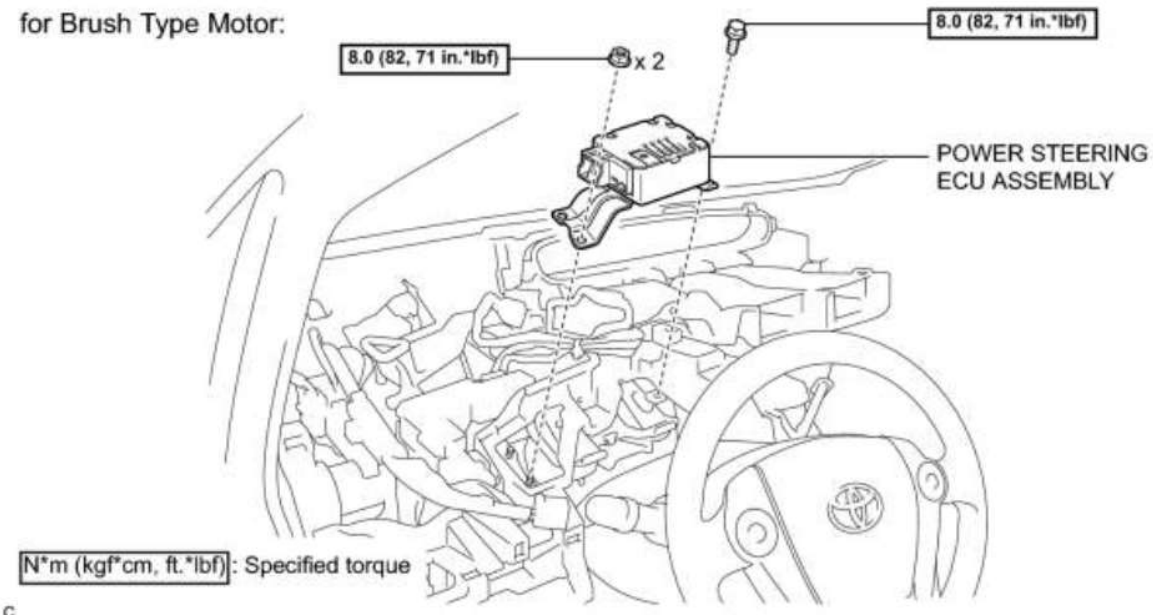
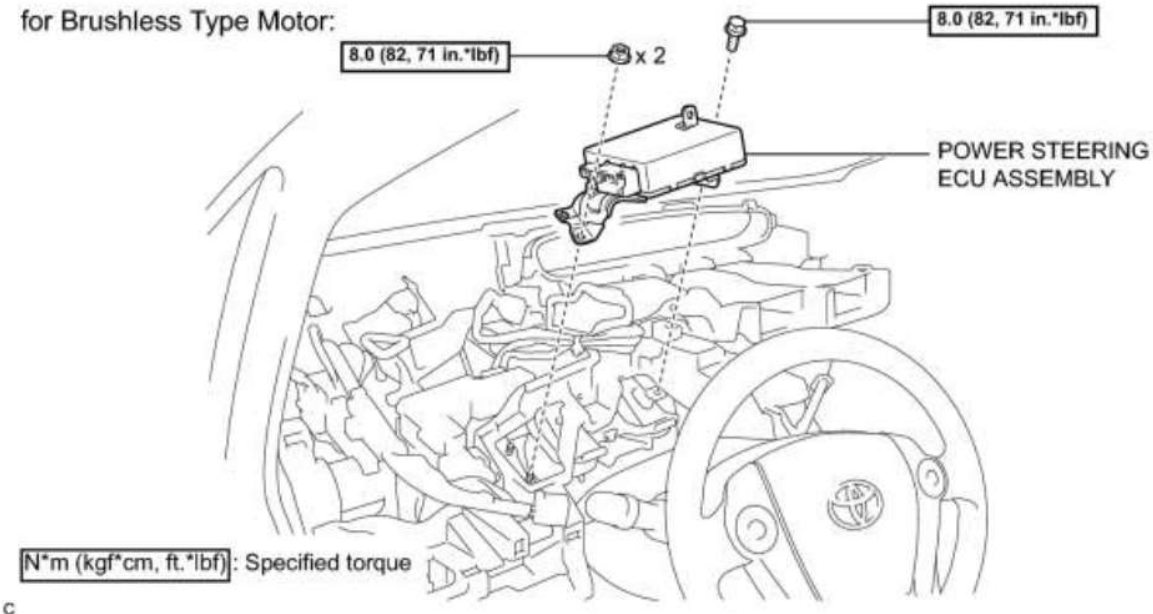
COMPONENTS

ILLUSTRATION



c

ILLUSTRATION



c

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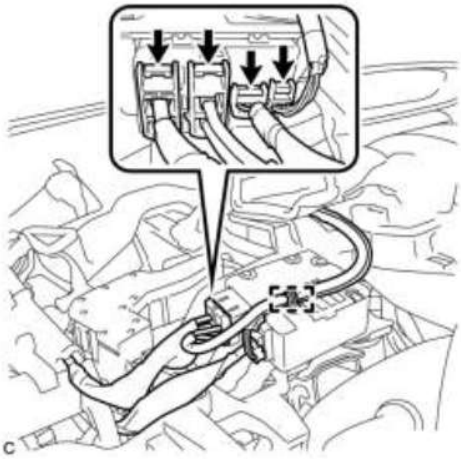
REMOVAL

1. REMOVE UPPER INSTRUMENT PANEL

HINT:

Refer to the instructions for Removal of the upper instrument panel INFO.

2. REMOVE POWER STEERING ECU ASSEMBLY (for Brush Type Motor)



(a) Disengage the wire harness clamp from the power steering ECU assembly.

(b) Disconnect the 4 connectors from the power steering ECU assembly.

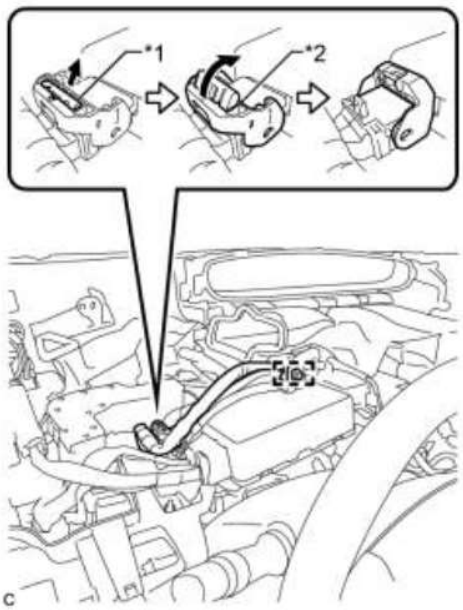


(c) Remove the bolt, 2 nuts, and the power steering ECU assembly.

3. REMOVE POWER STEERING ECU ASSEMBLY (for Brushless Type Motor)

(a) Disengage the wire harness clamp from the power steering ECU assembly.

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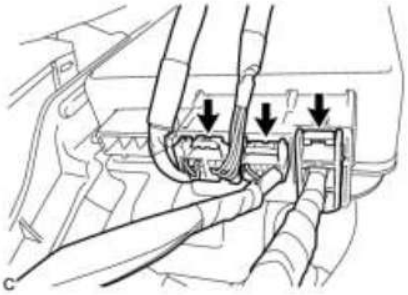
Text in Illustration

*1	Lock of the Lock Lever
*2	Lock Lever

(b) Disconnect the connector from the power steering ECU assembly.

HINT:

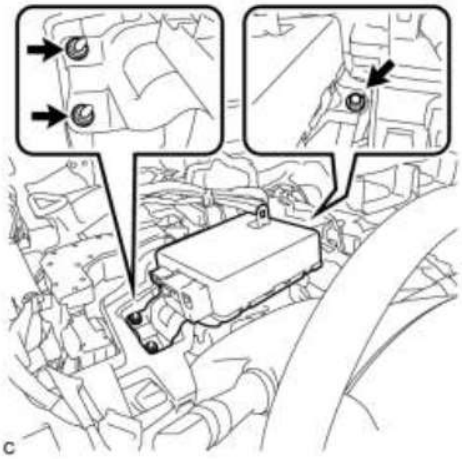
As shown in the illustration, pull out the lock of the lock lever and turn the lock lever to disconnect the connector.



(c) Disconnect the 3 connectors from the power steering ECU assembly.

(d) Remove the bolt, 2 nuts, and the power steering ECU assembly.

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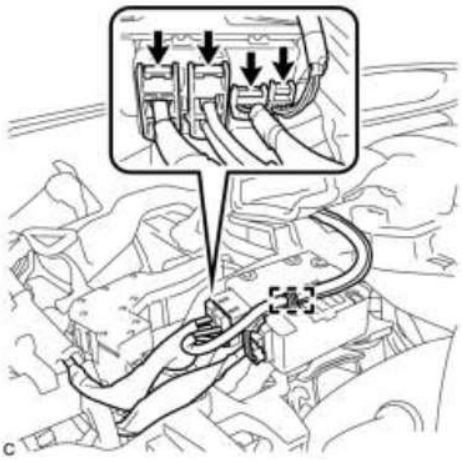
INSTALLATION

1. INSTALL POWER STEERING ECU ASSEMBLY (for Brush Type Motor)



(a) Install the power steering ECU assembly with the bolt and 2 nuts.

Torque: **8.0 N·m (82 kgf·cm, 71in·lbf)**



(b) Connect the 4 connectors to the power steering ECU assembly.

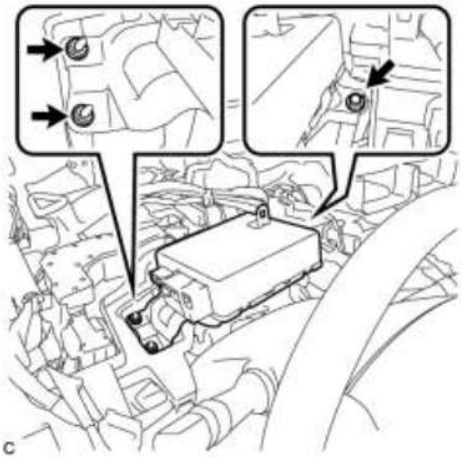
(c) Engage the wire harness clamp to the power steering ECU assembly.

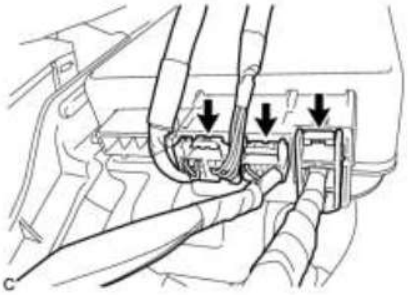
2. INSTALL POWER STEERING ECU ASSEMBLY (for Brushless Type Motor)

(a) Install the power steering ECU assembly with the bolt and 2 nuts.

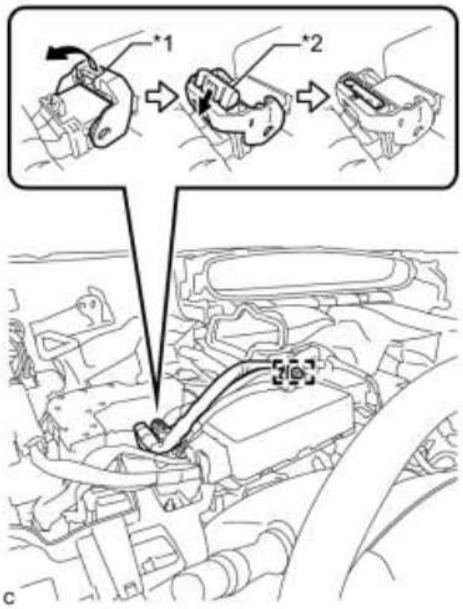
Torque: **8.0 N·m (82 kgf·cm, 71in·lbf)**

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(b) Connect the 3 connectors to the power steering ECU assembly.



(c) Connect the connector to the power steering ECU assembly.

Text in Illustration

*1	Lock Lever
*2	Lock of the Lock Lever

HINT:

As shown in the illustration, return the lock lever to its original position to connect the connector and securely push in the lock of the lock lever.

(d) Engage the wire harness clamp to the power steering ECU assembly.

3. INSTALL UPPER INSTRUMENT PANEL

HINT:

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Refer to the instructions for Installation of the upper instrument panel INFO.

4. TORQUE SENSOR ZERO POINT CALIBRATION (for Brush Type Motor)

(a) Perform the torque sensor zero point calibration INFO.

5. ASSIST MAP WRITING (for Brush Type Motor)

(a) Perform assist map writing INFO.

6. ROTATION ANGLE SENSOR INITIALIZATION AND TORQUE SENSOR ZERO POINT CALIBRATION (for Brushless Type Motor)

(a) Clear the rotation angle sensor calibration value, initialize the rotation angle sensor, and calibrate the torque sensor zero point INFO.

7. ASSIST MAP WRITING (for Brushless Type Motor)

(a) Perform assist map writing INFO.

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PRECAUTION

1. DETERMINING POWER STEERING SYSTEM TYPE

(a) Two types of power steering system are available for this model. A different type of motor is used for each system; a brushless type motor and a brush type motor. Refer to the table below to determine which type of motor is used.

Types

Type of Motor	Model
Brushless Type Motor	Mexico package models and models with 215/45R17 tires
Brush Type Motor	Other than those above

2. PRECAUTION FOR DISCONNECTING THE BATTERY CABLE

NOTICE:

When disconnecting the battery negative (-) cable, initialize the following system after the cable is reconnected:

System	See Procedure
Advanced Parking Guidance System	INFO

3. HANDLING PRECAUTIONS FOR SRS AIRBAG SYSTEM

(a) The vehicle is equipped with a Supplemental Restraint System (SRS). Failure to carry out service operations in the correct sequence could cause the SRS to unexpectedly deploy during servicing. This may cause a serious accident.

Before servicing (including inspection, replacement, removal and installation of parts), be sure to read the precautionary notices for the Supplemental Restraint System INFO.

4. PRECAUTIONS FOR REMOVAL, INSTALLATION AND REPLACEMENT OF ELECTRONIC POWER STEERING COMPONENTS

(a) Be sure to align the front wheels straight ahead when removing and installing the power steering gear assembly.

(b) When disconnecting the No. 2 steering intermediate shaft assembly, be sure to place matchmarks before starting the operation.

(c) After replacing the steering column assembly or power steering ECU, calibrate the torque sensor zero point INFO.

5. HANDLING PRECAUTION

(a) When handling electronic parts:

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(1) Avoid any impact to parts such as ECUs and relays. Replace them with new ones if dropped or subjected to a severe blow.

(2) Do not expose to high temperatures or humidity.

(3) In order to prevent deformation or malfunctions due to static electricity, do not touch the connector terminals.

(b) When handling the power steering ECU:

(1) When the power steering ECU has been replaced with a new one, perform the assist map writing and the torque sensor zero point calibration INFO.

(c) When handling the steering column assembly:

(1) Avoid any impact to the steering column assembly, especially to the motor and torque sensor. Replace them with new ones if dropped or subjected to a severe blow.

(2) Do not pull the wire harness when moving the steering column assembly.

(3) When the steering column assembly has been replaced, perform the torque sensor zero point calibration after initializing the torque sensor zero point INFO.

(d) When disconnecting and reconnecting the connectors:

(1) Before disconnecting the connectors related to the power steering system, turn the power switch on (IG), center the steering wheel, turn the power switch off, and then disconnect the connectors.

(2) Before reconnecting the connectors related to the power steering system, ensure that the power switch is off. Then center the steering wheel and turn the power switch on (IG).

NOTICE:

Do not turn the power switch on (IG) when the steering wheel is not centered.

(3) If the above operations are not carried out properly, the steering center point (zero point) will deviate, which may lead to a difference in steering effort between turning right and left. If there is a difference in steering effort between turning right and left, perform the torque sensor zero point calibration after initializing the torque sensor zero point INFO.

6. PRECAUTIONS FOR CAN COMMUNICATION

(a) CAN communication lines are used to receive information from the skid control ECU and the power management control ECU, and to transmit warnings to the combination meter. When there are any problems in the CAN communication lines, DTCs of the CAN communication line are output.

(b) Perform troubleshooting of the communication line problems when the CAN communication DTCs are output. Be sure to start troubleshooting on the electronic power steering system after confirming that the CAN communication system is normal.

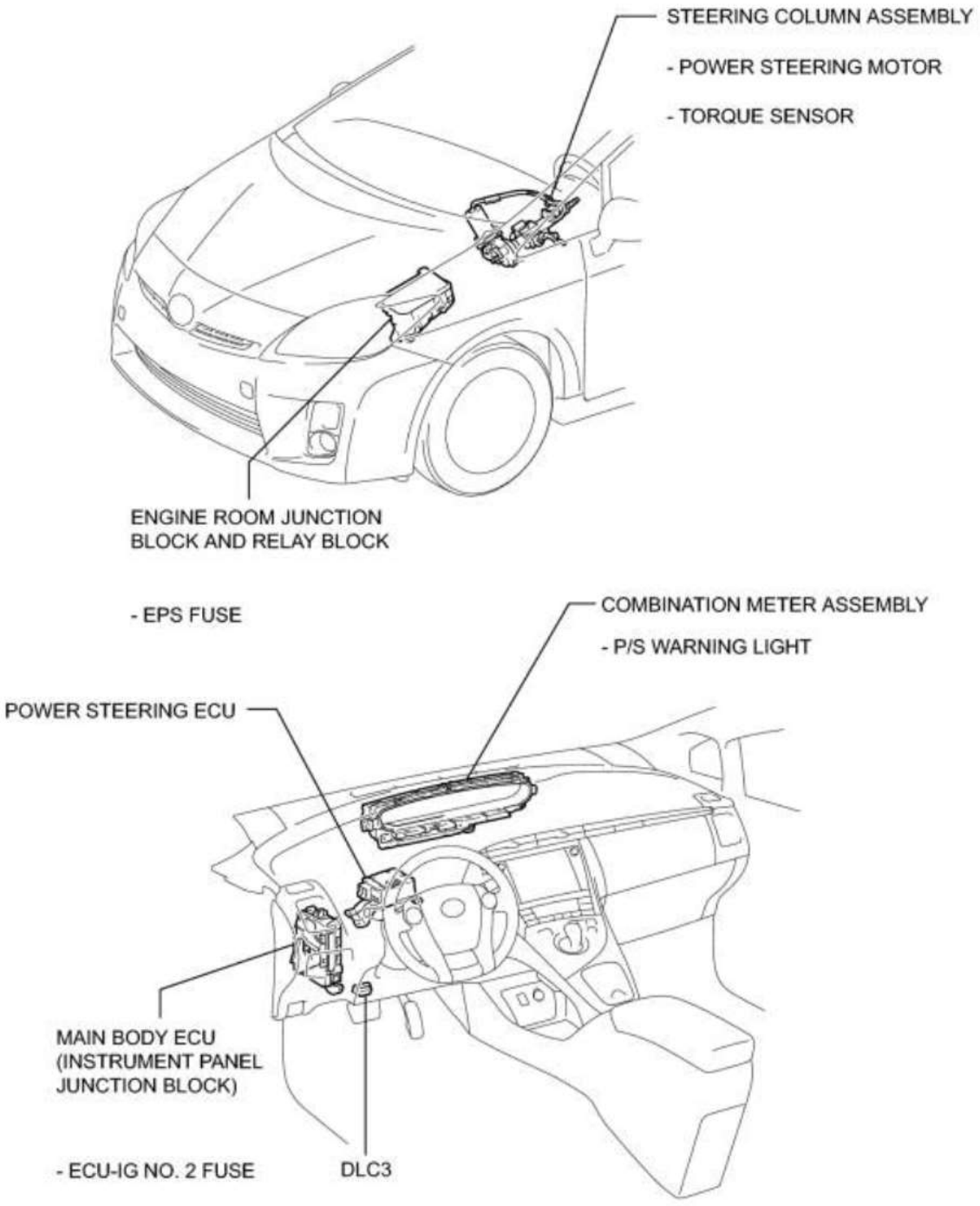
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(c) Since the CAN communication line has its own length and route, it cannot be temporarily repaired with a bypass wire, etc.

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PARTS LOCATION

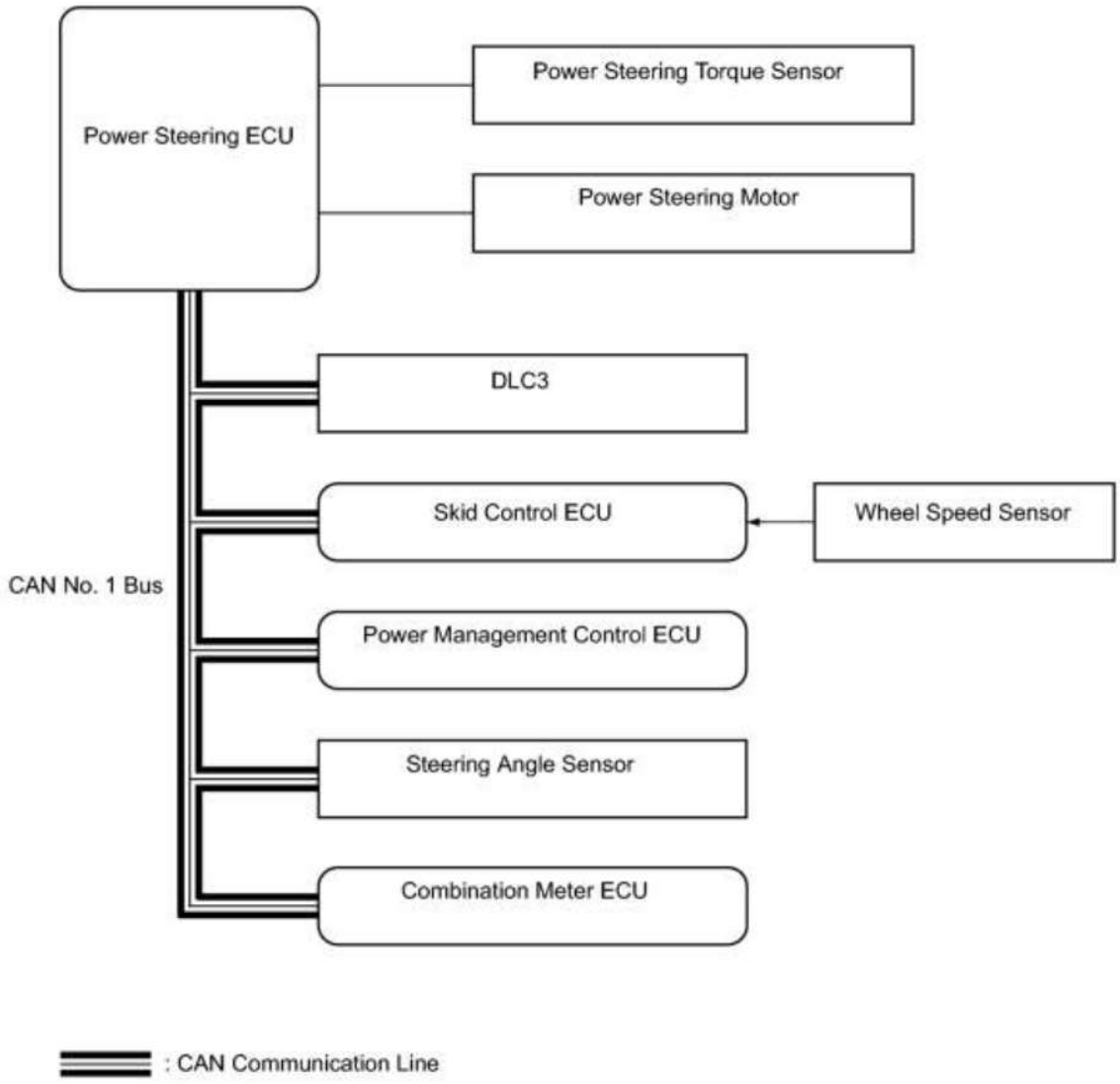
ILLUSTRATION



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SYSTEM DIAGRAM



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SYSTEM DESCRIPTION

1. DESCRIPTION

The power steering system generates torque through the operation of the motor and the reduction gear installed on the column shaft in order to assist steering effort.

The power steering ECU determines the direction and the amount of assisting power in accordance with the vehicle speed signals and signals from the torque sensor built into the steering column assembly. As a result, steering effort is controlled to be light during low speed driving and moderately high during high speed driving.

(a) Power steering ECU:

The power steering ECU calculates assisting power based on steering torque signals from the torque sensor and vehicle speed signals from the skid control ECU.

(b) Torque sensor:

The torque sensor detects the steering effort generated when the steering wheel is turned and converts it to an electrical signal.

(c) Power steering motor:

The power steering motor is activated by the current from the power steering ECU and generates torque to assist the steering effort.

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HOW TO PROCEED WITH TROUBLESHOOTING

HINT:

- Use these procedures to troubleshoot the power steering system.
- *: Use the Techstream.

1.	VEHICLE BROUGHT TO WORKSHOP

NEXT

2.	INSPECT BATTERY VOLTAGE

Standard voltage:

11 to 14 V

If the voltage is below 11 V, recharge or replace the battery before proceeding to the next step.

NEXT

3.	CHECK DTC AND FREEZE FRAME DATA*

HINT:

Refer to Clear DTCs INFO.

NEXT

4.	PROBLEM SYMPTOM CONFIRMATION

Result:

Result	Proceed to
Symptom does not occur.	A
Symptom occurs.	B

B Go to step 6

A

5.	SYMPTOM SIMULATION

NEXT

6.	CHECK CAN COMMUNICATION SYSTEM*

(a) Check for DTCs INFO.

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Result:

Result	Proceed to
CAN system DTC is not output	A
CAN system DTC is output	B

HINT:

- If any CAN communication system DTCs are output, perform troubleshooting on the CAN communication system first.
- If communication to the power steering ECU cannot be established through the Techstream, inspect terminals CANH and CANL of the DLC3 and the power steering ECU, and the IG circuit of the power steering ECU.

B INFO PROCEED TO CAN COMMUNICATION SYSTEM

A

7.	CHECK FOR DTC*

(a) Check for DTCs INFO.

HINT:

Refer to Diagnostic Trouble Code Chart when any DTCs are output INFO.

Result:

Result	Proceed to
DTC is not output	A
DTC is output	B

B Go to step 9

A

8.	PROBLEM SYMPTOMS TABLE

(a) Refer to Problem Symptoms Table INFO.

Result:

Result	Proceed to
Fault is not listed in problem symptoms table	A
Fault is listed in problem symptoms table	B

B Go to step 9

A

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9.	OVERALL ANALYSIS AND TROUBLESHOOTING*

(a) Refer to Terminals of ECU INFO.

(b) Refer to Data List / Active Test INFO.

NEXT

10.	REPAIR OR REPLACE

NEXT

11.	CONFIRMATION TEST

NEXT **END**

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CALIBRATION

1. TORQUE SENSOR ZERO POINT CALIBRATION

NOTICE:

Perform the torque sensor zero point calibration if any of the following conditions occur:

- The steering column assembly (containing the torque sensor) has been replaced.
- The power steering ECU has been replaced.
- There is a difference in steering effort between turning right and left.

HINT:

When torque sensor zero point calibration is performed, the assist map is written automatically at the same time.

(a) Inspection before calibration.

(1) Turn the power switch off.

(2) Connect the Techstream to the DLC3.

(3) Turn the power switch on (IG).

(4) Turn the Techstream on.

(5) Calibrate the power steering ECU. Enter the following menus: Chassis / EMPS / Data List.

(6) Check the values by referring to the table below.

EMPS

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
IG Power Supply	ECU power source voltage/ Min.: 0 V Max.: 20.1531 V	11 to 14 V	Power switch on (IG)

Standard voltage:

11 to 14 V

NOTICE:

If the IG power supply voltage is 9 V or less, calibration cannot be performed. In this case, charge or replace the battery, and then perform calibration.

(b) Perform the torque sensor zero point calibration.

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NOTICE:

If DTC C1516 (Torque Sensor Zero Point Adjustment Incomplete) is stored, the torque sensor zero point cannot be calibrated. Clear the DTC before starting calibration.

(1) Set the steering wheel to the center point and align the front wheels straight ahead.

(2) Turn the power switch off.

(3) Connect the Techstream to the DLC3.

(4) Turn the power switch on (READY).

(5) Turn the Techstream on.

(6) Calibrate the power steering ECU. Enter the following menus: Chassis / EMPS / Utility / Torque Sensor Adjustment.

NOTICE:

- Do not touch the steering wheel during the torque sensor zero point calibration.
- Perform the calibration only when the vehicle is stopped.

(7) Check for DTCs INFO.

NOTICE:

- After zero point calibration is completed normally, confirm that DTC is not output.
- If DTC C1515, C1516, C1534 or C1581 is output, perform troubleshooting for the corresponding DTC.

Result:

Result	See Procedure
DTC C1515 is output.	INFO
DTC C1516 is output.	INFO
DTC C1534 is output.	INFO
DTC C1581 is output.	INFO

2. ASSIST MAP WRITING

HINT:

If DTC C1581 is output after torque sensor zero point calibration, perform assist map writing.

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

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(c) Turn the power switch on (IG).

(d) Turn the Techstream on.

(e) Enter the following menus: Chassis / EMPS / Utility / Signal Check.

HINT:

- Follow the instructions on the Techstream to perform Signal Check.
- With DTC C1581 output, performing Signal Check will cause the power steering ECU to enter Test Mode and the assist map will be written automatically.

(f) Check for DTCs INFO.

HINT:

After writing the assist map, if DTC C1581 is output, perform the troubleshooting procedure for DTC C1581 INFO.

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PROBLEM SYMPTOMS TABLE

HINT:

- Use the table below to help determine the cause of problem symptoms. If multiple suspected areas are listed, the potential causes of the symptoms are listed in order of probability in the "Suspected Area" column of the table. Check each symptom by checking the suspected areas in the order they are listed. Replace parts as necessary.
- Inspect the fuses and relays related to this system before inspecting the suspected areas below.

Power Steering System

Symptom	Suspected Area	See page
Heavy steering	Front tires (improperly inflated, unevenly worn)	INFO
	Front wheel alignment (incorrect)	INFO
	Front suspension (lower ball joint)	INFO
	Steering column	INFO
	Torque sensor (built into steering column)	-
	Power steering motor	-
	Speed sensor	INFO
	Battery and power source system	-
	Power steering ECU power source voltage and relay	INFO
	Power steering ECU	INFO
	Skid control ECU	-
Steering effort differs between turning right and left, or steering effort is uneven.	Calibration of torque sensor zero point are not completed	INFO
	Front tires (improperly inflated, unevenly worn)	INFO
	Front wheel alignment (incorrect)	INFO
	Front suspension (lower ball joint)	INFO
	Power steering gear	INFO
	Torque sensor (built into steering column)	-
	Steering column	INFO
	Power steering motor	-
	Power steering ECU	INFO
While driving, steering effort does not change in accordance with vehicle speed or the steering wheel does not return properly.	Front suspension (lower ball joint)	INFO
	Speed sensor	INFO

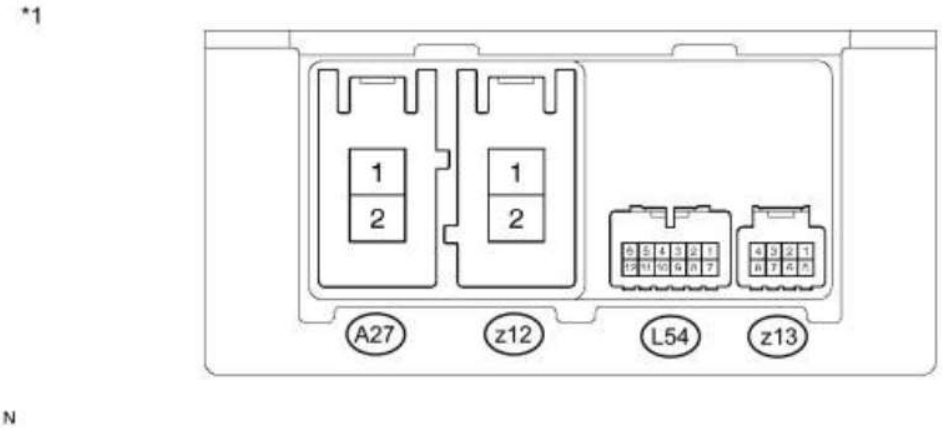
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Symptom	Suspected Area	See page
	Skid control ECU	-
	Combination meter	-
	Torque sensor (built into steering column)	-
	Power steering motor	-
	Power steering ECU	INFO
	CAN communication system	-
A knocking (or clunking) sound occurs when turning the steering wheel back and forth while power steering is operating.	Front suspension (lower ball joint)	INFO
	Steering intermediate shaft	-
	Power steering ECU	INFO
Noise occurs when turning the steering wheel during low-speed driving.	Power steering gear	INFO
	Steering column	INFO
Friction occurs when turning the steering wheel during low-speed driving.	Power steering motor	-
	Steering column	INFO
A high-pitched sound (squeaking) occurs when turning the steering wheel slowly with the vehicle stopped.	Power steering motor	-
The steering wheel vibrates and noise occurs when turning the steering wheel from lock to lock with the vehicle stopped.	Power steering gear	INFO
	Steering column	INFO
P/S warning light remains on.	P/S warning light	INFO

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TERMINALS OF ECU

1. CHECK POWER STEERING ECU



Text in Illustration

*1	Component without harness connected (Power Steering ECU)

(a) Measure the voltage and resistance according to the value(s) in the table below.

NOTICE:

- Check if the power steering ECU connectors are securely connected by pulling on them from the backside.
- If the P/S warning light is illuminated due to a malfunction, the fail-safe function may cause the voltage of the power steering ECU's terminals to become 0 V.

Terminals No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
A27-1 (PIG) - Body ground	W - Body ground	Power steering motor power supply input signal	Always	11 to 14 V
A27-2 (PGND) - Body ground	W-B - Body ground	Power ground	Always	Below 1 Ω
z12-1 (M1) - Body ground	R - Body ground	Power steering motor output signal 1	Power switch on (READY), steering wheel turned to left	11 to 14 V
			Power switch on (READY), steering wheel turned to right	Below 1 V
z12-2 (M2) - Body ground	B - Body ground	Power steering motor output signal 2	Power switch on (READY), steering wheel turned to left	Below 1 V
			Power switch on (READY), steering wheel turned to right	11 to 14 V

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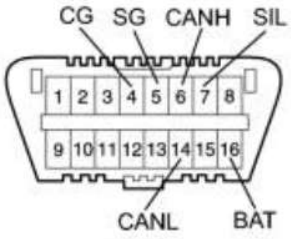
Terminals No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
L54-1 (CANH) - L54-7 (CANL)	R - W	CAN communication line (CAN HI signal)	Power switch off	54 to 69 Ω
L54-6 (IG) - Body ground	B - Body ground	IG power source	Power switch on (IG)	11 to 14 V
L54-7 (CANL) - L54-1 (CANH)	W - R	CAN communication line (CAN LO signal)	Power switch off	54 to 69 Ω
z13-5 (TRQ1) - Body ground	W - Body ground	Torque sensor 1 input signal	Power switch on (READY), steering wheel not turned (without load)	2.3 to 2.7 V
			Power switch on (READY), steering wheel turned to right	2.5 to 4.7 V
			Power switch on (READY), steering wheel turned to left	0.3 to 2.5 V
z13-6 (TRQV) - Body ground	R - Body ground	Torque sensor power source	Power switch on (READY)	7.5 to 8.5 V
z13-7 (TRQ2) - Body ground	Y - Body ground	Torque sensor 2 input signal	Power switch on (READY), steering wheel not turned (without load)	2.3 to 2.7 V
			Power switch on (READY), steering wheel turned to right	2.5 to 4.7 V
			Power switch on (READY), steering wheel turned to left	0.3 to 2.5 V
z13-8 (TRQG) - Body ground	B - Body ground	Torque sensor ground	Always	Below 1 Ω

If the result is not as specified, the ECU may have a malfunction.

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DIAGNOSIS SYSTEM

1. CHECK DLC3



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(a) The ECU uses ISO 15765-4 for communication protocol. The terminal arrangement of the DLC3 complies with SAE J1962 and matches the ISO 15765-4 format.

Symbol (Terminal No.)	Terminal Description	Condition	Specified Condition
SIL (7) - SG (5)	Bus "+" line	During transmission	Pulse generation
CG (4) - Body ground	Chassis ground	Always	Below 1 Ω
SG (5) - Body ground	Signal ground	Always	Below 1 Ω
BAT (16) - Body ground	Battery positive	Always	11 to 14 V
CANH (6) - CANL (14)	CAN bus line	Power switch off*	54 to 69 Ω
CANH (6) - CG (4)	HIGH-level CAN bus line	Power switch off*	200 Ω or higher
CANL (14) - CG (4)	LOW-level CAN bus line	Power switch off*	200 Ω or higher
CANH (6) - BAT (16)	HIGH-level CAN bus line	Power switch off*	6 Ω or higher
CANL (14) - BAT (16)	LOW-level CAN bus line	Power switch off*	6 Ω or higher

NOTICE:

*: Before measuring the resistance, leave the vehicle as is for at least 1 minute and do not operate the power switch or any other switches or the doors.

(b) If the result is not as specified, the DLC3 may have a malfunction. Repair or replace the harness and connector.

HINT:

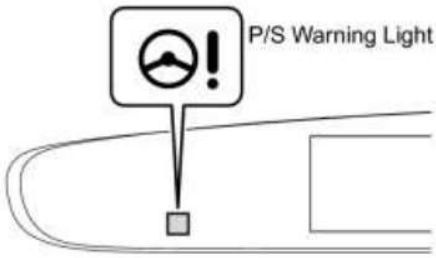
Connect the Techstream cable to the DLC3, turn the power switch on (IG) and attempt to use the Techstream. If the display indicates that a communication error has occurred, there is a problem either with the vehicle or with the Techstream.

- If communication is normal when the Techstream is connected to another vehicle, inspect the DLC3 of the original vehicle.

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- If communication is still not possible when the Techstream is connected to another vehicle, the problem may be in the Techstream itself. Consult the Service Department listed in the Techstream instruction manual.

2. CHECK WARNING LIGHT



(a) If a problem occurs in the power steering system, the P/S warning light on the combination meter comes on to inform the driver of the problem.

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DTC CHECK / CLEAR

1. CHECK DTCs

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (IG).

(d) Turn the Techstream on.

(e) Read the DTCs following the display on the Techstream. Enter the following menus: Chassis / EMPS / Trouble Codes.

(f) Refer to the Diagnostic Trouble Code Chart for DTC information INFO.

2. CLEAR DTCs

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (IG).

(d) Turn the Techstream on.

(e) Clear the DTCs following the display on the Techstream. Enter the following menus: Chassis / EMPS / Trouble Codes.

(f) According to the display on the Techstream, select the trouble code data display with the clear button.

(g) Turn the power switch off.

(h) Disconnect the Techstream from the DLC3.

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FREEZE FRAME DATA

1. FREEZE FRAME DATA

NOTICE:

- Freeze frame data values will vary depending on the measurement conditions, surroundings, or vehicle conditions. For this reason, there may be a problem even if the values are within specifications.
- Turn the power switch on (IG) and park the vehicle on level ground. Check the freeze frame data by using the Techstream.

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (IG).

(d) Turn the Techstream on.

(e) Check the freeze frame data on the Techstream.

EMPS

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Meter Vehicle Velocity	Vehicle speed from meter/ Min.: 0 km/h (mph) Max.: 300 km/h (186.4 mph)	0 km/h (0 mph)	Turn the power switch on (READY) and vehicle stopped
		No significant fluctuation	Turn the power switch on (READY) and vehicle driven at constant speed
Motor Actual Current	Current to motor/ Min.: -327.68 A Max.: 327.67 A	Value changes in proportion to steering effort	Turn the power switch on (READY) and power steering is in operation
Command Value Current	Requested current to motor/ Min.: -327.68 A Max.: 327.67 A	Value changes in proportion to steering effort	Turn the power switch on (READY) and power steering is in operation
Thermistor Temperature	ECU substrate temperature/ Min.: -40°C (-40°F) Max.: 150°C (302°F)	-40 to 150°C (-40 to 302°F)	-

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
PIG Power Supply	Power source voltage to activate motor/ Min.: 0 V Max.: 20.1531 V	11 to 14 V	Power switch on (READY)
IG Power Supply	ECU power source voltage/ Min.: 0 V Max.: 20.1531 V	11 to 14 V	Power switch on (READY)
Steering Wheel Torque	Steering wheel torque/ Min.: -327.68 Nm Max.: 7 Nm	Value changes in proportion to steering effort	Power switch on (READY) and power steering is in operation
Torque Sensor 1 Output	Torque sensor 1 output value/ Min.: 0 V Max.: 5 V	2.3 to 2.7 V	Turn the power switch on (READY) and steering wheel not turned (without load)
		2.5 to 4.7 V	Turn the power switch on (READY) and steering wheel turned to right with vehicle stopped
		0.3 to 2.5 V	Turn the power switch on (READY) and steering wheel turned to left with vehicle stopped
Torque Sensor 2 Output	Torque sensor 2 output value/ Min.: 0 V Max.: 5 V	2.3 to 2.7 V	Turn the power switch on (READY) and steering wheel not turned (without load)
		2.5 to 4.7 V	Turn the power switch on (READY) and steering wheel turned to right with vehicle stopped
		0.3 to 2.5 V	Turn the power switch on (READY) and steering wheel turned to left with vehicle stopped
TRQ1 Zero Point Value	Zero point value of torque sensor 1/ Min.: 0 V Max.: 5 V	2.3 to 2.7 V	Turn the power switch on (READY) and steering wheel not turned (without load)
TRQ2 Zero Point Value	Zero point value of torque sensor 2/ Min.: 0 V Max.: 5 V	2.3 to 2.7 V	Turn the power switch on (READY) and steering wheel not turned (without load)

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Motor Terminal Volt(+)	Motor terminal M1 voltage/ Min.: 0 V Max.: 25.5 V	11 to 14 V	Turn the power switch on (READY) and steering wheel turned to right
		Below 1 V	Turn the power switch on (READY) and steering wheel turned to left
Motor Terminal Volt(-)	Motor terminal M2 voltage/ Min.: 0 V Max.: 25.5 V	Below 1 V	Turn the power switch on (READY) and steering wheel turned to right
		11 to 14 V	Turn the power switch on (READY) and steering wheel turned to left
Ready Status	Ready status/ READY or OFF	READY or OFF	-

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FAIL-SAFE CHART

If a problem occurs in the power steering system, the P/S warning light will come on in the combination meter and the power steering assist will be stopped, locked at a particular point, or decreased simultaneously to protect the system.

DTC No.	DTC Detection Condition	Fail-safe
C1511 C1512 C1513 C1514 C1515 C1516	Torque sensor malfunction	Power assist stopped
C1517	Torque sensor malfunction	Power assist stopped
C1524	Motor malfunction	Power assist stopped
C1531 C1532	Power steering ECU malfunction	Power assist stopped
C1533	Temperature sensor malfunction in power steering ECU	Assist force restricted
C1534	EEPROM abnormal	Power assist stopped
C1535	Steering wheel location data error	Power assist stopped
C1551	IG power source voltage error	Power assist stopped
C1552	PIG power source voltage error	Power assist stopped
C1553	Overvoltage at IG and PIG terminals	Power assist stopped
C1554	Power source relay malfunction	Power assist stopped
C1555	Motor relay malfunction	Power assist stopped
C1581	ECU malfunction (Assist map number un-writing)	Permission of control assist map
C1582	Assist map number mismatch	Controlled using current default map
U0129	Skid control ECU communication error	Amount of power assist remains constant at speed of 70 km/h (43 mph)
U0293	HV ECU communication error	Power assist stopped
U1105	Parking assist ECU communication error	Power assist stopped

HINT:

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- The amount of power assist may be decreased to prevent the motor and ECUs from overheating if the steering wheel is continuously turned when the vehicle is either stopped or driven at a low speed, or if the steering wheel is kept in either full lock position for a long time. In such cases, the amount of power assist returns to normal if the steering wheel is not turned for approximately 10 minutes with the power switch on (READY).
- If the battery is not sufficiently charged or the voltage decreases temporarily, the amount of power assist will be reduced and the P/S warning light will come on. In such cases, the amount of power assist returns normal when the battery voltage recovers.

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DATA LIST / ACTIVE TEST

1. DATA LIST

HINT:

Using the Techstream to read the Data List allows the values or states of switches, sensors, actuators and other items to be read without removing any parts. This non-intrusive inspection can be very useful because intermittent conditions or signals may be discovered before parts or wiring is disturbed. Reading the Data List information early in troubleshooting is one way to save diagnostic time.

NOTICE:

In the table below, the values listed under "Normal Condition" are reference values. Do not depend solely on these reference values when deciding whether a part is faulty or not.

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (IG).

(d) Turn the Techstream on.

(e) Enter the following menus: Chassis / EMPS / Data List.

(f) According to the display on the Techstream, read the "Data List".

EMPS

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Meter Vehicle Velocity	Vehicle speed from meter/ Min.: 0 km/h (mph) Max.: 300 km/h (186.4 mph)	0 km/h (0 mph)	Turn the power switch on (READY) and vehicle stopped
		No significant fluctuation	Turn the power switch on (READY) and vehicle driven at constant speed
Motor Actual Current	Current to motor/ Min.: -327.68 A Max.: 327.67 A	Value changes in proportion to steering effort	Turn the power switch on (READY) and power steering is in operation
Command Value Current	Requested current to motor/ Min.: -327.68 A Max.: 327.67 A	Value changes in proportion to steering effort	Turn the power switch on (READY) and power steering is in operation
Thermistor Temperature	ECU substrate temperature/	-40 to 150°C (-40 to 302°F)	-

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	Min.: -40°C (-40°F) Max.: 150°C (302°F)		
PIG Power Supply	Power source voltage to activate motor/ Min.: 0 V Max.: 20.1531 V	11 to 14 V	Power switch on (READY)
IG Power Supply	ECU power source voltage/ Min.: 0 V Max.: 20.1531 V	11 to 14 V	Power switch on (READY)
Steering Angle Sens Sig	Steering angle sensor signal state/ OK or NG(1) or NG(2) or NG(3)	OK: Steering angle sensor signal received NG(1): The learning has not completed NG(2): Steering Sensor Abnormal NG(3): Communication Error	-
Steering Wheel Torque	Steering wheel torque/ Min.: -327.68 Nm Max.: 7 Nm	Value changes in proportion to steering effort	Power switch on (READY) and power steering is in operation
Torque Sensor 1 Output	Torque sensor 1 output value/ Min.: 0 V Max.: 5 V	2.3 to 2.7 V	Turn the power switch on (READY) and steering wheel not turned (without load)
		2.5 to 4.7 V	Turn the power switch on (READY) and steering wheel turned to right with vehicle stopped
		0.3 to 2.5 V	Turn the power switch on (READY) and steering wheel turned to left with vehicle stopped
Torque Sensor 2 Output	Torque sensor 2 output value/ Min.: 0 V Max.: 5 V	2.3 to 2.7 V	Turn the power switch on (READY) and steering wheel not turned (without load)
		2.5 to 4.7 V	Turn the power switch on (READY) and steering wheel turned to right with vehicle stopped
		0.3 to 2.5 V	Turn the power switch on (READY)

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
			and steering wheel turned to left with vehicle stopped
TRQ1 Zero Point Value	Zero point value of torque sensor 1/ Min.: 0 V Max.: 5 V	2.3 to 2.7 V	Turn the power switch on (READY) and steering wheel not turned (without load)
TRQ2 Zero Point Value	Zero point value of torque sensor 2/ Min.: 0 V Max.: 5 V	2.3 to 2.7 V	Turn the power switch on (READY) and steering wheel not turned (without load)
Motor Terminal Volt(+)	Motor terminal M1 voltage/ Min.: 0 V Max.: 25.5 V	11 to 14 V	Turn the power switch on (READY) and steering wheel turned to right
		Below 1 V	Turn the power switch on (READY) and steering wheel turned to left
Motor Terminal Volt(-)	Motor terminal M2 voltage/ Min.: 0 V Max.: 25.5 V	Below 1 V	Turn the power switch on (READY) and steering wheel turned to right
		11 to 14 V	Turn the power switch on (READY) and steering wheel turned to left
IG ON/OFF Times	Number of times of power switch ON/OFF after fail detection/ Min.: 0 time Max.: 65535 times	-	This value indicates the number of times of IG ON/OFF after the latest DTC detection.
Motor Overheat Record	Continuous overheat prevention control record/ Unrec or Rec	Unrec	-
Motor Lo Power Record	PIG power source voltage drop record/ Unrec or Rec	Unrec	-
Eng Rev Inter Record	Record of READY ON signal interruption/ Unrec or Rec	Unrec	-
Str Angle Inter Record	Record of steering sensor signal interruption occurrence	Unrec	-

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	display/ Unrec or Rec		
Spd Sig Invalid Record	Vehicle speed signal invalid record/ Unrec or Rec	Unrec	-
Battery Voltage Lo Record	Battery voltage reduction history/ Min.: 0 times, Max.: 65535 times	0 to 65535	-
Ready Status	Ready status/ READY or OFF	READY or OFF	-
The Number of DTCs	Number of detected DTCs when freeze frame data stored/ Min.: 0 Max.: 255	0 to 255	-

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DIAGNOSTIC TROUBLE CODE CHART

HINT:

If any DTCs are displayed during the DTC check, inspect the circuit listed for those DTCs. For details of each DTC, refer to the page indicated in the DTC chart.

Power Steering System

DTC Code	Detection Item	Trouble Area	Return-to-normal Condition	P/S Warning Light	See page
C1511	Torque Sensor Circuit Malfunction	1. Steering column assembly (Torque sensor) 2. Power steering ECU	Power switch on (IG) again	○	INFO
C1512	Torque Sensor Circuit Malfunction	1. Steering column assembly (Torque sensor) 2. Power steering ECU	Power switch on (IG) again	○	INFO
C1513	Torque Sensor Circuit Malfunction	1. Steering column assembly (Torque sensor) 2. Power steering ECU	Power switch on (IG) again	○	INFO
C1514	Torque Sensor Power Supply Abnormal	1. Steering column assembly (Torque sensor) 2. Power steering ECU	Power switch on (IG) again	○	INFO
C1515	Torque Sensor Zero Point Adjustment Undone	-	After calibrating torque sensor zero point	○	INFO
C1516	Torque Sensor Zero Point Adjustment Incomplete	-	After calibrating torque sensor zero point normally	○	INFO
C1517	Torque Hold Abnormal	1. Steering column assembly (Torque sensor) 2. Power steering ECU	Power switch on (IG) again	○	INFO
C1524	Motor Circuit Malfunction	1. Steering column assembly (Power steering motor) 2. Power steering ECU	Power switch on (IG) again	○	INFO
C1531	ECU Malfunction	Power steering ECU	Power switch on (IG) again	○	INFO
C1532	ECU Malfunction	Power steering ECU	Power switch on (IG) again	○	INFO
C1533	ECU Malfunction	Power steering ECU	Power switch on (IG)	○	INFO

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DTC Code	Detection Item	Trouble Area	Return-to-normal Condition	P/S Warning Light	See page
			again		
C1534	ECU Malfunction	Power steering ECU	Power switch on (IG) again	○	INFO
C1535	ECU Malfunction	Power steering ECU	-	○	INFO
C1551	IG Power Supply Voltage Malfunction	1. ECU-IG No. 2 fuse 2. IG power source circuit 3. Power steering ECU	Power switch on (IG) again and after normal confirmation	○	INFO
C1552	PIG Power Supply Voltage Malfunction	1. EPS fuse 2. PIG power source circuit 3. Power steering ECU	Power switch on (IG) again and after normal confirmation	○	INFO
C1553	PIG Power Supply Overvoltage	1. IG and PIG power source circuits 2. Power steering ECU	Power switch on (IG) again and after normal confirmation	○	INFO
C1554	Power Supply Relay Failure	1. EPS fuse 2. PIG power source circuit 3. Power steering ECU	Power switch on (IG) again	○	INFO
C1555	Motor Relay Welding Failure	1. Steering column assembly (Power steering motor) 2. Power steering ECU	Power switch on (IG) again	○	INFO
C1581	Assist Map Number Un-Writing	1. Power steering ECU 2. Hybrid control system 3. CAN communication system	Assist map written	○	INFO
C1582	Assist Map Number Mismatch	1. Power steering ECU 2. CAN communication system 3. Power management ECU	Power switch on (IG) again	○	INFO
U0129	Lost Communication with	1. CAN communication	Power switch on (IG)	○	INFO

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DTC Code	Detection Item	Trouble Area	Return-to-normal Condition	P/S Warning Light	See page
	Brake System Control Module	system 2. Skid control ECU	again or after normal confirmation		
U0293	Lost Communication with HV ECU	1. CAN communication system 2. Power management control ECU	Power switch on (IG) again or after normal confirmation	○	INFO
U1105	Lost Communication with Parking Assist ECU	1. CAN communication system 2. Parking assist ECU	Power switch on (IG) again or after normal confirmation	X	INFO

HINT:

- ○: Warning light comes on
- X: Warning light turns off (normal reset)
- *1: Depending on some detection conditions, there is a case that the warning light does not come on.

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ON-VEHICLE INSPECTION

1. CHECK STEERING EFFORT (TORQUE)

NOTICE:

Some of these service operations may affect the SRS airbags. Read the precautionary notices concerning the SRS airbag system before servicing.

(a) Stop the vehicle on a level, paved road and align the wheels facing straight ahead.

(b) Disconnect the cable from the negative (-) battery terminal.

CAUTION:

Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to disable the SRS system.

NOTICE:

When disconnecting the cable, some systems need to be initialized after the cable is reconnected INFO.

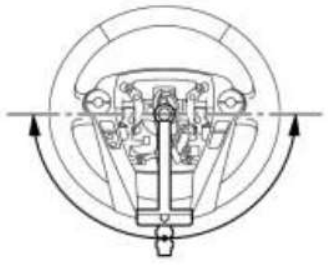
(c) Remove the steering pad INFO.

(d) Connect the cable to the negative (-) battery terminal.

(e) Using a torque wrench, check that the steering wheel set nut is properly tightened.

Torque: **50 N·m (510 kgf·cm, 37ft·lbf)**

(f) Turn the power switch to on (READY) so that the power steering is ready to operate.



C

(g) Turn the steering wheel 90 degrees to the right and check the steering effort (torque) while continuing to turn it further in the same direction.

Steering effort (Reference):

6.0 N*m (61 kgf*cm, 53 in.*lbf) or less

(h) Align the front wheels facing straight ahead.

(i) Disconnect the cable from the negative (-) battery terminal.

CAUTION:

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Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to disable the SRS system.

(j) Install the steering pad INFO.

(k) Connect the cable to the negative (-) battery terminal.

NOTICE:

When disconnecting the cable, some systems need to be initialized after the cable is reconnected INFO.

(l) Clear the DTCs INFO.

(m) Inspect the airbag warning light INFO.

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DTC	C1511	Torque Sensor Circuit Malfunction
DTC	C1512	Torque Sensor Circuit Malfunction
DTC	C1513	Torque Sensor Circuit Malfunction
DTC	C1514	Torque Sensor Power Supply Abnormal
DTC	C1517	Torque Hold Abnormal

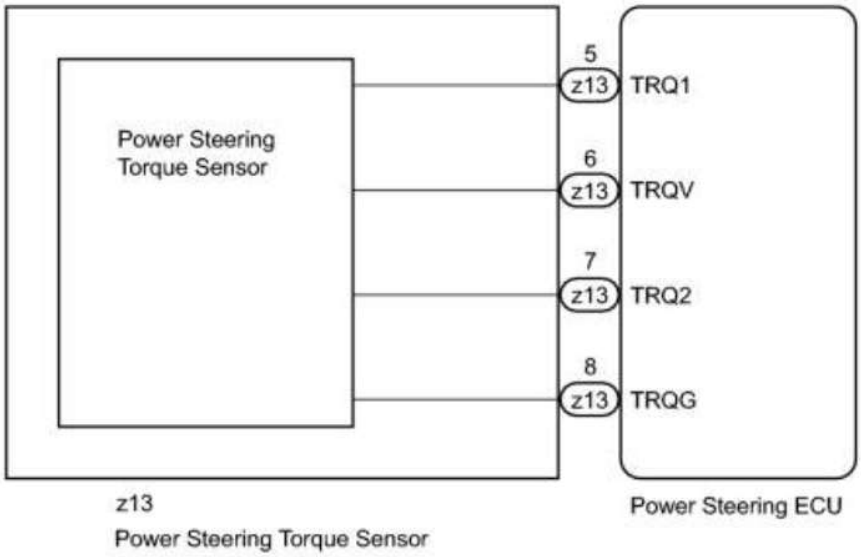
DESCRIPTION

The power steering ECU calculates assisting power based on steering torque signals from the torque sensor. If these DTCs are stored in the power steering ECU, the ECU stops steering power assist as a fail-safe function.

DTC No.	DTC Detection Condition	Trouble Area
C1511	Torque sensor (TRQ1) signal error or stop	• Steering column assembly (Torque sensor) • Power steering ECU
C1512	Torque sensor (TRQ2) signal error or stop	
C1513	Deviation between torque sensor TRQ1 and TRQ2 exceeds specified value	
C1514	Torque sensor power source voltage error	
C1517	Temporary control due to malfunction related to torque sensor continues for long time	

WIRING DIAGRAM

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H

INSPECTION PROCEDURE

NOTICE:

- If the power steering ECU has been replaced with a new one, perform the assist map writing and the torque sensor zero point calibration INFO.
- If the steering column assembly has been replaced with a new one, perform the torque sensor zero point calibration after performing the initialization of the torque sensor zero point value INFO.

PROCEDURE

1.	CHECK CONNECTOR CONNECTION CONDITION (TORQUE SENSOR - ECU)

(a) Check the installation condition of the torque sensor connector.

OK:

Torque sensor connector is securely connected to the power steering ECU.

NG ▶ CONNECT CONNECTOR

OK

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2.	READ VALUE USING TECHSTREAM (TORQUE SENSOR1, TORQUE SENSOR2)

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (READY).

(d) Turn the Techstream on.

(e) Enter the following menus: Chassis / EMPS / Data List.

(f) Select the items "Torque sensor 1 output" and "Torque sensor 2 output" in the Data List and read the value displayed on the Techstream.

EMPS

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Torque Sensor 1 Output	Torque sensor 1 output value/ Min.: 0 V Max.: 5 V	2.3 to 2.7 V	Turn the power switch on (READY) and steering wheel not turned (without load)
		2.5 to 4.7 V	Turn the power switch on (READY) and steering wheel turned to right with vehicle stopped
		0.3 to 2.5 V	Turn the power switch on (READY) and steering wheel turned to left with vehicle stopped
Torque Sensor 2 Output	Torque sensor 2 output value/ Min.: 0 V Max.: 5 V	2.3 to 2.7 V	Turn the power switch on (READY) and steering wheel not turned (without load)
		2.5 to 4.7 V	Turn the power switch on (READY) and steering wheel turned to right with vehicle stopped
		0.3 to 2.5 V	Turn the power switch on (READY) and steering wheel turned to left with vehicle stopped

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OK:

Normal condition value is displayed on the Techstream during each steering operation.

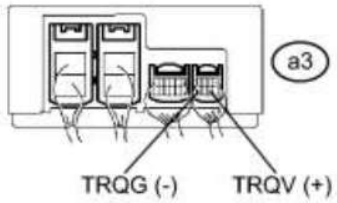
NG ▶ CHECK POWER STEERING ECU (TOQUE SENSOR OUTPUT)

OK ▶ **REPLACE POWER STEERING ECU**

3.	CHECK POWER STEERING ECU (TOQUE SENSOR OUTPUT)

(a) Turn the power switch on (READY).

*1



(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
z13-6 (TRQV) - z13-8 (TRQG)	Power switch on (READY)	7.5 to 8.5 V

Text in Illustration

*1	Component with harness connected (Power Steering ECU)

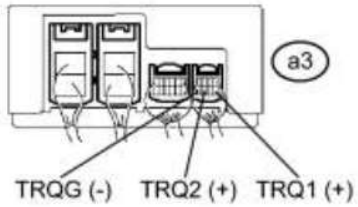
NG ▶ REPLACE POWER STEERING ECU

OK

▼

4.	CHECK STEERING COLUMN ASSEMBLY (TORQUE SENSOR)

*1



(a) Turn the power switch on (READY).

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(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition (Steering Wheel Position)	Specified Condition
z13-5 (TRQ1) - z13-8 (TRQG)	Power switch on (READY) Center position	2.3 to 2.7 V
z13-7 (TRQ2) - z13-8 (TRQG)	Power switch on (READY) Center position	2.3 to 2.7 V
z13-5 (TRQ1) - z13-8 (TRQG)	Power switch on (READY) Turned to right	2.5 to 4.7 V
z13-7 (TRQ2) - z13-8 (TRQG)	Power switch on (READY) Turned to right	2.5 to 4.7 V
z13-5 (TRQ1) - z13-8 (TRQG)	Power switch on (READY) Turned to left	0.3 to 2.5 V
z13-7 (TRQ2) - z13-8 (TRQG)	Power switch on (READY) Turned to left	0.3 to 2.5 V

Text in Illustration

*1	Component with harness connected (Power Steering ECU)

NG ▶ REPLACE STEERING COLUMN ASSEMBLY

OK ▶ **REPLACE POWER STEERING ECU**

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DTC	C1515	Torque Sensor Zero Point Adjustment Undone

DESCRIPTION

This DTC does not indicate a malfunction. The power steering ECU stores this DTC when it determines that the torque sensor zero point calibration has not been performed.

DTC No.	DTC Detection Condition	Trouble Area
C1515	Torque sensor zero point calibration not performed	There is no malfunction if DTC is not output after performing the torque sensor zero point calibration.

INSPECTION PROCEDURE

NOTICE:

- If the power steering ECU has been replaced with a new one, perform the assist map writing and the torque sensor zero point calibration INFO.
- If the steering column assembly has been replaced with a new one, perform the torque sensor zero point calibration after performing the initialization of the torque sensor zero point value INFO.

PROCEDURE

1.	PERFORM ZERO POINT CALIBRATION (TORQUE SENSOR)

(a) Perform the torque sensor zero point calibration INFO.

NEXT

2.	CHECK FOR DTC

(a) Check for DTCs INFO.

Result:

Result	Proceed to
DTC is still output even after performing torque sensor zero point calibration 3 times*1.	A
DTC is still output even after performing torque sensor zero point calibration once or twice*2.	B
Normal system code is output.	C

HINT:

- *1: The power steering ECU must be replaced if DTC C1515 is still output even after the torque sensor zero point calibration is performed 3 times.

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- *2: Perform the torque sensor zero point calibration again if DTC C1515 is still output even after the calibration is performed once or twice.

C ▶ END
B ▶ PERFORM ZERO POINT CALIBRATION AGAIN (TORQUE SENSOR)
A

3.	REPLACE POWER STEERING ECU

(a) Replace the power steering ECU INFO.

NEXT

4.	PERFORM ZERO POINT CALIBRATION (TORQUE SENSOR)

(a) Perform the torque sensor zero point calibration INFO.

NEXT

5.	CHECK FOR DTC

(a) Check for DTCs INFO.

Result:

Result	Proceed to
DTC is still output even after performing torque sensor zero point calibration 3 times*1.	A
DTC is still output even after performing torque sensor zero point calibration twice*2.	B
Normal system code is output.	C

HINT:

- *1: The steering column assembly must be replaced if DTC C1515 is still output even after the torque sensor zero point calibration is performed 3 times.
- *2: Perform the torque sensor zero point calibration again if DTC C1515 is still output even after the calibration is performed twice.

C ▶ END
B ▶ PERFORM ZERO POINT CALIBRATION AGAIN (TORQUE SENSOR)
A ▶ **REPLACE STEERING COLUMN ASSEMBLY**

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DTC	C1516	Torque Sensor Zero Point Adjustment Incomplete

DESCRIPTION

This DTC does not indicate a malfunction. The power steering ECU stores this DTC if it determines that the torque sensor zero point calibration has not been completed successfully.

DTC No.	DTC Detection Condition	Trouble Area
C1516	Torque sensor zero point calibration is not completed successfully.	There is no malfunction if DTC is not output after performing the torque sensor zero point calibration.

INSPECTION PROCEDURE

NOTICE:

- If the power steering ECU has been replaced with a new one, perform the assist map writing and the torque sensor zero point calibration INFO.
- If the steering column assembly has been replaced with a new one, perform the torque sensor zero point calibration after performing the initialization of the torque sensor zero point value INFO.

PROCEDURE

1.	CLEAR DTC

(a) Clear the DTCs INFO.

NEXT

2.	PERFORM ZERO POINT CALIBRATION (TORQUE SENSOR)

(a) Perform the torque sensor zero point calibration INFO.

NEXT

3.	CHECK FOR DTC

(a) Check for DTCs INFO.

Result:

Result	Proceed to
DTC is still output even after performing torque sensor zero point calibration 3 times*1.	A

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Result	Proceed to
DTC is still output even after performing torque sensor zero point calibration once or twice*2.	B
Normal system code is output.	C

HINT:

- *1: The power steering ECU must be replaced if DTC C1516 is still output even after the torque sensor zero point calibration is performed 3 times.
- *2: Perform the torque sensor zero point calibration again if DTC C1516 is still output even after the calibration is performed once or twice.

C ▶ END
B ▶ PERFORM ZERO POINT CALIBRATION AGAIN (TORQUE SENSOR)
A
▼

4.	REPLACE POWER STEERING ECU

(a) Replace the power steering ECU INFO.

NEXT
▼

5.	PERFORM ZERO POINT CALIBRATION (TORQUE SENSOR)

(a) Perform the torque sensor zero point calibration INFO.

NEXT
▼

6.	CHECK FOR DTC

(a) Check for DTCs INFO.

Result:

Result	Proceed to
DTC is still output even after performing torque sensor zero point calibration 3 times*1.	A
DTC is still output even after performing torque sensor zero point calibration twice*2.	B
Normal system code is output.	C

HINT:

- *1: The steering column assembly must be replaced if DTC C1516 is still output even after the torque sensor zero point calibration is performed 3 times.
- *2: Perform the torque sensor zero point calibration again if DTC C1516 is still output even after the calibration is performed twice.

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C ▶ END
B ▶ PERFORM ZERO POINT CALIBRATION AGAIN (TORQUE SENSOR)
A ▶ **REPLACE STEERING COLUMN ASSEMBLY**

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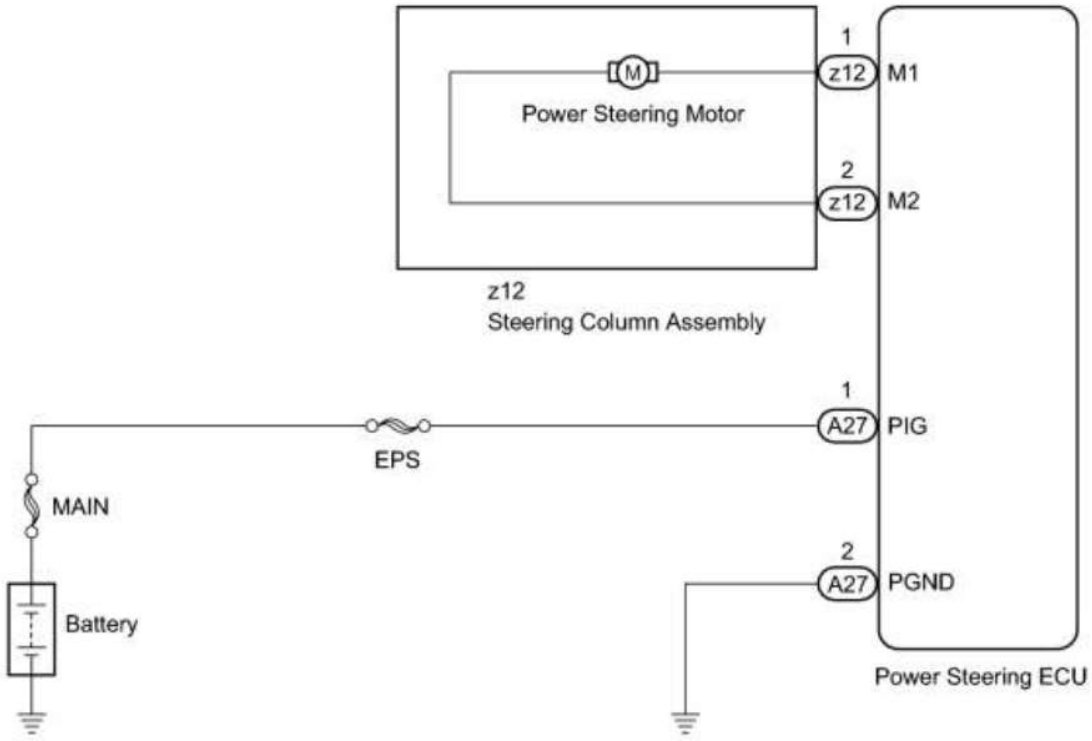
DTC	C1524	Motor Circuit Malfunction
DTC	C1555	Motor Relay Welding Failure

DESCRIPTION

The power steering ECU supplies current to the power steering motor through the motor circuit.

DTC No.	DTC Detection Condition	Trouble Area
C1524	Short (or open) in motor circuit or abnormal voltage in motor circuit	• Steering column assembly (Power steering motor) • Power steering ECU
C1555	Predriver (Motor relay circuit) malfunction	

WIRING DIAGRAM



H

INSPECTION PROCEDURE

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NOTICE:

- If the power steering ECU has been replaced with a new one, perform the assist map writing and the torque sensor zero point calibration INFO.
- If the steering column assembly has been replaced with a new one, perform the torque sensor zero point calibration after performing the initialization of the torque sensor zero point value INFO.

PROCEDURE

1.	CHECK POWER STEERING ECU

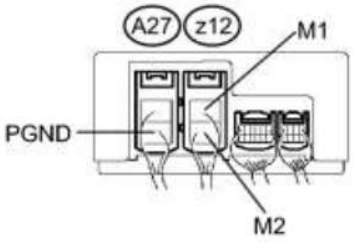
(a) Turn the power switch on (READY).

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition (Steering Wheel Position)	Specified Condition
z12-1 (M1) - A27-2 (PGND)	Power switch on (READY) (Turned to right)	Below 1 V
z12-1 (M1) - A27-2 (PGND)	Power switch on (READY) (Turned to left)	11 to 14 V
z12-2 (M2) - A27-2 (PGND)	Power switch on (READY) (Turned to right)	11 to 14 V
z12-2 (M2) - A27-2 (PGND)	Power switch on (READY) (Turned to left)	Below 1 V

*1



Text in Illustration

*1	Component with harness connected (Power Steering ECU)

NG ▶ CHECK HARNESS AND CONNECTOR (POWER STEERING ECU - BODY GROUND)

OK

▼

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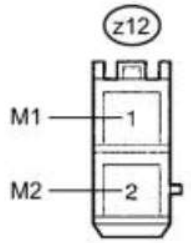
2.	CHECK STEERING COLUMN ASSEMBLY (POWER STEERING MOTOR)

(a) Disconnect the connector from the power steering ECU.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

*1



Tester Connection	Condition	Specified Condition
z12-1 (M1) - z12-2 (M2)	Always	0.08 to 0.15 Ω
z12-1 (M1) - Body ground	Always	1 MΩ or higher
z12-2 (M2) - Body ground	Always	1 MΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Power Steering ECU)

NG ▶ REPLACE STEERING COLUMN ASSEMBLY

OK

▼

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

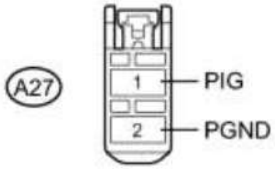
(a) Disconnect the connector from the power steering ECU.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

*1

Tester Connection	Switch Condition	Specified Condition
A27-1 (PIG) - Body ground	Power switch on (READY)	11 to 14 V



H

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
A27-2 (PGND) - Body ground	Always	Below 1 Ω

Text in Illustration

*1	Front view of wire harness connector (to Power Steering ECU)

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NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE POWER STEERING ECU**

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DTC	C1531	ECU Malfunction
DTC	C1532	ECU Malfunction
DTC	C1533	ECU Malfunction
DTC	C1534	ECU Malfunction
DTC	C1535	ECU Malfunction

DESCRIPTION

The fail-safe function operates to stop power assist when DTCs indicating ECU malfunctions are stored. However, the power assist operation continues when DTC C1533 or C1534 is stored because it indicates an EEPROM error in the ECU.

DTC No.	DTC Detection Condition	Trouble Area
C1531	ECU internal malfunction (CPU malfunction)	Power steering ECU
C1532	ECU internal malfunction (Peripheral circuit malfunction)	
C1533	ECU internal malfunction (Substrate temperature sensor malfunction)	
C1534	ECU internal malfunction (EEPROM error)	
C1535	ECU internal malfunction (Steering wheel location data error)	

INSPECTION PROCEDURE

NOTICE:

If the power steering ECU has been replaced with a new one, perform the assist map writing and the torque sensor zero point calibration INFO.

PROCEDURE

1.	CHECK FOR DTC

(a) Check for DTCs INFO.

OK:

DTCs other than C1531, C1532, C1533, C1534 and C1535 are not output.

NG ▶ REPAIR CIRCUITS INDICATED BY OUTPUT DTCS

OK ▶ **REPLACE POWER STEERING ECU**

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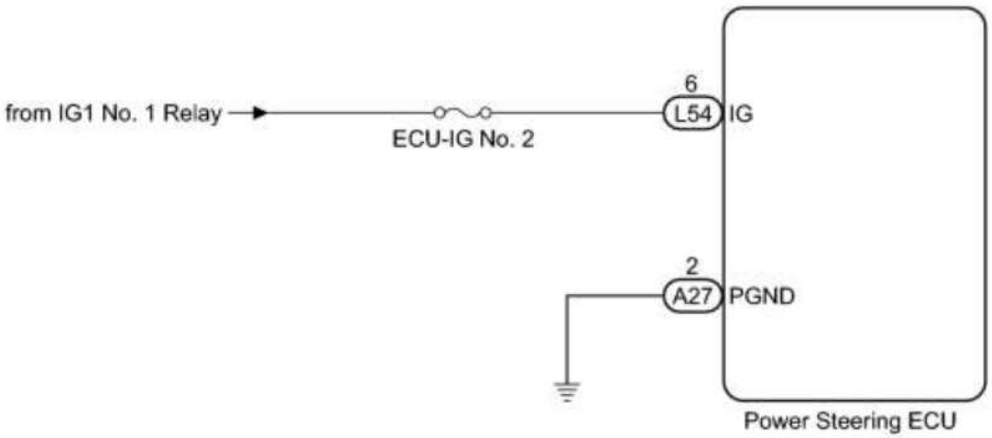
DTC	C1551	IG Power Supply Voltage Malfunction

DESCRIPTION

The power steering ECU distinguishes the power switch status as on (IG) or off through the IG power source circuit.

DTC No.	DTC Detection Condition	Trouble Area
C1551	Open or short in IG power source circuit with power switch on (IG)	• ECU-IG No. 2 fuse • IG power source circuit • Power steering ECU

WIRING DIAGRAM



H

INSPECTION PROCEDURE

NOTICE:

If the power steering ECU has been replaced with a new one, perform the assist map writing and the torque sensor zero point calibration INFO.

HINT:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

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PROCEDURE

1.	READ VALUE USING TECHSTREAM (IG POWER SUPPLY)

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (IG).

(d) Turn the Techstream on.

(e) Enter the following menus: Chassis / EMPS / Data List.

(f) Select the item "IG power supply" in the Data List and read the value displayed on the Techstream.

EMPS

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
IG power supply	IG power supply/ Min.: 0 V Max.: 20.1531 V	11 to 14 V	Power switch on (IG)

OK:

The normal condition value is displayed on the Techstream.

NG ▶ CHECK HARNESS AND CONNECTOR (POWER STEERING ECU - BODY GROUND)

OK ▶ **CHECK INTERMITTENT PROBLEMS**

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

(a) Disconnect the connectors from the power steering ECU.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
L54-6 (IG) - A27-2 (PGND)	Power switch on (IG)	11 to 14 V

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

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Tester Connection	Condition	Specified Condition
A27-2 (PGND) - Body ground	Always	Below 1 Ω

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE POWER STEERING ECU**

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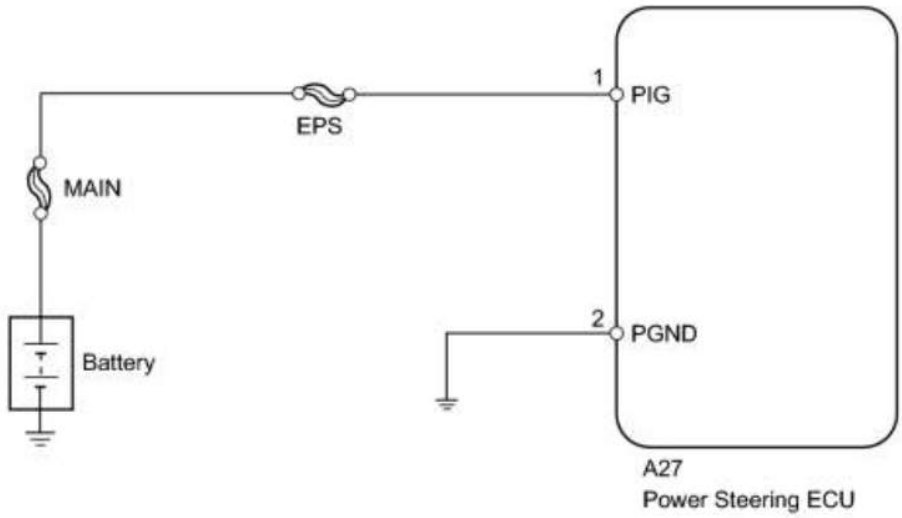
DTC	C1552	PIG Power Supply Voltage Malfunction
DTC	C1554	Power Supply Relay Failure

DESCRIPTION

When a problem occurs in the system, the power source relay circuit and the motor relay circuit are shut off to stop the power assist. The ECU must be replaced when there is a problem with the relays because the relays are built into the ECU.

DTC No.	DTC Detection Condition	Trouble Area
C1552	PIG power source circuit malfunction	• EPS fuse • PIG power source circuit • Power steering ECU
C1554	Power source relay circuit malfunction	• EPS fuse • PIG power source circuit • Power steering ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

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If the power steering ECU has been replaced with a new one, perform the assist map writing and the torque sensor zero point calibration INFO.

HINT:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1.	READ VALUE USING TECHSTREAM

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (READY).

(d) Turn the Techstream on.

(e) Enter the following menus: Chassis / EMPS / Data List.

(f) Select the item "PIG power supply" in the Data List and read the value displayed on the Techstream.

EMPS

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
PIG Power Supply	Power source voltage to activate motor/ Min.: 0 V Max.: 20.1531 V	11 to 14 V	Power switch on (READY)

OK:

The normal condition value is displayed on the Techstream.

NG ▶ CHECK HARNESS AND CONNECTOR (BATTERY - POWER STEERING ECU - BODY GROUND)

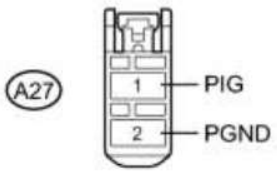
OK ▶ **CHECK INTERMITTENT PROBLEMS**

2.	CHECK HARNESS AND CONNECTOR (BATTERY - POWER STEERING ECU - BODY GROUND)

(a) Disconnect the connector from the power steering ECU.

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*1



H

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
A27-1 (PIG) - Body ground	Power switch on (READY)	11 to 14 V

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
A27-2 (PGND) - Body ground	Always	Below 1 Ω

Text in Illustration

*1	Front view of wire harness connector (to Power Steering ECU)

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE POWER STEERING ECU**

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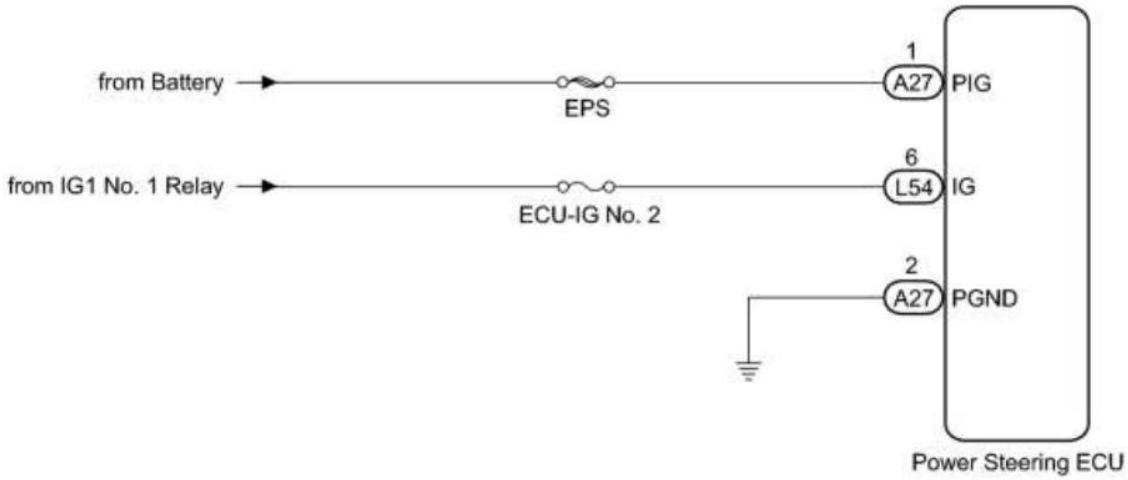
DTC	C1553	PIG Power Supply Overvoltage

DESCRIPTION

If the power steering ECU determines that the motor power source voltage and the IG voltage are not within the specified range, it stops the power assist as a fail-safe function.

DTC No.	DTC Detection Condition	Trouble Area
C1553	• PIG power source overvoltage • IG power source overvoltage	• IG and PIG power source circuits • Power steering ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

If the power steering ECU has been replaced with a new one, perform the assist map writing and the torque sensor zero point calibration INFO.

PROCEDURE

1.	CHECK HARNESS AND CONNECTOR (IG, PIG)

(a) Disconnect the connectors from the power steering ECU.

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(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Condition	Specified Condition
A27-1 (PIG) - A27-2 (PGND)	Always	11 to 14 V
L54-6 (IG) - A27-2 (PGND)	Power switch on (IG)	11 to 14 V

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶ **REPLACE POWER STEERING ECU**

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DTC	C1581	Assist Map Number Un-Writing

DESCRIPTION

DTC C1581 will be stored if the power steering ECU determines that the assist map is not written in the ECU.

DTC No.	DTC Detection Condition	Trouble Area
C1581	Assist map is not written in power steering ECU	• Power steering ECU • Hybrid control system • CAN communication system

INSPECTION PROCEDURE

NOTICE:

If the power steering ECU has been replaced with a new one, perform the assist map writing and the torque sensor zero point calibration INFO.

PROCEDURE

1.	PERFORM ASSIST MAP WRITING

(a) Perform the assist map writing INFO.

NEXT

2.	CHECK FOR DTC

(a) Check for DTCs INFO.

Result:

Result	Proceed to
DTC is still output even after performing assist map writing 3 times.	A
DTC is still output even after performing assist map writing once or twice*1	B
DTC is not output.	C

HINT:

*1: Perform the assist map writing again if DTC C1581 is still output even after the assist map writing is performed once or twice.

C END

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B ▶ PERFORM ASSIST MAP WRITING AGAIN

A ▼

3.	CHECK FOR DTC (CAN COMMUNICATION SYSTEM)

(a) Check for DTCs INFO.

OK:

DTC is not output.

HINT:

If the CAN communication system DTC is output, first troubleshoot the CAN communication system malfunction, then perform the assist map writing again INFO.

NG ▶ GO TO CAN COMMUNICATION SYSTEM

OK ▼

4.	CHECK FOR DTC (HYBRID CONTROL SYSTEM)

(a) Check for DTCs INFO.

OK:

DTC is not output.

HINT:

If the hybrid control system DTC is output, first troubleshoot the hybrid control system, then perform the assist map writing again INFO.

NG ▶ REPAIR CIRCUITS INDICATED BY OUTPUT DTCS

OK ▶ **REPLACE POWER STEERING ECU**

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DTC	C1582	Assist Map Number Mismatch

DESCRIPTION

When an incorrect skid control ECU is installed after the assist map has been recorded in the power steering ECU, then DTC C1582 is stored because the data does not match the vehicle specifications.

DTC No.	DTC Detection Condition	Trouble Area
C1582	Assist map number mismatch	• Power steering ECU • CAN communication system • Power management control ECU

INSPECTION PROCEDURE

NOTICE:

If the power steering ECU has been replaced with a new one, perform the torque sensor zero point calibration INFO.

PROCEDURE

1.	CHECK FOR DTC (CAN COMMUNICATION SYSTEM)

(a) Using the Techstream, check for DTCs and confirm that there are no problems in the CAN communication system INFO.

OK:

DTC is not output.

NG ▶ GO TO CAN COMMUNICATION SYSTEM
OK
▼

2.	CHECK POWER MANAGEMENT CONTROL ECU

(a) Check if a power management control ECU that complies with the vehicle specifications is installed.

OK:

The power management control ECU that complies with vehicle specifications is installed.

NG ▶ REPLACE POWER MANAGEMENT CONTROL ECU
OK ▶ **REPLACE POWER STEERING ECU**

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DTC	U0129	Lost Communication with Brake System Control Module
DTC	U0293	Lost Communication with HV ECU
DTC	U1105	Lost Communication with Parking Assist ECU

DESCRIPTION

The power steering ECU receives signals from the power management control ECU, the skid control ECU and the parking assist ECU via the CAN communication system.

DTC No.	DTC Detection Condition	Trouble Area
U0129	Lost communication with brake system control module	• CAN communication system • Skid control ECU
U0293	Lost communication with power management control ECU	• CAN communication system • Power management control ECU
U1105	Lost communication with parking assist ECU	• CAN communication system • Parking assist ECU

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK FOR DTC

(a) Clear the DTCs INFO.

(b) Check for DTCs INFO.

OK:

DTC is not output.

NG ▶ GO TO CAN COMMUNICATION SYSTEM
OK ▶ **CHECK INTERMITTENT PROBLEMS**

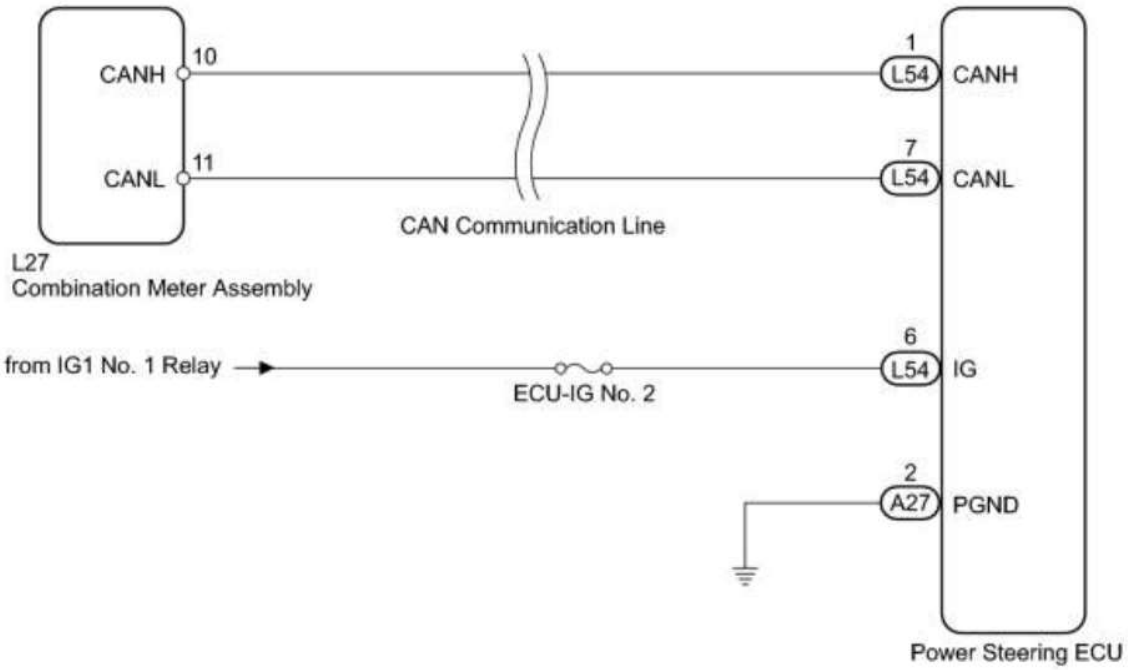
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EPS Warning Light Circuit

DESCRIPTION

If the power steering ECU detects a malfunction, the P/S warning light comes on. At this time, the power steering ECU stores the appropriate DTC in its memory.

WIRING DIAGRAM



INSPECTION PROCEDURE

PROCEDURE

1.	CHECK FOR DTC (CAN COMMUNICATION SYSTEM)

(a) Check for DTCs INFO.

OK:

DTC is not output.

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NG ▶ GO TO CAN COMMUNICATION SYSTEM

OK

▼

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

(a) Disconnect the connectors from the power steering ECU.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
L54-6 (IG) - A27-2 (PGND)	Power switch on (IG)	11 to 14 V

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
A27-2 (PGND) - Body ground	Always	Below 1 Ω

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

▼

3.	PERFORM ACTIVE TEST USING TECHSTREAM

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (IG).

(d) Turn the Techstream on.

(e) Enter the following menus: Body Electrical / Combination Meter / Active Test.

(f) Perform the Active Test of the combination meter using the Techstream.

Combination Meter

Tester Display	Test Part	Control Range	Diagnostic Note
Indicat. EPS	EPS warning light	OFF or ON	Confirm that the vehicle is stopped with the engine idling

(g) Check that the EPS warning light operates in accordance with the Active Test.

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HINT:

Reconnect the connectors and restore the vehicle to its previous condition before checking the combination meter.

NG ▶ REPLACE MATER CIRCUIT PLATE NO.3

OK ▶ **REPLACE POWER STEERING ECU**

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PRECAUTION

1. DETERMINING POWER STEERING SYSTEM TYPE

(a) Two types of power steering system are available for this model. A different type of motor is used for each system; a brushless type motor and a brush type motor. Refer to the table below to determine which type of motor is used.

Types

Type of Motor	Model
Brushless Type Motor	Mexico package models and models with 215/45R17 tires
Brush Type Motor	Other than those above

2. PRECAUTION FOR DISCONNECTING THE BATTERY CABLE

NOTICE:

When disconnecting the battery negative (-) cable, initialize the following system after the cable is reconnected:

System	See Procedure
Advanced Parking Guidance System	INFO

3. HANDLING PRECAUTIONS FOR SRS AIRBAG SYSTEM

(a) The vehicle is equipped with a Supplemental Restraint System (SRS). Failure to carry out service operations in the correct sequence could cause the SRS to unexpectedly deploy during servicing. This may cause a serious accident.

Before servicing (including inspection, replacement, removal and installation of parts), be sure to read the precautionary notices for the Supplemental Restraint System INFO.

4. PRECAUTIONS FOR REMOVAL, INSTALLATION AND REPLACEMENT OF ELECTRONIC MOTOR POWER STEERING COMPONENTS

(a) Be sure to align the front wheels straight ahead when removing and installing the power steering gear assembly.

(b) When disconnecting the No. 2 steering intermediate shaft assembly, be sure to place matchmarks before starting the operation.

(c) After replacing the steering column assembly or power steering ECU, clear the rotation angle sensor calibration value, initialize the rotation angle sensor, and calibrate the torque sensor zero point INFO.

5. HANDLING PRECAUTION

(a) When handling the electronic parts:

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(1) Avoid any impact to electronic parts such as ECUs and relays. Replace them with new ones if dropped or subjected to a severe blow.

(2) Do not expose any electronic parts to high temperatures or humidity.

(3) Do not touch the connector terminals in order to prevent deformation or malfunctions due to static electricity.

(b) When handling the power steering ECU:

(1) When the power steering ECU has been replaced with a new one, perform the assist map writing, the rotation angle sensor value initialization and the torque sensor zero point calibration INFO.

(c) When handling the steering column assembly:

(1) Avoid any impact to the steering column assembly, especially to the motor and torque sensor. Replace them with new ones if dropped or subjected to a severe blow.

(2) Do not pull the wire harness when moving the steering column assembly.

(3) When the steering column assembly has been replaced, perform the rotation angle sensor value initialization and the torque sensor zero point calibration after initializing the torque sensor zero point.

(d) When disconnecting and reconnecting the connectors:

(1) Before disconnecting the connectors related to the power steering system, turn the power switch on (IG), center the steering wheel, turn the power switch off, and then disconnect the connectors.

(2) Before reconnecting the connectors related to the power steering system, ensure that the power switch is off. Then center the steering wheel and turn the power switch on (IG).

NOTICE:

Do not turn the power switch on (IG) when the steering wheel is not centered.

(3) If the above operations are not carried out properly, the steering center point (zero point) will deviate, which may lead to a difference in steering effort between turning right and left. If there is a difference in steering effort between turning right and left, perform the rotation angle sensor value initialization and the torque sensor zero point calibration after initializing the torque sensor zero point INFO.

6. PRECAUTIONS FOR CAN COMMUNICATION

(a) CAN communication lines are used to receive information from the skid control ECU and the power management control ECU, and to transmit warnings to the combination meter.

When there are any problems in the CAN communication lines, DTCs of the CAN communication line are output.

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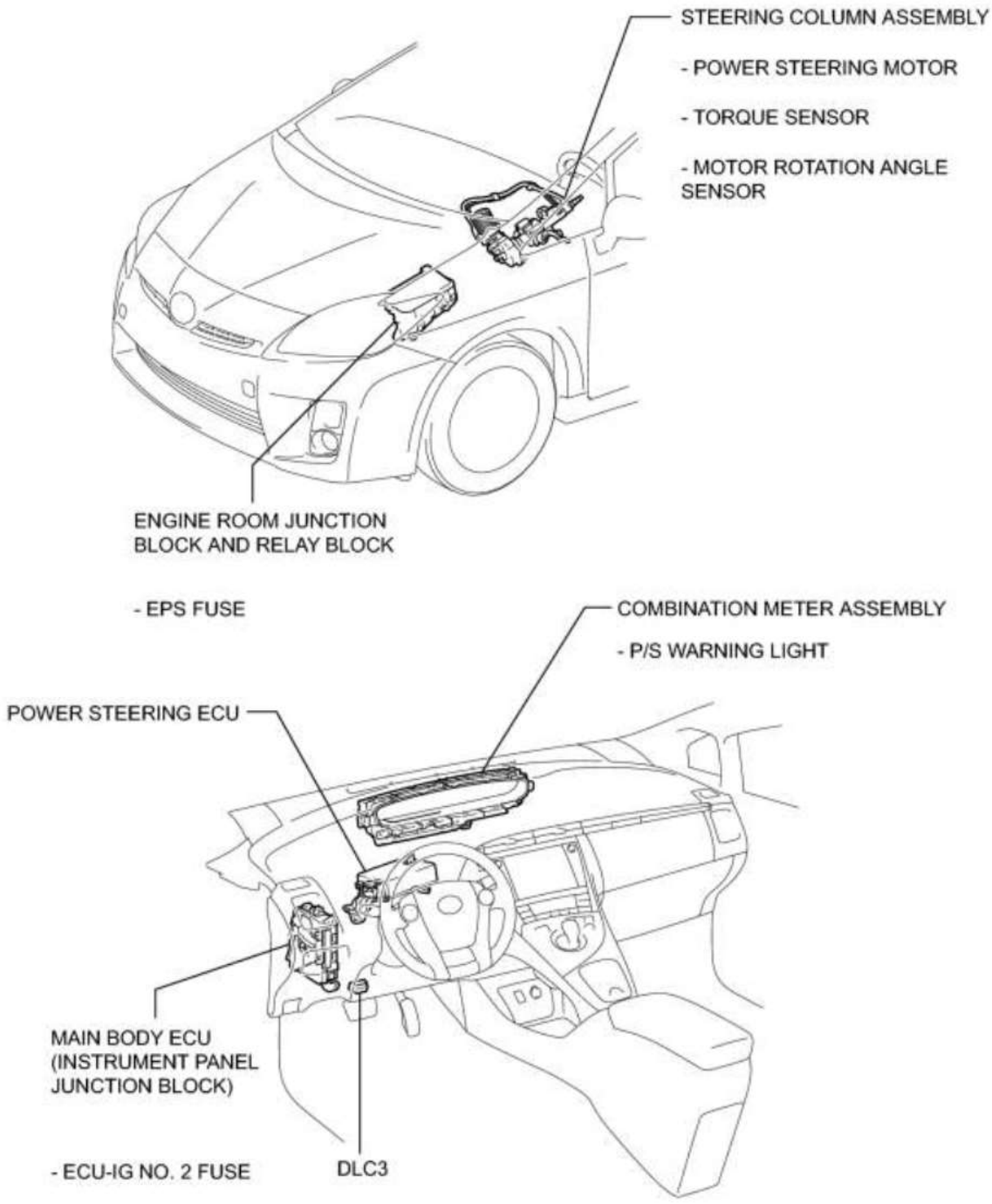
(b) Perform troubleshooting for the communication line problems when the CAN communication DTCs are output. Be sure to start troubleshooting on the power steering system after confirming that the CAN communication system is normal.

(c) Since the CAN communication line has its own length and route, it cannot be repaired temporarily with a bypass wire, etc.

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PARTS LOCATION

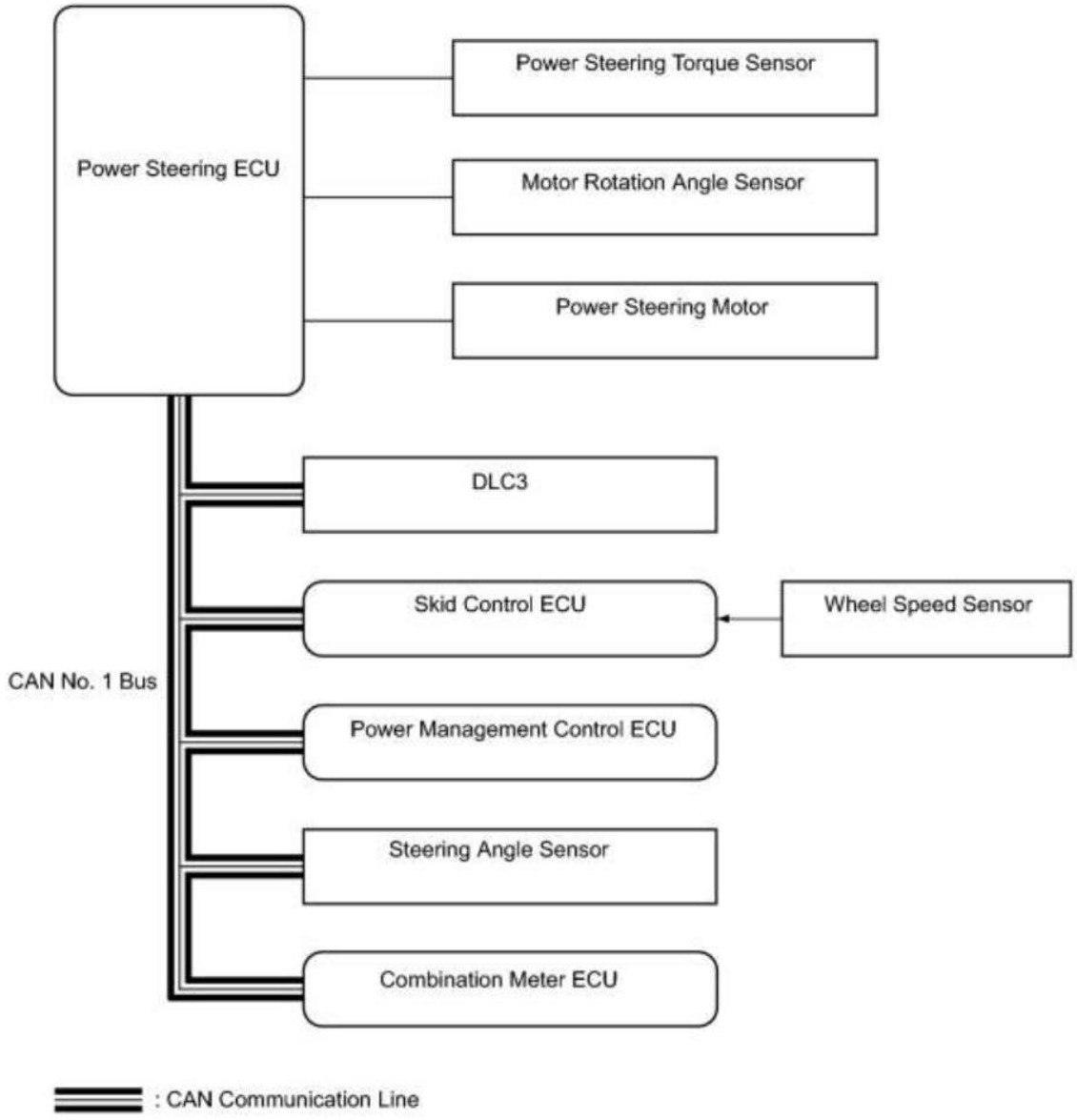
ILLUSTRATION



P

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SYSTEM DIAGRAM



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SYSTEM DESCRIPTION

1. DESCRIPTION

- The power steering system generates torque through the operation of the motor and the reduction gear installed on the column shaft in order to assist steering effort.
- The power steering ECU determines directions and the amount of assisting power in accordance with vehicle speed signals and signals from the torque sensor built into the steering column assembly. As a result, the power steering ECU adjusts the steering effort so that it is lighter during low speed driving and heavier during high speed driving.

(a) Power steering ECU:

The power steering ECU calculates assisting power based on steering torque signals from the torque sensor and vehicle speed signals from the skid control ECU.

(b) Torque sensor:

The torque sensor detects the steering effort generated when the steering wheel is turned and converts it to an electrical signal.

(c) Power steering motor:

The power steering motor is activated by the current from the power steering ECU and generates torque to assist the steering effort.

(d) Motor rotation angle sensor:

The motor rotation angle sensor consists of the resolver sensor, which excels in reliability and durability. The rotation angle sensor detects the rotation angle of the motor and outputs it to the power steering ECU. As a result, it ensures efficient EPS control.

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HOW TO PROCEED WITH TROUBLESHOOTING

HINT:

- Use these procedures to troubleshoot the power steering system.
- *: Use the Techstream.

1.	VEHICLE BROUGHT TO WORKSHOP

NEXT

2.	INSPECT BATTERY VOLTAGE

Standard voltage:

11 to 14 V

If the voltage is below 11 V, recharge or replace the battery before proceeding.

NEXT

3.	CHECK DTC AND FREEZE FRAME DATA*

HINT:

Refer to Clear DTCs INFO.

NEXT

4.	PROBLEM SYMPTOM CONFIRMATION

Result:

Result	Proceed to
Symptom does not occur.	A
Symptom occurs.	B

B Go to step 6

A

5.	SYMPTOM SIMULATION

NEXT

6.	CHECK CAN COMMUNICATION SYSTEM*

(a) Check for DTCs INFO.

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Result:

Result	Proceed to
CAN system DTC is not output	A
CAN system DTC is output	B

HINT:

- If any CAN communication system DTCs are output, perform troubleshooting on the CAN communication system first.
- If communication to the power steering ECU cannot be established through the Techstream, inspect terminals CANH and CANL of the DLC3 and the power steering ECU, and the IG circuit of the power steering ECU.

B INFO PROCEED TO CAN COMMUNICATION SYSTEM

A

7.	CHECK FOR DTC*

(a) Check for DTCs INFO.

HINT:

Refer to Diagnostic Trouble Code Chart when any DTCs are output INFO.

Result:

Result	Proceed to
DTC is not output	A
DTC is output	B

B Go to step 9

A

8.	PROBLEM SYMPTOMS TABLE

(a) Refer to Problem Symptoms Table INFO.

Result:

Result	Proceed to
Fault is not listed in problem symptoms table	A
Fault is listed in problem symptoms table	B

B Go to step 9

A

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9.	OVERALL ANALYSIS AND TROUBLESHOOTING*

(a) Refer to Terminals of ECU INFO.

(b) Refer to Data List / Active Test INFO.

NEXT

10.	REPAIR OR REPLACE

NEXT

11.	CONFIRMATION TEST

NEXT **END**

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CALIBRATION

1. ROTATION ANGLE SENSOR VALUE INITIALIZATION AND TORQUE SENSOR ZERO POINT CALIBRATION

NOTICE:

Clear the rotation angle sensor calibration value, initialize the rotation angle sensor value, and calibrate the torque sensor zero point if any of the following has occurred:

- The power steering ECU has been replaced.
- The steering column assembly has been replaced.
- Steering effort differs between left and right.

(a) Inspection before calibration

(1) Turn the power switch off.

(2) Connect the Techstream to the DLC3.

(3) Turn the power switch on (IG).

(4) Turn the Techstream on.

(5) Calibrate the power steering ECU. Enter the following menus: Chassis / EMPS / Data List.

(6) Check the values by referring to the table below.

Power Steering ECU

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
IG Power Supply	ECU power source voltage/ Min.: 0 V Max.: 20.1531 V	11 to 14 V	Power switch on (IG)

Standard voltage:

11 to 14 V

NOTICE:

If the IG power supply voltage is 9 V or less, calibration cannot be performed. In this case, charge or replace the battery, and then perform calibration.

(b) Rotation angle sensor calibration value clear, rotation angle sensor value initialization, and torque sensor zero point calibration

NOTICE:

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- If DTC C1516 (Torque Sensor Zero Point Adjustment Incomplete) is stored, the torque sensor zero point cannot be calibrated. Clear the DTC before starting calibration.
- If DTC C1526 (Rotation Angle Sensor Initialization Incomplete) is stored, the rotation angle sensor value cannot be initialized. Clear the DTC before starting initialization.

(1) Set the steering wheel to the center point and align the front tires straight ahead.

(2) Turn the power switch off.

(3) Connect the Techstream to the DLC3.

(4) Turn the power switch on (IG).

(5) Turn the Techstream on.

(6) Enter the following menus: Chassis / EMPS / Utility / Torque Sensor Adjustment.

NOTICE:

- Do not turn the steering wheel sharply.
- Do not touch the steering wheel during the torque sensor zero point calibration (for 3 seconds).

(7) Check for DTCs INFO.

NOTICE:

- After rotation angle sensor value initialization and zero point calibration is completed normally, confirm that DTC is not output.
- If DTC C1515, C1516, C1525, C1526, C1534 or C1581 is output, perform troubleshooting for the corresponding DTC.

Result:

Result	See Procedure
DTC C1515 is output.	INFO
DTC C1516 is output.	INFO
DTC C1525 is output.	INFO
DTC C1526 is output.	INFO
DTC C1534 is output.	INFO
DTC C1581 is output.	INFO

2. ASSIST MAP WRITING

HINT:

If DTC C1581 is output after torque sensor zero point calibration, perform assist map writing.

(a) Turn the power switch off.

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(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (IG).

(d) Turn the Techstream on.

(e) Enter the following menus: Chassis / EMPS / Utility / Signal Check.

HINT:

- Follow the instructions on the Techstream to perform Signal Check.
- With DTC C1581 output, performing Signal Check will cause the power steering ECU to enter Test Mode and the assist map will be written automatically.

(f) Check for DTCs INFO.

HINT:

After writing the assist map, if DTC C1581 is output, perform the troubleshooting procedure for DTC C1581 INFO.

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PROBLEM SYMPTOMS TABLE

HINT:

- Use the table below to help determine the cause of problem symptoms. If multiple suspected areas are listed, the potential causes of the symptoms are listed in order of probability in the "Suspected Area" column of the table. Check each symptom by checking the suspected areas in the order they are listed. Replace parts as necessary.
- Inspect the fuses and relays related to this system before inspecting the suspected areas below.

Power Steering System

Symptom	Suspected Area	See page
Heavy steering	Front tires (improperly inflated, unevenly worn)	INFO
	Front wheel alignment (incorrect)	INFO
	Front suspension (lower ball joint)	INFO
	Steering column	INFO
	Torque sensor (built into steering column)	-
	Power steering motor	-
	Speed sensor	INFO
	Battery and power source system	-
	Power steering ECU power source voltage and relay	INFO
	Power steering ECU	INFO
	Skid control ECU	-
Steering effort differs between turning right and left, or steering effort is uneven.	Initialization of rotation angle sensor and calibration of torque sensor zero point are not completed	INFO
	Front tires (improperly inflated, unevenly worn)	INFO
	Front wheel alignment (incorrect)	INFO
	Front suspension (lower ball joint)	INFO
	Power steering gear	INFO
	Torque sensor (built into steering column)	-
	Steering column	INFO
	Power steering motor	-
	Power steering ECU	INFO
While driving, steering effort does not change in accordance with vehicle speed or the steering wheel does not return properly.	Front suspension (lower ball joint)	INFO
	Speed sensor	INFO
	Skid control ECU	-

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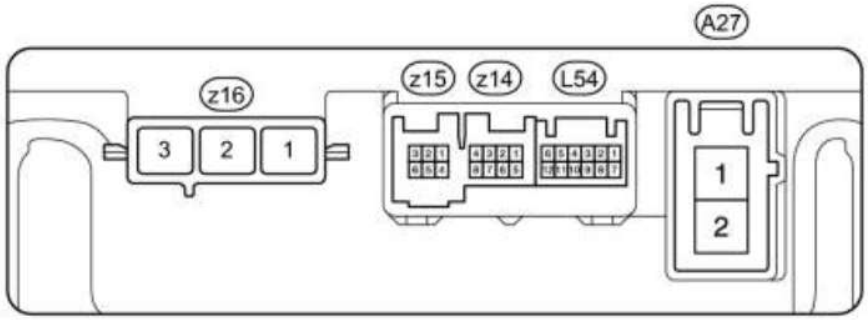
Symptom	Suspected Area	See page
	Combination meter	-
	Torque sensor (built into steering column)	-
	Power steering motor	-
	Power steering ECU	INFO
	CAN communication system	-
A knocking (or clunking) sound occurs when turning the steering wheel back and forth while power steering is operating.	Front suspension (lower ball joint)	INFO
	Steering intermediate shaft	-
	Power steering ECU	INFO
Noise occurs when turning the steering wheel during low-speed driving.	Power steering gear	INFO
	Steering column	INFO
Friction occurs when turning the steering wheel during low-speed driving.	Power steering motor	-
	Steering column	INFO
A high-pitched sound (squeaking) occurs when turning the steering wheel slowly with the vehicle stopped.	Power steering motor	-
The steering wheel vibrates and noise occurs when turning the steering wheel from lock to lock with the vehicle stopped.	Power steering gear	INFO
	Steering column	INFO
P/S warning light remains on.	P/S warning light	INFO

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TERMINALS OF ECU

1. CHECK POWER STEERING ECU

*1



Text in Illustration

*1	Component without harness connected (Power Steering ECU)

HINT:

As connector z16 uses a lock lever, each terminal cannot be checked while the connector is still connected to the power steering ECU.

Terminal No. (Symbols)	Wiring Color	Terminal Description
z16-1 (V)	W	V phase motor output
z16-2 (U)	B	U phase motor output
z16-3 (W)	R	W phase motor output

(a) Measure the voltage and resistance according to the value(s) in the table below.

NOTICE:

When the P/S warning light is illuminated during a malfunction, the fail-safe function may cause the voltage of the power steering ECU terminals to become 0 V.

Terminal No. (Symbols)	Wiring Color	Terminal Description	Condition	Specified Condition
A27-1 (PIG) - A27-2 (PGND)	W - W-B	Power source	Always	11 to 14 V
A27-2 (PGND) - Body ground	W-B - Body ground	Power ground	Always	Below 1 Ω

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Terminal No. (Symbols)	Wiring Color	Terminal Description	Condition	Specified Condition
L54-1 (CANH) - L54-7 (CANL)	R - W	CAN communication line	Power switch off	54 to 69 Ω
L54-6 (IG) - A27-2 (PGND)	B - W-B	IG power source	Power switch on (IG)	11 to 14 V
z15-1 (RZV) - A27-2 (PGND)	R - W-B	Rotation angle sensor excitation output signal	Power switch on (READY) Steering wheel turned	0.68 to 4.42 V
z15-3 (RZG) - A27-2 (PGND)	B - W-B	Rotation angle sensor excitation circuit GND	Always	Below 1 Ω
z15-5 (RZCS) - A27-2 (PGND)	L - W-B	Rotation angle sensor COS aspect output signal	Power switch on (READY) Steering wheel turned	0.68 to 4.42 V
z15-6 (RZSN) - A27-2 (PGND)	Y - W-B	Rotation angle sensor SIN aspect output signal	Power switch on (READY) Steering wheel turned	0.68 to 4.42 V
z14-5 (TRQ1) - z14-8 (TRQG)	-	Torque sensor signal	Power switch on (READY) Steering wheel not turned (without load)	2.3 to 2.7 V
			Power switch on (READY) Steering wheel turned to right with vehicle stopped	2.5 to 3.8 V
			Power switch on (READY) Steering wheel turned to left with vehicle stopped	1.2 to 2.5 V
z14-6 (TRQV) - z14-8 (TRQG)	-	Torque sensor voltage source	Power switch on (IG)	4.5 to 5.5 V
z14-7 (TRQ2) - z14-8 (TRQG)	-	Torque sensor signal	Power switch on (READY) Steering wheel not turned (without load)	2.3 to 2.7 V
			Power switch on (READY) Steering wheel turned to right with vehicle stopped	1.2 to 2.5 V
			Power switch on (READY) Steering wheel turned to left with vehicle stopped	2.5 to 3.8 V
z14-8 (TRQG) - Body ground	- Body ground	Torque sensor ground	Always	Below 1 Ω

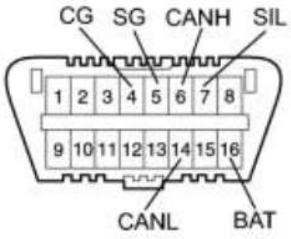
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If the result is not as specified, the ECU may have a malfunction.

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DIAGNOSIS SYSTEM

1. CHECK DLC3



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(a) The ECU uses ISO 15765-4 for communication. The terminal arrangement of the DLC3 complies with SAE J1962 and matches the ISO 15765-4 format.

Symbol (Terminal No.)	Terminal Description	Condition	Specified Condition
SIL (7) - SG (5)	Bus "+" line	During transmission	Pulse generation
CG (4) - Body ground	Chassis ground	Always	Below 1 Ω
SG (5) - Body ground	Signal ground	Always	Below 1 Ω
BAT (16) - Body ground	Battery positive	Always	11 to 14 V
CANH (6) - CANL (14)	CAN bus line	Power switch off*	54 to 69 Ω
CANH (6) - CG (4)	HIGH-level CAN bus line	Power switch off*	200 Ω or higher
CANL (14) - CG (4)	LOW-level CAN bus line	Power switch off*	200 Ω or higher
CANH (6) - BAT (16)	HIGH-level CAN bus line	Power switch off*	6 Ω or higher
CANL (14) - BAT (16)	LOW-level CAN bus line	Power switch off*	6 Ω or higher

NOTICE:

*: Before measuring the resistance, leave the vehicle as is for at least 1 minute and do not operate the power switch or any other switches or the doors.

(b) If the result is not as specified, the DLC3 may have a malfunction. Repair or replace the harness and connector.

HINT:

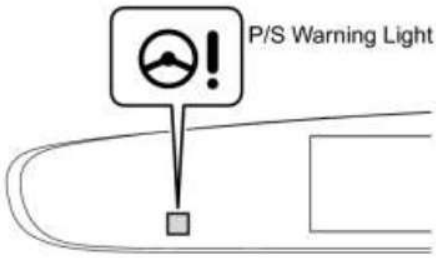
Connect the Techstream cable to the DLC3, turn the power switch on (IG) and attempt to use the Techstream. If the display indicates that a communication error has occurred, there is a problem either with the vehicle or with the Techstream.

- If communication is normal when the Techstream is connected to another vehicle, inspect the DLC3 of the original vehicle.

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- If communication is still not possible when the Techstream is connected to another vehicle, the problem may be in the Techstream itself. Consult the Service Department listed in the Techstream instruction manual.

2. CHECK WARNING LIGHT



(a) When a problem occurs in the power steering system, the P/S warning light on the combination meter comes on to inform the driver of the problem.

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DTC CHECK / CLEAR

1. CHECK DTC

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (IG).

(d) Turn the Techstream on.

(e) Read the DTCs following the display on the Techstream. Enter the following menus: Chassis / EMPS / Trouble Codes.

(f) Refer to the Diagnostic Trouble Code Chart for DTC information INFO.

2. CLEAR DTC

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (IG).

(d) Turn the Techstream on.

(e) Clear the DTCs following the display on the Techstream. Enter the following menus: Chassis / EMPS / Trouble Codes.

(f) According to the display on the Techstream, select the trouble code data display with the clear button.

(g) Turn the power switch off.

(h) Disconnect the Techstream from the DLC3.

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FREEZE FRAME DATA

1. FREEZE FRAME DATA

NOTICE:

- It is difficult to show the specified values (judgment values) clearly because freeze frame data values change significantly due to differences in measurement conditions, surroundings, or vehicle conditions. For this reason, there may be a problem even when the values are within specifications.
- Turn the power switch on (IG) and park the vehicle on level ground. Check the freeze frame data by using the Techstream.

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (IG).

(d) Turn the Techstream on.

(e) Check the freeze frame data on the Techstream.

EMPS

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Meter Vehicle Velocity	Vehicle speed from meter/ Min.: 0 km/h (0 mph) Max.: 300 km/h (186.4 mph)	0 km/h (0 mph)	Power switch on (READY) and vehicle stopped
		No significant fluctuation	Power switch on (READY) and vehicle driven at a constant speed
Motor Actual Current	Amount of current to motor/ Min.: -327.68 A Max.: 327.67 A	Value changes in proportion to steering effort	Power switch on (READY) and power steering is in operation
Command Value Current	Demanded amount of current to motor/ Min.: -327.68 A Max.: 327.67 A	Value changes in proportion to steering effort	Power switch on (READY) and power steering is in operation
Steering Angle Velocity	Steering angle speed/ Min.: -32768 deg/s Max.: 32767 deg/s	Value changes in proportion to steering effort	Power switch on (READY) and steering wheel is turned

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Thermistor Temperature	ECU substrate temperature/ Min.: -40°C (-40°F) Max.: 150°C (302°F)	-40°C to 150°C (-40°F to 302°F)	Power switch on (READY)
PIG Power Supply	Power source voltage to active motor/ Min.: 0 V Max.: 20.1531 V	11 to 14 V	Power switch on (READY) and power steering is in operation
IG Power Supply	ECU power source voltage/ Min.: 0 V Max.: 20.1531 V	11 to 14 V	Power switch on (IG)
Steering Wheel Torque	Steering wheel torque/ Min.: -327.68 Nm Max.: 7 Nm	Value changes in proportion to steering effort	Power switch on (READY) and power steering is in operation
Motor Rotation Angle	Motor rotation angle/ Min.: 0 deg Max.: 1441.77 deg	During steering operation, motor rotation angle value changes from 0 to 360°	Power switch on (READY) and power steering is in operation
Command Val Current 2	Demanded amount of current to motor/ Min.: -327.68 A Max.: 327.67 A	Value changes in proportion to steering effort	Power switch on (READY) and power steering is in operation
PIG2 Voltage	Coil rear pressurization voltage/ Min.: 0 V Max.: 45.955 V	Approximately 27 V	Power switch on (READY) and steering wheel is not turned
		Value changes within 4 to 35 V range	Power switch on (READY) and steering wheel is turned
Motor Voltage	Motor power supply voltage/ Min.: 0 V	Approximately 27 V	Power switch on (READY) and steering wheel is not turned
		Value changes within 4 to 35 V range	Power switch on (READY) and steering wheel is turned

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	Max.: 45.955 V		
Motor Terminal Volt (U)	Motor terminal voltage (U phase)/ Min.: 0 V Max.: 46.667 V	Value changes within 4 to 35 V range	Power switch on (READY) and steering wheel is turned
Motor Terminal Volt (V)	Motor terminal voltage (V phase)/ Min.: 0 V Max.: 46.667 V	Value changes within 4 to 35 V range	Power switch on (READY) and steering wheel is turned
Motor Terminal Volt (W)	Motor terminal voltage (W phase)/ Min.: 0 V Max.: 46.667 V	Value changes within 4 to 35 V range	Power switch on (READY) and steering wheel is turned
Torque Sensor 1 Output	Torque sensor voltage/ Min.: 0 V Max.: 5 V	2.3 to 2.7 V	Power switch on (READY) and steering wheel is not turned (without load)
		2.5 to 3.8 V	Power switch on (READY) and steering wheel turned to right with vehicle stopped
		1.2 to 2.5 V	Power switch on (READY) and steering wheel turned to left with vehicle stopped
Torque Sensor 2 Output	Torque sensor voltage/ Min.: 0 V Max.: 5 V	2.3 to 2.7 V	Power switch on (READY) and steering wheel is not turned (without load)
		1.2 to 2.5 V	Power switch on (READY) and steering wheel turned to right with vehicle stopped
		2.5 to 3.8 V	Power switch on (READY) and steering wheel turned to left with vehicle stopped
TRQ1 Zero Point Value	Torque sensor voltage/ Min.: 0 V Max.: 5 V	Values differ depending on vehicle	Power switch on (READY) and steering wheel is not turned
TRQ2 Zero Point Value	Torque sensor	Values differ depending on vehicle	Power switch on (READY) and steering wheel is not turned

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	voltage/ Min.: 0 V Max.: 5 V		
Ready Status	Ready status/ READY or OFF	READY or OFF	-

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FAIL-SAFE CHART

If a problem occurs in the power steering system, the P/S warning light will come on in the combination meter and the power steering assist will be stopped, locked at a particular point, or decreased simultaneously to protect the system.

Power Steering System

DTC No.	Detection Condition	Fail-safe
C1511	Torque sensor malfunction	Power assist stopped
C1512		
C1513		
C1514		
C1515		
C1516		
C1517		
C1521	Motor circuit malfunction	
C1522		
C1523		
C1524		
C1525	Motor rotation angle sensor malfunction	
C1526		
C1528		
C1531	ECU malfunction	
C1532		
C1533		Assist force restricted
C1534		
C1541	Vehicle speed signal malfunction	Amount of power assist is locked at 100 km/h (62 mph) level of power assist
C1551	IG power source voltage error	Power assist stopped
C1552	PIG power source voltage error	
C1554	Power source relay malfunction	
C1555	Motor relay malfunction	
C1581	Assist map not written in power steering ECU	Controlled using default map
C1582	Assist map mismatch written in power steering ECU	Controlled using current default map
U0129	Skid control ECU communication error	Amount of power assist is locked at 100 km/h (62 mph) level of power assist
U0293	HV ECU communication error	Power assist stopped
U1104	Driving support ECU communication	Power assist control normally (Lane keeping assist system

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DTC No.	Detection Condition	Fail-safe
	error	does not operate)
U1105	Parking assist ECU communication error	Power assist control normally (Parking assist system does not operate)

HINT:

- The amount of power assist may be decreased to prevent the motor and ECUs from overheating if the steering wheel is continuously turned when the vehicle is either stopped or driven at a low speed, or if the steering wheel is kept at either full lock position for a long time. In such cases, the amount of power assist returns to normal if the steering wheel is not turned for approximately 10 minutes with the power switch on (READY).
- If the battery is not sufficiently charged or the voltage decreases temporarily, the amount of power assist will be reduced and the P/S warning light will come on. In such cases, the amount of power assist returns to normal when the battery voltage recovers.

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DATA LIST / ACTIVE TEST

1. DATA LIST

HINT:

Using the Techstream to read the Data List allows the values or states of switches, sensors, actuators and other items to be read without removing any parts. This non-intrusive inspection can be very useful because intermittent conditions or signals may be discovered before parts or wiring is disturbed. Reading the Data List information early in troubleshooting is one way to save diagnostic time.

NOTICE:

In the table below, the values listed under "Normal Condition" are reference values. Do not depend solely on these reference values when deciding whether a part is faulty or not.

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (IG).

(d) Turn the Techstream on.

(e) Enter the following menus: Chassis / EMPS / Data List.

(f) According to the display on the Techstream, read the "Data List".

EMPS

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Meter Vehicle Velocity	Vehicle speed from meter/ Min.: 0 km/h (0 mph) Max.: 300 km/h (186.4 mph)	0 km/h (0 mph)	Power switch on (READY) and vehicle stopped
		No significant fluctuation	Power switch on (READY) and vehicle driven at a constant speed
Motor Actual Current	Amount of current to motor/ Min.: -327.68 A Max.: 327.67 A	Value changes in proportion to steering effort	Power switch on (READY) and power steering is in operation
Command Value Current	Demanded amount of current to motor/ Min.: -327.68 A Max.: 327.67 A	Value changes in proportion to steering effort	Power switch on (READY) and power steering is in operation

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Steering Angle Velocity	Steering angle speed/ Min.: -32768 deg/s Max.: 32767 deg/s	Value changes in proportion to steering effort	Power switch on (READY) and steering wheel is turned
Thermistor Temperature	ECU substrate temperature/ Min.: -40°C (-40°F) Max.: 150°C (302°F)	-40°C to 150°C (-40°F to 302°F)	Power switch on (READY)
PIG Power Supply	Power source voltage to active motor/ Min.: 0 V Max.: 20.1531 V	11 to 14 V	Power switch on (READY) and power steering is in operation
IG Power Supply	ECU power source voltage/ Min.: 0 V Max.: 20.1531 V	11 to 14 V	Power switch on (IG)
Steering Angle Sens Sig	Steering angle sensor signal state/ OK or NG(1) or NG(2) or NG(3)	OK: Steering angle sensor signal is received NG(1): The learning has not completed NG(2): Steering Sensor Abnormal NG(3): Communication Error	-
Steering Wheel Torque	Steering wheel torque/ Min.: -327.68 Nm Max.: 7 Nm	Value changes in proportion to steering effort	Power switch on (READY) and power steering is in operation
Motor Rotation Angle	Motor rotation angle/ Min.: 0 deg Max.: 1441.77 deg	During steering operation, motor rotation angle value changes from 0 to 360°	Power switch on (READY) and power steering is in operation
Command Val Current 2	Demanded amount of current to motor/ Min.: -327.68 A Max.: 327.67 A	Value changes in proportion to steering effort	Power switch on (READY) and power steering is in operation

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
PIG2 Voltage	Coil rear pressurization voltage/ Min.: 0 V Max.: 45.955 V	Approximately 27 V	Power switch on (READY) and steering wheel is not turned
		Value changes within 4 to 35 V range	Power switch on (READY) and steering wheel is turned
Motor Voltage	Motor power supply voltage/ Min.: 0 V Max.: 45.955 V	Approximately 27 V	Power switch on (READY) and steering wheel is not turned
		Value changes within 4 to 35 V range	Power switch on (READY) and steering wheel is turned
Motor Terminal Volt (U)	Motor terminal voltage (U phase)/ Min.: 0 V Max.: 46.667 V	Value changes within 4 to 35 V range	Power switch on (READY) and steering wheel is turned
Motor Terminal Volt (V)	Motor terminal voltage (V phase)/ Min.: 0 V Max.: 46.667 V	Value changes within 4 to 35 V range	Power switch on (READY) and steering wheel is turned
Motor Terminal Volt (W)	Motor terminal voltage (W phase)/ Min.: 0 V Max.: 46.667 V	Value changes within 4 to 35 V range	Power switch on (READY) and steering wheel is turned
Torque Sensor 1 Output	Torque sensor voltage/ Min.: 0 V Max.: 5 V	2.3 to 2.7 V	Power switch on (READY) and steering wheel is not turned (without load)
		2.5 to 3.8 V	Power switch on (READY) and steering wheel turned to right with vehicle stopped
		1.2 to 2.5 V	Power switch on (READY) and steering wheel turned to left with vehicle stopped
Torque Sensor 2 Output	Torque sensor voltage/ Min.: 0 V Max.: 5 V	2.3 to 2.7 V	Power switch on (READY) and steering wheel is not turned (without load)
		1.2 to 2.5 V	Power switch on (READY) and steering wheel turned to right with vehicle stopped
		2.5 to 3.8 V	Power switch on (READY) and

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
			steering wheel turned to left with vehicle stopped
TRQ1 Zero Point Value	Torque sensor voltage/ Min.: 0 V Max.: 5 V	Values differ depending on vehicle	Power switch on (READY) and steering wheel is not turned
TRQ2 Zero Point Value	Torque sensor voltage/ Min.: 0 V Max.: 5 V	Values differ depending on vehicle	Power switch on (READY) and steering wheel is not turned
IG ON/OFF Times	Number of times of power switch ON/OFF after fail detection/ Min.: 0 time Max.: 65535 times	-	This value indicates the number of times of IG ON/OFF after the latest DTC detection.
Motor Overheat Record	Continuous overheat prevention control record/ Unrec or Rec	Unrec	-
Motor Lo Power Record	PIG power source voltage drop record/ Unrec or Rec	Unrec	-
Eng Rev Inter Record	Record of READY ON signal interruption/ Unrec or Rec	Unrec	-
Str Angle Inter Record	Record of steering sensor signal interruption occurrence display/ Unrec or Rec	Unrec	-
Spd Sig Invalid Record	Record of vehicle speed signal invalid/ Unrec or Rec	Unrec	-
Battery Voltage Lo Record	Battery voltage reduction history/ Min.: 0 times, Max.: 65535 times	0 to 65535	-

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Ready Status	Ready status/ READY or OFF	READY or OFF	-
The Number of DTCs	Number of detected DTCs when freeze frame data stored/ Min.: 0 Max.: 255	0 to 255	-

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DIAGNOSTIC TROUBLE CODE CHART

HINT:

If any DTCs are displayed during the DTC check, inspect the circuit listed for those DTCs. For details of each DTC, refer to the page indicated in the DTC chart.

Power Steering System

DTC Code	Detection Item	Trouble Area	Return-to-normal Condition	P/S Warning Light	See page
C1511	Torque Sensor Circuit Malfunction	1. Steering column assembly (Torque sensor) 2. Power steering ECU	Power switch on (IG) again	○	INFO
C1512	Torque Sensor Circuit Malfunction	1. Steering column assembly (Torque sensor) 2. Power steering ECU	Power switch on (IG) again	○	INFO
C1513	Torque Sensor Circuit Malfunction	1. Steering column assembly (Torque sensor) 2. Power steering ECU	Power switch on (IG) again	○	INFO
C1514	Torque Sensor Power Supply Abnormal	1. Steering column assembly (Torque sensor) 2. Power steering ECU	Power switch on (IG) again	○	INFO
C1515	Torque Sensor Zero Point Adjustment Undone	-	Zero point calibration occurs	○	INFO
C1516	Torque Sensor Zero Point Adjustment Incomplete	-	Clear DTC	○	INFO
C1517	Torque Hold Abnormal	1. Steering column assembly (Torque sensor) 2. Power steering ECU	Power switch on (IG) again	○	INFO
C1521	Motor Circuit Malfunction	Power steering ECU	Power switch on (IG) again	○	INFO
C1522	Motor Circuit Malfunction	1. Steering column assembly 2. Power steering ECU	Power switch on (IG) again	○	INFO
C1523	Motor Circuit Malfunction	1. Steering column assembly 2. Power steering ECU	Power switch on (IG) again	○	INFO
C1524	Motor Circuit Malfunction	1. Steering column	Power switch on (IG)	○	INFO

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DTC Code	Detection Item	Trouble Area	Return-to-normal Condition	P/S Warning Light	See page
		assembly 2. Power steering ECU	again		
C1525	Rotation Angle Sensor Initialization Undone	-	Rotation angle sensor calibration occurs	○	INFO
C1526	Rotation Angle Sensor Initialization Incomplete	-	Clear DTC	○	INFO
C1528	Motor Rotation Angle Sensor Malfunction	1. Steering column assembly (Motor rotation angle sensor) 2. Power steering ECU	Power switch on (IG) again	○	INFO
C1531	ECU Malfunction	Power steering ECU	Power switch on (IG) again	○	INFO
C1532	ECU Malfunction	Power steering ECU	Power switch on (IG) again	○	INFO
C1533	ECU Malfunction	Power steering ECU	After normal judgment	X	INFO
C1534	ECU Malfunction	Power steering ECU	After normal judgment	X	INFO
C1541	Vehicle Speed Signal Malfunction	1. Speed sensor circuit 2. Skid control ECU 3. CAN communication system 4. Power steering ECU	Power switch on (IG) again	○	INFO
C1551	IG Power Supply Voltage Malfunction	1. ECU-IG No. 2 fuse 2. IG power source circuit 3. Power steering ECU	Power switch on (IG) again or after normal confirmation	○	INFO
C1552	PIG Power Supply Voltage Malfunction	1. EPS fuse 2. PIG power source circuit 3. Power steering ECU	Power switch on (IG) again or after normal confirmation	○	INFO
C1554	Power Supply Relay Failure	1. EPS fuse 2. PIG power source circuit 3. Power steering ECU	Power switch on (IG) again	○	INFO
C1555	Motor Relay Welding Failure	1. Steering column	Power switch on (IG) again	○	INFO

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DTC Code	Detection Item	Trouble Area	Return-to-normal Condition	P/S Warning Light	See page
		assembly 2. Power steering ECU			
C1581	Assist Map Number Un-Writing	1. Power steering ECU 2. CAN communication system 3. Hybrid control system	Assist map written	○	INFO
C1582	Assist Map Number Mismatch	1. Power steering ECU 2. CAN communication system 3. Power management control ECU	Power switch on (IG) again	○	INFO
U0129	Lost Communication with Brake System Control Module	1. CAN communication system 2. Skid control ECU	After normal confirmation	○	INFO
U0293	Lost Communication with HV ECU	1. CAN communication system 2. Power management control ECU	After normal confirmation	○	INFO
U1104	Lost Communication with Driving Support ECU	1. CAN communication system 2. Driving support ECU	After normal confirmation	X	INFO
U1105	Lost Communication with Parking Assist ECU	1. CAN communication system 2. Parking assist ECU	After normal confirmation	X	INFO

HINT:

- ○: Warning light comes on
- X: Warning light turns off (normal reset)

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ON-VEHICLE INSPECTION

1. CHECK STEERING EFFORT (TORQUE)

NOTICE:

Some of these service operations may affect the SRS airbags. Read the precautionary notices concerning the SRS airbag system before servicing.

(a) Stop the vehicle on a level, paved surface and align the wheels straight ahead.

(b) Disconnect the cable from the negative (-) battery terminal.

CAUTION:

Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to disable the SRS system.

NOTICE:

When disconnecting the cable, some systems need to be initialized after the cable is reconnected INFO.

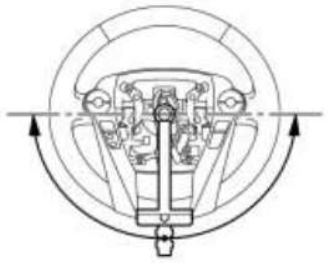
(c) Remove the steering pad INFO.

(d) Connect the cable to the negative (-) battery terminal.

(e) Using a torque wrench, check that the steering wheel set nut is properly tightened.

Torque: **50 N·m (510 kgf·cm, 37ft·lbf)**

(f) Turn the power switch on (READY) so that the power steering is ready to operate.



C

(g) Turn the steering wheel 90 degrees to the right and check the steering effort (torque) while continuing to turn it further in the same direction.

Standard steering effort (Reference):

6.0 N*m (61 kgf*cm, 53 in.*lbf) or less

(h) Align the front wheels facing straight ahead.

(i) Disconnect the cable from the negative (-) battery terminal.

CAUTION:

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Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to disable the SRS system.

(j) Install the steering pad INFO.

(k) Connect the cable to the negative (-) battery terminal.

NOTICE:

When disconnecting the cable, some systems need to be initialized after the cable is reconnected INFO.

(l) Clear the DTCs INFO.

(m) Inspect the airbag warning light INFO.

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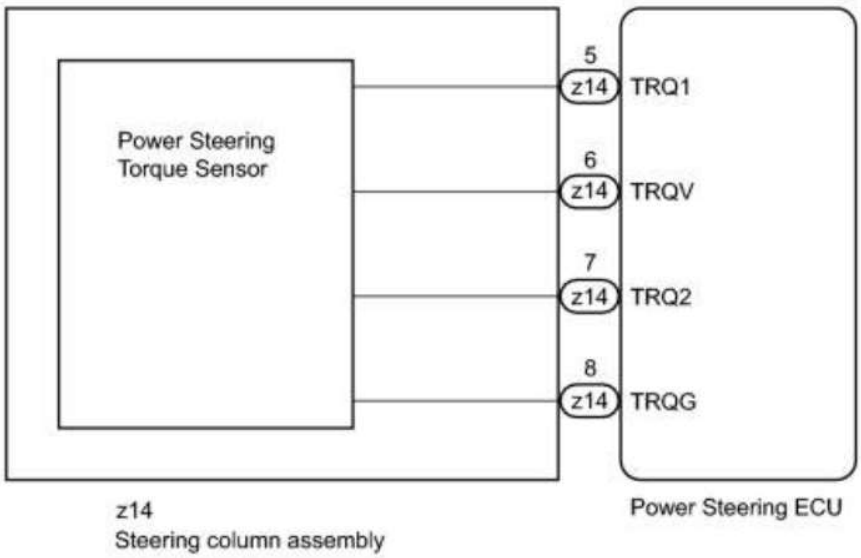
DTC	C1511	Torque Sensor Circuit Malfunction
DTC	C1512	Torque Sensor Circuit Malfunction
DTC	C1513	Torque Sensor Circuit Malfunction
DTC	C1514	Torque Sensor Power Supply Abnormal
DTC	C1517	Torque Hold Abnormal

DESCRIPTION

The torque sensor converts the rotation torque input from the steering wheel into electric signals and sends them to the power steering ECU.

DTC No.	DTC Detection Condition	Trouble Area
C1511	Torque sensor malfunction	• Steering column assembly (Torque sensor) • Power steering ECU
C1512		
C1513		
C1514		
C1517		

WIRING DIAGRAM



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INSPECTION PROCEDURE

NOTICE:

If the steering column assembly or power steering ECU has been replaced, perform the rotation angle sensor value initialization and torque sensor zero point calibration INFO.

PROCEDURE

1.	CHECK CONNECTOR CONNECTION CONDITION (TORQUE SENSOR - ECU)

(a) Check the installation condition of the torque sensor connector.

OK:

Torque sensor connector is securely connected to the power steering ECU.

NG ▶ CONNECT CONNECTOR

OK

▼

2.	READ VALUE USING TECHSTREAM (TORQUE SENSOR1, TORQUE SENSOR2)

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (READY).

(d) Turn the Techstream on.

(e) Enter the following menus: Chassis / EMPS / Data List.

(f) Select the items "Torque sensor 1 output" and "Torque sensor 2 output" in the Data List and read the value displayed on the Techstream.

EMPS

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Torque Sensor 1 Output	Torque sensor voltage/ Min.: 0 V Max.: 5 V	2.3 to 2.7 V	Power switch on (READY) Steering wheel not turned (without load)
		2.5 to 3.8 V	Power switch on (READY) Steering wheel turned to right with vehicle stopped

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
		1.2 to 2.5 V	Power switch on (READY) Steering wheel turned to left with vehicle stopped
Torque Sensor 2 Output	Torque sensor voltage/ Min.: 0 V Max.: 5 V	2.3 to 2.7 V	Power switch on (READY) Steering wheel not turned (without load)
		1.2 to 2.5 V	Power switch on (READY) Steering wheel turned to right with vehicle stopped
		2.5 to 3.8 V	Power switch on (READY) Steering wheel turned to left with vehicle stopped

OK:

Normal condition value is displayed on the Techstream during each steering operation.

NG ▶ CHECK POWER STEERING ECU (TRQV VOLTAGE)

OK ▶ **REPLACE POWER STEERING ECU**

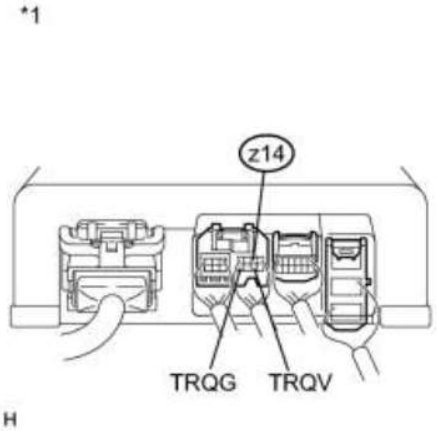
3.	CHECK POWER STEERING ECU (TRQV VOLTAGE)

(a) Turn the power switch on (READY).

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
z14-6 (TRQV) - z14-8 (TRQG)	Power switch on (READY)	4.5 to 5.5 V



Text in Illustration

*1	Component with harness connected (Power Steering ECU)

NG ▶ REPLACE POWER STEERING ECU

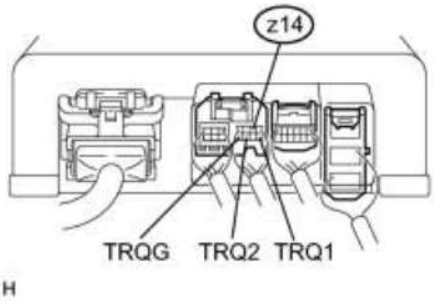
OK

▼

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4.	CHECK POWER STEERING ECU (TRQ1, TRQ2 VOLTAGE)

*1



(a) Turn the power switch on (READY).

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition (Steering Wheel Position)	Specified Condition
z14-5 (TRQ1) - z14-8 (TRQG)	Power switch on (READY) Steering wheel not turned (without load)	2.3 to 2.7 V
	Power switch on (READY) Steering wheel turned to right with vehicle stopped	2.5 to 3.8 V
	Power switch on (READY) Steering wheel turned to left with vehicle stopped	1.2 to 2.5 V
z14-7 (TRQ2) - z14-8 (TRQG)	Power switch on (READY) Steering wheel not turned (without load)	2.3 to 2.7 V
	Power switch on (READY) Steering wheel turned to right with vehicle stopped	1.2 to 2.5 V
	Power switch on (READY) Steering wheel turned to left with vehicle stopped	2.5 to 3.8 V

Text in Illustration

*1	Component with harness connected (Power Steering ECU)

NG ▶ REPLACE STEERING COLUMN ASSEMBLY

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OK ▶ **REPLACE POWER STEERING ECU**

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DTC	C1515	Torque Sensor Zero Point Adjustment Undone
DTC	C1525	Rotation Angle Sensor Initialization Undone

DESCRIPTION

These DTCs do not indicate a malfunction. The power steering ECU outputs these DTCs when it determines that the rotation angle sensor value initialization and torque sensor zero point calibration have not been performed.

DTC No.	DTC Detection Condition	Trouble Area
C1515	This DTC is detected when torque sensor zero point calibration has not been performed.	There is no malfunction if this DTC is not output again after performing zero point calibration.
C1525	This DTC is detected when rotation angle sensor value initialization has not been performed.	There is no malfunction if this DTC is not output again after performing rotation angle sensor value initialization.

INSPECTION PROCEDURE

NOTICE:

If the steering column assembly or power steering ECU has been replaced, perform the rotation angle sensor value initialization and torque sensor zero point calibration INFO.

PROCEDURE

1.	INITIALIZE ROTATION ANGLE SENSOR VALUE AND CALIBRATE TORQUE SENSOR ZERO POINT

(a) Initialize the rotation angle sensor value and calibrate the torque sensor zero point INFO.

NEXT

2.	CHECK FOR DTC

(a) Check for DTCs INFO.

Result:

Condition	Proceed to
DTCs are still output after performing rotation angle sensor value initialization and steering zero point calibration 3 times*1.	A
DTCs are still output even after performing rotation angle sensor value initialization and steering	B

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Condition	Proceed to
zero point calibration once or twice*2.	
Normal system code is output.	C

HINT:

- *1: The power steering ECU must be replaced if DTC C1515 or C1525 is still output even after the rotation angle sensor value initialization and torque sensor zero point calibration is performed 3 times.
- *2: Perform the rotation angle sensor value initialization and torque sensor zero point calibration again if DTC C1515 or C1525 is still output even after the rotation angle sensor value initialization and calibration is performed once or twice.

C ▶ END

B ▶ PERFORM ROTATION ANGLE SENSOR VALUE INITIALIZATION AND ZERO POINT CALIBRATION AGAIN

A ▼

3.	REPLACE POWER STEERING ECU

(a) Replace the power steering ECU INFO.

NEXT ▼

4.	INITIALIZE ROTATION ANGLE SENSOR VALUE AND CALIBRATE TORQUE SENSOR ZERO POINT

(a) Initialize the rotation angle sensor value and calibrate the torque sensor zero point INFO.

NEXT ▼

5.	CHECK FOR DTC

(a) Check for DTCs INFO.

Result:

Condition	Proceed to
DTCs are still output after performing rotation angle sensor value initialization and steering zero point calibration 3 times*1.	A
DTCs are still output even after performing rotation angle sensor value initialization and steering zero point calibration twice*2.	B
Normal system code is output.	C

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HINT:

- *1: The steering column assembly must be replaced if DTC C1515 or C1525 is still output even after the rotation angle sensor value initialization and torque sensor zero point calibration is performed 3 times.
- *2: Perform the rotation angle sensor value initialization and torque sensor zero point calibration again if DTC C1515 or C1525 is still output even after the rotation angle sensor value initialization and calibration is performed twice.

NOTICE:

If replacing the steering column assembly, clear the rotation angle sensor calibration value, initialize the rotation angle sensor value, and calibrate the torque sensor zero point INFO.

C ▶ END

B ▶ PERFORM ROTATION ANGLE SENSOR VALUE INITIALIZATION AND ZERO POINT CALIBRATION AGAIN

A ▶ **REPLACE STEERING COLUMN ASSEMBLY**

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DTC	C1516	Torque Sensor Zero Point Adjustment Incomplete
DTC	C1526	Rotation Angle Sensor Initialization Incomplete

DESCRIPTION

These DTCs do not indicate a malfunction. The power steering ECU outputs these DTCs when it determines that the rotation angle sensor value initialization and torque sensor zero point calibration are incomplete.

DTC No.	DTC Detection Condition	Trouble Area
C1516	Torque sensor zero point calibration is incomplete due to the steering wheel being touched during calibration.	There is no malfunction if this DTC is not output again after clearing the DTCs and torque sensor calibration value, and performing zero point calibration.
C1526	Rotation angle sensor value initialization is incomplete due to the steering wheel being touched during calibration.	There is no malfunction if this DTC is not output again after clearing the DTCs and torque sensor calibration value, and performing rotation angle sensor value initialization.

INSPECTION PROCEDURE

NOTICE:

If the steering column assembly or power steering ECU has been replaced, perform the rotation angle sensor value initialization and torque sensor zero point calibration INFO.

PROCEDURE

1.	CLEAR DTC

(a) Clear the DTCs INFO.

NEXT

2.	INITIALIZE ROTATION ANGLE SENSOR VALUE AND CALIBRATE TORQUE SENSOR ZERO POINT

(a) Initialize the rotation angle sensor value and calibrate the torque sensor zero point INFO.

NEXT

3.	CHECK FOR DTC

(a) Check for DTCs INFO.

Result:

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Condition	Proceed to
DTCs are still output after performing rotation angle sensor value initialization and steering zero point calibration 3 times*1.	A
DTCs are still output even after performing rotation angle sensor value initialization and steering zero point calibration once or twice*2.	B
Normal system code is output.	C

HINT:

- *1: The power steering ECU must be replaced if DTC C1516 or C1526 is still output even after the rotation angle sensor value initialization and torque sensor zero point calibration is performed 3 times.
- *2: Perform the rotation angle sensor value initialization and torque sensor zero point calibration again if DTC C1516 or C1526 is still output even after the rotation angle sensor value initialization and calibration is performed once or twice.

C ▶ END

B ▶ PERFORM ROTATION ANGLE SENSOR VALUE INITIALIZATION AND ZERO POINT CALIBRATION AGAIN

A ▼

4.	REPLACE POWER STEERING ECU

(a) Replace the power steering ECU INFO.

NEXT ▼

5.	CLEAR DTC

(a) Clear the DTCs INFO.

NEXT ▼

6.	INITIALIZE ROTATION ANGLE SENSOR VALUE AND CALIBRATE TORQUE SENSOR ZERO POINT

(a) Initialize the rotation angle sensor value and calibrate the torque sensor zero point INFO.

NEXT ▼

7.	CHECK FOR DTC

(a) Check for DTCs INFO.

Result:

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Condition	Proceed to
DTCs are still output after performing rotation angle sensor value initialization and steering zero point calibration 3 times*1.	A
DTCs are still output even after performing rotation angle sensor value initialization and steering zero point calibration twice*2.	B
Normal system code is output.	C

HINT:

- *1: The steering column assembly must be replaced if DTC C1516 or C1526 is still output even after the rotation angle sensor value initialization and torque sensor zero point calibration is performed 3 times.
- *2: Perform the rotation angle sensor value initialization and torque sensor zero point calibration again if DTC C1516 or C1526 is still output even after the rotation angle sensor value initialization and calibration is performed twice.

NOTICE:

If replacing the steering column assembly, clear the rotation angle sensor calibration value, initialize the rotation angle sensor value, and calibrate the torque sensor zero point INFO.

C ▶ END

B ▶ PERFORM ROTATION ANGLE SENSOR VALUE INITIALIZATION AND ZERO POINT CALIBRATION AGAIN

A ▶ **REPLACE STEERING COLUMN ASSEMBLY**

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DTC	C1521	Motor Circuit Malfunction
DTC	C1531	ECU Malfunction
DTC	C1532	ECU Malfunction
DTC	C1533	ECU Malfunction
DTC	C1534	ECU Malfunction

DESCRIPTION

If the power steering ECU detects these DTCs, it will shut off the motor relay circuit (built into the power steering ECU) and stop power assist. However, power assist continues if DTC C1533 or C1534 is output.

DTC No.	DTC Detection Condition	Trouble Area
C1521	Motor overcurrent	Power steering ECU
C1531	ECU internal malfunction (CPU malfunction)	
C1532	ECU internal malfunction (Peripheral circuit malfunction)	
C1533	ECU internal malfunction (Substrate temperature sensor malfunction)	
C1534	ECU internal malfunction (EEPROM error)	

INSPECTION PROCEDURE

NOTICE:

If the steering column assembly or power steering ECU has been replaced, perform the rotation angle sensor value initialization and torque sensor zero point calibration INFO.

PROCEDURE

1.	CHECK FOR DTC

(a) Clear the DTCs INFO.

(b) Check for DTCs. INFO

OK:

DTC is not output.

NG ▶ REPLACE POWER STEERING ECU

OK ▶ **CHECK INTERMITTENT PROBLEMS**

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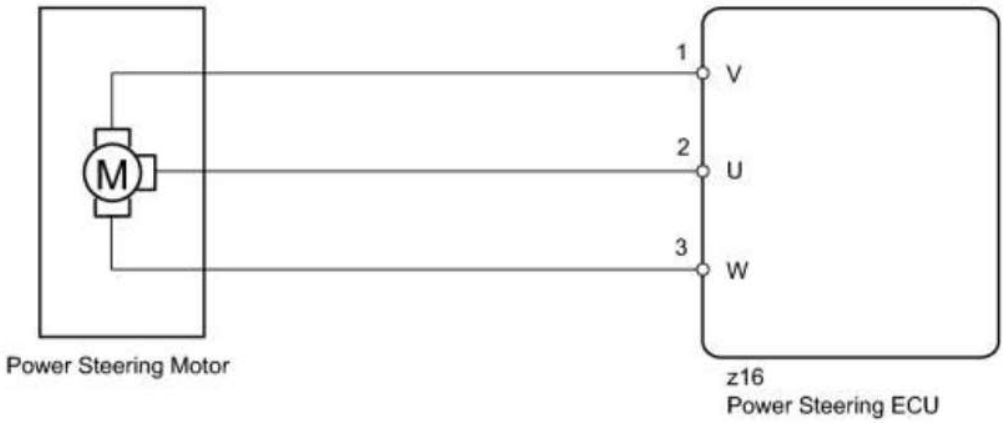
DTC	C1522	Motor Circuit Malfunction
DTC	C1523	Motor Circuit Malfunction
DTC	C1524	Motor Circuit Malfunction
DTC	C1555	Motor Relay Welding Failure

DESCRIPTION

The power steering ECU supplies the current to the power steering motor through the motor circuit.

DTC No.	DTC Detection Condition	Trouble Area
C1522	Motor current sensor malfunction	• Steering column assembly • Power steering ECU
C1523	Excessively large current deviation	
C1524	Short (or open) in motor circuit or abnormal voltage or current in motor circuit	
C1555	Motor relay circuit malfunction	

WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

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If the steering column assembly or power steering ECU has been replaced, perform the rotation angle sensor initialization and torque sensor zero point calibration INFO.

PROCEDURE

1.	READ VALUE USING TECHSTREAM (MOTOR VOLTAGE)

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (READY).

(d) Turn the Techstream on.

(e) Enter the following menus: Chassis / EMPS / Data List.

(f) Select the items "Motor Terminal Volt(U)", "Motor Terminal Volt(V)" and "Motor Terminal Volt(W)" in the Data List and read the value displayed on the Techstream.

EMPS

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Motor Terminal Volt (U)	Motor terminal voltage (U phase)/ Min.: 0 V Max.: 46.667 V	Value changes within 4 to 35 V range	Power switch on (READY) and steering wheel is turned
Motor Terminal Volt (V)	Motor terminal voltage (V phase)/ Min.: 0 V Max.: 46.667 V	Value changes within 4 to 35 V range	Power switch on (READY) and steering wheel is turned
Motor Terminal Volt (W)	Motor terminal voltage (W phase)/ Min.: 0 V Max.: 46.667 V	Value changes within 4 to 35 V range	Power switch on (READY) and steering wheel is turned

Result:

Result	Proceed to
During steering operation, value changes within 4 to 35 V range	A
During steering operation, voltage is not generated	B

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B ▶ REPLACE STEERING COLUMN ASSEMBLY

A ▶ **REPLACE POWER STEERING ECU**

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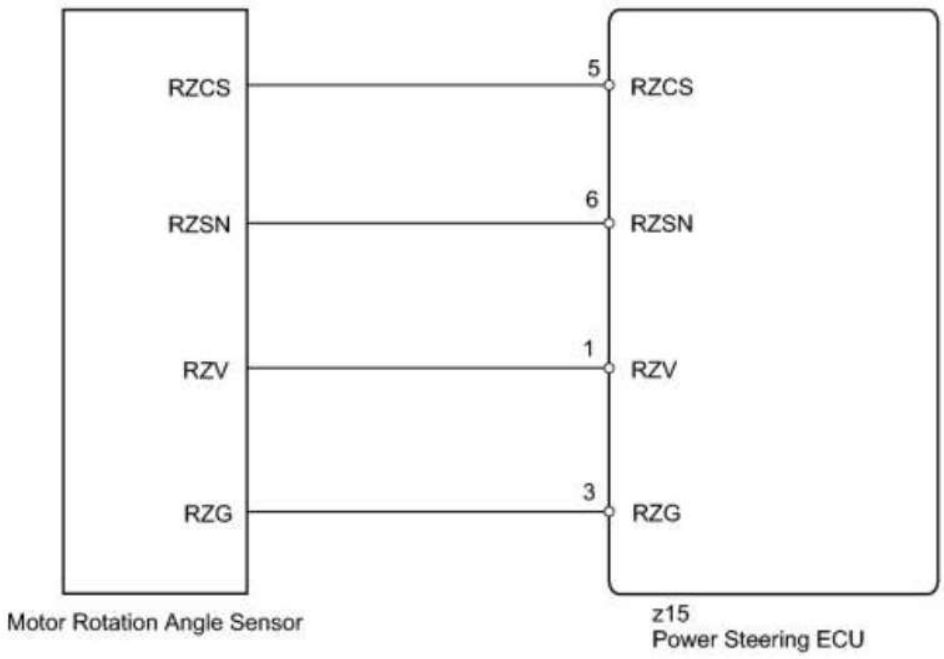
DTC	C1528	Motor Rotation Angle Sensor Malfunction

DESCRIPTION

The motor rotation angle sensor detects the motor rotation angle and sends this information to the power steering ECU.

DTC No.	DTC Detection Condition	Trouble Area
C1528	Motor rotation angle sensor malfunction	• Steering column assembly (Motor rotation angle sensor) • Power steering ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

If the steering column assembly or power steering ECU has been replaced, perform the rotation angle sensor initialization and torque sensor zero point calibration INFO.

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PROCEDURE

1.	CHECK CONNECTOR CONNECTION CONDITION

(a) Check the installation condition of the motor rotation angle sensor connector.

OK:

Motor rotation angle sensor connector is securely connected to the power steering ECU.

NG ▶ CONNECT CONNECTOR

OK

▼

2.	READ VALUE USING TECHSTREAM (MOTOR ROTATION ANGLE SENSOR)

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (READY).

(d) Turn the Techstream on.

(e) Enter the following menus: Chassis / EMPS / Data List.

(f) Select the item "Motor Rotation Angle" in the Data List and read the value displayed on the Techstream.

EMPS

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Motor Rotation Angle	Motor rotation angle/ Min.: 0 deg Max.: 1441.77 deg	During steering operation, motor rotation angle value changes from 0 to 360°	Power switch on (READY) and power steering in operation

OK:

During steering operation, motor rotation angle value changes from 0 to 360°.

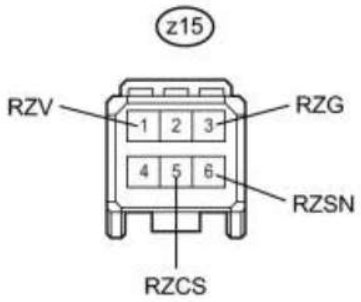
NG ▶ CHECK STEERING COLUMN ASSEMBLY

OK ▶ **REPLACE POWER STEERING ECU**

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3.	CHECK STEERING COLUMN ASSEMBLY

*1



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(a) Disconnect the connector from the motor rotation angle sensor.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
z15-6 (RZSN) - z15-3 (RZG)	Always	75.2 to 112.8 Ω
z15-1 (RZV) - z15-3 (RZG)	Always	27.6 to 41.4 Ω
z15-5 (RZCS) - z15-3 (RZG)	Always	73.2 to 110.8 Ω

Text in Illustration

*1	Front view of wire harness connector (to Motor Rotation Angle Sensor)

NG ▶ REPLACE STEERING COLUMN ASSEMBLY

OK ▶ **REPLACE POWER STEERING ECU**

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DTC	C1541	Vehicle Speed Signal Malfunction

DESCRIPTION

The power steering ECU receives vehicle speed signals from the skid control ECU via CAN communication. The ECU provides appropriate assisting force in accordance with the vehicle speed, based on the signals.

If the ECU detects this DTC, it adjusts the amount of power assistance for a speed of 100 km/h (62 mph) and continues the system control.

DTC No.	DTC Detection Condition	Trouble Area
C1541	This DTC is detected when vehicle speed signals via CAN communication are cut off for 3 seconds or more.	• Speed sensor circuit • Skid control ECU • CAN communication system • Power steering ECU

INSPECTION PROCEDURE

NOTICE:

If the steering column assembly or power steering ECU has been replaced, perform the rotation angle sensor value initialization and torque sensor zero point calibration INFO.

PROCEDURE

1.	CHECK OTHER DTC OUTPUT (CAN COMMUNICATION SYSTEM)

(a) Check if DTC U0129 is output.

Result:

Result	Proceed to
No output	A
U0129 is output	B

HINT:

DTC U0129 indicates a skid control ECU communication malfunction in the power steering system.

B ▶ GO TO CAN COMMUNICATION SYSTEM

A ▼

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2.	CHECK OTHER DTC OUTPUT (ELECTRONICALLY CONTROLLED BRAKE SYSTEM)

(a) Check for DTCs of the electronically controlled brake system INFO.

OK:

DTC of speed sensor malfunction is not output.

NOTICE:

If replacing the power steering ECU, initialize the rotation angle sensor and calibrate the torque sensor zero point INFO.

NG ▶ REPAIR CIRCUIT INDICATED BY OUTPUT CODE (for Electronically Controlled Brake System)
OK ▶ **REPLACE POWER STEERING ECU**

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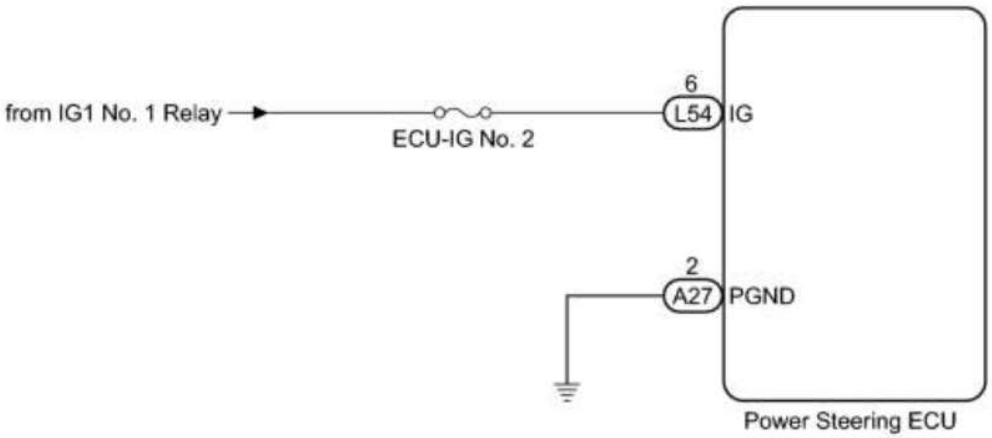
DTC	C1551	IG Power Supply Voltage Malfunction

DESCRIPTION

The power steering ECU distinguishes the power switch status as on (IG) or off through the IG power source circuit.

DTC No.	DTC Detection Condition	Trouble Area
C1551	IG power source circuit malfunction inside ECU	• ECU-IG No. 2 fuse • IG power source circuit • Power steering ECU

WIRING DIAGRAM



H

INSPECTION PROCEDURE

NOTICE:

If the steering column assembly or power steering ECU has been replaced, perform the rotation angle sensor value initialization and torque sensor zero point calibration INFO.

HINT:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

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PROCEDURE

1.	READ VALUE USING TECHSTREAM (IG POWER SUPPLY)

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (IG).

(d) Turn the Techstream on.

(e) Enter the following menus: Chassis / EMPS / Data List.

(f) Select the item "IG power supply" in the Data List and read the value displayed on the Techstream.

EMPS

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
IG power supply	IG power supply/ Min.: 0 V Max.: 20.1531 V	11 to 14 V	Power switch on (IG)

OK:

The normal condition value is displayed on the Techstream.

NG ▶ CHECK HARNESS AND CONNECTOR (BATTERY - POWER STEERING ECU)

OK ▶ **CHECK INTERMITTENT PROBLEMS**

2.	CHECK HARNESS AND CONNECTOR (BATTERY - POWER STEERING ECU)

(a) Disconnect the connectors from the power steering ECU.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
L54-6 (IG) - Body ground	Power switch on (IG)	11 to 14 V

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

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Tester Connection	Condition	Specified Condition
A27-2 (PGND) - Body ground	Always	Below 1 Ω

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE POWER STEERING ECU**

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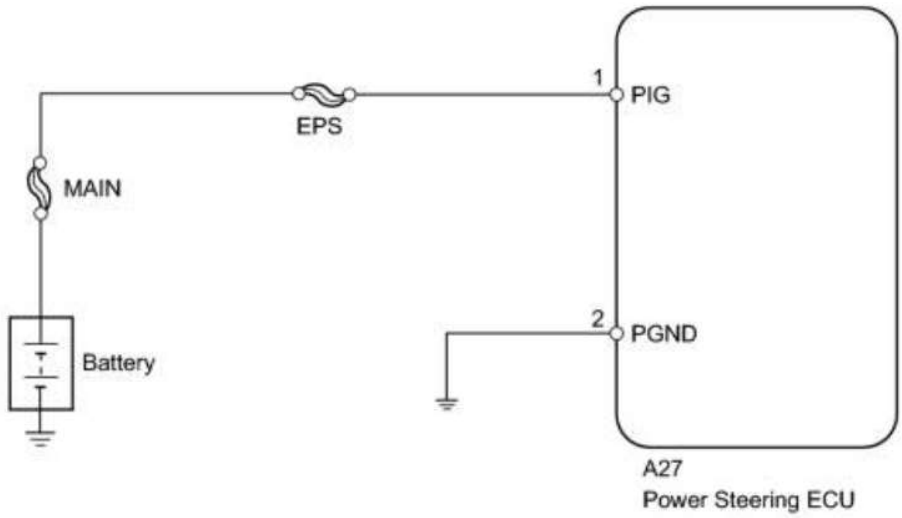
DTC	C1552	PIG Power Supply Voltage Malfunction
DTC	C1554	Power Supply Relay Failure

DESCRIPTION

When a problem occurs in the power steering system, the power source relay circuit is shut off to stop the power assist.

DTC No.	DTC Detection Condition	Trouble Area
C1552	PIG power source circuit malfunction inside ECU	• EPS fuse • PIG power source circuit • Power steering ECU
C1554	Power source relay circuit malfunction	• EPS fuse • PIG power source circuit • Power steering ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

If the steering column assembly or power steering ECU has been replaced, perform the rotation angle sensor initialization and torque sensor zero point calibration INFO.

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HINT:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1.	READ VALUE USING TECHSTREAM (PIG POWER SUPPLY)

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (READY).

(d) Turn the Techstream on.

(e) Enter the following menus: Chassis / EMPS / Data List.

(f) Select the item "PIG power supply" in the Data List and read the value displayed on the Techstream.

EMPS

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
PIG power supply	PIG power supply/ Min.: 0 V Max.: 20.1531 V	11 to 14 V	Power switch on (READY) and power steering in operation

OK:

The normal condition value is displayed on the Techstream.

NG ▶ CHECK HARNESS AND CONNECTOR (POWER STEERING ECU - BATTERY AND BODY GROUND)

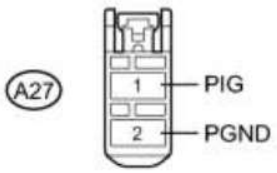
OK ▶ **CHECK INTERMITTENT PROBLEMS**

2.	CHECK HARNESS AND CONNECTOR (POWER STEERING ECU - BATTERY AND BODY GROUND)

(a) Disconnect the connector from the power steering ECU.

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*1



H

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Condition	Specified Condition
A27-1 (PIG) - Body ground	Always	11 to 14 V

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
A27-2 (PGND) - Body ground	Always	Below 1 Ω

Text in Illustration

*1	Front view of wire harness connector (to Power Steering ECU)

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ **REPLACE POWER STEERING ECU**

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DTC	C1581	Assist Map Number Un-Writing

DESCRIPTION

The power steering ECU outputs this DTC when it determines that the assist map is not written in the ECU.

DTC No.	DTC Detection Condition	Trouble Area
C1581	Assist map not written in power steering ECU	• Power steering ECU • Hybrid control system • CAN communication system

INSPECTION PROCEDURE

NOTICE:

If the steering column assembly or power steering ECU has been replaced, perform the rotation angle sensor value initialization and torque sensor zero point calibration INFO.

PROCEDURE

1.	PERFORM ASSIST MAP WRITING

(a) Perform the assist map writing INFO.

NEXT

2.	CHECK FOR DTC

(a) Check for DTCs INFO.

Result:

Result	Proceed to
DTC is still output even after performing assist map writing 3 times.	A
DTC is still output even after performing assist map writing once or twice*1	B
DTC is not output.	C

HINT:

*1: Perform the assist map writing again if DTC C1581 is still output even after the assist map writing is performed once or twice.

C END

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B ▶ PERFORM ASSIST MAP WRITING AGAIN

A ▼

3.	CHECK FOR DTC (CAN COMMUNICATION SYSTEM)

(a) Check for DTCs INFO.

OK:

DTC is not output.

HINT:

If the CAN communication system DTC is output, first troubleshoot the CAN communication system malfunction, then perform the assist map writing again INFO.

NG ▶ GO TO CAN COMMUNICATION SYSTEM

OK ▼

4.	CHECK FOR DTC (HYBRID CONTROL SYSTEM)

(a) Check for DTCs INFO.

OK:

DTC is not output.

HINT:

If the hybrid control system DTC is output, first troubleshoot the hybrid control system, then perform the assist map writing again INFO.

NG ▶ GO TO HYBRID CONTROL SYSTEM

OK ▶ **REPLACE POWER STEERING ECU**

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DTC	C1582	Assist Map Number Mismatch

DESCRIPTION

When an incorrect skid control ECU is installed after the assist map has been recorded in the power steering ECU, then DTC C1582 is stored because the data does not match the vehicle specifications.

DTC No.	DTC Detection Condition	Trouble Area
C1582	Assist map number mismatch	• Power steering ECU • CAN communication system • Power management control ECU

INSPECTION PROCEDURE

NOTICE:

If the power steering ECU has been replaced with a new one, perform the rotation angle sensor value initialization and torque sensor zero point calibration INFO.

PROCEDURE

1.	CHECK FOR DTC (CAN COMMUNICATION SYSTEM)

(a) Using the Techstream, check for DTCs and confirm that there are no problems in the CAN communication system INFO.

OK:

DTC is not output.

NG ▶ GO TO CAN COMMUNICATION SYSTEM
OK
▼

2.	CHECK POWER MANAGEMENT CONTROL ECU

(a) Check if a power management control ECU that complies with the vehicle specifications is installed.

OK:

The power management control ECU that complies with vehicle specifications is installed.

NG ▶ REPLACE POWER MANAGEMENT CONTROL ECU
OK ▶ **REPLACE POWER STEERING ECU**

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DTC	U0129	Lost Communication with Brake System Control Module
DTC	U0293	Lost Communication with HV ECU
DTC	U1104	Lost Communication with Driving Support ECU
DTC	U1105	Lost Communication with Parking Assist ECU

DESCRIPTION

The power steering ECU receives signals from the power management control ECU, the skid control ECU, the driving support ECU and the parking assist ECU via the CAN communication system.

DTC No.	DTC Detection Condition	Trouble Area
U0129	Lost communication with brake system control module	• CAN communication system • Skid control ECU
U0293	Lost communication with power management control ECU	• CAN communication system • Power management control ECU
U1104	Lost communication with driving support ECU	• CAN communication system • Driving support ECU
U1105	Lost communication with parking assist ECU	• CAN communication system • Parking assist ECU

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK FOR DTC

(a) Clear the DTCs INFO.

(b) Check for DTCs INFO.

OK:

DTC is not output.

NG ▶ GO TO CAN COMMUNICATION SYSTEM
OK ▶ **CHECK INTERMITTENT PROBLEMS**

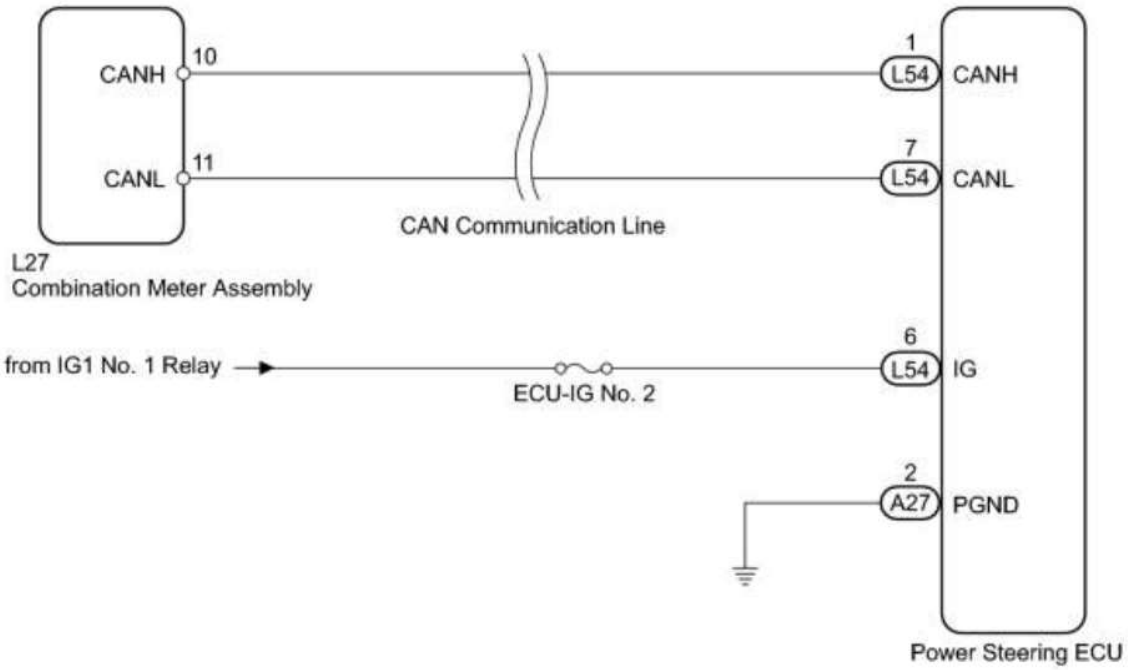
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EPS Warning Light Circuit

DESCRIPTION

If the power steering ECU detects a malfunction, the P/S warning light comes on. At this time, the power steering ECU stores a DTC in its memory.

WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

If the steering column assembly or power steering ECU has been replaced, perform the rotation angle sensor initialization and torque sensor zero point calibration INFO.

PROCEDURE

1.	CHECK FOR DTC (CAN COMMUNICATION SYSTEM)

(a) Check for DTCs INFO.

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OK:

DTC is not output.

NG ▶ GO TO CAN COMMUNICATION SYSTEM

OK

▼

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

(a) Disconnect the connectors from the power steering ECU.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Condition	Specified Condition
L54-6 (IG) - A27-2 (PGND)	Power switch on (IG)	11 to 14 V

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
A27-2 (PGND) - Body ground	Always	Below 1 Ω

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

▼

3.	PERFORM ACTIVE TEST USING TECHSTREAM

(a) Turn the power switch off.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (IG).

(d) Turn the Techstream on.

(e) Enter the following menus: Body Electrical / Combination Meter / Active Test.

(f) Perform the Active Test of the combination meter using the Techstream.

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Combination Meter

Tester Display	Test Part	Control Range	Diagnostic Note
Indicat. EPS	EPS warning light	OFF or ON	Confirm that the vehicle is stopped with the engine idling

(g) Check that the EPS warning light operates in accordance with the Active Test.

HINT:

Reconnect the connectors and restore the vehicle to its previous condition before checking the combination meter.

NG ▶ REPLACE MATER CIRCUIT PLATE NO.3

OK ▶ **REPLACE POWER STEERING ECU**

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