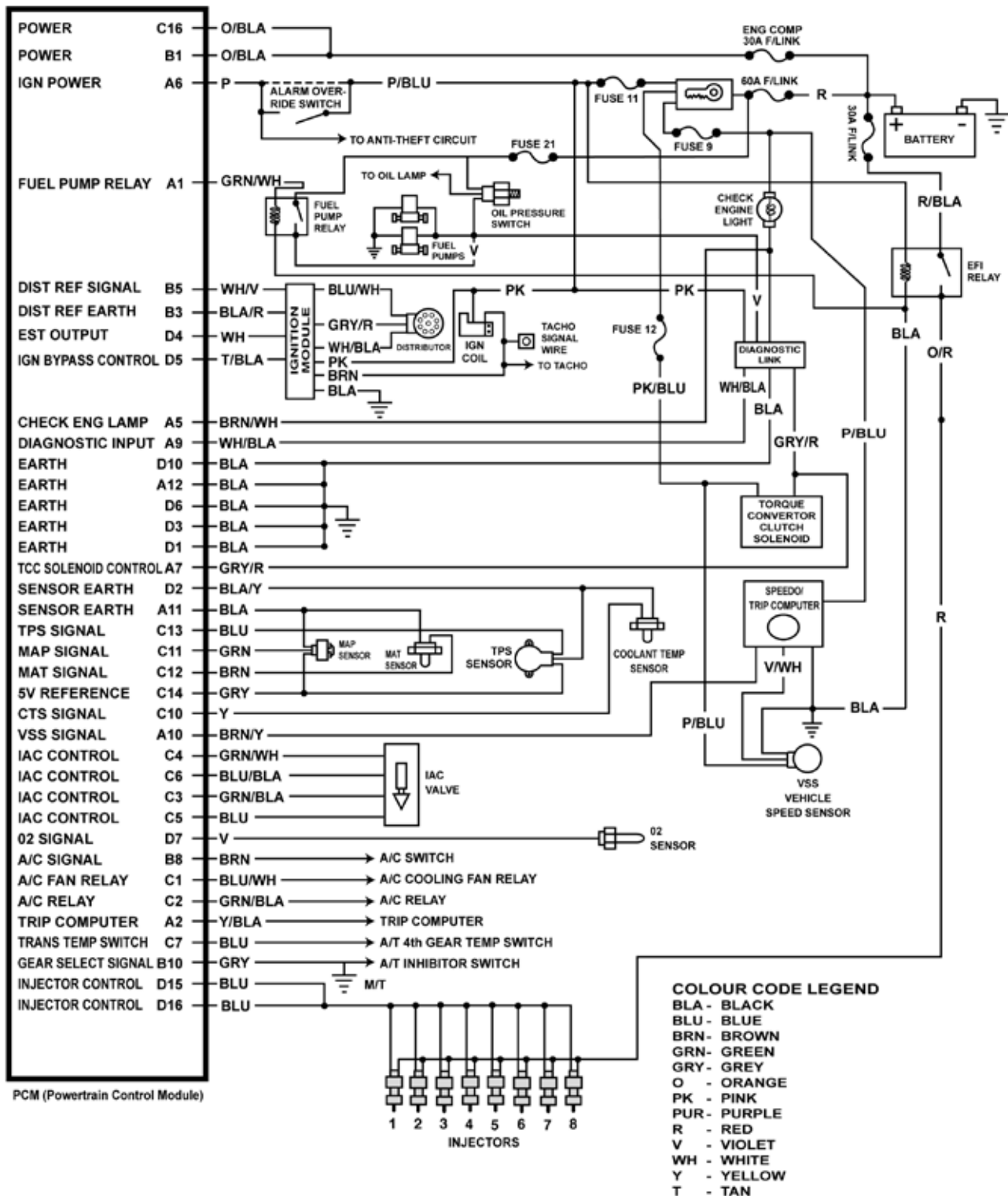
H002 VN Model (from Oct 1989) & VP Model V6 Wiring Diagram



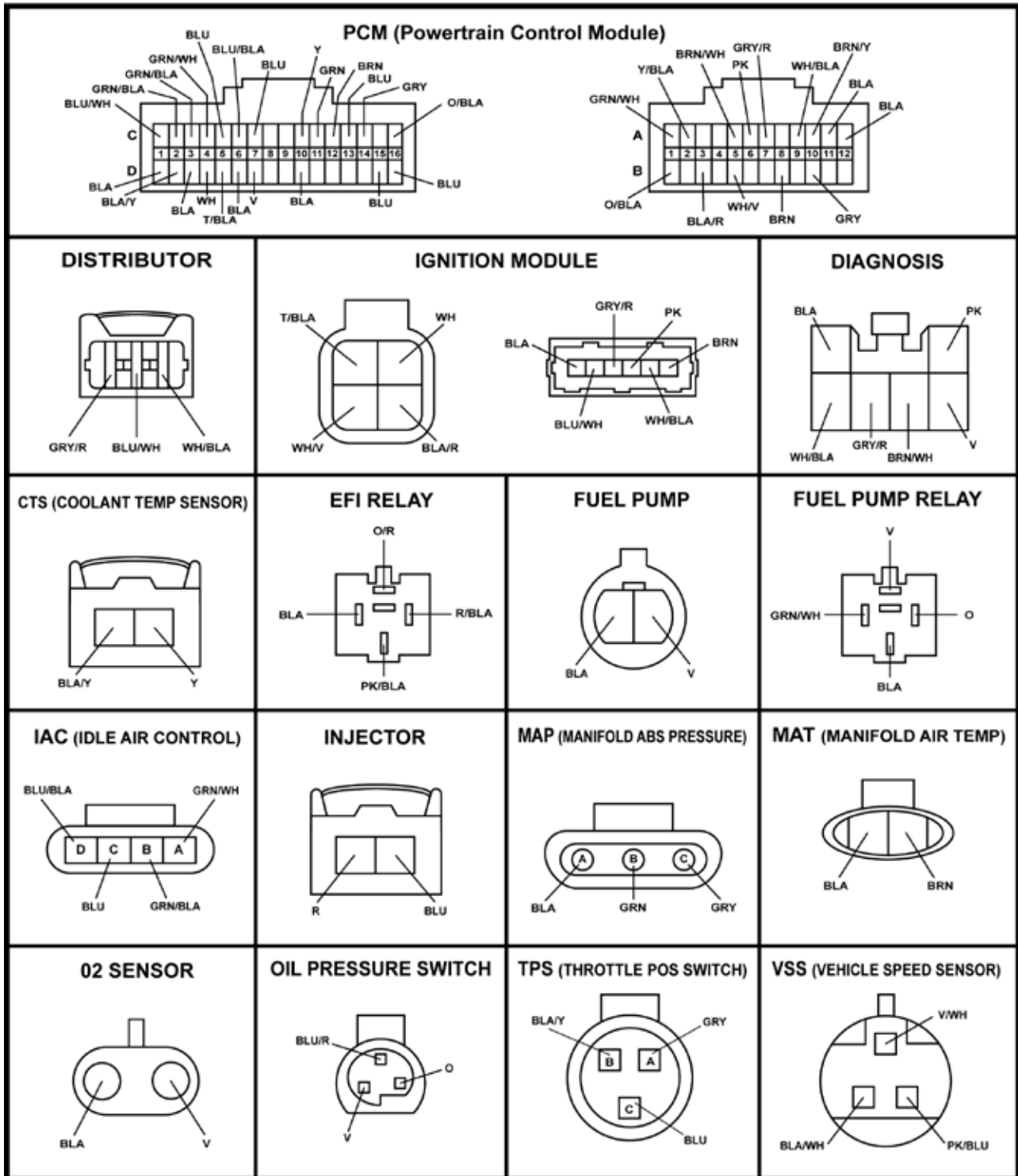
H002 VN Model (from Oct 1989) & VP Model V6 Connectors



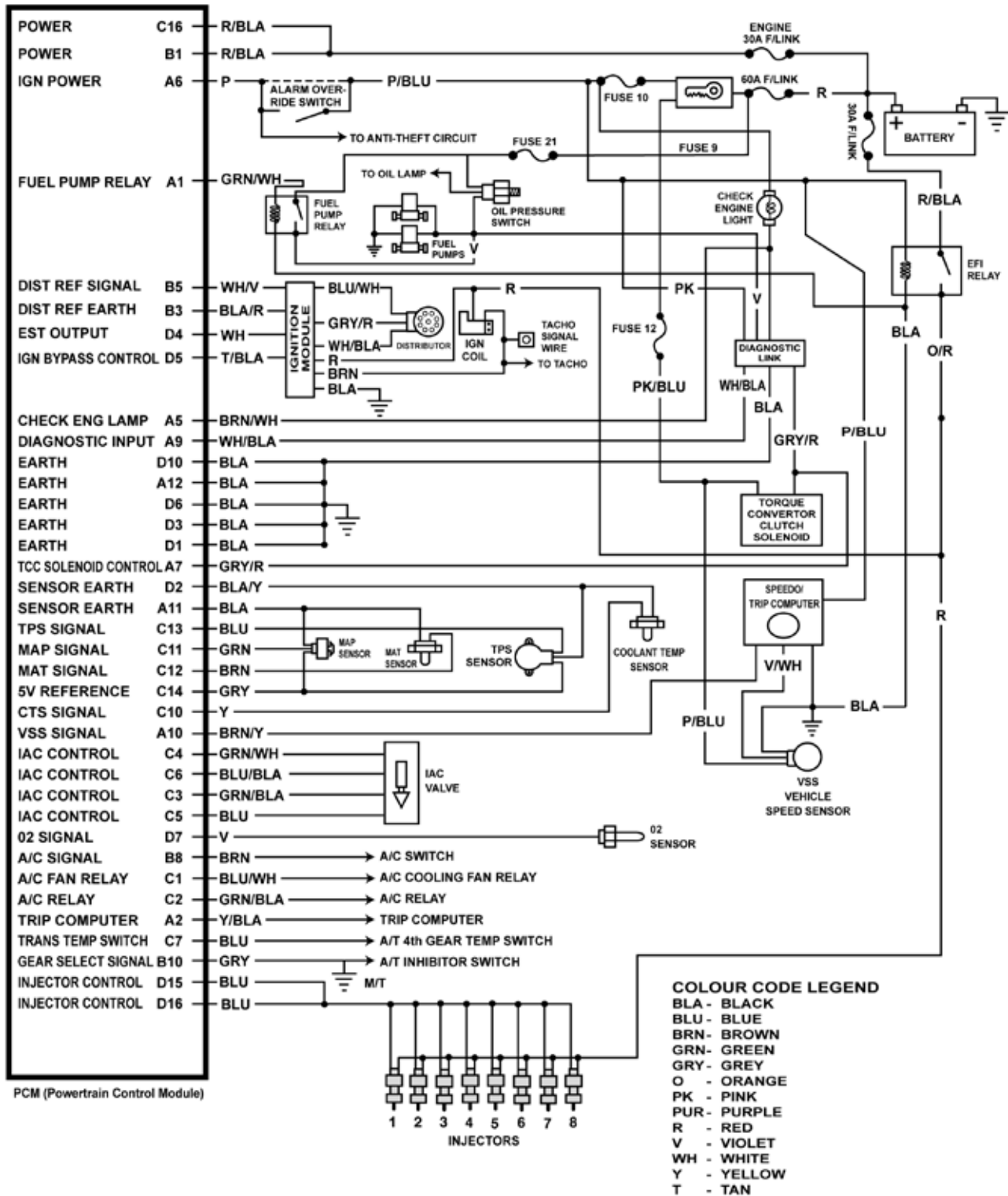
H003 VN Model (to Oct 1989) V8 Wiring Diagram



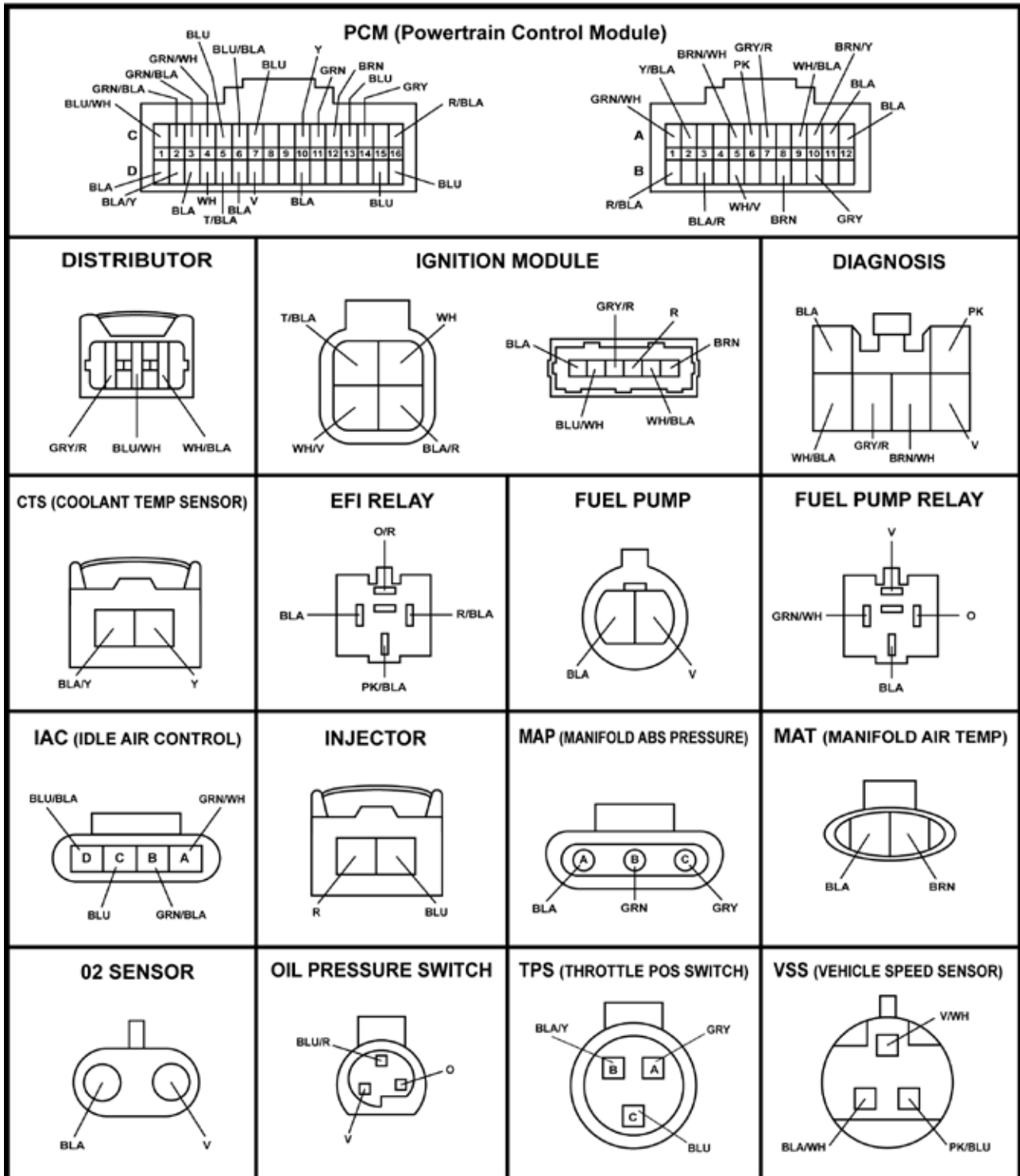
H003 VN Model (to Oct 1989) V8 Connectors



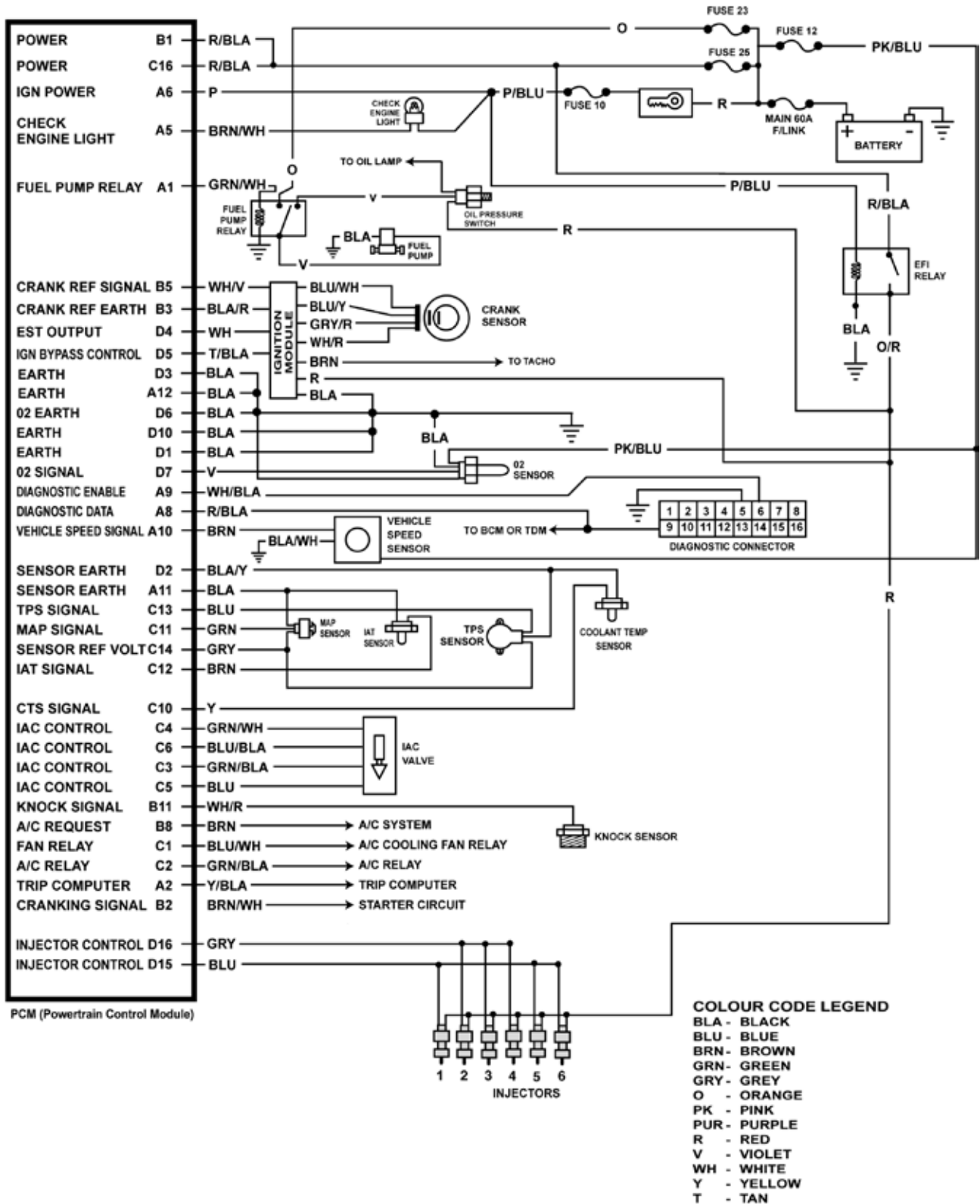
H004 VN Model (from Oct 1989) & VP Model V8 Wiring Diagram



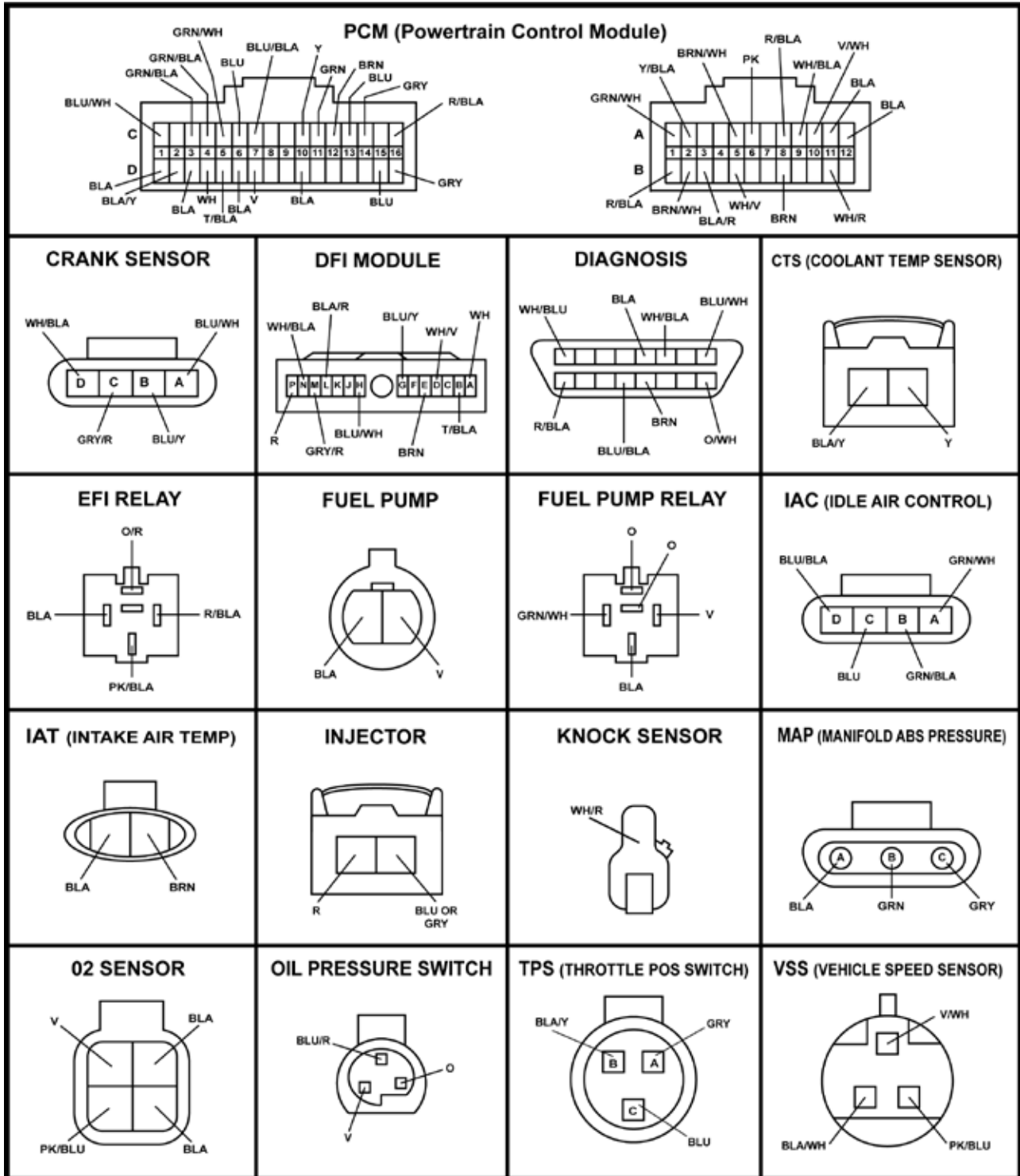
H004 VN Model (from Oct 1989) & VP Model V8 Connectors



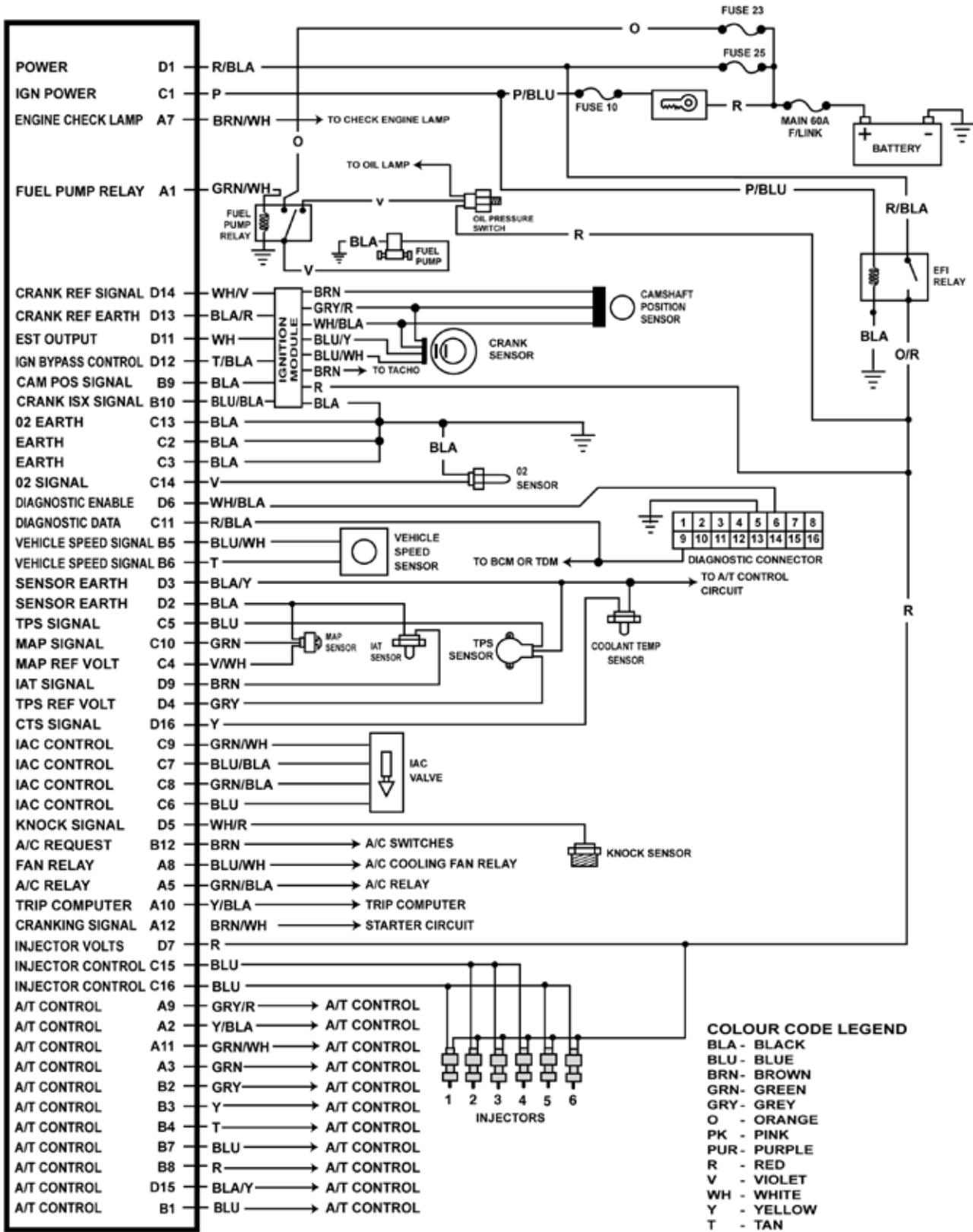
H005 VR Manual Model V6 Wiring Diagram



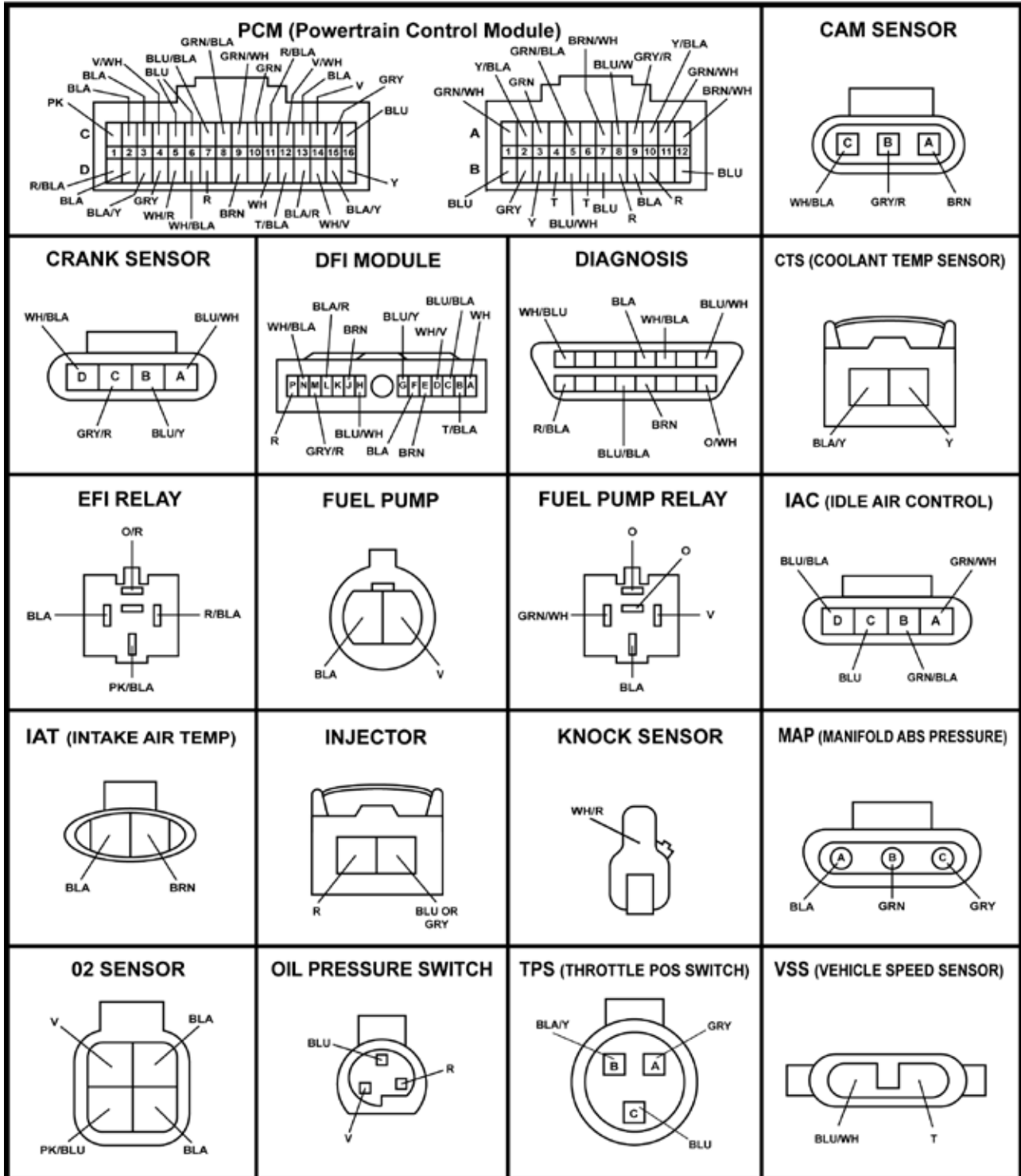
H005 VR Manual Model V6 Connectors



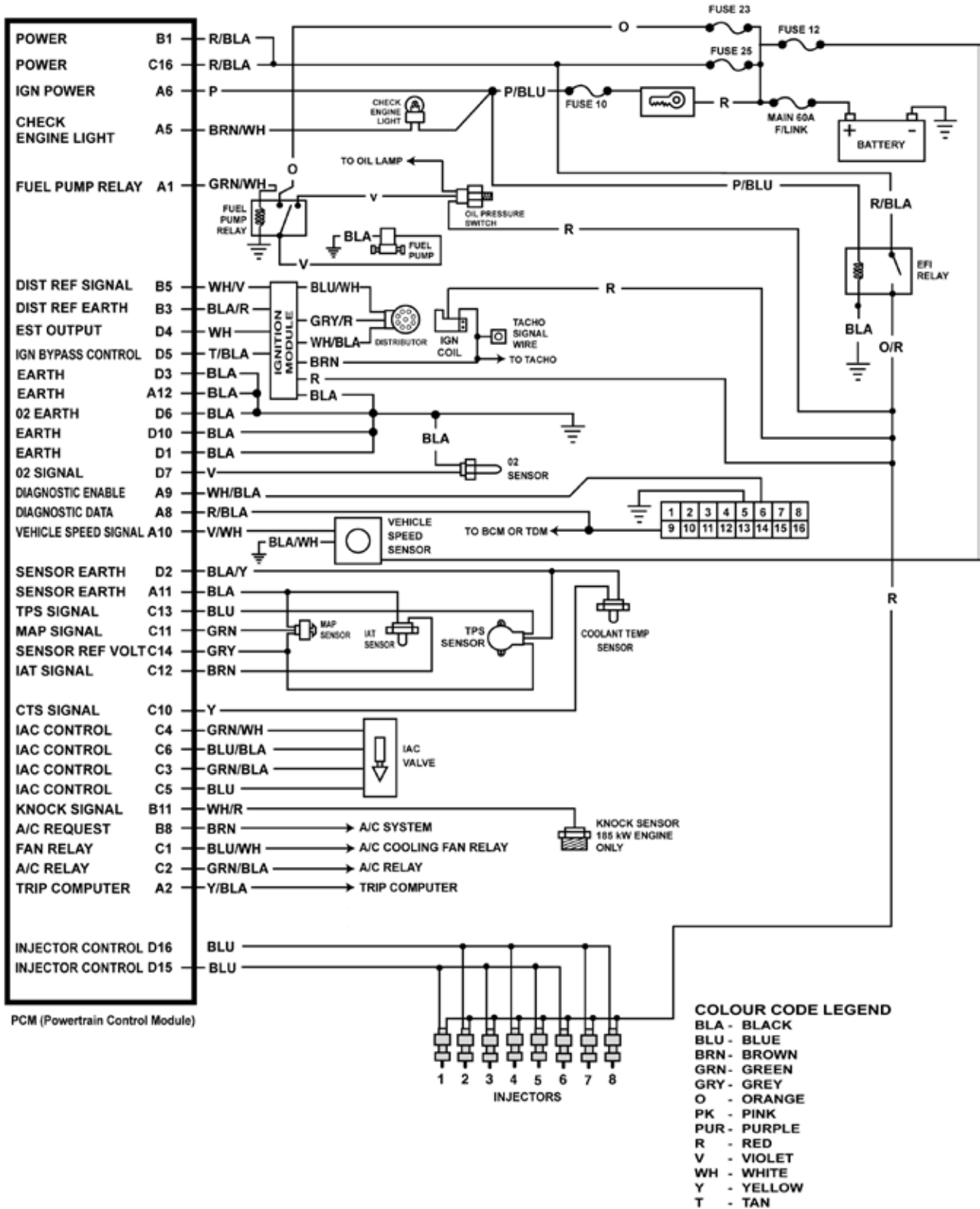
H006 VR Automatic Model V6 Wiring Diagram



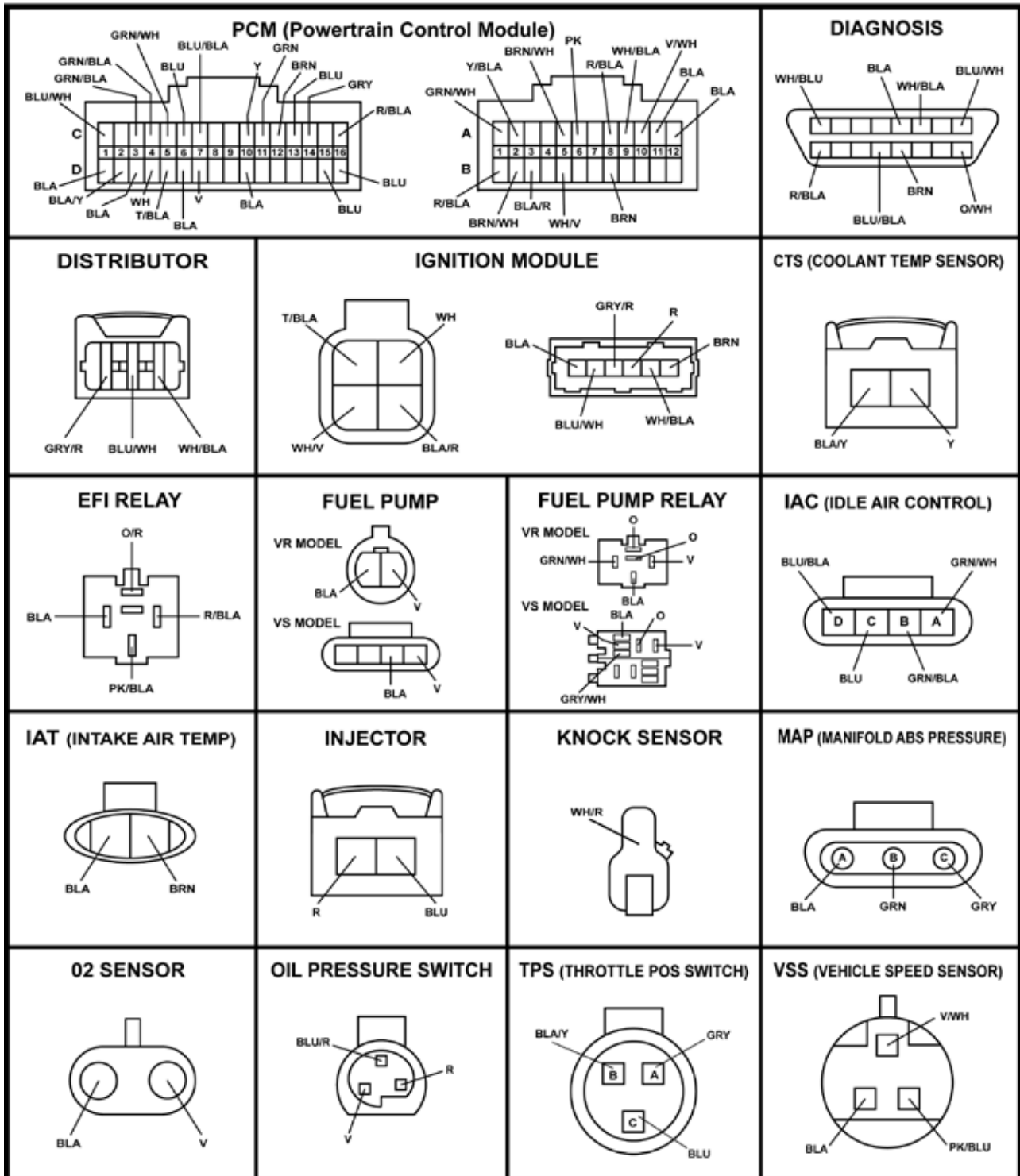
H006 VR Automatic Model V6 Connectors



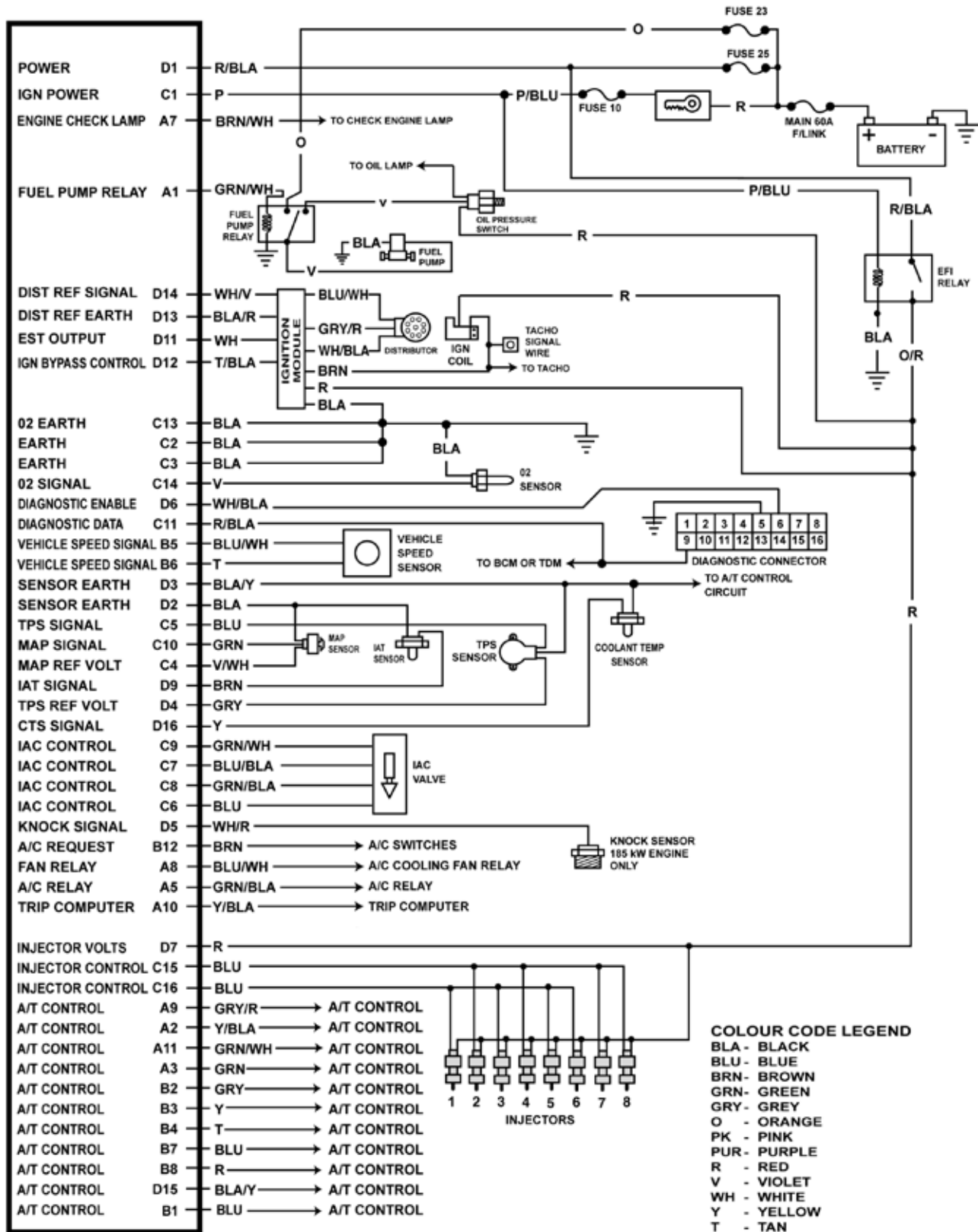
H007 VR & VS Manual Model V8 Wiring Diagram



H007 VR & VS Manual Model V8 Connectors

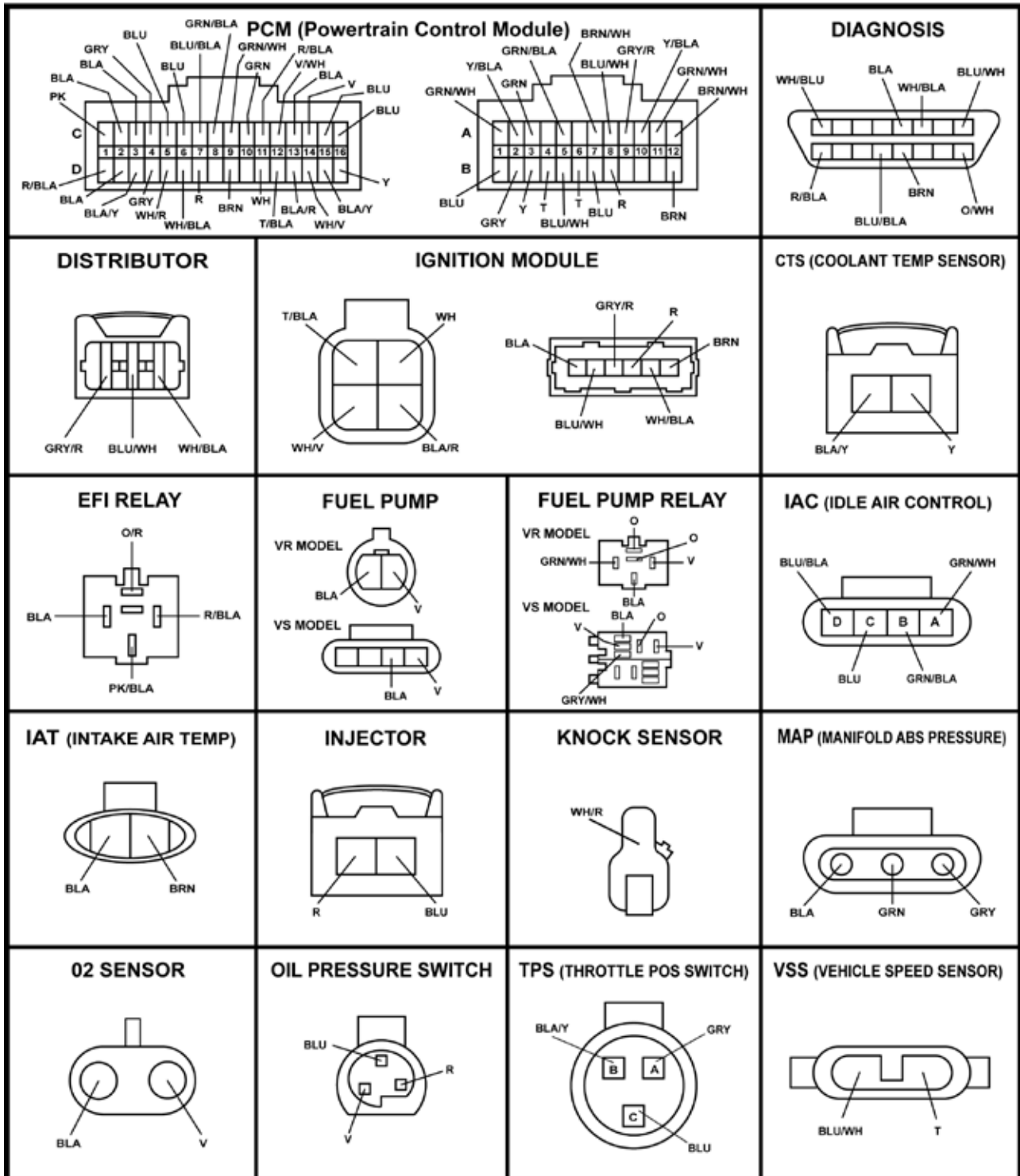


H008 VR & VS Automatic Model V8 Wiring Diagram

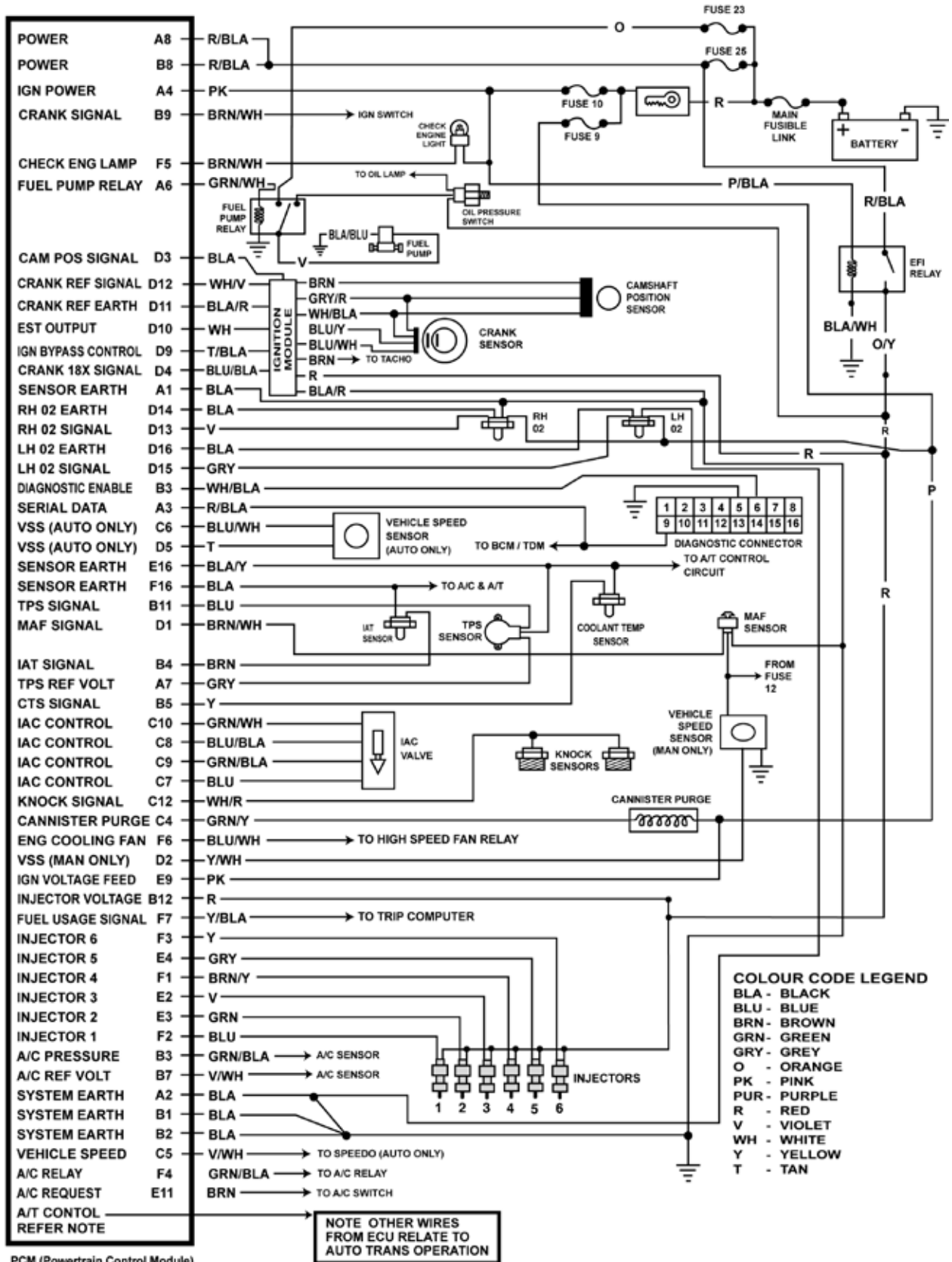


PCM (Powertrain Control Module)

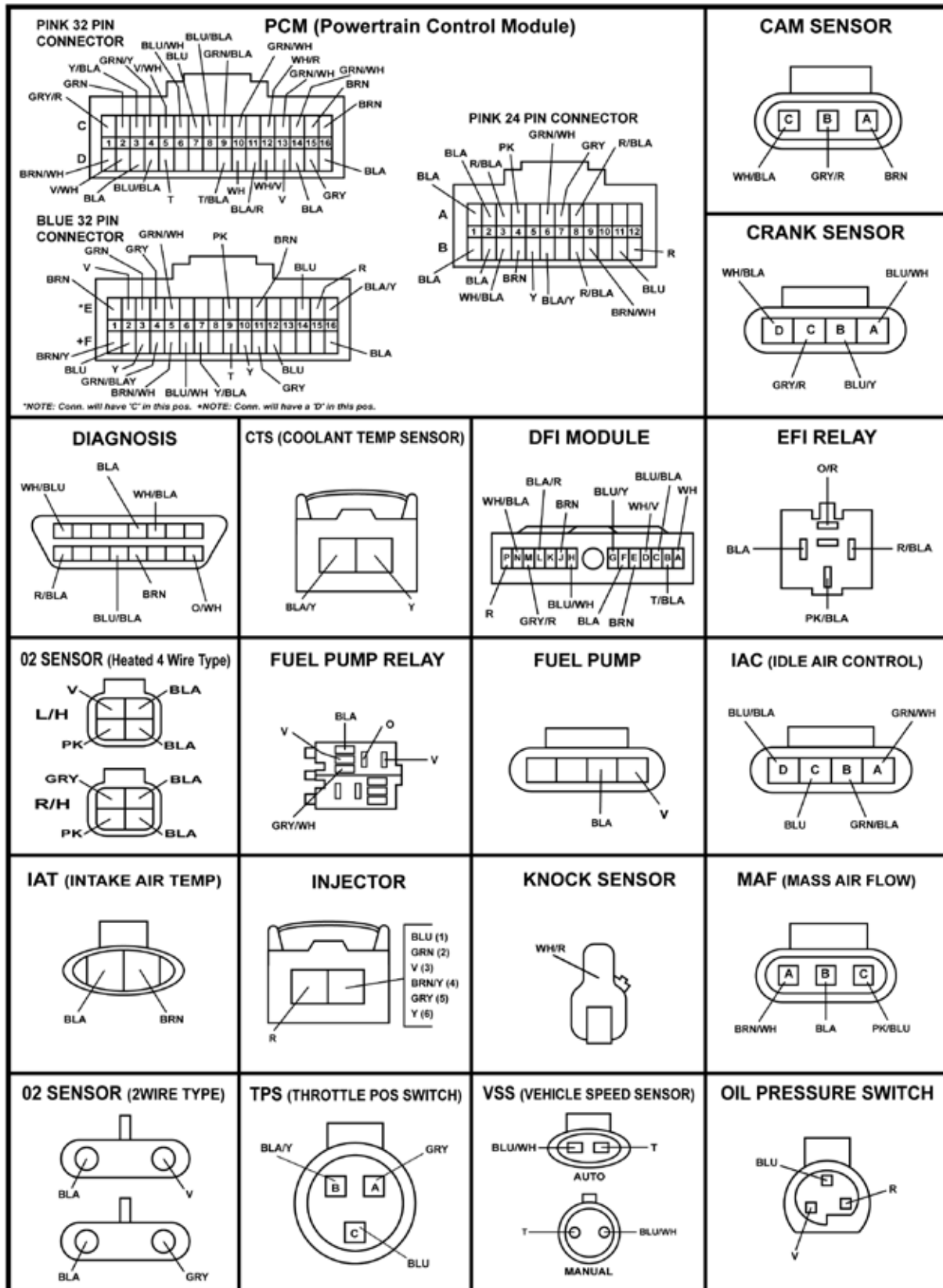
H008 VR & VS Automatic Model V8 Connectors



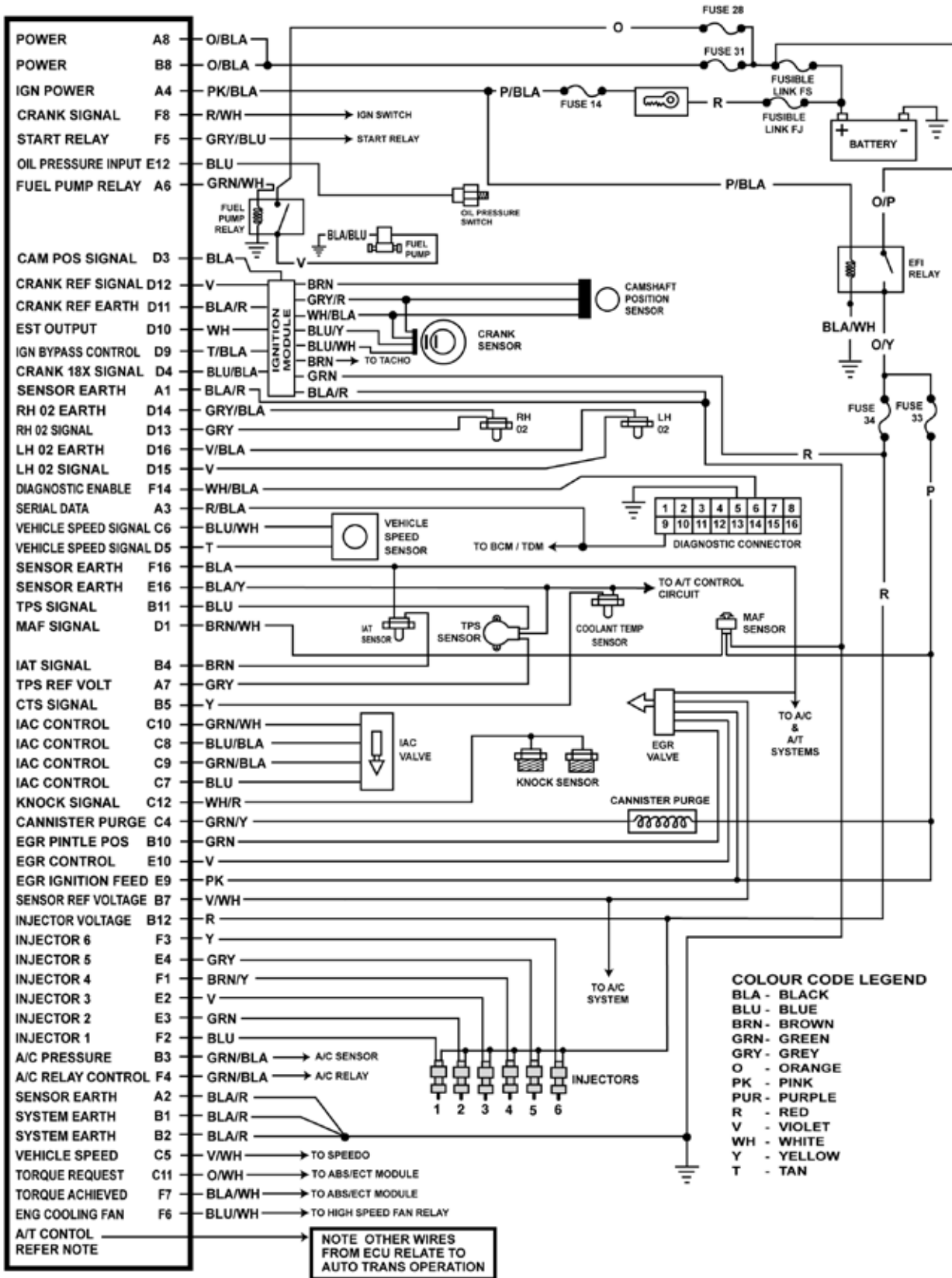
H009 VS Model V6 Wiring Diagram



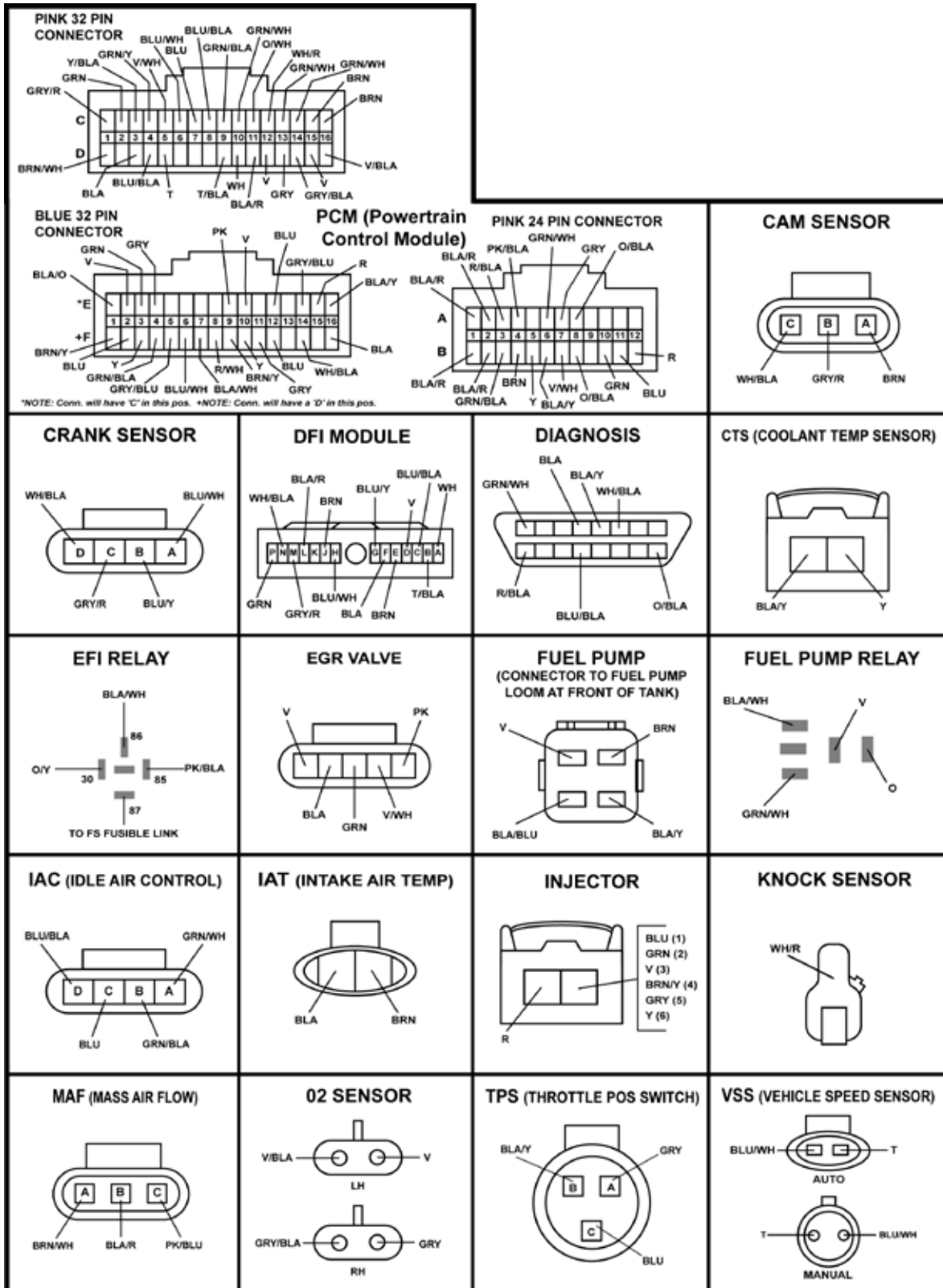
H009 VS Model V6 Connectors



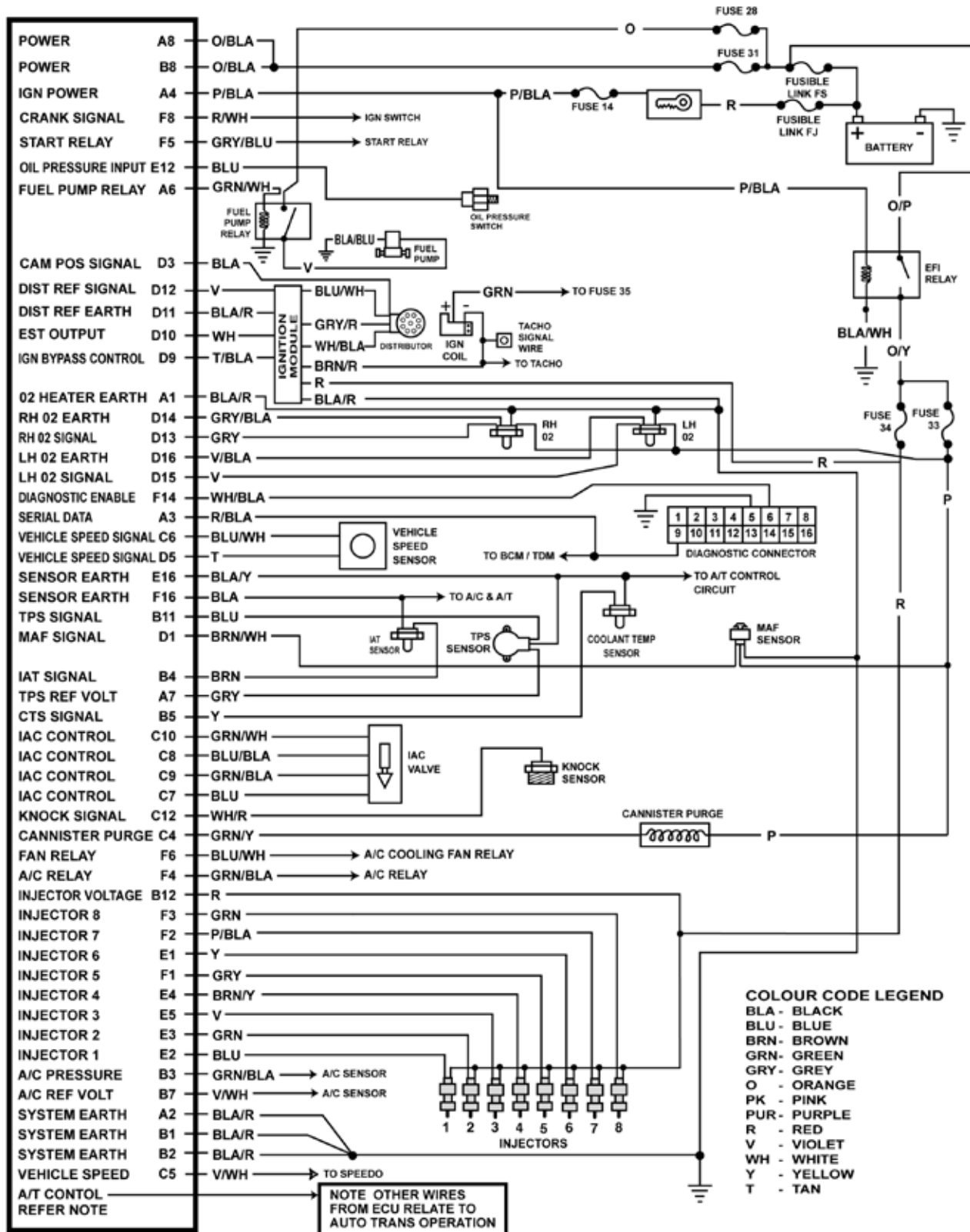
H010 VT Model V6 Wiring Diagram



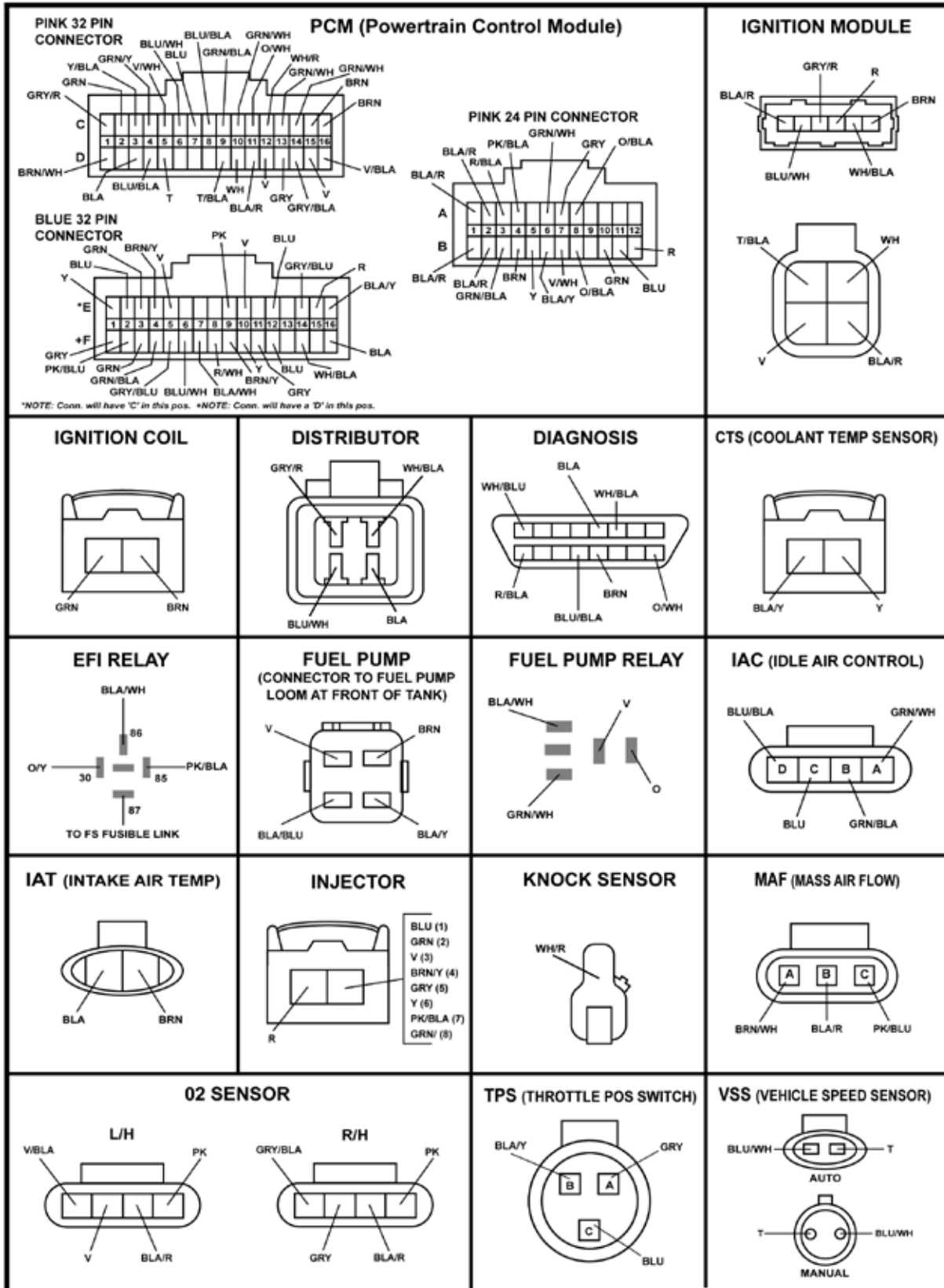
H010 VT Model V6 Connectors



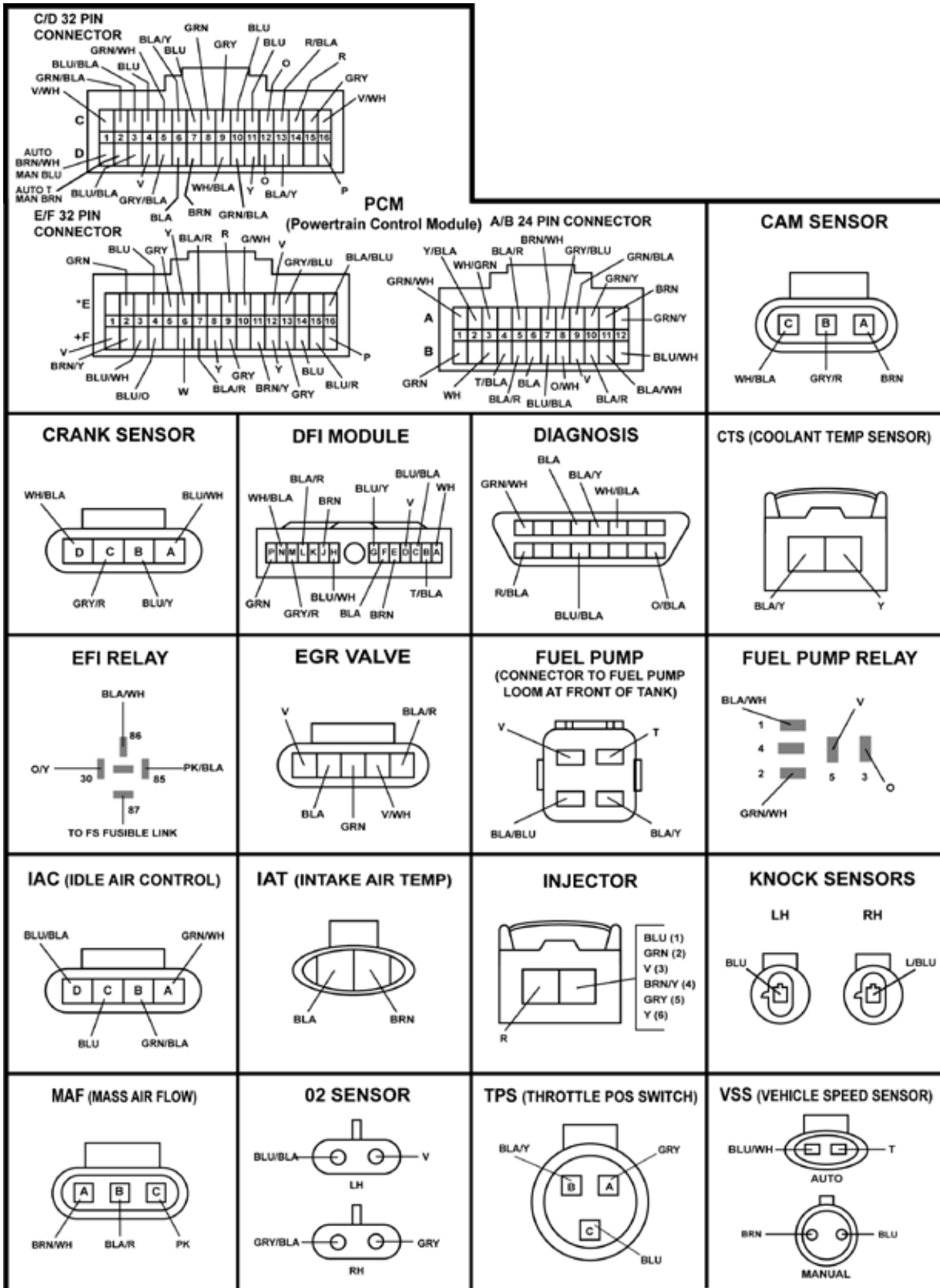
H011 VT Model 5.0 Litre V8 Wiring Diagram



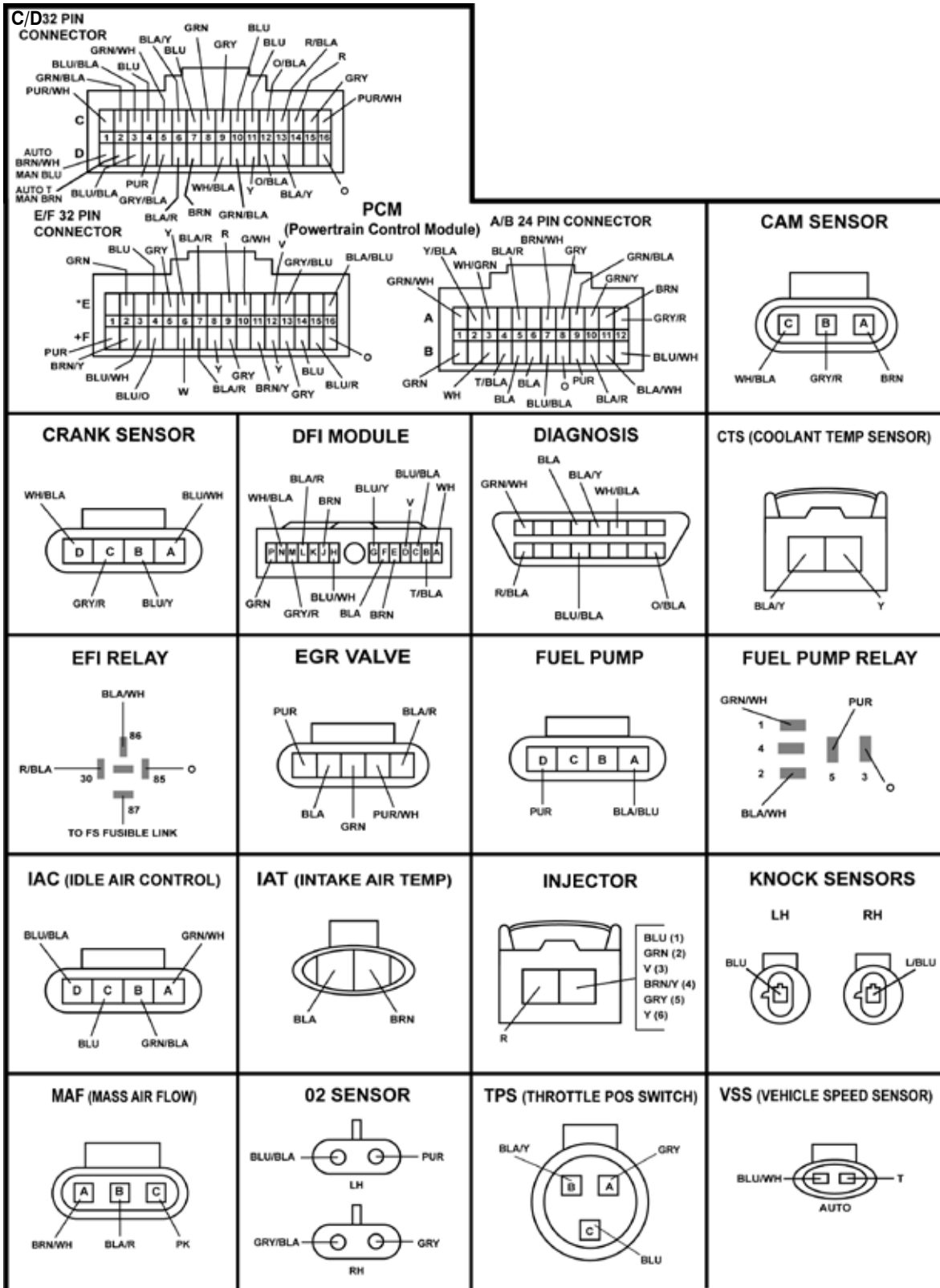
H011 VT Model 5.0 Litre V8 Connectors



H012 VX Model V6 Connector Diagram



H013 VY Model V6 Connector Diagram



H014 V6 Direct Fire Ignition (DFI) Power Balance Testing

Power Balance Testing

You can do a power balance test on a direct ignition system by using short lengths of vacuum hose and a 12-volt test lamp. The vacuum hose must have a high carbon content so that it will conduct secondary voltage. Install a short piece of hose between each coil terminal and its spark plug cable as per figure 1.

The vacuum hose should be long enough to be exposed when the plug cable is connected but short enough that they do not touch any metal object.

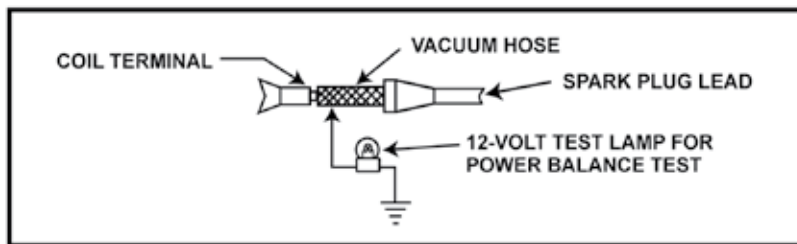


Figure 1: Vacuum hose connection for power balance testing.

Using a 12-volt test lamp connected to ground, touch each vacuum hose to short the cylinder. Note the engine speed as you short each cylinder. Then slowly move the test lamp probe away from the hose and note the strength of the arc between the vacuum hose and the test lamp probe. As with any power balance test, engine speed will *decrease the least* on a cylinder with a problem. Interpret the strength of the arc between the hose and the lamp probe as follows:

Touch the vacuum hoses with the test lamp until you find little or no rpm drop. Then move the probe away from the hose and note the arc. If the arc jumps a long distance to the grounded test lamp, suspect an open circuit between the coil and the plug. Look for an open plug cable or plug or a very wide plug gap. If the arc jumps only a short distance to the grounded test lamp, suspect a short circuit between the coil and the plug. Look for a shorted cable or plug, or a fouled, cracked, or carbon tracked spark plug, figure 2.

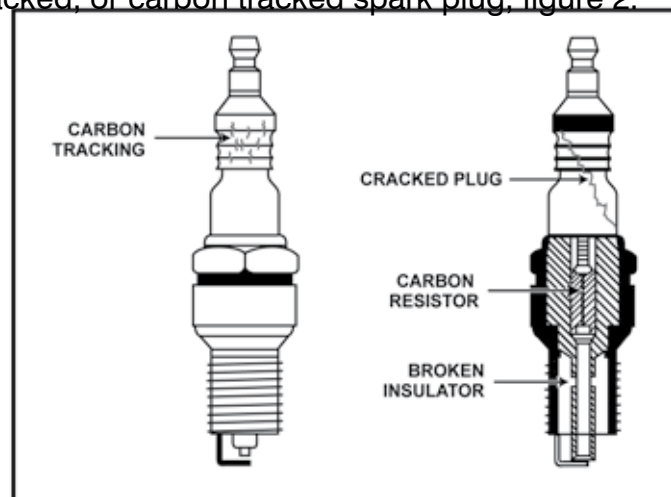


Figure 2: Spark Plug Insulation.

Broken Spark Plug Insulator

The ceramic spark plug insulator can break near the base where it is hard to see, figure 15. This can cause a misfire. You may need to gently tap on the spark plug. If the insulator slides down, it will mask the spark, causing a misfire. You can also check the resistance between the terminal and the centre electrode. Typically, the resistance should be 6000 ohms or less. A defective plug will often show an open circuit or high resistance.

H015 Fuel System Diagnosis Using Fuel Pump Current

Knowing whether a running fuel pump is drawing too much or too little current can help you identify a faulty fuel system component.

To measure fuel pump current, you can use an ammeter or a DMM with an inductive probe.

WARNING: High current flowing through faulty fuel pump circuits may damage a DMM. Do not use a measuring tool whose current-rating is less than the current you expect to measure.

If using an ammeter, remove the fuel pump fuse and connect the leads across the fuel terminals. If only using an inductive probe, attach its end around the positive feed wire to the fuel pump.

With the test leads or probe hooked up, start and run the engine if possible. If trouble-shooting an intermittent problem, allow the engine to run long enough to give the fault an opportunity to present itself. Then record the key-on engine-running fuel pump current. Turn the ignition switch to the OFF position and back to the ON position without restarting the vehicle. After the fuel pump stops running (usually about 2 seconds), record the current again. Normally this nominal current is 0 to 0.7 amps.

If the problem affecting the vehicle prevents you from starting the engine, turn the key to the ON position. Record the key-on engine-off current before the fuel pump stops running. Turn the ignition switch to the OFF position and back to the ON position without restarting the vehicle. After the fuel pump stops running (usually about 2 seconds), record the nominal current.

Subtract the nominal current from the key-on engine-off or key-on engine-running current to obtain the fuel pump current draw. Refer to table 1 to see if the current draw value falls within specification.

If the fuel pump current is much lower than specification, suspect:

- empty fuel tank
- an open pump circuit
- a damaged pulsator (dampener)
- a leaking internal connection between the pump and fuel line
- a broken pressure regulator spring
- a faulty fuel pump

If the fuel pump current is much greater than specification, suspect a:

- plugged fuel filter
- restricted fuel hose
- faulty fuel pump

Fuel Pump Priming Operation

When the ignition is turned on, the PCM for GM fuel injection systems energizes the fuel pump for about 2 seconds to prime the system. If the PCM does not get a tach (cranking) signal within the 2 seconds, it de-energizes the pump relay, figure 3. When cycling the ignition to pressurise the system for testing, leave the ignition off for 15 seconds before turning it on again; or the PCM will not re-energize the pump relay.

Note these systems hold residual pressure when the engine is off. Pressure can leak down, however, during a long engine-off period.

H016 Crankshaft Sensor Testing

The 3.8 litre V6 is fitted with a dual type crankshaft sensor. The outer crank sensor works with an 18-blade interrupter ring and sends an 18-pulse (18X) clock signal to the ignition module. The inner crank sensor works with an unevenly spaced 3-blade interrupter ring and sends a 3-pulse (3X) cylinder signal to the DFI module. Each of the three pulses has a different duration. The DFI ignition module compares the variable 3X pulses to the steady 18X clock pulses to determine which coil to fire. It can identify tdc on the compression stroke of the appropriate cylinder within 120 degrees of crankshaft rotation. The DFI module divides the 18X signal by 6 and sends it to the PCM for fuel control. (It also buffers the cam signal and sends it to the PCM to synchronize fuel injection on vehicles fitted with a separate camshaft position sensor.)

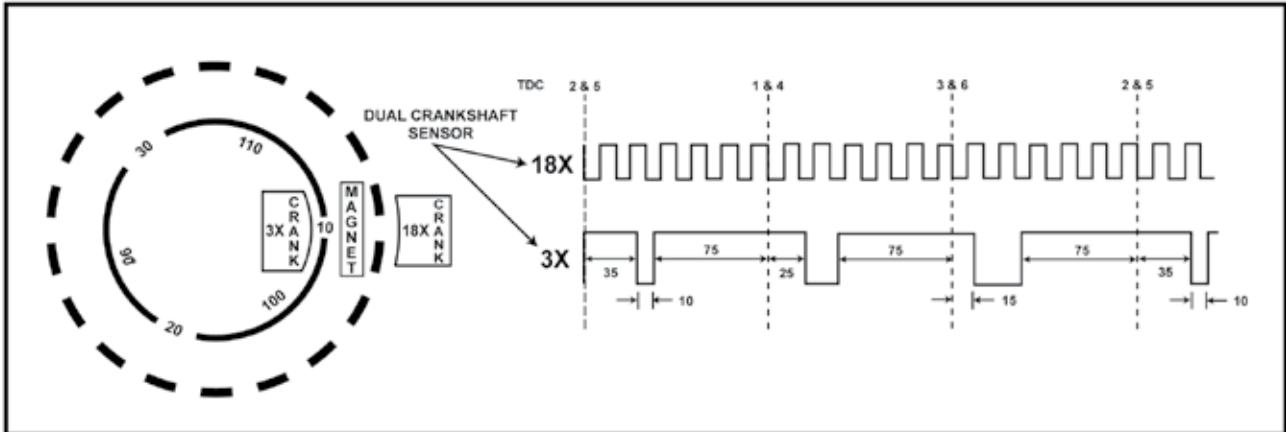
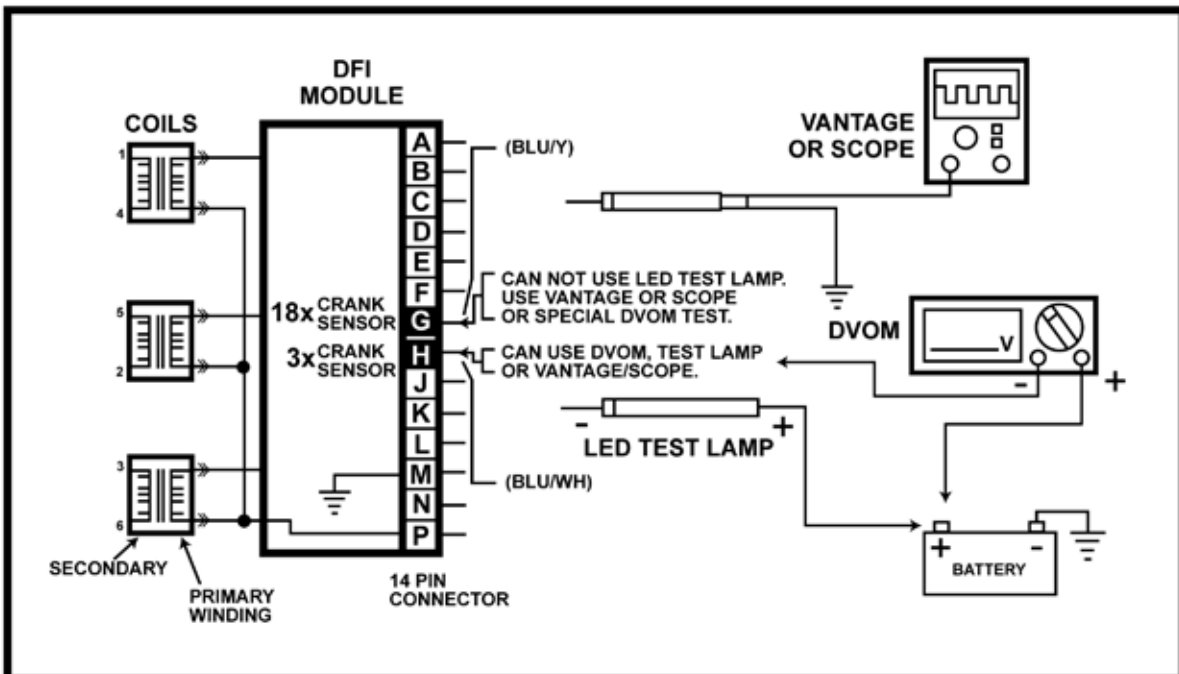


Figure 1: Crankshaft sensor signals.

H016 continued

- Verify that the module and the sensors all have good grounds. Refer to diagrams for terminal identification.
- If the engine does not start, tap the crank sensor lightly with a screwdriver handle. If the engine then starts, the sensor may have an intermittent open or short circuit.

You can use the Vantage Meter, an oscilloscope, a digital volt-ohmmeter (DVOM), or a light-emitting diode (LED) test lamp to check the sensor signal. Connect test equipment as shown in Figure 2. Set the scope for a 20-millisecond (20 ms) sweep and 5.0 volts per division. The scope display for a good sensor should be similar to the patterns previously shown in Figure 1.



- **1X and 3X Signals** – Check these signals with either a DVOM, LED test lamp, or a scope. Leave the sensor connected and backprobe the correct terminals at the ignition module; then crank the engine. DVOM dc voltage will fluctuate if the sensor is working. An LED will flash as the signal voltage goes high and low and actually provides a better indication than a DVOM.
- **18X Signal** – This signal is too fast to check reliability with a DVOM or an LED. A scope provides the most reliable reading. As an alternative, set a DVOM on the 20- or 40- volt scale and connect the positive (+) lead to a battery positive (+) voltage. Backprobe the sensor signal terminal at the module with the DVOM negative (-) lead. Turn the ignition on and bump the starter; do not crank the engine steadily. The DVOM reading should be high (above 9 volts) when a blade of the interrupter ring is in the sensor slot (window closed) and low (below 3 volts) when the blade is out of the slot (window open). It may take several tries to alternately position a blade in and out of the sensor slot and verify the high and low signal voltage levels.

H017 Integrator and Block Learn Functions

The integrator and block learn functions are responsible for making minor adjustments to the air-fuel mixture on fuel injected vehicles. The integrator makes temporary, short-term corrections, while block learn makes more permanent, long-term corrections. Integrator and block learn give useful diagnostic values only when the car is running in closed loop.

Integrator

The integrator monitors the oxygen sensor output voltage and adds or subtracts fuel, depending on the lean or rich condition of the O₂ sensor. Think of the integrator value as representing injector on time, the larger the number, the more fuel delivered. Even though integrator values go from 0 to 255, typically a low number would be 58 and a high number would be 198.

Block Learn

Block learn monitors the integrator value and compares it to engine operating ranges at various combinations of rpm and load. Load is determined by engine speed and MAP. A plot of rpm versus engine load is used to determine the performance boundaries. These performance boundaries are called cells or blocks. VN and VP models have 16 different cells.

The PCM has different fuel delivery values stored in each block. Block 0 is idle with no load, and block 15 is maximum rpm and maximum load. As the operating range changes to a different block, the fuel delivery changes to the operating value stored in that block.

If the integrator is far enough from 128, the PCM changes the block learn value. Once the block learn value is changed, it should force the integrator back to 128. If the mixture is still not correct, based on the O₂ sensor, the integrator will continue to have a large deviation from 128 and the block learn value will continue to change until the integrator value becomes balanced.

When integrator increases or decreases, block learn responds by making changes in the same direction. As block learn makes its long-term corrections, the need for the integrator short-term correction is reduced. In a properly operating system, integrator will adjust the fuel mixture until block learn takes over, and then integrator will return to its normal value of 128.

Both the integrator and block learn have limits that vary, depending on the vehicle. Once a problem exceeds the block learn correction limit, the integrator goes to its correction limit, and the check engine lamp will light.

Block Learn Memory Storage

The values stored in the block learn cells remain in memory when the ignition is turned OFF. Upon restart, the fuel delivery for a given block is based on the stored value. Disconnecting the battery or power supply to the PCM will cause the fuel trim memory to be lost.

H017 continued

Using Block Learn and Integrator To Find Vacuum Leaks

A block learn value that is high at idle, and normal at 3000 rpm, indicates a possible vacuum leak. This is because a vacuum leak is a larger percentage of total air flow at idle than at 3000 rpm. Thus, the fuel mixture needs more correction at idle.

Integrator can help you find a vacuum leak. Pinch off the vacuum hoses as close as possible to the intake manifold while observing the integrator value. A sudden drop in the reading while pinching a hose indicates a vacuum leak in that hose, or an attached component.

Using Block Learn To Diagnose Fuel Flow Problems

A block learn value that is normal at idle and high at 3000 rpm indicates a possible fuel flow problem. This is because the engine needs more fuel at 3000 rpm than at idle. Thus, the fuel mixture needs more correction at high rpm. Suspect a dirty fuel filter or a weak fuel pump.

A block learn value that is high at both idle and 3000 rpm indicates dirty fuel injectors, or low fuel pressure. This is because fuel injector flow and fuel pressure affects the engine at all rpm.

Using Block Learn To Diagnose A Rich Condition

A block learn reading that is low at idle – 100 or below – or low at 3000 rpm indicates a rich condition. Possible areas of concern at fuel-contaminated oil, a leaking fuel pressure regulator, a leaking fuel injector, or high fuel pressure.

H018 Short Term and Long Term Fuel Trim Functions

The short term fuel trim (STFT) and long term fuel trim (LTFT) functions are responsible for making minor adjustments to the air-fuel mixture on fuel injected vehicles. The STFT makes temporary, short-term corrections, while LTFT makes more permanent, long-term corrections. LTFT and STFT give useful diagnostic values only when the car is running in closed loop.

Short Term Fuel Trim

The STFT monitors the oxygen sensor output voltage and adds or subtracts fuel, depending on the lean or rich condition of the O2 sensor. Think of the STFT value as representing injector on time, value above 0%, the more fuel delivered. Even though STFT values go from -100% to +100%, typically a low number would be less than -20% and a high number would be above 25%.

Long Term Fuel Trim

LTFT monitors the STFT value and compares it to engine operating ranges at various combinations of rpm and load. Load is determined by engine speed and MAP. A plot of rpm versus engine load is used to determine the performance boundaries. These performance boundaries are called cells or blocks. VR and VS models have 24 and VT models onwards have 34 different cells.

The PCM has different fuel delivery values stored in each cell. As the operating range changes to a different cell, the fuel delivery changes to the operating value stored in that cell.

If the STFT is far enough from 0%, the PCM changes the LTFT value. Once the LTFT value is changed, it should force the STFT back to 0%. If the mixture is still not correct, based on the O2 sensor, the STFT will continue to have a large deviation from 0% and the LTFT value will continue to change until the STFT value becomes balanced.

When STFT increases or decreases, LTFT responds by making changes in the same direction. As LTFT makes its long-term corrections, the need for the STFT short-term correction is reduced. In a properly operating system, STFT will adjust the fuel mixture until STFT takes over, and then STFT will return to its normal value of 0%.

Both the STFT and LTFT have limits that vary, depending on the vehicle. Once a problem exceeds the LTFT correction limit, the STFT goes to its correction limit, and the check engine lamp will light.

LTFT Memory Storage

The values stored in the block learn cells remain in memory when the ignition is turned OFF. Upon restart, the fuel delivery for a given block is based on the stored value. Disconnecting the battery or power supply to the PCM will cause the fuel trim memory to be lost.

H018 continued

Using Fuel Trim Values To Find Vacuum Leaks

A LTFT value that is high at idle, and normal at 3000 rpm, indicates a possible vacuum leak. This is because a vacuum leak is a larger percentage of total air flow at idle than at 3000 rpm. Thus, the fuel mixture needs more correction at idle.

STFT can help you find a vacuum leak. Pinch off the vacuum hoses as close as possible to the intake manifold while observing the STFT value. A sudden drop in the reading while pinching a hose indicates a vacuum leak in that hose, or an attached component.

Using LTFT To Diagnose Fuel Flow Problems

A LTFT value that is normal at idle and high at 3000 rpm indicates a possible fuel flow problem. This is because the engine needs more fuel at 3000 rpm than at idle. Thus, the fuel mixture needs more correction at high rpm. Suspect a dirty fuel filter or a weak fuel pump.

A LTFT value that is high at both idle and 3000 rpm indicates dirty fuel injectors, or low fuel pressure. This is because fuel injector flow and fuel pressure affects the engine at all rpm.

Using LTFT To Diagnose A Rich Condition

A LTFT reading that is low at idle (below -10%) at idle or low at 3000 rpm indicates a rich condition. Possible areas of concern at fuel-contaminated oil, a leaking fuel pressure regulator, a leaking fuel injector, or high fuel pressure.

H019 3.8 Litre V6 Ignition Test

This test requires the use of 3 paper clips, 2 straightened for probing and earthing and 1 bent to a narrow “U” shape for bridging. The use of Snap-on part number MT3000430A5R back probes are recommended for probing but paperclips can be used if not available. Be careful not to allow any probes to touch or earth out.

Follow test as follows:

1.
 - a) With ignition OFF and DFI module 14-pin connector disconnected, bridge connector terminals N (white/black) and P (VN pre-Oct 89 pink/VN post-Oct 89, VP, VR, VS red/VT onwards green).
 - b) Insert probe into connector terminal M (grey/red) and connect it to earth.
 - c) Probe connector terminal H (blue/white) with a testlight which is connected to 12V positive.
 - d) Switch ignition on and slowly turn engine over by hand (28mm socket). Check if testlight goes ‘on’ and ‘off’ as 3X interrupter blades pass through crank sensor. If testlight goes ‘on’ and ‘off’ go to tip 2. If not check for continuity and no shorts of white/black, blue/white and grey/red wires from DFI connector to crank sensor. If wiring is okay then suspect crank sensor.

 2.
 - a) Switch ignition off
 - b) Remove testlight probe from connector terminal H (blue/white) and insert probe into connector terminal G (blue/yellow).
 - c) Switch ignition on and slowly turn engine over by hand. Testlight should go ‘on’ and ‘off’ as 18x interrupter ring passes through crank sensor.

If testlight goes ‘on’ and ‘off’ go to tip 3.
If not, check for continuity and no shorts of blue/yellow wire from crank sensor to DFI module pin G. If wiring okay, suspect faulty crank sensor.

 3.
 - a) Switch ignition off and remove all leads and refit 14-pin connector to DFI module.
 - b) Remove coil packs from top of DFI module including the terminals on base of coils.
 - c) Fit testlight across corresponding coil terminals from DFI module.
 - d) With engine cranking, testlight should blink. This test should be done across all three corresponding coil DFI terminals.

If testlight blinks across all three, go to tip 4.
If testlight did not blink across any one of the DFI terminals the suspect faulty DFI module.
-

H019 continued

4. a) Check coil primary resistance by using an ohmmeter across the underside corresponding terminals of each coil. Reading should be 0.30 ohms to 1.5 ohms across all these primary terminals of coils.

If reading is okay, go to tip 5.

If reading is out, suspect faulty ignition coil.

5. b) Check coil secondary resistance by using an ohmmeter across the corresponding plug lead posts of all three ignition coils.

If combined coil pack (pre-1999)
reading should be
10 Kohms to 14 Kohms

If separate coil packs (post-1990)
reading should be
5 Kohms to 7 Kohms

If any coil is out of range or if one coil differs from other two by more than 1 Kohm, then suspect faulty coil.

If all tests pass and ignition tests and plugs are okay, this indicates ignition system should operate. Check for poor connections etc for possible cause of intermittent fault.

NOTE: After test when components are reinstalled, switch ignition ON and reinput back to previous Scanner menu selection screen to continue with tip.

H020 Intake Air Temperature (IAT) and Manifold Air Temperature (MAT) Sensor Resistance to Temperature Values

3.8 Litre V6 Models VN, VP & VR Models

°C	OHMS
100	185
70	450
38	1,800
20	3,400
4	7,500
-7	13,500
-18	25,000
-40	100,700

VS, VT, VX & VY Models

°C	OHMS		°C	OHMS
-40	102,129		60	679
-35	73,345		65	566
-30	53,253		70	475
-25	39,066		75	400
-20	28,940		80	338
-15	21,638		85	287
-10	16,321		90	245
-5	12,414		95	210
0	9,517		100	180
5	7,355		105	156
10	5,729		110	135
15	4,497		115	117
20	3,555		120	102
25	2,830		125	89
30	2,268		130	79
35	1,829		135	69
40	1,483		140	61
45	1,210		145	54
50	993		150	48
55	819			

5.0 Litre V8 Models All Models

°C	OHMS
100	185
70	450
38	1,800
20	3,400
4	7,500
-7	13,500
-18	25,000
-40	100,700

H021 VS & VT 3.8 Litre V6 Knock Sensor Test

- 1) With ignition off disconnect PCM connectors.
- 2) Check resistance of PCM connector pin C12 (white/red) to ground.
If reading approx. 50 Kohms go to step 4.
If reading approx. 100 Kohms go to step 3.
If reading not 50 Kohms or 100 Kohms check wiring from PCM connector pin C12 (white/red) to knock sensors for open or short. If wiring is okay then suspect faulty knock sensors.
- 3) If reading was 100 Kohms then one knock sensor or wiring to one knock sensor has open circuit. Remove connector from knock sensors and check centre knock sensor terminal to ground resistance to see if one is open. If knock sensors are not open, trace open in wiring from PCM connector pin C12 (white/red) to one knock sensor connector and repair as needed.
- 4) If reading was 50 Kohms reconnect PCM connectors. With digital voltmeter set on AC voltage backprobe PCM connector pin C12 (white/red) with +ve lead and -ve to ground. Top alternator bracket with hammer while observing reading. If reading always less than 50mV AC then suspect faulty knock sensors. If reading goes over 50mV AC then suspect intermittent fault. Check all connectors.

NOTE: After test when components are reinstalled, switch ignition on and reinput back to previous Scanner menu selection screen to continue with tip.

H022 Quad Driver Circuit Check

Disconnect PCM connector and switch ignition on.

Check for battery voltage at PCM pin F4 (green/black). If not check circuit from A/C comp relay to pin F4 for open or short.

If battery voltage at pin F4, check for battery voltage at pin F5 (blue) with ignition on. If not check circuit from start relay to PCM pin F5.

If battery voltage at pin F5, check for battery voltage at PCM pin F6 (blue/white) with ignition on. If not check circuit from fan relay to PCM pin F5 for open or short.

If battery voltage at pin F6, switch ignition off and check for open or short in wiring from PCM pin F7 (black/white) to ABS/Trac Control ECU.

NOTE: After test when components are reinstalled, switch ignition on and reinput back to previous Scanner menu selection screen to continue with tip.

H023 5.0 Litre V8 Coil Resistance Check

Primary resistance across +ve and -ve of coil terminals 0.76 to 0.84 ohms.

Secondary resistance across -ve coil terminal and high tension post 4.5 Kohms to 6.0 Kohms.

Always check for cracks in coil casing particularly near mounting bracket.

After testing, reinstall components and switch ignition on to continue using the Troubleshooter.

H024 3.8 Litre V6 Coil Resistance Check

	One piece combined coil pack type	Individual coil pack type
Primary resistance checked across corresponding terminals on underside of coil	0.3 ohm to 1.5 ohm	0.3 ohm to 1.5 ohm
Secondary resistance checked across corresponding high tension posts	10 Kohm to 14 Kohm	5 Kohm to 7 Kohm

NOTE: If any coil out of range or if one coil secondary reading differs from other two by more than 1 Kohm then suspect faulty coil.

After testing, reinstall components and switch ignition on to continue using the Troubleshooter.

H025 VN (pre Oct 89) 5.0 Litre V8 Ignition Test

1. Disconnect the 6-pin connector from the ignition module. With the testlight connected to 12V +ve, probe black wire of connector. Testlight should light.

If okay, go to tip 2. If not, repair earth circuit as necessary.

2. Switch ignition on. With testlight connected to earth, probe pink wire of connector. Testlight should light.

If okay, go to tip 3. If not, check power supply to ignition module from ignition switch through fuse 11.

3. With testlight still connected to earth and ignition on, probe brown wire of connector. Testlight should light.

If okay, go to tip 4. If not, check power supply with ignition on to +ve of coil from ignition switch through fuse 11. If power supply to the +ve and -ve of coil okay, carry out resistance check across +ve and -ve of coil terminals. Resistance should be 0.76 ohms to 0.84 ohms. If coil resistance okay, check wiring from brown wire of ignition module connector to -ve coil terminal connector for open or short circuit and repair as necessary.

4. Refit 6-pin connector to ignition module. With testlight connected to 12V +ve, probe tacho wire or brown wire of 6-pin connector. Check for blinking of testlight while cranking engine.

If testlight blinks but ignition system has no spark, check for defective dist cap, roto or actual coil. If testlight did not blink, got to tip 5.

5. Disconnect 6-pin connector to ignition module. Install a bridge wire between grey/red and black wires of connector. Install a second bridge wire between white/black and pink wires of connector. With a low power LED testlight connected to 12V +ve, probe blue/white terminal of connector. Check for blinking testlight while cranking engine.

If testlight blinks, suspect faulty ignition module. If testlight did not blink, check white/black, grey/red and blue/white wires from ignition module to distributor for open or shorts. If wiring okay suspect faulty hall effect crank sensor in distributor.

After testing, reinstall components and switch ignition on to continue using the Troubleshooter.

H026 VN (post Oct 89) to VS 5.0 Litre V8 Ignition Test

1. Disconnect the 6-pin connector from the ignition module. With the testlight connected to 12V +ve, probe black wire of connector. Testlight should light.

If okay, go to tip 2. If not, repair earth circuit as necessary.

2. Switch ignition on. With testlight connected to earth, probe red wire of connector. Testlight should light.

If okay, go to tip 3. If not, check power supply to ignition module from EFI relay.

3. With testlight still connected to earth and ignition on, probe brown wire of connector. Testlight should light.

If okay, go to tip 4. If not, check power supply with ignition on to +ve of coil from EFI relay. If power supply to the +ve and -ve of coil okay, carry out resistance check across +ve and -ve of coil terminals. Resistance should be 0.76 ohms to 0.84 ohms. If coil resistance okay, check wiring from brown wire of ignition module connector to -ve coil terminal connector for open or short circuit and repair as necessary.

4. Refit 6-pin connector to ignition module. With testlight connected to 12V +ve, probe tach wire or brown wire of 6-pin connector. Check for blinking of testlight while cranking engine.

If testlight blinks but ignition system has no spark, check for defective dist cap, roto or actual coil. If testlight did not blink, got to tip 5.

5. Disconnect 6-pin connector to ignition module. Install a bridge wire between grey/red and black wires of connector. Install a second bridge wire between white/black and red wires of connector. With a low power LED testlight connected to 12V +ve, probe blue/white terminal of connector. Check for blinking testlight while cranking engine.

If testlight blinks, suspect faulty ignition module. If testlight did not blink, check white/black, grey/red and blue/white wires from ignition module to distributor for open or shorts. If wiring okay suspect faulty hall effect crank sensor in distributor.

After testing, reinstall components and switch ignition on to continue using the Troubleshooter.

H027 VT 5.0 Litre V8 Ignition Test

1. Disconnect the 6-pin connector from the ignition module. With the testlight connected to 12V +ve, probe black/red wire of connector. Testlight should light.

If okay, go to tip 2. If not, repair earth circuit as necessary.

2. Switch ignition on. With testlight connected to earth, probe red wire of connector. Testlight should light.

If okay, go to tip 3. If not, check power supply to ignition module from EFI relay.

3. With testlight still connected to earth and ignition on, probe brown/red wire of connector. Testlight should light.

If okay, go to tip 4. If not, check power supply with ignition on to +ve of coil from ignition switch through fuse 35. If power supply to the +ve and -ve of coil okay, carry out resistance check across +ve and -ve of coil terminals. Resistance should be 0.76 ohms to 0.84 ohms. If coil resistance okay, check wiring from brown wire of ignition module connector to -ve coil terminal connector for open or short circuit and repair as necessary.

4. Refit 6-pin connector to ignition module. With testlight connected to 12V +ve, probe tacho wire or brown/red wire of 6-pin connector. Check for blinking of testlight while cranking engine.

If testlight blinks but ignition system has no spark, check for defective dist cap, roto or actual coil. If testlight did not blink, got to tip 5.

5. Disconnect 6-pin connector to ignition module. Install a bridge wire between grey/red and black/red wires of connector. Install a second bridge wire between white/black and red wires of connector. With a low power LED testlight connected to 12V +ve, probe blue/white terminal of connector. Check for blinking testlight while cranking engine.

If testlight blinks, suspect faulty ignition module. If testlight did not blink, check white/black, grey/red and blue/white wires from ignition module to distributor for open or shorts. If wiring okay suspect faulty hall effect crank sensor in distributor.

After testing, reinstall components and switch ignition on to continue using the Troubleshooter.

H028 VR Model V6 Manual Transmission Electronic Spark Timing (EST) Check

1. Disconnect PCM connectors. Switch ignition on and check resistance of PCM connector pin D4 (white) to ground.

If reading under 500 ohms, go to tip 2.

If reading over 500 ohms, check for open in wiring from PCM pin D4 (white) to DFI module pin A (white) or for poor connection at DFI module and repair as necessary.

If wiring and circuit okay, suspect faulty DFI module.

2. Back probe PCM connector pin D5 (tan/black) with a testlight which is connected to 12V positive.

If testlight off, go to tip 3.

If testlight on, disconnect DFI module connector.

If testlight then goes off, suspect faulty DFI module.

If testlight stayed on with DFI module disconnected then trace and repair short in wiring from PCM pin D5 (tan/black) to DFI module pin B (tan/black).

3. Check resistance at PCM connector pin D4 (white) to ground while probing testlight which is connected to 12V positive on to PCM connector pin D5 (tan/black).

Reading should change from under 500 ohms to over 5000 ohms when testlight is placed on PCM connector pin D5 (tan/black).

If reading changes, suggest to reassemble and recheck if code returns. If code returns then suspect PCM or connection.

If reading did not change, disconnect DFI module connector while still checking resistance at PCM pin D4 (white) to ground.

If reading changes to open circuit, check for suspect short of wiring from PCM connector pin D5 (tan/black) to ground.

H029 VR Model V6 Automatic Transmission Electronic Spark Timing (EST) Check

1. Disconnect PCM connectors. Switch ignition on and check resistance of PCM connector pin D11 (white) to ground.

If reading under 500 ohms, go to tip 2.

If reading over 500 ohms, check for open in wiring from PCM pin D11 (white) to DFI module pin A (white) or check for poor connection at DFI module and repair as necessary.

If wiring and circuit okay, suspect faulty DFI module.

2. Back probe PCM connector pin D12 (tan/black) with a testlight which is connected to 12V positive.

If testlight off, go to tip 3.

If testlight on, disconnect DFI module connector.

If testlight then goes off, suspect faulty DFI module.

If testlight stayed on with DFI module disconnected then trace and repair short in wiring from PCM pin D12 (tan/black) to DFI module pin B (tan/black).

3. Check resistance at PCM connector pin D11 (white) to ground while probing testlight which is connected to 12V positive on to PCM connector pin D12 (tan/black).

Reading should change from under 500 ohms to over 5000 ohms when testlight is placed on PCM connector pin D12 (tan/black).

If reading changes, suggest to reassemble and recheck if code returns. If code returns then suspect PCM or connection.

If reading did not change, disconnect DFI module connector while still checking resistance at PCM pin D11 (white) to ground.

If reading changes to open circuit, check for suspect short of wiring from PCM connector pin D12 (tan/black) to ground.

H030 VS & VT 3.8 Litre V6 Electronic Spark Timing (EST)

1. Disconnect DFI module connector. Check voltage reading at DFI connector A (white) with the ignition on.

If reading is over 0.5V, go to tip 4.

If reading is under 0.5V, probe testlight which is connected to 12V positive to DFI module connector pin A (white).

If testlight is off, go to tip 2.

If testlight is on, switch off ignition and disconnect PCM connectors. Switch back on and check if testlight is still on with testlight still probing DFI connector pin A (white).

If testlight is now off, then suspect faulty PCM.

If testlight remains on, trace and repair short to earth of wiring from PCM pin D10 (white) to DFI module connector pin A (white).

2. With DFI module still disconnected, probe testlight which is connected to 12V positive to DFI connector pin B (tan/black) and switch ignition on.

If testlight is on, go to tip 3.

If testlight is off, check connection and wiring for open circuit from PCM pin D9 (tan/black) to DFI module connector pin B (tan/black).

If wiring and connector okay, switch ignition off and reconnect DFI module connector. Disconnect PCM connectors and switch ignition on. Check resistance of PCM harness connector pin D10 (white) to ground while placing testlight which is connected to 12V positive to PCM connector pin D9 (tan/black).

If reading goes from under 300 ohms to over 6000 ohms when testlight contacts ecu connector pin D9 (tan/black) then suspect faulty PCM. If reading does not change then suspect DFI module.

3. Switch off ignition and disconnect PCM connectors and DFI module connector. With testlight connected to 12V positive, probe DFI connector pin B (tan/black).

If testlight does not come on, then suspect faulty PCM.

If testlight comes on, trace and repair short to ground of wiring from PCM pin D9 (tan/black) to DFI module pin B (tan/black).

4. Switch ignition off and disconnect PCM connector. Check voltage at DFI module connector pin A (white) with the ignition on.

If reading is under 0.5V then suspect faulty DFI module.

If reading is still over 0.5V, trace and repair short to power of wiring from PCM pin D10 (white) to DFI module connector pin A (white).

H031 VN, VP 5.0 Litre V8 Model and VR, VS 5.0 Litre Manual Transmission Model Electronic Spark Timing (EST) Check

1. Disconnect PCM connectors. Switch ignition on and check resistance of PCM connector pin D4 (white) to ground.

If reading under 500 ohms, go to tip 2.

If reading over 500 ohms, check for open in wiring from PCM pin D4 (white) to ignition module white wire or check for poor connection at ignition module and repair as necessary.

If wiring and circuit okay, suspect faulty ignition module.

2. Back probe PCM connector pin D5 (tan/black) with a testlight which is connected to 12V positive.

If testlight off, go to tip 3.

If testlight on, disconnect 4-pin ignition module connector.

If testlight then goes off, suspect faulty ignition module.

If testlight stayed on with ignition module disconnected then trace and repair short in wiring from PCM pin D5 (tan/black) to ignition module tan/black wire.

3. Check resistance at PCM connector pin D4 (white) to ground while probing testlight which is connected to 12V positive on to PCM connector pin D5 (tan/black).

Reading should change from under 500 ohms to over 5000 ohms when testlight is placed on PCM connector pin D5 (tan/black).

If reading changes, suggest to reassemble and recheck if code returns. If code returns then suspect PCM or connection.

If reading did not change, disconnect ignition module connectors while still checking resistance at PCM pin D4 (white) to ground.

If reading changes to open circuit, check for suspect short of wiring from PCM connector pin D5 (tan/black) to ground.

H032 VR, VS 5.0 Litre V8 Automatic Transmission Model Electronic Spark Timing (EST) Check

1. Disconnect PCM connectors. Switch ignition on and check resistance of PCM connector pin D11 (white) to ground.

If reading under 500 ohms, go to tip 2.

If reading over 500 ohms, check for open in wiring from PCM pin D11 (white) to ignition module white wire or check for poor connection at ignition module and repair as necessary.

If wiring and circuit okay, suspect faulty ignition module.

2. Back probe PCM connector pin D12 (tan/black) with a testlight which is connected to 12V positive.

If testlight off, go to tip 3.

If testlight on, disconnect 4-pin ignition module connector.

If testlight then goes off, suspect faulty ignition module.

If testlight stayed on with ignition module disconnected then trace and repair short in wiring from PCM pin D12 (tan/black) to ignition module tan/black wire.

3. Check resistance at PCM connector pin D11 (white) to ground while probing testlight which is connected to 12V positive on to PCM connector pin D12 (tan/black).

Reading should change from under 500 ohms to over 5000 ohms when testlight is placed on PCM connector pin D12 (tan/black).

If reading changes, suggest to reassemble and recheck if code returns. If code returns then suspect PCM or connection.

If reading did not change, disconnect ignition module connector while still checking resistance at PCM pin D11 (white) to ground.

If reading changes to open circuit, check for suspect short of wiring from PCM connector pin D12 (tan/black) to ground.

H033 VT 5.0 Litre V8 Model

Electronic Spark Timing (EST) Check

1. Disconnect PCM connectors. Switch ignition on and check resistance of PCM connector pin D10 (white) to ground.

If reading under 500 ohms, go to tip 2.

If reading over 500 ohms, check for open in wiring from PCM pin D10 (white) to ignition module white wire or check for poor connection at ignition module and repair as necessary.

If wiring and circuit okay, suspect faulty ignition module.

2. Back probe PCM connector pin D9 (tan/black) with a testlight which is connected to 12V positive.

If testlight off, go to tip 3.

If testlight on, disconnect 4-pin ignition module connector.

If testlight then goes off, suspect faulty ignition module.

If testlight stayed on with ignition module disconnected then trace and repair short in wiring from PCM pin D9 (tan/black) to ignition module tan/black wire.

3. Check resistance at PCM connector pin D10 (white) to ground while probing testlight which is connected to 12V positive on to PCM connector pin D9 (tan/black).

Reading should change from under 500 ohms to over 5000 ohms when testlight is placed on PCM connector pin D9 (tan/black).

If reading changes, suggest to reassemble and recheck if code returns. If code returns then suspect PCM or connection.

If reading did not change, disconnect ignition module connector while still checking resistance at PCM pin D10 (white) to ground.

If reading changes to open circuit, check for suspect short of wiring from PCM connector pin D9 (tan/black) to ground.

H034 VX, VY V6 Electronic Spark Timing (EST) Check

1. Disconnect DFI module connector. Check voltage reading at DFI connector A (white) with the ignition on.

If reading is over 0.5V, go to tip 4.

If reading is under 0.5V, probe testlight which is connected to 12V positive to DFI module connector pin A (white).

If testlight is off, go to tip 2.

If testlight is on, switch off ignition and disconnect PCM connectors. Switch back on and check if testlight is still on with testlight still probing DFI connector pin A (white).

If testlight is now off, then suspect faulty PCM.

If testlight remains on, trace and repair short to earth of wiring from PCM pin B3 (white) to DFI module connector pin A (white).

2. With DFI module still disconnected, probe testlight which is connected to 12V positive to DFI connector pin B (tan/black) and switch ignition on.

If testlight is on, go to tip 3.

If testlight is off, check connection and wiring for open circuit from PCM pin B4 (tan/black) to DFI module connector pin B (tan/black).

If wiring and connector okay, switch ignition off and reconnect DFI module connector. Disconnect PCM connectors and switch ignition on. Check resistance of PCM harness connector pin B3 (white) to ground while placing testlight which is connected to 12V positive to PCM connector pin B4 (tan/black).

If reading goes from under 300 ohms to over 6000 ohms when testlight contacts ecu connector pin B4 (tan/black) then suspect faulty PCM. If reading does not change then suspect DFI module.

3. Switch off ignition and disconnect PCM connectors and DFI module connector. With testlight connected to 12V positive, probe DFI connector pin B (tan/black).

If testlight does not come on, then suspect faulty PCM.

If testlight comes on, trace and repair short to ground of wiring from PCM pin B4 (tan/black) to DFI module pin B (tan/black).

4. Switch ignition off and disconnect PCM connector. Check voltage at DFI module connector pin A (white) with the ignition on.

If reading is under 0.5V then suspect faulty DFI module.

If reading is still over 0.5V, trace and repair short to power of wiring from PCM pin B3 (white) to DFI module connector pin A (white).

**H035 Engine Coolant Temperature Sensor (CTS)
Resistance to Temperature Values**

3.8 Litre V6 Engine

**VN, VP & VR Models
(approximate)**

°C	OHMS
110	110
100	190
90	250
70	450
40	1,200
30	1,800
20	2,500
0	6,000
-10	8,750
-20	15,000

**VS, VT, VX & VY Models
(approximate)**

°C	OHMS
110	134
100	180
90	244
70	474
40	1,483
30	2,268
20	3,555
0	9,517
-10	16,320
-20	28,939

**5.0 Litre V8
All Models
(approximate)**

°C	OHMS
110	110
100	190
90	250
70	450
40	1,200
30	1,800
20	2,500
0	6,000
-10	8,750
-20	15,000

SNAP-ON TOOLS (AUSTRALIA) PTY LTD
ABN 55 010 793 683
