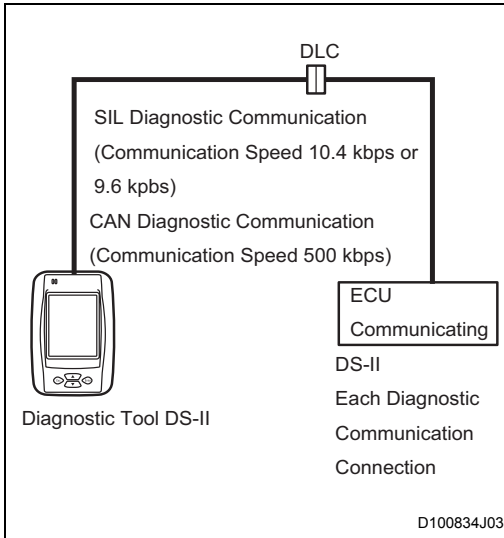


HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

NEW DIAGNOSTIC SYSTEM



1. DESCRIPTION

- (a) The new diagnostic system is a new diagnostic system compatible with the vehicle's highly developed and sophisticated electronic system. The function of the malfunction diagnostic system can be utilized with the DS-II diagnostic tool.

2. FUNCTIONS OF DS-II DIAGNOSTIC TOOL

- (a) The functions of the DS-II diagnostic tool, which is compatible with this new diagnostic system, are shown below.

Function	Description	
Diagnosis	Vehicle Diagnosis	ALL diagnosis
		CAN bus diagnosis
	System Diagnosis	Diagnostic code freeze data
		ECU DATA LIST
		ACTIVE TEST
		Mode change
		Freeze data operation
		TEST MODE INSPECTION
		BASIC INSPECTION
		Specified operation / Control record
OPERATION SUPPORT	Required operation support functions when replacing ECU or actuator	
Stored Data	Functions for outputting / Erasing stored data	
Measure	Load voltmeter side and oscilloscope functions	

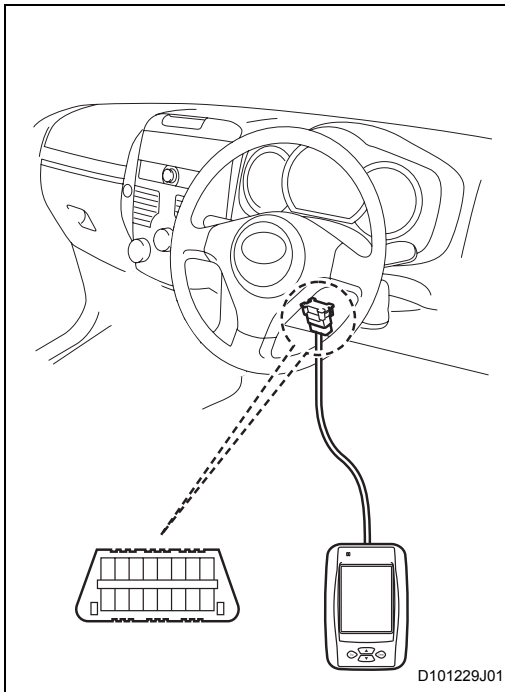
3. COMPUTERS AND SENSORS RELATED TO DIAGNOSTIC COMMUNICATION

Computer Sensor Name	DTC Check Normal Mode)	DTC Check (Check Mode, Test Mode)	Freeze Frame Data Computer Data When a Malfunction Occurs	Data Monitor Save / Display	ACTIVE TEST	DS-II and Communication Line
EFI ECU	○	-	○	○	○(*)	CAN
Automatic ECU	○	-	○	○	○(*)	SIL
ABS ECU	○	○	○	○	○	SIL
Airbag ECU	○	-	-	-	-	SIL
Immobilizer ECU	○	-	-	○	-	SIL

*: Data monitor can be used simultaneously



IN



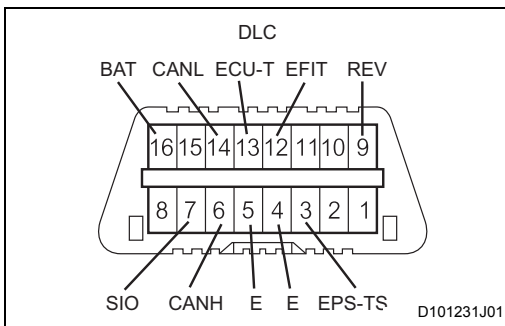
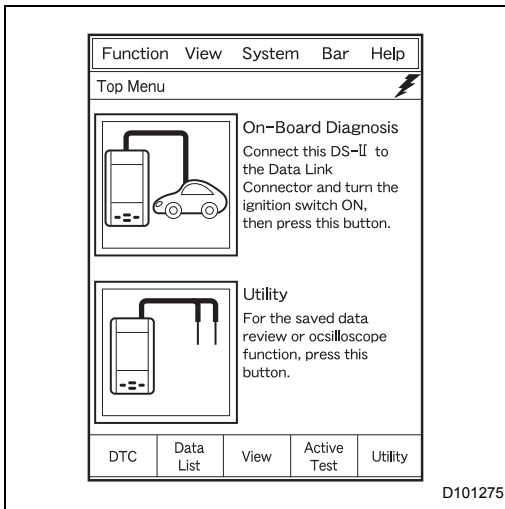
4. HOW TO USE DS-II DIAGNOSTIC TOOL

(a) CONNECT TO VEHICLE

- (1) Connect the DS-II to the DLC (data link connector No. 3) located in the area around the driver's foot.

(b) HOW TO USE DS-II DIAGNOSTIC TOOL

- (1) When the power switch of the diagnosis tool DS-II is turned ON, the menu screen will be displayed.
- (2) Select the options you wish to perform. Then perform work, following the prompts on the screen.

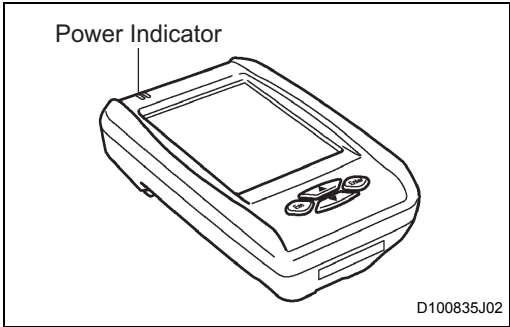


5. DIAGNOSIS CONNECTOR

- (a) With the adoption of the new diagnostic system, the functions are consolidated on the DLC (located in the lower portion of the driver instrument panel).
- (b) DLC Terminals and Functions

Terminal Name	Function
BAT	Battery power supply
CANL	Each computer and its diagnosis CAN communication LO
ECU-T	ECU-T check terminal
ECU-T	EFI-T check terminal
REV	Engine revolution signal
SIO	Each computer and diagnostic communication
CANH	Each computer and its diagnostic CANHI communication

Terminal Name	Function
E	Signal ground
E	Body ground
EPS-TS	EPS-TS check terminal



6. HOW TO PROCEED WHEN ERRORS OCCUR

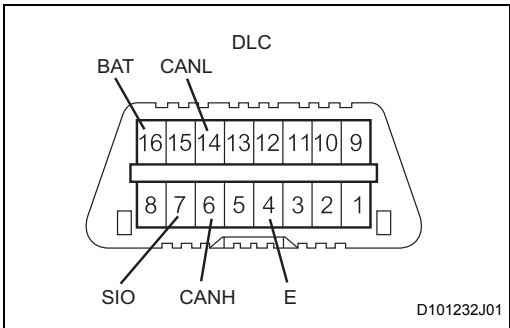
NOTICE:

Perform the following inspections if the DS-II power indicator does not light.

IN

(a) WHEN DS-II POWER INDICATOR FAILS TO ILLUMINATE

(1) Connect the DS-II to another vehicle and start the DS-II.



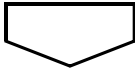
Operating Condition	Trouble area	Suspected Area
If the DS-II power indicator turns red or green	Vehicle side	1. Check the DLC BAT terminal voltage 2. Check the continuity between the DLC CG terminal and the body ground
If the DS-II power indicator light does not illuminate	DS-II tester	-

DESCRIPTION OF BASIC DIAGNOSTIC PROCEDURES

HINT:

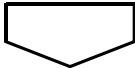
Perform troubleshooting in accordance with the procedures below. The following shows only basic procedures. Details about the most effective methods for each circuit are listed in the sections for each system. Confirm the troubleshooting procedures for the circuit you are working on before beginning troubleshooting.

1	VEHICLE BROUGHT TO WORKSHOP
---	-----------------------------



2	CUSTOMER PROBLEM ANALYSIS
---	---------------------------

- (a) Ask the customer about the conditions and environment when the problem occurred and create a customer problem analysis check.

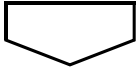


3	SYMPTOM CONFIRMATION AND DTC (AND FREEZE FRAME DATA) CHECK
---	--

- (a) Using an electrical tester, check the battery voltage.

Standard:**10 to 14 V (during engine stop)**

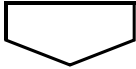
- (b) Visually check for broken fuses, disconnected wire harnesses, short circuits and connectors with bad connections.
- (c) Confirm the problem symptoms and conditions, and check the following chart for DTCs.

DTC is output:**Proceed to DTC Chart****DTC is not output:****Proceed to Problem Symptoms Chart****4****UNDERSTANDING VEHICLE CONDITION**

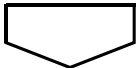
- (a) Memory is erased when the negative (-) battery terminal is disconnected. Therefore, in order to restore initial settings for replacement parts, make a note of initial system settings before conducting repairs.

HINT:

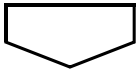
- For operation settings when disconnecting and reconnecting the negative (-) battery terminal.(See page SS-10)
- For operation settings when installing and removing parts. (See page SS-11)

**5****CIRCUIT INSPECTION OR PARTS INSPECTION**

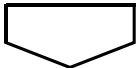
- (a) Using the DTC chart or problem symptom table, confirm whether a check of circuit system or parts is necessary.

**6****REPAIR OF PROBLEMS**

- (a) Following the directions found in step 5, repair the malfunctioning system or part.

**7****CONFIRMATION TEST**

- (a) When the repair is completed, confirmed that the malfunction has disappeared. If the malfunction does not reoccur, perform a confirmation test under the same conditions and in the same environment as when the malfunction occurred the first time.)
- (b) If the malfunction outputs a DTC, confirm the diagnostic result.

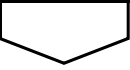


8**RESTORING VEHICLE**

- (a) Restore all vehicle settings using the procedure found in step 4.

HINT:

Explain to the customer that there may be some settings that cannot be restored.

IN**OK**

CUSTOMER PROBLEM ANALYSIS

1. In troubleshooting, confirm that the problem symptoms have been accurately identified. Preconceptions should be discarded in order to make an accurate judgment. To clearly understand what the problem symptoms are, it is extremely important to ask the customer about the problem and the conditions at the time the malfunction occurred.
2. The following 5 questions are important points in the problem analysis. Because past problems that seem unrelated may also help in some cases, when troubleshooting it is necessary to gather as much information as possible and possess a clear understanding of their relationship to the problem symptoms. Customer problem analysis is listed in the diagnosis section for each system.
 - What? Vehicle model, system name
 - When? Date, time, occurrence frequency
 - Where? Road conditions
 - Under what conditions? Driving conditions, weather conditions
 - How did it happen? Problem symptoms

HINT:

The following shows one example of a customer problem analysis.

Engine Problem Diagnosis Check Sheet

Model		Date vehicle brought in		Service history	No/Yes (_ times)
VIN		Date registered		Registration No.	
		Date problem first occurred		Odometer reading	km
Accessories					

Previous vehicle	Main region/purpose of travel
Customer profile/characteristics	
Description of symptoms	
Warning light illumination Off/On ()	

	System Conditions	Driving Conditions	Road Conditions	Others	Problem Frequency
Check Results	Speed problem first occurred()km/h Shift position () range <input type="checkbox"/> Starting off <input type="checkbox"/> Immediately after start off <input type="checkbox"/> () min after start <input type="checkbox"/> After ()min driving <input type="checkbox"/> Cold <input type="checkbox"/> Warm <input type="checkbox"/> Idling <input type="checkbox"/> Others ()	<input type="checkbox"/> Starting off Cruising <input type="checkbox"/> Increasing speed <input type="checkbox"/> Decreasing speed <input type="checkbox"/> Braking <input type="checkbox"/> Turning <input type="checkbox"/> Stopped <input type="checkbox"/> Not related <input type="checkbox"/> Others ()	<input type="checkbox"/> Level <input type="checkbox"/> Uphill <input type="checkbox"/> Downhill <input type="checkbox"/> Dry paved road <input type="checkbox"/> Wet paved road <input type="checkbox"/> Unpaved/rough road <input type="checkbox"/> Snowy/icy road <input type="checkbox"/> Uneven, manholes etc. <input type="checkbox"/> Others ()	Accelerator opening ()% Ambient air temperature () Weather ()	<input type="checkbox"/> Always <input type="checkbox"/> One time only <input type="checkbox"/> Sometimes <input type="checkbox"/> ()times a day <input type="checkbox"/> ()times a week <input type="checkbox"/> ()times a month
	Additional Items				

Inspection Results	DTC Inspection		
	Malfunction Indicator Lamp (MIL) Off/On	<input type="checkbox"/> Normal Code(s) <input type="checkbox"/> Malfunction code(s)(all noted)	Fuel pressure when engine stopped Fuel pressure 1 min. after engine stopped
	Problem details Driving conditions and location when problem first occurred and reoccurred		
	Reoccurrence conditions <input type="checkbox"/> Always <input type="checkbox"/> Occasional <input type="checkbox"/> Once problem occurs, it continues <input type="checkbox"/> Does not reoccur		

Dealer Name	Office	Person in charge	Technician
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CONFIRMING SYMPTOMS AND CHECKING DIAGNOSTIC TROUBLE CODES

HINT:

The diagnostic system has various functions. During troubleshooting, whenever a malfunction occurs in the signal circuits to the ECU, a Diagnostic Trouble Code (DTC) is recorded and stored in the ECU memory. By using these functions, the problem areas can quickly be narrowed down and troubleshooting is more effective. Diagnostic functions are incorporated in the following system.

System [ECU]	DTC Check (Normal Mode) DS-II	DTC Check (Normal Mode) DLC (ECUT-E short circuit)	DTC Check (Normal Mode) Panel Diagnosis	DTC Check (Check Mode) (Test Mode)
EFI System (3SZ-VE) [Engine ECU]	○	○	-	-
Electronic controlled automatic transmission <ECT> (A4Q-D1,M5S) (Transmission ECU)	○	○	-	-
ABS with EBD, TRC,VSC, and BA system (skid control ECU)	○	○	-	○
SRS Airbag System (Airbag ECU)	○	○	-	○ (*1)
Body electrical area network system <LIN> (door control relay) (keyless ECU) (combination meter)	-	○	-	-
CAN COMMUNICATION SYSTEM	○	○	-	-

(*1):

Check Mode

In the DTC check, it is very important to determine whether the problem indicated by the DTC is either 1) still occurring, or 2) occurred in the past but has since returned to normal. In addition, the DTC should be compared to the problem symptom to see if they are related.

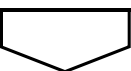
For this reason, DTCs should be checked before and after the confirmation of symptoms to determine current system conditions. Failure to check DTCs may, depending on the case, result in unnecessary troubleshooting for systems operating normally. Failure to check DTCs may also make it difficult to find where problems are occurring, or lead to repairs not related to the problem. Therefore, always perform a DTC check by following the proper procedure.

HINT:

- The following flowchart shows how to proceed with troubleshooting using the DTC check.
- The flowchart indicates how to utilize the DTC check effectively. Depending on the results of the check, it indicates how to proceed either to DTC troubleshooting or to the troubleshooting chart containing each problem symptom.

1

VERIFICATION OF PROBLEM (CUSTOMER INQUIRY)



2**CHECK FOR DTCs****NOTICE:****Always check ALL diagnoses and panel diagnoses.**

A	Cannot read from all of the ECU connections
B	DTC is not output
C	DTC is output

A**GO TO STEP 7****B****GO TO STEP 8****C****3****SAVING DTCs AND FREEZE FRAME DATA**(a) **SAVING RECORDED DTCs AND FREEZE FRAME DATA****NOTICE:**

- **Never delete without saving. Doing so will delete all DTCs, freeze frame data and history data.**
- **Always take notes, as it is not possible to save panel diagnosis.**

HINT:

- When multiple codes are recorded, determine the chief cause from all the DTCs.
- The EFI, AT and ABS utilizes the estimated data when DTCs are output.
- DTCs can be output even when no problem occurs. (Unlearned data from the air conditioning solar sensor, and from after clearing the battery)

A	Diagnosis of systems other than communication systems
B	Diagnosis of communication systems only
C	Diagnosis of communication systems and other systems

A**GO TO STEP 5****B****For bus (communication line) trouble .(See Page CA-5 (CAN) or SS-11 (LIN))****C****4****DETERMINING PROBLEM CAUSE**

- (a) Decide from all the DTCs if the main cause of the problem stems from parts or from the bus (communication line).

HINT:

It is possible that a communication diagnosis may not be shared because of a part malfunction.

A	Bus (communication line) malfunction
B	Part malfunction

A

Perform bus (communication line) troubleshooting. For the CAN communication system see CA-5. For the body electrical area network system (LIN), see MP-1.

IN**B****5****DELETING DTCs AND FREEZE FRAME DATA****6****Road test, DTC check**

A	DTC is output
B	DTC is not output

A

TROUBLESHOOTING WITH DTC-SPECIFIC INSPECTION PROCEDURE

B

Perform symptom reproduction using the reproduction method appropriate for the problem symptoms

7**CONNECT DS-II TO ANOTHER VEHICLE AND CHECK FOR DTC**

A	No DTCs are output on other vehicle as well.
B	Normal on other vehicle

A

DS-II malfunction (For procedure when DS-II errors occur, see IN-24.)

B

Bus (communication line) malfunction (For CAN communication system see CA-5. For body electric area network system (LIN), see MP-1.)

8

CHECK PROBLEM SYMPTOM

- (a) Utilizing the customer inquiry results and ECU data monitor, determine whether the problem is the same as the malfunction described by the customer.

NG

TROUBLESHOOTING WITH DTC-SPECIFIC
INSPECTION PROCEDURE

OK

SYSTEM NORMAL

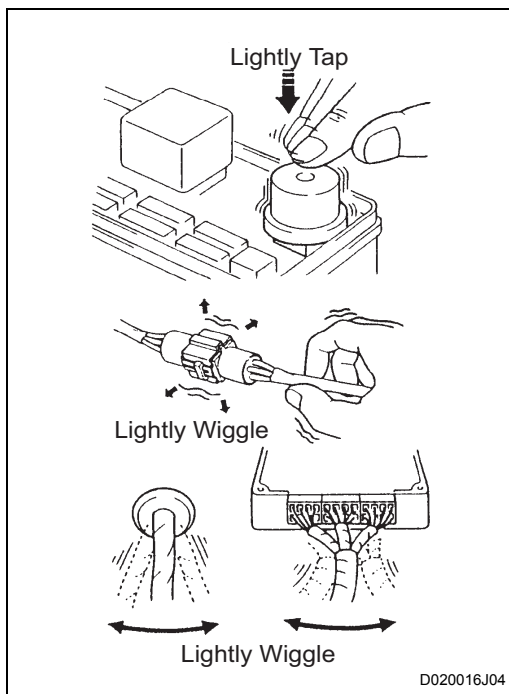
REPRODUCTION METHOD OF PROBLEM SYMPTOM

HINT:

- The most difficult case in troubleshooting is when no problem symptoms occur. In such a case, a thorough problem analysis must be carried out. A simulation of the same or similar conditions and environment in which the problem occurred in the customer's vehicle should be carried out. Troubleshooting without confirming the problem symptoms will lead to important repairs being overlooked and mistakes or delays.
- For example, with a problem that only occurs when the engine is cold or as a result of vibration caused by the road during driving, the problem can never be determined if the symptoms are being checked on a stationary vehicle or on a vehicle with a warmed-up engine.
- Vibration, heat or water penetration (moisture) is difficult to reproduce. The symptom reproduction tests that are introduced here are effective substitutes for these conditions and can be applied on a stationary vehicle.

IMPORTANT POINTS IN SYMPTOM REPRODUCTION TEST

In the symptom reproduction test, the problem symptoms as well as the problem area or parts must be confirmed. First, narrow down the possible problem circuits according to the symptoms. Then, connect the tester and carry out the symptom reproduction test. After that, determine whether the circuit being tested is defective or normal. Also, confirm the problem symptoms at the same time. Refer to the problem symptoms table for each system to narrow down the possible causes.



1. VIBRATION METHOD (MALFUNCTION APPEARS TO OCCUR AS RESULT OF VIBRATION)

(a) Parts and sensors

- (1) Apply slight vibration with a finger to the part of the sensor suspected to be the cause of the problem, and check whether or not the malfunction occurs.

HINT:

Applying strong vibration to relays may open them.

(b) Connectors

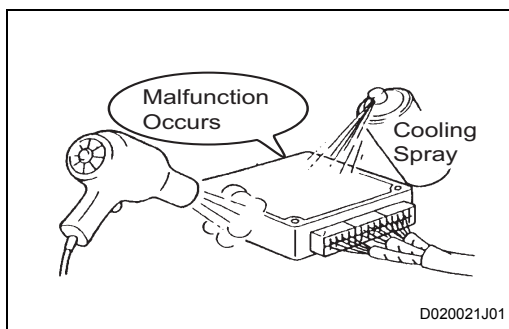
- (1) Slightly shake the connector vertically and horizontally.

(c) Wire harness

- (1) Slightly shake the wire harness vertically and horizontally and check whether or not the malfunction occurs.

HINT:

The connector joint, the fulcrum of the vibration, and the penetrating part of the body are the major areas that should be checked thoroughly.



2. HEAT METHOD (MALFUNCTION APPEARS TO OCCUR WHEN AREA IS HOT OR COLD)

- (a) Heat or cool the component that is the possible cause of the malfunction with a hair dryer or cooling agent. Check if the malfunction occurs.

NOTICE:

- Do not heat to more than 60°C (140°F) (a temperature at which you can still touch it with your hand).
- Open the lid of the ECU, but do not apply heat or cold directly to the electronic parts.

HINT:

Cooling agents can be obtained at an electronic parts store.



3. WATER SPRINKLING METHOD (MALFUNCTION APPEARS TO OCCUR ON RAINY DAYS OR IN HIGH HUMIDITY)

- (a) Sprinkle water onto the vehicle and check if the malfunction occurs.

NOTICE:

- Never sprinkle water directly into the engine compartment. Indirectly change the temperature and humidity by spraying water onto the front of the radiator.
- Never apply water directly onto the electronic components.

4. OTHER METHOD (MALFUNCTION APPEARS TO OCCUR BECAUSE ELECTRICAL LOAD IS EXCESSIVE)

- (a) Turn on the heater blower, headlights, rear window defogger and all other electrical loads. Check if the malfunction reoccurs.

DIAGNOSTIC TROUBLE CODE CHART

Using the DTCs listed in the diagnostic trouble code chart, you can perform accurate and effective troubleshooting. Perform troubleshooting based on

the inspection procedure of the corresponding diagnosis chart for the DTCs that are listed. The following is an example of a DTC for the EFI system.

IN

The left side is the SAE Output Code No./ The right side indicates the Output Code when the Check Engine Warning Light is used.

Indicates the contents of the system that is malfunctioning

Engine Control - EFI System

DTC Table

DTC No	Diagnosis Item	Light Illuminated	Code Memory	Reference Page
P0110/43	Intake Air Temperature Sensor Signal	○	○	○○-○○
P0115/42	Water Temperature Sensor Signal	○	○	○○-○○
P0120/41	Throttle Sensor Signal	○	○	○○-○○

Indicates repair manual instructions and the page on which each circuit detection procedure can be found.

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PROBLEM SYMPTOMS TABLE

PROBLEM SYMPTOMS TABLE

The suspected areas (circuits or parts) for each problem symptom are listed below. When a NORMAL code is output during a DTC check but the problem is still occurring, use the problem symptoms table to troubleshoot. Items in the suspected trouble area indicate circuits or parts that should be checked.

HINT:

In some cases, the problem is not detected by the diagnostic system even though a problem symptom is present. It is possible that the problem is occurring outside the detection range of the diagnostic system, or that the problem is occurring in a completely different system.

Indicates a symptom for which a DTC No. is not displayed.

Indicates part name and the circuit for each system to be inspected.

Indicates on which page the detection requirements and flow chart for each circuit are found.

Problem Symptoms Table

Symptoms	Inspection Item	Reference Page
Does not crank	Starter or Starter Relay	
	Neutral Starter Switch	
Fails to start (No initial combustion)	ECU Power	ES- 82
	Igniter	ES- 64
	Fuel Pump	ES- 78
	Fuel Injector	
	Crankshaft Angle Sensor	ES- 52
Fails to start (Combustion not complete)	Fuel Pump	ES- 78
	Igniter	ES- 64
	Fuel Injector	
	Crankshaft Angle Sensor	ES- 52
Fails to start (Cranking is normal)	Starter	ES- 76
	ISCV	ES- 61
	Fuel Pump	ES- 78
	Igniter	ES- 64
	Spark Plug	

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DTC SYSTEM-SPECIFIC INSPECTION PROCEDURE

DTC SYSTEM-SPECIFIC INSPECTION PROCEDURE

How to read and use each page is listed below.

- Troubleshooting indicates a procedure for each symptom, system and DTC, and makes it easy to determine problem symptoms and investigate their causes.

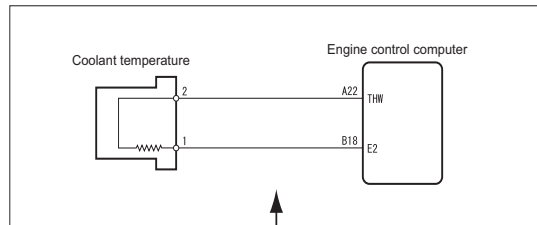
- Troubleshooting covers different diagnostic areas: DTC, circuit description, detection conditions, circuit diagrams and inspection procedures.

IN

DTC		DTC Name
DTC	P0115/22	COOLANT TEMPERATURE SENSOR SIGNAL SYSTEM
DESCRIPTION The resistance of the thermistor built into the coolant temperature sensor varies according to the coolant temperature.		
DTC No.	DTC Detection Condition	Suspected Area
P0115/22	1.IG ON 2.Open or short in coolant temperature circuit 3.0.5 seconds or more 4.1 trip	• Wire harness or connector • Coolant temperature • Engine control computer

Detection Conditions

CIRCUIT DIAGRAM



Circuit Diagram

This HINT is used to judge whether the circuit is normal or malfunctioning. This reference is used to determine if the malfunction is in the sensor, actuator, wire harness, or ECU.

HINT:

- Read the freeze frame data using the DS-7. Freeze frame data records aspects of the engine's condition when malfunctions occur. This information is helpful when troubleshooting.

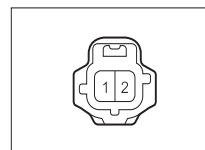
1 READ DS-7 DATA (COOLANT TEMPERATURE)

- Connect the DS-7 to the DLC.
- Read the engine coolant temperature displayed on the DS-7 while the ignition switch is turned to the ON position and the engine is stopped.

Tester Display	Proceed to
-40° C	A
140° C	B
Equivalent to actual coolant temperature	C

- B → GO TO STEP 4
C → CHECK FOR INTERMITTENT PROBLEMS

2 READ DS-7 DATA (CHECK FOR OPEN IN ENGINE CONTROL COMPUTER)

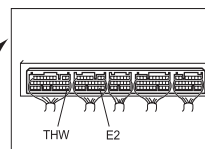


- SST 09843-18020
- Disconnect the connector of the coolant temperature sensor.
 - Shot the circuit between terminals 2 (+) and 1 (-) of the water temperature vehicle side connector using the SST(diagnosis check wire No.2).
 - Connect the DS-7 to the DLC.
 - Turn the ignition switch to the ON position.
 - Read the engine coolant temperature displayed on the DS-7.
Standard;
140°C

OK → REPLACE COOLANT TEMPERATURE SENSOR

NG

3 READ DS-7 DATA (CHECK FOR OPEN IN ENGINE CONTROL COMPUTER)

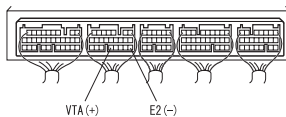


- SST 09843-18020
- Shot the circuit between terminals 54 (THW) and 19(E2) of the engine control computer using the SST(diagnosis check wire No.2). (For terminal layout, see page ES-16.)
 - Read the engine coolant temperature displayed on the DS-7.
Standard;
140°C

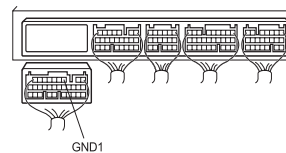
NG → CHECK AND REPLACE ENGIN CONTROL COMPUTER

REPAIR OR REPLACE WIRE HARNESS OR CONNECTOR

Indicates the condition of the ECU connector during inspection.



The (+) and (-) after the terminal name indicate the tester connection.



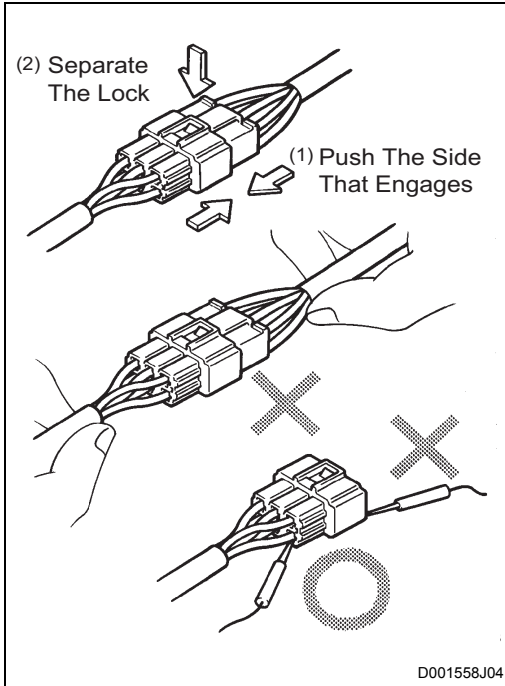
The ground side is not noted when inspecting body ground. Connectors are disconnected during inspection.

ELECTRONIC CIRCUIT INSPECTION PROCEDURE

1. BASIC INSPECTION

(a) WHEN MEASURING RESISTANCE OF ELECTRONIC PARTS

- (1) Unless otherwise stated, all resistance measurements should be made at an ambient temperature of 20°C (60°F). Resistance measurements may be inaccurate if measured at high temperatures, i.e. immediately after the vehicle has been running. Measurements should be made after the engine has cooled down.



(b) HANDLING CONNECTORS

- (1) When disconnecting a locked connector, first squeeze the mating halves tightly together to release the lock, and then press the lock claw and separate the connector.
- (2) When disconnecting a connector, do not pull on the harnesses. Grasp the connector directly and separate it.
- (3) Before connecting a connector, check that there are no deformed, damaged, loose or missing terminals.
- (4) When connecting a connector, press firmly until it locks with a click sound.
- (5) When checking a connector with an electrical tester, check the connector from the backside (harness side) using a mini test lead.

NOTICE:

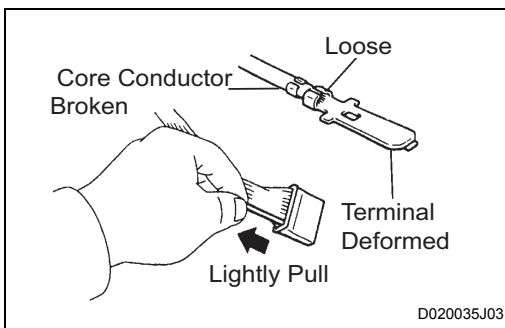
- As a waterproof connector cannot be checked from the backside, check it by connecting a sub-harness.
- Do not damage the terminals by moving the inserted tester needle.

(c) CHECKING CONNECTORS

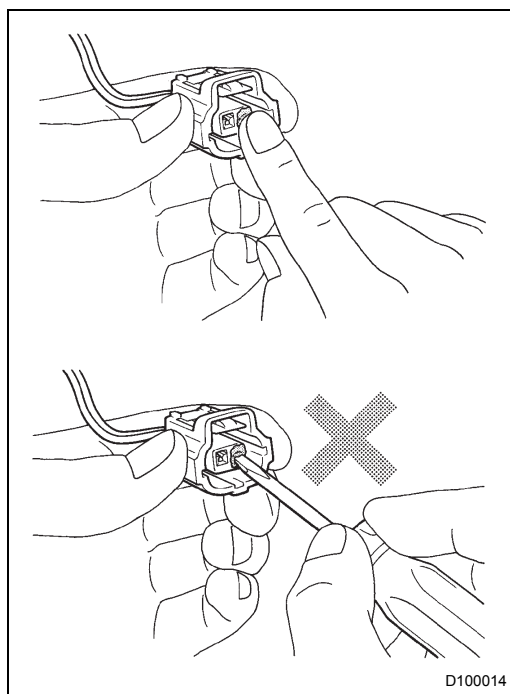
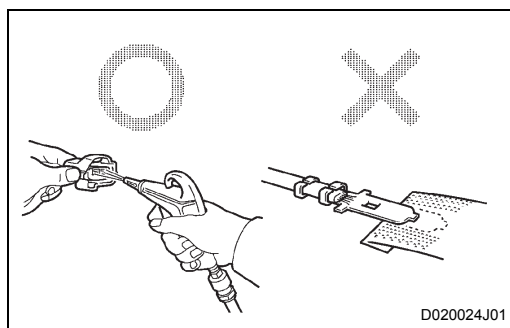
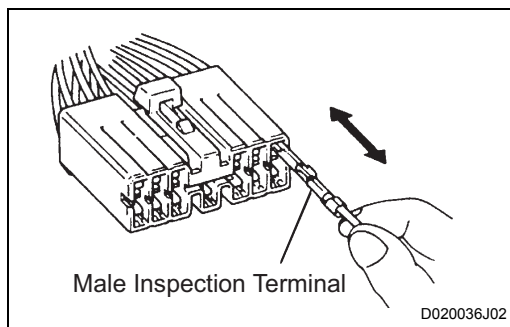
- (1) To check whether a connector is still connected, grasp the connector housing to confirm that it is fully inserted and locked. (Engaged condition)
- (2) To check whether a connector is disconnected, pull the wire harness lightly (missing terminals, caulked terminals, broken conductor wires). Check visually for corrosion, metal fragments, moisture, or bent terminals (corrosion, foreign matter, deformed terminals).

NOTICE:

When testing a gold-plated female terminal, always use a gold-plated male terminal.



IN



- (3) When checking the contact pressure of a terminal, prepare a spare male terminal. Insert it into a female terminal, and check for ample tension when inserting and after full engagement.

(d) REPAIR METHOD FOR CONNECTOR TERMINAL

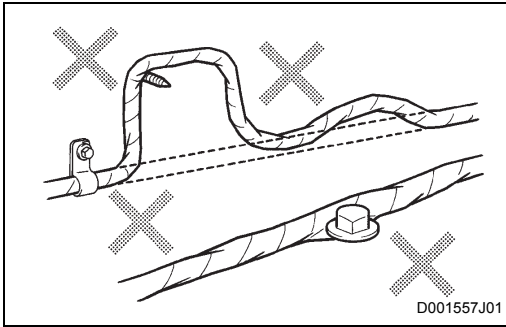
- (1) If there is any foreign matter on the terminal, clean the contact point using an air gun or cloth. Never rub the contact point using sandpaper, as the plating may come off.
- (2) If there is abnormal contact pressure, replace the female terminal. If the male terminal is gold-plated (gold color), use a gold-plated female terminal. If the male terminal is silver-plated (silver color), use a silver-plated female terminal.
- (3) If the terminal is not defective, clean the contact point with an air gun and apply connector grease. (This prevents oxidation and abrasion of the contact points.)

(e) CONNECTOR GREASE

- (1) Fill non-weather packed connectors that can easily get wet, such as the alternator or headlights with grease (white lithium) to prevent terminal decay.
- (2) If there is insufficient connector grease when repairing the terminals, use your hand to fill the female terminal with 100g of connector grease.

NOTICE:

- **Keep the terminals free of dust.**
 - **Do not use a screwdriver or any other tool to fill the terminals with grease.**
- (3) It is not a problem for grease to come in contact with waterproof connectors such as O-rings or rubber plugs. However, should grease come in contact with other rubber parts (such as weatherstrip or grommets for wire harnesses), there is a risk of deterioration and discoloration. In the event that grease does come in contact with these parts, quickly wipe them off.

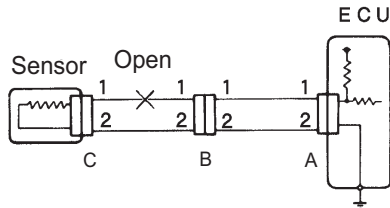


(f) HANDLING OF WIRE HARNESSES

- (1) When removing a wire harness, check the position of the wiring and clamping before proceeding so that the parts can be restored in the same way.
- (2) Never twist or pull the wire harness more than necessary.
- (3) The wire harness should never come into contact with a high temperature part, or rotating, moving, vibrating or sharp-edged parts. Avoid contact with panel edges, screw tips and other sharp items.
- (4) When installing parts, never pinch the wire harness.
- (5) Never cut or break the cover of the wire harness. If it is cut or broken, replace it or repair it with vinyl tape.

IN

Diagram 1



2. CHECKING FOR OPEN CIRCUITS

- (a) For an open circuit in the wire harness in Fig. 1, check the continuity or voltage for an open circuit.

- (b) Check the continuity.

- (1) Disconnect connectors A and C and measure the resistance between them.

Standard:**1Ω or less****HINT:**

Measure the resistance while lightly shaking the wire harness vertically and horizontally.

- (2) In Fig. 2, there is no continuity between terminal 1 of connector A and terminal 1 of connector C (open circuit) and there is continuity between terminal 3 of connector A and terminal 2 of connector C. As a result, there is an open circuit between terminal 1 of connector A and terminal 1 of connector C.

- (3) Disconnect connector B and measure the resistance between the connectors.

- (4) In Fig. 3, there is continuity between terminal 1 of connector A and terminal B1 of connector C and there is no continuity between terminal 1 of connector B2 and terminal 1 of connector C (open circuit). As a result, there is an open circuit between terminal 1 of connector B2 and terminal 1 of connector C.

Diagram 2

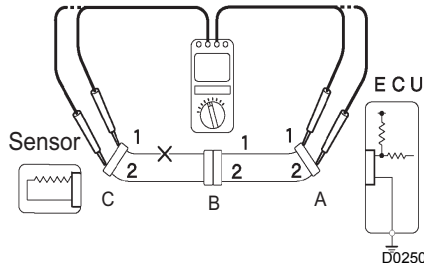


Diagram 3

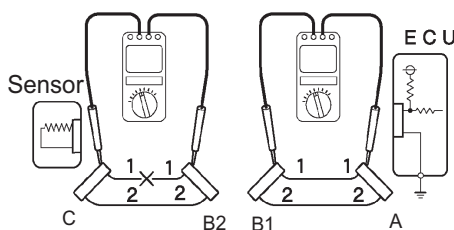
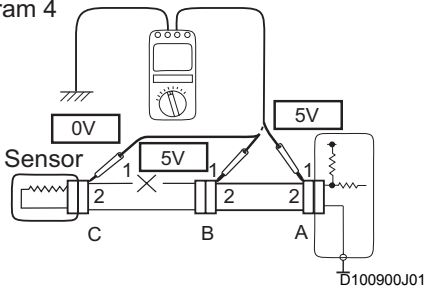


Diagram 4



(c) Check the voltage.

- (1) In a circuit in which voltage is applied to the ECU connector terminal, an open circuit can be checked by conducting a voltage check.
- (2) As shown in fig. 5, with each connector still connected, measure the voltage between the body ground and the ECU5 output terminals. Measure the voltages of the terminals in the following order: 1) terminal 1 of connector A; 2) terminal 1 of connector B; and 3) terminal 1 of connector C.
- (3) In the case of the results below, an open circuit exists in the wire harness between terminal 1 of connector B and terminal 1 of connector C.

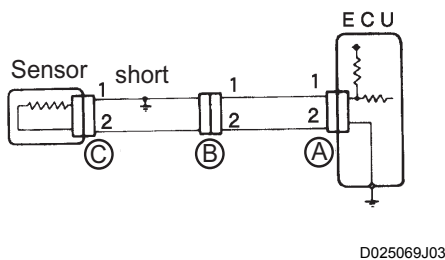
Standard:

The connector A terminal 1 - Body ground is 5V

The voltage between connector B terminal 1 and body ground is 5V.

The voltage between connector C terminal 1 and body ground is 0V

Diagram 5



3. CHECKING FOR SHORT CIRCUITS

- (a) As shown in Fig. 5, if a wire harness is shorted to ground, locate the section by conducting a resistance check with the body ground.

(b) Check the continuity with the body ground.

- (1) Disconnect connectors A and C and measure the resistance between the body ground and terminals 1 and 2 of connector A.

Standard:

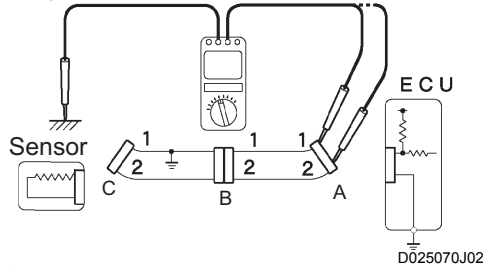
1Ω or less

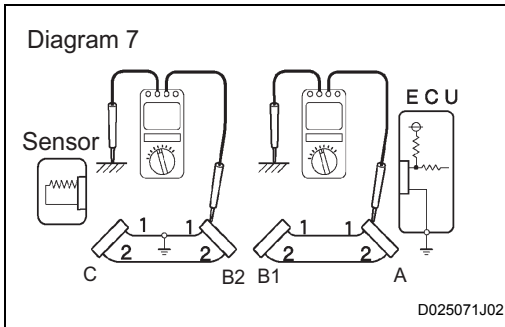
HINT:

Measure the resistance while lightly shaking the wire harness vertically and horizontally.

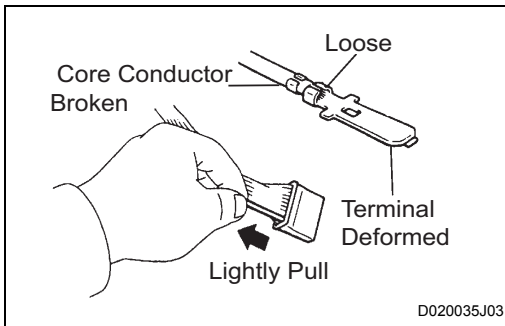
- (2) In Fig. 6, there is continuity between the body ground and terminal 1 of connector A (short circuit) and there is no continuity between the body ground and terminal 2 of connector A. This indicates that there is a short circuit between terminal 1 of connector A and terminal 1 of connector C.

Diagram 6





- (3) Disconnect connector B and measure the continuity between the body ground and connector A of terminal 1 and between the body ground and connector B2 of terminal 1. There is no continuity between the body ground and terminal 1 of connector A, and there is continuity (short circuit) between the body ground and terminal 1 of connector B2. This indicates that a short circuit exists between terminal 1 of connector B2 and terminal 1 of connector C.



4. VISUAL CHECK AND CONTACT PRESSURE CHECK

- Disconnect both ends of the connector.
- Check that there is no rust or foreign matter on the connector terminals.
- Confirm that no damage has occurred to rounded parts due to loosening, and check that the terminals are fixed in a firmly locked position.

HINT:

Check that the terminals do not come out if lightly pulled from behind.

- Insert a spare male test terminal into a female terminal and pull it out.

HINT:

If the test terminal can be more easily removed than other terminals then the contact of that part is not good.

5. CHECKING AND REPLACING ECUs

NOTICE:

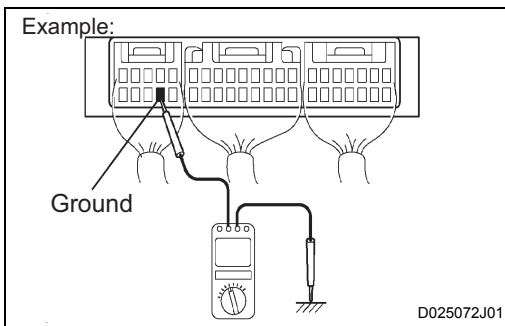
- The connectors should not be disconnected from the ECU. Perform the inspection from the backside of the connectors on the wire harness side.
- When no measuring condition is specified, perform the inspection with the engine stopped and with the ignition switch in the ON position.

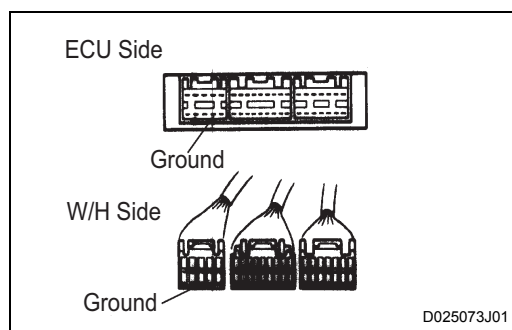
- First, check the ECU ground circuit. If it is faulty, repair it. If it is normal, the ECU may be faulty. Temporarily replace the ECU with a known-good ECU and check if the symptoms occur.

- Measure the resistance between the ECU ground terminal and body ground.

Standard:

1Ω or less





- (2) Disconnect the ECU connector. Check the ground terminal on the ECU side and wire harness side for bending. Lastly, check the contact pressure.

