

ENGINE CONTROL SYSTEM

1. General

The engine control system for the new 4A-FE and 7A-FE engines have the same basic construction and operation as the engine control system in the previous 4A-FE engine. In the new engines, a rotary solenoid type IAC [ISC] valve is used in the IAC [ISC] system and a test mode function has been added to the diagnosis system to achieve an engine control system which matches the new engines. In the 7A-FE engine, a knocking correction function using a knock sensor is also added.

Comparison of the engine control system between the new engines and previous 4A-FE engine is as follows:

System	Outline	New		Previous
		4A-FE	7A-FE	4A-FE
MFI*1 [EFI] ☞ Page 43	A D-Type MFI [EFI] system is used, which indirectly detects intake air volume by the manifold absolute pressure sensor signal.	○	○	○
	The fuel injection system is a 2-group type, each of which injects two cylinders simultaneously.	○	○	—
	The fuel injection system is a simultaneous all-cylinders injection system.	—	—	○
Cold Start Injector Control	The injection duration of the cold start injector is controlled by the start injector time switch.	—	—	○
EI*2 [ESA] ☞ Page 43	Ignition timing is determined by the ECM*4 [ECU] based on signals from various sensors.	○	○	○
	It retards ignition timing to suppress knocking when it occurs.	—	○	—
	In vehicle equipped with automatic trans-axle, torque control compensation during gear shifting is used to minimize the shift shock.	—	○	—
IAC*3 [ISC] ☞ Page 44	A rotary solenoid type IAC [ISC] valve is used, which controls the fast idle and idle speeds.	○	○	—
	A duty control VSV type IAC valve [ACV] regulates air volume bypassing the throttle valve and controls idling speed.	—	—	○
Fuel Pump Control	Fuel pump operation is controlled by signals from the ECM [ECU] based on the engine speed signal (NE).	○	○	○

*1: MFI (Multiport Fuel Injection)

*2: EI (Electronic Ignition)

*3: IAC (Idle Air Control)

*4: ECM (Engine Control Module)

System	Outline	New		Previous
		4A-FE	7A-FE	4A-FE
EGR Cut-Off Control	The EGR is cut off under light engine loads or low temperature conditions to maintain drivability.	○*1	○*1	○*2
Air Conditioning Cut-Off Control*3	By controlling the air conditioning compressor in accordance with the throttle valve opening angle and the vehicle speed, drivability is maintained.	○	○	○
Diagnosis ☞ Page 44	When a malfunction occurs, the ECM*4 [ECU] diagnoses and memorizes the failed section.	○	○	○
	A test mode function has been added.	○	○	—
Fail-Safe ☞ Page 46	When a malfunction occurs, the ECM*4 [ECU] stops or controls the engine according to the data already stored in memory.	○	○	○


*1: California specification vehicle only.

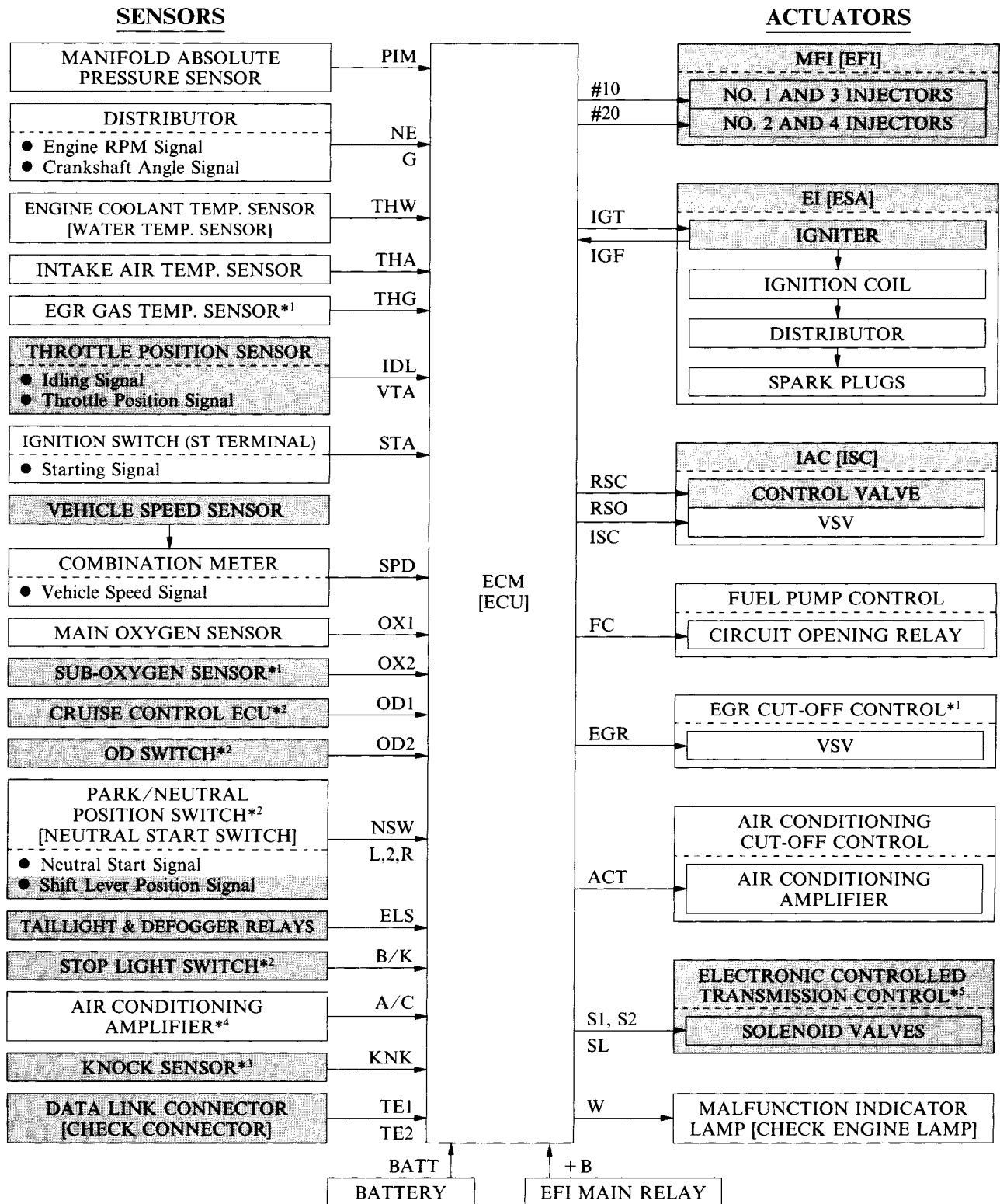
*2: 2WD for California specification and 4WD vehicles.

*3: Models with air conditioning.

*4: ECM (Engine Control Module)

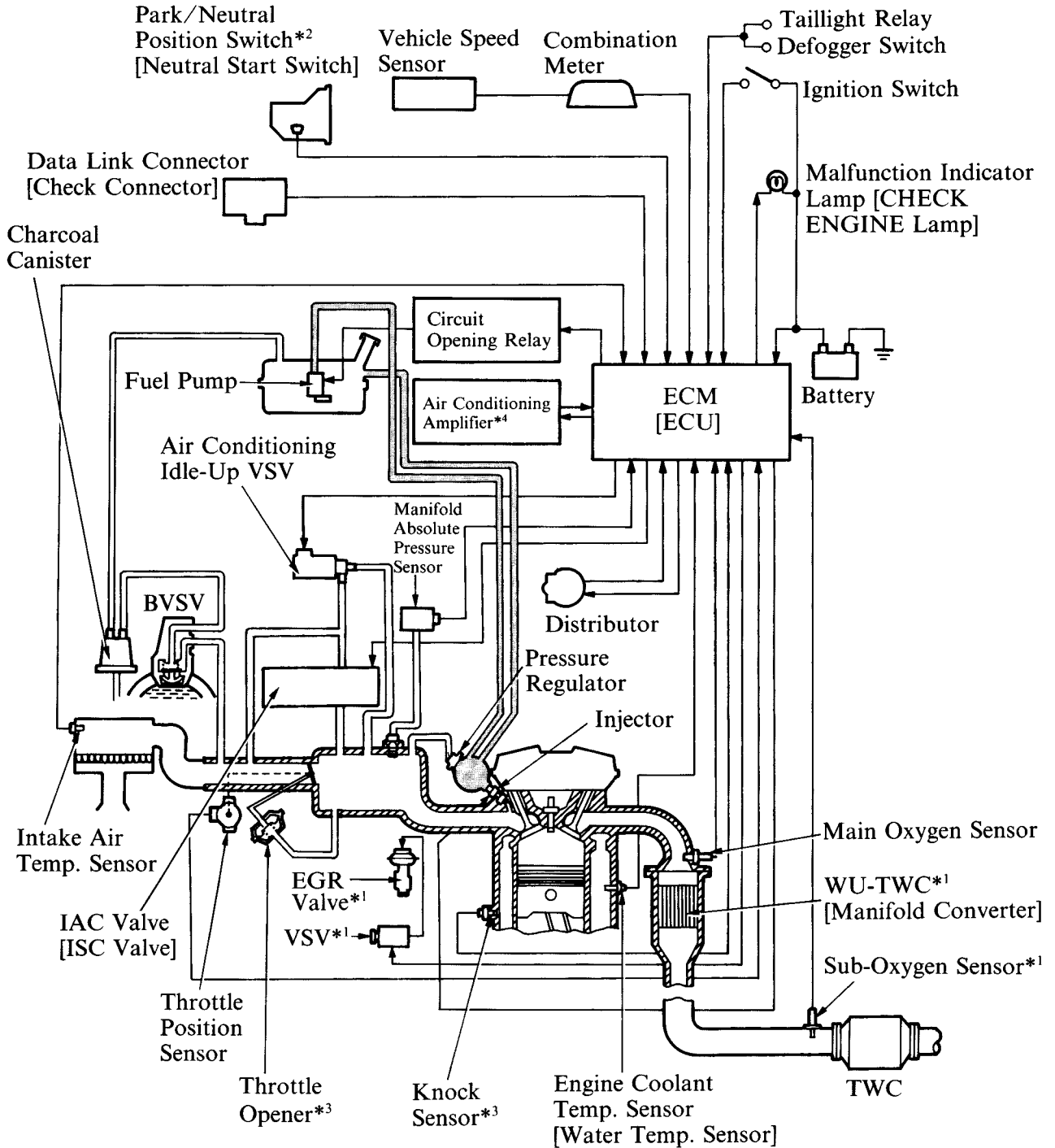
2. Construction

The configuration of the engine control system in the new 4A-FE and 7A-FE engine is as shown in the following chart. Shaded portions  differ from the previous 4A-FE engine.



*1: Applicable only to California specification vehicles.
 *2: Applicable only to automatic transaxle vehicles.
 *3: Applicable only to vehicles with 7A-FE engine.
 *4: Applicable only to vehicles with air conditioning.
 *5: Applicable only 7A-FE engine vehicles with automatic transaxle.

4. Engine Control System Diagram



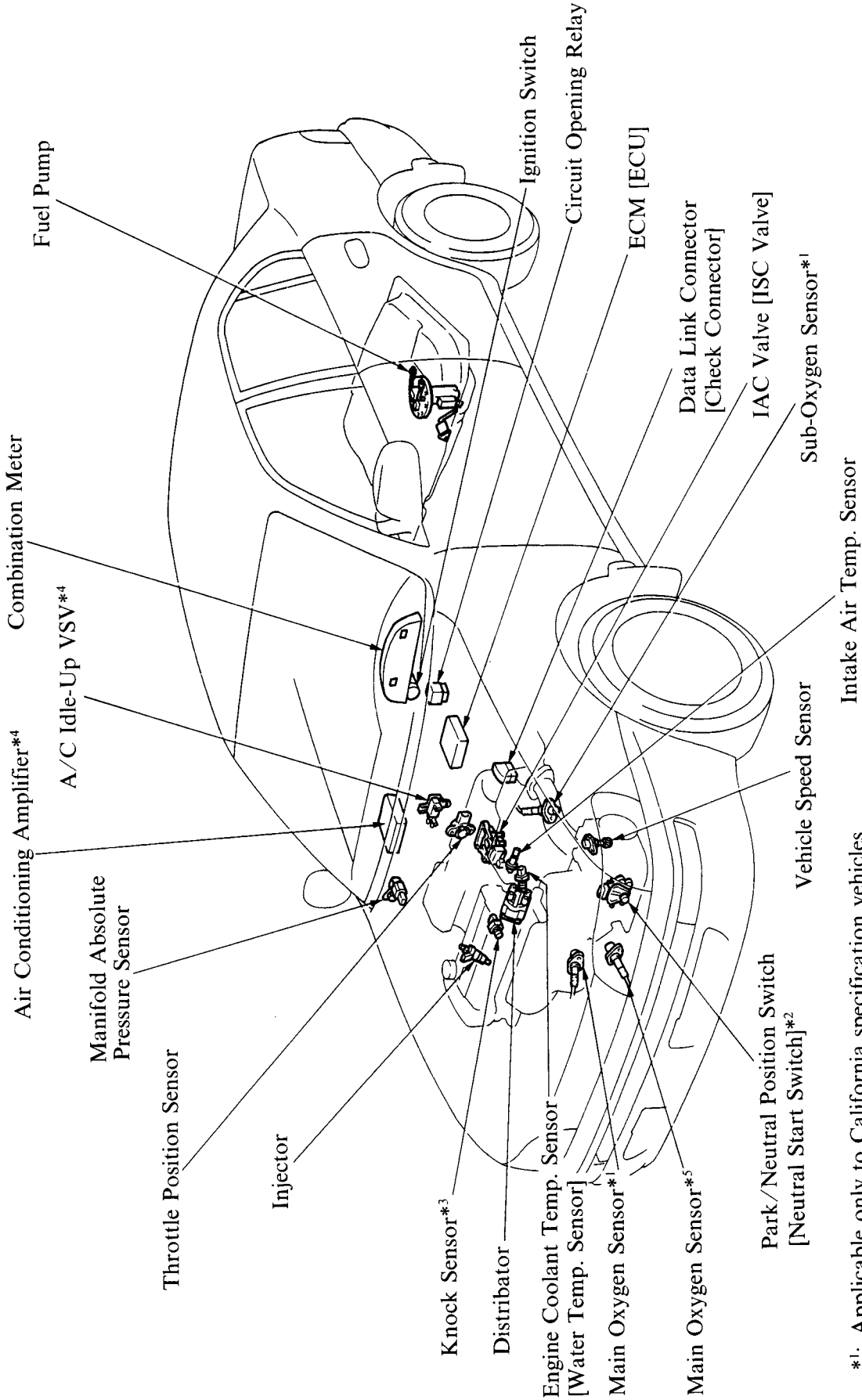
*1: Applicable only to California specification vehicles.

*2: Applicable only to automatic transaxle vehicles.

*3: Applicable only to vehicles with 7A-FE engine.

*4: Applicable only to vehicles with air conditioning.

5. Layout of Components



- *1: Applicable only to California specification vehicles.
- *2: Applicable only to automatic transaxle vehicles.
- *3: Applicable only to vehicles with 7A-FE engine.
- *4: Applicable only to vehicles with air conditioning.
- *5: Except California specification vehicles.

6. Modification of Main Components

Major modification in main components of the 4A-FE and 7A-FE engines are shown below.

Model		New		Previous	Reference manuals
Engine		4A-FE	7A-FE	4A-FE	
Component					
Throttle Position Sensor		Linear Type	←	Point Type	'87 CAMRY (NCF014U), TD-17
Oxygen Sensor	Main	without Heater, 1	←	without Heater, 1	'87 CAMRY (NCF014U), TD-18
	Sub*	without Heater, 1	←	N.A.	
Knock Sensor		N.A.	Built-In Piezoelectric Element Type	N.A.	'88 CELICA All-Trac/4WD (NCF033U), TD-31
Distributor	Engine RPM Sensor	2 Pick-Up Coils 4 Teeth	←	1 Pick-Up Coil 24 Teeth	'92 PASEO (NCF074U), page 38
	Camshaft Position Sensor	1 Pick-Up Coil 1 Tooth	←	1 Pick-Up Coil 4 Teeth	

*: California specification vehicles only.

7. MFI [EFI] System

General

The MFI [EFI] system in the new 4A-FE and 7A-FE engines are basically the same as that of the previous 4A-FE engine. However, the fuel injection pattern has changed from the simultaneous injection type to the 2-group injection type, as in the 5S-FE engine for the '92 Camry. Refer to page 50 of '92 Camry New Car Features (Pub. No. NCF077U) for details.

8. EI [ESA] System

General

The following changes were made in the electronic ignition system [ESA] of the new 4A-FE and 7A-FE engines.

Item	Outline of change	Applicable engine	Reference manuals
Roles of ECM [ECU] and igniter	Terms of the roles of the ECM [ECU] and igniter are changed.	4A-FE and 7A-FE	'91 TERCEL (NCF071U), page 51
Knocking correction	A knocking correction using a knock sensor is added.	7A-FE	'88 CELICA All-Trac 4WD (NCF033U), TD-35
Torque control compension	A torque control compensation during shifting is added.	7A-FE with automatic transaxle	'90 CELICA (NCF056U), page 86

9. IAC [ISC] System

General

A duty control VSV type IAC [ISC] valve in the previous 4A-FE engine was replaced by a rotary solenoid type valve in the new 4A-FE and 7A-FE engines. The new type offers improved response and reliability. This valve is basically the same in construction and operation as that of the '90 Celica. Refer to Page 87 of '90 Celica New Car Features (Pub. No. NCF056U) for details.


In the previous 4A-FE engine, the idle speed was controlled only by the IAC [ISA] valve. In the new engines, a VSV is used to increase the idle while the air conditioning is in operation. In addition, the IAC [ISC] system was changed to a new one that varies the target idling speed in accordance with the condition of the air conditioning. These systems are basically the same as those in the 5S-FE engine for the '92 Camry.

The difference from the '92 Camry is that this system has an electrical load signal (ELS) added to the relevant signals. The target idle speed thus varies according to electrical loads such as the taillights or defogger. Refer to page 51 of '92 Camry New Car Features (Pub. No. NCF077U) for details.

10. Diagnosis

As in the '89 Cressida, a test mode function has been added to the diagnosis system. For details of this function, see page TD-20 of '89 Cressida New Car Features (Pub. No. NCF044U).

Diagnostic Items

Diagnostic items for the new 4A-FE and 7A-FE engines are shown below. Information in the shaded area  applies only to the 7A-FE engine.

Code No.	Item	Diagnostic Mode*1		Diagnosis	Malfunction Stored in Memory
		Normal	Test		
12	RPM Signal	○	—	<ul style="list-style-type: none"> ● No "NE" signal to ECM [ECU] within 2 seconds after engine is cranked. ● No "G" signal to ECM [ECU] for 3 seconds when the engine speed is between 600 rpm and 4000 rpm. 	Yes
13	RPM Signal	○	—	No "NE" signal to ECM [ECU] when the engine speed is above 1500 rpm.	Yes
		—	○	No "G" signal to ECM [ECU] while "NE" signal is input 4 times to ECM [ECU] when engine speed is between 500 rpm and 4000 rpm.	Yes
14	Ignition Signal	○	—	No "IGF" signal to ECM [ECU] 4 times in succession.	Yes
16*2	Electronic Controlled Transmission Control Signal	○	—	Electronic Controlled Transmission control program faulty.	No
21	Main Oxygen Sensor Signal	○	○	During air-fuel ratio feedback correction, output voltage of main oxygen sensor remains between 0.35V and 0.7V continuously for a certain period.	Yes

Code No.	Item	Diagnostic Mode*1		Diagnosis	Malfunction Stored in Memory
		Normal	Test		
22	Engine Coolant Temp. Sensor Signal [Water Temp. Sensor Signal]	○	○	Open or short circuit in engine coolant temp. sensor signal [water temp. sensor signal] (THW).	Yes
24	Intake Air Temp. Sensor Signal	○	○	Open or short circuit in intake air temp. sensor signal (THA).	Yes
25	Air-Fuel Ratio Lean Malfunction	○*3	○*3	Open or short circuit in main oxygen sensor signal (OX1).	Yes
26	Air-Fuel Ratio Rich Malfunction	○*4	○*4	When marked variation is detected in engine revolutions during idle switch on and feedback condition.	Yes
27	Sub-Oxygen Sensor Signal	○*4	○*4	Open or short circuit in sub-oxygen sensor signal (OX2).	Yes
31	Manifold Absolute Pressure Sensor Signal	○	○	Open or short circuit in manifold absolute pressure sensor signal (PIM).	Yes
41	Throttle Position Sensor Signal	○*5	○	Open or short circuit in throttle position sensor signal (VTA).	Yes
42	Vehicle Speed Sensor Signal	○	—	No “SPD” signal to ECM [ECU] for 8 seconds when vehicle is running.	Yes
		—	X	No “SPD” signal input to ECM [ECU] after ignition switch is turned on.	No
43	Starter Signal	—	X	No “STA” signal input to ECM [ECU] after ignition switch is turned on.	No
52	Knock Sensor Signal	○	—	Open or short circuit in knock sensor signal (KNK).	Yes
71	EGR System Malfunction	○*4	○*4	<ul style="list-style-type: none"> ● EGR gas temp. below a predetermined level during EGR operation. ● Open circuit in EGR gas temp. sensor signal (THG). 	Yes
51	Switch Condition Signal	—	X	No “IDL” signal or no “NSW” signal or “A/C” signal to ECM [ECU] during diagnosis code check for test mode.	No

*1: ○ mark in the diagnostic mode column indicates that the malfunction indicator lamp [CHECK ENGINE lamp] will light up when a diagnosis is conducted and a malfunction is detected. X mark indicates that the lamp will not light up even if a malfunction is detected during a diagnosis. — mark indicates that diagnosis is not performed for that item.

*2: Models with automatic transaxle only.

*3: When a malfunction occurs, only code No. 25 is stored.

*4: This diagnosis occurs only for California specification vehicles. If a malfunction occurs involving a lean or rich air-fuel ratio, code Nos. 25 and 26 are stored simultaneously in the ECM [ECU].

*5: In the normal mode, when a malfunction occurs in code No. 41, the malfunction indicator lamp [CHECK ENGINE lamp] lights up only in California specification vehicles.

11. Fail-Safe

The fail-safe functions of the new 4A-FE engine are the same as those of the previous model. Note, however, that fail-safe functions related to the knock sensor and the electronic controlled transmission are added in the 7A-FE engine. These functions are the same as those in the 5S-FE engine for the '92 Camry. Refer to page 53 of '92 Camry New Car Features (Pub. No. NCF077U) for details.