E - THEORY/OPERATION - 4-CYL EFI

1989 Toyota 4Runner

1989 ENGINE PERFORMANCE
4-Cyl Theory & Operation - Fuel Injection

Camry, Celica, Corolla, MR2, Pickup, Van & 4Runner

NOTE: This section covers the basic description and operation of engine performance related systems and components. Prior to diagnosing vehicles or systems with which you are not completely familiar, read through this section.

AIR INDUCTION SYSTEM

VARIABLE INDUCTION SYSTEM

Celica (3S-GE & 3S-GTE), Corolla (4A-GE) & MR2

Each cylinder in the intake manifold is divided into 2 parts. An intake air control valve is installed in one passage on each cylinder runner. The opening and closing of this valve gives the best airflow possible, preventing low-speed performance loss and improved fuel economy. The intake control valves are vacuum actuated. The vacuum signal is controlled by the ECU through a vacuum switching valve.

TURBOCHARGERS

Celica Turbo (3S-GTE) uses a water-cooled intercooler. Intercooler system uses separate coolant reservoir and radiator from the engine coolant. Maximum boost pressure is relieved by wastegate. Wastegate has a dual control from 2 pressure signals: a direct signal from downstream of the impeller wheel, and ECU controlled signal from upstream of the impeller wheel.

Celica Turbo intercooler system also has coolant level warning sensor which signals a control module when the intercooler coolant is too low. Low coolant level will cause the "CHECK ENGINE" warning light to come on. Control module is above the glove box.

COMP ENGINE CONTROLS

TOYOTA COMPUTER CONTROL SYSTEM (TCCS)

Toyota Computer Control System (TCCS) is a computerized emission, ignition and fuel injection control system. TCCS lowers exhaust emissions while maintaining good fuel economy and driveability.

An Electronic Control Unit (ECU) governs TCCS based on input signals received from various engine sensors. ECU contains preprogrammed data to maintain optimum engine performance under all operating conditions.

ECU is also equipped with a self-diagnostic function. Trouble codes are set by the malfunction of engine sensors or circuits and stored in the ECU memory. A "CHECK ENGINE" light on the instrument panel will come on if a trouble code is stored.

CONTROL UNIT

Electronic Control Unit (ECU) is a microprocessor which controls all functions of TCCS. ECU receives signals from sensors, switches, and ignition and starting systems. ECU has constant source

of battery power at "BATT" terminal. EFI main relay provides battery voltage to terminals "+B" and "+B1" of ECU. EFI main relay is activated by turning on ignition switch.

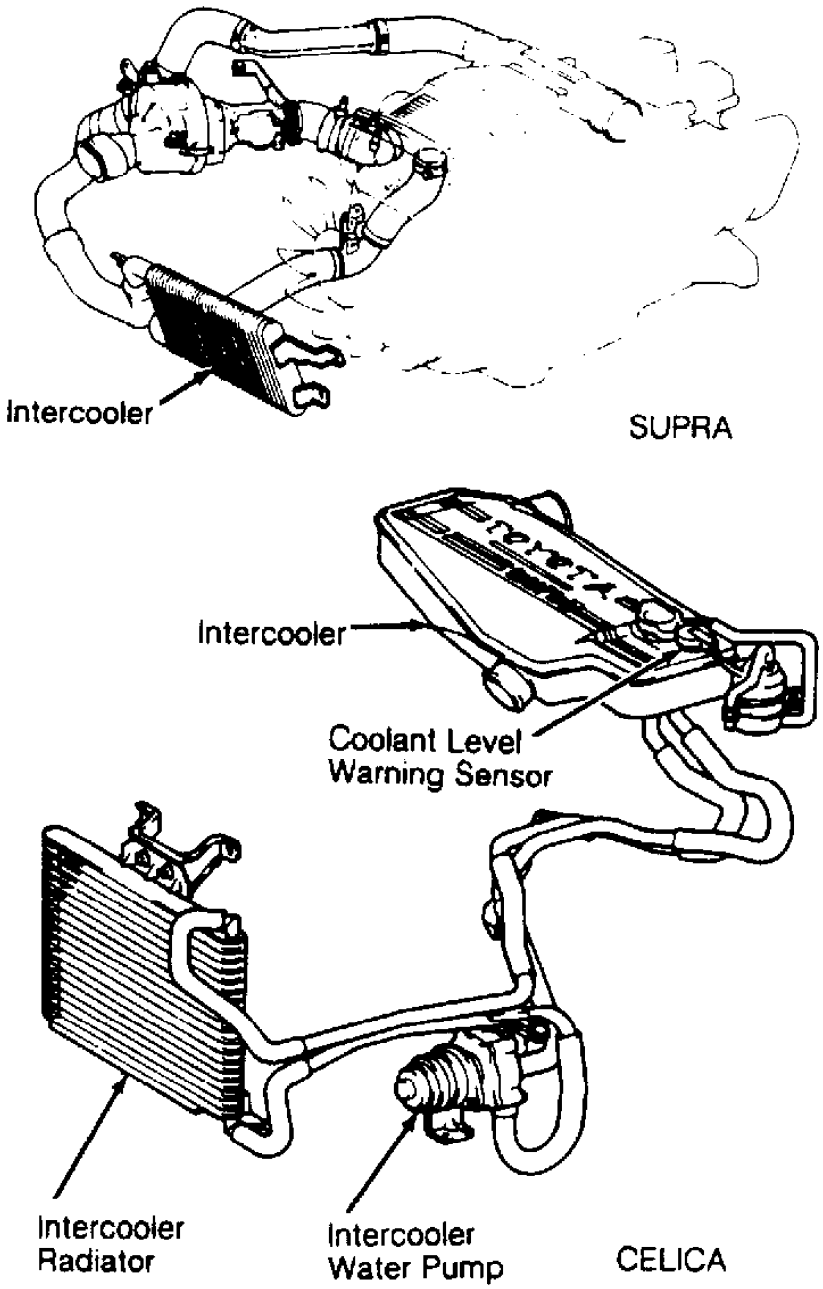

Fig. 1: Toyota Turbocharging Systems
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Signals are processed by the ECU for controlling the following functions:

* Air Injection (Emission Systems)
* Air Suction Control (Emission Systems)
* Electronic Fuel Injection (Fuel Delivery)
* Electronic Spark Advance (Ignition System)
* EGR Control (Emission Systems)
* Electronic Controlled Transmission
* Idle Speed Control (Fuel System)
* Idle-Up System (Fuel System)
* Intake Air Control System (Air Induction System)
* O2 Sensor Heater (Emission Systems)
* Self-Diagnostic System (Self-Diagnostic System)
* Turbocharging System (Air Induction System)

The ECU contains self-diagnostic and fail-safe capabilities. The ECU is equipped with a self-diagnostic system which detects system failures or abnormalities. When malfunction occurs, the "CHECK ENGINE" light on instrument panel is activated.

FAIL-SAFE SYSTEM

The ECU contains a fail-safe function that is used in case of data sensor or switch failure. The fail-safe function used preprogrammed engine values to provide a "limp-in" mode so the vehicle may be driven. If malfunction is serious enough, ECU may shut down engine.

ECU LOCATIONS TABLE

Model	Location
Camry, Celica & Corolla	Bottom Center Of Dash, In Front Of Console
MR2	Center Rear Of Engine Compartment
Pickup & 4Runner	Behind Right Kick Panel
Van	Behind Driver's Side Pillar

CIRCUIT OPENING & EFI MAIN RELAY

EFI MAIN RELAY

EFI main relay provides battery voltage to terminals "+B" and "+B1" of ECU. It also supplies current to circuit opening relay, engine check connector and, depending on model application, idle speed control valve and oxygen sensor. "EFI" fuse supplies constant battery voltage to EFI main relay.

CIRCUIT OPENING RELAY

Circuit opening relay controls fuel pump circuit. ECU receives input signal at "STA" terminal when engine is cranking. This same starter signal is also applied to terminal "STA" of circuit opening relay. Starter signal energizes circuit opening relay during cranking, which in turn, activates fuel pump. On all except Corolla (4A-FE) when airflow meter senses airflow to engine, fuel pump switch in airflow meter provides an alternate relay ground. On Corolla (4A-FE) circuit opening relay is grounded by ECU through "FC" terminal.

TCCS INPUT DEVICES & SIGNALS

NOTE: All data sensors are not necessarily used on every model. See appropriate computer control system illustration.

A/C SWITCH

When the air conditioner is turned on, the ECU monitors the signal that turns on the compressor clutch. ECU uses this signal for controlling idle speed during A/C operation.

AIRFLOW SENSOR

On all Models the airflow sensor in the airflow meter measures airflow volume through the airflow meter. Airflow meter converts intake air readings into a voltage signal by means of a variable resistor (potentiometer). Signal is sent to ECU for controlling fuel injection duration and spark advance system.

AIR TEMPERATURE SENSOR

On all except Corolla (4A-FE), sensor is mounted in airflow meter. On Corolla (4A-FE), sensor in mounted in air filter housing. On all models, sensor measures incoming air temperature. Signal is sent to ECU for controlling fuel injection duration.

BATTERY SIGNAL

Battery voltage is always present at "BATT" terminal of ECU. When ignition switch is turned on, voltage for ECU operation is applied through the EFI main relay to terminals "+B" and "+B1".

BRAKE LIGHT SIGNAL

The brake light switch is used to detect when the vehicle is braking. This signal is sent to terminal "STP" of the ECU.

COLD START INJECTOR TIME SWITCH

This switch determines cold start injector "ON" time for cold engine starting.

COOLANT TEMPERATURE SENSOR

Monitors coolant temperature. Sensor has a built-in thermistor whose resistance varies according to engine temperature. Coolant temperature signal is input to ECU at "THW" terminal. ECU uses sensor signal for controlling fuel injection duration, overdrive operation on electronically controlled transmissions, spark advance system, idle speed control system and EGR system.

COOLANT TEMPERATURE SWITCH

Van

This switch turns on above a specified temperature. Signal is used as an input to ECU terminal "TSW".

CRANKING SIGNAL

While the engine is cranking, the voltage applied the starter is also input to terminal "STA" of the ECU.

EGR GAS TEMPERATURE SENSOR

Sensor determines EGR gas temperature and sends signal to ECU.

KNOCK SENSOR

Sensor monitors ignition knock conditions and sends a signal to the ECU. ECU will in turn retard engine timing until knocking stops.

NEUTRAL/START SWITCH

Switch is installed on A/T models to inform ECU of gear selection. Information is used by the ECU to allow starter operation and control engine idle.

OXYGEN (O2) SENSOR

Oxygen sensor is installed in the exhaust system and monitors oxygen content of exhaust gases. Signal is sent to the ECU and is used for determining fuel injection duration. Some models are equipped with a second, sub-oxygen sensor downstream from the main oxygen sensor.

The oxygen sensor can be monitored at the engine check connector at the "VF" terminal. The ECU sends out a special 5 volt signal on this wire so the number of cross-counts the ECU sees from the O2 sensor can be read with an analog voltmeter.

RPM SIGNAL

On all models except, Van and Pickup (22R-E), crankshaft position and engine RPM are detected by pick-up coils in the distributor. Crankshaft position is read by ECU at "G1" terminal (and "G2" on some models), and engine RPM is input to ECU terminal "Ne".

On Pickup (22R-E) and Van, a single pick-up coil is used in the distributor. The ECU monitors the pick-up coil signal at "Ne" terminal.

SUB-OXYGEN SENSOR

Sensor is used in conjunction with O2 sensor. Sensor monitors oxygen content of exhaust gases and sends signal to the ECU.

THROTTLE POSITION SENSOR (TPS)

Throttle Position Sensor (TPS) is mounted on throttle body. Sensor determines changes in throttle valve positions and send signals to the ECU. Signals are used for controlling fuel injection duration and idle speed control system.

TURBO PRESSURE SENSOR

On Celica Turbo (3S-GTE), sensor monitors turbo pressure and sends signal to ECU.

VACUUM SENSOR

Corolla W/4A-FE

Also known as Manifold Absolute Pressure (MAP) sensor. This sensor monitors engine vacuum for the ECU. ECU uses this signal to help control fuel injection pulse width.

VEHICLE SPEED SENSOR (VSS)

Sensor is used to monitor vehicle speed. Vehicle speed information is used by the ECU for fuel injection, air injection (Corolla only), cruise control and electronic control of automatic transmission.

4WD SWITCH

Pickup/4Runner
Switch indicates 4WD operation and sends signal to ECU.

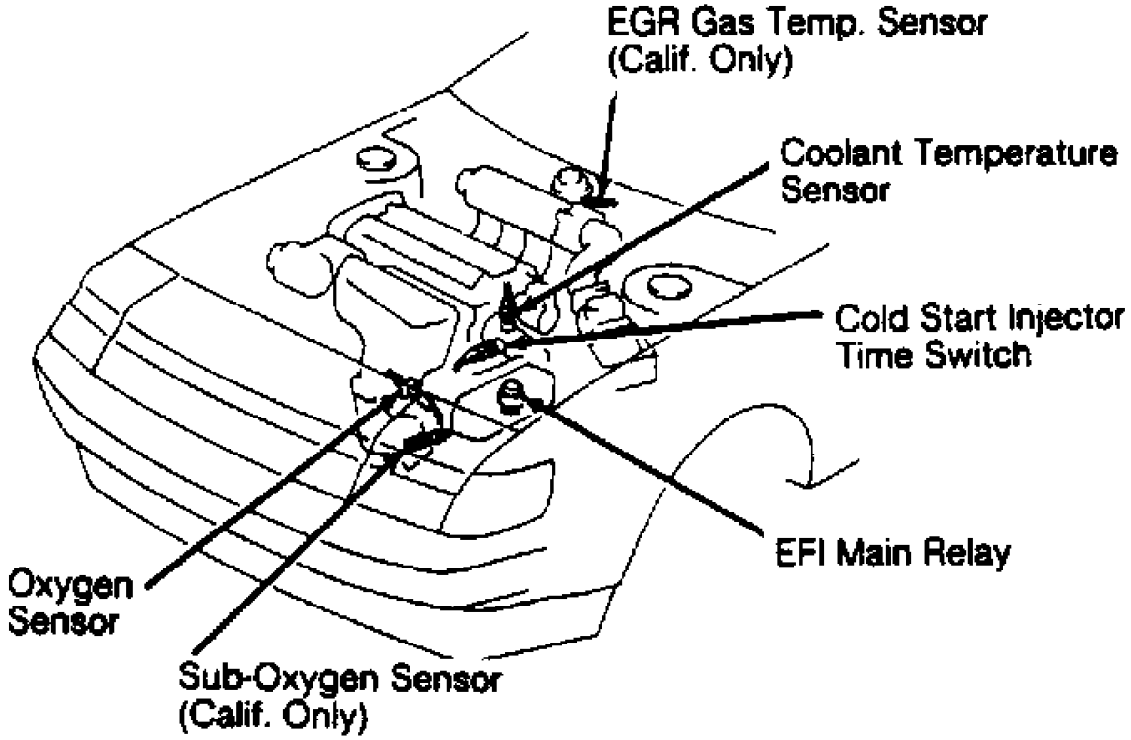

Fig. 2: TCCS Component Locations - Camry & Celica (3S-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

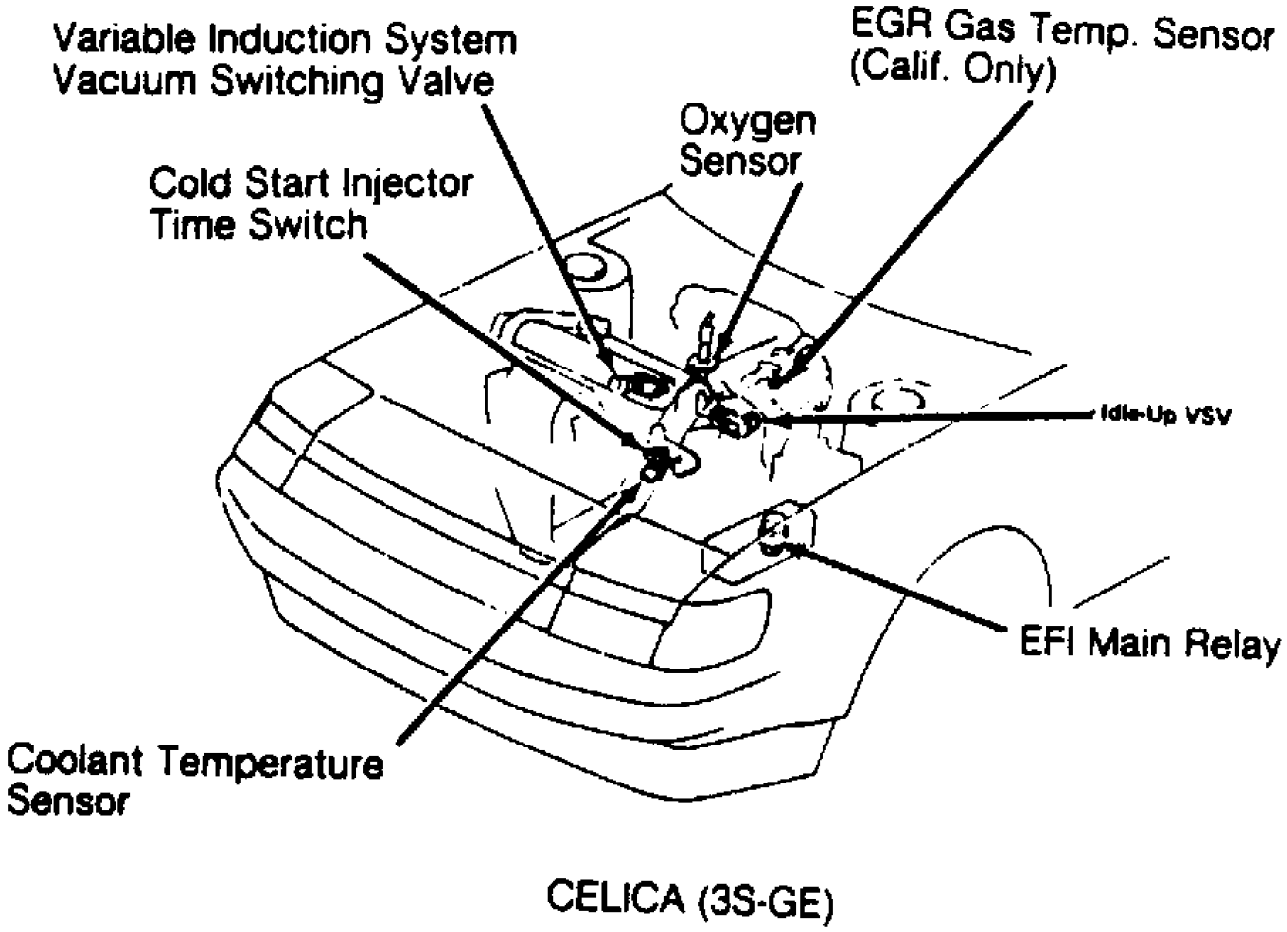

Fig. 3: TCCS Component Locations - Celica (3S-GE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

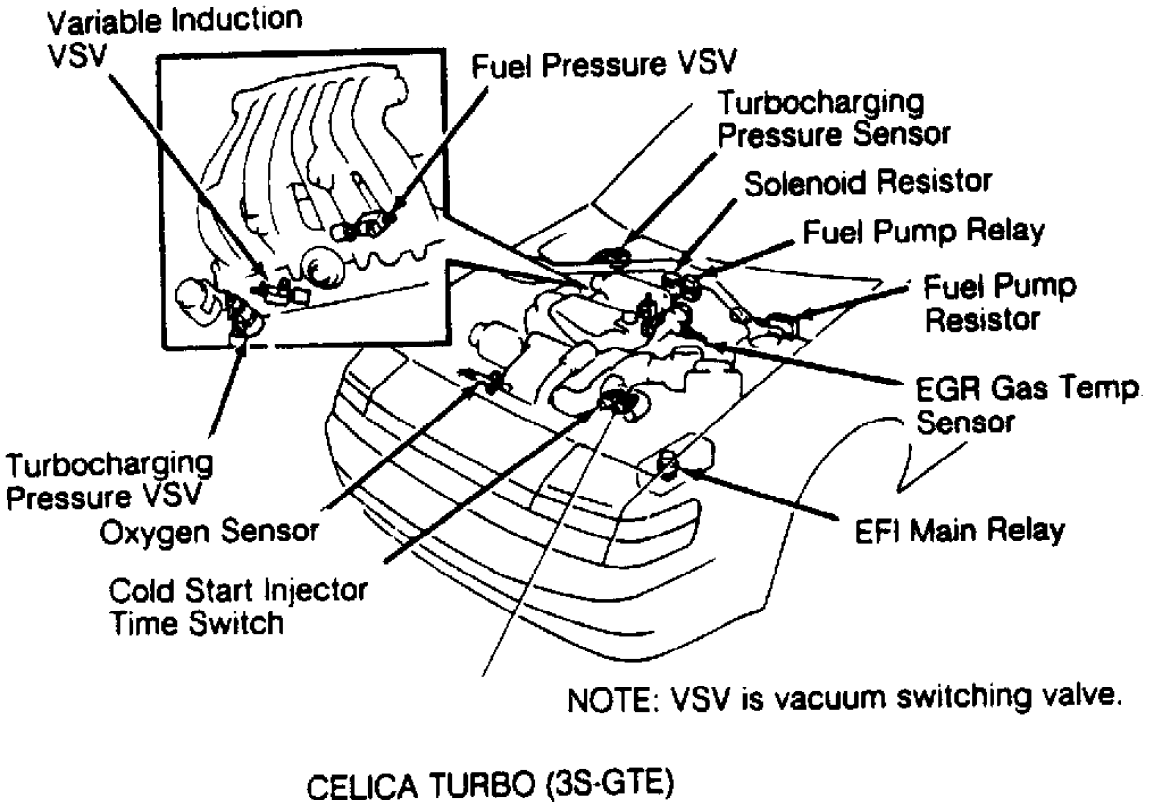

Fig. 4: TCCS Component Locations - Celica Turbo (3S-GTE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

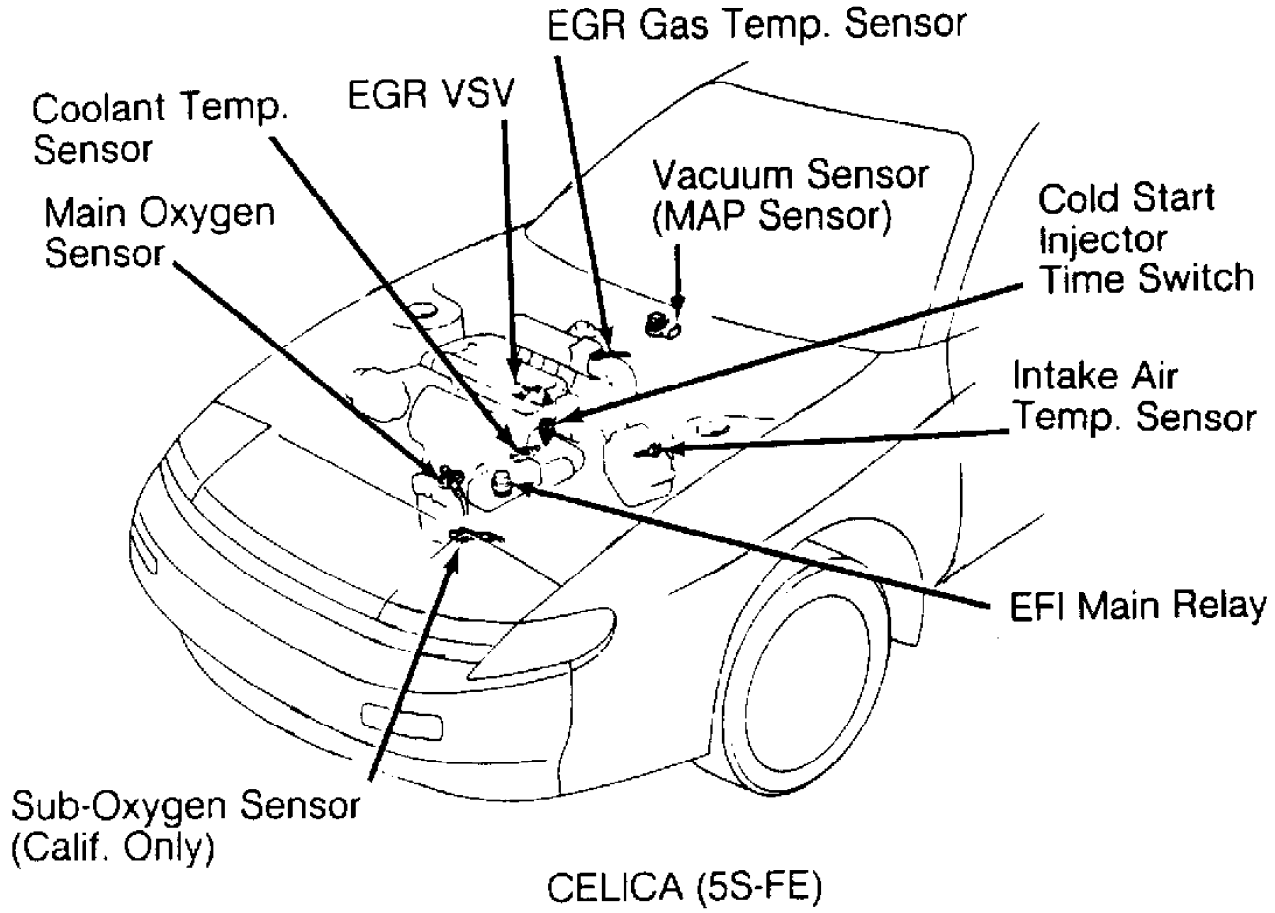

Fig. 5: ECU & Circuit Opening Relay Location - Celica
Courtesy of Toyota Motor Sales, U.S.A., Inc.

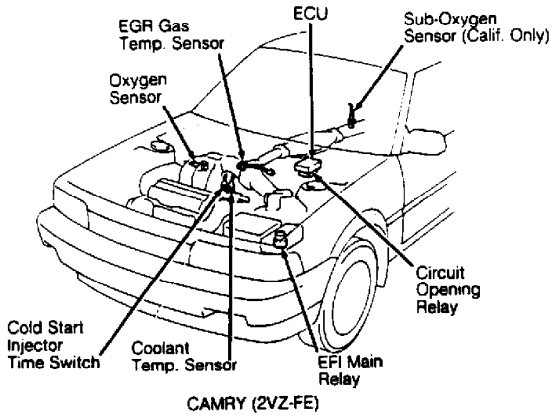

Fig. 6: TCCS Component Locations - Camry (2VZ-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

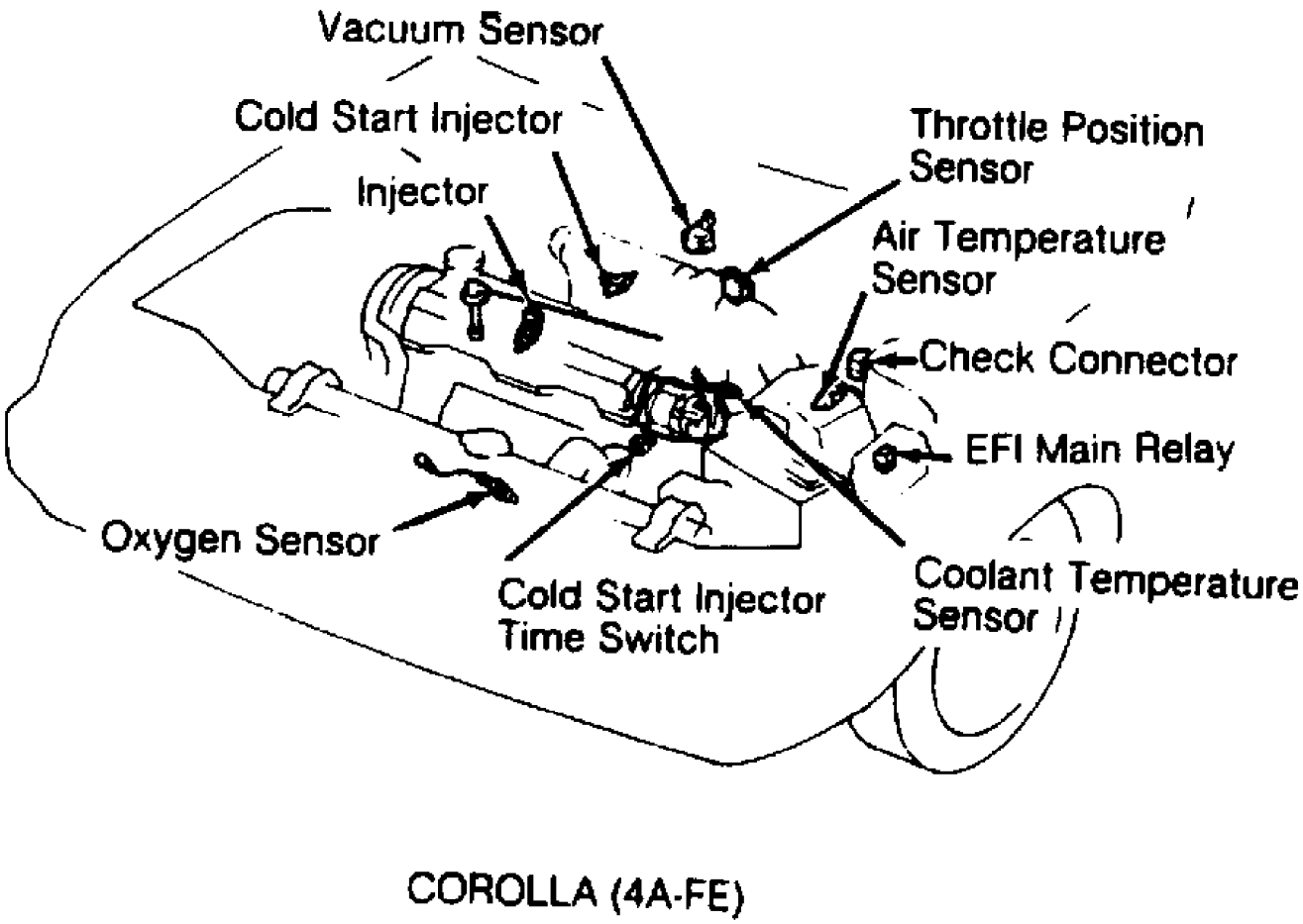

Fig. 7: TCCS Component Locations - Corolla (4A-FE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

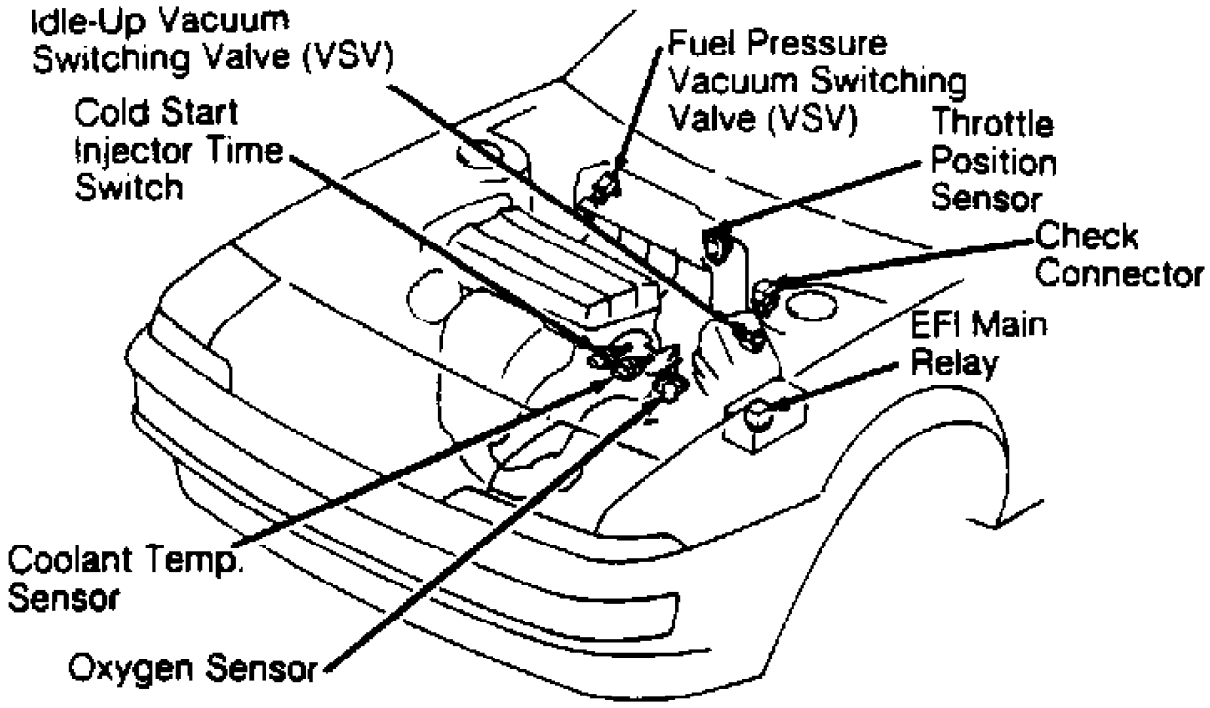

Fig. 8: TCCS Component Locations - Corolla (4A-GE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

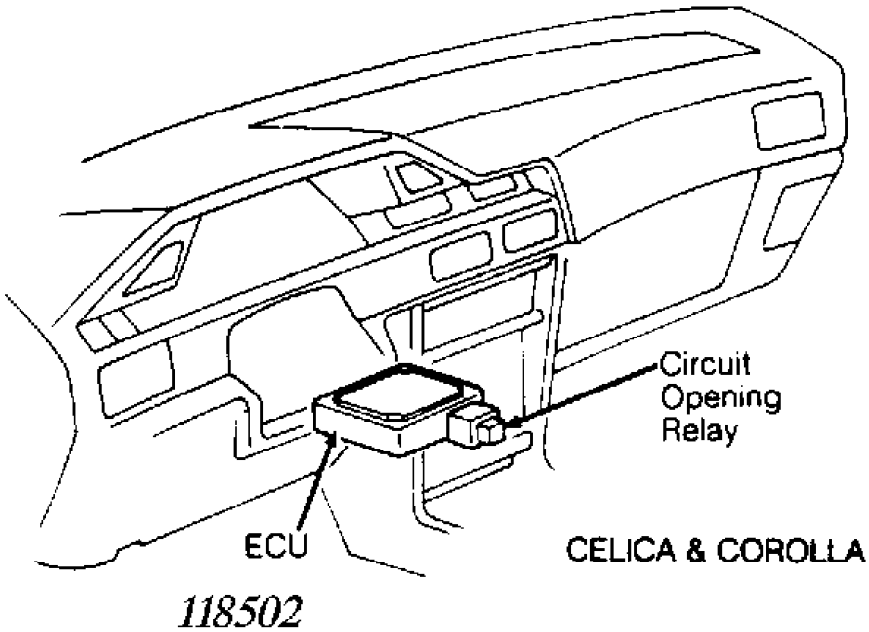

Fig. 9: ECU & Ckt Opening Relay Location - Corolla (4A-FE & 4A-GE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

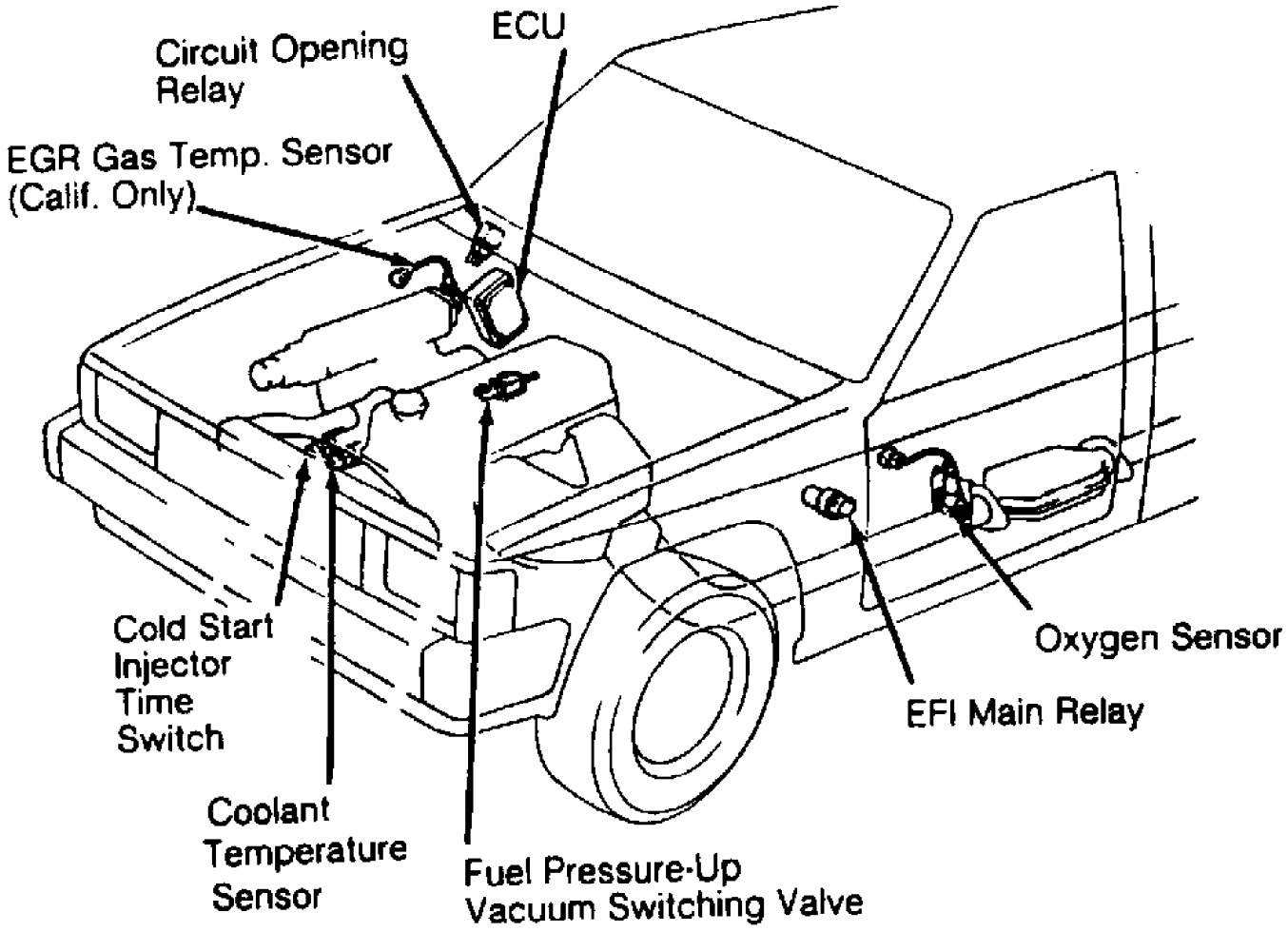

Fig. 10: TCCS Component Locations - Pickup/4Runner (22-RE)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

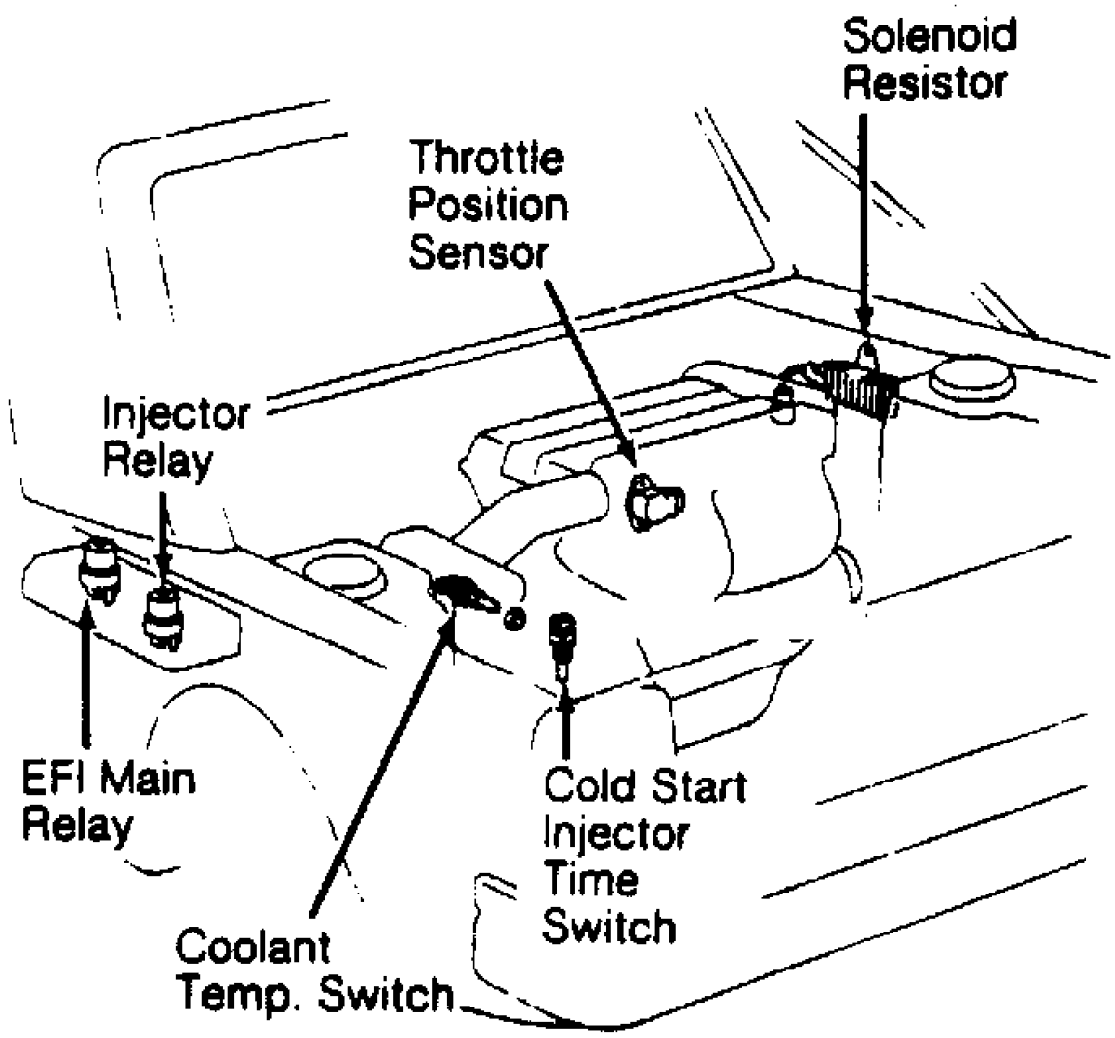

Fig. 11: TCCS Component Locations - MR2
Courtesy of Toyota Motor Sales, U.S.A., Inc.

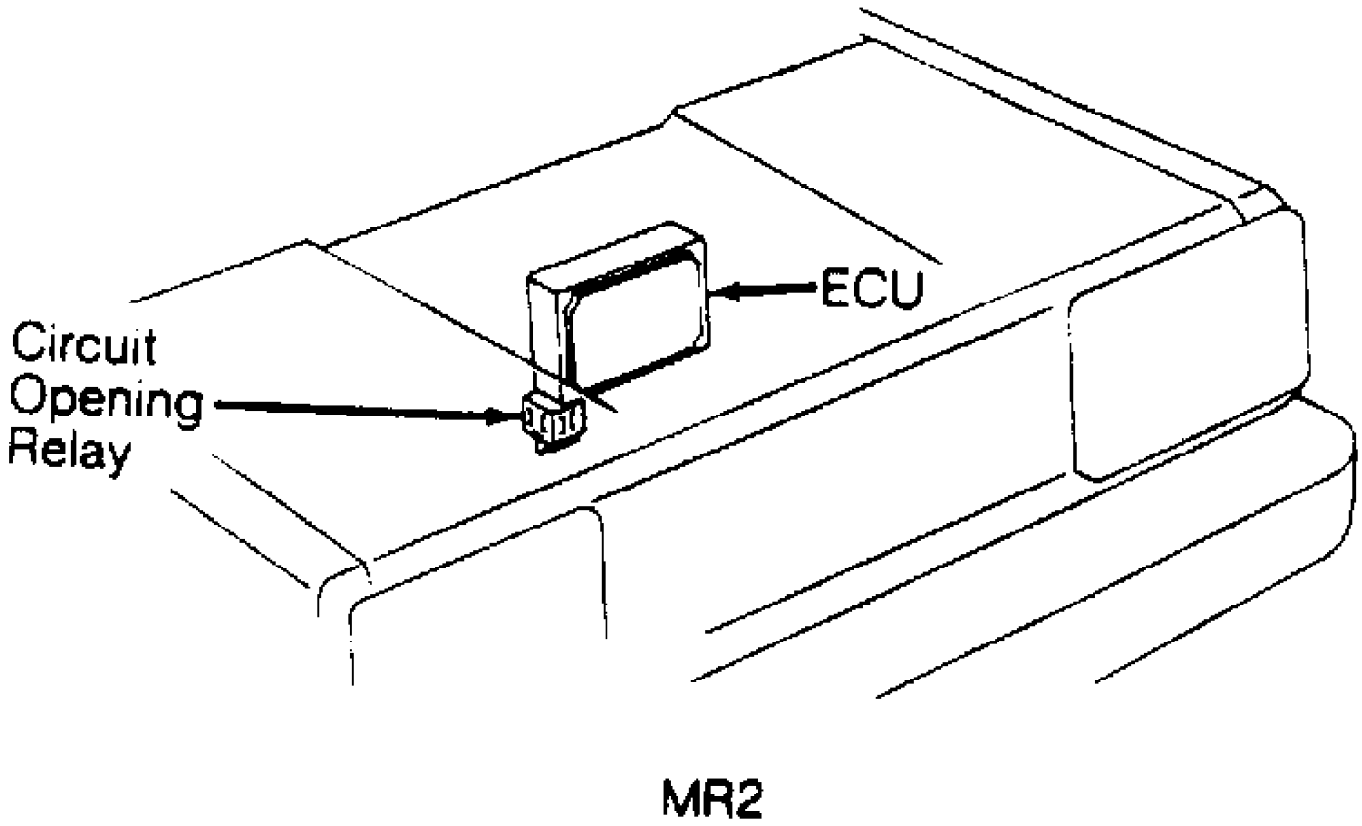

Fig. 12: ECU & Circuit Opening Relay Location - MR2
Courtesy of Toyota Motor Sales, U.S.A., Inc.

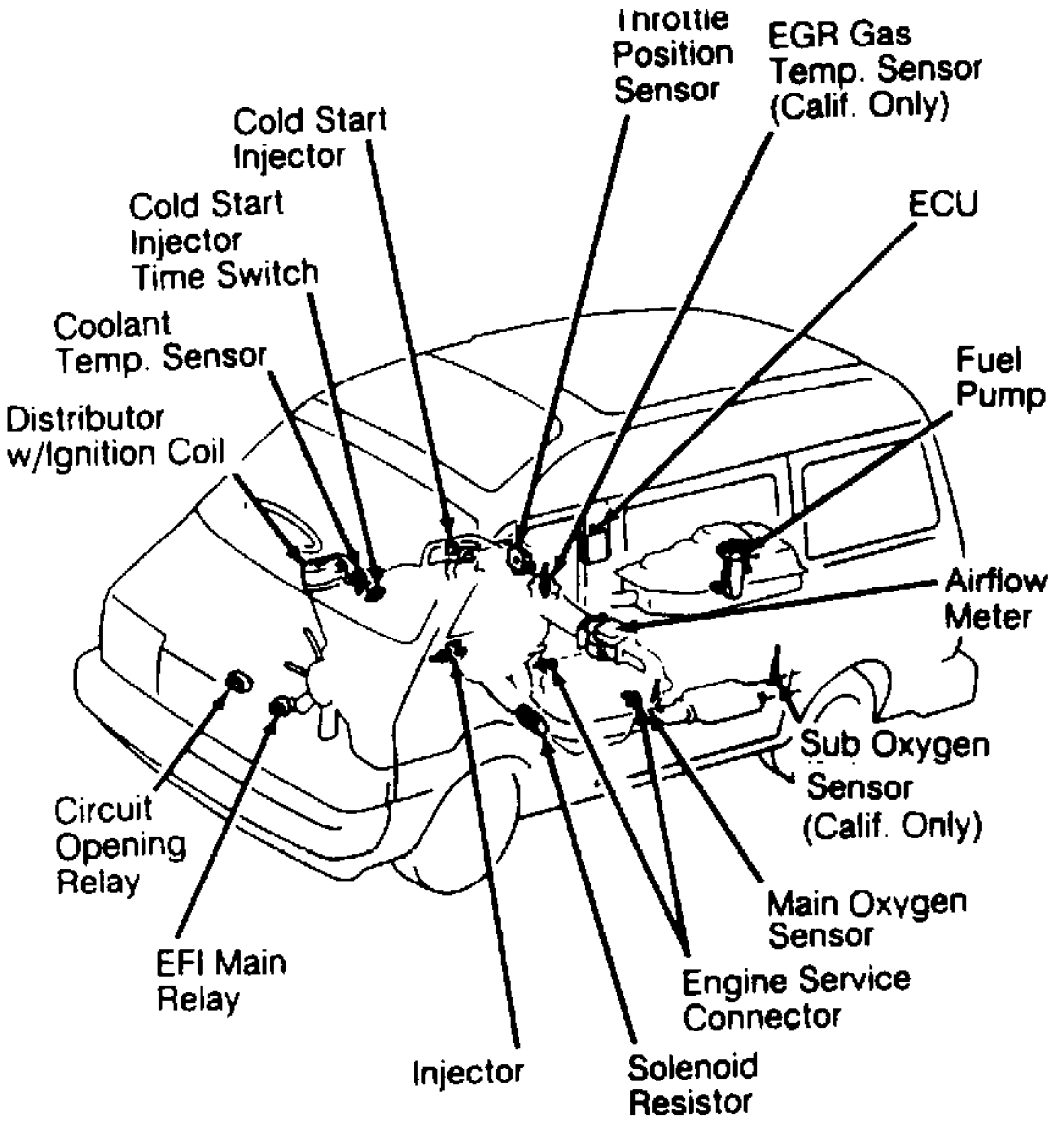

Fig. 13: TCCS Component Locations - Van
Courtesy of Toyota Motor Sales, U.S.A., Inc.

TCCS OUTPUT SIGNALS

The ECU of the TCCS receives input from data sensors and, depending on model application, controls the following components and subsystems:

* Air Injection (Emission Systems)
* Air Suction Control (Emission Systems)
* Electronic Fuel Injection (Fuel Delivery)
* Electronic Spark Advance (Ignition System)
* EGR Control (Emission Systems)
* Electronic Controlled Transmission (Transmission Controls)
* Idle Speed Control (Fuel System)
* Idle-Up System (Fuel System)
* Intake Air Control System (Air Induction System)
* O2 Sensor Heater (Emission Systems)
* Self-Diagnostic System (Self-Diagnostic System)

NOTE: For theory and operation of specific output components, refer to system indicated in parenthesis.

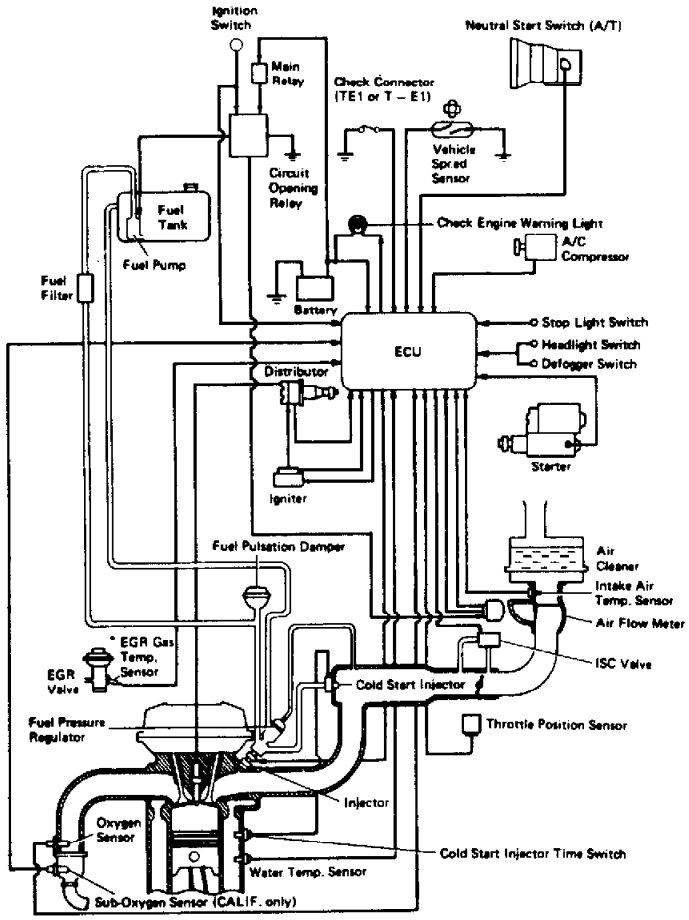

Fig. 14: Camry & Celica (3S-FE) Computer Control System
Courtesy of Toyota Motor Sales, U.S.A., Inc.

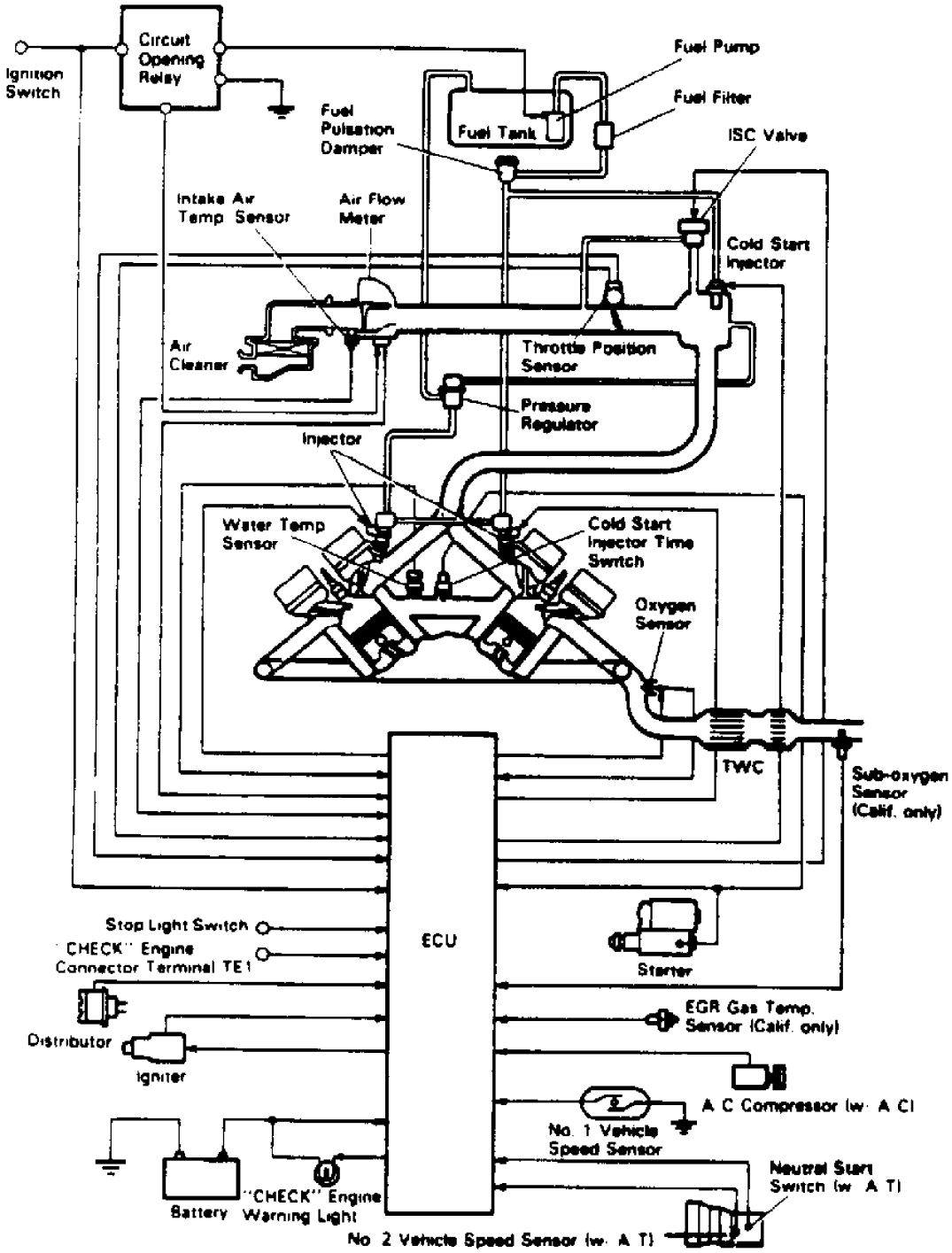

Fig. 15: Camry (2VZ-FE) Computer Control System
Courtesy of Toyota Motor Sales, U.S.A., Inc.

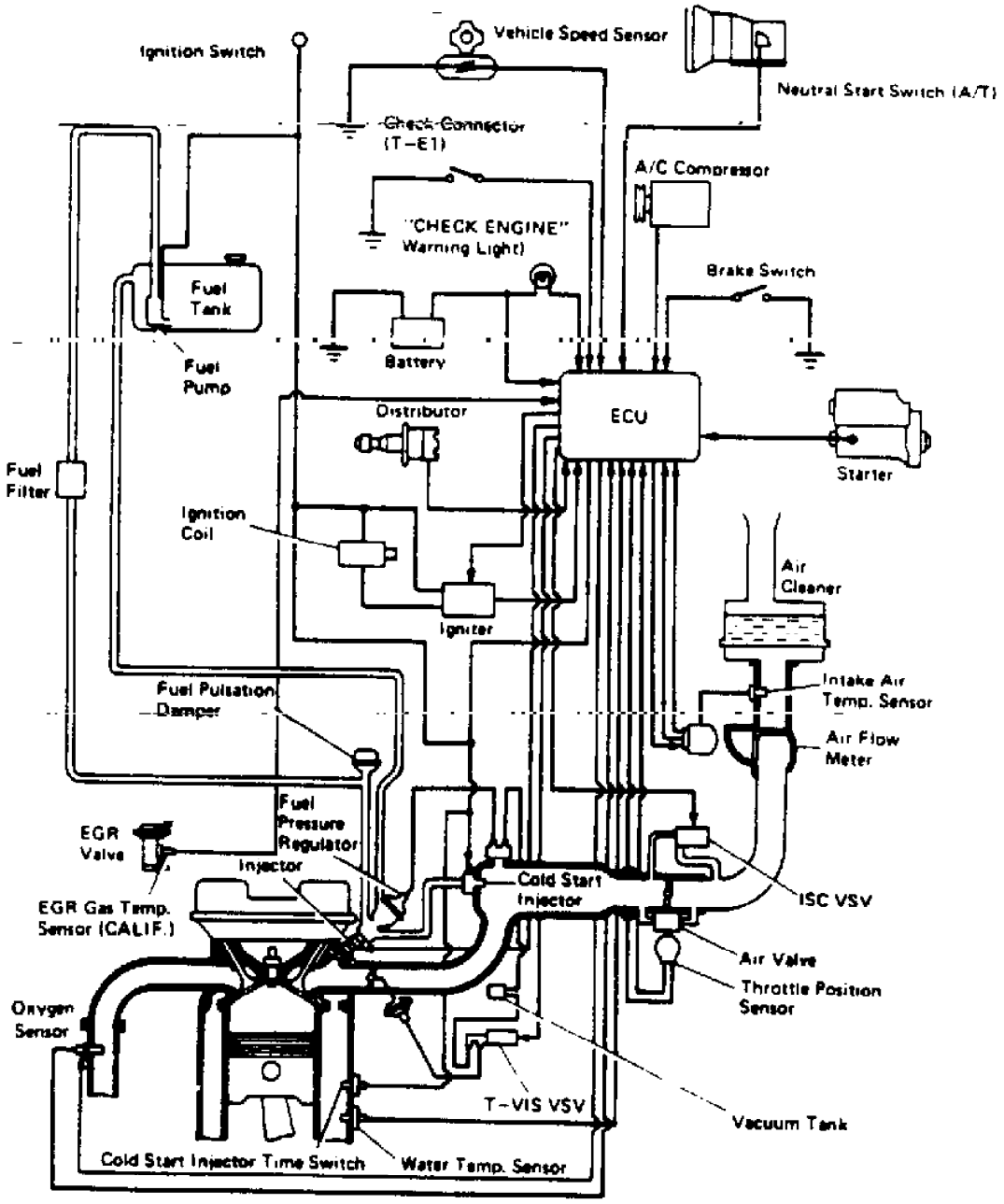

Fig. 16: Celica (3S-GE) Computer Control System
Courtesy of Toyota Motor Sales, U.S.A., Inc.

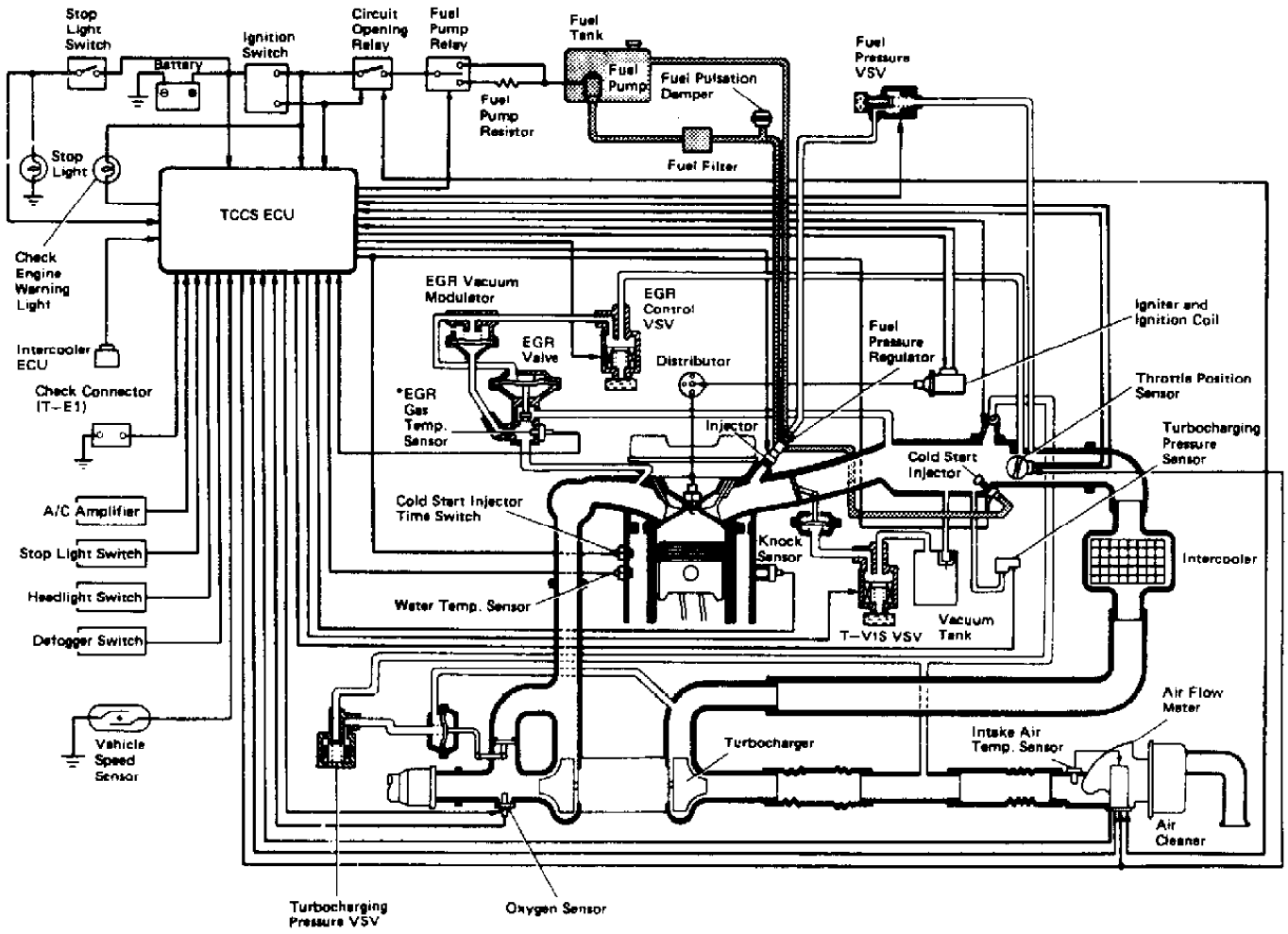

Fig. 17: Celica (3S-GTE) Computer Control System
Courtesy of Toyota Motor Sales, U.S.A., Inc.

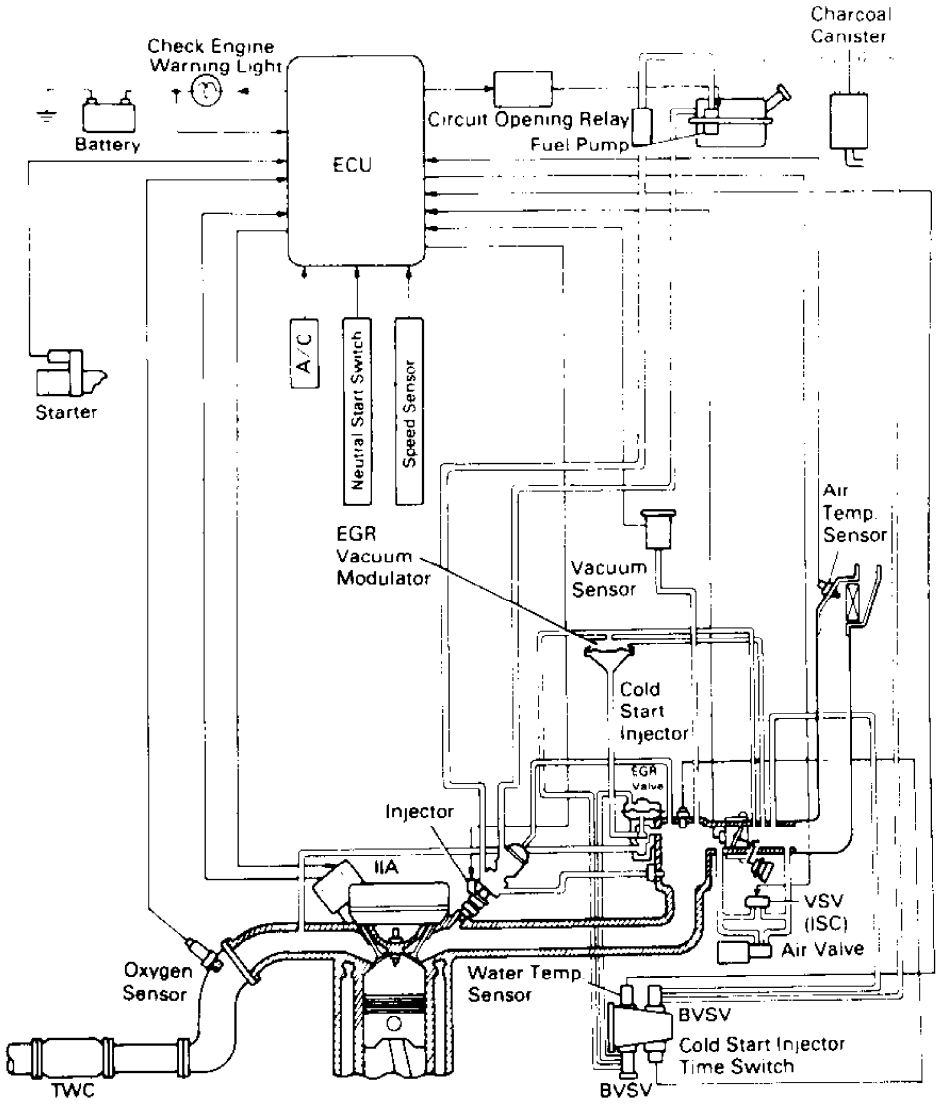

Fig. 18: Corolla (4A-FE) Computer Control System
Courtesy of Toyota Motor Sales, U.S.A., Inc.

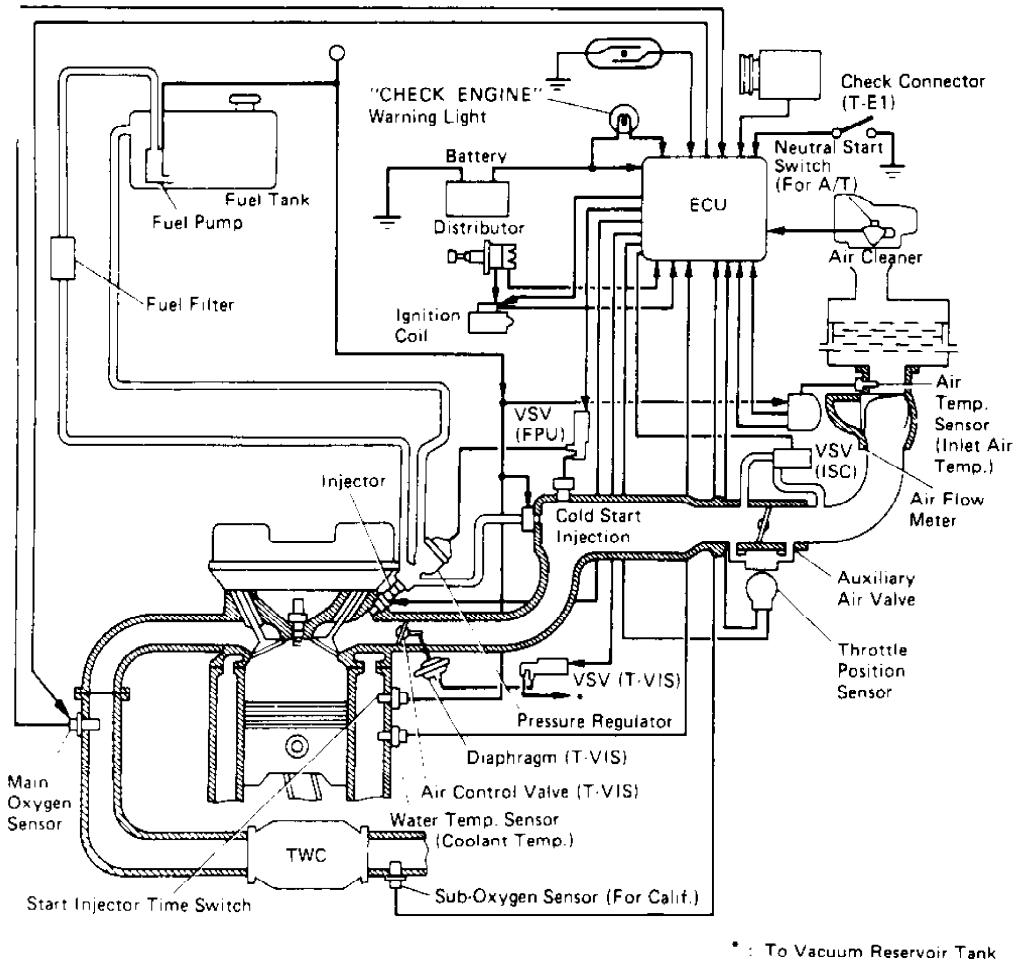

Fig. 19: Corolla (4A-GE) Computer Control System
Courtesy of Toyota Motor Sales, U.S.A., Inc.

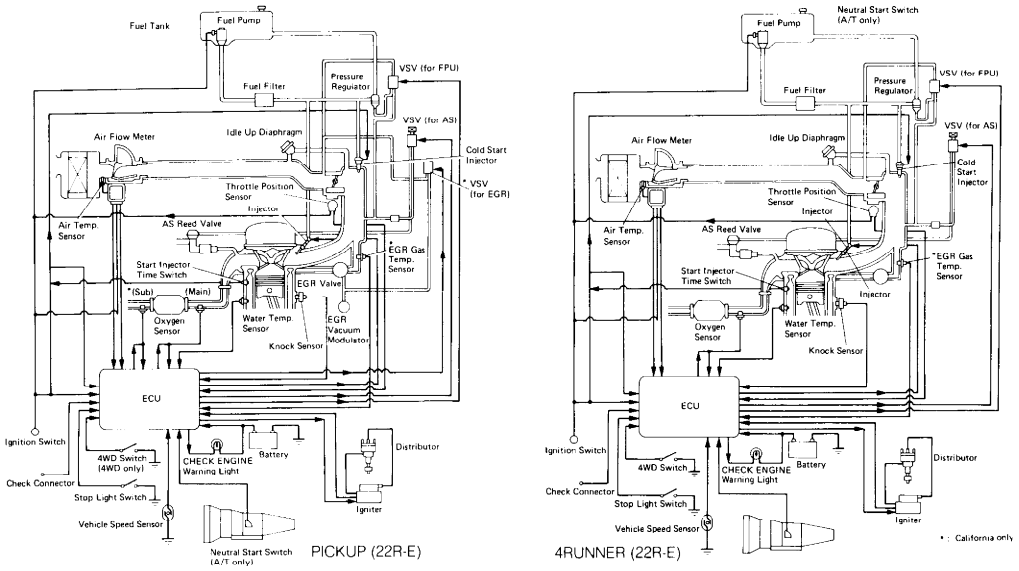

Fig. 20: Pickup & 4Runner (22R-E) Computer Control System
Courtesy of Toyota Motor Sales, U.S.A., Inc.

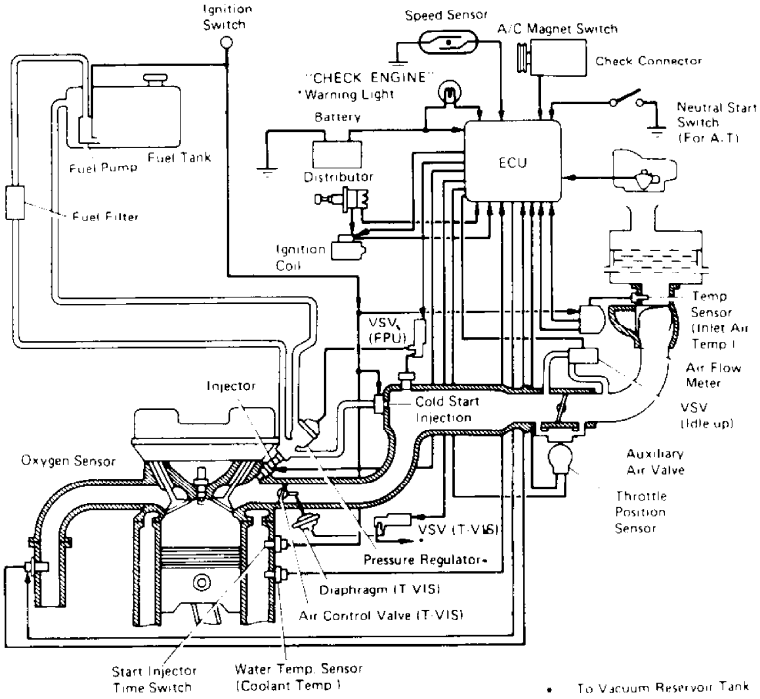

Fig. 21: MR2 Computer Control System
Courtesy of Toyota Motor Sales, U.S.A., Inc.

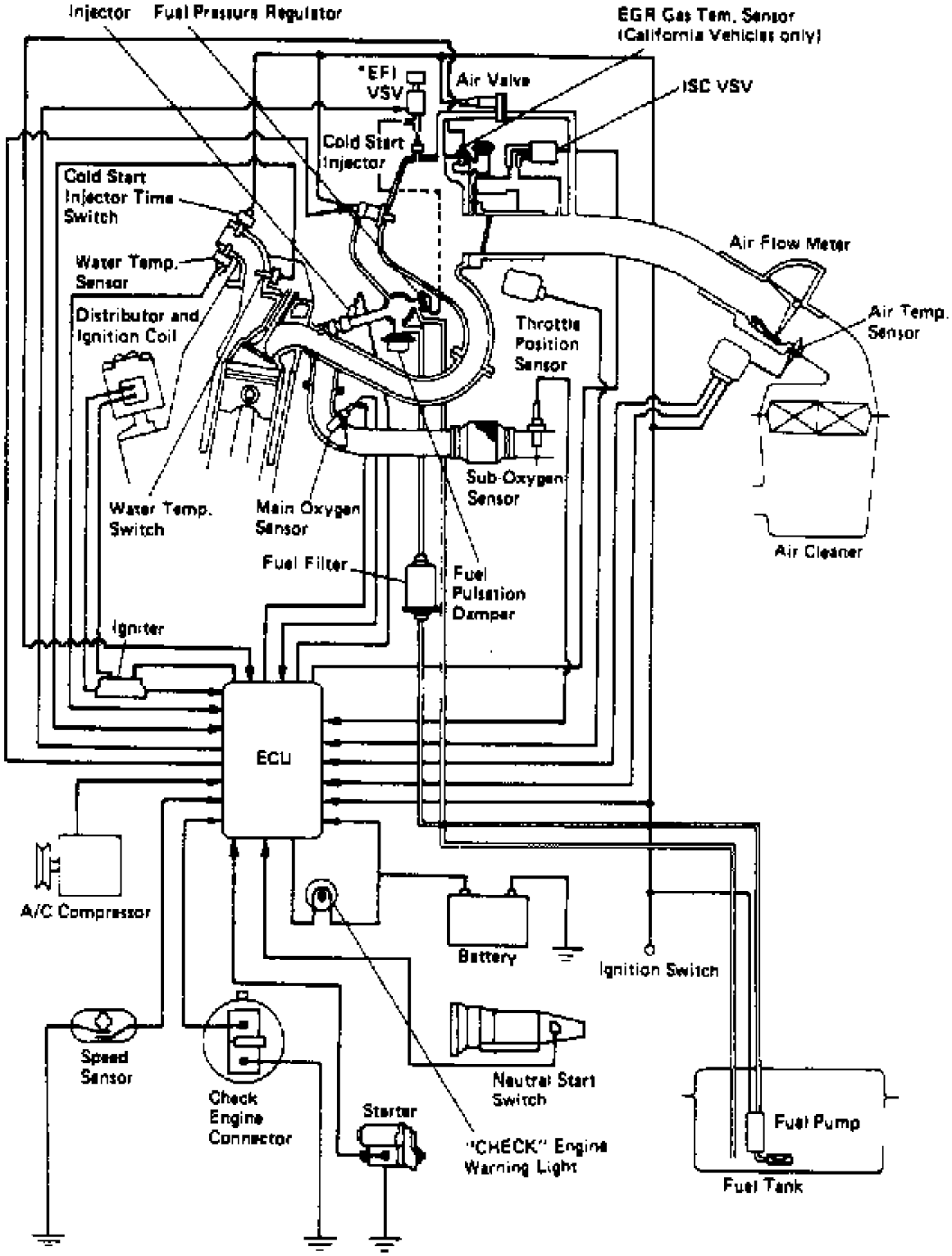

Fig. 22: Van Computer Control System
Courtesy of Toyota Motor Sales, U.S.A., Inc.

FUEL SYSTEM

FUEL DELIVERY

FUEL PUMP

All fuel injected vehicles use an electric fuel pump. Fuel pump is turned on by signal from the circuit opening relay, which in turn is controlled by the EFI main relay. Some models use a fuel pump relay. The fuel pump can be run with the engine off by turning on the ignition key and placing a jumper wire across terminals "+B" and "FP" of the engine check connector.

FUEL PRESSURE REGULATOR

Mounted on the fuel rail, the pressure regulator maintains constant fuel pressure to the injectors. An electric fuel pump provides fuel to the fuel pressure regulator. The pressure regulator is vacuum operated. As the throttle is depressed and manifold vacuum drops, the pressure regulator increases fuel pressure to maintain a constant flow to the injectors.

FUEL PRESSURE-UP SYSTEM

(Celica Turbo, Corolla (4A-GE), MR2, Pickup/4Runner (22R-E) and Van)

The fuel pressure-up system increases fuel pressure slightly on hot restarts for improved starting and idle stability. The pressure rise is accomplished by cutting off the vacuum signal to the fuel pressure regulator. The ECU controls the vacuum signal through the Vacuum Switching Valve (VSV). Pressure rise lasts for about 90-180 seconds after hot restart.

COLD START INJECTOR

All models use a cold start injector. This device delivers additional fuel for cold engine starting. ECU supplies voltage to injector, and a cold start injector time switch controls ground circuit for the cold start injector.

FUEL-CUT SYSTEM

Controlled through input from the throttle position sensor, the ECU will cut fuel delivery during closed throttle deceleration.

FUEL INJECTORS

Injectors are ECU actuated solenoids which deliver fuel to individual cylinders.

FUEL PULSATION DAMPER

The fuel pulsation damper eliminates pressure surges during vehicle operation.

NOTE: Not all models use a fuel pressure damper. See appropriate computer control system illustration for application.

FUEL CONTROL

MULTI-PORT FUEL INJECTION

All models except Corolla (4A-FE) are equipped with Bosch Airflow Controlled (AFC) fuel injection system. Corolla (4A-FE) uses "D" Jetronic type fuel injection. ECU controls injection duration in accordance with engine conditions to provide efficient engine operation. Data on engine temperature, engine and vehicle speed, intake air volume, throttle position, exhaust oxygen content, and intake air temperature are used by ECU to modify injection pulse width.

NOTE: ECU uses input signal on ignition system "IGF" wire to fire injectors. If this line is open or shorted to ground, injectors will not fire.

AIRFLOW METER

Mounted in the air induction system near the air cleaner, the airflow meter measures intake air volume.

On all models a Bosch vane airflow meter converts intake air readings into a voltage signal by means of a variable resistor (potentiometer). When intake air volume is low, the voltage is high; when the air volume is high the voltage signal is close to zero.

Corolla (4A-FE) do not use an airflow meter.

CIRCUIT OPENING RELAY

The ECU receives an input signal at the "STA" terminal when the engine is cranking. This same starter signal is also applied to terminal "STA" of the circuit opening relay.

The starter signal energizes the relay during cranking, which in turn turns on the fuel pump. On all except Corolla (4A-FE), when the airflow meter senses airflow to the engine, the fuel pump switch in the airflow meter provides an alternate ground for the relay. On Corolla (4A-FE), the ECU keeps the relay energized when engine is running.

EFI MAIN RELAY

The EFI main relay is activated by turning on the ignition switch. The EFI main relay provides battery voltage to terminals "+B" and "+B1" of ECU.

INJECTOR RESISTOR

Celica Turbo & Van

The injector resistor cuts current flow to the fuel injectors.

AIR VALVE

Van

Air valve allows extra air to flow into intake manifold when engine is cold. Air valve is fed 12 volts by the circuit opening relay and is on the same circuit as fuel pump. As the bi-metallic element in the air valve heats up, a gate valve closes the air passage.

AUXILIARY AIR VALVE

Celica (3S-GE), Corolla, MR2 & Pickup/4Runner

Auxiliary air valve provides extra air to the intake manifold

when the engine is cold. Valve is mounted on the throttle body and is fed coolant to determine engine operating temperature.

IDLE SPEED CONTROL (ISC)

Camry, Celica (Exc. 3S-GE)

The ECU is programmed with engine idle speed values. The ISC system gives a stable idle when the engine is cold and when idle speed has dropped due to electrical load. Such loads may be air conditioner, high beams or rear window defogger. The ECU receives input and controls idle speed through the idle speed control valve on the air intake system.

IDLE-UP SYSTEM

Celica (3S-GE), Corolla (4A-FE & 4A-GE), MR2 & Van

The idle-up system uses an ECU controlled vacuum switching valve to increase and stabilize idle speed due to electrical loads. The vacuum switching valve allows extra intake air to by-pass the throttle valve.

IGNITION SYSTEM

ELECTRONIC SPARK ADVANCE (ESA)

All Models

The ESA system replaces conventional mechanical and vacuum advance. The ECU controls the ignition spark advance curve for every driving condition. Spark advance is based on the following inputs: coolant temperature sensor, O2 sensor, engine RPM, vehicle speed sensor, A/C switch, 4WD operation (Pickup/4Runner only), airflow meter and cranking (starter) signal. Integrated (coil in distributor) and remote coil ignition designs are used, depending on model.

On all models except Van and Pickup (22R-E), crankshaft position and engine RPM are monitored by the ECU using permanent magnet pick-up coils in the distributor. Crankshaft position is read by ECU at "G1" terminal (and "G2" on some models), and engine RPM is input to ECU terminal "Ne". See Fig. 23.

The ECU uses the "Ne" and "G" pick-up coil inputs to switch the primary ignition circuit on and off. Primary circuit is turned off when the ECU sends a signal to the ignitor on the "IGT" wire. At the same time, the ignitor sends an "IGF" signal to the ECU. The ECU feeds voltage to the "IGF" circuit. The ground for this voltage is momentarily cut when the primary circuit is turned off. The ECU "watches" the "IGF" signal and can tell if the primary was switched on and off. After sending a command to turn off the primary circuit on the "IGT" wire, the ECU monitors the "IGF" circuit to ensure primary switching occurred. Normal cranking or running "IGF" voltage is 0.60-1.70 volts.

NOTE: The TCCS system uses the input signal on the "IGF" line to fire the injectors. If this line is open or shorted to ground, the injectors will not fire.

On Pickup (22R-E) and Van, a single pick-up coil is used in the distributor. Ignition system operation is similar to other models except there are no "G" signals. The ECU monitors the pick-up coil signal at "Ne" terminal.

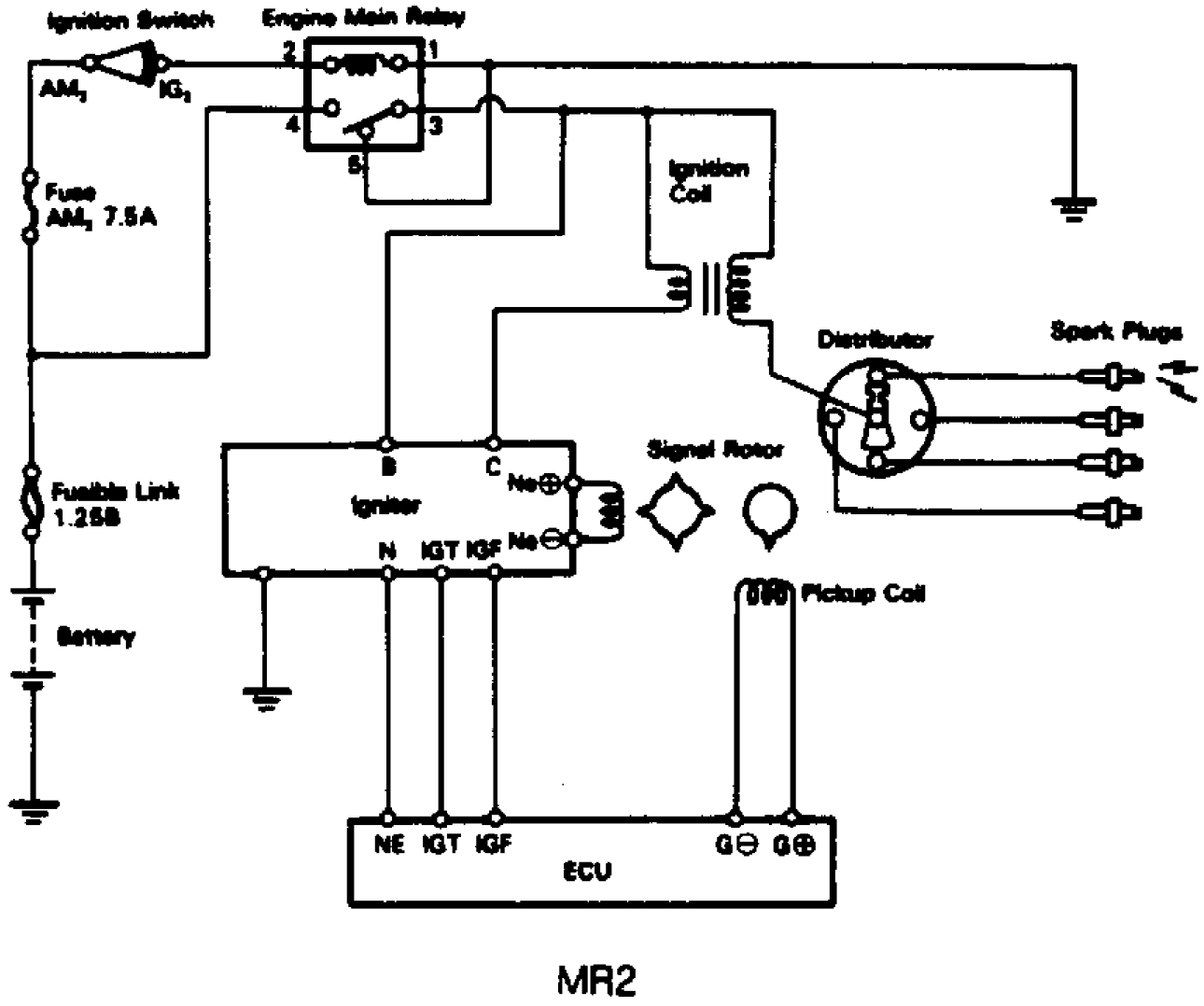

Fig. 23: Typical Toyota Ignition System Schematics - MR2
Courtesy of Toyota Motor Sales, U.S.A. Inc.

EMISSION SYSTEMS

AIR SUCTION SYSTEM

Pickup & 4Runner

The Air Suction (AS) system uses exhaust gas pulses to draw air into the exhaust manifold or catalytic converter to reduce Hydrocarbons (HC) and Carbon Monoxide (CO) emissions. The AS system works by drawing air through the air filter and reed valve into the exhaust manifold or catalytic converter. See Fig. 24. This fresh air

flow into the exhaust manifold can be turned on or off by the ECU based on inputs from coolant temperature, engine RPM, throttle valve position, and vehicle speed sensor.

AS system components and operating parameters vary between models. For specific system operating parameters and testing of system or components, see AIR INJECTION under EMISSION SYSTEMS & SUB-SYSTEMS in I - SYS/COMP TESTS article.

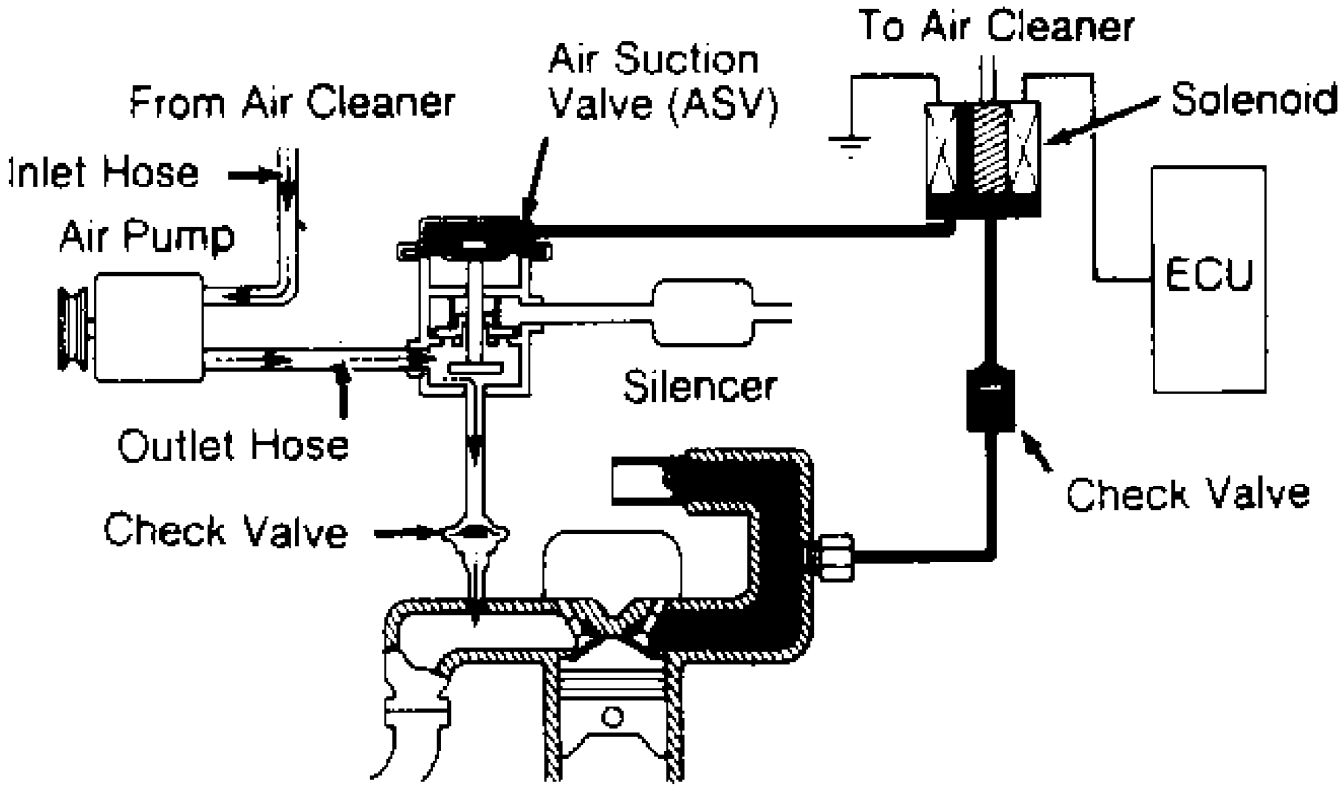

Fig. 24: Typical Air Suction System
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CRANKCASE VENTILATION

The Positive Crankcase Ventilation (PCV) system is designed to prevent contaminating hydrocarbons (HC), created in the crankcase, from escaping into the atmosphere.

Crankcase vapors are routed from the crankcase through a vacuum controlled fixed orifice or PCV valve, into the intake manifold. When vapors reach the intake manifold, they are mixed with air/fuel and burned in the combustion process. See Figs. 25 and 26.

The PCV system provides primary control by metering the flow of blow-by vapors, according to manifold vacuum. When manifold vacuum is high (at idle) the PCV restricts the flow to maintain a smooth idle condition.

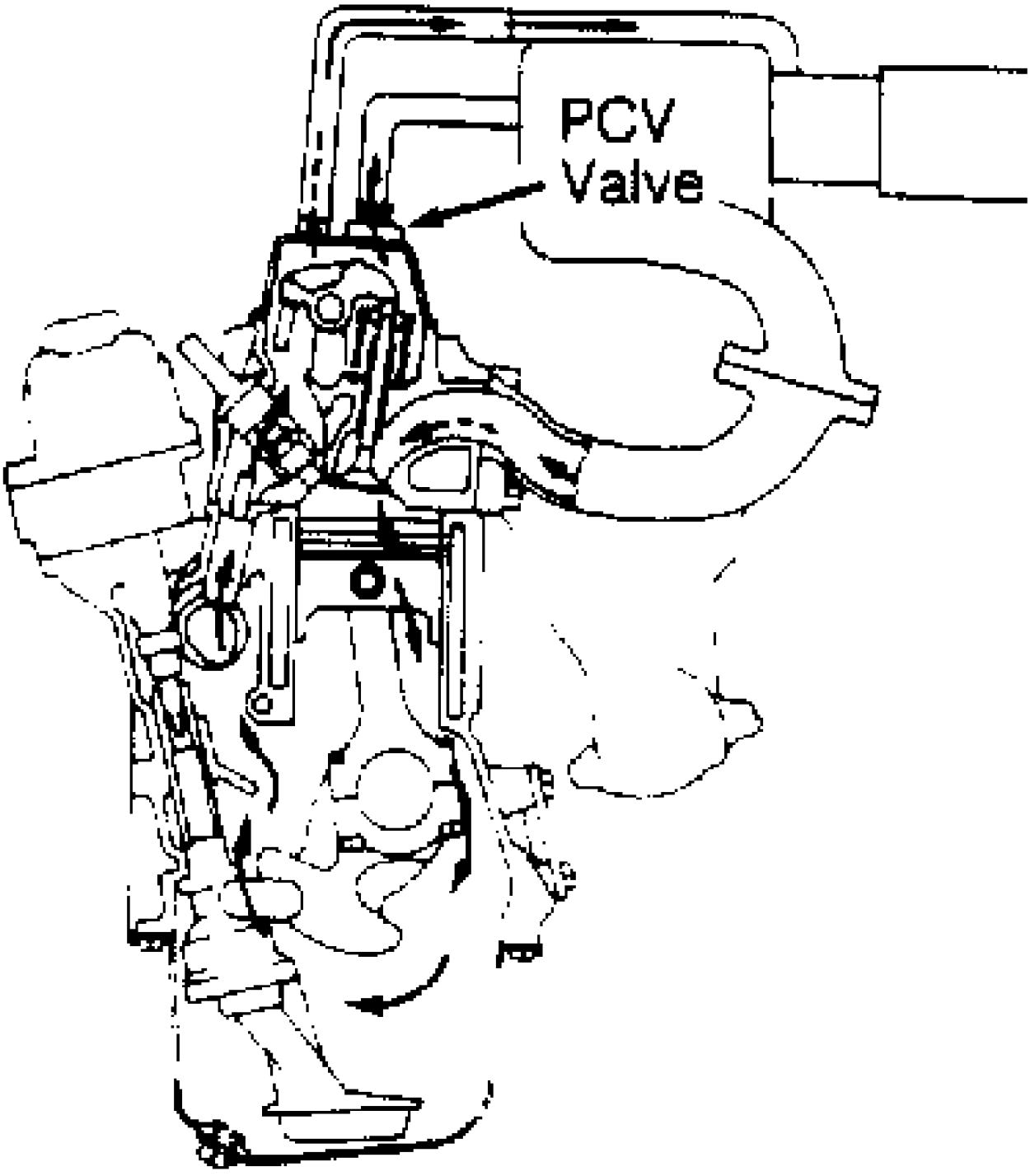

Fig. 25: Typical PCV System
Courtesy of Toyota Motor Sales, U.S.A., Inc.

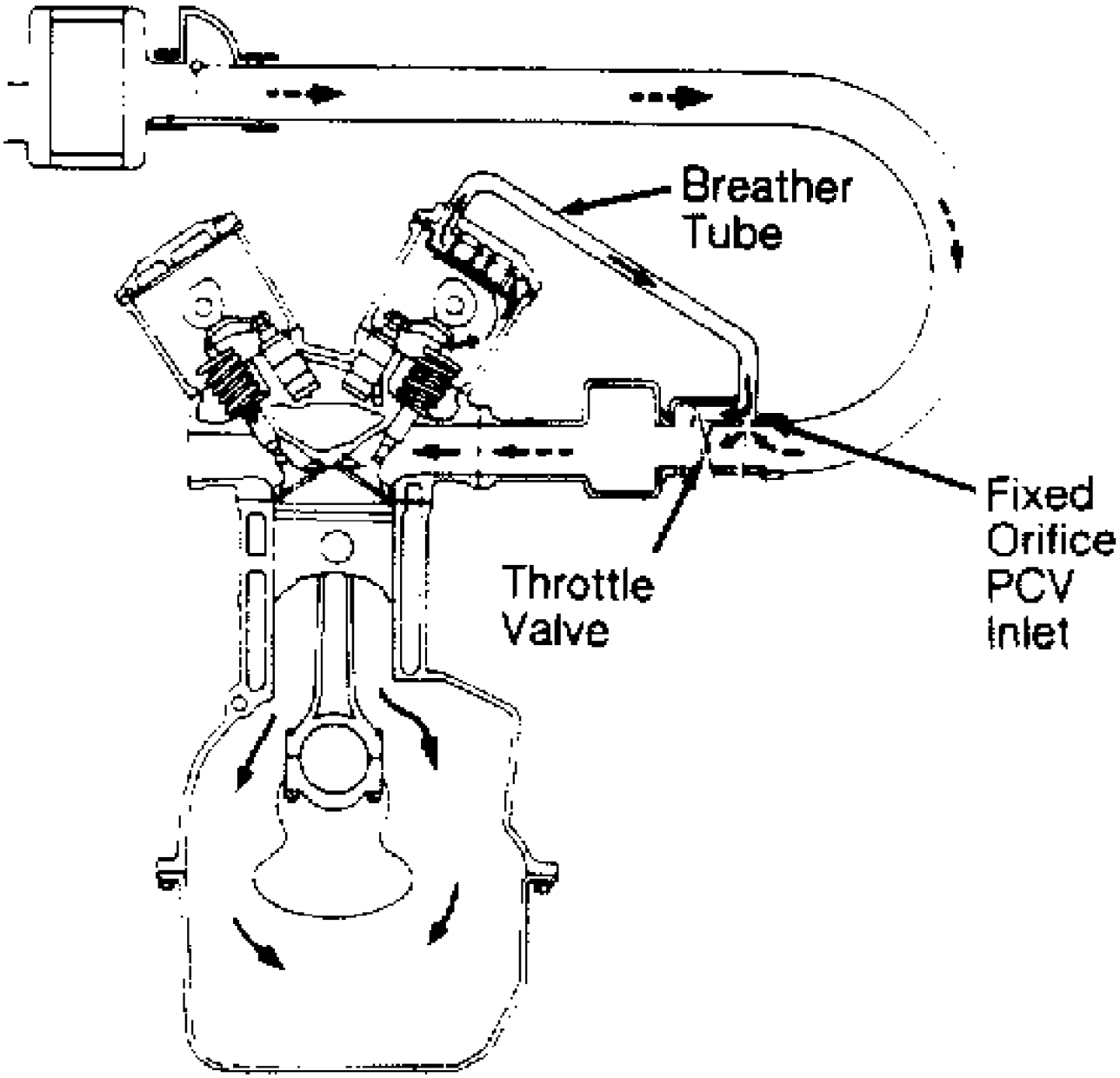

Fig. 26: Typical Fixed Orifice PCV System
Courtesy of Toyota Motor Sales, U.S.A., Inc.

DASHPOT SYSTEM

Camry, Corolla, MR2, Pickup/4Runner & Van

This system controls exhaust emissions during deceleration by holding throttle plate at an above-idle position during deceleration. This aids in complete burning of the air/fuel mixture.

DECELERATION FUEL-CUT SYSTEM

This system aids in controlling exhaust emissions and improving engine performance during prolonged periods of deceleration. The system cuts off the fuel or reduces the amount of fuel in the

mixture. The air/fuel ratio becomes lean during deceleration, therefore preventing afterburning and overheating.

The system consists of the ECU and throttle position sensor. The ECU adjusts the fuel injection duration depending on engine RPM.

EGR SYSTEM

The Exhaust Gas Recirculation (EGR) system is used to reduce NOx emissions by lowering combustion temperatures. Recycling metered amounts of exhaust gas back into the intake system lowers combustion temperatures. See Fig. 27.

When engine is below operating temperature, no exhaust gas recirculation is obtained. Increase in engine temperature allows control valves to regulate vacuum to EGR valve for gas recirculation. Vacuum modulator is used to regulate exhaust backpressure, balance atmospheric pressure and vacuum to allow EGR operation at heavy throttle.

Each system has a vacuum-operated EGR valve and a vacuum modulator. A check valve, EGR cooler and computer may also be used. Temperature sensing devices control EGR operation. Temperature sensing devices used could be a Vacuum Switching Valve (VSV), a Bi-Metallic Vacuum Switching Valve (BVSV), a Thermostatic Vacuum Switching Valve (TVSV), a Vacuum Control Valve (VCV) or a combination of these valves.

On Celica Turbo, MR2 and Pickup/4Runner models the ECU helps control EGR operation. Based on inputs from the coolant temperature sensor, engine RPM, throttle position sensor, and brake light switch, the ECU controls vacuum supply to the EGR valve. The ECU controls vacuum through a vacuum switching valve.

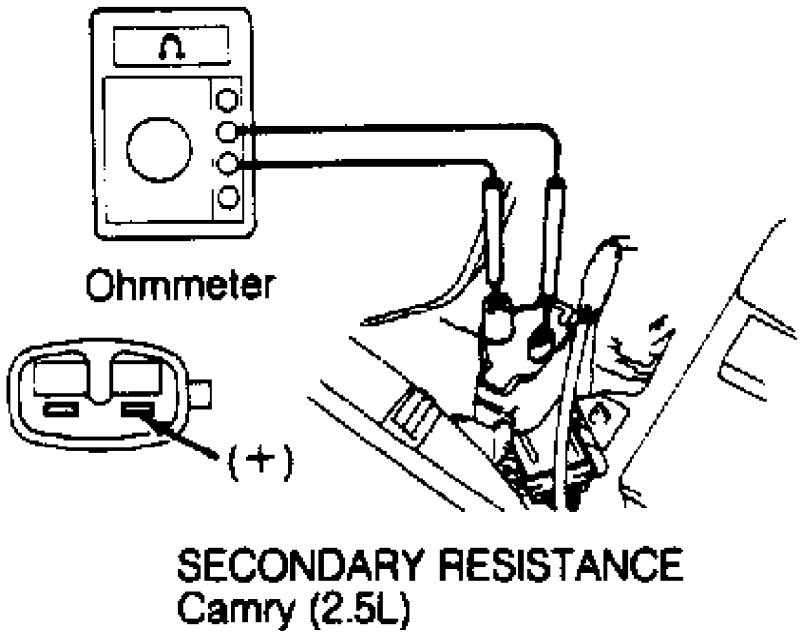

Fig. 27: Typical EGR System
Courtesy of Toyota Motor Sales, U.S.A., Inc.

EVAPORATIVE EMISSION SYSTEM

The purpose of the Fuel Evaporation Emission Control (EVAP) system is to prevent the escape of gasoline vapors (hydrocarbons) from the fuel tank into the atmosphere. To reduce Hydrocarbon (HC) emissions, evaporated fuel from the fuel tank is routed through the charcoal canister into the intake manifold for combustion in the cylinders. See Fig. 28. Various model and engine types will have different evaporative emission system components and operating parameters. For specific EVAP system operating parameters and testing of system or components on various models, see FUEL EVAPORATION under EMISSION SYSTEMS & SUB-SYSTEMS in I - SYS/COMP TESTS article.

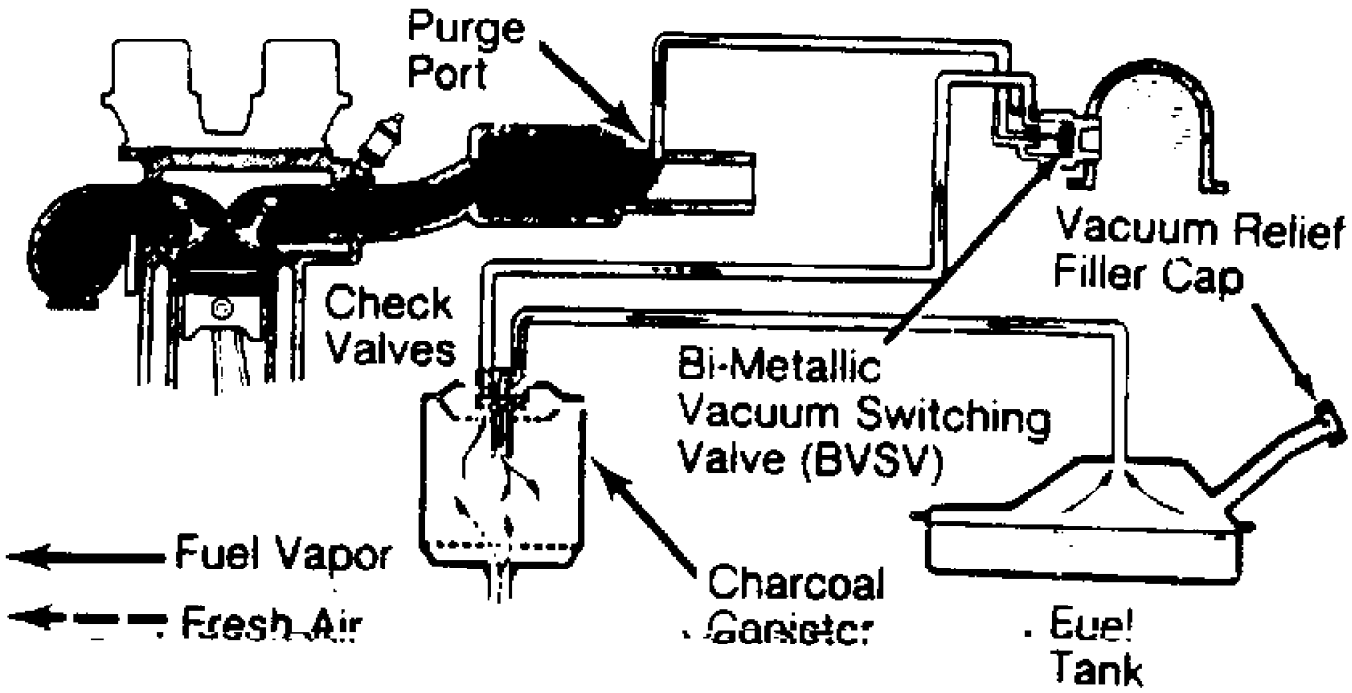

Fig. 28: Typical Fuel Evaporation System
Courtesy of Toyota Motor Sales, U.S.A., Inc.

OXYGEN SENSOR HEATER

Camry (2VZ-FE), Celica (Exc. 3S-FE), Corolla (4A-GE), MR2, Pickup/4Runner & Van

On some models the O2 sensor is equipped with a heating element. The ECU turns the heater on when intake air volume and coolant temperature are low, and warms O2 sensor to improve sensor performance.

TRANSMISSION CONTROLS

ELECTRONICALLY CONTROLLED TRANSMISSION (ECT)

On models with a separate control unit for the ECT, the engine ECU will transmit a signal to the transmission control unit to control overdrive engagement. The ECU uses input from the coolant temperature sensor to prevent a shift into overdrive when the engine is cold.

Some models do not have a separate control unit for the transmission. All shift functions are controlled by the engine ECU. See ECT CONTROL UNIT APPLICATION table.

ECT CONTROL UNIT APPLICATION TABLE

Model	Separate ECT Unit	Controlled By TCCS
Camry (4-Cyl.)	X	...
Camry (All-Trac)	X	...
Celica	X	...
MR2	X	...

SELF-DIAGNOSTIC SYSTEM

The ECU is equipped with a self-diagnostic system which detects system failures or abnormalities. When malfunction occurs, the "CHECK ENGINE" light on instrument panel is activated.

By analyzing various input signals, the ECU detects system malfunctions related to various operating parameter sensors. The ECU stores trouble codes associated with the detected failure until the diagnostic system is cleared. The "CHECK ENGINE" light will go out when trouble codes are cleared.

NOTE: Federal models of the Corolla (4A-F), Pickup (22R) and Tercel are not equipped with self-diagnostic systems.