DTC	P0087/49	FUEL RAIL/SYSTEM PRESSURE – TOO LOW

DTC	P0190/49	FUEL RAIL PRESSURE SENSOR CIRCUIT

DTC	P0192/49	FUEL RAIL PRESSURE SENSOR CIRCUIT LOW INPUT

DTC	P0193/49	FUEL RAIL PRESSURE SENSOR CIRCUIT HIGH INPUT

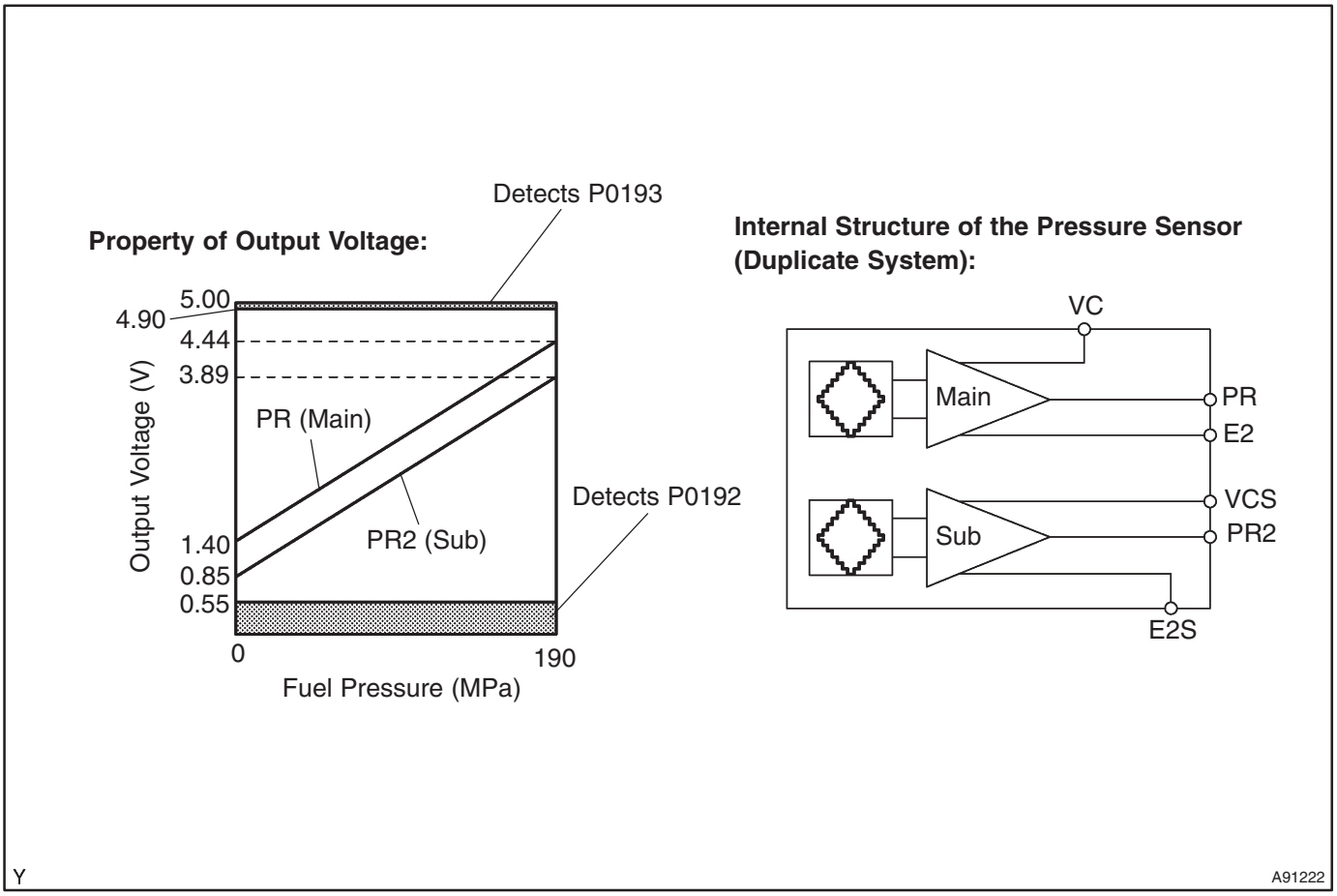
HINT:

- For more information on the fuel pressure sensor and common rail system, refer to the system description (see page 05–422).
- If P0087/49, P0190/49, P0192/49 and/or P0193/49 is present, refer to the ”Diagnostic Trouble Codes (DTCs) Table for Common Rail System” (see page 05–422).

CIRCUIT DESCRIPTION

The ECM monitors an internal fuel pressure of the common rail using the fuel pressure sensor, and controls the suction control valve to regulate the internal fuel pressure to the target pressure, approximately 20 to 160 MPa (204 to 1,632 kgf/cm^2, 2,900 to 23,206 psi).

The pressure sensor is a semiconductor pressure sensor that varies electric resistance when applying pressure to its silicon. This sensor output voltage changes in proportion to the internal fuel pressure. The sensor has been designed as a duplicate circuit, and its main (PR) circuit is used under normal condition. Even if either of the sensor circuit is failed, the other normal circuit will be used to monitor the internal fuel pressure.



DTC No.	DTC Detection Condition	Trouble Area
P0087/49	Fuel pressure sensor output voltage stays at fixed value (1 trip detection logic)	• Open or short in fuel pressure sensor circuit • Fuel pressure sensor • ECM
P0190/49	Fuel pressure sensor output voltage is 0.55 V or less, or 4.9 V or more for 0.5 seconds (1 trip detection logic)	• Open or short in fuel pressure sensor circuit • Fuel pressure sensor • ECM
P0192/49	Fuel pressure sensor output voltage is 0.55 V or less for 0.5 seconds (1 trip detection logic)	• Open or short in fuel pressure sensor circuit • Fuel pressure sensor • ECM
P0193/49	Fuel pressure sensor output voltage is 4.9 V or more for 0.5 seconds (1 trip detection logic)	• Open or short in fuel pressure sensor circuit • Fuel pressure sensor • ECM

HINT:
When DTC P0087/49, P0190/49, P0192/49 and/or P0193/49 is set, check the internal fuel pressure of the common rail by entering the following menus on the intelligent tester II: Powertrain / Engine / Data List / Common Rail Pressure.

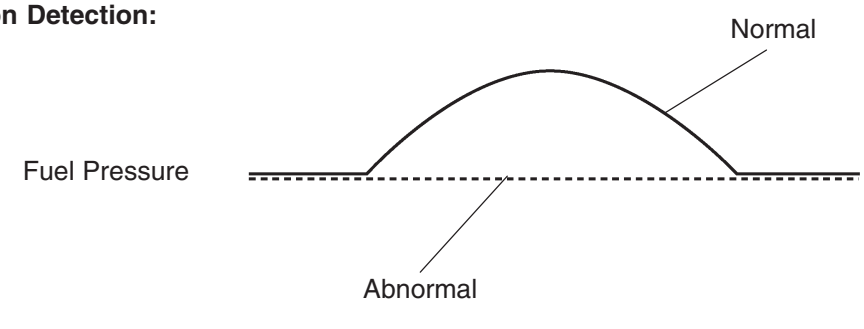
Reference:

Engine Speed	Fuel Pressure
Idling	Approximately 30 to 40 MPa
3,000 rpm (No engine load)	Approximately 50 to 70 MPa

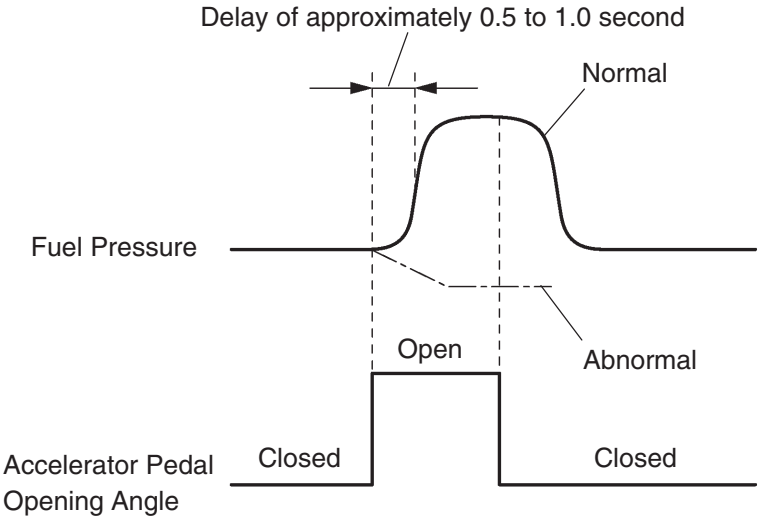
MONITOR DESCRIPTION

P0087/49 (Fuel pressure sensor output stays at fixed value):
Under normal condition, the internal fuel pressure of the common rail usually fluctuates 1 to 2 MPa (10 to 20 kgf/cm^2, 145 to 290 psi) even when the driving condition is constant. The internal fuel pressure is approximately 30 to 40 MPa (306 to 408 kgf/cm^2, 4,351 to 5,801 psi) when idling, and it increases to approximately 50 to 80 MPa (510 to 816 kgf/cm^2, 7,252 to 11,603 psi) when running the engine at 3,000 rpm. This DTC is set if there is no fluctuation in the internal fuel pressure.
If this DTC is set, the ECM enters fail–safe mode and limits engine power. The fail–safe mode continues until the ignition switch is turned OFF.

P0087 Malfunction Detection:



Idling:



A82882
G36533
Y

G37165

P0190/49, P0192/49 and P0193/49 (Open or short in fuel pressure sensor circuit):
These DTCs are set if the fuel pressure sensor output voltage is out of the standard range. The DTCs stand for an open or short malfunction of the sensor circuit.
If these DTCs are set, the ECM enters fail–safe mode and limits the engine power. The fail–safe mode continues until the ignition switch is turned OFF.

MONITOR STRATEGY

P0087/49:

Required sensors	Fuel pressure sensor
Frequency of operation	Continuous
Duration	1 second
MIL operation	1 driving cycle

P0190/49:

Required sensors	Fuel pressure sensor
Frequency of operation	Continuous
Duration	0.5 seconds
MIL operation	1 driving cycle

P0192/49:

Required sensors	Fuel pressure sensor
Frequency of operation	Continuous
Duration	0.5 seconds
MIL operation	1 driving cycle

P0193/49:

Required sensors	Fuel pressure sensor
Frequency of operation	Continuous
Duration	0.5 seconds
MIL operation	1 driving cycle

TYPICAL ENABLING CONDITIONS

P0087/49:

	Specification	Specification
Item	Minimum	Maximum
Engine speed	500 rpm	–
Battery voltage	8 V	–
Fuel volume	5 mm^3	–
The monitor will not run if the fuel pressure sensor circuit (P0190/49, P0192/49 and P0193/49) is malfunctioning		

TYPICAL MALFUNCTION THRESHOLDS

P0087/49:

Detection Criteria	Threshold
Changing value of fuel pressure	Virtually no fluctuation

P0190/49:

Detection Criteria	Threshold
Fuel pressure sensor output voltage	Less than 0.55 V or more than 4.9 V

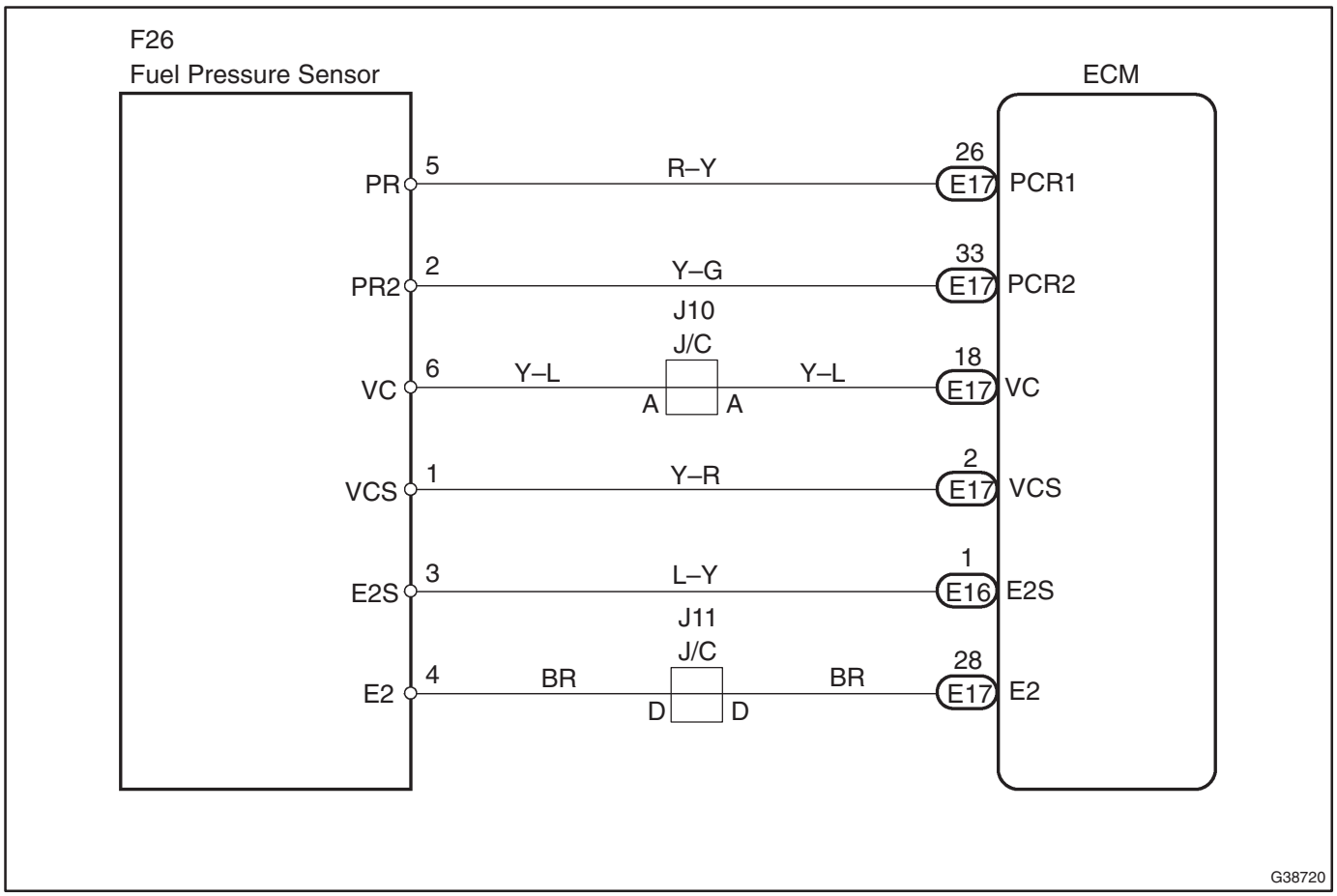
P0192/49:

Detection Criteria	Threshold
Fuel pressure sensor output voltage	Less than 0.55 V

P0193/49:

Detection Criteria	Threshold
Fuel pressure sensor output voltage	More than 4.9 V

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- After completing repairs, check that P0087/49, P0190/49, P0192/49 and/or P0193/49 is not set again.
- If different DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.
- Read freeze frame data using the intelligent tester II. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, and other data from the time the malfunction occurred.

When using intelligent tester II:

1	READ DATA LIST (FUEL PRESSURE)

(a) Connect the intelligent tester II to the DLC3.
(b) Start the engine and turn the intelligent tester II ON.
(c) Enter the following menus: Powertrain / Engine / Data List / Fuel Press.
(d) Read the values.
OK: The internal fuel pressure of the common rail is within the specification below.
Standard:

Engine Speed	Fuel Pressure
Idling	Approximately 30,000 to 40,000 kPa
3,000 rpm (No engine load)	Approximately 50,000 to 80,000 kPa

NG → **Go to step 3**

OK

2	CHECK IF DTC OUTPUT RECURS (FUEL PRESSURE SENSOR DTCS)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch ON and turn the intelligent tester II ON.
(c) Enter the following menus: Powertrain / Engine / DTC / Clear.
(d) Clear the DTC(s).
(e) Let the engine idle for 60 seconds, and repeat quick engine RPM accelerations (to 2,500 rpm) for 30 seconds.
(f) Enter the following menus: Powertrain / Engine / DTC.
(g) Read the DTC(s).
Result:

Display (DTC Output)	Proceed to
P0087/49, P0190/49, P0192/49 or P0193/49	A
No output	B

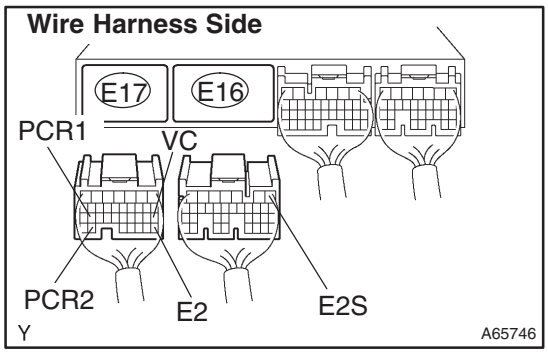
B → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–439)**

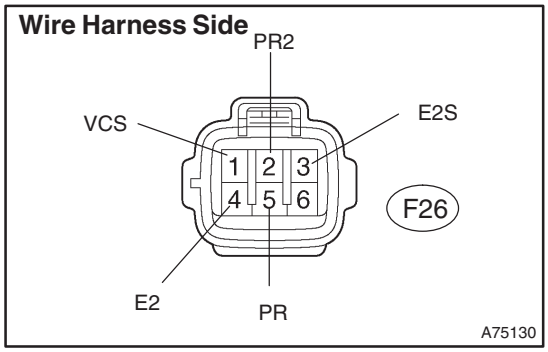
A

REPLACE ECM (See Pub. No. RM990E, page 10–34)

NOTICE:
After replacing the ECM, allow for ECM learning start the engine and idle it until it is fully warmed up.

3 CHECK WIRE HARNESS (FUEL PRESSURE SENSOR – ECM)





(a) Disconnect the E17 and E16 ECM connector.
(b) Disconnect the F26 sensor connector.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
E17–26 (PCR1) – F26–5 (PR)	Below 1 Ω
E17–33 (PCR2) – F26–2 (PR2)	Below 1 Ω
E17–18 (VC) – F26–1 (VCS)	Below 1 Ω
E17–28 (E2) – F26–4 (E2)	Below 1 Ω
E16–1 (E2S) – F26–3 (E2S)	Below 1 Ω
E17–26 (PCR1) or F26–5 (PR) – Body ground	10 kΩ or higher
E17–33 (PCR2) or F26–2 (PR2) – Body ground	10 kΩ or higher
E17–18 (VC) or F26–1 (VCS) – Body ground	10 kΩ or higher
E17–28 (E2) or F26–4 (E2) – Body ground	10 kΩ or higher
E16–1 (E2S) or F26–3 (E2S) – Body ground	10 kΩ or higher

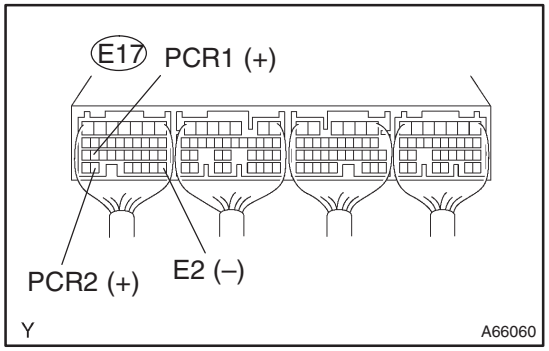
NG → **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

REPLACE COMMON RAIL ASSY (FUEL PRESSURE SENSOR) (See page 11–67)

When not using intelligent tester II:

1	CHECK ECM (PCR1, PCR2 VOLTAGE)



(a) Start the engine.
(b) Measure the voltage of the ECM connector.
Standard:

Tester Connection	Condition	Specified Condition
E17–26 (PCR1) – E17–28 (E2)	Idling	1.7 to 2.2 V
E17–33 (PCR2) – E17–28 (E2)	Idling	1.2 to 1.6 V

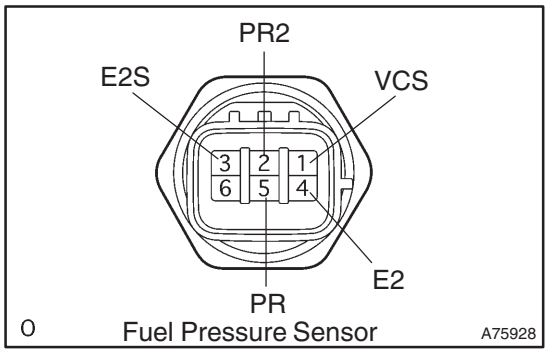
NG → **Go to step 2**

OK

REPLACE ECM (See Pub. No. RM990E, page 10–34)

NOTICE:
After replacing the ECM, allow for ECM learning start the engine and idle it until it is fully warmed up.

2	INSPECT COMMON RAIL ASSY (FUEL PRESSURE SENSOR)



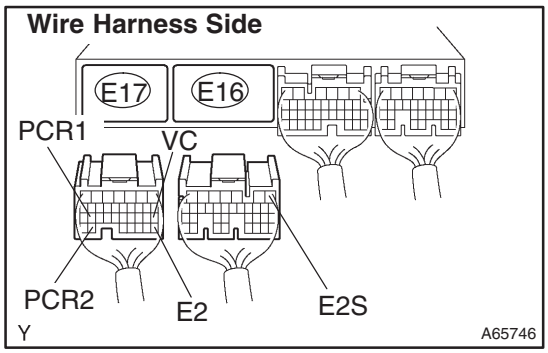
(a) Disconnect the F26 sensor connector.
(b) Measure the resistance of the sensor.
Standard:

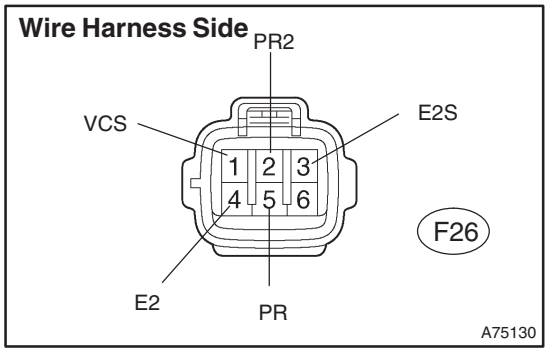
Tester Connection	Specified Condition
F26–4 (E2) – F26–5 (PR)	3 kΩ or less
F26–3 (E2S) – F26–2 (PR2)	3 kΩ or less
F26–5 (PR) – F26–1 (VCS)	16.4 kΩ or less
F26–2 (PR2) – F26–1 (VCS)	16.4 kΩ or less

NG → **REPLACE COMMON RAIL ASSY (FUEL PRESSURE SENSOR) (See page 11–67)**

OK

3 CHECK WIRE HARNESS (FUEL PRESSURE SENSOR – ECM)





(a) Disconnect the E17 and E16 ECM connector.
(b) Disconnect the F26 sensor connector.
(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
E17–26 (PCR1) – F26–5 (PR)	Below 1 Ω
E17–33 (PCR2) – F26–2 (PR2)	Below 1 Ω
E17–18 (VC) – F26–1 (VCS)	Below 1 Ω
E17–28 (E2) – F26–4 (E2)	Below 1 Ω
E16–1 (E2S) – F26–3 (E2S)	Below 1 Ω
E17–26 (PCR1) or F26–5 (PR) – Body ground	10 kΩ or higher
E17–33 (PCR2) or F26–2 (PR2) – Body ground	10 kΩ or higher
E17–18 (VC) or F26–1 (VCS) – Body ground	10 kΩ or higher
E17–28 (E2) or F26–4 (E2) – Body ground	10 kΩ or higher
E16–1 (E2S) or F26–3 (E2S) – Body ground	10 kΩ or higher

NG → **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

REPLACE ECM (See Pub. No. RM990E, page 10–34)

NOTICE:
After replacing the ECM, allow for ECM learning start the engine and idle it until it is fully warmed up.