

Progressive Power Steering System - Diagnostics - LS430

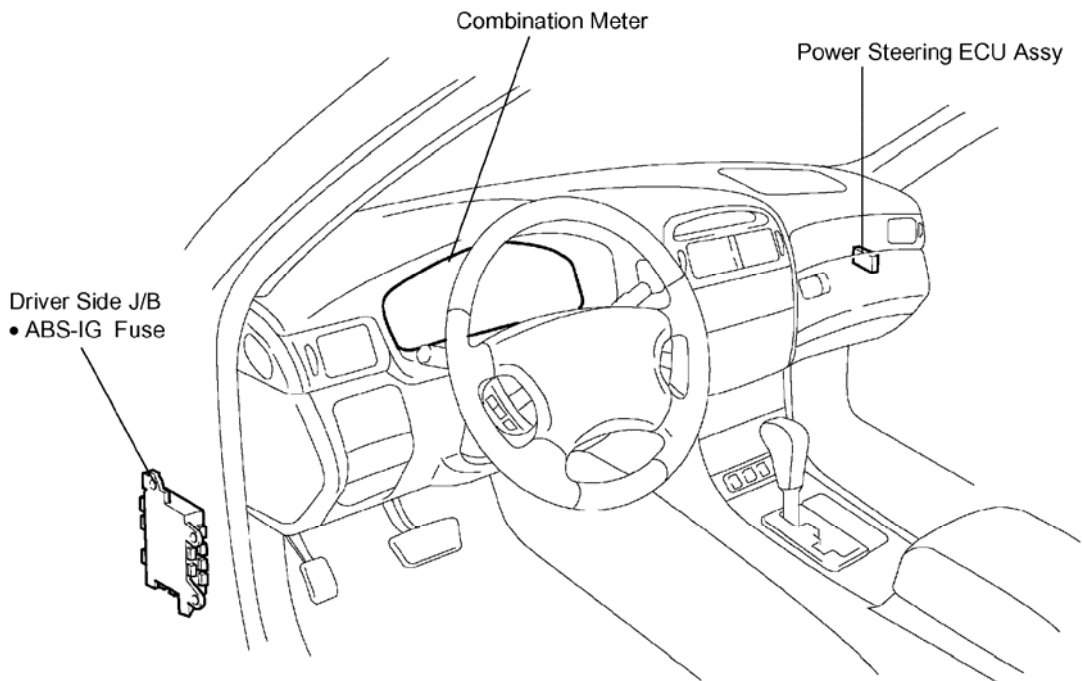
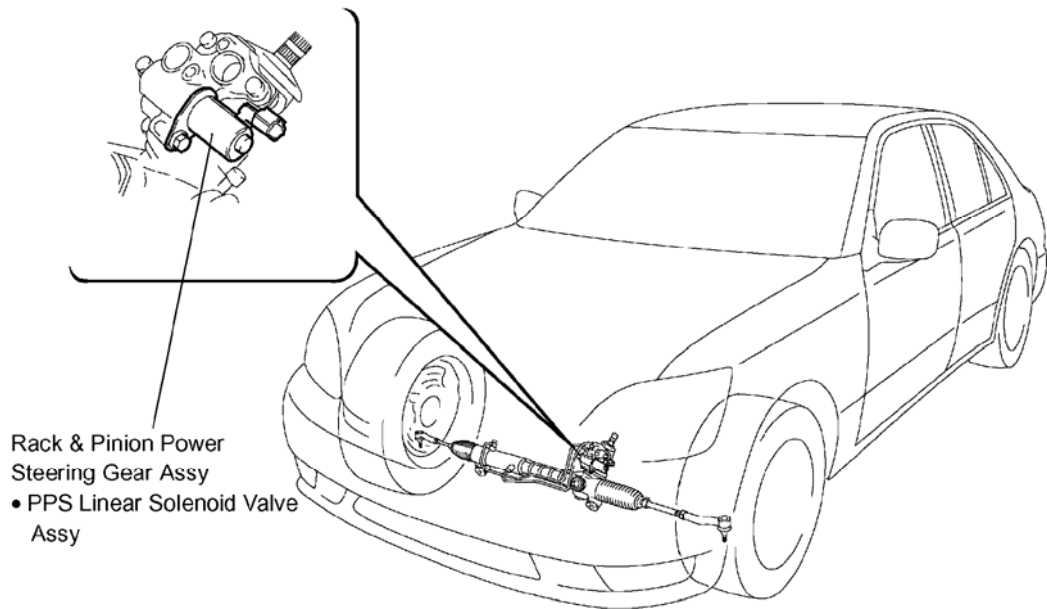
PRECAUTION

NOTE: When the negative (-) battery terminal is disconnected, initialize the following system after the terminal is reconnected.

SYSTEM REFERENCE TABLE

System Name	Proceed To
Front Power Seat Control System	<u>INITIALIZATION</u>

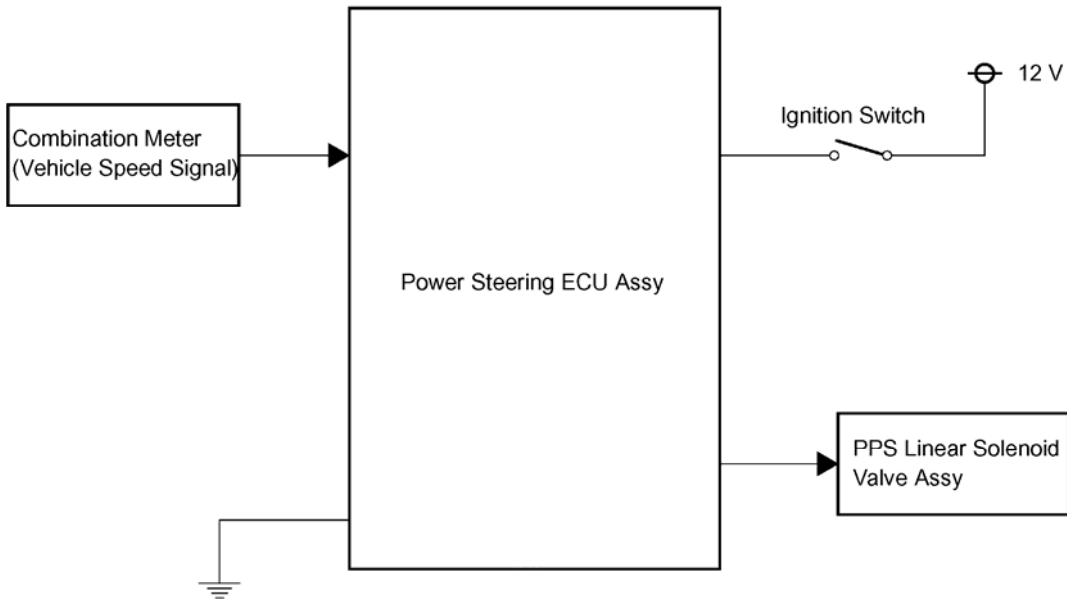
LOCATION



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Fig. 1: Identifying Power Steering System Components And Replacements Location
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SYSTEM DIAGRAM



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Fig. 2: Identifying Power Steering System Diagram
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SYSTEM DESCRIPTION

(d) The PPS (Progressive Power Steering) is vehicle speed sensing type power steering, which increases/decreases steering effort in accordance with vehicle speed.

The power steering ECU Assy sends a control signal to the steering gear (PPS linear solenoid valve Assy) based on a vehicle speed signal. This system enables obtainment of a heavy steering feeling when driving at high speeds.

1. Power steering ECU Assy

The power steering ECU Assy receives a vehicle speed signal from the combination meter. It then sends a signal to the PPS linear solenoid valve Assy.

2. PPS linear solenoid valve Assy

The PPS linear solenoid valve Assy controls power steering fluid pressure by receiving a signal from the power steering ECU Assy.

HOW TO PROCEED WITH TROUBLESHOOTING

1. VEHICLE BROUGHT TO WORKSHOP

Go to next step.

2. **CUSTOMER PROBLEM ANALYSIS (See CUSTOMER PROBLEM ANALYSIS CHECK)**

Go to next step.

3. **PROBLEM SYMPTOM CONFIRMATION**

SYMPTOM DOES NOT OCCUR (GO TO STEP 4)

SYMPTOM OCCURS (GO TO STEP 5)

4. **SYMPTOM SIMULATION (See HOW TO PROCEED WITH TROUBLESHOOTING)**

Go to next step.

5. **SEE PROBLEM SYMPTOMS TABLE)**

Go to next step.

6. **CIRCUIT INSPECTION (See IG POWER SOURCE CIRCUIT TO VEHICLE SPEED SIGNAL CIRCUIT)**

Go to next step.

7. **IDENTIFICATION OF PROBLEM**

Go to next step.

8. **REPAIR**

Go to next step.

9. **CONFIRMATION TEST**

END

CUSTOMER PROBLEM ANALYSIS CHECK

PPS Check Sheet

Inspector's Name _____

Customer's Name		VIN	
		Production Date	/ /
		Licence Plate No.	
Date Vehicle Brought In	/ /	Odometer Reading	km miles

Date Problem First Occurred	/ /
Frequency Problem Occurs	<input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent (times a day)

Symptoms	<input type="checkbox"/> Feels hard turning the steering wheel either right or left with the vehicle stopped.
	<input type="checkbox"/> Feels that the steering is unstable while driving at a high speed.

Check Item	Fluid Condition (See page 51-4 .)	<input type="checkbox"/> Normal	<input type="checkbox"/> Malfunction
	Drive Belt Condition (See page 51-4 .)	<input type="checkbox"/> Normal	<input type="checkbox"/> Malfunction
	Fluid Pressure (See page 51-4 .)	<input type="checkbox"/> Normal	<input type="checkbox"/> Malfunction

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Fig. 3: Identifying Customer Problem Analysis Check Sheet
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

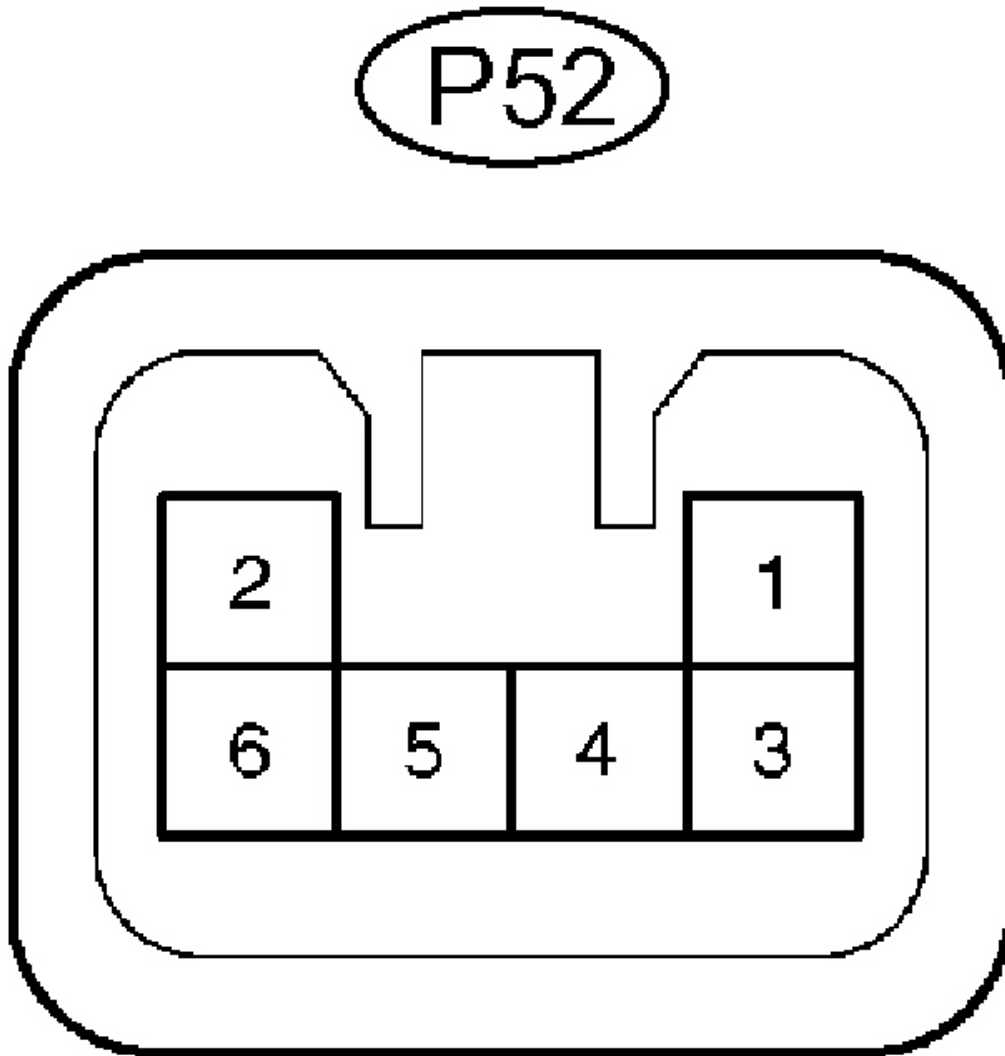
FAIL-SAFE CHART

- a. If a malfunction in the progressive power steering system is detected, steering effort increases and is maintained at a constant level.

FAIL-SAFE CHART

Malfunction Items	Computer Output	Fail-Safe Operation
There is a short in the PPS linear solenoid valve assy or PPS linear solenoid valve circuit.	Not output	Steering effort increases and is maintained at a constant level.
There is an open in the PPS linear solenoid valve assy or PPS linear solenoid valve circuit.	Output	Steering effort increases and is maintained at a constant level.

TERMINALS OF ECU



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Fig. 4: Identifying Terminals Of ECU
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TERMINALS OF ECU REFERENCE TABLE

Symbols (Terminal No.)	Wiring Color	Condition	Specified Condition
SOL+ (P52-1) - GND	G - W-B	Vehicle speed 0 km/h ->	6 -> 4.4V

(P52-6)		35 km/h	
SOL- (P52-2) - GND (P52-6)	L-B - W-B	IG switch ON	Below 1 V
IG (P52-4) - GND (P52-6)	B-R - W-B	IG switch ON	10 to 14V
SPD (P52-5) - GND (P52-6)	V-W - W-B	IG switch ON, rotate driving wheel slowly	Pulse generation
GND (P52-6) - Body ground	W-B -Body ground	Always	Below 1 ohms

PROBLEM SYMPTOMS TABLE

Use **Fig. 5**, with suspected areas listed in numerical order, to determine the cause of the problem. Inspect and repair parts as necessary according to the steps in the following information.

Symptom	Suspected Area
When the vehicle is idling, steering effort is high (with the vehicle stopped).	<p>If the symptoms still occur even after the following suspected areas are inspected and proved to be normal, replace the power steering ECU assy.</p> <ol style="list-style-type: none"> 1. Tire size and tire pressure 2. Oil reservoir fluid level 3. Steering fluid pressure 4. Front wheel alignment 5. IG power source circuit 6. PPS linear solenoid valve circuit
Even if vehicle speed increases, steering effort does not increase.	<p>If the symptoms still occur even after the following circuits in suspected areas are inspected and proved to be normal, replace the power steering ECU assy.</p> <ol style="list-style-type: none"> 1. PPS linear solenoid valve circuit 2. Vehicle speed signal circuit

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Fig. 5: Problem Symptoms Table

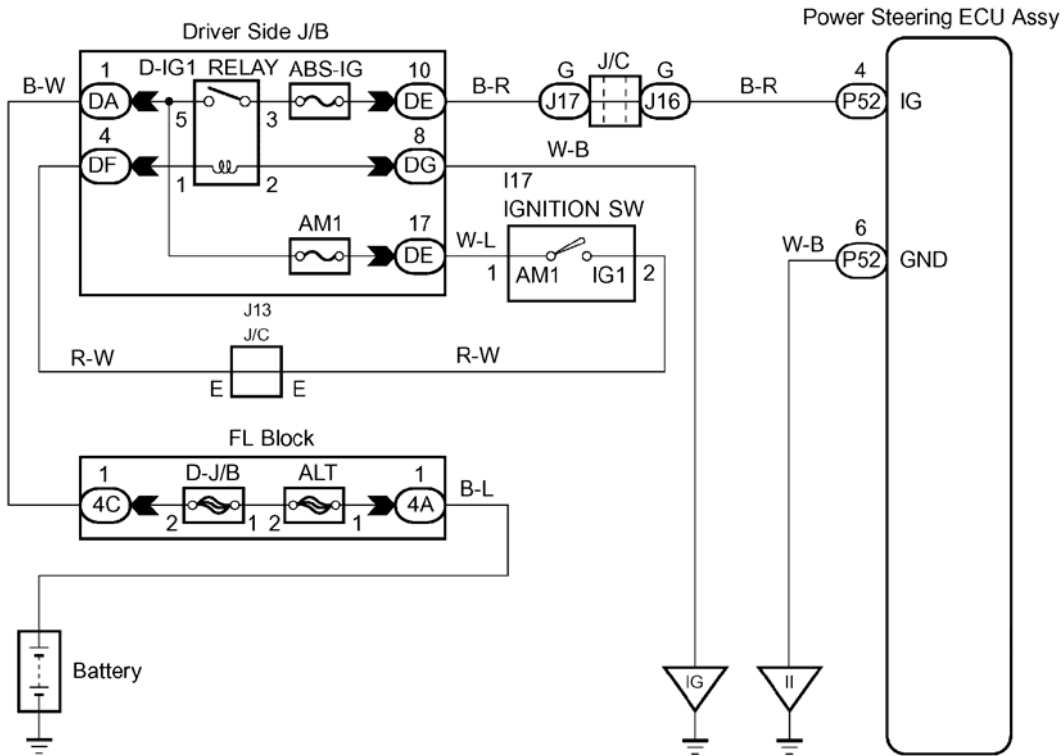
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

IG POWER SOURCE CIRCUIT

CIRCUIT DESCRIPTION

The IG power source circuit supplies battery voltage to the power steering ECU assy. This power source operates the PPS linear solenoid valve assy.

WIRING DIAGRAM



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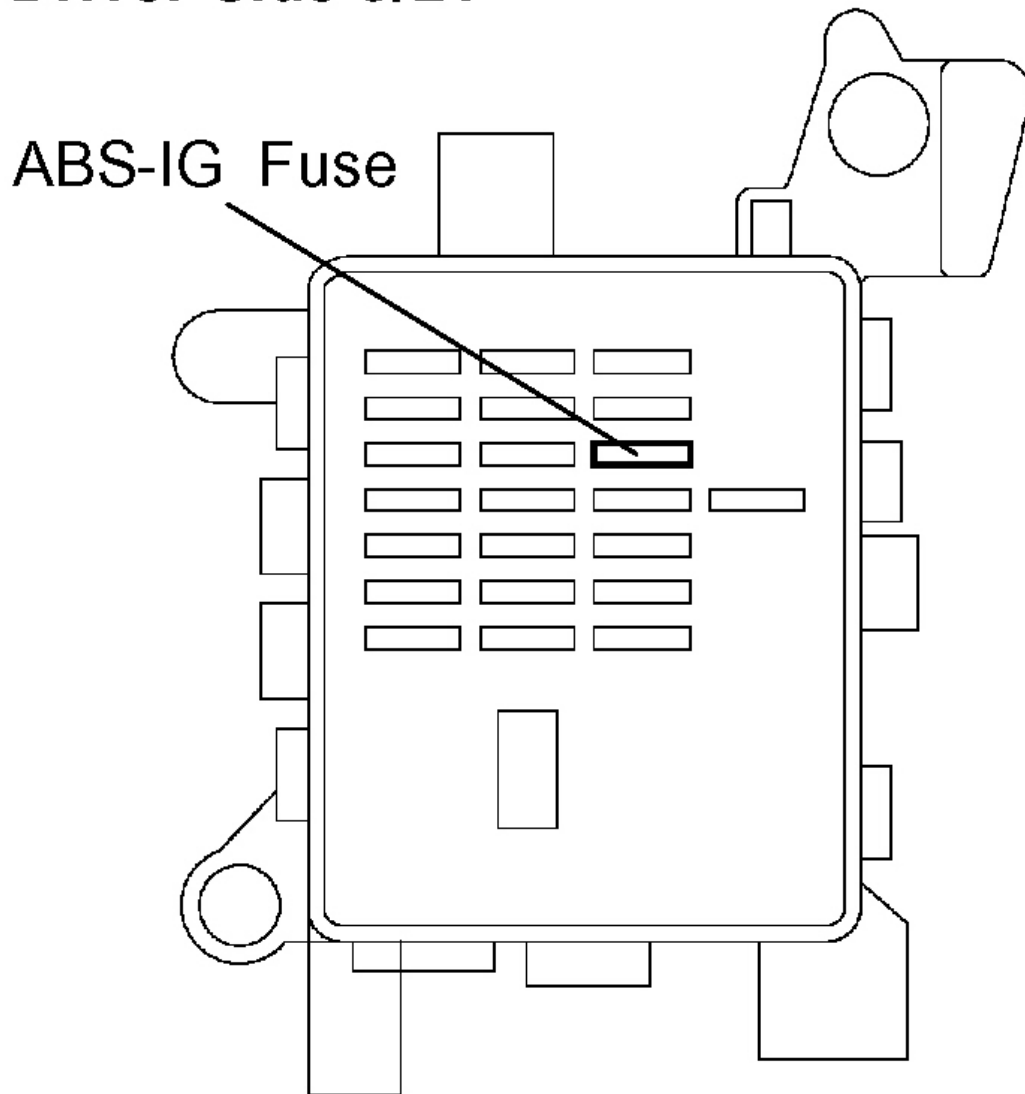
Fig. 6: IG Power Source Circuit - Wiring Diagram
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. **INSPECT FUSE (ABS-IG)**
 - a. Remove the ABS-IG fuse from the driver side J/B.
 - b. Check the continuity of the ABS-IG fuse.

Standard: Continuity

Driver Side J/B:



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Fig. 7: Inspecting Fuse (ABS-IG)

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

NG: INSPECT FOR SHORT IN ALL COMPONENTS CONNECTED TO FUSE AND REPAIR OR REPLACE THEM IF NEEDED, AND REPLACE FUSE

OK: Go to next step.

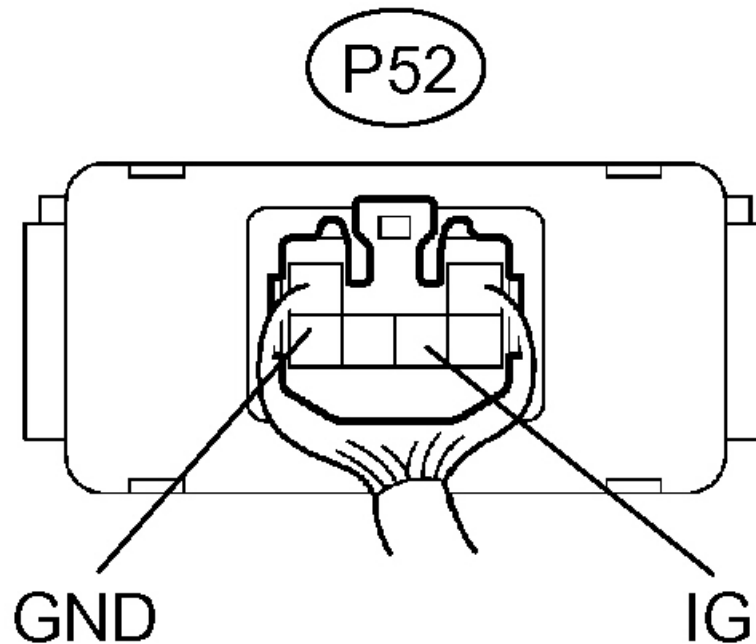
2. INSPECT POWER STEERING ECU ASSY

- a. Remove the power steering ECU assy with the connector still connected.
- b. Turn the ignition switch to the ON position.
- c. Measure the voltage according to the value(s) in **POWER STEERING ECU ASSY** .

Standard:

POWER STEERING ECU ASSY

Tester Connection	Condition	Specified Condition
P52-4 (IG)-P52-6 (GND)	Ignition switch ON	10 to 14V



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Fig. 8: Inspecting Power Steering ECU Assy
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: Go to step 3

OK: REPLACE POWER STEERING ECU ASSY (See step 8 in REPLACEMENT)

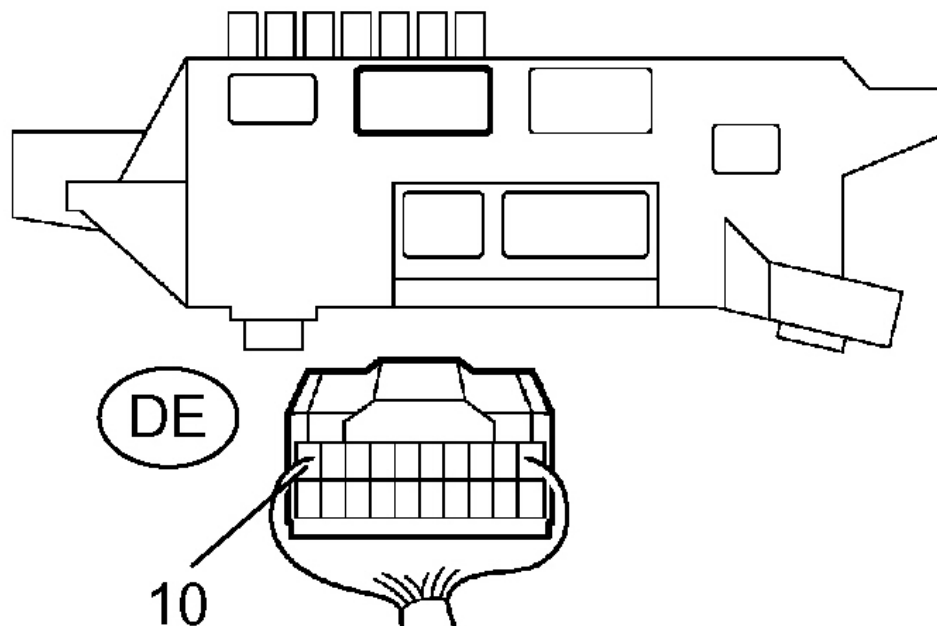
3. **CHECK HARNESS AND CONNECTOR (POWER STEERING ECU ASSY - DRIVER SIDE J/B)**
 - a. Disconnect the connector from the driver side J/B.
 - b. Disconnect the connector from the power steering ECU assy.
 - c. Measure the resistance according to the value(s) in **POWER STEERING ECU ASSY - DRIVER SIDE J/B** .

Standard:

POWER STEERING ECU ASSY - DRIVER SIDE J/B

Tester Connection	Condition	Specified Condition
DE-10 - P52-4 (IG)	Always	Below 1 ohms
P52-4 (IG) - Body ground	Always	10 kohms or higher

Driver Side J/B:



Power Steering ECU Assy:

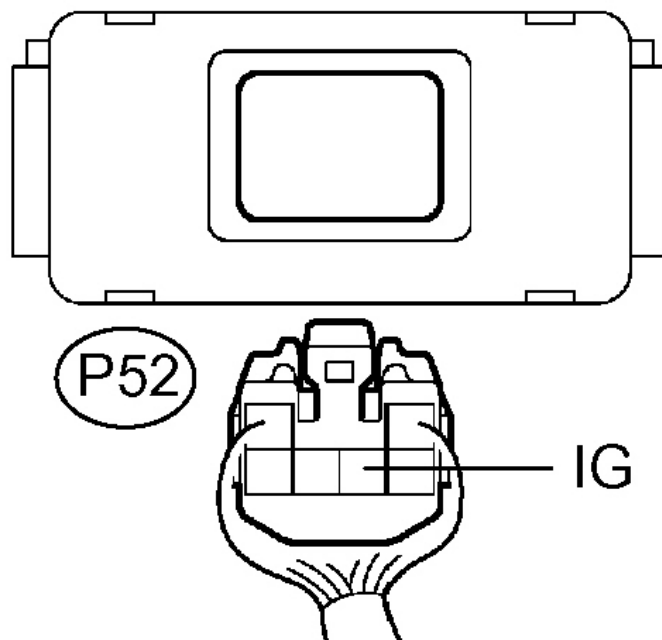


Fig. 9: Checking Harness And Connector (Power Steering ECU Assy - Driver Side J/B)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: Go to next step.

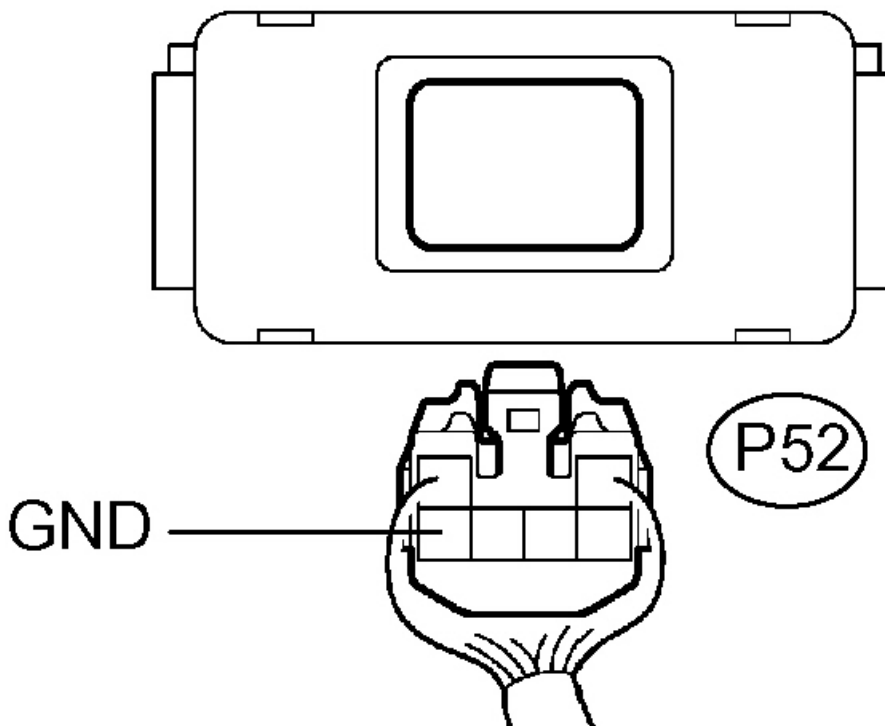
4. CHECK HARNESS AND CONNECTOR (POWER STEERING ECU ASSY - BODY GROUND)

- a. Measure the resistance according to the value(s) in **POWER STEERING ECU ASSY - BODY GROUND**.

Standard:

POWER STEERING ECU ASSY - BODY GROUND

Tester Connection	Condition	Specified Condition
P52-6 (GND) -Body ground	Always	Below 1 ohms



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Fig. 10: Checking Harness And Connector (Power Steering ECU Assy - Body Ground)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE

PPS LINEAR SOLENOID CIRCUIT

CIRCUIT DESCRIPTION

This circuit supplies electric power to the PPS linear solenoid valve assy. The power steering ECU assy controls the output current to the PPS linear solenoid valve assy in accordance with vehicle speed, adjusting the amount of power steering assist. As vehicle speed increases, the current to the solenoid decreases.

WIRING DIAGRAM

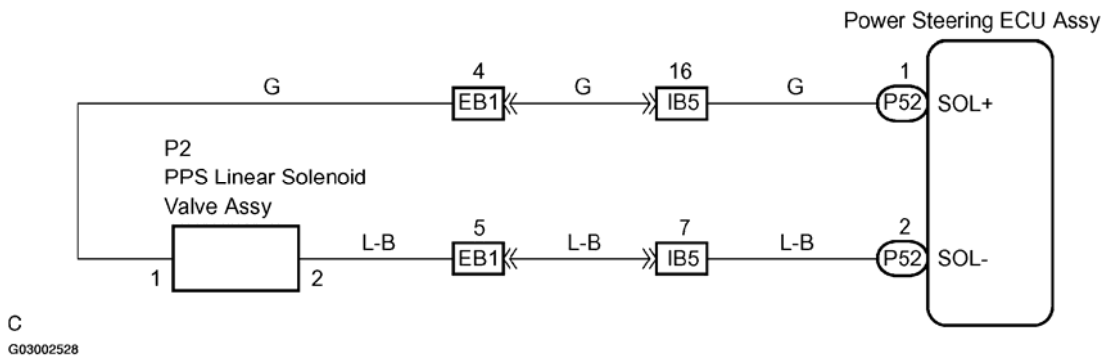


Fig. 11: PPS Linear Solenoid Circuit - Wiring Diagram
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. INSPECT PPS LINEAR SOLENOID VALVE ASSY

a. CHECK RESISTANCE OF SOLENOID

1. Disconnect the connector from the PPS linear solenoid valve assy.
2. Measure the resistance according to the value(s) in **PPS LINEAR SOLENOID VALVE - RESISTANCE TABLE**.

Standard:

PPS LINEAR SOLENOID VALVE - RESISTANCE TABLE

Tester Connection	Condition	Specified Condition
P2-1 (SOL+) -P2-2 (SOL-)	Always	6 to 11 ohms (-40 to 150°C)

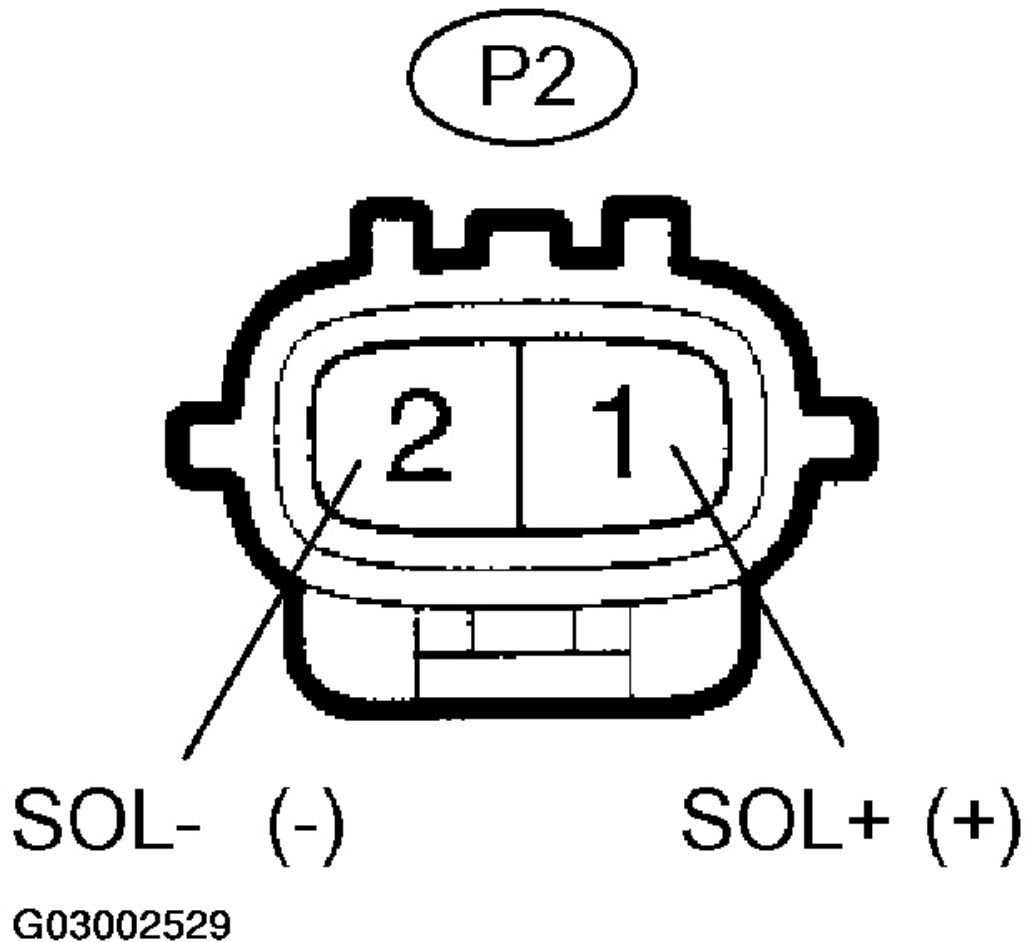


Fig. 12: Checking Resistance Of Solenoid
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. CHECK OPERATION OF SOLENOID

1. Connect the battery positive terminal to solenoid valve terminal 1 (SOL+) and the negative terminal to terminal 2 (SOL-).
2. Check that the solenoid makes a clicking sound.

OK:

The PPS linear solenoid valve assy makes a click sound.

HINT:

- Do not apply voltage for more than 30 seconds to avoid burnout of the solenoid.
- If repeating this step, wait until the solenoid cools down enough to be touched by hand.

NG: REPLACE RACK & PINION POWER STEERING GEAR ASSY (See step 15 in OVERHAUL)

OK: Go to next step.

2. CHECK HARNESS AND CONNECTOR (POWER STEERING ECU ASSY - PPS LINEAR SOLENOID VALVE ASSY)

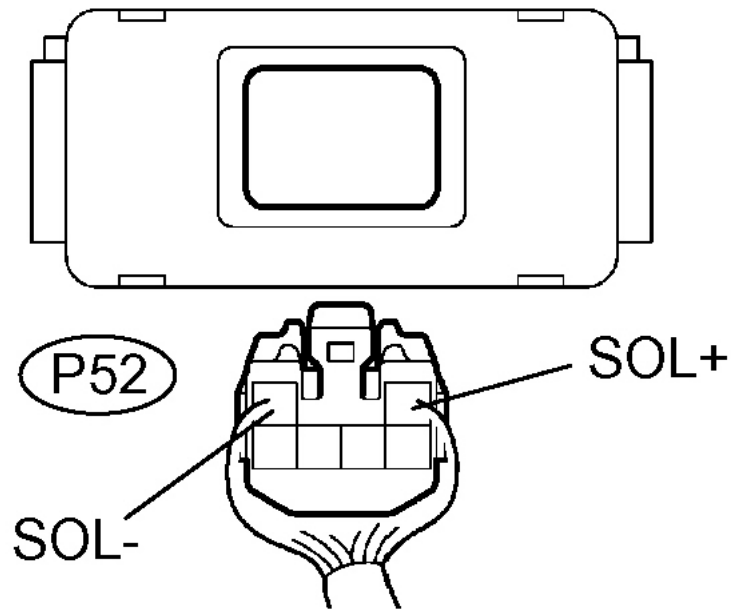
- Disconnect the connector from the power steering ECU assy.
- Measure the resistance according to the value(s) in the table below.

Standard:

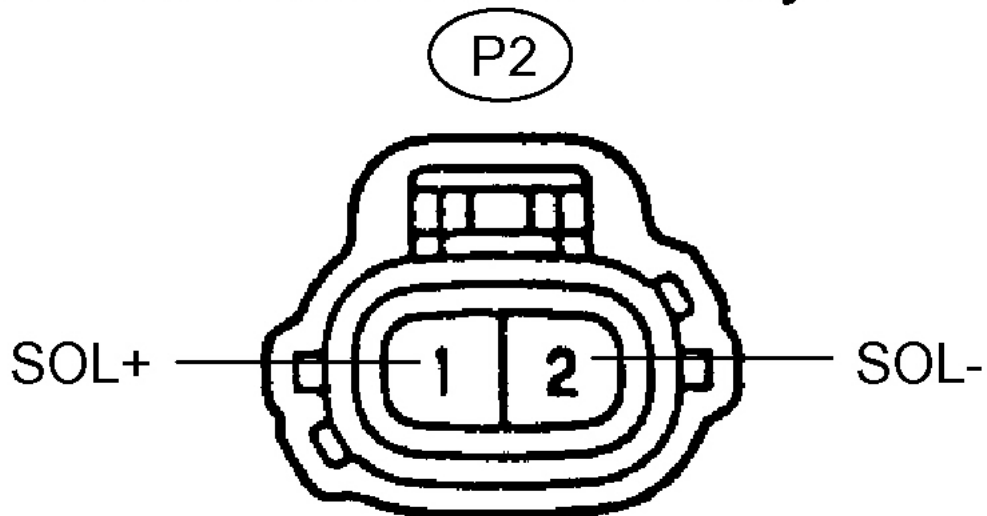
POWER STEERING ECU - PPS LINEAR SOLENOID VALVE - RESISTANCE TABLE

Tester Connection	Condition	Specified Condition
P52-1 (SOL+) -P2-1 (SOL+)	Always	Below 1 ohms
P52-2 (SOL-) -P2-2 (SOL-)	Always	Below 1 ohms
P52-1 (SOL+) -Body ground	Always	10 kohms or higher
P52-2 (SOL-) -Body ground	Always	10 kohms or higher

Power Steering ECU Assy:



PPS Linear Solenoid Valve Assy:



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Fig. 13: Checking Harness And Connector (Power Steering ECU Assy - PPS Linear Solenoid)

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

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE POWER STEERING ECU ASSY (See step 8 in REPLACEMENT)

VEHICLE SPEED SIGNAL CIRCUIT

CIRCUIT DESCRIPTION

In the vehicle speed signal circuit, the combination meter sends a vehicle speed signal to the power steering ECU assy. The power steering ECU assy controls the output current to the PPS linear solenoid valve assy based on this signal.

WIRING DIAGRAM

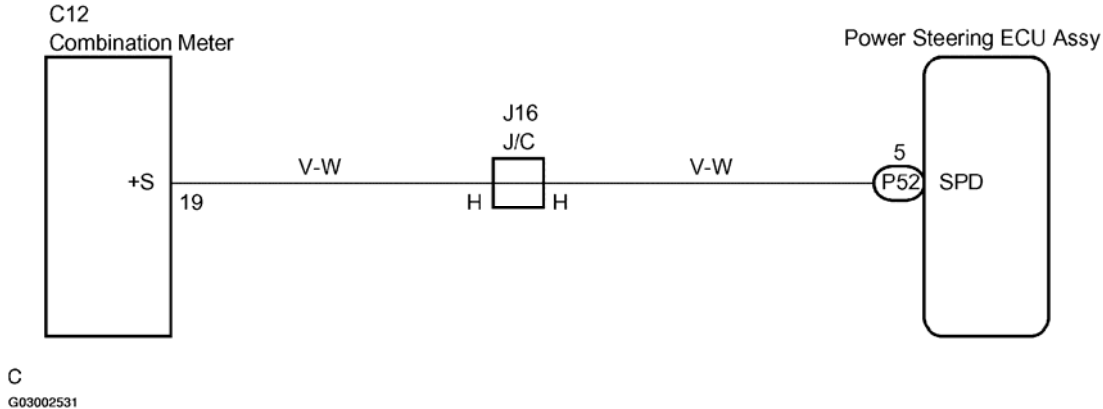


Fig. 14: Vehicle Speed Signal Circuit - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. **CHECK OPERATION OF SPEEDOMETER**
 - a. Drive the vehicle and check the operation of the speedometer.

HINT:

The vehicle speed sensor is operating normally if the speedometer display is normal

OK:

Speedometer display in the combination meter is normal.

NG: CHECK SPEEDOMETER CIRCUIT (See MALFUNCTION IN SPEEDOMETER)

OK: Go to next step.

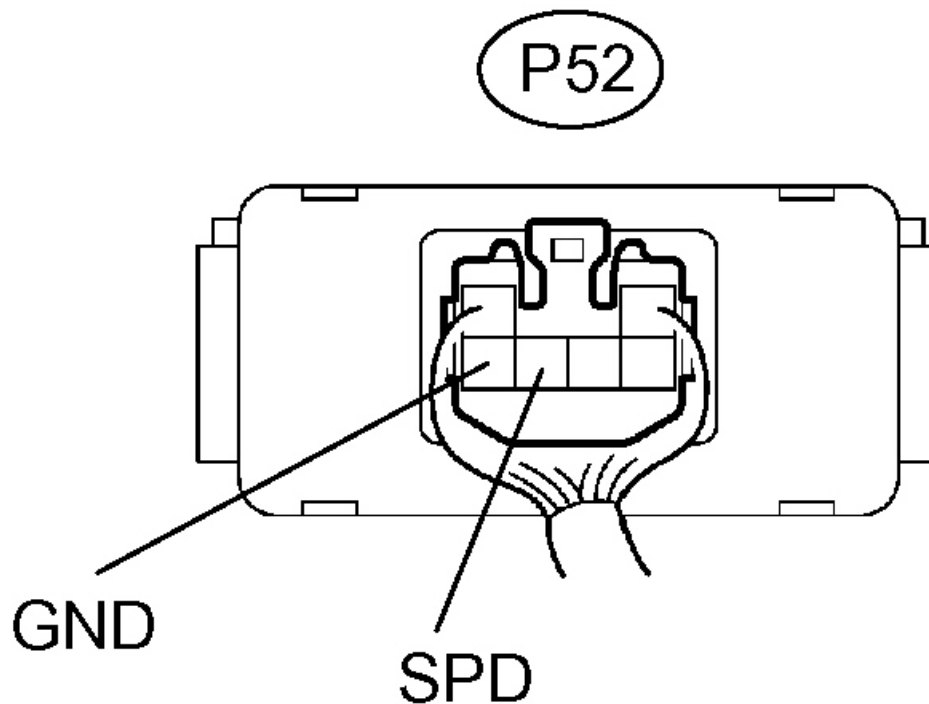
2. INSPECT POWER STEERING ECU ASSY (SPD VOLTAGE)

- a. Shift the lever to neutral.
- b. Jack up the vehicle.
- c. Turn the ignition switch to the ON position.
- d. Check the signal waveform according to the condition in **POWER STEERING ECU - WAVEFORM TABLE** .

OK:

POWER STEERING ECU - WAVEFORM TABLE

Tester Connection	Condition	Specified Condition
P52-5 (SPD) -P52-6 (GND)	Ignition switch ON, rotate driving wheel slowly	Pulse generation (4.5 to 5.5 <=> 0 V)



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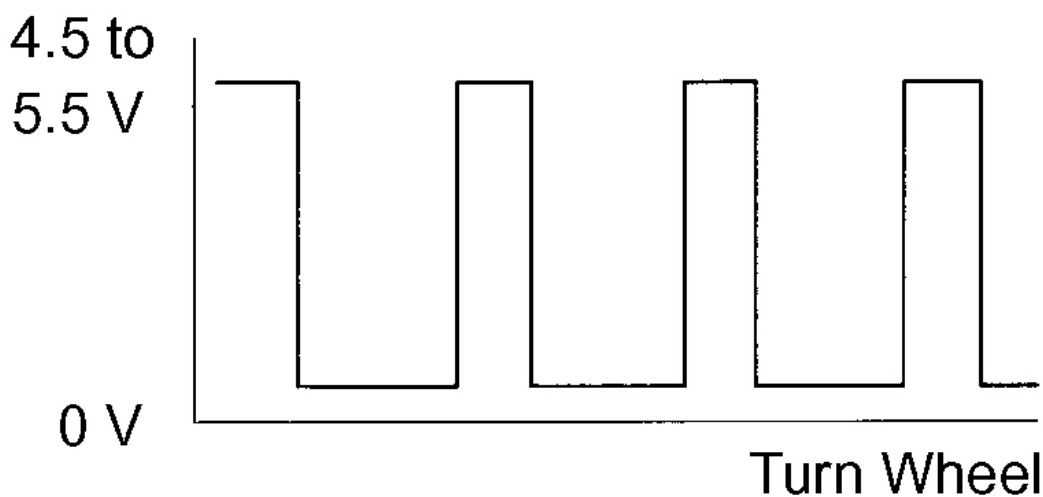
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Fig. 15: Inspecting Power Steering ECU Assy (SPD Voltage)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

The output voltage should fluctuate up and down similarly to the diagram when the wheel is turned slowly.

Pulse Generation



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Fig. 16: Identifying Output Voltage Should Fluctuate Up And Down Blinking Pattern
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE POWER STEERING ECU ASSY (See step 8 in REPLACEMENT)