

2001-02 AUTOMATIC TRANSMISSIONS

U140E & U140F Diagnosis

APPLICATION

WARNING: Vehicle is equipped with Supplemental Inflatable Restraint (SIR) system. When servicing vehicle, use care to avoid accidental air bag deployment. SIR system-related components are located in various locations throughout interior and exterior of vehicle, depending on application. Do not use electrical test equipment on or near these circuits. If necessary, deactivate SIR system before servicing components. See AIR BAG DEACTIVATION PROCEDURES article in GENERAL INFORMATION.

TRANSAXLE APPLICATION

Application	Transaxle Model
Lexus	
ES 300	U140E
RX 300	
2WD	U140E
4WD	U140F
Toyota	
Camry 3.0L	U140E
Highlander	
2WD	U140E
4WD	U140F
RAV4	
2WD	U241E
4WD	U140F

IDENTIFICATION

Vehicle Identification Number (VIN) is used for correct identification of component parts and assemblies. VIN locations are at top left corner of instrument panel and on driver's door post. See **Fig. 1 -Fig. 4** .

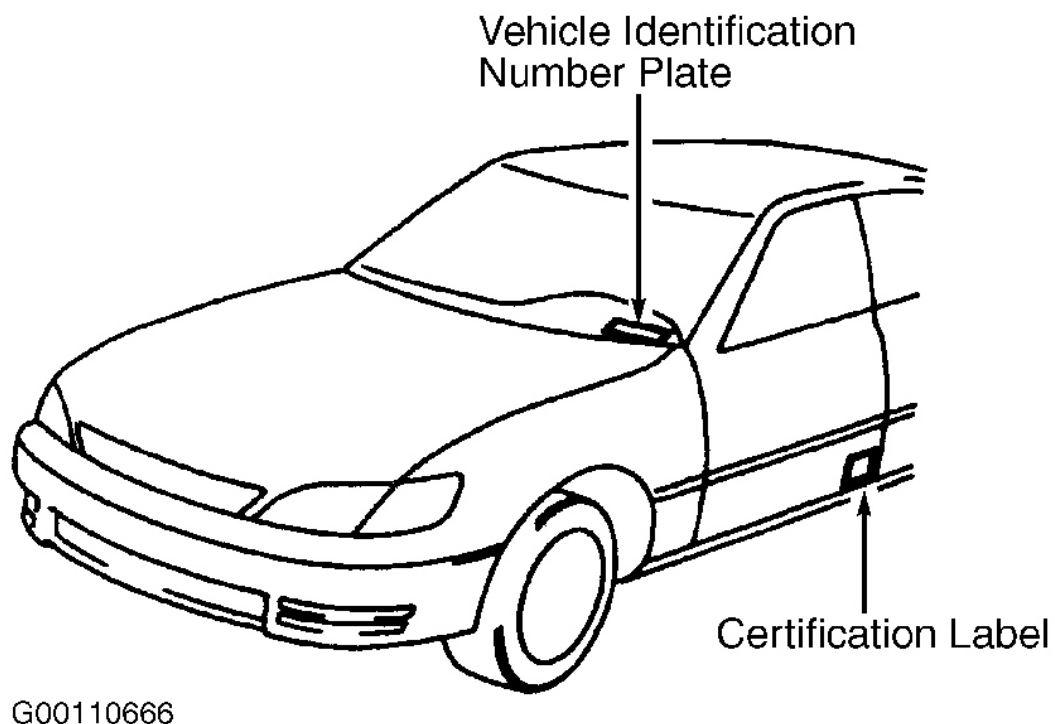
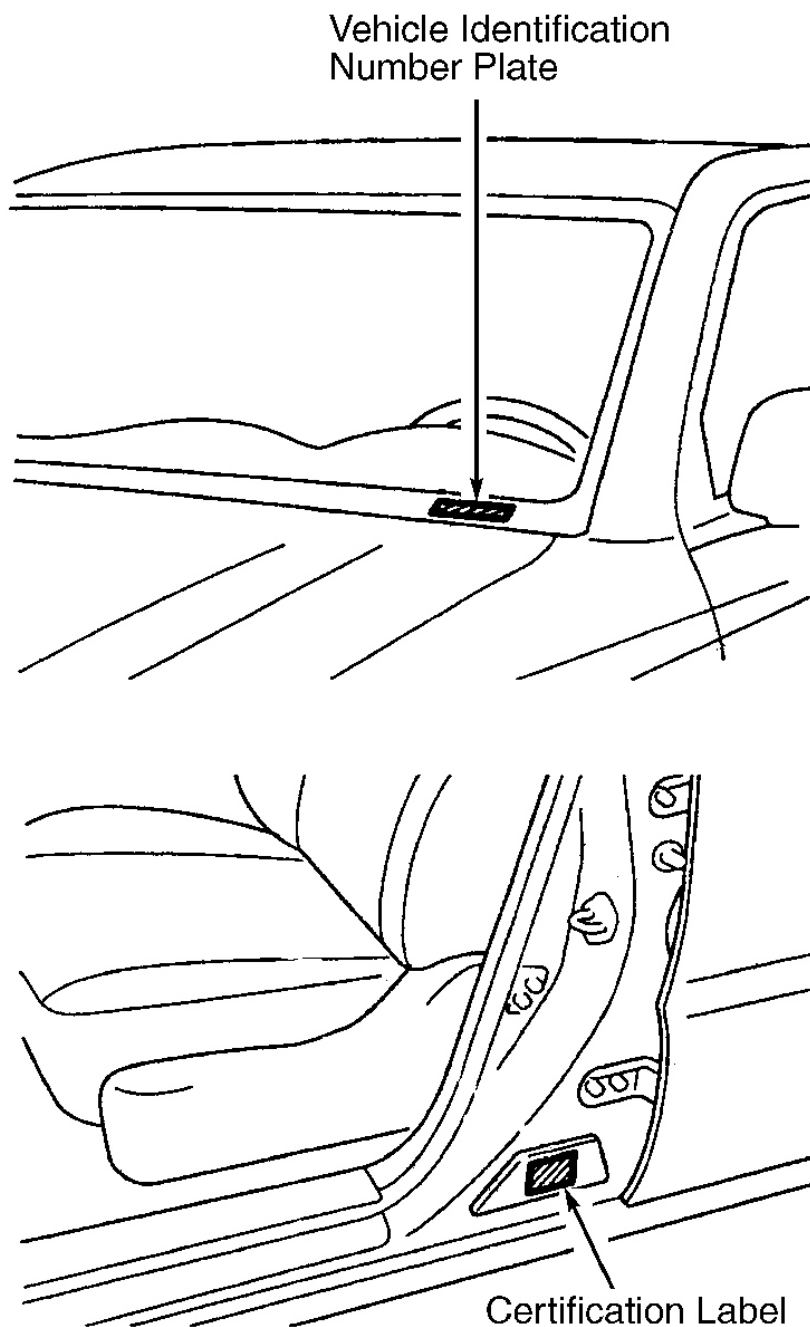
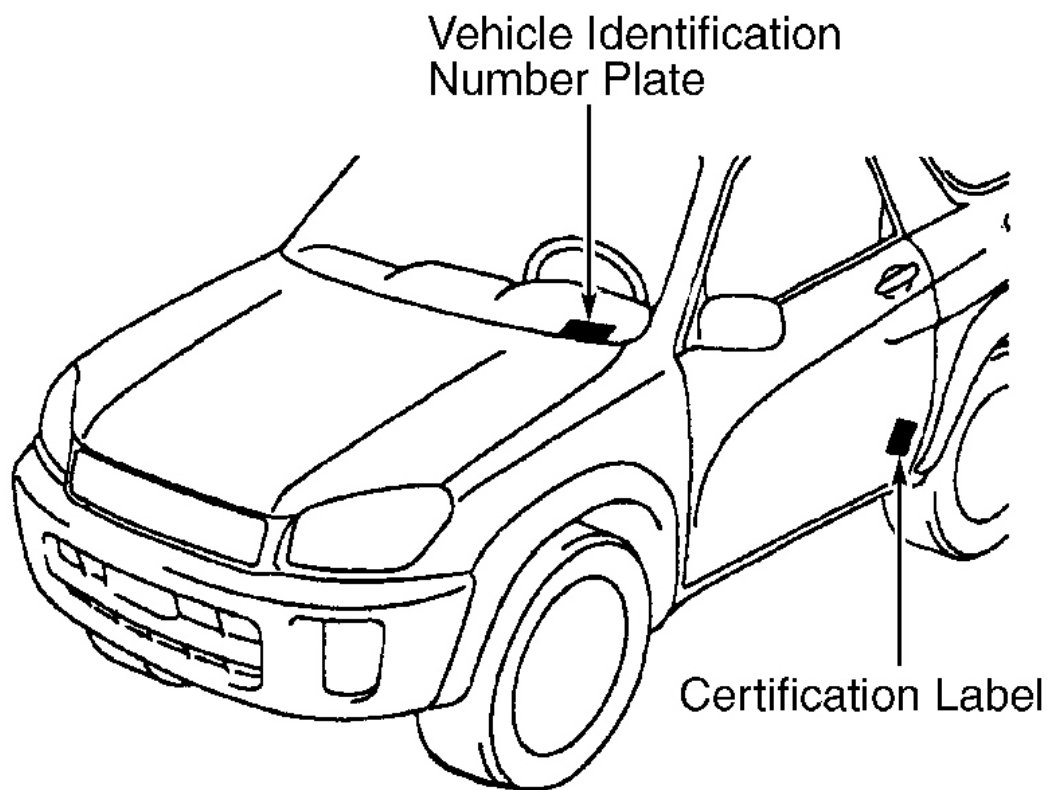


Fig. 1: Locating Vehicle Identification Number Plate (Camry & ES 300)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



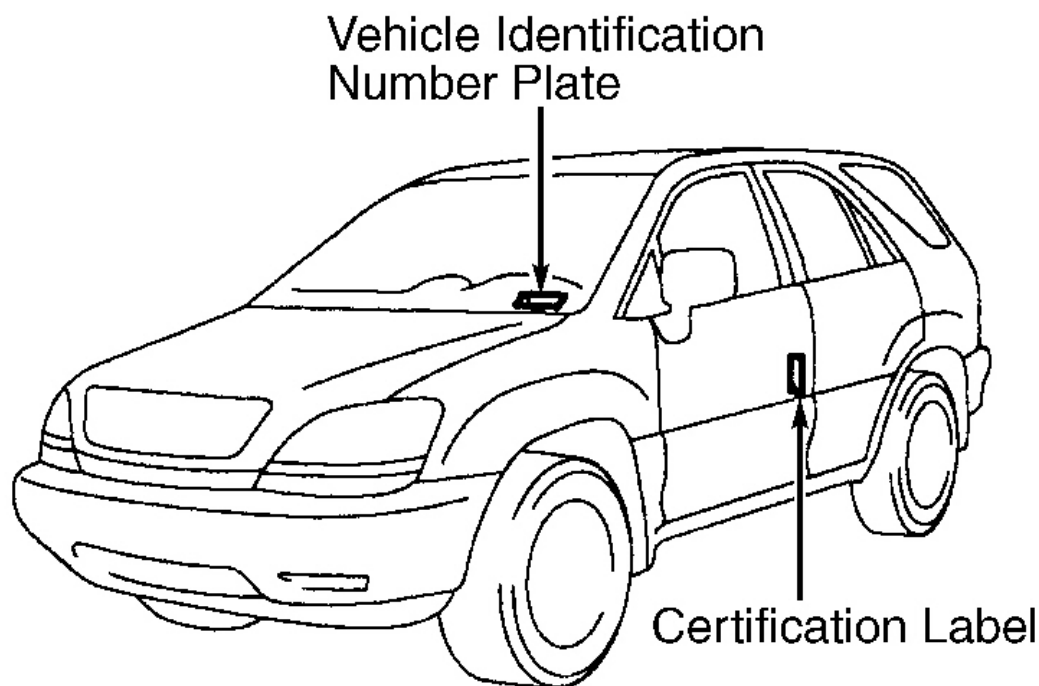
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Fig. 2: Locating Vehicle Identification Number Plates (Highlander)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 3: Locating Vehicle Identification Number Plates (RAV4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 4: Locating Vehicle Identification Number Plates (RX 300)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DESCRIPTION & OPERATION

INTRODUCTION

The U140E and U140F automatic transaxles are electronically controlled. Transaxle shifting and torque converter lock-up are controlled by an Electronic Control Module (ECM).

ECM receives information from various input devices and uses this information to control shift solenoids for transaxle shifting and torque converter lock-up.

An Overdrive (OD) switch is mounted on the selector lever. When OD switch is depressed to ON position, transaxle will shift into 4th gear when selector lever is in "D" position, and OD OFF light on instrument panel will go off. When OD switch is released to OFF position, transaxle will shift into 3rd gear, and OD OFF light will illuminate.

A pattern select switch is located near selector lever on center console. Pattern select switch contains a POWER (PWR), NORMAL and SNOW operating positions. When pattern select switch is depressed to PWR position, transaxle upshifts and downshifts will occur at a higher vehicle speed than with switch released. An indicator

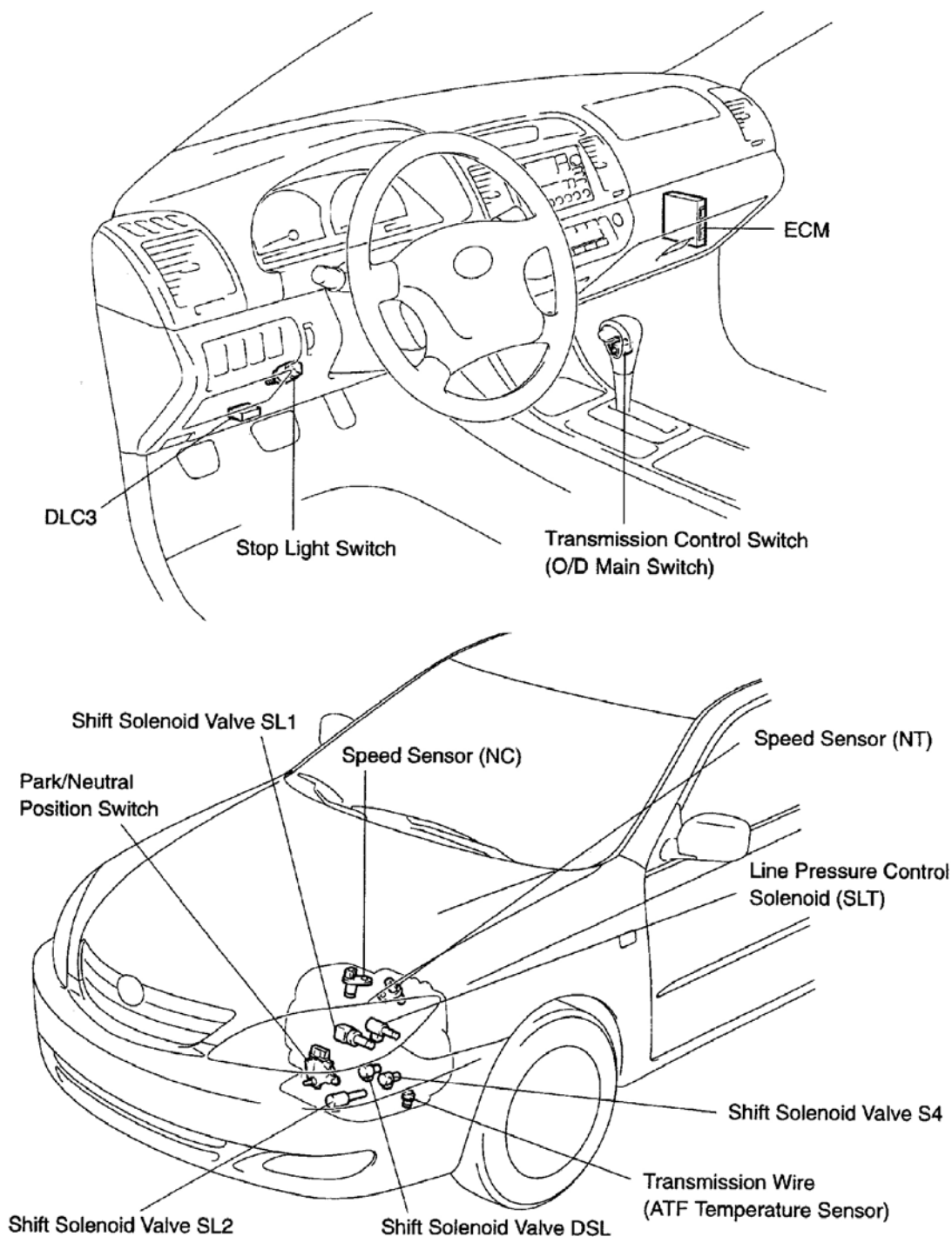
light on instrument panel indicates pattern select switch is in PWR (on) position. When pattern select switch is depressed to SNOW position, transaxle starts out in 2nd gear.

Transaxle is equipped with a shift lock and key lock system. Shift lock system prevents selector lever from being moved from Park unless brake pedal is depressed. In case of a malfunction, selector lever can be released by depressing shift lock override button located near selector lever. Key lock system prevents ignition key from being moved from ACC to LOCK position on ignition switch unless selector lever is in Park. For more information on shift lock and key lock system, see appropriate SHIFT INTERLOCK SYSTEMS article.

ELECTRONIC CONTROL MODULE

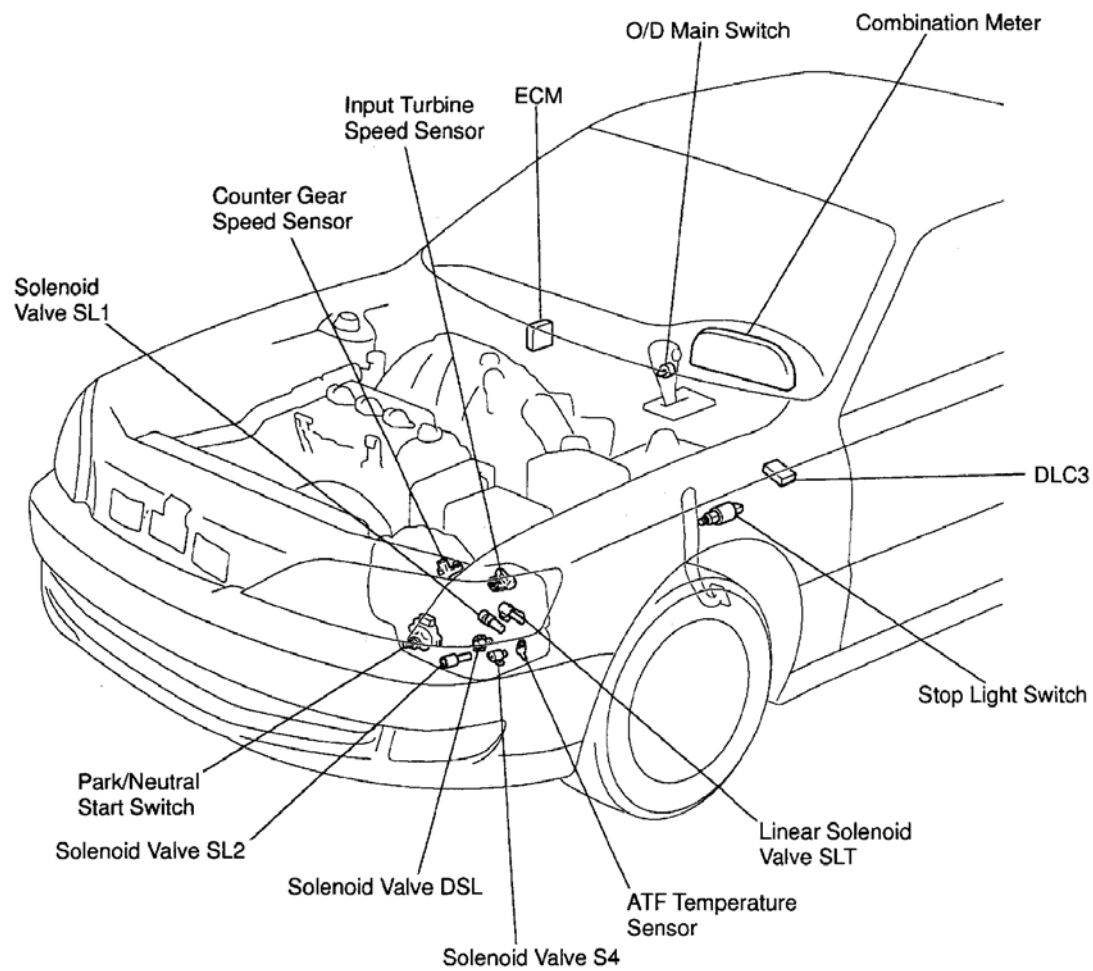
ECM receives information from various input devices and uses this information to control shift solenoids and torque converter lock-up. ECM contains a self-diagnostic system, which will store a Diagnostic Trouble Code (DTC) if failure or problem exists in the electronic control system. To find location of ECM, see **Fig. 5 -Fig. 9** .

DTC can be retrieved to determine transaxle problem area. See **RETRIEVING DIAGNOSTIC TROUBLE CODES** under SELF-DIAGNOSTIC SYSTEM.



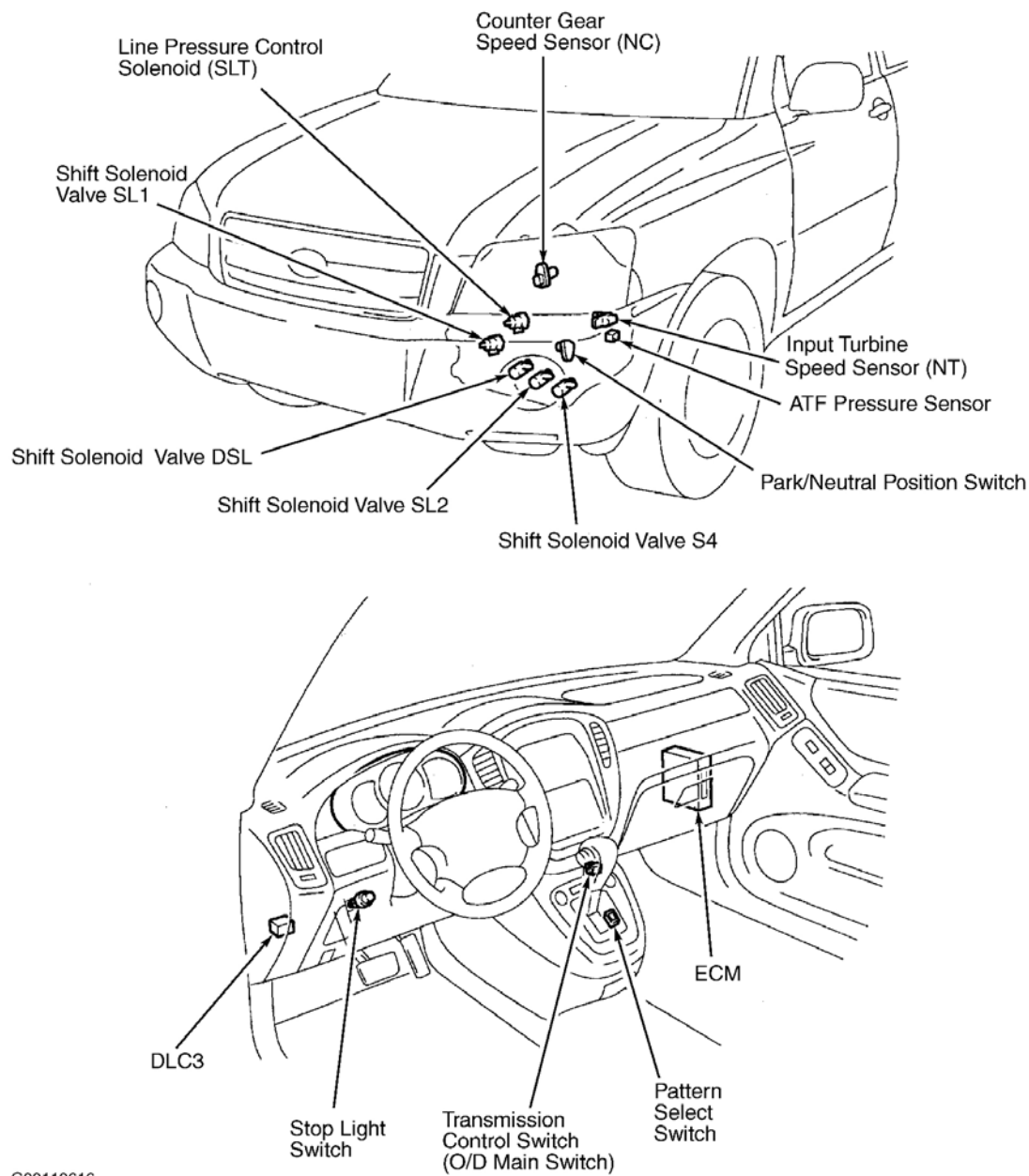
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Fig. 5: Identifying ECM Input & Output Devices (Camry)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



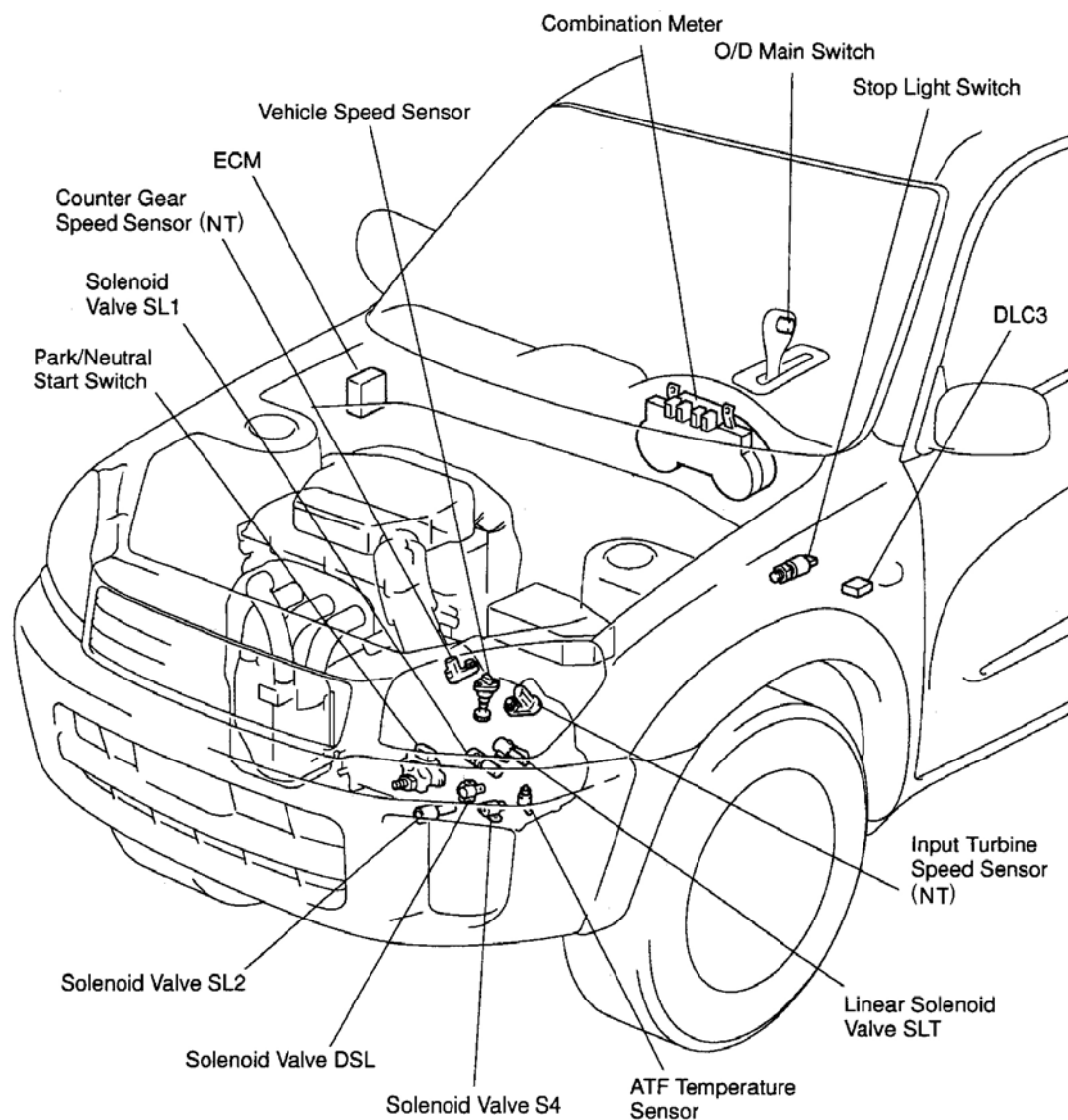
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Fig. 6: Identifying ECM Input & Output Devices (ES 300)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



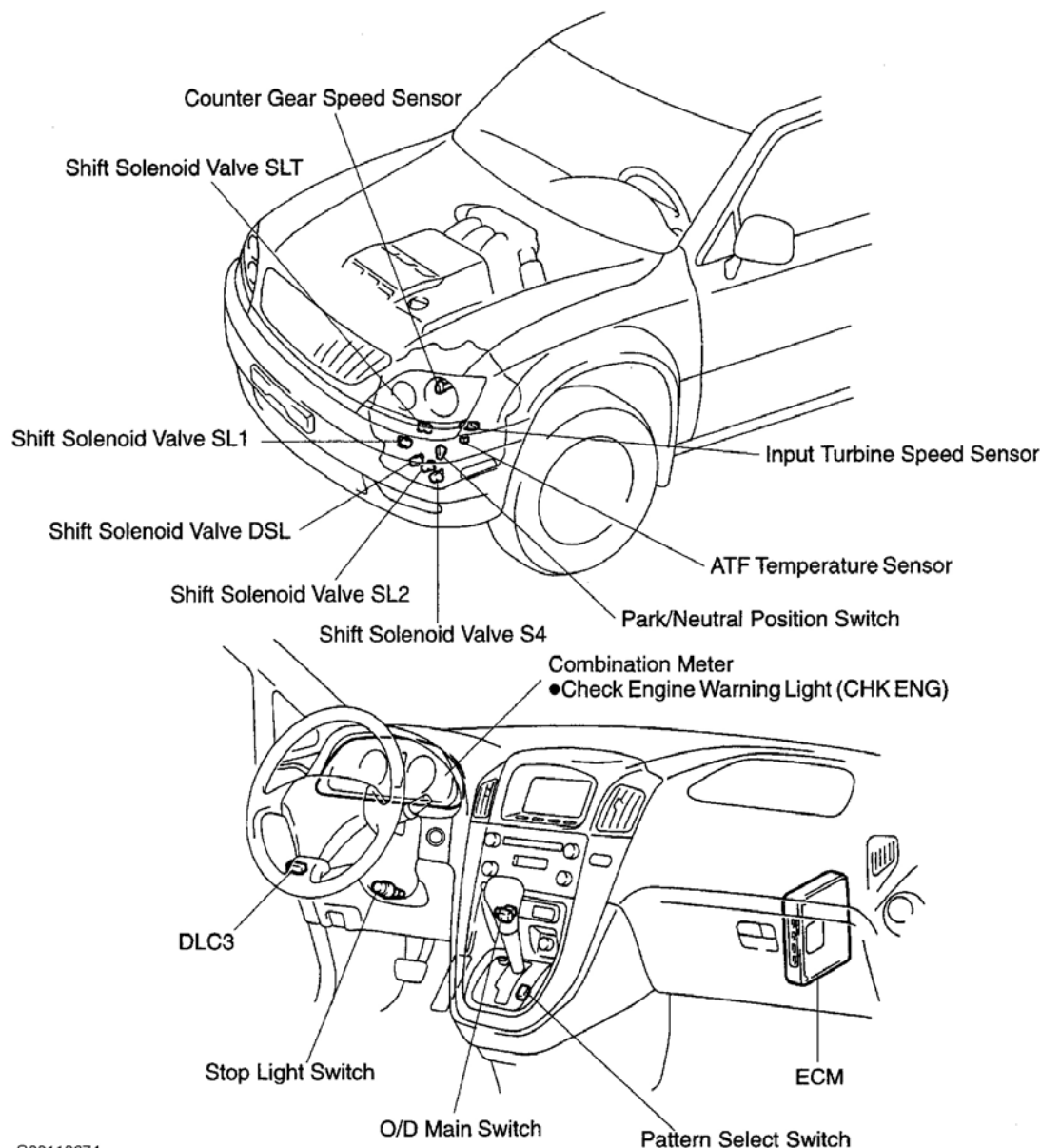
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Fig. 7: Identifying ECM Input & Output Devices (Highlander)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 8: Identifying ECM Input & Output Devices (RAV4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



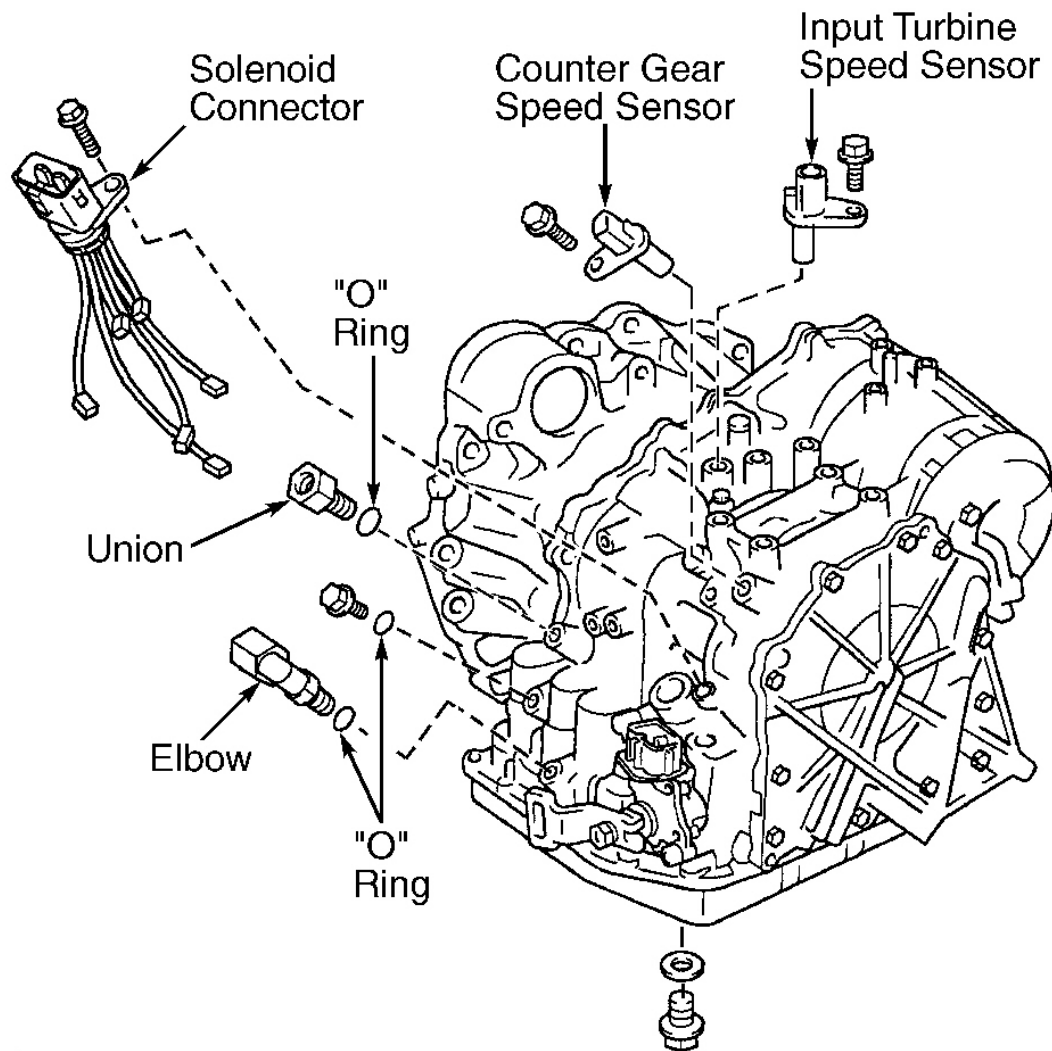
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Fig. 9: Identifying ECM Input & Output Devices (RX 300)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ELECTRONIC CONTROL MODULE INPUT DEVICES

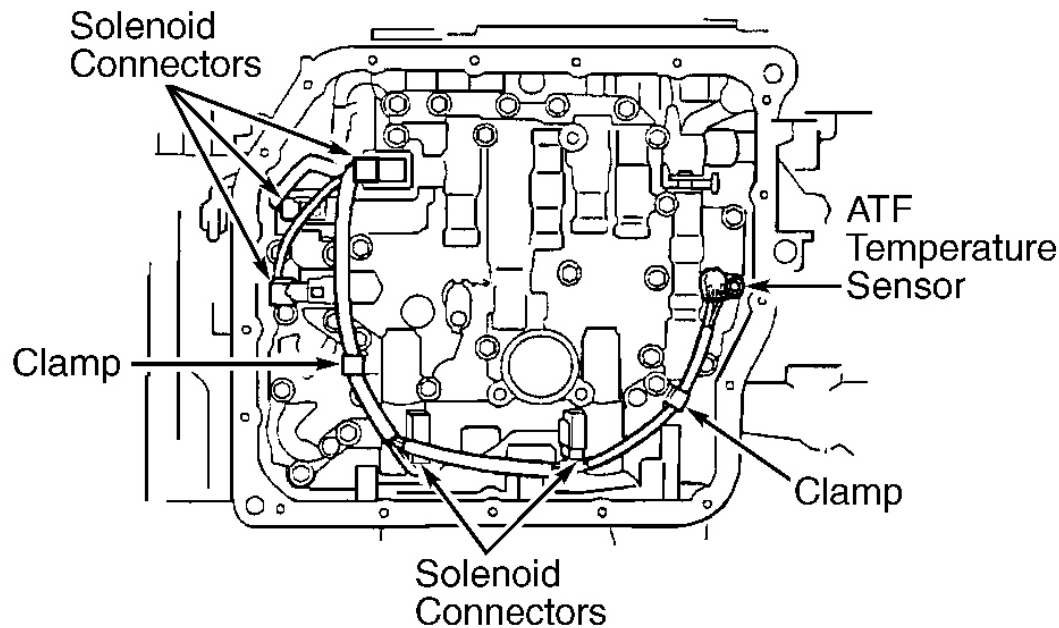
Automatic Transaxle Fluid Temperature Sensor

ATF temperature sensor (located on wiring harness inside transaxle oil pan) converts fluid temperature into a resistance value, which is input to ECM. See **Fig. 11** .



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Fig. 10: Identifying 10-Pin Solenoid Connector & Speed Sensor Locations
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 11: Locating Temperature Sensor & Solenoid Connectors
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Brakelight Switch

Brakelight switch delivers input signal to ECM, indicating vehicle braking. Brakelight switch is located on brake pedal support.

Counter Gear Speed Sensor

Counter gear speed sensor detects rotation of counter drive gear. By comparing counter gear speed sensor signal and input turbine speed sensor signal, ECM detects shift timing of gears and controls engine torque and hydraulic pressure in response to various conditions, resulting in smooth transaxle shifting. See **Fig. 10**.

Cruise Control Electronic Control Unit

Cruise control ECU delivers an input signal to control overdrive operation in accordance with vehicle speed when cruise control is operating. When in overdrive with cruise control on, if vehicle speed drops 3 MPH less than set speed, overdrive is released to prevent reduction in vehicle speed. Once vehicle speed is more than set speed, overdrive is resumed. Cruise control ECU is located behind instrument panel on driver's side of vehicle.

Engine Coolant Temperature Sensor

Engine coolant temperature sensor delivers input signal to ECM, indicating engine coolant temperature. ECT

sensor is located at right rear corner of engine, near upper radiator hose.

Input Turbine Speed Sensor

Input turbine speed sensor detects rotation of input shaft. By comparing input turbine speed sensor signal and counter gear speed sensor signal, ECM detects shift timing of gears and controls engine torque and hydraulic pressure in response to various conditions, resulting in smooth transaxle shifting. See **Fig. 10** .

Overdrive Switch

OD switch provides an input signal to ECM to indicate when overdrive is selected by vehicle operator. When OD switch is depressed to ON position, transaxle will shift into 4th gear when selector lever is in "D" position, and OD OFF light on instrument panel will go off. When OD switch is released to OFF position, transaxle will shift into 3rd gear, and OD OFF light will illuminate. OD switch is mounted on selector lever.

Park/Neutral Position Switch

Park/Neutral Position (PNP) switch delivers an input signal to ECM to indicate selector lever position. PNP switch is located on side of transaxle, below solenoid connector.

Throttle Position Sensor

TP sensor delivers an input signal to ECM indicating throttle position. TP sensor is located on side of throttle body.

Vehicle Speed Sensor

Vehicle speed signal is delivered to ABS ECU by ABS wheel speed sensors. ABS ECU converts signals into a 4-pulse signal and outputs signal to instrument cluster. Instrument cluster converts signal to a more precise waveform and outputs signal to ECM. Speed sensors are located at each wheel.

ELECTRONIC CONTROL MODULE OUTPUT DEVICES

NOTE: **In case of a short in a shift solenoid circuit, ECM will stop sending current to the shift solenoid with the short circuit.**

Shift Solenoid DSL

ECM uses signals from TP sensor, airflow meter and crankshaft position sensor to monitor torque converter lock-up engagement condition. ECM compares torque converter lock-up engagement condition with lock-up schedule in ECM memory to detect a malfunction with valve body, torque converter clutch or shift solenoid DSL. Shift solenoid DSL controls hydraulic pressure acting on lock-up relay valve, which contains torque converter clutch lock-up. Shift solenoid DSL is located on transaxle valve body. See **Fig. 12** .

Shift Solenoids SL1, SL2 & S4

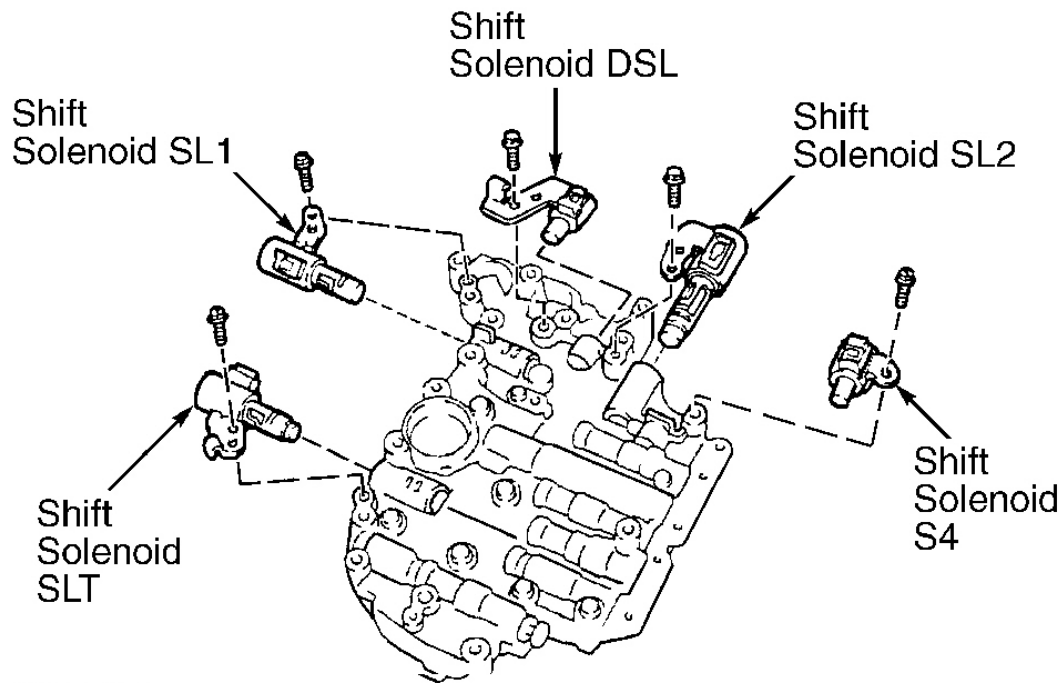
ECM controls transaxle shifting by delivering an output signal to operate proper shift solenoid. Solenoids are

located on transaxle valve body. See **Fig. 12** . Solenoids are operated in accordance with selector lever position. If a solenoid malfunctions, ECM defaults transaxle to a designated gear. See **Fig. 13** .

NOTE: ECM provides a fail-safe system which places transaxle in a designated gear depending on which solenoid fails. In some gears, fail-safe system will not be activated and transaxle will shift to the fail-safe gear. See **Fig. 13** .

Shift Solenoid SLT

ECM controls line pressure by sending a predetermined duty ratio to shift solenoid SLT, modulating line pressure and generating throttle pressure. Shift solenoid SLT is used to precisely and minutely modulate and generate line pressure according to accelerator pedal effort, or engine power output detected. Shift solenoid SLT is located on transaxle valve body. See **Fig. 12** .



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Fig. 12: Locating Shift Solenoids
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NORMAL				SHIFT SOLENOID SL1 MALFUNCTIONING								SHIFT SOLENOID SL2 MALFUNCTIONING			
				Driving at 3rd or O/D				Driving at 1st or 2nd							
Solenoid Valve			Gear	Solenoid Valve			Gear	Solenoid Valve			Gear	Solenoid Valve			Gear
SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4	
ON	ON	OFF	1st	X	ON ↓ OFF	OFF	3rd	X	ON	OFF	2nd	ON ↓ OFF	X	OFF	3rd
OFF	ON	OFF	2nd	X	ON ↓ OFF	OFF	3rd	X	ON	OFF	2nd	OFF	X	OFF	3rd
	OFF	OFF	3rd	X	OFF	OFF	3rd	X	OFF ↓ ON	OFF ↓ ON	3rd		X	OFF	3rd
	OFF	ON	O/D	X	OFF	ON	O/D	X	OFF ↓ ON	ON	3rd		X	ON	O/D

SHIFT SOLENOID S4 MALFUNCTIONING				SHIFT SOLENOID SL1 & SL2 MALFUNCTIONING				SHIFT SOLENOID SL1 & S4 MALFUNCTIONING							
								Driving at 3rd or O/D				Driving at 1st or 2nd			
Solenoid Valve			Gear	Solenoid Valve			Gear	Solenoid Valve			Gear	Solenoid Valve			Gear
SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4	
ON	ON	X	1st	X	X	OFF	3rd	X	ON ↓ OFF	X	3rd	X	ON	X	2nd
OFF	ON	X	2nd	X	X	OFF	3rd	X	ON ↓ OFF	X	3rd	X	ON	X	2nd
	OFF	X	3rd	X	X	OFF	3rd	X	OFF	X	3rd	X	OFF ↓ ON	X	2nd
	OFF	X	3rd	X	X	ON	O/D	X	OFF	X	3rd	X	OFF ↓ ON	X	2nd

SHIFT SOLENOID SL2 & S4 MALFUNCTIONING				SHIFT SOLENOID SL1, SL2 & S4 MALFUNCTIONING			
Solenoid Valve			Gear	Solenoid Valve			Gear
SL1	SL2	S4		SL1	SL2	S4	
ON ↓ OFF	X	X	3rd	X	X	X	3rd
OFF	X	X	3rd	X	X	X	3rd
	X	X	3rd	X	X	X	3rd
	X	X	3rd	X	X	X	3rd

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Fig. 13: Checking Shift Solenoid Operation
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SHIFT INTERLOCK SYSTEM

Vehicles are equipped with a shift interlock and key lock system. The shift interlock system prevents the gearshift lever from being moved from the Park position unless brake pedal is depressed. In case of a malfunction, the gearshift lever can be released by depressing the shift interlock override button located near the gearshift lever. The key lock system prevents ignition key from being moved from ACC to LOCK position on ignition switch unless the gearshift lever is in the Park position. For more information on shift interlock and key lock system, see appropriate SHIFT INTERLOCK SYSTEMS article.

COMPONENT LOCATIONS

For further information on component location, see Fig. 5 -Fig. 8 .

COMPONENT LOCATIONS

Component	Location
Brakelight Switch	On Brake Pedal Bracket
Counter Gear Speed Sensor	On Transaxle
DLC3	Under Left Side Of Instrument Panel
ECM	
Camry, Highlander & RX 300	Behind Glove Box
RAV4 & ES 300	Behind Right Side Of Instrument Panel, Near Lower "A" Pillar
Input Turbine Speed Sensor	On Transaxle
O/D Main Switch	On Gearshift Lever
Vehicle Speed Sensor	On Transaxle

TROUBLE SHOOTING

NOTE: For identification of electrical circuits for wiring repairs, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

NOTE: Any diagnosis should begin with confirming the customer's complaint. If possible, road test vehicle first, and note transaxle performance for future reference during diagnosis. When trouble shooting transaxle, perform PRELIMINARY INSPECTION first, then check for stored DTCs and repair as necessary. If no DTCs exist, perform manual shift test to determine if problem area is an electrical circuit or a mechanical transaxle problem. See MANUAL SHIFT TEST under PERFORMANCE TESTS.

PRELIMINARY INSPECTION

NOTE: Before testing the transaxle, ensure the fluid level is correct and the throttle and shift cables are properly adjusted. Ensure engine starts with the gearshift lever in the Park and Neutral positions, to ensure proper adjustment of PNP switch. If a problem is duplicated on a road test, and no mechanical malfunction is found, check for stored DTCs. See RETRIEVING DIAGNOSTIC TROUBLE CODES under SELF-DIAGNOSTIC SYSTEM.

SYMPTOM DIAGNOSIS

NOTE: No. 2 one-way clutch may also be referred to as underdrive one-way clutch.

Harsh Engagement From Neutral To Drive

Check forward clutch accumulator, forward clutch, underdrive clutch and No. 1 one-way clutch.

Harsh Engagement From Neutral To Low

Check solenoid modulator valve.

Harsh Engagement From Neutral To Reverse

Check accumulators, lower valve body control valves, direct clutch and 1st/reverse brake.

Harsh Engagement During Upshift

Check upper valve body check, control and lock valves.

Harsh Lock-Up Engagement

Check lock-up relay valve and torque converter clutch.

No Engine Braking In Low

Check solenoid modulator valve and 1st/reverse brake.

No Engine Braking In "2" Position

Check solenoid modulator valve and 2nd brake.

No 1-2 Upshift

Check lower valve body control valves, 2nd brake and No. 1 one-way clutch.

No 2-3 Upshift

Check lower valve body control valves and direct clutch.

No 3-4 Upshift

Check 3-4 shift valve and underdrive clutch.

No Lock-Up Or Lock-Up Off

Check lock-up relay valve and torque converter clutch.

No 2-1 Downshift

Check lower valve body control valves.

No 3-2 Downshift

Check lower valve body control valves.

No 4-3 Downshift

Check 3-4 shift valve.

No Kickdown

Check lower valve body control valves and 3-4 shift valve.

Poor Acceleration (All Positions)

Check torque converter clutch and underdrive planetary gear.

Poor Acceleration In Overdrive

Check underdrive clutch and underdrive planetary gear.

Slip Or Shudder In 1st Gear

Check No. 1 one-way clutch.

Slip Or Shudder In 2nd Gear

Check 2nd brake and No. 2 one-way clutch.

Slip Or Shudder In 3rd Gear

Check direct clutch.

Slip Or Shudder In Overdrive

Check underdrive clutch.

Slip Or Shudder In Reverse

Check direct clutch, and 1st/reverse brake.

Slip Or Shudder In Forward Position After Warm-Up

Check upper valve body, oil strainer, torque converter clutch, forward clutch, direct clutch, underdrive brake, No. 1 one-way clutch and underdrive clutch.

Vehicle Does Not Move In Any Forward Or Reverse Gear

Check manual valve, primary regulator valve, parking lock pawl, front planetary gear, rear planetary gear, underdrive planetary gear, forward clutch, underdrive brake and No. 2 one-way clutch.

Vehicle Does Not Move In Reverse

Check front planetary gear, rear planetary gear, underdrive planetary gear, direct clutch, underdrive brake and 1st/reverse brake.

CLUTCH & BRAKE APPLICATIONS

CLUTCH & BRAKE APPLICATIONS

Gearshift Lever Position	Elements In Use
"D" (Drive)	
1st Gear	Forward Clutch, Underdrive Brake, No. 1 One-Way Clutch & No. 2 One-Way Clutch
2nd Gear	Forward Clutch, 2nd Brake, Underdrive Brake & No. 2 One-Way Clutch
3rd Gear	Direct Clutch, Forward Clutch, Underdrive Brake & No. 2 One-Way Clutch
Overdrive	Forward Clutch, Direct Clutch & Underdrive Clutch
"2" (Second)	
1st Gear	Forward Clutch, Underdrive Brake, No. 1 One-Way Clutch & No. 2 One-Way Clutch
2nd Gear	Forward Clutch, 1st/Reverse Brake, 2nd Brake, Underdrive Brake & No. 2 One-Way Clutch
"L" (Low)	Forward Clutch, Underdrive Brake, No. 1 One-Way Clutch & No. 2 One-Way Clutch
"P" (Park)	Underdrive Brake
"R" (Reverse)	Direct Clutch, Underdrive Brake & 1st/Reverse Brake
"N" (Neutral)	Underdrive Brake

PERFORMANCE TESTS

ROAD TEST

NOTE: Perform test at normal operating fluid temperature of 122-176°F (50-80°C).

"D" Position

1. Place selector lever in "D" position. Hold accelerator pedal constant at full throttle. Check 1-2, 2-3, and 3-4 upshift and lock-up points. See appropriate table under **SHIFT SPEED SPECIFICATIONS** .

NOTE: There is no overdrive lock-up when coolant temperature is less than 140°F (60°C) or when vehicle speed is 6 MPH less than the set cruise control speed. There is no lock-up when brake pedal is depressed.

- If no 1-2 upshift occurs, check lower valve body control valves or shift solenoid.
- If no 2-3 upshift occurs, check lower valve body control valves or shift solenoid.

- If no 3-4 upshift occurs, check 3-4 shift valve or shift solenoid.
 - If all shift points are incorrect, check upper valve body, lower valve body control valves and 3-4 shift valve.
 - If all lock-up points are incorrect, check lock-up relay valve or shift solenoid.
2. Use procedure outlined in step **1)** to check for shock and slip between 1-2, 2-3, and 3-4 upshifts. If shock is harsh, line pressure may be too high. Check accumulator or check ball.
 3. Drive vehicle in "D" position lock-up or overdrive gear. Check for abnormal noise and vibration.

NOTE: **Check for cause of abnormal noise and vibration must be made with extreme care as problem could be due to an unbalanced axle shaft, differential, tire, torque converter, etc.**

4. While driving in "D" position, confirm correct kickdown vehicle speed limits for 2-1, 3-2, 4-3 shift points. Check for abnormal shock and slip at kickdown.
5. Check lock-up function. Drive vehicle in overdrive in "D" position with lock-up on. Hold vehicle speed steady at 37 MPH. Lightly depress accelerator pedal. Ensure engine RPM does not change abruptly. Large increase in engine RPM indicates lock-up function is faulty.

"2" Position

1. Place selector lever in "2" position. Drive vehicle with accelerator pedal held constantly at full throttle. Ensure 1-2 upshift points take place and are operating properly.

NOTE: **In "2" position, there will be no lock-up to 2nd gear.**

2. While driving in "2" position, release accelerator pedal and check engine braking effect. If there is no engine braking effect, 2nd brake is defective. Check for abnormal noise and shock at acceleration and deceleration.

"L" Position

While driving, place selector lever to "L" position, and ensure there is no upshift to 2nd gear. While driving in "L" position, release accelerator pedal. If there is no engine braking effect, 1st/reverse brake is defective. Check for abnormal noise during acceleration and deceleration.

"R" Position

Place selector lever in "R" position. Accelerate in Reverse from a stop at full throttle. Ensure slipping does not occur.

"P" Position

Stop vehicle on grade of more than 5 percent. Place selector lever in "P" position. Release parking brake. Ensure parking lock pawl holds vehicle.

SHIFT SPEED SPECIFICATIONS

NOTE: All specifications taken at wide open throttle except "D" position, 3rd-4th and 4th-3rd. See footnotes.

SHIFT SPEED SPECIFICATIONS (CAMRY)

Application	MPH
"D" Position	
1st-2nd	33-39
2nd-3rd	62-68
3rd-4th	94-104
3rd-4th ⁽¹⁾	24-29
4th-3rd ⁽¹⁾	9-13
4th-3rd	89-99
3rd-2nd	57-63
2nd-1st	27-31
"2" Position	
1st-2nd	33-39
3rd-2nd	62-68
2nd-1st	27-31
"L" Position	
3rd-2nd	62-68
2nd-1st	29-34
(1) Fully closed throttle.	

SHIFT SPEED SPECIFICATIONS (ES 300)

Application	MPH
"D" Position	
1st-2nd	38-42
2nd-3rd	71-76
3rd-4th	108-116
3rd-4th ⁽¹⁾	21-25
4th-3rd ⁽¹⁾	12-16
4th-3rd	101-109
3rd-2nd	66-71
2nd-1st	25-29
"2" Position	
1st-2nd	38-42
3rd-2nd	75-79
2nd-1st	25-29

"L" Position	
3rd-2nd	75-79
2nd-1st	33-37
(1) Fully closed throttle.	

SHIFT SPEED SPECIFICATIONS (HIGHLANDER 2.4L - U140F)

Application	MPH
"D" Position	
1st-2nd	34-35
2nd-3rd	58-63
3rd-4th	93-101
3rd-4th ⁽¹⁾	25-29
4th-3rd ⁽¹⁾	9-13
4th-3rd	89-96
3rd-2nd	55-59
2nd-1st	26-30
"2" Position	
1st-2nd	31-35
3rd-2nd	58-63
2nd-1st	26-30
"L" Position	
3rd-2nd	58-63
2nd-1st	29-32
(1) Fully closed throttle.	

SHIFT SPEED SPECIFICATIONS (HIGHLANDER 3.0L - U140E)

Application	MPH
"D" Position	
1st-2nd	36-41
2nd-3rd	68-73
3rd-4th	104-112
3rd-4th ⁽¹⁾	21-24
4th-3rd ⁽¹⁾	11-15
4th-3rd	98-107
3rd-2nd	63-68
2nd-1st	29-32
"2" Position	
1st-2nd	36-41
3rd-2nd	70-75

2nd-1st	29-32
"L" Position	
3rd-2nd	70-75
2nd-1st	32-36
(1) Fully closed throttle.	

SHIFT SPEED SPECIFICATIONS (HIGHLANDER 3.0L - U140F)

Application	MPH
"D" Position	
1st-2nd	31-39
2nd-3rd	64-69
3rd-4th	98-106
3rd-4th ⁽¹⁾	19-23
4th-3rd ⁽¹⁾	11-14
4th-3rd	92-100
3rd-2nd	60-64
2nd-1st	27-30
"2" Position	
1st-2nd	34-39
3rd-2nd	66-70
2nd-1st	27-30
"L" Position	
3rd-2nd	66-70
2nd-1st	30-34
(1) Fully closed throttle.	

SHIFT SPEED SPECIFICATIONS (RAV4)

Application	MPH
"D" Position	
1st-2nd	35-41
2nd-3rd	67-73
3rd-4th	103-112
3rd-4th ⁽¹⁾	24-28
4th-3rd ⁽¹⁾	11-15
4th-3rd	96-106
3rd-2nd	63-68
2nd-1st	27-31
"2" Position	
1st-2nd	35-41

3rd-2nd	69-75
2nd-1st	27-31
"L" Position	
3rd-2nd	69-75
2nd-1st	31-36
(1) Fully closed throttle.	

SHIFT SPEED SPECIFICATIONS (RX 300 - U140E)

Application	MPH
"D" Position	
1st-2nd	36-41
2nd-3rd	68-73
3rd-4th	104-112
3rd-4th ⁽¹⁾	21-24
4th-3rd ⁽¹⁾	11-15
4th-3rd	98-107
3rd-2nd	63-68
2nd-1st	29-32
"2" Position	
1st-2nd	36-41
3rd-2nd	70-75
2nd-1st	29-32
"L" Position	
3rd-2nd	70-75
2nd-1st	32-36
(1) Fully closed throttle.	

SHIFT SPEED SPECIFICATIONS (RX 300 - U140F)

Application	MPH
"D" Position	
1st-2nd	34-39
2nd-3rd	64-69
3rd-4th	98-106
3rd-4th ⁽¹⁾	19-23
4th-3rd ⁽¹⁾	11-14
4th-3rd	92-100
3rd-2nd	60-64
2nd-1st	27-30
"2" Position	

1st-2nd	34-39
3rd-2nd	66-70
2nd-1st	27-30
"L" Position	
3rd-2nd	66-70
2nd-1st	30-34
(1) Fully closed throttle.	

LOCK-UP SPEED SPECIFICATIONS

NOTE: **Throttle valve opening is 5 percent for all lock-up specifications**

LOCK-UP SPEED SPECIFICATIONS (CAMRY)

Application	MPH
"D" Position ⁽¹⁾	
Lock-Up On in 3rd ⁽²⁾	94-104
Lock-Up Off in 3rd ⁽²⁾	89-99
Lock-Up On in OD	32-37
Lock-Up Off in OD	30-35
(1) There is no lock-up in "L" or "2" position.	
(2) With OD switch off.	

LOCK-UP SPEED SPECIFICATIONS (ES 300)

Application	MPH
"D" Position ⁽¹⁾	
Lock-Up On in 3rd ⁽²⁾	49-53
Lock-Up Off in 3rd ⁽²⁾	44-48
Lock-Up On in OD	37-40
Lock-Up Off in OD	32-36
(1) There is no lock-up in "L" or "2" position.	
(2) With OD switch off.	

LOCK-UP SPEED SPECIFICATIONS (HIGHLANDER 2.4L - U140F)

Application	MPH
"D" Position ⁽¹⁾	
Lock-Up On in 3rd ⁽²⁾	60-65
Lock-Up Off in 3rd ⁽²⁾	58-63

Lock-Up On in OD	35-39
Lock-Up Off in OD	34-38
(1) There is no lock-up in "L" or "2" position.	
(2) With OD switch off.	

LOCK-UP SPEED SPECIFICATIONS (HIGHLANDER 3.0L - U140E)

Application	MPH
"D" Position ⁽¹⁾	
Lock-Up On in 3rd ⁽²⁾	104-113
Lock-Up Off in 3rd ⁽²⁾	98-107
Lock-Up On in OD	50-55
Lock-Up Off in OD	48-53
(1) There is no lock-up in "L" or "2" position.	
(2) With OD switch off.	

LOCK-UP SPEED SPECIFICATIONS (HIGHLANDER 3.0L - U140F)

Application	MPH
"D" Position ⁽¹⁾	
Lock-Up On in 3rd ⁽²⁾	98-106
Lock-Up Off in 3rd ⁽²⁾	92-100
Lock-Up On in OD	47-52
Lock-Up Off in OD	44-48
(1) There is no lock-up in "L" or "2" position.	
(2) With OD switch off.	

LOCK-UP SPEED SPECIFICATIONS (RAV4)

Application	MPH
Lock-Up On in OD	35-39
Lock-Up Off in OD	34-38

LOCK-UP SPEED SPECIFICATIONS (RX 300 - U140E)

Application	MPH
"D" Position ⁽¹⁾	
Lock-Up On in 3rd ⁽²⁾	104-113
Lock-Up Off in 3rd ⁽²⁾	98-107
Lock-Up On in OD	50-55
Lock-Up Off in OD	48-53

(1) There is no lock-up in "L" or "2" position.

(2) With OD switch off.

LOCK-UP SPEED SPECIFICATIONS (RX 300 - U140F)

Application	MPH
"D" Position ⁽¹⁾	
Lock-Up On in 3rd ⁽²⁾	98-106
Lock-Up Off in 3rd ⁽²⁾	92-100
Lock-Up On in OD	47-52
Lock-Up Off in OD	44-48
(1) There is no lock-up in "L" or "2" position.	
(2) With OD switch off.	

MANUAL SHIFT TEST

NOTE: Perform manual shift test if no DTCs exist. Manual shift test determines if problem is in electrical circuits or is a mechanical transaxle problem.

1. Ensure ignition is off. Disconnect 10-pin solenoid connector located above PNP switch on transaxle.
2. Road test vehicle and ensure transaxle gear changes correspond with selector lever position. See **GEAR APPLICATION** table. If abnormality exists, a mechanical transaxle problem may exist. Turn ignition off.
3. Reconnect solenoid connector. Clear DTCs from ECM memory, as disconnecting solenoid connector will set a DTC. See **CLEARING DIAGNOSTIC TROUBLE CODES** under SELF DIAGNOSTIC SYSTEM.

GEAR APPLICATION

Selector Lever Position	Gear
"D"	Overdrive
"4"	4th
"3"	3rd
"2"	2nd
"L"	1st
"R"	Reverse
"P"	Park

STALL SPEED TEST

CAUTION: Perform test at normal operating fluid temperature of 122-176°F (50-80°C).
DO NOT continue test for more than 5 seconds.

1. Testing is done to check overall performance of transaxle and engine by measuring maximum engine speeds in "D" and "R" positions.
2. Block front and rear wheels. Connect scan tool to Data Link Connector (DLC) to monitor engine RPM. Apply parking and service brakes. Start engine. Place selector lever in "D" position. Fully depress accelerator pedal. Release pedal after 5 seconds.
3. Record highest engine RPM. Repeat test in "R" position. Compare reading obtained to specification. See **STALL SPEED SPECIFICATIONS** table.
4. If stall speed is same for both positions, but less than specified RPM, engine output may be insufficient or stator one-way clutch is not operating properly.

NOTE: **If stall speed RPM is more than 600 RPM less than specification, torque converter may be faulty.**

5. If stall speed in "D" position is higher than specification, forward clutch may be slipping, No. 2 one-way clutch may not be operating properly, underdrive clutch may be slipping, or line pressure is too low.
6. If stall speed in "R" position is higher than specification, direct clutch may be slipping, 1st/reverse brake may be slipping, line pressure is too low or underdrive clutch may be slipping.
7. If stall speed in "R" and "D" positions is higher than specification, line pressure is too low, incorrect fluid level exists or No. 2 one-way clutch is not operating properly.

STALL SPEED SPECIFICATIONS

Application	Specification (RPM)
Lexus	
ES 300	2350-2800
RX 300	2325-2775
Toyota	
Camry	2200-2500
Highlander 3.0L	2500-2800
Highlander 2.4L	2200-2500
RAV4	2530-2830

TIME LAG TEST

CAUTION: Perform this test at normal operating fluid temperature of 122-176°F (50-80°C). Allow one minute between tests. Record 3 measurements and average results.

1. If selector lever is actuated with engine idling, a time lag will be noted before shock can be felt. This test is used for checking condition of underdrive clutch, forward clutch, direct clutch and 1st/reverse brake.
2. Apply parking brake. Connect scan tool to DLC3 to monitor engine RPM. Start engine. Ensure idle speed is 650-750 RPM with transaxle in Neutral and A/C off. Move selector lever from "N" to "D" position. Use a stop watch to measure elapsed time between shifting lever until shock is felt.

3. Standard time lag is less than 1.2 seconds. Repeat test to measure time lag for "N" to "R" position. Standard time lag is less than 1.5 seconds. If "N" to "D" position time lag is longer than specified, line pressure is too low, forward clutch may be worn or No. 2 one-way clutch is not operating properly.
4. If "N" to "R" position time lag is longer than specified, direct clutch may be worn, 1st/reverse brake may be worn, line pressure is too low or No. 2 one-way clutch may be worn.

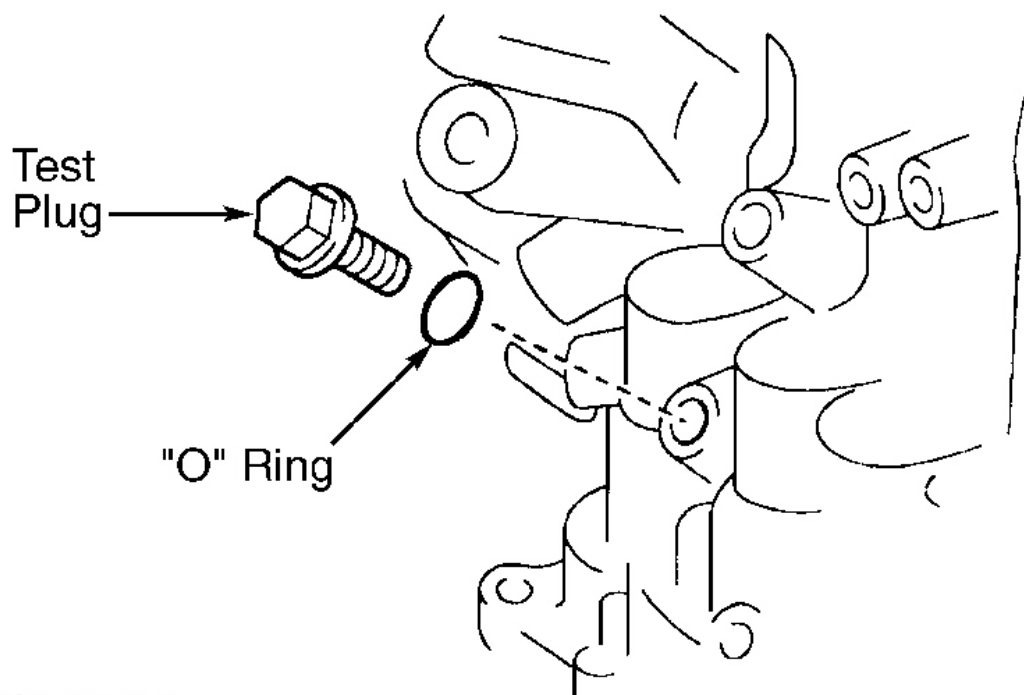
TORQUE CONVERTER LOCK-UP

Road test vehicle. Increase vehicle speed until lock-up should occur. To confirm lock-up operation, very lightly depress brake pedal with left foot and release while maintaining constant speed. Monitor vehicle tachometer. Transaxle should downshift into 3rd gear and then upshift into lock-up once brake pedal is released. Ensure lock-up speeds are within specification. See **LOCK-UP SPEED SPECIFICATIONS** .

HYDRAULIC PRESSURE TESTS

CAUTION: Perform test at normal operating fluid temperature of 122-176°F (50-80°C).

1. Ensure transaxle fluid is at operating temperature. Raise and support vehicle. Remove transaxle case test plug. See **Fig. 14** . Install hydraulic pressure gauge. Lower vehicle.
2. Fully apply parking brake. Block all wheels. Start engine and ensure idle speed is 650-750 RPM. Place selector lever in "D" position. Read and record pressure at idle. Fully apply brakes. Depress accelerator pedal to floor. DO NOT apply full throttle for more than 5 seconds.
3. Measure highest line pressure. Refer to specifications. See **LINE PRESSURE SPECIFICATIONS** table. Repeat test in "R" position. If pressures exceed specification in all ranges, regulator valve or control valve in upper valve body is defective. Ensure no TP sensor-related DTCs are present.
4. If pressures in both positions are lower than specification, oil pump, regulator valve or underdrive clutch is defective. Ensure no TP sensor-related DTCs are present.
5. If pressure is lower than specification in "D" position only, forward clutch is defective or "D" range circuit has a fluid leak. If pressure is lower than specification in "R" position only, direct clutch is defective, 1st/reverse brake is defective or "R" range circuit has a fluid leak.



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Fig. 14: Locating Transaxle Test Plug
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

LINE PRESSURE SPECIFICATIONS

Engine RPM	"D" Range - psi (kg/cm ²)	"R" Range - psi (kg/cm ²)
Lexus		
ES 300		
Idle Speed	54-59 (3.8-4.2)	97-107 (6.9-7.5)
Stall Speed	134-149 (9.5-10.5)	255-284 (18.0-20.1)
RX 300		
Idle Speed	54-59 (3.8-4.2)	97-107 (6.9-7.6)
Stall Speed	134-139 (9.5-10.5)	255-284 (18.0-20.1)
Toyota		
Camry		
Idle Speed	54-65 (3.8-4.6)	93-116 (6.5-8.2)
Stall Speed	131-160 (9.2-11.2)	251-294 (17.6-20.7)
Highlander		
Idle Speed	54-60 (3.8-4.2)	135-149 (9.5-10.5)
Stall Speed	135-150 (9.5-10.5)	256-285 (18.0-20.0)

RAV4		
Idle Speed	54-60 (3.8-4.2)	97-111 (7.6-7.8)
Stall Speed	135-150 (9.5-10.5)	256-285 (18.0-20.0)

SELF-DIAGNOSTIC SYSTEM

INTRODUCTION

NOTE: Before testing transaxle, ensure fluid level is correct and shift cables are properly adjusted. Ensure engine starts with selector lever in Park and Neutral to ensure proper adjustment of PNP switch. Transaxle must first be tested by checking for stored DTCs. See RETRIEVING DIAGNOSTIC TROUBLE CODES .

ECM monitors transaxle operation and contains a self-diagnostic system which stores DTCs if transaxle electronic control system failure or problem exists. Malfunction Indicator Light (MIL) on instrument panel will illuminate to warn driver a malfunction has occurred.

RETRIEVING DIAGNOSTIC TROUBLE CODES

On all models, DTCs are a 4-digit code. See DIAGNOSTIC TROUBLE CODE DEFINITIONS table. DTCs can only be retrieved using Toyota or Lexus scan tool or On-Board Diagnostic (OBD-II) scan tool that complies with SAE standard J-1978. Connect scan tool to 16-pin Data Link Connector (DLC3). See **Fig. 15** . DLC3 is located under instrument panel, near steering column. See **Fig. 16** . When DTCs are present, MIL on instrument panel will illuminate. To retrieve DTCs using scan tool, follow scan tool manufacturer's operating instructions.

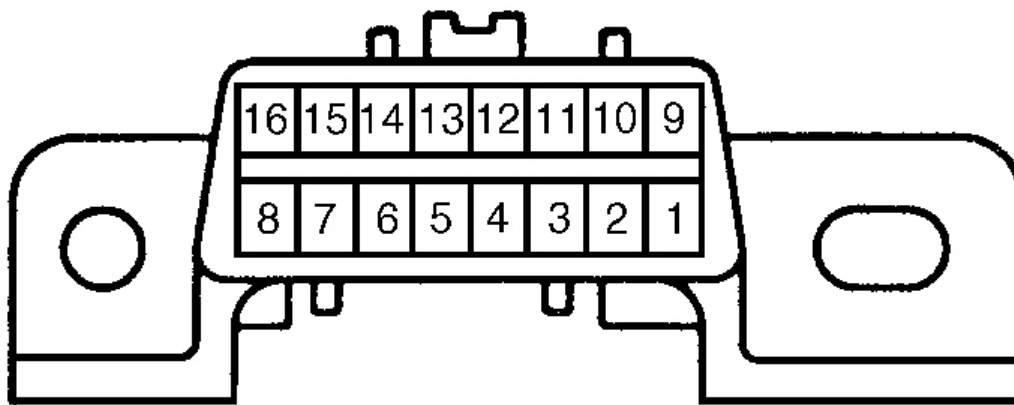
If no DTCs exist, perform manual shift test to determine if problem area is in electrical circuits or a mechanical transaxle problem. See MANUAL SHIFT TEST under PERFORMANCE TESTS.

NOTE: When using Toyota or Lexus scan tool, when ignition is turned from ON to ACC or OFF position or scan tool is switched from NORMAL mode to CHECK mode, all DTCs and freeze-frame data will be erased. DO NOT switch modes until all DTCs and freeze-frame data are recorded.

NOTE: Aftermarket scan tool may be operated in NORMAL mode when retrieving DTCs. Only Toyota or Lexus scan tool can be used in CHECK mode when retrieving DTCs.

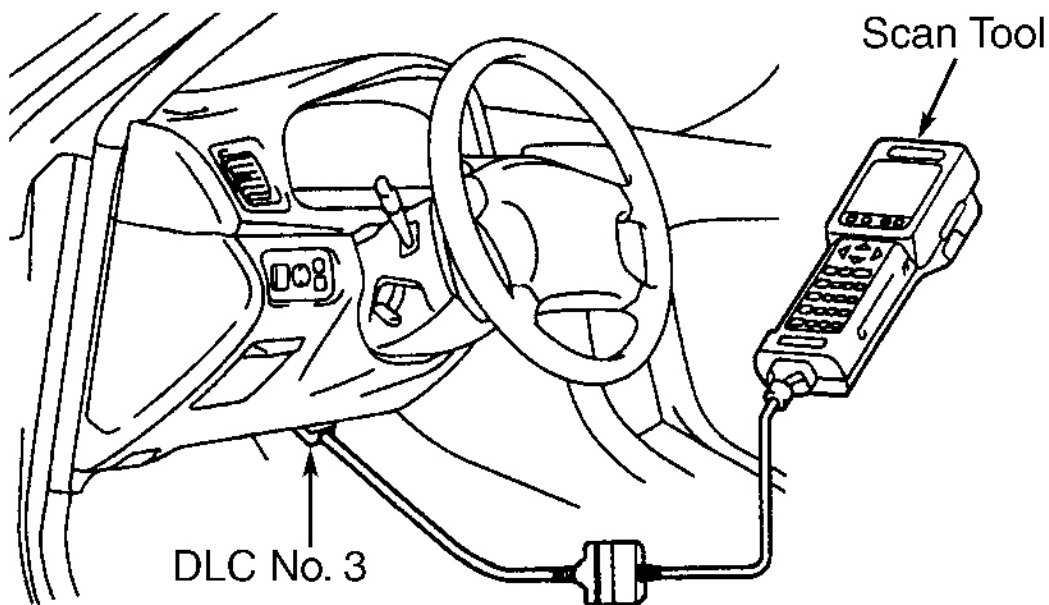
NORMAL mode is used to retrieve DTCs from ECT ECU. CHECK mode is used to check for DTCs when operating vehicle to simulate conditions in which DTC was set. CHECK mode contains a higher sensing ability to detect malfunctions. CHECK mode helps determine malfunctions caused by poor electrical connections, which are difficult to determine using NORMAL mode.

NOTE: Once repairs have been performed, DTCs must be cleared from ECM memory. See CLEARING DIAGNOSTIC TROUBLE CODES .



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Fig. 15: Identifying Data Link Connector Terminals
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G99E51320

Fig. 16: Connecting Scan Tool To Data Link Connector
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DIAGNOSTIC TROUBLE CODE DEFINITIONS

NOTE: Only transaxle-related DTCs are listed. See **DIAGNOSTIC TROUBLE CODE DEFINITIONS** table. For engine-related DTC definitions and diagnosis, see appropriate **SELF-DIAGNOSTIC** article in **ENGINE PERFORMANCE**. These DTCs pertain to engine performance and must be repaired first, as engine performance and related component signals will affect transaxle operation and diagnosis.

DIAGNOSTIC TROUBLE CODE DEFINITIONS

DTC	(1) Probable Cause
<u>P0500</u>	Vehicle Speed Sensor
<u>P0710</u>	ATF Temperature Sensor
<u>P0750</u>	(2) Shift Solenoid SL1
<u>P0753</u>	Shift Solenoid SL1 Circuit Malfunction
<u>P0755</u>	(2) Shift Solenoid SL2
<u>P0758</u>	Shift Solenoid SL2 Circuit Malfunction
<u>P0765</u>	(2) Shift Solenoid S4
<u>P0768</u>	Shift Solenoid S4 Circuit Malfunction
<u>P0770</u>	(2) Shift Solenoid DSL
<u>P0773</u>	(2) Shift Solenoid DSL Circuit Malfunction
<u>P1520</u>	Brakelight Switch
<u>P1725</u>	Input Turbine Speed Sensor
<u>P1730</u>	Counter Gear Speed Sensor
<u>P1760</u>	Shift Solenoid SLT
<u>P1780</u>	Park/Neutral Position Switch Malfunction
(1) Check listed component for probable cause. Check wiring and connections of specified component.	
(2) To diagnose this DTC, see appropriate solenoid test under COMPONENT TESTS .	

CLEARING DIAGNOSTIC TROUBLE CODES

NOTE: If using Toyota or Lexus scan tool, DTCs and freeze-frame data may be cleared by switching from **CHECK** mode to **NORMAL** mode or from **NORMAL** mode to **CHECK** mode.

DTCs can be cleared using scan tool connected to DLC3. DLC3 is located under instrument panel, near steering column. See **Fig. 15** and **Fig. 16** .

DIAGNOSTIC TESTS

NOTE: For DTC P0750, P0755, P0765 and P0770 diagnosis, see appropriate solenoid test under COMPONENT TESTS .

DTC P0500: VEHICLE SPEED SENSOR CIRCUIT MALFUNCTION (CAMRY, RAV4 & RX 300)

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

Anti-Lock Brake System (ABS) wheel speed sensors detect wheel speed and sends signals to ABS ECU. The ABS ECU converts signals into a 4-pulse signal and outputs signal to instrument cluster. Instrument cluster converts signal to a more precise waveform and outputs signal to ECM. ECM determines vehicle speed based on frequency of these pulse signals. DTC is set when ECM does not detect any VSS signal while vehicle is in motion. Possible causes are:

- Faulty speed sensors.
- Open or short in VSS circuit.
- Faulty instrument cluster.
- Faulty ECM.

Diagnostic Procedure

1. Test drive vehicle and check operation of speedometer. If speedometer is not operating correctly, repair speedometer as necessary. See appropriate INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT. If speedometer is operating correctly, go to next step.
2. Access ECM. See **Fig. 5 -Fig. 8** . Disconnect appropriate ECM connector containing terminal SPD. See WIRING DIAGRAMS . Using a DVOM, check for continuity between ground and terminal SPD at appropriate ECM connector. If continuity does not exist, check and repair harness or connector as needed. If continuity exists, go to next step.
3. Raise and support vehicle. Turn ignition switch to ON position. Using a DVOM, measure voltage between ground and terminal SPD at appropriate ECM connector. Measure voltage while slowly rotating one of the front wheels. If voltage is generated intermittently, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If no voltage was generated, repair or replace wiring harness and connector.

DTC P0500: VEHICLE SPEED SENSOR (VSS) MALFUNCTION (ES 300 & HIGHLANDER)

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM harness connector and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction. If ECM is replaced, ECM must be programmed with proper ignition key code for engine immobilizer system. For programming procedures, see COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION.

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

Anti-Lock Brake System (ABS) wheel speed sensors detect wheel speed and sends signals to ABS ECU. The ABS ECU converts signals into a 4-pulse signal and outputs signal to instrument cluster. Instrument cluster converts signal to a more precise waveform and outputs signal to ECM. ECM determines vehicle speed based on frequency of these pulse signals. DTC is set when ECM does not detect any VSS signal while vehicle is in motion. Possible causes are:

- Faulty wheel speed sensors.
- Open or short in VSS circuit.
- Faulty instrument cluster.
- Faulty ECM.

Diagnosis & Repair

1. Test drive vehicle and check operation of speedometer. If speedometer is not operating correctly, repair speedometer as necessary. See appropriate INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT. If speedometer is operating correctly, go to next step.
2. Raise and support front of vehicle. Shift transmission into Neutral. Access ECM behind glove box. Using DVOM, backprobe terminal No. 22 at appropriate ECM connector. Turn ignition on. Slowly rotate a drive wheel while observing voltage on DVOM. Voltage should fluctuate from zero volts to 4.5-5.5 volts as wheel is turned. If voltage is not as specified, locate and repair open/short circuit between terminal No. 22 at ECM harness connector and appropriate instrument cluster connector. If voltage is as specified, go to next step.
3. Check for loose or poor connection at ECM connector E8. Repair as necessary. If connection is okay, replace ECM and retest system. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.

Diagnostic Aids

Using scan tool, read freeze frame data. Freeze frame records will indicate engine conditions when malfunction is detected.

DTC P0710: AUTOMATIC TRANSAXLE FLUID TEMPERATURE SENSOR CIRCUIT MALFUNCTION (ES 300)

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

ATF temperature sensor converts fluid temperature into a resistance value which is input to ECM. DTC is set

when temperature sensor resistance is less than 79 ohms, or after engine has been operating for 15 minutes or more, temperature sensor resistance is more than 156 k/ohms. Either condition must be set for .5 second or more. Possible causes are:

- Open or short in ATF temperature sensor circuit.
- ATF temperature sensor malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Raise and support vehicle. Disconnect 10-pin solenoid connector located above PNP switch on side of transaxle. See **Fig. 10** . Remove transaxle oil pan. See LUBRICATION in appropriate AUTOMATIC article in TRANSMISSION SERVICING. Disconnect all solenoid connectors at solenoids. See **Fig. 11** . Remove transaxle wiring harness from transaxle. Submerge ATF temperature sensor in water.
2. Heat water while measuring sensor resistance between solenoid connector terminals No. 1 and 6. At 77°F (25°C), resistance should be 3.5 k/ohms. At 231°F (110°C), resistance should be 231-263 ohms.
3. If resistance is not as specified, replace ATF temperature sensor. Sensor is part of transaxle internal wiring harness. If resistance is as specified, check and repair wiring harness and connector between ATF temperature sensor and ECM. If wiring harness and connector are okay, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.

DTC P0710 & P0711: AUTOMATIC TRANSAXLE FLUID TEMPERATURE SENSOR CIRCUIT MALFUNCTION (CAMRY, HIGHLANDER, RAV4 & RX 300)

NOTE: For circuit reference, see **CONNECTOR IDENTIFICATION** and/or **WIRING DIAGRAMS** .

Circuit Description

ATF temperature sensor converts fluid temperature into a resistance value which is input to ECM. DTC is set when temperature sensor resistance is less than 79 ohms, or after engine has been operating for 15 minutes or more, temperature sensor resistance is more than 156 k/ohms. Either condition must be set for .5 second or more. Possible causes are:

- Open or short in ATF temperature sensor circuit.
- ATF temperature sensor malfunction.
- ECM malfunction.

Diagnostic Procedure

NOTE: The values given below for "normal operating temperature" are representative values, so a vehicle may still be normal even if its value differs from those listed here. Do not depend solely on the "normal operating temperature" here when deciding whether or not the part is faulty.

1. Start and warm the engine to normal operating temperature. Turn ignition off. Install a scan tool. Turn ignition on, and turn the scan tool on. Select AT FLUID TEMP in the data list and read the displayed value. Normal operating temperature should be approximately 176°F (80°C). If temperature is close to specification, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If temperature reads -40°F (-40°C) or 437°F (225°C), the circuit is open or shorted to ground. If reading was not close to 176°F (80°C) and not open or shorted, go to next step.
2. Raise and support vehicle. Disconnect 10-pin solenoid connector located above PNP switch on side of transaxle. See **Fig. 10** . Remove transaxle oil pan. See LUBRICATION in appropriate AUTOMATIC article in TRANSMISSION SERVICING. Disconnect all solenoid connectors at solenoids. See **Fig. 11** . Remove transaxle wiring harness from transaxle. Submerge ATF temperature sensor in water. Heat water while measuring sensor resistance between solenoid connector terminals No. 1 and 6. At 77°F (25°C), resistance should be 3.5 k/ohms. At 230°F (110°C), resistance should be 231-263 ohms.
3. If resistance is not as specified, replace ATF temperature sensor. Sensor is part of transaxle internal wiring harness. If resistance is as specified, check and repair wiring harness and connector between ATF temperature sensor and ECM. If wiring harness and connector are okay, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.

DTC P0753: SHIFT SOLENOID CIRCUIT MALFUNCTION

NOTE: For circuit reference, see **CONNECTOR IDENTIFICATION** and/or **WIRING DIAGRAMS** .

Circuit Description

Shifting from 1st to overdrive is performed in combination with on and off cycle of shift solenoids SL1 and SL2. Solenoids are controlled by ECM. If an open or short circuit occurs in either solenoid, DTC will set. ECM controls remaining shift solenoids to allow vehicle to operate and ensure smooth transaxle shifting. See **Fig. 13** . ECM checks for an open or short circuit when solenoid is energized (duty cycle exceeds 75 percent), and when solenoid is not energized (duty cycle is less than 3 percent). Possible causes are:

- Open or short in solenoid circuit.
- Shift solenoid malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Access ECM. Disconnect appropriate ECM connector. Using a DVOM, measure resistance between terminal SL1+ and SL1- at ECM connector. See **PIN VOLTAGE TESTS** .
2. Resistance should be 5.1-5.5 ohms. If resistance is as specified, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If resistance is not as specified, disconnect 10-pin solenoid connector located above PNP switch on side of transaxle. See **Fig. 10** . Check circuit continuity between ECM connector terminal SL1+ and solenoid connector terminal No. 5, and between ECM connector terminal SL1- and solenoid connector terminal No. 10.
3. If continuity exists, check shift solenoid SL2 for malfunction. See appropriate solenoid test under **COMPONENT TESTS** . If continuity does not exist, check and repair wiring harness or connector

between solenoid connector and ECM.

DTC P0758: SHIFT SOLENOID CIRCUIT MALFUNCTION

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

Shifting from 1st to overdrive is performed in combination with on and off cycle of shift solenoids SL1 and SL2. Solenoids are controlled by ECM. If an open or short circuit occurs in either solenoid, DTC will set. ECM controls remaining shift solenoids to allow vehicle to operate and ensures smooth transaxle shifting. See **Fig. 13** . ECM checks for an open or short circuit when solenoid is energized (duty cycle exceeds 75 percent), and when solenoid is not energized (duty cycle is less than 3 percent). Possible causes are:

- Open or short in solenoid circuit.
- Shift solenoid malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Access ECM located behind glove compartment. Disconnect appropriate ECM connector. Using a DVOM, measure resistance between terminal SL2+ and SL2- at ECM connector. See PIN VOLTAGE TESTS .
2. Resistance should be 5.1-5.5 ohms. If resistance is as specified, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If resistance is not as specified, disconnect 10-pin solenoid connector located above PNP switch on side of transaxle. See **Fig. 10** . Check circuit continuity between ECM connector terminal SL2+ and solenoid connector terminal No. 4, and between ECM connector terminal SL2- and solenoid connector terminal No. 9.
3. If continuity exists, check shift solenoid SL1 for malfunction. See appropriate solenoid test under COMPONENT TESTS . If continuity does not exist, check and repair wiring harness or connector between solenoid connector and ECM.

DTC P0768: SHIFT SOLENOID CIRCUIT MALFUNCTION

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

Shifting from 1st to overdrive is performed in combination with on and off cycle of shift solenoids SL1 and SL2. Solenoids are controlled by ECM. If an open or short circuit occurs in either solenoid, ECM controls remaining shift solenoids to allow vehicle to operate and ensures smooth transaxle shifting. See **Fig. 13** . ECM checks for an open or short circuit in shift solenoid S4. DTC will set when ECM detects solenoid is energized and resistance is 8 ohms or less, or when solenoid is not energized and solenoid resistance is 100 k/ohms or

more. Possible causes are:

- Open or short in solenoid circuit.
- Shift solenoid malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Access ECM located behind glove compartment. Disconnect appropriate ECM connector. Using a DVOM, measure resistance between ground and terminal S4 at ECM connector. See **PIN VOLTAGE TESTS** .
2. Resistance should be 11-15 ohms. If resistance is as specified, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If resistance is not as specified, disconnect 10-pin solenoid connector located above PNP switch on side of transaxle. See **Fig. 10** . Check circuit continuity between ECM connector terminal S4 and solenoid connector terminal No. 8.
3. If continuity exists, check shift solenoid S4 for malfunction. See appropriate solenoid test under **COMPONENT TESTS** . If continuity does not exist, check and repair wiring harness or connector between solenoid connector and ECM.

DTC P0773: SHIFT SOLENOID CIRCUIT MALFUNCTION (CAMRY)

NOTE: For circuit reference, see **CONNECTOR IDENTIFICATION** and/or **WIRING DIAGRAMS** .

Circuit Description

Shift solenoid DSL is controlled by ECM to control hydraulic pressure acting on lock-up relay valve, which controls torque converter clutch lock-up. DTC will set if ECM detects an open or short circuit when solenoid resistance is 8 ohms or less with solenoid energized, or 100 k/ohms or more with solenoid not energized. If ECM detects a malfunction, shift solenoid DSL is turned off. Possible causes are:

- Open or short in solenoid circuit.
- Shift solenoid malfunction.
- ECM malfunction.

Diagnostic Procedure

NOTE: The values given below for "Normal Condition" are representative values, so a vehicle may still be normal even if its value differs from those listed here. Do not depend solely on the "Normal Condition" here when deciding whether or not the part is faulty.

1. Warm up the engine. Turn ignition off. Connect the OBD-II scan tool or hand-held tester to the DLC3. Turn ignition on and push the OBD-II scan tool or hand-held tester main switch ON. Select the item

"LOCK UP" in the ACTIVE TEST and operate the Lock-up solenoid valves on the OBD-II scan tool or hand-held tester. Road test vehicle to at least 36 MPH. Command the DSL solenoid ON. If the solenoid engages, replace the ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If not, go to next step.

2. Disconnect the solenoid connector from the transaxle. See **Fig. 10** . Measure resistance between terminal No. 3 and body ground. Resistance should be 11-15 ohms at 68°F (20°C). If resistance is as specified, go to next step. If not, go to step 4 .
3. Connect the transmission harness connector. Disconnect the ECM connector. Measure the resistance between terminal DSL and E1. Resistance should be 11-13 ohms at 68°F (20°C). If resistance is not as specified, repair or replace wiring harness and connector. If resistance is as specified, go to next step.
4. Raise and support the vehicle. Remove transaxle oil pan. See LUBRICATION in appropriate AUTOMATIC article in TRANSMISSION SERVICING. If solenoid does not operate, replace shift solenoid DSL. If solenoid operates, check and repair wiring harness or connector as necessary.

DTC P0773: SHIFT SOLENOID CIRCUIT MALFUNCTION (HIGHLANDER)

NOTE: For circuit reference, see **CONNECTOR IDENTIFICATION** and/or **WIRING DIAGRAMS** .

Circuit Description

Shift solenoid DSL is controlled by ECM to control hydraulic pressure acting on lock-up relay valve, which controls torque converter clutch lock-up. DTC will set if ECM detects an open or short circuit when solenoid resistance is 8 ohms or less with solenoid energized, or 100 k/ohms or more with solenoid not energized. If ECM detects a malfunction, shift solenoid DSL is turned off. Possible causes are:

- Open or short in solenoid circuit.
- Shift solenoid malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Disconnect the solenoid connector from the transaxle. Measure the resistance between terminal No. 3 and body ground. Resistance should be 11-13 ohms at 68°F (20°C). If resistance is not as specified, go to step 3 . If measurement is within specification, go to next step.
2. Connect the transmission harness connector. Disconnect the ECM connector. Measure the resistance between terminal DSL and E1. Resistance should be 11-13 ohms at 68°F (20°C). If resistance is not as specified, repair or replace wiring harness and connector. If resistance is as specified, go to next step.
3. Remove the transaxle oil pan. See LUBRICATION in appropriate AUTOMATIC article in TRANSMISSION SERVICING. Remove the shift solenoid valve DSL. Measure the resistance between the terminal DSL of shift solenoid valve and the solenoid body. Resistance should be 11-13 ohms at 68°F (20°C). If within specification, connect battery voltage to the positive lead of the solenoid connector, and ground the solenoid body. If the solenoid does not operate, replace the solenoid. If it does operate, repair or replace the wiring harness and connector.

DTC P0773: SHIFT SOLENOID CIRCUIT MALFUNCTION (RAV4)

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

Shift solenoid DSL is controlled by ECM to control hydraulic pressure acting on lock-up relay valve, which controls torque converter clutch lock-up. DTC will set if ECM detects an open or short circuit when solenoid resistance is 8 ohms or less with solenoid energized, or 100 k/ohms or more with solenoid not energized. If ECM detects a malfunction, shift solenoid DSL is turned off. Possible causes are:

- Open or short in solenoid circuit.
- Shift solenoid malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Access ECM. See **Fig. 5 -Fig. 8** . Disconnect appropriate ECM connector. Disconnect 10-pin solenoid connector located above PNP switch on side of transaxle. See **Fig. 10** . Using a DVOM, check circuit for continuity between ECM connector terminal DSL and solenoid connector DSL. See **PIN VOLTAGE TESTS** . If continuity exists, go to next step. If continuity does not exist, check and repair wiring harness or connector as needed.
2. Raise and support vehicle. Remove transaxle oil pan. See LUBRICATION in appropriate AUTOMATIC article in TRANSMISSION SERVICING. Disconnect shift solenoid DSL connector. See **Fig. 12** . Remove solenoid. Using a DVOM, measure resistance between solenoid body and solenoid connector terminal. Resistance should be 11-13 ohms at 68°F (20°C). If resistance is not as specified, replace solenoid. If resistance is as specified, go to next step.
3. Connect jumper wire from positive battery post to solenoid connector terminal and add an additional jumper wire from negative battery post to solenoid body. If solenoid does not operate, replace shift solenoid DSL. If solenoid operates, check and repair wiring harness or connector as necessary.

DTC P0773: SHIFT SOLENOID CIRCUIT MALFUNCTION (ES 300 & RX 300)

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

Shift solenoid DSL is controlled by ECM to control hydraulic pressure acting on lock-up relay valve, which controls torque converter clutch lock-up. DTC will set if ECM detects an open or short circuit when solenoid resistance is 8 ohms or less with solenoid energized, or 100 k/ohms or more with solenoid not energized. If ECM detects a malfunction, shift solenoid DSL is turned off. Possible causes are:

- Open or short in solenoid circuit.

- Shift solenoid malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Disconnect the solenoid connector at the transaxle. Check the harness connector between terminal DSL and the ECM terminal DSL for continuity. If continuity is found, go to next step. If no continuity is found, repair or replace wiring harness and connector.
2. Raise and support vehicle. Remove transaxle oil pan. See LUBRICATION in appropriate AUTOMATIC article in TRANSMISSION SERVICING. Remove the shift solenoid valve connector and remove the shift solenoid. Measure resistance between terminal SL of the shift valve and the solenoid body. Resistance should be 11-15 ohms. If within specification, go to next step. If not, connect battery voltage to solenoid positive terminal and ground solenoid body. If the solenoid does not operate, replace the solenoid. If it does operate, go to next step
3. Repair or replace the wiring harness and connector.

DTC P1520: BRAKELIGHT SWITCH CIRCUIT MALFUNCTION

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

When brake pedal is depressed, brakelight switch sends a signal to ECM. If transaxle is in lock-up mode, ECM cancels lock-up operation and prevents engine stall. DTC will set if ECM detects brakelight switch signal does not turn off during driving. Possible causes are:

- Open or short in brakelight switch circuit.
- Brakelight switch malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Access ECM. See **Fig. 5 -Fig. 8** . Turn ignition switch to ON position. Using a DVOM, measure voltage between ground and ECM STP circuit terminal. See PIN VOLTAGE TESTS .
2. With brake pedal depressed, voltage should be 7.5-14 volts. With brake pedal released, voltage should be less than 1.5 volts. If voltage is not as specified, go to next step. If voltage is as specified, problem is intermittent. Check wiring harness and connector.
3. Check brakelight switch. See BRAKELIGHT SWITCH under COMPONENT TESTS. If brakelight switch is okay, check circuit between brakelight switch and ECM. If circuit is okay, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.

DTC P1725: INPUT TURBINE SPEED SENSOR CIRCUIT MALFUNCTION (ES 300 & RX 300)

NOTE: Sensor may also be referred to as NT revolution sensor.

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

Input turbine speed sensor detects rotation speed of input shaft. By comparing input turbine speed sensor signal and counter gear speed sensor signal, ECM detects shift timing of gears and controls engine torque and hydraulic pressure in response to various conditions to ensure smooth transaxle shifting. DTC will set if ECM detects vehicle speed of 20 MPH or more, transaxle is in 2nd, 3rd or OD gear, shift solenoids and PNP switch status is normal, and input shaft speed is less than 300 RPM. Possible causes are:

- Open or short in speed sensor circuit.
- Speed sensor malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Access ECM located behind glove compartment. Disconnect appropriate ECM connector. Using a DVOM, measure resistance between ECM connector terminals NT+ and NT-. See PIN VOLTAGE TESTS . Resistance should be 560-680 ohms. If resistance is as specified, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If resistance is not as specified, go to next step.
2. Remove input turbine speed sensor from transaxle. See Fig. 10 . Measure resistance between speed sensor terminals. Resistance should be 560-680 ohms. Connect a DVOM to speed sensor terminals.
3. Measure voltage when a magnet is placed close to tip of speed sensor, then taken away quickly. See Fig. 17 . Voltage generated should be intermittent and extremely low. If resistance and voltage are not as specified, replace speed sensor. If resistance and voltage are as specified, check and repair wiring harness or connector between speed sensor and ECM.

DTC P1725: INPUT TURBINE SPEED SENSOR CIRCUIT MALFUNCTION (CAMRY, HIGHLANDER & RAV4)

NOTE: Sensor may also be referred to as NT revolution sensor.

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

Input turbine speed sensor detects rotation speed of input shaft. By comparing input turbine speed sensor signal and counter gear speed sensor signal, ECM detects shift timing of gears and controls engine torque and hydraulic pressure in response to various conditions to ensure smooth transaxle shifting. DTC will set if ECM detects vehicle speed of 20 MPH or more, transaxle is in 2nd, 3rd or OD gear, shift solenoids and PNP switch

status is normal, and input shaft speed is less than 300 RPM. Possible causes are:

- Open or short in speed sensor circuit.
- Speed sensor malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Access ECM. See **Fig. 5 -Fig. 8** . Disconnect appropriate ECM connector. Using a DVOM, measure resistance between ECM connector terminals NT+ and NT-. See **PIN VOLTAGE TESTS** . Resistance should be 500-620 ohms for Toyota made sensors and 560-680 ohms for AISIN made sensors. If resistance is as specified, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If resistance is not as specified, go to next step.
2. Remove the transaxle oil pan. See LUBRICATION in appropriate AUTOMATIC article in TRANSMISSION SERVICING. Remove input turbine speed sensor from transaxle. See **Fig. 10** . Measure resistance between speed sensor terminals. Resistance should be 500-620 ohms for Toyota made sensors and 560-680 ohms for AISIN made sensors. Connect a DVOM to speed sensor terminals.
3. Measure voltage when a magnet is placed close to tip of speed sensor, then taken away quickly. See **Fig. 17** . Voltage generated should be intermittent and extremely low. If resistance and voltage are not as specified, replace speed sensor. If resistance and voltage are as specified, check and repair wiring harness or connector between speed sensor and ECM.

DTC P1730: COUNTER GEAR SPEED SENSOR CIRCUIT MALFUNCTION (CAMRY & ES 300)

NOTE: For circuit reference, see **CONNECTOR IDENTIFICATION** and/or **WIRING DIAGRAMS** .

Circuit Description

NOTE: Sensor may also be referred to as NC revolution sensor.

Counter gear speed sensor detects rotation of counter drive gear. By comparing input turbine speed sensor signal and counter gear speed sensor signal, ECM detects shift timing of gears and controls engine torque and hydraulic pressure in response to various conditions to ensure smooth transaxle shifting. DTC will set if ECM detects vehicle speed of 20 MPH or more, transaxle is in 2nd, 3rd or OD gear, shift solenoids and PNP switch status is normal, and counter drive gear speed is less than 300 RPM. Possible causes are:

- Open or short in speed sensor circuit.
- Speed sensor malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Warm up the engine. Turn ignition off. Connect the OBD-II scan tool or hand-held tester to the DLC3. Turn ignition on and turn the OBD-II scan tool or hand-held tester main SW ON. Select the item "SPD

(NC)" in the DATA LIST and read its value displayed on the OBD-II scan tool or hand-held tester. Does the counter gear read at least 50 RPM? If so, replace the ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If not, go to next step.

2. Disconnect the speed sensor wiring connector at the speed sensor and measure the resistance between the terminals. See **Fig. 17** . Resistance should be 500-620 ohms at 68°F (20°C) for Toyota made sensors, and 560-680 ohms at 68°F (20°C) for ASIAN made sensors. If readings are within specification, go to next step. If not, replace speed sensor.
3. Connect the speed sensor connector. Disconnect the ECM connector. Measure the resistance between terminal NC+ and NC-. Resistance should be 500-620 ohms at 68°F (20°C) for Toyota made sensors, and 560-680 ohms at 68°F (20°C) for ASIAN made sensors. If readings are within specification, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If not, repair or replace wiring harness and connector.

DTC P1730: COUNTER GEAR SPEED SENSOR CIRCUIT MALFUNCTION (HIGHLANDER & RAV4)

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

NOTE: Sensor may also be referred to as NC revolution sensor.

Counter gear speed sensor detects rotation of counter drive gear. By comparing input turbine speed sensor signal and counter gear speed sensor signal, ECM detects shift timing of gears and controls engine torque and hydraulic pressure in response to various conditions to ensure smooth transaxle shifting. DTC will set if ECM detects vehicle speed of 20 MPH or more, transaxle is in 2nd, 3rd or OD gear, shift solenoids and PNP switch status is normal, and counter drive gear speed is less than 300 RPM. Possible causes are:

- Open or short in speed sensor circuit.
- Speed sensor malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Access ECM. See **Fig. 5 -Fig. 8** . Disconnect appropriate ECM connector. Using a DVOM, measure resistance between ECM connector terminals NC+ and NC-. See PIN VOLTAGE TESTS . Resistance should be 500-620 ohms for Toyota made sensors, and 560-680 ohms for AISIN made sensors. If resistance is as specified, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If resistance is not as specified, go to next step.
2. Remove the oil pan. See LUBRICATION in appropriate AUTOMATIC article in TRANSMISSION SERVICING. Remove counter gear speed sensor from transaxle. See **Fig. 10** . Measure resistance between speed sensor terminals. Resistance should be 500-620 ohms for Toyota made sensors, and 560-680 ohms for AISIN made sensors. Go to next step.
3. Connect a DVOM to speed sensor terminals. Measure voltage when a magnet is placed close to tip of

speed sensor, then taken away quickly. See **Fig. 17** . Voltage generated should be intermittent and extremely low. If resistance and voltage are not as specified, replace speed sensor. If resistance and voltage are as specified, check and repair wiring harness or connector between speed sensor and ECM.

DTC P1730: COUNTER GEAR SPEED SENSOR CIRCUIT MALFUNCTION (RX 300)

NOTE: For circuit reference, see **CONNECTOR IDENTIFICATION** and/or **WIRING DIAGRAMS** .

Circuit Description

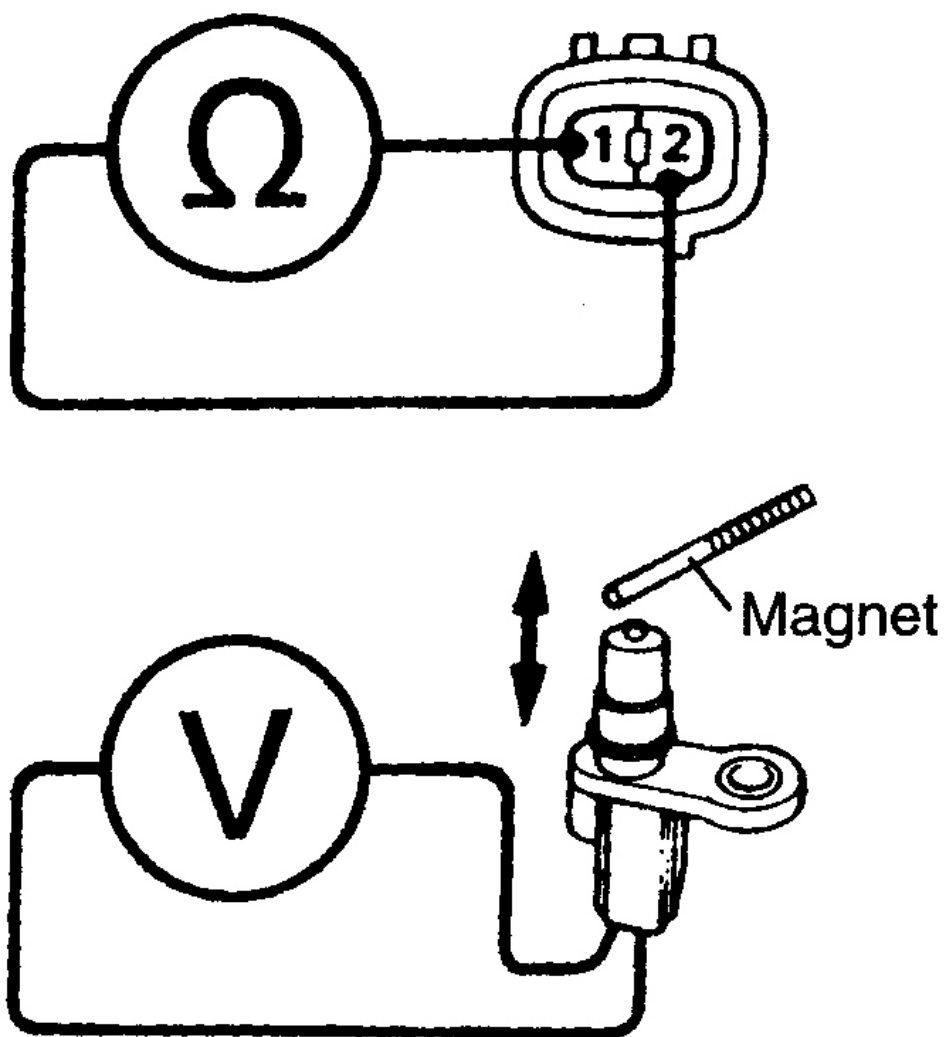
NOTE: Sensor may also be referred to as NC revolution sensor.

Counter gear speed sensor detects rotation of counter drive gear. By comparing input turbine speed sensor signal and counter gear speed sensor signal, ECM detects shift timing of gears and controls engine torque and hydraulic pressure in response to various conditions to ensure smooth transaxle shifting. DTC will set if ECM detects vehicle speed of 20 MPH or more, transaxle is in 2nd, 3rd or OD gear, shift solenoids and PNP switch status is normal, and counter drive gear speed is less than 300 RPM. Possible causes are:

- Open or short in speed sensor circuit.
- Speed sensor malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Access ECM. See **Fig. 5 -Fig. 8** . Disconnect appropriate ECM connector. Using a DVOM, measure resistance between ECM connector terminals NC+ and NC-. See **PIN VOLTAGE TESTS** . Resistance should be 560-680 ohms. If resistance is as specified, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If resistance is not as specified, go to next step.
2. Remove counter gear speed sensor from transaxle. See **Fig. 10** . Measure resistance between speed sensor terminals. See **Fig. 17** . Resistance should be 560-680 ohms. Connect a DVOM to speed sensor terminals.
3. Measure voltage when a magnet is placed close to tip of speed sensor, then taken away quickly. See **Fig. 17** . Voltage generated should be intermittent and extremely low. If resistance and voltage are not as specified, replace speed sensor. If resistance and voltage are as specified, check and repair wiring harness or connector between speed sensor and ECM.



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Fig. 17: Testing Vehicle Speed Sensor
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DTC P1760: SHIFT SOLENOID MALFUNCTION (CAMRY & ES 300)

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS.

Circuit Description

Throttle pressure applied to primary regulator valve, which modulates line pressure, causes shift solenoid SLT to precisely and minutely modulate and generate line pressure according to accelerator pedal effort, or engine power output detected. This reduces line pressure and provides smooth transaxle shifts. Upon receiving throttle valve opening angle signal, ECM controls line pressure by sending a predetermined duty cycle to shift solenoid SLT, modulating line pressure and generating throttle pressure. Duty cycle is ratio of period of continuity in one cycle. Shift solenoid SLT is located on transaxle valve body. See **Fig. 12** . DTC will set if voltage at ECM terminal SLT- is zero volts or 12 volts for one second or more. Possible causes are:

- Open or short in solenoid circuit.
- Solenoid malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Start and warm the engine to normal operating temperature. Turn ignition off. Connect the OBD-II scan tool or hand-held tester to the DLC3. Turn ignition on and turn the OBD-II scan tool or hand-held tester ON. Select the item "LINE PRESS UP" in the ACTIVE TEST and operate the shift solenoid SLT on the OBD-II scan tool or hand-held tester. If line pressure can be raised, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If the line pressure cannot be raised, go to next step.
2. Disconnect the transmission wire connector from the transaxle. Measure the resistance between the terminal SLT+ and SLT-. See **PIN VOLTAGE TESTS** . Resistance should be between 5.0-5.6 ohms, at 68°F (20°C). If readings are within specifications, go to next step. If not, go to step 4 .
3. Connect the transmission wire connector to the transaxle. Disconnect the ECM connector. Measure the resistance between terminals SLT+ and SLT- of ECM connector. See **PIN VOLTAGE TESTS** . Resistance should be between 5.0-5.6 ohms, at 68°F (20°C). If readings are within specification, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If not, go to next step.
4. Raise and support the vehicle. Remove the oil pan. See LUBRICATION in appropriate AUTOMATIC article in TRANSMISSION SERVICING. Disconnect the solenoid connector. Measure the solenoid resistance between terminals 1 and 2 of the solenoid connector. Resistance should be between 5.0-5.6 ohms at 68°F (20°C).

Connect battery voltage, with an 21-watt bulb, to terminal No. 1 of the solenoid connector and ground terminal No. 2, then check the movement of the valve. When battery voltage is applied, valve should move out of solenoid. See **Fig. 19** . When battery positive voltage is removed, valve should move back in. If both checks operated as described, replace transaxle wiring harness and connector. If both checks did not operate as described, replace pressure control solenoid valve.

DTC P1760: SHIFT SOLENOID MALFUNCTION (HIGHLANDER)

NOTE: For circuit reference, see **CONNECTOR IDENTIFICATION** and/or **WIRING DIAGRAMS** .

Circuit Description

Throttle pressure applied to primary regulator valve, which modulates line pressure, causes shift solenoid SLT to precisely and minutely modulate and generate line pressure according to accelerator pedal effort, or engine power output detected. This reduces line pressure and provides smooth transaxle shifts. Upon receiving throttle valve opening angle signal, ECM controls line pressure by sending a predetermined duty cycle to shift solenoid SLT, modulating line pressure and generating throttle pressure. Duty cycle is ratio of period of continuity in one cycle. Shift solenoid SLT is located on transaxle valve body. See **Fig. 12** . DTC will set if voltage at ECM terminal SLT- is zero volts or 12 volts for one second or more. Possible causes are:

- Open or short in solenoid circuit.
- Solenoid malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Disconnect the wiring harness to the transaxle. Measure the resistance between terminal SLT+ and SLT-. See **Fig. 18** . Resistance should be 5.0-5.6 ohms at 68°F (20°C). If readings are within specification, go to next step. If not, go to step 3 .
2. Connect the transmission wire connector to the transaxle. Disconnect the ECM connector. Measure the resistance between terminals SLT+ and SLT- of ECM connector. Resistance should be 5.0-5.6 ohms at 68°F (20°C). If readings are within specification, replace the ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If readings are not within specification, repair or replace the wiring harness and connector.
3. Remove the line pressure control solenoid (SLT). Applying 71 psi (5 kg/cm²) of compressed air, check that the solenoid valve does not leak the air. Also check that when battery voltage is supplied to the line pressure control solenoid (SLT), check that the valve opens. If both checks are okay, replace transaxle wiring harness and connector. If checks were not okay, replace the line control solenoid.

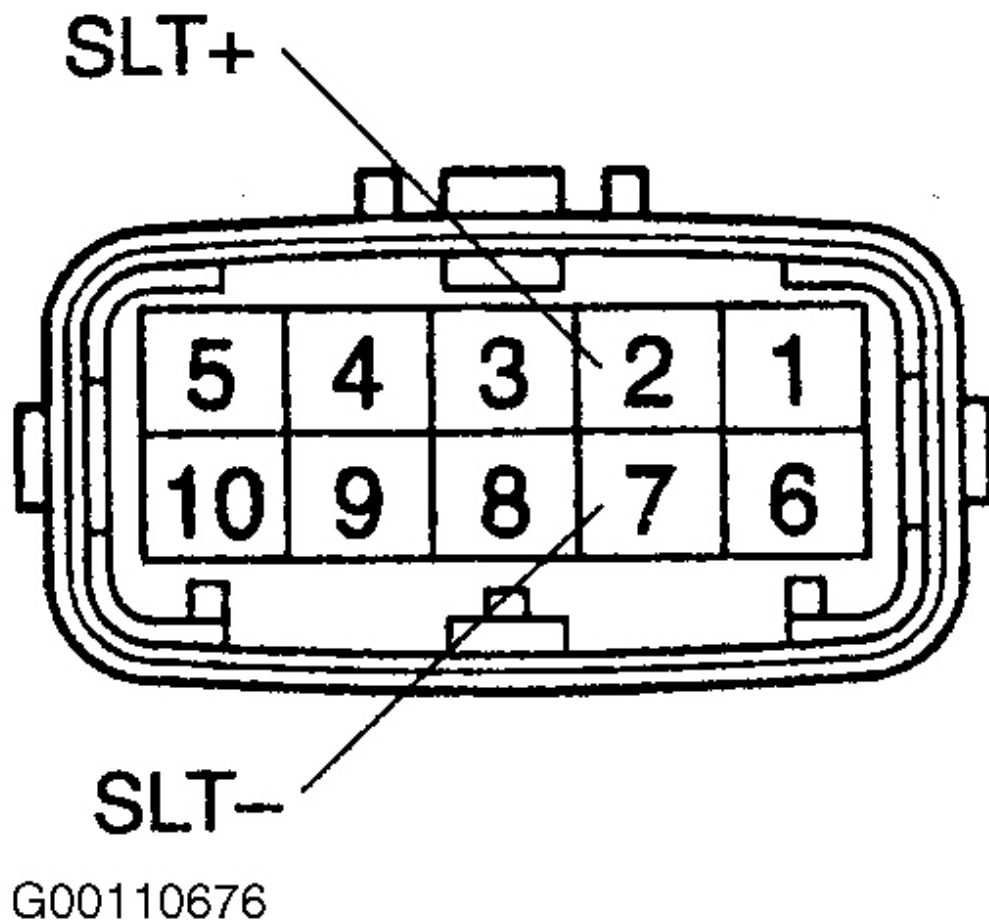


Fig. 18: Testing SLT Circuit

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DTC P1760: SHIFT SOLENOID MALFUNCTION (RAV4 & RX 300)

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS.

Circuit Description

Throttle pressure applied to primary regulator valve, which modulates line pressure, causes shift solenoid SLT to precisely and minutely modulate and generate line pressure according to accelerator pedal effort, or engine power output detected. This reduces line pressure and provides smooth transaxle shifts. Upon receiving throttle

valve opening angle signal, ECM controls line pressure by sending a predetermined duty cycle to shift solenoid SLT, modulating line pressure and generating throttle pressure. Duty cycle is ratio of period of continuity in one cycle. Shift solenoid SLT is located on transaxle valve body. See **Fig. 12** . DTC will set if voltage at ECM terminal SLT- is zero volts or 12 volts for one second or more. Possible causes are:

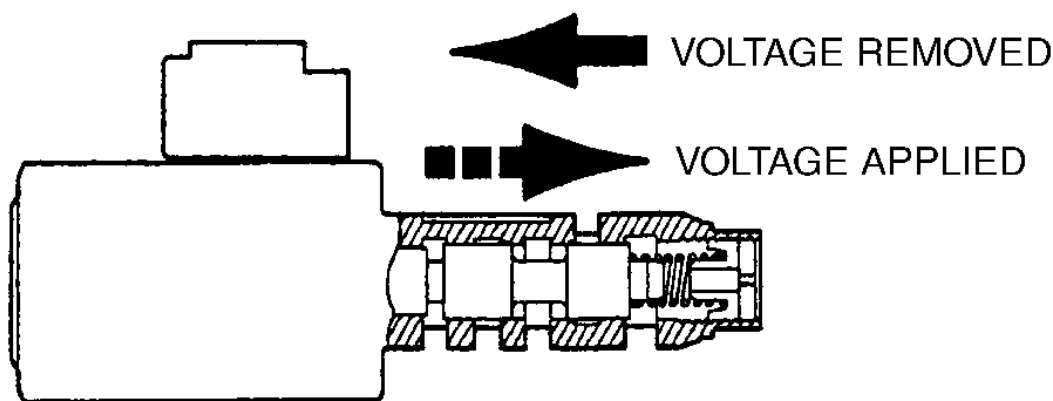
- Open or short in solenoid circuit.
- Solenoid malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Raise and support the vehicle. Remove the oil pan. See LUBRICATION in appropriate AUTOMATIC article in TRANSMISSION SERVICING. Disconnect the solenoid connector. Measure the solenoid resistance between terminals 1 and 2 of the solenoid connector. Resistance should be between 5.1-5.5 ohms at 68°F (20°C).

Connect battery voltage, with an 8-10 watt bulb, to terminal No. 1 of the solenoid connector and ground terminal No. 2, then check the movement of the valve. When battery voltage is applied, valve should move out of solenoid. See **Fig. 19** . When battery positive voltage is removed, valve should move back in. If both checks operated as described, go to next step. If both checks did not operate as described, replace SLT shift solenoid valve.

2. Check transaxle wiring harness for an intermittent open circuit or weak terminal tension at connectors. It may be necessary to manipulate harness with testing equipment connected to locate condition. If wiring harness and connector are okay, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.



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Fig. 19: Testing Shift Solenoid Valve SLT
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DTC P1780: PARK/NEUTRAL POSITION SWITCH CIRCUIT MALFUNCTION (CAMRY & ES 300)

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

When ignition key turns to START position, battery voltage is input to the NSW terminal of ECM. Condition for setting this code are: Ignition key is in the START position, vehicle speed must be at least 44 MPH and engine speed between 1500-2500 RPM for 30 seconds or more.

Possible causes are:

- Short in PNP switch circuit.
- Ignition switch/wiring harness malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Check battery voltage. If voltage is between 10-14 volts, go to next step. If battery failed voltage check, charge or replace the battery.
2. Disconnect the ECM connector. Measure the voltage between terminals NSW and E1 when the ignition key is turned to each position. See **PIN VOLTAGE TESTS** . At the START position reading should be 10-14 volts, and all other positions should read zero volts. If reading is within specification, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If not within specification, repair or replace transaxle wiring harness and connector.

DTC P1780: PARK/NEUTRAL POSITION SWITCH CIRCUIT MALFUNCTION (HIGHLANDER)

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

The PNP switch detects the gearshift lever position and sends signals to the ECM. The ECM receives signals (PNP SW, REVERSE, DRIVE, 2ND and LOW) from the PNP switch. DTC will set when ECM detects 2 or more circuits are on, vehicle has been driven for 30 seconds or more at 44 MPH or more, engine speed is 1500-2500 RPM and PNP switch is on ("N" position). Possible causes are:

- Short in PNP switch circuit.
- PNP switch malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Install scan tool to DLC3 and monitor gearshift position. Move the gearshift lever to the "P", "R", "N", "D", "2" and "L" ranges, and read the NSW, REVERSE, DRIVE, 2ND and LOW signals on the hand-held tester. See **Fig. 20** . If readings are as specified, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If values differ, go to next step.
2. Remove the neutral start switch. Check for continuity between each terminal shown when the gearshift lever is moved to each range. See **Fig. 21** . If readings are as specified, replace PNP switch. If values differ, go to next step.
3. Connect the PNP switch connector. Disconnect the ECM connector. Turn ignition on and measure the voltage between terminals "P", "R", "N", "D", "2", and "L" of ECM and terminal E1 when the gearshift lever is placed into specified positions. See **Fig. 22** . If readings are as specified, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If readings are not as specified, repair or replace transaxle wiring harness and connector.

Shift range	Signal
P, N	NSW OFF → ON
R	REVERSE OFF → ON
D	DRIVE OFF → ON
2	2ND OFF → ON
L	LOW OFF → ON

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Fig. 20: Identifying Scan Tool Gearshift Position Signal Values
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Shift Range	Terminal No. to continuity	
P	1 – 3	6 – 9
R	2 – 3	–
N	3 – 5	6 – 9
D	3 – 7	–
2	3 – 4	–
L	3 – 8	–

G00110680

Fig. 21: Checking Park/Neutral Position Switch For Continuity
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Shift position	Terminal	Voltage (V)
P	P – E1	7.5 – 14
R	R – E1	7.5 – 14
N	N – E1	7.5 – 14
D	D – E1	7.5 – 14
2	2 – E1	7.5 – 14
L	L – E1	7.5 – 14

G00110678

Fig. 22: Checking Wiring Harness For Proper Voltages
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DTC P1780: PARK/NEUTRAL POSITION SWITCH CIRCUIT MALFUNCTION (RAV4)

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

The PNP switch detects the gearshift lever position and sends signals to the ECM. The ECM receives signals (PNP SW, REVERSE, DRIVE, 2ND and LOW) from the PNP switch. When the signal is not sent to the ECM from the PNP switch, the ECM judges that the gearshift lever is in the DRIVE position. DTC will set when ECM detects 2 or more circuits are on, vehicle has been driven for 30 seconds or more at 44 MPH or more,

engine speed is 1500-2500 RPM and PNP switch is in the "N" position. Possible causes are:

- Short in PNP switch circuit.
- PNP switch malfunction.
- ECM malfunction.

Diagnostic Procedure

NOTE: **If Toyota scan tool is not available, begin at step 2 .**

1. Install scan tool to DLC3. Turn ignition on. Monitor PNP switch function. Move the gearshift lever through all gear ranges, while observing the scan tool. See **Fig. 23** . If the readings are within specification, check for intermittent condition: Loose terminal tension, corroded terminals, cut or broken wiring or chaffed wiring harness. If readings are not within specification, go to step [3](#) .
2. Turn ignition on. Measure the voltage between terminals "P", "N" R", "D", "2" and "L" of the ECM connector and ground when the gearshift lever is shifted into the positions shown in figure. See **Fig. 24** . If the readings are within specification, check for intermittent condition: Loose terminal tension, corroded terminals, cut or broken wiring or chaffed wiring harness. If readings are not within specification, go to step [3](#) .
3. Raise and support vehicle. Remove the PNP switch. Check the continuity between each terminal shown when the gearshift lever is moved into each position. See **Fig. 25** and **Fig. 44** . If continuity is within specification, replace the PNP switch. If continuity is not within specification, go to next step.
4. Check harness and connector between battery and PNP switch, and PNP switch and ECM. If problem was found, replace wiring harness and connector. If no problem was found, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.

Shift position	Signal
P, N	PNP SW OFF → ON
R	REVERSE OFF → ON
D	DRIVE OFF → ON
2	2ND OFF → ON
L	LOW OFF → ON

G00110681

Fig. 23: Identifying Scan Tool Gearshift Position Signal Values
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Position	Tester connection	Specified value
P, N	NSW – Body ground	10 – 14 V
R	R – Body ground	10 – 14 V
D	D – Body ground	10 – 14 V
2	2 – Body ground	10 – 14 V
L	L – Body ground	10 – 14 V

G00110682

Fig. 24: Measuring ECM Voltages From PNP Switch
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Shift range	Terminal No. to continuity	
P	6 – 9	1 – 3
R	2 – 3	–
N	6 – 9	3 – 5
D	3 – 7	–
2	3 – 4	–
L	3 – 8	–

G00110683

Fig. 25: Checking For Continuity At PNP Switch Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DTC P1780: PARK/NEUTRAL POSITION SWITCH CIRCUIT MALFUNCTION (RX 300)

NOTE: If Lexus scan tool is not available, begin at step 2 .

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

The PNP switch detects the gearshift lever position and sends signals to the ECM. The ECM receives signals (NSW, REVERSE, 2ND and LOW) from the PNP switch. When the signal is not sent to the ECM from the

PNP switch, the ECM judges that the gearshift lever is in the DRIVE position. DTC will set when ECM detects 2 or more circuits are on, vehicle has been driven for 30 seconds or more at 44 MPH or more, engine speed is 1500-2500 RPM and PNP switch is in the "N" Position. Possible causes are:

- Short in PNP switch circuit.
- PNP switch malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Install scan tool to DLC3. Turn ignition on. Monitor PNP switch function. Move the gearshift lever through all gear ranges, while observing the scan tool. See **Fig. 26** . If the readings are within specification, check for intermittent condition: Loose terminal tension, corroded terminals, cut or broken wiring or chaffed wiring harness and repair as necessary. If readings are not within specification, go to step 3 .
2. Turn ignition on. Measure voltage between ground and terminals NSW, "2", "L" and "R" of ECM, while the gearshift lever is moved through all positions. See **Fig. 27** . If voltage is not as specified, go to next step. If voltage is as specified, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.
3. Raise and support vehicle. Remove the PNP switch. Check for continuity between each terminal shown when the gearshift lever is moved into each position. See **Fig. 21** and **Fig. 44** . If continuity is not within specification, replace the PNP switch. If continuity is within specification, go to next step.
4. Check wiring harness and connector between battery and PNP switch, and from PNP switch to ECM. If problem was found, replace wiring harness and connector. If no problem was found, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.

Shift position	Signal
2	2ND OFF → ON
L	LOW OFF → ON
R	REVERSE OFF → ON
P, N	NSW OFF → ON

G00115726

Fig. 26: Identifying Scan Tool Gearshift Position Signal Values
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Position	Tester connection	Specified value
P	P – Body ground	Battery positive voltage
R	R – Body ground	Battery positive voltage
N	N – Body ground	Battery positive voltage
D	D – Body ground	Battery positive voltage
2	2 – Body ground	Battery positive voltage
L	L – Body ground	Battery positive voltage

G00115727

Fig. 27: Measuring ECM Voltages From PNP Switch
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CIRCUIT TESTS

OVERDRIVE CANCEL SIGNAL (HIGHLANDER & RX 300)

NOTE: For circuit reference, see **CONNECTOR IDENTIFICATION** and/or **WIRING DIAGRAMS**.

1. Access ECM. See **Fig. 5 -Fig. 8**. Turn ignition switch to ON position. Using a DVOM, measure voltage (backprobe) between terminal OD1 of appropriate ECM harness connector and ground. If 10-14 volts is present, substitute known-good ECM and retest. If voltage is not as specified, go to next step.
2. Turn ignition off. Disconnect cruise control ECU harness connector located behind instrument panel on driver's side of vehicle. Turn ignition on. Measure voltage between terminal OD and ground. See **Fig. 28**. If 10-14 volts is present, replace cruise control ECU and retest. If 10-14 volts is not present, check and repair circuit between cruise control ECU and ECM.

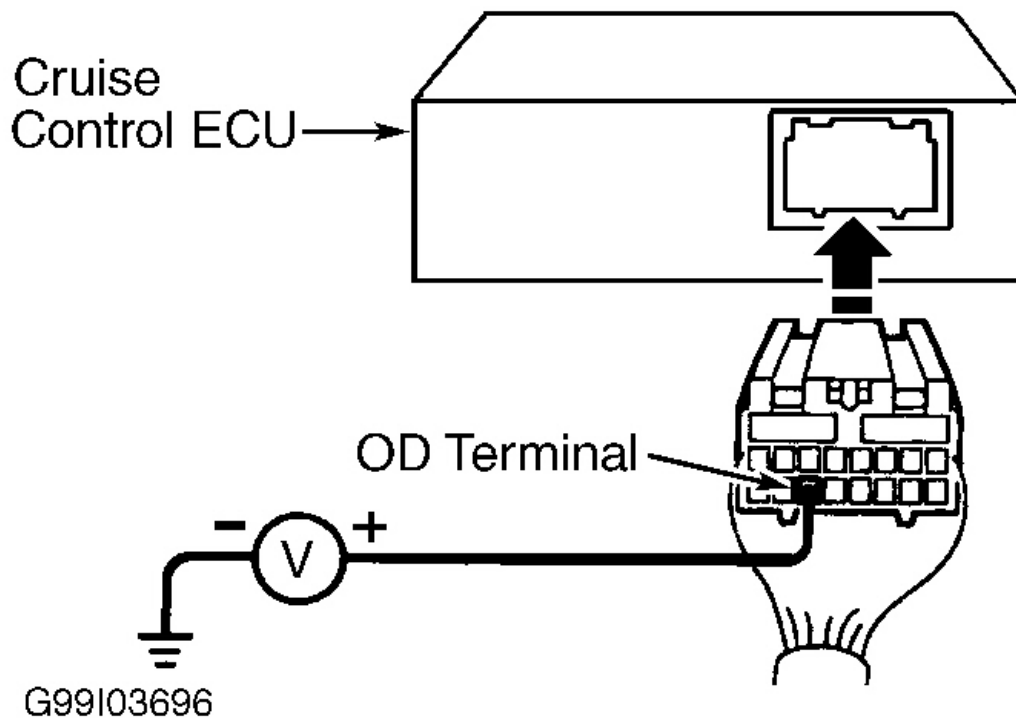


Fig. 28: Testing Cruise Control ECU Terminal
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OVERDRIVE MAIN SWITCH CIRCUIT (CAMRY)

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

NOTE: The values given for "Normal Condition" are representative values, so a vehicle may still be normal even if its value differs from those listed here. Do not depend solely on the "Normal Condition" here when deciding whether or not the part is faulty.

Circuit Description

The O/D main switch is a momentary type switch. When pressing the O/D main switch, the O/D OFF indicator light illuminates and the ECM prohibits shifting into O/D, and when pressing it once again, the O/D OFF indicator light goes off and the ECM allows shifting into O/D. Turning the ignition switch OFF will reset the O/D OFF indicator light.

Inspection Procedure

- 1. Warm up the engine. Turn ignition off. Connect the scan tool or hand-held tester to the DLC3. Turn ignition on and turn ON the scan tool or hand-held tester. Select the item OVERDRV CUT SW1 in the DATA LIST and read its value displayed on the OBD-II scan tool or hand held tester. See **Fig. 29** . If scan tool parameters are within specification, install a known-good ECM, if problem is gone, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If parameters are not within specification, go to next step.
- 2. Disconnect the transmission control switch connector. Check for continuity between terminals No. 2 and 4 of transmission control switch. See **Fig. 46** and **Fig. 30** . If continuity is as specified, go to next step. If not, replace transmission control switch.
- 3. Connect the transmission control switch connector. Check for continuity between terminals ODMS and E1 of ECM. See **Fig. 31** . If continuity is as specified, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If not, repair or replace wiring harness and connector.

Item	MeasurementItem/ Display (Range)	NormalCondition	Diagnostic Note
OVERDRV CUT SW1	O/D SW Status/ ON or OFF	• O/D SW Push: ON • O/D SW Release: OFF	←

G00115737

Fig. 29: Testing O/D Main Switch With Scan Tool
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Transmission control switch	Specified condition
Press continuously transmission control switch	Continuity
Release transmission control switch	No continuity

G00115739

Fig. 30: Checking For Continuity At Transmission Control Switch
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Transmission control switch	Specified condition
Press continuously transmissin control switch	Continuity
Release transmission control switch	No continuity

G00115740

Fig. 31: Checking Transmission Control Harness Continuity
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OVERDRIVE MAIN SWITCH CIRCUIT (HIGHLANDER)

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

NOTE: The values given for "Normal Condition" are representative values, so a vehicle may still be normal even if its value differs from those listed here. Do not depend solely on the "Normal Condition" here when deciding whether or not the part is faulty.

Circuit Description

The O/D main switch is a momentary type switch. When pressing the O/D main switch, the O/D OFF indicator light illuminates and the ECM prohibits shifting into O/D, and when pressing it once again, the O/D OFF indicator light goes off and the ECM allows shifting into O/D. Turning the ignition switch OFF will reset the O/D OFF indicator light.

Inspection Procedure

1. Disconnect the transmission control switch connector. Check for continuity between terminals No. 3 and 6 of transmission control switch. See **Fig. 46** and **Fig. 30** . If continuity is as specified, go to next step. If not, replace transmission control switch.
2. Connect the transmission control switch connector. Check for continuity between terminals ODMS and E1 of ECM. See **Fig. 31** . If continuity is as specified, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If not, repair or replace wiring harness and connector.

OVERDRIVE MAIN SWITCH CIRCUIT (RAV4 & RX 300)

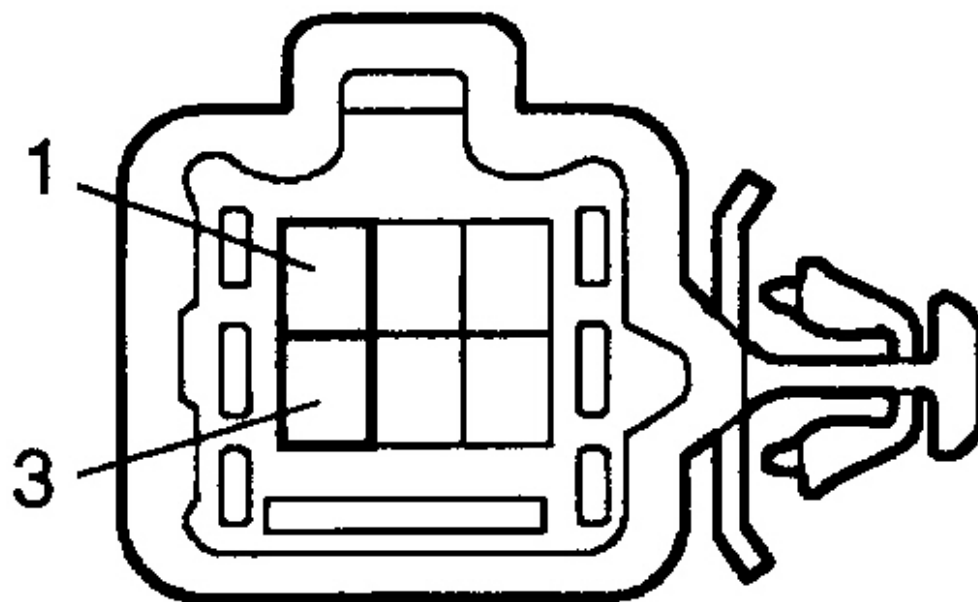
NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

The O/D main switch is a momentary type switch. When pressing the O/D main switch, the O/D OFF indicator light illuminates and the ECM prohibits shifting into O/D, and when pressing it once again, the O/D OFF indicator light goes off and the ECM allows shifting into O/D. Turning the ignition switch OFF will reset the O/D OFF indicator light.

Inspection Procedure

1. Turn ignition on. Check the O/D OFF indicator light when the O/D main switch is pressed to the ON position. The lamp should illuminate. Check the O/D OFF indicator light when the O/D main switch is pressed once again the lamp should go out. If system operates as specified, problem is intermittent. Check for intermittent condition: Loose terminal tension, corroded terminals, cut or broken wiring or chaffed wiring harness and repair as necessary. If system does not operate as specified, go to next step.
2. Check the instrument cluster for proper operation. See appropriate INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT. Check bulb for O/D ON/OFF lamp. If operation is okay, go to next step. If not, repair or replace instrument cluster or bulb.
3. Disconnect O/D main switch connector. Check for continuity between terminals No. 1 and No. 3 while pressing the O/D switch. See **Fig. 32** . There should be continuity. If not, replace O/D main switch. If okay, go to next step.
4. Turn ignition on. Measure the voltage between ground and the ODMS terminal of the ECM connector. Press O/D switch on. Voltage should be less than one volt. Release the switch. The reading should be battery voltage. If check is within parameters, replace the ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If check was not within parameters, go to next step.
5. Disconnect the ECM connector. Turn ignition on. Measure the voltage between ground and terminal ODLP of the ECM connector. Voltage should be between 7.5-14 volts. If reading is within specification, replace the ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If not, replace the wiring harness between the instrument cluster and the ECM, and the wiring harness between the O/D main switch and ground.



G00115744

Fig. 32: Testing O/D Main Switch Connector Terminals
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

PARK/NEUTRAL POSITION SWITCH CIRCUIT (CAMRY, ES 300 & RAV4)

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

NOTE: The values given for "Normal Condition" are representative values, so a vehicle may still be normal even if its value differs from those listed here. Do not depend solely on the "Normal Condition" here when deciding whether or not the part is faulty.

The PNP switch detects the gearshift lever position and sends signals to the ECM. The ECM receives signals (REVERSE, DRIVE, 4th, 2nd and LOW) from PNP switch.

Inspection Procedure

1. Warm up the engine. Turn ignition off. Connect the scan tool or hand-held tester to the DLC3. Turn ignition and the scan tool on. Place the gearshift lever to the "R", "D", "2", and "L" positions. Select the REVERSE, 4th/DRIVE, 2ND and LOW in the DATA LIST and read its value displayed on the scan tool or hand-held tester. See **Fig. 33** . If all parameters are within specification, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If not, go to next step.
2. Disconnect the PNP switch connector. Check for continuity between each terminal shown in figure, while moving gearshift lever to each position. See **Diagnostic Procedure** . If continuity is within specification, go to next step. If not, replace PNP switch. See **PARK/NEUTRAL POSITION SWITCH (CAMRY, ES 300, HIGHLANDER & RAV4)** .
3. Connect the PNP switch connector. Disconnect the ECM connector. Turn ignition on and measure the voltage from terminal E1 to terminals "R", "D", "2" and "L" when the gearshift lever is moved through the specified positions. See **Fig. 34** . If readings are within specification, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If not, repair or replace wiring harness and connector.

Item	Measurement/Item/ Display (Range)	Normal Condition	Diagnostic Note
LOW	PNP SW Status/ ON or OFF	Shift lever position is; L: ON Except L: OFF	The shift lever position and these values are different, there are failures of the PNP switch or shift cable adjustment.
2ND	PNP SW Status/ ON or OFF	Shift lever position is; 2: ON Except 2: OFF	
REVERSE	PNP SW Status/ ON or OFF	Shift lever position is; R: ON Except R: OFF	
4TH/DRIVE	PNP SW Status/ ON or OFF	Shift lever position is; D: ON Except D: OFF	

G00115730

Fig. 33: Identifying Scan Tool Data Parameters
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Shift position	Terminal	Voltage (V)
R	R – E1	7.5 – 14
D	D – E1	7.5 – 14
2	2 – E1	7.5 – 14
L	L – E1	7.5 – 14

G00115732

Fig. 34: Measuring Voltages At ECM Harness Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

PARK/NEUTRAL POSITION SWITCH CIRCUIT (HIGHLANDER & RX 300)

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

NOTE: The values given for "Normal Condition" are representative values, so a vehicle may still be normal even if its value differs from those listed here. Do not depend solely on the "Normal Condition" here when deciding whether or not the part is faulty.

The PNP switch detects the gearshift lever position and sends signals to the ECM. The ECM receives signals ("R", "D", "4", "3", "2", and "L") from PNP switch.

Inspection Procedure

1. Warm up the engine. Turn ignition off. Connect the scan tool or hand-held tester to the DLC3. Turn ignition and the scan tool on. Place the gearshift lever to the "R", "D", "4", "3", "2", and "L" positions. Select the REVERSE, 5th/DRIVE, 4th, 3rd, 2nd and LOW in the DATA LIST and read its value displayed on the scan tool or hand-held tester. See **Fig. 35** . If all parameters are within specification, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If not, go to next step.
2. Disconnect the PNP switch connector. Check for continuity between each terminal shown in figure, while moving gearshift lever to each position. See **Fig. 36** . If continuity is within specification, go to next step. If not, replace PNP switch.
3. Connect the PNP switch connector. Disconnect the transmission control switch connector. Turn ignition on and check for continuity when the gearshift lever is moved through the specified positions. See **Fig. 37** . If readings are not within specification, replace the shift lock control assembly. See REMOVAL & INSTALLATION in appropriate SHIFT INTERLOCK SYSTEMS article. If readings are within specification, go to next step.
4. Connect the transmission control switch connector. Disconnect the ECM connector. Turn ignition on and measure the voltage from terminal E1 to terminals "P", "R", "N", "D", "4", "3", "2" and "L" when the gearshift lever is moved through the specified positions. See **Fig. 38** . If readings are within specification, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If not, repair or replace wiring harness and connector.

Item	Measurement/Item/ Display (Range)	Normal/Condition	Diagnostic Note
REVERSE	PNP SW Status/ ON or OFF	Shift lever position is; R: ON Except R: OFF	The shift lever position and these values are different, there are failures of the PNP switch or shift cable adjustment.
5TH/DRIVE	PNP SW Status/ ON or OFF	Shift lever position is; D and 4: ON Except D and 4: OFF	
4th	PNP SW Status/ ON or OFF	Shift lever position is; 4: ON Except 4: OFF	
3rd	PNP SW Status/ ON or OFF	Shift lever position is; 3: ON Except 3: OFF	
2ND	PNP SW Status/ ON or OFF	Shift lever position is; 2 and L: ON Except 2 and L: OFF	
LOW	PNP SW Status/ ON or OFF	Shift lever position is; L: ON Except L: OFF	

G00115733

Fig. 35: Identifying Scan Tool Parameters
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Shift Position	Terminal No. to continuity	
P	1 – 3	6 – 9
R	2 – 3	—
N	3 – 5	6 – 9
D, 4	3 – 7	—
3	3 – 4	—
2, L	3 – 8	—

G00115734

Fig. 36: Checking For Continuity At The PNP Switch Connect
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Shift Position	Terminal No. to continuity	
P	4 – 6	1 – 3
R	4 – 6	1 – 3
N	4 – 6	1 – 3
D	4 – 6	1 – 3
4	4 – 6	1 – 2
3	4 – 6	1 – 2
2	4 – 6	1 – 3
L	5 – 6	1 – 3

G00115735

Fig. 37: Checking For Continuity At Transmission Control Switch Connector
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Shift position	Terminal	Voltage (V)
P*1, N*1	STA – E1	10 – 14
R	R – E1	10 – 14
D, 4	D – E1	10 – 14
4	4 – E1	10 – 14
3	3 – E1	10 – 14
2, L	2 – E1	10 – 14
L	L – E1	10 – 14

G00115736

Fig. 38: Measuring Voltage At ECM Connector
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

PATTERN SELECT SWITCH CIRCUIT (HIGHLANDER)

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

Circuit Description

When 2nd start mode is selected with the pattern select switch, the ECM controls the solenoid valves and the transmission starts from 2nd gear. In "D" position, the transmission automatically shifts up through 3rd to O/D as usual. In 2nd position, the transmission is held in 2nd gear.

Inspection Procedure

1. Disconnect the pattern select switch connector. While pressing the pattern control switch, check for continuity between terminals No. 1 and 2. See **Fig. 45** . Release the pattern control switch and check for continuity. Continuity should exist when the switch is pressed, and not exist when the switch is released.

Connect battery voltage to terminal No. 4 and ground terminal No. 2 of the pattern select switch harness connector. The pattern select lamp in the instrument panel cluster should illuminate. If all tests were as described, go to next step. If not, replace pattern select switch.

2. Check for an intermittent condition such as: Corroded terminals, poor grounds, loose connectors, cut or chaffed wiring or a pinched/damaged wiring harness. If a problem was found, repair or replace wiring harness and connector. If no problem was found, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.

PATTERN SELECT SWITCH CIRCUIT (RX 300)

NOTE: For circuit reference, see **CONNECTOR IDENTIFICATION** and/or **WIRING DIAGRAMS** .

Circuit Description

When 2nd start mode is selected with the pattern select switch, the ECM controls the solenoid valves and the transmission starts from 2nd gear. In "D" position, the transmission automatically shifts up through 3rd to O/D as usual. In 2nd position, the transmission is held in 2nd gear.

Inspection Procedure

Disconnect the pattern select switch connector. While pressing the pattern control switch in the snow position, check for continuity between terminals No. 3 and 4. See **Fig. 45** . Release the pattern control switch and check for continuity. Continuity should exist when the switch is pressed, and not exist when the switch is released. If switch does not operate as described, replace pattern select switch.

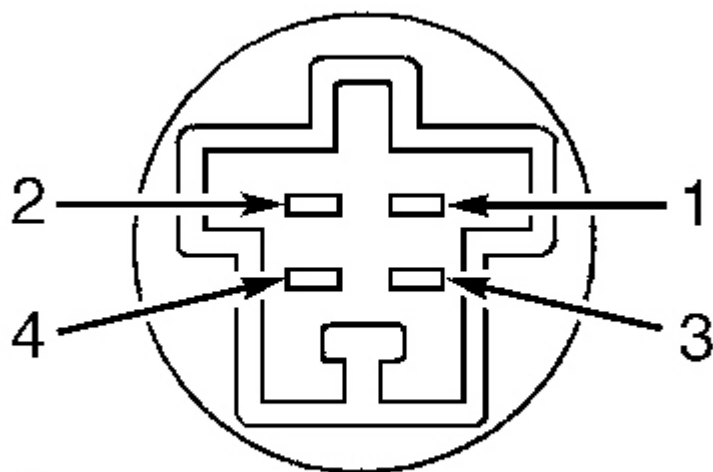
COMPONENT TESTS

BRAKELIGHT SWITCH

NOTE: For circuit reference, see **CONNECTOR IDENTIFICATION** and/or **WIRING DIAGRAMS** .

On models without cruise control (2-pin connector), continuity should exist between terminals No. 1 and 2 with brake pedal depressed, and should not exist with brake pedal released. On models with cruise control (4-pin

connector), continuity should exist between terminals No. 1 and 2 with brake pedal depressed, and should not exist with brake pedal released. Continuity should not exist between terminals No. 3 and 4 with brake pedal depressed, and should exist with brake pedal released. See **Fig. 39** . Replace switch if continuity is not as specified.



G93E24160

Fig. 39: Identifying Brakelight Switch Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SHIFT SOLENOID DSL

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

NOTE: The following information can also be used to diagnose DTC P0770. For testing of shift solenoid SLT, see DTC P1760: SHIFT SOLENOID SLT under DIAGNOSTIC TESTS.

1. Raise and support vehicle. Remove transaxle oil pan. See LUBRICATION in appropriate AUTOMATIC article in TRANSMISSION SERVICING. Remove shift solenoid DSL. See **Fig. 12** . Connect battery voltage to solenoid. Apply 71 psi (5 kg/cm²) of compressed air to solenoid with battery voltage connected. See **Fig. 40** .
2. With battery voltage connected, air should not pass through solenoid. Disconnect voltage to solenoid. Ensure air passes through solenoid. Replace solenoid as necessary.

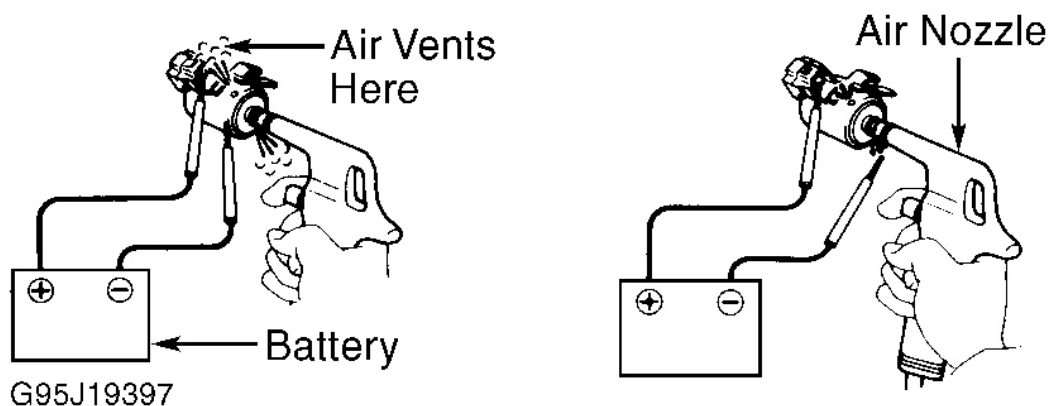


Fig. 40: Checking Solenoid Operation
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SHIFT SOLENOIDS SL1 & SL2

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

NOTE: The following information can also be used to diagnose DTCs P0750, P0755 and P0765. For testing of shift solenoid SLT, see DTC P1760: SHIFT SOLENOID SLT under DIAGNOSTIC TESTS.

1. Raise and support vehicle. Remove transaxle oil pan. See LUBRICATION in appropriate AUTOMATIC article in TRANSMISSION SERVICING. Remove shift solenoid(s). See **Fig. 12** . Using a DVOM, measure resistance between shift solenoid terminals. Resistance should be 5.1-5.5 ohms. If resistance is not as specified, replace solenoid.
2. To check shift solenoid operation, connect positive lead with 23-watt bulb from battery to terminal No. 1 (White wire on shift solenoid SL1, or Yellow wire on shift solenoid SL2) of solenoid. Connect negative lead to terminal No. 2 of solenoid. With power supplied to solenoid, ensure solenoid valve moves outward. With power disconnected, ensure solenoid valve moves inward. Replace solenoid if operating sound cannot be heard. If solenoid operates, diagnose valve body malfunction. See appropriate OVERHAUL article.

SHIFT SOLENOID S4

NOTE: For circuit reference, see CONNECTOR IDENTIFICATION and/or WIRING DIAGRAMS .

NOTE: The following information can also be used to diagnose DTCs P0750, P0755 and

P0765. For testing of shift solenoid SLT, see DTC P1760: SHIFT SOLENOID SLT under DIAGNOSTIC TESTS.

1. Raise and support vehicle. Remove transaxle oil pan. See LUBRICATION in appropriate AUTOMATIC article in TRANSMISSION SERVICING. Remove shift solenoid(s). See **Fig. 12** . Using a DVOM, measure resistance between ground and solenoid terminal. Resistance should be 11-15 ohms. If resistance is not as specified, replace solenoid.
2. To check shift solenoid operation, connect positive lead with 23-watt bulb from battery to solenoid terminal. Connect negative lead to solenoid body. With power supplied to solenoid, ensure solenoid valve moves outward. With power disconnected, ensure solenoid valve moves inward. Replace solenoid if operating sound cannot be heard. If solenoid operates, diagnose valve body malfunction. See appropriate OVERHAUL article.

REMOVAL & INSTALLATION

WARNING: Vehicle is equipped with Supplemental Inflatable Restraint (SIR) system. When servicing vehicle, use care to avoid accidental air bag deployment. SIR system-related components are located in various locations throughout interior and exterior of vehicle, depending on application. Do not use electrical test equipment on or near these circuits. If necessary, deactivate SIR system before servicing components. See AIR BAG DEACTIVATION PROCEDURES article in GENERAL INFORMATION.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

OVERDRIVE SWITCH

Overdrive switch is mounted on selector lever. Replacement information is not available from manufacturer.

PARK/NEUTRAL POSITION SWITCH (CAMRY, ES 300, HIGHLANDER & RAV4)

Removal

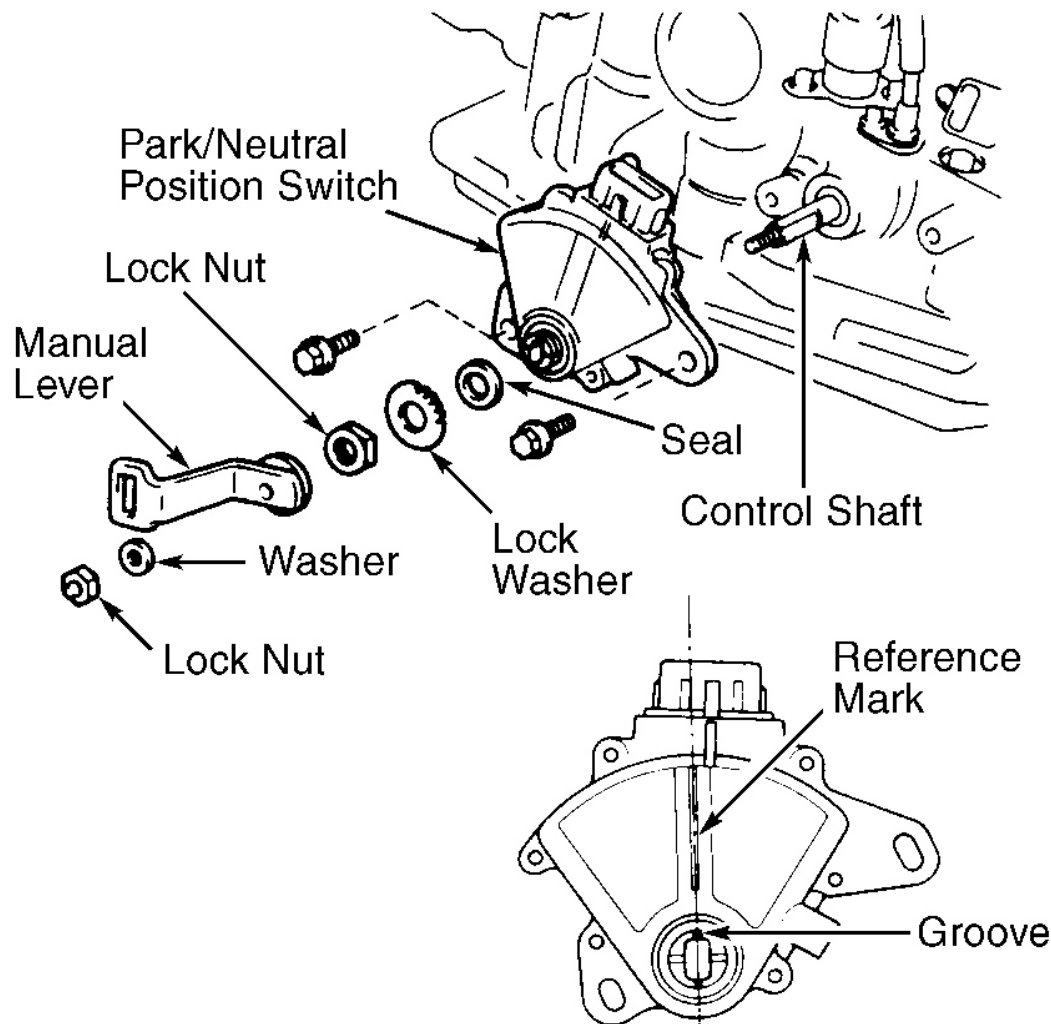
1. PNP switch is located on side of transaxle. Disconnect switch connector. Remove shift control nut and cable from manual lever. Remove lock nut, washer and manual lever from control shaft. See **Fig. 41** .
2. Bend up tabs on lock washer. Remove lock nut, lock washer and seal from control shaft. Remove adjusting bolts and PNP switch.

Installation

1. Install switch on control shaft. Loosely install PNP position switch adjusting bolts. Install seal and lock

washer. Install lock nut and tighten to specification. See **TORQUE SPECIFICATIONS** . Bend tabs on lock washer over against lock nut.

2. Ensure parking brake is applied. Temporarily install manual lever. Turn lever counterclockwise until it stops, then turn clockwise 2 notches. Remove manual lever. Rotate switch and align reference mark on switch with groove. See **Fig. 41** . Hold switch in this position. Tighten 2 adjusting bolts to specification See **TORQUE SPECIFICATIONS** . Stake lock tab onto nut. Install manual lever, washer and nut. Tighten nut to specification. Install shift control cable and nut. Tighten nut to specification. Connect switch connector.



G93F24161

Fig. 41: Removing & Installing Park/Neutral Position Switch
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

PARK/NEUTRAL POSITION SWITCH (RX 300)

Removal

- 1. PNP switch is located on side of transaxle. Disconnect switch connector. Remove shift control nut and cable from manual lever. Remove lock nut, washer and manual lever from control shaft. See **Fig. 41** .
- 2. Using a screwdriver, bend up tabs on lock washer. Remove lock nut, lock washer and seal from control shaft. Discard lock nut and lock washer. Remove adjusting bolts and PNP switch.

Installation

- 1. Install switch on control shaft. Install PNP position switch adjusting bolts and align reference marks. See **Fig. 41** . Tighten to specification. See **TORQUE SPECIFICATIONS** . Install seal and NEW lock washer and NEW lock nut and tighten to specification. Bend tabs on lock washer over against lock nut. Install the shift control cable to the control shaft. Install nut and tighten to specification.
- 2. Ensure engine starts only in the Neutral and Park positions. Readjust if necessary.

SHIFT SOLENOIDS

Removal & Installation

Shift solenoids are located on transaxle valve body. Raise and support vehicle. Remove transaxle oil pan. See LUBRICATION in appropriate AUTOMATIC article in TRANSMISSION SERVICING. Disconnect electrical connector on shift solenoid. Remove bolt and shift solenoid. To install, reverse removal procedure. Install NEW "O" ring on shift solenoid.

SPEED SENSORS

Removal & Installation

Speed sensors are located on top of transaxle. See **Fig. 5 -Fig. 8** . Disconnect electrical connector. Remove bolt and speed sensor. To install, reverse removal procedure. Install NEW "O" ring on speed sensor. Tighten bolt to specifications. See **TORQUE SPECIFICATIONS** .

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	INCH Lbs. (N.m)
Manual Detent Spring Top Bolt	106 (12)
Parking Lock Pawl Clamp Bolt	87 (9.8)
Park/Neutral Position Switch	
Bolt	48 (5.4)
Nut	61 (6.9)
Shift Control Cable Nut	133 (15)
Shift Control Lever Bolt	61 (6.9)

Shift Control Lever Lock Tab Nut	61 (6.9)
Solenoid Connector Bolt	48 (5.4)
Speed Sensor Bolt	97 (11)

ELECTRONIC COMPONENT SPECIFICATIONS

COMPONENT RESISTANCE SPECIFICATIONS

Application	Ohms
Counter Gear & Input Turbine Speed Sensor	560-680
Shift Solenoids DSL & S4	11-15
Shift Solenoid SLT	5.0-5.6
Shift Solenoids SL1 & SL2	5.1-5.5

CONNECTOR IDENTIFICATION

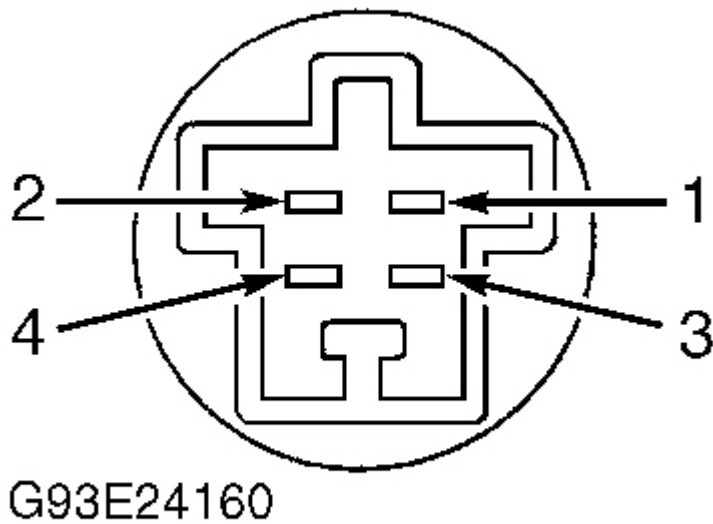
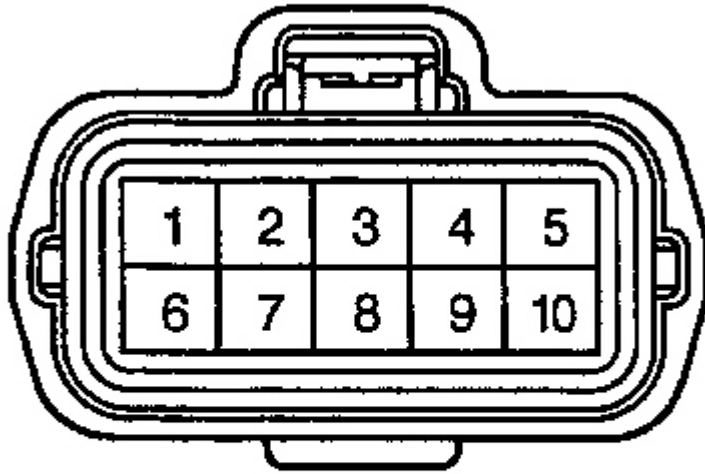


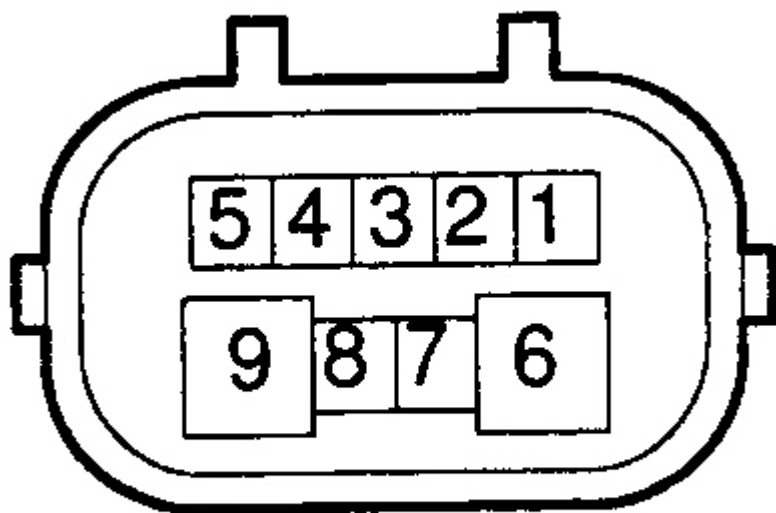
Fig. 42: Identifying Brakelight Switch Terminals
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



SOLENOID CONNECTOR

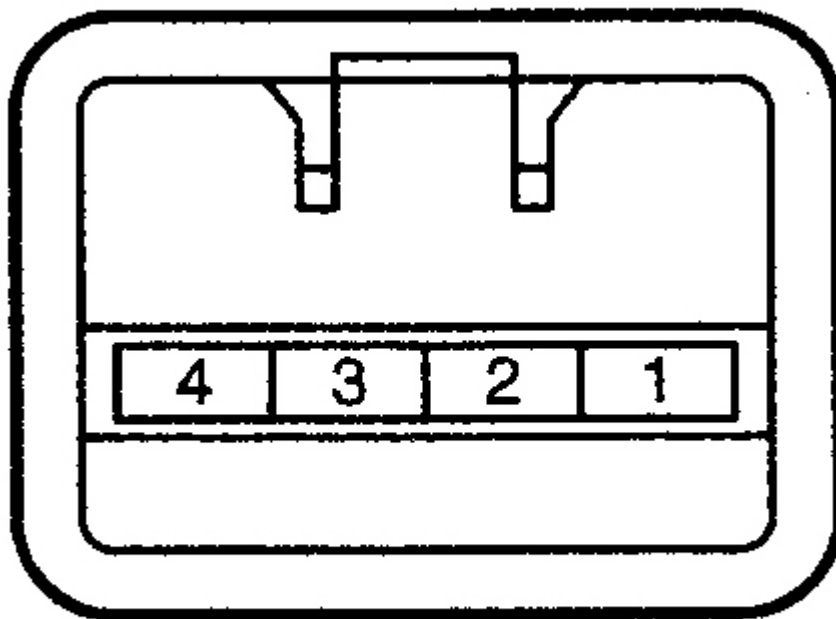
G00011315

Fig. 43: Identifying Solenoid Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



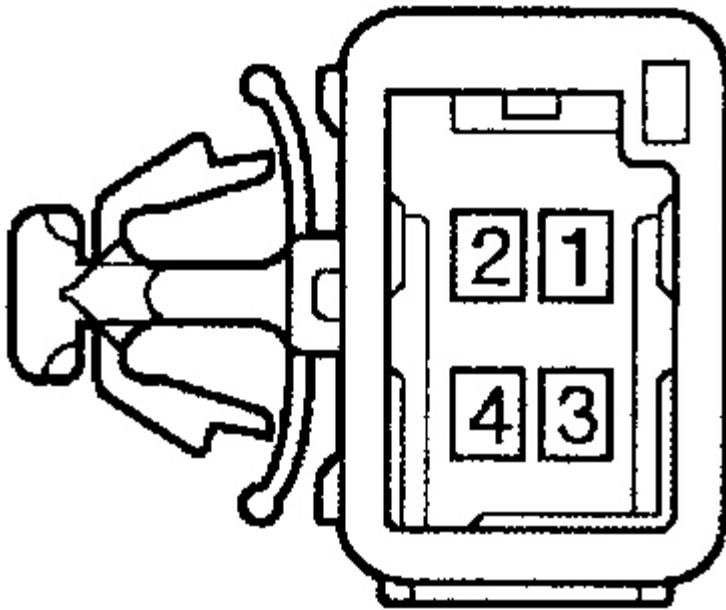
G00115725

Fig. 44: Identifying Park/Neutral Position Switch Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



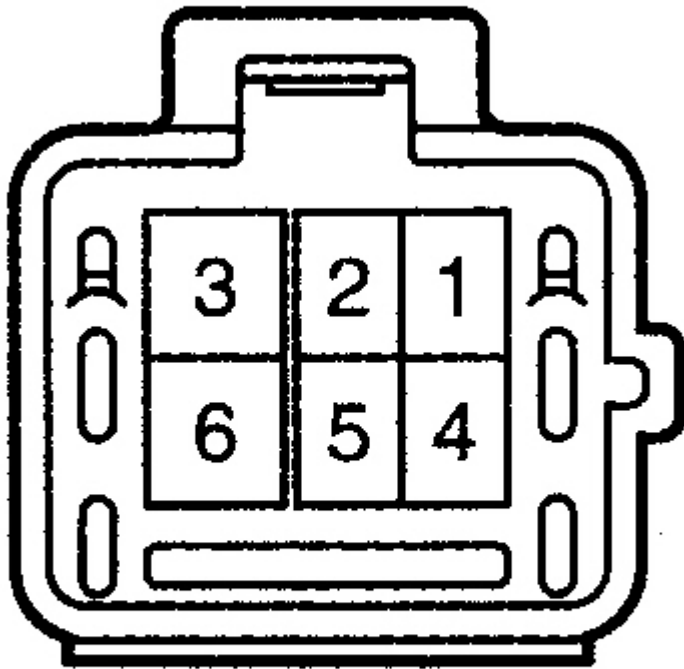
G00115729

Fig. 45: Identifying Pattern Select Switch Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00115738

Fig. 46: Identifying Transmission Control Switch Connector Terminals (Camry)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

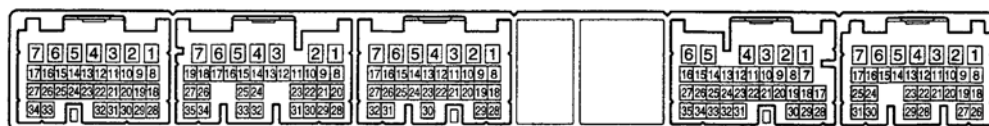


G00115741

Fig. 47: Identifying Transmission Control Switch Connector Terminals (Highlander)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

PIN VOLTAGE TESTS

Access ECM located behind glove compartment. Turn ignition switch to ON position. Using a DVOM, backprobe ECM harness connector. Measure voltage between selected terminals. Voltage should be as specified. See **Fig. 48 -Fig. 52** .



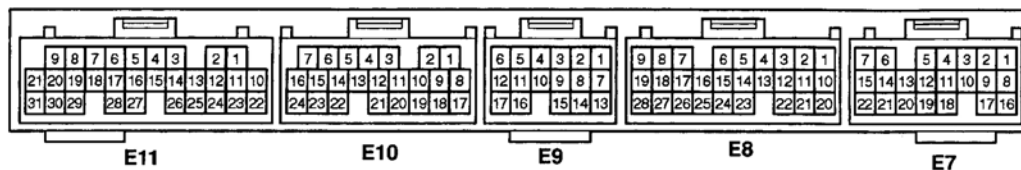
E10	E9	E8	E7	E6
Symbols (Terminal No.)	Wiring Color	Condition		STD Voltage (V)
NSW (E9-8) ⇔ E1 (E8-1)	B-Y ⇔ BR	Ignition key is START position		10 – 14
DSL (E9-11) ⇔ E1 (E8-1)	Y ⇔ BR	IG switch ON		Below 1
		Vehicle driving under lock-up position		10 – 14
S4 (E9-13) ⇔ E1 (E8-1)	L ⇔ BR	IG switch ON		Below 1
		O/D gear		10 – 14
		Except O/D gear		Below 1
SL2+ (E9-17) ⇔ SL2- (E9-16)	L-Y ⇔ L-R	IG switch ON		Below 1
		1st or 2nd gear		10 – 14
		3rd or O/D gear		Below 1
SL1+ (E9-19) ⇔ SL1- (E9-18)	R-B ⇔ P	IG switch ON		10 – 14
		1st gear		10 – 14
		Except 1st gear		Below 1
NC+ (E9-26) ⇔ NC- (E9-34)	R ⇔ G	Engine is running		Below 1 and 4 – 5
NT+ (E9-27) ⇔ NT- (E9-35)	L ⇔ LG	Engine is running		Below 1 and 4 – 5
SLT+ (E10-17) ⇔ SLT- (E10-16)	Y-R ⇔ Y-B	IG switch ON		10 – 14
THO (E10-30) ⇔ E2 (E10-28)	G*1 ⇔ BR	ATF temperature: 115 °C (239 °F) or more		Below 1.5
	G-R*2 ⇔ BR			
ODLP (E7-7) ⇔ E1 (E8-1)	O ⇔ BR	O/D main switch ON (O/D OFF)		Below 3
		O/D main switch OFF (O/D ON)		9 – 14
L (E7-8) ⇔ E1 (E8-1)	Y ⇔ BR	IG switch ON Shift lever L position		10 – 14
		IG switch ON Shift lever other than L position		Below 1
2 (E7-9) ⇔ E1 (E8-1)	L-W ⇔ BR	IG switch ON Shift lever 2 position		10 – 14
		IG switch ON Shift lever other than 2 position		Below 1
D (E7-10) ⇔ E1 (E8-1)	W-L ⇔ BR	IG switch ON Shift lever D position		10 – 14
		IG switch ON Shift lever other than D position		Below 1
R (E7-11) ⇔ E1 (E8-1)	R-B ⇔ BR	IG switch ON Shift lever R position		10 – 14
		IG switch ON Shift lever other than R position		Below 1
SPD (E7-17) ⇔ E1 (E8-1)	V-W ⇔ BR	IG switch ON		4.5 – 5.5
ODMS (E6-16) ⇔ E1 (E8-1)	G-O ⇔ BR	IG switch ON		10 – 14
		IG switch ON Press continuously O/D main switch		Below 1

*1: TMC Made *2: TMMK Made

NOTE: The letter "L" under wiring color represents Blue.

G00110670

Fig. 48: Identifying ECM Connector Terminals, Wire Colors & Pin Voltages (Camry)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

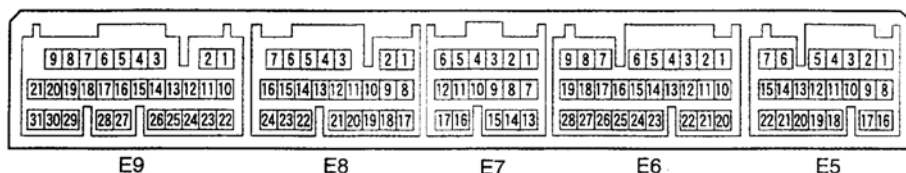


Symbols (Terminal No.)	Wiring Color	Condition	STD Voltage (V)
SPD (E8-22) – E1 (E10-17)	V-W – BR	IG switch ON Rotate driving wheel slowly	Pulse generation
SL1+ (E11-20) – SL1- (E11-19)	B-Y – Y	IG switch ON	10 – 14
		1st or 2nd gear	10 – 14
		3rd or O/D gear	Below 1
SL2+ (E11-9) – SL2- (E11-8)	P-L – W-L	IG switch ON	Below 1
		1st or 2nd gear	10 – 14
		3rd or O/D gear	Below 1
DSL (E11-7) – Body ground	V – Body ground	IG switch ON	Below 1
		Vehicle driving under lock-up position	10 – 14
NC+ (E11-24) – NC- (E11-23)	R – G	Engine is running	Pulse signal is output Below 1 ↔ 4 – 5
NT+ (E9-5) – NT- (E9-4)	L – LG	Engine is running	Pulse signal is output Below 1 ↔ 4 – 5
SLT+ (E9-3) – SLT- (E9-2)	L-R – G-Y	IG switch ON	10 – 14
OD1 (E8-24) – E1 (E10-17)	Y-B – BR	IG switch ON	5 – 6
L (E9-13) – E1 (E10-17)	Y – BR	IG switch ON Shift lever L position	10 – 14
		IG switch ON Shift lever other than L position	Below 1
2 (E9-14) – E1 (E10-17)	L-W – BR	IG switch ON Shift lever 2 position	10 – 14
		IG switch ON Shift lever other than 2 position	Below 1
R (E9-8) – E1 (E10-17)	R-B – BR	IG switch ON Shift lever R position	10 – 14
		IG switch ON Shift lever other than R position	Below 1
D (E9-16) – E1 (E10-17)	B-R – BR	IG switch ON Shift lever D position	10 – 14
		IG switch ON Shift lever other than D position	Below 1
NSW (E8-20) – E1 (E10-17)	B-W – BR	IG switch ON Shift lever P or N position	10 – 14
		IG switch ON Shift lever other than P or N position	Below 1
THO (E10-13) – E2 (E10-18)	B – BR	IG switch ON ATF temperature 110 °C (230 °F)	Below 1
S4 (E9-1) – E1 (E10-17)	L-B – BR	IG switch ON	Below 1
		IG switch ON O/D gear	10 – 14
ODLP (E7-9) – E1 (E10-17)	P – BR	IG switch ON O/D OFF indicator light lights up	Below 1
		IG switch ON O/D OFF indicator light goes off	10 – 14
ODMS (E9-12) – E1 (E10-17)	G-O – BR	IG switch ON	10 – 14
		IG switch ON Press continuously O/D main switch	Below 1

NOTE: The letter "L" under wiring color represents Blue.

G00110667

Fig. 49: Identifying ECM Connector Terminals, Wire Colors & Pin Voltages (ES 300)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

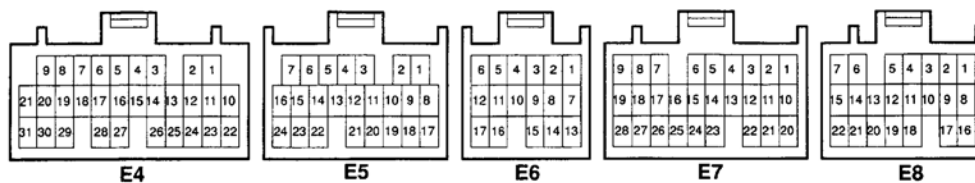


Symbols (Terminal No.)	Wiring Color	Condition	STD Voltage (V)
SL1+ (E9-20) ⇔ SL1- (E9-19)	L-B ⇔ L-W	IG switch ON	10 – 14
		1st gear	10 – 14
		Except 1st gear	Below 1
SL2+ (E9-9) ⇔ SL2- (E9-8)	R-B ⇔ R-W	IG switch ON	Below 1
		1st or 2nd gear	10 – 14
		3rd or O/D gear	Below 1
S4 (E7-1) ⇔ E1 (E8-17)	R-Y ⇔ BR	IG switch ON	Below 1
		O/D gear	10 – 14
		Except O/D gear	Below 1
DSL (E9-7) ⇔ E1 (E8-17)	R-L ⇔ BR	IG switch ON	Below 1
		Vehicle driving under lock-up position	10 – 14
NC+ (E9-24) ⇔ NC- (E9-23)	W-R ⇔ L	Engine is running	Below 1 and 4 – 5
NT+ (E7-5) ⇔ NT- (E7-4)	P ⇔ G	Engine is running	Below 1 and 4 – 5
SLT+ (E7-3) ⇔ SLT- (E7-2)	G-Y ⇔ B-R	IG switch ON	10 – 14
L (E7-13) ⇔ E1 (E8-17)	L-R ⇔ BR	IG switch ON Shift lever L position	10 – 14
		IG switch ON Shift lever other than L position	Below 1
2 (E7-14) ⇔ E1 (E8-17)	L-Y ⇔ BR	IG switch ON Shift lever 2 position	10 – 14
		IG switch ON Shift lever other than 2 position	Below 1
R (E7-8) ⇔ E1 (E8-17)	R-B ⇔ BR	IG switch ON Shift lever R position	10 – 14
		IG switch ON Shift lever other than R position	Below 1
D (E7-16) ⇔ E1 (E8-17)	G-B ⇔ BR	IG switch ON Shift lever D position	10 – 14
		IG switch ON Shift lever other than D position	Below 1
P (E7-9) ⇔ E1 (E8-17)	G-W ⇔ BR	IG switch ON Shift lever P position	10 – 14
		IG switch ON Shift lever other than P position	Below 1
N (E7-7) ⇔ E1 (E8-17)	R-W ⇔ BR	IG switch ON Shift lever N position	10 – 14
		IG switch ON Shift lever other than N position	Below 1
ODMS (E7-12) ⇔ E1 (E8-17)	B-O ⇔ BR	IG switch ON	10 – 14
		IG switch ON Press continuously O/D main switch	Below 1
OD1 (E6-24) ⇔ E1 (E8-17)	W ⇔ BR	IG switch ON	9 – 14
SPD (E6-22) ⇔ E01 (E9-21)	W-R ⇔ W-B	IG switch ON	9 – 14

NOTE: The letter "L" under wiring color represents Blue.

G00110671

Fig. 50: Identifying ECM Connector Terminals, Wire Colors & Pin Voltages (Highlander)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



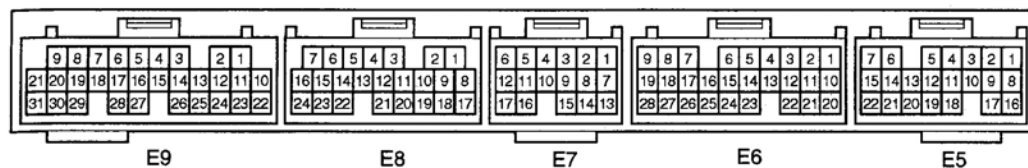
Symbols (Terminal No.)	Wiring Color	Condition	STD Voltage (V)
SL1+ (E4-7) – SL1– (E4-9)	G–W – V	IG switch ON	10 – 14
		1st or 2nd gear	10 – 14
		3rd or O/D gear	Below 1
SL2+ (E4-8) – SL2– (E4-20)	P – Y–B	IG switch ON	Below 1
		1st or 2nd gear	10 – 14
		3rd or O/D gear	Below 1
DSL (E6-6) – Body ground	R–W – Body ground	IG switch ON	Below 1
		Vehicle driving under lock-up position	10 – 14
NC+ (E4-14) – NC– (E4-26)	R – G	Engine is running	Below 1 and 4 – 5*
NT+ (E4-16) – NT– (E4-15)	W – B	Engine is running	Below 1 and 4 – 5*
SLT+ (E4-6) – SLT– (E4-5)	Y–R – Y–G	IG switch ON	10 – 14
L (E7-12) – E1 (E4-17)	LG (W) – BR	IG switch ON Shift lever L position	10 – 14
		IG switch ON Shift lever other than L position	Below 1
2 (E7-3) – E1 (E4-17)	LG–B (W) – BR	IG switch ON Shift lever 2 position	10 – 14
		IG switch ON Shift lever other than 2 position	Below 1
R (E7-2) – E1 (E4-17)	R–B (W) – BR	IG switch ON Shift lever R position	10 – 14
		IG switch ON Shift lever other than R position	Below 1
D (E7-1) – E1 (E4-17)	L–B (W) – BR	IG switch ON Shift lever D position	10 – 14
		IG switch ON Shift lever other than D position	Below 1
NSW (E7-20) – E1 (E4-17)	B–Y (W) – BR	IG switch ON Shift lever P and N ranges	10 – 14
		IG switch ON Shift lever other than P and N ranges	Below 1
ODLP (E8-5) – E1 (E4-17)	LG–B (W) – BR	IG switch ON O/D OFF indicator light lights up	Below 1
		IG switch ON O/D OFF indicator light goes off	10 – 14
ODMS (E8-10) – E1 (E4-17)	LG (W) – BR	IG switch ON	10 – 14
		IG switch ON Press continuously O/D main switch	Below 1
SPD (E7-22) – E01 (E4-21)	V–W (W) – W–B	IG switch ON	9 – 14

*: Alternates repeatedly between below 1V and 4 – 5V.

NOTE: The letter "L" under wiring color represents Blue.

G00110672

Fig. 51: Identifying ECM Connector Terminals, Wire Colors & Pin Voltages (RAV4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



Symbols (Terminals No.)	Wiring Color	Condition	STD Voltage (V)
SL1+ (E9-20) ↔ SL1- (E9-19)	L-B ↔ L-W	IG ON	10 – 14
		1st or 2nd gear	10 – 14
		3rd or O/D gear	Below 1
SL2+ (E9-9) ↔ SL2- (E9-8)	R-B ↔ R-W	IG ON	Below 1
		1st or 2nd gear	10 – 14
		3rd or O/D gear	Below 1
DSL (E9-7) ↔ Body ground	R-L ↔ Body ground	IG ON	Below 1
		Vehicle driving under lock-up position	10 – 14
NC+ (E9-24) ↔ NC- (E9-23)	R ↔ G	Engine is running	Pulse signal is output Below 1 ↔ 4 – 5
NT+ (E7-5) ↔ NT- (E7-4)	L ↔ LG	Engine is running	Pulse signal is output Below 1 ↔ 4 – 5
SLT+ (E7-3) ↔ SLT- (E7-2)	G-B ↔ G	IG ON	10 – 14
OD1 (E6-24) ↔ E1 (E8-17)	Y-G ↔ BR	IG ON	5 – 6
L (E7-13) ↔ E1 (E8-17)	L-R ↔ BR	IG ON and Shift lever L position	10 – 14
		IG ON and Shift lever other than L position	Below 1
2 (E7-14) ↔ E1 (E8-17)	G-Y ↔ BR	IG ON and Shift lever 2 position	10 – 14
		IG ON and Shift lever other than 2 position	Below 1
R (E7-8) ↔ E1 (E8-17)	R-B ↔ BR	IG ON and Shift lever R position	10 – 14
		IG ON and Shift lever other than R position	Below 1
D (E7-16) ↔ E1 (E8-17)	G-R ↔ BR	IG ON and Shift lever D position	10 – 14
		IG ON and Shift lever other than D position	Below 1
N (E7-7) ↔ E1 (E8-17)	R-W ↔ BR	IG ON and Shift lever N position	10 – 14
		IG ON and Shift lever other than N position	Below 1
P (E7-9) ↔ E1 (E8-17)	G-W ↔ BR	IG ON and Shift lever P position	10 – 14
		IG ON and Shift lever other than P position	Below 1
ODLP (E5-9) ↔ E1 (E8-17)	R-W ↔ BR	IG ON and O/D OFF indicator light lights up	Below 1
		IG ON and O/D OFF indicator light goes off	10 – 14
ODMS (E7-12) ↔ E1 (E8-17)	GR-L ↔ BR	IG ON	10 – 14
		IG ON and press continuously O/D main switch	Below 1

NOTE: The letter "L" under wiring color represents Blue.

G00110668

Fig. 52: Identifying ECM Connector Terminals, Wire Colors & Pin Voltages (RX 300)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

WIRING DIAGRAMS

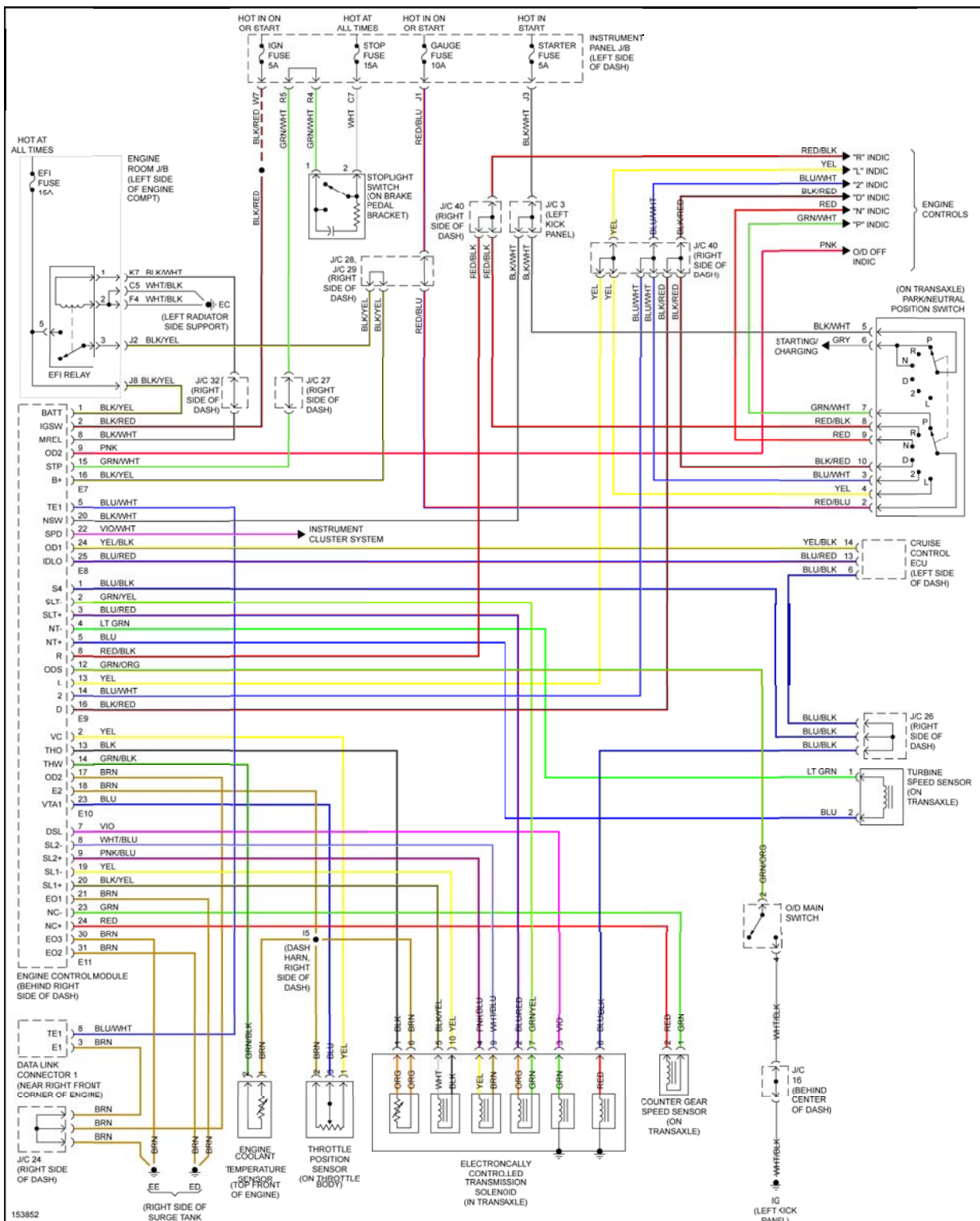


Fig. 53: Transaxle Electronic Control System Wiring Diagram (2001 Lexus ES 300)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Fig. 54: Transaxle Electronic Control System Wiring Diagram (2001-02 Lexus RX 300)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

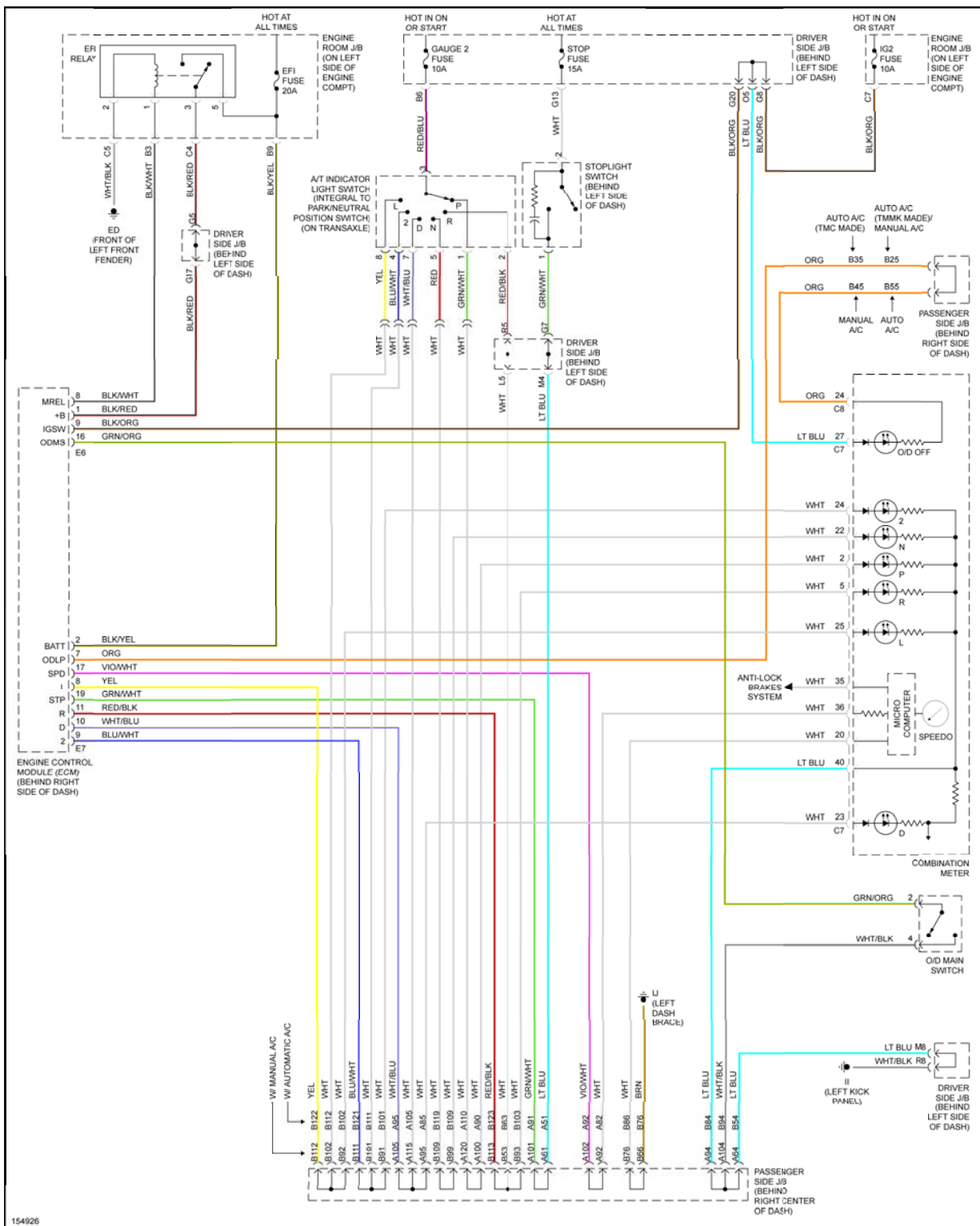


Fig. 55: Transaxle Electronic Control System Wiring Diagram (2002 Toyota Camry 3.0L - 1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

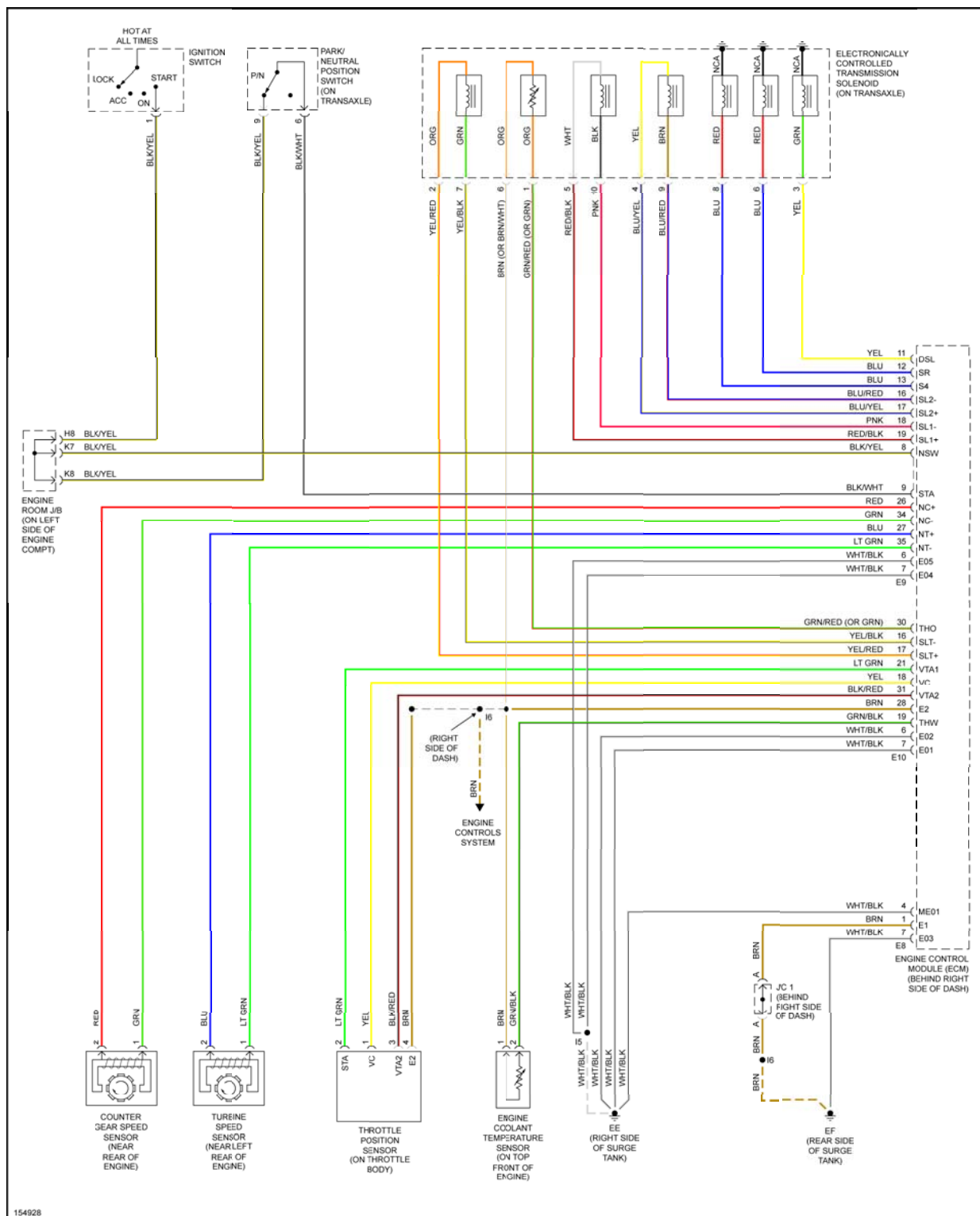


Fig. 56: Transaxle Electronic Control System Wiring Diagram (2002 Toyota Camry 3.0L - 2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

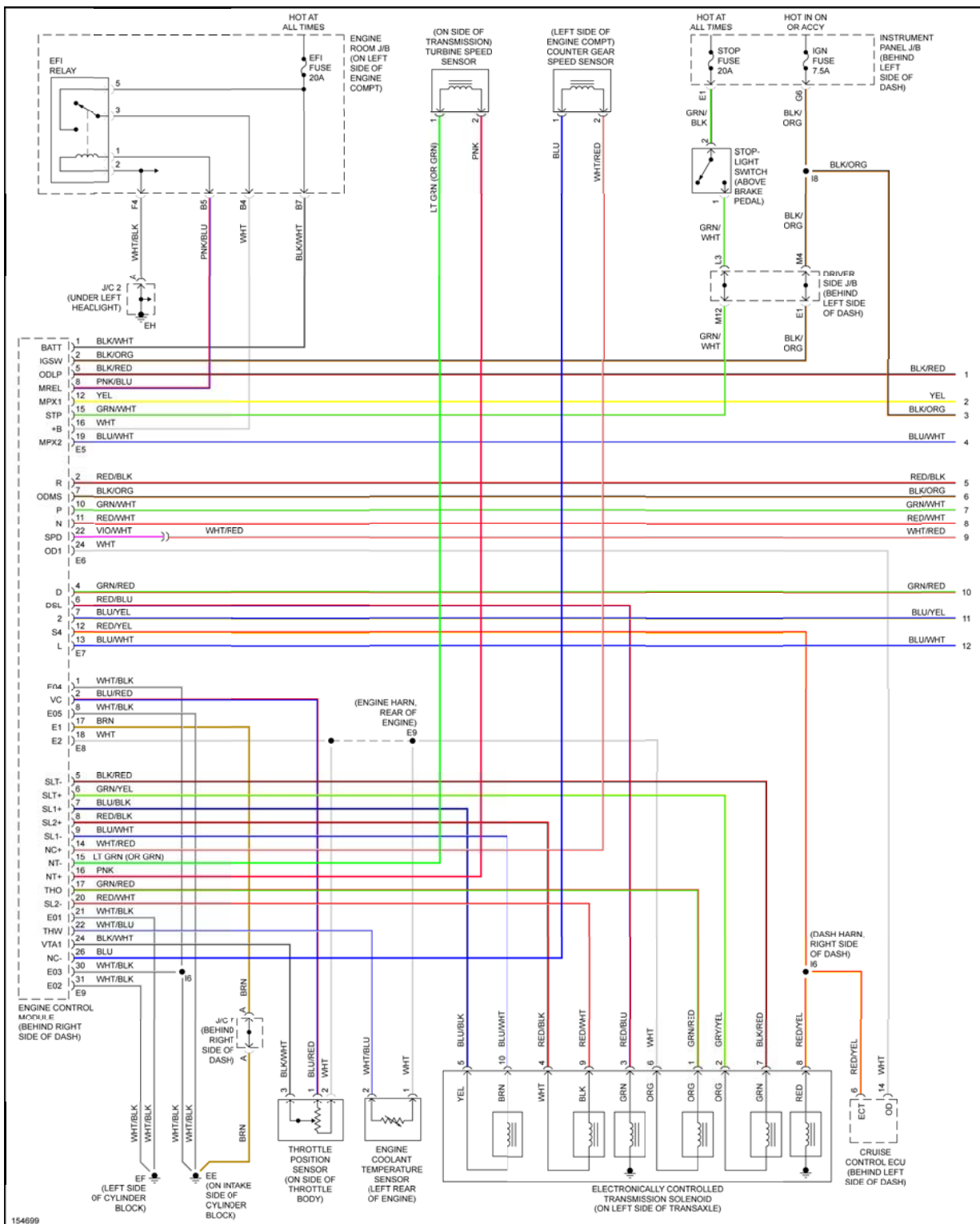


Fig. 57: Transaxle Electronic Control System Wiring Diagram (2001-02 Highlander 2.4L - 1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

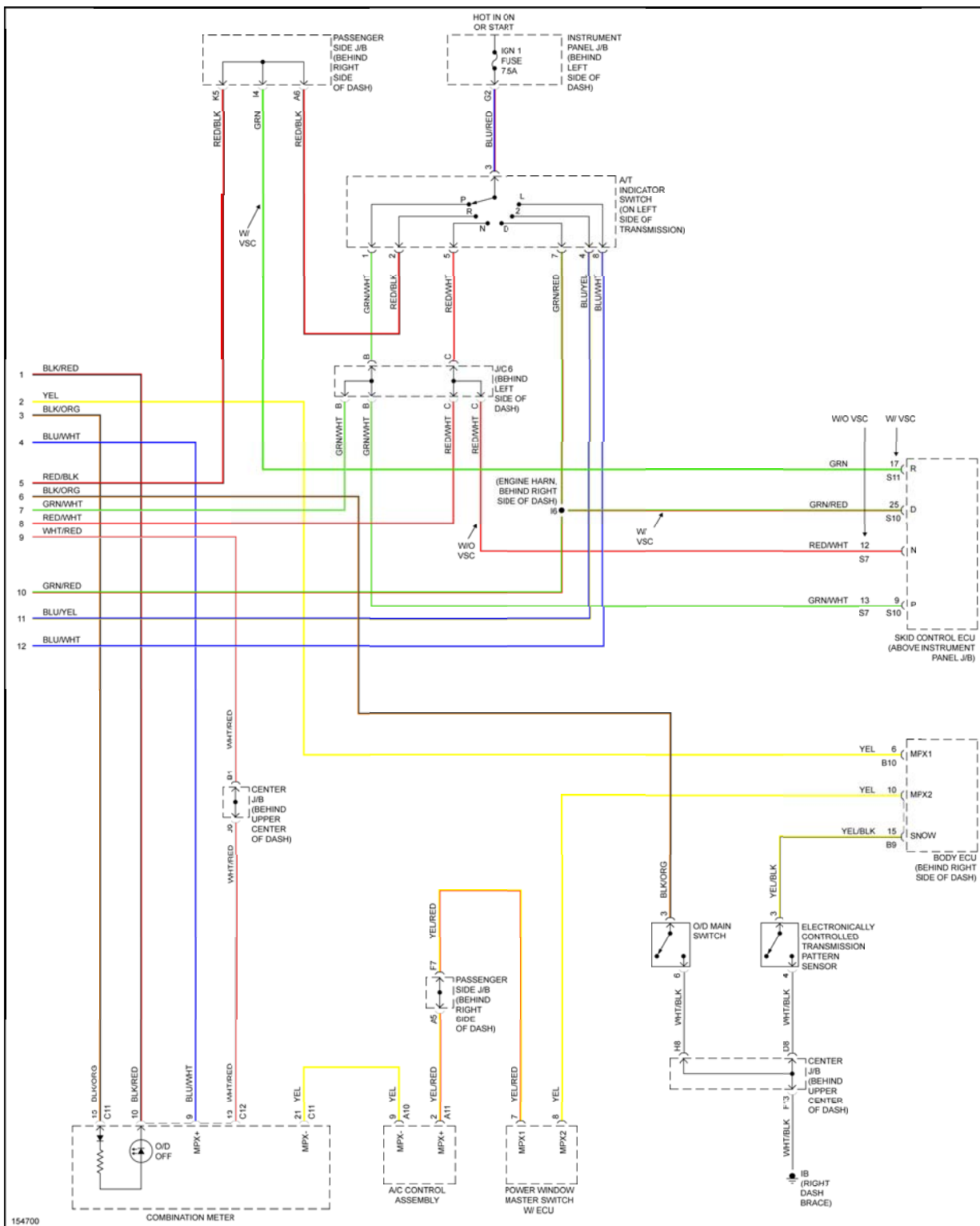


Fig. 58: Transaxle Electronic Control System Wiring Diagram (2001-02 Highlander 2.4L - 2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

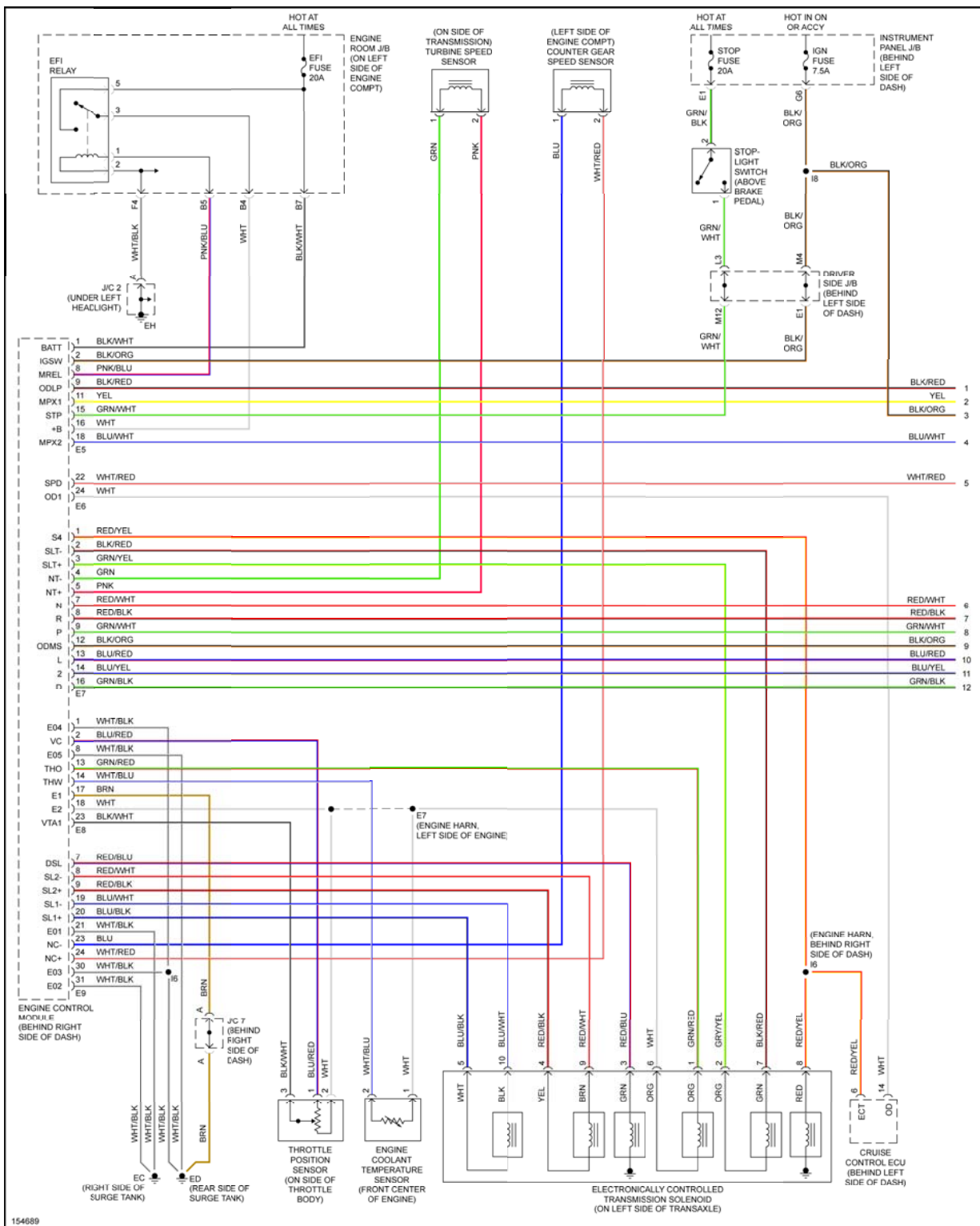


Fig. 59: Transaxle Electronic Control System Wiring Diagram (2001-02 Highlander 3.0L - 1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

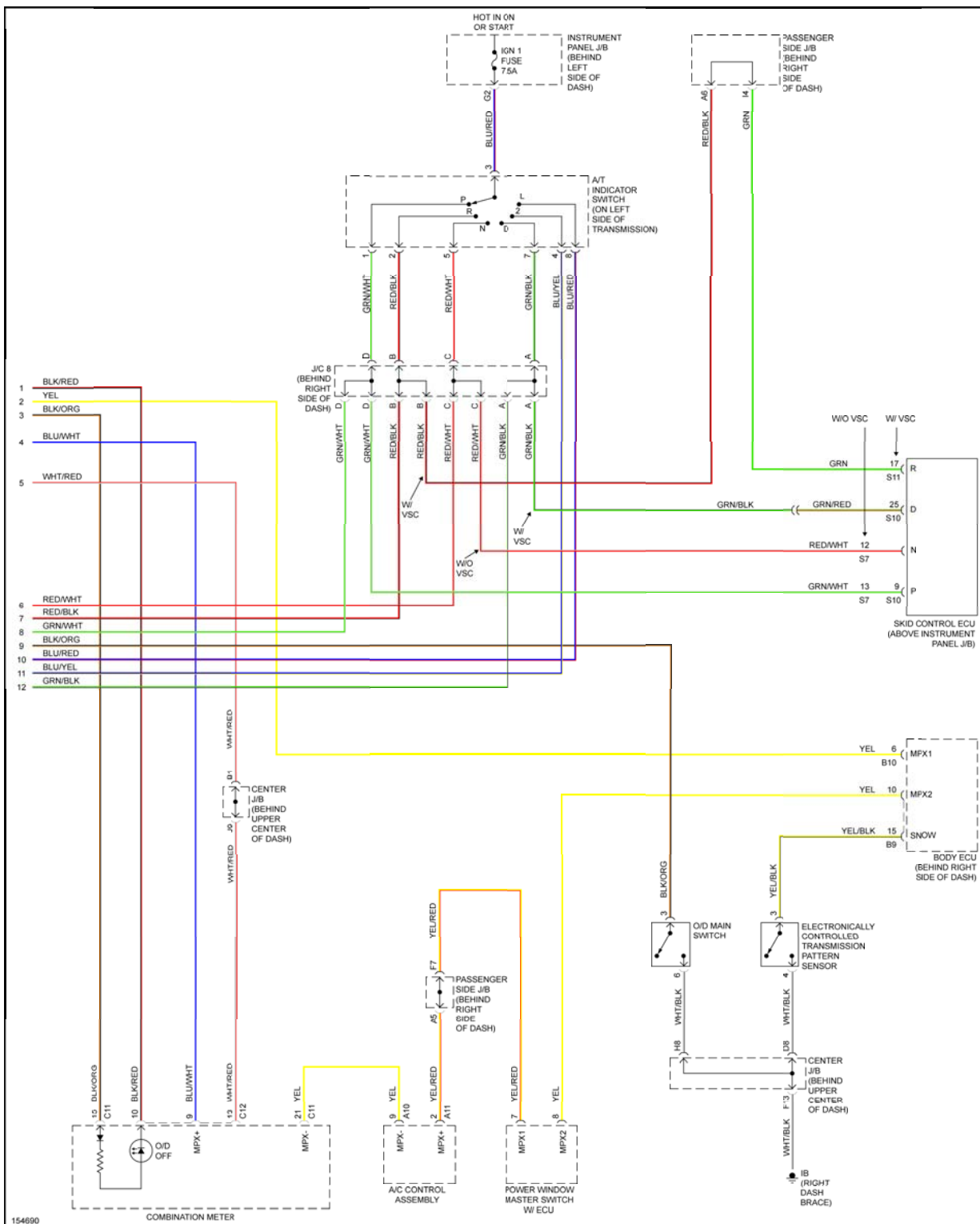


Fig. 60: Transaxle Electronic Control System Wiring Diagram (2001-02 Highlander 3.0L - 2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

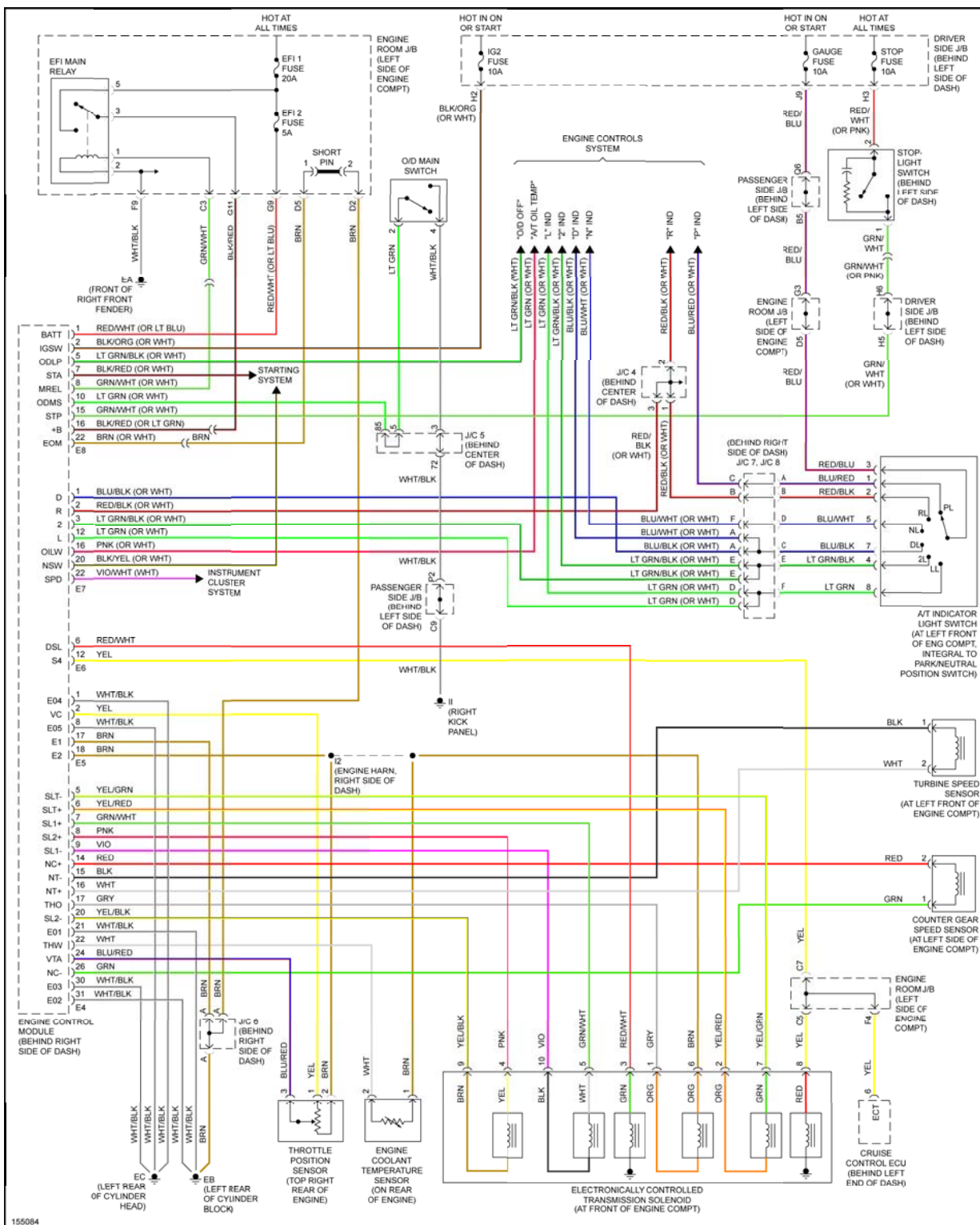


Fig. 61: Transaxle Electronic Control System Wiring Diagram (2001-02 RAV4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2001-02 AUTOMATIC TRANSMISSIONS

U241E Diagnosis - Highlander & RAV4

APPLICATION

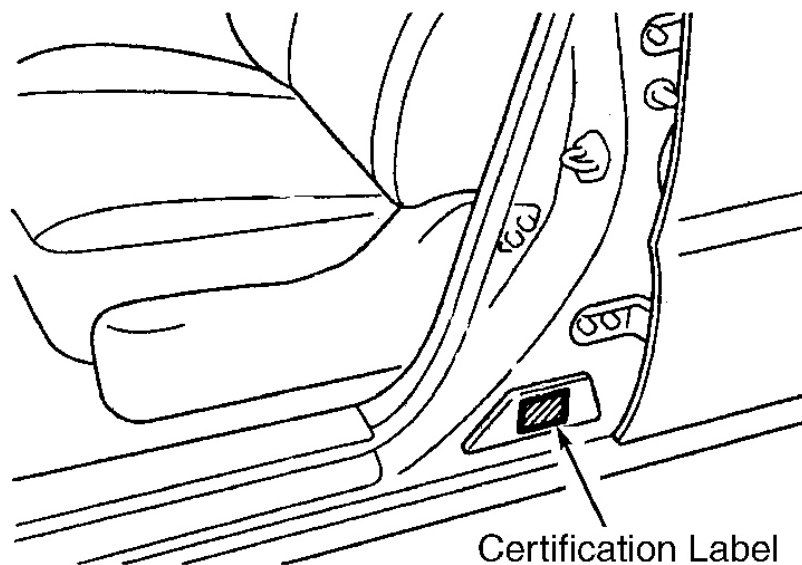
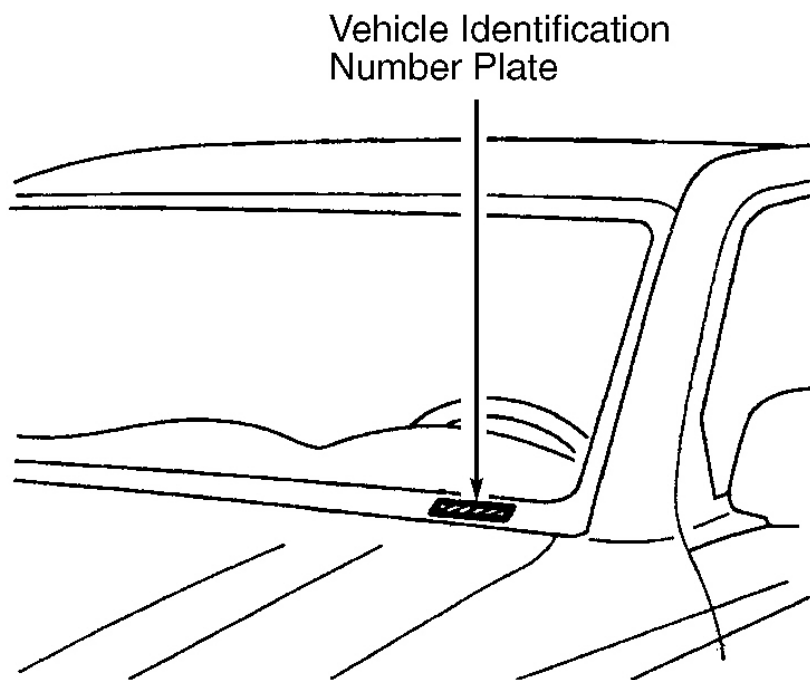
WARNING: Vehicles are equipped with Supplemental Inflatable Restraint (SIR) system. When servicing vehicles, use care to avoid accidental air bag deployment. SIR system-related components are located in various locations throughout interior and exterior of vehicles, depending on application. Do not use electrical test equipment on or near these circuits. If necessary, deactivate SIR system before servicing components. See appropriate AIR BAG RESTRAINT SYSTEMS article in RESTRAINTS.

TRANSAXLE APPLICATION

Application	Transaxle Model
Highlander (2.4L)	U241E
RAV4 (2.0L)	U241E

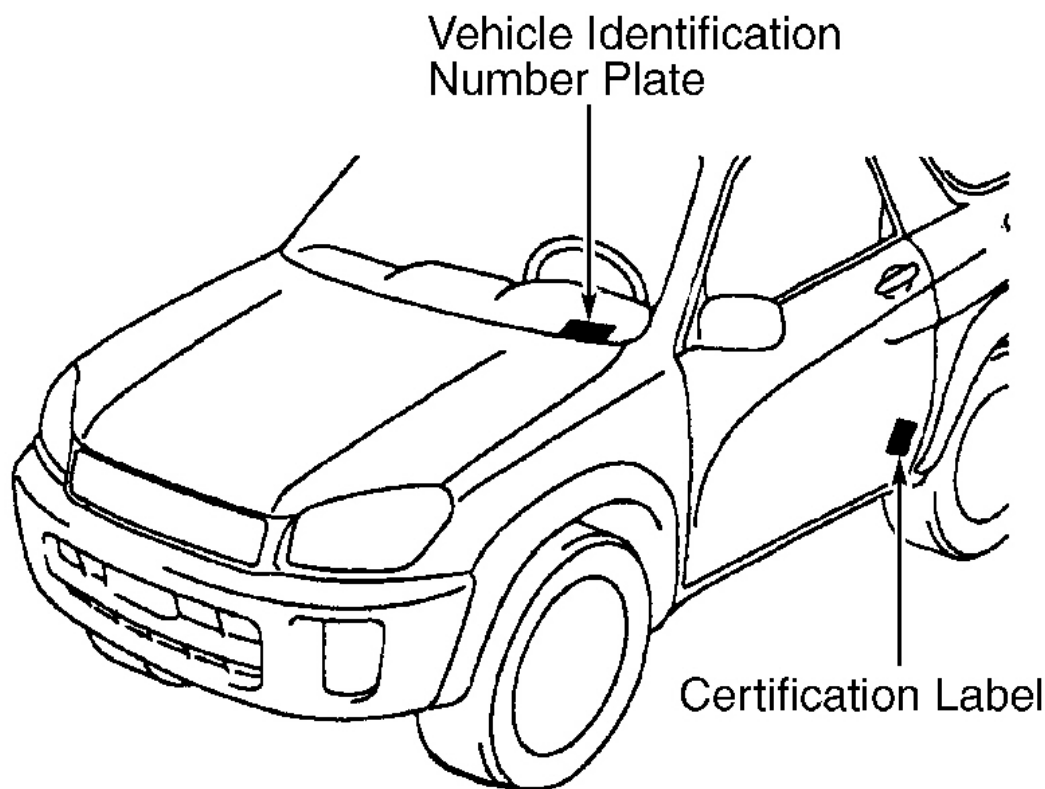
IDENTIFICATION

Vehicle Identification Number (VIN) is used for correct identification of component parts and assemblies. VIN locations are at top left corner of instrument panel and on driver's door post. See **Fig. 1** and **Fig. 2** .



G00110613

Fig. 1: Locating Vehicle Identification Number Plates (Highlander)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00110614

Fig. 2: Locating Vehicle Identification Number Plates (RAV4)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DESCRIPTION & OPERATION

INTRODUCTION

The U241E automatic transaxle is electronically controlled. Transaxle shifting and torque converter clutch lock-up are controlled by an Engine Control Module (ECM). The ECM receives information from various input devices and uses this information to control shift solenoids for transaxle shifting and torque converter clutch lock-up.

An Overdrive (O/D) switch is mounted on the gearshift lever. When O/D main switch is pressed to ON position, transaxle will shift into 4th gear when gearshift lever is in "D" position, and O/D OFF light on instrument panel will go off. When O/D main switch is released to OFF position, transaxle will shift into 3rd gear, and O/D OFF light will illuminate.

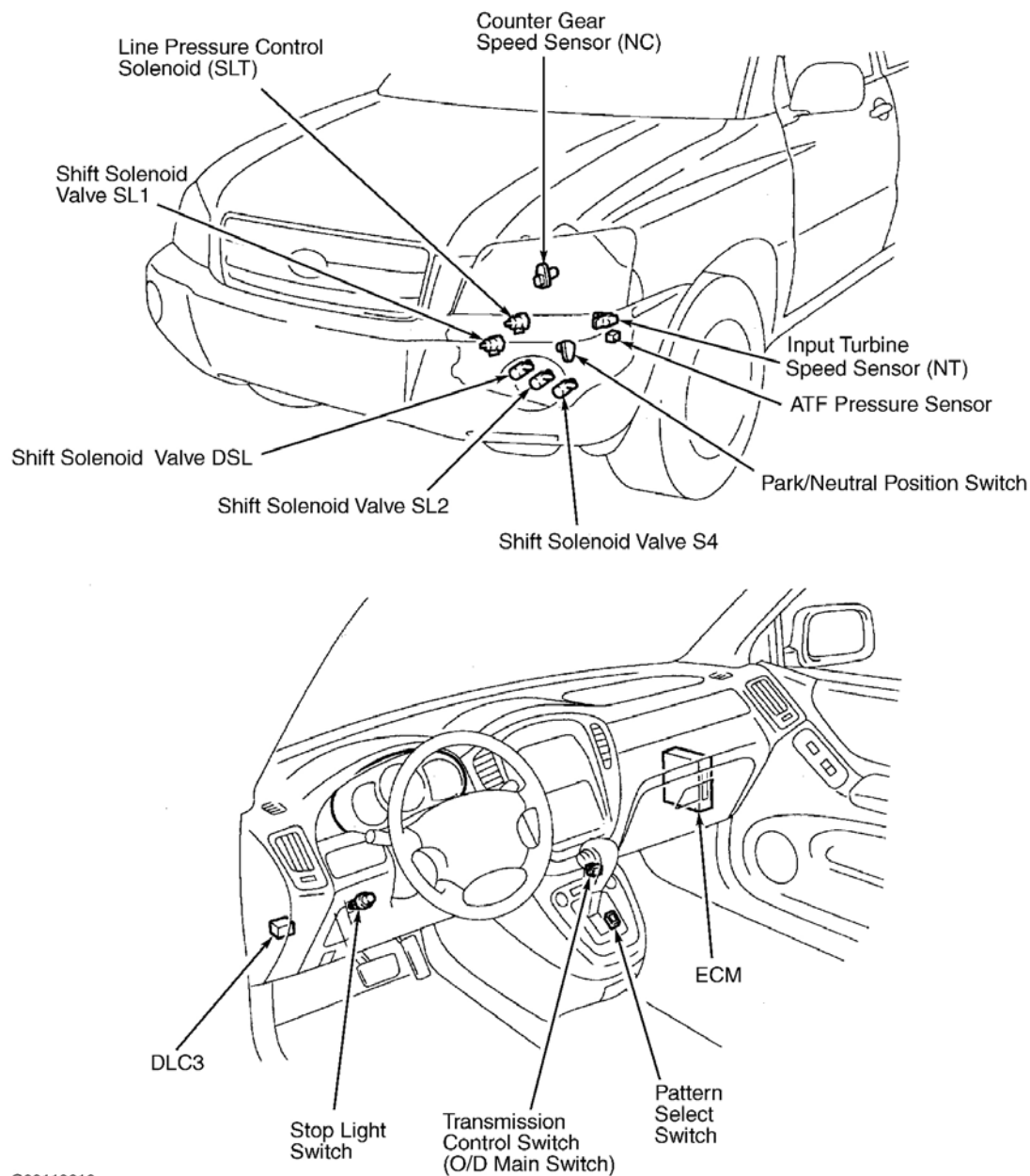
Transaxle is equipped with a shift lock and key lock system. Shift lock system prevents gearshift lever from

being moved from Park unless brake pedal is depressed. In case of a malfunction, gearshift lever can be released by depressing shift lock override button, located near gearshift lever. Key lock system prevents ignition key from being moved from ACC to LOCK position unless gearshift lever is in Park. For more information on shift lock and key lock system, see **SHIFT INTERLOCK SYSTEMS - LEXUS & TOYOTA** article.

ENGINE CONTROL MODULE

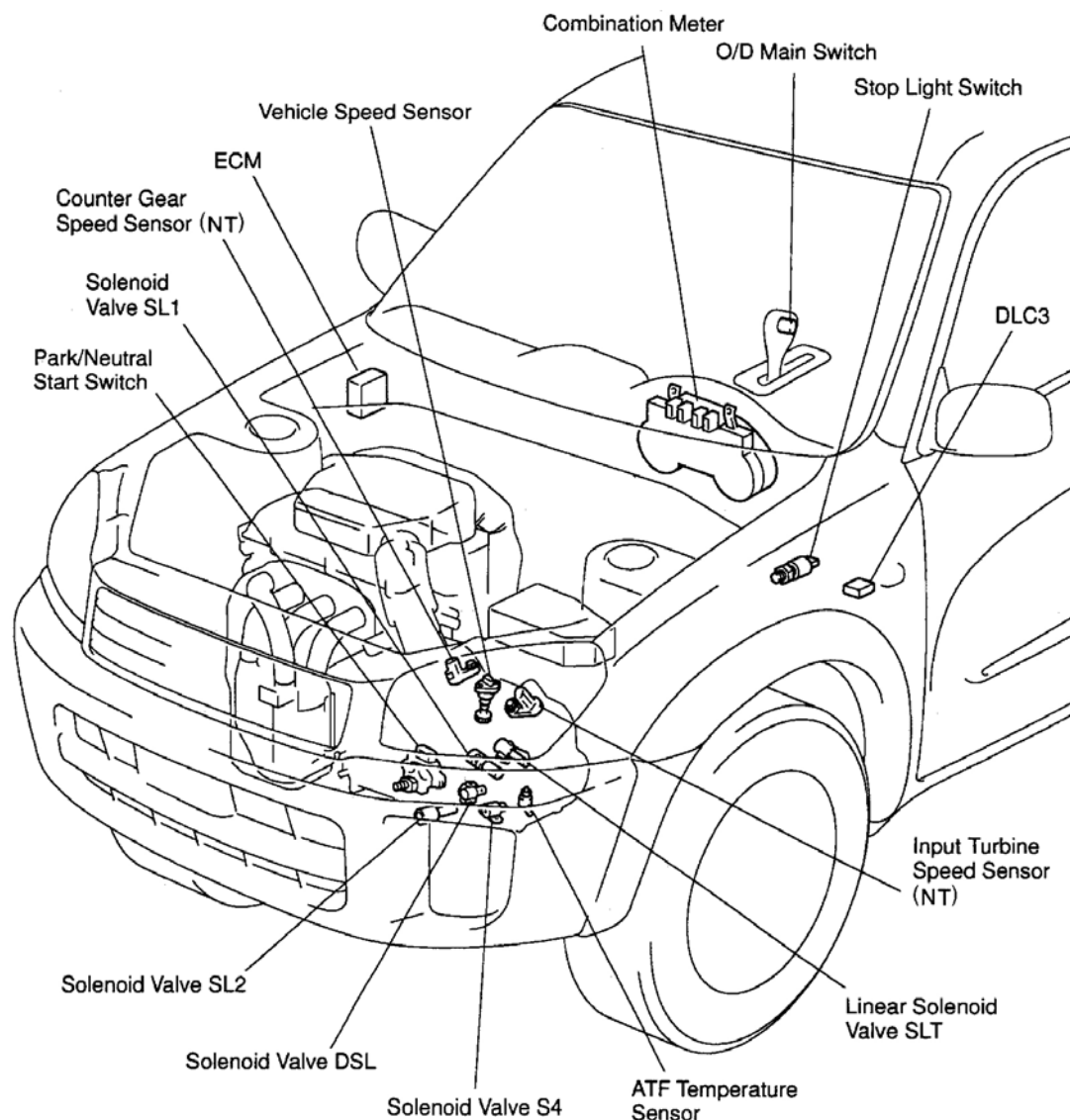
ECM receives information from various input devices and uses this information to control shift solenoids and torque converter clutch lock-up. ECM contains a self-diagnostic system which will store a Diagnostic Trouble Code (DTC) if a failure or problem exists in the electronic control system.

DTCs can be retrieved to determine transaxle problem area. On RAV4, the ECM is located in the right side of the instrument panel, and on Highlander the ECM is located behind glove box in instrument panel. See **Fig. 3** and **Fig. 4** .



G00110616

Fig. 3: Identifying ECM & Input & Output Devices (Highlander)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



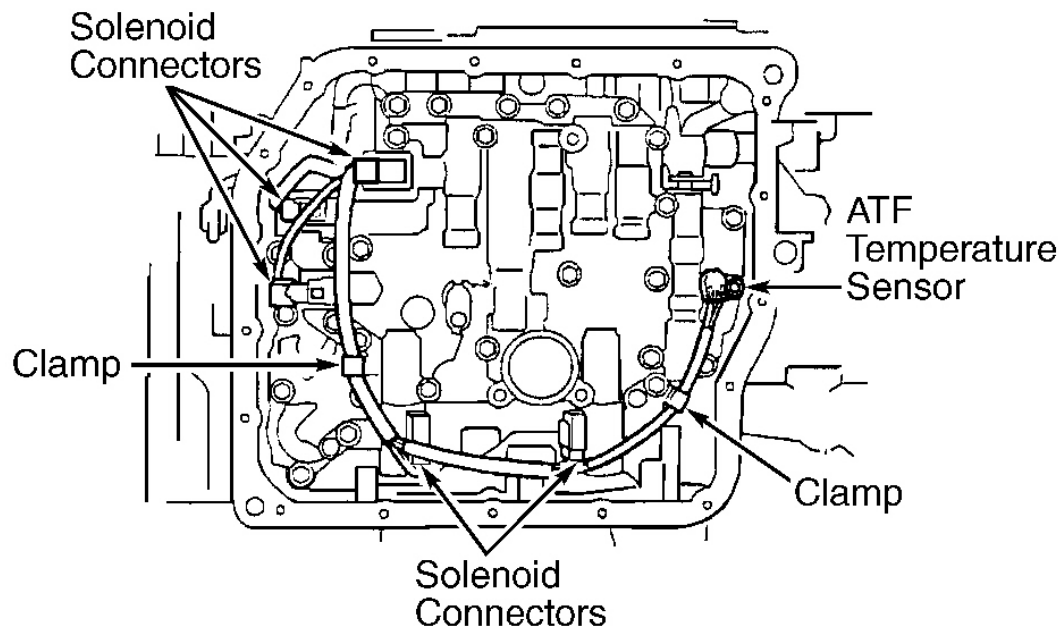
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Fig. 4: Identifying ECM & Input & Output Devices (RAV4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ECM INPUT DEVICES

Automatic Transmission Fluid Temperature Sensor

Automatic Transmission Fluid (ATF) temperature sensor, located on wiring harness inside transaxle oil pan, converts fluid temperature into a resistance value, which is input to ECM. See **Fig. 5**.



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Fig. 5: Locating ATF Temperature Sensor & Solenoid Connectors
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

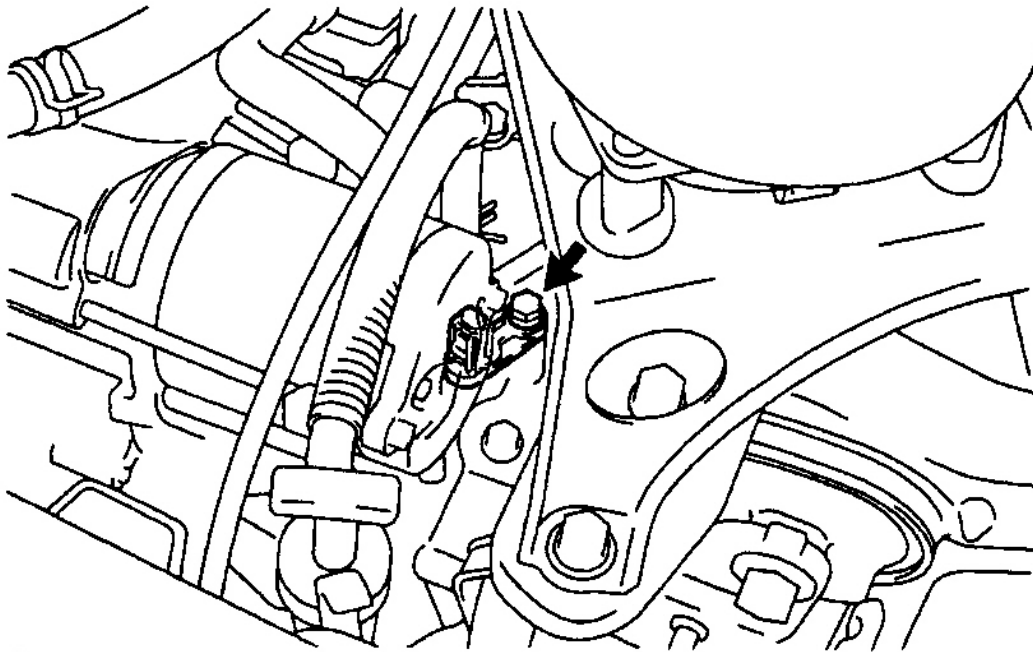
Brakelight Switch

NOTE: **Brakelight switch may be referred to as stoplight switch.**

Brakelight switch delivers input signal to ECM, indicating vehicle braking. Brakelight switch is located on brake pedal support.

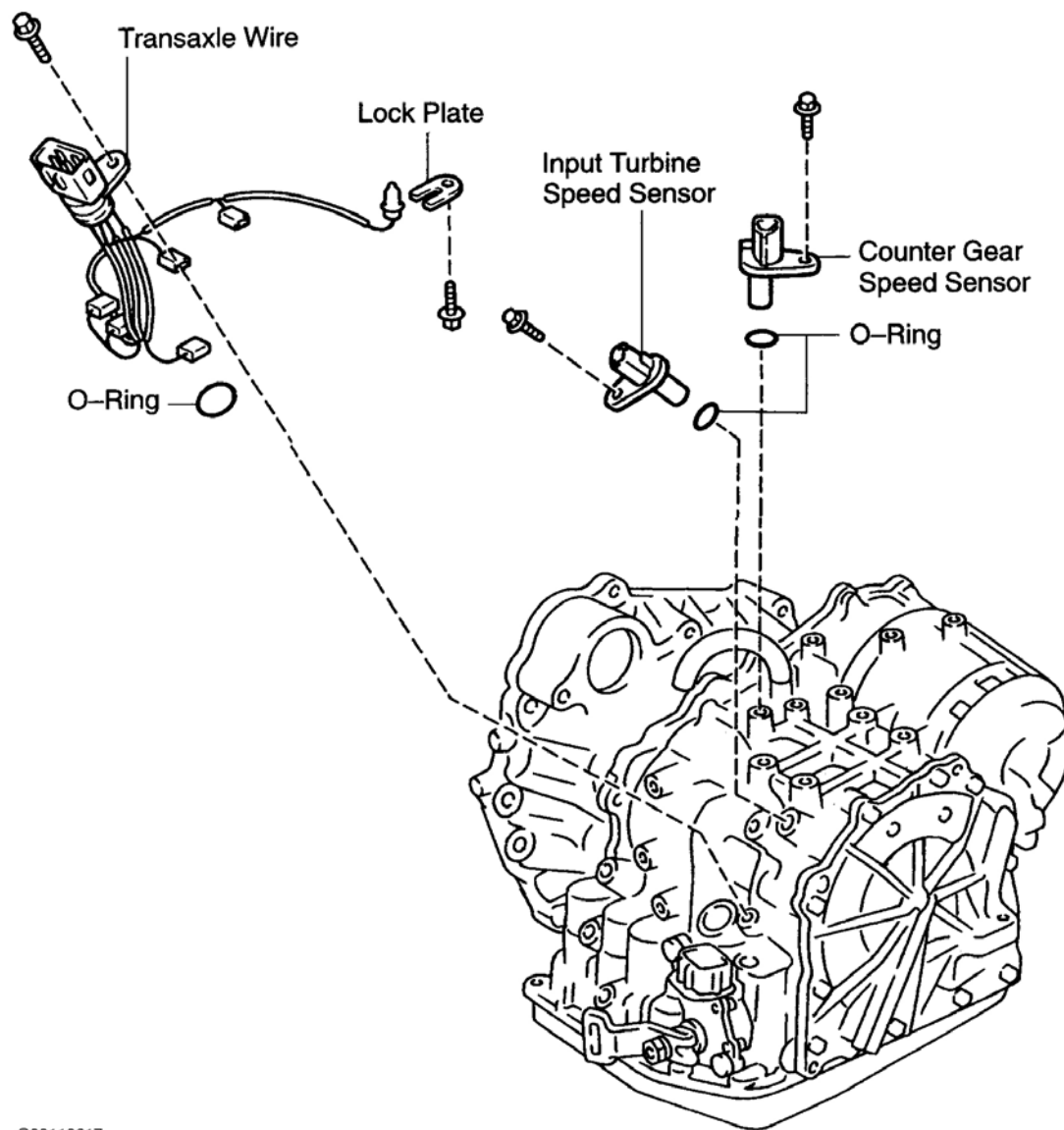
Counter Gear Speed Sensor (NC)

Counter gear speed sensor detects rotation of counter gear. By comparing counter gear speed sensor signal and input turbine speed sensor signal, ECM detects shift timing of gears and controls engine torque and hydraulic pressure in response to various conditions, resulting in smooth transaxle shifting. See **Fig. 6** .



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Fig. 6: Locating Counter Gear Speed Sensor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00110617

Fig. 7: Identifying Transaxle Internal Wiring Harness & Speed Sensor Locations
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Cruise Control Electronic Control Unit

Cruise control Electronic Control Unit (ECU) delivers an input signal to ECM to control overdrive operation in accordance with vehicle speed when cruise control is operating. When in overdrive with cruise control on, if vehicle speed drops 10 MPH less than set speed, transaxle downshifts out of overdrive to prevent reduction in vehicle speed. Once vehicle speed is more than set speed, transaxle will upshift back into overdrive. Cruise control ECU is located behind instrument panel on driver's side of vehicle.

Engine Coolant Temperature Sensor

Engine Coolant Temperature (ECT) sensor delivers input signal to ECM, indicating engine coolant temperature. ECT sensor is located at left side of engine, near upper radiator hose.

Turbine Speed Sensor (NT)

Input turbine speed sensor detects rotation of input turbine shaft. By comparing input turbine speed sensor signal and counter gear speed sensor signal, ECM detects shift timing of gears and controls engine torque and hydraulic pressure in response to various conditions, resulting in smooth transaxle shifting. See **Fig. 8**.

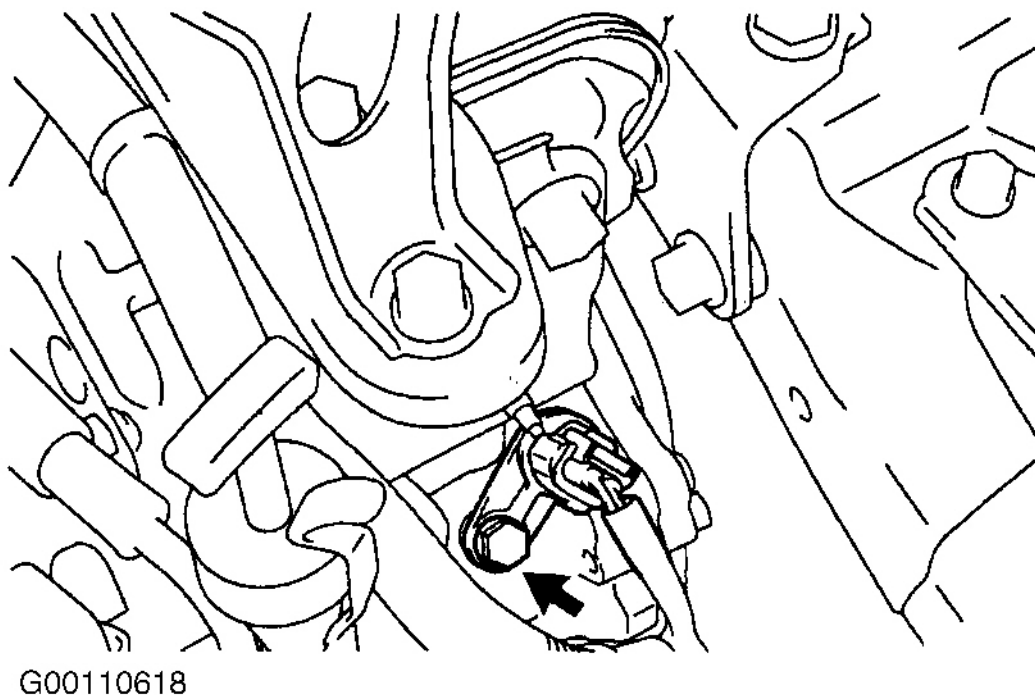


Fig. 8: Locating Turbine Speed Sensor

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Overdrive Switch

Overdrive (O/D) switch is a momentary type switch and provides an input signal to ECM to indicate when overdrive is disabled by vehicle operator. When ignition switch is turned to ON position, O/D main switch is reset to ON position. 4th gear is enabled with gearshift lever in "D" position, and O/D OFF indicator on instrument panel will not illuminate. When O/D main switch is pressed once (O/D OFF position), 4th gear is disabled and O/D OFF indicator will illuminate. O/D main switch is mounted on gearshift lever.

Park/Neutral Position Switch

Park/Neutral Position (PNP) switch delivers an input signal to ECM to indicate gearshift lever position. PNP

switch is located on side of transaxle, below transaxle connector.

Throttle Position Sensor

Throttle Position (TP) sensor delivers an input signal to ECM indicating throttle position. TP sensor is located on side of throttle body.

Vehicle Speed Sensor

Vehicle Speed Sensor (VSS) detects transaxle output shaft RPM. VSS outputs a 4-pulse signal for every revolution of transaxle output shaft. Signal is converted into a more precise rectangular wave form by combination meter. This signal is used to calculate vehicle speed for the speedometer. Signal is then delivered to ECM for cruise control information. See **Fig. 9**.



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Fig. 9: Locating Vehicle Speed Sensor

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ECM OUTPUT DEVICES

NOTE: In case of a short in a shift solenoid circuit, ECM will stop sending current to the shift solenoid with the short circuit.

Shift Solenoid DSL

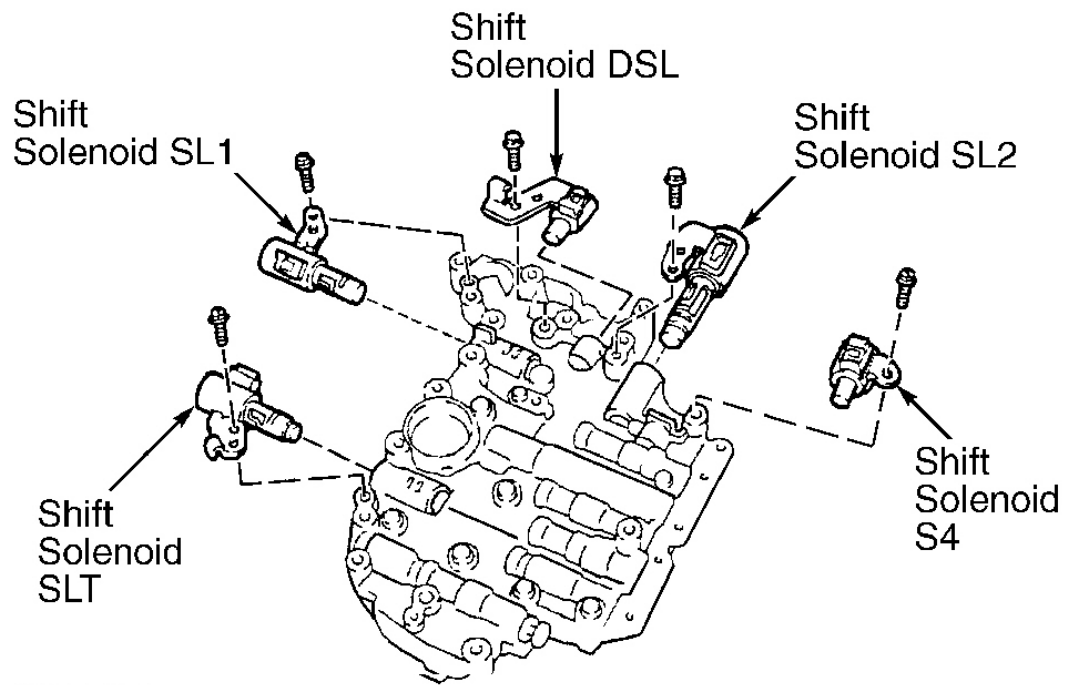
ECM uses signals from TP sensor, airflow meter and crankshaft position sensor to monitor torque converter clutch lock-up engagement condition. ECM compares torque converter clutch lock-up engagement condition with lock-up schedule in ECM memory to detect a malfunction with valve body, torque converter clutch or shift solenoid (DSL). Shift solenoid (DSL) controls hydraulic pressure acting on lock-up relay valve, which contains torque converter clutch lock-up. Shift solenoid (DSL) is located on transaxle valve body. See **Fig. 10** .

Shift Solenoids SL1, SL2 & S4

ECM controls transaxle shifting by delivering an output signal to operate proper shift solenoid. Shift solenoids are located on transaxle valve body. See **Fig. 10** . Shift solenoids are operated in accordance with gearshift lever position. If (SL1) or (SL2) shift solenoid electrical circuit is open or shorted, ECM will switch the other solenoid on or off to obtain a gear that is operational (ECM controlled fail-safe mode). If both (SL1) and (SL2) shift solenoid circuits malfunction, transaxle electronic control will no longer be possible. Transaxle must be operated manually to obtain operational gears shown in illustration. See **Fig. 11** .

Shift Solenoid SLT

ECM controls line pressure by sending a predetermined duty ratio to shift solenoid SLT, modulating line pressure and generating throttle pressure. Shift solenoid SLT is used to precisely and minutely modulate and generate line pressure according to accelerator pedal effort, or engine power output detected. Shift solenoid SLT is located on transaxle valve body. See **Fig. 10** .



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Fig. 10: Identifying Shift Solenoid Locations
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NORMAL				SHIFT SOLENOID SL1 MALFUNCTIONING								SHIFT SOLENOID SL2 MALFUNCTIONING			
				Driving at 3rd or O/D				Driving at 1st or 2nd							
Solenoid Valve			Gear	Solenoid Valve			Gear	Solenoid Valve			Gear	Solenoid Valve			Gear
SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4	
ON	ON	OFF	1st	X	ON ↓ OFF	OFF	3rd	X	ON	OFF	2nd	ON ↓ OFF	X	OFF	3rd
OFF	ON	OFF	2nd	X	ON ↓ OFF	OFF	3rd	X	ON	OFF	2nd	OFF	X	OFF	3rd
OFF	OFF	OFF	3rd	X	OFF	OFF	3rd	X	OFF ↓ ON	OFF ↓ ON	3rd	OFF	X	OFF	3rd
OFF	OFF	ON	O/D	X	OFF	ON	O/D	X	OFF ↓ ON	ON	3rd	OFF	X	ON	O/D

SHIFT SOLENOID S4 MALFUNCTIONING				SHIFT SOLENOID SL1 AND SL2 MALFUNCTIONING				SHIFT SOLENOID SL1 AND S4 MALFUNCTIONING							
								Driving at 3rd or O/D				Driving at 1st or 2nd			
Solenoid Valve			Gear	Solenoid Valve			Gear	Solenoid Valve			Gear	Solenoid Valve			Gear
SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4		SL1	SL2	S4	
ON	ON	X	1st	X	X	OFF	3rd	X	ON ↓ OFF	X	3rd	X	ON	X	2nd
OFF	ON	X	2nd	X	X	OFF	3rd	X	ON ↓ OFF	X	3rd	X	ON	X	2nd
OFF	OFF	X	3rd	X	X	OFF	3rd	X	OFF	X	3rd	X	OFF ↓ ON	X	2nd
OFF	OFF	X	3rd	X	X	ON	O/D	X	OFF	X	3rd	X	OFF ↓ ON	X	2nd

SHIFT SOLENOID SL2 AND S4 MALFUNCTIONING				SHIFT SOLENOID SL1, SL2 AND S4 MALFUNCTIONING			
Solenoid Valve			Gear	Solenoid Valve			Gear
SL1	SL2	S4		SL1	SL2	S4	
ON ↓ OFF	X	X	3rd	X	X	X	3rd
OFF	X	X	3rd	X	X	X	3rd
OFF	X	X	3rd	X	X	X	3rd
OFF	X	X	3rd	X	X	X	3rd

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Fig. 11: Checking Shift Solenoid Operation
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

COMPONENT LOCATIONS

COMPONENT LOCATIONS

Component	Location
Brakelight Switch	On Brake Pedal Bracket

Counter Gear Speed Sensor	On Transaxle
DLC3	Under Left Side Of Instrument Panel
ECM (Highlander)	Behind Glove Box
ECM (RAV4)	Behind Right Side Of Instrument Panel, Near Lower "A" Pillar
Input Turbine Speed Sensor	On Transaxle
O/D Main Switch	On Gearshift Lever
Vehicle Speed Sensor	On Transaxle

TROUBLE SHOOTING

NOTE: Any diagnosis should begin with confirming the customer's complaint. If possible, road test vehicle first, and note transmission performance for future reference during diagnosis.

PRELIMINARY INSPECTION

Transmission malfunctions may be caused by poor engine performance, improper adjustments or failure of hydraulic, mechanical or electronic components. Prior to diagnosing transmission concerns, always begin by checking fluid level, fluid condition and shift cable adjustment. Ensure engine starts with gearshift lever in Park and Neutral to ensure proper adjustment of park/neutral position switch. Ensure all system-related fuses are okay. Check wire harnesses for proper routing. Verify all harness and component connections are clean and tight. See **WIRING DIAGRAMS** . If area of fault cannot be located or repaired during preliminary inspection, check self-diagnostic system. See **SELF-DIAGNOSTIC SYSTEM** . Repair as necessary.

Perform road test to determine if problem has been corrected. See **ROAD TEST** under PERFORMANCE TESTS. If problem still exists, diagnose by symptom. See **SYMPTOM DIAGNOSIS** .

SYMPTOM DIAGNOSIS

NOTE: Perform **PRELIMINARY INSPECTION** prior to diagnosing by symptom.

NOTE: Use the following symptoms to aid in preliminary diagnosis. If a listed symptom matches the customer's concern, check the applicable items for possible cause.

NOTE: No. 2 one-way clutch may also be referred to as underdrive one-way clutch.

Fluid Discolored Or Smells Burnt

Fluid contaminated. Torque converter or transaxle faulty.

Harsh Engagement During Upshift

Check upper valve body check, control and lock valves.

Harsh Engagement (Neutral To Drive)

Check forward clutch accumulator, forward clutch, underdrive clutch and No. 1 one-way clutch.

Harsh Engagement (Neutral To Low)

Check solenoid modulator valve.

Harsh Engagement (Neutral To Reverse)

Check accumulators, lower valve body control valves, direct clutch and 1st/reverse brake.

Harsh Lock-Up Engagement

Check lock-up relay valve and torque converter clutch.

No Engine Braking In Low

Check low coast modulator valve and, 1st and reverse brake.

No Engine Braking In "2" Position

Check 2nd coast modulator valve and 2nd coast brake.

No Kickdown

Check lower valve body control valves and 3-4 shift valve.

No Lock-Up Or Lock-Up Off

Check lock-up relay valve and torque converter clutch. Check shift solenoid valve SL circuit, TP sensor circuit, VSS circuit, O/D cancel circuit, brakelight circuit, ECT sensor circuit, ECM circuit.

No 1-2 Upshift

Check lower valve body control valves, 2nd brake and No. 1 one-way clutch.

No 1-2 &/Or 2-3 Upshift

Check Throttle Position (TP) sensor circuit, SL1 and SL2 shift solenoid circuit, Vehicle Speed Sensor (VSS) circuit, ECM, 1-2 shift valve, 2-3 shift valve, 2nd brake, direct clutch and No. 1 one-way clutch.

No 2-3 Upshift

Check lower valve body control valves and direct clutch.

No 3-O/D Upshift

Check O/D main switch and O/D OFF indicator circuit, O/D cancel signal circuit, SL1 and SL2 shift solenoid circuit, VSS circuit, Engine Coolant Temperature (ECT) sensor circuit, ECM, 3-4 shift valve and underdrive brake.

No 3-4 Upshift

Check 3-4 shift valve and underdrive clutch.

No 3-2 &/Or 2-1 Downshift

Check SL1 and SL2 shift solenoid valves, VSS circuit, TP sensor circuit, ECM circuit, 2-3 shift valve, 1-2 shift valve and 2nd coast brake.

No 3-2 Downshift

Check lower valve body control valves.

No 4-3 Downshift

Check 3-4 shift valve.

Poor Acceleration In All Positions

Check torque converter clutch and underdrive planetary gear.

Poor Acceleration In Overdrive

Check underdrive clutch and underdrive planetary gear.

Shift Speeds Too High Or Too Low

Check TP sensor circuit, VSS circuit, shift solenoid valve SL circuit, O/D cancel signal circuit, pattern select switch circuit and ECM.

Slip Or Shudder In Forward Position After Warm-Up

Check upper valve body, oil strainer, torque converter clutch, forward clutch, direct clutch, underdrive brake, No. 1 one-way clutch and underdrive clutch.

Slip Or Shudder In Overdrive

Check underdrive clutch.

Slip Or Shudder In Reverse

Check direct clutch and 1st/reverse brake.

Slip Or Shudder In 1st Gear

Check No. 1 one-way clutch.

Slip Or Shudder In 2nd Gear

Check 2nd brake and SL2 one-way clutch.

Slip Or Shudder In 3rd Gear

Check direct clutch.

Torque Converter Lock-Up Will Not Release

Check shift solenoid valve SL circuit, TP sensor circuit, brakelight circuit, ECM circuit, lock-up relay valve and torque converter clutch.

Vehicle Does Not Move In Any Forward Gear

Check forward clutch, No. 2 one-way clutch, 1st and reverse brake, 2nd coast brake, 2nd brake and direct clutch.

Vehicle Does Not Move In Any Forward Or Reverse Gear

Check manual valve, primary regulator valve, parking lock pawl, front planetary gear, rear planetary gear, underdrive planetary gear, forward clutch, underdrive brake and No. 2 one-way clutch.

Vehicle Does Not Move In Reverse

Check 1-2 shift valve, 2-3 shift valve, 2nd coast brake, front planetary gear, rear planetary gear, direct clutch, underdrive clutch and 1st and reverse brake.

CLUTCH & BRAKE APPLICATIONS

CLUTCH & BRAKE APPLICATIONS

Gearshift Lever Position	Elements In Use
"D" (Drive)	
1st Gear	Forward Clutch, No. 2 One-Way Clutch & Underdrive Brake
2nd Gear	Forward Clutch, No. 1 One-Way Clutch, 2nd Brake, Underdrive Brake & Underdrive One-Way Clutch
3rd Gear	Direct Clutch, Forward Clutch, 2nd Brake & Underdrive Brake
Overdrive	Direct Clutch, Forward Clutch, 2nd Brake & Underdrive Clutch
"2" (2nd)	
1st Gear	Forward Clutch, No. 2 One-Way Clutch, Underdrive One-Way Clutch & Underdrive Brake
2nd Gear	Forward Clutch, 2nd Brake, No. 1 One-Way Clutch, Underdrive Brake, Underdrive One-Way Clutch & 2nd Coast Brake

3rd Gear ⁽¹⁾	Direct Clutch, Forward Clutch, 2nd Brake, Underdrive Brake & Underdrive One-Way Clutch
"L" (Low)	
1st Gear	Forward Clutch, Underdrive Brake, No. 2 One-Way Clutch & 1st & Reverse Brake
2nd Gear ⁽²⁾	Forward Clutch, 2nd Coast Brake, 2nd Brake, No. 1 One-Way Clutch, Underdrive One-Way Clutch & Underdrive Brake
"R" (Reverse)	Direct Clutch, Underdrive Brake, & 1st & Reverse Brake
"N" (Neutral)	Underdrive Brake
"P" (Park)	Underdrive Brake
(1) Downshift only in 3rd gear for "2" position.	
(2) Downshift only in 2nd gear for "L" position. Upshift does not occur.	

PERFORMANCE TESTS

ROAD TEST

NOTE: Ensure transaxle is at normal operating temperature. There is no OD upshift or torque converter lock-up when fluid temperature is less than 140°F (60°C).

NOTE: There is no torque converter clutch lock-up when vehicle speed is 6 MPH less than cruise control set speed. Ensure cruise control is off during road test.

"D" Range Test

- Shift into "D" range. Hold accelerator pedal constant at full throttle. Check 1-2, 2-3, and 3-OD lock-up and upshift points. See **SHIFT SPEED SPECIFICATIONS** and **LOCK-UP SPEED SPECIFICATIONS** . If shift points are not as specified, diagnose by symptom. See **SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING.
- Use procedure outlined in step 1 to check for shock and slip between 1-2, 2-3, and 3-OD upshifts. If shock is harsh, line pressure may be too high. Check accumulator or check ball.
- Run vehicle in "D" range lock-up or overdrive gear. Check for abnormal noise and vibration.

NOTE: Check for cause of abnormal noise and vibration must be made with extreme care as problem could be due to an unbalanced drive axle, differential, tire, torque converter, etc.

- While running in "D" range, confirm correct kickdown vehicle speed limits for 2-1, 3-2, OD-3 shift points. Check for abnormal shock and slip at kickdown.
- Check lock-up function. Drive vehicle in OD gear of "D" range with lock-up on. Hold vehicle speed steady at about 47 MPH. Lightly depress accelerator pedal. Ensure engine RPM does not change abruptly. Large increase in engine RPM indicates lock-up function is faulty.

"2" Range Test

1. Shift to "2" range. Drive with accelerator pedal held constantly at full throttle. Ensure 1-2 upshift points take place and are operating properly. See **SHIFT SPEED SPECIFICATIONS** . If shift points are not as specified, diagnose by symptom. See **SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING.
- NOTE:** In "2" range there will be no lock-up to 2nd gear.
2. While driving in "2" range, 2nd gear, release accelerator pedal and check engine braking effect. If there is no engine braking effect, check for faulty 2nd coast brake, or sticking or binding 2nd coast modulator valve in valve body. Check for abnormal noise and shock at acceleration and deceleration.

"L" Range Test

While running in "L" range, ensure there is no upshift to 2nd gear. While running in "L" range, release accelerator pedal. If there is no engine braking effect, check for faulty 1st and reverse brake, or sticking or binding low coast modulator valve in valve body. Check for abnormal noise at acceleration and deceleration.

"R" Range Test

Shift into "R" range. Accelerate vehicle from a stop at full throttle. Ensure slipping does not occur. If slipping occurs, check for faulty direct clutch, 1st and reverse brake, sticking or binding primary regulator valve, or restricted oil filter.

"P" Range Test

Stop vehicle on at least a 5 degree grade. Shift transaxle into "P" range. Release parking brake. Ensure parking pawl holds vehicle.

SHIFT SPEED SPECIFICATIONS

SHIFT SPEED SPECIFICATIONS (HIGHLANDER)

Application	MPH
"D" Position	
1st-2nd ⁽¹⁾	35-39
2nd-3rd ⁽¹⁾	65-70
3rd-4th ⁽¹⁾	104-112
4th-3rd ⁽¹⁾	99-108
3rd-2nd ⁽¹⁾	61-66
2nd-1st ⁽¹⁾	29-33
3rd-4th ⁽²⁾	26-30
4th-3rd ⁽²⁾	11-14
"2" Position	

1st-2nd ⁽¹⁾	35-39
3rd-2nd ⁽¹⁾	65-70
2nd-1st ⁽¹⁾	29-33
"L" Position	
3rd-2nd ⁽¹⁾	70-76
2nd-1st ⁽¹⁾	32-36
(1) Wide open throttle.	
(2) Fully closed throttle.	

SHIFT SPEED SPECIFICATIONS (RAV4)

Application	MPH
"D" Position	
1st-2nd ⁽¹⁾	35-40
2nd-3rd ⁽¹⁾	65-71
3rd-4th ⁽¹⁾	99-109
4th-3rd ⁽¹⁾	94-104
3rd-2nd ⁽¹⁾	60-66
2nd-1st ⁽¹⁾	28-32
3rd-4th ⁽²⁾	25-28
4th-3rd ⁽²⁾	9-12
"2" Position	
1st-2nd ⁽¹⁾	35-40
3rd-2nd ⁽¹⁾	65-71
2nd-1st ⁽¹⁾	28-32
"L" Position	
3rd-2nd ⁽¹⁾	65-71
2nd-1st ⁽¹⁾	30-35
(1) Wide open throttle.	
(2) Fully closed throttle.	

LOCK-UP SPEED SPECIFICATIONS

LOCK-UP SPEEDS (HIGHLANDER)

Application	MPH
"D" Position ⁽¹⁾	
Lock-Up On In 3rd ⁽²⁾	60-65

Lock-Up Off In 3rd ⁽²⁾	59-63
Lock-Up On In OD ⁽²⁾	39-43
Lock-Up Off In OD ⁽²⁾	32-42
(1) There is no lock-up in "L" or "2" position. (2) Throttle valve opening 5 percent.	

LOCK-UP SPEEDS (RAV4)⁽¹⁾

Application	MPH
"D" Position ⁽¹⁾	
Lock-Up On In 3rd ⁽²⁾	99-110
Lock-Up Off In 3rd ⁽²⁾	94-104
Lock-Up On In OD ⁽²⁾	34-39
Lock-Up Off In OD ⁽²⁾	32-37
(1) There is no lock-up in "L" or "2" position. (2) Throttle valve opening 5 percent.	

STALL SPEED TEST

Stall Speed Test Procedure

CAUTION: Perform test at normal operating fluid temperature of 122-176°F (50-80°C). DO NOT continue test for more than 10 seconds.

1. Testing is done to check overall performance of transaxle and engine by measuring maximum engine speeds in "D" and "R" positions.
2. Block front and rear wheels. Connect scan tool to Data Link Connector (DLC3) to monitor engine RPM. Apply parking and service brakes. Start engine. Place gearshift lever into "D" position. Fully depress accelerator pedal. Release pedal after 10 seconds.
3. Record highest engine RPM. Repeat test in "R" position. Compare reading obtained to specification. Stall speed should be 2200-2550 in both "D" and "R" positions.
4. If stall speed is same for both positions, but lower than specified RPM, engine output may be insufficient or stator one-way clutch is not operating properly.

NOTE: If stall speed RPM is more than 600 RPM less than specification, torque converter may be faulty.

5. If stall speed in "D" position is higher than specification, forward clutch may be slipping, No. 2 one-way clutch may not be operating properly, underdrive clutch may be slipping, or line pressure is too low.
6. If stall speed in "R" position is higher than specification, direct clutch may be slipping, 1st/reverse brake

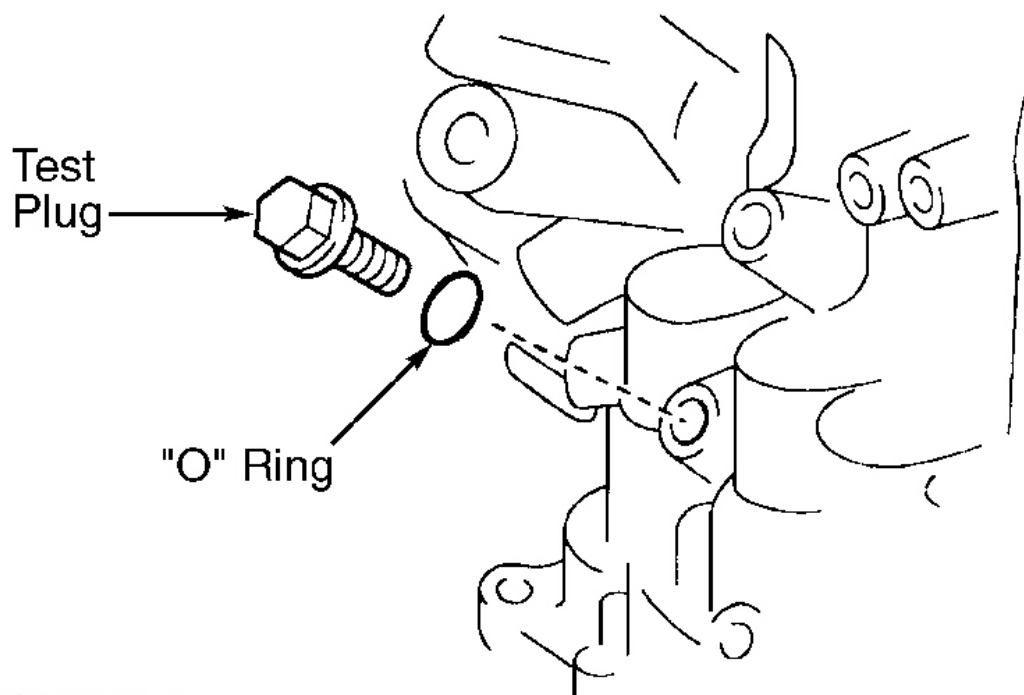
may be slipping, line pressure is too low or underdrive clutch may be slipping.

7. If stall speed in "R" and "D" positions is higher than specification, line pressure is too low, incorrect fluid level exists or No. 2 one-way clutch is not operating properly.

HYDRAULIC PRESSURE TESTS

CAUTION: Perform test at normal operating fluid temperature of 122-176°F (50-80°C).

1. Ensure transaxle fluid is at operating temperature. Raise and support vehicle. Remove transaxle case test plug. See **Fig. 12** . Install hydraulic pressure gauge. Lower vehicle.
2. Fully apply parking brake. Block all wheels. Start engine and ensure idle speed is 600-700 RPM. Shift transaxle into "D" position. Read and record pressure at idle. Fully apply brakes. Depress accelerator pedal to floor. DO NOT apply full throttle for more than 5 seconds.
3. Measure highest line pressure. See **LINE PRESSURE SPECIFICATIONS** . Repeat test in "R" position. If pressures exceed specification in all ranges, regulator valve or control valve in upper valve body is defective. Ensure no Throttle Position (TP) sensor related DTCs are present.
4. If pressures in both positions are lower than specification, oil pump, regulator valve or underdrive clutch is defective. Ensure no TP sensor related DTCs are present.
5. If pressure is lower than specification in "D" position only, forward clutch is defective or "D" range circuit has a fluid leak. If pressure is lower than specification in "R" position only, direct clutch is defective, 1st/reverse brake is defective or "R" range circuit has a fluid leak.



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Fig. 12: Locating Transaxle Test Plug
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

LINE PRESSURE SPECIFICATIONS

LINE PRESSURE SPECIFICATIONS (HIGHLANDER)

Engine RPM	"D" Range - psi (kg/cm ²)	"R" Range - psi (kg/cm ²)
Idle Speed	54-60 (3.8-4.2)	135-149 (9.5-10.5)
Stall Speed (Throttle Fully Open)	135-150 (9.5-10.5)	256-285 (18.0-20.0)

LINE PRESSURE SPECIFICATIONS (RAV4)

Engine RPM	"D" Range - psi (kg/cm ²)	"R" Range - psi (kg/cm ²)
Idle Speed	54-65 (3.8-4.6)	93-116 (6.5-8.2)
Stall Speed (Throttle Fully Open)	131-160 (9.2-11.2)	251-294 (17.6-20.7)

TIME LAG TEST

CAUTION: Perform this test at normal operating fluid temperature of 122-176°F (50-80°C). Allow one minute between tests. Record 3 measurements and

average results.

- 1. If gearshift lever is actuated with engine idling, a time lag will be noted before shock can be felt. This test is used for checking condition of underdrive clutch, forward clutch, direct clutch and 1st/reverse brake.
- 2. Apply parking brake. Connect scan tool to DLC3 to monitor engine RPM. Start engine. Ensure idle speed is 600-700 RPM with transaxle in Neutral and A/C off. Shift transaxle from "N" to "D" position. Use a stop watch to measure elapsed time between shifting lever until shock is felt.
- 3. Standard time lag is less than 1.2 seconds. Repeat test to measure time lag for "N" to "R" position. Standard time lag is less than 1.5 seconds. If "N" to "D" position time lag is longer than specified, line pressure is too low, forward clutch may be worn or No. 2 one-way clutch is not operating properly.
- 4. If "N" to "R" position time lag is longer than specified, direct clutch may be worn, 1st/reverse brake may be worn, line pressure is too low or No. 2 one-way clutch may be worn.

MANUAL SHIFT TEST

NOTE: Perform manual shift test if no DTCs are stored. Manual shift test determines if problem is in electrical circuits or is a mechanical transaxle problem. If the "L", "2" and "D" gear positions are difficult to distinguish, do the following road test. If any abnormalities are found in test, the problem is in the transaxle itself.

Highlander

Ensure ignition switch is in OFF position. Disconnect 10-pin transaxle connector, located above PNP switch on transaxle. Road test vehicle and ensure transaxle gear changes correspond with gearshift lever position. See **GEAR APPLICATION (HIGHLANDER)** table. If abnormality exists, a mechanical transaxle problem may exist. Turn ignition switch to the OFF position. Reconnect transaxle connector. Disconnecting transaxle connector may set DTC. Clear DTCs from ECM memory. See [CLEARING DIAGNOSTIC TROUBLE CODES](#) under SELF-DIAGNOSTIC SYSTEM.

GEAR APPLICATION (HIGHLANDER)

Gearshift Lever Position	Gear
"D"	3rd
"2"	3rd
"L"	3rd
"R"	Reverse
"P"	Pawl Park

RAV4

NOTE: Perform manual shift test if no DTCs are stored. Manual shift test determines if problem is in electrical circuits or is a mechanical transaxle problem. If the "L", "2" and "D" gear positions are difficult to distinguish, do the following road test. If any abnormalities are found in test, the problem is in the transaxle itself.

Ensure ignition switch is in OFF position. Disconnect 10-pin transaxle connector, located above PNP switch on transaxle. Road test vehicle and ensure transaxle gear changes correspond with gearshift lever position. See **GEAR APPLICATION (RAV4)** table. If abnormality exists, a mechanical transaxle problem may exist. Turn ignition switch to the OFF position. Reconnect transaxle connector. Disconnecting transaxle connector may set DTC. Clear DTCs from ECM memory. See [CLEARING DIAGNOSTIC TROUBLE CODES](#) under SELF-DIAGNOSTIC SYSTEM.

GEAR APPLICATION (RAV4)

Gearshift Lever Position	Gear
"D"	Overdrive
"2"	Overdrive
"L"	1st
"R"	Reverse
"P"	Pawl Park

SELF-DIAGNOSTIC SYSTEM

INTRODUCTION

NOTE: Before testing transaxle, ensure fluid level is correct and shift cables are properly adjusted. Ensure engine starts with gearshift lever in Park and Neutral positions to ensure proper adjustment of PNP switch. ECM must first be tested for stored DTCs. See [RETRIEVING DIAGNOSTIC TROUBLE CODES](#) .

ECM monitors transaxle operation and contains a self-diagnostic system which stores DTCs if transaxle electronic control system failure or problem exists. Malfunction Indicator Light (MIL) on instrument panel will illuminate to warn driver a malfunction exists and that a DTC has been stored.

RETRIEVING DIAGNOSTIC TROUBLE CODES

- NOTE:** DTCs are 4-digit. See [DIAGNOSTIC TROUBLE CODE DEFINITIONS](#) table. DTCs can only be retrieved using a TOYOTA scan tool or OBD-II scan tool that complies with SAE standard J-1987. Connect scan tool to 16-pin Data Link Connector (DLC3). DLC3 is located under instrument panel, near steering column. See [Fig. 13](#) . When a DTC is stored in ECM, MIL on instrument panel will illuminate. To retrieve DTCs using OBD-II scan tool, follow scan tool manufacturer's operating instructions.
- NOTE:** Scan tool may be operated in NORMAL mode when retrieving DTCs. Only the TOYOTA scan tool may be used in CHECK mode when retrieving DTCs.

NORMAL mode is used to retrieve DTCs from ECM. CHECK mode is used to check for DTCs when operating vehicle to simulate conditions in which DTC was set. CHECK mode contains a higher sensing ability to detect malfunction. CHECK mode helps determine malfunctions caused by poor electrical connections, which are

difficult to determine using NORMAL mode.

NOTE: If using TOYOTA scan tool, when ignition switch is turned from ON to ACC or OFF position, or if scan tool is switched from NORMAL mode to CHECK mode, all DTCs and freeze frame data will be erased. DO NOT switch modes until all DTCs and freeze frame data are recorded.

NOTE: Once repairs have been performed, DTCs must be cleared from ECM memory. See CLEARING DIAGNOSTIC TROUBLE CODES .

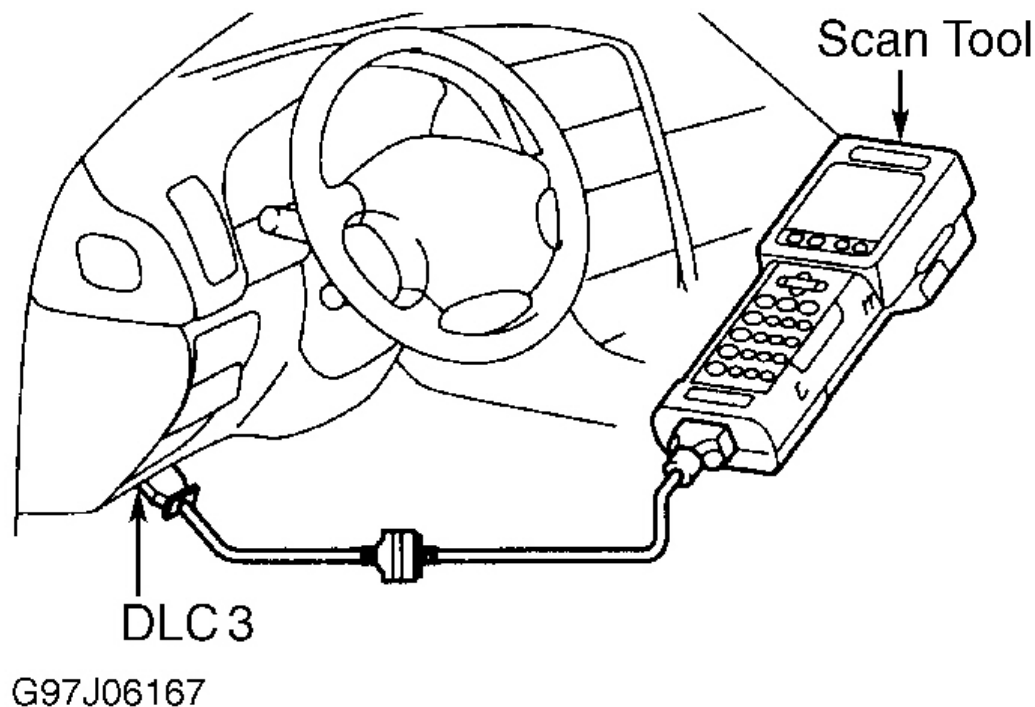


Fig. 13: Connecting Scan Tool To DLC3
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DIAGNOSTIC TROUBLE CODE DEFINITIONS

NOTE: Only transaxle related DTCs are listed. See DIAGNOSTIC TROUBLE CODE DEFINITIONS table. For engine-related DTC definitions, see TROUBLE CODE DEFINITIONS article in GENERAL INFORMATION. For engine-related DTC diagnosis, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE. These DTCs pertain to engine performance and must be

repaired first, as engine performance and related component signals will affect transaxle operation and diagnosis.

DIAGNOSTIC TROUBLE CODE DEFINITIONS

DTC	(1) Probable Cause
P0500	Vehicle Speed Sensor
P0710 & P0711	ATF Temperature Sensor (Highlander)
P0710 & P0711	ATF Temperature Sensor (RAV4)
P0750	(2) Shift Solenoid SL1
P0753	Shift Solenoid SL1 Circuit Malfunction (Highlander)
P0753	Shift Solenoid SL1 Circuit Malfunction (RAV4)
P0755	(2) Shift Solenoid SL2
P0758	Shift Solenoid SL2 Circuit Malfunction (Highlander)
P0758	Shift Solenoid SL2 Circuit Malfunction (RAV4)
P0765	(2) Shift Solenoid S4 (RAV4)
P0768	Shift Solenoid S4 Circuit Malfunction (Highlander)
P0768	Shift Solenoid S4 Circuit Malfunction (RAV4)
P0770	(2) Shift Solenoid DSL
P0773	Shift Solenoid DSL Circuit Malfunction (Highlander)
P0773	Shift Solenoid DSL Circuit Malfunction (RAV4)
P1520	Brakelight Switch
P1725	Input Turbine Speed Sensor (Highlander)
P1725	Input Turbine Speed Sensor (RAV4)
P1730	Counter Gear Speed Sensor
P1760	Shift Solenoid SLT (Highlander)
P1760	Shift Solenoid SLT (RAV4)
P1780	Park/Neutral Position Switch Malfunction (Highlander)
P1780	Park/Neutral Position Switch Malfunction (RAV4)
(1) Check listed component for probable cause. Check wiring and connections of specified component.	
(2) To diagnose DTC, perform appropriate solenoid test under COMPONENT TESTS .	

CLEARING DIAGNOSTIC TROUBLE CODES

NOTE: If using TOYOTA scan tool, DTCs and freeze frame data may be cleared by switching from CHECK mode to NORMAL mode, or from NORMAL mode to CHECK mode.

DTCs can be cleared using scan tool connected to 16-pin DLC3. DLC3 is located under instrument panel, near steering column. See **Fig. 13** . If using OBD-II scan tool to clear DTCs, follow scan tool manufacturer's operating instructions.

SUMMARY

If no hard DTCs are present, and driveability symptoms or intermittent DTCs exist, attempt diagnosis by symptom, or by testing individual components related to system fault. See **TROUBLE SHOOTING** and/or **COMPONENT TESTS** . If no problem is found, verify proper electronic control system circuit operation. See **PIN VOLTAGE TESTS** .

DIAGNOSTIC TESTS

When trouble shooting transaxle, first check for stored DTCs and repair as necessary. If no DTCs exist, perform manual shift test to determine if problem is in transaxle electrical circuits or a transaxle mechanical problem. See appropriate **MANUAL SHIFT TEST** under PERFORMANCE TESTS.

NOTE: For DTC P0750, P0755, P0765 and P0770 diagnosis, see appropriate solenoid test under **COMPONENT TESTS** .

NOTE: Always clear DTCs once repairs are complete. See **CLEARING DIAGNOSTIC TROUBLE CODES** . Road test vehicle and retrieve DTCs to determine if complaint or DTC is repaired.

DTC P0500: VEHICLE SPEED SENSOR

NOTE: For circuit reference, see **WIRING DIAGRAMS** and **CONNECTOR IDENTIFICATION** .

Circuit Description

Vehicle Speed Sensor (VSS) outputs a 4-pulse signal for every revolution of transaxle output shaft. Signal is converted into a more precise rectangular wave form by combination meter and is then delivered to ECM. DTC P0500 is set if there is no VSS signal to ECM while vehicle is being driven, counter drive gear RPM is equal to or greater than vehicle speed, an error is detected in ECT sensor circuits causing ECT sensor signal to be less than 68°F (20°C), and PNP switch is in "P" or "N" position for more than 30 seconds. Possible causes are:

- Combination meter.
- VSS.
- Open or shorted VSS circuit.
- ECM malfunction.

Diagnostic Procedure

1. Test drive vehicle and check operation of speedometer. If speedometer is not operating correctly, repair speedometer as necessary. See appropriate INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT. If speedometer is operating correctly, go to next step.
2. Access ECM. See **Fig. 3** or **Fig. 4** . Turn ignition switch to the OFF position. Disconnect appropriate ECM connector. See **Fig. 44** or **Fig. 45** . Using a DVOM, check continuity between ground and ECM

harness connector E7, terminal No. 23 (SPD) for RAV4, or connector E6 terminal No. 22 (SPD) on Highlander. If continuity does not exist, go to next step. If continuity exists, repair short to ground in harness or connector as needed.

3. On Highlander, disconnect the ECM harness connector E6, terminal No. 22 (SPD). If voltage is not 9-14 volts, check for open in wiring harness or connector between ECM and combination meter. Repair as necessary. If wiring harness and connector are okay, retrieve DTCs from ECM. If DTC P0500 is still set, replace ECM and retest system. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If system is still malfunctioning, check for transaxle mechanical fault. See appropriate OVERHAUL article.
4. On RAV4, raise vehicle on hoist. Turn ignition switch to the ON position. Using a DVOM, measure voltage between ground and ECM harness connector E7, terminal No. 23 (SPD), while rotating the front wheel slowly. Voltage should be generated intermittently. If no voltage is generated, check connector or harness. If okay, replace the ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.

DTC P0710 & P0711: ATF TEMPERATURE SENSOR CIRCUIT MALFUNCTION (HIGHLANDER)

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

Circuit Description

Shifting from 1st to O/D is performed in combination with ON and OFF operation of the shift solenoid valves (SL1) and (SL2) which is controlled by the ECM. If an open or short circuit occurs in either of the shift solenoid valves, the ECM controls the remaining normal shift solenoid valve to allow the vehicle to be operated smoothly (fail safe function). Possible causes are:

- Open in ATF temperature sensor circuit.
 - ATF temperature sensor malfunction.
 - ECM malfunction.
1. Raise and support vehicle. Disconnect 10-pin transaxle connector, located above PNP switch on side of transaxle. See **Fig. 7** . Remove transaxle oil pan. See LUBRICATION in appropriate SERVICING article. Disconnect the transaxle 10 Pin wiring connector from the transaxle. Measure the resistance between terminals THO and E2. If measurements coincide with ATF TEMPERATURE , go to next step. If not, repair or replace transaxle wiring or connector.
 2. Connect the transaxle wiring connector to transaxle. Disconnect the appropriate ECM connector and measure the resistance between terminals THO and E2. If measurements coincide with ATF TEMPERATURE , go to next step. If not, repair or replace transaxle wiring or connector.
 3. Replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.

ATF TEMPERATURE

Temperature - °F (°C)	Resistance - k/Ohms
-39 (-40)	156

50 (10)	6.445
77 (25)	3.5
230 (110)	0.247
302 (150)	0.09

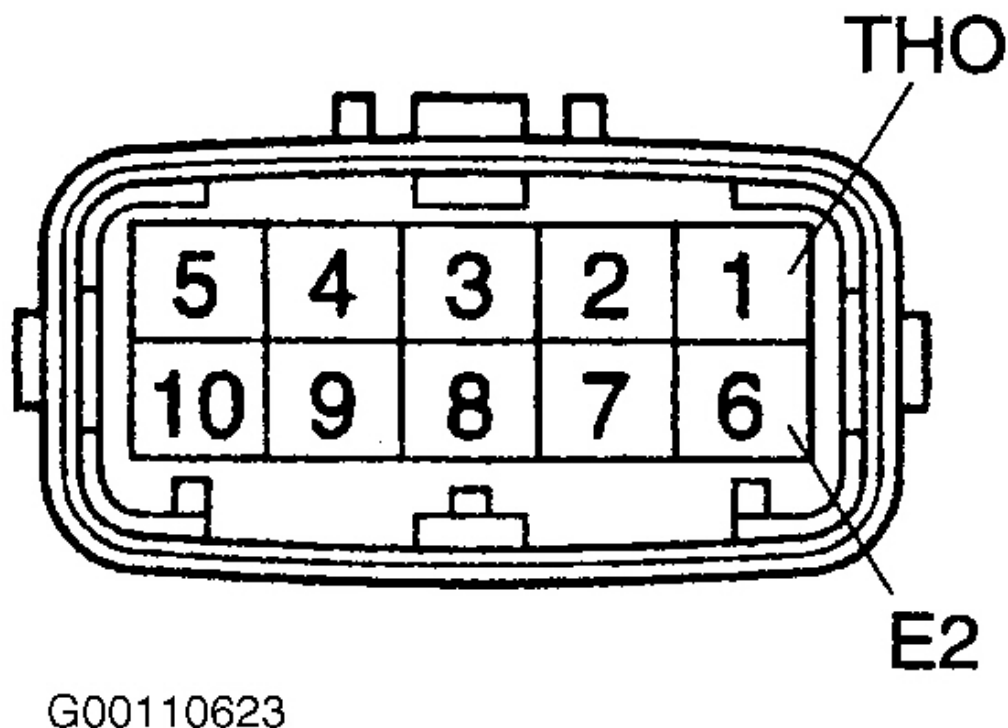


Fig. 14: Identifying Transaxle 10-Pin Connector For Testing Terminals
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DTC P0710 & P0711: ATF TEMPERATURE SENSOR CIRCUIT MALFUNCTION (RAV4)

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

Circuit Description

Automatic Transmission Fluid ATF temperature sensor converts fluid temperature into a resistance value which is input to ECM. DTC is set when ATF temperature sensor resistance is less than 79 ohms, or if after engine has been operating for 15 minutes or more and ATF temperature sensor resistance is more than 156 k/ohms. Either

condition must exist for .5 second or more. Possible causes are:

- Open or short in ATF temperature sensor circuit.
- ATF temperature sensor malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Raise and support vehicle. Disconnect 10-pin transaxle connector, located above PNP switch on side of transaxle. See **Fig. 7** . Remove transaxle oil pan. See LUBRICATION in appropriate SERVICING article. Disconnect all solenoid connectors at solenoids. See **Fig. 5** . Remove transaxle wiring harness from transaxle. ATF sensor is part of transaxle internal wiring harness. Submerge ATF temperature sensor in water.
2. Heat water while measuring ATF temperature sensor resistance between transaxle wiring connector terminals No. 1 and 6. At 77°F (25°C), resistance should be 3.5 k/ohms. At 231°F (110°C), resistance should be 231-263 ohms. If resistance is not as specified, replace ATF temperature sensor. If resistance is as specified, check and repair wiring harness and connector between ATF temperature sensor and ECM. If wiring harness and connector are okay, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.

DTC P0753, P0758 & P0768: SHIFT SOLENOID CIRCUIT MALFUNCTION (HIGHLANDER)

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

Circuit Description

NOTE: Check the shift solenoid (SL1) when DTC P0753 is output, check the shift solenoid valve (SL2) when DTC P0758 is output and check the shift solenoid valve (S4) when DTC P0768 is output.

Shifting from 1st to O/D is performed in combination with ON and OFF cycle of shift solenoids (SL1) and (SL2). Solenoids are controlled by ECM. If an open or short circuit occurs in either solenoid, DTC will set. ECM controls remaining shift solenoids to allow vehicle to operate and ensure smooth transaxle shifting (fail safe mode). See **Fig. 11** . ECM checks for an open or short circuit when solenoid is energized (duty cycle exceeds 75 percent), and when solenoid is not energized (duty cycle is less than 3 percent). Possible causes are:

- Open or short in solenoid circuit.
- Shift solenoid malfunction in (SL1), (SL2) or (S4).
- ECM malfunction.

Diagnostic Procedure

1. Disconnect the solenoid connector from the transaxle. Measure the resistance between terminal No. 5 (SL1+) and No. 10 (SL1-). See **Fig. 15** . If the resistance is not between 5.0-5.6 ohms at approximately

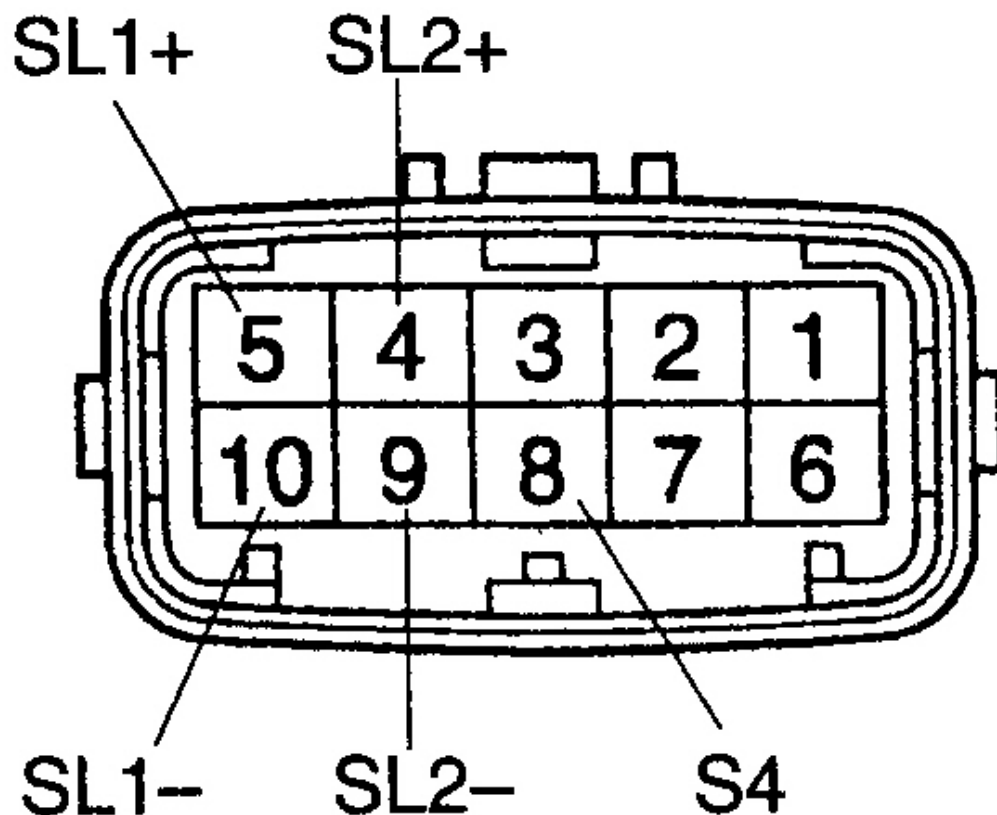
68°F (20°C), go to step 3 . Measure the resistance between terminal No. 4 (SL2+) and 9 (SL2-). If the resistance is not between 5.1-5.5 ohms at approximately 68°F (20°C), go to step 4 . Measure resistance between terminal No. 8 (S4) and body ground. If the resistance is not between 11-15 ohms at approximately 68°F (20°C), go to step 5 . If these measurements are within specification, go to next step.

2. Connect the solenoid connector to the transaxle. Disconnect the connector from the ECM. Measure the resistance between the following terminals at ECM:

- (SL1+) to (SL1-) should be 5.0-5.6 ohms at 68°F (20°C)
- (SL2+) to (SL2-) should be 5.1-5.5 ohms at 68°F (20°C)
- (S4) to ground should be 11-15 ohms at 68°F (20°C)

If readings are within specifications, check all connections at ECM. If okay, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If not, repair or replace transaxle-to-ECM harness and connector.

3. Remove oil pan. See LUBRICATION in appropriate SERVICING article. Remove the shift solenoid valve (SL1). Measure the resistance between the terminals. Resistance should be between 5.0-5.6 ohms at 68°F (20°C). If resistance is within specification, repair or replace transaxle wire. If not, replace shift solenoid valve (SL1).
4. Remove oil pan. See LUBRICATION in appropriate SERVICING article. Remove the shift solenoid valve (SL2). Measure the resistance between the terminals. Resistance should be between 5.1-5.5 ohms at 68°F (20°C). Connect the positive lead with a 21 watt bulb to terminal No. 2 and the negative lead to terminal SL1 of the solenoid valve connector, then check the movement of the valve. If the valve makes an operating noise, go to next step. If no noise is heard, or resistance is not as specified, replace shift solenoid (SL2).
5. Remove oil pan. See LUBRICATION in appropriate SERVICING article. Remove the shift solenoid valve (S4). Measure the resistance between the solenoid connector and the solenoid body. Resistance should be between 11-15 ohms at 68°F (20°C). Connect battery voltage to lead to the terminal of solenoid connector, and place a grounded lead to the solenoid body. If the solenoid makes an operating noise repair or replace wiring harness or connector. If no noise is heard, or resistance is not as specified, replace shift solenoid (S4).



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Fig. 15: Identifying Solenoid Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DTC P0753, P0758 & P0768: SHIFT SOLENOID CIRCUIT MALFUNCTION (RAV4)

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION.

NOTE: Check the shift solenoid (SL1) when DTC P0753 is output, check the shift solenoid valve (SL2) when DTC P0758 is output and check the shift solenoid valve (S4) when DTC P0768 is output.

Shifting from 1st to overdrive is performed in combination with on and off cycle of shift solenoids (SL1) and (SL2). Solenoids are controlled by ECM. If an open or short circuit occurs in either solenoid, DTC will set. ECM controls remaining shift solenoids to allow vehicle to operate and ensures smooth transaxle shifting. See **Fig. 11** . ECM checks for an open or short circuit when solenoid is energized (duty cycle exceeds 75 percent), and when solenoid is not energized (duty cycle is less than 3 percent). Possible causes are:

- Open or short in solenoid circuit.
- Shift solenoid malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Access ECM. See **Fig. 3** or **Fig. 4** . Turn ignition switch to the OFF position. Disconnect ECM connector E4. Using a DVOM, measure resistance between ECM harness connector E4 terminals No. 8 (SL2+) and No. 20 (SL2-). See **PIN VOLTAGE TESTS** . Resistance should be 5.1-5.5 ohms. If resistance is as specified, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If resistance is not as specified, go to next step.
2. Remove oil pan. See LUBRICATION in appropriate SERVICING article. Check the harness and connector between terminal (SL1+) or (SL1-) of the ECM and terminal (SL1+) or (SL1-) of the solenoid connector. Check the harness and connector between terminal (SL2+) or (SL2-) of the ECM and terminal (SL2+) or (SL2-) of the solenoid connector. Check the harness and connector between terminal (S4) of the ECM and terminal (S4) of the solenoid connector. If no short or open is found, go to next step. If a short or open is found, repair or replace harness and connector.
3. Check shift solenoids (SL1) (SL2) OR (S4) for malfunction. See **SHIFT SOLENOIDS SL1, SL2 & S4** under COMPONENT TESTS. Replace shift solenoid as necessary. If shift solenoids are okay, check and repair affected circuit in wiring harness between ECM and transaxle.

DTC P0773: SHIFT SOLENOID DSL CIRCUIT MALFUNCTION (RAV4)

NOTE: For circuit reference, see **WIRING DIAGRAMS** and **CONNECTOR IDENTIFICATION** .

Circuit Description

Shift solenoid (DSL) is controlled by ECM to control hydraulic pressure acting on lock-up relay valve, which controls torque converter clutch lock-up. DTC will set if ECM detects an open or short circuit when solenoid resistance is 8 ohms or less with solenoid energized, or 100 k/ohms or more with solenoid not energized. If ECM detects a malfunction, shift solenoid (DSL) is turned off. Possible causes are:

- Open or short in solenoid circuit.
- Shift solenoid malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Access ECM. See **Fig. 4** . Turn ignition switch to the OFF position. Disconnect ECM connector E6. Disconnect 10-pin transaxle connector, located above PNP switch on side of transaxle. See **Fig. 7** . Using a DVOM, check circuit continuity between ECM harness connector E6 terminal No. 6 (DSL) and transaxle harness connector terminal No. 3. See **PIN VOLTAGE TESTS** . If continuity exists, go to next step. If continuity does not exist, check and repair wiring harness or connector as needed.
2. Raise and support vehicle. Remove transaxle oil pan. See LUBRICATION in appropriate SERVICING article. Disconnect shift solenoid (DSL) connector. See **Fig. 10** . Remove shift solenoid (DSL). Using a DVOM, measure resistance between shift solenoid (DSL) body and shift solenoid (DSL) connector terminal. Resistance should be 11-13 ohms. If resistance is not as specified, replace shift solenoid (DSL). If resistance is as specified, connect jumper wire from positive battery terminal to shift solenoid (DSL) connector terminal and another jumper wire from negative battery terminal to shift solenoid (DSL) body. If shift solenoid (DSL) does not operate, replace shift solenoid (DSL). If shift solenoid (DSL) operates, check and repair wiring harness or connector as necessary.

DTC P0773: SHIFT SOLENOID DSL CIRCUIT MALFUNCTION (HIGHLANDER)

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

Circuit Description

Shift solenoid (DSL) is controlled by ECM to control hydraulic pressure acting on lock-up relay valve, which controls torque converter clutch lock-up. DTC will set if ECM detects an open or short circuit when solenoid resistance is 8 ohms or less with solenoid energized, or 100 k/ohms or more with solenoid not energized. If ECM detects a malfunction, shift solenoid (DSL) is turned off. Possible causes are:

- Open or short in solenoid circuit.
- Shift solenoid malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Raise and support vehicle. Remove transaxle oil pan. See LUBRICATION in appropriate SERVICING article. Disconnect the solenoid connector from the transaxle. Measure resistance between the terminal No. 3 and the body ground. See **Fig. 15** . Resistance should be between 11-13 ohms at 68°F (20°C). If resistance is within specifications, go to next step. If not, go to step 3 .
2. Connect the transaxle wire connector. Disconnect the appropriate ECM connector. Measure the resistance between terminal (DSL) and E1. Resistance should be between 11-13 ohms at 68°F (20°C). If resistance is within specifications, go to next step. If not, repair or replace transaxle wiring harness.
3. Remove the shift solenoid valve (DSL). Measure the resistance between the shift solenoid valve terminal and the solenoid body. Resistance should be between 11-13 ohms at 68°F (20°C). If resistance is within specifications, connect battery voltage to the terminal of solenoid connector and ground the solenoid body. The (SL) solenoid valve should make an operational noise. If solenoid does not make noise, replace the solenoid. If a noise is heard, repair or replace wiring harness.

DTC P1520: BRAKELIGHT SWITCH

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

Circuit Description

When brake pedal is applied, brakelight switch sends a signal to ECM. If torque converter clutch is in lock-up mode, ECM cancels lock-up operation and prevents engine stall when coming to a stop. DTC will set if ECM detects brakelight switch signal does not turn off during driving. Possible causes are:

- Open or short in brakelight switch circuit.
- Brakelight switch malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Access ECM. See **Fig. 3** or **Fig. 4** . Turn ignition switch to the ON position. Using a DVOM, measure voltage by backprobing between appropriate ECM harness connector, terminal No. 15 (STP) and ground. With brake pedal applied, voltage should be 7.5-14 volts. With brake pedal released, voltage should be less than 1.5 volts. If voltage is not as specified, go to next step. If voltage is as specified, problem is intermittent. Check wiring harness and connector.
2. Check brakelight switch. See **BRAKELIGHT SWITCH** under COMPONENT TESTS. Replace brakelight switch as necessary. If brakelight switch is okay, check circuit between brakelight switch and ECM. If circuit is okay, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.

DTC P1725: INPUT TURBINE SPEED SENSOR (HIGHLANDER)

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

NOTE: When checking speed sensor with magnet, voltage generated is extremely low.

Circuit Description

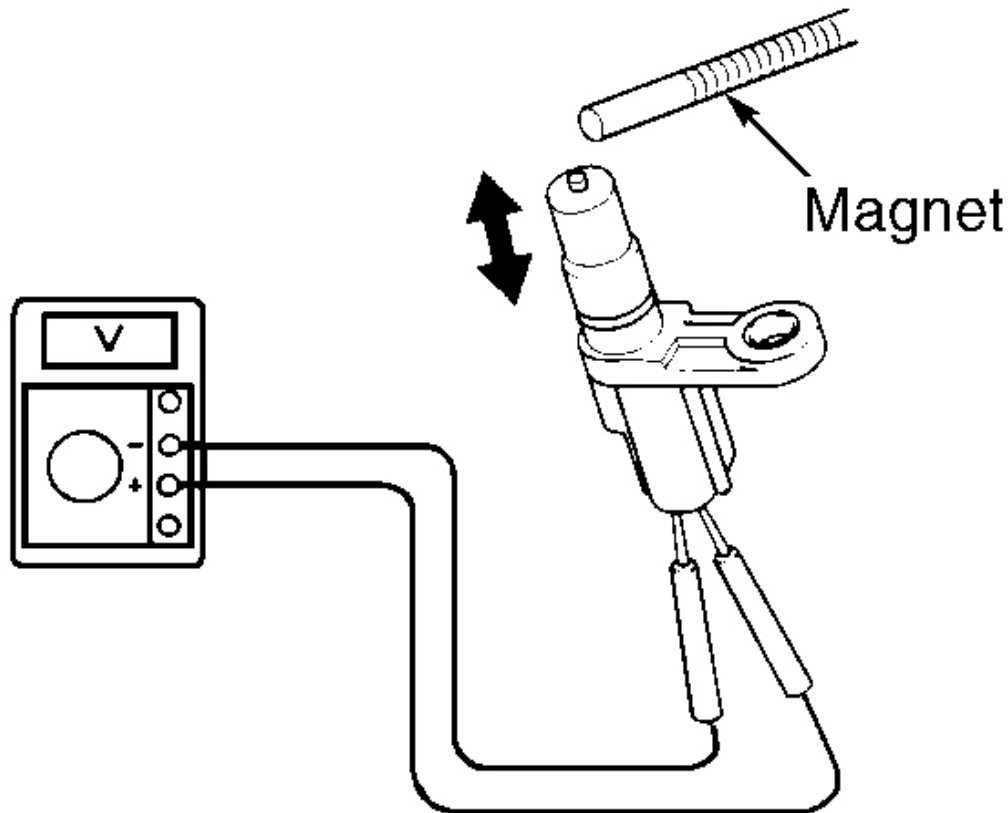
Input turbine speed sensor detects rotation speed of input shaft. By comparing input turbine speed sensor signal and counter gear speed sensor signal, ECM detects shift timing of gears and controls engine torque and hydraulic pressure in response to various conditions to ensure smooth transaxle shifting. DTC will set if ECM detects vehicle speed of 20 MPH or more, transaxle in 2nd, 3rd or O/D gear, shift solenoids and PNP switch status normal, input shaft speed is 300 RPM or less, and output shaft speed is 1000 RPM or more. Possible causes are:

- Open or short in input turbine speed sensor circuit.
- Input turbine speed sensor malfunction.

- ECM malfunction.

Diagnostic Procedure

1. Disconnect the speed sensor connector from the transaxle. Measure the resistance between terminals of NT revolution sensor. See **Fig. 16** . On TOYOTA made sensors, resistance is between 500-620 ohms at 68°F (20°C). On AISIN made sensors, resistance is between 560-680 at 68°F (20°C). If resistance is within specification, go to next step. If not, replace speed sensor.
2. Connect the speed sensor connector. Disconnect the appropriate ECM connector. Measure the resistance between terminal (NT+) and (NT-). On TOYOTA made sensors, resistance is between 500-620 ohms at 68°F (20°C). On AISIN made sensors, resistance is between 560-680 at 68°F (20°C). If resistance is within specification, check and replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If not, repair or replace wiring harness and connector.
3. Check the voltage between terminals No. 1 and 2 of the speed sensor when a magnet is put close to the front end of the speed sensor then taken away quickly. Voltage is generated intermittently. If no voltage is indicated, replace the turbine speed sensor.



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Fig. 16: Testing Speed Sensors

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DTC P1725: INPUT TURBINE SPEED SENSOR (RAV4)

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

NOTE: When checking speed sensor with magnet, voltage generated is extremely low.

Circuit Description

Input turbine speed sensor detects rotation speed of input shaft. By comparing input turbine speed sensor signal and counter gear speed sensor signal, ECM detects shift timing of gears and controls engine torque and hydraulic pressure in response to various conditions to ensure smooth transaxle shifting. DTC will set if ECM

detects vehicle speed of 20 MPH or more, transaxle in 2nd, 3rd or O/D gear, shift solenoids and PNP switch status normal, input shaft speed is 300 RPM or less, and output shaft speed is 1000 RPM or more. Possible causes are:

- Open or short in input turbine speed sensor circuit.
- Input turbine speed sensor malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Disconnect the speed sensor connector from the transaxle. Measure the resistance between terminals of NT revolution sensor. See **Fig. 16** . On TOYOTA made sensors, resistance is between 500-620 ohms at 68°F (20°C). On AISIN made sensors, resistance is between 560-680 at 68°F (20°C). If resistance is within specification, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If not go to next step.
2. Remove the input turbine speed sensor from the transaxle. Measure the resistance between terminals No. 1 and 2 of the speed sensor. On TOYOTA made sensors, resistance is between 500-620 ohms at 68°F (20°C). On AISIN made sensors, resistance is between 560-680 at 68°F (20°C). If readings are within specifications, check and repair wiring harness and connector. If not, go to next step.
3. Check the voltage between terminals No. 1 and 2 of the speed sensor when a magnet is put close to the front end of the speed sensor then taken away quickly. See **Fig. 16** . Voltage is generated intermittently. If no voltage is indicated, replace the input turbine speed sensor.

DTC P1730: COUNTER GEAR SPEED SENSOR

NOTE: For circuit reference, see **WIRING DIAGRAMS** and **CONNECTOR IDENTIFICATION** .

Circuit Description

NOTE: Counter gear speed sensor may also be referred to as NC revolution sensor.

This sensor detects the rotation speed of the counter gear. By comparing the counter gear speed signal with the direct clutch speed sensor signal (NT), the ECM detects the shift timing of the gears and appropriately controls the engine torque and hydraulic pressure according to various conditions. Possible causes are:

- Open or short in counter gear speed sensor circuit.
- Counter gear speed sensor malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Disconnect the speed sensor connector from the transaxle. Measure the resistance between terminals of transaxle revolution (NC) sensor. See **Fig. 16** . On TOYOTA made sensors, resistance is between 500-620 ohms at 68°F (20°C). On AISIN made sensors, resistance is between 560-680 at 68°F (20°C). If

readings are not within specifications, replace speed sensor. If readings are within specification, go to next step.

2. Connect the speed sensor connector. Disconnect the appropriate ECM connector. Measure the resistance between terminal (NC+) and (NC-). On TOYOTA made sensors, resistance is between 500-620 ohms at 68°F (20°C). On AISIN made sensors, resistance is between 560-680 at 68°F (20°C). If readings are not within specifications, repair or replace wiring harness or connector. If readings are within specification, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.

DTC P1760: SHIFT SOLENOID SLT (HIGHLANDER)

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

Circuit Description

Throttle pressure applied to primary regulator valve, which modulates line pressure, causes shift solenoid SLT to precisely and minutely modulate and generate line pressure according to accelerator pedal effort, or engine power output detected. This reduces line pressure and provides smooth transaxle shifts. Upon receiving throttle valve opening angle signal, ECM controls line pressure by sending a predetermined duty cycle to shift solenoid SLT, modulating line pressure and generating throttle pressure. Duty cycle is ratio of period of continuity in one cycle. Shift solenoid SLT is located on transaxle valve body. See **Fig. 10** . DTC will set if voltage at ECM terminal SLT- is zero volts or 12 volts for one second or more. Possible causes are:

- Open or short in shift solenoid SLT circuit.
- Shift solenoid SLT malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Disconnect the transmission wire connector from the transaxle. Measure the resistance between the terminal SLT+ and SLT-. Using a DVOM, measure resistance between shift solenoid SLT terminals. If resistance is 5.0-5.6 ohms at 68°F (20°C), go to next step. If resistance is not 5.0-5.6 ohms at 68°F (20°C), go to step 3 .
2. Connect the transaxle wiring harness connector. Disconnect the appropriate ECM connector. Measure the resistance between terminals (STL+) and (STL-) of ECM connector. Specification is 5.0-5.6 ohms at 68°F (20°C). If reading is not within specification, repair or replace wiring harness and connector between shift solenoid SLT and ECM. If wiring harness and connector are okay, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.
3. Remove the line pressure control solenoid (SLT). Applying 71 psi or (5.0 kg/cm²) of compressed air, check that the solenoid valve does not leak air. If it does, replace it. Apply battery voltage to the line pressure control solenoid (SLT). The valve should open. If it does not, replace the line pressure control solenoid (SLT).

DTC P1760: SHIFT SOLENOID SLT (RAV4)

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

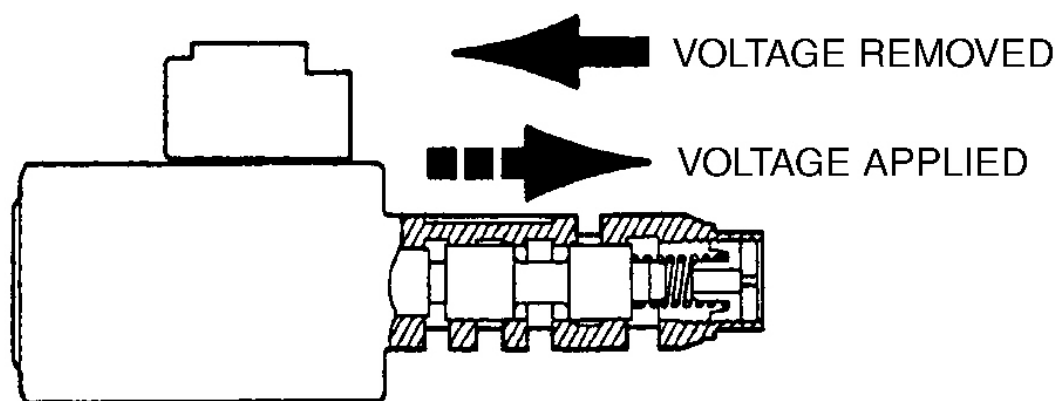
Circuit Description

Throttle pressure applied to primary regulator valve, which modulates line pressure, causes shift solenoid SLT to precisely and minutely modulate and generate line pressure according to accelerator pedal effort, or engine power output detected. This reduces line pressure and provides smooth transaxle shifts. Upon receiving throttle valve opening angle signal, ECM controls line pressure by sending a predetermined duty cycle to shift solenoid SLT, modulating line pressure and generating throttle pressure. Duty cycle is ratio of period of continuity in one cycle. Shift solenoid SLT is located on transaxle valve body. See **Fig. 10** . DTC will set if voltage at ECM terminal (SLT-) is zero volts or 12 volts for one second or more. Possible causes are:

- Open or short in shift solenoid SLT circuit.
- Shift solenoid SLT malfunction.
- ECM malfunction.

Diagnostic Procedure

1. Raise and support the vehicle. Remove the oil pan. See LUBRICATION in appropriate SERVICING article. Disconnect the (SLT) solenoid connector. Measure the solenoid resistance between terminals No. 1 (Orange wire) and 2 (Green wire) of the solenoid connector. Resistance should be between 5.1-5.5 ohms. Check the solenoid operation. Connect the positive lead with an 8-10 watt bulb to terminal SL1 of the solenoid connector and negative lead to terminal SL2, then check the movement of the valve. When battery positive voltage is applied, the valve should move out. When voltage is removed the valve should move in. See **Fig. 17** . If valve does not operate as defined, replace (SLT) solenoid. If valve operates okay, go to next step.
2. Check harness and connector between shift solenoid valve (SLT) and ECM for an open or a shorted condition. If wiring is okay, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.



G00110626

Fig. 17: Testing (SLT) Shift Solenoid
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DTC P1780: PARK/NEUTRAL POSITION SWITCH (HIGHLANDER)

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

Circuit Description

The Park/Neutral Position (PNP) switch detects the gearshift lever position and sends signals to the ECM. The ECM receives signals (PNP switch, Reverse, Drive, 2nd and Low) from the PNP switch. DTC P1780 will set when ECM detects 2 or more of the following conditions for 30 seconds or more. Vehicle speed is at least 44 MPH, engine speed is between 1500-2500 RPM, while the PNP switch is in the "N" position. Possible causes are:

- Short in PNP switch circuit.
- PNP switch.
- ECM malfunction.

Diagnostic Procedure

1. Install the scan tool. Shift the gearshift lever to the "P", "R", "N", "D", "2" and "L" ranges, and monitor the NSW, Reverse, Drive, 2nd and Low signals on the scan tool. See **Fig. 18** . If values are not as specified, go to next step. If the scan tool values are as specified, replace the ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.
2. Remove the PNP switch. Check continuity between appropriate terminals when the gearshift lever is moved to each range. See **Fig. 19** . If tests show continuity, go to next step. If no continuity is found, replace PNP switch.

3. Connect the PNP switch connector. Disconnect the appropriate ECM connector. Turn the ignition switch ON and measure the voltage between terminals "P", "R", "N", "D", "2", and "L" and the E1 terminal of ECM when the gearshift lever is shifted to each gear position. See **Fig. 20** . If PNP switch values do not match figure, repair or replace the harness and connector. If values are okay, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.

Shift range	Signal
P, N	NSW OFF → ON
R	REVERSE OFF → ON
D	DRIVE OFF → ON
2	2ND OFF → ON
L	LOW OFF → ON

G00110627

Fig. 18: Checking PNP Switch Values Using Scan Tool
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Shift Range	Terminal No. to continuity	
P	1 – 3	6 – 9
R	2 – 3	–
N	3 – 5	6 – 9
D	3 – 7	–
2	3 – 4	–
L	3 – 8	–

G00110629

Fig. 19: Checking PNP Switch Continuity Values (Highlander)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Shift position	Terminal	Voltage (V)
P	P – E1	7.5 – 14
R	R – E1	7.5 – 14
N	N – E1	7.5 – 14
D	D – E1	7.5 – 14
2	2 – E1	7.5 – 14
L	L – E1	7.5 – 14

G00110628

Fig. 20: Testing PNP Switch Voltage Values (Highlander)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DTC P1780: PARK/NEUTRAL POSITION SWITCH (RAV4)

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

Circuit Description

The Park/Neutral Position (PNP) switch detects the gearshift lever position and sends signals to the ECM. The ECM receives signals (PNP switch, Reverse, Drive, 2nd and Low) from the PNP switch. DTC P1780 will set when ECM detects 2 or more of the following conditions for 30 seconds or more. Vehicle speed is at least 44 MPH, engine speed is between 1500-2500 RPM, while the PNP switch is in the "N" position. Possible causes are:

- Short in PNP switch circuit.
- PNP switch.
- ECM malfunction.

Diagnostic Procedure

1. Connect scan tool to the DLC3. Turn the ignition switch ON and press the scan tool main switch ON. Shift the gearshift lever into the "P", "R", "N", "D", "2" and "L" positions, and read the signal of PNP switch, Reverse, Drive, 2nd and Low on the scan tool. See **Fig. 18** . If values are as specified, attempt to diagnose by symptom. If values are different than specified, go to next step.
2. Raise and support vehicle. Remove the PNP switch. Check the continuity between appropriate terminals when the shift lever is moved into each position. See **Fig. 21** . If continuity is as specified, go to next step. If not, replace PNP switch.
3. Check harness and connector between battery and PNP switch, and PNP switch and ECM. If wiring problem was found, repair or replace as necessary. If no problem was found, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.

Shift range	Terminal No. to continuity	
P	6 – 9	1 – 3
R	2 – 3	–
N	6 – 9	3 – 5
D	3 – 7	–
2	3 – 4	–
L	3 – 8	–

G00110633

Fig. 21: Checking PNP Switch Harness Continuity Values (RAV4)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CIRCUIT TESTS

O/D CANCEL SIGNAL CIRCUIT (HIGHLANDER)

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

Circuit Description

While driving uphill with cruise control activated, in order to minimize gear shifting and provide smooth cruising, overdrive may be prohibited temporarily under some conditions. The cruise control ECU sends O/D cut signals to the ECM as necessary and the ECM cancels overdrive shifting until these signals are discontinued.

Diagnostic Procedure

1. Access ECM. See **Fig. 3** or **Fig. 4** . Turn ignition switch to the ON position. Using a DVOM, measure voltage by backprobing between ECM harness connector E6 terminal No. 24 (White wire) and ground. If 10-14 volts is present, substitute known good ECM and retest. If voltage is not as specified, go to next step.
2. Turn ignition switch to the OFF position. Disconnect cruise control ECU harness connector, located behind instrument panel on driver's side of vehicle. Turn ignition switch to the ON position. Using a DVOM, measure voltage between cruise control harness connector terminal No. 14 (White wire) and ground. See **Fig. 22** . If 10-14 volts is present, replace cruise control ECU and retest. If 10-14 volts is not present, check and repair circuit or connectors between cruise control ECU and ECM. If circuit and connectors are okay, replace ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.

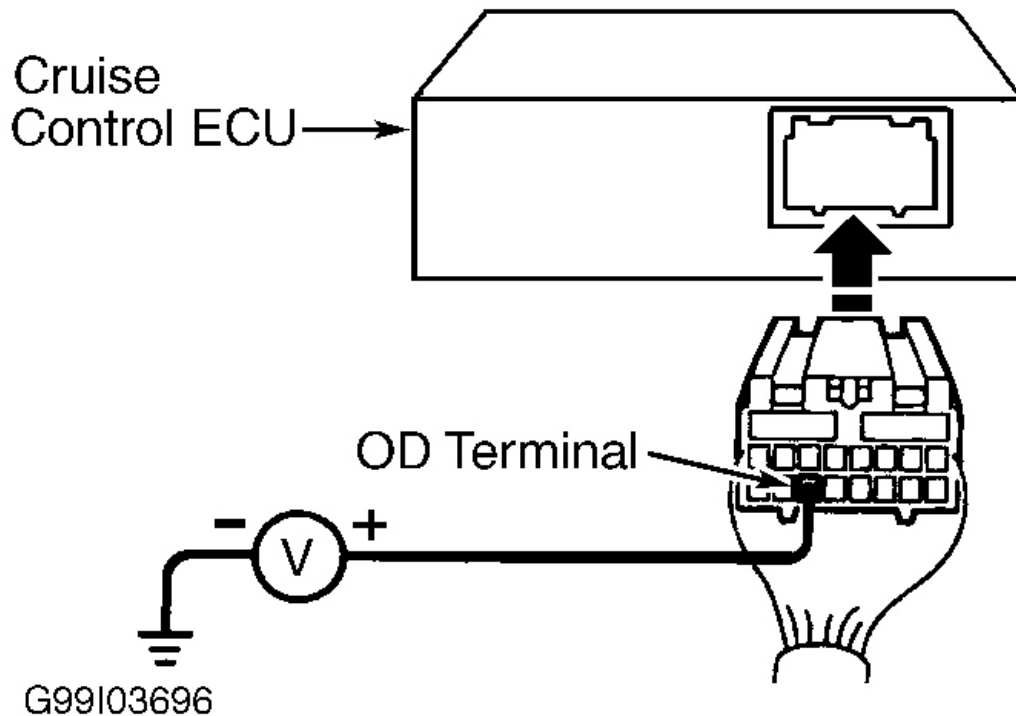


Fig. 22: Identifying Cruise Control ECU Terminal (Highlander)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

O/D MAIN SWITCH & O/D OFF INDICATOR LIGHT CIRCUIT (HIGHLANDER)

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

Circuit Description

The O/D main switch is a momentary type switch. When pressing the O/D main switch, the O/D OFF indicator light illuminates and the ECM prohibits shifting into O/D, and when pressing it once again, the O/D OFF indicator light goes off and the ECM allows shifting into O/D. Turning the ignition switch OFF will reset the O/D OFF indicator light.

Diagnostic Procedure

1. Disconnect the O/D main switch connector. Using an ohmmeter, check continuity between terminals No. 3 and No. 6 of the O/D main switch while pressing and releasing the O/D main switch. While pressed, the switch should show continuity, and while released, the switch should not show continuity. If the results were as specified, go to next step. If the results were not as specified, replace the O/D main switch.

2. Connect the connector of transmission control switch. Check continuity between terminal ODMS and E1 of ECM. While pressed, the switch should show continuity, and while released, the switch should not show continuity. If the results were not as specified, repair or replace wiring harness and connector. If the results were as specified, replace the ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE.

O/D MAIN SWITCH & O/D OFF INDICATOR LIGHT CIRCUIT (RAV4)

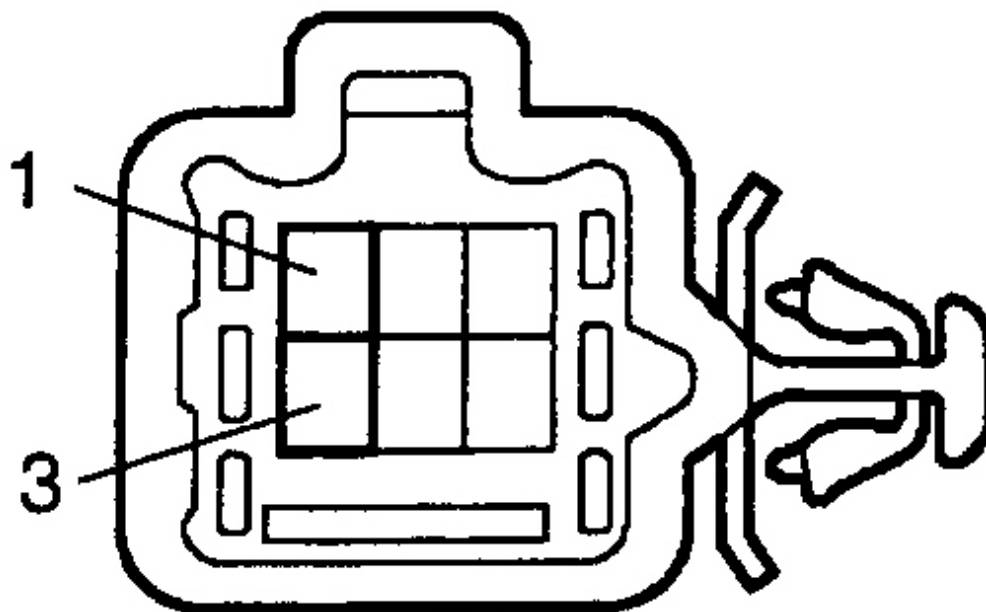
NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

Circuit Description

The O/D main switch is a momentary type switch. When pressing the O/D main switch, the O/D OFF indicator light illuminates and the ECM prohibits shifting into O/D, and when pressing it once again, the O/D OFF indicator light goes off and the ECM allows shifting into O/D. Turning the ignition switch OFF will reset the O/D OFF indicator light.

Diagnostic Procedure

1. Turn the ignition switch ON. Check the O/D OFF indicator light when the O/D main switch is pressed to ON position. It should light up. Check the O/D OFF indicator light when the O/D main switch is pressed once again. It should turn OFF. If system operates as described, check and replace the ECM. See appropriate REMOVAL, OVERHAUL & INSTALLATION article in ENGINE PERFORMANCE. If not, go to next step.
2. Check combination meter (instrument cluster) for failure or poor connections. If combination meter is found to be at fault, replace combination meter. If no problem was found, go to next step.
3. Disconnect O/D main switch connector. Using an ohmmeter, check the continuity between terminals No. 1 and No. 3 of the O/D main switch connector. See **Fig. 23** . Press the switch while observing the ohmmeter. There should be continuity. Release the switch while watching the ohmmeter. There should be no continuity. If results are as specified, go to next step. If not, replace O/D main switch.
4. Turn the ignition switch ON. Check the voltage between terminal ODMS of the ECM connector E8 and ground when the O/D main switch is toggled from ON to OFF. When O/D main switch is ON voltage should be less than one volt. Release O/D main switch. Voltage should be 10-14 volts. If readings are as specified, check and replace ECM. If readings are not as specified, go to next step.
5. Disconnect the ECM connector E8. Turn the ignition ON. Measure the voltage between terminal ODL P of the ECM connector (E8) and ground. If the measured voltage is between 7.5-14 volts, check and replace ECM. If the measured voltage is not between 7.5-14 volts, replace the wiring harness between the combination meter and the ECM.



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Fig. 23: Testing Overdrive Main Switch Connector Terminals (RAV4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

PATTERN SELECT SWITCH CIRCUIT (HIGHLANDER)

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

Circuit Description

When 2nd start mode is selected with the pattern select switch, the ECM controls the solenoid valves and the transaxle starts from 2nd gear. In "D" position, the transaxle automatically shifts up through 3rd to O/D as usual. In 2nd position, the transaxle is held in 2nd gear.

Diagnostic Procedure

1. Disconnect the pattern select switch connector (located under gearshift lever bezel). Install an ohmmeter between terminal No. 1 and 2 of switch while pushing the switch ON. Continuity should be present. Release the switch. There should be no continuity. Connect a test light from terminal No. 2 and probe

terminal No. 4 of the pattern select switch connector. If the test light illuminates, go to next step. If readings are not as specified, replace switch.

2. Check harness and connector of the pattern select switch, ECM, pattern select switch body ground. If okay, condition is intermittent. If wiring problem was found, repair as necessary.

COMPONENT TESTS

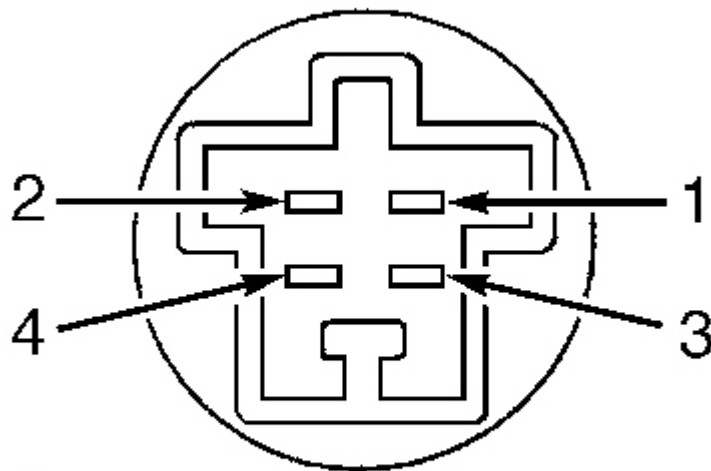
WARNING: Vehicles are equipped with Supplemental Inflatable Restraint (SIR) system. When servicing vehicles, use care to avoid accidental air bag deployment. SIR system-related components are located in various locations throughout interior and exterior of vehicles, depending on application. Do not use electrical test equipment on or near these circuits. If necessary, deactivate SIR system before servicing components. See appropriate AIR BAG RESTRAINT SYSTEMS article in RESTRAINTS.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

BRAKELIGHT SWITCH

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

Disconnect electrical connector from brakelight switch, located near brake pedal. Using a DVOM, ensure continuity exists between switch terminals No. 1 and 2 with brake pedal applied. See **Fig. 24** . Continuity should exist between terminals No. 3 and No. 4 (on vehicles equipped with cruise control) with pedal released. Replace switch if continuity is not as specified.



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Fig. 24: Testing Brakelight Switch Terminals
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OVERDRIVE SWITCH & OVERDRIVE OFF INDICATOR (HIGHLANDER)

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

1. Turn ignition switch to the ON position. Observe Overdrive OFF (O/D OFF) indicator while pressing O/D main switch to ON position. O/D OFF indicator should illuminate. Observe O/D OFF indicator and press O/D main switch again. O/D main switch should be in OFF position and O/D OFF indicator should go off. If O/D OFF indicator does not operate as specified, go to next step. If O/D OFF indicator operates as specified, O/D main switch and O/D OFF indicator are okay.
2. Check and repair instrument panel as necessary. See appropriate INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT. If instrument panel is operating correctly, go to next step.
3. Disconnect electrical connector from O/D main switch, located on gearshift lever. Using a DVOM, check for continuity between O/D main switch connector terminals No. 3 and No. 6 with switch released. Continuity should not exist with switch released. Press and hold O/D main switch and check continuity again. Continuity should exist. If both continuity checks are as specified, switch is okay. If not, replace switch.

OVERDRIVE SWITCH & OVERDRIVE OFF INDICATOR (RAV4)

1. Turn ignition switch to the ON position. Observe Overdrive OFF (O/D OFF) indicator while pressing O/D main switch to ON position. O/D OFF indicator should illuminate. Observe O/D OFF indicator and press O/D main switch again. O/D main switch should be in OFF position and O/D OFF indicator should go off. If O/D OFF indicator does not operate as specified, go to next step. If O/D OFF indicator operates as specified, O/D main switch and O/D OFF indicator are okay.
2. Check and repair instrument panel as necessary. See appropriate INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT. If instrument panel is operating correctly, go to next step.
3. Disconnect electrical connector from O/D main switch, located on gearshift lever. Using a DVOM, check for continuity between O/D main switch connector terminals No. 2 and No. 4 with switch released. Continuity should not exist with switch released. Press and hold O/D main switch and check continuity again. Continuity should exist. If both continuity checks are as specified, switch is okay. If not, replace switch.

PARK/NEUTRAL POSITION SWITCH

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

Disconnect harness connector at Park/Neutral Position (PNP) switch. PNP switch is located on side of transaxle. Using a DVOM, check for continuity between specified terminals with gearshift lever in appropriate position. See [Fig. 19](#) or [Fig. 21](#) . Replace PNP switch if continuity is not as specified. If switch is okay, check and repair wiring harness or connector between PNP switch and ECM.

SHIFT SOLENOIDS SL1, SL2 & S4

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

NOTE: The following information can also be used to diagnose DTCs P0750, P0755 and P0765. For testing of shift solenoid SLT, go to appropriate DTC 1760. See DIAGNOSTIC TROUBLE CODE DEFINITIONS .

1. Raise and support vehicle. Remove transaxle oil pan. See LUBRICATION in appropriate SERVICING article. Remove shift solenoid(s). See [Fig. 10](#) . Using a DVOM, measure resistance between shift solenoid SL1, terminals (SL1+) and (SL1-), resistance should be 5.0-5.6 ohms. For shift solenoid SL2, measure between terminals (SL2+) and (SL2-), resistance should be 5.1-5.5 ohms. On shift solenoid (S4), measure resistance between ground and solenoid terminal. On shift solenoids (SL1) and (SL2), resistance should be 5.1-5.5 ohms. On shift solenoid (S4), resistance should be 11-15 ohms. On all solenoids, if resistance is not as specified, replace appropriate shift solenoid. If resistance is within specification, go to next step for shift solenoids (SL1) and (SL2) or for shift solenoid (S4), go to step 3 .
2. To check shift solenoids (SL1) and (SL2) operation, connect jumper wire with a 23 watt bulb from positive battery terminal to shift solenoid terminal SL1 (White wire), or (Yellow wire) on shift solenoid (SL2). Connect another jumper wire from negative battery terminal to appropriate shift solenoid terminal SL2. With power supplied to solenoid, ensure solenoid makes a "click" sound. Replace solenoid if "click" sound cannot be heard. If solenoid "clicks", diagnose valve body malfunction.

3. To check shift solenoid (S4) operation, connect jumper wire with a 23-watt bulb from positive battery terminal to shift solenoid (S4) terminal. Connect another jumper wire from negative battery terminal to shift solenoid (S4) body. With power supplied to solenoid, ensure solenoid makes a "click" sound. Replace solenoid if "click" sound cannot be heard. If solenoid "clicks", diagnose valve body malfunction.

SHIFT SOLENOID DSL

NOTE: For circuit reference, see WIRING DIAGRAMS and CONNECTOR IDENTIFICATION .

NOTE: The following information can also be used to diagnose DTC P0770. For testing of shift solenoid SLT, go to appropriate DTC 1760. See DIAGNOSTIC TROUBLE CODE DEFINITIONS .

Raise and support vehicle. Remove transaxle oil pan. See LUBRICATION in appropriate SERVICING article. Remove shift solenoid (DSL). See **Fig. 10** . Connect battery voltage to solenoid. Apply 71 psi (5 kg/cm²) of compressed air to solenoid with battery voltage connected. See **Fig. 25** . With battery voltage connected, air should not pass through solenoid. Disconnect voltage to solenoid. Air should now pass through solenoid. Replace solenoid as necessary.

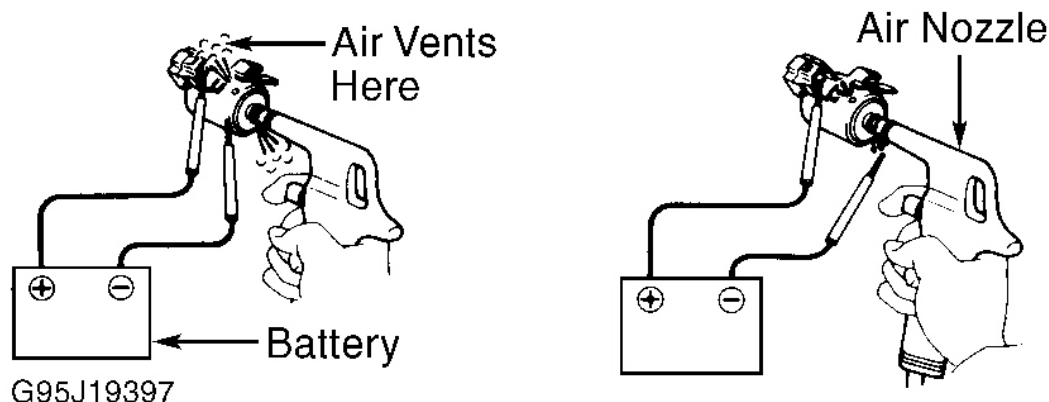


Fig. 25: Checking Shift Solenoid (DSL)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL & INSTALLATION

WARNING: Vehicles are equipped with Supplemental Inflatable Restraint (SIR) system. When servicing vehicles, use care to avoid accidental air bag deployment. SIR system-related components are located in various locations throughout interior and exterior of vehicles, depending on

application. Do not use electrical test equipment on or near these circuits. If necessary, deactivate SIR system before servicing components. See appropriate AIR BAG RESTRAINT SYSTEMS article in RESTRAINTS.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See **COMPUTER RELEARN PROCEDURES** article in **GENERAL INFORMATION** before disconnecting battery.

NOTE: Removal and installation of vehicle speed sensor and input speed sensor is an un-bolt and bolt-on procedure. Only torque specifications are given. See **TORQUE SPECIFICATIONS** .

OVERDRIVE SWITCH

Overdrive (O/D) switch is mounted on gearshift lever. Replacement information is not available from manufacturer.

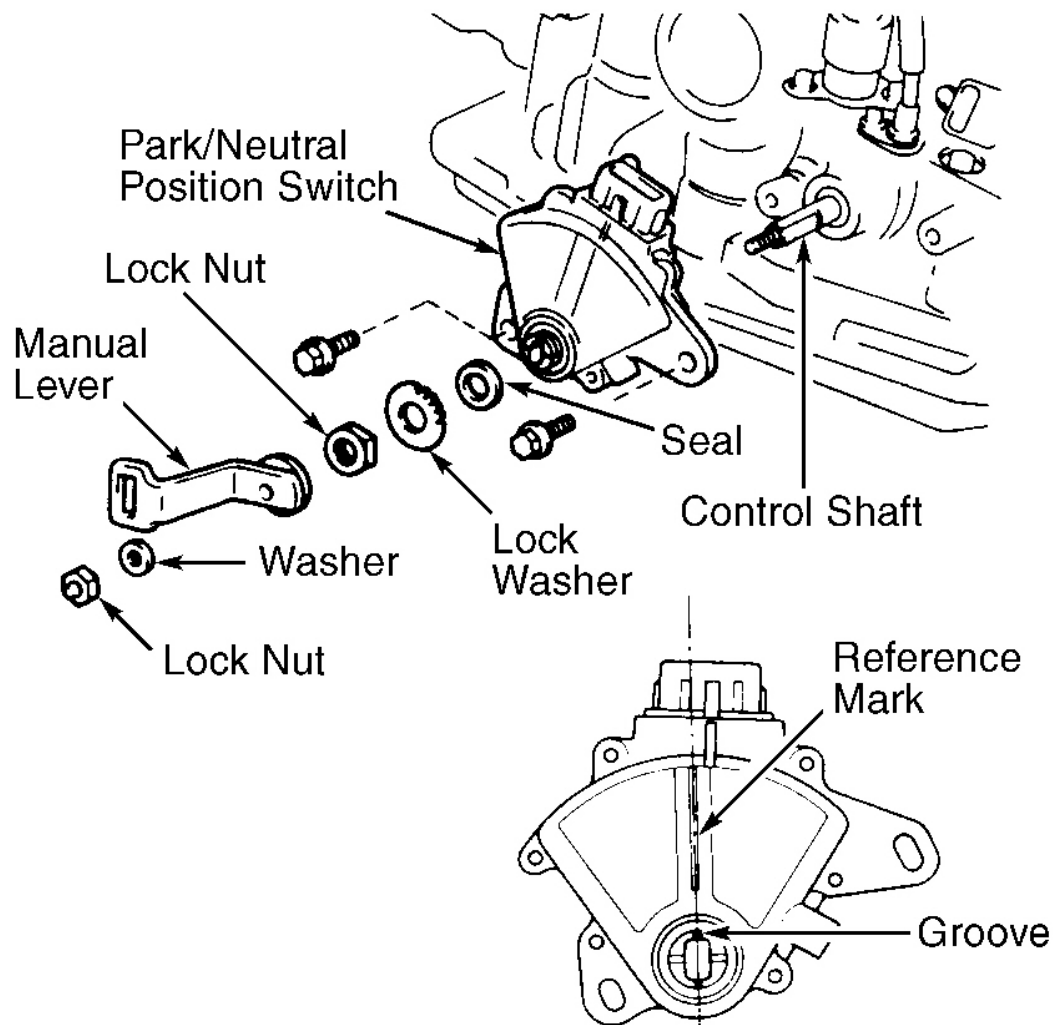
PARK/NEUTRAL POSITION SWITCH

Removal

1. Park/Neutral Position (PNP) switch is located on side of transaxle. Disconnect switch connector. Remove shift control nut and cable from manual lever. Remove lock nut, washer and manual lever from control shaft. See **Fig. 26** .
2. Bend up tabs on lock washer. Remove lock nut, lock washer and seal from control shaft. Remove adjusting bolts and PNP switch.

Installation

1. Install switch on control shaft. Loosely install PNP switch adjusting bolts. Install seal and lock washer. Install lock nut and tighten to 61 INCH lbs. (6.9 N.m). Bend tabs on lock washer over against lock nut.
2. Ensure parking brake is applied. Temporarily install manual lever on control shaft. Turn lever counterclockwise until it stops, then turn it clockwise 2 notches. Remove manual lever. Rotate switch and align reference mark on switch with groove. See **Fig. 26** . Hold switch in this position. Tighten adjusting bolts to 48 INCH lbs. (5.4 N.m). Stake lock tab onto nut. Install manual lever, washer and nut. Tighten nut to 61 INCH lbs. (6.9 N.m). Install shift control cable and nut. Tighten nut to 11 ft. lbs. (15 N.m). Connect PNP switch connector.



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Fig. 26: Removing & Installing PNP Switch
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SHIFT SOLENOIDS

NOTE: See REMOVAL & INSTALLATION in appropriate SERVICING article.

SPEED SENSORS

Removal & Installation

Speed sensors are located on top of transaxle. See **Fig. 7** . Disconnect electrical connector. Remove bolt and

speed sensor. To install, reverse removal procedure. Install NEW "O" ring on speed sensor. Tighten bolt to 100 INCH lbs. (11.3 N.m).

ELECTRICAL SPECIFICATIONS

COMPONENT RESISTANCE SPECIFICATIONS

Application	Ohms
Counter Gear & Input Turbine Speed Sensor	560-680
Shift Solenoids DSL	11-13
Shift Solenoid SLT	5.0-5.6
Shift Solenoid SL1	5.0-5.6
Shift Solenoid SL2	5.1-5.5
Shift Solenoid S4	11-15

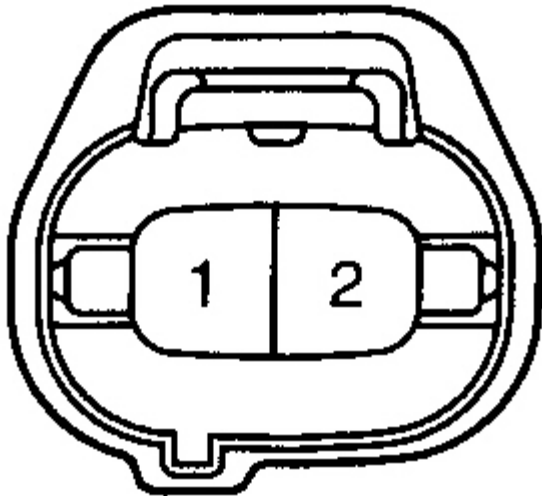
TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	INCH Lbs. (N.m)
Manual Lever Nut	61 (6.9)
Park/Neutral Position Switch	
Nut	61 (6.9)
Bolt	48 (5.4)
Shift Control Cable Nut	133 (15)
Speed Sensor Bolt	100 (11.3)
Temperature Sensor Clamp Bolt	58 (6.6)

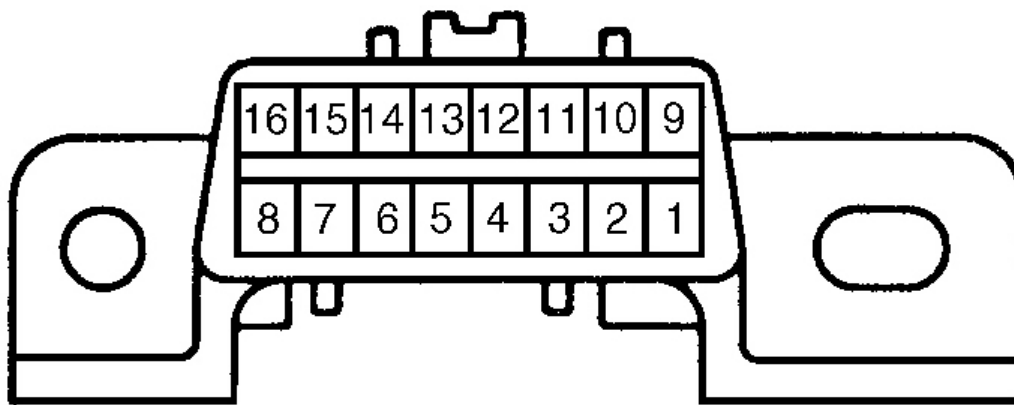
CONNECTOR IDENTIFICATION

C6
BLACK



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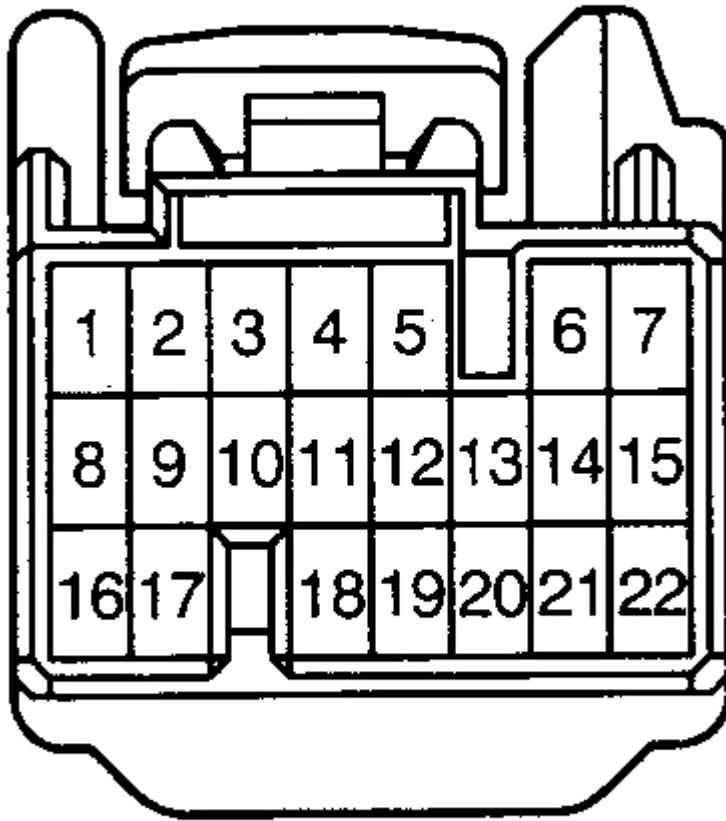
Fig. 27: Identifying Counter Gear Speed Sensor Harness Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 28: Identifying DLC3 Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

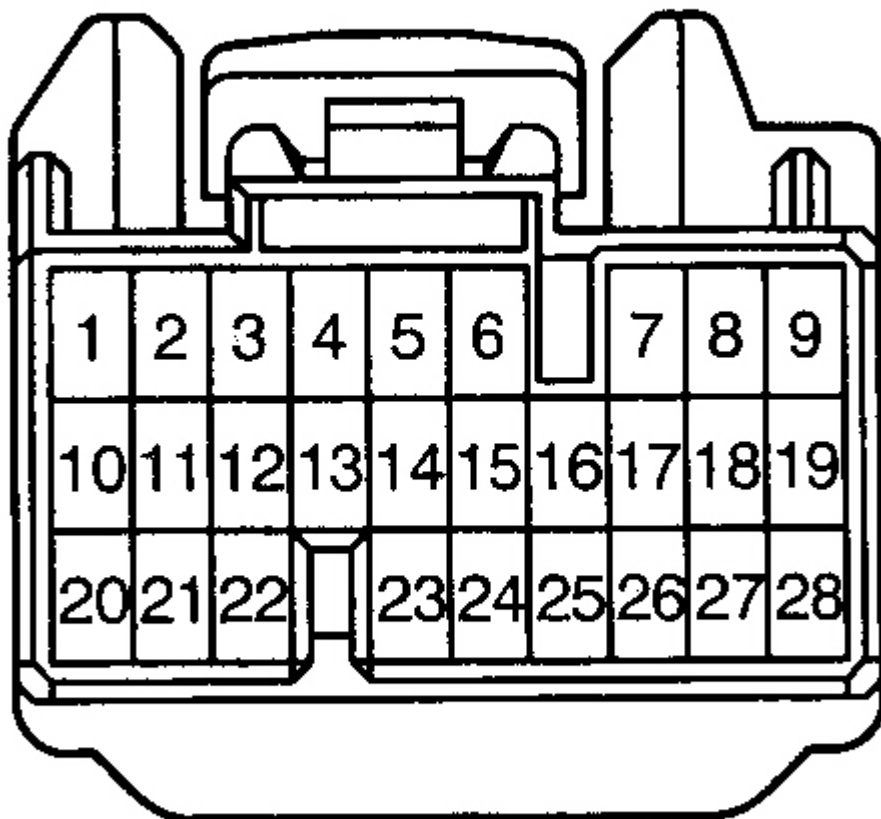
E5



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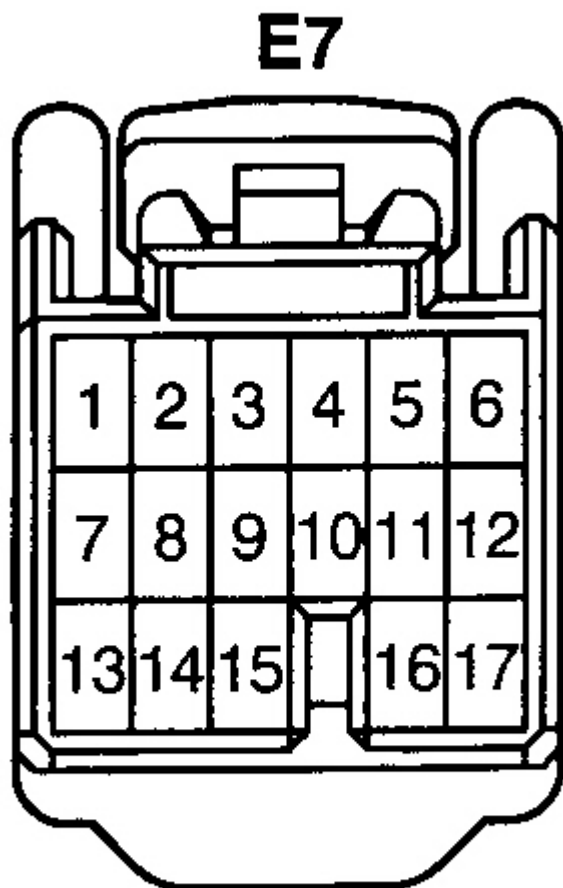
Fig. 29: Identifying ECM Harness Connector (E5) Terminals (Highlander)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

E6



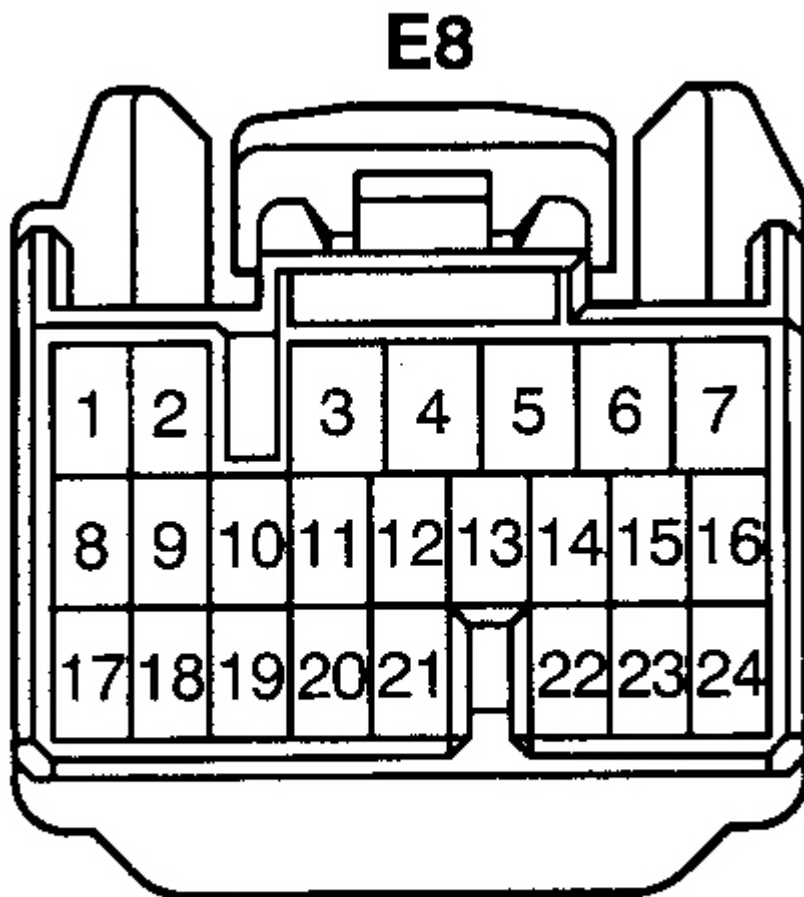
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Fig. 30: Identifying ECM Harness Connector (E6) Terminals (Highlander)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



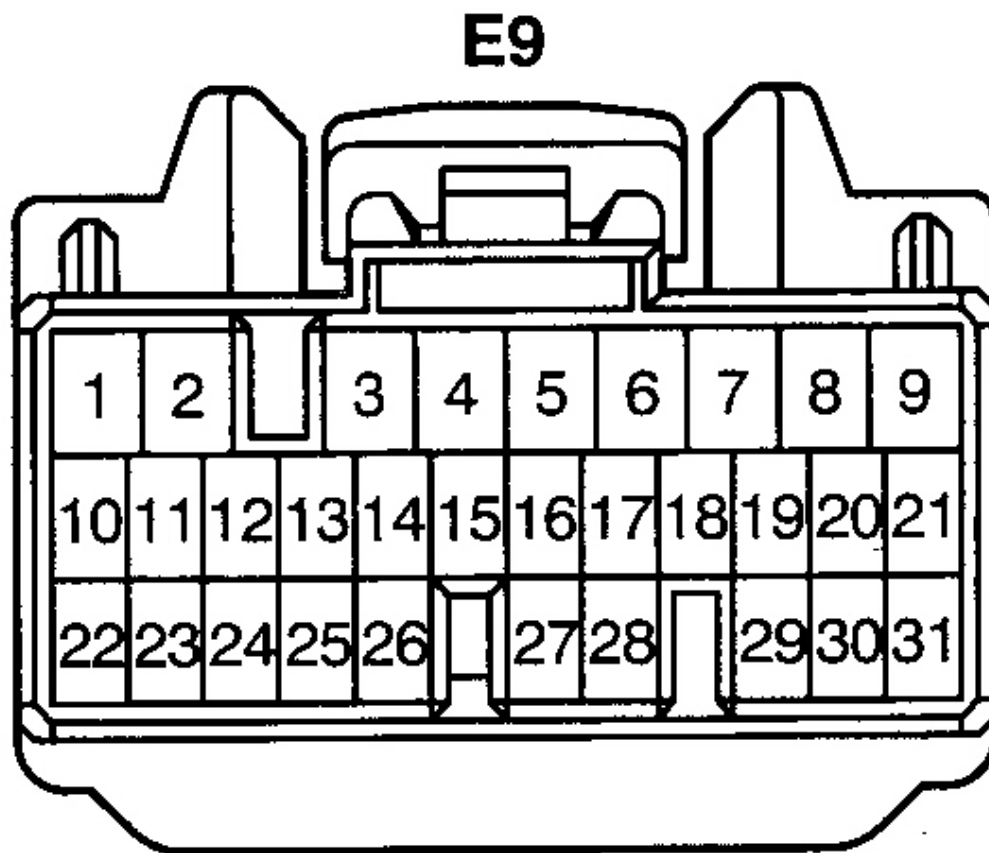
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Fig. 31: Identifying ECM Harness Connector (E7) Terminals (Highlander)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



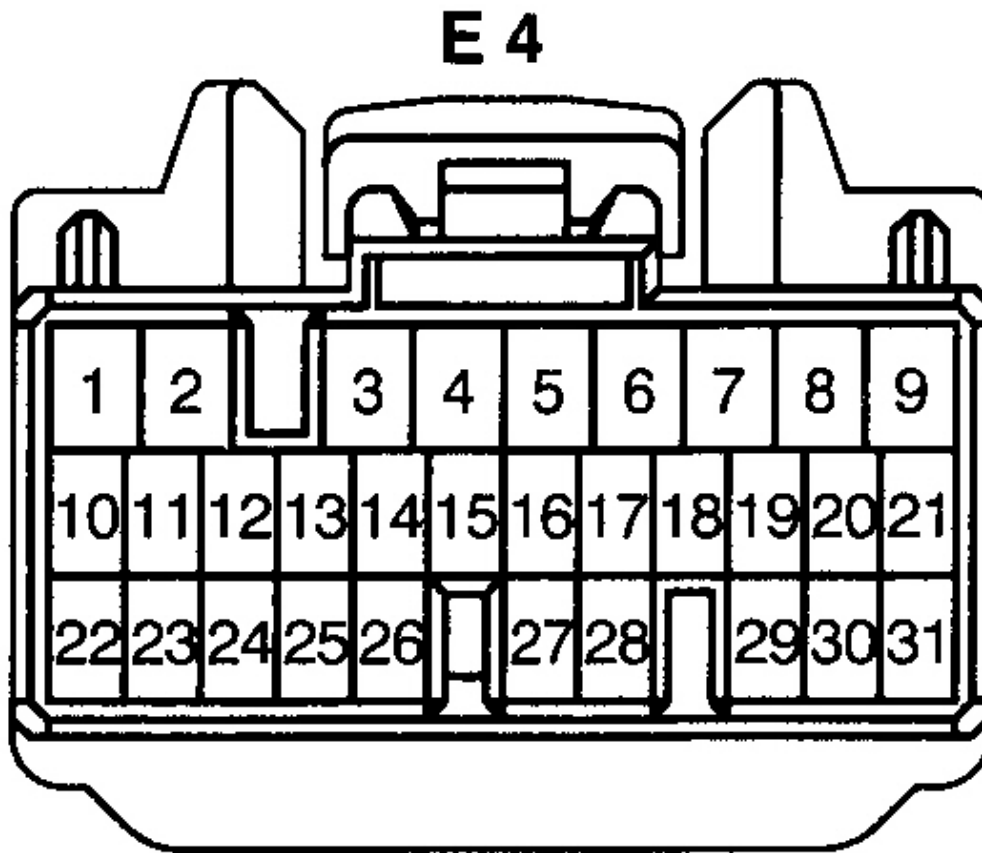
G00110639

Fig. 32: Identifying ECM Harness Connector (E8) Terminals (Highlander)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



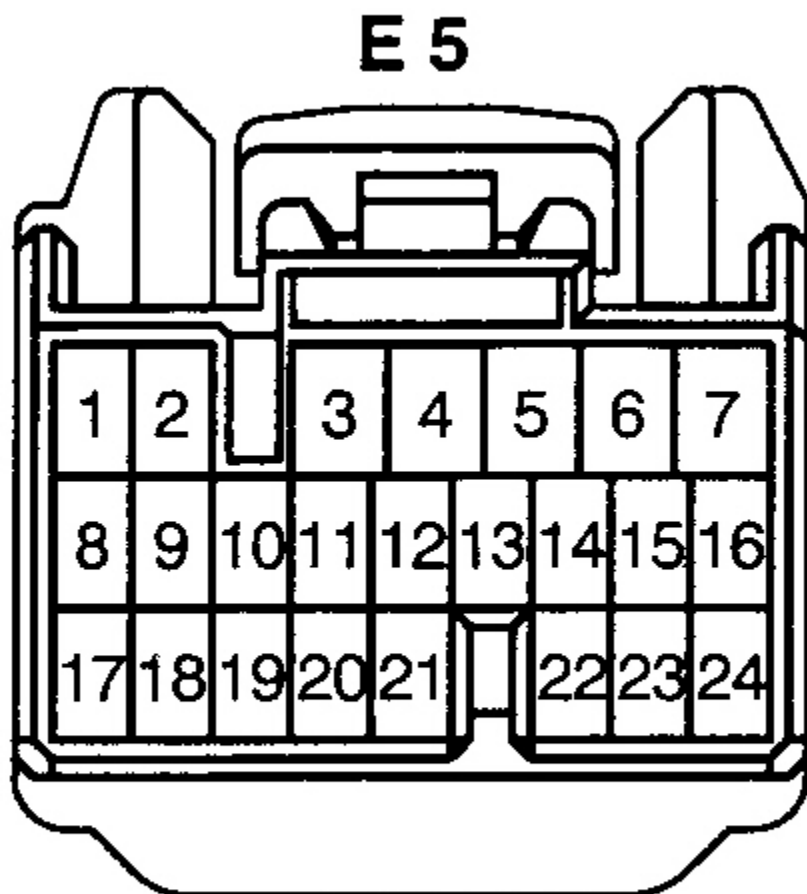
G00110640

Fig. 33: Identifying ECM Harness Connector (E9) Terminals (Highlander)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00110645

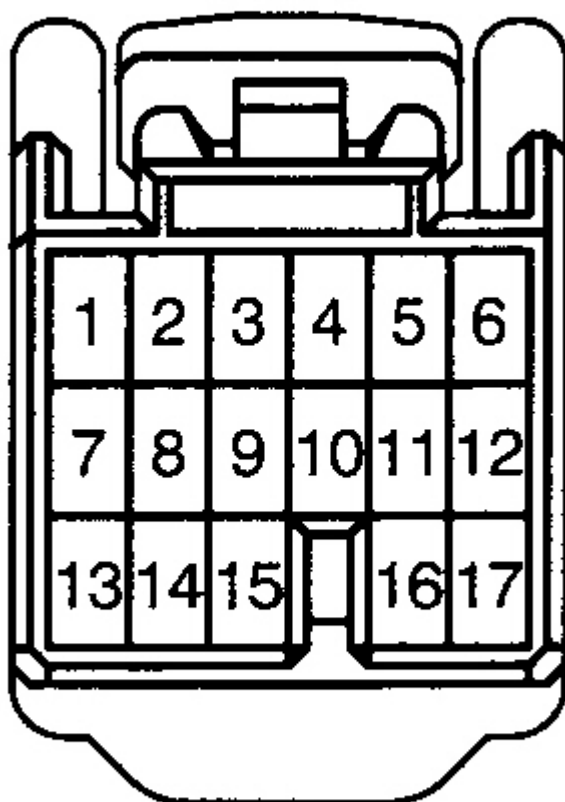
Fig. 34: Identifying ECM Harness Connector (E4) Terminals (RAV4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00110646

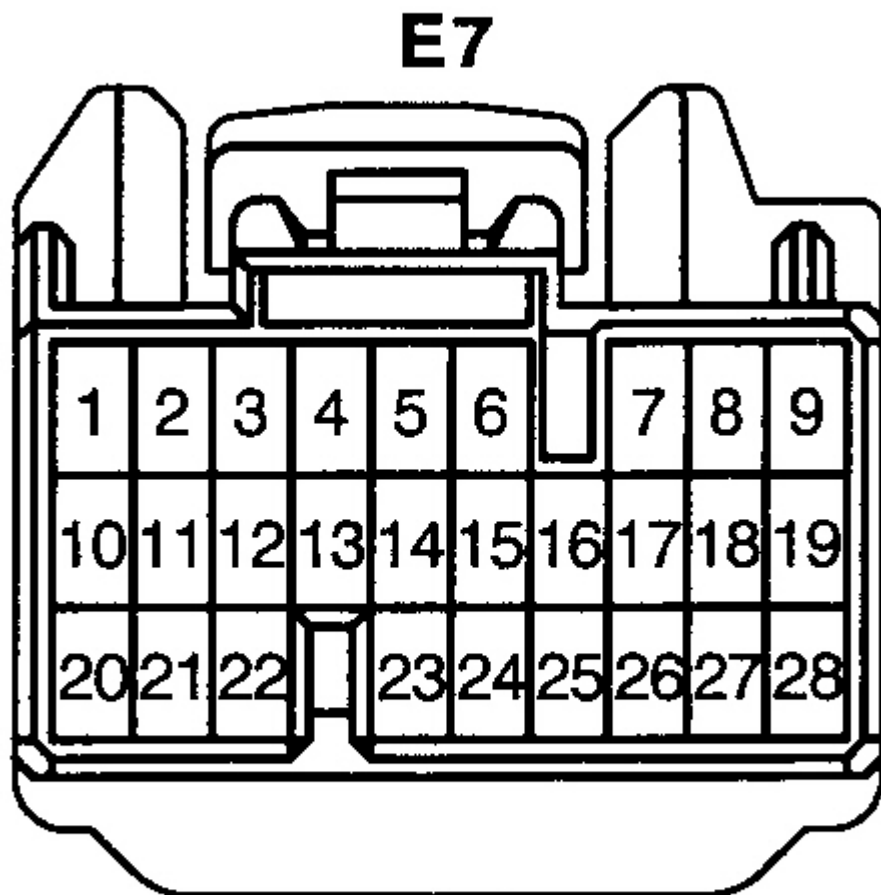
Fig. 35: Identifying ECM Harness Connector (E5) Terminals (RAV4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

E 6



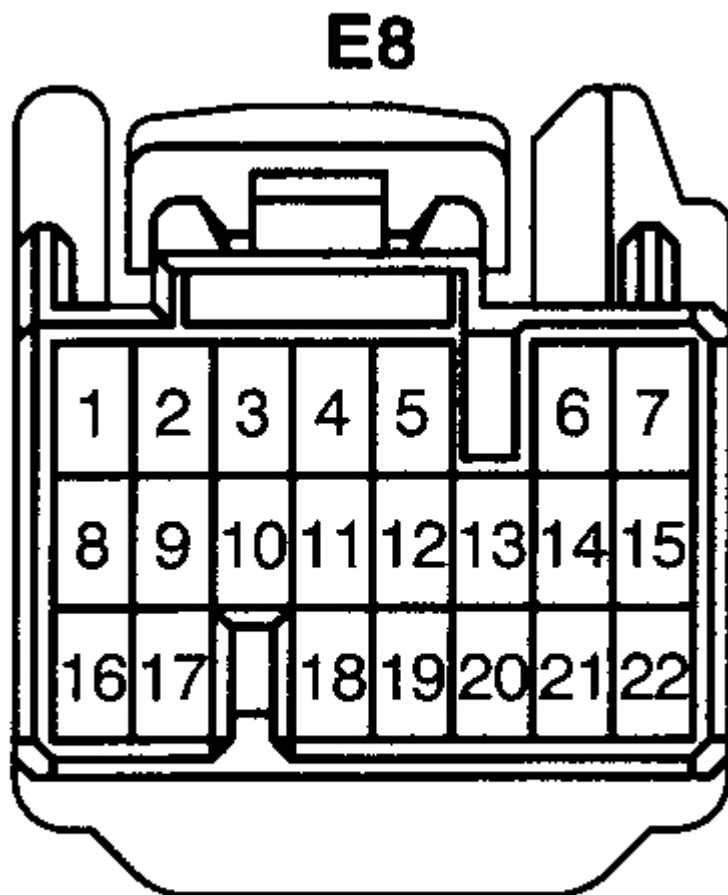
G00110647

Fig. 36: Identifying ECM Harness Connector (E6) Terminals (RAV4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00110648

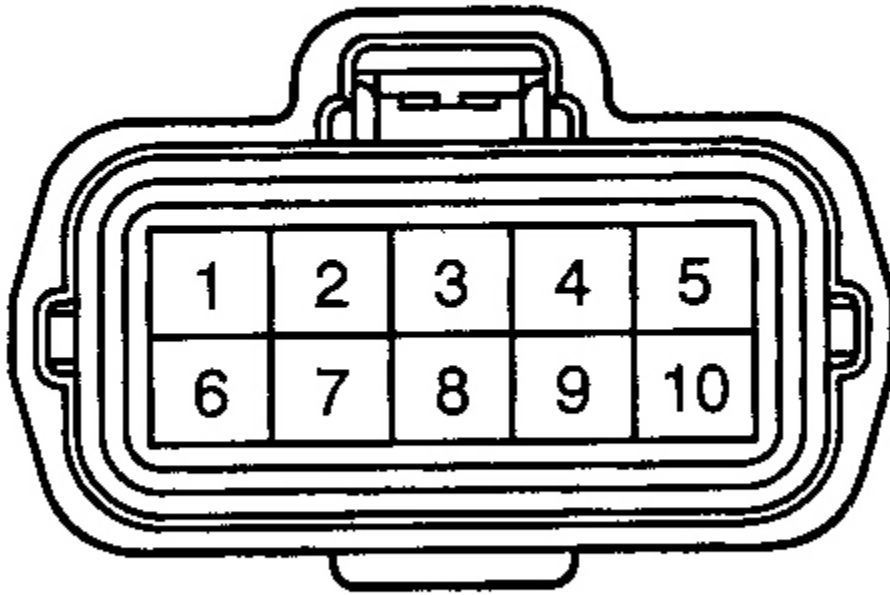
Fig. 37: Identifying ECM Harness Connector (E7) Terminals (RAV4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00110649

Fig. 38: Identifying ECM Harness Connector (E8) Terminals (RAV4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

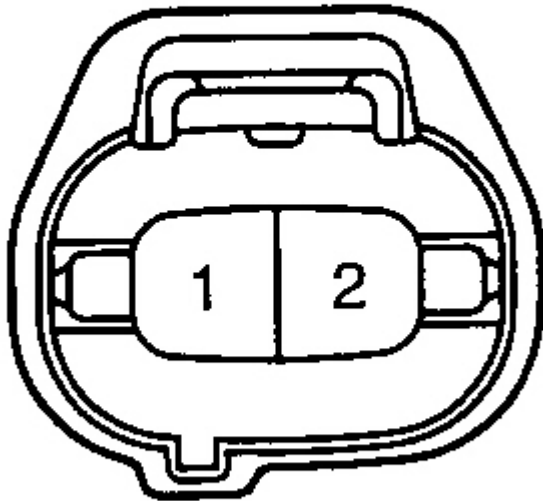
E1
GRAY



G00103032

Fig. 39: Identifying Electronically Controlled Transaxle Solenoid Harness Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

T3
BLACK



G00110643

Fig. 40: Identifying Input Turbine Shaft Speed Sensor Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

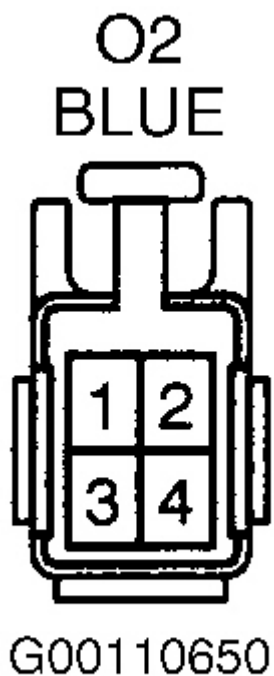
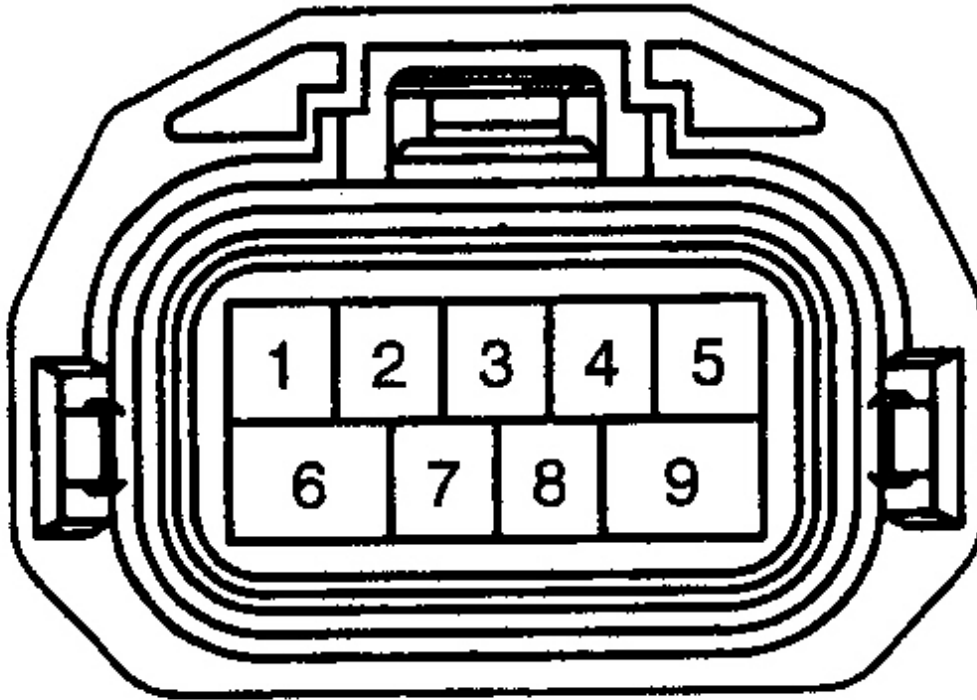


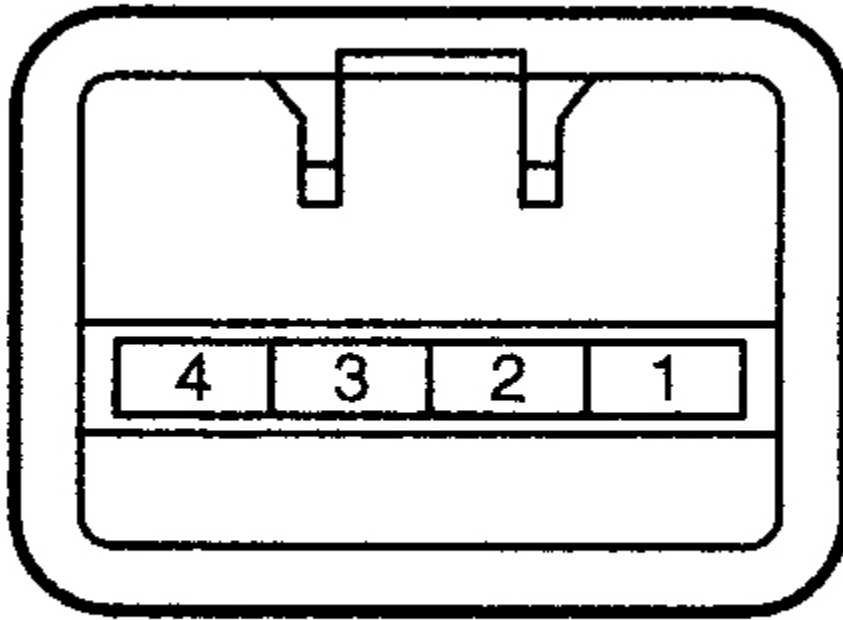
Fig. 41: Identifying O/D Main Switch Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

P1
GRAY



G00103039

Fig. 42: Identifying Park/Neutral Position Switch Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

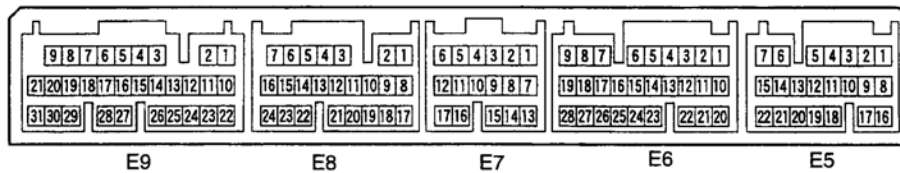


G00110634

Fig. 43: Identifying Pattern Select Switch Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

PIN VOLTAGE TESTS

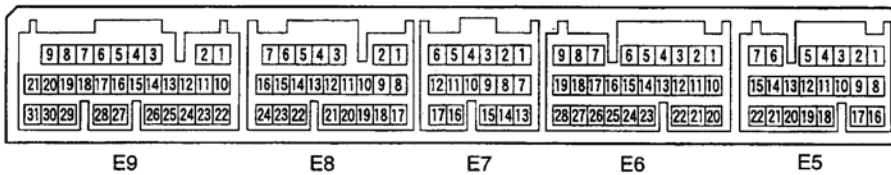
Access ECM. See **Fig. 3** or **Fig. 4** . Using a DVOM, measure between specified terminals with vehicle operated in specified "Condition". See **Fig. 44** and **Fig. 45** . Voltages should be as specified.



Symbols (Terminal No.)	Wiring Color	Condition	STD Voltage (V)
SL1+ (E9-7) ⇔ SL1- (E9-9)	L-B ⇔ L-W	IG switch ON	10 – 14
		1st gear	10 – 14
		Except 1st gear	Below 1
SL2+ (E9-8) ⇔ SL2- (E9-20)	R-B ⇔ R-W	IG switch ON	Below 1
		1st or 2nd gear	10 – 14
		3rd or O/D gear	Below 1
S4 (E7-12) ⇔ E1 (E8-17)	R-Y ⇔ BR	IG switch ON	Below 1
		O/D gear	10 – 14
		Except O/D gear	Below 1
DSL (E7-6) ⇔ E1 (E8-17)	R-L ⇔ BR	IG switch ON	Below 1
		Vehicle driving under lock-up position	10 – 14
NC+ (E9-14) ⇔ NC- (E9-26)	W-R ⇔ L	Engine is running	Below 1 and 4 – 5
NT+ (E9-16) ⇔ NT- (E9-15)	P ⇔ G	Engine is running	Below 1 and 4 – 5
SLT+ (E9-6) ⇔ SLT- (E9-5)	G-Y ⇔ B-R	IG switch ON	10 – 14
L (E7-13) ⇔ E1 (E8-17)	L-R ⇔ BR	IG switch ON Shift lever L position	10 – 14
		IG switch ON Shift lever other than L position	Below 1
2 (E7-7) ⇔ E1 (E8-17)	L-Y ⇔ BR	IG switch ON Shift lever 2 position	10 – 14
		IG switch ON Shift lever other than 2 position	Below 1
R (E6-2) ⇔ E1 (E8-17)	R-B ⇔ BR	IG switch ON Shift lever R position	10 – 14
		IG switch ON Shift lever other than R position	Below 1
D (E7-1) ⇔ E1 (E8-17)	G-R ⇔ BR	IG switch ON Shift lever D position	10 – 14
		IG switch ON Shift lever other than D position	Below 1
P (E6-10) ⇔ E1 (E8-17)	G-W ⇔ BR	IG switch ON Shift lever P position	10 – 14
		IG switch ON Shift lever other than P position	Below 1
N (E6-11) ⇔ E1 (E8-17)	R-W ⇔ BR	IG switch ON Shift lever N position	10 – 14
		IG switch ON Shift lever other than N position	Below 1
ODMS (E6-7) ⇔ E1 (E8-17)	B-O ⇔ BR	IG switch ON	10 – 14
		IG switch ON Press continuously O/D main switch	Below 1
OD1 (E6-24) ⇔ E1 (E8-17)	W ⇔ BR	IG switch ON	10 – 14
SPD (E6-22) ⇔ E01 (E9-21)	W-R ⇔ W-B	IG switch ON	10 – 14

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Fig. 44: ECM Pin Voltage Tests (Highlander)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



Symbols (Terminal No.)	Wiring Color	Condition	STD Voltage (V)
SL1+ (E4-7) – SL1– (E4-9)	G–W – V	IG switch ON	10 – 14
		1st or 2nd gear	10 – 14
		3rd or O/D gear	Below 1
SL2+ (E4-8) – SL2– (E4-20)	P – Y–B	IG switch ON	Below 1
		1st or 2nd gear	10 – 14
		3rd or O/D gear	Below 1
DSL (E6-6) – Body ground	R–W – Body ground	IG switch ON	Below 1
		Vehicle driving under lock-up position	10 – 14
NC+ (E4-14) – NC– (E4-26)	R – G	Engine is running	Below 1 and 4 – 5*
NT+ (E4-16) – NT– (E4-15)	W – B	Engine is running	Below 1 and 4 – 5*
SLT+ (E4-6) – SLT– (E4-5)	Y–R – Y–G	IG switch ON	10 – 14
L (E7-12) – E1 (E4-17)	LG (W) – BR	IG switch ON Shift lever L position	10 – 14
		IG switch ON Shift lever other than L position	Below 1
2 (E7-3) – E1 (E4-17)	LG–B (W) – BR	IG switch ON Shift lever 2 position	10 – 14
		IG switch ON Shift lever other than 2 position	Below 1
R (E7-2) – E1 (E4-17)	R–B (W) – BR	IG switch ON Shift lever R position	10 – 14
		IG switch ON Shift lever other than R position	Below 1
D (E7-1) – E1 (E4-17)	L–B (W) – BR	IG switch ON Shift lever D position	10 – 14
		IG switch ON Shift lever other than D position	Below 1
NSW (E7-20) – E1 (E4-17)	B–Y (W) – BR	IG switch ON Shift lever P and N ranges	10 – 14
		IG switch ON Shift lever other than P and N ranges	Below 1
ODLP (E8-5) – E1 (E4-17)	LG–B (W) – BR	IG switch ON O/D OFF indicator light lights up	Below 1
		IG switch ON O/D OFF indicator light goes off	10 – 14
ODMS (E8-10) – E1 (E4-17)	LG (W) – BR	IG switch ON	10 – 14
		IG switch ON Press continuously O/D main switch	Below 1
SPD (E7-22) – E01 (E4-21)	V–W (W) – W–B	IG switch ON	9 – 14

*: Alternates repeatedly between below 1V and 4 – 5V.

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Fig. 45: ECM Pin Voltage Tests (RAV4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

WIRING DIAGRAMS

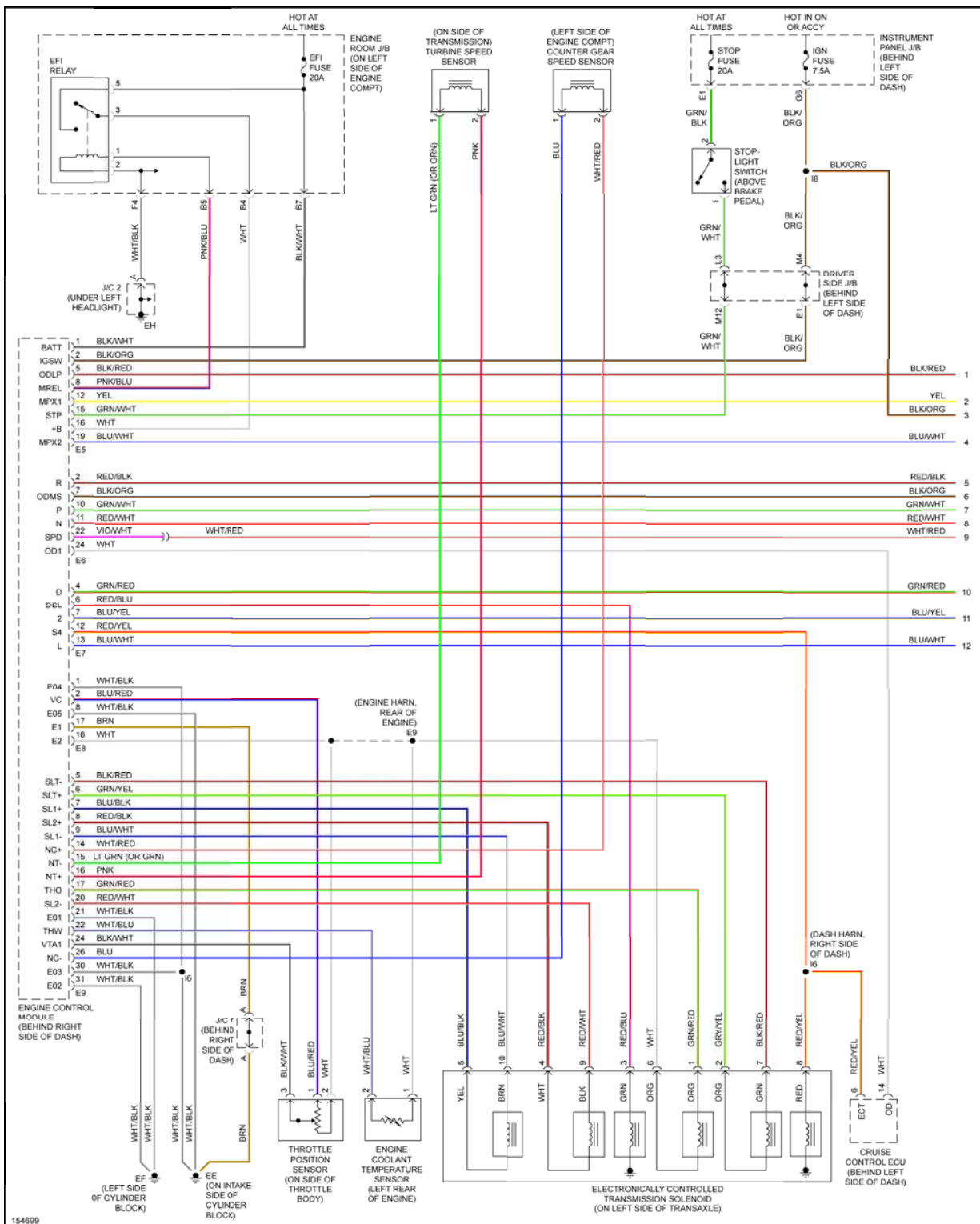


Fig. 46: Transaxle Electronic Control System Wiring Diagram (2001-02 Highlander - 1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

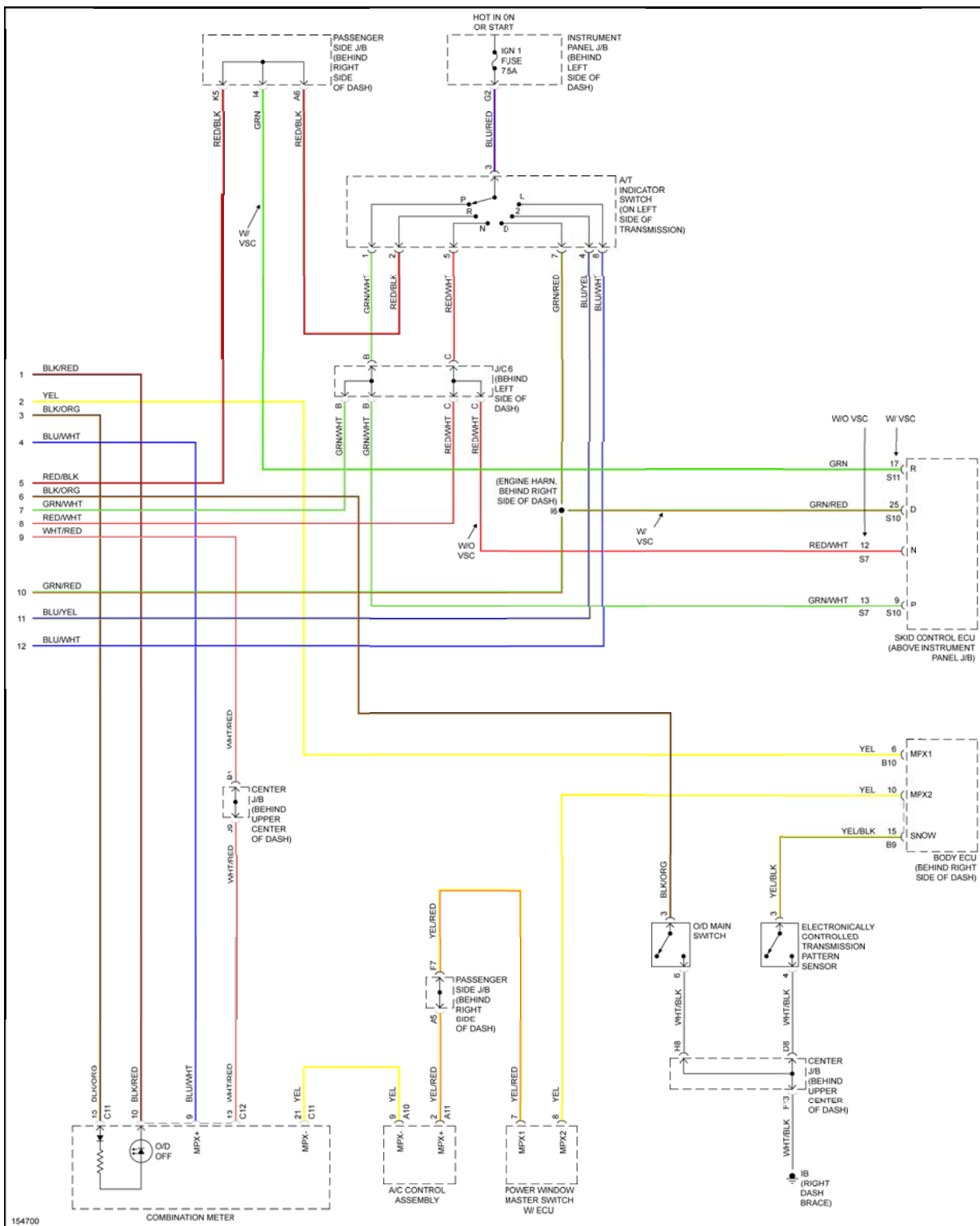


Fig. 47: Transaxle Electronic Control System Wiring Diagram (2001-02 Highlander - 2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

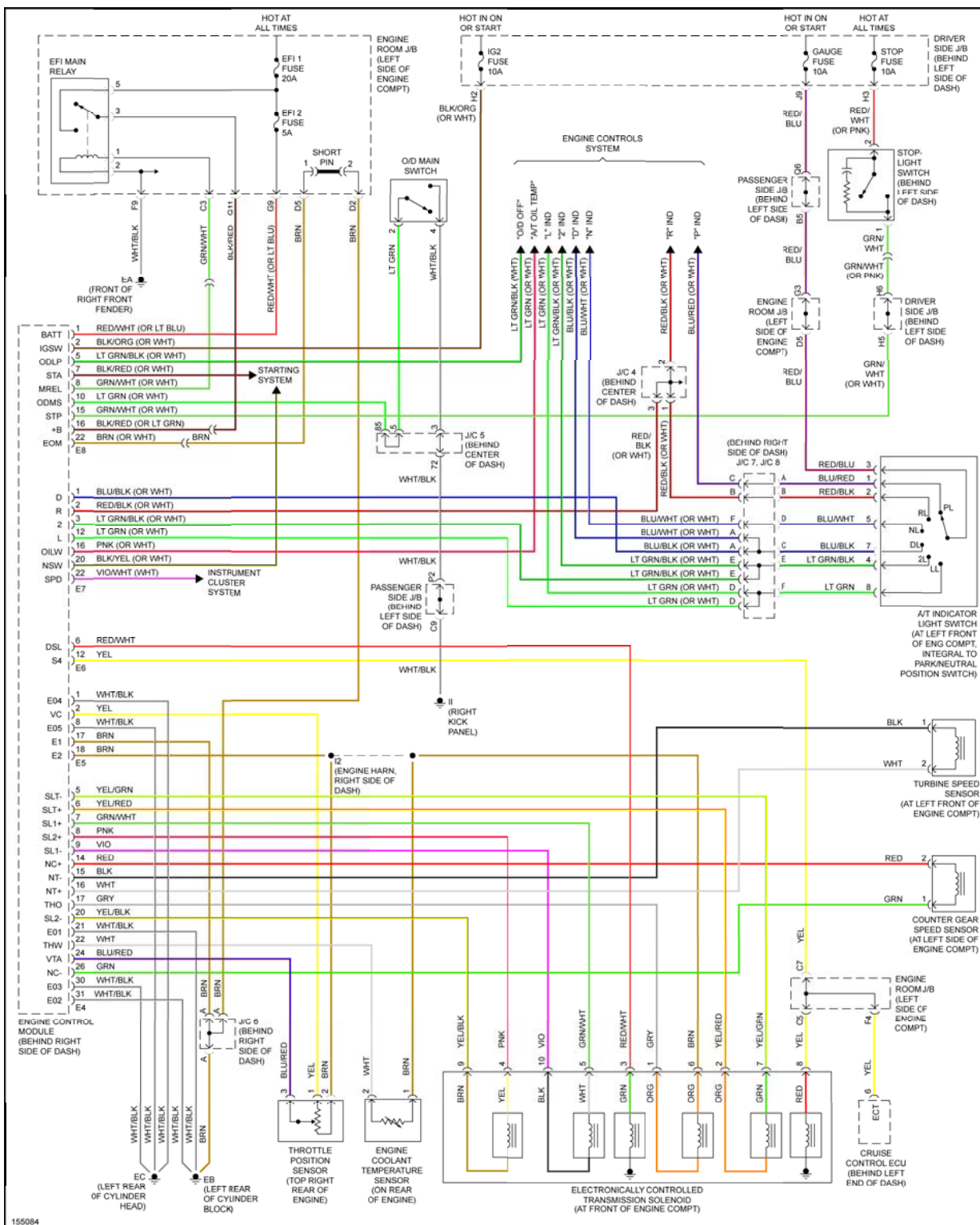


Fig. 48: Transaxle Electronic Control System Wiring Diagram (RAV4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.