GENERAL MOTORS COMPUTER COMMAND CONTROL

Buick
Cadillac
Chevrolet
Oldsmobile
Pontiac

NOTE — *This article will refer to various models by body style. "T" bodies — Chevette and T1000; "X" bodies — Citation, Omega, Phoenix and Skylark; "A" bodies — Century, Celebrity, Ciera and 6000; "F" bodies — Camaro and Firebird; "J" bodies — Cavalier, Cimarron, Firenza, J2000 and Skyhawk.*

DESCRIPTION

The Computer Command Control (CCC) system is an electronically controlled system that monitors up to 15 engine/vehicle functions to control engine operation and lower exhaust emissions while maintaining good fuel economy and driveability. The Electronic Control Module (ECM) is the "brain" of the CCC system. The ECM can control as many as 9 engine-related systems to constantly adjust engine operation to maintain good vehicle performance under all normal driving conditions.

The CCC system is primarily an emission control system. Primary objective of CCC system is to maintain an ideal air-/fuel ratio of 14.7:1 under all operating conditions. When an ideal ratio is maintained, the catalytic converter can effectively control nitrogen oxides (NOx), hydrocarbons (HC) and carbon monoxide (CO).

OPERATION

The CCC system consists of the following sub-systems: Fuel control, data sensors, Electronic Control Module (ECM), spark timing, Idle Speed Control (ISC) system (all carbureted models and Cadillac 4.1L V8), Idle Air Control (IAC) system (all fuel injected models, except Cadillac 4.1L V8), emission control, Torque Converter Clutch (TCC), diagnostic system and catalytic converter.

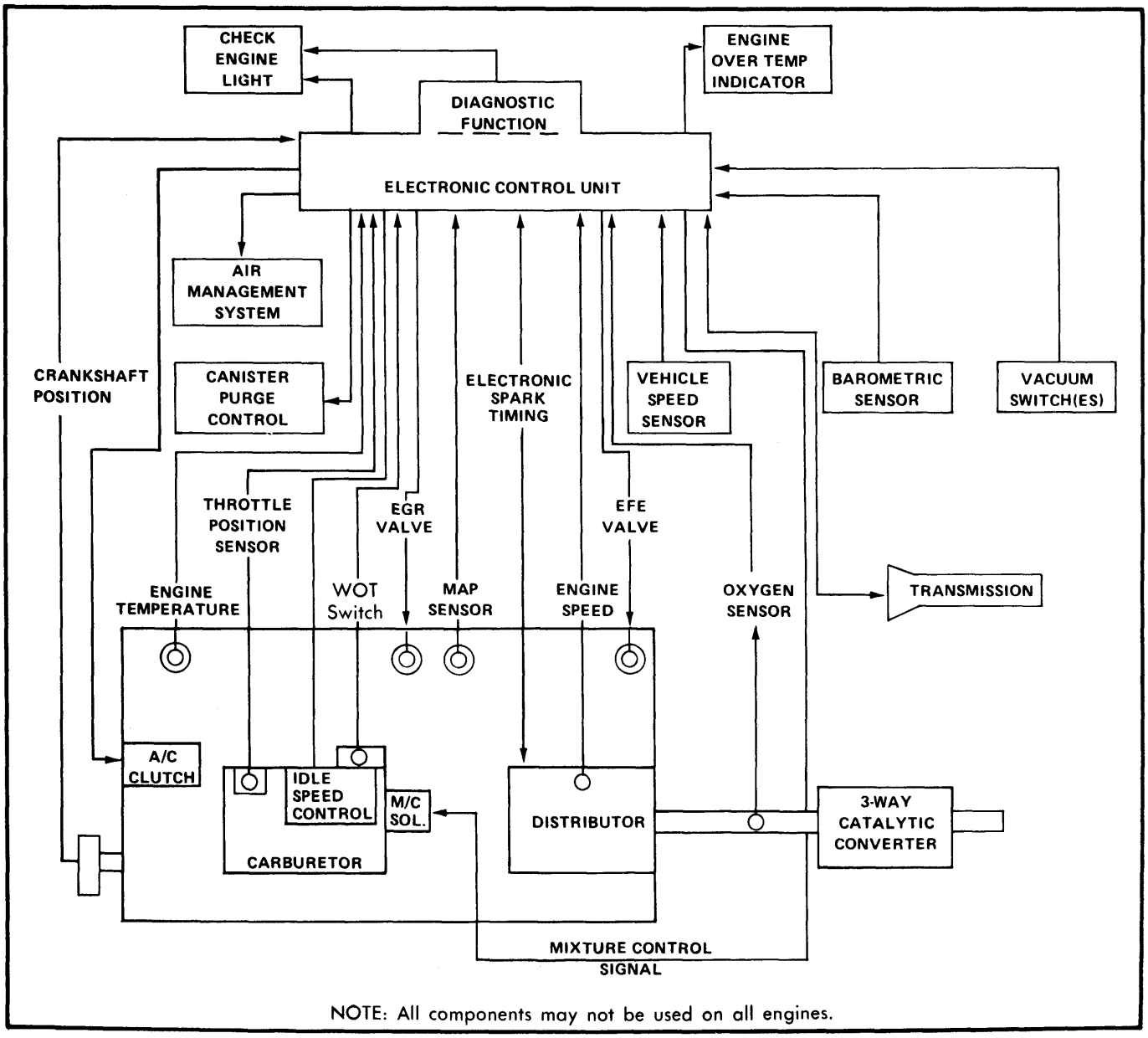


Fig. 1 Schematic of Computer Command Control System

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

FUEL CONTROL (CARBURETED MODELS)

All models are equipped with "feedback" carburetors which contain an electrically operated Mixture Control (M/C) solenoid. The M/C solenoid operates single or dual metering rods in float bowl. Metering rod(s) supplement fuel supplied to idle and main systems, varying air/fuel ratio within a pre-calibrated range. The M/C solenoid also controls air/fuel ratio through use of an idle air bleed circuit that operates in conjunction with metering rod(s).

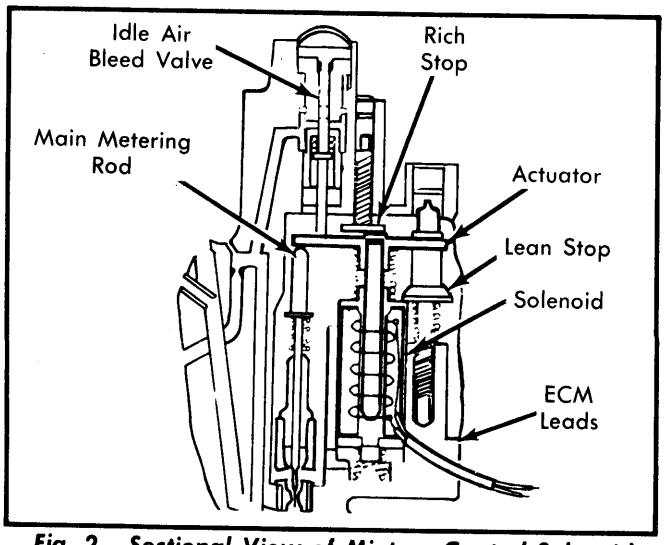


Fig. 2 Sectional View of Mixture Control Solenoid (Model E2ME and E4ME Carburetors Shown)

The ECM, responding to inputs from data sensors, constantly adjusts air/fuel mixture to maintain engine performance. The ECM controls M/C solenoid by providing a ground for solenoid. When solenoid is energized, fuel flow through carburetor is reduced, providing a leaner mixture. When solenoid is de-energized, fuel flow through carburetor is increased, providing a richer mixture. The solenoid is cycled (turned on and off) at a rate of 10 times per second.

When ECM responds to signals received from oxygen sensor to adjust fuel mixture, the CCC system is in closed loop operation. Under certain operating conditions, the ECM may ignore inputs from various sensors and use a pre-programmed calibration control to operate the engine under that particular condition. During cold engine starts (engine speed below 200 RPM), M/C solenoid is turned off by ECM to provide rich mixture. Operating conditions which cause ECM to ignore oxygen sensor signals cause the CCC system to operate in open loop mode.

FUEL CONTROL (FUEL INJECTED MODELS)

All electronic fuel injected (EFI) models are equipped with an electrically-pulsed injector located in a throttle body unit on the intake manifold. The ECM, responding to inputs from data sensors, constantly adjusts air/fuel mixture to maintain engine performance. The ECM controls the pulse width (injector "on" time) to provide the proper amount of fuel for the specific engine requirement. Increasing the injector pulse width, richens the air/fuel ratio. Decreasing the injector pulse width, leans the air/fuel ratio.

When ECM responds to signals received from oxygen sensor to adjust fuel mixture, the CCC system is in closed loop operation. Under certain operating conditons, the ECM may ignore inputs from the oxygen sensor and use a pre-programmed calibration program to control the engine under that particular operating mode. Operating conditions which cause the ECM to ignore oxygen sensor signals cause the CCC system to operate in open loop mode.

DATA SENSORS

Each sensor furnishes electronic impulses to ECM. The ECM computes spark timing and fuel mixture ratio necessary to maintain proper engine operation. The function of each sensor is closely related to each of the other sensors. Operation of each sensor is as follows:

Oxygen Sensor – This sensor is mounted in engine exhaust stream. It supplies a low voltage (under ½ volt) when fuel mixture is lean (too much oxygen) and a higher voltage (up to 1 volt) when fuel mixture is rich (not enough oxygen). Oxygen sensor must be hot (over 600°F) to function properly. The oxygen sensor measures quantity of oxygen only. On some models, oxygen sensor may cool off during idle, causing CCC system to go into open loop mode. Running the engine at fast idle will warm up oxygen sensor.

NOTE – *No attempt should be made to measure oxygen sensor voltage output. Current drain of conventional voltmeter could permanently damage sensor, shift sensor calibration range and/or render sensor unusable. Do not connect jumper wire, test leads or other electrical connectors to sensor. Use these devices only on ECM side of harness after disconnecting from sensor.*

Coolant Temperature Sensor (CTS) – The CTS is located in the engine coolant stream to supply coolant temperature information to ECM. This information affects the following engine systems: Air/fuel ratio control (as engine coolant temperature varies with time during a cold start), switching functions for emission controls and torque converter clutch, spark timing, and engine temperature lamp operation.

Manifold Absolute Pressure Sensor (MAP) – This sensor is mounted in engine compartment or under instrument panel. It measures changes in manifold pressure (vacuum). The MAP sensor sends electrical signals to ECM, reflecting need for adjustment in air/fuel mixture and spark timing under various operating conditions.

NOTE – *The MAP sensor is not used on all engine applications. The 3.8L turbo engine uses a special MAP sensor that also detects altitude changes.*

Vacuum Sensor – Vehicles not equipped with MAP sensors may be equipped with vacuum sensors, which are located on right fender panel. The vacuum sensor performs the same function as the MAP sensor. The vacuum sensor may be called a pressure differential sensor because it works on the difference between atmospheric and manifold pressure.

Barometric Pressure Sensor (BARO) – This sensor is mounted on MAP sensor bracket. This sensor measures ambient or barometric pressures and signals ECM of pressure changes due to altitude and/or weather. This sensor is used only on engines equipped with MAP sensor.

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

Throttle Position Sensor (TPS) – This sensor is mounted on the carburetor or throttle body unit. The sensor, a variable resistor similar to fuel tank sending unit, signals ECM of changes in throttle blade position from closed to wide open throttle.

NOTE – *The 2.8L engine with manual transmission uses a vacuum sensor for fuel enrichment.*

Vehicle Speed Sensor (VSS) – This sensor is mounted behind the speedometer in instrument cluster. It provides a series of 8 volt pulses to ECM to indicate vehicle speed. The VSS is not used on all vehicles.

High Gear Switch – This switch is mounted on automatic transmissions. The switch opens when the transmission has shifted into high gear (3rd or 4th) and closes under all other conditions. High gear switch information is used for emission control.

Park/Neutral Switch (P/N Switch) – This switch is connected to transmission gear selector. It is closed when selector is in "P" or "N" positions and open when selector is in gear. This switch is used for ISC and TCC operations.

Air Conditioner "ON" Switch (A/C "ON") – This switch is mounted in air conditioner compressor of some vehicles to signal ECM that air conditioner is operating. This switch supplies 12 volts when compressor is engaged and 0 volts when disengaged.

ELECTRONIC CONTROL MODULE (ECM)

The ECM is located in passenger compartment and controls all CCC system functions. The ECM consists of input/output devices, Central Processing Unit (CPU), power supply and memories. A brief description and operation of each component is as follows:

Input/Output Devices – These integral devices of ECM convert electrical signals received by data sensors and switches to digital signals for use by CPU.

Central Processing Unit (CPU) – Digital signals received by CPU are used to perform all mathematical computations and logic functions necessary to deliver proper air/fuel mixture. The CPU also calculates spark timing and idle speed information. The CPU commands operation of emission control, closed loop fuel control and diagnostic system.

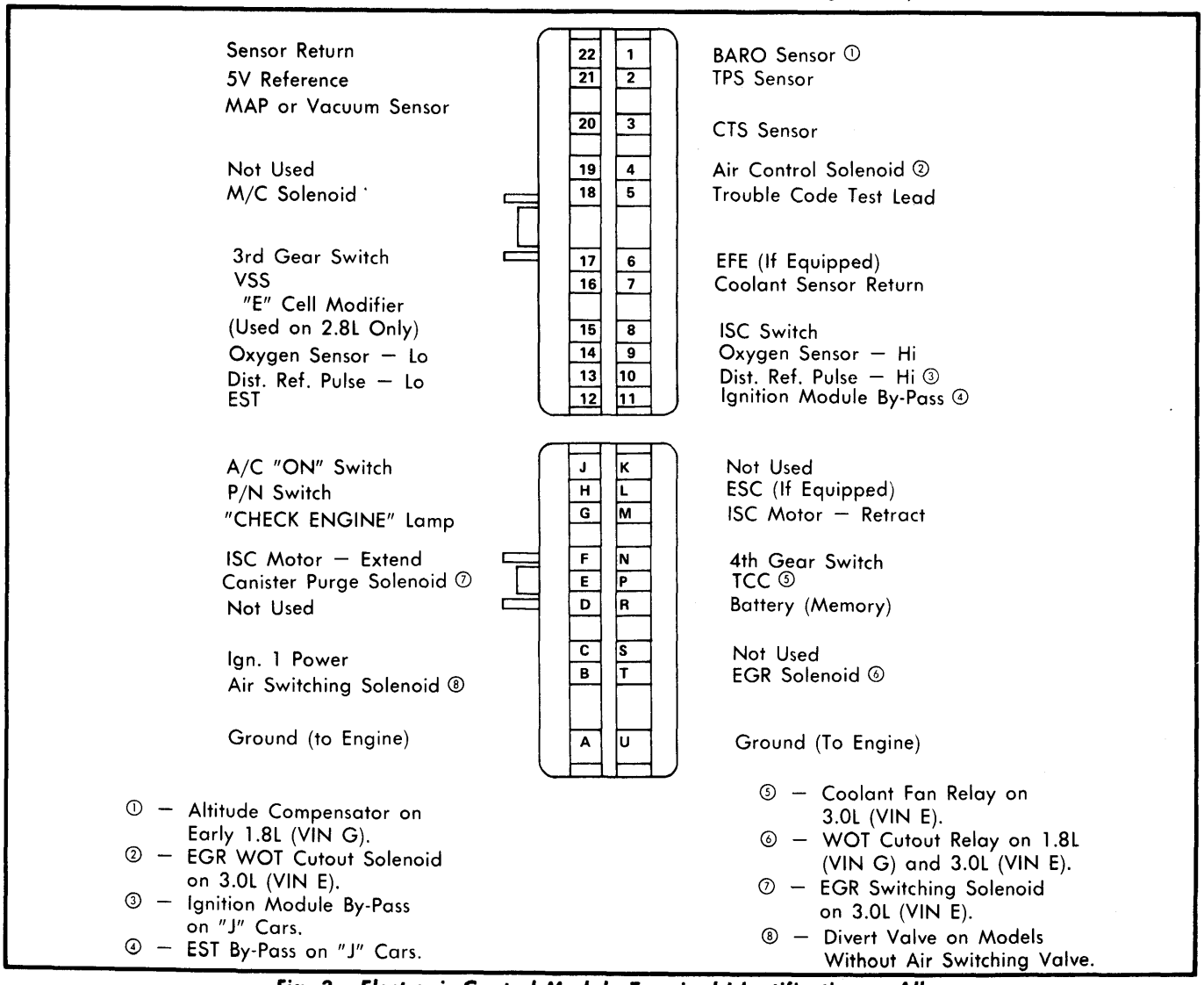


Fig. 3 Electronic Control Module Terminal Identification – All Models Except Fuel Injected and Federal "T" Cars Without 5-Speed Transmission

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

Power Supply – Main source of power for the ECM is from the battery, through the No. 1 ignition circuit.

Memories – The 3 types of memories in the ECM are: Read Only Memory (ROM), Random Access Memory (RAM) and Programmable Read Only Memory (PROM). Function of each memory is as follows:

- **Read Only Memory (ROM)** – The ROM is programmed information that can only be read by ECM. The ROM program cannot be changed. If battery voltage is removed, ROM information will be retained.
- **Random Access Memory (RAM)** – This memory is the scratch pad for the CPU. Information can be read into or out of RAM memory; similar to a calculator. Data sensor information, diagnostic codes and results of calculations are temporarily stored in RAM memory. If battery voltage is removed, all information stored in this memory is lost.
- **Programmable Read Only Memory (PROM)** – This memory is factory-programmed information containing engine calibration data for each engine, transmission, body and rear axle ratio application. The PROM is easily removed from ECM. If battery voltage is removed, PROM information will be retained.

SPARK TIMING

Spark timing is controlled by 1 of 2 different systems: Electronic Spark Timing (EST) and Electronic Spark Timing with Electronic Spark Control (EST/ESC). Operation of each system is as follows:

Electronic Spark Timing (EST) – The EST system consists of ECM and modified HEI distributor with 7 terminal HEI module. The EST distributor contains no vacuum or centrifugal advance. The HEI distributor communicates to ECM through a 4-terminal connector which contains 4 circuits: Distributor reference circuit, by-pass circuit, EST circuit and ground circuit.

Whenever pick-up coil signals HEI module to open primary circuit, it also sends spark timing signals to ECM through reference line. When voltage on HEI by-pass line is 0 volts (engine cranking), HEI module switches to by-pass circuit. In by-pass circuit, HEI module provides spark advance at base timing and disregards spark advance signal from ECM. When voltage on HEI by-pass circuit is 5 volts (engine running), HEI module accepts spark timing signal provided by ECM.

The ECM monitors engine speed through HEI reference line and monitors engine operating conditions through data sensors and switches. From these parameters, ECM calculates proper spark advance and supplies signal to HEI distributor through EST line. The EST system is used on all models except Federal Chevette and T1000 models without 5-speed manual transmission.

Electronic Spark Timing With Electronic Spark Control (EST/ESC) – This is a closed loop system that controls engine detonation by adjusting spark timing. This system consists of EST system, detonation sensor, modified electronic control module in HEI distributor and a controller.

The detonation sensor is mounted in engine block (behind intake manifold) and it detects presence (or absence) and intensity of detonation by vibration characteristics of engine. Sensor sends electrical signal to controller. If sensor fails, no retard will occur. The controller constantly processes sensor signal into command signal to distributor to adjust spark timing. Controller failure would cause either no ignition, no retard or full retard.

The distributor receives commands from controller, and spark firing is delayed while detonation is occurring, thus providing required retard. The EST/ESC system is used on 3.8L (VIN 3), 4.1L (VIN 4), 5.0L (VIN 7) and 5.7L (VIN 8) engines.

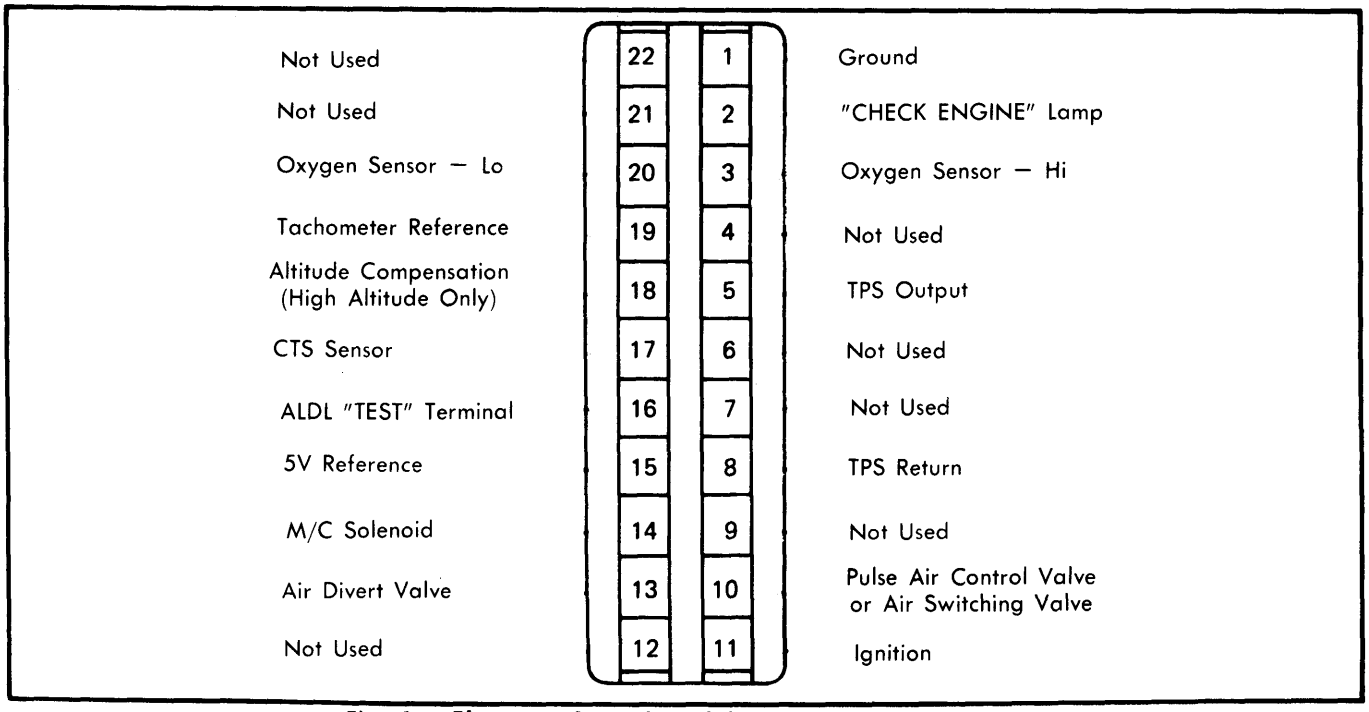


Fig. 4 Electronic Control Module Terminal Identification (Federal "T" Cars Without 5-Speed Transmission)

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

IDLE SPEED CONTROL (ISC) (CARBURETED MODELS & CADILLAC 4.1L V8)

The ISC is an electrically driven actuator which changes throttle valve angle (in idle position), according to commands from ECM. The ISC maintains low idle speeds while preventing stalls due to engine load changes.

The ECM monitors engine load to determine proper idle speed. To prevent stalling, the ECM monitors A/C "ON" switch, Park-Neutral switch and ISC throttle switch. With this information, the ECM will control idle speed by operating the ISC motor.

When engine is cold, ECM holds throttle valve open for longer period of time to provide faster warm-up. This function is bypassed when throttle is opened enough to bring TPS off its idle circuit. The ISC is located on side of carburetor (throttle body on Cadillac 4.1L V8).

NOTE – *Not all engines are equipped with ISC system. Some may use an Idle Speed Solenoid (ISS) or an Idle Load Compensator (ILC) to control engine idle speed without ECM commands.*

IDLE AIR CONTROL (IAC) (FUEL INJECTED MODELS, EXCEPT CADILLAC 4.1L V8)

The IAC valve is an electrically-driven actuator which changes the idle air flow around the throttle plate according to commands from ECM. The IAC controls air flow in a similar manner as the ISC to maintain low idle speeds while preventing stalls due to engine load changes.

EMISSION CONTROL

The ECM electrically controls the following emission systems: AIR Management (AIR), Pulse AIR Injection (PAIR), Early Fuel Evaporation (EFE), Exhaust Gas Recirculation (EGR) and Evaporation Emission Control System (EECS). A brief description of each system follows:

AIR Management System – This system helps to reduce HC and CO content in exhaust gases and to quickly heat up catalytic converter and oxygen sensor during cold engine operation. This is accomplished by injecting air into exhaust port of each cylinder. The ECM energizes an air control solenoid which allows air to flow to air switching valve, directing air to exhaust ports. During warm engine (closed loop) operation, the ECM de-energizes air switching valve, directing air to dual-bed converter, which lowers HC and CO emissions.

If air control valve detects rapid increase in manifold vacuum (deceleration condition), or ECM detects any failure in CCC system, air is diverted to air cleaner or dumped to atmosphere.

Pulse AIR Management (PAIR) – This system is used on 1.6L engines and is controlled in same manner as AIR management system.

NOTE – *Vehicles may use separate air switching and air control valves, integral control valves or an air diverter valve.*

Early Fuel Evaporation (EFE) – The ECM controls EFE system by either of the following methods: Vacuum operated valve and actuator, or ceramic heater grid located underneath carburetor primary bore. The vacuum operated valve and actuator is opened by a control solenoid mounted on valve cover. This solenoid controls vacuum to EFE valve from an electrical signal supplied by ECM.

The ceramic heater grid system is part of carburetor insulator. When ignition is turned on and engine coolant temperature is low, voltage is applied to EFE relay through ECM, energizing EFE heater. When coolant temperature increases, ECM de-energizes EFE relay, which shuts off voltage to EFE heater.

NOTE – *EFE may not be used on all vehicles. Some vehicles may incorporate EFE control through EGR or AIR system.*

Exhaust Gas Recirculation (EGR) – The ECM controls ported vacuum to EGR valve with an electrically operated solenoid valve. When engine is cold, solenoid is energized, blocking vacuum to EGR valve. When engine is warm, solenoid is de-energized and EGR operation is allowed.

NOTE – *Vehicles may use an integral EFE/EGR valve, TCC/EGR valve or an EFE/EGR/Canister Purge Valve.*

Evaporative Emission Control System (EECS) – This is canister purge control. The ECM controls vacuum to purge valve in charcoal canister through a solenoid valve. When engine is operating in open loop mode, solenoid valve is energized and blocks vacuum to purge valve. When engine is operating in closed loop mode above prescribed RPM, solenoid valve is de-energized and vacuum is applied to purge valve. This draws collected vapors into intake manifold.

NOTE – *Some vehicles control canister purge operation through an integral EFE/EGR/Canister Purge Valve.*

TORQUE CONVERTER CLUTCH (TCC)

The ECM controls a solenoid (mounted on automatic transmission) to allow torque converter to directly connect engine to transmission, providing direct drive. When vehicle speed is high enough, ECM energizes TCC solenoid and engine is mechanically coupled to transmission. When operating conditions indicate that transmission should operate as normal (during rapid acceleration or deceleration), solenoid is de-energized. The transmission also returns to normal automatic operation when brake pedal is depressed.

DIAGNOSTIC SYSTEM

NOTE – *A "CHECK ENGINE" lamp driver is installed in the wiring harness from ECM to the "CHECK ENGINE" lamp on some models. This driver amplifies the power to the "CHECK ENGINE" lamp to reduce amperage draw on the battery.*

The ECM of the CCC system is equipped with a self-diagnostic system which detects system failures or abnormalities. When a malfunction occurs, ECM will light the amber "CHECK ENGINE" lamp located on instrument panel. When malfunction is detected and lamp is turned on, a corresponding trouble code is stored in ECM memory. Malfunctions are recorded as "hard failures" or "intermittent failures".

- "Hard failures" cause "CHECK ENGINE" lamp to glow and remain on until malfunction is repaired. If the "CHECK ENGINE" lamp comes on and remains on during vehicle operation, cause of malfunction MUST be determined.

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

- "Intermittent failures" cause lamp to flicker or go out after 10 seconds when fault goes away. However, the associated trouble code will be retained in ECM memory. "Intermittent failures" may be sensor related. If a sensor fails, ECM will use a substitute value in its calculations to continue engine operation. In this condition, service is not mandatory; but loss of driveability may be encountered. If the related fault does not recur within 50 ignition cycles, related trouble code will be erased from ECM memory.

As a bulb and system check, the "CHECK ENGINE" lamp will glow when ignition switch is turned on and engine is not running. When engine is started, the lamp should go out after 1-4 seconds. If not, a malfunction has been detected in CCC system.

NOTE – *Trouble codes will be recorded at various operating times. Some codes require operation of that sensor or switch for 5 seconds; others require operation for 5 minutes or longer.*

CATALYTIC CONVERTER

Proper emission control is accomplished with a special 3-way catalytic converter which converts all 3 major pollutants (HC, CO and NOx). The converter is a dual-bed converter. The "upstream" section of the converter contains a reducing/oxidizing bed to reduce NOx while at the same time oxidizing HC and CO. An air supply pipe from the AIR or PAIR system introduces an extra amount of air between the dual beds (during closed loop mode), so second bed can oxidize any remaining HC and CO with a high conversion efficiency to minimize overall emissions.

DIAGNOSIS & TESTING

CCC DIAGNOSIS

NOTE – *Federal "T" cars without 5-speed manual transmission do not have "long-term" memory capability. All codes stored in the memory will be erased when ignition switch is turned off. Memory is operational only while engine is running and problem or malfunction exists.*

The ECM stores component failure information for CCC system under a related trouble code which can be recalled for diagnosis and repair. When recalled, these codes will be displayed by flashes of "CHECK ENGINE" lamp. Codes are displayed starting with lowest numbered code. Only codes in which a related malfunction has occurred will be displayed.

NOTE – *Example of trouble codes is as follows: "FLASH", "FLASH", "FLASH", pause, "FLASH", "FLASH", "FLASH" followed by a longer pause identifies trouble code "33". First series of flashes indicates first digit of trouble code; second series of flashes indicates second digit of trouble code.*

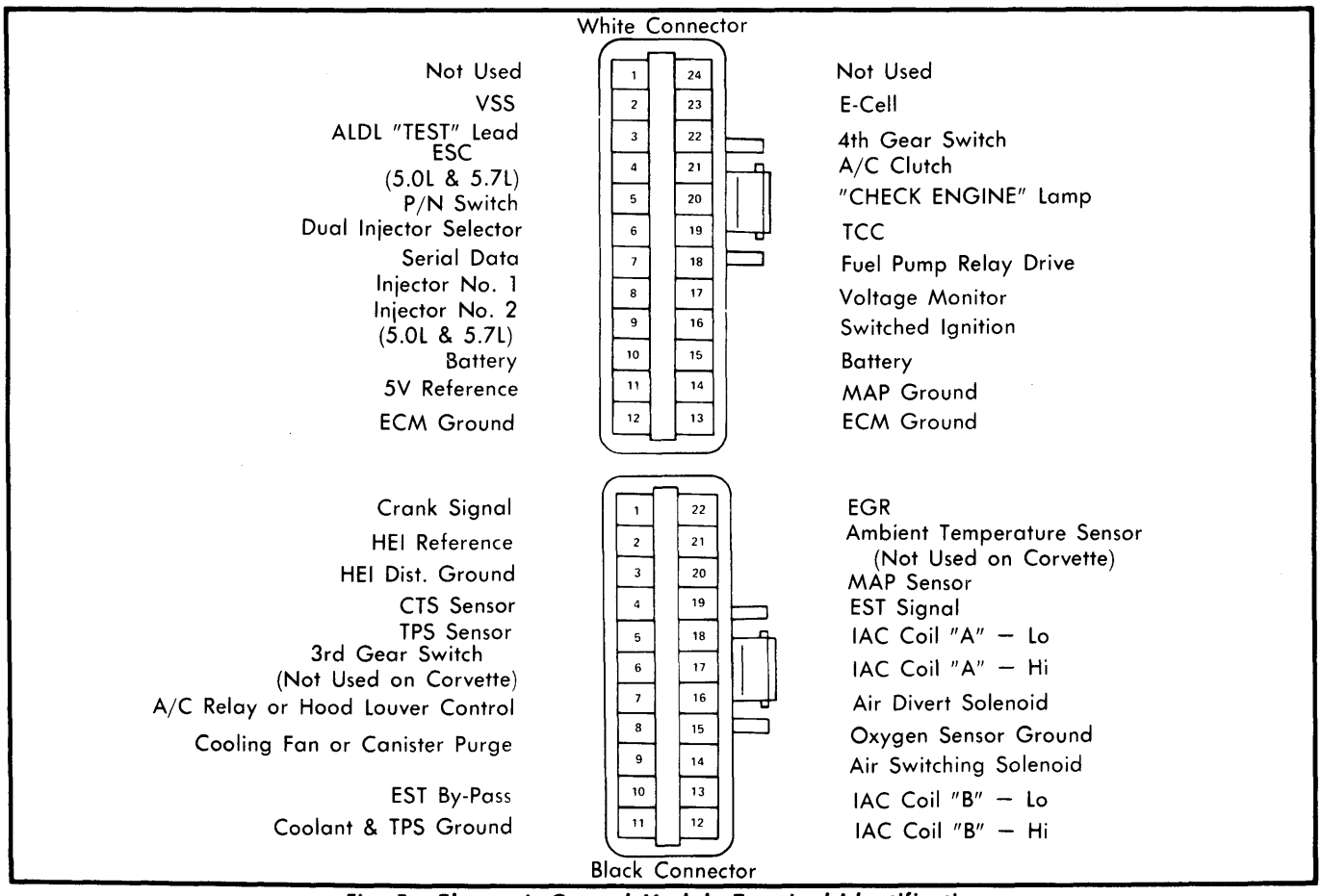


Fig. 5 Electronic Control Module Terminal Identification (Fuel Injected Models, Except Cadillac 4.1L V8)

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

Entering Diagnostic Mode – 1) Turn ignition on (engine off). "CHECK ENGINE" lamp should glow. Locate Assembly Line Data Link (ALDL) connector attached to ECM wiring harness under instrument panel. Insert lug terminal across "TEST" terminal and "GROUND" terminal. *See Fig. 6.*

NOTE – *Early model "J" cars are equipped with a 5-pin ALDL connector. Later model "J" cars and all other models are equipped with a 12-pin connector.*

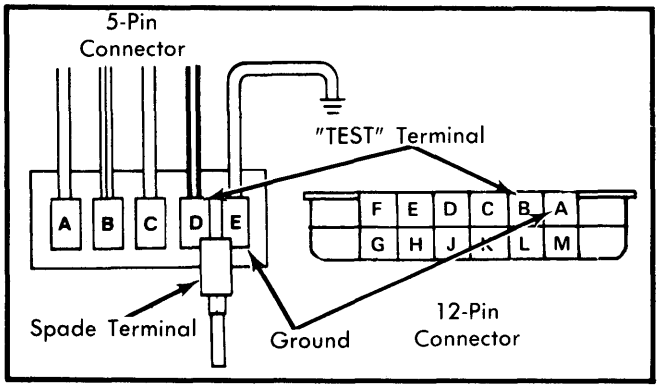


Fig. 6 Exploded View of ALDL Connectors

2) "CHECK ENGINE" lamp should flash code "12". Code "12" consists of "FLASH", pause, "FLASH", "FLASH" followed by a longer pause. Trouble code "12" will be repeated 2 more times, then if any trouble codes are stored in ECM memory, they will be displayed in same manner.

3) Trouble codes will be displayed from lowest to highest numbered code (3 times each) and be repeated as long as the "TEST" terminal of ALDL connector is grounded.

CAUTION – *Inserting lug in terminals of ALDL connector grounds "TEST" terminal lead. Do not ground ALDL connector before ignition is turned on or engine is started.*

Clearing Trouble Codes – To clear memory of trouble codes, turn ignition on and ground "TEST" lead at ALDL connector. Turn ignition off and remove ECM fuse from fuse block for 10 seconds. Remove "TEST" lead ground.

Exiting Diagnostic Mode – To exit diagnostic mode, turn ignition off and remove spade lug terminal from ALDL connector.

NOTE – *The terms "enter diagnostics" and "exit diagnostics" will be used periodically throughout this section. Follow the procedure for entering diagnostic mode when instructed to "enter diagnostics". Follow the procedure for exiting diagnostic mode when instructed to "exit diagnostics".*

FAILURE CODE DETERMINATION

During any diagnostic procedure, "hard failure" codes MUST be distinguished from "intermittent failure" codes. Diagnostic charts CANNOT be used to analyze "intermittent failure" codes, except as noted under Diagnostic Procedure. To determine "hard failure" codes and "intermittent failure" codes, proceed as follows:

1) Turn ignition on and enter diagnostics. Read and record all stored trouble codes. Exit diagnostics and clear trouble codes.

ECM TROUBLE CODE IDENTIFICATION

Code	Circuit Affected	Application
12	No reference pulse to ECM. (Not stored in memory).	All Models
13	Oxygen sensor circuit.	Exc. Fed. "T" Car
14	Shorted coolant temperature sensor circuit.	Exc. Fed. "T" Car
15	Open coolant temperature sensor circuit.	All Models
21	TPS circuit high.	All Models
22	TPS circuit low.	EFI Models Only
23	Open or grounded M/C solenoid circuit.	Exc. EFI Models
24	VSS circuit.	Exc. Fed. "T" Car
32	BARO sensor circuit low. (Altitude compensator low on "J" cars).	Exc. EFI & Fed. "T" Car
33	MAP sensor circuit high.	EFI Models Only
34	MAP or vacuum circuit.	Exc. Fed. "T" Car
35	ISC circuit sorted.	Exc. EFI & Fed. "T" Car
41	No distributor reference pulses with 8 in. Hg at MAP sensor.	Exc. EFI & Fed. "T" Car
42	EST circuit or by-pass grounded or open.	Exc. Fed. "T" Car
43	ESC retard signal too long.	Exc. Fed. "T" Car
44	Lean oxygen sensor value.	All Models
44 & 55	At same time, faulty oxygen sensor circuit.	Exc. EFI & Fed. "T" Car
45	Rich oxygen sensor value.	All Models
51	Faulty PROM or improper PROM installation.	All Models
54	Shorted M/C solenoid or faulty ECM.	Exc. EFI & Fed. "T" Car
55	Grounded voltage regerence, faulty oxygen sensor or ECM.	Exc. Fed. "T" Car

NOTE – *Trouble codes will be recorded on Federal "T" cars only with engine running. Turning ignition off after any trouble codes have been set will erase all codes.*

2) Apply parking brake and place transmission in neutral (manual) or park (automatic). Block drive wheels. Start engine. "CHECK ENGINE" lamp should go out. Run warm engine at specified curb idle for 2 minutes and note "CHECK ENGINE" light.

NOTE – *Grounding "TEST" terminal with engine running will force engine to operate in closed loop mode if engine is warm and oxygen sensor is hot. If "CHECK ENGINE" lamp does not glow while in closed loop, CCC system is operating properly.*

3) If "CHECK ENGINE" lamp comes on, enter diagnostics, read and record trouble codes. This will reveal "hard failure" codes. Codes "13", "15", "24", "35", "44", "45" and "55" may require road test to reset "hard failure" after trouble codes were cleared.

4) If "CHECK ENGINE" lamp does not come on, all stored trouble codes were "intermittent failures", except as noted under Diagnostic Procedure.

NOTE – *Trouble code "15" malfunction will only display after 5 minutes of engine operation. Trouble code "12" will display only during time of no reference pulses received by ECM; it will never be stored as a malfunction.*

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

DIAGNOSTIC PROCEDURE

NOTE – *If vehicle exhibits performance problems and no codes are set, refer to System Performance Chart. Components recorded by trouble codes generally do not cause performance problems when no codes are stored in ECM memory.*

The CCC system should be considered as a possible source of trouble on engine performance, fuel economy and exhaust emission complaints ONLY after normal checks (which apply to a vehicle without CCC) have been performed. Diagnosis of CCC system consists of 3 types of check sheets: Diagnostic Circuit Check, Driver Complaint and System Performance Check. Any of these check sheets may lead to a chart for locating source of problem or indicate no problem on that sheet and refer to another sheet. If there is no trouble in CCC system, all 3 check sheets will result in that conclusion. The check sheets and their procedures are as follows:

Diagnostic Circuit Check – 1) If complaint is "CHECK ENGINE" lamp related, this check will lead to most likely problem area, if malfunction exists. Enter diagnostics and record stored trouble codes. Begin diagnosis with lowest numbered code which is displayed and refer to appropriate trouble code chart.

2) If code "51" is displayed, refer to PROM removal and installation in this article for diagnosis of this code.

3) If codes "54" or "55" are displayed with another code, always refer to diagnostic chart for code "54" or "55" first, then proceed to next lowest numbered code.

NOTE – *Any time codes "51", "54" or "55" are displayed with another code, start with "50-series" code first, then proceed to next lowest numbered code.*

4) If codes "13" and "21", "14" and "21" or "15" and "21" are displayed, start with code "21" first, then proceed to code "13", "14" or "15".

5) On 2.8L engine with manual transmission, if codes "13" and "34", "14" and "34" or "15" and "34" are displayed, start with code "34" first, then proceed to code "13", "14" or "15".

6) If "intermittent failure" codes "13", "15", "24", "35", "44", "45" or "55" are displayed, use diagnostic chart for corresponding "hard failure" code.

Driver Complaint Sheet – 1) If complaint is not "CHECK ENGINE" lamp related, this check will lead to most likely problem area, if malfunction exists. Make checks that would normally be made for the complaint on a vehicle without CCC system.

2) Follow diagnostic chart and repair malfunction. After repair, perform System Performance Check.

NOTE – *EFI vehicles do not use a System Performance Check chart.*

System Performance Check – 1) This check verifies that CCC system is functioning correctly. This check should always be made after any repair on CCC system.

2) When performing this check, always engage parking brake and block DRIVE wheels. Parking brake on front-wheel drive models does not hold drive wheels. On engines equipped with Varajet carburetors (E2SE Model), remove bowl vent line at carburetor and plug hose at carburetor during check and reconnect it after the check is complete.

3) On some engines, the oxygen sensor will cool off after only a short period of time while engine is idling. This will cause engine to go into open loop. To restore closed loop mode, run engine at part throttle several minutes and accelerate from idle to part throttle several times.

NOTE – *Although there are many charts connected with CCC diagnosis, only 2 charts are needed to prove the system is operating properly. Normally, only 3 charts are necessary to find a problem, if one exists.*

Diagnostic Tools – 1) The CCC system does not require special tools for diagnosis. A dwell meter, tachometer, test light, ohmmeter, digital voltmeter with 10 megohms impedance (minimum), vacuum pump, vacuum gauge and 6 jumper wires 6" long (1 wire with female connectors at both ends; 1 wire with male connectors at both ends; 4 wires with male and female connectors at opposite ends) are only tools necessary for diagnosis.

NOTE – *If dwell meter causes a change in engine operation when connected to M/C solenoid "DWELL" lead (green connector near carburetor), it CANNOT be used. The following tach/dwell models should not be used: G, GA, TDT 1, 2 or 5, 216 and 216/1.*

2) A test light, rather than a voltmeter, must be used when indicated by diagnostic chart.

Connecting Dwell Meter – 1) A dwell meter set on "6-cylinder" scale for all carbureted engines is used to measure ECM output and M/C dwell (duty cycle). A green connector located in wiring harness near carburetor is the dwell meter connection point.

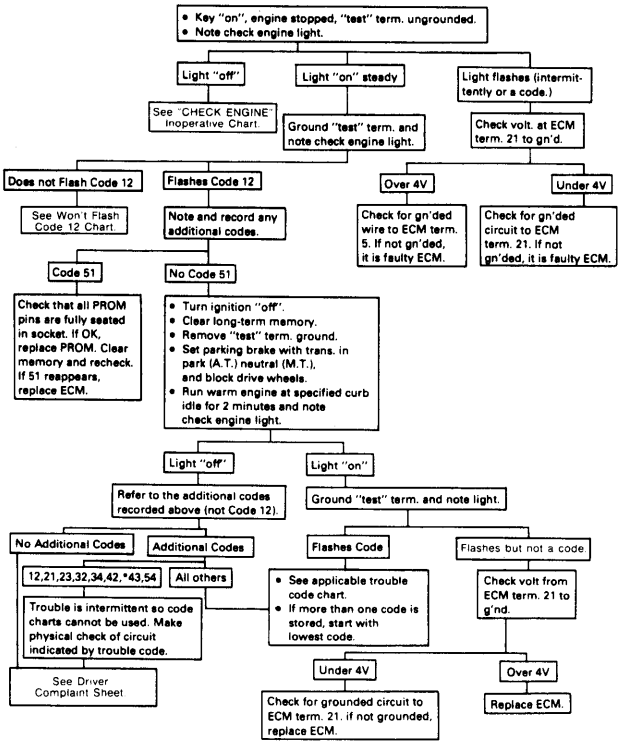
2) When dwell meter is connected, do not allow terminal to touch any ground source, including hoses. This could damage ECM. On a normal operating engine, dwell at both idle and part throttle should read between 10-50° and will be varying. "Varying" means needle will continually move up and down the scale. The amount of variation does not matter, only fact that it does move.

3) This variation of needle indicates system is in closed loop and ECM is responding to signals from oxygen sensor. At wide open throttle or cold engine operation, dwell will be fixed (needle steady). This indicates open loop and that ECM is ignoring oxygen sensor signals.

4) If there is doubt whether engine is in closed loop or open loop, richen or lean mixture (choke carburetor or cause air leak). This action will cause dwell to change if engine is in closed loop.

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

DIAGNOSTIC CIRCUIT CHECK ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED

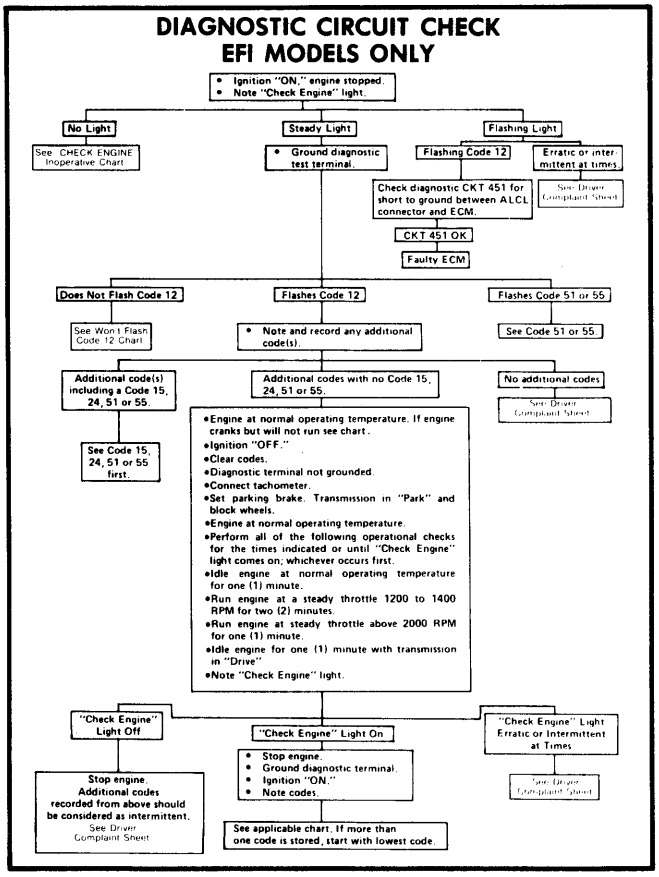


Before replacing an ECM, always check PROM for correct application and installation. Also, remove terminal(s) from ECM connector for circuit involved, clean terminal contact and expand it slightly to increase contact pressure and recheck to see if problem is corrected.

The system performance check should be performed after any repairs to the system have been made.

*It is possible to set a false Code 42 on starting, but the "CHECK ENGINE" lamp will not be on. No corrective action is required.

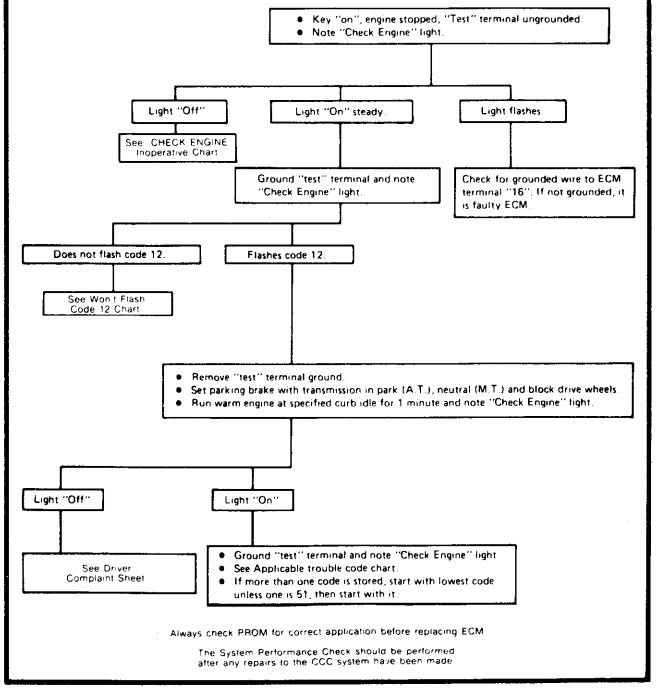
DIAGNOSTIC CIRCUIT CHECK EFI MODELS ONLY



DIAGNOSTIC CIRCUIT CHECK FED. "T" CAR WITHOUT 5-SPEED

Trouble codes are lost when the ignition is turned off. Therefore, on "Check Engine" light complaints, codes should be checked before ignition is turned off, if possible. (See "trouble code memory").

Always check PROM for correct application and installation before replacing an ECM. Also, remove terminal(s) from ECM connector for circuit involved, clean terminal contact and expand it slightly to increase contact pressure and recheck to see if problem is corrected.



GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

DRIVER COMPLAINT SHEET ALL EXC. EFI

Engine performance problem (odor, surge, fuel economy, etc. ...) Emission problem.

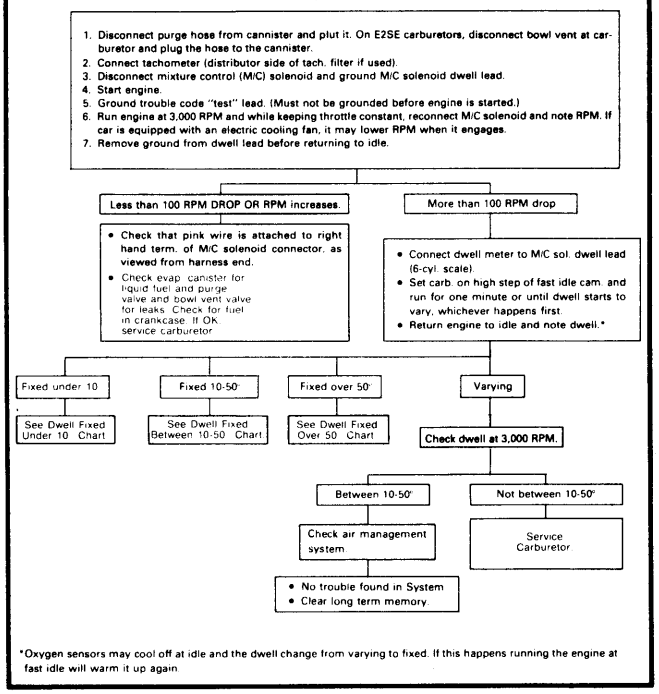
If "CHECK ENGINE" lamp is not on, normal checks that would be performed on cars without CCC should be done first.

If generator or coolant light is on with the "CHECK ENGINE" lamp, they should be diagnosed first.

Inspect for poor connections at coolant sensor, M/C solenoid, etc., and poor or loose vacuum hoses and connections. Repair as necessary.

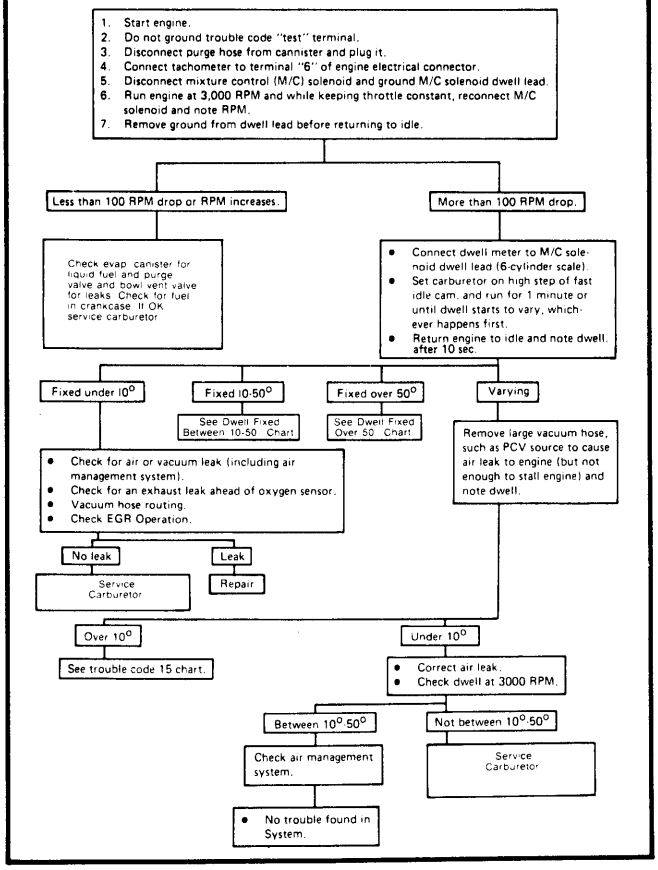
- Intermittent "CHECK ENGINE" lamp, but no trouble code stored:
  - — Check for intermittent connection in circuit from:
    - Ignition coil to ground and arcing at spark plugs or wires (all engines).
    - Battery to ECM terminals "C" and "R" (exc Fed. "T" car without 5-speed).
    - Battery to ECM terminal "11" (Fed. "T" car without 5-speed).
    - ECM terminal "1" to engine ground (Fed. "T" car without 5-speed).
    - ECM terminal "19" to distributor, including tach filter (Fed. "T" car without 5-speed).
  - — Loss of long term memory (exc. Fed. "T" car without 5-speed).
    - Grounding dwell lead for 10 seconds with "test" lead ungrounded should give code 23. It should be retained after engine is stopped and ignition turned to run position. If it is not, ECM is defective.
  - — EST wires (exc. Fed. "T" car without 5-speed).
    - EST wires should be kept away from spark plug wires, distributor housing, coil and generator. Wires from ECM terminal "13" to distributor and shield around EST wires should be a good ground.
- Stalling, Rough Idle or Improper Idle Speed. (exc. Fed. "T" car without 5-speed).
  - — See Idle Speed Control.
- Detonation - Spark Knock (exc. Fed. "T" car without 5-speed).
  - — Check ESC performance (if equipped).
  - — Check MAP or vacuum sensor output.
  - — Check EGR operation.
  - — Check TPS enrichment operation.
  - — Check HEI operation.
- Poor performance and/or Fuel Economy (exc. Fed. "T" car without 5-speed).
  - — Perform EST diagnosis.
  - — Perform ESC diagnosis (if equipped).
- Poor Full-Throttle Performance.
  - — Perform TPS diagnosis (if equipped).
- All Other Complaints.
  - — Make System Performance Check on warm engine (upper radiator hose hot).

SYSTEM PERFORMANCE CHECK (ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED)



*Oxygen sensors may cool off at idle and the dwell change from varying to fixed. If this happens running the engine at fast idle will warm it up again.

SYSTEM PERFORMANCE CHECK (FED. "T" CAR WITHOUT 5-SPEED)



GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

DRIVER COMPLAINT SHEET (EFI MODELS)

Intermittent "CHECK ENGINE" lamp or stored codes.

NOTE – Do not use diagnostic charts for intermittent problems. Fault must be present to locate the problem. If fault is intermittent, use of charts may result in replacement of non-defective parts.

– Most intermittent problems are caused by faulty electrical connectors or wiring. Diagnosis must include a careful visual and physical inspection of the following circuit wiring and connectors:
- Poor mating of connector halves or terminals not fully seated in connector body (backed out "terminals").
- Improperly formed or damaged terminals. All connector terminals in problem circuit should be carefully reformed to increase contact tension.
- HEI distributor EST wires should be routed away from distributor, ignition coil, secondary wiring and generator.
- Circuit 419 – "CHECK ENGINE" lamp to ECM – short to ground.
- Circuit 451 – Diagnostic connector to ECM – short to ground.
- Circuit 450 and 450R – Check ECM ground at engine block.
- Improper installation of electrical options.
- Open air conditioning clutch diode.
- Electrical system interference caused by a defective relay. ECM driven solenoid, or a switch causing a sharp electrical surge. Normally, the problem will occur when defective component is operated.

- Stalling, Rough or Improper Idle Speed.
  – See EFI Idle Air Control Chart.

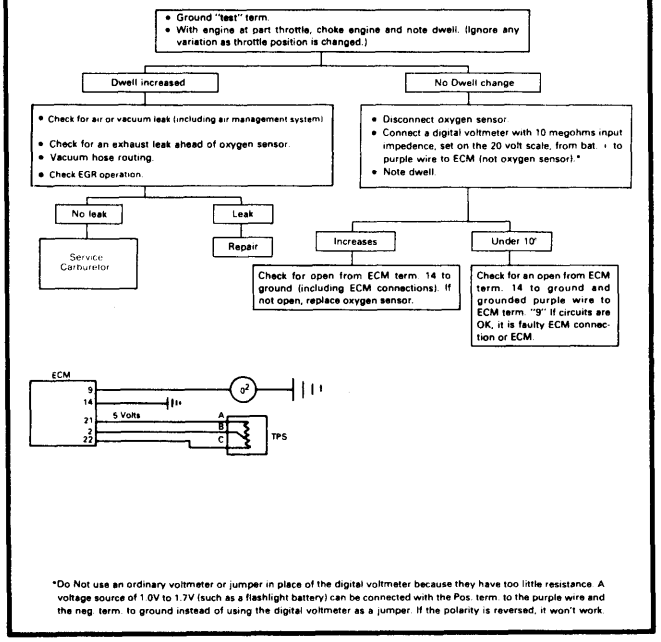
- Engine Cranks But Will Not Run.
  – Perform injector test.

- Hard Starting, Poor Performance, Driveability or Fuel Economy.
  – Service fuel system.

- Detonation – Spark Knock.
  – Diagnosis ESC system.
  – Diagnosis EGR system.

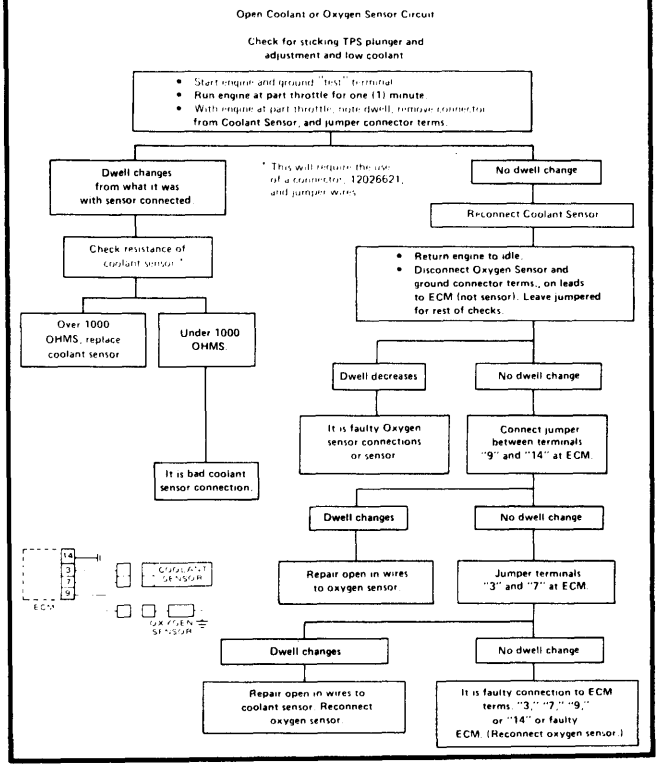
Following any repairs or adjustments, clear codes and confirm closed loop operation and no "CHECK ENGINE" lamp.

DWELL FIXED UNDER 10° ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED



*Do Not use an ordinary voltmeter or jumper in place of the digital voltmeter because they have too little resistance. A voltage source of 1.0V to 1.7V (such as a flashlight battery) can be connected with the Pos. term. to the purple wire and the neg. term. to ground instead of using the digital voltmeter as a jumper. If the polarity is reversed, it won't work.

DWELL FIXED BETWEEN 10-50° ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED



GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

DWELL FIXED BETWEEN 10-50° FED. "T" CAR WITHOUT 5-SPEED

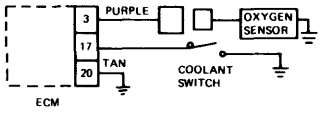
(Lean engine, open coolant switch, or open or grounded oxygen sensor circuit.)

Ground "test" term. and note dwell.

- Fixed
- Varying (closed loop) → Diagnose CTS Circuit

With engine at part throttle, choke engine. (Disregard any dwell variation as throttle is being opened or closed.)

- Dwell increased
  - Check for air or vacuum leak (including air management system)
  - Check for an exhaust leak ahead of oxygen sensor.
  - Vacuum hose routing.
  - Check EGR Operation.
  - No leak → Service Carburetor
  - Leak → Repair
- No dwell increase
  - Disconnect oxygen sensor.
  - Connect a digital voltmeter with 10 meg-ohms input impedence, set on the 20 volt scale, from bettery + to purple wire to ECM (not oxygen sensor).*
  - Note dwell.
  - Dwell increases → Check for open from ECM terminal "20" to ground (including ECM connections). If not open, it is faulty oxygen sensor connection or sensor.
  - No Dwell Change → Check for an open or grounded purple wire to ECM terminal "3". If not open or grounded, it is faulty ECM connection or ECM.

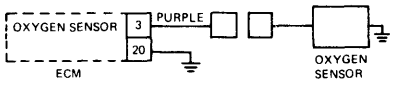


*Do Not use an ordinary voltmeter or jumper in place of digital voltmeter, because they have too little resistance. A voltage source of 1.0V to 1.7V (such as a flashlight battery) can be connected with the positive terminal to the purple wire and the negative terminal to ground as a jumper. If the polarity is reversed, it won't work.

DWELL FIXED OVER 50° FED. "T" CAR WITHOUT 5-SPEED

Remove large vacuum hose such as PCV source to cause air leak to engine. (But not enough to stall engine.)

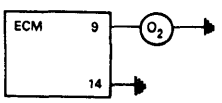
- Dwell decreases.
  - Check evap. canister for liquid fuel and purge valve and bowl vent valve for leaks. Check for fuel in crankcase. If OK, service carburetor.
  - Dwell decreases.
    - Check voltage on purple oxygen sensor wire from ECM with digital voltmeter, (sensor disconnected).
    - Under .5 volt → Replace oxygen sensor.
    - Over .5 volt → Repeat voltage check with ECM disconnected.
      - Under .5 volt → Replace ECM.
      - Over .5 volt → Check for short in harness to purple wire from oxygen sensor.
  - No dwell change. → Replace ECM.
- No dwell change.
  - Disconnect oxygen sensor.
  - Ground connector terminal on lead to ECM (not oxygen sensor.)



DWELL FIXED OVER 50° ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED

Run engine at fast idle, then with engine idling, remove large vacuum hose such as PCV source to cause air leak to engine. (But not enough to stall the engine).

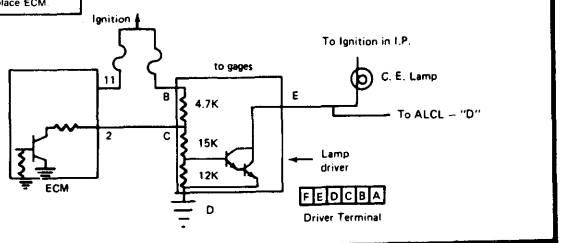
- Dwell changes.
  - Check evap. canister for liquid fuel and purge valve and bowl vent valve for leaks. Check for fuel in crankcase. If OK, service carburetor.
  - Dwell drops to under 10°.
    - Ign. "on", engine stopped.
    - Remove ground from O_2 harness connector and check voltage from that term. to ground with digital voltmeter.
    - Under .55V → It is faulty oxygen sensor.
    - Over .55V → Check wire from ECM term. 9 for short to Bat.+. If not shorted, it is faulty ECM.
  - No dwell change. → Replace ECM.
- No dwell change.
  - Disconnect oxygen sensor.
  - Ground connector terminal on lead to ECM (not oxygen sensor).



"CHECK ENGINE" LAMP INOPERATIVE ALL EXC. EFI MODELS

- Ignition "on", engine stopped.
- Ground "Check Engine" lamp terminal in ALCL connector (terminal "D") and note "Check Engine" light.

- Light "OFF" → Check for blown gage fuse and open in wire from ALCL to Instrument Panel (I.P.) "Check Engine" light terminal. If not open, it is faulty bulb or connection to it.
- Light "ON" → Check voltage from driver terminal "C" to ground.
  - Under 6 volts → Check voltage from driver terminal "B" to ground.
    - Under 10 volts → Repair open in circuit to gage fuse from terminal "B".
    - Over 10 volts
      - Remove wire from driver connector cavity "C".
      - Reconnect driver and note "Check Engine" light.
      - Light "ON" → Check for grounded wire from driver terminal "C" to ECM terminal "G" (2 on Fed. "T" car w/o 5-spd). If not grounded, replace ECM.
      - Light "OFF" → It is faulty driver connections or driver.
  - 6 to 11 volts → Ground driver terminal "E" and note "Check Engine" light.
    - Light "ON" → It is faulty driver connection or driver.
    - Light "OFF" → Repair open in wire to driver terminal "E".
  - Over 11 volts → Check for open from lamp driver terminal "D" to ground. If not open, replace lamp driver.



GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

"CHECK ENGINE" LAMP INOPERATIVE EFI MODELS

- Ignition "ON," engine stopped.
- Back probe white ECM connector Pin 20, CKT 419, with a test light to ground.

Test Light "ON"

- Faulty "Check Engine" light bulb.
- Bulb OK. Repair open ign. 1 CKT. or CKT. 419.

Test Light "OFF"

- Back probe ECM connector, Pin 16, ignition CKT 439, with a test light to ground.

Test Light "OFF"

Repair open or short to ground in CKT 439.

Test Light "ON"

- Back probe white connector Pins 10 or 15, continuous battery, with a test light to ground.

Test Light "OFF"

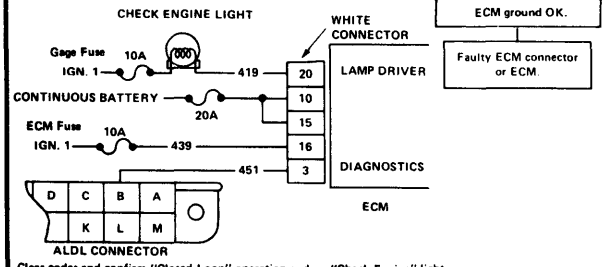
Repair open or short to ground in continuous battery circuit.

Test Light "ON"

Check ECM engine ground CKTS 450 and 450R

ECM ground OK.

Faulty ECM connector or ECM.



Clear codes and confirm "Closed Loop" operation and no "Check Engine" light.

WON'T FLASH CODE 12 ALL EXC. EFI MODELS

Remote Lamp Driver in Harness.

Check fuses that supply power to ECM

- Disconnect ground from "test" terminal.
- Key "on", engine stopped.
- Check voltage from lamp driver terminal "C" to ground.

Over 11 volts

Check for short from terminal "C" wire to B+.

Under 11 volts

Ground lamp driver terminal "C" and note "Check Engine" light.

Light "ON"

Disconnect driver and note "Check Engine" light.

Light "OFF"

It is faulty connection to driver terminal "C" or faulty driver.

Light "ON"

Repair ground in wire from driver terminal "E" to "Check Engine" light.

Light "OFF"

Ground terminal "5" (16 on Fed. T car w/o 5-spd) at ECM and note "CHECK ENGINE" light.

Light "ON"

Repair open in wire from ECM terminal "5" (16 on Fed. T car w/o 5-spd) to driver terminal "C".

Light Flashes

Repair open in wire from ECM terminal "5" (16 on Fed. T car w/o 5-spd) to "test" terminal.

Light "ON" steady

Disconnect ground from terminal "5" (16 on Fed. T car w/o 5-spd).
Check voltage from ECM terminals "C" & "B" (11 on Fed. T car w/o 5-spd) to ground.

Under 9 volts

Repair poor connection or open in circuit to terminal that reads low.

Over 9 volts

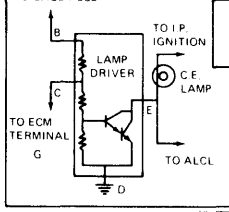
Check voltage from ECM terminal "D" (1 on Fed. T car w/o 5-spd) to ground.

Over 1 volt

Repair open or poor connection from terminals "A" & "D" (1 & 22 on Fed. T car w/o 5-spd) to ground.

Under 1 volt

- Turn ignition "off", remove PROM.
- Turn ignition "on".
- After 30 seconds, check for Code 12 and 51.



No Code 12 and 51

It is faulty ECM connection or ECM.

Code 12 and 51

Check for proper PROM installation. If OK, install new PROM and recheck for code 12. If code 12 does not flash, replace ECM.

Repeat diagnostic circuit check

TPS ENRICHMENT CHECK ALL EXC. EFI MODELS

Except 2.8/ V-6 with manual transmission. It uses vacuum sensor output for enrichment

- Connect dwell meter set on 6 cyl. scale to M/C Sol.
- Start engine and ground "test" term. With engine running at part throttle, depress TPS plunger completely and note dwell.

Under 10°

Enrichment Circuit OK. Make system performance check.

No dwell change

Disconnect TPS Harness Connector from sensor and note dwell.

Under 10°

Adjust TPS or replace faulty TPS.

No change

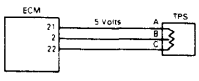
Check voltage from harness connector terminal "B" to "C" with digital voltmeter.

Under 2 volts

Check for ground "C" wire to ECM terminal "2" (5 on Fed. T car w/o 5-spd). If not grounded, it is faulty ECM.

Over 2 volts

It is a faulty ECM.



WON'T FLASH CODE 12 EFI MODELS

- Ignition "OFF."
- Disconnect White ECM connector.
- Ignition "ON."

Light "OFF"

- Ignition "OFF."
- Reconnect ECM.
- Ignition on, engine stopped.
- Back probe white ECM connector Pin 3, CKT. 451, with a test light to ground.

Light "ON"

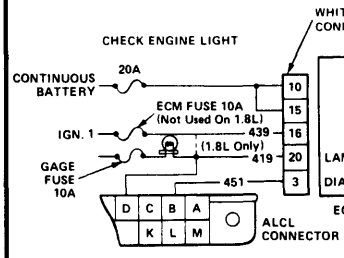
Repair short to ground in CKT. 419.

Code 12

Repair open in diagnostic CKT. 451.

No Code 12

- Ignition "OFF," engine stopped.
- Remove PROM.
- Ignition "ON."
- Ground diagnostic term.
- Note code.



No Code

Code 51

Faulty ECM connector or ECM.

Check for proper PROM installation. If OK, install new PROM and recheck for code 12.

No Code 12, replace ECM.

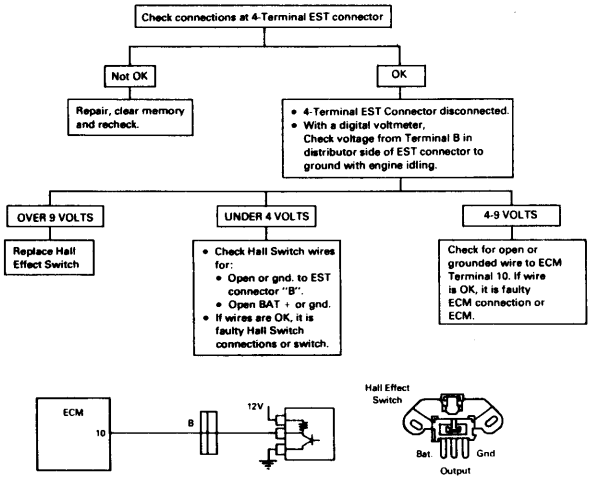
Code 12

System OK.

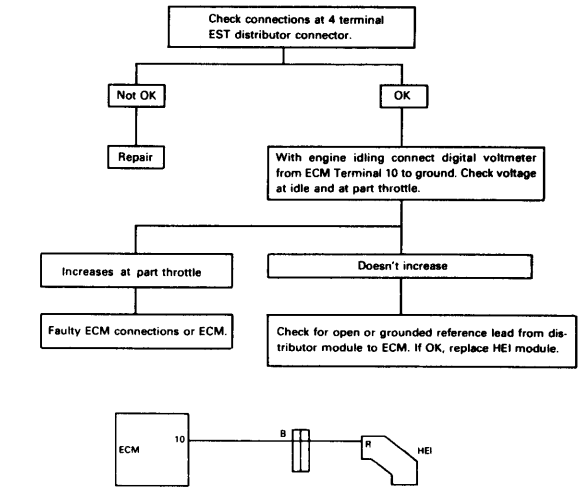
Clear codes and confirm "Closed Loop" operation and no "Check Engine" light.

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

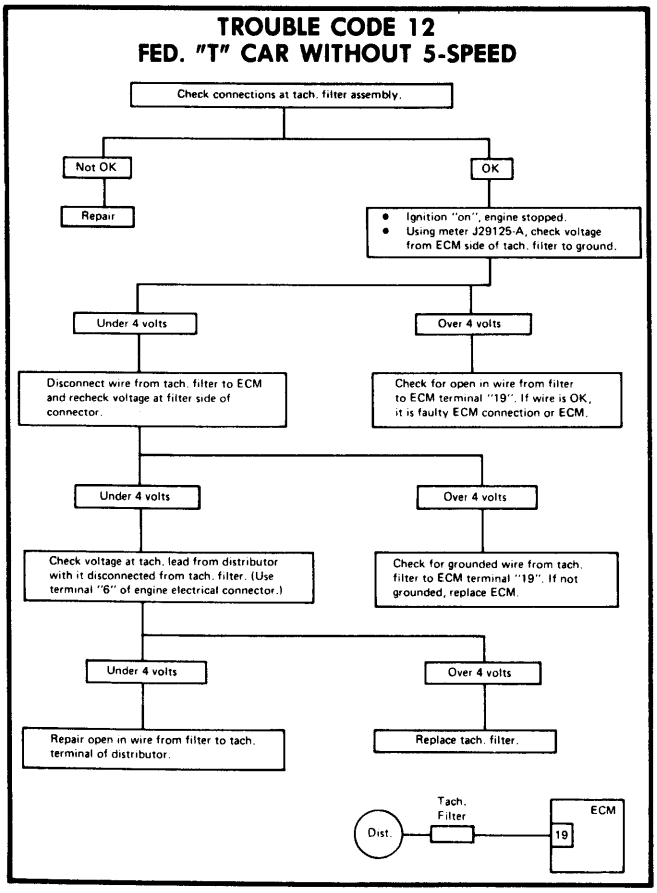
TROUBLE CODE 12
3.8L VIN CODE K



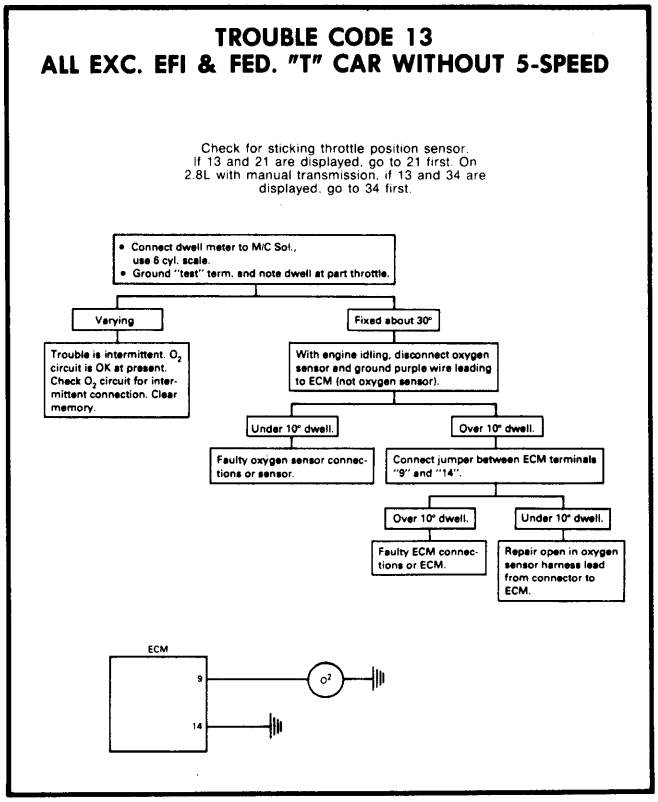
TROUBLE CODE 12
ALL OTHER MODELS



TROUBLE CODE 12
FED. "T" CAR WITHOUT 5-SPEED



TROUBLE CODE 13
ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED



GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

TROUBLE CODE 13
EFI MODELS

- Ignition "OFF."
- Diagnostic terminal grounded.
- Disconnect oxygen sensor and jumper harness connector CKT 412 to ground.
- Start engine and note "Check Engine" light.

"Check Engine" light went off for at least 15 seconds.

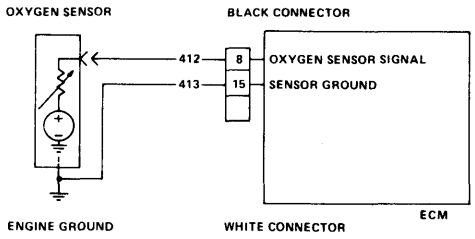
Faulty oxygen sensor connector or sensor.

"Check Engine" light flashing Open Loop.

Check for open oxygen sensor CKT 412.

Signal CKT 412 OK.

Faulty ECM connector or ECM.



Clear codes and confirm "Closed Loop" operation and no "Check Engine" light.

Field Service Mode:
- Engine running -- diagnostic terminal grounded.
  - Open Loop; "Check Engine" light will flash approx. 2.5 times per second.
  - Closed Loop; "Check Engine" light will flash approx. 1 time per second.

TROUBLE CODE 14
EFI MODELS

If the "Engine Hot" light is "ON," check for overheating condition before making following test.

Engine stopped, Ignition "OFF".
- Diagnostic terminal ungrounded.
- Disconnect coolant sensor.
- Jumper harness connector signal CKT. 410 to ground, CKT. 452.
- Start engine and idle at normal operating temperature for 1 minute or until "Check Engine" light comes on.
- With engine idling, remove jumper from harness connector and run engine for 1 more minute.
- Stop engine, enter diagnostics and note code(s).

Code 14 only.

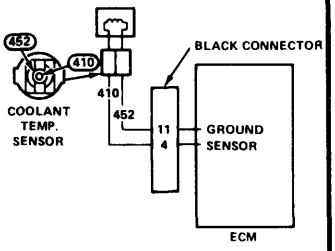
- Disconnect black ECM connector.
- Check signal CKT. 410 for short to CKT. 452 or chassis ground.

CKT. 410 OK

Replace ECM.

Both Code 14 and 15.

Replace coolant sensor.



Clear codes and confirm "Closed Loop" operation and no "Check Engine" light.

TROUBLE CODE 14
ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED

If 14 and 21 are displayed, go to 21 first.
On 2.8L with manual transmission, if 14 and 34 are displayed, go to 34 first.
If the engine hot light is "on", check for overheating before making following test.

Run engine for 5 minutes with "test" term. ungrounded and note light.

Off

Trouble is intermittent. Make physical check of circuit and clear memory.

On

- Stop engine.
- Connect dwell meter to M/C Solenoid. (Use 6 cyl. scale.)
- Remove connector from Coolant Sensor.
- Start engine and ground "test" term.

Dwell fixed about 30°.

Replace Coolant Sensor.

Dwell varies.

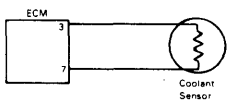
Remove numbered term. ECM connector and connect test light from Bat. - to term. 3 of connector (not ECM).

Lights

Repair grounded wire to ECM term. "3".

No light.

Check for short between coolant sensor wires. If not shorted, replace ECM.



TROUBLE CODE 15
ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED

If 15 and 21 are displayed, go to 21 first.
On 2.8L with manual transmission, if 15 and 34 are displayed, go to 34 first.

- Connect dwell meter to M/C Sol. - Use 6 cyl. scale.
- Start engine.
- Ground "test" term. and note dwell at part throttle.

Varying (closed loop).

Trouble is intermittent. Circuit not open at present. Make physical inspection of circuit for intermittent connection. Clear memory.

Fixed about 30°.

- Disconnect Coolant Sensor.
- Ignition "on", engine stopped, check voltage between sensor connector terms., should be over 4 volts.

OK

Check resistance of coolant sensor. Should be under 1000 ohms on warm engine.*

OK

It is poor sensor connection or low coolant level.

Not OK

Replace sensor.

Not OK

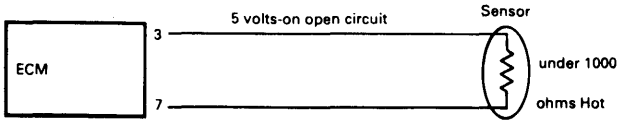
Check voltage from ECM term. 3 to 7 (sensor disconnected).

Under 4 volts.

It is faulty ECM connection or ECM.

Over 4 volts.

Check for open in wires to ECM terms. 3 and 7.



*This may require use of connector and lead assembly #12026621.

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

TROUBLE CODE 15 EFI MODELS

- Engine at normal operating temperature.
- Disconnect Coolant Sensor.
- Ignition "ON," engine stopped.
- Check voltage between harness connector terminals, CKTS 410 and 452.

Over 4 volts.

Check resistance across coolant sensor terminals. Should be less than 1000 ohms.

OK

Intermittent fault in sensor circuit or conn. If additional codes were stored, return to "Diagnostic Circuit Check".

NOT OK

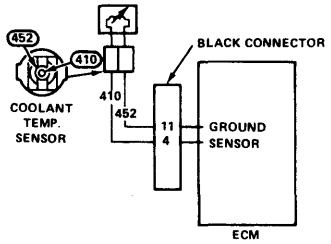
Replace Sensor.

Below 4 volts.

Check for open in CKTS 410 or 452.

CKTS 410 and 452 OK.

Faulty ECM connector or ECM.



* Sensor check may require use of wire and connector assy, Part Number 12026621. Clear codes and confirm "Closed Loop" operation and no "Check Engine" light.

TROUBLE CODE 21 ALL EXC. EFI MODELS

Check for stuck or misadjusted TPS plunger. Repair as necessary and proceed with test.

On Fed. "T" car without 5-speed, trouble code 44 may also be set if altitude compensation lead is grounded. Enrichment under this condition is about 30°.

- Connect dwell meter to M/C solenoid — use 6-cyl. scale.
- Disconnect TPS harness connector from sensor.
- Check voltage from harness connector term. "A" to "C" then "B to C" with a digital voltmeter J#29125 or equivalent, and ign. "ON", engine stopped.

Either or both under 2 volts

Check voltage from ECM terminal "15" to "8" and from "5" to "8" ("21" to "22" and "2" to "22" on Fed. "T" car w/o 5-spd)

Either or both under 2 volts

Faulty ECM Connections or ECM

Both over 2 volts

Repair open in harness to TPS.

Both over 2 volts

- Start engine and let it idle.
- Jumper harness connector term. "B" to "C" and note dwell.

Under 10°

Replace ECM

Not OK

Repair

Any over 20,000 ohms

Replace sensor

Over 10°

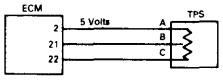
Check TPS connector terminal connections

OK

Check TPS resistance from "A to B" then "A to C"

Both under 20,000 ohms

Adjust TPS. If unable to adjust, replace TPS.



TROUBLE CODE 15 FED. "T" CAR WITHOUT 5-SPEED

If Code 15 and 21 are displayed, go to 21 first.

- Engine idling.
- Connect dwell meter to M/C solenoid dwell lead (6 cylinder scale).
- After engine has been running for one minute, cause large air leak to engine, but not enough to stall it, and note dwell.

Under 10°

Trouble is intermittent. Circuit is not open at present. Make physical inspection of circuit for intermittent connection.

Fixed between 10° - 50°.

- With engine idling.
- Disconnect coolant switch and check voltage from harness connector term. to ground.

Under 10 volts

- Ignition "ON", engine stopped.
- Check voltage from ECM terminal "17" to ground.

Over 10 volts

Repair open in wire from ECM terminal "17" to coolant switch.

Under 10 volts

It is faulty ECM connection or ECM.

Over 10 volts

Connect test light from Battery + to coolant switch terminal and note "Check Engine" light.

Light "OFF"

Replace coolant switch.

Light "ON"

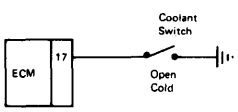
- Ground coolant switch harness connector terminal.
- Cause large air leak to engine (but not enough to stall engine) and note dwell.

Fixed 10° - 50°.

Replace ECM.

Varying

It is faulty coolant switch connection.



TROUBLE CODE 21 EFI MODELS

- Diagnostic terminal not grounded.
- Clear codes.
- Disconnect TPS sensor.
- Start engine and idle for 1 minute or until "Check Engine" light comes on.
- Ignition "ON" engine stopped.
- Ground Diagnostic Terminal and Note Code.

Code 22

Probe TPS harness connector CKT 452 with test light to 12 volts.

Light

Replace TPS Sensor.

No light.

Repair open CKT 452.

Code 21

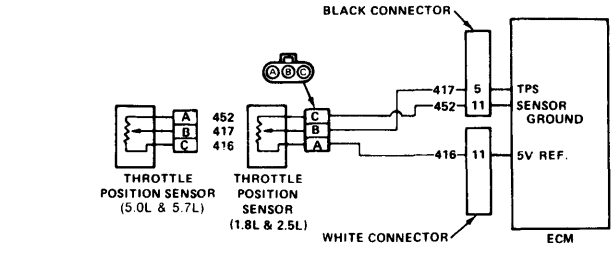
Disconnect black ECM connector and probe harness connector Pin 5 with a test light to ground.

No light.

Replace ECM.

Light

Repair short to voltage CKT 417.



Clear codes and confirm "Closed Loop" operation and no "Check Engine" light.

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

TROUBLE CODE 22
EFI MODELS

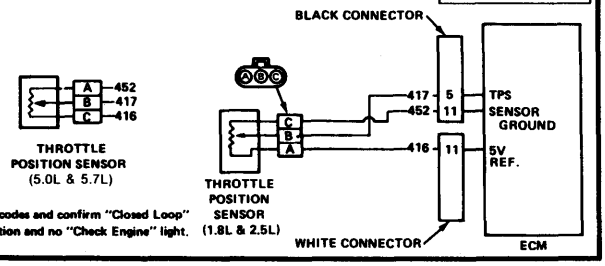
- Diagnostic terminal not grounded.
- Clear codes.
- Disconnect TPS and jumper CKTS 416 and 417.
- Start engine and idle for 1 minute or until "Check Engine" light comes on.
- Ignition "ON," engine stopped. Ground Diagnostic Terminal and Note Code.

Code 21
- Check TPS Adjustment
- Adjustment OK, Replace TPS.

Code 22
- Remove jumper from CKTS 416 and 417.
- Check voltage between harness conn. Pins A and C using digital voltmeter (J 29125)

4-6 Volts
- Check for open or short to ground in CKT 417.
- CKT 417 OK. Faulty ECM connector or ECM.

Below 4 volts
- Disconnect white ECM connector. Check for open or short to ground in CKT 416.
- CKT 416 OK. Faulty ECM connector or ECM.



Clear codes and confirm "Closed Loop" operation and no "Check Engine" light.

TROUBLE CODE 23
FED. "T" CAR WITHOUT 5-SPEED

- Turn ignition "on", engine stopped.
- Do NOT ground "Test" terminal.
- Check voltage at M/C solenoid dwell lead.

Under 10 volts
- Disconnect M/C solenoid.
- Connect test light from the solenoid connector battery terminal pink lead to ground.

Light "ON"
- Connect test light between solenoid harness connecter terminals. Do not use voltmeter.

Light "ON"
- Check for an open in wire from M/C solenoid to dwell connector. If not open, it is a faulty M/C solenoid connection or solenoid.

Light "OFF"
- Remove ECM connector

Light "OFF"
- Replace ECM

Light "ON"
- Repair ground in wire from solenoid to ECM terminal "14"

Light "OFF"
- Check for open circuit from solenoid to ignition switch.

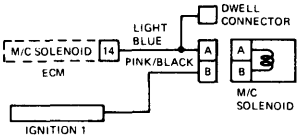
Over 10 volts
- Check voltage at ECM terminal "14".

Under 10 volts
- Repair open in SOL/ECM wire.

Over 10 volts
- Check carburetor M/C solenoid resistance.

Under 10 ohms
- Replace solenoid and ECM

Over 10 ohms
- Faulty ECM connections or ECM



TROUBLE CODE 23
ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED

Check connections at M/C solenoid. If OK: Clear memory and recheck for Code. If no Code 23, circuit is OK

- Turn ignition "on", engine stopped.
- Do NOT ground "test" lead.
- Check voltage at M/C solenoid dwell lead.

Under 10V
- Disconnect M/C solenoid.
- Connect test light from the sol. connector battery terminal pink lead to ground.

Lights
- Connect test light between sol. harness connector terminals. Do not use voltmeter.

No Light
- Check for an open in wire from M/C Sol. to dwell connector. If not open, it is a faulty M/C Solenoid connection or Solenoid.

Lights
- Remove numbered term. ECM connector

No Light
- Replace ECM

Lights
- Repair ground in wire from solenoid to ECM terminal "18".

No Light
- Check for open B+ circuit to solenoid

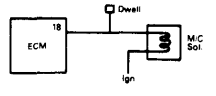
Over 10V
- Check voltage at ECM term. "18".

Under 10V
- Repair open in SOL/ECM wire.

Over 10V
- Check carburetor M/C Sol. Resistance

Under 10 ohms
- Replace solenoid and ECM

Over 10 ohms
- Faulty ECM connections or ECM



TROUBLE CODE 24
EFI MODELS

NOTICE: A False Code 24 and "Check Engine" light may be set if engine is run above 1200 RPM in Neutral on vehicles equipped with manual transmission. To prevent misdiagnosis, disregard Code 24 if set under these circumstances.

- Speedometer working OK.
- Lift drive wheels.
- Back probe white ECM connector Pin 2, signal CKT 437 with a voltmeter to ground.
- Ignition "ON."
- Transmission in "NEUTRAL."
- Rotate drive wheel manually while observing voltage. Be sure opposite wheel does not turn.

No voltage variation
- Disconnect buffer amplifie.
- Ignition "ON."
- Probe harness connector Pin C with a voltmeter to ground. Should be 9-12 volts.

Not OK
- Repair open CKT 39, ignition 12 volts.

OK
- Connect voltmeter between harness connector Pins B and C. Should be 9-12 volts.

Not OK
- Repair open ground CKT 450.

OK
- Connect voltmeter between harness connector Pins A & B. Should be 9-12 volts.

Not OK
- Repair open or short to ground in signal CKT 437.
- CKT 437 OK. Faulty ECM connector or ECM.

OK
- Faulty connector or VSS.
- Recheck voltage at white ECM connector Pin 2, CKT 437 as drive wheel is turned.

No voltage variation.
- Reinstall original VSS and repair speedometer.

Voltage varies from under 1.0 volt to over 10 volts.
- Park/Neutral switch Chart 9A.

Park/Neutral switch OK.
- Clear codes.
- Diagnostic term. not grounded.
- Road test—At steady 40 MPH for one minute
- Note "Check Engine" light.

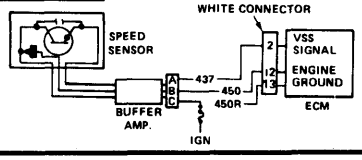
No Light
- VSS system OK. No trouble found.

Light "ON"
- Stop engine.
- Ignition "ON."
- Ground diagnostic term.

No Code 24
- See chart for code indicated.

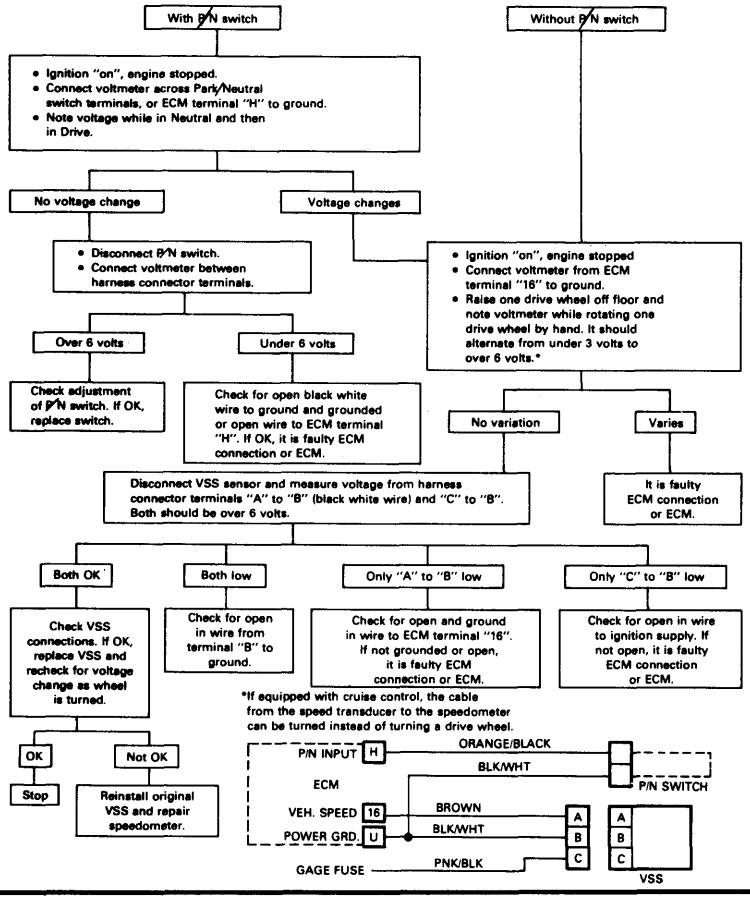
Code 24
- Faulty buffer connector or ECM.

Clear codes and confirm "Closed Loop" operation and no "Check Engine" light.

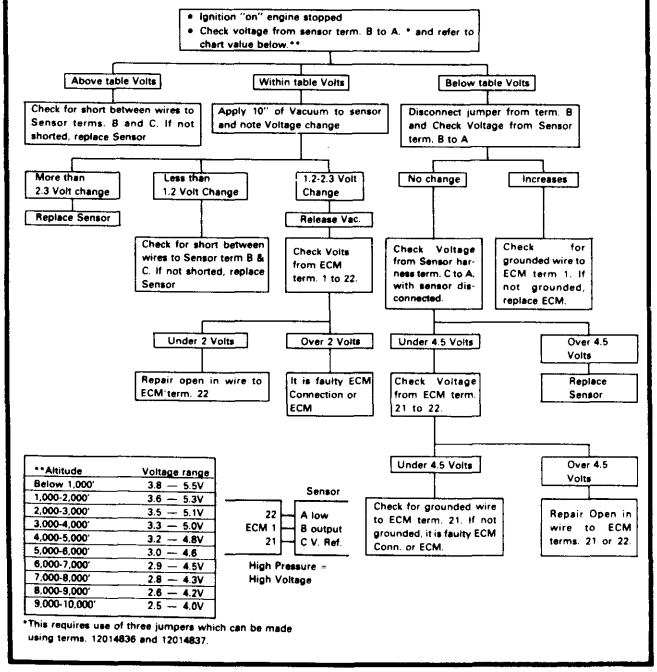


GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

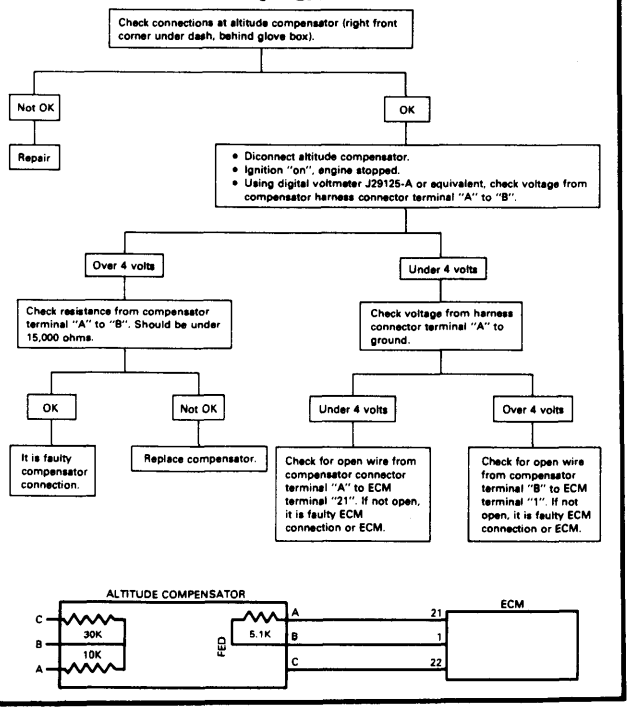
TROUBLE CODE 24
ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED



TROUBLE CODE 32
ALL EXC. EFI, "J" CAR & FED. "T" CAR WITHOUT 5-SPEED



TROUBLE CODE 32
"J" CAR



GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

TROUBLE CODE 33
EFI MODELS

- Ignition "OFF," clear codes.
- Disconnect MAP sensor connector.
- Diagnostic terminal not grounded.
- Start engine and run for 1 minute or until "Check Engine" light comes on.
- Ignition "ON," engine stopped.
- Ground diagnostic terminal and note code.

CODE 33

Check for open in ground CKT 469.

CKT 469

Check for short to voltage CKT 432.

CKT 432 OK.

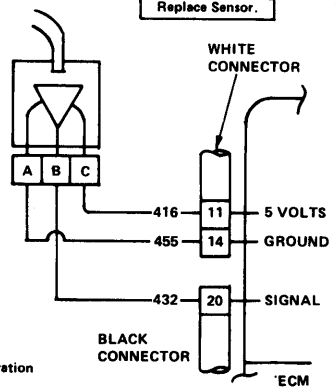
Replace ECM.

CODE 34

Check for plugged or leaking sensor vacuum line.

Vacuum line OK.

Replace Sensor.



Clear codes and confirm "Closed Loop" operation and no "Check Engine" light.

TROUBLE CODE 34
MAP SENSOR (NON-TURBO MODELS)

Check for over 34 kPa (10 inches) vacuum at MAP sensor with engine idling. If not OK, repair hoses or connections.

- Ignition "on" engine stopped.
- Check voltage from sensor term. "B" to "A" * and refer to chart value below. **

Above table Volts

Check for short between wires to Sensor terms. "B" and "C." If not shorted, replace Sensor.

More than 2.3 Volt change

Replace Sensor

Less than 1.2 Volt change

Check for short between wires to Sensor term "B" & "C." If not shorted, replace Sensor.

Within table Volts

Apply 34 kPa (10 inches) of vacuum sensor and note Voltage change.

1.2–2.3 Volt change

Remove vacuum

Check Volts from ECM term. "20" to "22."

Under 2 Volts

Repair open in wire to ECM term. "22."

Over 2 Volts

It is faulty ECM Connection or ECM.

Below table Volts

Disconnect jumper from term. B and check Voltage from Sensor term. "B" to "A."

No change

Check Voltage from Sensor harness term. "C" to "A" with sensor disconnected.

Under 4.5 Volts

Check Voltage from ECM term. "21" to "22."

Under 4.5 Volts

Check for grounded wire to ECM term. "21." If not grounded, it is faulty ECM Conn. or ECM.

Over 4.5 Volts

Repair open in wire to ECM terms. "21" or "22."

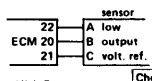
Increases

Check for grounded wire to ECM term. "20." If not grounded, replace ECM.

Over 4.5 Volts

Replace Sensor

**Altitude	Voltage Range
Below 1,000'	3.8 – 5.5V
1,000–2,000'	3.6 – 5.3V
2,000–3,000'	3.5 – 5.1V
3,000–4,000'	3.3 – 5.0V
4,000–5,000'	3.2 – 4.8V
5,000–6,000'	3.0 – 4.6V
6,000–7,000'	2.9 – 4.5V
7,000–8,000'	2.8 – 4.3V
8,000–9,000'	2.6 – 4.2V
9,000–10,000'	2.5 – 4.0V



High Pressure = High Voltage

*This requires use of three jumpers which can be made using terms. part numbers 12014836 and 12014837.

TROUBLE CODE 34
VACUUM SENSOR CIRCUIT

Check for over 10" of vacuum at sensor with engine idling. If not OK, repair.

With engine idling, check voltage from sensor terms. B to A *

Under 2 volts

- Disconnect jumper from term. B
- Check voltage from sensor term B to A

Over 2 volts

Under 2 volts

Check for grounded wire to ECM term. 20. If not grounded, replace ECM.

Over 2 volts

- Disconnect sensor
- Check voltage from harness connector terms. C to A

Under 2 volts

Check voltage from ECM term. 21 to 22

Faulty sensor connections or sensor.

Over 2 volts

Repair open in wire(s) to ECM terms. 21 and/or 22.

Under 2 volts

It is faulty ECM connections or ECM.

Over 2 volts

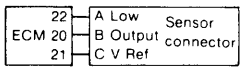
Disconnect vacuum hose from sensor

Under 2 volts

Check for open in harness to term. 20 of ECM. If OK, it is faulty ECM connections or ECM.

Over 2 volts

Check for short to V ref. If OK, replace sensor.



High Vacuum High Output

*This requires use of three jumpers between the sensor and the connector. They can be made using terminals 12014836 and 12014837.

TROUBLE CODE 34
MAP SENSOR (TURBO MODELS)

Check for over 34 kPa (10 inches) vacuum at MAP sensor with engine idling. If not OK, repair hoses or connections.

- Ignition "on" engine stopped
- Check voltage from sensor term. "B" to "A"* and refer to chart value below. **

Above table volts

Check for short between wires to Sensor terms. "B" and "C." If not shorted, replace Sensor.

More than 1.7 Volt change

Replace Sensor

Less than 2.9 Volt change

Check for short between wires to Sensor term. "B" & "C." If not shorted, replace Sensor.

Within table volts

Apply 50 kPa (15 inches) of vacuum sensor and note Voltage change

0.9-1.7 Volt change

Remove Vacuum

Check Volts from ECM term. "20" to "22."

Under 1 Volt

Repair open in wire to ECM term. "22."

Over 1 Volt

It is faulty ECM Connection or ECM.

Below table volts

Disconnect jumper from term. "B" and check Voltage from Sensor term. "B" to "A".

No change

With sensor disconnected, check voltage from sensor harness term. "C" to "A."

Under 4.5 Volts

Check Voltage from ECM term. "21" to "22."

Under 4.5 Volts

Check for grounded wire to ECM term. "21." If not grounded, it is faulty ECM Conn. or ECM.

Over 4.5 Volts

Repair Open in wire to ECM terms. "21" or "22."

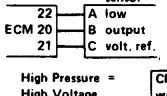
Increases

Check for grounded wire to ECM term. "20." If not grounded, replace ECM

Over 4.5 Volts

Replace Sensor

**Altitude	Voltage Range
Below 1,000'	1.7 – 3.2V
1,000–2,000'	1.6 – 3.0V
2,000–3,000'	1.5 – 2.8V
3,000–4,000'	1.4 – 2.7V
4,000–5,000'	1.3 – 2.6V
5,000–6,000'	1.3 – 2.5V
6,000–7,000'	1.2 – 2.5V
7,000–8,000'	1.1 – 2.4V
8,000–9,000'	1.1 – 2.3V
9,000–10,000'	1.0 – 2.2V



High Pressure = High Voltage

*This requires use of three jumpers which can be made using terms. part number 12014836 and 12014837.

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

TROUBLE CODE 34
EFI MODELS

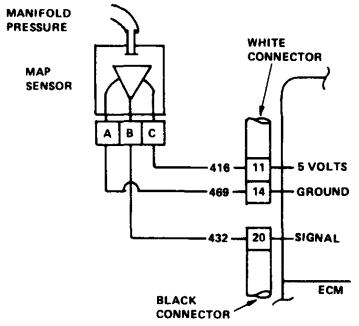
- Ignition "OFF," clear codes.
- Disconnect MAP sensor and jumper harness connector pins "B" to "C."
- Diagnostic terminal not grounded.
- Start engine and run for 1 minute or until "Check Engine" light comes on.
- Ignition "ON," engine stopped.
- Ground diagnostic terminal and note code.

CODE 33 → Replace sensor.

CODE 34 →
- Remove jumper from Pins "B" to "C."
- Check voltage between harness connector Pins "A" and "C" using voltmeter J-29125.

4 TO 6 VOLTS → Disconnect ECM black connector. Check for open or short to ground in CKT 432. → CKT 432 OK, faulty ECM connector or ECM.

BELOW 4 VOLTS → Check for open or short to ground in CKT 416. → CKT 416 OK, faulty ECM connector or ECM.



Clear codes and confirm "Closed Loop" operation and no "Check Engine" light.

TROUBLE CODE 41
ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED

With engine idling, check output of vacuum sensor as vacuum hose is removed.

- Less than .5 volt change → See trouble code 34 chart
- More than .5 volt change → Make physical check of wires and connections for intermittent grounds and bad connections. Also, check distributor pick-up coil resistance and connections. Trouble is intermittent.

TROUBLE CODE 42
ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED

If car will not start and run, check for ungrounded EST wire to ECM terminal "12". (Grounded and open EST circuit on 4.3L VIN 8 and 5.0L VIN Y).

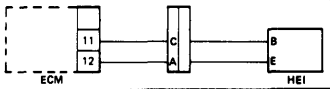
With engine at fast idle, note timing. Ground "test" terminal and note timing; it should change.

- No change →
  - Disconnect 4 terminal EST connector from distributor
  - With engine stopped, connect jumper from "A" to "B" in distributor side of EST connector
  - Start engine, ground "test" terminal and connect test light from Battery + to term. "C" of 4 term. EST conn.

  - Engine stops → Check for open EST wire to terminal "E" of HEI module. If wire is OK, it is faulty HEI module connection or module.
  - Engine runs → With test light still connected, remove jumper between terminals "A" and "B."

    - Engine runs → Check distributor wires for
      - Open or ground to module terminal "B"
      - Short between module terminals "R" and "E"

      If wires are OK, it is faulty HEI module connection or module.
    - Engine stops → Check for open wire from: EST Connector terminal "A" to ECM terminal "12" and open or ground wire from EST Connector terminal "C" to ECM terminal "11". If not grounded or open, it is faulty ECM connection or ECM



- OK → No trouble found.

TROUBLE CODE 35
ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED

Check for sticking TPS plunger. Repair as necessary and proceed with test.

- Test terminal ungrounded.
- Run engine at 3000 RPM for 5 seconds and note "check engine" light.

Light "OFF" → Trouble is intermittent and system is OK at present. Make physical inspection of circuit. Clear memory.

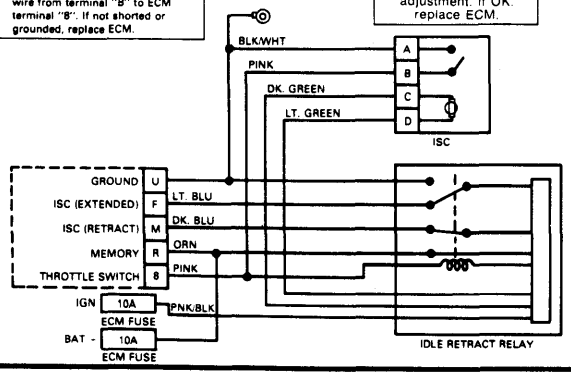
Light "ON" →
- Ignition "OFF."
- Disconnect ISC connector.
- Connect ohmmeter from Term. "A" to "B" on ISC motor assembly.
- Open throttle and note resistance.

Under 10 ohms → Replace ISC motor

Over 10 ohms →
- Ign. "ON," engine stopped.
- Check voltage from terminal "A" to "B" on harness connector.

Under 6 volts → Check for shorted or grounded wire from terminal "B" to ECM terminal "B". If not shorted or grounded, replace ECM.

Over 6 volts → Check TPS adjustment. If OK, replace ECM.



TROUBLE CODE 42
EFI MODELS

- Run engine at 1800 to 2200 RPM and note timing.
- Ground diagnostic terminal and note timing; it should change.

NO CHANGE →
- Disconnect HEI distributor 4-way connector.
- Using two jumpers, reconnect HEI connector term. "B" to harness connector term. "B" and HEI connector term. "D" to harness connector term. "D".
- Start and idle engine.
- Probe chassis harness connector term. "A," CKT 423, with voltmeter J-29125. Voltage should vary 1.8 to 3.8 volts AC.

  - OK →
    - Ignition "OFF," engine stopped.
    - Using third jumper, reconnect HEI connector term. "A" to harness connector term. "A".
    - With engine idling, again probe CKT 423, with voltmeter to ground.
    - Voltage should be less than .7 volts.

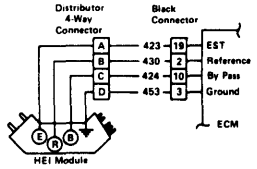
    - NOT OK → Faulty wire or connector to HEI term. "E". Wire and connector OK. Replace HEI module.
    - OK →
      - Engine idling.
      - Again probe term. "A" with a volt meter to gnd. Note voltage while probing HEI conn. term. "C," CKT 424, with a test light connected to 12V. Voltage should be .7 to 2.8 volts AC.

      - NOT OK → Faulty HEI harness wire or connector to module term. "B". If OK, replace module.
      - OK →
        - Stop engine, ignition off for 10 seconds.
        - Using fourth jumper, reconnect HEI connector term. "C" to harness connector term. "C".
        - Engine idling.
        - Check voltage at term. "C," should be above 2 volts DC.

        - NOT OK → Check for open or short to ground in CKT 424 to ECM. → CKT 424 OK → Faulty ECM connector or ECM
        - OK → EST OK. No trouble found.

  - NOT OK → Check for open or short to ground in EST CKT 423 → CKT 423 OK. → Faulty ECM connector or ECM.

CHANGE → No trouble found. Infrequently a rare set of circumstances during engine crank could result in a "Check Engine" light after engine starts. The light will stay on until ignition "OFF" for 10 seconds and a normal restart. EST circuits 430 and 423 should be physically checked for proper harness routing, connectors and wiring for intermittent open or short to ground. If OK, no further repairs should be made.



Clear codes and confirm "Open Loop" operation and no "Check Engine" light.

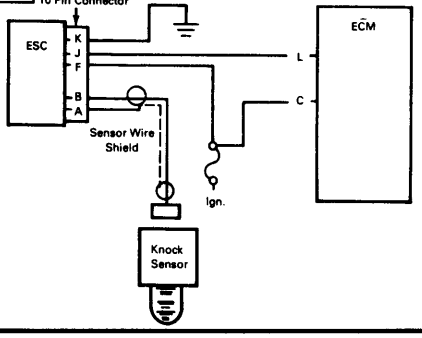
*This test requires the use of four jumpers using terminals 12014836 and 12014837.

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

TROUBLE CODE 43
ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED

With engine idling, check voltage from ECM term. L to ground.

- Under 6 volts.
  - • Ignition "on", engine stopped.
  - • Recheck voltage at ECM term. L.
    - Under 6 volts.
      - Disc. ECM connector and recheck voltage at L in connector.
        - Under 6 volts.
          - Check volt. from ESC term. J. to ground.
            - Over 6 volts.
              - Repair open in wire to ECM term. L.
            - Over 9 volts.
              - Check for grounded wire to ESC term. J. If not grounded, it is faulty ESC connection or ESC controller.
        - Over 6 volts.
          - Replace ECM.
            - Under 6 volts.
              - Check volt from ESC term. F to ground.
            - Under 9 volts.
              - Repair circuit from ESC term. F to ign.
    - Over 6 volts.
      - It is faulty ECM connection or ECM.
- Over 6 volts.
  - ESC controller harness connector term. A should be grounded with controller connected and not grounded with its disconnected. Check for this.
    - Not OK
      - Repair
    - OK
      - It is most likely a faulty ESC controller, but could be a knock sensor.



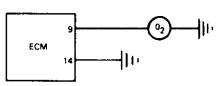
TROUBLE CODE 44 OR TROUBLE CODE 44 & 55 TOGETHER
ALL EXC. EFI MODELS

If Code 44 and 55 are displayed, check resistance of circuit from ECM terminal "14"; it should be under 10 ohms (exc. Fed. "T" car w/o 5-spd).

Note: Federal "T" car without 5-speed will display Code 44 only, it has no ability to set Code 55.

If M/C solenoid does not click with ignition "on" and "test" terminal grounded and there is no Code 23 or 54, check for sticking M/C solenoid.

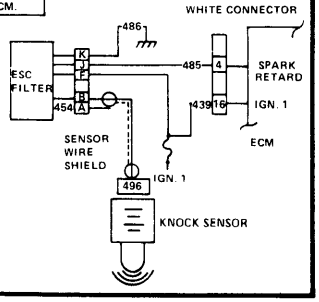
- • Ground test term.
- • Connect dwell meter to M/C solenoid — use 6 cylinder scale.
- • Run engine at 3000 RPM and note dwell.
  - Between 10°-50°.
    - Replace Oxygen Sensor
      - Dwell increases
        - • Check for air leak (including air management system).
        - • Check for exhaust leak ahead of oxygen sensor.
          - No leak
            - Service Carburetor.
          - Leak
            - Repair
      - No dwell change
        - • Disconnect oxygen sensor.
        - • Connect a digital voltmeter with 10 megohms input impedence, set on the 20 volt scale, from bat. + to purple wire to ECM (not oxygen sensor).*
        - • Note dwell.*
          - Increases
            - Check for open circuit from ECM terminal 14 (-20 on Fed. "T" car w/o 5-spd) to ground. If not open, replace oxygen sensor.
          - Reads Under 10°
            - Check for open from ECM terminal 14 to ground and grounded purple wire to ECM terminal 9 (Fed. "T" car w/o 5-spd: check for grounded or open circuit to ECM terminal 13.) If circuits are OK, it is faulty ECM connection or ECM unit.
  - Under 10°.
    - With engine at part throttle, Choke engine



*Do Not use an ordinary voltmeter or jumper in place of the digital voltmeter because they have too little resistance. A voltage source of 1.0V to 1.7V (such as a flashlight battery) can be connected with the Pos. term. to the purple wire and the neg. term. to ground instead of using the digital voltmeter as a jumper. If the polarity is reversed, it won't work.

TROUBLE CODE 43
EFI MODELS
(5.0L & 5.7L ONLY)

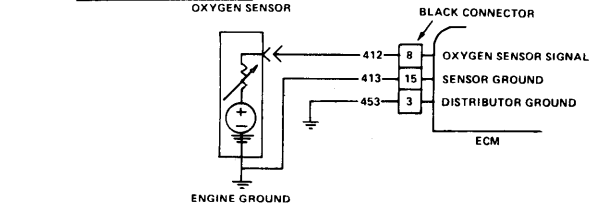
- • Engine idling at normal operating temperature.
- • Using voltmeter J-29125 back probe ECM white connector Pin 4, signal CKT 485.
  - Less Than 6 Volts
    - • Ign. "ON," engine stopped.
    - • Recheck voltage at ECM Pin 4.
      - Less Than 6 Volts
        - • Ignition "ON," engine stopped.
        - • Disconnect ECM white connector.
        - • Recheck voltage at harness connector Pin 4, CKT 485.
          - Over 6 Volts
            - Replace ECM
          - Less Than 6 Volts
            - Back probe ESC connector Pin J, CKT 485, with voltmeter to ground.
              - Less Than 6 Volts
                - Back probe between ESC connector Pins F, CKT 439 and Pin K, CKT 486.
                  - Above 9 Volts
                    - Check and repair signal CKT 485 if shorted to ground.
                      - CKT 485 OK
                        - Faulty ESC connector or controller.
                  - Less Than 9 Volts
                    - Repair open in ignition CKT 439.
              - Over 6 Volts
                - Repair open in signal CKT 485, between ESC and ECM.
      - Over 6 Volts
        - Disconnect controller. Check and repair sensor shield CKT 454 if open or shorted to ground.
          - Shield CKT 454 OK
            - Most likely a faulty controller but could be knock sensor.
  - Over 6 Volts
    - Faulty ECM connector or ECM.



Clear codes and confirm "Closed Loop" operation and no "Check Engine" light.

TROUBLE CODE 44
EFI MODELS

- • Ignition "OFF".
- • Diagnostic terminal grounded.
- • Disconnect oxygen sensor.
- • Start engine and note "Check Engine" light.
  - "Check Engine" light went off for at least 15 seconds.
    - • Measure voltage at oxygen sensor harness connector CKT 412 using J-29125 voltmeter or equivalent.
    - • Voltage should be .36 to .54 volts.
      - Not OK.
        - Check signal CKT 412 for open or short to ground.
          - CKT 412 OK.
            - Faulty ECM connector or ECM.
      - OK
        - Check for open oxygen sensor ground CKT 413.
          - CKT 413 OK.
            - Faulty ECM connector or ECM.
  - "Check Engine" light flashing Open Loop.
    - • Check for ground in wire from connector to sensor.
    - • Check for intake air leaks, including air management.
    - • Check for imbalance of TBI units on 5.0L and 5.7L.
    - • Check EGR, see Service Manual Section 6E or Chart 8 for 5.0L and 5.7L.
    - • Check fuel pressure. Should be 9-13 PSI.
      - All checks OK.
        - Faulty oxygen sensor.



Clear codes and confirm "Closed Loop" operation and no "Check Engine" light.
FIELD SERVICE MODE: Engine running, diagnostic terminal grounded.
Open-Loop: "Check Engine" light flashes at a rate of 2 times per second.
Closed-Loop: "Check Engine" light flashes at a rate of 1 time per second.

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

TROUBLE CODE 45
ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED

If M/C solenoid does not click with ignition "on" and "test" terminal grounded and there is no Code 23 or 54, check for sticking M/C solenoid. If Code 54 is displayed, go to 54 first.

- Connect dwell meter to M/C Sol. — use 6 cyl. scale. Run at 3000 RPM in Park or Neutral and note dwell.

Under 50°. → Trouble is intermittent. System is OK at present. Clear memory.

Over 50°. → With engine idling, note dwell. Remove large vacuum hose (such as PCV source) to cause an air leak (but not enough to stall engine).

Dwell decreased.
- Check that pink wire is attached to right-hand term. of M/C solenoid connector, as viewed from harness end.
- Check evap. canister for liquid fuel and purge valve and bowl vent valve for leaks. Check for fuel in crankcase. If OK, service carburetor.

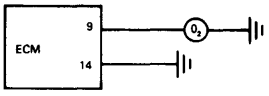
No dwell change.
- Disconnect oxygen sensor.
- Ground connector terminal on lead to ECM (not oxygen sensor).

Dwell drops to under 10°.
- Ign. "on", engine stopped.
- Remove ground from O_2 harness connector and check voltage from that term. to ground with digital voltmeter.

No dwell change. → Replace ECM.

Under .55V → It is faulty oxygen sensor.

Over .55V → Check wire from ECM term. 9 for short to Bat.+. If not shorted, it is faulty ECM.



TROUBLE CODE 45
EFI MODELS

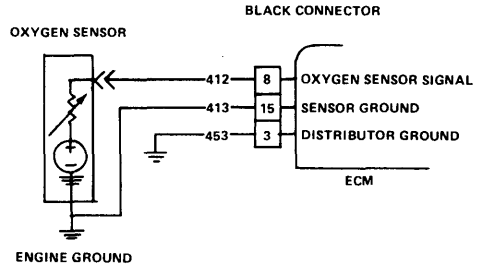
- Ignition "OFF."
- Diagnostic terminal grounded.
- Disconnect oxygen sensor and jumper harness connector signal CKT 412 to ground.
- Start engine and note "Check Engine" light.

"Check Engine" light went off for at least 15 seconds.

System rich, check:
- Fuel pressure 9-13 PSI.
- Injector(s) for leakage or sticking.
- HEI shield CKT 453 for open circuit.
- Check for leakage or restriction in MAP hose.
- Check CCP Chart

Steady Light. → Replace ECM.

Clear codes and confirm "Closed Loop" operation and no "Check Engine" light.
FIELD SERVICE MODE:
Open-Loop: "Check Engine" light flashes at a rate of 2 times per second.
Closed-Loop: "Check Engine" light flashes at a rate of 1 time per second.



TROUBLE CODE 45
FED. "T" CAR WITHOUT 5-SPEED

If M/C solenoid does not click with ignition on and "test" terminal grounded and there is no Code 23, check for sticking M/C solenoid.

- Connect dwell meter to M/C Solenoid — use 6 cylinder scale. Run at 3000 RPM in Park or Neutral and note dwell.

Under 50°. → Trouble is intermittent. System is OK at present.

Over 50°. → With engine idling, note dwell. Remove large vacuum hose (such as PCV source) to cause air leak (but not enough to stall engine).

Dwell decreased.
- Check that pink wire is attached to right-hand terminal of M/C solenoid connector, as viewed from harness end.
- Check evap. canister for being loaded with fuel and related valves such as purge and bowl vent for leaks which would cause richness, also fuel in crankcase. If OK, see carburetor calibration procedure, section 6C.

No dwell change.
- Disconnect oxygen sensor.
- Ground connector terminal on lead to ECM (not oxygen sensor).

Dwell drops to under 10°.
- Ignition "ON", engine stopped.
- Remove ground from O_2 harness connector and check voltage from that terminal to ground with digital voltmeter.

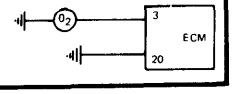
Under .55 volts. → It is faulty oxygen sensor.

Over .55 volts. → Check wire from ECM terminal "9" for short to battery +. If not shorted, it is faulty ECM.

No dwell change. → Ground terminal 3 at ECM and note dwell.

Dwell drops to under 10°. → Repair open or short in wire from oxygen sensor to ECM terminal "3".

No dwell change. → It is faulty ECM.



TROUBLE CODE 51
ALL MODELS

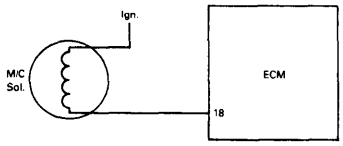
Check that all pins are fully inserted in the socket. If OK, replace PROM, clear memory, and recheck. If code 51 reappears, replace ECM.

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

TROUBLE CODE 54
ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED

Check M/C Solenoid Resistance

- Under 10 ohms
  - • Replace solenoid
    • Clear Memory
    • Start engine and check for trouble code
    - No Code → Make system perform. check.
    - Code → See applicable code chart.
- Over 10 ohms
  - • Ignition "on" engine stopped.
    • Connect test light from ground to dwell lead at M/C solenoid with sol. disconnected.
    • Disconnect numbered terminal connector at ECM.
    - No Light → Replace ECM
    - Light → Replace short to bat. + in blue wire to ECM term. 18. Clear memory and check for trouble codes.



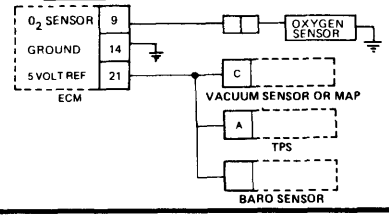
TROUBLE CODE 55
EFI MODELS
Replace Electronic Control Module (ECM)

Clear codes and confirm "Closed Loop" operation and no "Check Engine" light.

TROUBLE CODE 55
ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED

Check for corrosion at ECM edgeboard connectors and terminals. If present, check for coolant sensor, windshield or heater core leaks. Repair leak, clean connector terminals and replace ECM. Also check for 4 terminal EST harness being too close to electrical signals such as spark plug wires, generator, distributor housing, etc.

- • Disconnect test terminal.
  • Disconnect oxygen sensor and note "check engine" light with engine idling for less than one minute.
  - Light On
    - • Ignition "ON," engine stopped.
      • Check voltage from ECM Terminal "21" to "22."
      - Over 6 Volts
        - • Turn Ign. "OFF."
          • Disconnect numbered connector from ECM.
          • Ign. "ON," check voltage from connector Term. "21" to "22."
          - Voltage → Check for short in B+ wire to Term. "21."
          - 0 Volts → Replace ECM
      - Under 4 Volts → Check for ground in circuit to ECM Terminal "21" (includes) shorted or grounded TPS Vacuum or Vehicle Speed Sensors). If not grounded or shorted, replace ECM.
      - 4 to 6 Volts
        - • Disconnect O_2 sensor.
          • Ign. "ON," engine stopped.
          • Check voltage from connector of purple wire disconnected from oxygen sensor.
          - Over 1 Volt
            - • Turn "OFF" ign., disconnect numbered ECM connector and then turn ign. "ON."
              • Check voltage from ECM, harness connector Term. "9" to ground.
              - Over 1 Volt → Check for short from wire to ECM Term. "9" to Bat.
              - Under 1 Volt → Check for open circuit from Term. "14" to ground. If not open, replace ECM.
          - Under 1 Volt → Check for intermittent ground in circuit to ECM Terminal "21" (includes TPS, MAP, BARO, and Vacuum Sensors). Clear codes and check for reoccurrence of Code 55. If it reappears, it could be faulty oxygen sensor (except on 4.3L VIN Code 8 and 5.0 VIN Code Y).
  - Light Off



ENGINE CRANKS BUT WILL NOT RUN
FED. "T" CAR WITHOUT 5-SPEED

ENGINE CRANKS BUT WILL NOT RUN

IF A TACHOMETER IS CONNECTED TO THE TACHOMETER TERMINAL, DISCONNECT IT BEFORE PROCEEDING WITH THE TEST.

1. Check spark at plug with ST-125 while cranking (If no spark on one wire, check a second wire.)
   - Spark → Check fuel, spark plugs, etc.
   - No Spark → 2. Check for spark at coil wire with ST-125 while cranking. Leave ST-125 connected to coil wire for steps 3-7.

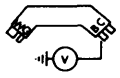


FIG. 1

2. Check for spark at coil wire with ST-125 while cranking. Leave ST-125 connected to coil wire for steps 3-7.
   - Spark → Inspect cap for water, cracks, etc. If ok, replace rotor.
   - No Spark → 3. Remove distributor cap with IGNITION ON. Check voltage at "B" terminal on distributor module. See Figure 1.

3. Remove distributor cap with IGNITION ON. Check voltage at "B" terminal on distributor module. See Figure 1.
   - 10 Volts or More → 4. With ignition on, check "C" terminal voltage on HEI module. See figure 2.
   - Under 10 Volts → Repair wire from "B" terminal on module to ignition coil "B" connection at ignition coil and primary circuit to ignition switch.

4. With ignition on, check "C" terminal voltage on HEI module. See figure 2.
   - Under 1 Volt → It is open or grounded lead from coil to distributor "C" terminal, connection or ignition coil or open primary circuitry in coil.
   - 10 Volts or More → 5. Remove pick-up coil connector from module. Check "C" terminal voltage with "IGNITION" "ON". Watch voltmeter as test light is momentarily connected from battery "+" to module terminal "G", not more than 5 seconds. See figure 3.
   - Under 10 volts → Repair wire from "B" term. on module to ign. coil "B" connection at ign. coil and primary circuit to ign. switch.

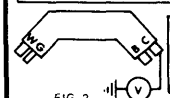


FIG. 2

5. Remove pick-up coil connector from module. Check "C" terminal voltage with "IGNITION" "ON". Watch voltmeter as test light is momentarily connected from battery "+" to module terminal "G", not more than 5 seconds. See figure 3.
   - No Drop in Voltage → Check module ground. If OK, replace module.
   - Voltage Drops → 6. Check for spark from coil wire with ST-125 as test light is removed from module terminal.

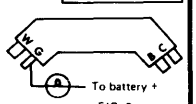


FIG. 3

6. Check for spark from coil wire with ST-125 as test light is removed from module terminal.
   - No Spark
     - If module tester is available, test module.
       - OK → Check coil wire from cap to coil. If OK, replace coil.
       - Bad → Replace Module
     - If no module tester is available → 7. Replace HEI module and repeat Step 6.
       - Spark → System OK
       - No Spark → Module removed is ok, reinstall module. Check coil wire from cap to coil. If OK, replace coil.
   - Spark → It is pick-up coil or connections. Coil resistance should be 500-1500 ohms and not grounded.

5. Remove pick-up coil connector from module. Check "C" terminal voltage with "IGNITION" "ON". Watch voltmeter as test light is momentarily connected from battery "+" to module terminal "G", not more than 5 seconds. See figure 3.
   - Spark → System OK
   - No Spark → Replace ignition coil, it too is faulty.

ENGINE CRANKS BUT WILL NOT RUN
ALL EXC. FED. "T" CAR WITHOUT 5-SPEED
(WITH REMOTE COIL)

NOTE: PERFORM DIAGNOSTIC CIRCUIT CHECK BEFORE PROCEEDING WITH THIS TEST.

NOTE: IF A TACHOMETER IS CONNECTED TO THE TACHOMETER TERMINAL, DISCONNECT IT BEFORE PROCEEDING WITH THE TEST.

1. CHECK SPARK AT PLUG WITH ST-125 WHILE CRANKING (IF NO SPARK ON ONE WIRE, CHECK A SECOND WIRE.)
   - SPARK → CHECK FUEL, SPARK PLUGS ETC.
   - NO SPARK → 2. CHECK FOR SPARK AT COIL WIRE WITH ST-125 WHILE CRANKING. LEAVE ST-125 CONNECTED TO COIL WIRE FOR STEPS 3-7.

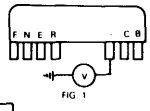


FIG. 1

2. CHECK FOR SPARK AT COIL WIRE WITH ST-125 WHILE CRANKING. LEAVE ST-125 CONNECTED TO COIL WIRE FOR STEPS 3-7.
   - SPARK
     - • INSPECT CAP FOR WATER, CRACKS, ETC. IF OK, REPLACE ROTOR
     - 10 VOLTS OR MORE → 4. WITH IGN. ON, CHECK "C" TERM. VOLTAGE ON HEI MODULE. SEE FIGURE 2
       - UNDER 1 VOLT → IT IS OPEN OR GROUNDED LEAD FROM COIL TO DIS. "C" TERM., CONNECTION OR IGN. COIL OR OPEN PRIMARY CIRCUIT IN COIL
       - 10 VOLTS OR MORE → 5. REMOVE PICK-UP COIL CONNECTOR FROM MODULE. CHECK "C" TERM. VOLTAGE WITH "IGN" "ON" WATCH VOLTMETER AS TEST LIGHT IS MOMENTARILY CONNECTED FROM BAT. TO MODULE TERM. "P", NOT MORE THAN 5 SEC. SEE FIGURE 3
         - NO DROP IN VOLTAGE → CHECK MODULE GROUND. IF OK, REPLACE MODULE
         - VOLTAGE DROPS → 6. CHECK FOR SPARK FROM COIL WIRE WITH ST-125 AS TEST LIGHT IS REMOVED FROM MODULE TERM.
           - NO SPARK
             - IF MODULE TESTER IS AVAILABLE, TEST MOD
               - OK → CHECK COIL WIRE FROM CAP TO COIL. IF OK, REPLACE COIL
               - BAD → REPLACE MOD
             - IF NO MODULE TESTER IS AVAILABLE → 7. REPLACE HEI MODULE AND REPEAT STEP 6
               - SPARK → SYSTEM OK
               - NO SPARK → MODULE REMOVED IS OK, REINSTALL MODULE. CHECK COIL WIRE FROM CAP TO COIL. IF OK, REPLACE COIL
           - SPARK → IT IS PICK-UP COIL OR CONNECTIONS. COIL RESISTANCE SHOULD BE 500-1500 OHMS AND NOT GROUNDED
     - 1 TO 10 VOLTS → REPLACE MODULE AND CHECK FOR SPARK FROM COIL AS IN STEP 6
       - SPARK → SYSTEM OK
       - NO SPARK → REPLACE IGN. COIL. IT TOO IS FAULTY

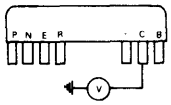


FIG. 2

5. REMOVE PICK-UP COIL CONNECTOR FROM MODULE. CHECK "C" TERM. VOLTAGE WITH "IGN" "ON" WATCH VOLTMETER AS TEST LIGHT IS MOMENTARILY CONNECTED FROM BAT. TO MODULE TERM. "P", NOT MORE THAN 5 SEC. SEE FIGURE 3.

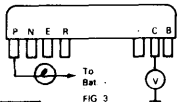
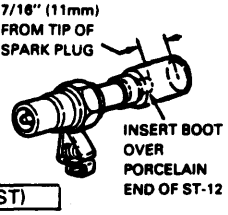


FIG. 3

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

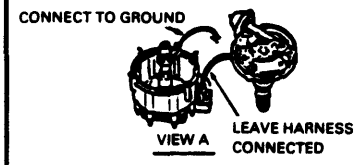
ENGINE CRANKS BUT WILL NOT RUN
ALL EXC. FED. "T" CAR WITHOUT 5-SPEED
(WITH INTEGRAL COIL)



NOTE: PERFORM DIAGNOSTIC CIRCUIT CHECK BEFORE USING THIS PROCEDURE.

1. CHECK SPARK AT PLUG WITH ST-125 WHILE CRANKING (IF NO SPARK ON ONE WIRE, CHECK A SECOND WIRE).*

- SPARK → CHECK FUEL, SPARK PLUGS, ETC.
- NO SPARK (WITHOUT EST) → 2. CHECK VOLTAGE AT DISTRIBUTOR "BAT" TERMINAL WHILE CRANKING
- NO SPARK (WITH EST) → DISCONNECT 4 TERM. EST CONNECTOR AND RECHECK FOR SPARK.
  - NO SPARK → 2. CHECK VOLTAGE AT DISTRIBUTOR "BAT" TERMINAL WHILE CRANKING
  - SPARK → SEE EST DIAGNOSIS



2. CHECK VOLTAGE AT DISTRIBUTOR "BAT" TERMINAL WHILE CRANKING

- 7 VOLTS OR MORE → 3. WITH IGNITION "ON" CHECK "TACH" TERMINAL VOLTAGE.
- UNDER 7 VOLTS → REPAIR PRIMARY CIRCUIT TO IGNITION SWITCH.

3. WITH IGNITION "ON" CHECK "TACH" TERMINAL VOLTAGE.

- UNDER 1 VOLT → It is faulty ign. coil connection or coil.
- 10 VOLTS OR MORE → 4. CHECK FOR SPARK AT COIL OUTPUT TERMINAL WITH ST-125 WHILE CRANKING (VIEW A).
- 1 TO 10 VOLTS → REPLACE MODULE AND CHECK FOR SPARK FROM COIL AS IN STEP 6.

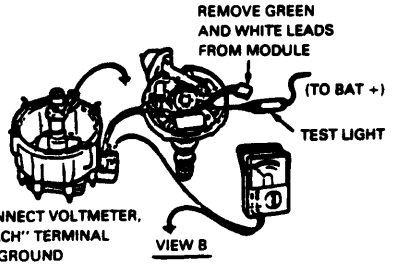
4. CHECK FOR SPARK AT COIL OUTPUT TERMINAL WITH ST-125 WHILE CRANKING (VIEW A).

- SPARK → • CHECK COLOR MATCH OF PICK-UP COIL CONNECTOR AND IGN. COIL LEAD. *** • INSPECT CAP FOR WATER, CRACKS, ETC. IF OK, REPLACE ROTOR.
- NO SPARK → 5. REMOVE PICK-UP COIL LEADS FROM MODULE. CHECK TACH. TERM. VOLTAGE WITH "IGN" "ON". WATCH VOLTMETER AS TEST LIGHT IS MOMENTARILY CONNECTED FROM BAT. + TO MODULE TERM:
  - 4 TERM. MOD. — TERM G
  - 5 TERM. MOD. ESC — TERM. D
  - 7 TERM. MOD. — TERM P

  (VIEW B) NOT MORE THAN 5 SECONDS.

REPLACE MODULE AND CHECK FOR SPARK FROM COIL AS IN STEP 6.

- SPARK → SYSTEM OK
- NO SPARK → REPLACE IGN. COIL. IT TOO IS FAULTY.



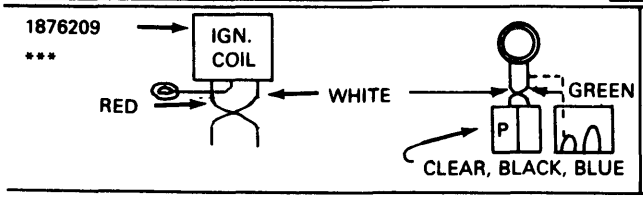
5. REMOVE PICK-UP COIL LEADS FROM MODULE. CHECK TACH. TERM. VOLTAGE WITH "IGN" "ON". WATCH VOLTMETER AS TEST LIGHT IS MOMENTARILY CONNECTED FROM BAT. + TO MODULE TERM:
4 TERM. MOD. — TERM G
5 TERM. MOD. ESC — TERM. D
7 TERM. MOD. — TERM P
(VIEW B) NOT MORE THAN 5 SECONDS.

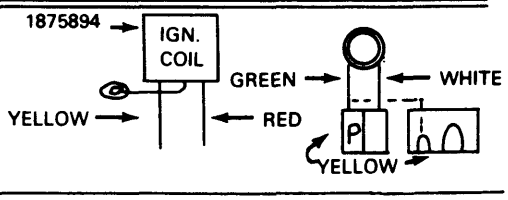
- NO DROP IN VOLTAGE → CHECK MODULE GRND. AND FOR OPEN IN WIRES FROM CAP ** TO DISTRIBUTOR. IF OK, REPLACE MOD.
- VOLTAGE DROPS → 6. CHECK FOR SPARK FROM COIL WITH ST-125 AS TEST LIGHT IS REMOVED FROM MODULE TERMINAL.

6. CHECK FOR SPARK FROM COIL WITH ST-125 AS TEST LIGHT IS REMOVED FROM MODULE TERMINAL.

- NO SPARK → IF MODULE TESTER IS AVAILABLE, TEST MOD.
  - OK → CHECK IGN. COIL GROUND. IF OK, REPLACE IGN COIL.
  - BAD → REPLACE MOD.

  IF NO MODULE TESTER IS AVAILABLE → 7. CHECK IGN. COIL GROUND CIRCUIT. IF OK, REPLACE IGN. COIL AND REPEAT STEP 6.
  - SPARK → SYSTEM OK
  - NO SPARK → COIL REMOVED IS OK, REINSTALL ORIGINAL COIL AND REPLACE MODULE.
- SPARK → IT IS PICK-UP COIL OR CONNECTIONS. COIL RESISTANCE SHOULD BE 500-1500 OHMS AND NOT GROUNDED.

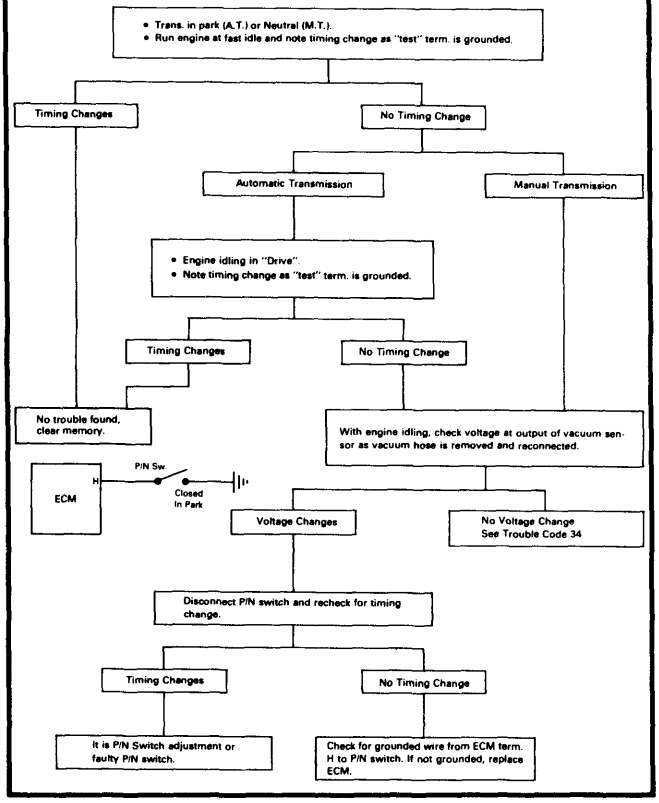




* SOME EST PROBLEMS WILL RESULT IN ONE OR TWO SPARKS WHEN CRANKING IS STARTED, THEN SPARK WILL STOP.

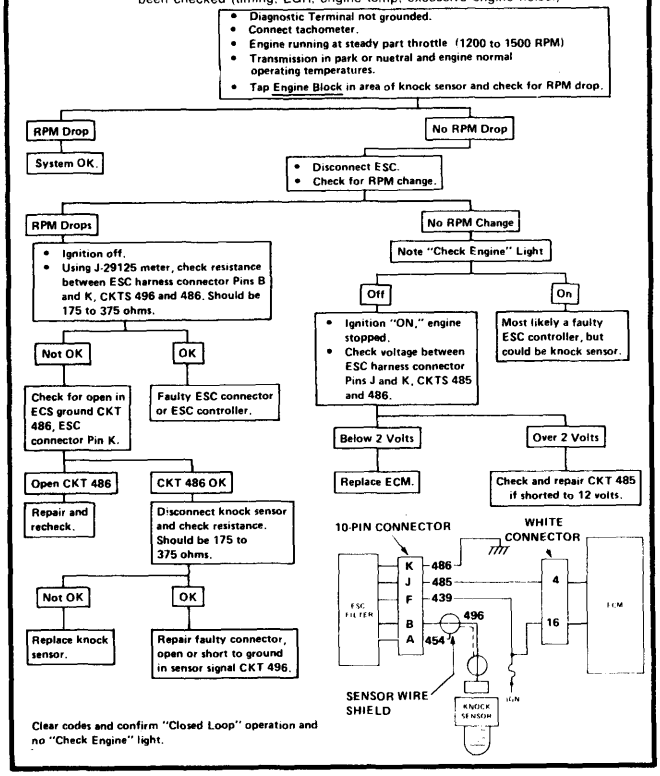
GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

EST PERFORMANCE CHECK ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED



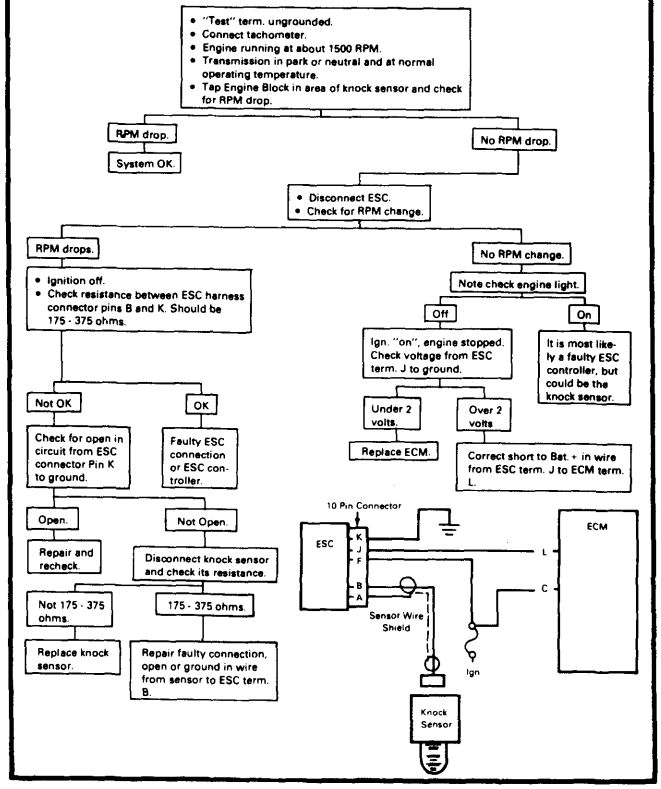
ESC PERFORMANCE CHECK – NO CODE 43 EFI MODELS (5.0L & 5.7L)

Use this chart only after all other causes of spark knock have been checked (timing, EGR, engine temp, excessive engine noise.)

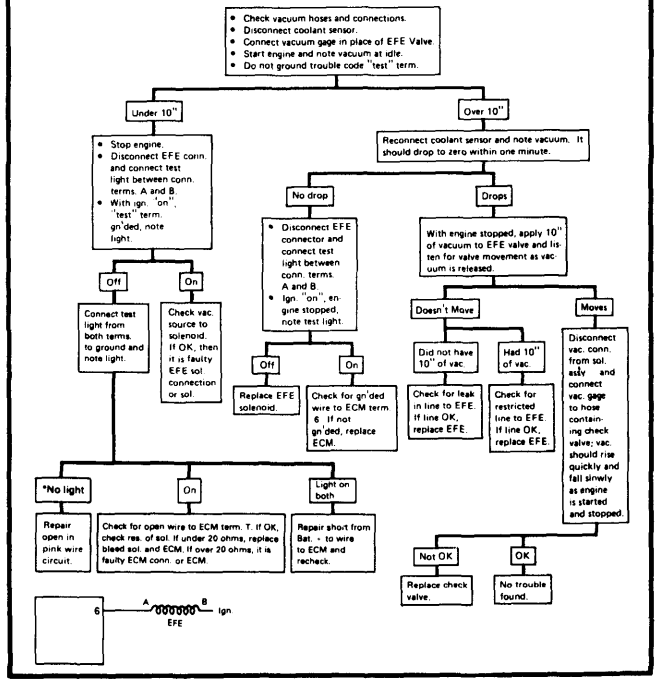


ESC PERFORMANCE CHECK – NO CODE 43 ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED

Use this chart only after all other causes of spark knock have been checked (timing, EGR, engine temp, excessive engine noise.)

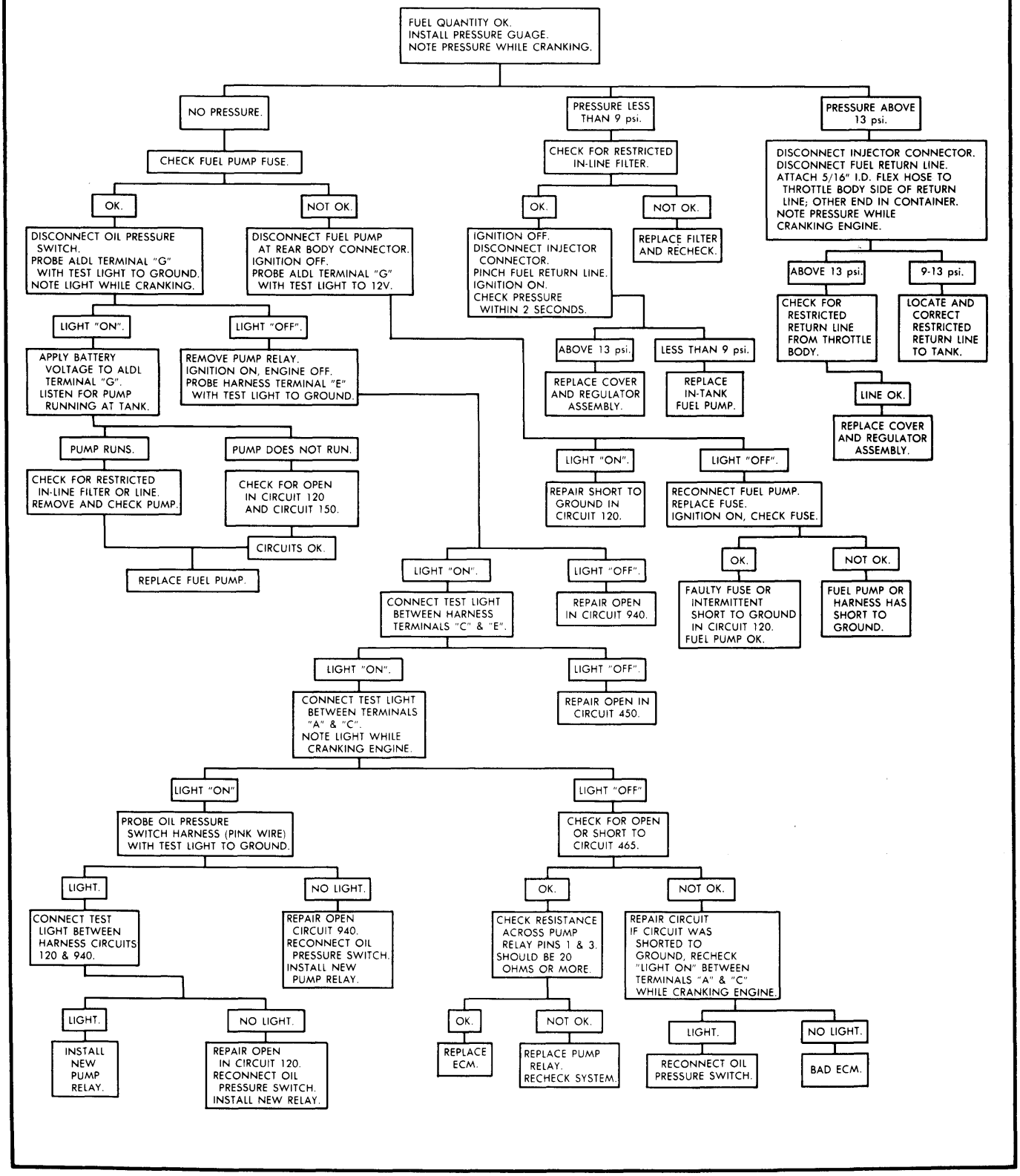


EFE OPERATIONAL CHECK VACUUM SERVO TYPE



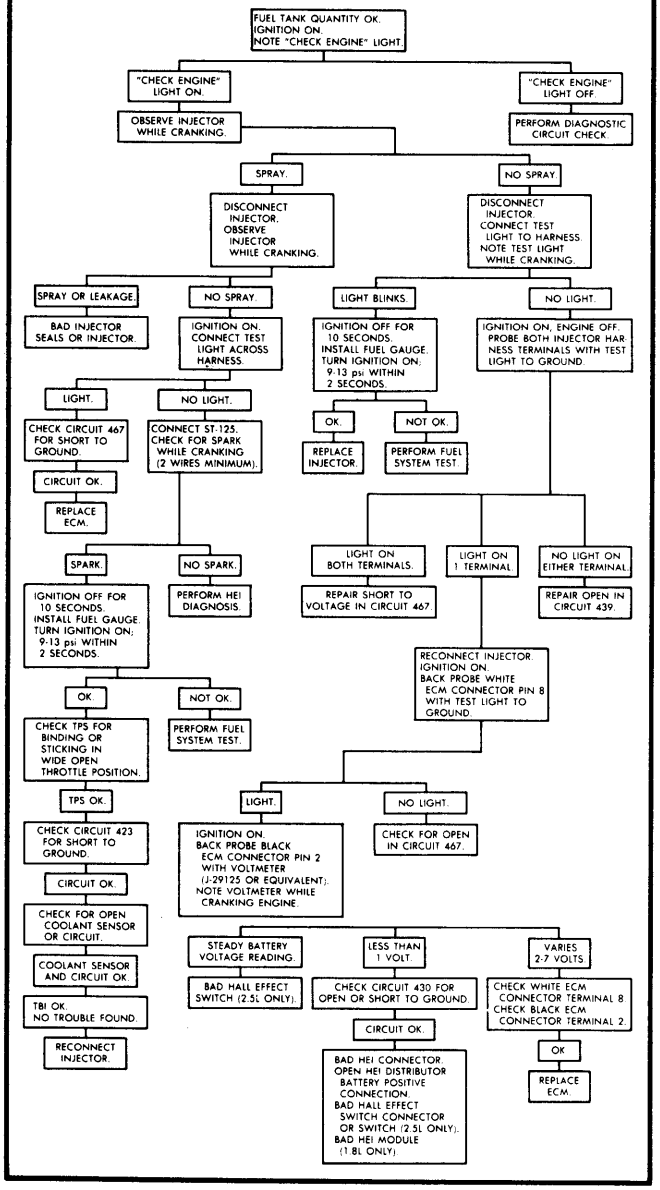
GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

FUEL SYSTEM CHECK
1.8L & 2.5L EFI MODELS

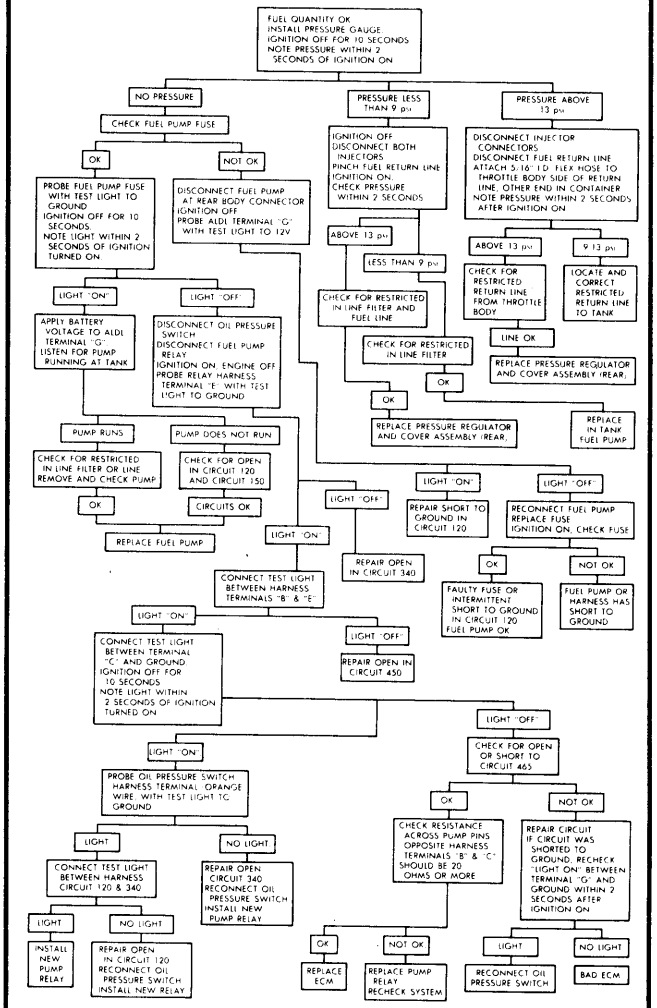


GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

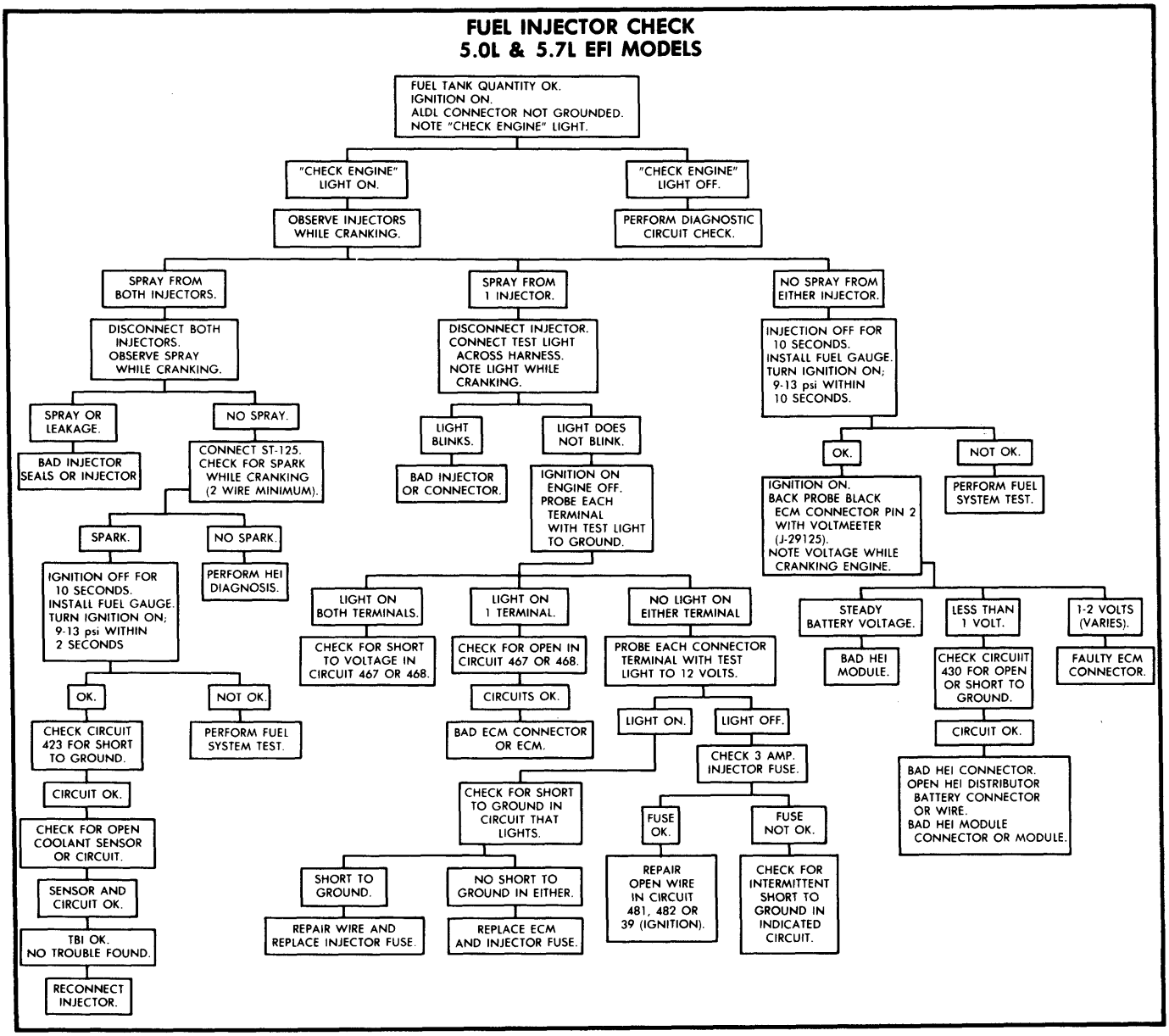
FUEL INJECTOR CHECK
1.8L & 2.5L EFI MODELS



FUEL SYSTEM CHECK
5.0L & 5.7L EFI MODELS



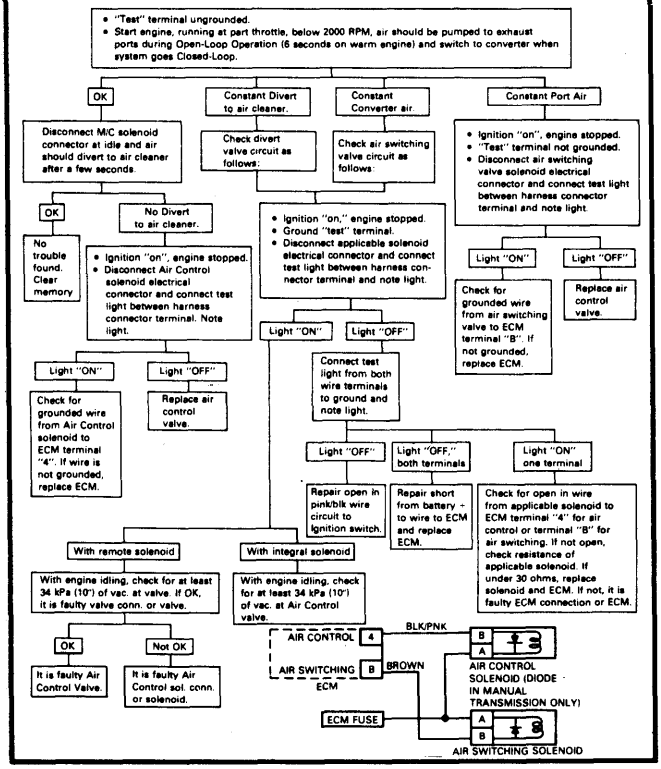
GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)



GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

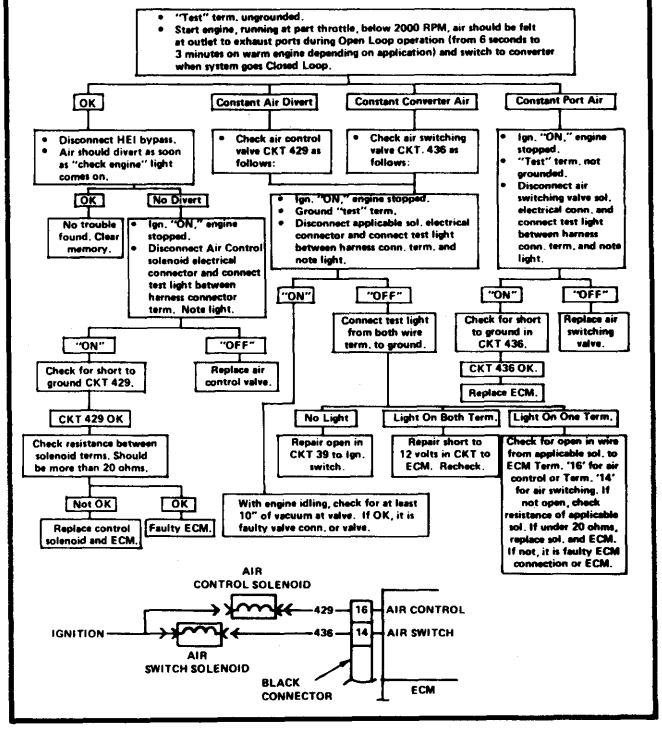
AIR MANAGEMENT CHECK MODELS WITH ELECTRIC DIVERT & ELECTRIC SWITCHING (ED/ES) ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED

Check vacuum hoses for condition and connection. Repair as required.
On some applications, some air may divert to air cleaner above 2000 RPM.

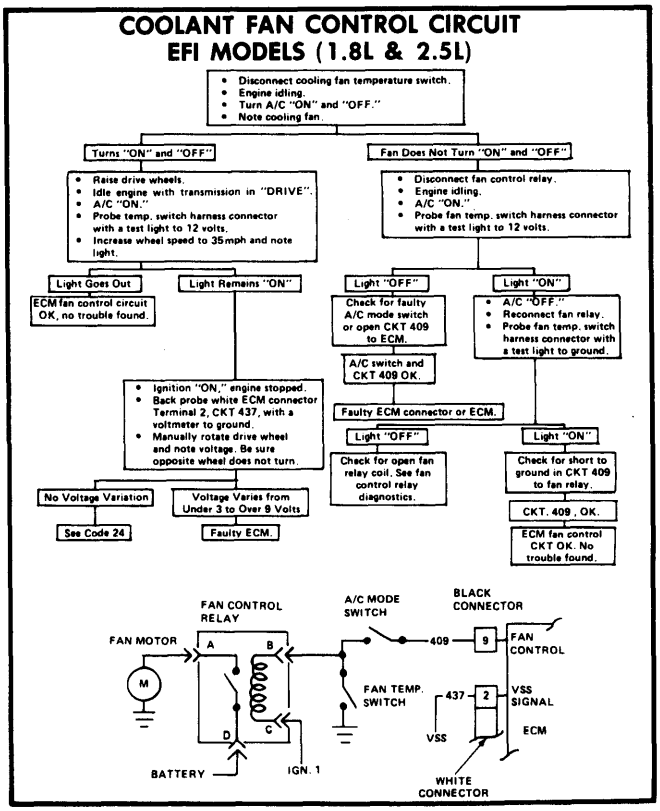


AIR MANAGEMENT CHECK MODELS WITH ELECTRIC DIVERT & ELECTRIC SWITCHING (ED/ES) EFI MODELS (5.0L & 5.7L)

Check vacuum hoses for condition and connection. Repair as required.
On some applications, some air may divert to air cleaner above 2000 RPM.



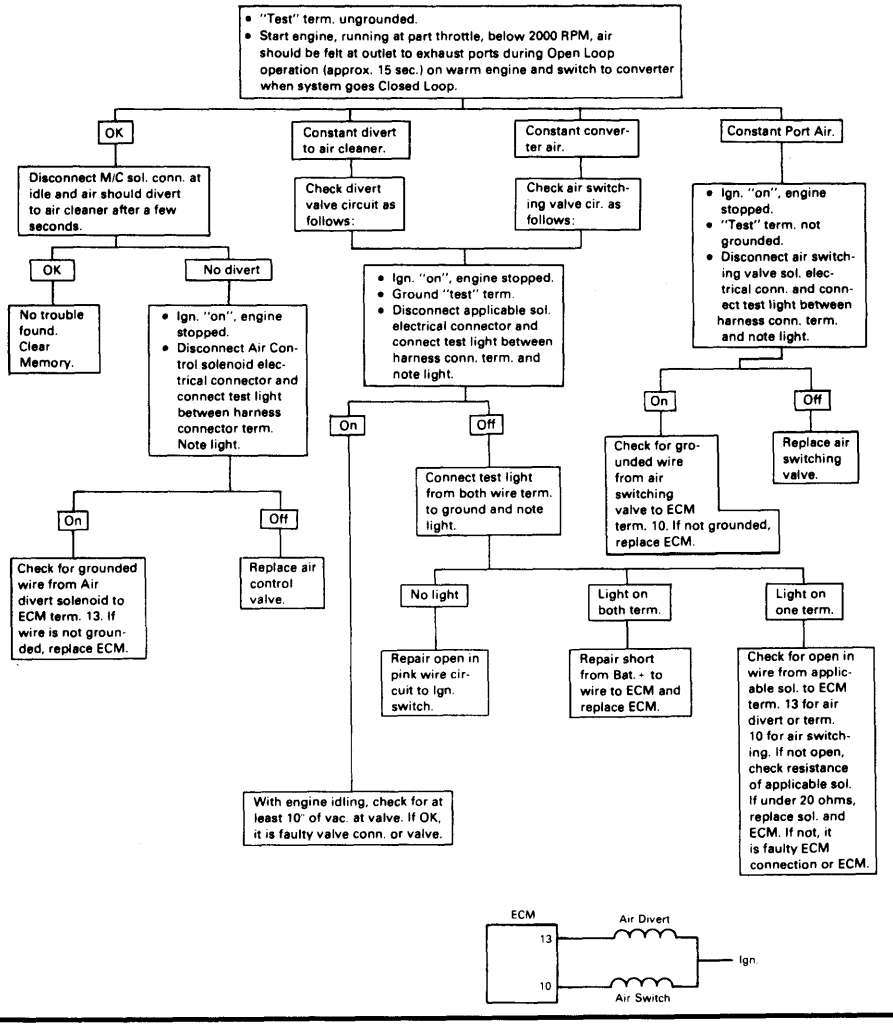
COOLANT FAN CONTROL CIRCUIT EFI MODELS (1.8L & 2.5L)



GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

AIR MANAGEMENT CHECK
MODELS WITH ELECTRIC DIVERT & ELECTRIC SWITCHING (ED/ES)
FED. "T" CAR WITHOUT 5-SPEED

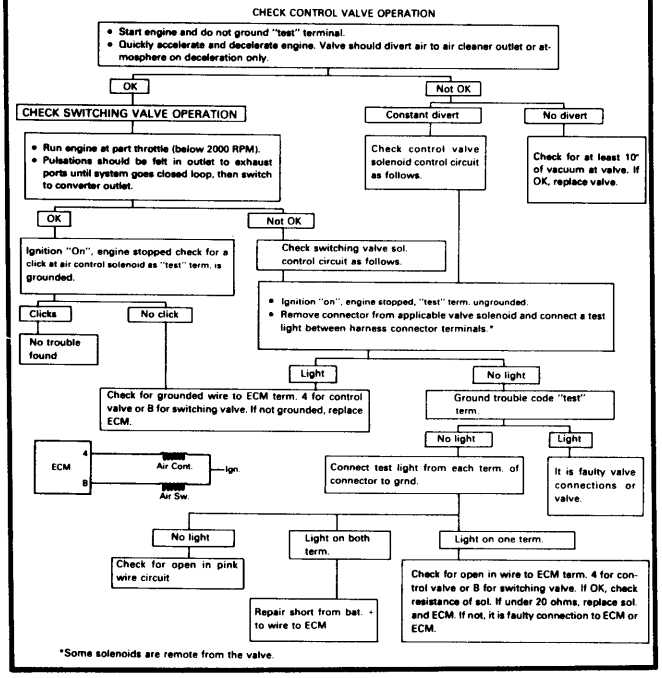
Check vacuum hoses for condition and connection. Repair as required.
On some applications, some air may divert to air cleaner above 2000 RPM.



GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

AIR MANAGEMENT CHECK
MODELS WITH DUAL BED CONVERTER & ELECTRIC AIR CONTROL VALVE (EAC/ES)
ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED

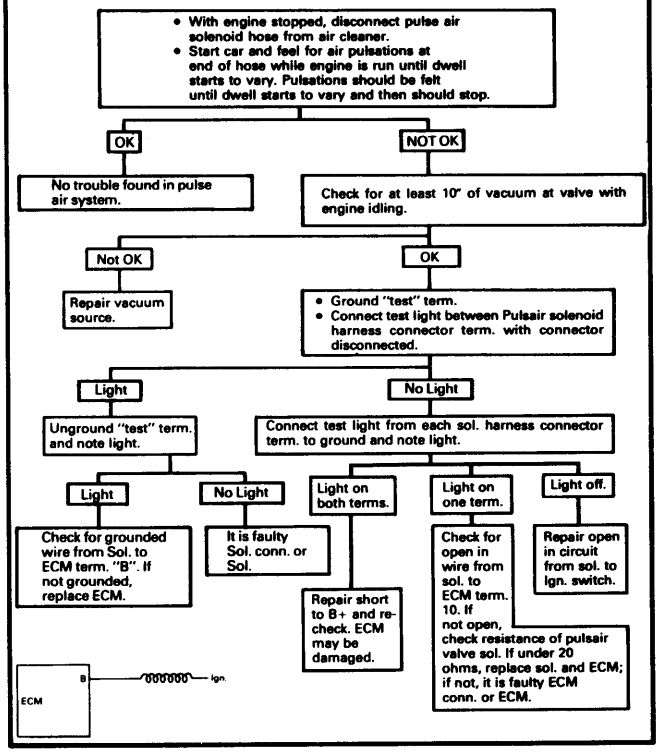
Check vacuum hoses for condition and connection. Repair as required. On some applications, some air may divert to air cleaner above 2000 RPM.



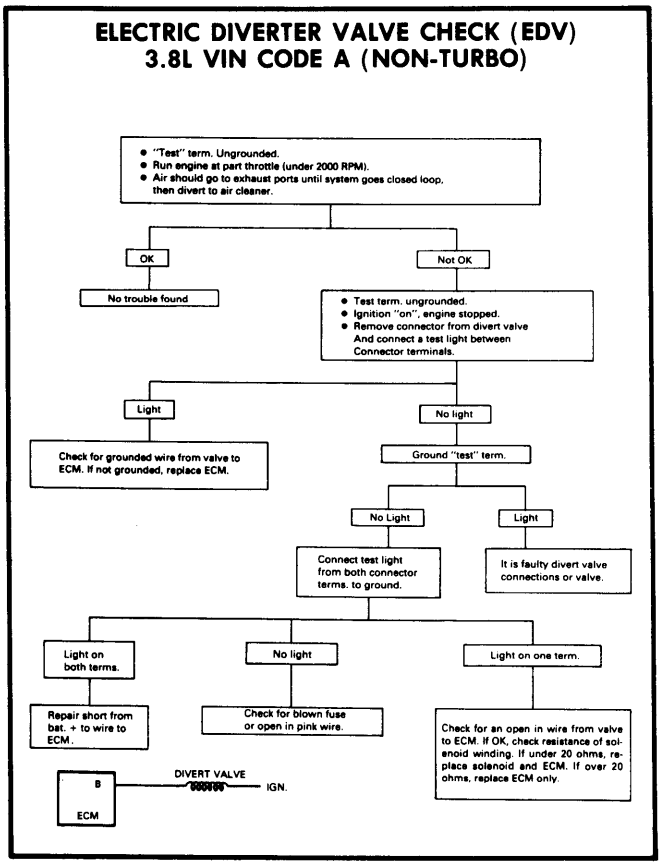
*Some solenoids are remote from the valve.

PULSAIR SOLENOID CHECK
ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED

Make physical check of Pulsair hoses and connections. On Chevette, pipe should be removed from PCV air inlet rocker cover and that end of pipe plugged to prevent pulses from rocker cover causing a false reading.

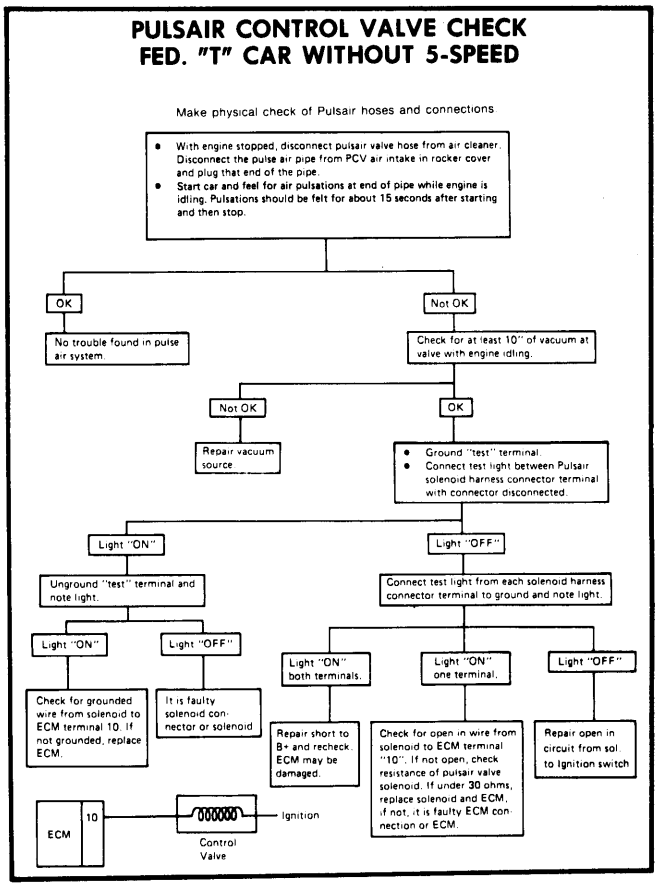


ELECTRIC DIVERTER VALVE CHECK (EDV)
3.8L VIN CODE A (NON-TURBO)



PULSAIR CONTROL VALVE CHECK
FED. "T" CAR WITHOUT 5-SPEED

Make physical check of Pulsair hoses and connections.



GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

EGR CHECK
ALL EXC. EFI, FED. "T" CAR WITHOUT 5-SPEED, 3.0L VIN E, 3.8L VIN 3 (TURBO), 5.0L VIN H & 2.8L ("A", "X" AND "F" MODELS)

Make physical check of hoses and electrical connections.

- Start warm engine with Coolant Sensor disconnected.
- Ground "Test" term.
- Push up on underside of EGR to open it and note RPM change as valve opens

No Change
- Clean EGR passages or replace valve as needed.

RPM Drops
- Check for movement of EGR diaphram as engine RPM is changed from approximately 2000 RPM to idle.

Moves
- With engine idling, connect test light between EGR solenoid connector terminals with connector diconnected.

Lights
- Faulty EGR solenoid connections or solenoid.

No Light
- Connect test light from each term. of connector to grnd.

No light
- Check for blown fuse or open pink wire.

Light on both terms.
- Repair short from Bat. + to wire to ECM.

Light on one term.
- Check for open wire to ECM term. "T". If OK, check res. of sol. If under 20 ohms, replace sol. and ECM. If not, it is faulty ECM connection or ECM.

Doesn't Move
- Repeat above check with coolant sensor connected.

Doesn't Move
- Check vacuum at EGR valve at approx. 2000 engine RPM.

Over 6"
- Replace EGR valve.

Not OK-Repair
- Disconnect ground from test term.
- Ign. "on" engine stopped.
- Remove connector from sol.
- Connect test light between conn. terminals.

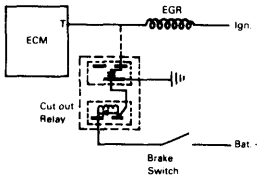
Light
- Check for grounded wire to ECM term. "T". On 3.8/ V-6 VIN Code A, disconnect EGR cut-out relay and note the test light. If it goes out, check cut-out relay circuit.

No light
- Replace EGR solenoid.

Moves
- No trouble found.

Under 6"
- Check vacuum circuit for restrictions, leaks, and connections.

OK
- Disconnect ground from test term.
- Ign. "on" engine stopped.
- Remove connector from sol.
- Connect test light between conn. terminals.



EGR CHECK
3.0L VIN E

Make physical inspection of hoses and electrical connections.

- Start engine; do not ground "test" term.
- With engine idling, RPM should drop as EGR valve is opened by pushing up on underside of EGR diaphragm.

No Change
- Clean EGR passages or replace valve as needed.

RPM Drops
- Within 35 seconds after start-up (system will be in open loop), check for movement of EGR diaphragm as RPM is changed from about 3000 RPM to idle.
- Repeat check after system goes closed loop (35 seconds).

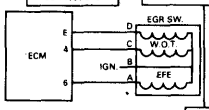
No Movement
- Connect vac. gage in place of EGR valve and check vac. at 3000 RPM.

Over 3"
- Replace EGR valve.

Under 3"
- Check vac. at engine side of WOT sol. at 3000 RPM.

Under 3"
- Repair hose or connections.

Over 3"
- Check WOT sol. elec. circuit as follows:



Moves in Closed Loop Only
- Check hoses to vac. regulator. If OK, replace regulator.

Moves in both Open and Closed Loop
- Connect vac. gage in place of EGR valve.
- Stop and start engine.
- With engine at 3000 RPM, note vac. should be under 3" in open loop and over 3" in closed loop.

Over 3" in both Cases
- Check vac. at sol. side of vac. reg. at 3000 RPM.

Over 3"
- Replace vac. regulator.

Under 3"
- Check sw. sol. elec. circuit as follows:

Under 3" in both Cases
- Check sw. sol. elec. circuit as follows:

Over 3"
- Check WOT sol. elec. circuit as follows:

Under 3"
- No trouble found.

OK
- Fully depress TPS at 3000 RPM and note vac.

Over 3"
- Replace vac. regulator.

Under 3"
- Check sw. sol. elec. circuit as follows:

- Ignition "ON", engine stopped.
- Disconnect sol. and connect test light across harness connector terminals and note light.

"ON"
- Check for grounded wire from sol. to ECM. If not grounded, replace ECM.

"OFF"
- Ground "test" terminal and note light.

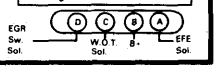
"OFF"
- Connect test light from each harness connector terminal to ground and note light.

"ON"
- It is faulty sol. connector or sol.

Light on One Terminal
- Check for open in wire from sol. to ECM. If not open, check resistance of sol. If under 20 ohms, replace sol. and ECM. If sol. OK, replace ECM.

Light on both Terminals
- Repair short between bat. + and wire from sol. to ECM and recheck. ECM may be damaged.

No Light
- Repair open circuit between sol. and ignition sw.



EGR CHECK
EFI MODELS (5.0L & 5.7L)

Make physical inspection of hoses and electrical connections:

- Install tachometer.
- Engine at normal operating temperature.
- Start engine; do not ground "test" term.
- With engine idling, RPM should drop as EGR valve is opened by pushing up on underside of EGR diaphragm.

No Change
- Clean EGR passages or replace valve as needed.

RPM Drops
- Check for movement of EGR diaphragm as RPM is increased to 1200 RPM and returned to idle.

No Movement
- Connect vac. gage in place of EGR valve and check vac. at 1200 RPM.

Over 3"
- Replace EGR valve.

Under 3"
- Check vac. at engine side of EGR sol. 1200 RPM.

Under 3"
- Repair hose or connections.

Over 3"
- Check EGR sol. elec. circuit as follows:
- Ignition "ON," engine stopped.
- Disconnect sol. and connect test light across harness connector terminals and note light.

"ON"
- Check for grounded wire from sol. to ECM. If not grounded, replace ECM.

"OFF"
- Ground diagnostic terminal and note light.

"OFF"
- Connect test light from each harness connector terminal to ground and note light.

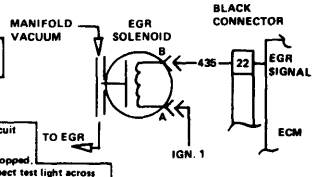
"ON"
- Faulty EGR sol. connector or solenoid.

Light On One Terminal
- Check for open in wire from sol. to ECM. If not open, check resistance of sol. If under 20 ohms, replace sol. and ECM. If solenoid OK, replace ECM.

Light On Both Terminals
- Repair short between bat. + and wire from sol. to ECM and recheck. ECM may be damaged.

No Light
- Repair open circuit between sol. and ignition switch.

Movement
- System OK. No trouble found.



CANISTER PURGE VALVE CHECK
ALL EXC. EFI, 3.8L VIN CODE A & FED. "T" CAR WITHOUT 5-SPEED

Check purge hose condition and connection. Repair as required.

- Ignition "on" engine stopped.
- Ground "test" lead.
- Apply vacuum to carb. side of purge solenoid (at solenoid). Should be able to get at least 10" on all but 3.8/ turbo V-6 in "G" Series, it has a built in leak. Should be able to get 2" at least momentarily on it.

Not OK
- Remove connector from solenoid and connect test light between harness connector terminals.

Light
- Faulty solenoid connections or solenoid.

No Light
- Connect test light from each term. of connector to grnd.

No Light
- Check for open wire to fuse.

Light on both terms.
- Repair short from Bat. + to wire to ECM.

Light on one term.
- Check for open wire to ECM terminal E. If OK, check resistance of sol. If under 20 ohms, replace sol. and ECM. If not, it is faulty ECM connections or ECM.

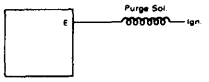
OK
- Unground "test" term. and note vacuum.

No Drop
- Disconnect solenoid.

Drops
- No trouble found.

Drops
- Check for grounded wire to ECM term. E. If not grounded, replace ECM.

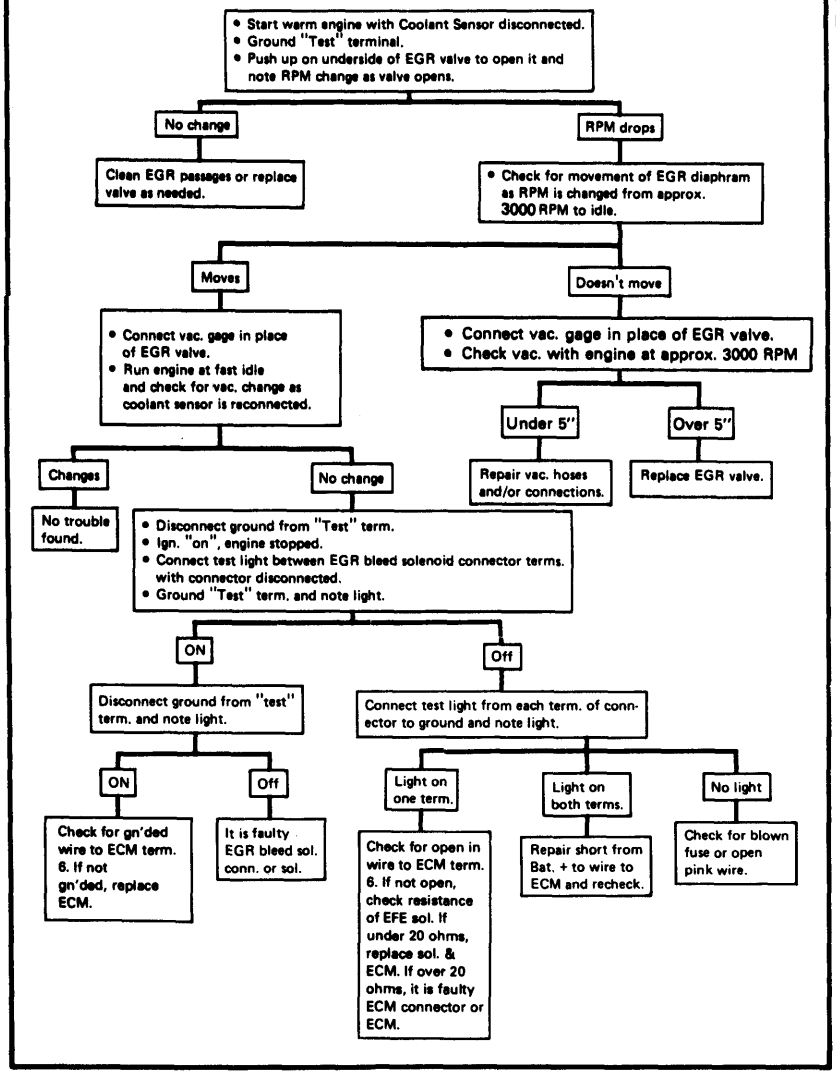
No Drop
- Replace solenoid.



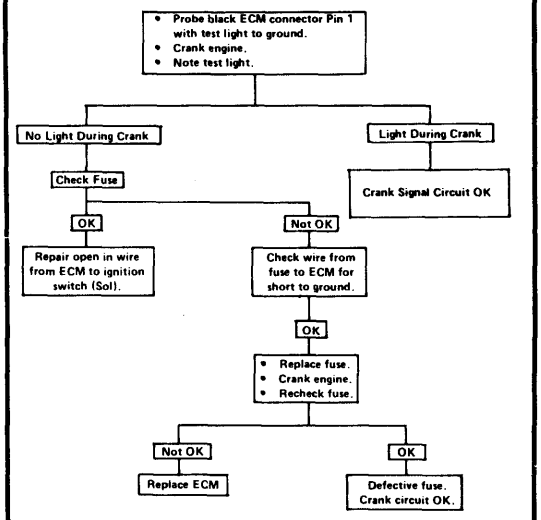
GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

EGR BLEED CHECK
3.8L VIN 3 (TURBO), 5.0L VIN H & 2.8L ("A", "X" AND "F" MODELS)

See TCC/EGR Bleed Check for 2.8L ("A", "X" and "F" models with Auto. Trans.) and 5.0L VIN H.

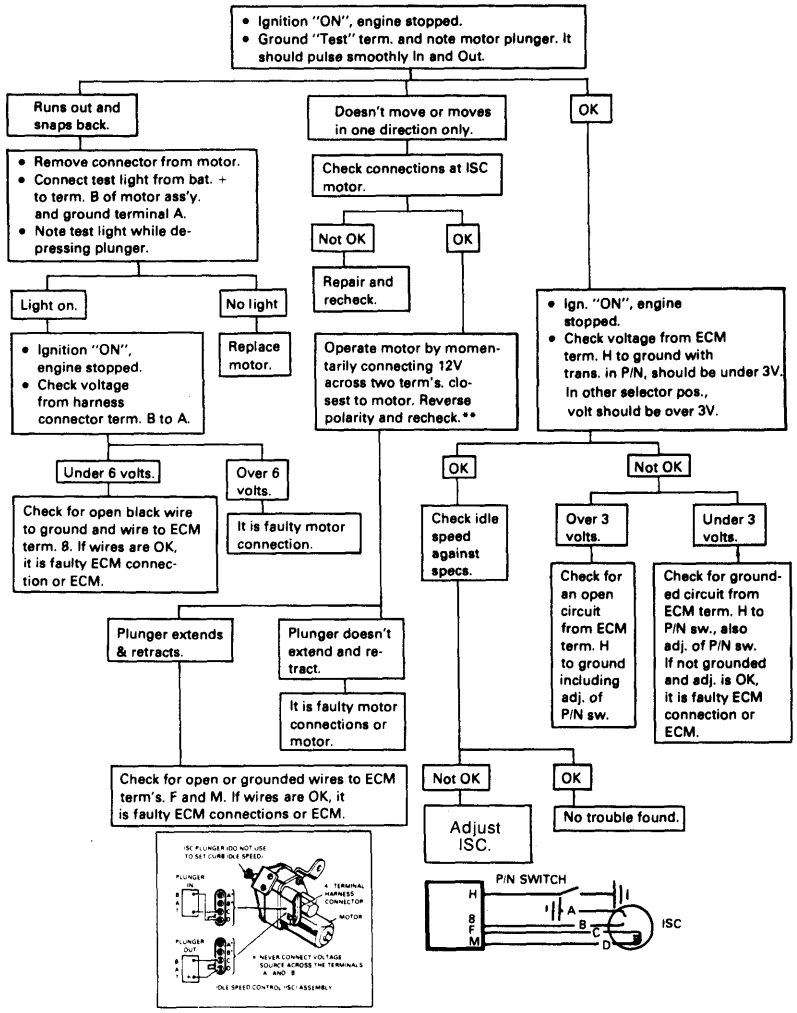


CRANK SIGNAL
EFI MODELS



GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

IDLE SPEED CONTROL (ISC) CHECK* ALL EXC. EFI, 1.8L VIN G & FED. "T" CAR WITHOUT 5-SPEED

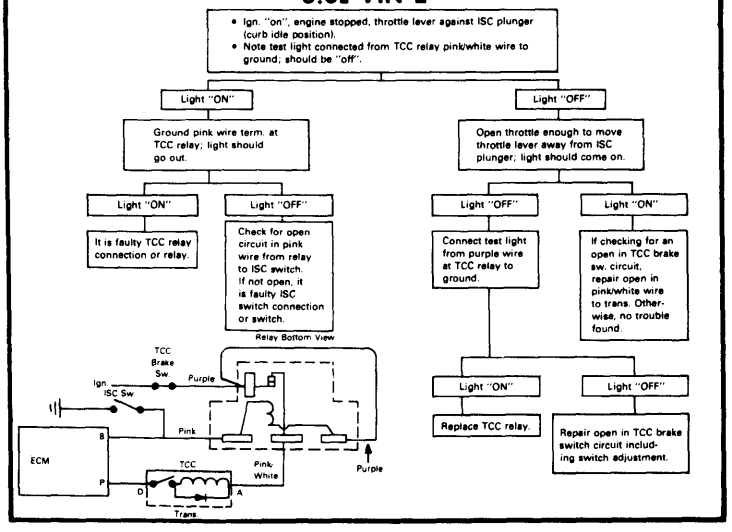


**DO NOT LEAVE BATTERY VOLTAGE APPLIED LONGER THAN NECESSARY TO RETRACT PLUNGER (NOT OVER 10 SECONDS). USE ADAPTER MADE WITH ISC CONNECTOR #12015387.

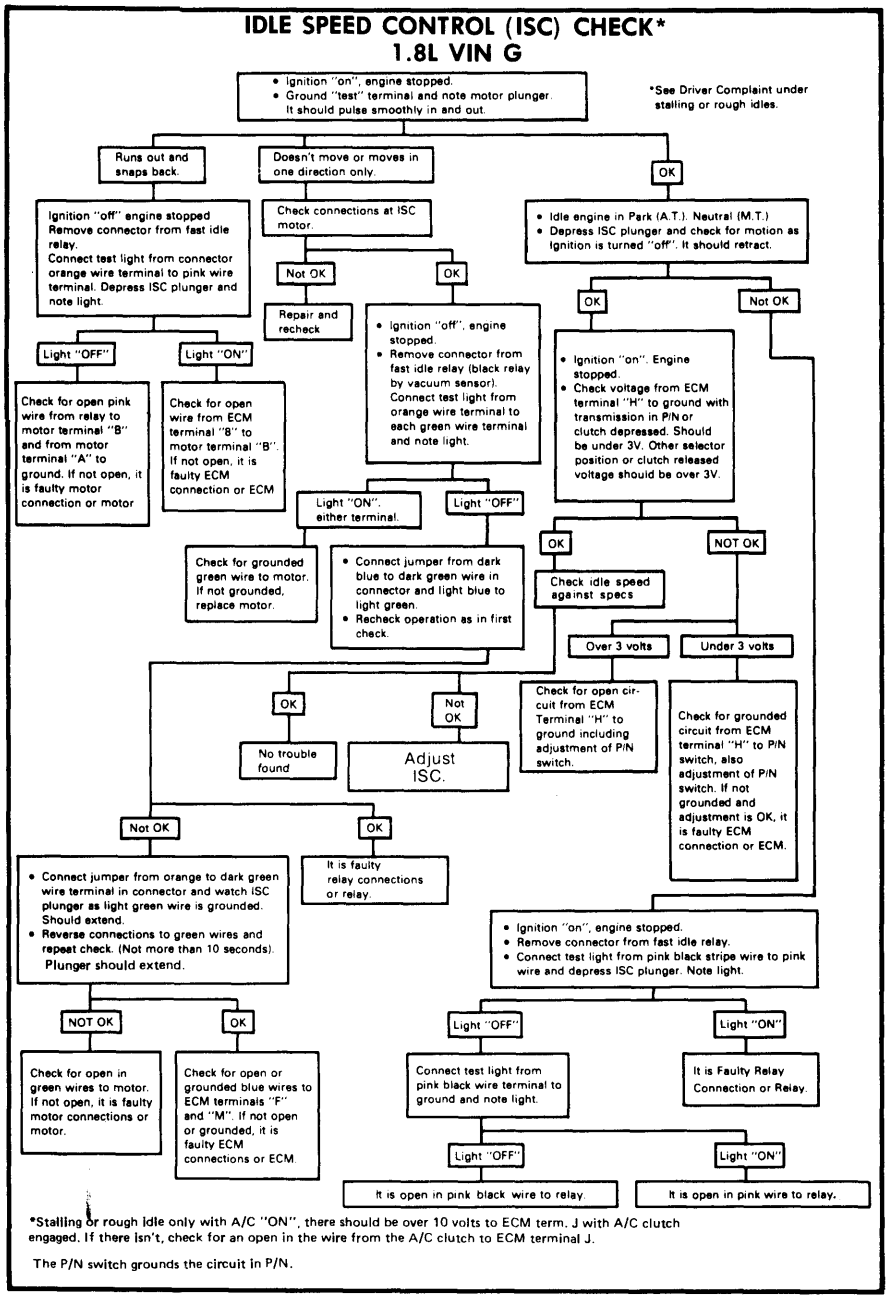
*STALLING OR ROUGH IDLE ONLY WITH A/C "ON", THERE SHOULD BE OVER 10 VOLTS TO ECM TERM. J WITH A/C CLUTCH ENGAGED. IF THERE ISN'T, CHECK FOR AN OPEN IN THE WIRE FROM THE A/C CLUTCH TO ECM TERMINAL J.

THE P/N SWITCH GROUND THE CIRCUIT IN P/N.

TRANSMISSION CONVERTER CLUTCH (TCC) RELAY CHECK 3.0L VIN E

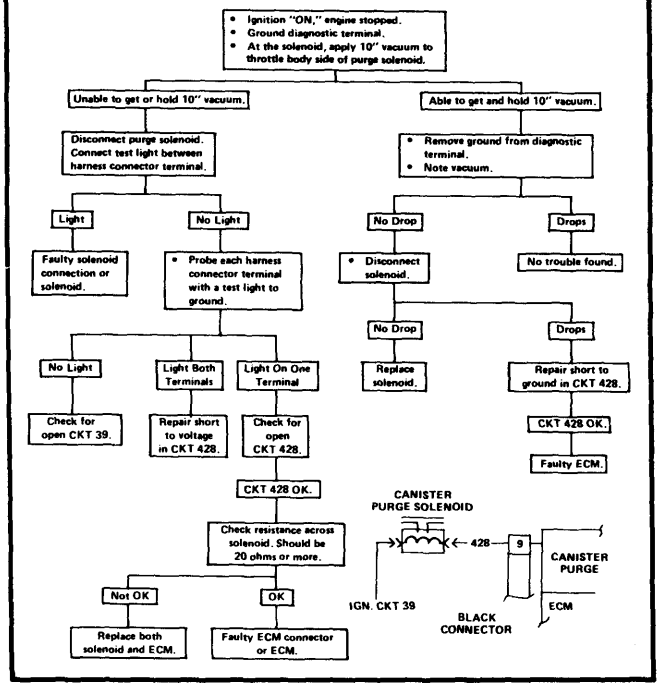


GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

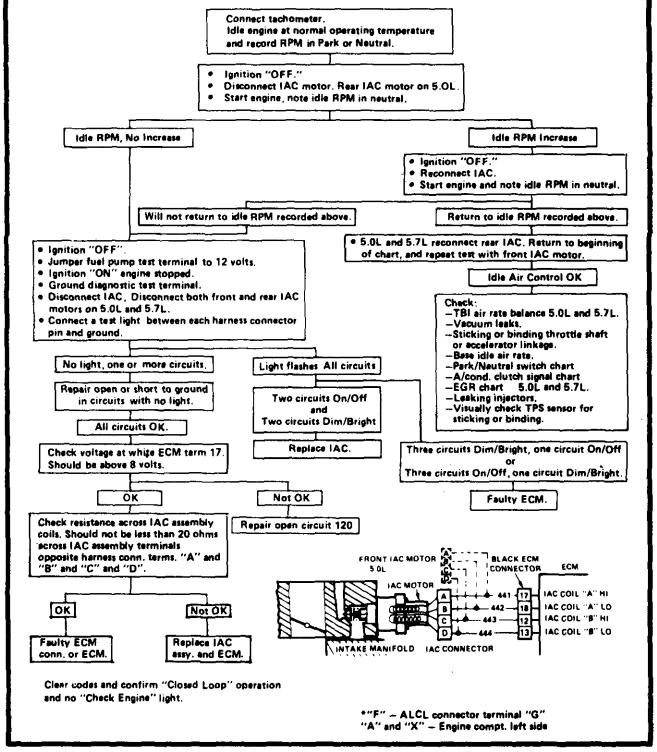


GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

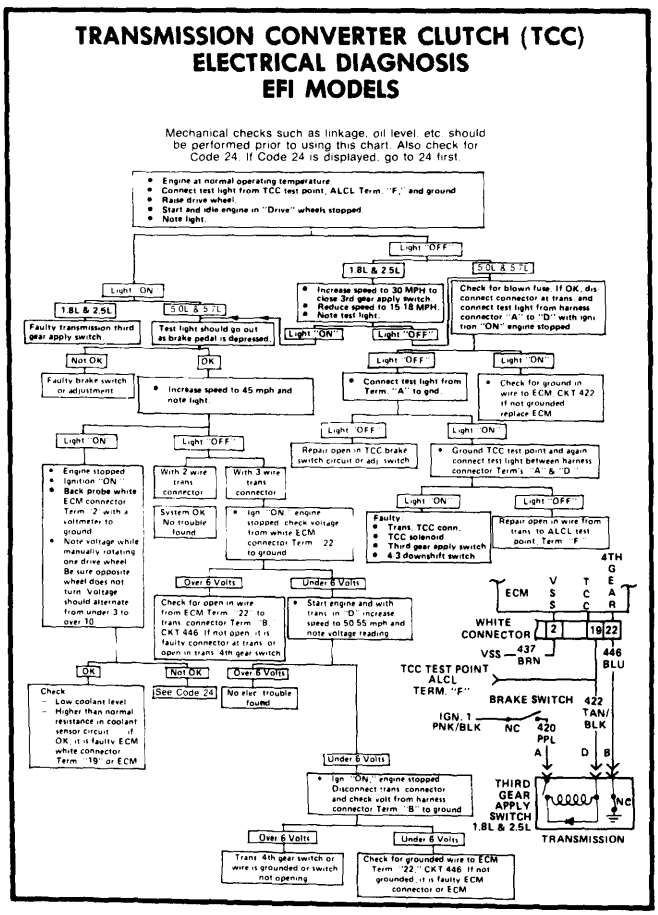
CANISTER PURGE VALVE CHECK EFI MODELS (5.0L & 5.7L)



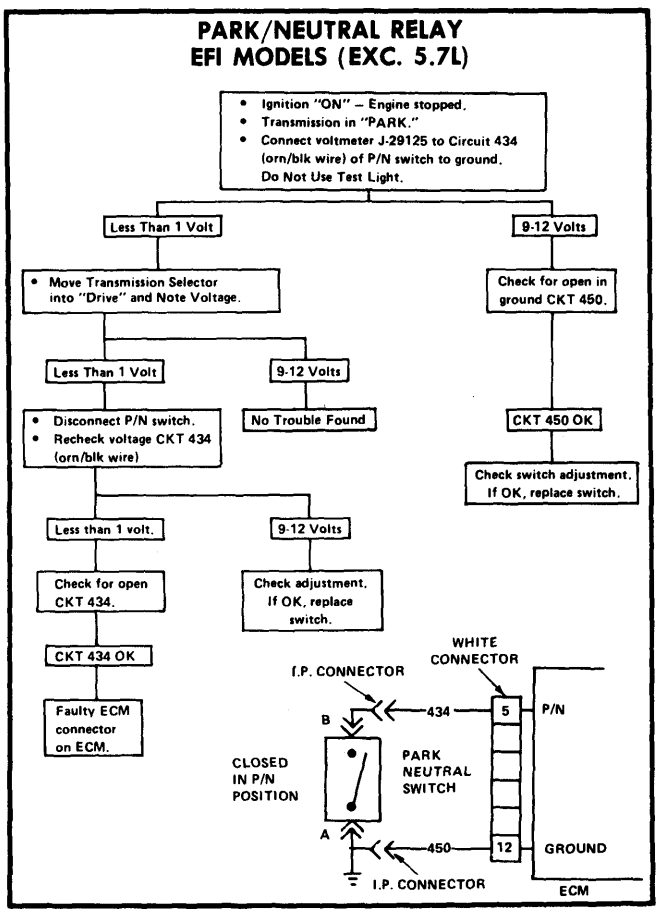
IDLE AIR CONTROL (IAC) CHECK EFI MODELS



TRANSMISSION CONVERTER CLUTCH (TCC) ELECTRICAL DIAGNOSIS EFI MODELS

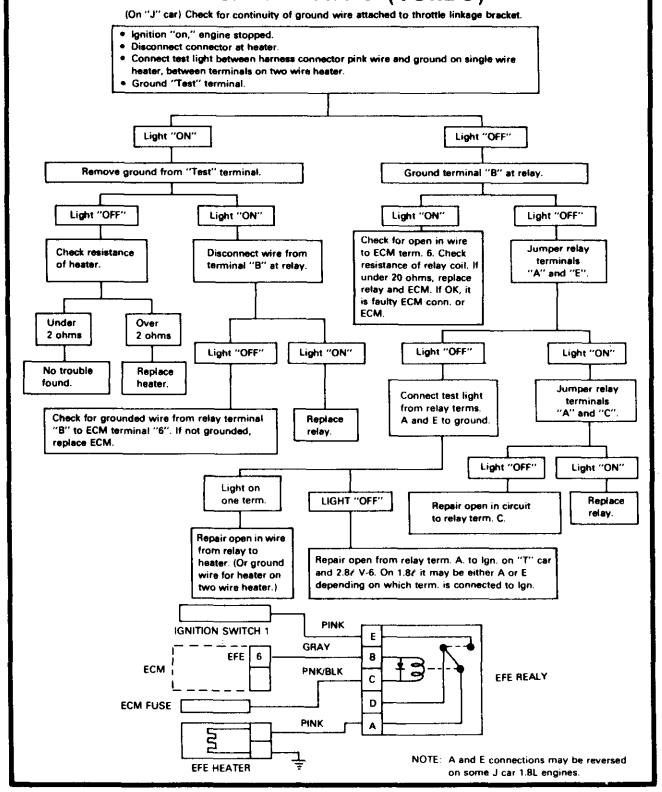


PARK/NEUTRAL RELAY EFI MODELS (EXC. 5.7L)

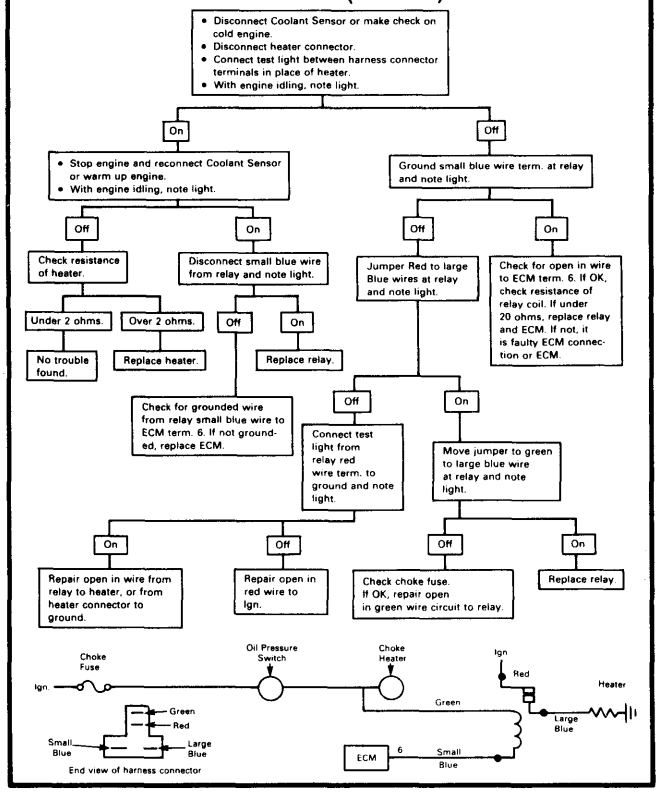


GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

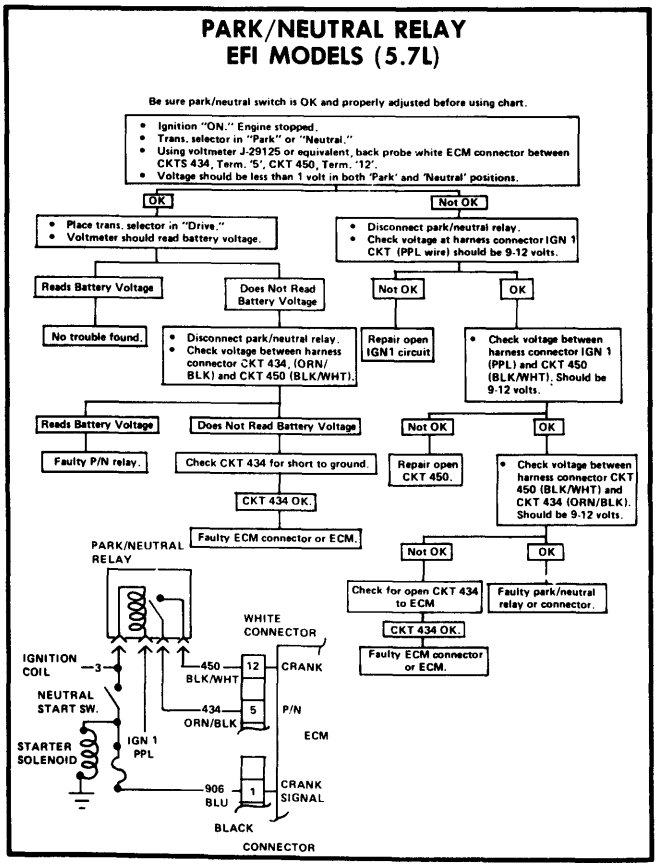
EFE OPERATIONAL CHECK ELECTRICALLY-HEATED TYPE EXC. 3.8L VIN 3 (TURBO)



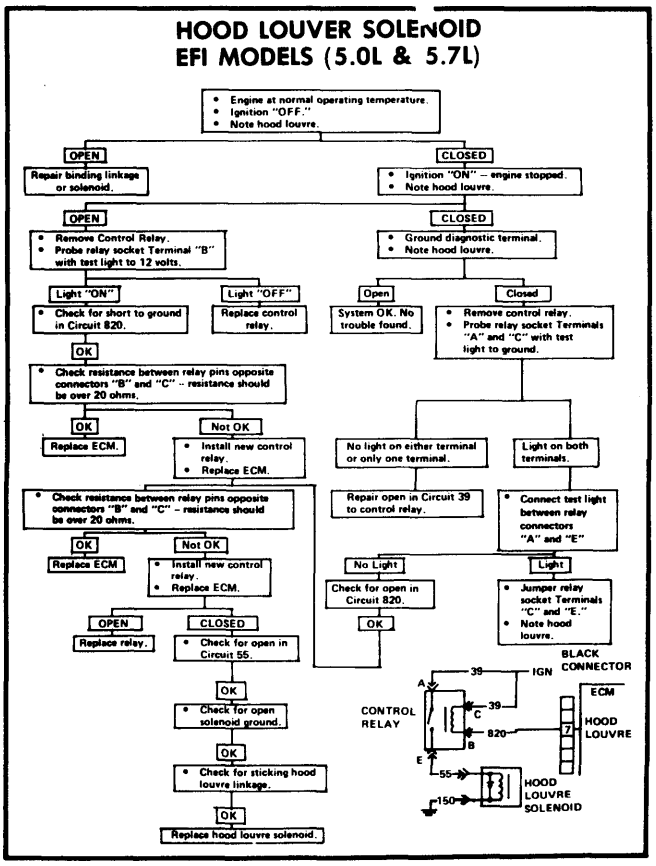
EFE OPERATIONAL CHECK ELECTRICALLY-HEATED TYPE 3.8L VIN 3 (TURBO)



PARK/NEUTRAL RELAY EFI MODELS (5.7L)



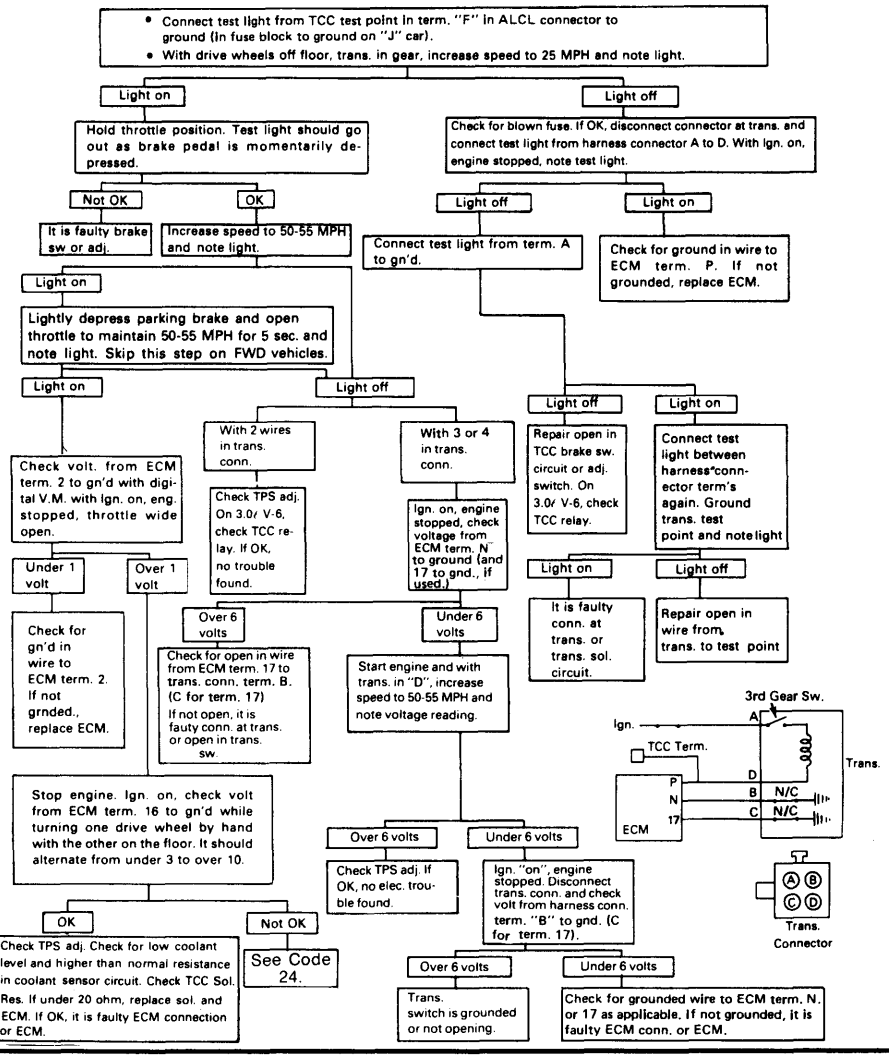
HOOD LOUVER SOLENOID EFI MODELS (5.0L & 5.7L)



GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

TRANSMISSION CONVERTER CLUTCH (TCC) ELECTRICAL DIAGNOSIS ALL EXC. EFI & FED. "T" CAR WITHOUT 5-SPEED

Mechanical checks such as linkage, oil level, etc. should be performed prior to using this chart. Also check for Code 24. If Code 24 is displayed, go to 24 first.



MAINTENANCE

OXYGEN SENSOR REPLACEMENT

Chevette (Suffix "Z" Engine Only) – Every 30,000 miles, a maintenance reminder labeled "EMISSIONS" appears in speedometer face, indicating need for oxygen sensor replacement. Replace oxygen sensor as described under Removal & Installation in this article. Reset maintenance reminder.

All Other Models – The CCC system does not require periodic maintenance. The ECM signals need for repair or replacement of oxygen sensor. However, if the vehicle is raised for other services, check the general condition of catalytic converter and exhaust system.

MAINTENANCE REMINDER RESET

Chevette (Suffix "Z" Engine Only) – Remove instrument panel trim plate. Remove instrument cluster lens. Using pointed tool, apply light downward pressure on notches of flag until it is reset. An alignment mark will appear in left center of odometer window when label is reset.

REMOVAL & INSTALLATION

ELECTRONIC SPARK CONTROL (ESC) UNIT

NOTE – *ESC unit is located between ECM and HEI/EST distributor. To locate, trace wiring from distributor to ECM.*

Removal & Installation – Remove ECM if necessary. Disconnect electrical connectors. Remove mounting hardware and ESC. To install, reverse removal procedure.

ELECTRONIC CONTROL MODULE (ECM)

NOTE – *The ECM may be located at right side kick panel, glove compartment area, center console area or behind driver's seat.*

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

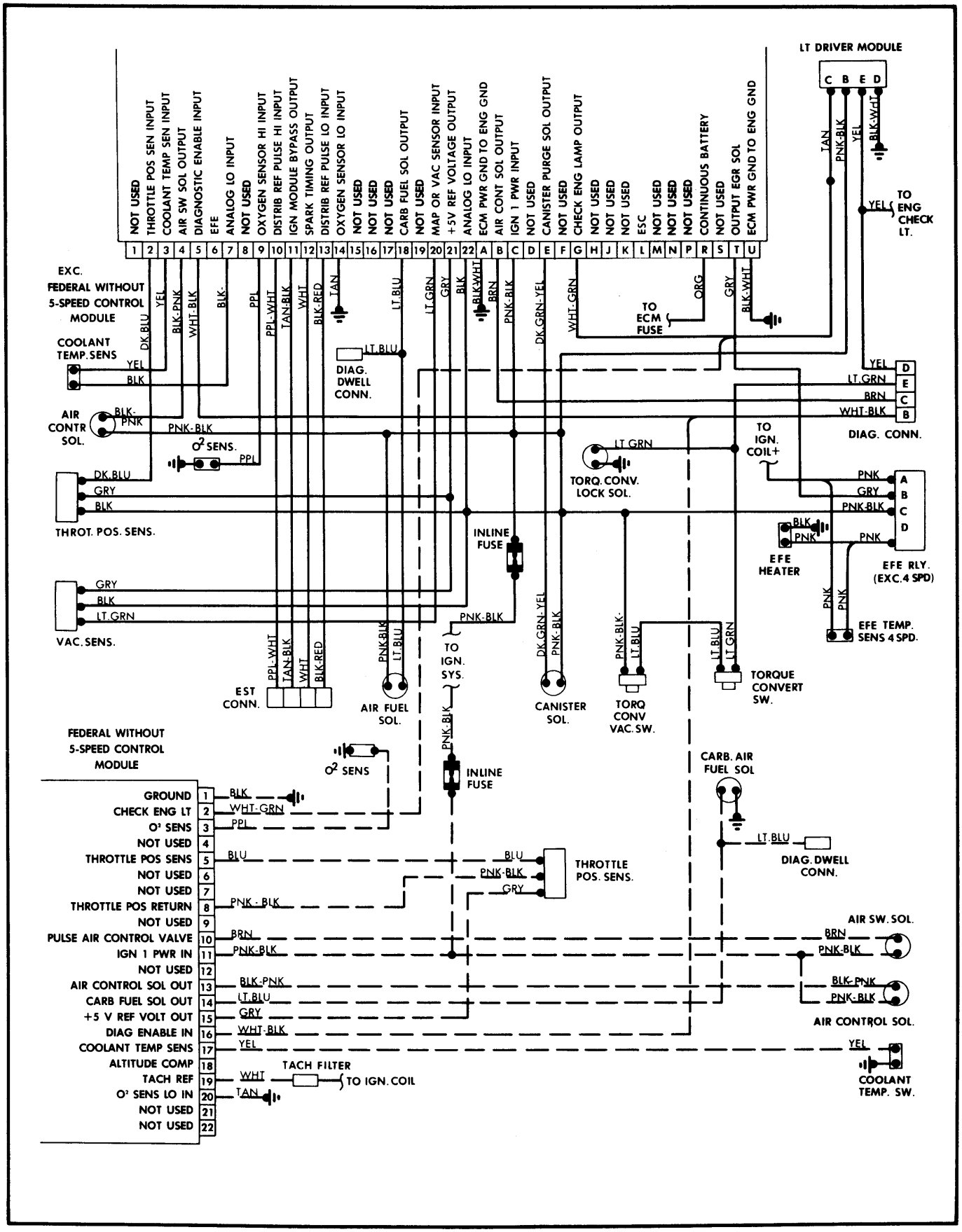


Fig. 7 Wiring Diagram for Chevette and T1000

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

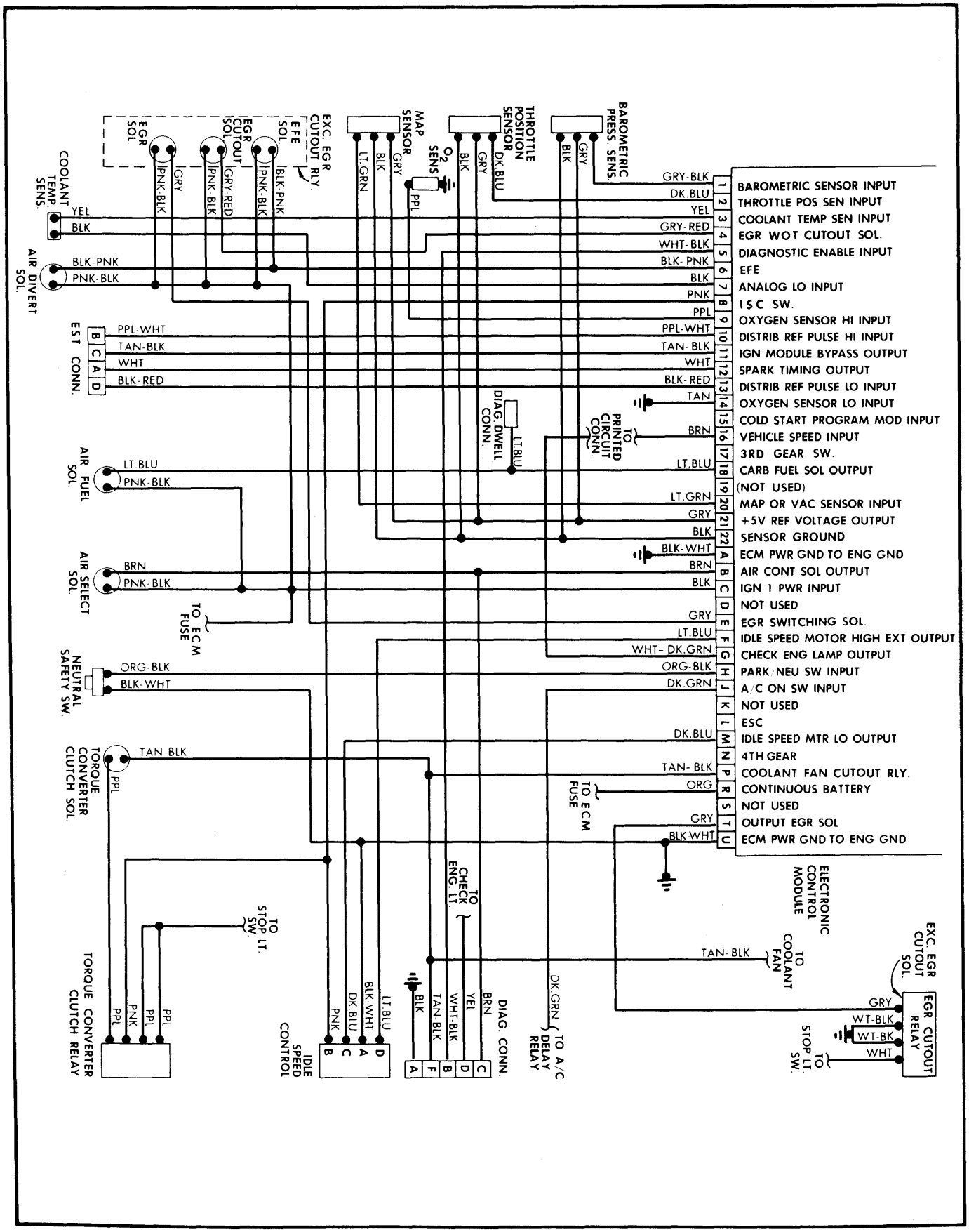


Fig. 8 Wiring Diagram for 3.0L VIN E Engine

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

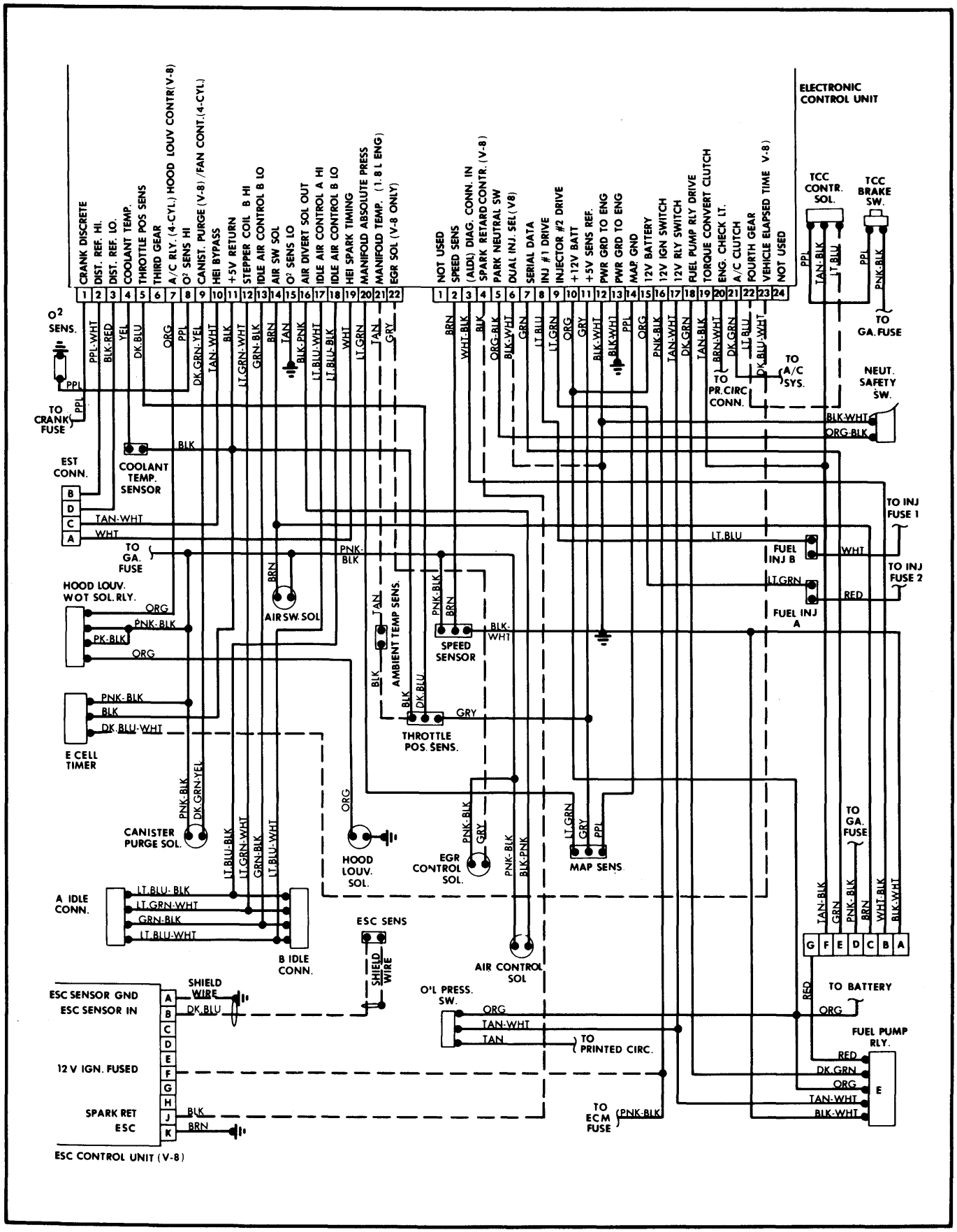


Fig. 9 Wiring Diagram for All Electronic Fuel Injection (EFI) Engines

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

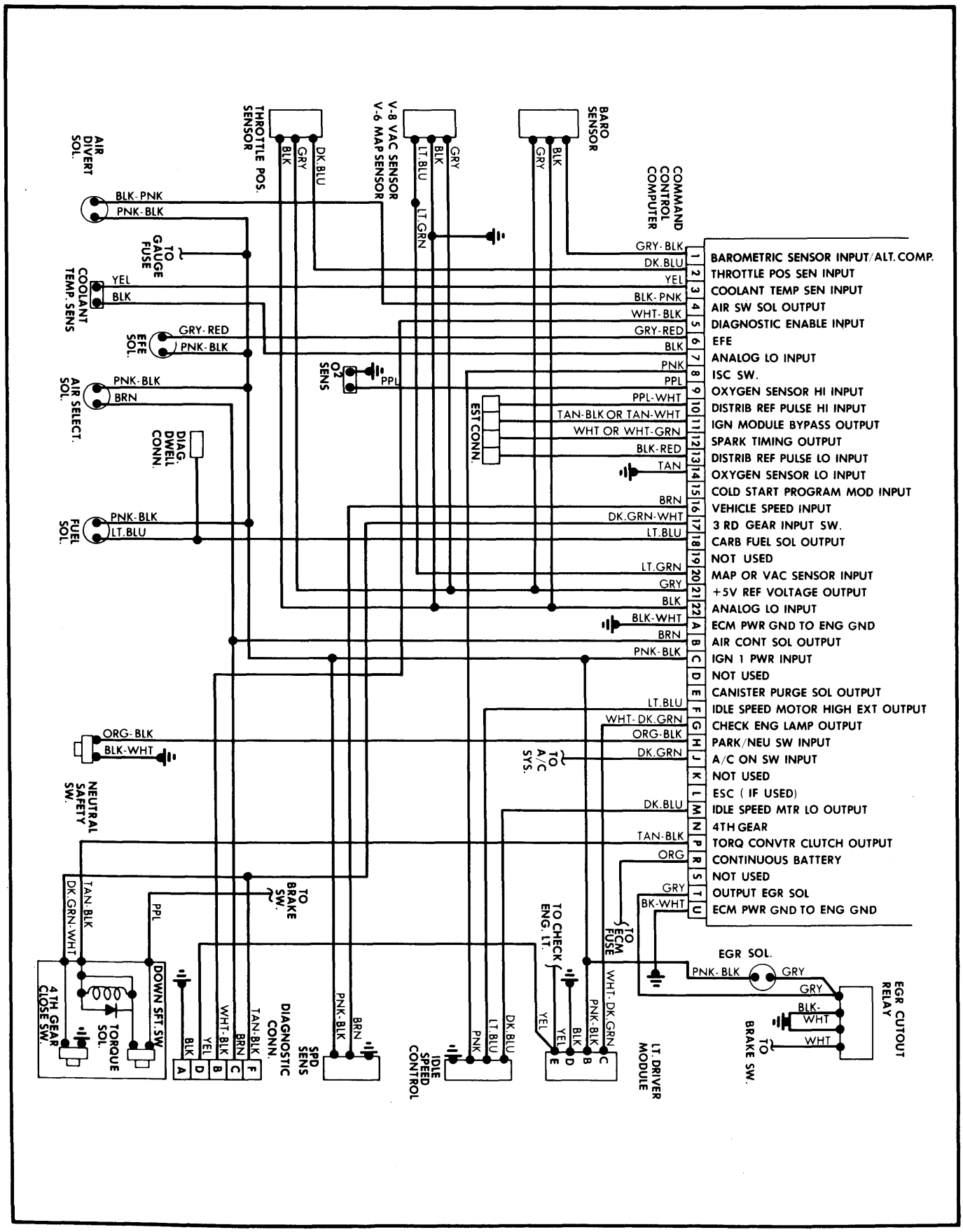


Fig. 10 Wiring Diagram for All Other General Motors Engines

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

Removal & Installation – Remove ECM mounting hardware. Disconnect electrical connectors and ground strap. Remove ECM. To install ECM, reverse removal procedure and ensure ground strap is securely attached.

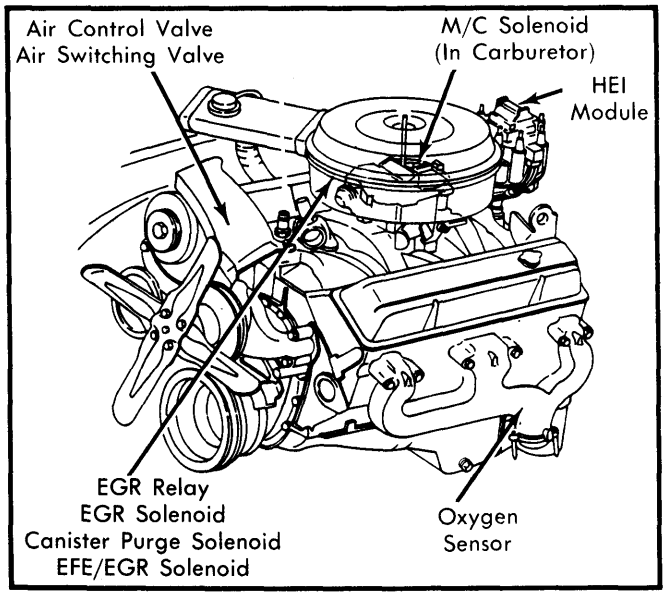


Fig. 11 Location of CCC System Components

PROGRAMMABLE READ ONLY MEMORY (PROM)

Removal – **1)** Remove ECM as previously described. Remove sheet metal screw holding access cover closed and remove access cover. Using a small flat tip screwdriver, place blade at PROM carrier reference end between edge of opening in case and underside of protruding lip of carrier. Apply prying force and force side of carrier up as far as possible. Repeat procedure on other reference end lip.

2) Using prying force explained in step **1)**, force opposite end of carrier up as far as possible. Grasp carrier with thumb and forefinger. Gently rock carrier from side to side while applying upward force and remove PROM.

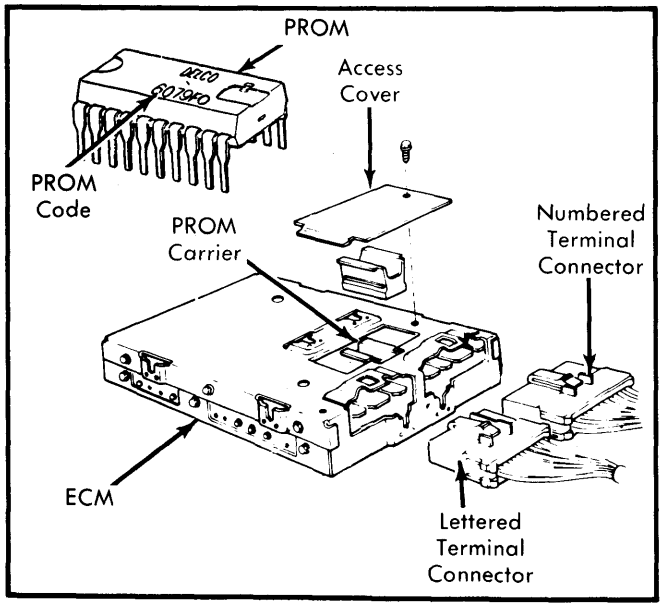


Fig. 12 Replacement of PROM in ECM

Installation – **1)** Before installing new PROM, ensure that part number agrees with removed PROM. Ensure that molded "half-round" depression of PROM is at same end as "squared-off" symmetrical end of carrier and that PROM is centered in carrier.

NOTE – *Any time PROM is installed backwards and ignition is turned on, PROM is destroyed and must be replaced.*

2) Position carrier squarely over PROM socket with "squared-off" symmetrical end of carrier aligned with small notch in socket. Press down firmly on top of carrier and press down on body of PROM with narrow blunt tool. Squarely seat PROM in socket by alternately pressing down on either end of PROM.

3) Replace access cover and reinstall ECM. Reconnect electrical connectors and start engine. Enter diagnostics and check for trouble code "51". If trouble code "51" does not appear, PROM is correctly installed.

4) If code "51" does appear, PROM is not fully seated, is installed backwards, has bent pins, or is defective. Remove ECM and fully seat PROM. If pins are bent, remove PROM, straighten pins and reinstall PROM. If pins break or crack during straightening process, replace PROM. If PROM is installed backwards, replace PROM.

NOTE – *Oxygen sensor may be difficult to remove when engine temperature is below 120°F (45°C). Excessive force may damage threads in exhaust manifold or cross-over pipe.*

OXYGEN SENSOR

Removal – Raise and support vehicle (if required). Disconnect electrical connector at harness. Spray threads of oxygen sensor with penetrating oil and allow to soak for 5 minutes. Carefully remove oxygen sensor.

Installation – Install new oxygen sensor and torque to 30 ft. lbs. When installing new oxygen sensor, do not remove glass bead coating (anti-seize compound) from threads or install with any type of sealant. Reconnect electrical connector. Ensure oxygen sensor boot is 5/16" away from wrench fitting of oxygen sensor.

NOTE – *DO NOT attempt to reinstall an oxygen sensor. Reinstallation of a sensor without special glass bead thread coating may require complete replacement of exhaust system.*

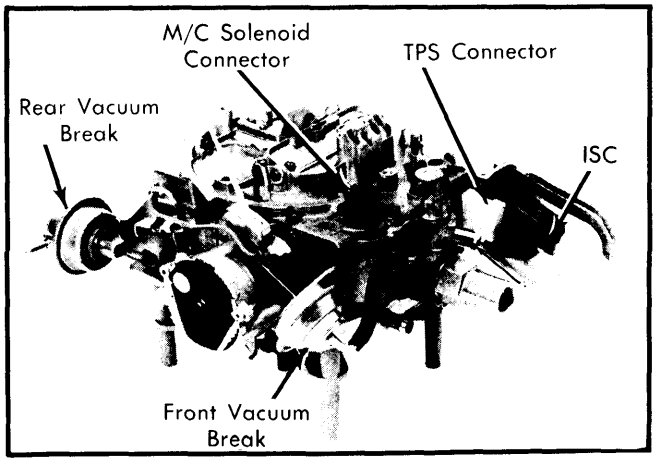


Fig. 13 Location of CCC Components on Carburetor

GENERAL MOTORS COMPUTER COMMAND CONTROL (Cont.)

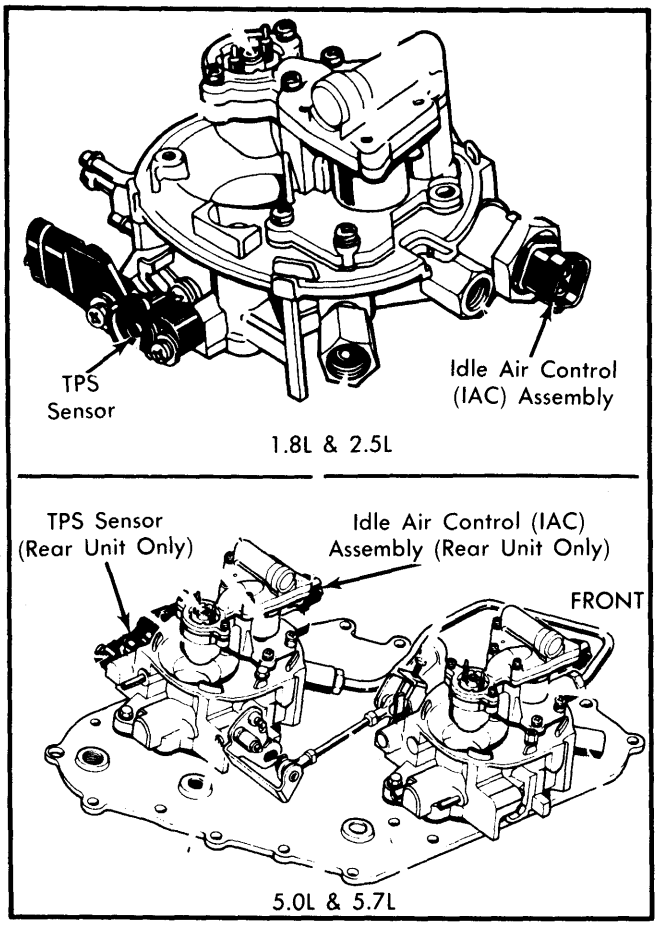


Fig. 14 Location of CCC Components on EFI Throttle Body Assemblies

IDLE SPEED CONTROL (ISC), IDLE SPEED SOLENOID (ISS), IDLE LOAD COMPENSATOR (ILC), IDLE AIR CONTROL (IAC)

Removal & Installation – Disconnect electrical harness connector, if equipped. Remove mounting screws and idle control device. To install, reverse removal procedure and adjust idle control device.

THROTTLE POSITION SENSOR (TPS)

Removal and installation requires removal of carburetor or throttle body unit.

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP), BAROMETRIC PRESSURE SENSOR (BARO), VACUUM SENSOR

Removal & Installation – These sensors may be located in engine compartment or instrument panel. Locate sensor and remove electrical connector. Remove mounting screws and remove sensor. To install sensor, reverse removal procedure and reconnect ground strap (if equipped).

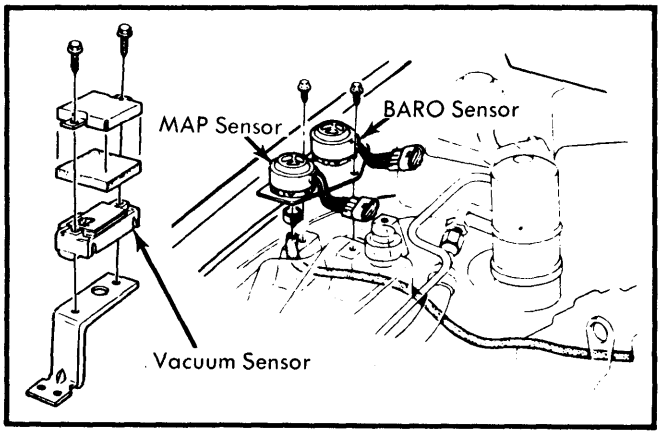


Fig. 15 MAP/BARO Sensor or Vacuum Sensor Location (Location May Also Be in Passenger Compartment)

COOLANT TEMPERATURE SENSOR (CTS)

Removal – Drain radiator until coolant level is below sensor. Remove alternator (if required) to gain access to sensor. Disconnect harness connector from sensor and remove sensor from block.

Installation – Apply non-hardening sealer to threads of sensor and install sensor. Reconnect harness connector and install alternator (if removed). Refill radiator.

Vehicle Speed Sensor (VSS)

Removal & Installation – Remove speedometer cluster and disconnect VSS electrical harness. Remove mounting hardware and remove sensor. To install, reverse removal procedure.

EMISSION CONTROL SOLENOIDS

Removal & Installation – Remove electrical connector and hoses (if equipped). Remove solenoid. To install, reverse removal procedure.

TORQUE CONVERTER CLUTCH SOLENOID (TCC), HIGH GEAR SWITCH

Removal and installation requires disassembly of transmission.

DETONATION SENSOR, (ESC EQUIPPED ENGINES)

Removal & Installation – Remove electrical harness and remove sensor. To install, coat threads of sensor with anti-seize compound and install sensor.