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FOREWORD

This supplement has been prepared to provide information covering general service repairs for CAMRY which underwent changes in January, 2006.

Applicable models	ACV36 series
	MCV36 series

For the service specifications and repair procedures of the above model other than those listed in the supplement, refer to the following manuals.

Manual Name	Pub. No.
Repair Manual	AC-RM033V1
Repair Manual	AC-RM033V2
Electrical Wiring Diagram 2002	AC-EWD019
U241E Automatic Transaxle Repair Manual	RM840U
A541E Automatic Transaxle Repair Manual	AC-RM034
Collision Damage Repair Manual	AC-BRM003
Service Data Sheet	AC-SDS008
CD-ROM Repair Manual	AC-CDRM003
CD-ROM Repair Manual Supplement	AC-CDRM010

All information in this manual is based on the latest product information at the time of publication. However, specifications and procedures are subject to change without notice.

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INTRODUCTION

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HOW TO USE THIS MANUAL

GENERAL INFORMATION

1. GENERAL DESCRIPTION

(a) This manual is written in accordance with SAE J2008.
  (1) Diagnosis
  (2) Removing / Installing, Replacing, Disassembling / Reassembling, Checking and Adjusting
  (3) Final Inspection

(b) The following procedures are omitted from this manual. However, these procedures must be performed.
  (1) Use a jack or lift to perform operations
  (2) Clean all removed parts
  (3) Perform a visual check

2. INDEX

(a) An alphabetical INDEX section is provided at the end of the manual as a reference to help you find the item to be repaired.

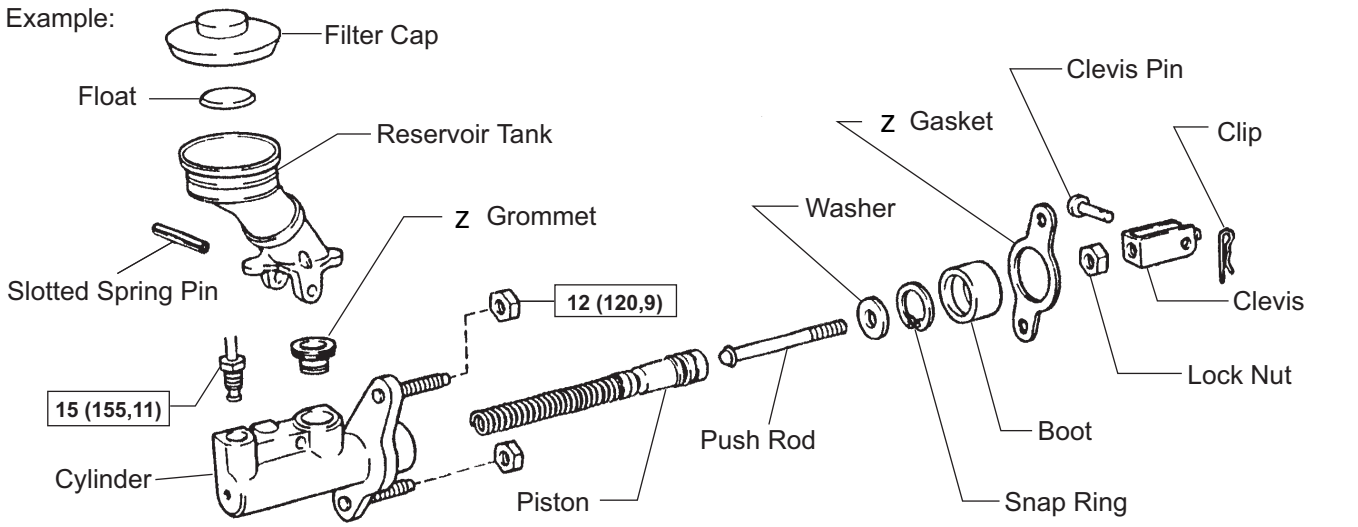
3. PREPARATION

(a) Use of Special Service Tools (SST) and Special Service Materials (SSM) may be required, depending on the repair procedure. Be sure to use SST and SSM when they are required and follow the working procedure properly. A list of SST and SSM is in the "Preparation" section of this manual.

4. REPAIR PROCEDURES

(a) A component illustration is placed under the title where necessary.

(b) Non-reusable parts, grease application areas, precoated parts and torque specifications are noted in the component illustrations.
The following illustration is an example.



(c) Torque specifications, grease application areas and non-reusable parts are emphasized in the procedures.
HINT:
There are cases where such information can only be explained by using an illustration. In these cases, torque, oil and other information are described in the illustration.

(d) Only items with key points are described in the text. What to do and other details are explained using illustrations next to the text. Both the text and illustrations are accompanied by standard values and notices.

Illustration	What to do and where to do it
Task heading	What work will be performed
Explanation text	How to perform the task Also has information such as specifications and warnings, which are written in boldface text

(e) Illustrations of similar vehicle models are sometimes used. In these cases, minor details may be different from the actual vehicle.

(f) Procedures are presented in a step-by-step format.

5. SERVICE SPECIFICATIONS

(a) SPECIFICATIONS are presented in boldface text throughout the manual. The specifications are also found in the "Service Specifications" section for reference.

6. TERM DEFINITIONS

CAUTION	Possibility of injury to you or other people.
NOTICE	Possibility of damage to components being repaired.
HINT	Provides additional information to help you perform repairs.

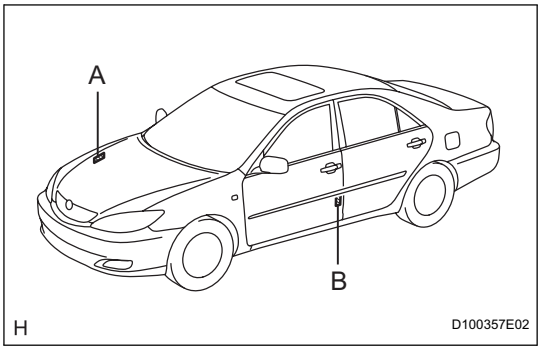
7. INTERNATIONAL SYSTEM OF UNITS

(a) The units used in this manual comply with the International System of Units (SI UNIT) standard. Units from the metric system and the English systems are also provided.
Example:

Torque: 30 Nm (310 kgf cm, 22 lbf ft)

IDENTIFICATION INFORMATION

VEHICLE IDENTIFICATION AND SERIAL NUMBERS

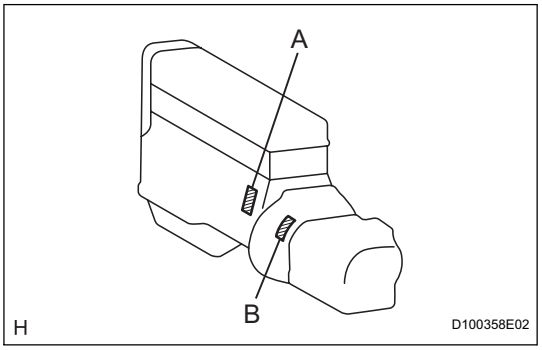


1. VEHICLE IDENTIFICATION NUMBER

(a) The vehicle identification number is stamped on the vehicle body and on the certification label, as shown in the illustration.

A:
Vehicle Identification Number

B:
Certification Label



2. ENGINE SERIAL NUMBER AND TRANSMISSION SERIAL NUMBER

(a) The engine serial number is stamped on the cylinder block of the engine, and the transaxle serial number is stamped on the housing as shown in the illustration.

A:
Engine Serial Number

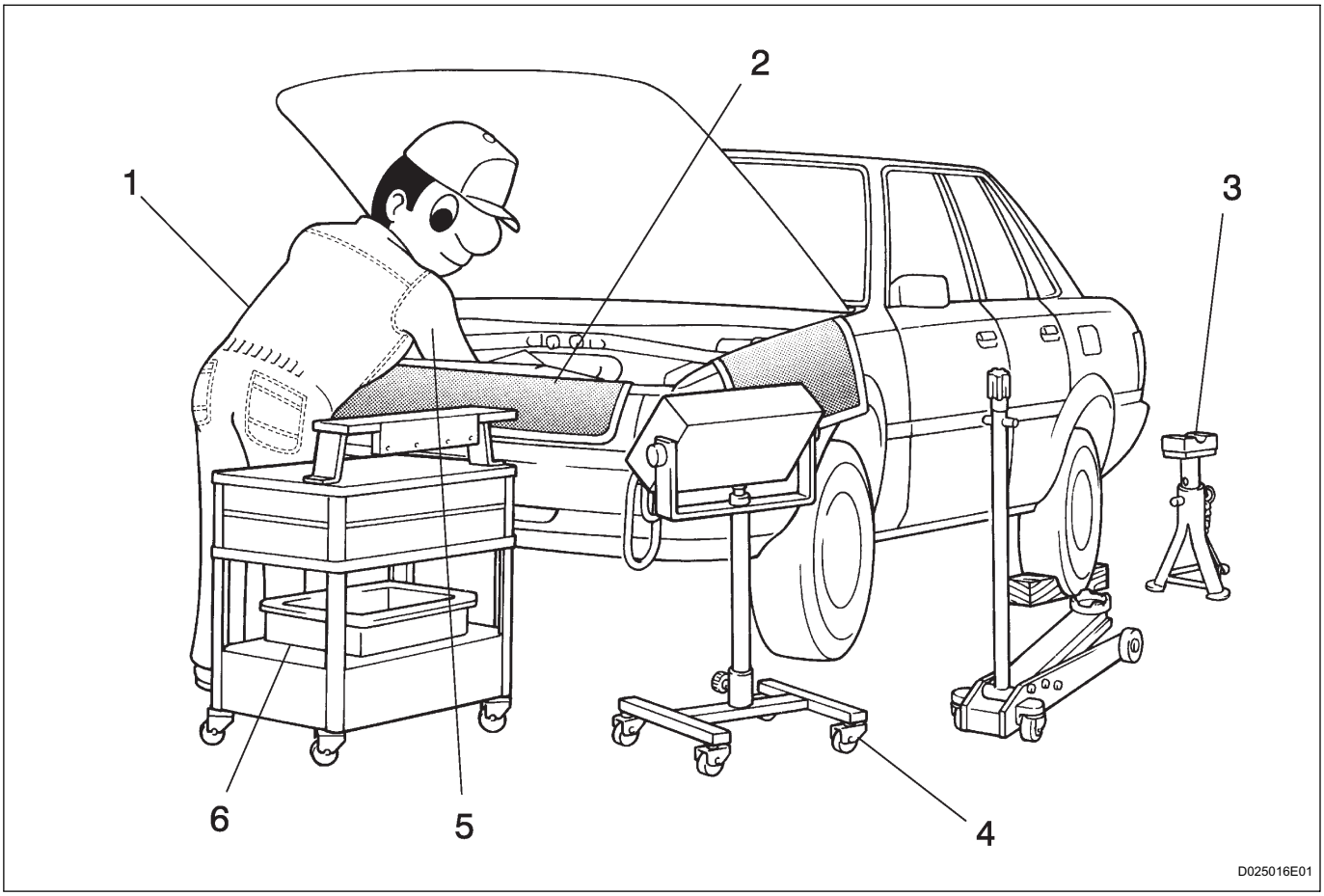
B:
Transaxle Serial Number

REPAIR INSTRUCTION

PRECAUTION

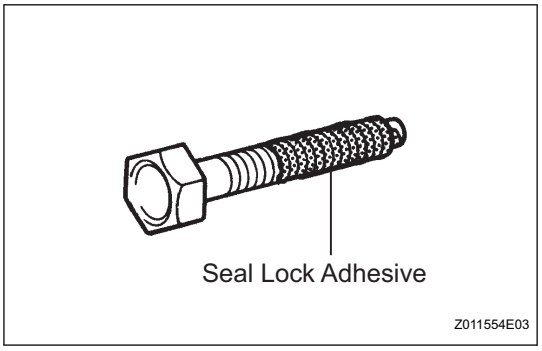
1. BASIC REPAIR HINT

(a) HINTS ON OPERATIONS



1	Attire	• Always wear a clean uniform. • Hat and safety shoes must be worn.
2	Vehicle protection	Prepare a grille cover, fender cover, seat cover and floor mat before starting the operation.
3	Safety operation	• When working with 2 or more persons, be sure to check safety for one another. • When working with the engine running, make sure to provide ventilation for exhaust fumes in the workshop. • If working on high temperature, high pressure, rotating, moving, or vibrating parts, wear appropriate safety equipment and take extra care not to injure yourself or others. • When jacking up the vehicle, be sure to support the specified location with a safety stand. • When lifting up the vehicle, use appropriate safety equipment.
4	Preparation of tools and measuring gauge	Before starting operation, prepare a tool stand, SST, gauge, oil and parts for replacement.
5	Removal and installation, disassembly and assembly operations	• Diagnose with a thorough understanding of proper procedures and of the reported problem. • Before removing the parts, check the general condition of the assembly and for deformation and damage. • When the assembly is complicated, take notes. For example, note the total number of electrical connections, bolts, or hoses removed. Add matchmarks to insure reassembly of components in the original positions. Temporarily mark hoses and their fittings if needed. • Clean and wash the removed parts if necessary and assemble them after a thorough check.

6	Removed parts	• Place the removed parts in a separate box to avoid mixing them up with the new parts or contaminating the new parts. • For non-reusable parts such as gaskets, O-rings, and self-locking nuts, replace them with new ones as instructed in this manual. • Retain the removed parts for customer inspection, if requested.

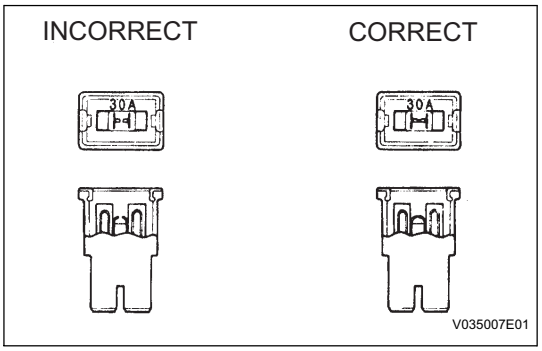


(b) JACKING UP AND SUPPORTING VEHICLE
(1) Care must be taken when jacking up and supporting the vehicle. Be sure to lift and support the vehicle at the proper locations.

(c) PRECOATED PARTS
(1) Precoated parts are bolts and nuts that are coated with a seal lock adhesive at the factory.
(2) If a precoated part is retightened, loosened or moved in any way, it must be recoated with the specified adhesive.
(3) When reusing a precoated part, clean off the old adhesive and dry the part with compressed air. Then apply new seal lock adhesive appropriate to that part.
(4) Some seal lock agents harden slowly. You may have to wait for the seal lock adhesive to harden.

(d) GASKETS
(1) When necessary, use a sealer on gaskets to prevent leaks.

(e) BOLTS, NUTS AND SCREWS
(1) Carefully follow all the specifications for tightening torques. Always use a torque wrench.



(f) FUSES
(1) When inspecting a fuse, check that the wire of the fuse is not broken.
(2) When replacing fuses, be sure that the new fuse has the correct amperage rating. Do not exceed the rating or use one with a lower rating.

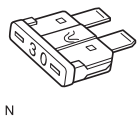
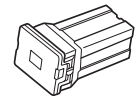
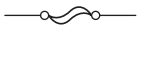
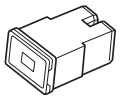
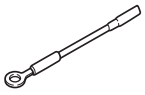
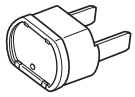
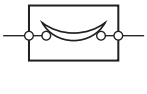
Illustration	Symbol	Part Name	Abbreviation
 N	N	FUSE	FUSE

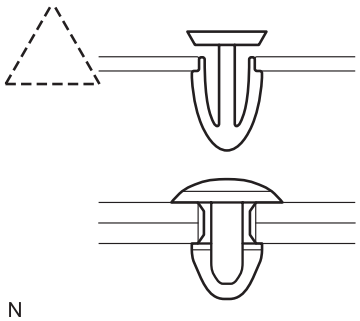
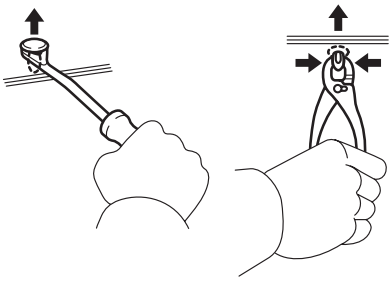
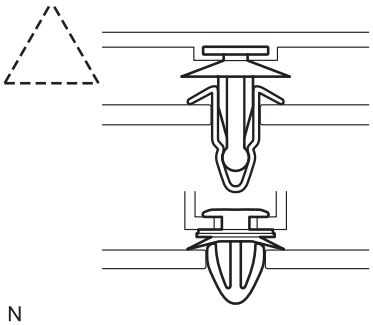
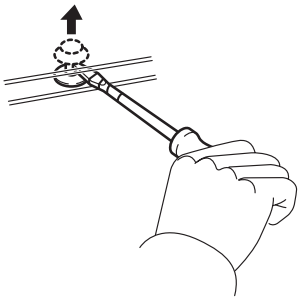
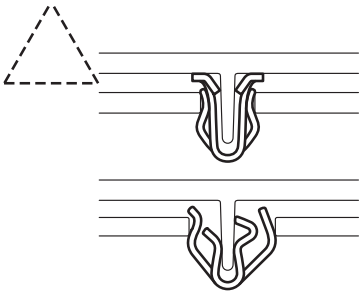
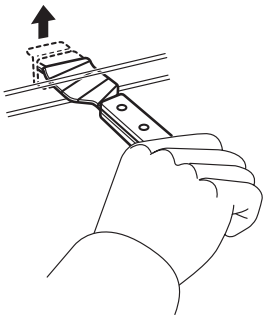
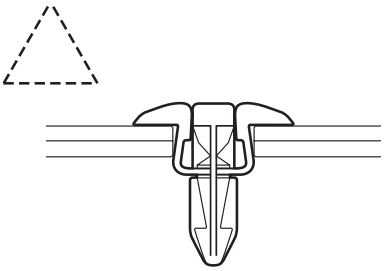
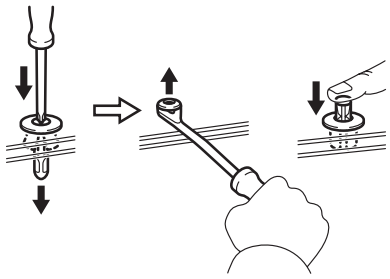
Illustration	Symbol	Part Name	Abbreviation
 N	 N	MEDIUM CURRENT FUSE	M-FUSE
 N	 N	HIGH CURRENT FUSE	H-FUSE
 N	 N	FUSIBLE LINK	FL
 N	 N	CIRCUIT BREAKER	CB

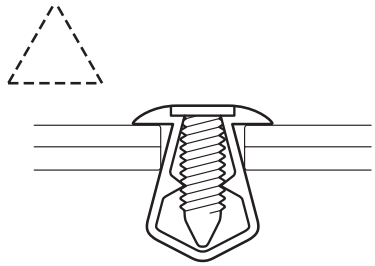
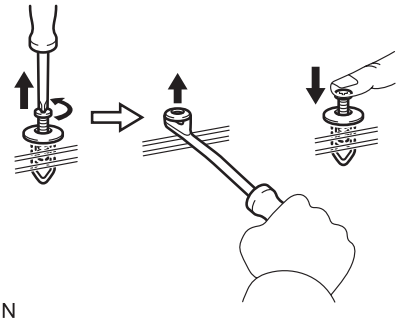
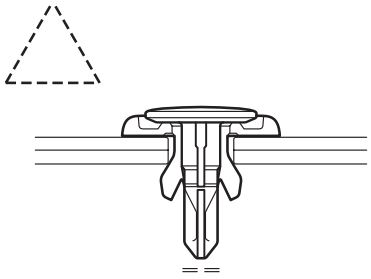
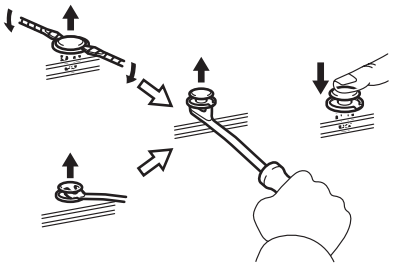
(g) CLIPS

(1) The removal and installation methods of typical clips used for vehicle body parts are shown in the table below.

HINT:

If clips are damaged during work, always replace the damaged clip with a new one.

Shape (Example)	Removal/Installation
 N	Remove clips with clip remover or pliers.  N
 N	Remove fasteners with clip remover or screwdriver.  N
 N	Remove clips with wide scraper to prevent panel damage.  N
 N	Remove clips by pushing center pin through and prying out shell.  N

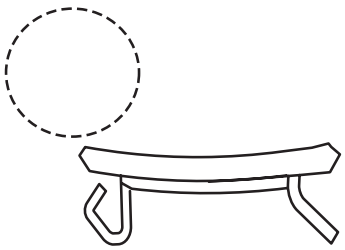
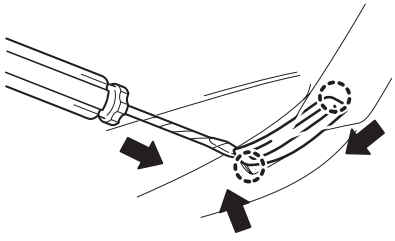
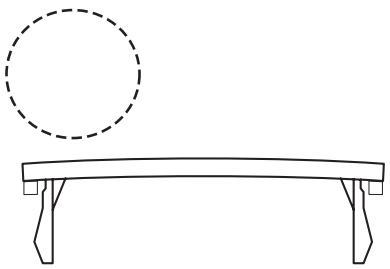
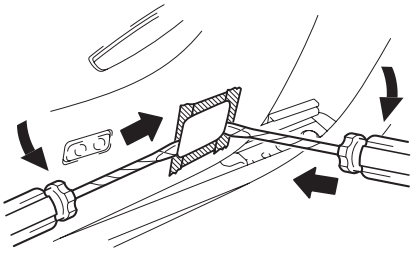
Shape (Example)	Removal/Installation
 N	Remove clips by unscrewing center pin and prying out shell.  N
 N	Remove clips by prying out pin and then prying out shell.  N

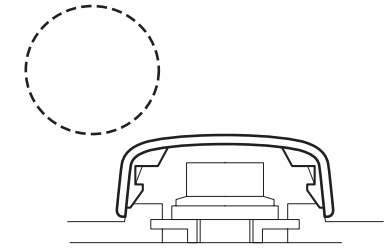
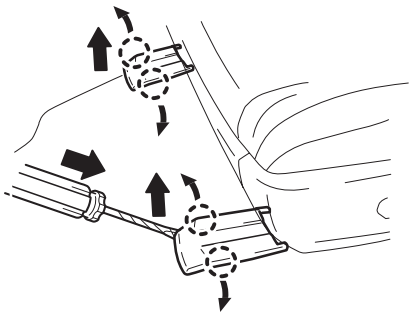
(h) CLAWS

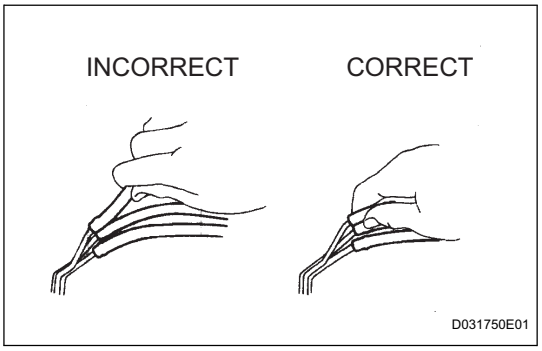
(1) The removal and installation methods of typical claws used for vehicle body parts are shown in the table below.

HINT:

If claws are damaged during a procedure, always replace the damaged claws with a new caps or covers.

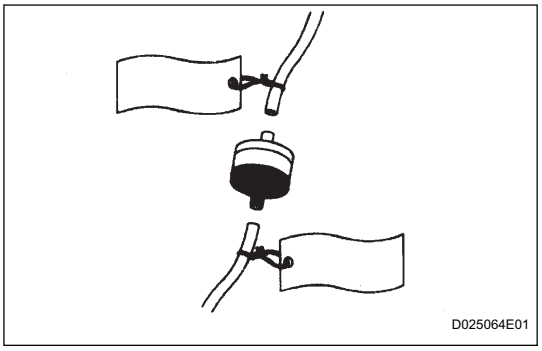
Shape (Example)	Illustration	Procedures
		1. Using a screwdriver, detach the claws and remove the cap or covers.
		1. Using a screwdriver, detach the claws and remove the cap or covers.

Shape (Example)	Illustration	Procedures
		1. Using a screwdriver, detach the claws and remove the cap or covers.



(i) REMOVAL AND INSTALLATION OF VACUUM HOSES

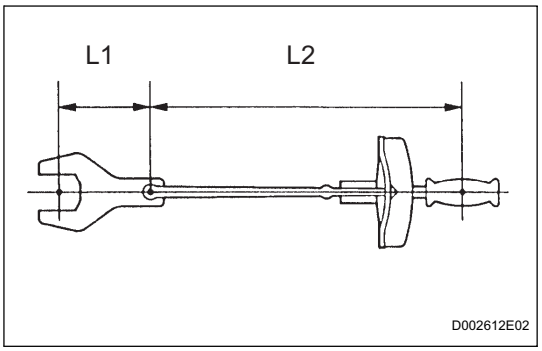
(1) To disconnect a vacuum hose, pull and twist from the end of the hose. Do not pull from the middle of the hose as this may damage the hose.



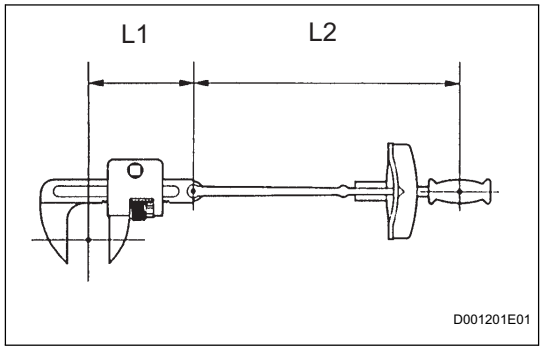
(2) When disconnecting vacuum hoses, use tags to identify where they should be reconnected.

(3) After completing any hose related repairs, double check that the vacuum hoses are properly connected. The label under the hood shows the proper layout.

(4) When using a vacuum gauge, never force the hose onto a connector that is too large. If a hose has been stretched, air may leak. Use a step-down adapter if necessary.



(j) TORQUE WHEN USING TORQUE WRENCH WITH EXTENSION TOOL



(1) Use the formula below to calculate special torque values for situations where SST or an extension tool is combined with the torque wrench.

Formula:

T' = L2/(L1 + L2) * T

T'	**Reading of torque wrench {Nm (kgf cm, lbf ft)}**
T	**Torque {Nm (kgf cm, lbf ft)}**
L1	**Length of SST or extension tool {cm (in)}**
L2	**Length of torque wrench {cm (in)}**

NOTICE:

If an extension tool or SST is combined with a torque wrench and the wrench is used to tighten to a torque specification in this manual, the actual torque will be excessive and parts will be damaged.

2. FOR VEHICLES EQUIPPED WITH SRS AIRBAG AND SEAT BELT PRETENSIONER

The CAMRY is equipped with a Supplemental Restraint System (SRS).

CAUTION:

Failure to carry out the service operations in the correct sequence could cause the SRS to unexpectedly deploy during servicing and lead to serious injury. Furthermore, if a mistake is made when servicing SRS, it is possible that the SRS may fail to operate properly. Before servicing (including removal or installation of parts, inspection or replacement), be sure to read the following section carefully.

(a) GENERAL NOTICE

(1) As malfunctions of the SRS are difficult to confirm, the Diagnostic Trouble Codes (DTCs) become the most important source of information when troubleshooting. When troubleshooting the SRS, always check the DTCs before disconnecting the battery (See page **05-461**).

(2) Work must be started at least 90 seconds after the ignition switch is turned off and after the cable is disconnected from the negative (-) battery terminal.
The SRS is equipped with a back-up power source. If work is started within 90 seconds after turning the ignition switch off and disconnecting the cable from the negative (-) battery terminal, the SRS may deploy.
When the cable is disconnected from the negative (-) battery terminal, clock and audio system memory is erased. Before starting work, make a note of the settings of each memory system. When work is finished, reset the clock and audio system as before.
CAUTION:
Never use a back-up power source (battery or other) to avoid erasing system memory. The back-up power source may inadvertently power the SRS and cause it to deploy.

(3) In minor collisions where the SRS does not deploy, the steering pad, front passenger airbag assembly, driver side knee airbag assembly, passenger side knee airbag assembly, front seat side airbag assembly, curtain shield airbag assembly and front seat outer belt assembly should be inspected before further use of the vehicle.

(See page **60-15** for steering pad)

(See page **60-28** for front passenger airbag assembly)

(See page **60-48** for front seat side airbag assembly)

(See page **61-5** for front seat outer belt assembly)

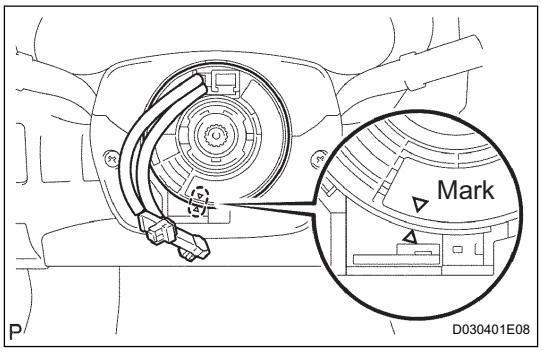
(4) Never use SRS parts from another vehicle.
When replacing parts, use new parts.

(5) Before repairs, remove the airbag sensor assemblies if impacts are likely to be applied to the sensor during repairs.

(6) Never disassemble and attempt to repair all airbag sensor assemblies and all airbag assemblies.
1. Steering pad
2. Front passenger airbag assembly
3. Front seat side airbag assembly
4. Front seat outer belt assembly

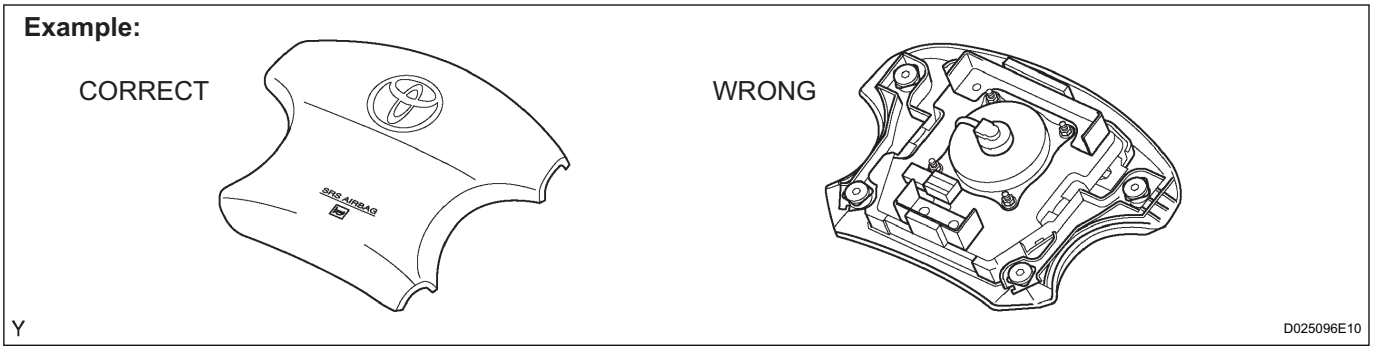
(7) Replace the airbag sensor assemblies and the airbag assemblies if: 1) damage has occurred from being dropped, or 2) cracks, dents or other defects in the case, bracket or connector are present.

(8) Do not directly expose the airbag sensor assembly or airbag assembly to hot air or flames.
(9) Use a voltmeter / ohmmeter with high impedance (minimum=10 kΩ) for troubleshooting electrical circuits.
(10) Information labels are attached to the SRS components. Follow the instructions on the labels.
(11) After work on the SRS is completed, check the SRS warning light.

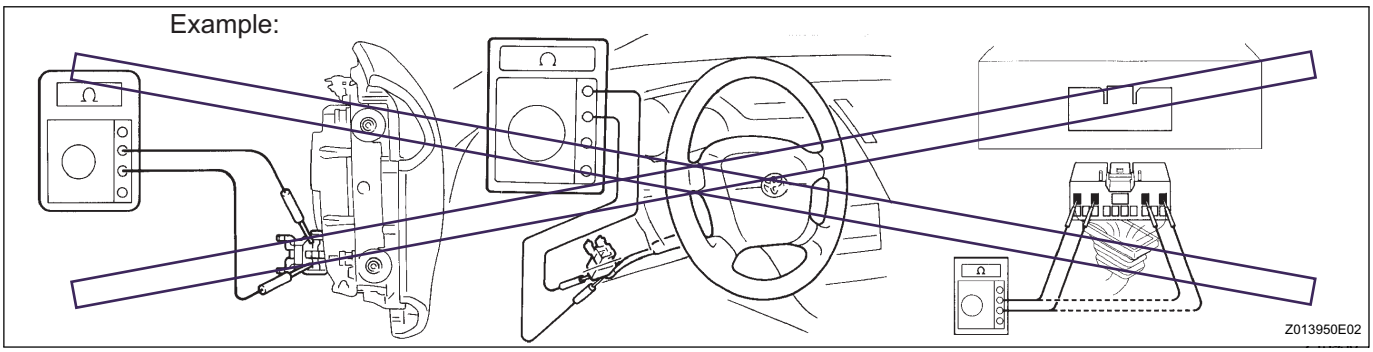


(b) SPIRAL CABLE
(1) The steering wheel must be fitted correctly to the steering column with the spiral cable at the neutral position, as cable disconnection and other problems may occur. Refer to the information about correct installation of the steering wheel (See page 60-24).

(c) STEERING PAD
(1) Always place a removed or new steering pad surface upward as shown in the illustration. Placing the horn button with the pad surface facing down could cause a serious accident if the airbag inflates. Also, do not place anything on top of the horn button.



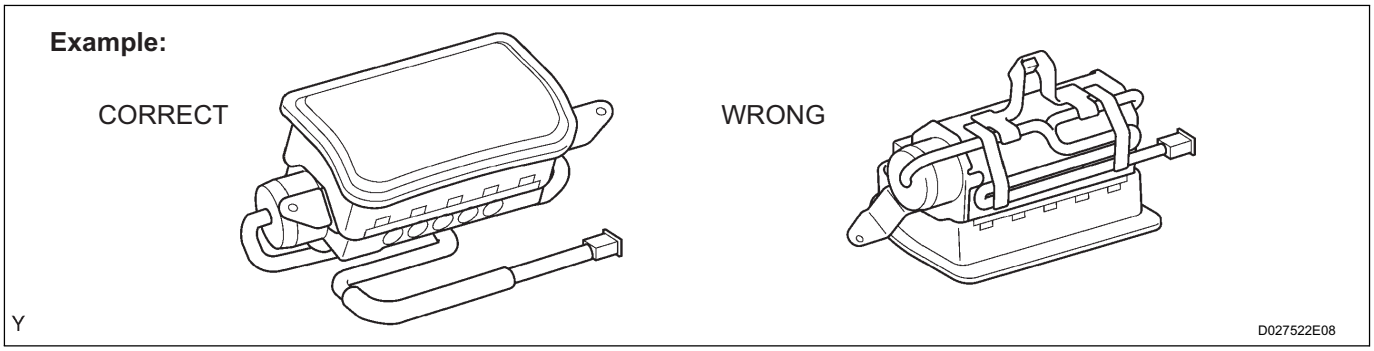
(2) Never measure the resistance of the airbag squib. This may cause the airbag to inflate, which could cause serious injury.



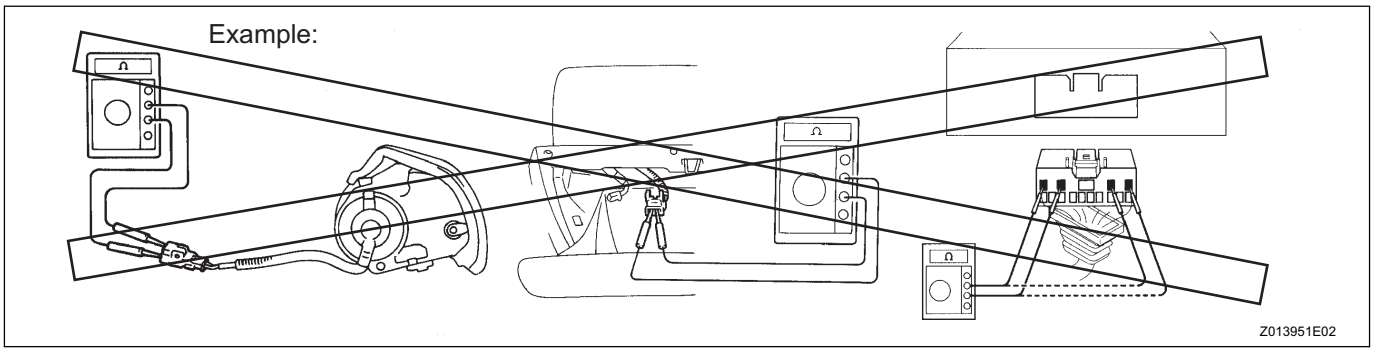
(3) Grease or detergents of any kind should not be applied to the horn button.

(4) Store the horn button assembly in an area where the ambient temperature is below 93°C (200°F), the humidity is not high and there is no electrical noise.
(5) When using electric welding anywhere on the vehicle, disconnect the airbag ECU connectors (4 pins). These connectors contain shorting springs. This feature reduces the possibility of the airbag deploying due to current entering the squib wiring.
(6) When disposing of the vehicle or the horn button assembly by itself, the airbag should be deployed using SST before disposal (See page **60-16**). Activate the airbag in a safe place away from electrical noise.

(d) FRONT PASSENGER AIRBAG ASSEMBLY
(1) Always place a removed or new front passenger airbag assembly with the pad surface facing upward as shown in the illustration. Placing the airbag assembly with the airbag inflation direction facing down could cause a serious accident if the airbag inflates.



(2) Never measure the resistance of the airbag squib. This may cause the airbag to inflate, which could cause serious injury.



(3) Grease or detergents of any kind should not be applied to the front passenger airbag assembly.
(4) Store the airbag assembly in an area where the ambient temperature is below 93°C (200°F), the humidity is not high and there is no electrical noise.

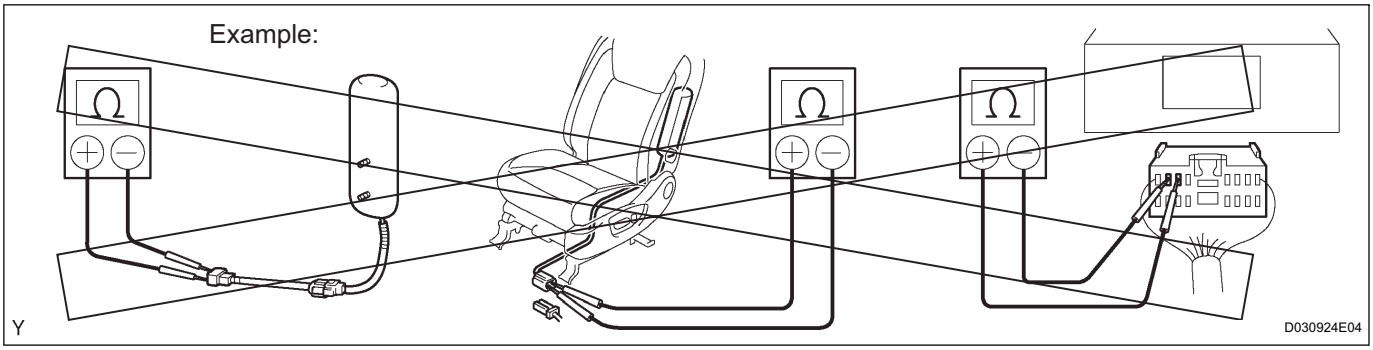
(5) When using electric welding anywhere on the vehicle, disconnect the airbag ECU connectors (4 pins). These connectors contain shorting springs. This feature reduces the possibility of the airbag deploying due to current entering the squib wiring.

(6) When disposing of the vehicle or the airbag assembly unit by itself, the airbag should be deployed using SST before disposal (See page 60-31). Activate in a safe place, away from electrical noise.

(e) FRONT SEAT SIDE AIRBAG ASSEMBLY

(1) Always place a removed or new front seat side airbag assembly with the airbag inflation direction facing up.

(2) Never measure the resistance of the airbag squib. This may cause the airbag to inflate, which could cause serious injury.



(3) Grease or detergents of any kind should not be applied to the front seat side airbag assembly.

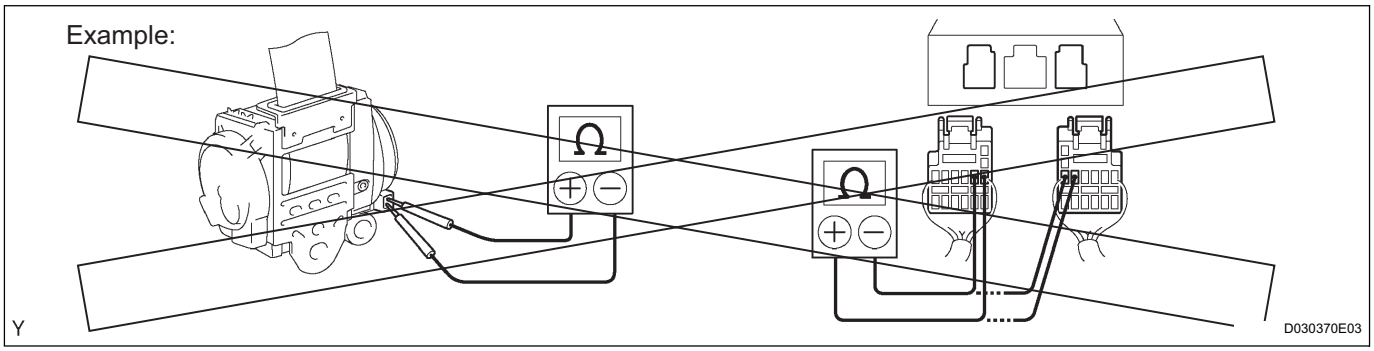
(4) Store the airbag assembly in an area where the ambient temperature is below 93°C (200°F), the humidity is not high and there is no electrical noise.

(5) When using electric welding anywhere on the vehicle, disconnect the airbag ECU connectors (2 pins). These connectors contain shorting springs. This feature reduces the possibility of the airbag deploying due to current entering the squib wiring.

(6) When disposing of a vehicle or the airbag assembly unit by itself, the airbag should be deployed using SST before disposal (See page 60-48). Activate in a safe place away from electrical noise.

(f) FRONT SEAT OUTER BELT ASSEMBLY AND REAR SEAT OUTER BELT ASSEMBLY (SEAT BELT PRETENSIONER)

(1) Never measure the resistance of the seat outer belt. This may cause the pretensioner of the seat belt to activate, which could cause serious injury.



(2) Never disassemble the seat outer belt.

(3) Never install the seat outer belt on another vehicle.

(4) Store the seat outer belt in an area where the ambient temperature is below 80°C (176°F), the humidity is not high and there is no electrical noise.

(5) When using electric welding anywhere on the vehicle, disconnect the airbag ECU connectors (2 pins). These connectors contain shorting springs. This feature reduces the possibility of the airbag deploying due to current entering the squib wiring.

(6) When disposing of a vehicle or the seat outer belt unit by itself, the seat outer belt should be activated before disposal (See page 61-7). Activate in a safe place away from electrical noise.

(7) As the seat outer belt is hot after being activated, allow some time for it to cool down sufficiently before disposal. Never apply water to cool down the seat outer belt.

(8) Grease, detergents, oil or water should not be applied to the front seat outer belt.

(g) AIRBAG SENSOR ASSEMBLY

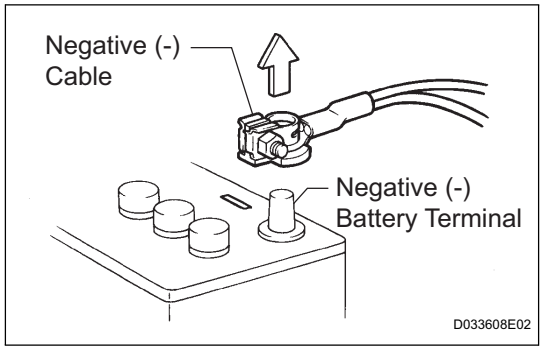
(1) Never reuse an airbag sensor assembly that has been involved in a collision where the SRS has deployed.

(2) The connectors to the airbag sensor assembly should be connected or disconnected with the sensor placed on the floor. If the connectors are connected or disconnected while the airbag sensor assembly is not placed on the floor, the SRS may activate.

(3) Work must be started at least 90 seconds after the ignition switch is turned off and the cable is disconnected from the negative (-) battery terminal, even if only loosening the set bolts of the airbag sensor assembly.

(h) WIRE HARNESS AND CONNECTOR

(1) The SRS wire harness is integrated with the instrument panel wire harness assembly. All the connectors in the system are a standard yellow color. If the SRS wire harness becomes disconnected or the connector becomes broken, repair or replace it.



3. ELECTRONIC CONTROL

(a) REMOVAL AND INSTALLATION OF BATTERY TERMINAL

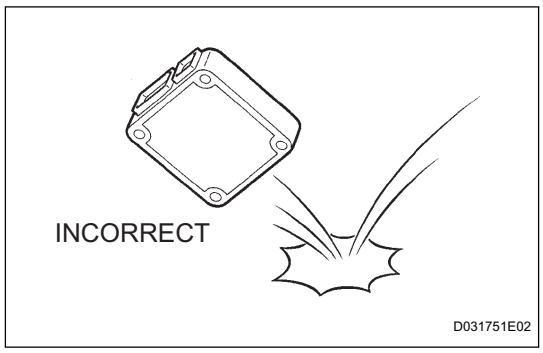
NOTICE:

Certain systems need to be initialized after disconnecting and reconnecting the cable from the negative (-) battery terminal.

(1) Before performing electronic work, disconnect the cable from the negative (-) battery terminal to prevent component and wire damage caused by accidental short circuits.

(2) When disconnecting the cable, turn the ignition switch and headlight dimmer switch off and loosen the cable nut completely. Perform these operations without twisting or prying the cable. Then disconnect the cable.

(3) Clock settings, radio settings, audio system memory, DTCs and other data are erased when the cable is disconnected from the negative (-) battery terminal. Write down any necessary data before disconnecting the cable.



(b) HANDLING OF ELECTRONIC PARTS

(1) Do not open the cover or case of the ECU unless absolutely necessary. If the IC terminals are touched, the IC may be rendered inoperative by static electricity.

(2) Do not pull the wires when disconnecting electronic connectors. Pull the connector itself.

(3) Do not drop electronic components, such as sensors or relays. If they are dropped on a hard surface, they should be replaced.

(4) When cleaning the engine with steam, protect the electronic components, air filter and emission-related components from water.

(5) Never use an impact wrench to remove or install temperature switches or temperature sensors.

(6) When measuring the resistance between terminals of a wire connector, insert the tester probe carefully to prevent terminals from bending.

4. REMOVAL AND INSTALLATION OF FUEL CONTROL PARTS

(a) PLACE FOR REMOVING AND INSTALLING FUEL SYSTEM PARTS

(1) Work in a location with good air ventilation that does not have welders, grinders, drills, electric motors, stoves, or any other ignition sources.

(2) Never work in a pit or near a pit as vaporized fuel will collect in those places.

(b) REMOVING AND INSTALLING FUEL SYSTEM PARTS

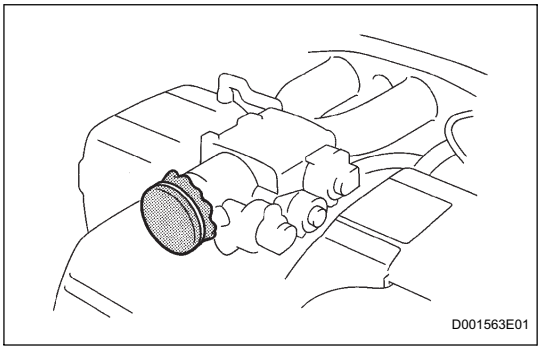
(1) Prepare a fire extinguisher before starting the operation.

(2) To prevent static electricity, install a ground wire to the fuel changer, vehicle and fuel tank, do not spray the surrounding area with water. Be careful when performing work in this area, as the work surface will become slippery. Do not clean up gasoline spills with water, as this may cause the gasoline to spread, and possibly create a fire hazard.

(3) Avoid using electric motors, working lights and other electric equipments that can cause sparks or high temperatures.

(4) Avoid using iron hammers as they may create sparks.

(5) Dispose of fuel-contaminated cloth separately using a fire resistant container.

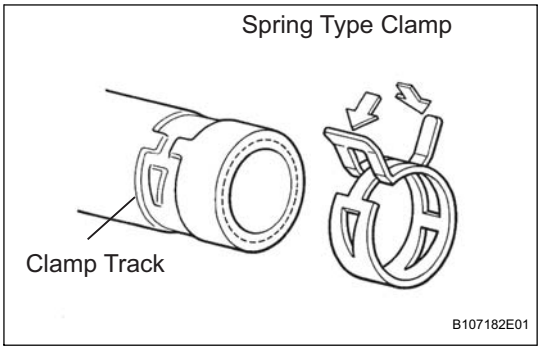


5. REMOVAL AND INSTALLATION OF ENGINE INTAKE PARTS

(a) If any metal particles enter inlet system parts, this may damage the engine.

(b) When removing and installing inlet system parts, cover the openings of the removed parts and engine openings. Use gummed tape or other suitable materials.

(c) When installing inlet system parts, check that no metal particles have entered the engine or the installed parts.



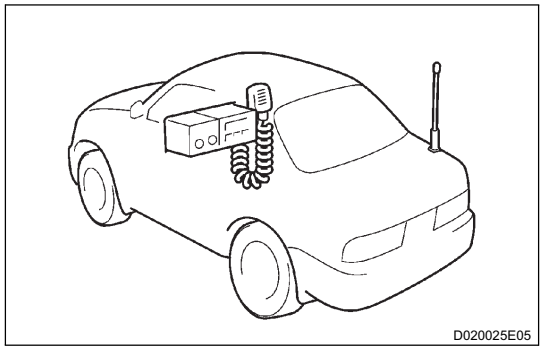
6. HANDLING OF HOSE CLAMPS

(a) Before removing the hose, check the clamp position so that it can be reinstalled in the same position.

(b) Replace any deformed or dented clamps with new ones.

(c) When reusing a hose, attach the clamp on the clamp track portion of the hose.

(d) For a spring type clamp, you may want to spread the tabs slightly after installation by pushing in the direction of the arrows as shown in the illustration.



7. FOR VEHICLES EQUIPPED WITH MOBILE COMMUNICATION SYSTEMS

(a) Install the antenna far away from the ECU and sensors of the vehicle electronic systems as possible.

(b) Install an antenna feeder at least 20 cm (7.87 in) away from the ECU and sensors of the vehicle electronic systems. For details about ECU and sensors locations, refer to the section on the applicable components.

(c) Keep the antenna and feeder separate from other wirings as much as possible. This will prevent signals sent from the communication equipment from affecting vehicle equipment and vice-versa.

(d) Check that the antenna and feeder are correctly adjusted.

(e) Do not install any high-powered mobile communication system.

8. FOR VEHICLES EQUIPPED WITH CATALYTIC CONVERTER

CAUTION:

If a large amount of unburned gasoline or gasoline vapors flow into the converter, it may cause overheating and create a fire hazard. To prevent this, observe the following precautions.

(a) Use only unleaded gasoline.

(b) Avoid idling the engine for more than 20 minutes.

(c) Avoid performing unnecessary spark jump tests.

(1) Perform a spark jump test only when absolutely necessary. Perform this test as rapidly as possible.

(2) While testing, never race the engine.

(d) Avoid a prolonged engine compression measurement. Engine compression measurements must be performed as rapidly as possible.

(e) Do not run the engine when the fuel tank is nearly empty. This may cause the engine to misfire and create an extra load on the converter.

VEHICLE LIFT AND SUPPORT LOCATIONS

1. NOTICE ABOUT VEHICLE CONDITION WHEN JACKING UP

(a) As a rule, the vehicle must be unloaded when jacking up. Never jack up or lift up the vehicle loaded with things of heavy weight.

(b) When removing any parts of heavy weight like the engine and transmission, the center of gravity of the vehicle moves. Place a balance weight so as to keep it from rolling, or hold the jacking support location using the mission jack.

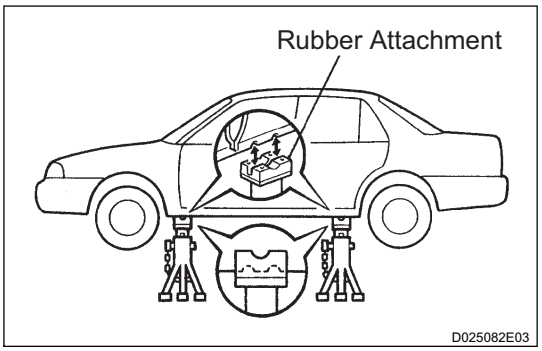
2. NOTICE FOR USING 4 POST LIFT

(a) Follow the instruction manual for a safety operation.

(b) Do not damage tyres or wheels with a free wheel beam.
(c) Using a wheel stopper, fix the vehicle.

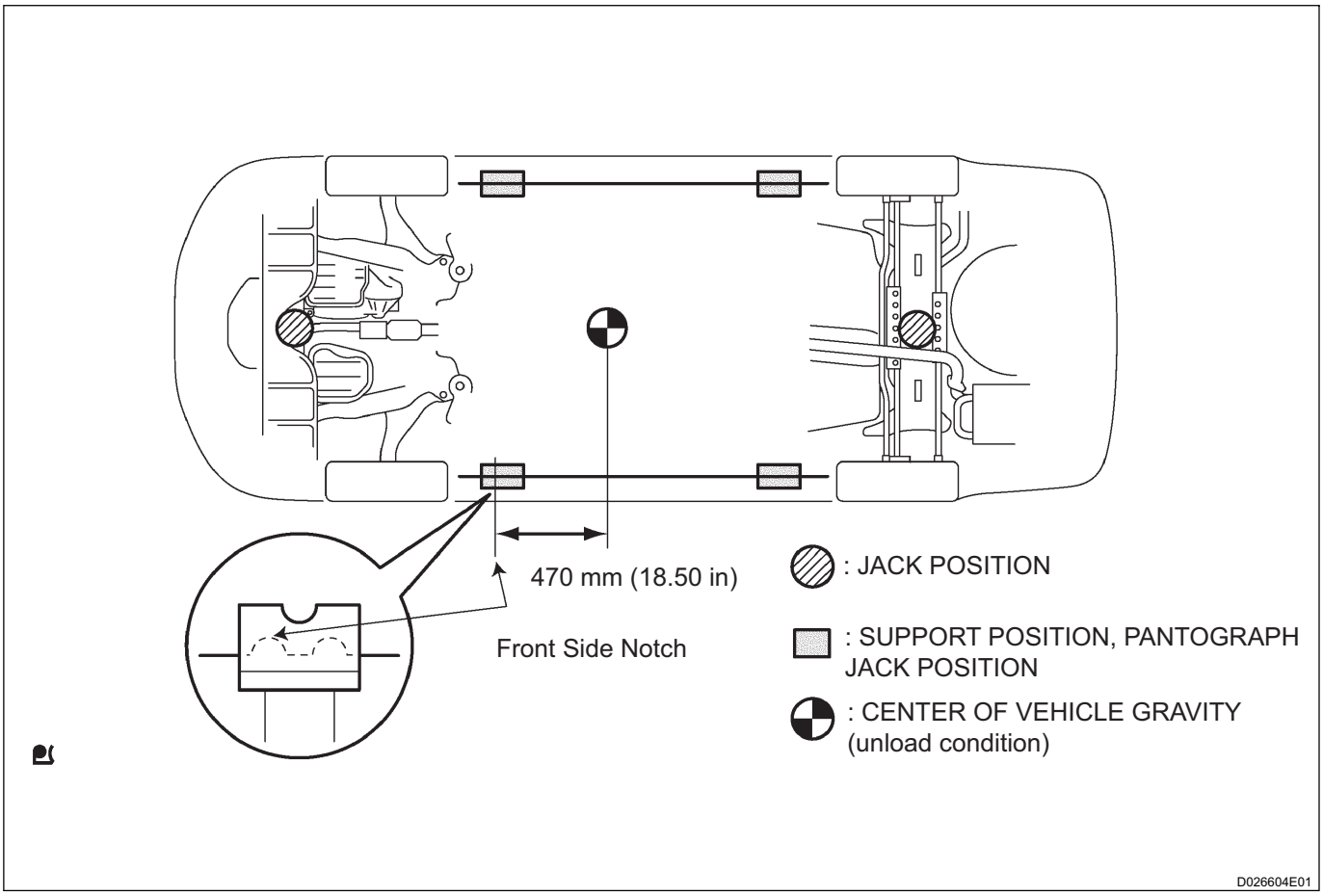
3. NOTICE FOR USING JACK AND SAFETY STAND

(a) Work in the flat place using a wheel stopper at all times.



(b) Use a safety stand with a rubber attachment, as shown in the illustration.
(c) Support the specified location with a jack and safety stand accurately.
(d) When jacking up the front wheels, release the parking brake and place wheel stoppers only behind the rear wheels. When jacking up the rear wheels, place wheel stoppers only in front of the front wheels.
(e) Do not work or leave the vehicle supported only by a jack. Be sure to support the vehicle with a safety stand.
(f) When jacking up only the front wheels or only the rear wheels, place wheel stoppers to both sides of the wheels that contact ground.

(g) When jacking down the vehicle with its front wheels jacked up, release the parking brake and place wheel stoppers only in front of the rear wheels. When jacking down the vehicle with its rear wheels jacked up, place wheel stoppers only behind the front wheels.



4. NOTICE FOR USING SWING ARM TYPE LIFT

(a) Follow the instruction manual of the lift for a safety operation.

(b) Use a cradle with a rubber attachment, as shown in the illustration.

(c) Set in the vehicle so as to make its center of gravity as close as possible to the center of the lift.

(d) Place the vehicle horizontally by adjusting the height of the cradle, and match the groove of the cradle and the safety stand support location accurately.

(e) Be sure to lock the swing arm during the operation.

(f) Lift the vehicle up until the tyres float, and shake the vehicle to make sure that the vehicle is stable.

5. NOTICE FOR USING PLATE TYPE LIFT

(a) Follow the instruction manual of the lift for a safety operation.

(b) Use a plate lift attachment.

(c) Be sure to set the vehicle to the specified position.

Right and left set position	• Place the vehicle over the center of the lift.

Front and rear set position	• Align the cushion gum ends of the plate with the attachment lower ends (A and C). • Align the attachment upper end (B) with the rocker flange front side notch.

(d) Lift the vehicle up until the tyres float, and shake the vehicle to make sure that the vehicle is stable.

Swing Arm Type Lift:

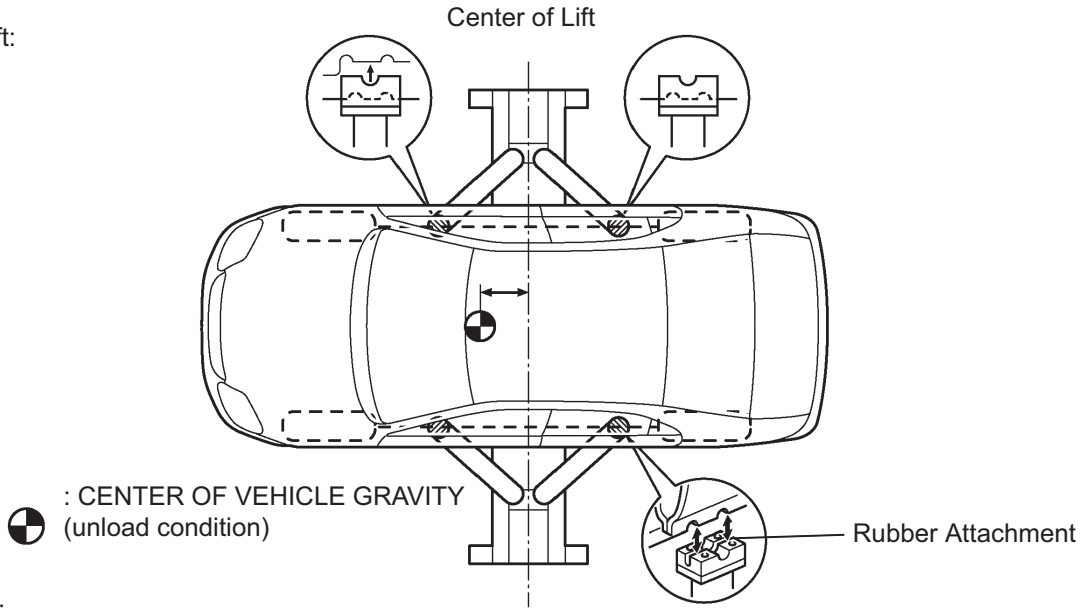
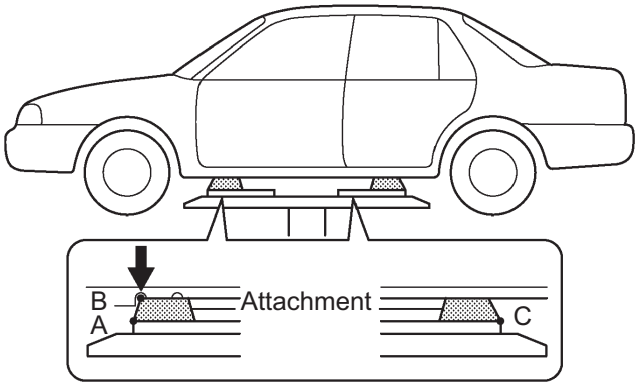
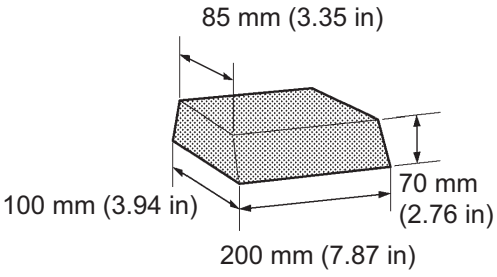


Plate Arm Type Lift:



Attachment Dimensions



Y

D025021E03

HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

GENERAL INFORMATION

A large number of ECU controlled systems are used in the CAMRY. In general, ECU controlled systems are considered to be very intricate, requiring a high level of technical knowledge to troubleshoot. However, most problem checking procedures only involve inspecting the ECU controlled system's circuits one by one. An adequate understanding of the system and a basic knowledge of electricity is enough to perform effective troubleshooting, accurate diagnoses and necessary repairs.

FOR USING INTELLIGENT TESTER

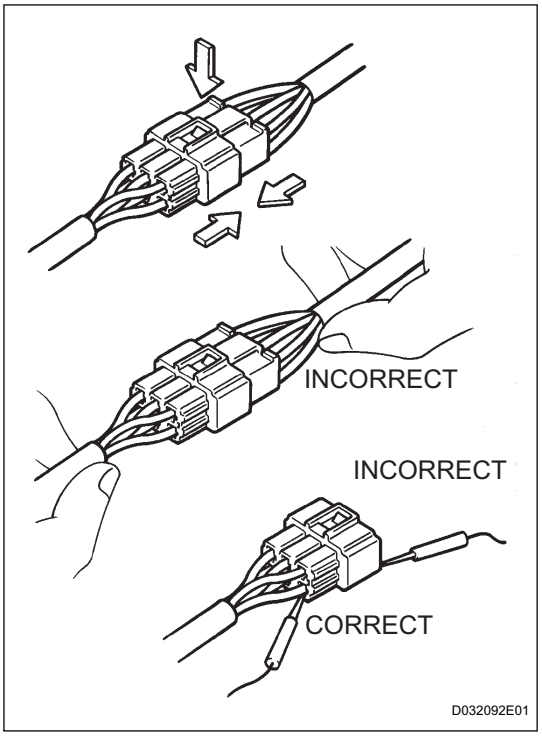
– Before using the intelligent tester, read the tester operator's manual thoroughly.
– If the tester cannot communicate with the ECU controlled systems when the tester is connected to the DLC3 with the ignition switch on and the tester turned on, there is a problem on the vehicle side or tester side.
  (1) If communication is normal when the tester is connected to another vehicle, inspect the diagnosis data link line (Bus (+) line) or ECU power circuit of the vehicle.
  (2) If communication is still not possible when the tester is connected to another vehicle, the problem is probably in the tester itself. Perform the Self Test procedures outlined in the tester operator's manual.

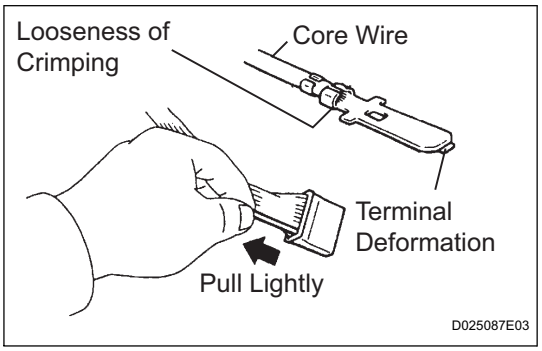
ELECTRONIC CIRCUIT INSPECTION PROCEDURE

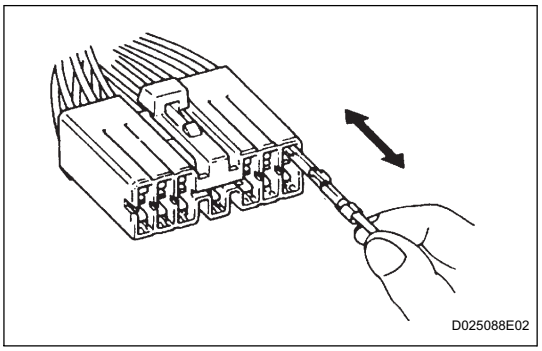
1. BASIC INSPECTION

(a) WHEN MEASURING RESISTANCE OF ELECTRONIC PARTS

(1) Unless otherwise stated, all resistance measurements should be made at an ambient temperature of 20°C (68°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 connector, first squeeze the mating connector housing 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 deformations, damage, looseness or missing terminals.

(4) When connecting a connector, press firmly until it locks with a "click" sound.

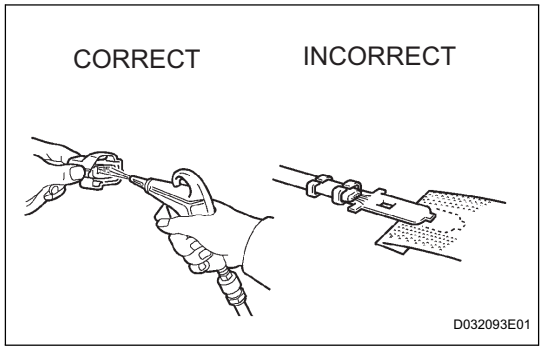
(5) If checking a connector with a TOYOTA electrical tester, check the connector from the backside (harness side) using a mini test lead.
NOTICE:
- **As a waterproof connector cannot be checked from the backside, check it by connecting a sub-harness.**
- **Do not damage the terminals by moving the inserted tester needle.**

(c) CHECKING CONNECTORS

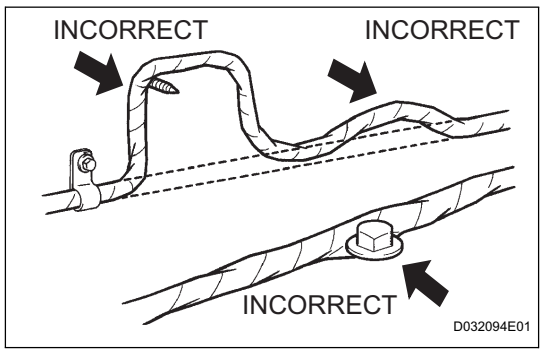
(1) Checking when a connectors is disconnected: Squeeze the connector together to confirm that they are fully connected and locked.

(2) Checking when a connector is disconnected: Check by pulling the wire harness lightly from the backside of the connector. Look for unlatched terminals, missing terminals, loose crimps or broken conductor wires. Check visually for corrosion, metallic or foreign matter and water, and bent, rusted, overheated, contaminated, or deformed terminals.

(3) Checking the contact pressure of the terminal: Prepare a spare male terminal. Insert it into a female terminal, and check for ample tension when inserting and after full engagement.
NOTICE:
When testing a gold-plated female terminal, always use a gold-plated male terminal.

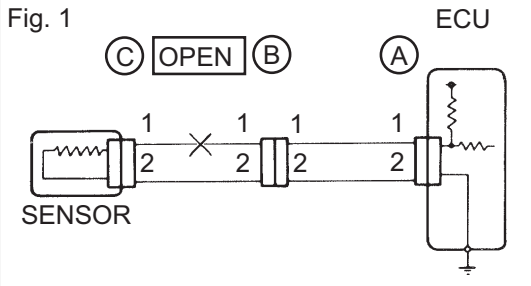


(d) REPAIR METHOD OF CONNECTOR TERMINAL
(1) If there is any foreign matter on the terminal, clean the contact point with compressed air or a cloth. Never rub the contact point using sandpaper as the plating may come off.
(2) If there is abnormal contact pressure, replace the female terminal. If the male terminal is gold-plated (gold color), use a gold-plated female terminal; if it is silver-plated (silver color), use a silver-plated female terminal.
(3) Damaged, deformed, or corroded terminals should be replaced. If the terminal does not lock into the housing, the housing may have to be replaced.



(e) HANDLING OF WIRE HARNESS
(1) If removing a wire harness, check the wiring and clamping before proceeding so that it can be restored in the same way.
(2) Never twist, pull or slacken 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.

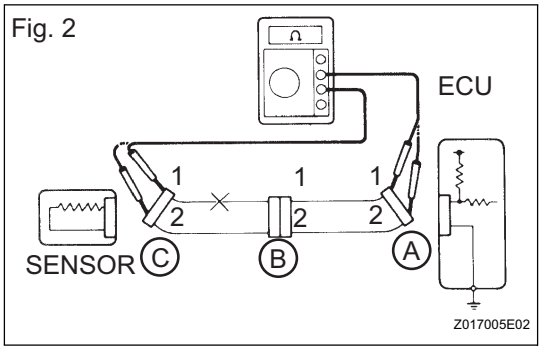
Fig. 1



2. CHECK FOR OPEN CIRCUIT

(a) For an open circuit in the wire harness in Fig. 1, the resistance or voltage, as described below.

Fig. 2



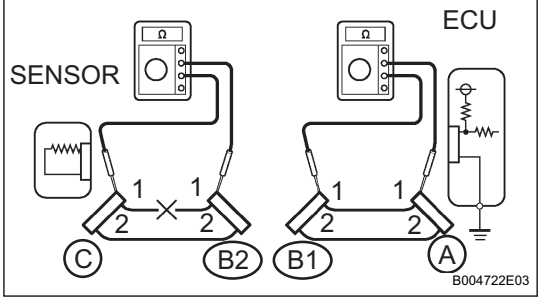
(b) Check the resistance.
(1) Disconnect connectors A and C and measure the resistance between the terminals of the connectors.
Standard resistance (Fig. 2)

Tester Connection	Specified Condition
Connector A terminal 1 - Connector C terminal 1	10 kΩ or higher
Connector A terminal 2 - Connector C terminal 2	Below 1Ω

HINT:
Measure the resistance while lightly shaking the wire harness vertically and horizontally. If the results match the examples above, an open circuit exists between terminal 1 of connector A and terminal 1 of connector C.

(2) Disconnect connector B and measure the resistance between the terminals of the connectors.
Standard resistance (Fig. 3)

Fig. 3

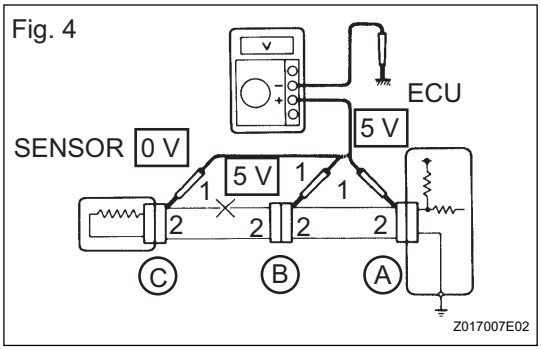


Tester Connection	Specified Condition
Connector A terminal 1 - Connector B1 terminal 1	Below 1 Ω
Connector B2 terminal 2 - Connector C terminal 2	10 kΩ or higher

If the results match the examples above, an open circuit exists between terminal 1 of connector B2 and terminal 1 of connector C.

(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.
With each connector still connected, measure the voltage between the body ground and these terminals (in this order): 1) terminal 1 of connector A, 2) terminal 1 of connector B, and 3) terminal 1 of connector C.
Standard voltage (Fig. 4)

Fig. 4



Tester Connection	Specified Condition
Connector A terminal 1 - Body ground	5 V
Connector B terminal 1 - Body ground	5 V
Connector C terminal 1 - Body ground	Below 1 V

If the results match the examples above, an open circuit exists in the wire harness between terminal 1 of connector B and terminal 1 of connector C.

3. CHECK FOR SHORT CIRCUIT

(a) If the wire harness is ground shorted (Fig. 5), locate the section by conducting a resistance check with the body ground (below).

Fig. 5

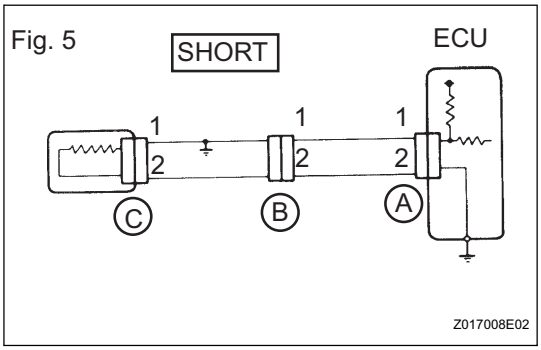
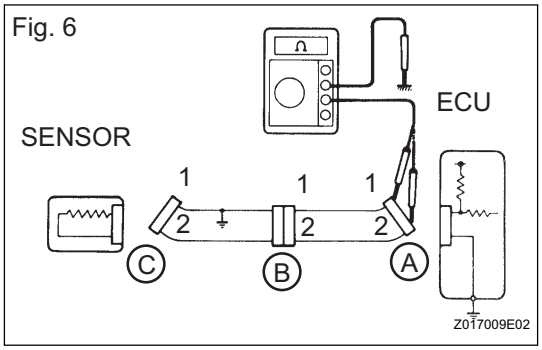


Fig. 6

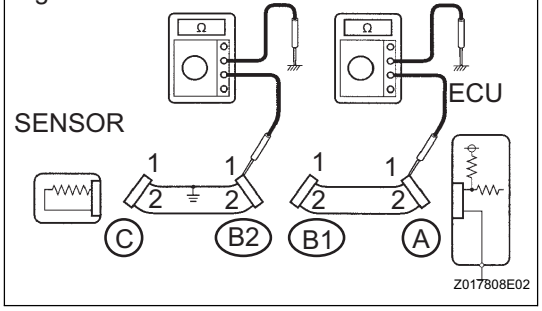


(b) Check the resistance with the body ground.
(1) Disconnect connectors A and C and measure the resistance.
Standard resistance (Fig. 6)

Tester Connection	Specified Condition
Connector A terminal 1 - Body ground	Below 1 Ω
Connector A terminal 2 - Body ground	10 kΩ or higher

HINT:
Measure the resistance while lightly shaking the wire harness vertically and horizontally. If your results match the examples above, an open circuit exists between terminal 1 of connector A and terminal 1 of connector C.

Fig. 7



(2) Disconnect connector B and measure the resistance.
Standard resistance (Fig. 7)

Tester Connection	Specified Condition
Connector A terminal 1 - Body ground	10 kΩ or higher
Connector B2 terminal 2 - Body ground	Below 1 Ω

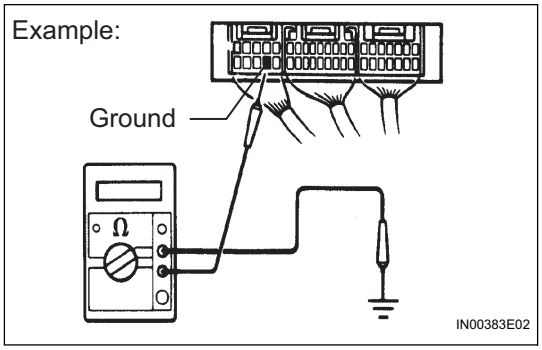
If the results match the examples above, a short circuit exists between terminal 1 of connector B2 and terminal 1 of connector C.

4. CHECK AND REPLACE ECU

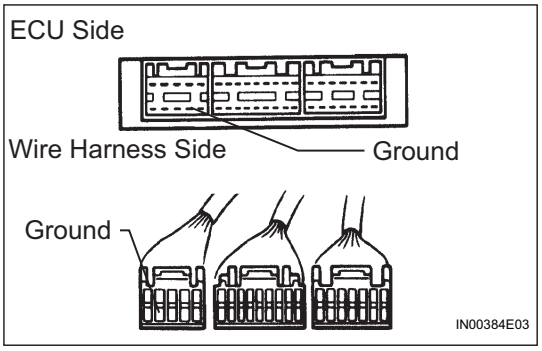
NOTICE:

- **The connector should not be disconnected from the ECU. Perform the inspection from the backside of the connector on the wire harness side.**
- **When no measuring condition is specified, perform the inspection with the engine stopped and the ignition switch on.**
- **Check that the connectors are fully seated. Check for loose, corroded or broken wires.**

Example:



(a) First, check the ECU ground circuit. If it is faulty, repair it. If it is normal, the ECU could be faulty. Temporarily replace the ECU with a normally functioning one and check if the symptoms occur. If the trouble symptoms disappear, replace the original ECU.
(1) Measure the resistance between the ECU ground terminal and body ground.
Standard resistance:
Below 1 Ω



(2) Disconnect the ECU connector. Check the ground terminal on the ECU side and wire harness side for bending, corrosion or foreign matter. Lastly, check the contact pressure of the female terminals.

HOW TO PROCEED WITH TROUBLESHOOTING

1. OPERATION FLOW

HINT:
Perform troubleshooting in accordance with the procedures below. The following is an outline of basic troubleshooting procedures. Confirm the troubleshooting procedures for the circuit you are working on before beginning troubleshooting.

1	VEHICLE BROUGHT TO WORKSHOP

NEXT

2	CUSTOMER PROBLEM ANALYSIS

(a) Ask the customer about the conditions and environment when the problem occurred.

NEXT

3	INSPECT BATTERY VOLTAGE

Standard voltage:
11 to 14 V
If the voltage is below 11 V, recharge or replace the battery before proceeding.

NEXT

4	SYMPTOM CONFIRMATION AND DTC (AND FREEZE FRAME DATA) CHECK

(a) Visually check the wire harnesses, connectors and fuses for open and short circuits.
(b) Warm up the engine to the normal operating temperature.
(c) Confirm the problem symptoms and conditions, and check for DTCs

Result

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

B	GO TO STEP 6

A

5	DTC CHART

(a) Check the results obtained in step 4. Then find the output DTC in the DTC chart. Look at the "Trouble Area" column for a list of potentially malfunctioning circuits and / or parts.

NEXT → GO TO STEP 7

6	PROBLEM SYMPTOMS CHART

(a) Check the results obtained in step 4. Then find the problem symptoms in the problem symptoms table. Look at the "Suspected Area" column for a list of potentially malfunctioning circuits and / or parts.

NEXT

7	CIRCUIT INSPECTION OR PARTS INSPECTION

(a) Identify the malfunctioning circuit or part.

NEXT

8	ADJUST, REPAIR OR REPLACE

(a) Adjust, repair or replace the malfunctioning circuit or parts.

NEXT

9	CONFIRMATION TEST

(a) After the adjustment, repairs or replacement, confirm that the malfunction no longer exists. 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.

NEXT

END

2. CUSTOMER PROBLEM ANALYSIS

HINT:

- 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.
- Gather as much information as possible for reference. Past problems that seem unrelated may also help in some cases.
- The following 5 items are important points in the problem analysis:

What	Vehicle model, system name
When	Date, time, occurrence frequency
Where	Road conditions
Under what conditions?	Running conditions, driving conditions, weather conditions
How did it happen?	Problem symptoms

3. SYMPTOM CONFIRMATION AND DIAGNOSTIC TROUBLE CODE

HINT:

The diagnostic system in the CAMRY has various functions.

- The first function is the Diagnostic Trouble Code (DTC) check. A DTC is a code stored in the ECU memory whenever a malfunction in the signal circuits to the ECU occurs. In a DTC check, a previous malfunction's DTC can be checked by a technician during troubleshooting.
- Another function is the Input Signal Check, which checks if the signals from various switches are sent to the ECU correctly.

  By using these functions, the problem areas can be narrowed down and troubleshooting is more effective. Diagnostic functions are incorporated in the following system in the CAMRY.

System	DTC Check (Normal Mode)	DTC Check (Check Mode)	Sensor Check/Test Mode (Input Signal Check)	Data List	Active Test
SFI System (2AZ-FE)	○	○		○	○
SFI System (1MZ-FE)	○	○		○	○
Automatic Transaxle System (U541E)	○	○		○	○
Automatic Transaxle System (U241E)	○	○		○	○
Anti-Lock Brake System	○		○	○	○
Air Conditioning System					
Engine Immobiliser System (2AZ-FE)	○				
Engine Immobiliser System (1MZ-FE)	○			○	○
Cruise Control System					
Meter / Gauge System					

- In the DTC check, it is very important to determine whether the problem indicated by the DTC either: 1) still occurs, or 2) occurred in the past but has 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 confirmation of symptoms (i.e., whether or not problem symptoms exist) to determine current system conditions, as shown in the flowchart below.
- Never skip the DTC check. Failing to check DTCs may, depending on the case, result in unnecessary troubleshooting for systems operating normally or lead to repairs not related to the problem. Follow the procedures listed in the flowchart in the correct order.
- The following flowchart shows how to proceed with troubleshooting using the DTC check. Directions from the flowchart will indicate how to proceed either to DTC troubleshooting or to the troubleshooting of each problem symptom.

1	DTC CHECK

NEXT

2	MAKE A NOTE OF DTCS DISPLAYED AND THEN CLEAR MEMORY

NEXT

3	SYMPTOM CONFIRMATION

Result

Result	Proceed to
No symptoms exist	A
Symptoms exist	B

B → GO TO STEP 5

A

4	SIMULATION TEST USING SYMPTOM SIMULATION METHODS

NEXT

5	DTC CHECK

Result

Result	Proceed to
DTC is not output	A

Result	Proceed to
DTC is output	B

B → TROUBLESHOOTING OF PROBLEM INDICATED BY DTC

A

6 SYMPTOM CONFIRMATION

Result

Result	Proceed to
Symptoms exist	A
No symptoms exist	B

If a DTC was displayed in the initial DTC check, the problem may have occurred in a wire harness or connector in that circuit in the past. Check the wire harness and connectors.

B → SYSTEM NORMAL

A

TROUBLESHOOTING OF EACH PROBLEM SYMPTOM

The problem still occurs in a place other than the diagnostic circuit (the DTC displayed first is either for a past problem or a secondary problem).

4. SYMPTOM SIMULATION

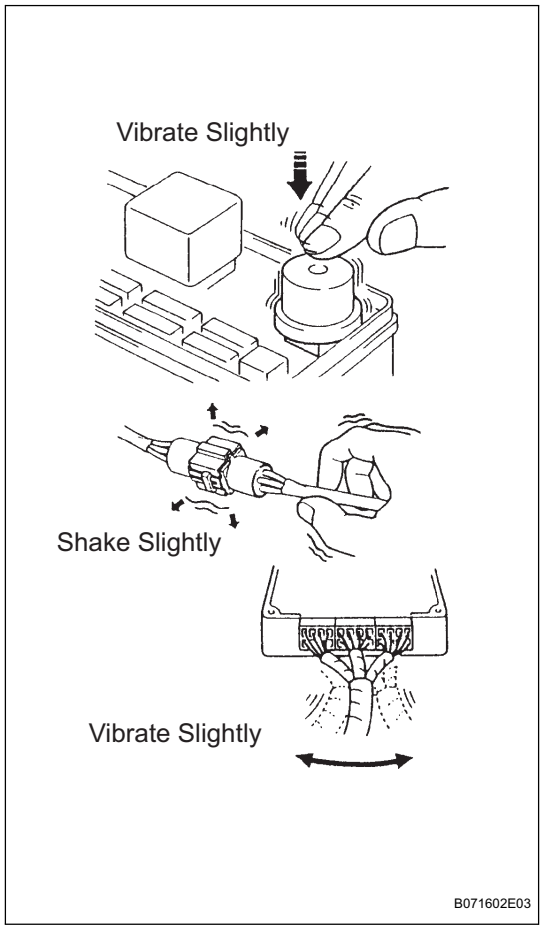
HINT:

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. No matter how much skill or experience a technician has, troubleshooting without confirming the problem symptoms will lead to important repairs being overlooked and mistakes or delays.

For example:

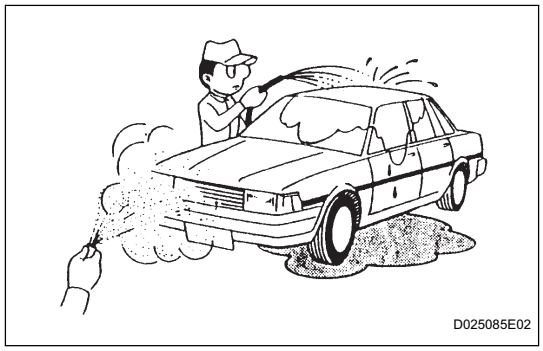
With a problem that only occurs when the engine is cold or as a result of vibration caused by the road during driving, the problem can never be determined if the symptoms are being checked on a stationary vehicle or a vehicle with a warmed-up engine. Vibration, heat or water penetration (moisture) is difficult to reproduce. The symptom simulation tests below are effective substitutes for the conditions and can be applied on a stationary vehicle. Important points in the symptom simulation test:

In the symptom simulation 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 simulation test, judging 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.



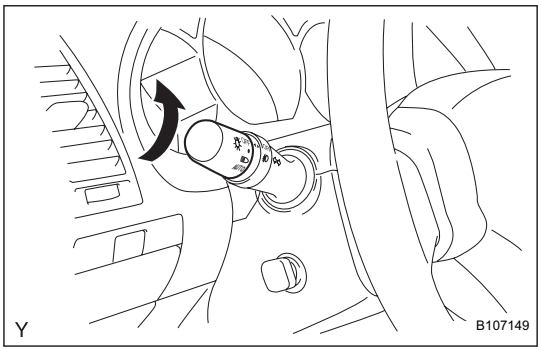
(a) VIBRATION METHOD: When a malfunction seems to occur as a result of vibration.
  (1) PART AND SENSOR
    Apply slight vibration with a finger to the part of the sensor suspected to be the cause of the problem, and check whether or not the malfunction occurs.
    NOTICE:
    Applying strong vibration to relays may open relays.
  (2) CONNECTORS
    Slightly shake the connector vertically and horizontally.
  (3) WIRE HARNESS
    Slightly shake the wire harness vertically and horizontally.
    HINT:
    The connector joint and fulcrum of the vibration are the major areas that should be checked thoroughly.

(b) HEAT METHOD: When a malfunction seems to occur when the area in question is heated.
  (1) Heat the component that is the possible cause of the malfunction with a hair dryer or similar device. Check if the malfunction occurs.
    NOTICE:
    - **Do not heat to more than 60°C (140°F). Exceeding this temperature may damage the components.**
    - **Do not apply heat directly to the parts in the ECU.**



(c) WATER SPRINKLING METHOD: When a malfunction seems to occur on a rainy day or in high-humidity.
  (1) 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.**

HINT:
If the vehicle has or had a water leakage problem, the leakage may have damaged the ECU or connections. Look for evidence of corrosion or short circuits. Proceed with caution during water tests.



(d) HIGH ELECTRICAL LOAD METHOD: When a malfunction seems to occur when electrical load is excessive.
(1) Turn on the heater blower, headlight, rear window defogger and all other electrical loads. Check if the malfunction reoccurs.

5. DIAGNOSTIC TROUBLE CODE CHART

Look for output Diagnostic Trouble Codes (DTCs) (from the DTC checks) in the appropriate section's Diagnostic Trouble Code Chart. Use the chart to determine the trouble area and the proper inspection procedure. A description of each of the chart's columns is shown in the table below.

Item	Description
DTC No.	Indicates the diagnostic trouble code
Detection Item	Indicates the system or details of the problem
Trouble Area	Indicates the suspect areas of the problem
See Page	Indicates the page where the inspection procedures for each circuit is to be found, or gives instruction for checking and repairs.

6. PROBLEM SYMPTOMS TABLE

When a "Normal" code is output during a DTC check but the problem still occurs, use the Problem Symptoms Table. The suspected areas (circuits or parts) for each problem symptoms are in the table. The suspected areas are listed in order of probability. A description of each of the chart's columns is shown in the table below.

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

Item	Description
Problem Symptom	-
Circuit Inspection, Inspection Order	Indicates the order in which the circuits need to be checked
Circuit or Part Name	Indicates the circuit or part which needs to be checked
See Page	Indicates the page where the flowchart for each circuit is located

7. CIRCUIT INSPECTION

A description of the main areas of each circuit inspection is shown in the table below.

Item	Description
Circuit Description	The major role, operation of the circuit and its component parts are explained.
Diagnostic Trouble Code No. and Detection item	Indicates the diagnostic trouble codes, diagnostic trouble code settings and suspected areas for a problem

Item	Description
Wiring diagram	This shows a wiring diagram of the circuit. Use this diagram together with ELECTRICAL WIRING DIAGRAM to thoroughly understand the circuit. Wire colors are indicated by an alphabetical code. B = Black, L = Blue, R = Red, BR = Brown, LG = Light Green, V = Violet, G = Green, O = Orange, W = White, GR = Gray, P = Pink, Y = Yellow, SB = Sky Blue The first letter indicates the basic wire color and the second letter indicates the color of the stripe.
Inspection Procedures	Use the inspection procedures to determine if the circuit is normal or abnormal. If abnormal, use the inspection procedures to determine whether the problem is located in the sensors, actuators, wire harnesses or ECU.
Indicates the condition of the connector of the ECU during the check	Connector being checked is connected. Connections of tester are indicated by (+) or (-) after the terminal name. Connector being checked is disconnected. The inspections between a connector and body ground, information about the body ground is not shown in the illustration.

TERMS

ABBREVIATIONS USED IN MANUAL

Abbreviations	Meaning
ABS	Anti-Lock Brake System
A/C	Air Conditioner
AC	Alternating Current
ACC	Accessory
ACIS	Acoustic Control Induction System
ACM	Active Control Engine Mount
ACSD	Automatic Cold Start Device
A.D.D	Automatic Disconnecting Differential
A/F	Air-Fuel Ratio
AHC	Active Height Control Suspension
ALR	Automatic Locking Retractor
ALT	Alternator
AMP	Amplifier
ANT	Antenna
APPROX.	Approximately
ASSY	Assembly
A/T, ATM	Automatic Transmission (Transaxle)
ATF	Automatic Transmission Fluid
AUTO	Automatic
AUX	Auxiliary
AVG	Average
AVS	Adaptive Variable Suspension
AWD	All Wheel Drive Vehicle
B+	Battery Voltage
BA	Brake Assist
BACS	Boost Altitude Compensation System
BAT	Battery
BDC	Bottom Dead Center
B/L	Bi-Level
B/S	Bore-Stroke Ratio
BTDC	Before Top Dead Center
BVSV	Bimetallic Vacuum Switching Valve
CAN	Controller Area Network
CB	Circuit Breaker
CCo	Catalytic Converter For Oxidation
CCV	Canister Closed Valve
CD	Compact Disc
CF	Cornering Force
CG	Center Of Gravity
CH	Channel
CKD	Complete Knock Down
COMB.	Combination
CPE	Coupe
CPS	Combustion Pressure Sensor
CPU	Central Processing Unit
CRS	Child Restraint System

Abbreviations	Meaning
CTR	Center
C/V	Check Valve
CV	Control Valve
CW	Curb Weight
DC	Direct Current
DEF	Defogger
DFL	Deflector
DIFF.	Differential
DIFF. LOCK	Differential Lock
D/INJ	Direct Injection
DLC	Data Link Connector
DLI	Distributorless Ignition
DOHC	Double Overhead Camshaft
DP	Dash Pot
DS	Dead Soak
DSP	Digital Signal Processor
DTC	Diagnostic Trouble Code
DVD	Digital Versatile Disc
EBD	Electric Brake Force Distribution
EC	Electrochromic
ECAM	Engine Control And Measurement System
ECD	Electronically Controlled Diesel
ECDY	Eddy Current Dynamometer
ECT	Electronic Controlled Automatic Transmission
ECU	Electronic Control Unit
ED	Electro-Deposited Coating
EDU	Electronic Driving Unit
EDIC	Electric Diesel Injection Control
EFI	Electronic Fuel Injection
E/G	Engine
EGR	Exhaust Gas Recirculation
EGR-VM	EGR-Vacuum Modulator
ELR	Emergency Locking Retractor
EPS	Electric Power Steering
ENG	Engine
ES	Easy & Smooth
ESA	Electronic Spark Advance
ETCS-i	Electronic Throttle Control System-intelligent
EVAP	Evaporative Emission Control
EVP	Evaporator
E-VRV	Electric Vacuum Regulating Valve
EX	Exhaust
FE	Fuel Economy
FF	Front-Engine-Front-Wheel-Drive
F/G	Fuel Gauge
FIPG	Formed In Place Gasket
FL	Fusible Link
F/P	Fuel Pump
FPU	Fuel Pressure Up

Abbreviations	Meaning
FR	Front
F/W	Flywheel
FW/D	Flywheel Damper
FWD	Front-Wheel-Drive
GAS	Gasoline
GND	Ground
GPS	Global Positioning System
GSA	Gear Shift Actuator
HAC	High Altitude Compensator
H/B	Hatchback
H-FUSE	High Current Fuse
HI	High
HID	High Intensity Discharge (Headlight)
HPU	Hydraulic Power Unit
HSG	Housing
HT	Hard Top
HV	Hybrid Vehicle
HWS	Heated Windshield System
IC	Integrated Circuit
IDI	Indirect Diesel Injection
IFS	Independent Front Suspension
IG	Ignition
IIA	Integrated Ignition Assembly
IN	Intake (Manifold, Valve)
INT	Intermittent
I/P	Instrument Panel
IRS	Independent Rear Suspension
ISC	Idle Speed Control
J/B	Junction Block
J/C	Junction Connector
KD	Kick-Down
LAN	Local Area Network
LB	Liftback
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LH	Left-Hand
LHD	Left-Hand Drive
LIN	Local Interconnect Network
L/H/W	Length, Height, Width
LLC	Long-Life Coolant
LNG	Liquefied Natural Gas
LO	Low
LPG	Liquefied Petroleum Gas
LSD	Limited Slip Differential
LSP & BV	Load Sensing Proportioning and Bypass Valve
LSPV	Load Sensing Proportioning Valve
MAP	Manifold Absolute Pressure
MAX.	Maximum
MIC	Microphone

Abbreviations	Meaning
MIL	Malfunction Indicator Lamp
MIN.	Minimum
MG1	Motor Generator No. 1
MG2	Motor Generator No. 2
MMT	Multi-mode Manual Transmission
MP	Multipurpose
MPI	Multipoint Electronic Injection
MPX	Multiplex Communication System
M/T, MTM	Manual Transmission (Transaxle)
MT	Mount
MTG	Mounting
N	Neutral
NA	Natural Aspiration
NO.	Number
O2S	Oxygen Sensor
OC	Oxidation Catalyst
OCV	Oil Control Valve
O/D	Overdrive
OEM	Original Equipment Manufacturing
OHC	Overhead Camshaft
OHV	Overhead Valve
OPT	Option
ORVR	On-board Refilling Vapor Recovery
O/S	Oversize
P & BV	Proportioning and Bypass Valve
PBD	Power Back Door
PCS	Power Control System
PCV	Positive Crankcase Ventilation
PKB	Parking Brake
PPS	Progressive Power Steering
PROM	Programmable Read Only Memory
PS	Power Steering
PSD	Power Slide Door
PTC	Positive Temperature Coefficient
PTO	Power Take-Off
PZEV	Partial Zero Emission Vehicle
P/W	Power Window
R & P	Rack and Pinion
RAM	Random Access Memory
R/B	Relay Block
RBS	Recirculating Ball Type Steering
R/F	Reinforcement
RFS	Rigid Front Suspension
RH	Right-Hand
RHD	Right-Hand Drive
RLY	Relay
ROM	Read Only Memory
RR	Rear
RRS	Rigid Rear Suspension

Abbreviations	Meaning
RSE	Rear Seat Entertainment
RWD	Rear-Wheel Drive
SC	Supercharger
SCV	Swirl Control Valve
SDN	Sedan
SEN	Sensor
SICS	Starting Injection Control System
SOC	State Of Charge
SOHC	Single Overhead Camshaft
SPEC	Specification
SPI	Single Point Injection
SRS	Supplemental Restraint System
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
STJ	Cold-Start Fuel Injection
SW	Switch
SYS	System
T/A	Transaxle
TACH	Tachometer
TBI	Throttle Body Electronic Fuel Injection
TC	Turbocharger
TCCS	TOYOTA Computer-Controlled System
TCV	Timing Control Valve
TDC	Top Dead Center
TEMP.	Temperature
TFT	TOYOTA Free-Tronic
TIS	Total Information System For Vehicle Development
T/M	Transmission
TMC	TOYOTA Motor Corporation
TMMIN	PT. TOYOTA Motor Manufacturing Indonesia
TMMK	TOYOTA Motor Manufacturing Kentucky, Inc.
TMT	TOYOTA Motor Thailand Co. Ltd.
TRAC/TRC	Traction Control System
TURBO	Turbocharge
TWC	Three-Way Catalyst
U/D	Underdrive
U/S	Undersize
VCV	Vacuum Control Valve
VDIM	Vehicle Dynamics Integrated Management
VENT	Ventilator
VIM	Vehicle Interface Module
VGRS	Variable Gear Ratio Steering
VIN	Vehicle Identification Number
VPS	Variable Power Steering
VSC	Vehicle Skid Control
VSV	Vacuum Switching Valve
VTV	Vacuum Transmitting Valve
VVT-i	Variable Valve Timing-intelligent

Abbreviations	Meaning
W/	With
WGN	Wagon
W/H	Wire Harness
W/O	Without
1ST	First
2ND	Second
2WD	Two Wheel Drive Vehicle (4 x 2)
3RD	Third
4TH	Fourth
4WD	Four Wheel Drive Vehicle (4 x 4)
4WS	Four Wheel Steering System
5TH	Fifth

PREPARATION

2AZ-FE ENGINE CONTROL SYSTEM
RECOMMENDED TOOLS PP-1
EQUIPMENT PP-1

1MZ-FE ENGINE CONTROL SYSTEM
RECOMMENDED TOOLS PP-2
EQUIPMENT PP-2

2AZ-FE ENGINE MECHANICAL
EQUIPMENT PP-3

2AZ-FE FUEL
SST PP-4
RECOMMENDED TOOLS PP-4
EQUIPMENT PP-4

A541E AUTOMATIC TRANSAXLE
RECOMMENDED TOOLS PP-5

U241E AUTOMATIC TRANSAXLE
RECOMMENDED TOOLS PP-6

BRAKE CONTROL
RECOMMENDED TOOLS PP-7

AIR CONDITIONING
RECOMMENDED TOOLS PP-8

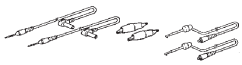
ENGINE IMMOBILISER
RECOMMENDED TOOLS PP-9

CRUISE CONTROL
RECOMMENDED TOOLS PP-10
EQUIPMENT PP-10

METER
RECOMMENDED TOOLS PP-11

2AZ-FE ENGINE CONTROL SYSTEM

RECOMMENDED TOOLS

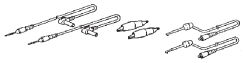
	09082-00040	TOYOTA Electrical Tester	
	(09083-00150)	Test Lead Set	

EQUIPMENT

Ohmmeter	-
Torque wrench	-

1MZ-FE ENGINE CONTROL SYSTEM

RECOMMENDED TOOLS

	09082-00040	TOYOTA Electrical Tester	
	(09083-00150)	Test Lead Set	

EQUIPMENT

Ohmmeter	

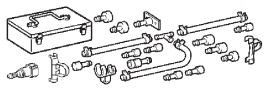
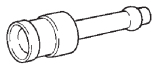
2AZ-FE ENGINE MECHANICAL

EQUIPMENT

Micrometer	-

2AZ-FE FUEL

SST

	09268-31011	Injection Measuring Tool Set	
	(09268-41110)	Adaptor	
	(09268-41300)	Clamp	
	(09268-41500)	Fuel Tube Connector	
	(90467-13001)	Clip	
	(95336-08070)	Hose	
	09842-30080	Wire H EFI Inspection	

RECOMMENDED TOOLS

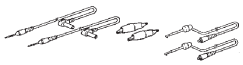
	09082-00040	TOYOTA Electrical Tester	
	(09083-00150)	Test Lead Set	

EQUIPMENT

Measuring Flask	
Ohmmeter	
Stopwatch	
Vinyl tube	

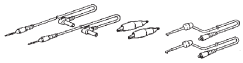
A541E AUTOMATIC TRANSAXLE

RECOMMENDED TOOLS

	09082-00050	TOYOTA Electrical Tester Set	
	(09083-00150)	Test Lead Set	

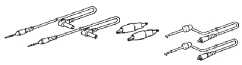
U241E AUTOMATIC TRANSAXLE

RECOMMENDED TOOLS

	09082-00040	TOYOTA Electrical Tester	
	(09083-00150)	Test Lead Set	

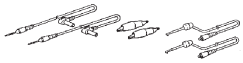
BRAKE CONTROL

RECOMMENDED TOOLS

	09082-00040	TOYOTA Electrical Tester	
	(09083-00150)	Test Lead Set	

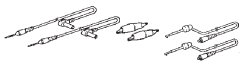
AIR CONDITIONING

RECOMMENDED TOOLS

	09082-00040	TOYOTA Electrical Tester	
	(09083-00150)	Test Lead Set	

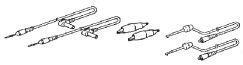
ENGINE IMMOBILISER

RECOMMENDED TOOLS

	09082-00040	TOYOTA Electrical Tester	
	(09083-00150)	Test Lead Set	

CRUISE CONTROL

RECOMMENDED TOOLS

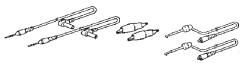
	09082-00040	TOYOTA Electrical Tester	
	(09083-00150)	Test Lead Set	

EQUIPMENT

Torque wrench	

METER

RECOMMENDED TOOLS

	09082-00040	TOYOTA Electrical Tester	
	(09083-00150)	Test Lead Set	

SERVICE SPECIFICATIONS

STANDARD BOLT
- HOW TO DETERMINE BOLT STRENGTH SS-1
- SPECIFIED TORQUE FOR STANDARD BOLTS SS-2
- HOW TO DETERMINE NUT STRENGTH SS-3

2AZ-FE ENGINE MECHANICAL
- SERVICE DATA SS-4

2AZ-FE FUEL
- SERVICE DATA SS-5

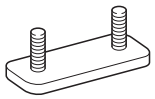
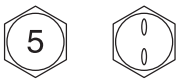
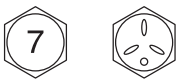
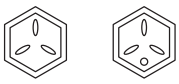
A541E AUTOMATIC TRANSAXLE
- SERVICE DATA SS-6

U241E AUTOMATIC TRANSAXLE
- SERVICE DATA SS-7

STANDARD BOLT

HOW TO DETERMINE BOLT STRENGTH

Bolt Type

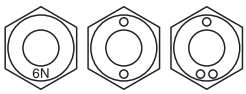
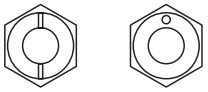
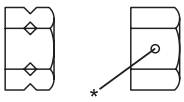
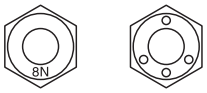
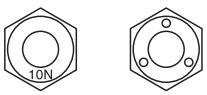
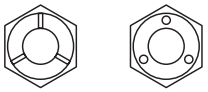
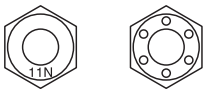
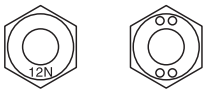
Hexagon Head Bolt			Stud Bolt	Weld Bolt	Class
Normal Recess Bolt		Deep Recess Bolt			
	No Mark 	No Mark 	No Mark 		4T
					5T
	w/ Washer 	w/ Washer 			6T
					7T
					8T
					9T
					10T
					11T

SPECIFIED TORQUE FOR STANDARD BOLTS

Class	Diameter (mm)	Pitch (mm)	Specified torque					
			Hexagon head bolt			Hexagon flange bolt		
			Nm	kgf cm	lbf ft	Nm	kgf cm	lbf ft
4T	6	1	5	55	48 lbf in	6	60	52 lbf in
	8	1.25	12.5	130	9	14	145	10
	10	1.25	26	260	19	29	290	21
	12	1.25	47	480	35	53	540	39
	14	1.5	74	760	55	84	850	61
	16	1.5	115	1,150	83	-	-	-
5T	6	1	6.5	65	56 lbf in	7.5	75	65 lbf in
	8	1.25	15.5	160	12	17.5	175	13
	10	1.25	32	330	24	36	360	26
	12	1.25	59	600	43	65	670	48
	14	1.5	91	930	67	100	1,050	76
	16	1.5	140	1,400	101	-	-	-
6T	6	1	8	80	69 lbf in	9	90	78 lbf in
	8	1.25	19	195	14	21	210	15
	10	1.25	39	400	29	44	440	32
	12	1.25	71	730	53	80	810	59
	14	1.5	110	1,100	80	125	1,250	90
	16	1.5	170	1,750	127	-	-	-
7T	6	1	10.5	110	8	12	120	9
	8	1.25	25	260	19	28	290	21
	10	1.25	52	530	38	58	590	43
	12	1.25	95	970	70	105	1,050	76
	14	1.5	145	1,500	108	165	1,700	123
	16	1.5	230	2,300	166	-	-	-
8T	8	1.25	29	300	22	33	330	24
	10	1.25	61	620	45	68	690	50
	12	1.25	110	1,100	80	120	1,250	90
9T	8	1.25	34	340	25	37	380	27
	10	1.25	70	710	51	78	790	57
	12	1.25	125	1,300	94	140	1,450	105
10T	8	1.25	38	390	28	42	430	31
	10	1.25	78	800	58	88	890	64
	12	1.25	140	1,450	105	155	1,600	116
11T	8	1.25	42	430	31	47	480	35
	10	1.25	87	890	64	97	990	72
	12	1.25	155	1,600	116	175	1,800	130

HOW TO DETERMINE NUT STRENGTH

Nut Type

Present Standard Hexagon Nut	Old Standard Hexagon Nut		Class
	Cold Forging Nut	Cutting Processed Nut	
No Mark 			4N
No Mark (w/ Washer) 	No Mark (w/ Washer) 	No Mark 	5N (4T)
			6N
 			7N (5T)
			8N
		No Mark 	10N (7T)
			11N
			12N

HINT:

- *: Nut with 1 or more marks on one side surface of the nut.
- Use the nut with the same number of the nut strength classification or greater than the bolt strength classification number when tightening parts with a bolt and nut.

Example:

- Bolt = 4T
- Nut = 4N or more

2AZ-FE ENGINE MECHANICAL

SERVICE DATA

Camshaft	Cam lobe height	Standard	46.709 to 46.809 mm (1.8389 to 1.8429 in)
		Maximum	46.599 mm (1.8346 in)

2AZ-FE FUEL

SERVICE DATA

Fuel injector	Resistance	at 20°C (68°F)	11.6 to 12.4 Ω
	Injection volume		76 to 92 cm^3 (4.6 to 5.6 cu in) per 15 seconds
	Difference between each injector		16 cm^3 (1.0 cu in) or less
	Fuel leakage		1 drop or less per 12 minutes

A541E AUTOMATIC TRANSAXLE

SERVICE DATA

A541E		
Line pressure (wheel locked) at transmission stall speed (Throttle valve fully opened)	D position	1,138 to 1,236 kPa (11.6 to 12.6 kgf cm^2, 165 to 179 psi)
	R position	1,716 to 1,854 kPa (17.5 to 18.9 kgf cm^2, 249 to 269 psi)
Line pressure (wheel locked) at engine idle speed	D position	401 to 461 kPa (4.1 to 4.7 kgf cm^2, 58 to 66 psi)
	R position	804 to 882 kPa (8.2 to 9.0 kgf cm^2, 117 to 128 psi)
Engine stall speed		2,450 to 2,750 rpm
Time lag	N → D position	Less than 1.2 seconds
	N → R position	Less than 1.5 seconds
Engine idle speed (A/C OFF)	N position	Approx. 700 rpm
Shift schedule (Normal pattern)		
D position (Throttle valve fully opened)	1 → 2	60 to 66 km/h
	2 → 3	112 to 121 km/h
	3 → 4	174 to 183 km/h
	4 → 3	167 to 176 km/h
	3 → 2	104 to 112 km/h
	2 → 1	50 to 55 km/h
D position (Throttle valve fully closed)	3 → 4	35 to 40 km/h
	4 → 3	20 to 25 km/h
2 position (Throttle valve fully opened)	1 → 2	60 to 66 km/h
	3 → 2	122 to 130 km/h
	2 → 1	50 to 55 km/h
L position (Throttle valve fully opened)	3 → 2	106 to 115 km/h
	2 → 1	54 to 59 km/h
Lock-up point		
D position (Throttle valve opening 5%)	Lock-up ON 3 → 3L	60 to 65 km/h
	Lock-up ON 4 → 4L	73 to 77 km/h
	Lock-up OFF 4L → 4	68 to 72 km/h
	Lock-up OFF 3L → 3	53 to 58 km/h

U241E AUTOMATIC TRANSAXLE

SERVICE DATA

U241E		
Line pressure (wheel locked) at stall (Throttle valve fully opened)	D position	931 to 1,031 kPa (9.5 to 10.5 kgf cm^2, 135 to 150 psi)
	R position	1,768 to 1968 kPa (18.0 to 20.0 kgf cm^2, 256 to 285 psi)
Line pressure (wheel locked) Engine idling	D position	372 to 412 kPa (3.8 to 4.2 kgf cm^2, 54 to 60 psi)
	R position	672 to 742 kPa (6.9 to 7.6 kgf cm^2, 97 to 108 psi)
Engine stall revolution		2,550 +- 150 rpm
Time lag	N → D position	Less than 1.2 seconds
	N → R position	Less than 1.5 seconds
Engine idle speed (A/C OFF)	N position	Approx. 700 rpm
Shift schedule (Normal pattern)		
D position (Throttle valve fully opened)	1 → 2	57 to 66 km/h
	2 → 3	107 to 117 km/h
	3 → 4	171 to 188 km/h
	4 → 3	163 to 180 km/h
	3 → 2	98 to 108 km/h
	2 → 1	47 to 55 km/h
D position (Throttle valve fully closed)	3 → 4	40 to 47 km/h
	4 → 3	18 to 24 km/h
2 position (Throttle valve fully opened)	1 → 2	57 to 66 km/h
	3 → 2	107 to 117 km/h
	2 → 1	47 to 55 km/h
L position (Throttle valve fully opened)	3 → 2	107 to 117 km/h
	2 → 1	53 to 60 km/h
Lock-up point		
D position (Throttle valve opening 5%)	Lock-up ON 4 → 4L	64 to 72 km/h
	Lock-up OFF 4L → 4	62 to 70 km/h

2AZ-FE ENGINE CONTROL SYSTEM

SFI SYSTEM

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SFI SYSTEM

PRECAUTION

NOTICE:
Perform the RESET MEMORY (AT initialisation) operation after replacing the automatic transaxle assembly, engine assembly or ECM.
HINT:
Initialisation cannot be completed by only removing the battery cable.

HOW TO PROCEED WITH TROUBLESHOOTING

The intelligent tester is used in steps 3, 4, 5, 7 and 10.

1	VEHICLE BROUGHT TO WORKSHOP

NEXT

2	CUSTOMER PROBLEM ANALYSIS

NEXT

3	CONNECT INTELLIGENT TESTER TO DLC3

HINT:
If the display indicates a communication fault in the tester, inspect the DLC3.

NEXT

4	CHECK DTC AND FREEZE FRAME DATA

HINT:
Record or print DTCs and freeze frame data, if needed.

NEXT

5	CLEAR DTC AND FREEZE FRAME DATA

NEXT

6	CONDUCT VISUAL INSPECTION

NEXT

7	SET CHECK MODE DIAGNOSIS

NEXT

8	CONFIRM PROBLEM SYMPTOMS

HINT:
If the engine does not start, perform steps 10 and 12 first.

Result

Condition	Proceed to
Malfunction does not occur	A
Malfunction occurs	B

B → GO TO STEP 10

A

9	SIMULATION SYMPTOMS

NEXT

10	DTC CHECK

Result

Condition	Proceed to
Malfunction code	A
No code	B

B → GO TO STEP 12

A

11	REFER TO DTC CHART

NEXT

GO TO STEP 14

12	CONDUCT BASIC INSPECTION

Result

Condition	Proceed to
Wrong parts not confirmed	A
Wrong parts confirmed	B

B → GO TO STEP 17

A

13	REFER TO PROBLEM SYMPTOMS TABLE

Result

Condition	Proceed to
Wrong circuit confirmed	A
Wrong parts confirmed	B

B → GO TO STEP 17

A

14	CHECK ECM POWER SOURCE CIRCUIT

NEXT

15	CONDUCT CIRCUIT INSPECTION

Result

Condition	Proceed to
Malfunction not confirmed	A
Malfunction confirmed	B

B → GO TO STEP 18

A

16	CHECK FOR INTERMITTENT PROBLEMS

NEXT

GO TO STEP 18

17	CONDUCT PARTS INSPECTION

NEXT

18	IDENTIFY PROBLEM

NEXT

19	ADJUSTMENT AND/OR REPAIR

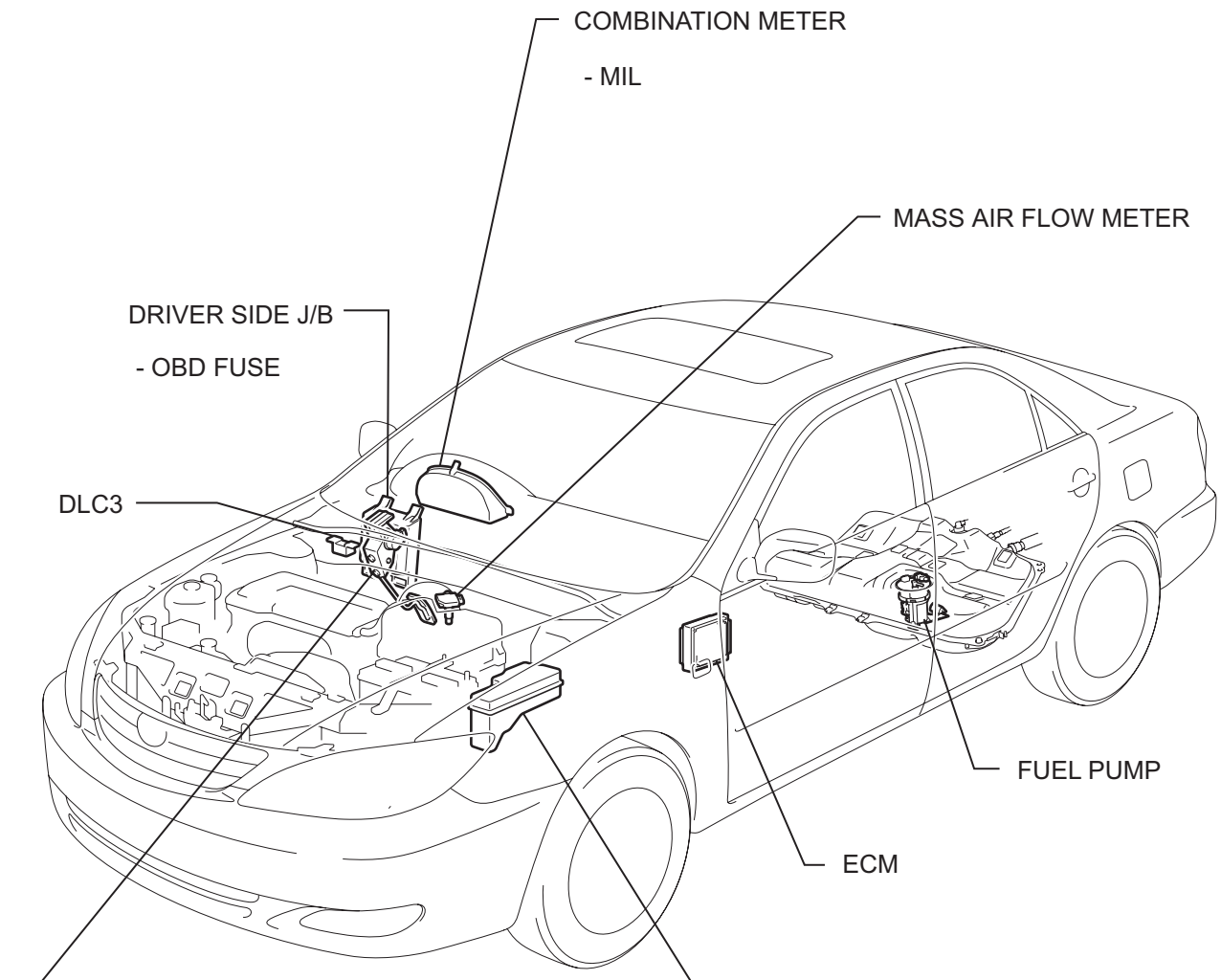
NEXT

20	CONDUCT CONFIRMATION TEST

NEXT

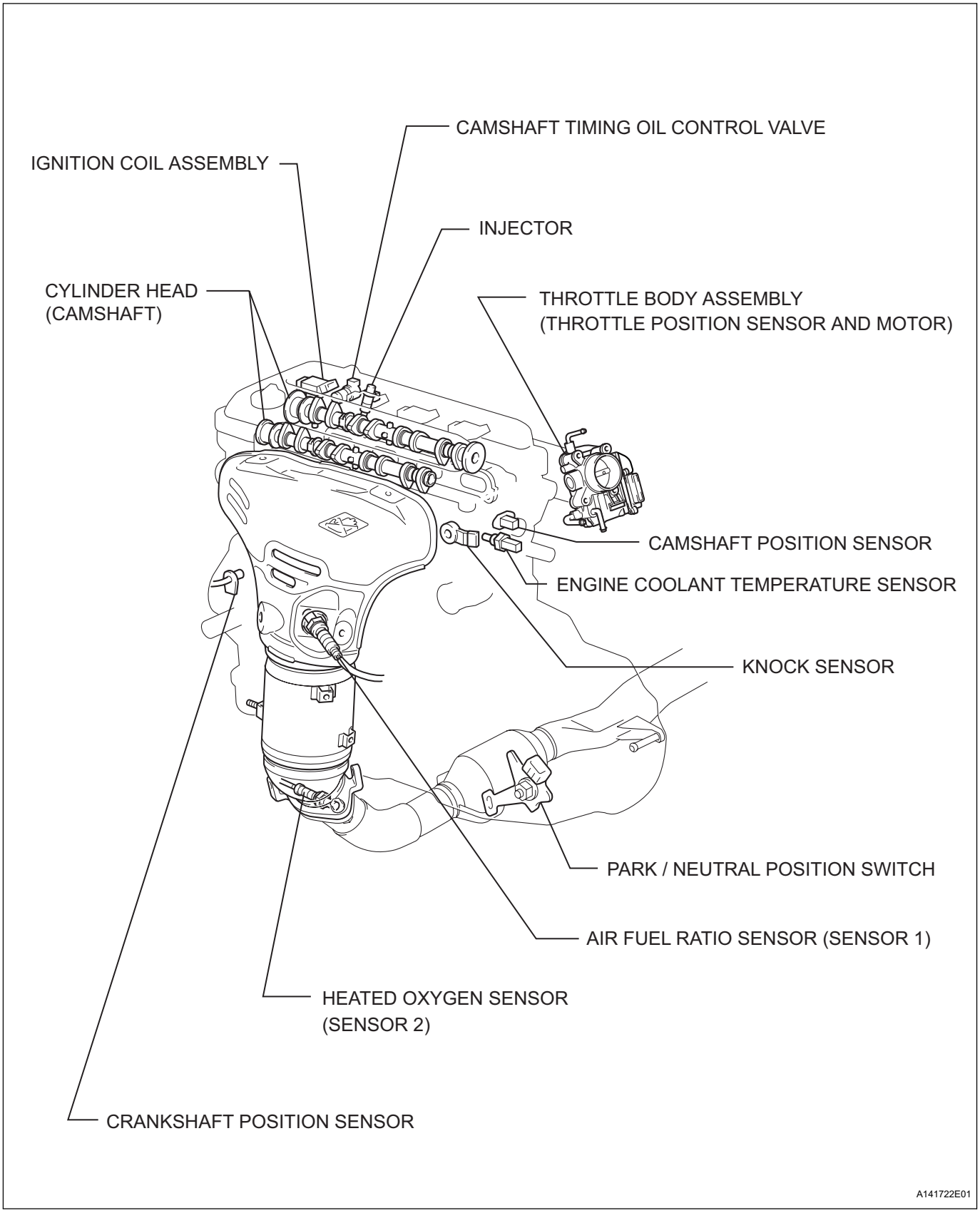
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PARTS LOCATION

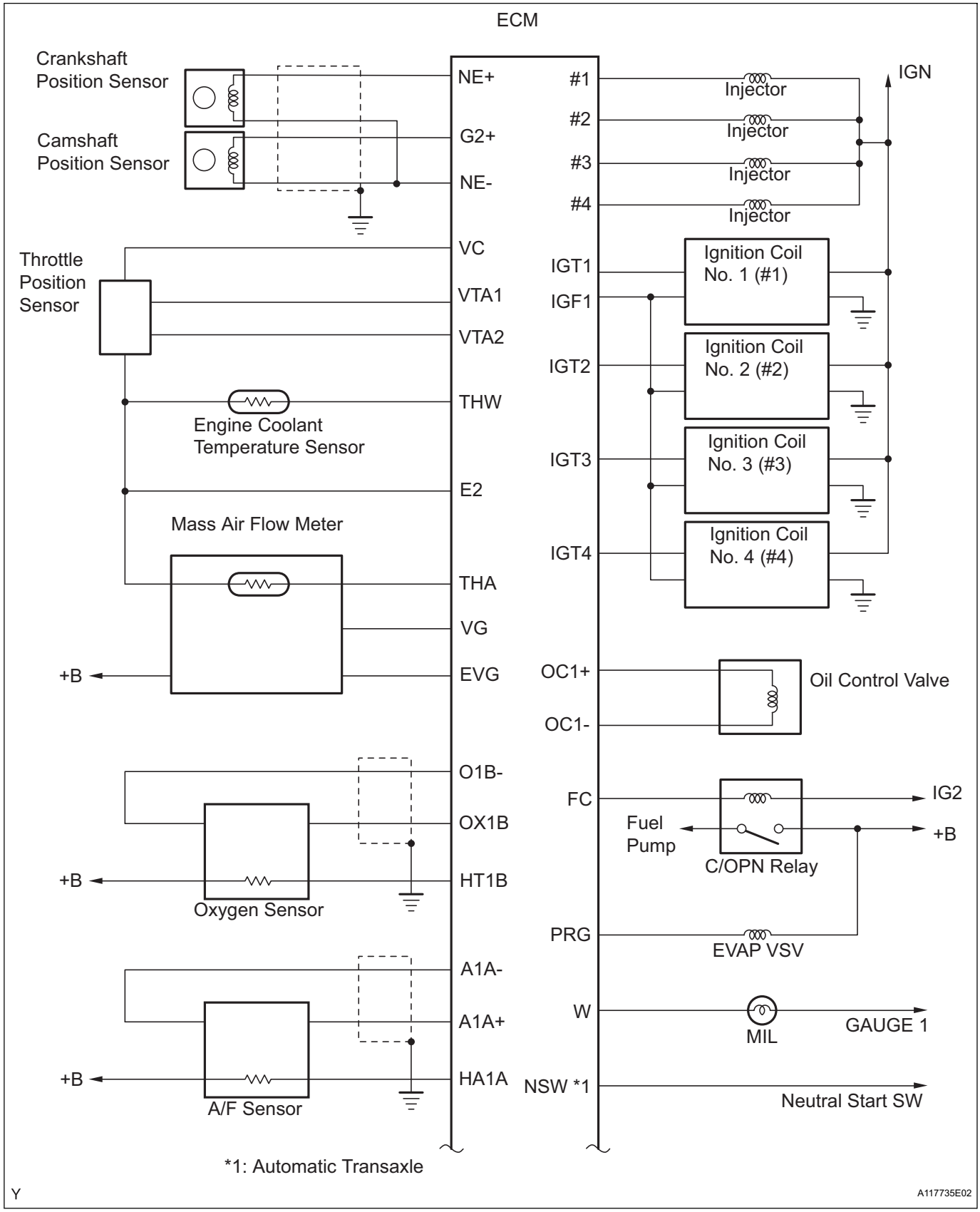


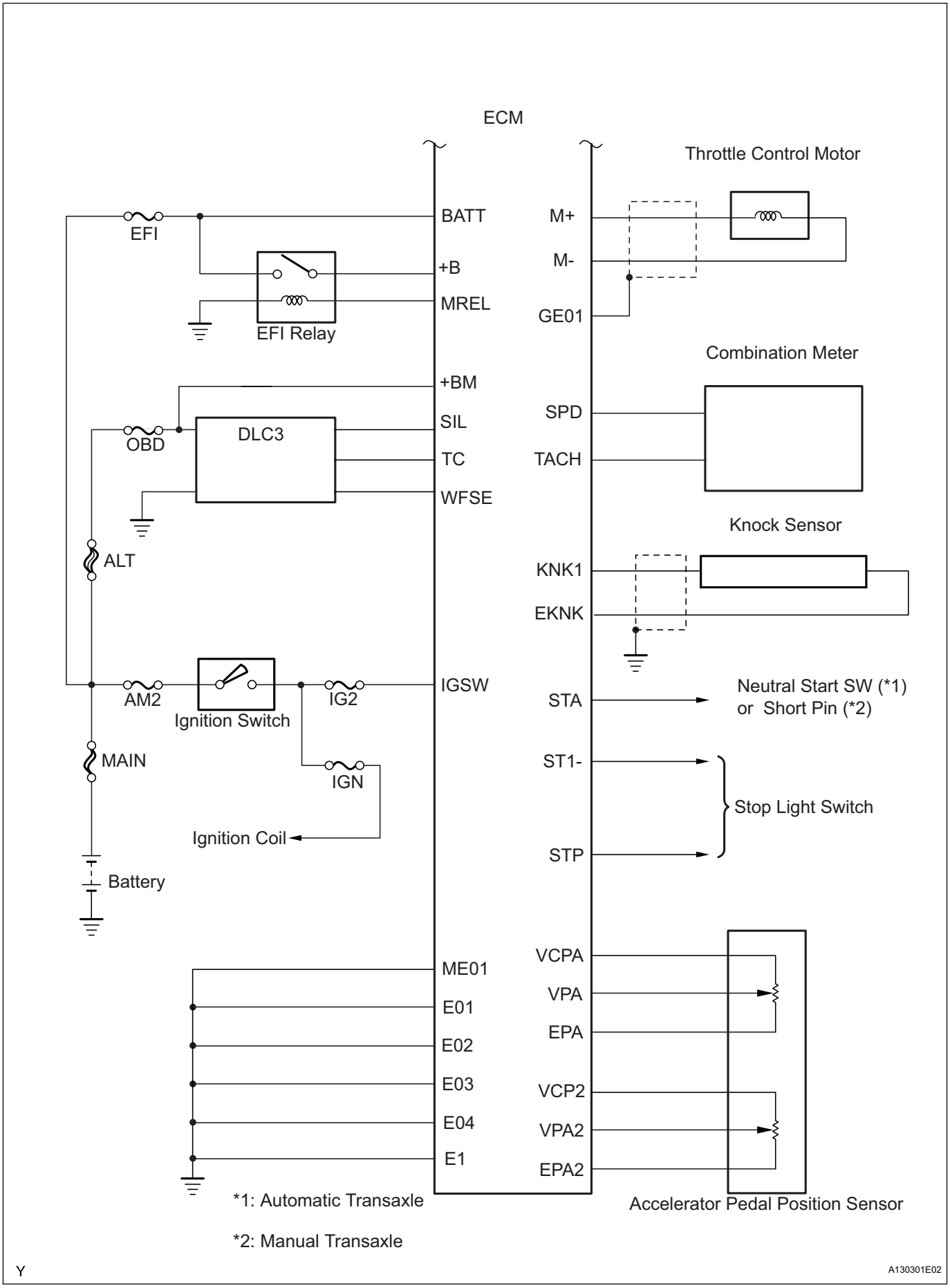
P

A130295E01


CAMSHAFT TIMING OIL CONTROL VALVE
IGNITION COIL ASSEMBLY
INJECTOR
CYLINDER HEAD
(CAMSHAFT)
THROTTLE BODY ASSEMBLY
(THROTTLE POSITION SENSOR AND MOTOR)
CAMSHAFT POSITION SENSOR
ENGINE COOLANT TEMPERATURE SENSOR
KNOCK SENSOR
PARK / NEUTRAL POSITION SWITCH
AIR FUEL RATIO SENSOR (SENSOR 1)
HEATED OXYGEN SENSOR
(SENSOR 2)
CRANKSHAFT POSITION SENSOR
A141722E01

SYSTEM DIAGRAM




ECM
Throttle Control Motor
BATT
M+
M-
GE01
EFI
+B
MREL
EFI Relay
Combination Meter
+BM
SPD
TACH
SIL
TC
WFSE
OBD
DLC3
Knock Sensor
KNK1
EKNK
ALT
IGSW
STA
Neutral Start SW (*1)
or Short Pin (*2)
AM2
IG2
Ignition Switch
ST1-
MAIN
IGN
Stop Light Switch
Ignition Coil
STP
Battery
ME01
VCPA
E01
VPA
E02
EPA
E03
VCP2
E04
VPA2
E1
EPA2
*1: Automatic Transaxle
*2: Manual Transaxle
Accelerator Pedal Position Sensor
Y
A130301E02

CHECK FOR INTERMITTENT PROBLEMS

Intelligent tester only:
Inspect the vehicle's ECM using check mode. Intermittent problems are easier to detect when the ECM is in check mode with the intelligent tester. In check mode, the ECM uses 1 trip detection logic, which has a higher sensitivity to malfunctions than normal mode (default), which uses 2 trip detection logic.

1. **Clear the DTCs (See page ES-16).**
2. **Set the check mode (See page ES-17).**
3. **Perform a simulation test (See page IN-28).**
4. **Check the connector and terminal (See page IN-23).**
5. **Wiggle the harness and the connector (See page IN-23).**

BASIC INSPECTION

When the malfunction is not confirmed by the DTC check, troubleshooting should be carried out in all the possible circuits considered as possible causes of the problem. In many cases, by carrying out the basic engine check shown in the following flowchart, the problem can be found quickly and efficiently. Therefore, using this check is essential in engine troubleshooting.

1	CHECK BATTERY VOLTAGE

NOTICE:
Check the battery voltage with the engine stopped and ignition switch OFF.

Standard voltage

Voltage	Proceed to
11 V or more	OK
Less than 11 V	NG

NG → CHARGE OR REPLACE BATTERY

OK

2	CHECK IF ENGINE CRANKS

NG → PROCEED TO PROBLEM SYMPTOMS TABLE

OK

3	CHECK IF ENGINE STARTS

NG → GO TO STEP 6

OK

4	CHECK AIR FILTER

Visually check if the air filter is contaminated or oily.

NG → CLEAN OR REPLACE AIR FILTER

OK

5	CHECK IDLE SPEED

NG → PROCEED TO PROBLEM SYMPTOMS TABLE

OK

6	CHECK FUEL PRESSURE

NG → PROCEED TO FUEL PUMP CONTROL CIRCUIT INSPECTION AND CONTINUE TO TROUBLESHOOT

OK

7	CHECK FOR SPARK

NG → PROCEED TO IGNITION SYSTEM INSPECTION AND CONTINUE TO TROUBLESHOOT

OK

PROCEED TO PROBLEM SYMPTOMS TABLE

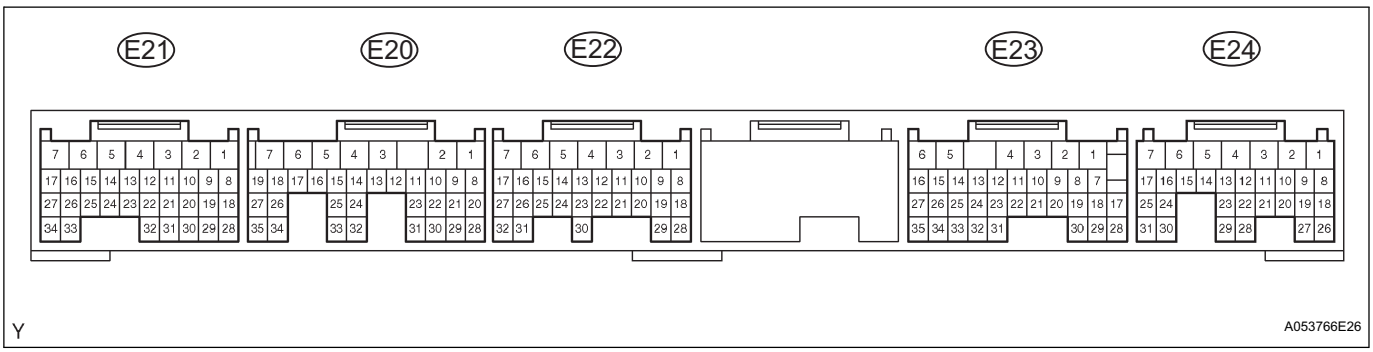
PROBLEM SYMPTOMS TABLE

When the malfunction is not confirmed in the diagnostic trouble code check and the problem still cannot be confirmed in the basic inspection, use this table and troubleshoot according to the priority order given below.

SFI SYSTEM:

Symptom	Suspected Area	See Page
Engine does not crank (does not start)	1. Starter signal circuit	ES-149
	2. Starter	-
	3. STARTER relay	-
No initial combustion (does not start)	1. ECM power source circuit	ES-197
	2. Fuel pump control circuit	ES-201
	3. ECM	-
No complete combustion (does not start)	Fuel pump control circuit	ES-201
Difficult to start (engine cranks normally)	1. Starter signal circuit	ES-149
	2. Fuel pump control circuit	ES-201
	3. Compression	-
Difficult to start with cold engine	1. Starter signal circuit	ES-149
	2. Fuel pump control circuit	ES-201
Difficult to start with hot engine	1. Starter signal circuit	ES-149
	2. Fuel pump control circuit	ES-201
High engine idle speed (poor idling)	1. A/C signal circuit (Compressor circuit)	-
	2. ECM power source circuit	ES-197
Low engine idle speed (poor idling)	1. A/C signal circuit (Compressor circuit)	-
	2. Fuel pump control circuit	ES-201
Rough idling (poor idling)	1. Compression	-
	2. Fuel pump control circuit	ES-201
Hunting (poor idling)	1. ECM power source circuit	ES-197
	2. Fuel pump control circuit	ES-201
Hesitation / Poor acceleration (poor driveability)	1. Fuel pump control circuit	ES-201
	2. Automatic transaxle assembly	-
Surging (poor driveability)	Fuel pump control circuit	ES-201
Engine stalls soon after starting	Fuel pump control circuit	ES-201
Engine stalls during A/C operation	1. A/C signal circuit (Compressor circuit)	-
	2. ECM	-

TERMINALS OF ECM



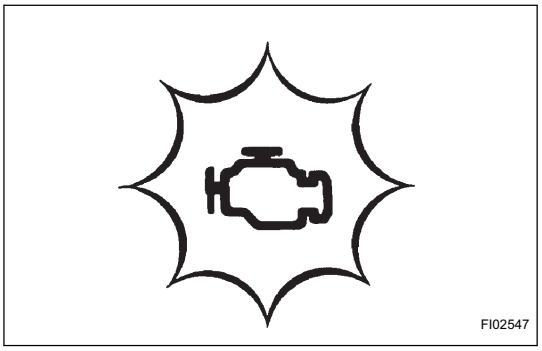
HINT:
Standard voltage for each ECM terminal is shown in the table below.
In the table, first follow the information under "Condition".
Next look under "Symbols (Terminal No.)" for the terminals to be inspected. The standard voltage between the terminals is shown under "Specified Condition".
Use the illustration above as a reference for the ECM terminals.

Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
BATT (E24-3) - E1 (E22-1)	B-Y - BR	Battery (for measuring battery voltage and for ECM memory)	Always	9 to 14 V
+BM (E23-6) - E1 (E22-1)	B - BR	Power source of throttle motor	Always	9 to 14 V
IGSW (E24-9) - E1 (E22-1)	B - BR	Ignition switch	Ignition switch ON	9 to 14 V
+B (E24-1) - E1 (E22-1)	B-R - BR	Power source of ECM	Ignition switch ON	9 to 14 V
OC1+ (E22-16) - OC1- (E22-15)	B-W - Y	Camshaft timing oil control valve (OCV)	Ignition switch ON	Pulse generation (See page ES-32)
MREL (E24-8) - E1 (E22-1)	B-W - BR	EFI relay	Ignition switch ON	9 to 14 V
VC (E21-18) - E2 (E21-28)	Y - BR	Power source of sensor (specific voltage)	Ignition switch ON	4.5 to 5.5 V
VG (E21-30) - EVG (E21-29)	R - L-W	Mass air flow meter	Idling, shift lever position P or N position, A/C switch OFF	0.5 to 3.0 V
THA (E21-20) - E2 (E21-28)	L-B - BR	Intake air temperature sensor	Idling, intake air temp. 20°C (68°F)	0.5 to 3.4 V
THW (E21-19) - E2 (E21-28)	G - BR	Engine coolant temperature sensor	Idling, engine coolant temp. 80°C (176°F)	0.2 to 1.0 V
VTA1 (E21-21) - E2 (E21-28)	LG - BR	Throttle position sensor (for engine control)	Ignition switch ON, accelerator pedal released	0.3 to 1.0 V
VTA1 (E21-21) - E2 (E21-28)	LG - BR	Throttle position sensor (for engine control)	Ignition switch ON, accelerator pedal depressed	3.2 to 4.9 V
VTA2 (E21-31) - E2 (E21-28)	L - BR	Throttle position sensor (for sensor malfunction detection)	Ignition switch ON, accelerator pedal released	2.1 to 3.1 V
VTA2 (E21-31) - E2 (E21-28)	L - BR	Throttle position sensor (for sensor malfunction detection)	Ignition switch ON, accelerator pedal depressed	4.5 to 5.5 V
VPA (E24-22) - EPA (E24-28)	L-W - L-R	Accelerator pedal position sensor (for engine control)	Ignition switch ON, accelerator pedal released	0.5 to 1.1 V
VPA (E24-22) - EPA (E24-28)	L-W - L-R	Accelerator pedal position sensor (for engine control)	Ignition switch ON, accelerator pedal depressed	2.6 to 4.5 V
VPA2 (E24-23) - EPA2 (E24-29)	L-O - GR	Accelerator pedal position sensor (for sensor malfunction detection)	Ignition switch ON, accelerator pedal released	1.2 to 2.0 V
VPA2 (E24-23) - EPA2 (E24-29)	L-O - GR	Accelerator pedal position sensor (for sensor malfunction detection)	Ignition switch ON, accelerator pedal depressed	3.4 to 5.3 V
VCPA (E24-26) - EPA (E24-28)	L - L-R	Power source of accelerator pedal position sensor (for VPA)	Ignition switch ON	4.5 to 5.5 V
VCP2 (E24-27) - EPA2 (E24-29)	L-B - GR	Power source of accelerator pedal position sensor (for VPA2)	Ignition switch ON	4.5 to 5.5 V
HA1A (E20-5) - E04 (E20-7)	B - W-B	A/F sensor heater	Idling	Below 3.0 V
HA1A (E20-5) - E04 (E20-7)	B - W-B	A/F sensor heater	Ignition switch ON	9 to 14 V

Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
A1A+ (E20-23) - E1 (E22-1)	B - BR	A/F sensor	Ignition switch ON	3.0 to 3.6 V
A1A- (E20-31) - E1 (E22-1)	W - BR	A/F sensor	Ignition switch ON	2.7 to 3.3 V
HT1B (E20-21) - E1 (E22-1)	B-W - BR	Heated oxygen sensor heater	Idling	Below 3.0 V
HT1B (E20-21) - E1 (E22-1)	B-W - BR	Heated oxygen sensor heater	Ignition switch ON	9 to 14 V
OX1B (E20-29) - O1B- (E20-28)	G - R	Heated oxygen sensor	Maintain engine speed at 2,500 rpm for 2 minutes after warming up	Pulse generation
#1 (E21-1) - E01 (E21-7) #2 (E21-2) - E01 (E21-7) #3 (E21-3) - E01 (E21-7) #4 (E21-4) - E01 (E21-7)	L - W-B R - W-B Y - W-B W - W-B	Injector	Ignition switch ON	9 to 14 V
#1 (E21-1) - E01 (E21-7) #2 (E21-2) - E01 (E21-7) #3 (E21-3) - E01 (E21-7) #4 (E21-4) - E01 (E21-7)	L - W-B R - W-B Y - W-B W - W-B	Injector	Idling	Pulse generation (See page ES-95)
KNK1 (E20-1) - EKNK (E20-2)	W - B	Knock sensor	Maintain engine speed at 4,000 rpm after warming up	Pulse generation (See page ES-109)
G2+ (E22-27) - NE- (E22-24)	Y - G	Camshaft position sensor	Idling	Pulse generation (See page ES-117)
NE+ (E22-25) - NE- (E22-24)	R - G	Crankshaft position sensor	Idling	Pulse generation (See page ES-113)
IGT1 (E21-8) - E1 (E22-1) IGT2 (E21-9) - E1 (E22-1) IGT3 (E21-10) - E1 (E22-1) IGT4 (E21-11) - E1 (E22-1)	R-W - BR P - BR LG-B - BR L-Y - BR	Ignition coil with igniter (ignition signal)	Idling	Pulse generation (See page ES-120)
IGF1 (E21-24) - E1 (E22-1)	W-R - BR	Ignition coil with igniter (ignition confirmation signal)	Ignition switch ON	4.5 to 5.5 V
IGF1 (E21-24) - E1 (E22-1)	W-R - BR	Ignition coil with igniter (ignition confirmation signal)	Idling	Pulse generation (See page ES-120)
PRG (E21-34) - E1 (E22-1)	B-R - BR	Purge valve	Ignition switch ON	9 to 14 V
SPD (E23-17) - E1 (E22-1)	V-W - BR	Speed signal from combination meter	Ignition switch ON, rotate driving wheel slowly	Pulse generation (See page ES-137)
STA (E21-17) - E1 (E22-1)	B-Y - BR	Starter signal	Shift lever position P or N, ignition switch START	9 to 14 V
STP (E23-19) - E1 (E22-1)	G-W - BR	Stop light switch	Brake pedal is depressed	7.5 to 14 V
STP (E23-19) - E1 (E22-1)	G-W - BR	Stop light switch	Brake pedal is released	Below 1.5 V
ST1- (E23-12) - E1 (E22-1)	R - BR	Stop light switch	Ignition switch ON, brake pedal is depressed	Below 1.5 V
ST1- (E23-12) - E1 (E22-1)	R - BR	Stop light switch	Ignition switch ON, brake pedal is released	7.5 to 14 V
NSW (E21-16) *1 - E1 (E22-1)	B-O - BR	PNP switch	Ignition switch ON, shift position P or N	0 to 3.0 V
NSW (E21-16) *1 - E1 (E22-1)	B-O - BR	PNP switch	Ignition switch ON, shift position except P or N	9 to 14 V
M+ (E22-3) - ME01 (E22-4)	L - W-B	Throttle actuator	Idling	Pulse generation
M- (E22-2) - ME01 (E22-4)	Y - W-B	Throttle actuator	Idling	Pulse generation
FC (E24-10) - E1 (E22-1)	G-B - BR	Fuel pump control	Ignition switch ON	9 to 14 V
W (E24-11) - E1 (E22-1)	G-R - BR	MIL	Ignition switch ON	Below 3.0 V
W (E24-11) - E1 (E22-1)	G-R - BR	MIL	Idling	9 to 14 V
ELS (E24-12) - E1 (E22-1)	G - BR	Electric load	Power outlet OFF	0 to 1.5 V
ELS (E24-12) - E1 (E22-1)	G - BR	Electric load	Power outlet ON	7.5 to 14 V
TC (E24-20) - E1 (E22-1)	P-B - BR	Terminal TC of DLC3	Ignition switch ON	9 to 14 V

Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
SIL (E24-18) - E1 (E22-1)	W - BR	Terminal SIL of DLC3	During charge of gears	Pulse generation
TACH (E24-5) - E1 (E22-1)	B-O - BR	Engine speed	Idling	Pulse generation
PSW (E22-10) - E1 (E22-1)	R-W - BR	PS oil pressure switch	Ignition switch ON	9 to 14 V

*1: Automatic transaxle only

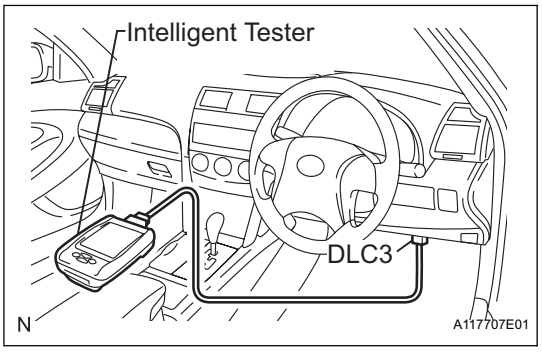


DIAGNOSIS SYSTEM

1. DESCRIPTION

(a) When troubleshooting Euro-OBD vehicles, the only difference from the usual troubleshooting procedure is that you connect the intelligent tester to the vehicle, and read the various data output from the vehicle's ECM.

(b) Euro-OBD regulations require that the vehicle's on-board computer illuminates the MIL (Malfunction Indicator Lamp) on the instrument panel when the computer detects a malfunction in: 1) the emission control systems and components, or 2) the powertrain control components (which affect vehicle emissions), or 3) the computer. In addition, the applicable DTCs (Diagnostic Trouble Codes) prescribed by ISO 15031-4 are recorded in the ECM memory (See page ES-23).
If the malfunction does not recur in 3 consecutive trips, the MIL turns off automatically but the DTCs remain recorded in the ECM memory.

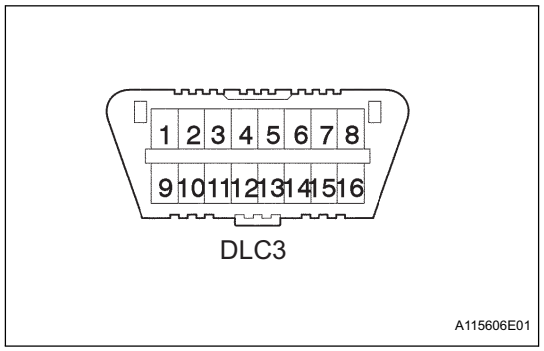


(c) To check the DTCs, connect the intelligent tester to the DLC3 (Data Link Connector 3) on the vehicle. The intelligent tester also enables you to erase the DTCs and check the freeze frame data and various forms of engine data. (See the instruction manual for the OBD scan tool or intelligent tester).

(d) The diagnosis system operates in normal mode during normal vehicle use. In normal mode, 2 trip detection logic* is used to ensure accurate detection of malfunctions. Check mode is also available to technicians as an option. In check mode, 1 trip detection logic is used for simulating malfunction symptoms and increasing the system's ability to detect malfunctions, including intermittent problems (intelligent tester only) (See page ES-17).

(e) *2 trip detection logic:
When a malfunction is first detected, the malfunction is temporarily stored in the ECM memory (1st trip). If the ignition switch is turned OFF and then to ON again, and the same malfunction is detected again, the MIL will illuminate (2nd trip).

(f) Freeze frame data:
The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.



2. CHECK DLC3

(a) The vehicle's ECM uses the ISO 9141-2 (Euro-OBD) communication protocol. The terminal arrangement of the DLC3 complies with ISO 15031-03 and matches the ISO 9141-2 format.

Symbol	Terminal No.	Name	Reference Terminal	Result	Condition
SIL	7	Bus "+" line	5 - Signal ground	Pulse generation	During transmission
CG	4	Chassis ground	Body ground	1 Ω or less	Always
SG	5	Signal ground	Body ground	1 Ω or less	Always
BAT	16	Battery positive	Body ground	9 to 14 V	Always

HINT:
When you use the intelligent tester, first connect the cable of the tester to the DLC3. Next, turn the ignition switch to the ON position. Finally turn the tester ON. If the display informs that a communication error has occurred, there is a problem either with the vehicle or with the tester.

- If communication is normal when the tester is connected to another vehicle, inspect the DLC3 on the original vehicle.
- If communication is still not possible when the tester is connected to another vehicle, the problem is probably in the tester or the cable, so consult the Service Department listed in its instruction manual.

3. INSPECT BATTERY VOLTAGE

Measure the battery voltage.

Standard voltage:

11 to 14 V

If the voltage is below 11 V, recharge the battery.

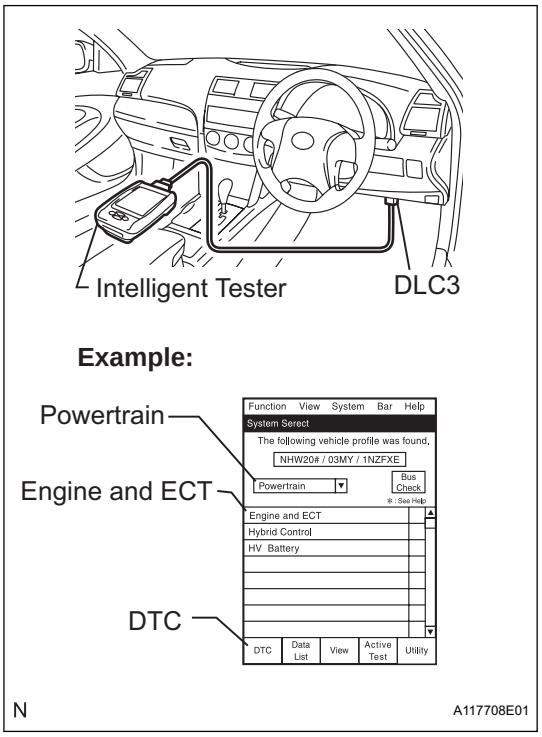
4. CHECK MIL

(a) The MIL illuminates when the ignition switch is turned to the ON position and the engine is not running.
HINT:
If the MIL is not illuminated, check the MIL circuit (See page **ES-206**).

(b) When the engine is started, the MIL should turn off. If the MIL remains on, the diagnosis system has detected a malfunction or abnormality in the system.

DTC CHECK / CLEAR

NOTICE:
Intelligent tester only:
When the diagnosis system is changed from normal mode to check mode or vice-versa, all DTCs and freeze frame data recorded in normal mode will be erased. Before changing modes, always check and make a note of DTCs and freeze frame data.

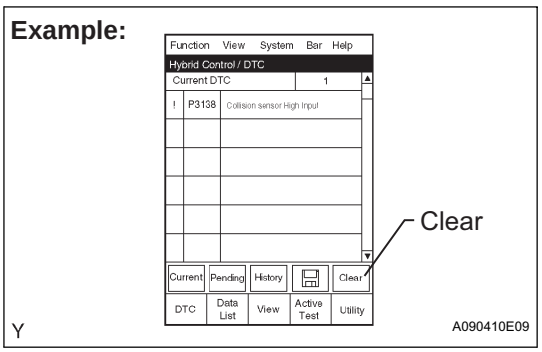


1. CHECK DTC

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Check DTCs and freeze frame data, and then write them down.
HINT:
If you need help using the intelligent tester, refer to the instruction manual.
(e) Confirm the details of the DTCs (See page ES-23).

2. FREEZE FRAME DATA

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Read DTCs by selecting the following menu items: Powertrain / Engine and ECT / DTC.
(d) Select a parameter(s) to check the freeze frame data.
(e) Note down the DTC(s) and freeze frame data.
HINT:
If you need help using the intelligent tester, refer to the instruction manual.



3. CLEAR DTCS AND FREEZE FRAME DATA (using the intelligent tester)

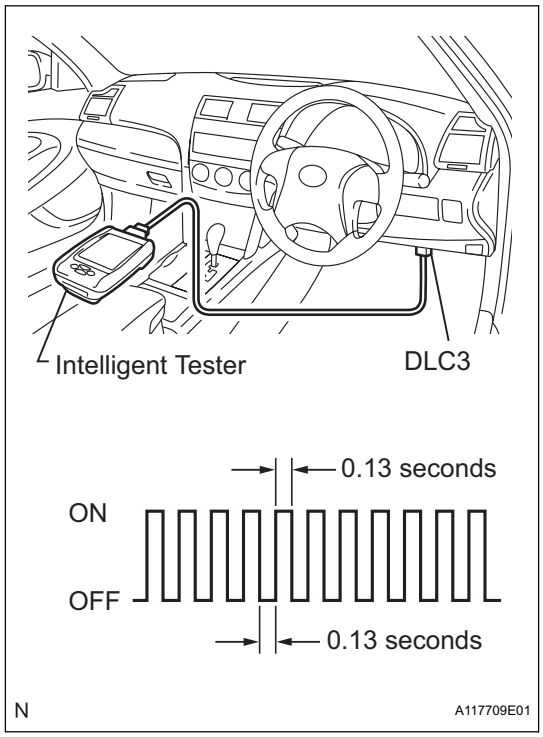
(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position (do not start the engine) and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC / Clear.
(d) Erase DTCs and freeze frame data by pressing the YES button on the tester.
HINT:
If you need help using the intelligent tester, refer to the instruction manual.

4. CLEAR DTCS AND FREEZE FRAME DATA (not using the intelligent tester)

(a) Remove the EFI fuse from the engine room J/B for more than 60 seconds, or disconnect the negative battery cable for more than 60 seconds.

CHECK MODE PROCEDURE

HINT:
Intelligent tester only:
Compared to normal mode, check mode has more sensing ability to detect malfunctions. Furthermore, the same diagnostic items which are detected in normal mode can also be detected in check mode.



1. CHECK MODE PROCEDURE

(a) Make sure that the items below are true.
  (1) Battery voltage 11 V or more.
  (2) Throttle valve fully closed.
  (3) Transmission in the P or N position.
  (4) A/C switched OFF.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(e) Select the following menu items: Powertrain / Engine and ECT / Utility / Check Mode.
(f) Make sure that the MIL flashes as shown in the illustration.
  NOTICE:
  All the recorded DTCs and freeze frame data will be erased if: 1) the intelligent tester is used to change the ECM from normal mode to check mode or vice-versa; or 2) during check mode, the ignition switch is turned from ON to ACC or OFF.
(g) Start the engine (the MIL should turn off).
(h) Simulate the condition of the malfunction described by the customer.
(i) After simulating the malfunction condition, check the DTCs, freeze frame data and other data.
(j) After checking the DTCs, inspect the applicable circuits (See page ES-23).

FAIL-SAFE CHART

If any of the following codes are recorded, the ECM enters fail-safe mode.

DTC No.	Fail-Safe Operation	Fail-Safe Deactivation Condition
P0031 P0032	A/F heater is turned off	Ignition switch turned off
P0037 P0038	Heated Oxygen Sensor (HO2S) heater is turned off	Ignition switch turned off
P0100 P0102 P0103	Ignition timing is calculated from engine RPM and Throttle Position (TP)	"Pass" condition detected
P0110 P0112 P0113	Intake Air Temperature (IAT) is fixed at 20°C (68°F)	"Pass" condition detected
P0115 P0117 P0118	Engine Coolant Temperature (ECT) is fixed at 80°C (176°F)	"Pass" condition detected

DTC No.	Fail-Safe Operation	Fail-Safe Deactivation Condition
P0120 P0121 P0122 P0123 P0220 P0222 P0223 P0604 P0606 P0607 P0657 P2102 P2103 P2111 P2112 P2118 P2119 P2135	When Electronic Throttle Control System (ETCS) is malfunctioning, electric current to throttle actuator is cut off and throttle valve returns to Throttle Position (TP) 16° by its spring. Then, required engine power is calculated by using ignition timing and Accelerator Pedal Position (APP). Engine is controlled by intermittent fuel-cut. As a result, slowly and fully depressing accelerator pedal enables driving at a minimum speed. However, quickly depressing pedal would vary vehicle speed remarkably.	"Pass" condition detected and then the ignition switch turned off
P0325 P0327 P0328	Maximum ignition timing retardation	Ignition switch turned off
P0351 P0352 P0353 P0354	Fuel is cut	"Pass" condition detected
P2120 P2121 P2122 P2123 P2125 P2127 P2128 P2138	Accelerator Pedal Position (APP) sensor has main circuit and associate circuit. When one of circuits is malfunctioning, APP is calculated by output of the other circuits. When both of circuits are malfunctioning, it is interpreted that accelerator pedal is released. As a result, throttle valve is closed and engine idles.	"Pass" condition detected and then the ignition switch turned off

DATA LIST / ACTIVE TEST

1. DATA LIST

HINT:

Using the Data List displayed on the intelligent tester, you can read values including those of the switches, sensors, and actuator, without removing any parts. Reading the Data List as the first step in troubleshooting is one method to shorten 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) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn the intelligent tester ON.
(f) Select the following menu items: Powertrain / Engine and ECT / Data List.

(g) Check the results by referring to the following table:

Intelligent Tester Display (Abbreviation)	Measurement Item / Range (Display)	Normal Condition *1	Diagnostic Note
Injector (INJECTOR)	Injection period of the No. 1 cylinder/ Min.: 0 ms., Max.: 32.6 ms.	Idling: 1.92 to 3.37 ms.	-
IGN Advance (IGN ADVANCE)	Ignition timing advance for No. 1 cylinder/ Min.: -64 deg., Max.: 63.5 deg.	Idling: BTDC 5 to 15°	-
CALC Load (CALC LOAD)	Calculated load by ECM/ Min.: 0 %, Max.: 100 %	• Idling: 3.3 to 26.7 % • Running without load (2,500 rpm): 12.0 to 14.7 %	-
AFM (AFM)	Air flow rate from MAF meter/ Min.: 0 g/s, Max.: 665.35 g/s	• Idling: M/T 0.54 to 4.33 gm/s A/T 0.58 to 4.67 gm/s • Running without load (2,500 rpm): 3.33 to 9.17 gm/s	If the value is approximately 0.0 g/s: • Mass air flow meter power source circuit is open • VG circuit is open or shorted If the value is 160.0 g/s or more: • E2G circuit is open
Engine SPD (ENGINE SPD)	Engine speed/ Min.: 0 rpm, Max.: 16,383 rpm	Idling: M/T 650 to 750 rpm A/T 550 to 750 rpm	-
Coolant Temp (COOLANT TEMP)	Engine coolant temperature/ Min.: -40°C (-40°F) Max.: 215°C (419°F)	After warming up the engine: 80 to 95°C (176 to 203°F)	• If the value is -40°C (-40°F): sensor circuit is open • If the value is 140°C (284°F): sensor circuit is shorted
Intake Air (INTAKE AIR)	Intake air temperature/ Min.: -40°C (-40°F) Max.: 215°C (419°F)	Equivalent to ambient air temperature	• If the value is -40°C (-40°F): sensor circuit is open • If the value is 140°C (284°F): sensor circuit is shorted
Throttle POS (THROTTLE POS)	Absolute throttle position sensor/ Min.: 0 %, Max.: 100 %	• Throttle fully closed: 6 to 16 % • Throttle fully open: 64 to 98 %	Read the value with the ignition switch ON (Do not start engine)
IDL SIG (IDL SIG)	Status of the IDL signal/ ON or OFF	Idling: ON	-
Vehicle SPD (VEHICLE SPD)	Vehicle speed/ Min.: 0 km/h, Max.: 255 km/h	Actual vehicle speed	Speed indicated on the speedometer
Accelerator POS No. 1 (ACCEL POS #1)	Accelerator pedal position sensor No. 1 output voltage/ Min.: 0 V, Max.: 5 V	• Accelerator pedal released: 0.5 to 1.1 V • Accelerator pedal depressed: 2.6 to 4.5 V	Read the value with the ignition switch ON (Do not start engine)
Accelerator POS No. 2 (ACCEL POS #2)	Accelerator pedal position sensor No. 2 output voltage/ Min.: 0 V, Max.: 5 V	• Accelerator pedal released: 1.2 to 2.0 V • Accelerator pedal depressed: 3.4 to 5.3 V	Read the value with the ignition switch ON (Do not start engine)
Throttle POS No. 2 (THROTTLE POS #2)	Throttle position sensor No. 2 output voltage/ Min.: 0 V, Max.: 5 V	• Throttle fully closed: 2.1 to 3.1 V • Throttle fully open: 4.5 to 5.5 V	Read the value with the ignition switch ON (Do not start engine)
Throttle Request POS (THROTTLE TARGT)	Throttle requirement position/ Min.: 0 V, Max.: 5 V	Idling: 0.4 to 1.1 V	-
Throttle Motor Open Duty (THROTL OPN DUTY)	Throttle motor opening duty ratio/ Min.: 0 %, Max.: 100 %	Throttle fully closed: 0 %	• When the accelerator pedal is depressed, duty ratio is increased • Read the value with the ignition switch ON (Do not start engine)
Throttle Motor Close Duty (THROTL CLS DUTY)	Throttle motor closed duty ratio/ Min.: 0 %, Max.: 100 %	Throttle fully closed: 0 %	• When the accelerator pedal is released quickly, duty ratio is increased • Read the value with the ignition switch ON (Do not start engine)

Intelligent Tester Display (Abbreviation)	Measurement Item / Range (Display)	Normal Condition *1	Diagnostic Note
Throttle Motor (THROTTLE MOT)	Whether or not throttle motor control is permitted/ ON or OFF	Idling: ON	Read the value with the ignition switch ON (Do not start engine)
ETCS Actuator Power (+BM)	Whether or not electric throttle control system power is applied/ ON or OFF	Idling: ON	-
Accelerator IDL POS (ACCEL IDL POS)	Whether or not accelerator pedal position sensor is detecting engine idling/ ON or OFF	Idling: ON	-
Throttle IDL POS (THROTTL IDL POS)	Whether or not throttle position sensor is detecting engine idling/ ON or OFF	Idling: ON	-
Fail Safe Drive (FAIL #1)	Whether or not fail-safe function is executed/ ON or OFF	ETCS has failed: ON	-
Fail Safe Drive (Main CPU) (FAIL #2)	Whether or not fail-safe function is executed/ ON or OFF	ETCS has failed: ON	-
Throttle Closed Initial Value (THROTTL INITIAL)	Throttle fully closed (learned value)/ Min.: 0 V, Max.: 5 V	0.5 to 0.9 V	-
Accelerator Learned Value (ACCEL LEARN VAL)	Accelerator fully closed (learned value)/ Min.: 0 V, Max.: 5 V	0.4 to 0.8 V	-
Throttle Motor Current (THROTTLE MOT)	Throttle motor current/ Min.: 0 A, Max.: 20 A	Idling: 0 to 3.0 A	-
O2S B1 S2 (O2S B1 S2)	Heated oxygen sensor output voltage for bank 1 sensor 2/ Min.: 0 V, Max.: 1.275 V	Driving (50 km/h): 0.1 to 0.9 V	Performing the Control the Injection Volume (Inj Vol or A/F Control) function of the Active Test enables the technician to check voltage output of the sensor
AFS B1 S1 (AFS B1 S1)	A/F sensor output voltage for bank 1 sensor 1/ Min.: 0 V, Max.: 7.999 V	Idling: 2.8 to 3.8 V	Performing the Control the Injection Volume (Inj Vol or A/F Control) function of the Active Test enables the technician to check voltage output of the sensor
Short FT #1 (SHORT FT #1)	Short-term fuel trim of bank 1/ Min.: -100 %, Max.: 100 %	0 +- 20 %	This item is the short-term fuel compensation used to maintain the air-fuel ratio at stoichiometric air-fuel ratio
Long FT #1 (LONG FT #1)	Long-term fuel trim of bank 1/ Min.: -100 %, Max.: 99.2 %	0 +- 20 %	This item is overall long-term fuel compensation that helps to maintain air-fuel ratio at stoichiometric air-fuel ratio (steadies long term deviations of short-term fuel trim from central value)
TOTAL FT #1 (TOTAL FT #1)	Total fuel trim of bank 1/ Min.: 0.5, Max.: 1.496	Idling: 0.5 to 1.4	-
O2FT B1 S2 (O2FT B1 S2)	Short-term fuel trim associated with the bank 1 sensor 2/ Min.: -100 %, Max.: 100 %	0 +- 20 %	Same as SHORT FT #1
AF FT B1 S1 (AF FT B1 S1)	Short-term fuel trim associated with the bank 1 sensor 1/ Min.: 0, Max.: 1.999	• Value less than 1 (0.000 to 0.999) = Lean • Stoichiometric air-fuel ratio = 1 • Value greater than 1 (1.001 to 1.999) = RICH	-

Intelligent Tester Display (Abbreviation)	Measurement Item / Range (Display)	Normal Condition *1	Diagnostic Note
FUEL SYS #1 (FUEL SYS #1)	Fuel system status (Bank1)/ OL or CL or OL DRIVE or OL FAULT or CL FAULT	Idling after warming up: CL	• OL (Open Loop): Has not yet satisfied conditions for closed loop • CL (Closed Loop): Using the heated oxygen sensor as feedback for fuel control • OL DRIVE: Open loop due to driving conditions (fuel enrichment) • OL FAULT: Open loop due to detected system fault • CL FAULT: Closed loop but the heated oxygen sensor which is used for fuel control is malfunctioning
FC IDL (FC IDL)	Fuel cut idle/ ON or OFF	Fuel cut operation: ON	Fuel cut idle = "ON" when the throttle valve is fully closed and engine speed is over 1,500 rpm
MIL Status (MIL/WARN LIGHT)	MIL status/ ON or OFF	MIL ON: ON	-
Starter SIG (STARTER SIG)	Starter signal/ ON or OFF	Cranking: ON	-
A/C SIG (A/C SIG)	A/C signal/ ON or OFF	A/C ON: ON	-
PNP SW (PNP SW [NSW]) *2	Park / Neutral position switch signal/ ON or OFF	P or N position: ON	-
Elect Load SIG (ELECT LOAD SIG)	Electrical load signal/ ON or OFF	• Tail light switch ON: ON • Defogger switch ON: ON	-
Stop Light SW (STOP LIGHT SW)	Stop light switch/ ON or OFF	• Brake pedal depressed: ON • Brake pedal released: OFF	-
PS Oil Press SW (PS OIL PRESS SW)	Power steering oil pressure switch signal/ ON or OFF	• While turning the steering wheel: ON • While not turning the steering wheel: OFF	Idle-up control is performed when PS is ON
PS Signal (PS SIGNAL)	Power steering signal/ ON or OFF	When the steering wheel is turned	This signal is usually ON until the ignition switch is turned off
Fuel Pump FUEL PUMP / SPD)	Fuel pump/speed status/ ON/H or OFF/M, L	Idling: ON	-
A/C MAG Clutch (A/C MAG CLUTCH)	A/C magnet clutch status/ ON or OFF	A/C magnet clutch ON: ON	-
EVAP VSV (EVAP VSV)	EVAP VSV/ ON or OFF	VSV operating: ON	EVAP VSV is controlled by the ECM (ground side duty control)
VVT CTRL B1 (VVT CTRL B1)	VVT control status (bank 1)/ ON or OFF	VVT system in operation: ON	-
IGNITION (IGNITION)	Ignition counter/ Min.: 0, Max.: 400	0 to 400	-
Cylinder #1,#2,#3,#4 Misfire Rate (CYL #1, #2, #3, #4)	Misfire ratio of the cylinder 1 to 4/ Min.: 0 %, Max.: 50 %	0 %	This item is displayed only when idling
MISFIRE RPM (MISFIRE RPM)	Engine RPM for first misfire range/ Min.: 0 rpm, Max.: 6,375 rpm	Misfire 0: 0 rpm	-
MISFIRE LOAD (MISFIRE LOAD)	Engine load for first misfire range/ Min.: 0 g/rev., Max.: 3.98 g/rev.	Misfire 0: 0 g/rev.	-
FC TAU (FC TAU)	Fuel cut TAU: Fuel cut under very light load/ ON or OFF	Fuel cut operating: ON	Fuel cut is being performed under very light load to prevent engine combustion from becoming incomplete
# Codes (# CODES)	# Codes/ Min.: 0, Max.: 255	-	Number of detected DTCs

Intelligent Tester Display (Abbreviation)	Measurement Item / Range (Display)	Normal Condition *1	Diagnostic Note
Check Mode (CHECK MODE)	Check mode/ ON or OFF	Check mode ON: ON	-
OXS1 Test (OXS1 TEST)	Check mode result for heated oxygen sensor (bank 1)/ 0: COMPL, 1: INCMPL	-	-
AF1 Test (A/F1 TEST)	Check mode result for air fuel ratio sensor (bank 1)/ 0: COMPL, 1: INCMPL	-	-
Distance after MIL ON (MIL ON RUN DIST)	This parameter indicates the distance travelled while MIL is activated/ Min.: 0 km, Max.: 65,535 km	Distance after DTC is detected	-

*1: If no conditions are specifically stated for "Idling", the shift lever is in the N or P position, the A/C switch is OFF and all accessory switches are OFF.
*2: Automatic transaxle only

2. ACTIVE TEST

HINT:
Performing an Active Test using the intelligent tester enables components including the relay, VSV and actuator, to be operated without removing any parts. Performing Active Test as a first step in troubleshooting is one method to shorten diagnostic time.
Data List is displayed during Active Test.

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn the intelligent tester ON.
(f) Select the following menu items: Powertrain / Engine and ECT / Active Test.
(g) Perform Active Test by referring to the following table:

Intelligent Tester Display	Test Details	Diagnostic Note
Injector Volume (INJ VOL)	[Test Details] Control the injection volume Min.: -12 %, Max.: 25 % [Vehicle Condition] Engine speed: 3,000 rpm or less	• All injectors are tested at once • Injection volume is gradually changed between -12 % and 25 %
A/F Control (A/F CONTROL)	[Test Details] Control the injection volume -12.5 or 25 % (Change the injection volume by 12.5 % or 25 %) [Vehicle Condition] Engine speed: 3,000 rpm or less	The following A/F Control procedure enables the technician to check and graph the voltage outputs of both the A/F sensor and heated oxygen sensor. To display the graph indication, select the following menu items: View / Line graph 1 or Line graph 2.
Fuel Pump (FUEL PUMP / SPD)	[Test Details] Control the fuel pump ON or OFF	-
A/C Magnetic Clutch Relay (A/C MAG CLUTCH)	[Test Details] Control the A/C magnet clutch ON or OFF	-
Purge VSV (EVAP (PURGE) VSV)	[Test Details] Activate the EVAP VSV control ON or OFF	-

Intelligent Tester Display	Test Details	Diagnostic Note
VVT Control (Bank 1) (VVT CTRL B1)	[Test Details] Activate the VVT system (Bank 1) ON or OFF	• ON: Rough idle or engine stall • OFF: Normal engine speed
FC IDL Prohibit (FC IDL PROHBT)	[Test Details] Control the idle fuel cut prohibition ON or OFF	During idling
TE1 (TC) (TC/TE1)	[Test Details] Connect the TC and TE1 ON or OFF	-

DIAGNOSTIC TROUBLE CODE CHART

HINT:
Parameters listed in the chart may not be exactly the same as your readings due to factors such as the type of the instrument.
If a DTC is displayed during the DTC check in check mode, check the circuit for the DTC listed in the table below. For details of each DTC, refer to the "See page" under the respective "DTC No." in this chart.

SFI SYSTEM:

DTC No.	Detection Item	Trouble Area	MIL *1	Memory	See Page
P0010	Camshaft Position "A" Actuator Circuit (Bank 1)	1. Open or short in oil control valve circuit 2. Oil control valve 3. ECM	Comes on	DTC stored	ES-32
P0011	Camshaft Position "A" - Timing Over-Advanced or System Performance (Bank 1)	1. Valve timing 2. Oil control valve 3. Camshaft timing gear assembly 4. ECM	Comes on	DTC stored	ES-36
P0012	Camshaft Position "A" - Timing Over-Retarded (Bank 1)	1. Valve timing 2. Oil control valve 3. Camshaft timing gear assembly 4. ECM	Comes on	DTC stored	ES-36
P0016	Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A)	1. Mechanical system (Jumped tooth of timing chain, chain stretched) 2. ECM	Comes on	DTC stored	ES-40
P0031	Oxygen (A/F) Sensor Heater Control Circuit Low (Bank 1 Sensor 1)	1. Open or short in heater circuit of A/F sensor 2. A/F sensor heater 3. EFI relay 4. ECM	Comes on	DTC stored	ES-41
P0032	Oxygen (A/F) Sensor Heater Control Circuit High (Bank 1 Sensor 1)	1. Open or short in heater circuit of A/F sensor 2. A/F sensor heater 3. EFI relay 4. ECM	Comes on	DTC stored	ES-41
P0037	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)	1. Open in heater circuit of heated oxygen sensor 2. Heated oxygen sensor heater 3. EFI relay 4. ECM	Comes on	DTC stored	ES-45

DTC No.	Detection Item	Trouble Area	MIL *1	Memory	See Page
P0038	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)	1. Short in heater circuit of heated oxygen sensor 2. Heated oxygen sensor heater 3. EFI relay 4. ECM	Comes on	DTC stored	ES-45
P0100	Mass or Volume Air Flow Circuit	1. Open or short in mass air flow meter circuit 2. Mass air flow meter 3. ECM	Comes on	DTC stored	ES-49
P0102	Mass or Volume Air Flow Circuit Low Input	1. Open or short in mass air flow meter circuit 2. Mass air flow meter 3. ECM	Comes on	DTC stored	ES-49
P0103	Mass or Volume Air Flow Circuit High Input	1. Short in mass air flow meter circuit (+B circuit) 2. Mass air flow meter 3. ECM	Comes on	DTC stored	ES-49
P0110	Intake Air Temperature Circuit	1. Open or short in intake air temperature sensor circuit 2. Intake air temperature sensor (built into mass air flow meter) 3. ECM	Comes on	DTC stored	ES-55
P0112	Intake Air Temperature Circuit Low Input	1. Short in intake air temperature sensor circuit 2. Intake air temperature sensor (built into mass air flow meter) 3. ECM	Comes on	DTC stored	ES-55
P0113	Intake Air Temperature Circuit High Input	1. Open in intake air temperature sensor circuit 2. Intake air temperature sensor (built into mass air flow meter) 3. ECM	Comes on	DTC stored	ES-55
P0115	Engine Coolant Temperature Circuit	1. Open or short in engine coolant temperature sensor circuit 2. Engine coolant temperature sensor 3. ECM	Comes on	DTC stored	ES-60
P0116	Engine Coolant Temperature Circuit Range / Performance Problem	Engine coolant temperature sensor	Comes on	DTC stored	ES-65

DTC No.	Detection Item	Trouble Area	MIL *1	Memory	See Page
P0117	Engine Coolant Temperature Circuit Low Input	1. Short in engine coolant temperature sensor circuit 2. Engine coolant temperature sensor 3. ECM	Comes on	DTC stored	ES-60
P0118	Engine Coolant Temperature Circuit High Input	1. Open in engine coolant temperature sensor circuit 2. Engine coolant temperature sensor 3. ECM	Comes on	DTC stored	ES-60
P0120	Throttle Pedal Position Sensor / Switch "A" Circuit Malfunction	1. Throttle position sensor (built into throttle body) 2. ECM	Comes on	DTC stored	ES-66
P0121	Throttle / Pedal Position Sensor / Switch "A" Circuit Range / Performance Problem	Throttle position sensor (built into throttle body)	Comes on	DTC stored	ES-72
P0122	Throttle / Pedal Position Sensor / Switch "A" Circuit Low Input	1. Throttle position sensor (built into throttle body) 2. Short in VTA1 circuit 3. Open in VC circuit 4. ECM	Comes on	DTC stored	ES-66
P0123	Throttle / Pedal Position Sensor / Switch "A" Circuit High Input	1. Throttle position sensor (built into throttle body) 2. Open in VTA1 circuit 3. Open in E2 circuit 4. Short in VC and VTA1 circuits 5. ECM	Comes on	DTC stored	ES-66
P0136	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)	1. Open or short in heated oxygen sensor (sensor 2) circuit 2. Heated oxygen sensor (sensor 2) 3. Heated oxygen sensor heater (sensor 2) 4. A/F sensor (sensor 1) 5. EFI relay	Comes on	DTC stored	ES-73

DTC No.	Detection Item	Trouble Area	MIL *1	Memory	See Page
P0171	System Too Lean (Bank 1)	1. Air induction system 2. Injector blockage 3. Mass air flow meter 4. Engine coolant temperature sensor 5. Fuel pressure 6. Gas leakage in exhaust system 7. Open or short in A/F sensor (sensor 1) circuit 8. A/F sensor (sensor 1) 9. A/F sensor heater (sensor 1) 10. A/F sensor heater relay 11. PCV valve and hose 12. PCV hose connection	Comes on	DTC stored	ES-82
P0172	System Too Rich (Bank 1)	1. Injector leakage or blockage 2. Mass air flow meter 3. Engine coolant temperature sensor 4. Ignition system 5. Fuel pressure 6. Gas leakage in exhaust system 7. Open or short in A/F sensor (sensor 1) circuit 8. A/F sensor (sensor 1) 9. A/F sensor heater 10. A/F sensor heater relay	Comes on	DTC stored	ES-82
P0220	Throttle / Pedal Position Sensor / Switch "B" Circuit	1. Throttle position sensor (built into throttle body) 2. ECM	Comes on	DTC stored	ES-66
P0222	Throttle / Pedal Position Sensor / Switch "B" Circuit Low Input	1. Throttle position sensor (built into throttle body) 2. Short in VTA2 circuit 3. Open in VC circuit 4. ECM	Comes on	DTC stored	ES-66
P0223	Throttle / Pedal Position Sensor / Switch "B" Circuit High Input	1. Throttle position sensor (built into throttle body) 2. Open in VTA2 circuit 3. Open in E2 circuit 4. Short in VC and VTA2 circuits 5. ECM	Comes on	DTC stored	ES-66

DTC No.	Detection Item	Trouble Area	MIL *1	Memory	See Page
P0300	Random / Multiple Cylinder Misfire Detected	1. Open or short in engine wire harness 2. Connector connection 3. Vacuum hose connection 4. Ignition system 5. Injector 6. Fuel pressure 7. Mass air flow meter 8. Engine coolant temperature sensor 9. Compression pressure 10. Valve clearance 11. Valve timing 12. PCV hose connection 13. PCV hose 14. ECM	Comes on *2	DTC stored	ES-95
P0301	Cylinder 1 Misfire Detected	Same as DTC P0300	Comes on *2	DTC stored	ES-95
P0302	Cylinder 2 Misfire Detected	Same as DTC P0300	Comes on *2	DTC stored	ES-95
P0303	Cylinder 3 Misfire Detected	Same as DTC P0300	Comes on *2	DTC stored	ES-95
P0304	Cylinder 4 Misfire Detected	Same as DTC P0300	Comes on *2	DTC stored	ES-95
P0325	Knock Sensor 1 Circuit	1. Open or short in knock sensor circuit 2. Knock sensor (under-torqued or looseness) 3. ECM	Comes on	DTC stored	ES-109
P0327	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)	1. Short in knock sensor circuit 2. Knock sensor 3. ECM	Comes on	DTC stored	ES-109
P0328	Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)	1. Open in knock sensor circuit 2. Knock sensor 3. ECM	Comes on	DTC stored	ES-109
P0335	Crankshaft Position Sensor "A" Circuit	1. Open or short in crankshaft position sensor circuit 2. Crankshaft position sensor 3. Sensor plate (crankshaft position sensor plate No. 1) 4. ECM	Comes on	DTC stored	ES-113
P0339	Crankshaft Position Sensor "A" Circuit Intermittent	Same as DTC P0335	-	DTC stored	ES-113
P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)	1. Open or short in camshaft position sensor circuit 2. Camshaft position sensor 3. Camshaft timing pulley 4. Jumped tooth of timing chain 5. ECM	Comes on	DTC stored	ES-117

DTC No.	Detection Item	Trouble Area	MIL *1	Memory	See Page
P0341	Camshaft Position Sensor "A" Circuit Range / Performance (Bank 1 or Single Sensor)	Same as DTC P0340	Comes on	DTC stored	ES-117
P0351	Ignition Coil "A" Primary / Secondary Circuit	1. Ignition system 2. Open or short in IGF or IGT1 to 4 circuits from ignition coil with igniter to ECM 3. Ignition coil with igniter (No. 1 to No. 4) 4. ECM	Comes on	DTC stored	ES-120
P0352	Ignition Coil "B" Primary / Secondary Circuit	Same as DTC P0351	Comes on	DTC stored	ES-120
P0353	Ignition Coil "C" Primary / Secondary Circuit	Same as DTC P0351	Comes on	DTC stored	ES-120
P0354	Ignition Coil "D" Primary / Secondary Circuit	Same as DTC P0351	Comes on	DTC stored	ES-120
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	1. Gas leakage in exhaust system 2. A/F sensor (sensor 1) 3. Heated oxygen sensor (sensor 2) 4. Three-way catalytic converter	Comes on	DTC stored	ES-129
P0443	Evaporative Emission Control System Purge Control Valve Circuit	1. Open or short in EVAP VSV circuit 2. EVAP VSV 3. ECM	Comes on	DTC stored	ES-133
P0500	Vehicle Speed Sensor "A"	1. Open or short in speed sensor circuit 2. Vehicle speed sensor 3. Combination meter 4. ECM 5. Skid control ECU	Comes on	DTC stored	ES-137
P0503	Vehicle Speed Sensor "A" Intermittent / Erratic / High	Same as DTC P0500	-	DTC stored	ES-137
P0504	Brake Switch "A" / "B" Correlation	1. Short in stop light switch signal circuit 2. Stop fuse 3. Stop light switch 4. ECM	-	DTC stored	ES-139
P0505	Idle Control System Malfunction	1. Electronic throttle control system 2. Air induction system 3. PCV hose connection	Comes on	DTC stored	ES-143
P0560	System Voltage	1. Open in back-up power source circuit 2. ECM	Comes on	DTC stored	ES-145

DTC No.	Detection Item	Trouble Area	MIL *1	Memory	See Page
P0604	Internal Control Module Random Access Memory (RAM) Error	ECM	Comes on	DTC stored	ES-148
P0606	ECM / PCM Processor	ECM	Comes on	DTC stored	ES-148
P0607	Control Module Performance	ECM	Comes on	DTC stored	ES-148
P0617	Starter Relay Circuit High	1. Short in park / neutral position switch circuit (Automatic transaxle) 2. Short in STA circuit 3. Park / neutral position switch (Automatic transaxle) 4. Ignition switch 5. ECM	Comes on	DTC stored	ES-149
P0657	Actuator Supply Voltage Circuit / Open	ECM	Comes on	DTC stored	ES-148
P2102	Throttle Actuator Control Motor Circuit Low	1. Open in throttle actuator circuit 2. Throttle actuator 3. ECM	Comes on	DTC stored	ES-153
P2103	Throttle Actuator Control Motor Circuit High	1. Short in throttle actuator circuit 2. Throttle actuator 3. Throttle valve 4. Throttle body assembly 5. ECM	Comes on	DTC stored	ES-153
P2111	Throttle Actuator Control System - Stuck Open	1. Throttle actuator circuit 2. Throttle actuator 3. Throttle body assembly 4. Throttle valve	Comes on	DTC stored	ES-156
P2112	Throttle Actuator Control System - Stuck Closed	Same as DTC P2111	Comes on	DTC stored	ES-156
P2118	Throttle Actuator Control Motor Current Range / Performance	1. Open in electric throttle control system power source circuit 2. ETCS fuse 3. ECM	Comes on	DTC stored	ES-158
P2119	Throttle Actuator Control Throttle Body Range / Performance	1. Electric throttle control system 2. ECM	Comes on	DTC stored	ES-162
P2120	Throttle / Pedal Position Sensor / Switch "D" Circuit	1. Accelerator pedal position sensor 2. ECM	Comes on	DTC stored	ES-164
P2121	Throttle / Pedal Position Sensor / Switch "D" Circuit Range / Performance	1. Open or short in accelerator pedal position sensor circuit 2. Accelerator pedal position sensor 3. ECM	Comes on	DTC stored	ES-169

DTC No.	Detection Item	Trouble Area	MIL *1	Memory	See Page
P2122	Throttle / Pedal Position Sensor / Switch "D" Circuit Low Input	1. Accelerator pedal position sensor 2. Open in VCP1 circuit 3. Open or ground short in VPA circuit 4. ECM	Comes on	DTC stored	ES-164
P2123	Throttle / Pedal Position Sensor / Switch "D" Circuit High Input	1. Accelerator pedal position sensor 2. Open in EPA circuit 3. ECM	Comes on	DTC stored	ES-164
P2125	Throttle / Pedal Position Sensor / Switch "E" Circuit	1. Accelerator pedal position sensor 2. ECM	Comes on	DTC stored	ES-164
P2127	Throttle / Pedal Position Sensor / Switch "E" Circuit Low Input	1. Accelerator pedal position sensor 2. Open in VCP2 circuit 3. Open or ground short in VPA2 circuit 4. ECM	Comes on	DTC stored	ES-164
P2128	Throttle / Pedal Position Sensor / Switch "E" Circuit High Input	1. Accelerator pedal position sensor 2. Open in EPA2 circuit 3. ECM	Comes on	DTC stored	ES-164
P2135	Throttle / Pedal Position Sensor / Switch "A" / "B" Voltage Correlation	1. Short in VTA1 and VTA2 circuits 2. Throttle position sensor (built into throttle body) 3. ECM	Comes on	DTC stored	ES-66
P2138	Throttle / Pedal Position Sensor / Switch "D" / "E" Voltage Correlation	1. VPA and VPA2 circuits are short circuit 2. Accelerator pedal position sensor 3. ECM	Comes on	DTC stored	ES-164
P2195	Oxygen (A/F) Sensor Signal Stuck Lean (Bank 1 Sensor 1)	1. Open or short in A/F sensor (sensor 1) circuit 2. A/F sensor (sensor 1) 3. A/F sensor (sensor 1) heater 4. EFI relay 5. A/F sensor heater and relay circuit 6. Air induction system 7. Fuel pressure 8. Injector 9. ECM	Comes on	DTC stored	ES-171
P2196	Oxygen (A/F) Sensor Signal Stuck Rich (Bank 1 Sensor 1)	Same as DTC P2195	Comes on	DTC stored	ES-171

DTC No.	Detection Item	Trouble Area	MIL *1	Memory	See Page
P2238	Oxygen (A/F) Sensor Pumping Current Circuit Low (Bank 1 Sensor 1)	1. Open or short in A/F sensor (sensor 1) circuit 2. A/F sensor (sensor 1) 3. A/F sensor (sensor 1) heater 4. EFI relay 5. A/F sensor (sensor 1) heater and relay circuit 6. ECM	Comes on	DTC stored	ES-183
P2239	Oxygen (A/F) Sensor Pumping Current Circuit High (Bank 1 Sensor 1)	Same as DTC P2238	Comes on	DTC stored	ES-183
P2252	Oxygen (A/F) Sensor Reference Ground Circuit Low (Bank 1 Sensor 1)	Same as DTC P2238	Comes on	DTC stored	ES-183
P2253	Oxygen (A/F) Sensor Reference Ground Circuit High (Bank 1 Sensor 1)	Same as DTC P2238	Comes on	DTC stored	ES-183
P2A00	A/F Sensor Circuit Slow Response (Bank 1 Sensor 1)	1. Open or short in A/F sensor (sensor 1) circuit 2. A/F sensor (sensor 1) 3. A/F sensor (sensor 1) heater 4. EFI relay 5. A/F sensor heater and relay circuit 6. Air induction system 7. Fuel pressure 8. Injector 9. ECM	Comes on	DTC stored	ES-188

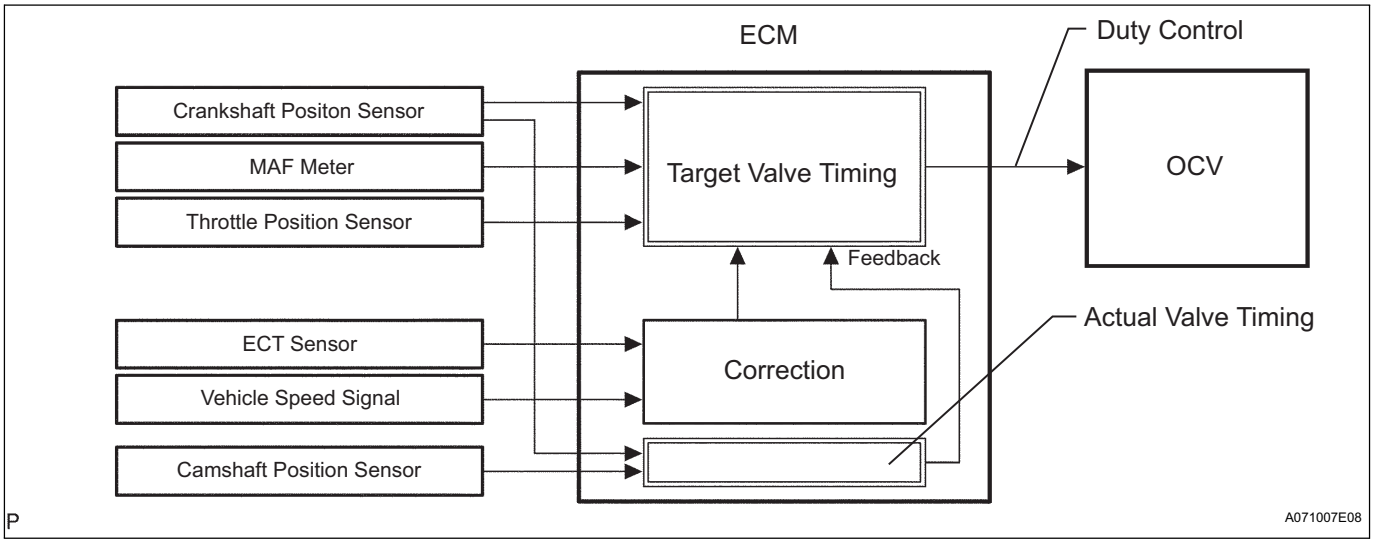
*1: MIL (Malfunction indicator lamp) illuminates.
*2: MIL illuminates or flashes continuously.

DTC	P0010	Camshaft Position "A" Actuator Circuit (Bank 1)

DESCRIPTION

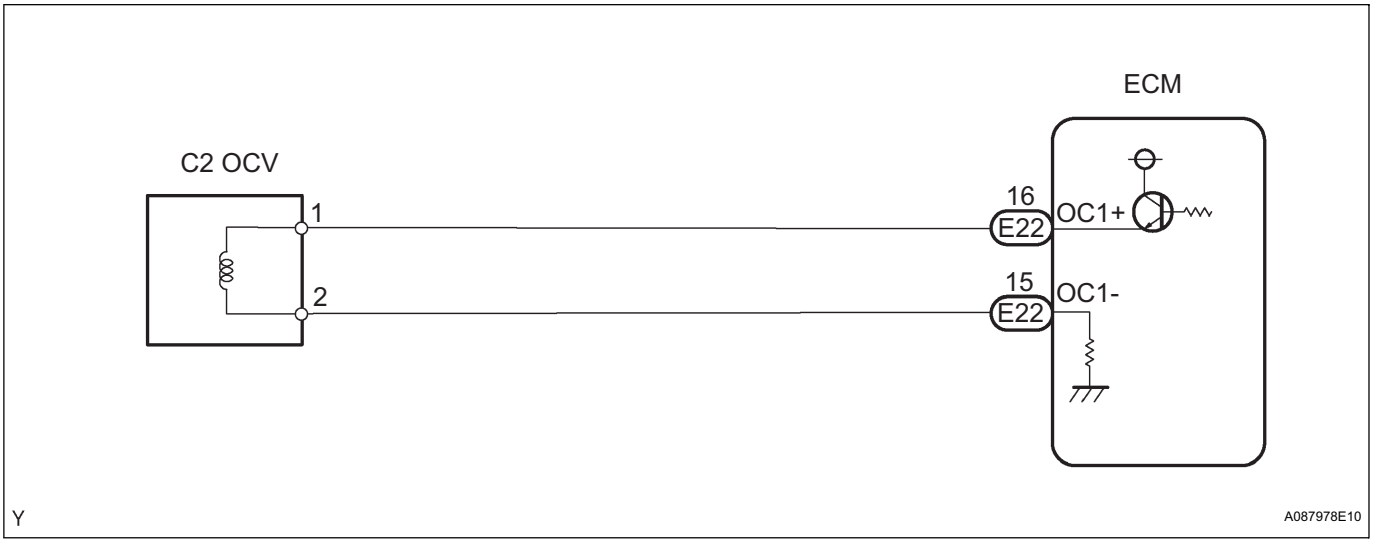
The Variable Valve Timing (VVT) system includes the ECM, the Oil Control Valve (OCV) and the VVT controller. The ECM sends a target duty-cycle control signal to the OCV. This control signal, sent to the OCV, regulates the oil pressure applied to the VVT controller. Camshaft timing control is performed based on engine operation conditions such as intake air volume, throttle position and engine coolant temperature.

The ECM controls the OCV based on the signals output from several sensors. The VVT controller regulates the intake camshaft angle using oil pressure through the OCV. As a result, the relative position between the camshaft and the crankshaft is optimized. Also, the engine torque and fuel economy improve, and exhaust emissions decrease. The ECM detects the actual valve timing using signals from the camshaft position sensor and the crankshaft position sensor. The ECM performs feedback control and verifies target valve timing.



DTC No.	DTC Detection Condition	Trouble Area
P0010	Open or short in OCV circuit (1 trip detection logic)	• Open or short in OCV circuit • OCV • ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (OCV OPERATION)

(a) Start the engine and warm it up.
(b) Connect the intelligent tester to the DLC3.
(c) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / Active Test / VVT Control (Bank 1).
(e) Using the intelligent tester, operate the OCV and check the engine speed.

Standard

Tester Operation	Specified Condition
OCV is OFF	Normal engine speed
OCV is ON	Rough idle or engine stall

NG → **GO TO STEP 2**

OK

CHECK FOR INTERMITTENT PROBLEMS

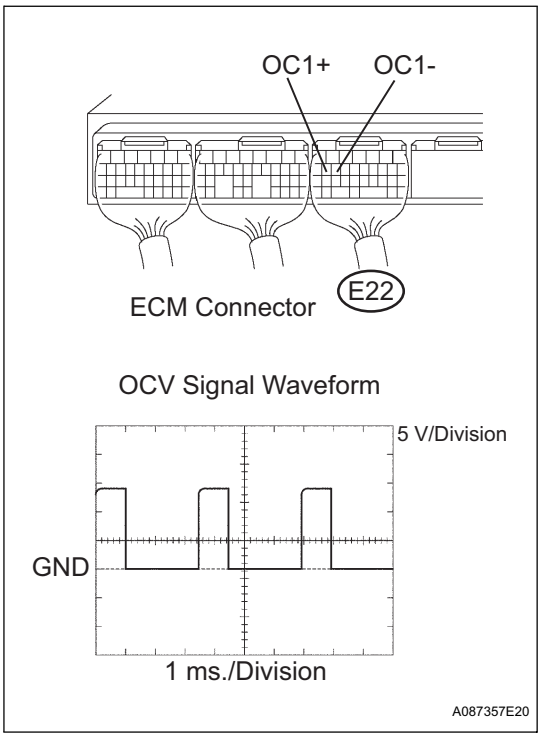
2	INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (OCV)

OK:
OCV has no contamination and moves smoothly.

NG → REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

OK

3	INSPECT ECM (OCV SIGNAL)



(a) During idling, check the waveform of the E22 ECM connector using an oscilloscope.

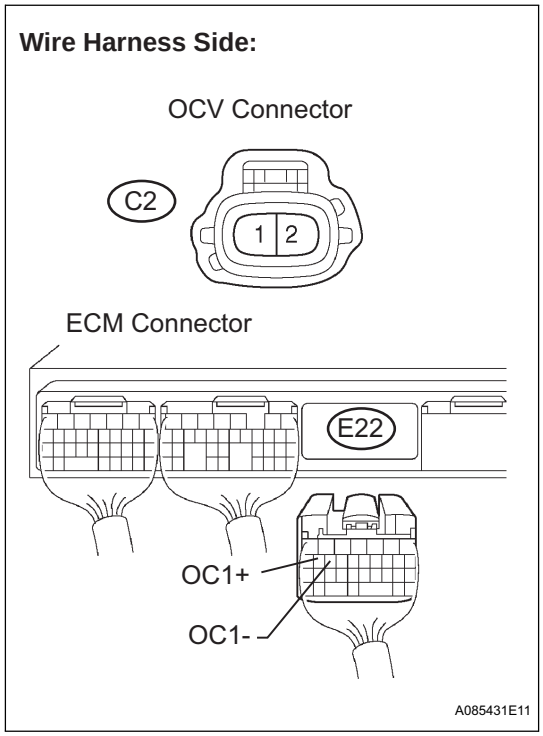
Standard

Tester Connection	Specified Condition
E22-16 (OC1+) - E22-15 (OC1-)	Correct waveform appears as shown

NG → REPLACE ECM

OK

4	CHECK HARNESS AND CONNECTOR (OCV - ECM)



(a) Disconnect the C2 OCV connector.
(b) Disconnect the E22 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
C2-1 (OCV) - E22-16 (OC1+) C2-2 (OCV) - E22-15 (OC1-)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
C2-1 (OCV) or E22-16 (OC1+) - Body ground C2-2 (OCV) or E22-15 (OC1-) - Body ground	10 kΩ or higher

(d) Connect the connectors.

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

OK

CHECK FOR INTERMITTENT PROBLEMS

DTC	P0011	Camshaft Position "A" - Timing Over-Advanced or System Performance (Bank 1)

DTC	P0012	Camshaft Position "A" - Timing Over-Retarded (Bank 1)

DESCRIPTION

Refer to DTC P0010 (See page ES-32).

DTC No.	DTC Detection Condition	Trouble Area
P0011	After engine is warmed up and engine speed is at 550 to 4,000 rpm, condition (1) continues (1 trip detection logic) 1. Valve timing does not change from current valve timing (Problem of advanced valve timing)	• Valve timing • OCV • Camshaft timing gear assembly • ECM
P0012	After engine is warmed up and engine speed is at 550 to 4,000 rpm, condition (1) continues (2 trip detection logic) 1. Valve timing does not change from current valve timing (Problem of retarded valve timing)	Same as DTC No. P0011

WIRING DIAGRAM

Refer to DTC P0010 (See page ES-33).

INSPECTION PROCEDURE

HINT:

Abnormal bank	Problem of Advanced OCV	Problem of Retarded OCV
Bank 1	P0011	P0012

Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	CHECK VALVE TIMING

(a) Check for loose or a jumped tooth of the timing chain.
OK:
The matchmarks of the crankshaft pulley and camshaft pulley are aligned.

NG → ADJUST VALVE TIMING

OK

2	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (OPERATION OF OCV)

(a) Start the engine and warm it up.
(b) Connect the intelligent tester to the DLC3.

(c) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / Active Test / VVT Control (Bank 1).
(e) Using the intelligent tester, operate the OCV and check the engine speed.

Standard

Tester Operation	Specified Condition
OCV is OFF	Normal engine speed
OCV is ON	Rough idle or engine stall

NG → **GO TO STEP 4**

OK

3	CHECK IF DTC OUTPUTS REOCCUR (DTC P0011 OR P0012)

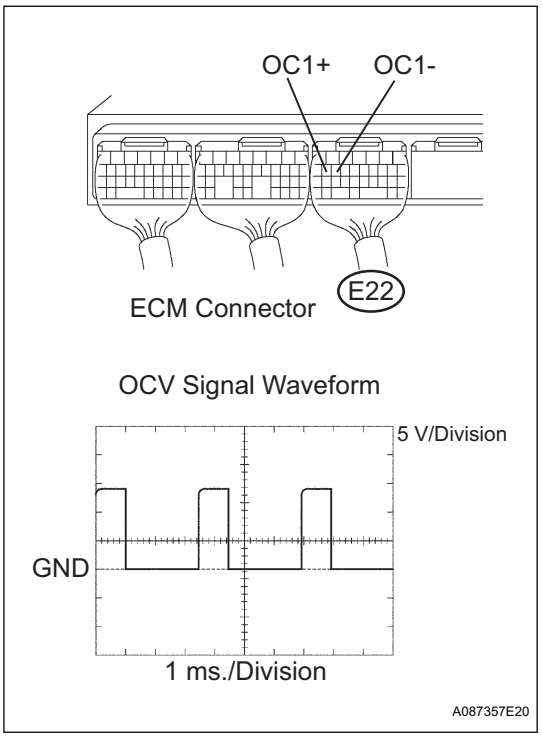
(a) Erase the DTC(s) using one of the following methods: 1) use the intelligent tester, 2) disconnect the battery terminals for more than 60 seconds, or 3) remove the EFI fuse for more than 60 seconds.
(b) Start the engine and warm it up.
(c) Drive the vehicle for 10 minutes or more.
(d) Read output DTC using the intelligent tester.
OK:
No DTC output.
HINT:
DTC P0011 or P0012 is output when a foreign object in the engine oil enters the system. These codes will stay even if the system returns to normal for a short time. Foreign objects are filtered out by the oil filter.

NG → **GO TO STEP 4**

OK

VVT SYSTEM OK

4	INSPECT ECM (OCV SIGNAL)



(a) During idling, check the waveform of the E22 ECM connector using an oscilloscope.
Standard

Tester Connection	Specified Condition
E22-16 (OC1+) - E22-15 (OC1-)	Correct waveform appears as shown

NG → **REPLACE ECM**

OK

5	CHECK OIL CONTROL VALVE FILTER

OK:
The filter is not clogged.

NG → **REPLACE OIL CONTROL VALVE FILTER**

OK

6	CHECK CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (OCV)

OK:
OCV has no contamination and moves smoothly.

OK → **GO TO STEP 8**

NG

7	REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (OCV)

NEXT

8	CHECK CAMSHAFT TIMING GEAR ASSEMBLY

OK → GO TO STEP 10

NG

9	REPLACE CAMSHAFT TIMING GEAR ASSEMBLY

NEXT

10	CHECK IF DTC OUTPUTS REOCCUR (DTC P0011 OR P0012)

(a) Erase the DTC(s) using one of the following methods: 1) use the intelligent tester, 2) disconnect the battery terminals for more than 60 seconds, or 3) remove the EFI fuse for more than 60 seconds.
(b) Start and warm up the engine.
(c) Drive the vehicle for 10 minutes or more.
(d) Read output DTC using the intelligent tester.
OK:
No DTC output.

HINT:
DTC P0011 or P0012 is output when a foreign object in the engine oil enters the system. These codes will stay even if the system returns to normal for a short time. Foreign objects are filtered out by the oil filter.

NG → REPLACE ECM

OK

VVT SYSTEM OK

DTC	P0016	Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A)

DESCRIPTION

Refer to DTCs P0335 and P0339 (See page ES-113).

DTC No.	DTC Detection Condition	Trouble Area
P0016	Deviation between crankshaft position sensor signal and VVT sensor (bank 1) signal (2 trip detection logic)	• Mechanical system (jumped tooth of timing chain, chain stretched) • ECM

WIRING DIAGRAM

Refer to DTCs P0335 and P0339 (See page ES-114).

INSPECTION PROCEDURE

HINT:

Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	CHECK VALVE TIMING

(a) Check for loose or a jumped tooth of the timing chain.

OK:

The matchmarks of the crankshaft pulley and camshaft pulley are aligned.

NG → ADJUST VALVE TIMING

OK ↓

REPLACE ECM

DTC	P0031	Oxygen (A/F) Sensor Heater Control Circuit Low (Bank 1 Sensor 1)

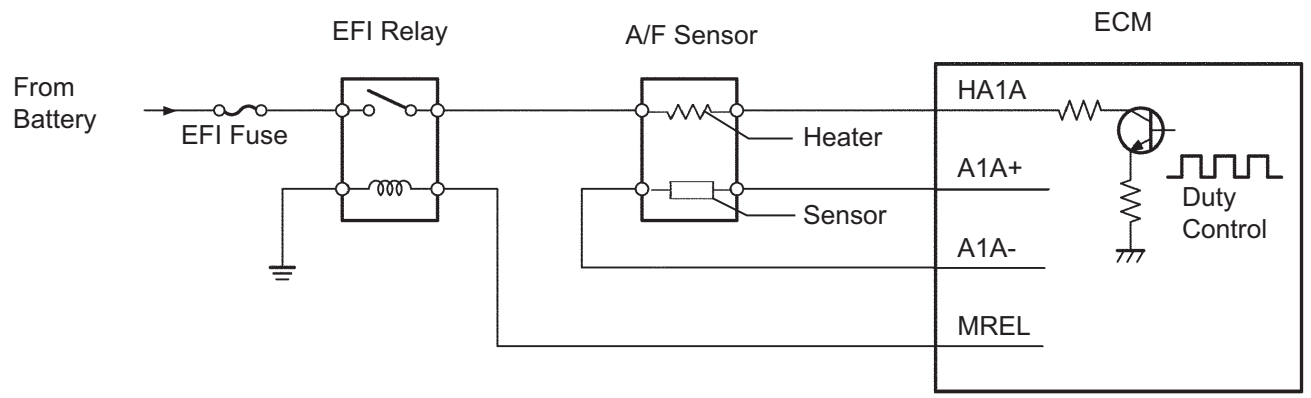
DTC	P0032	Oxygen (A/F) Sensor Heater Control Circuit High (Bank 1 Sensor 1)

HINT:
- Although the title (DTC description) says "oxygen sensor", this DTC is related to the "A/F sensor".
- The ECM provides a pulse width modulated signal to the control circuit to adjust current through the heater. The A/F sensor heater circuit uses a relay on the +B side of the circuit.
- Sensor 1 refers to the sensor mounted in front of the Three-Way Catalytic Converter (TWC) and is located near the engine assembly.
- Sensor 2 refers to the sensor mounted behind the TWC and is located far from the engine assembly.

DESCRIPTION

Refer to DTC P2195 (See page ES-171).

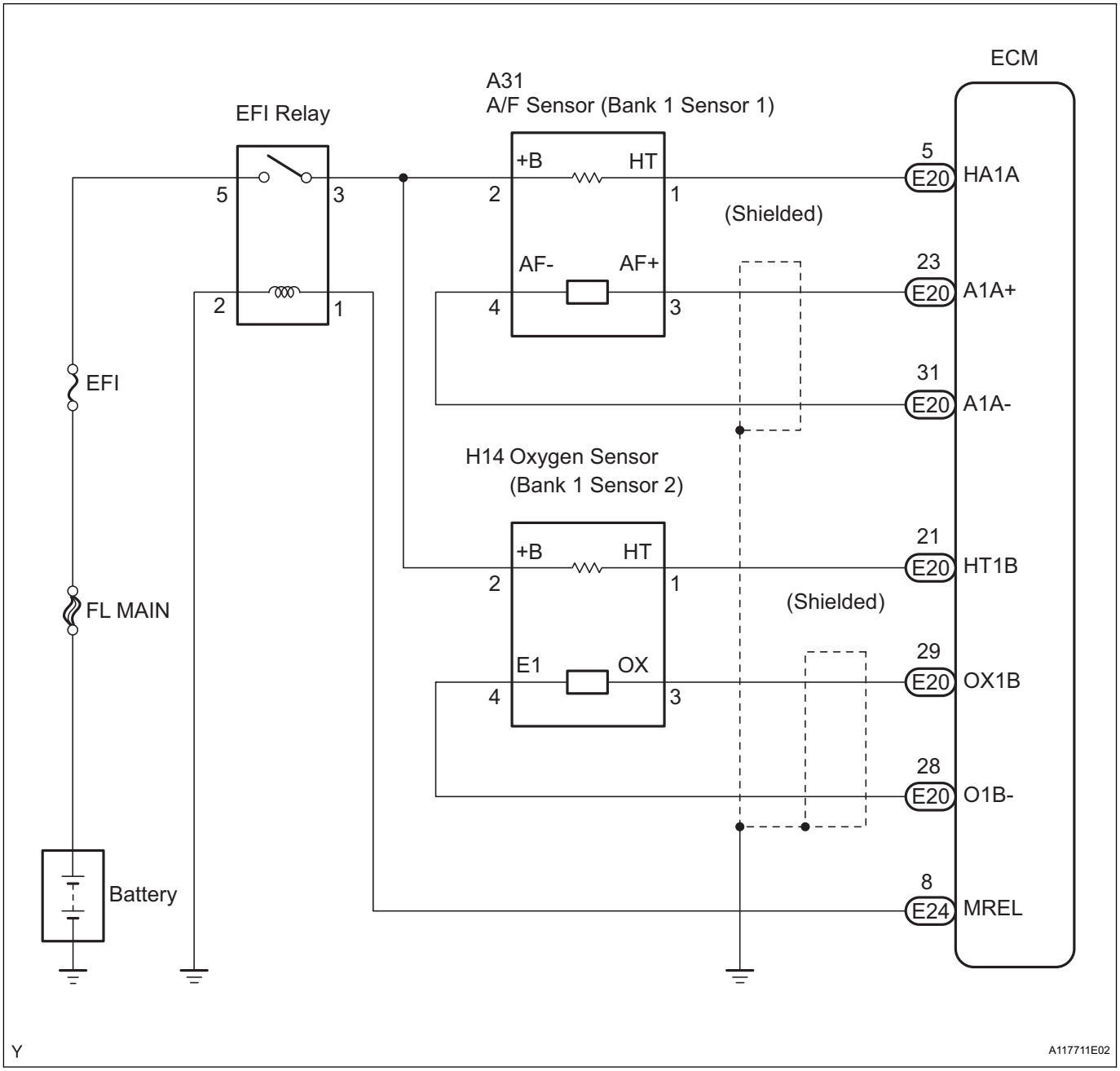
Reference:



DTC No.	DTC Detection Condition	Trouble Area
P0031	Heater current is less than 0.8 A when the heater operates (1 trip detection logic)	• Open or short in heater circuit of A/F sensor • A/F sensor heater • EFI relay • ECM
P0032	Heater current exceeds 10 A when the heater operates (1 trip detection logic)	• Open or short in heater circuit of A/F sensor • A/F sensor heater • EFI relay • ECM

HINT:
Sensor 1 is the sensor closest to the engine assembly.

WIRING DIAGRAM

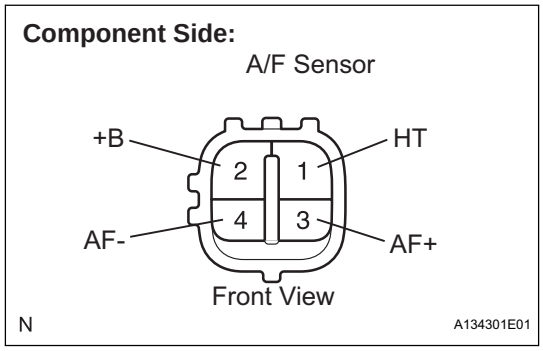


INSPECTION PROCEDURE

HINT:

Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1 INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)



(a) Disconnect the A31 A/F sensor connector.
(b) Measure the resistance according to the value(s) in the table below.
Standard resistance

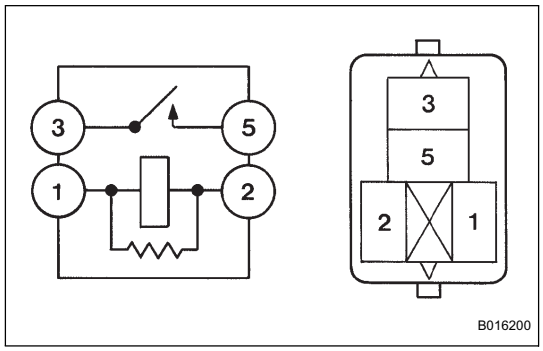
Tester Connection	Specified Condition
1 (HT) - 2 (+B)	2.16 to 2.9 Ω
1 (HT) - 4 (AF-)	10 kΩ or higher

(c) Connect the connector.

NG → **REPLACE AIR FUEL RATIO SENSOR**

OK

2 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room J/B.
(b) Measure the resistance according to the value(s) in the table below.
Standard resistance

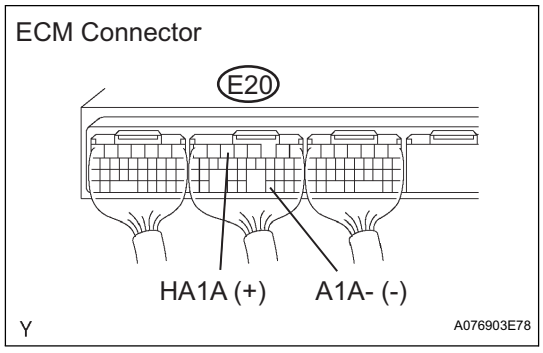
Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

(c) Reinstall the EFI relay.

NG → **REPLACE EFI RELAY**

OK

3 INSPECT ECM (HA1A VOLTAGE)



(a) Turn the ignition switch to the ON position.
(b) Measure the voltage according to the value(s) in the table below.
Standard voltage

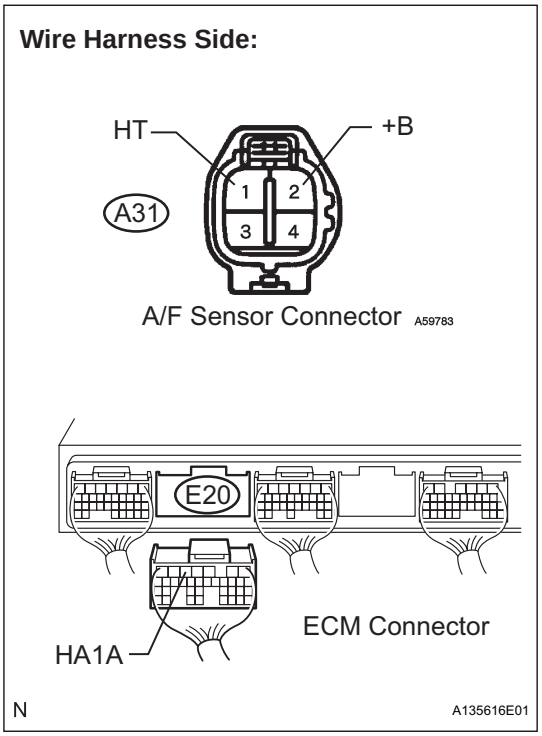
Tester Connection	Specified Condition
E20-5 (HA1A) - E20-31 (A1A-)	9 to 14 V

NG → **GO TO STEP 4**

OK

REPLACE ECM

4	CHECK HARNESS AND CONNECTOR (ECM - A/F SENSOR, A/F SENSOR - EFI RELAY)



(a) Check the wire harness between the ECM and A/F sensor.
(1) Disconnect the E20 ECM connector.
(2) Disconnect the A31 A/F sensor connector.
(3) Measure the resistance according to the value(s) in the table below.

Standard resistance:

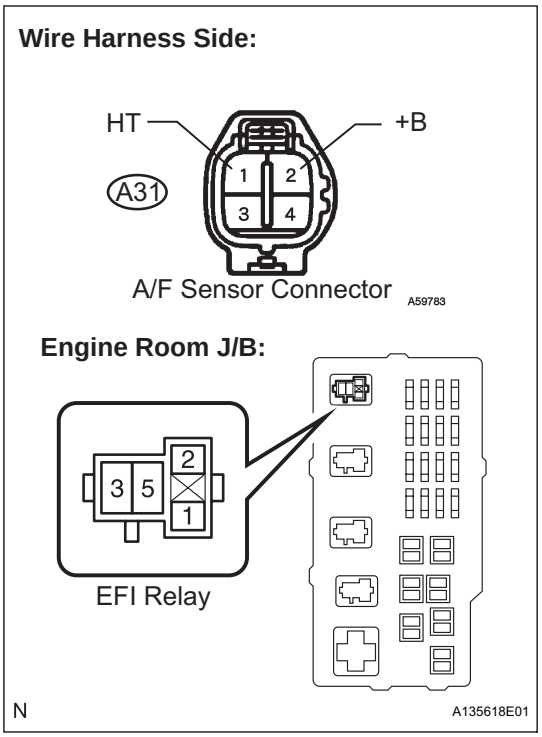
Check for open

Tester Connection	Specified Condition
A31-1 (HT) - E20-5 (HA1A)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
A31-1 (HT) or E20-5 (HA1A) - Body ground	10 kΩ or higher

(4) Connect the connectors.



(b) Check the wire harness between the A/F sensor and EFI relay.
(1) Disconnect the A31 A/F sensor connector.
(2) Remove the EFI relay from the engine room J/B.
(3) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
A31-2 (+B) - Engine room J/B EFI relay terminal 3	Below 1 Ω

Check for short

Tester Connection	Specified Condition
A31-2 (+B) or Engine room J/B EFI relay terminal 3 - Body ground	10 kΩ or higher

(4) Connect the connectors.
(5) Reinstall the EFI relay.

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

OK

REPLACE ECM

DTC	P0037	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)

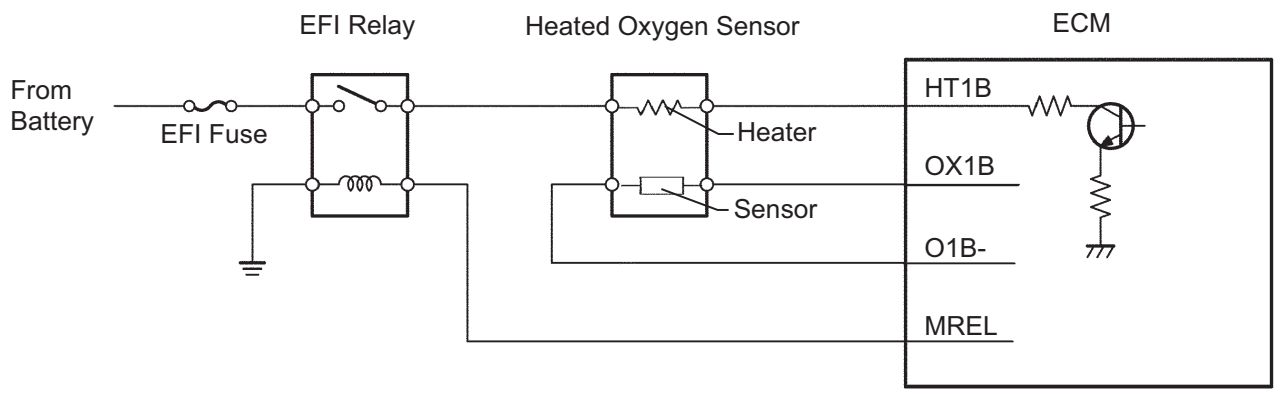
DTC	P0038	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)

HINT:
- Sensor 1 refers to the sensor mounted in front of the Three-Way Catalytic Converter (TWC) and is located near the engine assembly.
- Sensor 2 refers to the sensor mounted behind the TWC and is located far from the engine assembly.

DESCRIPTION

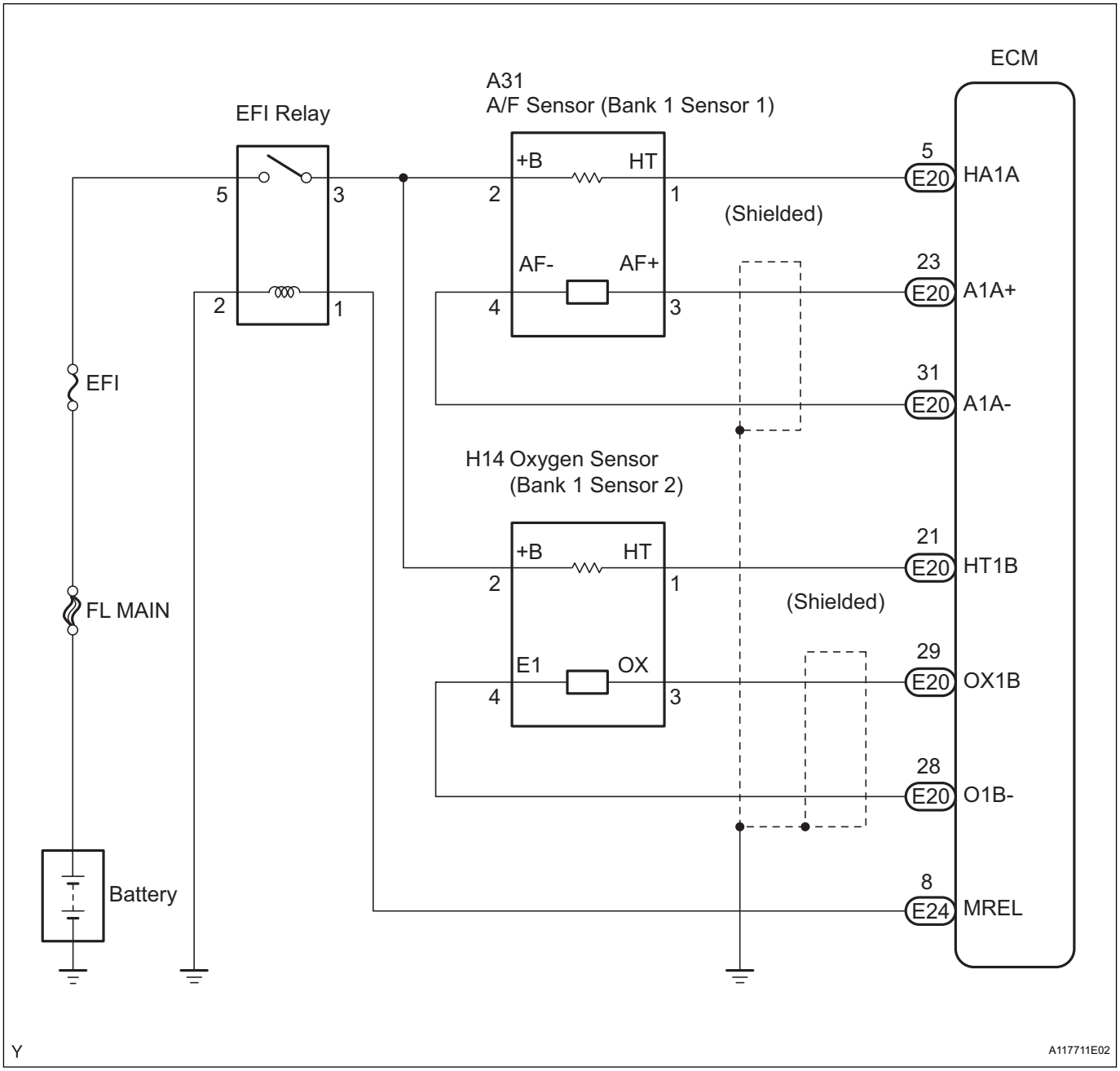
HINT:
Refer to DTC P0136 (See page ES-73).
The ECM provides a pulse width modulated signal to the control circuit to adjust the current through the heater. The heated oxygen sensor heater circuit uses a relay on the +B side of the circuit.

Reference:



DTC No.	DTC Detection Condition	Trouble Area
P0037	Heater current is 0.25 A or less when the heater operates (1 trip detection logic)	• Open in heater circuit of heated oxygen sensor • Heated oxygen sensor heater • EFI relay • ECM
P0038	Heater current exceeds 2 A when the heater operates (1 trip detection logic)	• Short in heater circuit of heated oxygen sensor • Heated oxygen sensor heater • EFI relay • ECM

WIRING DIAGRAM

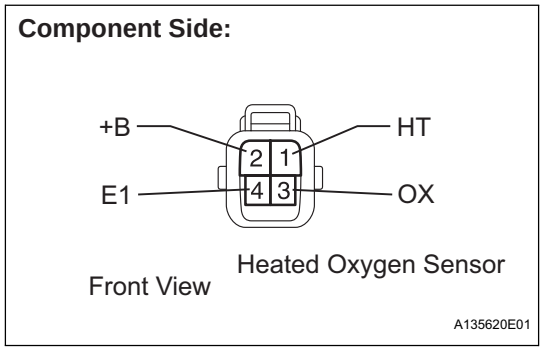


INSPECTION PROCEDURE

HINT:

Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1 INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)



(a) Disconnect the H14 heated oxygen sensor connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

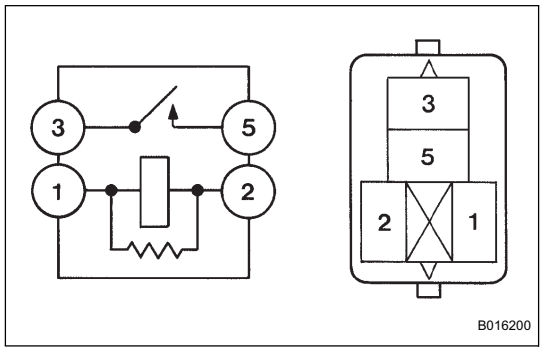
Tester Connection	Specified Condition
1 (HT) - 2 (+B)	11 to 16 Ω at 20°C (68°F)
1 (HT) - 4 (E1)	10 kΩ or higher

(c) Connect the connector.

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

2 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room J/B.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

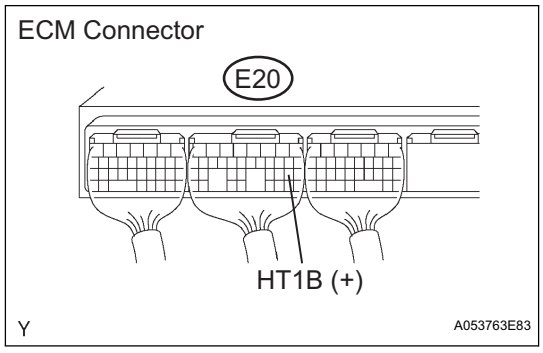
Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the EFI relay.

NG → **REPLACE EFI RELAY**

OK

3 INSPECT ECM (HT1B VOLTAGE)



(a) Turn the ignition switch to the ON position.
(b) Measure the voltage according to the value(s) in the table below.

Standard voltage

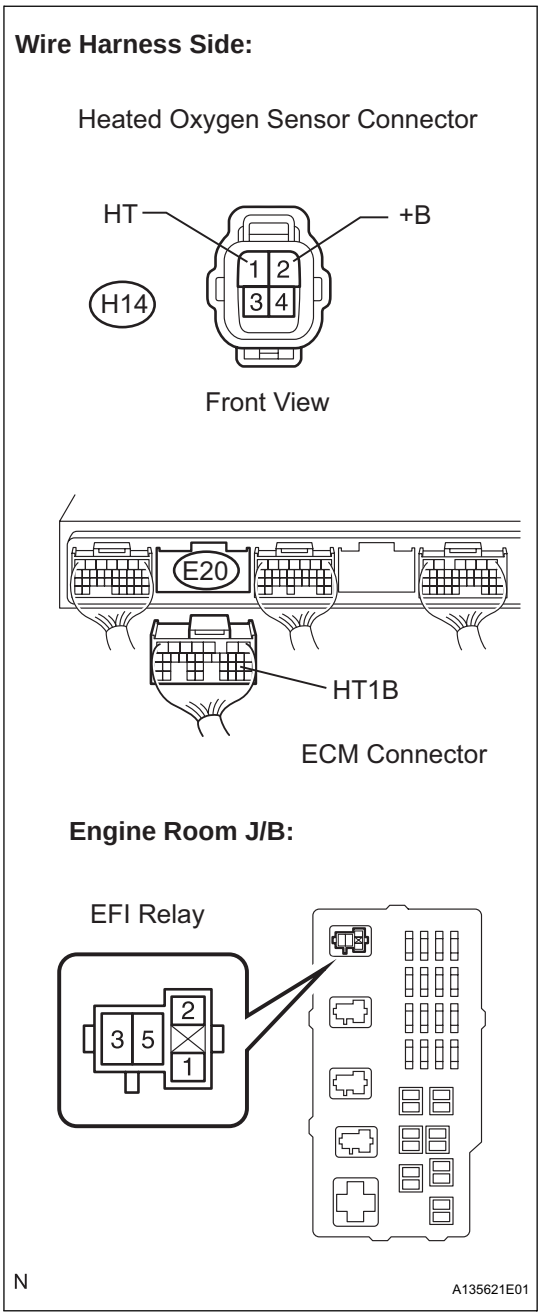
Tester Connection	Specified Condition
HT1B (E20-21) - Body ground	9 to 14 V

NG → **GO TO STEP 4**

OK

REPLACE ECM

4	CHECK HARNESS AND CONNECTOR (HO2 SENSOR - ECM, HO2 SENSOR - EFI RELAY)



(a) Check the harness and the connectors between the ECM and heated oxygen sensor.
(1) Disconnect the H14 heated oxygen sensor connector.
(2) Disconnect the E20 ECM connector.
(3) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
H14-1 (HT) - E20-21 (HT1B)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
H14-1 (HT) or E20-21 (HT1B) - Body ground	10 kΩ or higher

(4) Connect the connectors.

(b) Check the harness and the connectors between the heated oxygen sensor and EFI relay.
(1) Disconnect the H14 heated oxygen sensor connector.
(2) Remove the EFI relay from the engine room J/B.
(3) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
H14-2 (+B) - Engine room J/B EFI relay terminal 3	Below 1 Ω

Check for short

Tester Connection	Specified Condition
H14-2 (+B) or Engine room J/B EFI relay terminal 3 - Body ground	10 kΩ or higher

(4) Connect the connector.
(5) Reinstall the EFI relay.

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

OK

REPLACE ECM

DTC	P0100	Mass or Volume Air Flow Circuit

DTC	P0102	Mass or Volume Air Flow Circuit Low Input

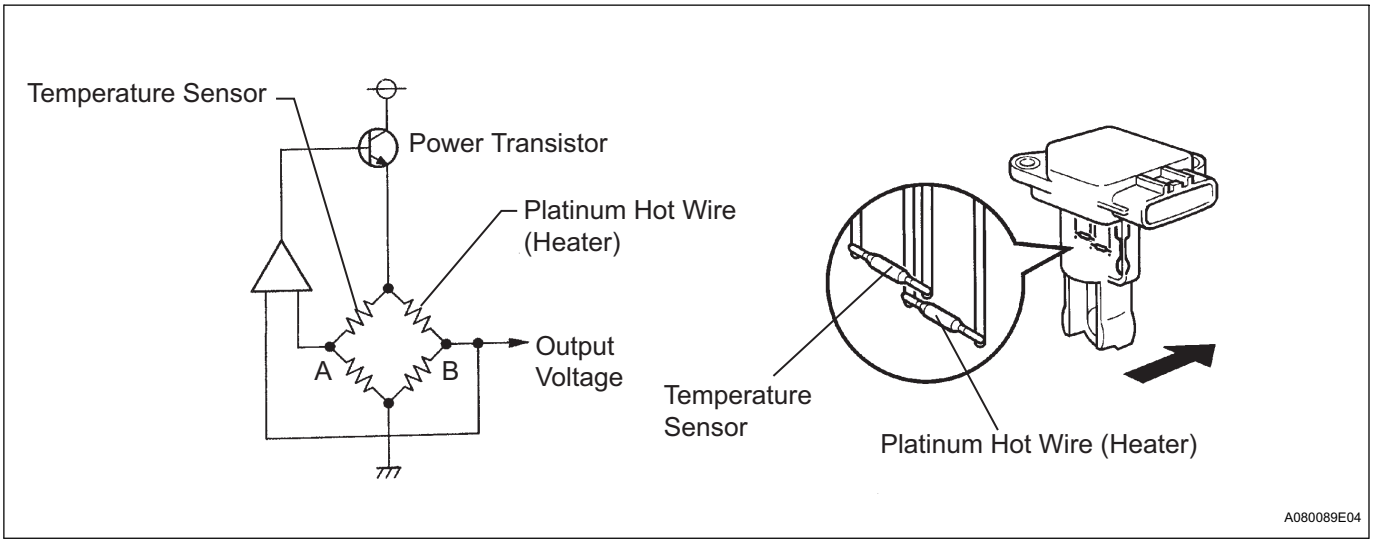
DTC	P0103	Mass or Volume Air Flow Circuit High Input

DESCRIPTION

The Mass Air Flow (MAF) meter measures the amount of air flowing through the throttle valve. The ECM uses this information to determine the fuel injection time and provide the proper air fuel ratio. Inside the MAF meter, there is a heated platinum wire exposed to the flow of intake air.

By applying a specific current to the wire, the ECM heats this wire to a given temperature. The flow of incoming air cools the wire and an internal thermistor, changing their resistance. To maintain a constant current value, the ECM varies the voltage applied to these components in the MAF meter. The voltage level is proportional to the air flow through the sensor. The ECM interprets this voltage as the intake air amount.

The circuit is constructed so that the platinum hot wire and temperature sensor provide a bridge circuit, with the power transistor controlled so that the potential of A and B remains equal to maintain the set temperature.



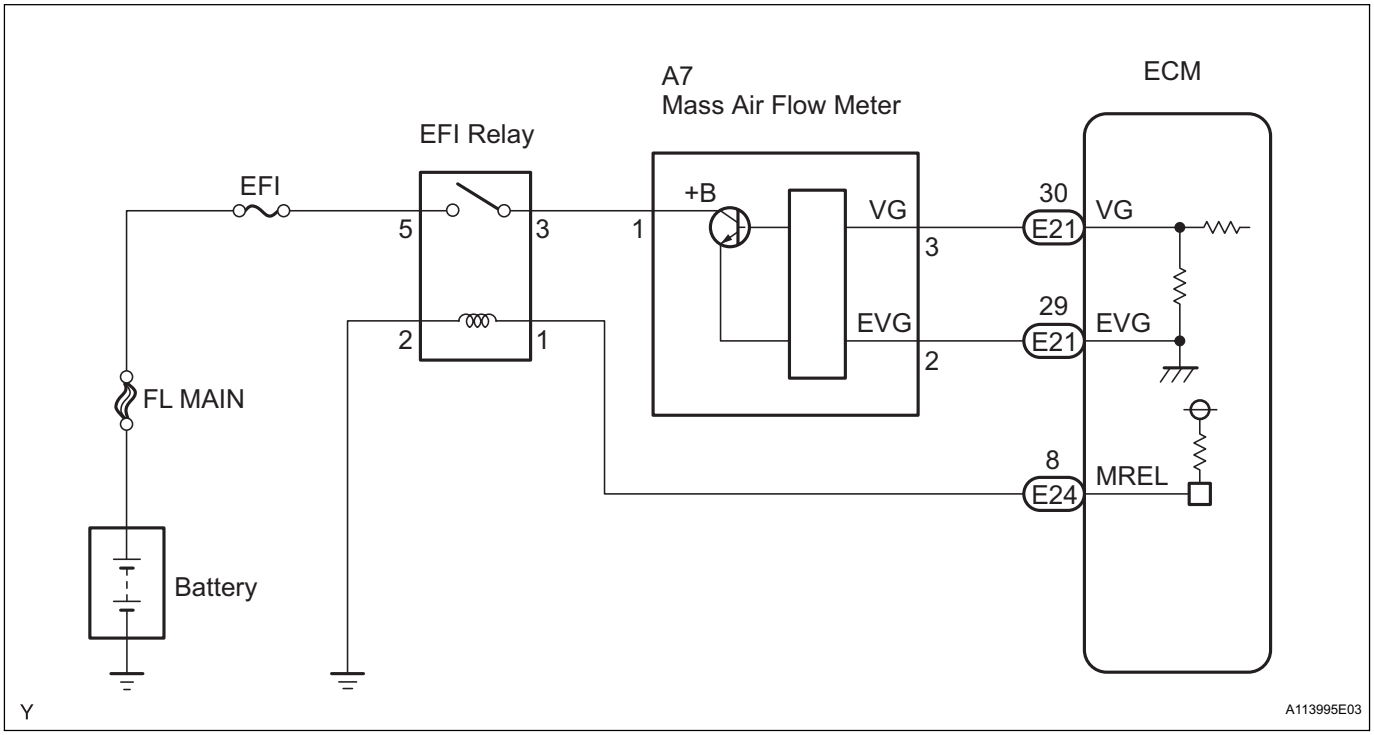
DTC No.	DTC Detection Condition	Trouble Area
P0100	When MAF meter circuit has an open or a short for more than 3 seconds under 4,000 rpm engine speed (1 trip detection logic)	• Open or short in MAF meter circuit • MAF meter • ECM
P0102	When MAF meter circuit has an open for more than 3 seconds under 4,000 rpm engine speed (1 trip detection logic)	• Open or short in MAF meter circuit • MAF meter • ECM
P0103	When MAF meter circuit has a short for more than 3 seconds under 4,000 rpm engine speed (1 trip detection logic)	• Short in MAF meter circuit (+B circuit) • MAF meter • ECM

HINT:

When DTC P0100, P0102, or P0103 is detected, check the air-flow ratio by selecting Powertrain / Engine and ECT / Data List / AFM on the intelligent tester.

Air Flow Value (g/s)	Malfunction
Approximately 0.0	• Open in MAF meter power source circuit • Open or short in VG circuit
271.0 or more	Open in EVG circuit

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	READ VALUE OF INTELLIGENT TESTER (MAF RATE)

(a) Connect the intelligent tester to the DLC3.
(b) Start the engine.
(c) Turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / Data List / AFM. Read the values.

Result

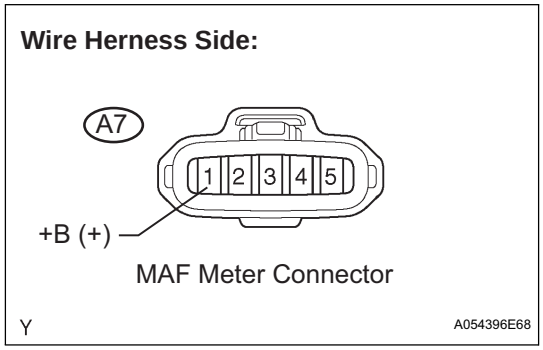
Mass Air Flow Rate (g/second)	Proceed to
0.0	A
271.0 or more	B
Between 1 and 270.0*	C

HINT:
*: The value must change when the throttle valve is opened or closed.

B	GO TO STEP 6
C	CHECK FOR INTERMITTENT PROBLEMS

A

2 CHECK MASS AIR FLOW METER (POWER SOURCE VOLTAGE)



(a) Turn the ignition switch to the ON position.
(b) Disconnect the A7 MAF meter connector.
(c) Measure the voltage according to the value(s) in the table below.

Standard voltage

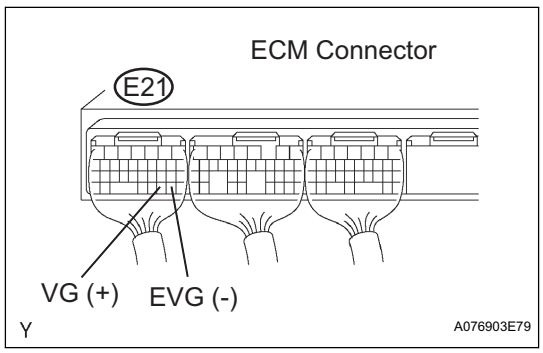
Tester Connection	Specified Condition
A7-1 (+B) - Body ground	9 to 14 V

(d) Connect the connector.

NG → **GO TO STEP 5**

OK

3 INSPECT ECM (VG VOLTAGE)



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

Standard voltage

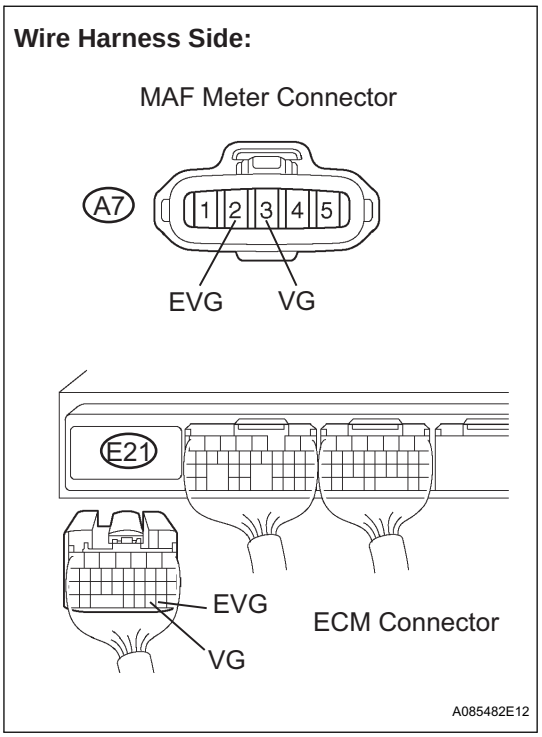
Tester Connection	Condition	Specified Condition
E21-30 (VG) - E21-29 (EVG)	Engine is idling (Automatic transaxle: N or P position and A/C switch OFF)	0.5 to 3.0 V
E21-30 (VG) - E21-29 (EVG)	Engine is idling (Manual transaxle: Neutral position and A/C switch OFF)	0.5 to 3.0 V

NG → **GO TO STEP 4**

OK

REPLACE ECM

4	CHECK HARNESS AND CONNECTOR (MAF METER - ECM)



(a) Disconnect the A7 MAF meter connector.
(b) Disconnect the E21 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
A7-3 (VG) - E21-30 (VG) A7-2 (EVG) - E21-29 (EVG)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
A7-3 (VG) or E21-30 (VG) - Body ground	10 kΩ or higher

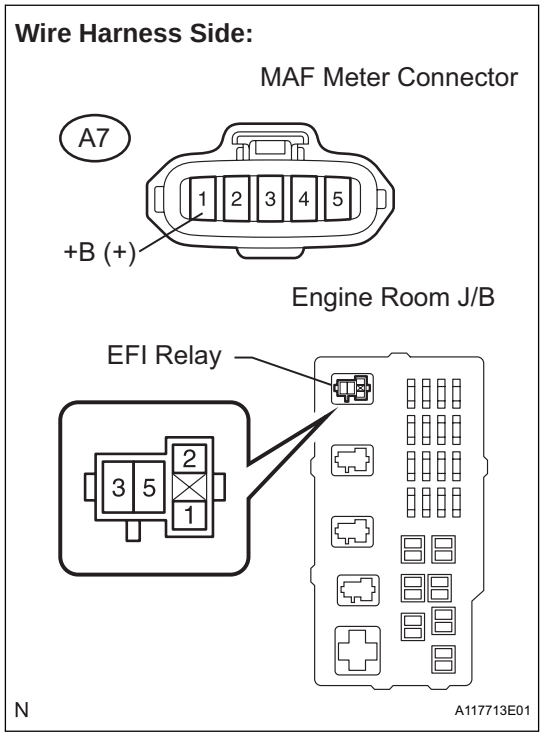
(d) Connect the connectors.

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

OK

REPLACE MASS AIR FLOW METER

5 CHECK HARNESS AND CONNECTOR (MAF METER - EFI RELAY)



(a) Disconnect the A7 MAF meter connector.
(b) Remove the EFI relay from the engine room J/B.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
A7-1 (+B) - Engine room J/B EFI relay terminal 3	Below 1 Ω

Check for short

Tester Connection	Specified Condition
A7-1 (+B) or Engine room J/B EFI relay terminal 3 - Body ground	10 kΩ or higher

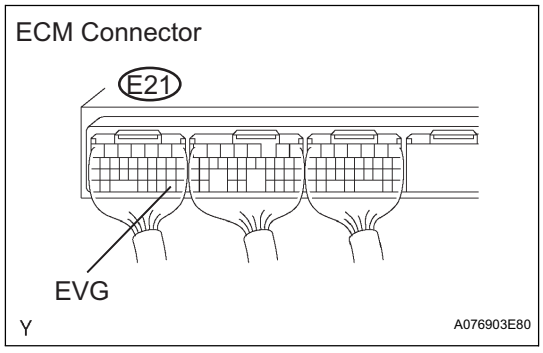
(d) Reinstall the EFI relay.
(e) Connect the connector.

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

OK

INSPECT ECM POWER SOURCE CIRCUIT

6 INSPECT ECM (SENSOR GROUND)



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

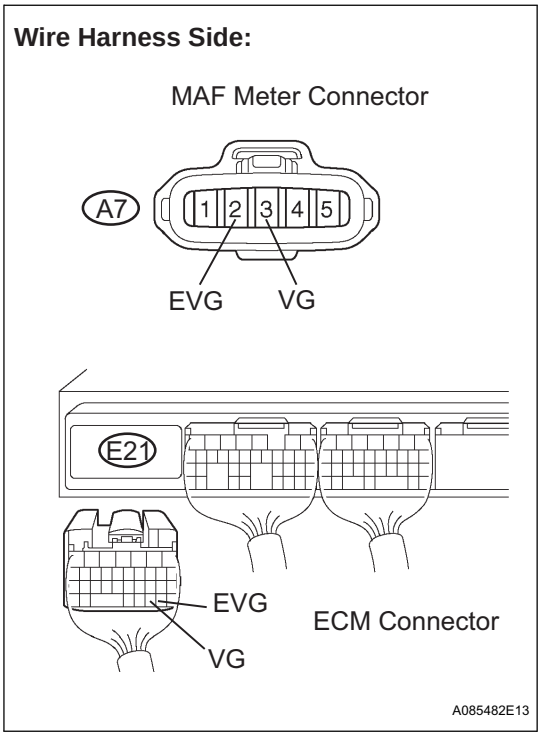
Standard resistance

Tester Connection	Specified Condition
E21-29 (EVG) - Body ground	Below 1 Ω

NG → **REPLACE ECM**

OK

7	CHECK HARNESS AND CONNECTOR (MAF METER - ECM)



(a) Disconnect the A7 MAF meter connector.
(b) Disconnect the E21 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
A7-3 (VG) - E21-30 (VG) A7-2 (EVG) - E21-29 (EVG)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
A7-3 (VG) or E21-30 (VG) - Body ground	10 kΩ or higher

(d) Reconnect the connectors.

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

OK

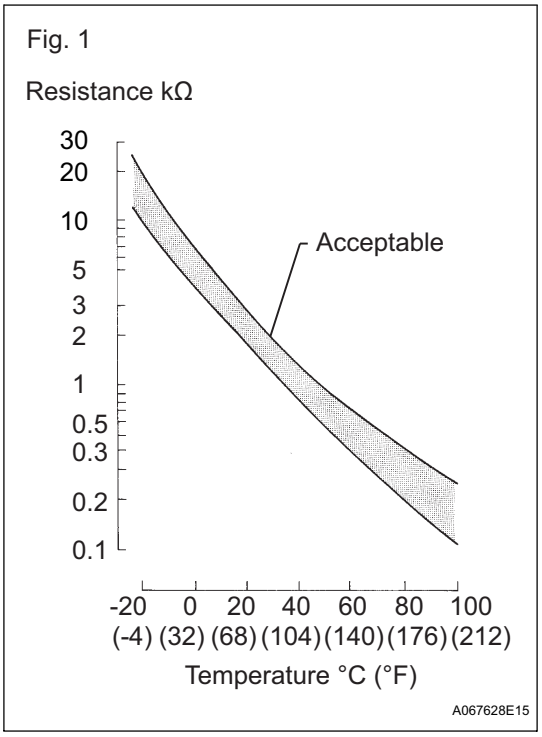
REPLACE MASS AIR FLOW METER

DTC	P0110	Intake Air Temperature Circuit
DTC	P0112	Intake Air Temperature Circuit Low Input
DTC	P0113	Intake Air Temperature Circuit High Input

DESCRIPTION

The Intake Air Temperature (IAT) sensor, mounted on the Mass Air Flow (MAF) meter, monitors the intake air temperature. The IAT sensor has a thermistor that varies its resistance depending on the temperature of the intake air. When the air temperature is low, the resistance in the thermistor increases. When the temperature is high, the resistance drops. The variations in resistance are reflected in the voltage output from the sensor (see Fig. 1).

Fig. 1



The IAT sensor is connected to the ECM. The 5 V power source voltage in the ECM is applied to the IAT sensor from terminal THA via resistor R.

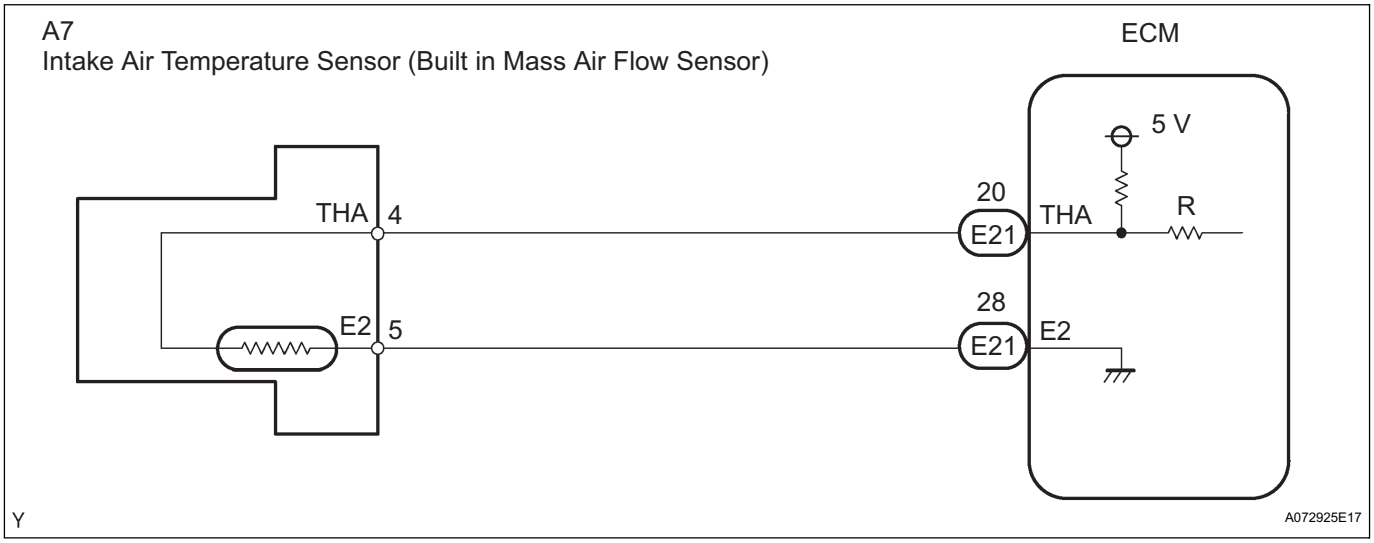
That is, the resistor R and the IAT sensor are connected in series. When the resistance value of the IAT sensor changes in accordance with changes in the IAT, the voltage at terminal THA also changes. Based on this signal, the ECM increases the fuel injection volume to improve the driveability during cold engine operation.

DTC No.	Proceed to	DTC Detection Condition	Trouble Area
P0110	Step 1	Open or short in IAT sensor circuit for 0.5 seconds (1 trip detection logic)	• Open or short in IAT sensor circuit • IAT sensor (built into MAF meter) • ECM
P0112	Step 4	Short in IAT sensor circuit for 0.5 seconds (1 trip detection logic)	• Short in IAT sensor circuit • IAT sensor (built into MAF meter) • ECM
P0113	Step 2	Open in IAT sensor circuit for 0.5 seconds (1 trip detection logic)	• Open in IAT sensor circuit • IAT sensor (built into MAF meter) • ECM

HINT:
When DTC P0110, P0112 or P0113 is detected, check the intake air temperature by selecting Powertrain / Engine and ECT / Data List / Intake air on the intelligent tester.

Temp. Displayed	Malfunction
-40°C (-40°F)	Open circuit
140°C (284°F) or more	Short circuit

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
- If DTCs that are related to different systems are output simultaneously while terminal E2 is used as a ground terminal, terminal E2 may have an open circuit.
- Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	READ VALUE OF INTELLIGENT TESTER (INTAKE AIR TEMPERATURE)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position. Turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Intake Air. Read the values.
Temperature:
The same as actual intake air temperature

Result

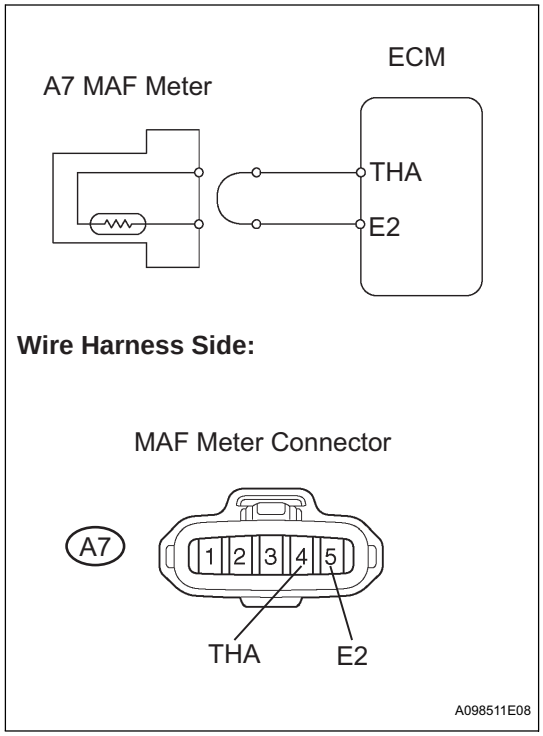
Display	Proceed to
-40°C (-40°F)	**A**
140°C (284°F) or more	**B**
OK (same as present temperature)	**C**

HINT:
- If there is an open circuit, the intelligent tester indicates -40°C (-40°F).
- If there is a short circuit, the intelligent tester indicates 140°C (284°F) or more.

B	GO TO STEP 4
C	CHECK FOR INTERMITTENT PROBLEMS

A

2 READ VALUE OF INTELLIGENT TESTER (CHECK FOR OPEN IN HARNESS)



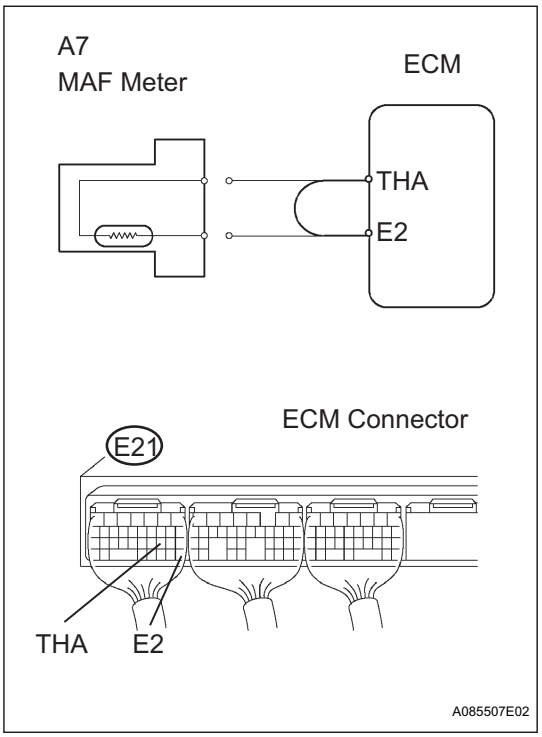
(a) Disconnect the A7 MAF meter connector.
(b) Connect terminals THA and E2 of the A7 MAF meter wire harness side connector.
(c) Turn the ignition switch to the ON position.
(d) Select the following menu items: Powertrain / Engine and ECT / Data List / Intake Air. Read the values.
OK:
Temperature value: 140°C (284°F) or more
(e) Connect the connector.

NG	GO TO STEP 3

OK

REPLACE MASS AIR FLOW METER

3	READ VALUE OF INTELLIGENT TESTER (CHECK FOR OPEN IN ECM)



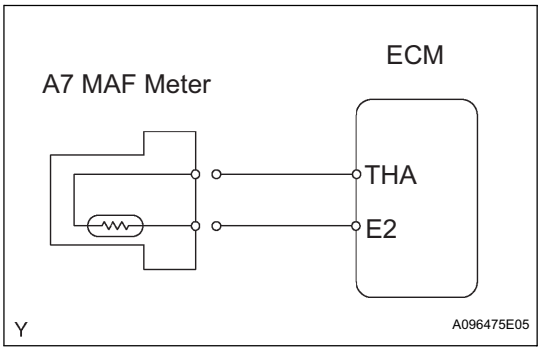
(a) Disconnect the A7 MAF meter connector.
(b) Connect terminals THA and E2 of the E21 ECM connector.
HINT:
Before checking, perform a visual and contact pressure check for the ECM connector.
(c) Turn the ignition switch to the ON position.
(d) Select the following menu items: Powertrain / Engine and ECT / Data List / intake Air. Read the values.
OK:
Temperature value: 140°C (284°F) or more
(e) Connect the connector.

NG → **REPLACE ECM**

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

4	READ VALUE OF INTELLIGENT TESTER (CHECK FOR SHORT IN HARNESS)



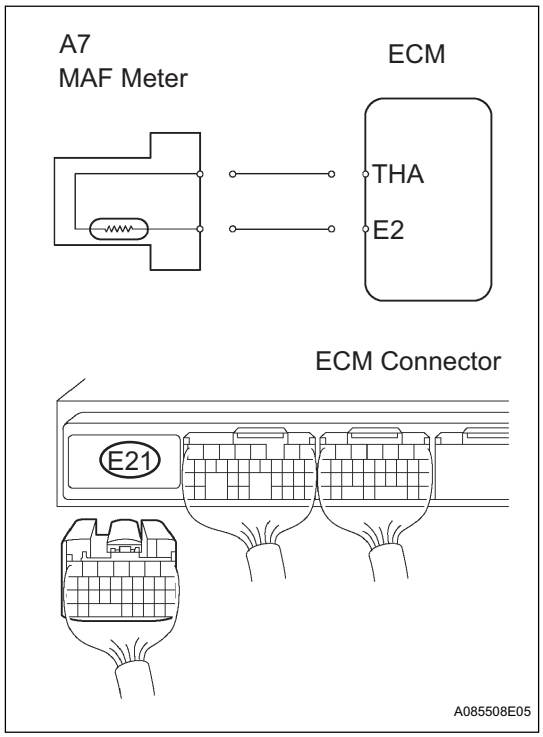
(a) Disconnect the A7 MAF meter connector.
(b) Turn the ignition switch to the ON position.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Intake Air. Read the values.
OK:
Temperature value: -40°C (-40°F)
(d) Connect the connector.

NG → **GO TO STEP 5**

OK

REPLACE MASS AIR FLOW METER

5	READ VALUE OF INTELLIGENT TESTER (CHECK FOR SHORT IN ECM)



(a) Disconnect the A7 MAF meter connector.
(b) Disconnect the E21 ECM connector.
(c) Turn the ignition switch to the ON position.
(d) Select the following menu items: Powertrain / Engine and ECT / Data List / Intake Air. Read the values.
OK:
Temperature value: -40°C (-40°F)
(e) Connect the connectors.

NG → **REPLACE ECM**

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

DTC	P0115	Engine Coolant Temperature Circuit

DTC	P0117	Engine Coolant Temperature Circuit Low Input

DTC	P0118	Engine Coolant Temperature Circuit High Input

DESCRIPTION

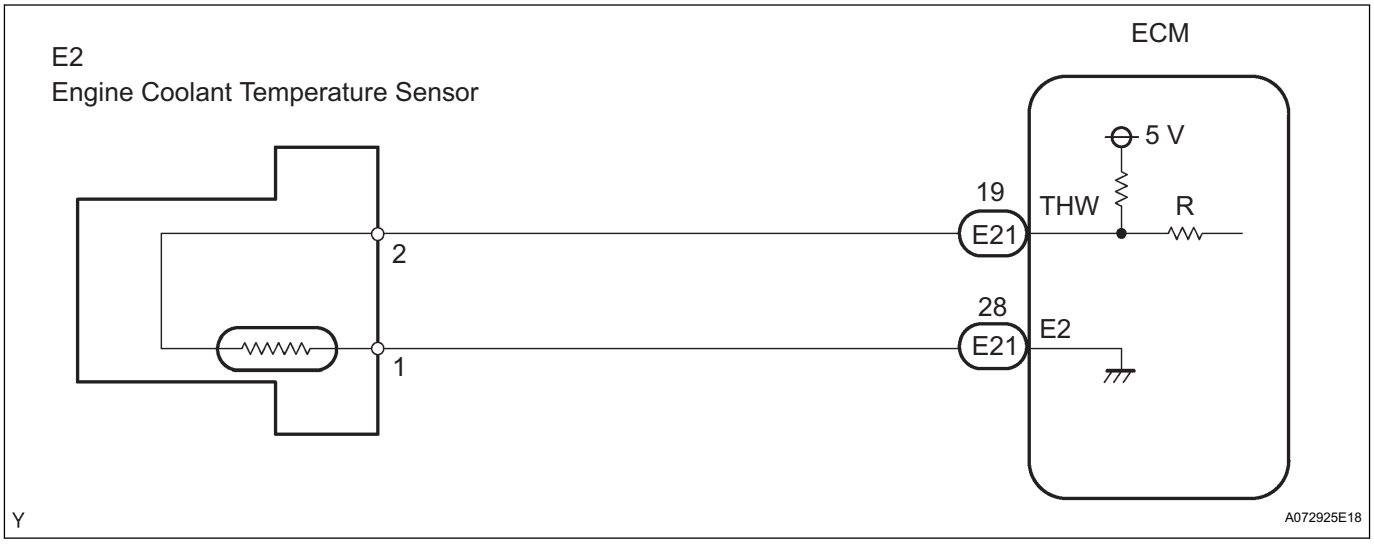
A thermistor is built into the Engine Coolant Temperature (ECT) sensor and changes the resistance value according to the engine coolant temperature.
The structure of the sensor and connection to the ECM are the same as the Intake Air Temperature (IAT) sensor.
HINT:
If the ECM detects the DTC P0115, P0117 or P0118, it operates the fail-safe function in which the ECT is assumed to be 80°C (176°F).

DTC No.	Proceed to	DTC Detection Condition	Trouble Area
P0115	Step 1	Open or short in ECT sensor circuit for 0.5 seconds (1 trip detection logic)	• Open or short in ECT sensor circuit • ECT sensor • ECM
P0117	Step 4	Short in ECT sensor circuit for 0.5 seconds (1 trip detection logic)	• Short in ECT sensor circuit • ECT sensor • ECM
P0118	Step 2	Open in ECT sensor circuit for 0.5 seconds (1 trip detection logic)	• Open in ECT sensor circuit • ECT sensor • ECM

HINT:
When DTC P0115, P0117 or P0118 is detected, check the engine coolant temperature by selecting Powertrain / Engine and ECT / Data List / Coolant Temp on the intelligent tester.

Temperature Displayed	Malfunction
-40°C (-40°F)	Open circuit
140°C (284°F) or more	Short circuit

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTCs that are related to different systems are output simultaneously while terminal E2 is used as a ground terminal, terminal E2 may have an open circuit.
- Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	READ VALUE OF INTELLIGENT TESTER (ENGINE COOLANT TEMPERATURE)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position. Turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Coolant Temp. Read the values.
Temperature:
Same value as the actual engine coolant temperature.

Result

Temperature Displayed	Proceed to
-40°C (-40°F)	A
140°C (284°F) or more	B
OK (same as present temperature)	C

HINT:

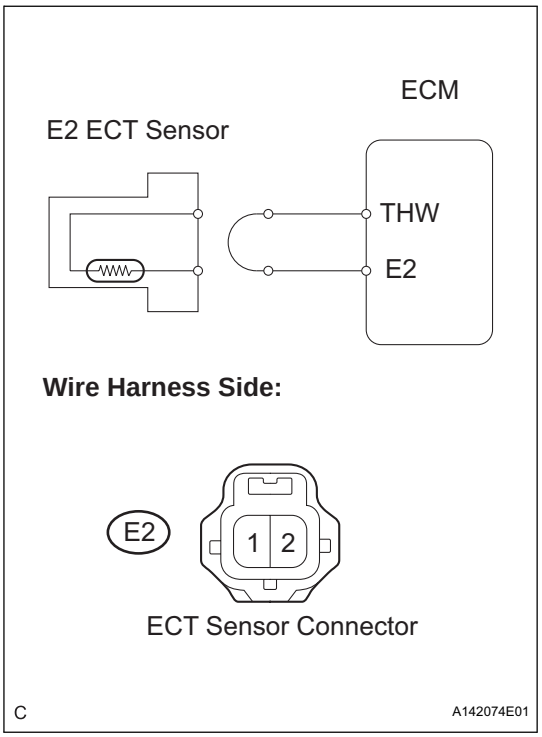
- If there is an open circuit, the intelligent tester indicates -40°C (-40°F).
- If there is a short circuit, the intelligent tester indicates 140°C (284°F) or more.

B → GO TO STEP 4

C → CHECK FOR INTERMITTENT PROBLEMS

A

2	READ VALUE OF INTELLIGENT TESTER (CHECK FOR OPEN IN WIRE HARNESS)



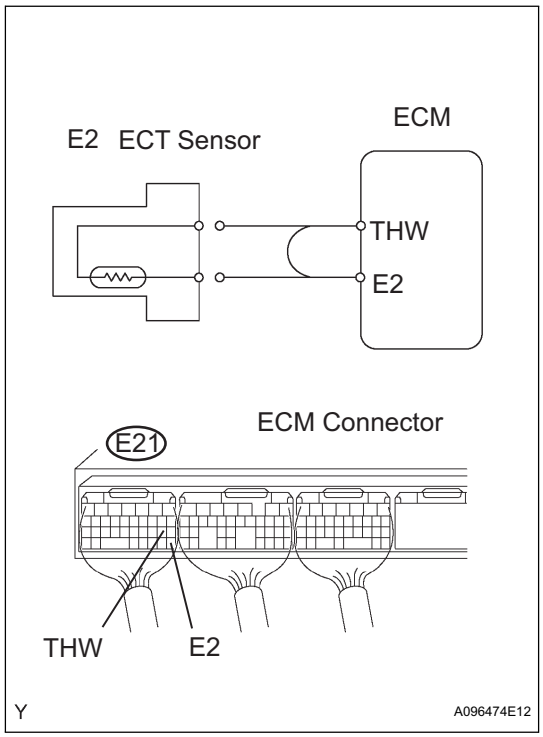
(a) Disconnect the E2 ECT sensor connector.
(b) Connect terminals 1 and 2 of the E2 ECT sensor wire harness side connector.
(c) Turn the ignition switch to the ON position.
(d) Select the following menu items: Powertrain / Engine and ECT / Data List / Coolant Temp. Read the values.
OK:
Temperature value: 140°C (284°F) or more
(e) Connect the connector.

NG → **GO TO STEP 3**

OK

REPLACE ENGINE COOLANT TEMPERATURE SENSOR

3	READ VALUE OF INTELLIGENT TESTER (CHECK FOR OPEN IN ECM)



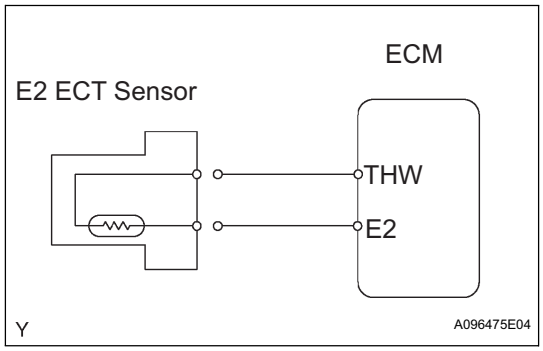
(a) Disconnect the E2 ECT sensor connector.
(b) Connect terminals THW and E2 of the E21 ECM connector.
HINT:
Before checking, perform a visual and contact pressure check for the ECM connector.
(c) Turn the ignition switch to the ON position.
(d) Select the following menu items: Powertrain / Engine and ECT / Data List / Coolant Temp. Read the values.
OK:
Temperature value: 140°C (284°F) or more
(e) Connect the connector.

NG → **REPLACE ECM**

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

4	READ VALUE OF INTELLIGENT TESTER (CHECK FOR SHORT IN WIRE HARNESS)



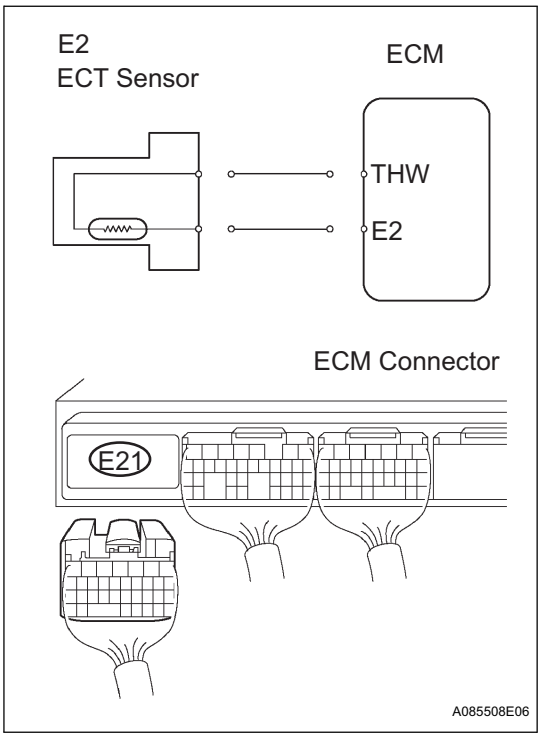
(a) Disconnect the E2 ECT sensor connector.
(b) Turn the ignition switch to the ON position.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Coolant Temp. Read the values.
OK:
Temperature value: -40°C (-40°F)
(d) Connect the connector.

NG → **GO TO STEP 5**

OK

REPLACE ENGINE COOLANT TEMPERATURE SENSOR

5	READ VALUE OF INTELLIGENT TESTER (CHECK FOR SHORT IN ECM)



(a) Disconnect the E2 ECT sensor connector.
(b) Disconnect the E21 ECM connector.
(c) Turn the ignition switch to the ON position.
(d) Select the following menu items: Powertrain / Engine and ECT / Data List / Coolant Temp. Read the values.
OK:
Temperature value: -40°C (-40°F)
(e) Connect the connectors.

NG → **REPLACE ECM**

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

DTC	P0116	Engine Coolant Temperature Circuit Range / Performance Problem

DESCRIPTION

A thermistor is built into the Engine Coolant Temperature (ECT) sensor and changes the resistance value according to the engine coolant temperature.
The structure of the sensor and connection to the ECM are the same as the Intake Air Temperature (IAT) sensor.
HINT:
If the ECM detects the DTC P0115, P0117 or P0118, it operates the fail-safe function in which the ECT is assumed to be 80°C (176°F).

DTC No.	DTC Detection Condition	Trouble Area
P0116	If the engine coolant temperature is between -40°C (-40°F) and 60°C (140°F) at engine start, and conditions (a) and (b) are met (2 trip detection logic): (a) Vehicle is driven at varying speeds (under acceleration and deceleration) (b) Engine coolant temperature remains within 3°C (5.4°F) of the engine starting temperature	Engine coolant temperature sensor

INSPECTION PROCEDURE

HINT:

- If DTCs P0115/22, P0116, P0117/22 and P0118/22 are output simultaneously, the engine coolant temperature sensor circuit may be open or short. Perform troubleshooting on DTC P0115/22, P0117/22 or P0118/22 first.
- Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	REPLACE ENGINE COOLANT TEMPERATURE SENSOR

NEXT

END

DTC	P0120	Throttle / Pedal Position Sensor / Switch "A" Circuit Malfunction
DTC	P0122	Throttle / Pedal Position Sensor / Switch "A" Circuit Low Input
DTC	P0123	Throttle / Pedal Position Sensor / Switch "A" Circuit High Input
DTC	P0220	Throttle / Pedal Position Sensor / Switch "B" Circuit Malfunction
DTC	P0222	Throttle / Pedal Position Sensor / Switch "B" Circuit Low Input
DTC	P0223	Throttle / Pedal Position Sensor / Switch "B" Circuit High Input
DTC	P2135	Throttle / Pedal Position Sensor / Switch "A" / "B" Voltage Correlation

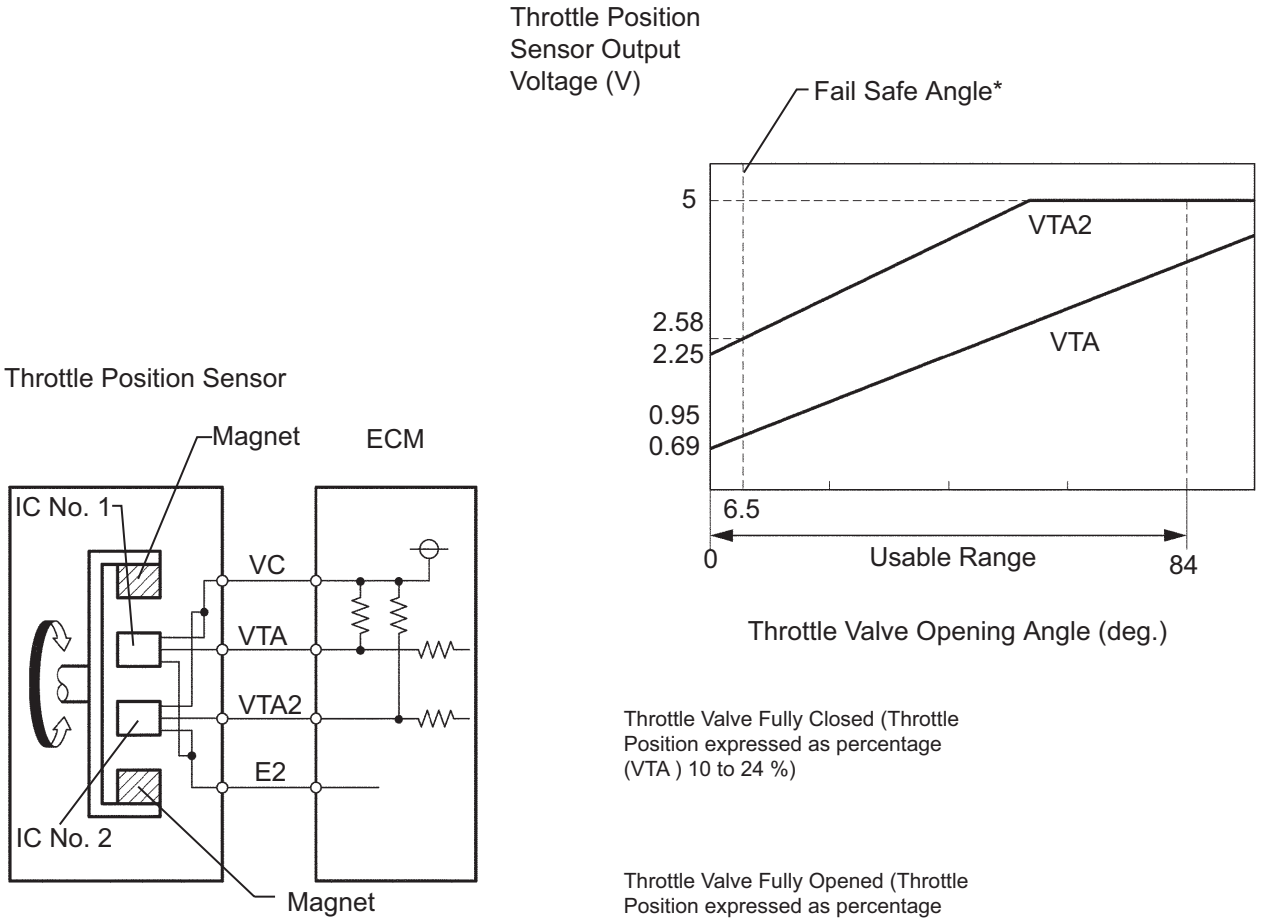
DESCRIPTION

HINT:

- This Electronic Throttle Control System (ETCS) does not use a throttle cable.
- This throttle position sensor is a non-contact type.

The throttle position sensor is mounted on the throttle body and it detects the opening angle of the throttle valve. This sensor is electronically controlled and uses Hall-effect elements, so that accurate control and reliability can be obtained. The throttle position sensor has 2 sensor elements/signal outputs: VTA and VTA2. VTA is used to detect the throttle opening angle and VTA2 is used to detect malfunctions in VTA. Voltage applied to VTA and VTA2 changes between 0 V and 5 V in proportion to the opening angle of the throttle valve. There are several checks that the ECM performs to confirm proper operation of the throttle position sensor and VTA.

The ECM judges the current opening angle of the throttle valve from these signals input from terminals VTA and VTA2, and the ECM controls the throttle motor to make the throttle valve angle properly in response to driver inputs.



Throttle Valve Fully Closed (Throttle Position expressed as percentage (VTA) 10 to 24 %)

Throttle Valve Fully Opened (Throttle Position expressed as percentage (VTA) 64 to 96 %)

*: Fail Safe Angle 6.5° (Throttle Position expressed as percentage (VTA) about 16 %)

DTC No.	DTC Detection Condition	Trouble Area
Condition (1) of DTC P0120, P0122, P0123, P0220, P0222 or P0223 continues for 2 seconds (open or short in the throttle position sensor circuit)		
P0120	Detection conditions for DTCs P0122 and P0123 are not satisfied but condition (1) is satisfied (1) VTA is 0.2 V or less or VTA1 is 4.8 V or more (1 trip detection logic)	• Throttle position sensor (built into throttle body) • ECM
P0122	(1) VTA is 0.2 V or less (1 trip detection logic)	• Throttle position sensor (built into throttle body) • Short in VTA1 circuit • Open in VC circuit • ECM
P0123	(1) VTA is 4.8 V or more (1 trip detection logic)	• Throttle position sensor (built into throttle body) • Open in VTA1 circuit • Open in E2 circuit • Short in VC and VTA1 circuits • ECM

DTC No.	DTC Detection Condition	Trouble Area
Condition (1) of DTC P0120, P0122, P0123, P0220, P0222 or P0223 continues for 2 seconds (open or short in the throttle position sensor circuit)		
P0220	Detection conditions for DTCs P0222 and P0223 are not satisfied but condition (1) is satisfied (1) VTA2 is 0.5 V or less or VTA2 is 4.8 V or more (1 trip detection logic)	• Throttle position sensor (built into throttle body) • ECM
P0222	(1) VTA2 is 0.5 V or less (1 trip detection logic)	• Throttle position sensor (built into throttle body) • Short in VTA2 circuit • Open in VC circuit • ECM
P0223	(1) VTA2 is 4.8 V or more and VTA is 0.2 V or more and VTA is 1.8 V or less (1 trip detection logic)	• Throttle position sensor (built into throttle body) • Open in VTA2 circuit • Open in E2 circuit • Short in VC and VTA2 circuits • ECM
P2135	Condition (1) continues for 0.5 seconds or more, or condition (2) continues for 0.4 seconds or more: (1) Difference between VTA and VTA2 is 0.02 V or less (2) VTA is 0.2 V or less and VTA2 is 0.5 V or less (1 trip detection logic)	• Short in VTA1 and VTA2 circuits • Throttle position sensor (built into throttle body) • ECM

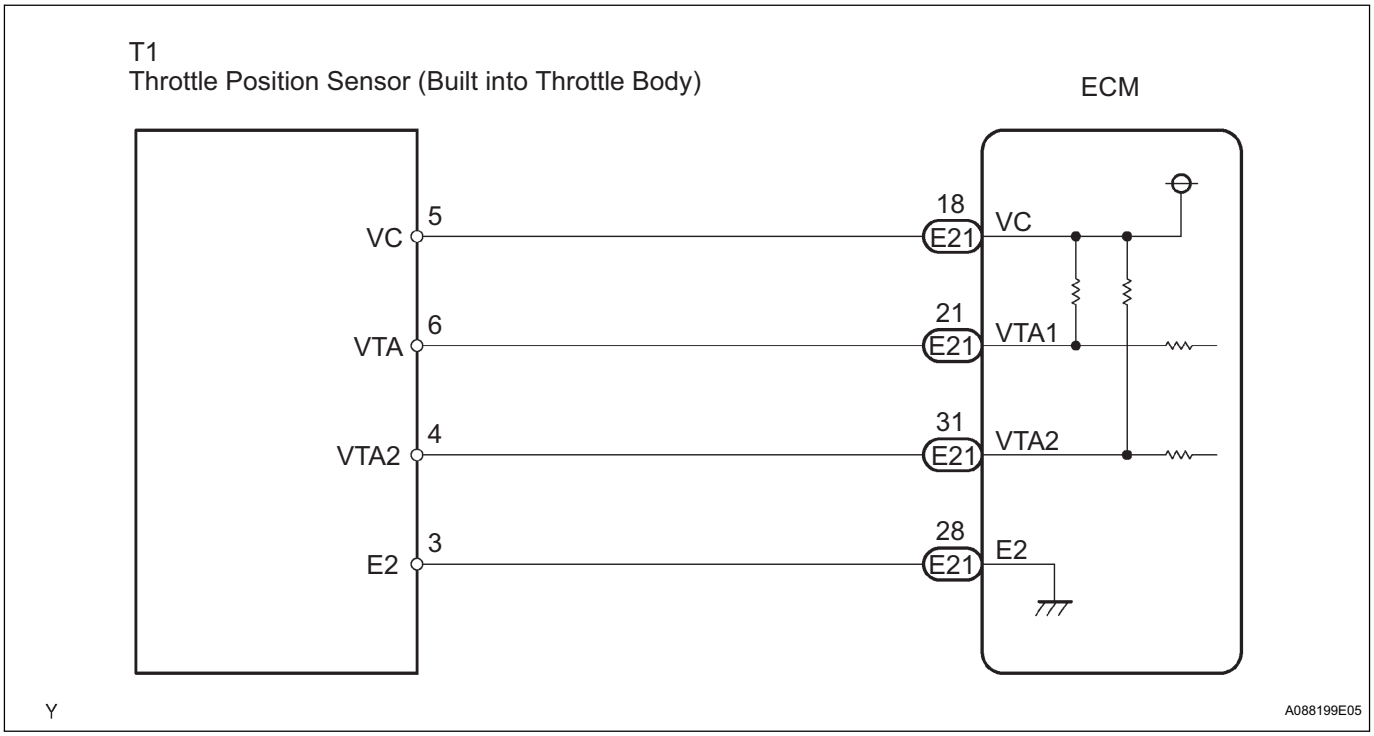
HINT:

- After confirming DTCs, use the intelligent tester to confirm the throttle valve opening percentage and closed throttle position switch condition.
- "Throttle POS" is the VTA signal. "Throttle POS No. 2" is the VTA2 signal.

Reference (Normal condition):

Tester Display	Accelerator Pedal Fully Released	Accelerator Pedal Fully Depressed
Throttle POS	10 to 24 %	64 to 96 %
Throttle POS No. 2	2.1 to 3.1 V	4.5 to 5.5 V

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTCs that are related to different systems are output simultaneously while terminal E2 is used as a ground terminal, terminal E2 may have an open circuit.
- Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	READ VALUE OF INTELLIGENT TESTER (THROTTLE POS AND THROTTLE POS NO. 2)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position. Turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Throttle POS and Throttle POS No. 2. Read the values.

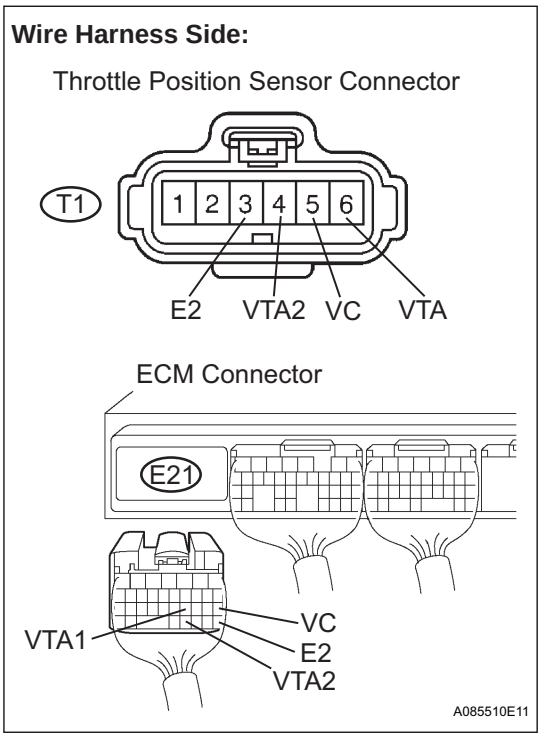
Result

Throttle position expressed as percentage and voltage				Trouble Area	Proceed to
Accelerator pedal released		Accelerator pedal depressed			
Throttle POS (VTA1)	Throttle POS No. 2 (VTA2)	Throttle POS (VTA1)	Throttle POS No. 2 (VTA2)		
0 %	0 to 0.2 V	0 %	0 to 0.2 V	VC circuit open	A
100 %	4.5 to 5.5 V	100 %	4.5 to 5.5 V	E2 circuit open	A
0 % or 100 %	2.1 to 3.1 V (fail safe)	0 % or 100 %	2.1 to 3.1 V (fail safe)	VTA circuit open or ground short	A
about 16 % (fail safe)	0 to 0.2 or 4.5 to 5.5 V	about 16 % (fail safe)	0 to 0.2 or 4.5 to 5.5 V	VTA2 circuit open or ground short	A
10 to 24 %	2.1 to 3.1 V	64 to 96 % (not fail safe)	4.5 to 5.5 V (not fail safe)	Throttle position sensor circuit is normal	B

B → GO TO STEP 5

A

2 CHECK HARNESS AND CONNECTOR (THROTTLE POSITION SENSOR - ECM)



(a) Disconnect the T1 throttle position sensor connector.
(b) Disconnect the E21 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
T1-5 (VC) - E21-18 (VC) T1-6 (VTA) - E21-21 (VTA1) T1-4 (VTA2) - E21-31 (VTA2) T1-3 (E2) - E21-28 (E2)	Below 1 Ω

Check for short

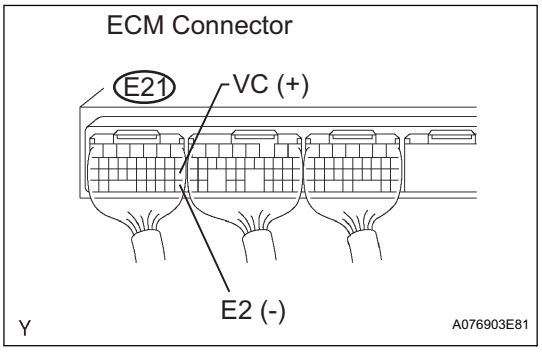
Tester Connection	Specified Condition
T1-5 (VC) or E21-18 (VC) - Body ground T1-6 (VTA) or E21-21 (VTA1) - Body ground T1-4 (VTA2) or E21-31 (VTA2) - Body ground	10 kΩ or higher

(d) Connect the connectors.

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

OK

3 INSPECT ECM (VC VOLTAGE)



(a) Disconnect the T1 throttle position sensor connector.
(b) Turn the ignition switch to the ON position.
(c) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
E21-18 (VC) - E21-28 (E2)	4.5 to 5.5 V

(d) Connect the connector.

NG → **REPLACE ECM**

OK

4 REPLACE THROTTLE BODY ASSEMBLY

NEXT

5 READ OUTPUT DTC (THROTTLE POSITION SENSOR DTCS ARE OUTPUT AGAIN)

(a) Clear the DTC (See page ES-16).
(b) Start the engine.
(c) Run the engine at idle for 15 seconds or more.

(d) Read the DTC.

Result

Display (DTC Output)	Proceed to
P0120, P0122, P0123, P0220, P0222, P0223 and/or P2135 are output again	A
No DTC output	B

B → **SYSTEM OK**

A → **REPLACE ECM**

DTC	P0121	Throttle / Pedal Position Sensor / Switch "A" Circuit Range / Performance Problem

DESCRIPTION

Refer to DTC P0120 (See page ES-66).

DTC No.	DTC Detection Condition	Trouble Area
P0121	Condition (1) continues for 2.0 seconds: (1) Difference between VTA1 and VTA2 deviates from threshold (1 trip detection logic)	Throttle position sensor

INSPECTION PROCEDURE

HINT:

Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	REPLACE THROTTLE POSITION SENSOR

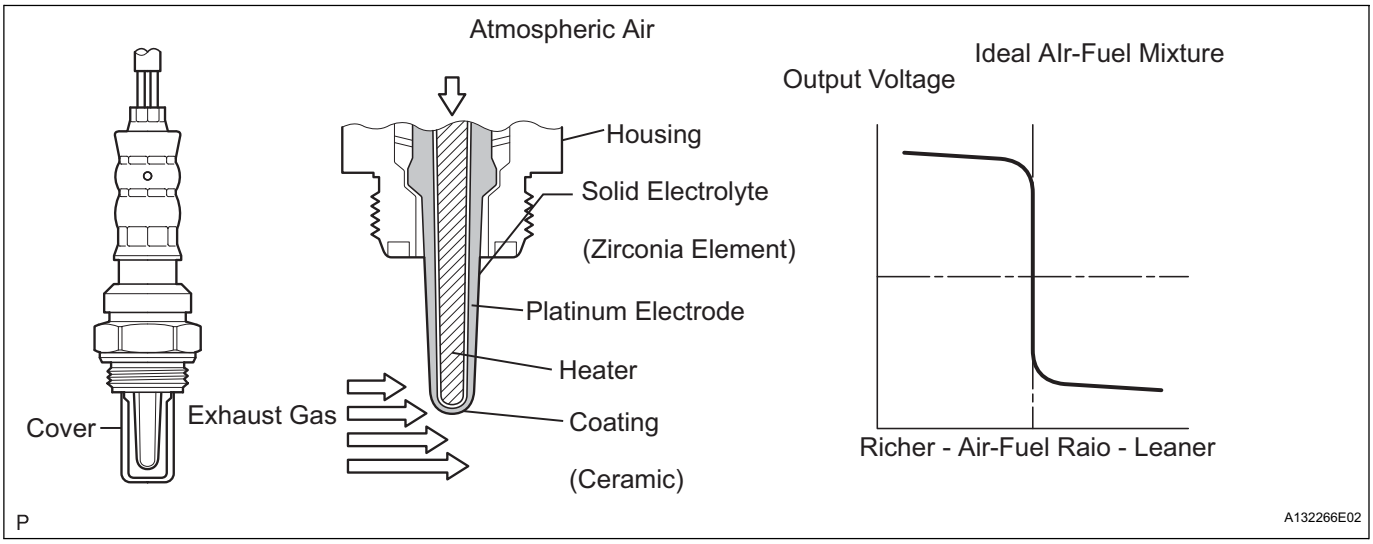
NEXT

END

DTC	P0136	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)

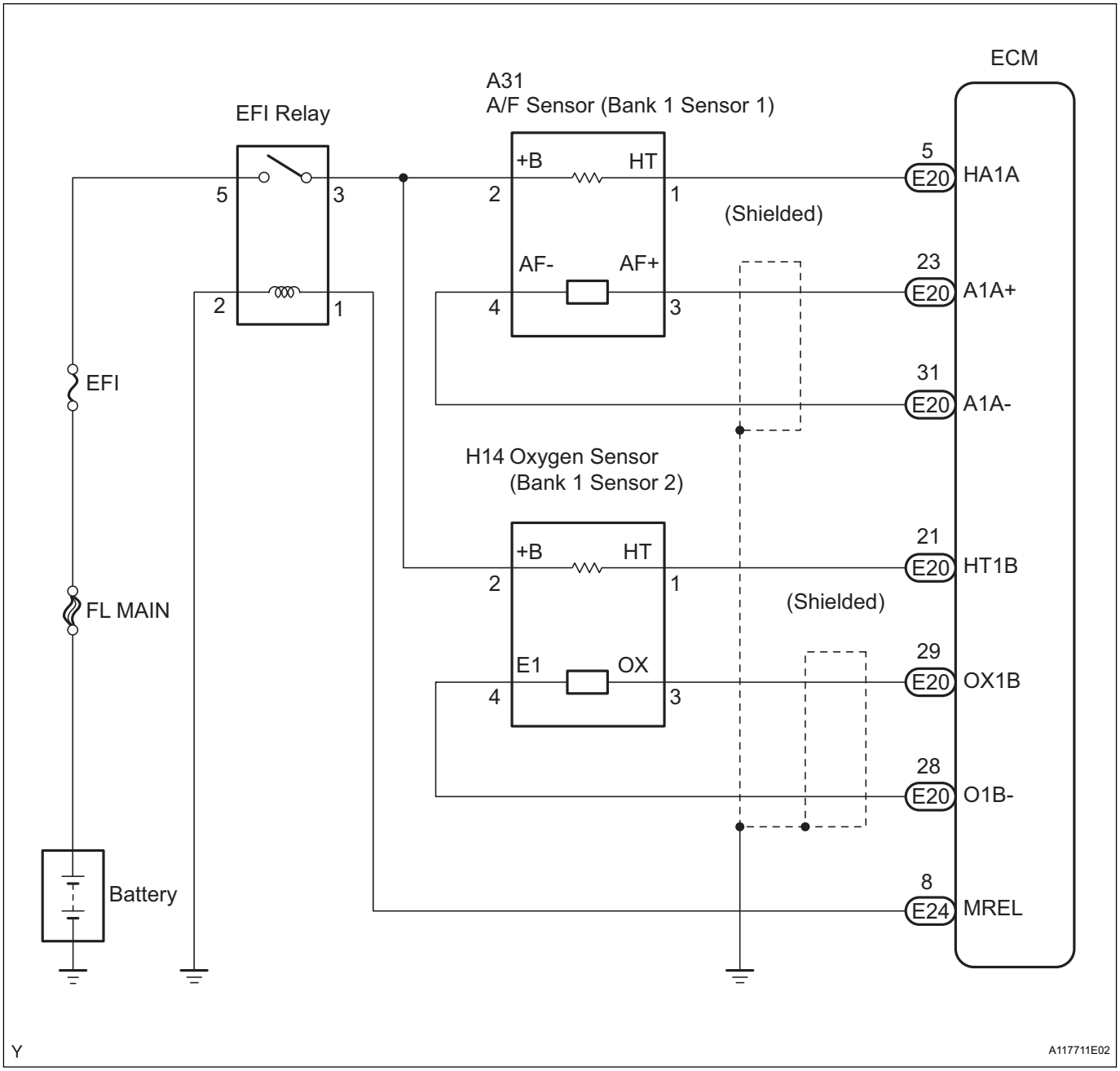
DESCRIPTION

A three-way catalytic converter (TWC) is used in order to convert the carbon monoxide (CO), hydrocarbons (HC), and nitrogen oxides (Nox) into less harmful substances. To allow the TWC to function effectively, it is necessary to keep the air-fuel ratio of the engine near the stoichiometric air-fuel ratio.
The voltage output by a heated oxygen sensor changes suddenly in the vicinity of the stoichiometric air-fuel ratio. This voltage change is used to detect the oxygen concentration in the exhaust gas, and to provide feedback that the ECM can use to control the air-fuel ratio.
When the air-fuel ratio is lean, the oxygen content in the exhaust gas is high. The output of the oxygen sensor will be low (less than 0.45 volts). This low voltage is used by the ECM to determine that the air-fuel ratio is on the lean side of a stoichiometric ratio.
When the air-fuel ratio is rich, the oxygen content in the exhaust gas is low. The output of the oxygen sensor will be high (more than 0.45 volts). This high voltage is used by the ECM to determine that the air-fuel ratio is on the rich side of a stoichiometric ratio.
Based on the voltage output by the heated oxygen sensor, the ECM judges whether the air-fuel ratio is rich or lean, and makes adjustments to the injection duration to compensate. If the heated oxygen sensor malfunctions, and an abnormal voltage is output, the ECM will be unable to perform accurate air-fuel ratio control.
The heated oxygen sensor includes a heater for the zirconia element. The heater is controlled by the ECM. When the intake air volume is low, the temperature of the exhaust gas will be low. At this time, current is provided to the heater to allow accurate oxygen concentration detection.

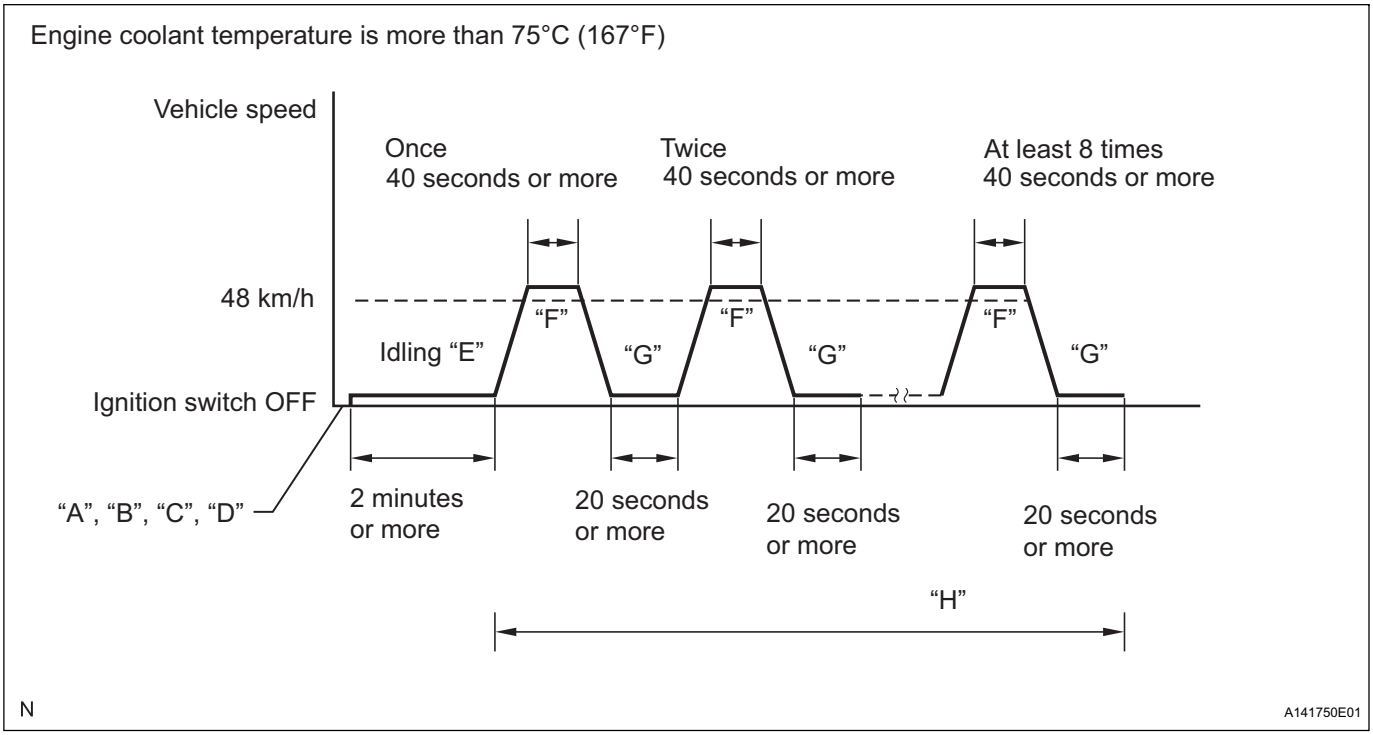


DTC No.	DTC Detection Condition	Trouble Area
P0136	The following condition (a) or (b) continues for 8 minutes: (a) Heated oxygen sensor voltage does not change (b) Heated oxygen sensor voltage is extremely low (2 trip detection logic)	• Open or short in heated oxygen sensor (sensor 2) circuit • Heated oxygen sensor (sensor 2) • Heated oxygen sensor heater (sensor 2) • A/F sensor (sensor 1) • EFI relay

WIRING DIAGRAM



CONFIRMATION DRIVING PATTERN



1. Connect the intelligent tester to the DLC3. (Procedure "A")
2. Turn the ignition switch to the ON position and turn the intelligent tester ON. (Procedure "B")
3. Switch the ECM from normal mode to check mode using the intelligent tester. (Procedure "C")
4. Start the engine. (Procedure "D")
5. Allow the engine to idle for 2 minutes. (Procedure "E")
6. Warm up the engine until the engine coolant temperature reaches more than 75°C (167°F).
7. Drive the vehicle at 48 km/h or more for 40 seconds or more. (Procedure "F")
8. Stop the vehicle and allow the engine to idle for 20 seconds or more. (Procedure "G")
9. Repeat the procedures "F" and "G" at least 8 times in one driving cycle. (Procedure "H")

HINT:
If a malfunction exists, the MIL will be illuminated during procedure "H".

NOTICE:
If the conditions in this test are not strictly followed, no malfunction will be detected. If you do not have the intelligent tester, turn the ignition switch OFF after performing procedures from "E" to "H", then perform procedures from "E" to "H" again.

INSPECTION PROCEDURE

HINT:
Intelligent tester only:
Malfunctioning areas can be found by performing the Active Test / A/F control operation. The A/F control operation can determine if the A/F sensor, heated oxygen sensor or other potential trouble areas are malfunctioning or not.

1. Perform Active Test using the intelligent tester.

HINT:
The A/F Control operation lowers the injection volume by 12.5 % or increases the injection volume by 25 %.

(a) Connect the intelligent tester to the DLC3.
(b) Start the engine and turn the intelligent tester ON.
(c) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds.
(d) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.

(e) Select the following monitor items: AFS B1 S1 and O2S B1 S2.
(f) Perform the A/F control operation with the engine in an idling condition (press the right or left button).

Result:

The A/F sensor reacts in accordance with increase and decrease of the injection volume:

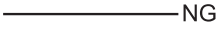
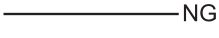
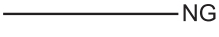
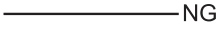
+25 % → Rich output: Less than 3.0 V
-12.5 % → Lean output: More than 3.35 V

The heated oxygen sensor reacts in accordance with increase and decrease of the injection volume:

+25 % → Rich output: More than 0.55 V
-12.5 % → Lean output: Less than 0.4 V

NOTICE:

The A/F sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

Case	Output Voltage of A/F Sensor (Sensor 1)		Output Voltage of Heated Oxygen Sensor (Sensor 2)		Main Suspected Trouble Area
1	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		-
	Output Voltage More than 3.35 V Less than 3.0 V		Output Voltage More than 0.55 V Less than 0.4 V		
2	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		A/F sensor (A/F sensor, sensor heater, sensor circuit)
	Output Voltage Almost no reaction		Output Voltage More than 0.55 V Less than 0.4 V		
3	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		Heated oxygen sensor (Heated oxygen sensor, sensor heater, sensor circuit)
	Output Voltage More than 3.35 V Less than 3.0 V		Output Voltage Almost no reaction		
4	Injection volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		Extremely rich or lean actual air-fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)
	Output Voltage Almost no reaction		Output Voltage Almost no reaction		

Following A/F control procedure enables the technician to check and graph the voltage output of both A/F sensor and heated oxygen sensor.
To display the graph, select the following menu items on the tester: View / Line graph.
HINT:

- Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.
- A low A/F sensor voltage could be caused by a rich air-fuel mixture. Check the conditions that would cause the engine to run rich.

- A high A/F sensor voltage could be caused by a lean air-fuel mixture. Check the conditions that would cause the engine to run lean.

1	CHECK DTC OUTPUT (IN ADDITION TO DTC P0136)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
Only P0136	A
P0136 and other DTCs	B

HINT:
If any DTCs other than P0136 are output, perform the troubleshooting for those DTCs first.

B → **GO TO DTC CHART (See page ES-23)**

A

2	READ VALUE OF INTELLIGENT TESTER (OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

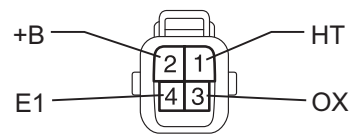
(a) After warming up the engine, run the engine at 2,500 rpm for 3 minutes.
(b) Read the output voltage of the heated oxygen sensor when the engine rpm is suddenly increased.
HINT:
Quickly accelerate to 4,000 rpm 3 times by using the accelerator pedal.
Standard voltage:
Fluctuates between 0.4 V or less and 0.5 V or more.

OK → **GO TO STEP 6**

NG

3	INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)

Component Side:



Front View
Heated Oxygen Sensor
A135620E01

(a) Disconnect the H14 heated oxygen sensor connector.
(b) Measure the resistance according to the value(s) in the table below.
Standard resistance

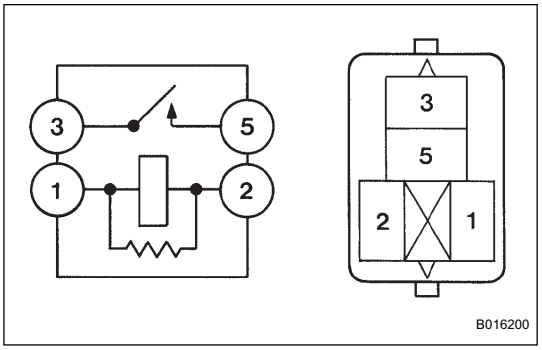
Tester Connection	Specified Condition
1 (HT) - 2 (+B)	11 to 16 Ω at 20°C (68°F)
1 (HT) - 4 (E1)	10 kΩ or higher

(c) Connect the connector.

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

4 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room J/B.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

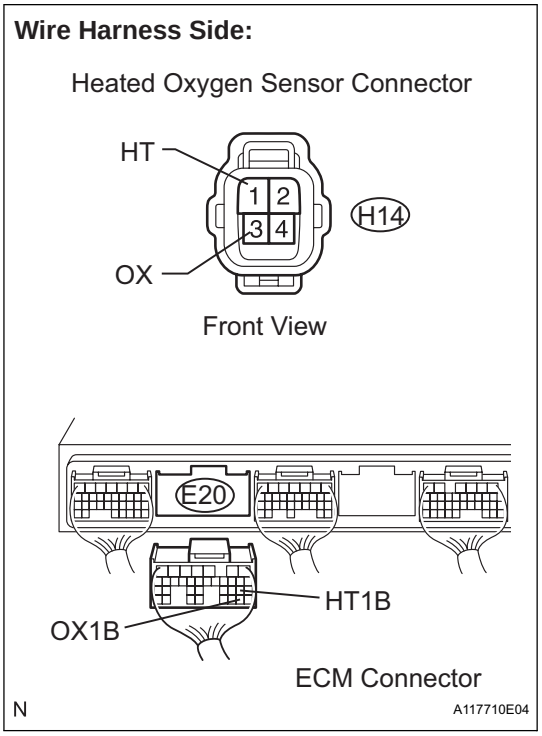
Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the EFI relay.

NG → **REPLACE EFI RELAY**

OK

5 CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - ECM)



(a) Disconnect the H14 heated oxygen sensor connector.
(b) Disconnect the E20 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

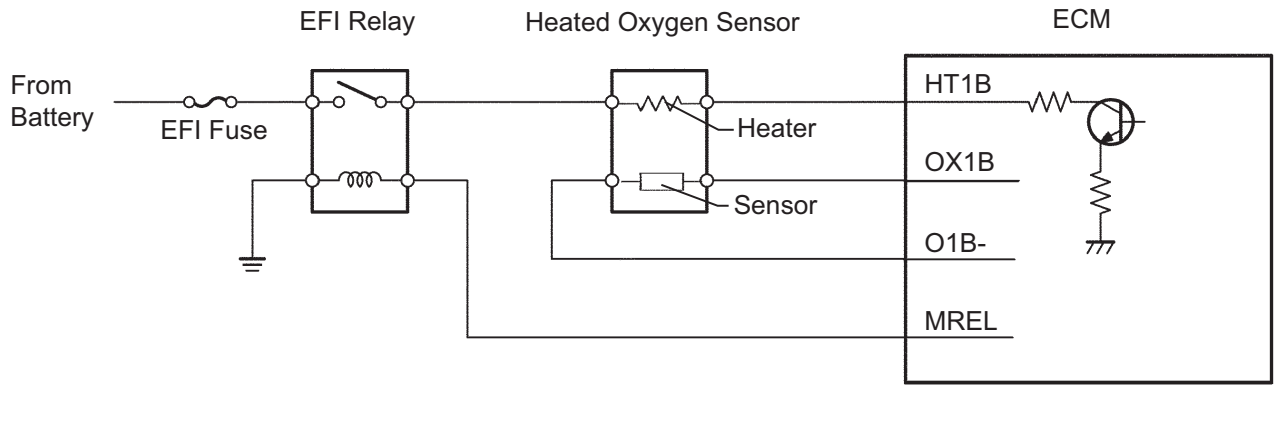
Tester Connection	Specified Condition
OX (H14-3) - OX1B (E20-29)	Below 1 Ω
HT (H14-1) - HT1B (E20-21)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
OX (H14-3) or OX1B (E20-29) - Body ground	10 kΩ or higher
HT (H14-1) or HT1B (E20-21) - Body ground	10 kΩ or higher

(d) Connect the connectors.

Reference:



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

OK

REPLACE HEATED OXYGEN SENSOR

6	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

NEXT

7	CHECK IF DTC RECURS (DTC P0136)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
Only P0136	A
No output	B

B → **CHECK FOR INTERMITTENT PROBLEMS**

A

8	REPLACE HEATED OXYGEN SENSOR

NEXT

9	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

NEXT

10	CHECK IF DTC RECURS (DTC P0136)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
Only P0136	A
No output	B

B → END

A

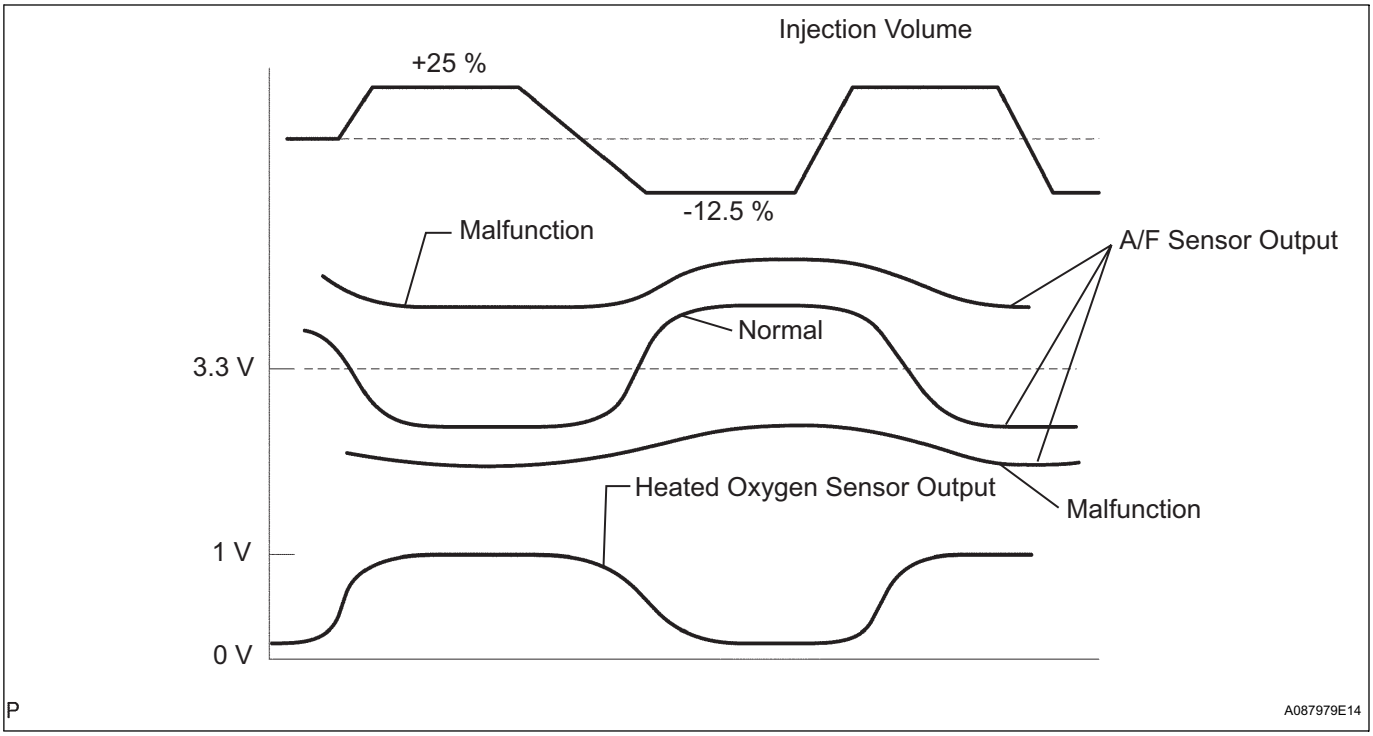
11	PERFORM ACTIVE TEST BY INTELLIGENT TESTER

HINT:
The A/F control operation lowers the injection volume by 12.5 % or increases the injection volume by 25 %.
(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds.
(d) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.
(e) Select the following monitor items: AFS B1 S1 and O2S B1 S2.
(f) Perform the A/F control operation with the engine in an idling condition (press the right or left button).
Result:
The A/F sensor reacts in accordance with increase and decrease of the injection volume:
+25 % → Rich output: Less than 3.0 V
-12.5 % → Lean output: More than 3.35 V

The heated oxygen sensor reacts in accordance with increase and decrease of the injection volume:

+25 % → Rich output: More than 0.55 V

-12.5 % → Lean output: Less than 0.4 V



NG → **REPAIR AIR FUEL RATIO SENSOR**

OK

REPAIR OR REPLACE EXTREMELY RICH OR LEAN ACTUAL AIR FUEL RATIO (INJECTOR, FUEL PRESSURE, GAS LEAKAGE IN EXHAUST SYSTEM, ETC.)

DTC	P0171	System Too Lean (Bank 1)

DTC	P0172	System Too Rich (Bank 1)

DESCRIPTION

The fuel trim is related to the feedback compensation value, not to the basic injection time. The fuel trim includes the short-term fuel trim and the long-term fuel trim.

The short-term fuel trim is the short-term fuel compensation used to maintain the air-fuel ratio at its ideal theoretical value. The signal from the heated oxygen sensor indicates whether the air-fuel ratio is rich or lean compared to the ideal theoretical value, triggering a reduction in the fuel volume if the air-fuel ratio is rich, and an increase in the fuel volume if it is lean.

The long-term fuel trim controls overall fuel compensation. The long-term fuel trim compensates for long term deviations of the fuel trim from the ideal theoretical value. These long term deviations result from the corrections made by the short-term fuel trim.

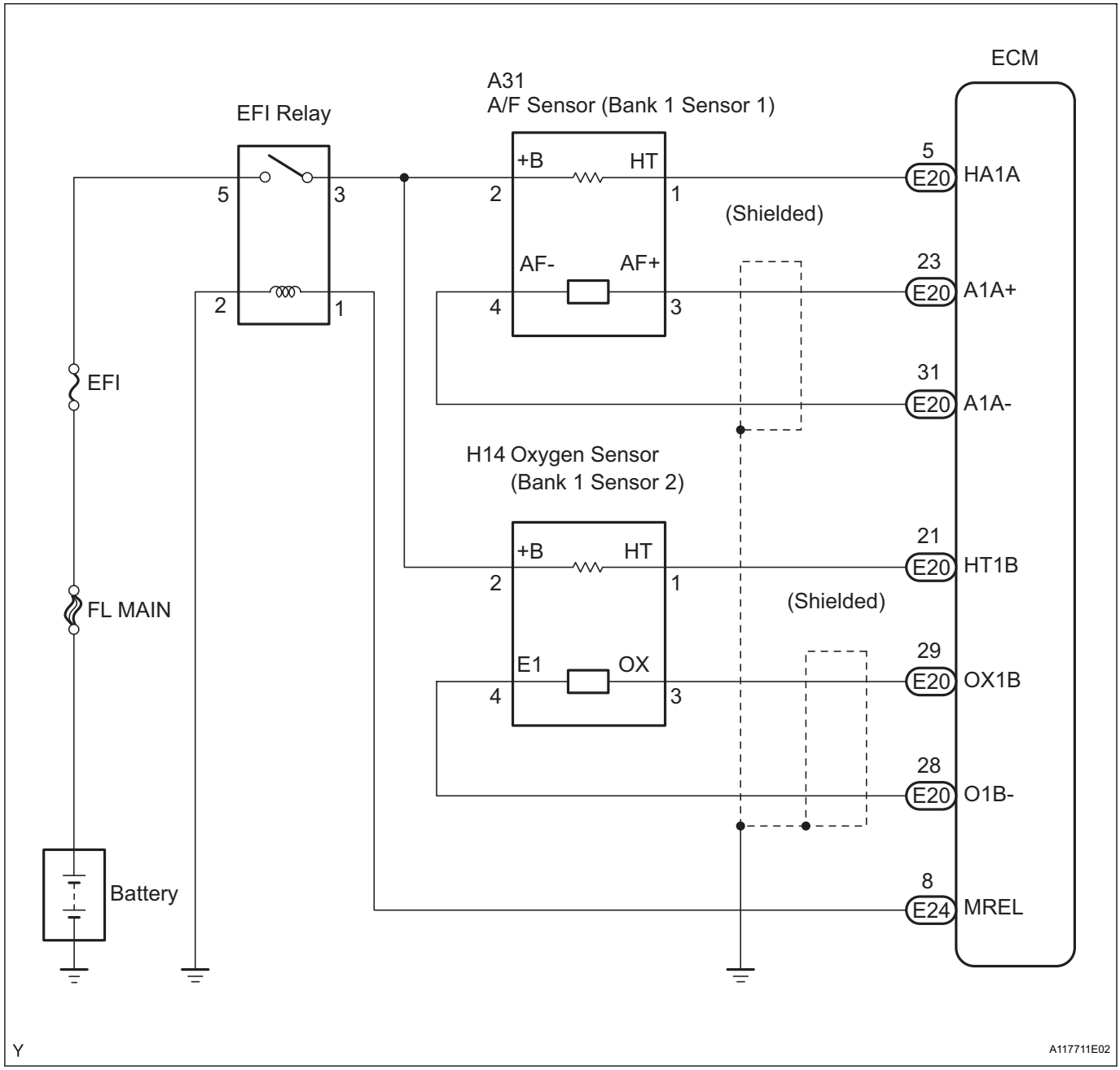
If both the short-term fuel trim and the long-term fuel trim are lean or rich beyond standard levels, it is detected as a malfunction in the SFI system. The ECM illuminates the MIL and the DTC is set.

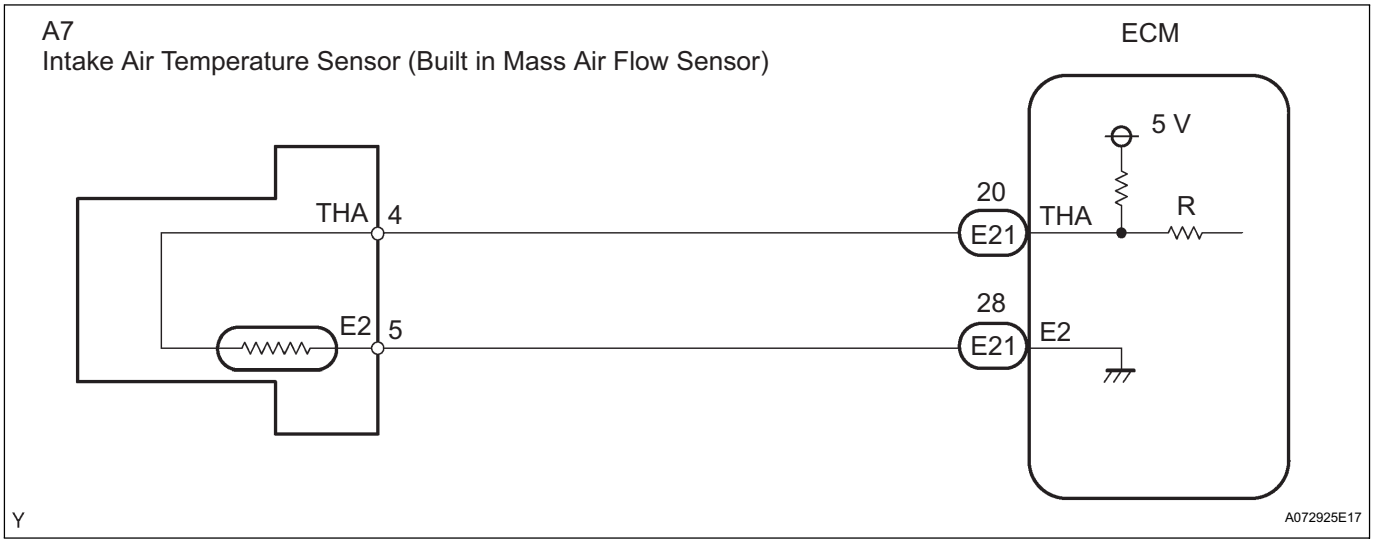
DTC No.	DTC Detection Condition	Trouble Area
P0171	When air-fuel ratio feedback is stable after warming up engine, fuel trim is considerably in error on lean side (2 trip detection logic)	• Air induction system • Injector blockage • Mass air flow meter • Engine coolant temperature sensor • Fuel pressure • Gas leakage in exhaust system • Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor heater (sensor 1) • A/F sensor heater relay • PCV valve and hose • PCV hose connection
P0172	When air-fuel ratio feedback is stable after warming up engine, fuel trim is considerably in error on rich side (2 trip detection logic)	• Injector blockage • Mass air flow meter • Engine coolant temperature sensor • Ignition system • Fuel pressure • Gas leakage in exhaust system • Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor heater • A/F sensor heater relay

HINT:

- When DTC P0171 is set, the actual air-fuel ratio is lean. When DTC P0172 is set, the actual air-fuel ratio is rich.
- If the vehicle runs out of fuel, the air-fuel ratio is lean and DTC P0171 may be set. The MIL then illuminates.
- If the total of the short-term fuel trim value and long-term fuel trim value is within +- 20 %, the system is functioning normally.

WIRING DIAGRAM





INSPECTION PROCEDURE

HINT:
Intelligent tester only:
Malfunctioning areas can be found by performing the Active Test / A/F Control operation. The A/F Control operation can determine if the A/F sensor, heated oxygen sensor or other potential trouble areas are malfunctioning or not.

1. Perform Active Test using the intelligent tester.

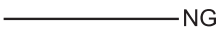
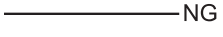
HINT:
The A/F Control operation lowers the injection volume by 12.5 % or increases the injection volume by 25 %.

(a) Connect the intelligent tester to the DLC3.
(b) Start the engine and turn the intelligent tester ON.
(c) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds.
(d) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.
(e) Select the following monitor items: AFS B1 S1 and O2S B1 S2.
(f) Perform the A/F control operation with the engine in an idling condition (press the right or left button).

Result:

The A/F sensor reacts in accordance with increase and decrease of the injection volume:
+25 % → Rich output: Less than 3.0 V
-12.5 % → Lean output: More than 3.35 V
The heated oxygen sensor reacts in accordance with increase and decrease of the injection volume:
+25 % → Rich output: More than 0.55 V
-12.5 % → Lean output: Less than 0.4 V

NOTICE:
The A/F sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

Case	Output Voltage of A/F Sensor (Sensor 1)		Output Voltage of Heated Oxygen Sensor (Sensor 2)		Main Suspected Trouble Area
1	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		-
	Output Voltage More than 3.35 V Less than 3.0 V		Output Voltage More than 0.55 V Less than 0.4 V		
2	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		A/F sensor (A/F sensor, sensor heater, sensor circuit)
	Output Voltage Almost no reaction		Output Voltage More than 0.55 V Less than 0.4 V		
3	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		Heated oxygen sensor (Heated oxygen sensor, sensor heater, sensor circuit)
	Output Voltage More than 3.35 V Less than 3.0 V		Output Voltage Almost no reaction		
4	Injection volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		Extremely rich or lean actual air-fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)
	Output Voltage Almost no reaction		Output Voltage Almost no reaction		

The following A/F control procedure enables the technician to check and graph the voltage output of both A/F sensor and heated oxygen sensor.
To display the graph, select the following menu items on the tester: View / Line graph.
HINT:

- Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.
- A low A/F sensor voltage could be caused by a rich air-fuel mixture. Check the conditions that would cause the engine to run rich.
- A high A/F sensor voltage could be caused by a lean air-fuel mixture. Check the conditions that would cause the engine to run lean.

1	CHECK AIR INDUCTION SYSTEM

(a) Check for vacuum leaks in the air induction system.
OK:
No vacuum leak

NG → **REPAIR OR REPLACE AIR INDUCTION SYSTEM**

OK

2	CHECK PCV HOSE

OK:
The PCV hose is connected correctly, and not damaged.

NG → **REPAIR OR REPLACE PCV HOSE**

OK

3	INSPECT FUEL INJECTOR ASSEMBLY (INJECTION AND VOLUME)

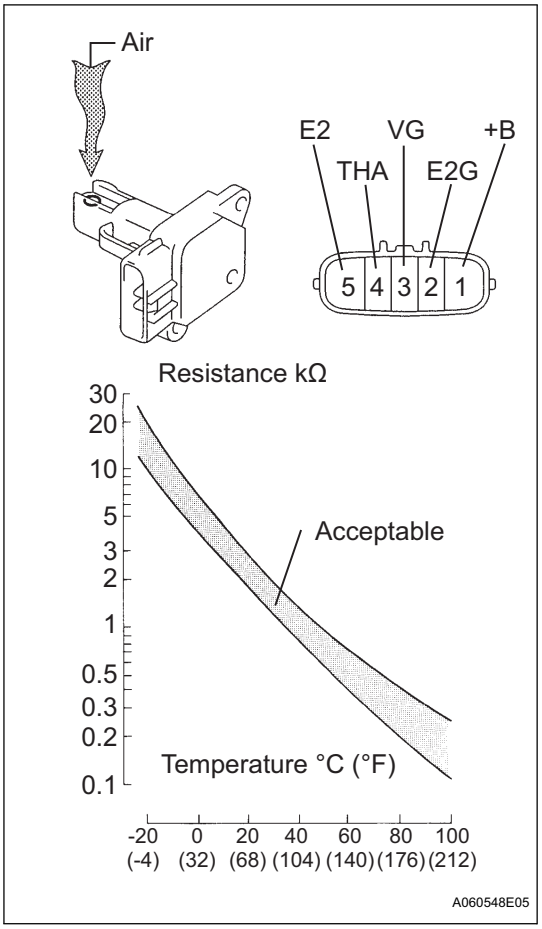
Standard

Item	Specified Condition
Injection Volume	76 to 92 cm^3 (4.6 to 5.6 cu in)/15 seconds
Difference between each injector	16 cm^3 (1.0 cu in) or less

NG → **REPLACE FUEL INJECTOR ASSEMBLY**

OK

4	INSPECT MASS AIR FLOW METER



(a) Remove the mass air flow meter.
(b) Inspect output voltage.
  (1) Apply battery voltage between terminals +B and E2G.
  (2) Connect the positive (+) tester probe to terminal VG, and negative (-) tester probe to terminal E2G.
  (3) Blow air into the mass air flow meter, and check that the voltage fluctuates.
(c) Inspect the resistance.
  (1) Measure the resistance according to the value(s) in the table below.
  Standard resistance

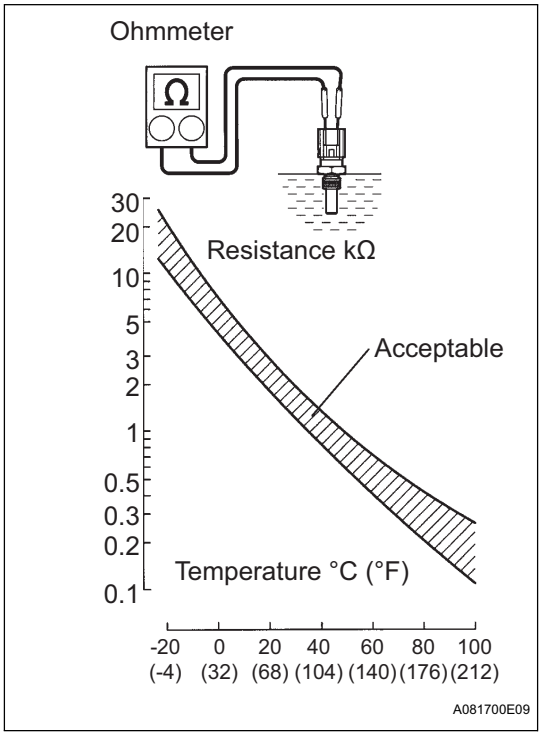
Tester Connection	Specified Condition
4 (THA) - 5 (E2)	13.6 to 18.4 kΩ at -20°C (-4°F)
4 (THA) - 5 (E2)	2.21 to 2.69 kΩ at 20°C (68°F)
4 (THA) - 5 (E2)	0.49 to 0.67 kΩ at 60°C (140°F)

(d) Reinstall the mass air flow meter.

NG → **REPLACE MASS AIR FLOW METER**

OK

5	INSPECT ENGINE COOLANT TEMPERATURE SENSOR (RESISTANCE)



(a) Remove the engine coolant temperature sensor.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
1 - 2	2.32 to 2.59 kΩ at 20°C (68°F)
1 - 2	0.310 to 0.326 kΩ at 80°C (176°F)

NOTICE:
When checking the engine coolant temperature sensor in water, be careful not to allow water to contact the terminals. After checking, dry the sensor.
HINT:
Alternative procedure: Connect an ohmmeter to the installed engine coolant temperature sensor and read the resistance. Use an infrared thermometer to measure the engine temperature in the immediate vicinity of the sensor. Compare these values to the resistance/temperature graph. Change the engine temperature (warm up or allow to cool down) and repeat the test.

NG → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK

6	CHECK FOR SPARK

OK:
A spark occurs.

NG → **REPAIR OR REPLACE IGNITION SYSTEM**

OK

7	CHECK FUEL PRESSURE

(a) Check the fuel pressure (high or low pressure).

Standard

Item	Specified Condition
Fuel Pressure	304 to 343 kPa (3.1 to 3.5 kgf cm^2, 44 to 55 psi)

NG → **CHECK AND REPLACE FUEL SYSTEM**

OK

8	CHECK FOR EXHAUST GAS LEAKAGE

OK:
No gas leakage

NG → **REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT**

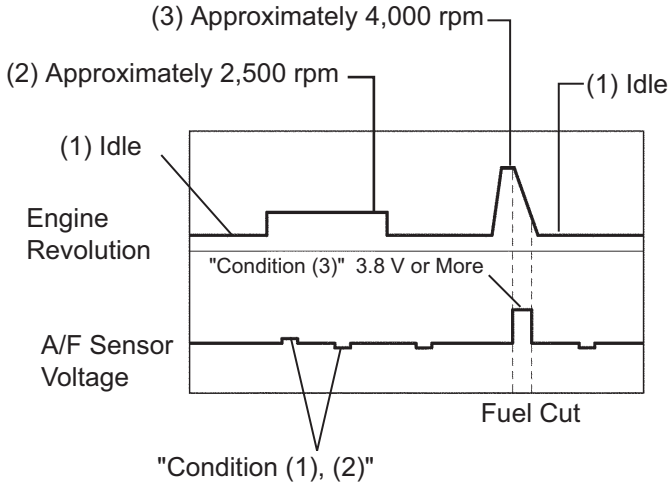
OK

9	READ VALUE OF INTELLIGENT TESTER (OUTPUT VOLTAGE OF AIR FUEL RATIO SENSOR)

(a) Connect the intelligent tester to the DLC3.
(b) Start the engine and turn the intelligent tester ON.
(c) Warm up the A/F sensor with the engine at 2,500 rpm for approximately 90 seconds.
(d) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Data List.
(e) Select the following monitor items: AFS B1 S1 and Engine Speed.
(f) Monitor the A/F sensor voltage carefully.
(g) Check the A/F sensor voltage under the following conditions:
(1) Allow the engine to idle for 30 seconds. (Condition 1)
(2) Run the engine at approximately 2,500 rpm (where the engine RPM is not suddenly changed). (Condition 2)
(3) Raise the engine speed to 4,000 rpm and quickly release the accelerator pedal so that the throttle valve is fully closed. (Condition 3)

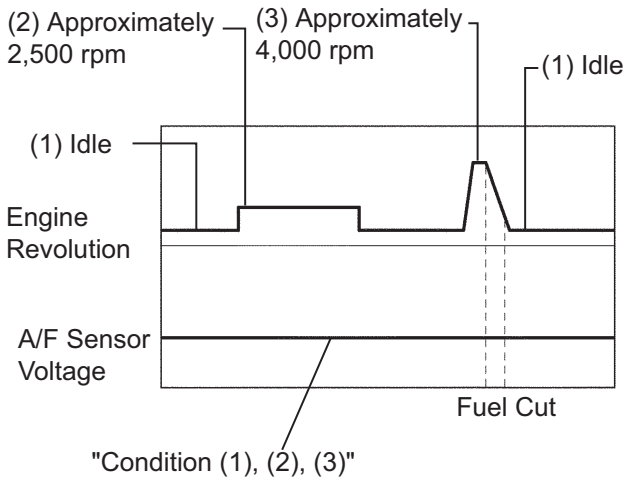
Standard:
Conditions (1) and (2)
The voltage changes in the vicinity of 3.3 V (between approximately 3.1 to 3.5 V) as shown in the illustration on the next page.
Condition (3)
The voltage increases to 3.8 V or more during engine deceleration (when fuel is cut) as shown in the illustration on the next page.

Normal Condition:



Change in the vicinity of approximately 3.3 V

Malfunction Condition:



When A/F sensor circuit is malfunctioning, voltage output does not change

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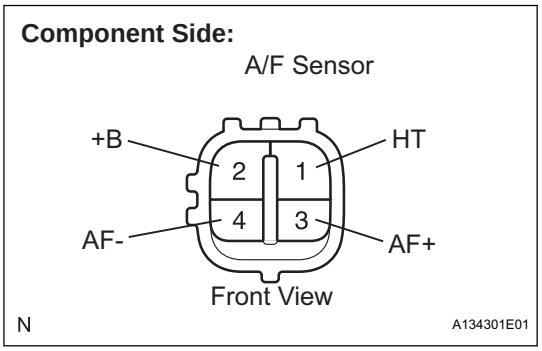
HINT:

- Whenever the output voltage of the A/F sensor remains at approximately 3.3 V (see diagram Malfunction Condition) under any condition as well as the above conditions, the A/F sensor may have an open circuit. (This will also happen when the A/F sensor heater has an open circuit.)
- Whenever the output voltage of the A/F sensor remains at a certain value of approximately 3.8 V or more, or 2.8 V or less (see diagram "Malfunction Condition") under any condition as well as the above conditions, the A/F sensor may have a short circuit.
- The ECM will stop fuel injection (fuel cut) during engine deceleration. This will cause a lean condition and should result in a momentary increase in the A/F sensor voltage output.
- The ECM must establish a closed throttle position learned value to perform fuel cut. If the battery terminal was reconnected, the vehicle must be driven at over 16 km/h to allow the ECM to learn the closed throttle position.
- When the vehicle is driven:
  The output voltage of the A/F sensor may be below 2.8 V during fuel enrichment. For the vehicle, this translates to a sudden increase in speed with the accelerator pedal fully depressed when trying to overtake another vehicle. The A/F sensor is functioning normally.
- The A/F sensor is a current output element, therefore the current is converted into voltage inside the ECM. If measuring voltage at the connectors of the A/F sensor or ECM, you will obtain a constant voltage.

OK → GO TO STEP 17

NG

10 INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)



(a) Disconnect the A31 A/F sensor connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

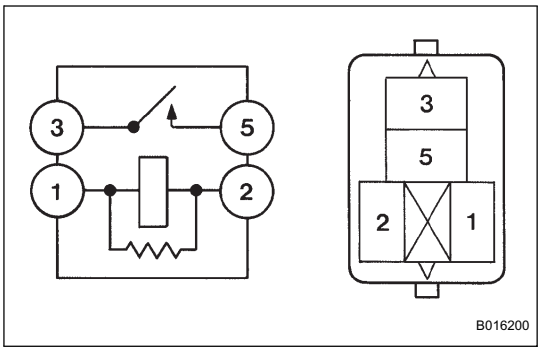
Tester Connection	Specified Condition
1 (HT) - 2 (+B)	2.16 to 2.9 Ω at 20°C (68°F)

(c) Connect the connector.

NG → REPLACE AIR FUEL RATIO SENSOR

OK

11 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room J/B.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

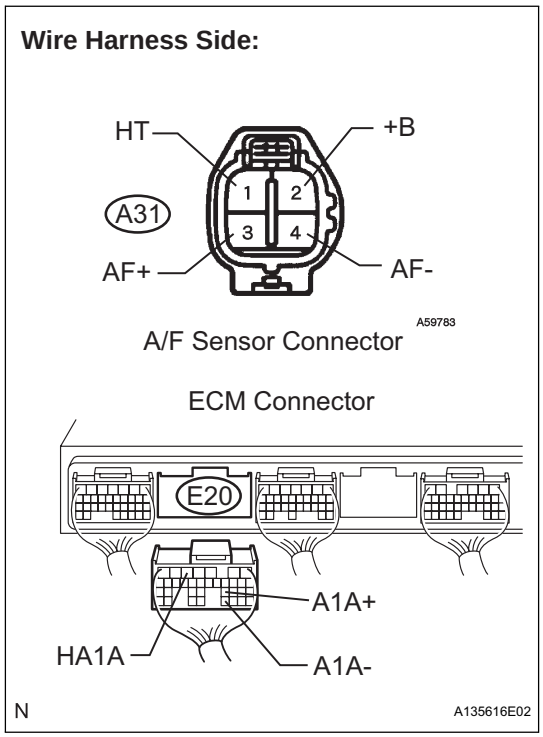
Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the EFI relay.

NG → REPLACE EFI RELAY

OK

12 CHECK HARNESS AND CONNECTOR (A/F SENSOR - ECM)



(a) Disconnect the A31 A/F sensor connector.
(b) Disconnect the E20 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

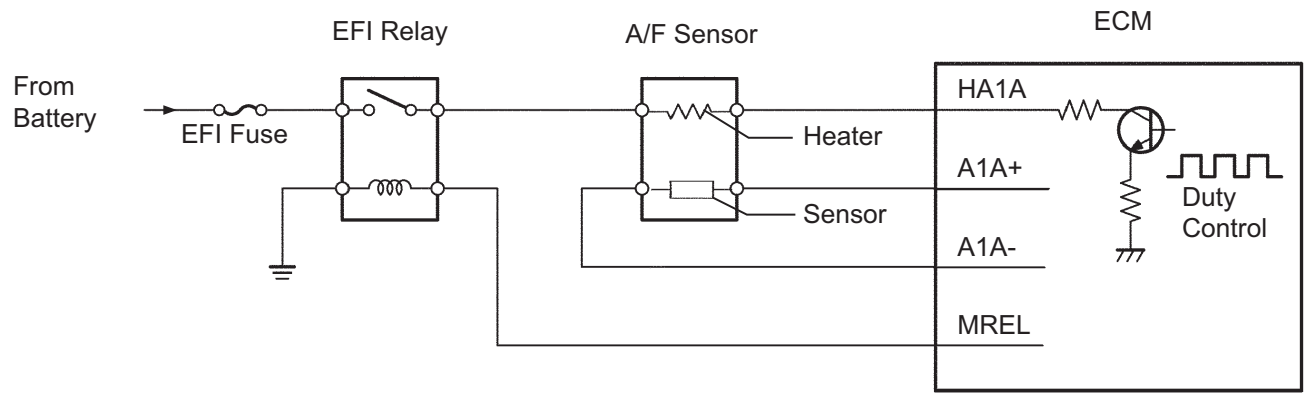
Tester Connection	Specified Condition
A31-1 (HT) - E20-5 (HA1A)	Below 1 Ω
A31-3 (AF+) - E20-23 (A1A+)	Below 1 Ω
A31-4 (AF-) - E20-31 (A1A-)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
A31-1 (HT) or E20-5 (HA1A) - Body ground	10 kΩ or higher
A31-3 (AF+) or E20-23 (A1A+) - Body ground	10 kΩ or higher
A31-4 (AF-) or E20-31 (A1A-) - Body ground	10 kΩ or higher

(d) Connect the connectors.

Reference:



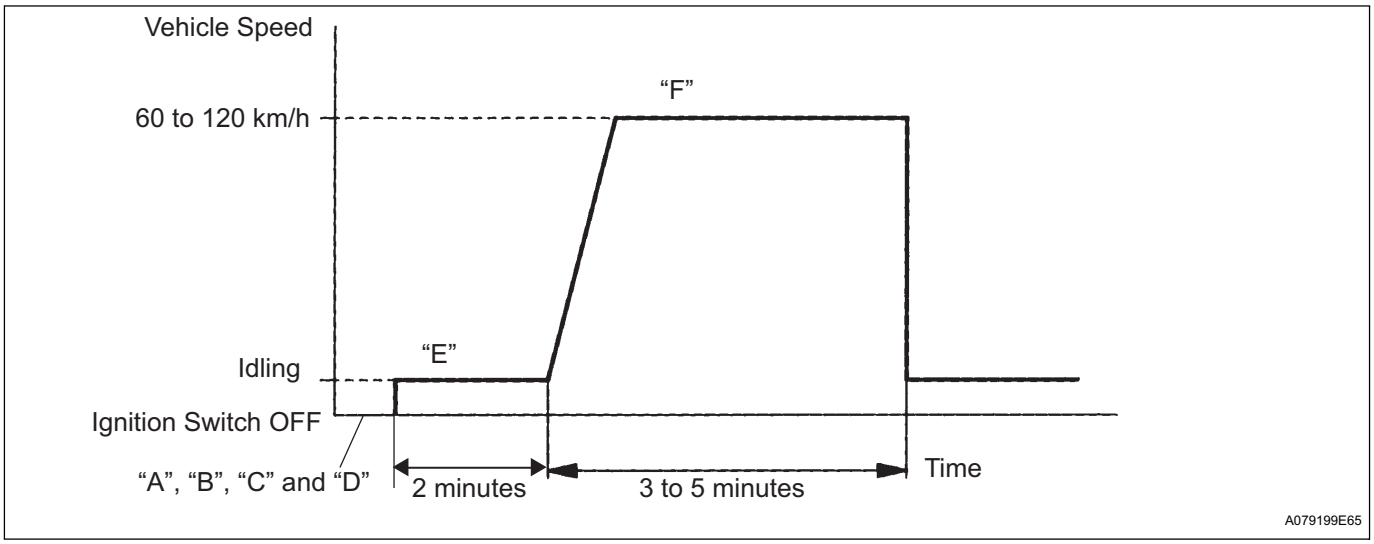
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

13 REPLACE AIR FUEL RATIO SENSOR

NEXT

14	PERFORM CONFIRMATION DRIVING PATTERN



(a) Connect the intelligent tester to the DLC3. (Procedure "A")
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON. (Procedure "B")
(c) Clear the DTC(s) using the intelligent tester. (Procedure "C")
(d) Switch the ECM from normal mode to check mode using the intelligent tester. (Procedure "D")
(e) Start the engine and warm it up with all the accessories switched OFF. (Procedure "E")
(f) Drive the vehicle at 60 to 120 km/h and at an engine speed of 1,400 to 3,200 rpm for 3 to 5 minutes. (Procedure "F")
HINT:
If a malfunction exists, the MIL will be illuminated during procedure "F".
NOTICE:
If the conditions in this test are not strictly followed, no malfunction will be detected. If you do not have the intelligent tester, turn the ignition switch OFF after performing procedures "E" and "F", then perform procedure "F" again.

NEXT

15	CHECK IF DTC RECURS (DTC P0171 AND/OR P0172)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
No output	A
P0171 and/or P0172	B

B → REPLACE ECM

A

16 CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

(a) Has the vehicle run out of fuel in the past?

NO → CHECK FOR INTERMITTENT PROBLEMS

YES

DTC WAS CAUSED BY RUNNING OUT OF FUEL (DTC P0171 AND/OR P0172)

17 PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern (refer to step 14).

NEXT

18 CHECK IF DTC RECURS (DTC P0171 AND/OR P0172)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
P0171 and/or P0172	A
No output	B

B → GO TO STEP 22

A

19 REPLACE AIR FUEL RATIO SENSOR

NEXT

20	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern (refer to step 14).

NEXT

21	CHECK IF DTC RECURS (DTC P0171 AND/OR P0172)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
No output	A
P0171 and/or P0172	B

B → REPLACE ECM

A

22	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

(a) Has the vehicle run out of fuel in the past?

NO → CHECK FOR INTERMITTENT PROBLEMS

YES

DTC WAS CAUSED BY RUNNING OUT OF FUEL (DTC P0171 AND/OR P0172)

DTC	P0300	Random / Multiple Cylinder Misfire Detected

DTC	P0301	Cylinder 1 Misfire Detected

DTC	P0302	Cylinder 2 Misfire Detected

DTC	P0303	Cylinder 3 Misfire Detected

DTC	P0304	Cylinder 4 Misfire Detected

DESCRIPTION

When a misfire occurs in the engine, hydrocarbons (HC) enter the exhaust gas in high concentrations. If this HC concentration is high enough, there could be an increase in exhaust emission levels. High concentrations of HC can also cause temperature of the catalyst to increase, possibly damaging the catalyst. To prevent this increase in emissions and limit the possibility of thermal damage, the ECM monitors the misfire rate. When the temperature of the catalyst reaches a point of thermal degradation, the ECM will blink the MIL. For monitoring misfire, the ECM uses both the camshaft position sensor and the crankshaft position sensor. The camshaft position sensor is used to identify misfiring cylinders and the crankshaft position sensor is used to measure variations in the crankshaft rotation speed. The misfire counter increments when crankshaft rotation speed variations exceed threshold values.
If the misfiring rate exceeds the threshold and could cause emission deterioration, the ECM illuminates the MIL.
HINT:

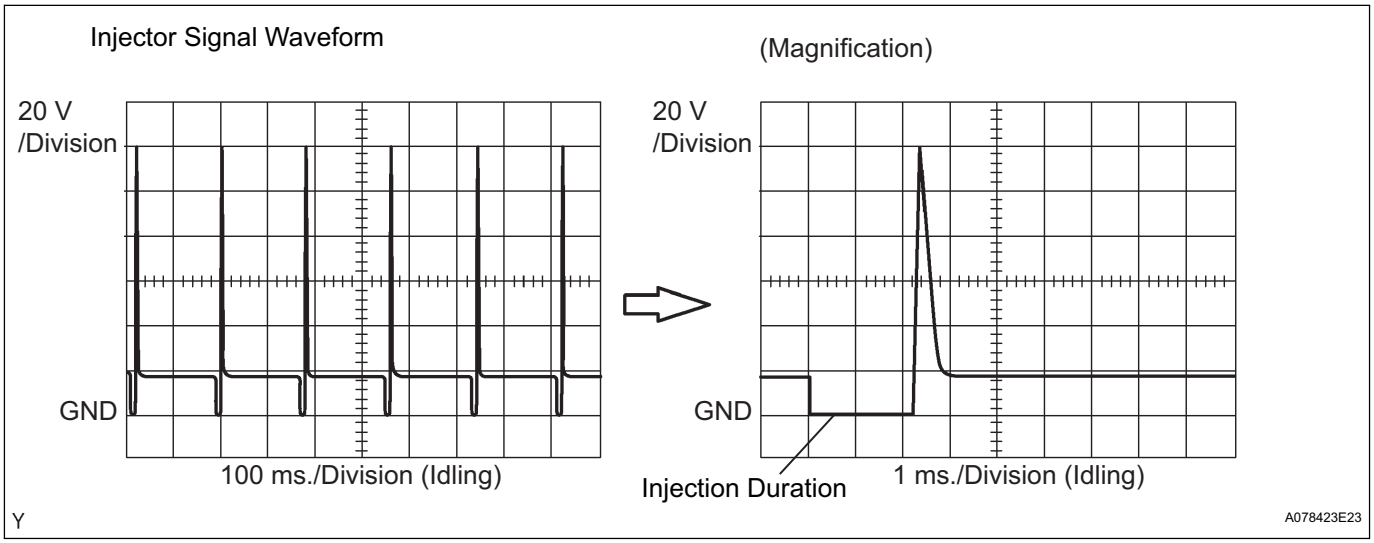
- For any particular 200 revolutions of the engine, misfiring which could result in overheating of the catalyst is detected. This will cause the MIL to blink (1 trip detection logic).
- For any particular 1,000 revolutions of the engine, misfiring which could result in emission deterioration is detected. This will cause the MIL to illuminate (2 trip detection logic).

DTC No.	DTC Detection Condition	Trouble Area
P0300	Misfiring of random cylinders is detected (2 trip detection logic)	• Open or short in engine wire harness • Connector connection • Vacuum hose connection • Ignition system • Injector • Fuel pressure • Mass air flow meter • Engine coolant temperature sensor • Compression pressure • Valve clearance • Valve timing • PCV hose connection • PCV hose • ECM
P0301 P0302 P0303 P0304	Misfiring of each cylinder is detected (2 trip detection logic)	• Open or short in engine wire harness • Connector connection • Vacuum hose connection • Ignition system • Injector • Fuel pressure • Mass air flow meter • Engine coolant temperature sensor • Compression pressure • Valve clearance • Valve timing • PCV hose connection • PCV hose • ECM

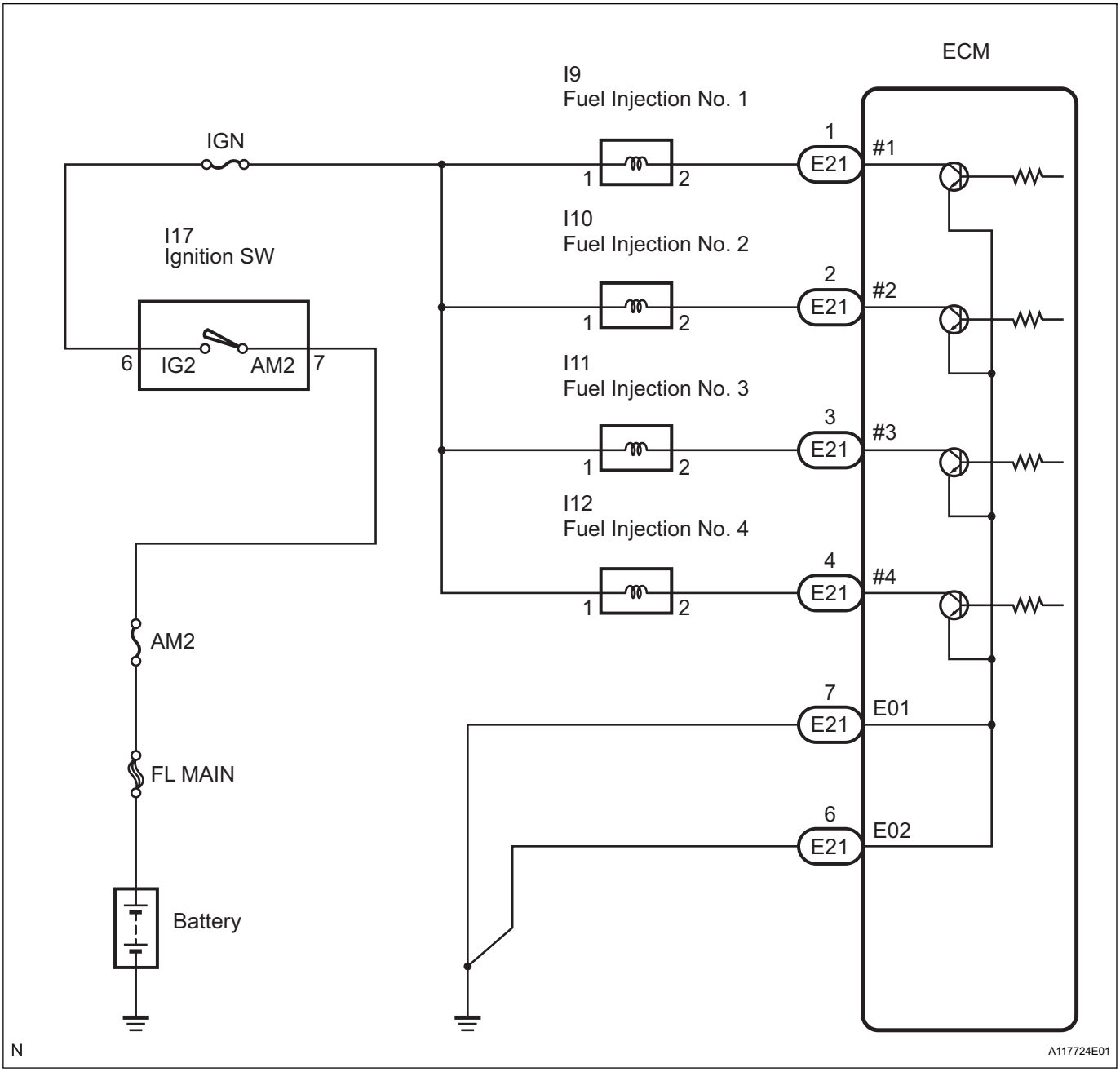
HINT:
When the DTCs for misfiring cylinders are recorded repeatedly but no random misfire DTC is recorded, it indicates that the misfires have been set and recorded at different times.
Reference: Inspection using the oscilloscope
With the engine idling, check the waveform between terminals #1 to #4 and E01 of the ECM connectors.

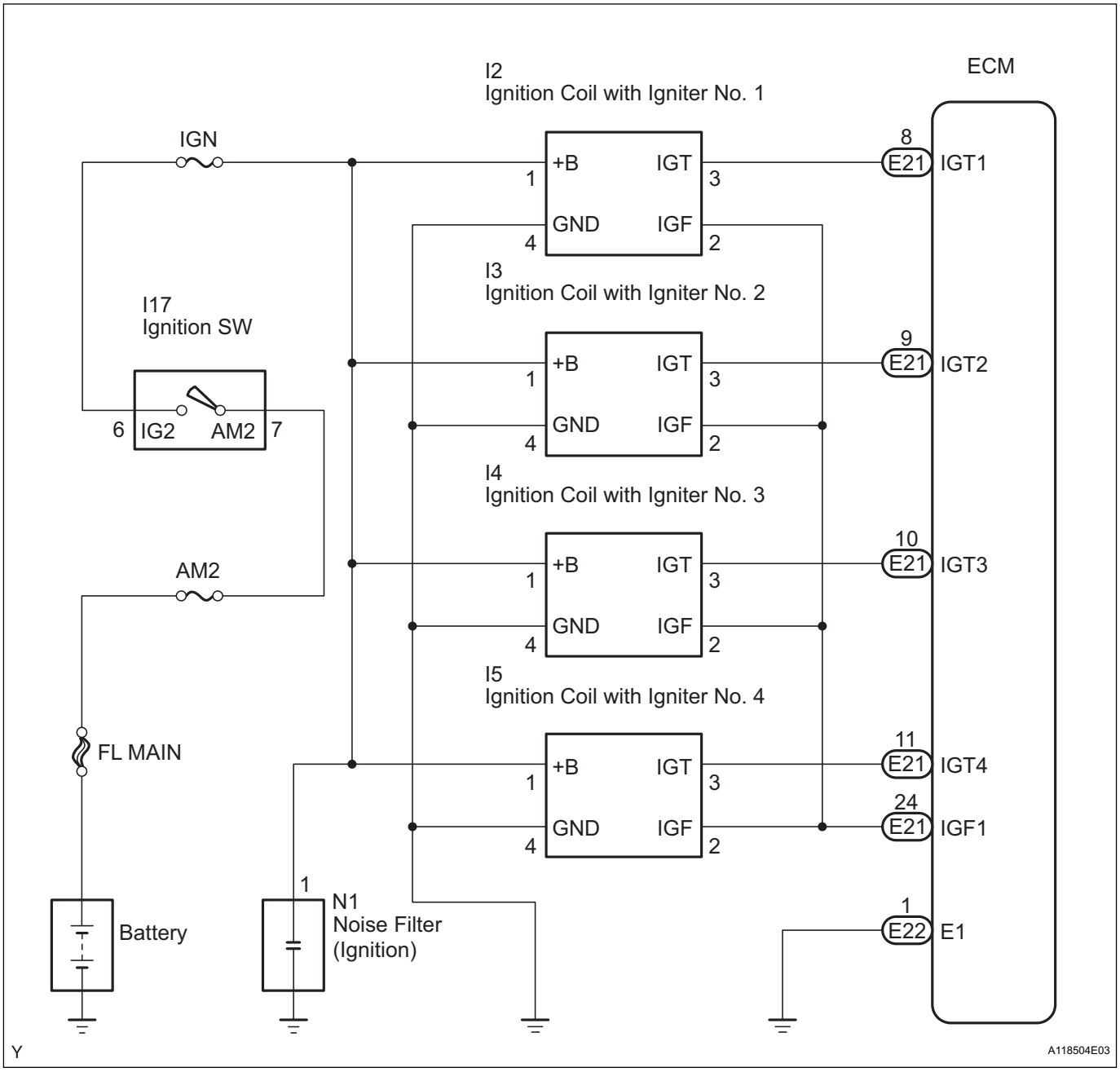
Item	Contents
Terminal	#1 to #4 - E01
Equipment Setting	20 V/Division, 100 or 1 ms./Division
Condition	Idling

HINT:
The correct waveform is as shown below.



WIRING DIAGRAM





CONFIRMATION DRIVING PATTERN

1. Connect the intelligent tester to the DLC3.
2. Turn the ignition switch to the ON position and turn the intelligent tester ON.
3. Note down the DTC(s) and freeze frame data.
4. Switch the ECM from normal mode to check mode using the intelligent tester.
5. Check the misfire counter values for each cylinder when idling. If the misfire counter value indicates 0, perform the following procedure of the confirmation driving pattern.

6. Drive the vehicle several times under an engine speed (Engine Speed), engine load (Calculate Load) and other condition stored in the freeze frame data.
   If you have no intelligent tester, turn the ignition switch OFF after the symptom is simulated once. Then repeat the simulation process again.
   HINT:
   In order to memorise the misfire DTCs, it is necessary to drive around the Misfire RPM and Misfire Load conditions stored in Data List for the following period of time. Do not turn the ignition switch OFF. Turning the ignition switch OFF changes the diagnosis system from check mode to normal mode and all DTCs and other data will be erased.

Engine Speed	Time
Idling	5 minutes and 45 seconds or more
1,000 rpm	4 minutes or more
2,000 rpm	2 minutes and 30 seconds or more
3,000 rpm	1 minute and 30 seconds or more

7. Check if there is the DTC(s) to verify whether misfires have occurred. If the DTC(s) is present, record the DTC and freeze frame data.
8. Turn the ignition switch OFF and wait for at least 5 seconds.

INSPECTION PROCEDURE

HINT:

- If any DTCs other than the misfire DTCs are set simultaneously, first perform troubleshooting for them.
- If a misfire does not occur when the vehicle is brought to a workshop, a misfire can be confirmed by reproducing the condition of the freeze frame data. Also, after finishing repairs, confirm that misfires do not recur (see the confirmation driving pattern).
- Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.
- On 4 cylinder engines, misfiring cylinder identification cannot be identified at a high engine speed and only a general misfire DTC P0300 is stored instead of the individual misfiring cylinder DTCs (P0301 to P0304).
  If a misfire starts in a high engine speed area or a misfire occurs only in a high engine speed area, only DTC P0300 may be stored.
  When only a general misfire DTC P0300 is stored:
- Erase the general misfire DTC from the ECM using the intelligent tester.
- Start the engine and perform the confirmation driving pattern.
- Check the value of the misfire ratio for each cylinder. Or check the DTC(s).
- Perform repairs on the cylinder that has a high misfire ratio. Or repair the cylinder indicated by the DTC.
- After finishing repairs, perform the confirmation driving pattern again and confirm that no misfire occurs.
- When either of Short FT #1 or Long FT #1 in the freeze frame data is out of the range of +-20 %, there is a possibility that the air-fuel ratio is becoming rich (-20 % or less) or lean (+20 % or more).
- When Coolant Temp in the freeze frame data is less than 80°C (176°F), there is a possibility that misfires occur only while the engine is being warmed-up.
- If a misfire cannot be reproduced, the following reasons may apply: 1) the vehicle has low fuel, 2) improper fuel is being used, and 3) the ignition plug has been contaminated.
- Be sure to check the misfire counter value after repairs.

1	CHECK DTC OUTPUT (IN ADDITION TO MISFIRE DTCS)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
P0300, P0301, P0302, P0303 and/or P0304	A
P0300, P0301, P0302, P0303 or P0304 and other DTCs	B

HINT:
If any DTCs other than P0300, P0301, P0302, P0303 or P0304 are output, perform troubleshooting for those DTCs.

B → **GO TO DTC CHART (See page ES-23)**

A

2	CHECK WIRE HARNESS, CONNECTOR AND VACUUM HOSE IN ENGINE COMPARTMENT

(a) Check the connection condition of the wire harnesses and connector.
(b) Check the piping of the vacuum hose.
(c) Check the vacuum hose for disconnection or breakage.

OK:
Connected correctly and no damage on the wire harnesses.

NG → **REPAIR OR REPLACE, THEN CONFIRM THAT THERE IS NO MISFIRE**

OK

3	CHECK PCV HOSE

OK:
The PCV hose is connected correctly, and the PCV hose is not damaged.

NG → **REPAIR OR REPLACE PCV HOSE**

OK

4	READ VALUE OF INTELLIGENT TESTER (NUMBER OF MISFIRING CYLINDERS)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.

(c) Start the engine.
(d) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Data List / Cylinder #1 Misfire Rate - Cylinder #4 Misfire Rate.
(e) Check the number of misfiring cylinders on the intelligent tester.
HINT:
When a misfire is not reproduced, proceed to the next step based on the stored DTC.

Result

High Misfire Rate Cylinder	Proceed To
1 or 2 cylinders	A
More than 3 cylinders	B

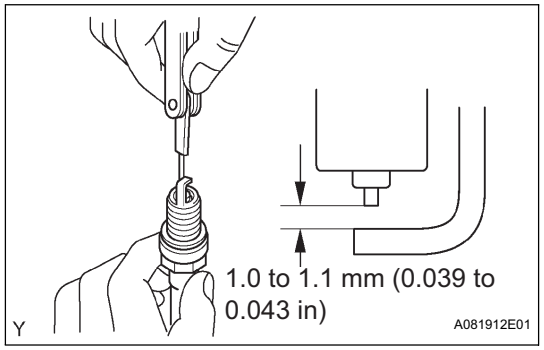
B → **GO TO STEP 15**

A

5	CHECK FOR SPARK

(a) Remove the ignition coil assembly.
(b) Remove the spark plug.
(c) Check the spark plug type.
Recommended spark plug:

Supplier	Type
DENSO	SK20R11
NGK	IFR6A11



(d) Check the spark plug electrode gap.
Standard:
1.0 to 1.1 mm (0.039 to 0.043 in)
Maximum:
1.3 mm (0.051 in)
NOTICE:
If adjusting the gap of a new spark plug, bend only the ground electrode. Do not touch the tip. Never attempt to adjust the gap of a used plug.
(e) Check the electrode for carbon deposits.
(f) Perform a spark test.
CAUTION:
Be sure to disconnect each injector connector.
NOTICE:
Do not crank the engine for more than 10 seconds.
(1) Install the spark plug to the ignition coil, and connect the ignition coil connector.
(2) Disconnect the injector connector.
(3) Ground the spark plug.
(4) Check if a spark occurs while the engine is being cranked.
OK:
A spark jumps across the electrode gap.
(g) Reinstall the spark plug.
(h) Reinstall the ignition coil assembly.

OK → GO TO STEP 8

NG

6	CHANGE NEW SPARK PLUG AND CHECK FOR SPARK

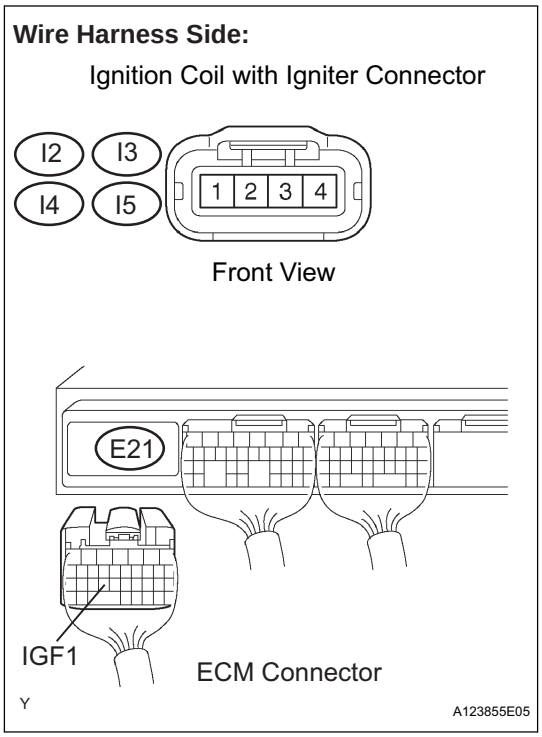
(a) Change the installed spark plug with a new spark plug.
(b) Perform a spark test.
CAUTION:
Be sure to disconnect each injector connector.
NOTICE:
Do not crank the engine for more than 10 seconds.
(1) Install the spark plug to the ignition coil, and connect the ignition coil connector.
(2) Disconnect the injector connector.
(3) Ground the spark plug.
(4) Check if a spark occurs while the engine is being cranked.
OK:
A spark jumps across the electrode gap.

NG → GO TO STEP 7

OK

REPLACE SPARK PLUG

7	CHECK HARNESS AND CONNECTOR OF MISFIRING CYLINDER (IGNITION COIL WITH IGNITER - ECM)



(a) Check the harness and the connectors between the ignition coil with the igniter and ECM (IGF1 terminal).
(1) Disconnect the I2, I3, I4 and/or I5 ignition coil with the igniter connector.
(2) Disconnect the E21 ECM connector.
(3) Measure the resistance according to the value(s) in the table below.

Standard resistance:

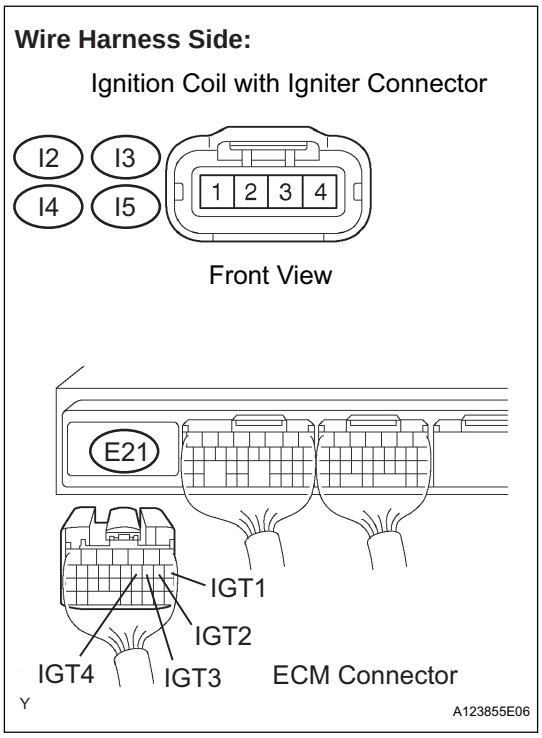
Check for open

Tester Connection	Specified Condition
I2-2 (Ignition coil with igniter) - E21-24 (IGF1)	Below 1 Ω
I3-2 (Ignition coil with igniter) - E21-24 (IGF1)	Below 1 Ω
I4-2 (Ignition coil with igniter) - E21-24 (IGF1)	Below 1 Ω
I5-2 (Ignition coil with igniter) - E21-24 (IGF1)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
I2-2 (Ignition coil with igniter) or E21-24 (IGF1) - Body ground	10 kΩ or higher
I3-2 (Ignition coil with igniter) or E21-24 (IGF1) - Body ground	10 kΩ or higher
I4-2 (Ignition coil with igniter) or E21-24 (IGF1) - Body ground	10 kΩ or higher
I5-2 (Ignition coil with igniter) or E21-24 (IGF1) - Body ground	10 kΩ or higher

(4) Connect the connectors.



(b) Check the harness and the connectors between the ignition coil with the igniter and ECM (IGT terminal).
(1) Disconnect the I2, I3, I4 and/or I5 ignition coil with the igniter connector.
(2) Disconnect the E21 ECM connector.
(3) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
I2-3 (Ignition coil with igniter) - E21-8 (IGT1)	Below 1 Ω
I3-3 (Ignition coil with igniter) - E21-9 (IGT2)	Below 1 Ω
I4-3 (Ignition coil with igniter) - E21-10 (IGT3)	Below 1 Ω
I5-3 (Ignition coil with igniter) - E21-11 (IGT4)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
I2-3 (Ignition coil with igniter) or E21-8 (IGT1) - Body ground	10 kΩ or higher
I3-3 (Ignition coil with igniter) or E21-9 (IGT2) - Body ground	10 kΩ or higher
I4-3 (Ignition coil with igniter) or E21-10 (IGT3) - Body ground	10 kΩ or higher

Tester Connection	Specified Condition
I5-3 (Ignition coil with igniter) or E21-11 (IGT4) - Body ground	10 kΩ or higher

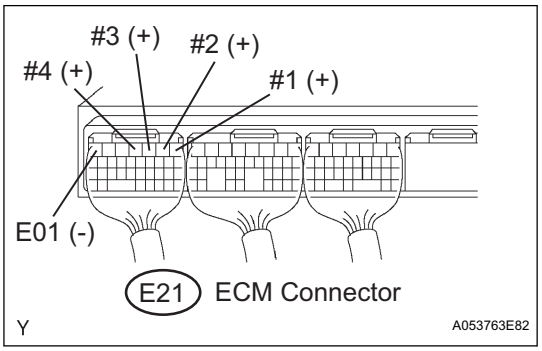
(4) Connect the connectors.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE IGNITION COIL WITH IGNITER

8 INSPECT ECM TERMINAL OF MISFIRING CYLINDER (#1, #2, #3, #4 VOLTAGE)



(a) Turn the ignition switch to the ON position.
(b) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
E21-1 (#1) - E21-7 (E01)	9 to 14 V
E21-2 (#2) - E21-7 (E01)	9 to 14 V
E21-3 (#3) - E21-7 (E01)	9 to 14 V
E21-4 (#4) - E21-7 (E01)	9 to 14 V

OK → GO TO STEP 11

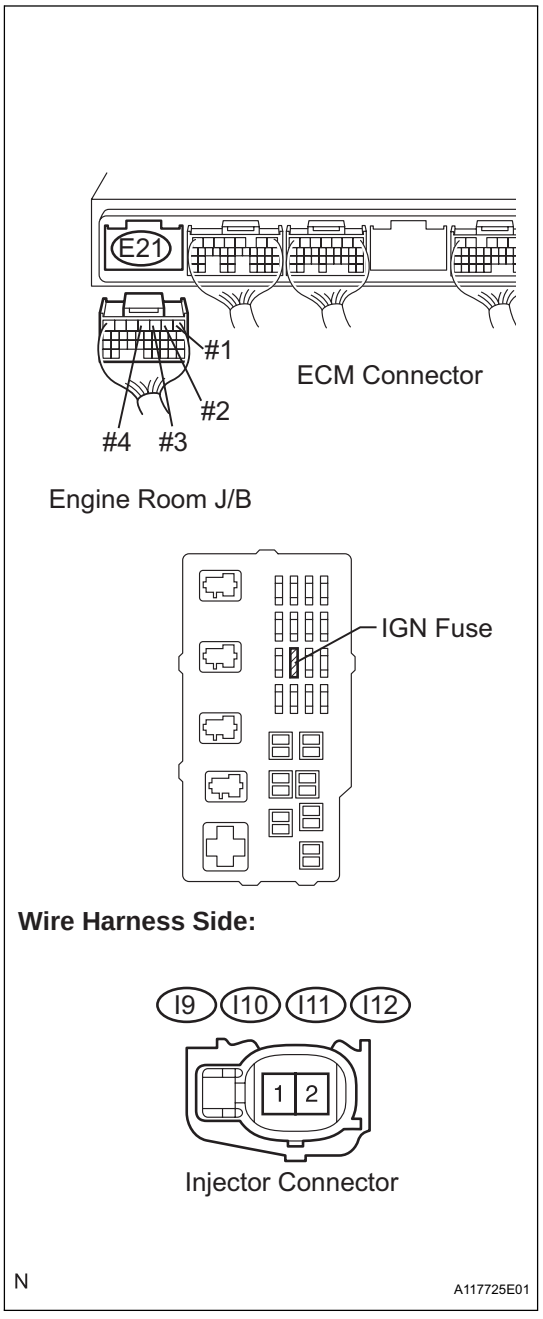
NG

9 INSPECT FUEL INJECTOR RESISTANCE OF MISFIRING CYLINDER

NG → REPLACE FUEL INJECTOR ASSEMBLY

OK

10	CHECK HARNESS AND CONNECTOR OF MISFIRING CYLINDER (INJECTOR - ECM, INJECTOR - IG2 RELAY)



(a) Check the harness and connectors between the injector and ECM.

(1) Disconnect the I9, I10, I11 and/or I12 injector connector.

(2) Disconnect the E21 ECM connector.

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

Standard resistance:

Check for open

Tester Connection	Specified Condition
I9-2 (Injector) - E21-1 (#1)	Below 1 Ω
I10-2 (Injector) - E21-2 (#2)	Below 1 Ω
I11-2 (Injector) - E21-3 (#3)	Below 1 Ω
I12-2 (Injector) - E21-4 (#4)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
I9-2 (Injector) or E21-1 (#1) - Body ground	10 kΩ or higher
I10-2 (Injector) or E21-2 (#2) - Body ground	10 kΩ or higher
I11-2 (Injector) or E21-3 (#3) - Body ground	10 kΩ or higher
I12-2 (Injector) or E21-4 (#4) - Body ground	10 kΩ or higher

(4) Connect the connectors.

(b) Check the harness and connectors between the injector and IGN fuse.

(1) Disconnect the I9, I10, I11 and/or I12 injector connector.

(2) Remove the IGN fuse from the engine room J/B.

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

Standard resistance:

Check for open

Tester Connection	Specified Condition
I9-1 (Injector) - Engine room J/B IGN fuse	Below 1 Ω
I10-1 (Injector) - Engine room J/B IGN fuse	Below 1 Ω
I11-1 (Injector) - Engine room J/B IGN fuse	Below 1 Ω
I12-1 (Injector) - Engine room J/B IGN fuse	Below 1 Ω

Check for short

Tester Connection	Specified Condition
I9-1 (Injector) or Engine room J/B IGN fuse - Body ground	10 kΩ or higher
I10-1 (Injector) or Engine room J/B IGN fuse - Body ground	10 kΩ or higher
I11-1 (Injector) or Engine room J/B IGN fuse - Body ground	10 kΩ or higher
I12-1 (Injector) or Engine room J/B IGN fuse - Body ground	10 kΩ or higher

(4) Reconnect the connectors.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

11 INSPECT FUEL INJECTOR INJECTION AND INJECTION VOLUME OF MISFIRING CYLINDER

Standard

Item	Specified Condition
Injection Volume	76 to 92 cm^3 (4.6 to 5.6 cu in)/15 seconds
Difference between each injector	16 cm^3 (1.0 cu in) or less

NG → REPLACE FUEL INJECTOR ASSEMBLY

OK

12 CHECK CYLINDER COMPRESSION PRESSURE OF MISFIRING CYLINDER

(a) Measure the cylinder compression pressure of the misfiring cylinder.

Compression pressure:

1.3 MPa (13.2 kgf cm^2, 188 psi)

Minimum pressure:

0.98 MPa (10 kgf cm^2, 142 psi)

Difference between each cylinder:

0.1 MPa (1.0 kgf cm^2, 14 psi)

NG → REPAIR OR REPLACE ENGINE TO DETERMINE CAUSE OF LOW COMPRESSION

OK

13 CHECK VALVE CLEARANCE OF MISFIRING CYLINDER

(a) Check the valve clearance of the misfiring cylinder.

Standard

Item	Specified Condition
Intake	0.21 to 0.27 mm (0.0083 to 0.0106 in)
Exhaust	0.32 to 0.38 mm (0.0126 to 0.0150 in)

NG → ADJUST VALVE CLEARANCE

OK

14 SWITCH STEP BY NUMBER OF MISFIRING CYLINDER (REFER TO RESULT OF STEP 4)

HINT:

- If the result of step 4 is "1 or 2 cylinders", proceed to A.

- If the result of step 4 is "more than 3 cylinders", proceed to B.

B → CHECK FOR INTERMITTENT PROBLEMS

A

15 CHECK VALVE TIMING (CHECK FOR LOOSENESS AND JUMPED TOOTH OF TIMING CHAIN)

OK:
The matchmarks of the crankshaft pulley and camshaft pulley are aligned.

NG → ADJUST VALVE TIMING

OK

16 CHECK FUEL PRESSURE

(a) Check the fuel pressure (high or low pressure).

Standard

Item	Specified Condition
Fuel Pressure	304 to 343 kPa (3.1 to 3.5 kgf cm^2, 44 to 55 psi)

NG → CHECK AND REPLACE FUEL PUMP, PRESSURE REGULATOR, FUEL PIPE LINE AND FILTER

OK

17 READ VALUE OF INTELLIGENT TESTER (INTAKE AIR TEMPERATURE AND MASS AIR FLOW RATE)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) Check the intake air temperature.
  (1) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Data List / Intake Air.
  (2) Read the value.
  Standard:
  Equivalent to ambient temperature
(d) Check the mass air flow rate.
  (1) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Data List / AFM.
  (2) Read the values.

Standard

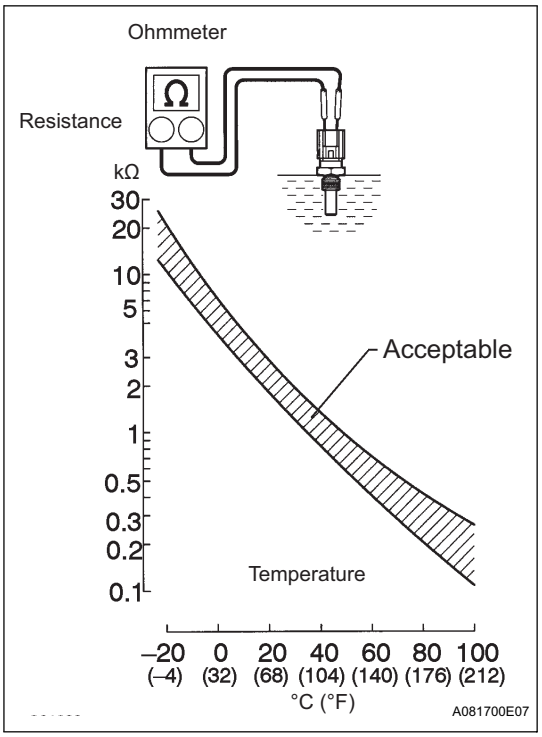
Condition	Mass Air Flow Rate (gm/s)
Ignition switch ON (do not start engine)	0
Idling	0.54 to 4.33 (Manual Transaxle) 0.58 to 4.67 (Automatic Transaxle)

Condition	Mass Air Flow Rate (gm/s)
Revving up without load (2,500 rpm)	3.33 to 9.17
Idling - Revving up	Mass air flow rate fluctuates

NG → REPLACE MASS AIR FLOW METER

OK

18 INSPECT ENGINE COOLANT TEMPERATURE SENSOR (RESISTANCE)



(a) Remove the engine coolant temperature sensor.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
1 - 2	2.32 to 2.59 kΩ at 20°C (68°F)
1 - 2	0.310 to 0.326 kΩ at 80°C (176°F)

NOTICE:
When checking the engine coolant temperature sensor in water, be careful not to allow water to contact the terminals. After the check, dry the sensor.
HINT:
Alternative procedure: Connect an ohmmeter to the installed engine coolant temperature sensor and read the resistance. Use an infrared thermometer to measure the engine temperature in the immediate vicinity of the sensor. Compare these values to the resistance/temperature graph. Change the engine temperature (warm up or allow to cool down) and repeat the test.

NG → REPLACE ENGINE COOLANT TEMPERATURE SENSOR

OK

19 SWITCH STEP BY NUMBER OF MISFIRING CYLINDER (REFER TO RESULT OF STEP 4)

HINT:
- If the result of step 4 is "1 or 2 cylinders", proceed to A.
- If the result of step 4 is "more than 3 cylinders", proceed to B.

B → GO TO STEP 5

A

CHECK FOR INTERMITTENT PROBLEMS

DTC	P0325	Knock Sensor 1 Circuit

DTC	P0327	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)

DTC	P0328	Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)

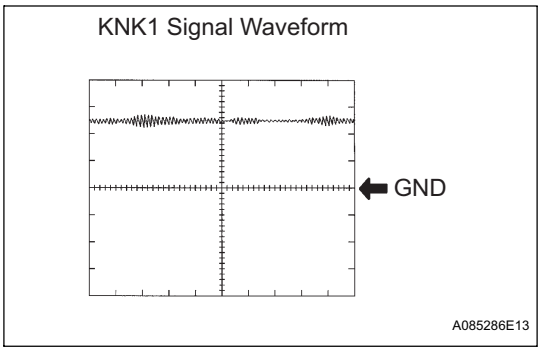
DESCRIPTION

The flat type knock sensor (non-resonant type) has a structure that can detect vibration in a wide band of frequency from about 6 kHz to 15 kHz and has the following features:

- The knock sensor is fitted to the cylinder block to detect engine knocking.
- The sensor contains a piezoelectric element which generates voltage when it becomes deformed. This occurs when the cylinder block vibrates due to knocking. If engine knocking occurs, the ignition timing is retarded to suppress it.

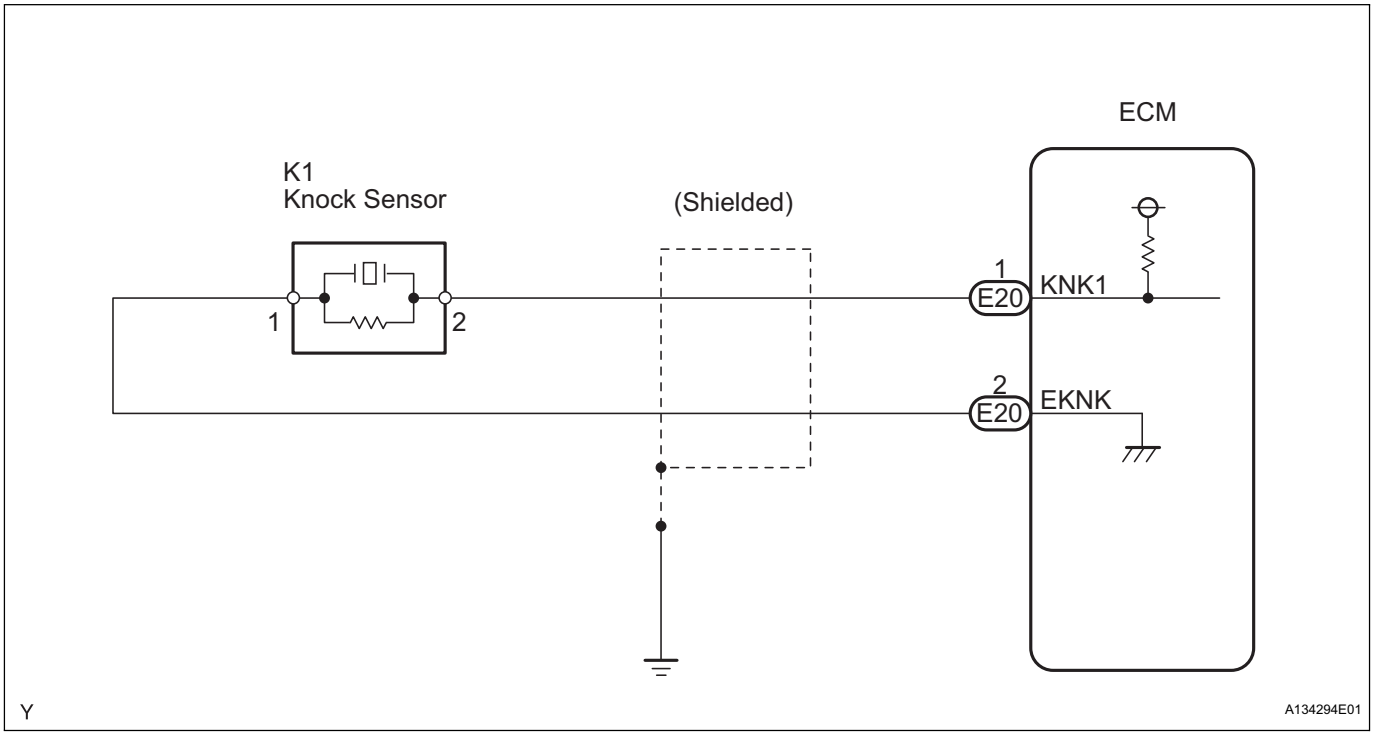
DTC No.	DTC Detection Condition	Trouble Area
P0325	Knock sensor signal level remains low for more than 10 seconds (1 trip detection logic)	• Open or short in knock sensor circuit • Knock sensor (under-torqued or looseness) • ECM
P0327	Output voltage of the knock sensor is 0.5 V or less (1 trip detection logic)	• Short in knock sensor circuit • Knock sensor • ECM
P0328	Output voltage of the knock sensor is 4.5 V or more (1 trip detection logic)	• Open in knock sensor circuit • Knock sensor • ECM

HINT:
If the ECM detects DTCs P0325, P0327 and/or P0328, it enters fail-safe mode in which the corrective retarded angle value is set to the maximum value.
Reference: Inspection by using an oscilloscope.
The correct waveform is as shown.



Item	Contents
Terminal	KNK1 - EKNK
Equipment Setting	0.01 to 10 V/Division, 0.01 to 10 ms./Division
Condition	After warming up the engine, keep the engine speed at 4,000 rpm

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	READ OUTPUT DTC

(a) Clear the DTC(s) (See page ES-16).
(b) Warm up the engine.
(c) Run the engine at 3,000 rpm for 10 seconds or more.
(d) Connect the intelligent tester to the DLC3.
(e) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(f) Select the following menu items: Powertrain / Engine and ECT / DTC.
(g) Read DTCs.

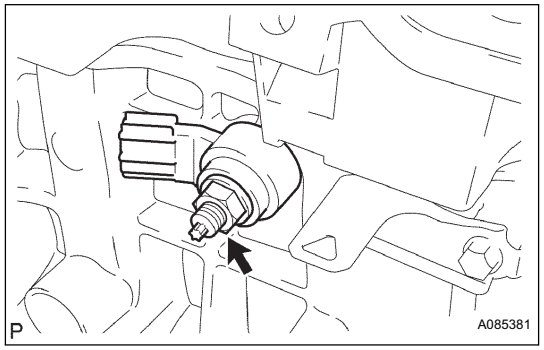
Result

Display (DTC Output)	Proceed To
P0325	A
P0325, and P0327 and/or P0328	B
No output	C

B	GO TO STEP 3
C	CHECK FOR INTERMITTENT PROBLEMS

A

2 INSPECT KNOCK CONTROL SENSOR



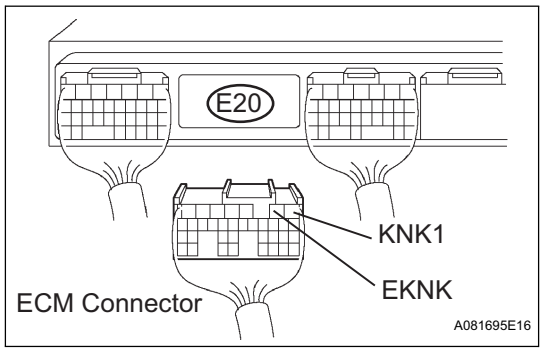
(a) Check the knock sensor installation.
Torque: 15 to 25 Nm (153 to 255 kgf cm, 11 to 18 lbf ft)

NG → **SECURELY REINSTALL SENSOR**

OK

REPLACE KNOCK CONTROL SENSOR

3 CHECK HARNESS AND CONNECTOR (ECM - KNOCK CONTROL SENSOR)



(a) Disconnect the E20 ECM connector.
(b) Measure the resistance between the terminals of the E20 ECM connector.
Standard resistance

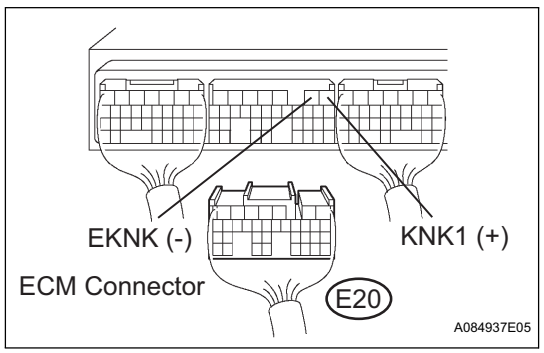
Tester Connection	Specified Condition
KNK1 (E20-1) - EKNK (E20-2)	120 to 280 kΩ at 20°C (68°F)

(c) Connect the connector.

NG → **GO TO STEP 5**

OK

4 INSPECT ECM (KNK1 VOLTAGE)



(a) Disconnect the E20 ECM connector.
(b) Turn the ignition switch to the ON position.
(c) Measure the voltage between the terminals of the E20 ECM connector.
Standard voltage

Tester Connection	Specified Condition
KNK1 (E20-1) - EKNK (E20-2)	4.5 to 5.5 V

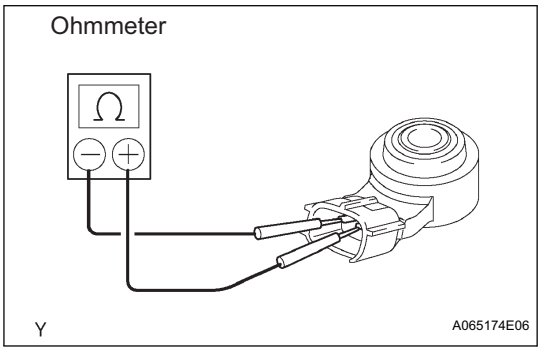
(d) Connect the connector.
NOTICE:
Fault may be intermittent. Check the wire harness and connectors carefully.

NG → **REPLACE ECM**

OK

CHECK FOR INTERMITTENT PROBLEMS

5 INSPECT KNOCK CONTROL SENSOR



(a) Remove the knock sensor.
(b) Measure the resistance between the terminals.
Standard resistance

Tester Connection	Specified Condition
KNK1 (K1-1) - EKNK (K1-2)	120 to 280 kΩ at 20°C (68°F)

(c) Reinstall the knock sensor.

NG → **REPLACE KNOCK CONTROL SENSOR**

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

DTC	P0335	Crankshaft Position Sensor "A" Circuit

DTC	P0339	Crankshaft Position Sensor "A" Circuit Intermittent

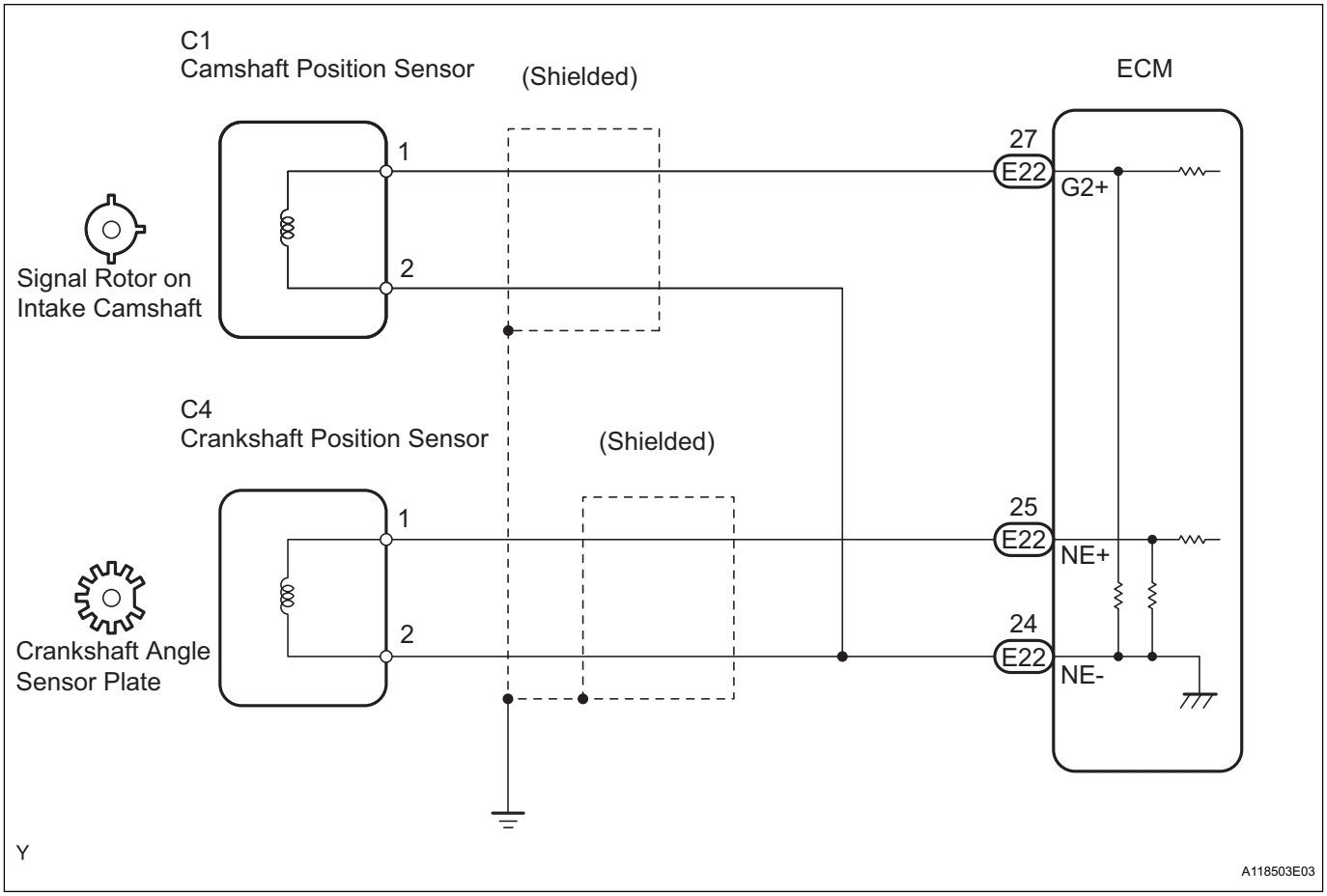
DESCRIPTION

The crankshaft position sensor (CKP) system consists of a crankshaft position sensor plate and a pickup coil.

The sensor plate has 34 teeth and is installed on the crankshaft. The pickup coil is made of an iron core and magnet. The sensor plate rotates and as each tooth passes through the pickup coil, a pulse signal is generated. The pickup coil generates 34 signals for each engine revolution. Based on these signals, the ECM calculates the crankshaft position and engine RPM. Using these calculations, the fuel injection time and ignition timing are controlled.

DTC No.	DTC Detection Condition	Trouble Area
P0335	• No crankshaft position sensor signal to ECM during cranking (2 trip detection logic) • No crankshaft position sensor signal to ECM with engine speed of 600 rpm or more (2 trip detection logic)	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Sensor plate (Crankshaft position sensor plate No. 1) • ECM
P0339	No crankshaft position sensor signal is input to ECM for 0.05 seconds or more, and conditions (a), (b) and (c) are met: (a) Engine runs at 1,000 rpm or more (b) STA signal is OFF (c) 3 seconds or more have elapsed after STA signal is switched from ON to OFF (1 trip detection logic)	Same as DTC P0335

WIRING DIAGRAM



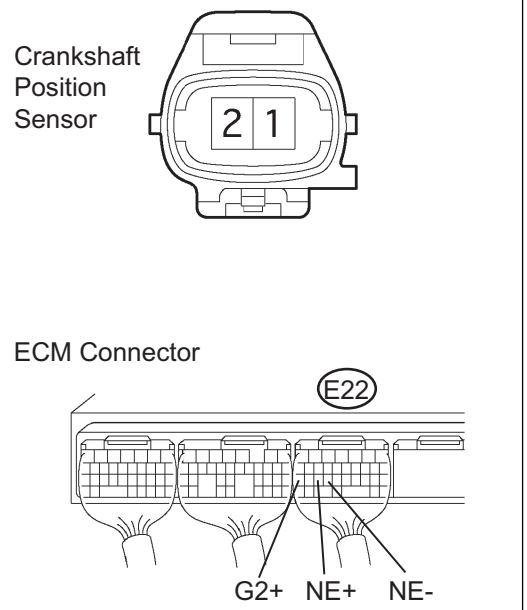
INSPECTION PROCEDURE

HINT:

- Read values on the intelligent tester.
  (a) Connect the intelligent tester to the DLC3.
  (b) Start the engine and turn the intelligent tester ON.
  (c) Select the following menu items: Powertrain / Engine and ECT / Data List / Engine Speed.
- The engine speed can be confirmed in DATA LIST using the intelligent tester. If there are no NE signals from the crankshaft position sensor despite the engine revolving, the engine speed will be indicated as zero. If voltage output of the crankshaft position sensor is insufficient, the engine speed will be indicated as lower than the actual rpm.
- Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	INSPECT CRANKSHAFT POSITION SENSOR (RESISTANCE)

Component Side:



(a) Disconnect the C4 sensor connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
1 - 2	1,150 to 1,450 Ω

(c) Connect the connector.

HINT:
Reference: Inspection using an oscilloscope.
During cranking or idling, check the waveform between the terminals of the E22 ECM connector.

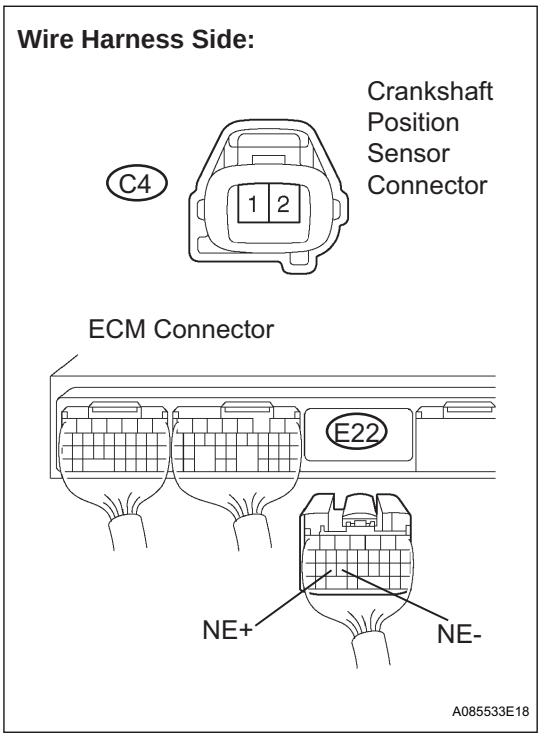
Standard

Tester Connection	Specified Condition
E22-27 (G2+) - E22-24 (NE-) E22-25 (NE+) - E22-24 (NE-)	Correct waveform appears as shown

NG → **REPLACE CRANKSHAFT POSITION SENSOR**

OK

2	CHECK HARNESS AND CONNECTOR (CRANKSHAFT POSITION SENSOR - ECM)



(a) Disconnect the C4 sensor connector.
(b) Disconnect the E22 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
C4-1 - E22-25 (NE+) C4-2 - E22-24 (NE-)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
C4-1 or E22-25 (NE+) - Body ground C4-2 or E22-24 (NE-) - Body ground	10 kΩ or higher

(d) Connect the connectors.

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

OK

3	CHECK CRANKSHAFT POSITION SENSOR INSTALLATION

(a) Check the crankshaft position sensor installation.

OK:

Sensor is installed correctly.

NG → **TIGHTEN CRANKSHAFT POSITION SENSOR**

OK

4	INSPECT CRANKSHAFT POSITION SENSOR PLATE NO. 1 (TEETH OF SIGNAL PLATE)

(a) Remove the crankshaft position sensor plate No. 1.
(b) Check the teeth of the signal plate.

OK:

The pulley does not have any cracks or deformation.

NG → **REPLACE CRANKSHAFT POSITION SENSOR NO. 1**

OK

REPLACE ECM

DTC	P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)

DTC	P0341	Camshaft Position Sensor "A" Circuit Range / Performance (Bank 1 or Single Sensor)

DESCRIPTION

The Camshaft Position (CMP) sensor, like the Crankshaft Position (CKP) sensor, consists of a magnet and an iron core wrapped in copper wire. The camshaft has 3 teeth and the CMP sensor is installed so that it can detect these teeth passing by. When the camshaft rotates and the teeth pass by the CMP sensor, the magnet on the CMP sensor creates a magnetic field and voltage is generated in the copper wire. When the crankshaft makes 2 rotations, voltage will be generated in the CMP sensor 3 times. The CKP sensor is roughly the same. When the crankshaft makes 1 rotation, its 34 teeth pass by the CKP sensor and voltage is generated 34 times. The camshaft rotates at half the speed of the crankshaft. Therefore, the CMP sensor generates voltage 3 times in the time the crankshaft makes 2 rotations. The Engine Control Module (ECM) detects generation of these voltages to locate the camshaft position, which are used to indicate the cylinder.

DTC No.	DTC Detection Condition	Trouble Area
P0340	• No camshaft position sensor signal to ECM during cranking (2 trip detection logic) • No camshaft position sensor signal to ECM with engine speed 600 rpm or more (1 trip detection logic)	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Camshaft timing pulley • Jumped tooth of timing chain • ECM
P0341	While crankshaft rotates twice, camshaft position sensor signal is input to ECM 12 times or more (1 trip detection logic)	Same as DTC P0340

HINT:

- DTC P0340 indicates a malfunction related to the camshaft position sensor (+) circuit (Wire harness (ECM - camshaft position sensor) and camshaft position sensor).
- DTC P0341 indicates a malfunction related to the camshaft position sensor (-) circuit (Wire harness (ECM - camshaft position sensor) and camshaft position sensor).

WIRING DIAGRAM

Refer to DTC P0335 (See page ES-114).

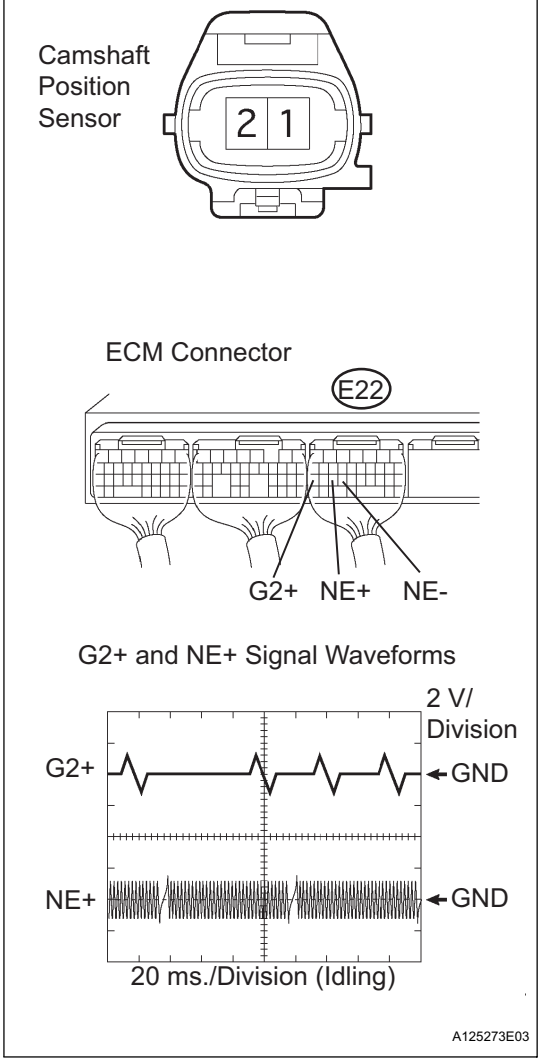
INSPECTION PROCEDURE

HINT:

Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	INSPECT CAMSHAFT POSITION SENSOR

Component Side:



(a) Disconnect the C1 sensor connector.

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

Standard resistance

Tester Connection	Specified Condition
1 - 2	950 to 1,250 Ω

(c) Connect the connector.

HINT:

Reference: Inspection using an oscilloscope.

During cranking or idling, check the waveform between the terminals of the E22 ECM connector.

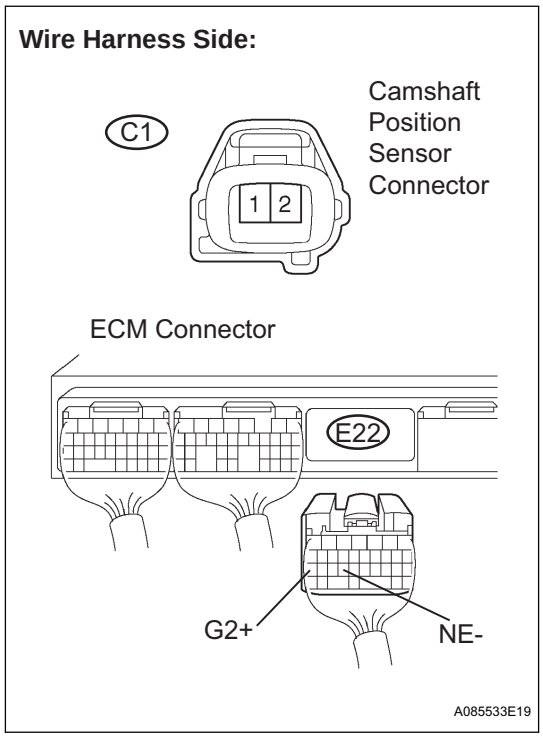
Standard

Tester Connection	Specified Condition
E22-27 (G2+) - E22-24 (NE-) E22-25 (NE+) - E22-24 (NE-)	Correct waveform appears as shown

NG → **REPLACE CAMSHAFT POSITION SENSOR**

OK

2	CHECK HARNESS AND CONNECTOR (CAMSHAFT POSITION SENSOR - ECM)



(a) Disconnect the C1 sensor connector.
(b) Disconnect the E22 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
C1-1 - E22-27 (G2+) C1-2 - E22-24 (NE-)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
C1-1 or E22-27 (G2+) - Body ground C1-2 or E22-24 (NE-) - Body ground	10 kΩ or higher

(d) Connect the connectors.

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

OK

3	CHECK CAMSHAFT POSITION SENSOR INSTALLATION

(a) Check the sensor installation.

OK:

Sensor is installed correctly.

NG → **TIGHTEN CAMSHAFT POSITION SENSOR**

OK

4	INSPECT CAMSHAFT

(a) Remove the camshafts.
(b) Check the camshaft lobes.

OK:

The camshaft lobes do not have any cracks or deformation.

NG → **REPLACE CAMSHAFT**

OK

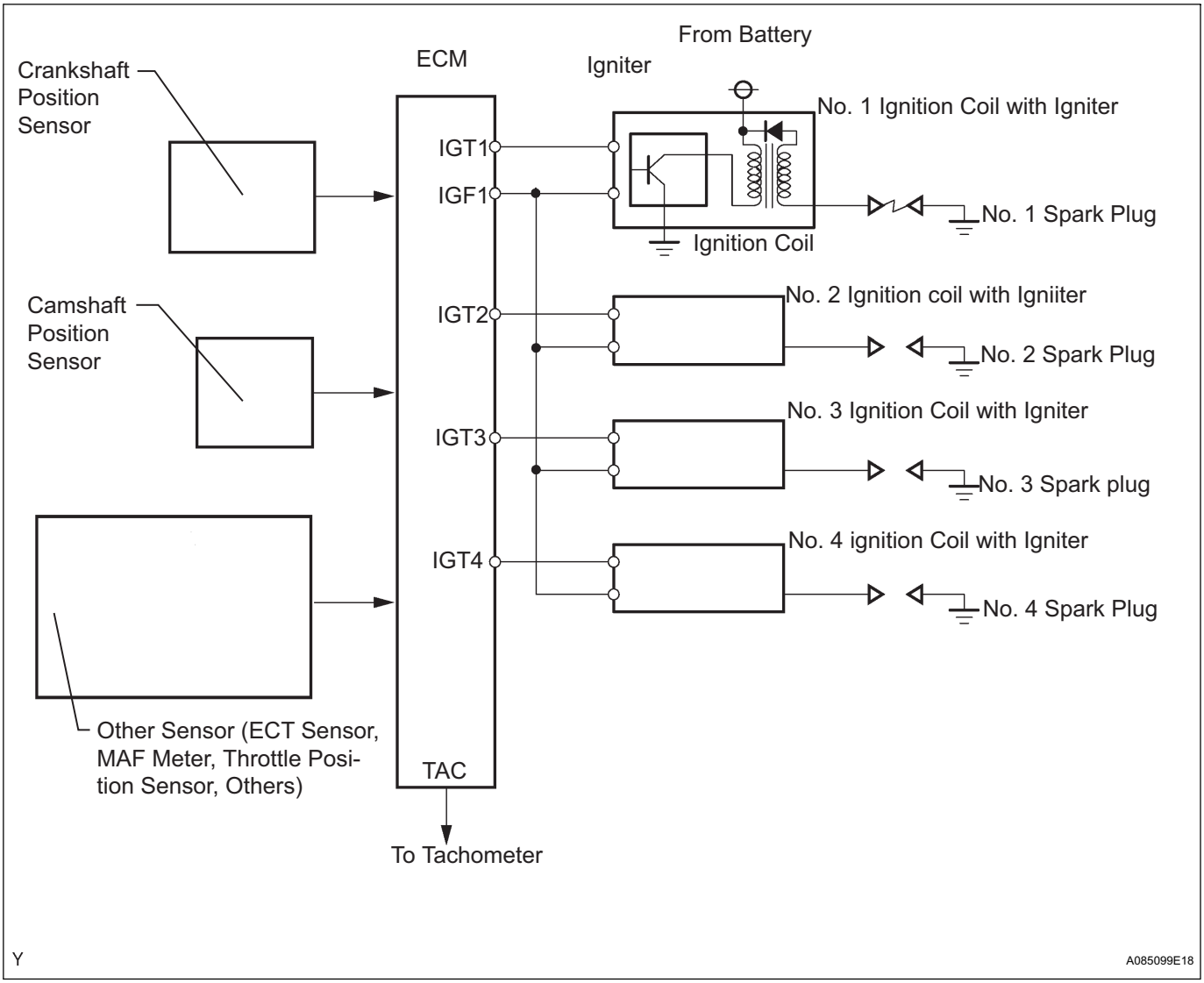
REPLACE ECM

DTC	P0351	Ignition Coil "A" Primary / Secondary Circuit
DTC	P0352	Ignition Coil "B" Primary / Secondary Circuit
DTC	P0353	Ignition Coil "C" Primary / Secondary Circuit
DTC	P0354	Ignition Coil "D" Primary / Secondary Circuit

HINT:
- These DTCs indicate a malfunction related to the primary circuit.
- If DTC P0351 is displayed, check the No. 1 ignition coil with igniter circuit.
- If DTC P0352 is displayed, check the No. 2 ignition coil with igniter circuit.
- If DTC P0353 is displayed, check the No. 3 ignition coil with igniter circuit.
- If DTC P0354 is displayed, check the No. 4 ignition coil with igniter circuit.

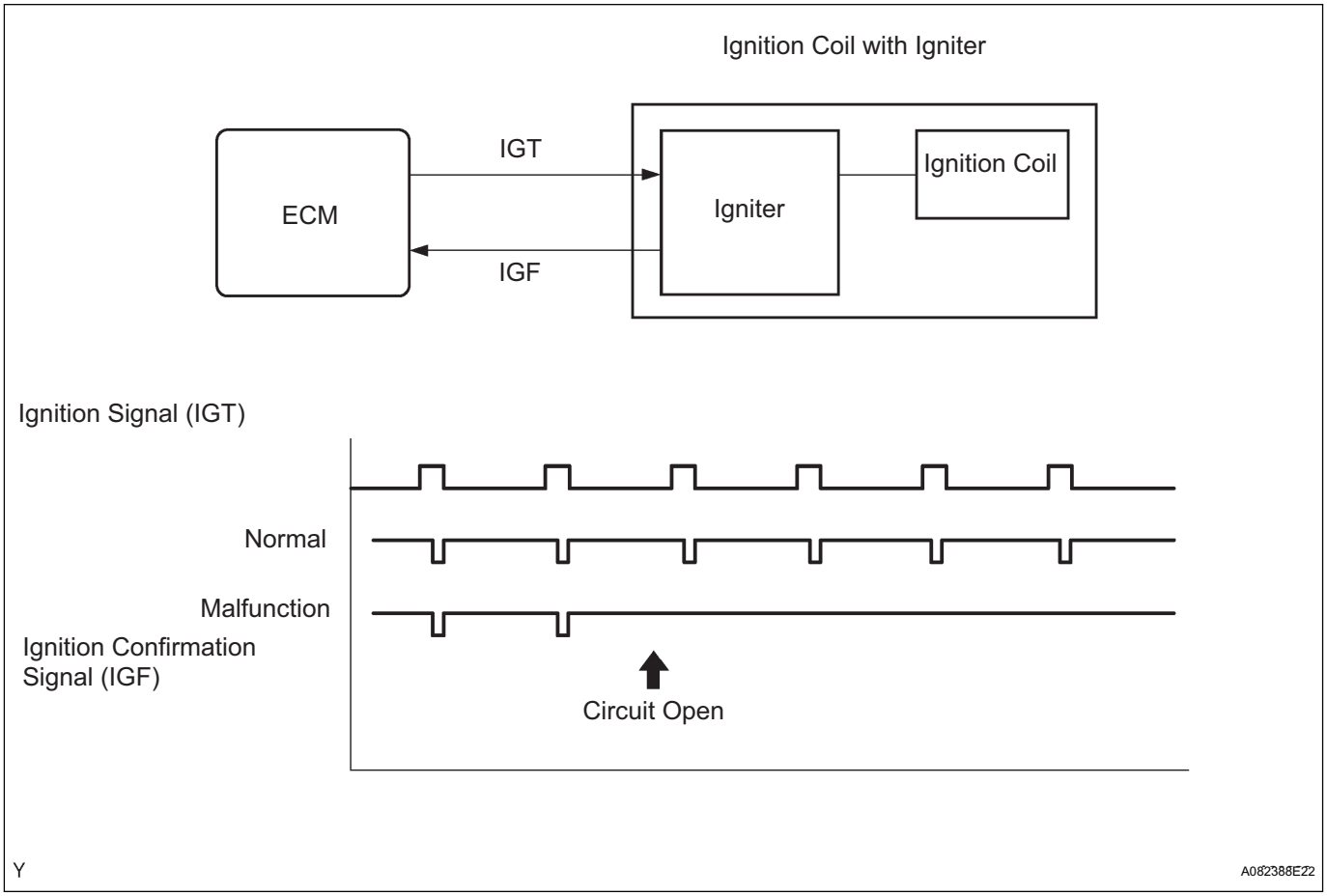
DESCRIPTION

A Direct Ignition System (DIS) is used on this vehicle.
The DIS is a 1-cylinder ignition system which ignites one cylinder with one ignition coil. In the 1-cylinder ignition system, one spark plug is connected to the end of the secondary winding. High-voltage is generated in the secondary winding and is applied directly to the spark plug. The spark of the spark plug passes from the centre electrode to the ground electrode.
The ECM determines the ignition timing and outputs the ignition signals (IGTs) for each cylinder. Using the IGT, the ECM turns on and off the power transistor inside the igniter, which switches on and off current to the primary coil. When current to the primary coil is cut off, high-voltage is generated in the secondary coil and this voltage is applied to the spark plugs to create a spark inside the cylinders. As the ECM cuts the current to the primary coil, the igniter sends back the ignition confirmation signal (IGF) for each cylinder ignition to the ECM.



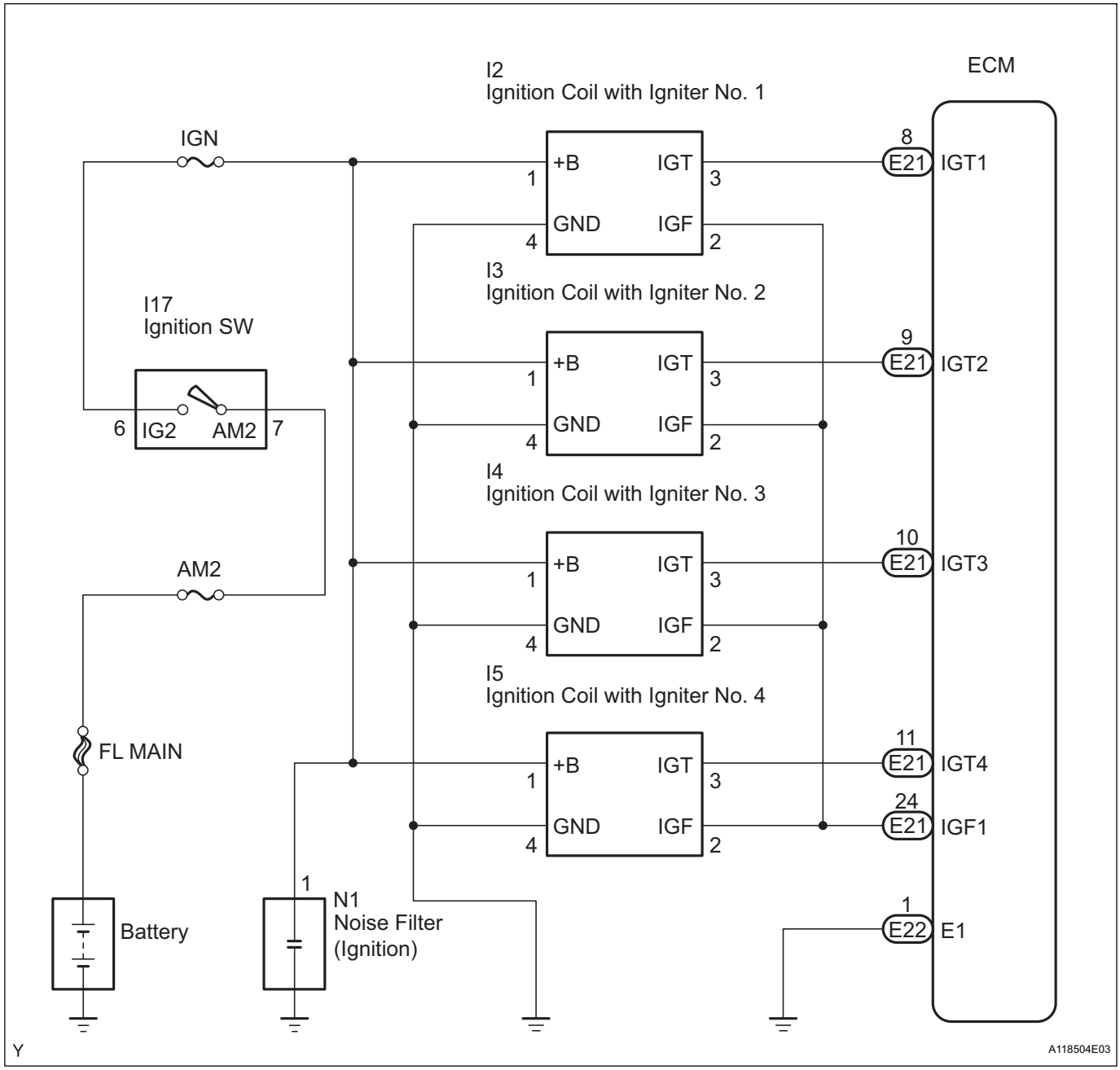
DTC No.	DTC Detection Condition	Trouble Area
P0351 P0352 P0353 P0354	No IGF signal to ECM while engine is running (1 trip detection logic)	• Ignition system • Open or short in IGF and IGT circuits (1 through 4) from ignition coil with igniter to ECM • Ignition coil with igniter (No. 1 to No. 4) • ECM

MONITOR DESCRIPTION



If the ECM does not receive the IGF after sending the IGT, it interprets this as a fault in the igniter and sets a DTC.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	**CHECK FOR SPARK OF MISFIRING CYLINDER**

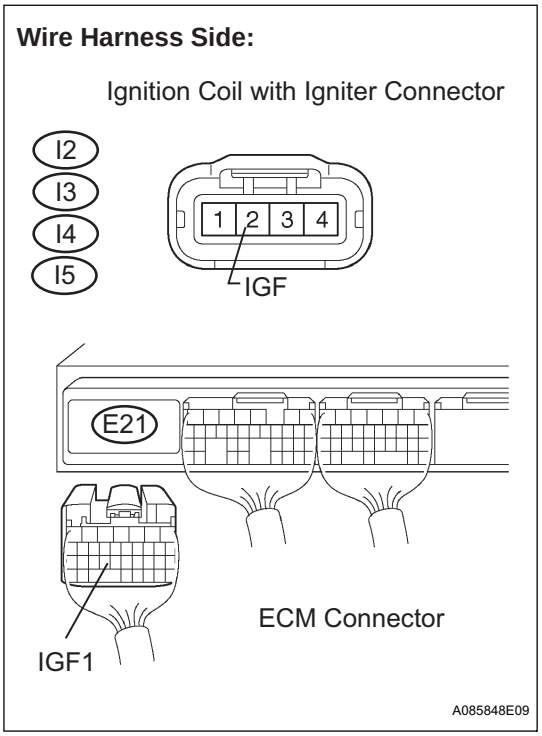
OK:

A spark occurs.

NG → GO TO STEP 4

OK

2	CHECK HARNESS AND CONNECTOR (IGNITION COIL WITH IGNITER - ECM (IGF TERMINAL))



(a) Disconnect the I2, I3, I4 and I5 ignition coil with igniter connectors.
(b) Disconnect the E21 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
I2-2 (IGF) - E21-24 (IGF1) I3-2 (IGF) - E21-24 (IGF1) I4-2 (IGF) - E21-24 (IGF1) I5-2 (IGF) - E21-24 (IGF1)	Below 1 Ω

Check for short

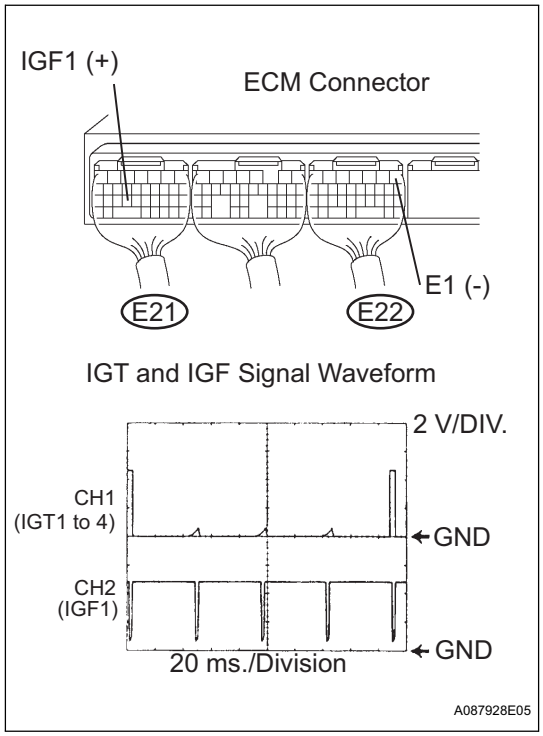
Tester Connection	Specified Condition
I2-2 (IGF) or E21-24 (IGF1) - Body ground I3-2 (IGF) or E21-24 (IGF1) - Body ground I4-2 (IGF) or E21-24 (IGF1) - Body ground I5-2 (IGF) or E21-24 (IGF1) - Body ground	10 kΩ or higher

(d) Connect the connectors.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

3	INSPECT ECM (IGF1 VOLTAGE)



(a) Turn the ignition switch to the ON position.
(b) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
E21-24 (IGF1) - E22-1 (E1)	4.5 to 5.5 V

HINT:
Reference: Inspection using an oscilloscope.
During cranking or idling, check the waveform of the ECM connectors.

Standard

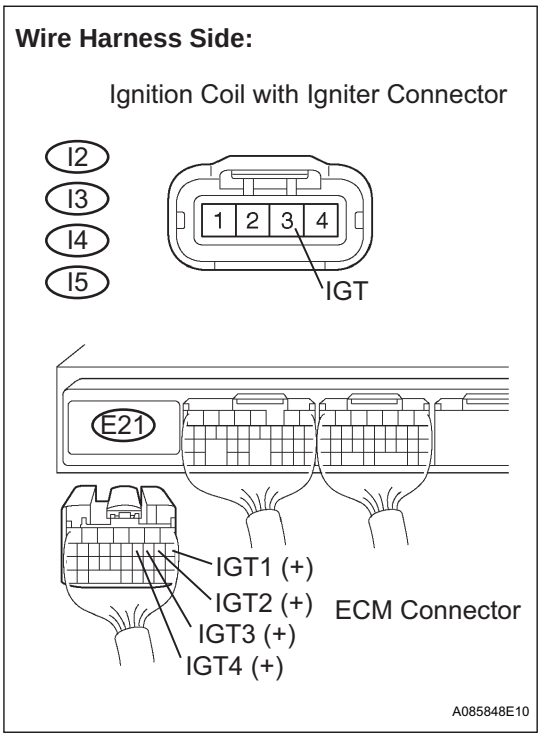
Tester Connection	Specified Condition
E21-24 (IGF1) - E22-1 (E1)	Correct waveform appears as shown

NG → **REPLACE ECM**

OK

REPLACE IGNITION COIL WITH IGNITER

4 CHECK HARNESS AND CONNECTOR (IGNITION COIL WITH IGNITER - ECM)



(a) Disconnect the I2, I3, I4 and I5 ignition coil with igniter connectors.
(b) Disconnect the E21 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
I2-3 (IGT) - E21-8 (IGT1) I3-3 (IGT) - E21-9 (IGT2) I4-3 (IGT) - E21-10 (IGT3) I5-3 (IGT) - E21-11 (IGT4)	Below 1 Ω

Check for short

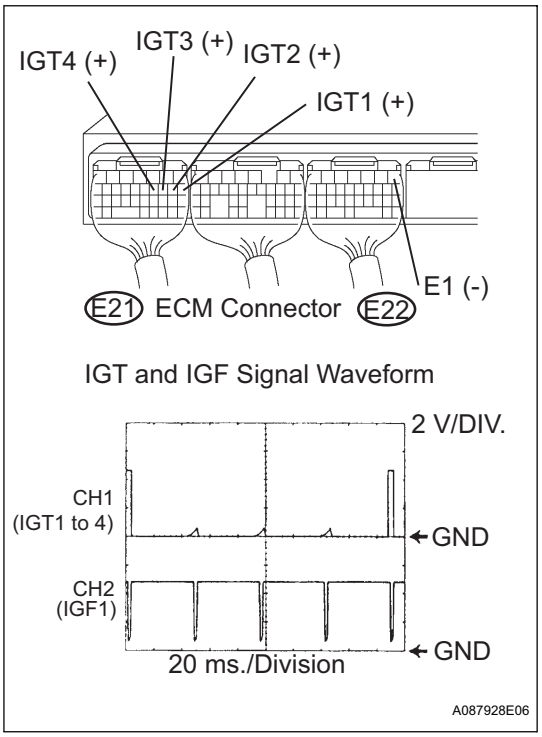
Tester Connection	Specified Condition
I2-3 (IGT) or E21-8 (IGT1) - Body ground I3-3 (IGT) or E21-9 (IGT2) - Body ground I4-3 (IGT) or E21-10 (IGT3) - Body ground I5-3 (IGT) or E21-11 (IGT4) - Body ground	10 kΩ or higher

(d) Connect the connectors.

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

OK

5 INSPECT ECM (IGT1, IGT2, IGT3, IGT4 VOLTAGE)



(a) Measure the voltage according to the value(s) in the table below when the engine is cranked.

Standard voltage

Tester Connection	Specified Condition
E21-8 (IGT1) - E22-1 (E1) E21-9 (IGT2) - E22-1 (E1) E21-10 (IGT3) - E22-1 (E1) E21-11 (IGT4) - E22-1 (E1)	More than 0.1 V or less than 4.5 V

(b) Disconnect the I2, I3, I4 and I5 ignition coil with igniter connectors.
(c) Measure the voltage according to the value(s) in the table below when the engine is cranked.

Standard voltage

Tester Connection	Specified Condition
E21-8 (IGT1) - E22-1 (E1) E21-9 (IGT2) - E22-1 (E1) E21-10 (IGT3) - E22-1 (E1) E21-11 (IGT4) - E22-1 (E1)	4.5 V or more

(d) Connect the connectors.
HINT:
Reference: Inspection using an oscilloscope.

During cranking or idling, check the waveform of the ECM connectors.

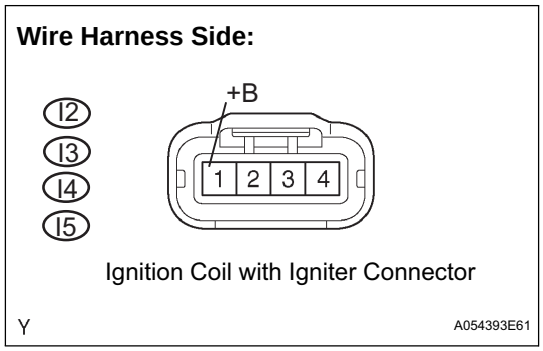
Standard

Tester Connection	Specified Condition
E21-8 (IGT1) - E22-1 (E1) E21-9 (IGT2) - E22-1 (E1) E21-10 (IGT3) - E22-1 (E1) E21-11 (IGT4) - E22-1 (E1)	Correct waveform appears as shown

NG → **REPLACE ECM**

OK

6 CHECK IGNITION COIL WITH IGNITER (POWER SOURCE)



(a) Disconnect the I2, I3, I4 and I5 ignition coil with igniter connectors.
(b) Turn the ignition switch to the ON position.
(c) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
I2-1 (+B) - Body ground I3-1 (+B) - Body ground I4-1 (+B) - Body ground I5-1 (+B) - Body ground	9 to 14 V

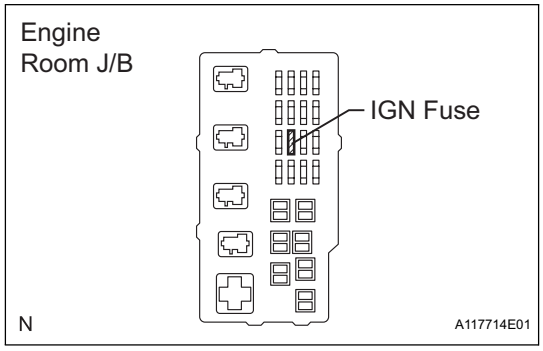
(d) Connect the connector.

NG → **GO TO STEP 7**

OK

REPLACE IGNITION COIL WITH IGNITER

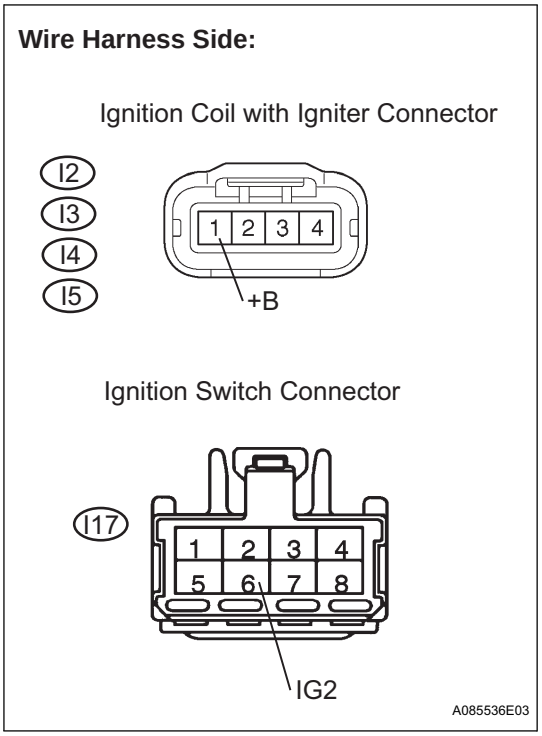
7 CHECK HARNESS AND CONNECTOR (IGNITION COIL WITH IGNITER - IGNITION SWITCH)



(a) Check the IGN fuse.
(1) Remove the IGN fuse from the engine room J/B.
(2) Measure the resistance of the IGN fuse.

Standard resistance:

Below 1 Ω



(b) Disconnect the I2, I3, I4 and I5 ignition coil with igniter connectors.
(c) Disconnect the I17 ignition switch connector.
(d) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
I2-1 (+B) - I17-6 (IG2) I3-1 (+B) - I17-6 (IG2) I4-1 (+B) - I17-6 (IG2) I5-1 (+B) - I17-6 (IG2)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
I2-1 (+B) or I17-6 (IG2) - Body ground I3-1 (+B) or I17-6 (IG2) - Body ground I4-1 (+B) or I17-6 (IG2) - Body ground I5-1 (+B) or I17-6 (IG2) - Body ground	10 kΩ or higher

(e) Connect the connectors.

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

OK →

REPLACE IGNITION COIL WITH IGNITER

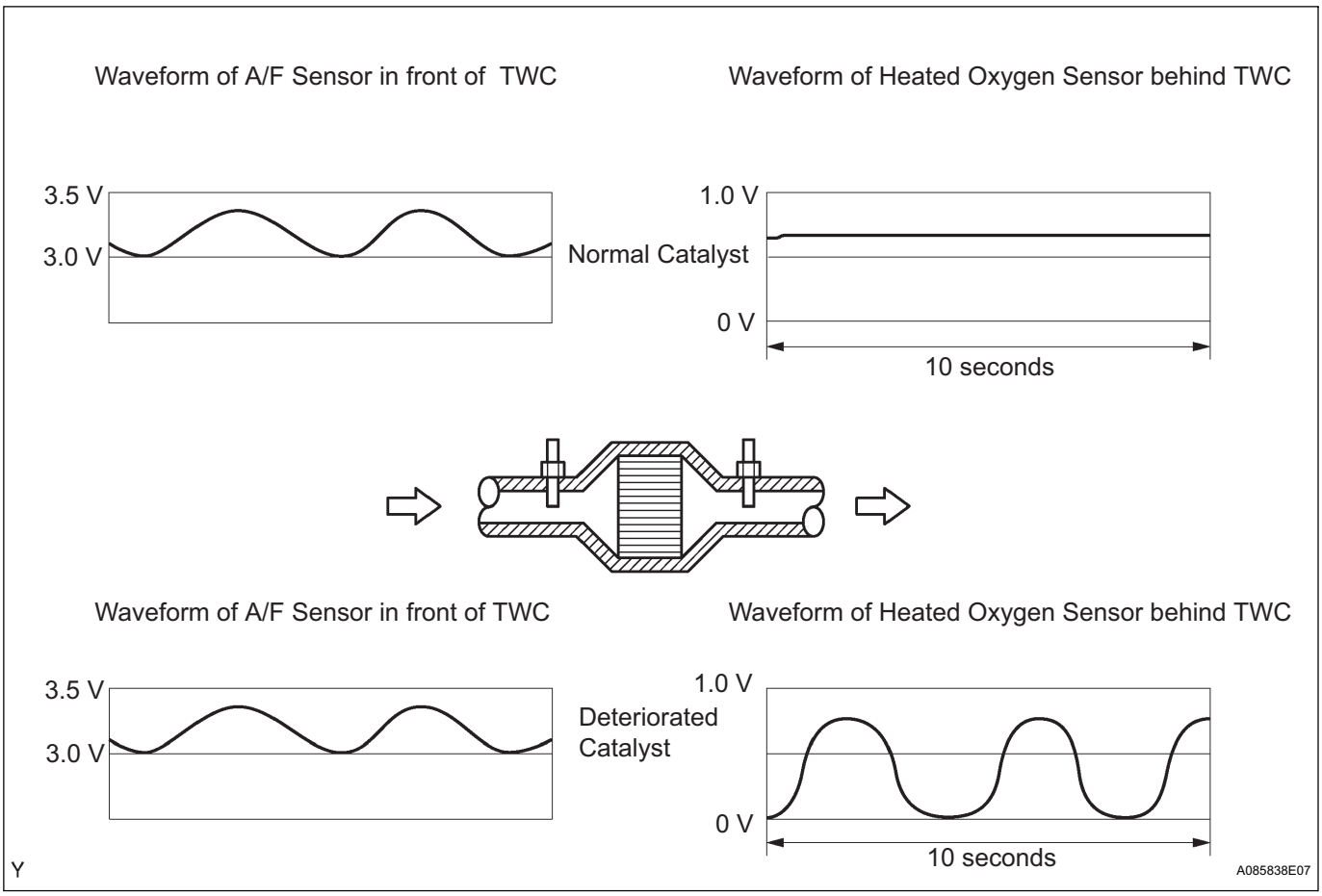
DTC	P0420	Catalyst System Efficiency Below Threshold (Bank 1)

DESCRIPTION

The ECM uses 2 sensors located in front of and behind the Three-Way Catalytic Converter (TWC) to monitor its efficiency. The air-fuel ratio (A/F) sensor (sensor 1) sends pre-catalyst information to the ECM. The heated oxygen (O2) sensor (sensor 2) sends post-catalyst information to the ECM. The ECM compares these two signals to judge the efficiency of the catalyst and the catalyst's ability to store oxygen. During normal operation, the TWC stores and releases oxygen as needed. The capacity to store oxygen results in a low variation in the post-TWC exhaust stream as shown below.

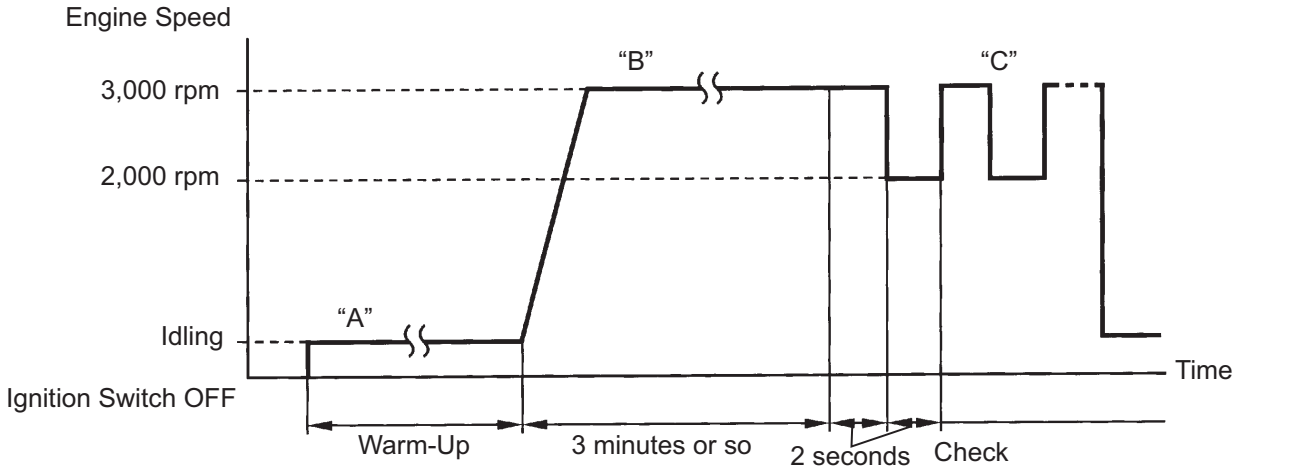
If the catalyst is functioning normally, the waveform of the O2 sensor slowly switches between rich and lean. If the catalyst is deteriorated, the waveform will fluctuate frequently between rich and lean. As the catalyst efficiency degrades, its ability to store oxygen is reduced and the catalyst output becomes more variable. When running the monitor, the ECM compares sensor signals before and after the TWC over a specific amount of time to determine catalyst efficiency. The ECM begins by comparing them calculating the signal length for both sensors (using each output voltage of the sensors). If the O2 sensor signal length is greater than the threshold (the threshold is calculated based on the A/F sensor signal length), the ECM concludes that the TWC is malfunctioning.

The ECM will turn on the MIL and the DTC will be set.



DTC No.	DTC Detection Condition	Trouble Area
P0420	After engine and catalyst are warmed up, and while vehicle is driven within set vehicle speed and engine speed range: Waveform of heated oxygen sensor frequently fluctuates between rich and lean (2 trip detection logic)	• Gas leakage in exhaust system • A/F sensor (sensor 1) • Heated oxygen sensor (sensor 2) • Three-way catalytic converter

CONFIRMATION DRIVING PATTERN



1. Start the engine and warm it up with all the accessories switched OFF until the engine coolant temperature becomes stable. (Procedure "A")
2. Run the engine at 2,500 to 3,000 rpm for about 3 minutes. (Procedure "B")
3. Rev up the engine at 3,000 rpm for 2 seconds and at 2,000 rpm for 2 seconds alternately. (Procedure "C")

INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	CHECK OTHER DTC OUTPUT (IN ADDITION TO DTC P0420)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
Only P0420	A
P0420 and other DTCs	B

HINT:
If any DTCs other than P0420 are output, perform troubleshooting for those DTCs first.

B → GO TO DTC CHART (See page ES-23)

A

2	CHECK FOR EXHAUST GAS LEAKAGE

OK:
No gas leakage

NG → **REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT**

OK ↓

3	INSPECT AIR FUEL RATIO SENSOR (SENSOR 1)

NG → **REPLACE AIR FUEL RATIO SENSOR**

OK ↓

4	INSPECT HEATED OXYGEN SENSOR (SENSOR 2)

OK:
During air-fuel ratio feedback, the oxygen sensor output fluctuates between rich and lean.

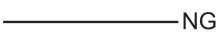
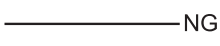
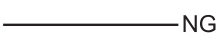
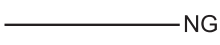
NOTICE:
On the damaged bank, replace both the front catalyst and rear catalyst.

Intelligent tester only:
Malfunctioning areas can be found by performing the Active Test / A/F Control operation. The A/F Control operation can determine if the A/F sensor, heated oxygen sensor or other potential trouble areas are malfunctioning or not.

(a) Perform Active Test using the intelligent tester.
HINT:
The A/F Control operation lowers the injection volume by 12.5 % or increases the injection volume by 25 %.
(1) Connect the intelligent tester to the DLC3.
(2) Start the engine and turn the intelligent tester ON.
(3) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds.
(4) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.
(5) Select the following monitor items: AFS B1 S1 and O2S B1 S2.
(6) Perform the A/F Control operation with the engine in an idling condition (press the right or left button).
Result:
The A/F sensor reacts in accordance with increase and decrease of the injection volume:
+25 % → Rich output: Less than 3.0 V
-12.5 % → Lean output: More than 3.35 V
The heated oxygen sensor reacts in accordance with increase and decrease of the injection volume:

+25 % → Rich output: More than 0.55 V
-12.5 % → Lean output: Less than 0.4 V

NOTICE:
The A/F sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

Case	Output Voltage of A/F Sensor (Sensor 1)		Output Voltage of Heated Oxygen Sensor (Sensor 2)		Main Suspected Trouble Area
1	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		-
	Output Voltage More than 3.35 V Less than 3.0 V		Output Voltage More than 0.55 V Less than 0.4 V		
2	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		A/F sensor (A/F sensor, sensor heater, sensor circuit)
	Output Voltage Almost no reaction		Output Voltage More than 0.55 V Less than 0.4 V		
3	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		Heated oxygen sensor (Heated oxygen sensor, sensor heater, sensor circuit)
	Output Voltage More than 3.35 V Less than 3.0 V		Output Voltage Almost no reaction		
4	Injection volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		Extremely rich or lean actual air-fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)
	Output Voltage Almost no reaction		Output Voltage Almost no reaction		

Following A/F Control procedure enables the technician to check and graph the voltage output of both A/F sensor and heated oxygen sensor.
To display the graph, select the following menu items on the tester: View / Line graph.

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

REPLACE THREE-WAY CATALYTIC CONVERTER (BOTH FRONT AND REAR TWC)

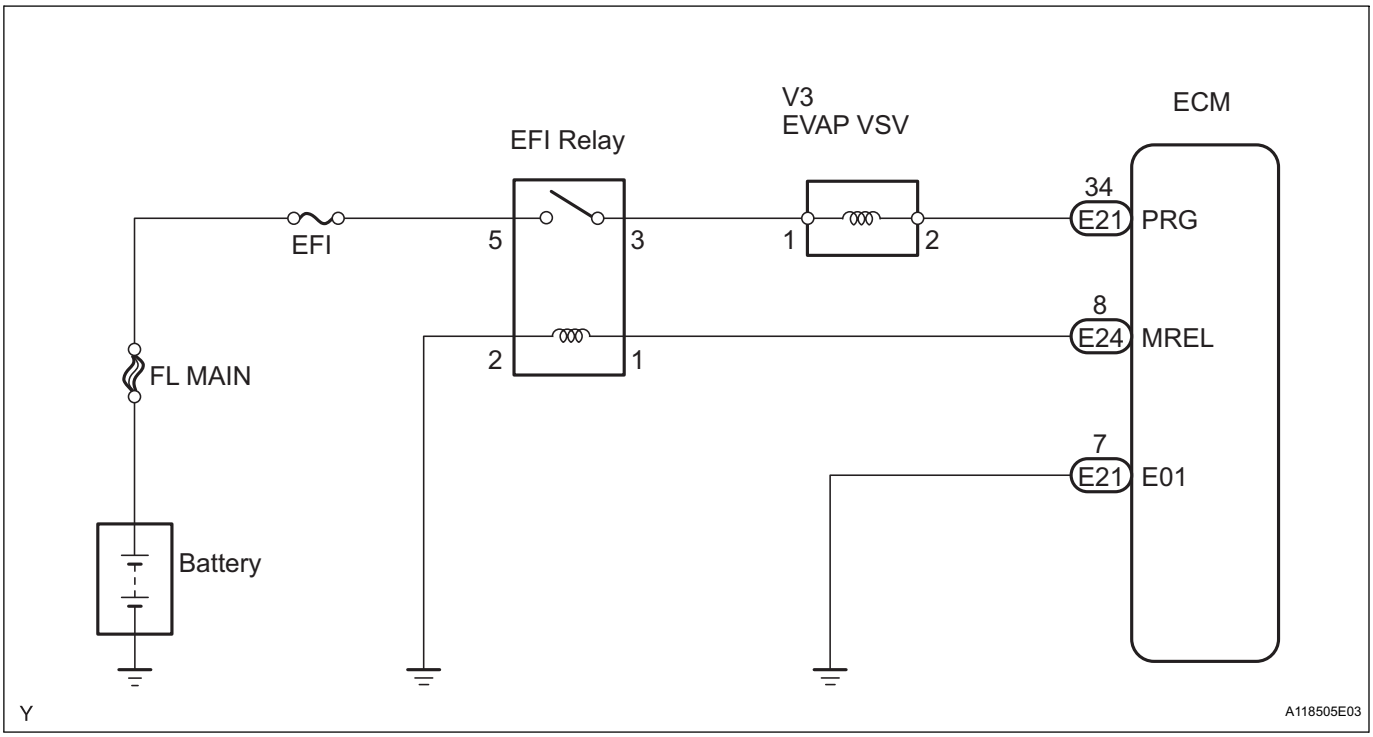
DTC	P0443	Evaporative Emission Control System Purge Control Valve Circuit

DESCRIPTION

In order to reduce Hydro Carbon (HC) emissions, evaporated fuel from the fuel tank is routed through the charcoal canister to the intake manifold for combustion in the cylinders.
The ECM changes the duty signal to the EVAP VSV so that the intake of HC emissions is appropriate for the driving conditions (engine load, engine speed, vehicle speed, etc.) after the engine is warmed up.

DTC No.	DTC Detection Condition	Trouble Area
P0443	Proper response to ECM command does not occur (1 trip detection logic)	• Open or short in EVAP VSV circuit • EVAP VSV • ECM

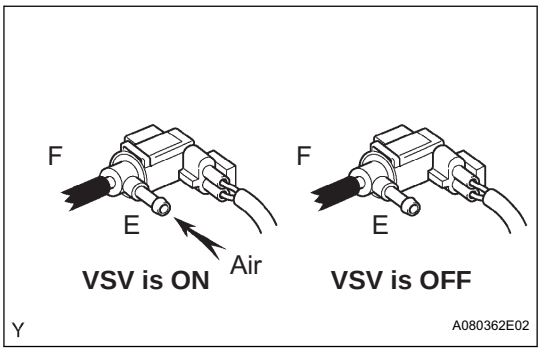
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (EVAP VSV)



(a) Disconnect the vacuum hose of the EVAP VSV.
(b) Connect the intelligent tester to the DLC3.
(c) Start the engine and turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / Active Test / Purge VSV. Press the right or left button.
(e) Use your finger to check if the disconnected port has suction when operating the EVAP VSV using the intelligent tester.

Standard

Tester Operation	Specified Condition
VSV is ON	Suction applied to your finger
VSV is OFF	No suction

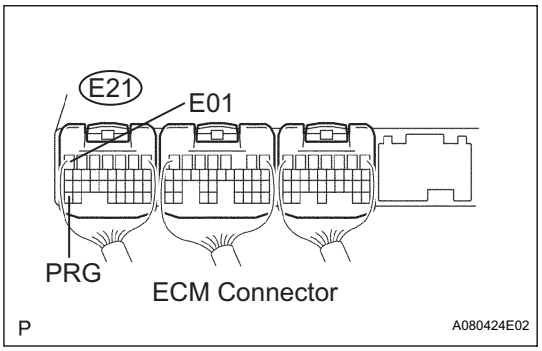
(f) Reconnect the vacuum hose.

NG → **GO TO STEP 2**

OK

CHECK FOR INTERMITTENT PROBLEMS

2	INSPECT ECM (CHECK VOLTAGE)



(a) Turn the ignition switch to the ON position.
(b) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
PRG (E21-34) - E01 (E21-7)	9 to 14 V

NG → **GO TO STEP 3**

OK

REPLACE ECM

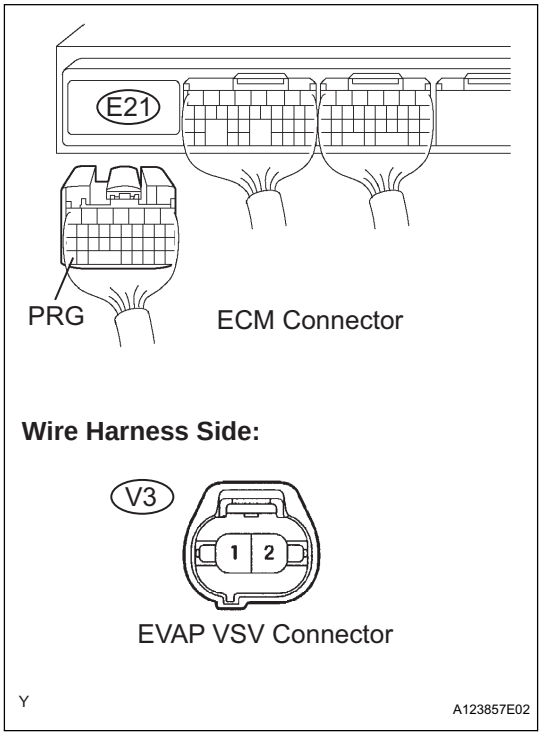
3	INSPECT VACUUM SWITCHING VALVE ASSEMBLY NO. 1 (OPERATION OF EVAP VSV)

OK:
Air flows when the battery voltage is applied to the EVAP VSV.

NG → **REPLACE VACUUM SWITCHING VALVE ASSEMBLY NO. 1**

OK

4 CHECK HARNESS AND CONNECTOR (ECM - EVAP VSV)



(a) Disconnect the E21 ECM connector.
(b) Disconnect the V3 EVAP VSV connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
V3-2 (EVAP VSV) - E21-34 (PRG)	Below 1 Ω

Check for short

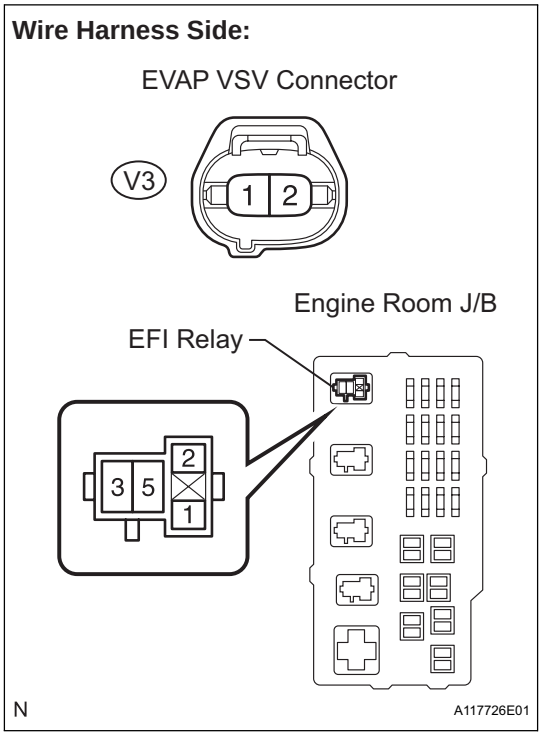
Tester Connection	Specified Condition
V3-2 (EVAP VSV) or E21-34 (PRG) - Body ground	10 kΩ or higher

(d) Connect the connectors.

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

OK

5 CHECK HARNESS AND CONNECTOR (EFI RELAY - EVAP VSV)



(a) Remove the EFI relay from the engine room J/B.
(b) Disconnect the V3 EVAP VSV connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
V3-1 (EVAP VSV) - Engine room J/B EFI relay terminal 3	Below 1 Ω

Check for short

Tester Connection	Specified Condition
V3-1 (EVAP VSV) or Engine room J/B EFI relay terminal 3 - Body ground	10 kΩ or higher

(d) Reinstall the EFI relay
(e) Connect the connector.

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

OK

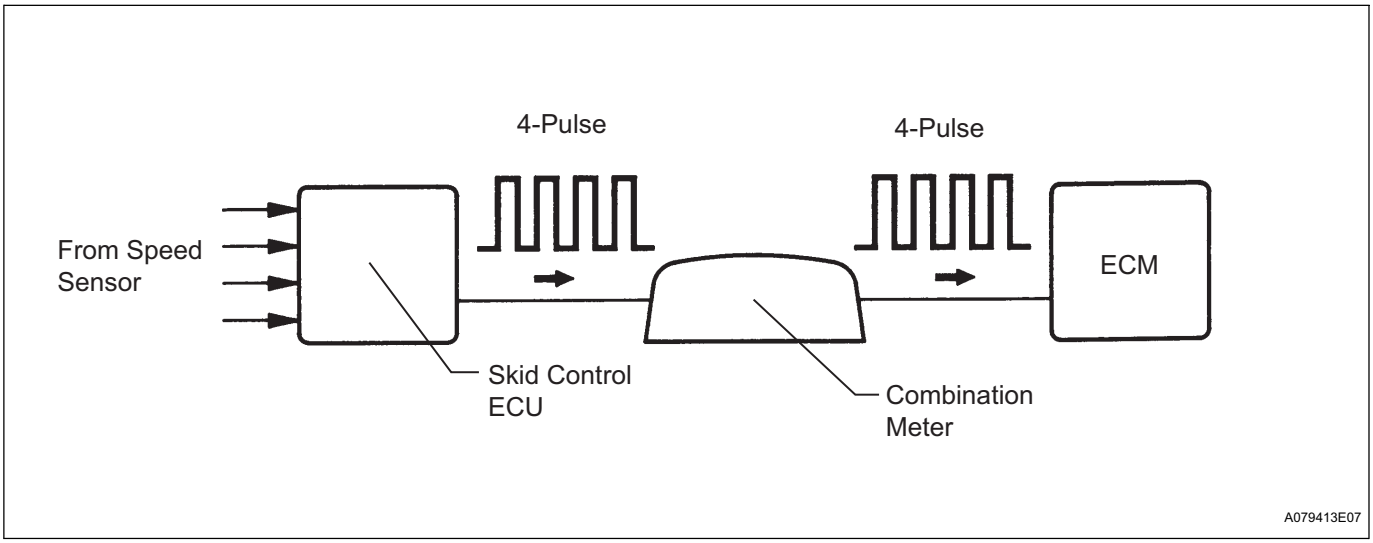
INSPECT ECM POWER SOURCE CIRCUIT

DTC	P0500	Vehicle Speed Sensor "A"

DTC	P0503	Vehicle Speed Sensor "A" Intermittent / Erratic / High

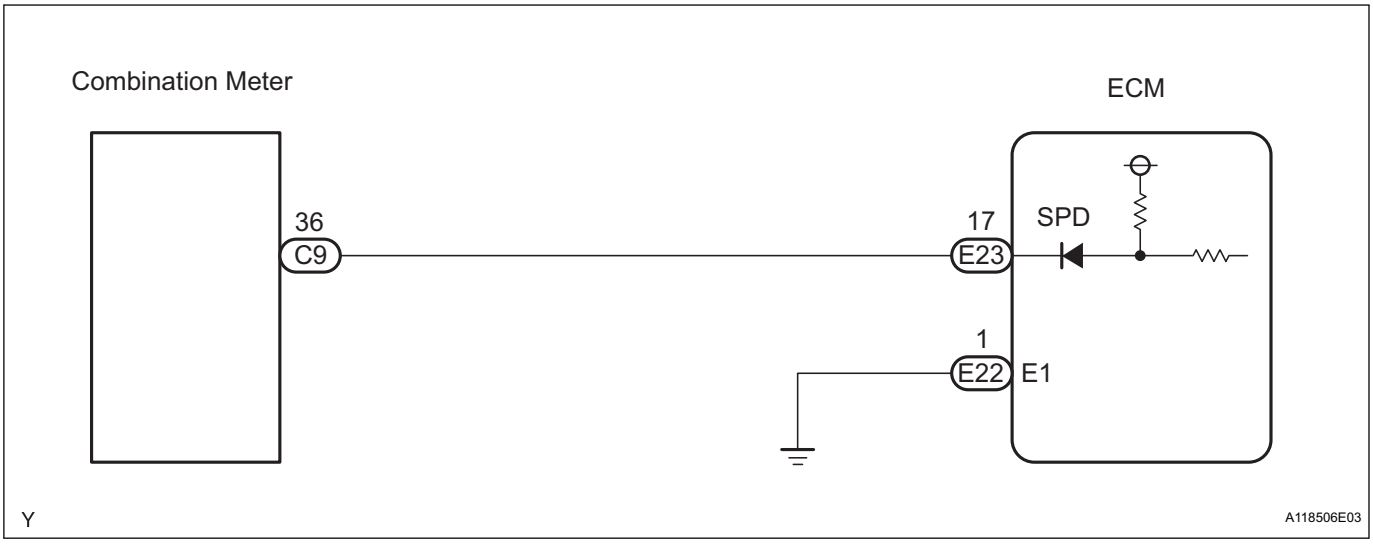
DESCRIPTION

The speed sensor detects the wheel speed and sends the appropriate signals to the skid control ECU. The skid control ECU converts these wheel speed signals into a 4-pulse signal and outputs it to the ECM via the combination meter. The ECM determines the vehicle speed based on the frequency of these pulse signals.



DTC No.	DTC Detection Condition	Trouble Area
P0500 P0503	The ECM detects the following conditions simultaneously for 2 seconds: • No SPD (speed sensor) signal while ECM detects NC (transmission counter gear) signal is more than 300 rpm • Park/Neutral position switch is OFF (When shift lever is in other than P and N positions)	• Open or short in speed sensor circuit • Vehicle speed sensor • Combination meter • ECM • Skid control ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

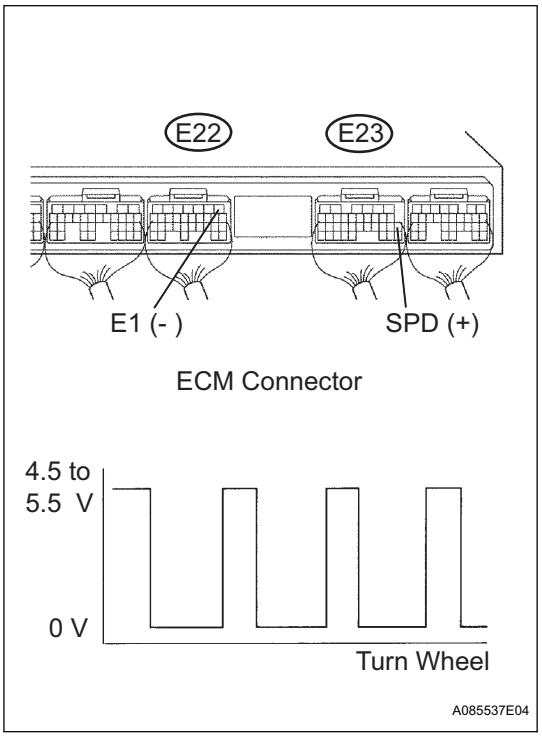
1	CHECK OPERATION OF SPEEDOMETER

(a) Drive the vehicle and check if operation of the speedometer in the combination meter is normal.
HINT:
The vehicle speed sensor is operating normally if the speedometer display is normal.

NG → CHECK SPEEDOMETER CIRCUIT

OK

2	INSPECT ECM (SPD VOLTAGE)



(a) Shift the lever to the neutral position.
(b) Jack up the vehicle.
(c) Turn the ignition switch to the ON position.
(d) Measure the voltage according to the value(s) in the table below when the wheel is turned slowly.
Standard voltage

Tester Connection	Specified Condition
E23-17 (SPD) - E22-1 (E1)	Generated intermittently

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

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM

DTC	P0504	Brake Switch "A" / "B" Correlation

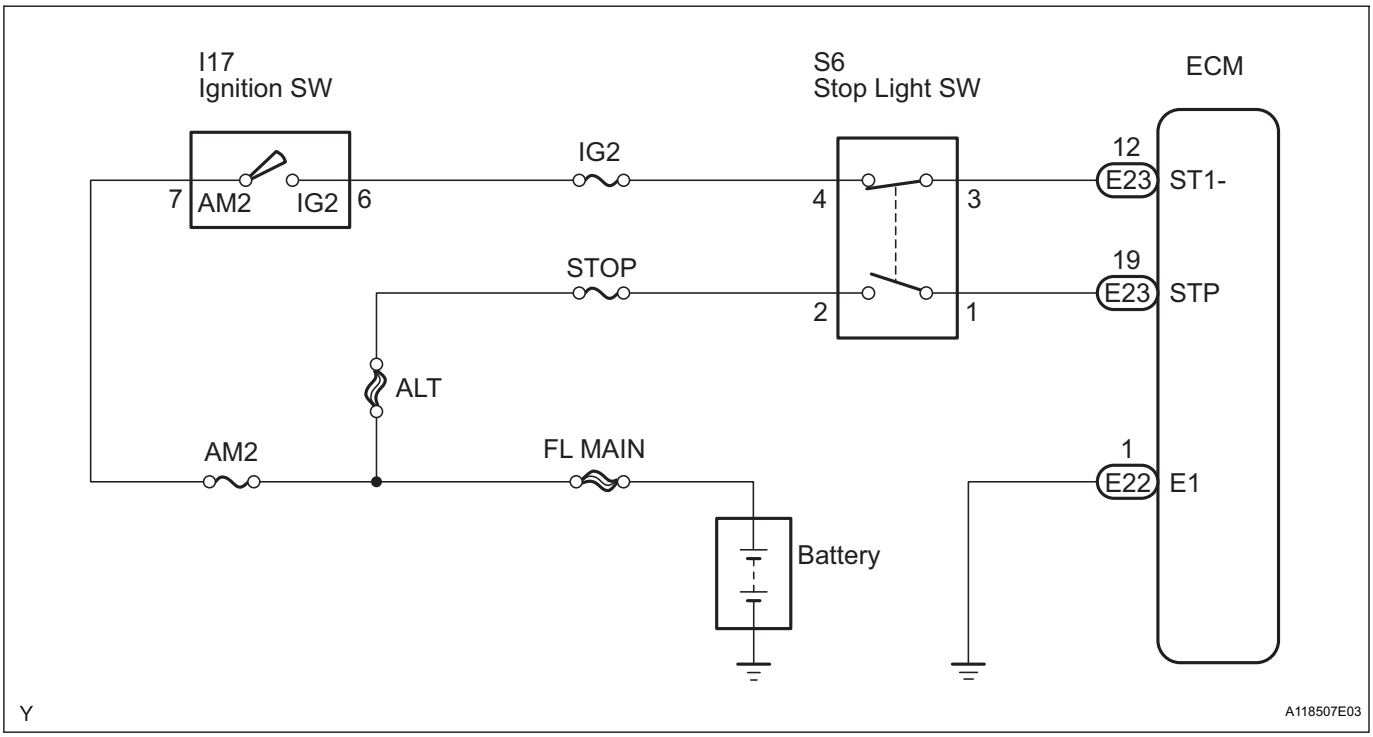
DESCRIPTION

In addition to turning on the stop light, the stop light switch signals are used for a variety of engine, transmission, and suspension functions as well as being an input for diagnostic checks. It is important that the switch operates properly, therefore this switch is designed with 2 complementary signal outputs: STP and ST1-. The ECM analyses these signal outputs to detect malfunctions in the stop light switch.
HINT:
Normal condition is as shown in the table.

Signal	Brake Pedal Released	In transition	Brake Pedal Depressed
STP	OFF	ON	ON
ST1-	ON	ON	OFF

DTC No.	DTC Detection Condition	Trouble Area
P0504	Conditions 1, 2 and 3 continue for 0.5 seconds or more: 1. Ignition switch ON 2. Brake pedal released 3. STP signal is OFF when the ST1- signal is OFF (1 trip detection logic)	• Short in stop light switch signal circuit • STOP fuse • Stop light switch • ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

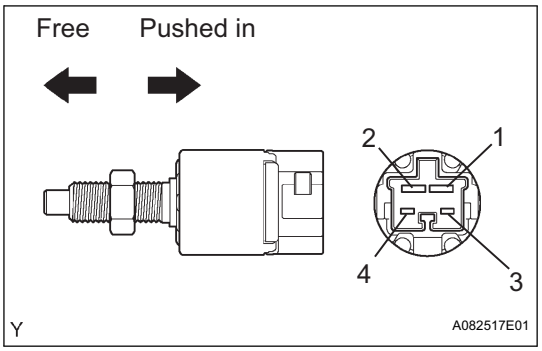
1	CHECK STOP LIGHT (OPERATION)

(a) Check if the stop lights turn on and off normally when the brake pedal is depressed and released.
OK:
The stop lights turn on when you depress the brake pedal.

NG → **REPAIR OR REPLACE STOP LIGHT SWITCH CIRCUIT**

OK

2	INSPECT STOP LIGHT SWITCH ASSEMBLY (RESISTANCE)



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

Switch Condition	Tester Connection	Specified Condition
Switch pin free	1 - 2	Below 1 Ω
Switch pin free	3 - 4	10 kΩ or higher
Switch pin pushed in	1 - 2	10 kΩ or higher
Switch pin pushed in	3 - 4	Below 1 Ω

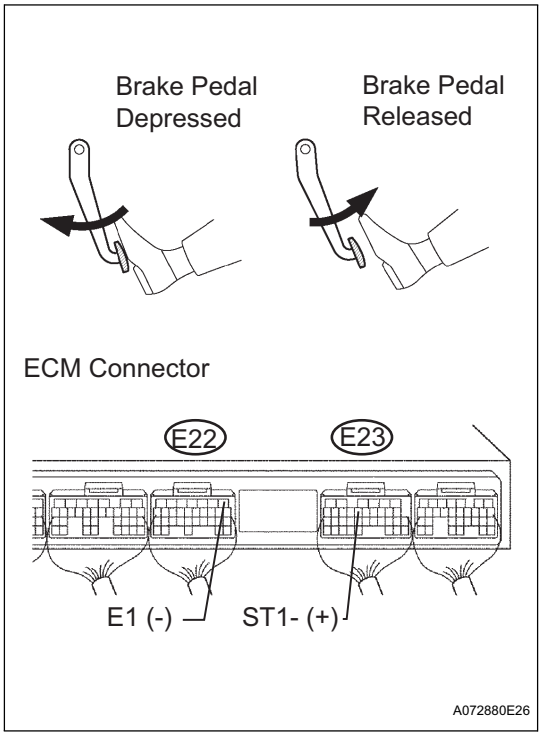
NG → **REPLACE STOP LIGHT SWITCH ASSEMBLY**

OK

3	READ VALUE OF INTELLIGENT TESTER (STP SIGNAL, ST1 - VOLTAGE)

(a) Turn the ignition switch to the ON position.
(b) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Data List / Stop Light Switch. Read the value.
Standard

Brake Pedal Condition	Specified Condition
Depressed	STP Signal ON
Released	STP Signal OFF



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

Standard voltage

Tester Connection	Brake Pedal Condition	Specified Condition
E23-12 (ST1-) - E22-1 (E1)	Depressed	Below 1.5 V
E23-12 (ST1-) - E22-1 (E1)	Released	7.5 to 14 V

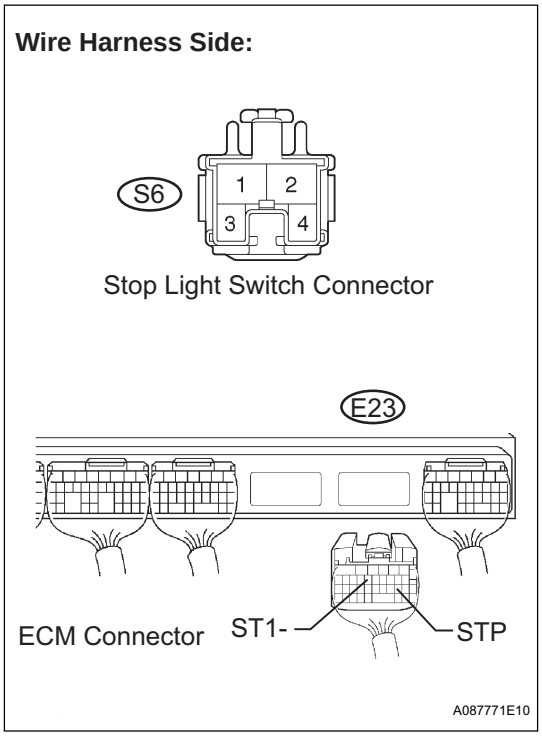
(d) Connect the connectors.

NG → **GO TO STEP 4**

OK

CHECK FOR INTERMITTENT PROBLEMS

4 CHECK HARNESS AND CONNECTOR (STOP LIGHT SWITCH - ECM)



(a) Disconnect the S6 stop light switch connector.
(b) Disconnect the E23 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
S6-1 - E23-19 (STP) S6-3 - E23-12 (ST1-)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
S6-1 or E23-19 (STP) - Body ground S6-3 or E23-12 (ST1-) - Body ground	10 kΩ or higher

(d) Connect the connectors.

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

OK

REPLACE ECM

DTC	P0505	Idle Control System Malfunction

DESCRIPTION

The idle speed is controlled by the ETCS (Electronic Throttle Control System).
The ETCS is composed of the throttle actuator which operates the throttle valve, and the throttle position sensor which detects an opening angle of the throttle valve.
The ECM controls the throttle motor to provide the proper throttle valve opening angle to obtain the target idling speed.

DTC No.	DTC Detection Condition	Trouble Area
P0505	Idling speed continues to vary greatly from target speed (2 trip detection logic)	• Electronic throttle control system • Air induction system • PCV hose connection

INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	CHECK FOR OTHER DTC OUTPUT (IN ADDITION TO DTC P0505)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
Only P0505	A
P0505 and other DTCs	B

HINT:
If any DTCs other than P0505 are output, perform troubleshooting for those DTCs first.

B → **GO TO DTC CHART (See page ES-23)**

A

2	CHECK CONNECTION OF PCV HOSE

OK:
The PCV hose is connected correctly, and it is not damaged.

NG → **REPAIR OR REPLACE PCV HOSE**

OK

3	CHECK AIR INDUCTION SYSTEM

(a) Check for vacuum leaks in the air induction system.
OK:
No leak in the air induction system

NG → **REPAIR OR REPLACE AIR INDUCTION SYSTEM**

OK ↓

CHECK ELECTRIC THROTTLE CONTROL SYSTEM

DTC	P0560	System Voltage

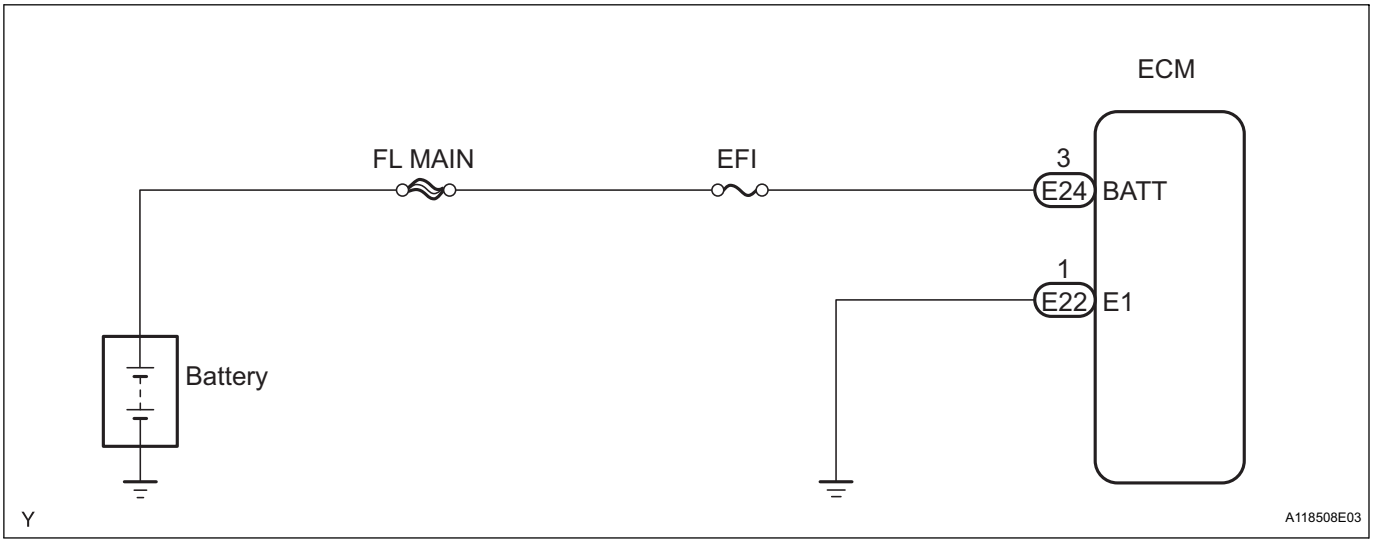
MONITOR DESCRIPTION

The battery supplies electricity to the ECM even when the ignition switch is OFF. This electricity allows the ECM to store data such as DTC history, freeze frame data, fuel trim values and other data. If the battery voltage falls below a minimum level, the ECM will conclude that there is a fault in the power supply circuit. The next time the engine starts, the ECM will turn on the MIL and a DTC will be set.

DTC No.	DTC Detection Condition	Trouble Area
P0560	Open in back-up power source circuit (1 trip detection logic)	• Open in back-up power source circuit • ECM

HINT:
If DTC P0560 is present, the ECM will not store other DTCs.

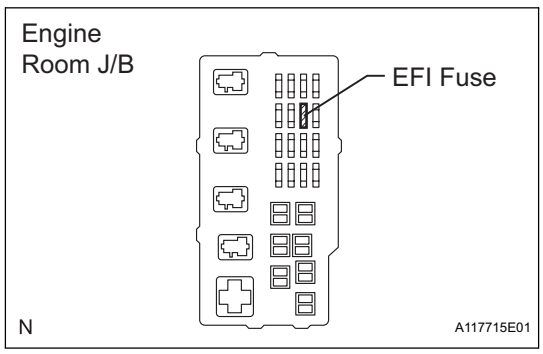
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	INSPECT EFI FUSE

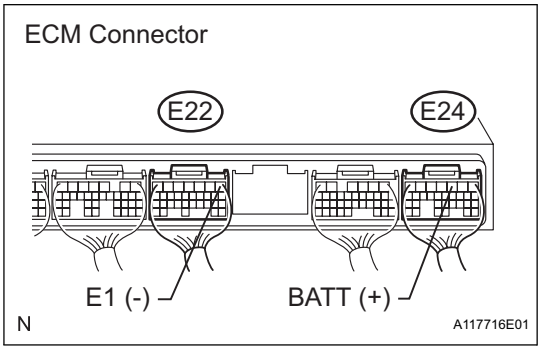


(a) Remove the EFI fuse from the engine room J/B.
(b) Measure the resistance of the EFI fuse.
Standard resistance:
Below 1 Ω
(c) Reinstall the EFI fuse.

NG	REPLACE EFI FUSE

OK

2 INSPECT ECM (BATT VOLTAGE)



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

Standard voltage

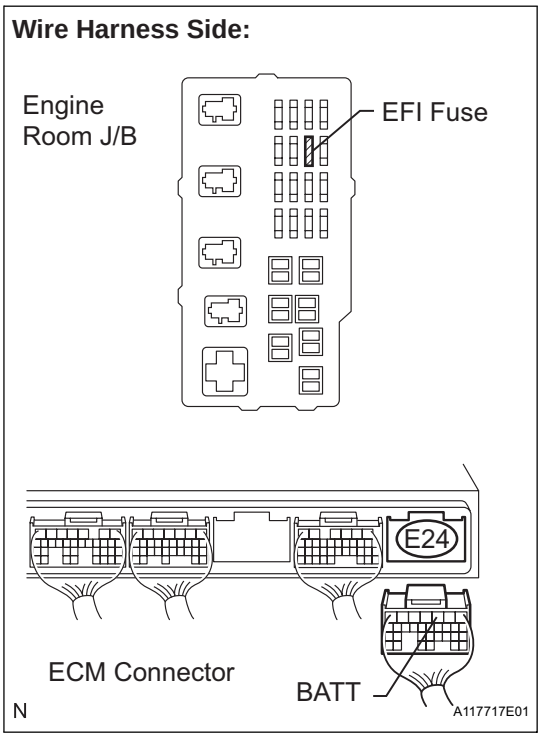
Tester Connection	Specified Condition
E24-3 (BATT) - E22-1 (E1)	9 to 14 V

NG → GO TO STEP 3

OK

REPLACE ECM

3 CHECK HARNESS AND CONNECTOR (ECM - EFI FUSE, EFI FUSE - BATTERY)



(a) Check the wire harness between the EFI fuse and ECM.
(1) Remove the EFI fuse from the engine room J/B.
(2) Disconnect the battery negative cable.
(3) Disconnect the E24 ECM connector.
(4) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
Engine room J/B EFI fuse - E24-3 (BATT)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
Engine room J/B EFI fuse or E24-3 (BATT) - Body ground	10 kΩ or higher

(5) Reinstall the EFI fuse.
(6) Connect the connector.
(7) Connect the battery negative cable.

(b) Check the wire harness between the EFI fuse and battery.
(1) Remove the EFI fuse from the engine room J/B.
(2) Disconnect the battery negative cable.
(3) Disconnect the battery positive cable.
(4) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
Battery positive cable - Engine room J/B EFI fuse	Below 1 Ω

Check for short

Tester Connection	Specified Condition
Battery positive cable or Engine room J/B EFI fuse - Body ground	10 kΩ or higher

(c) Reinstall the EFI fuse.
(d) Connect the battery positive cable.
(e) Connect the battery negative cable.

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

OK

CHECK AND REPLACE ENGINE ROOM JUNCTION BLOCK

DTC	P0604	Internal Control Module Random Access Memory (RAM) Error
DTC	P0606	ECM / PCM Processor
DTC	P0607	Control Module Performance
DTC	P0657	Actuator Supply Voltage Circuit / Open

MONITOR DESCRIPTION

The ECM continuously monitors its internal memory status, internal circuits, and output signals to the throttle actuator. This self-check ensures that the ECM is functioning properly. If any malfunction is detected, the ECM will set the appropriate DTC and illuminate the MIL.
The ECM memory status is diagnosed by internal "mirroring" of the main CPU and the sub CPU to detect random access memory (RAM) errors. The 2 CPUs also perform continuous mutual monitoring. The ECM sets a DTC if: 1) outputs from the 2 CPUs are different and deviate from the standards, 2) the signals to the throttle actuator deviate from the standards, 3) a malfunction is found in the throttle actuator supply voltage, and 4) any other ECM malfunction is found.

DTC No.	DTC Detection Condition	Trouble Area
P0604 P0606 P0607 P0657	ECM internal error (1 trip detection logic)	ECM

INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	REPLACE ECM

(a) Check for DTCs.
OK:
DTC P0604, P0606, P0607 or P0657 is not output.

NEXT

END

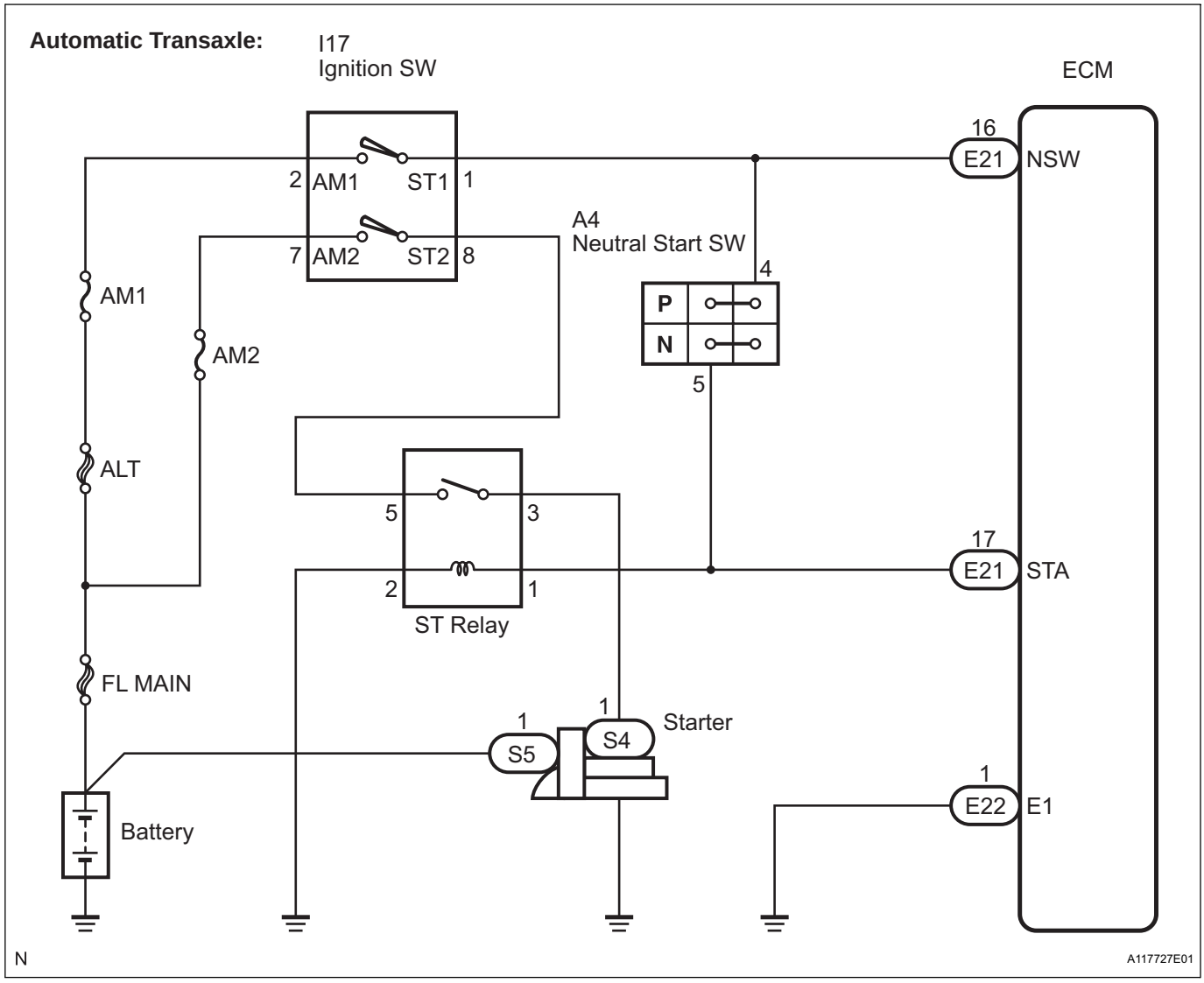
DTC	P0617	Starter Relay Circuit High

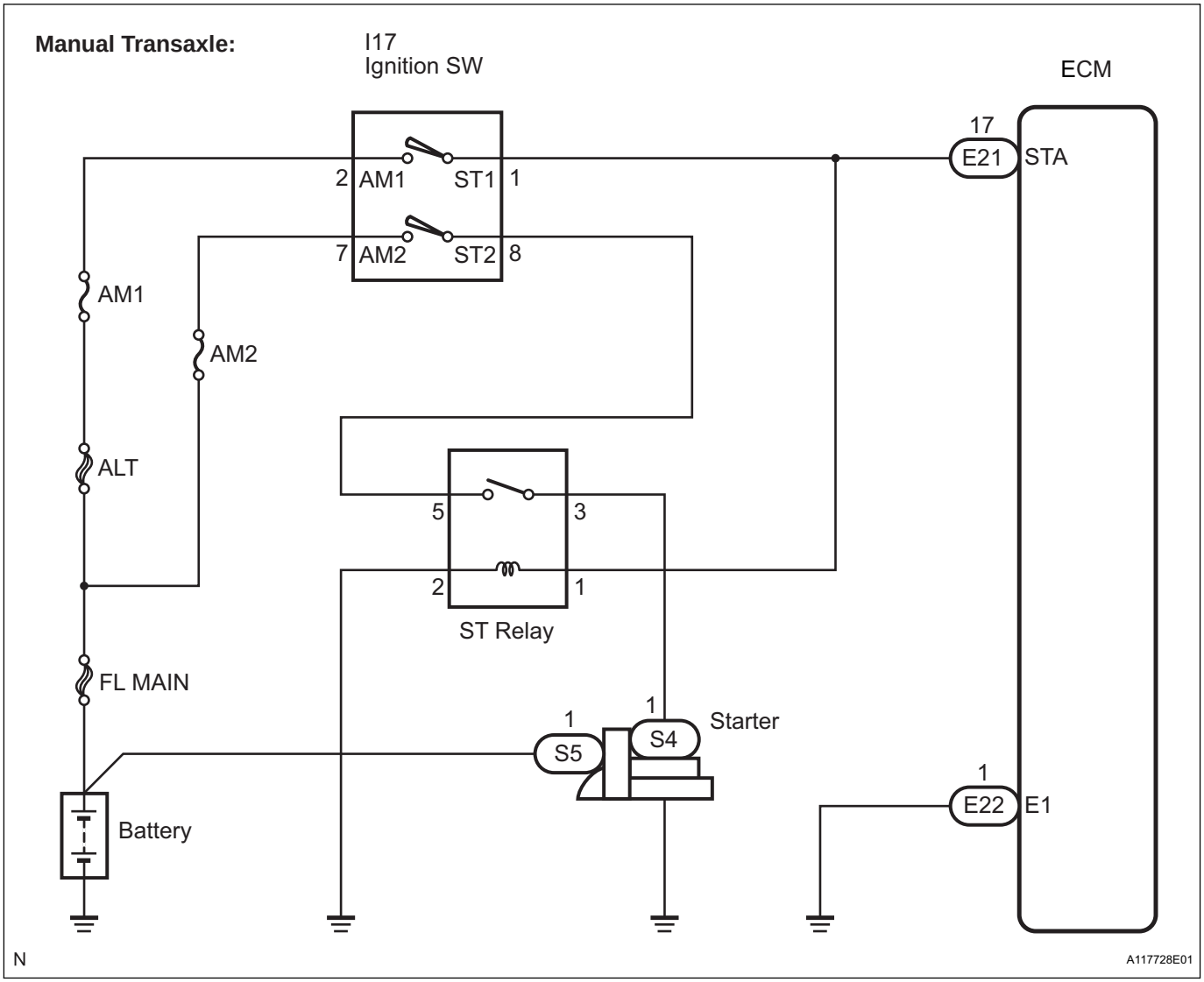
DESCRIPTION

While the engine is being cranked, the battery voltage is applied to terminal STA of the ECM.

DTC No.	DTC Detection Condition	Trouble Area
P0617	Conditions (a), (b) and (c) are met when the battery voltage of 10.5 V or more is applied for 20 seconds (a) Vehicle speed greater than 20 km/h (b) Engine RPM greater than 1,000 rpm (c) STA signal ON (1 trip detection logic)	• Short in park / neutral position switch circuit (Automatic transaxle) • Short in STA circuit • Park / neutral position switch (Automatic transaxle) • Ignition switch • ECM

WIRING DIAGRAM





INSPECTION PROCEDURE

HINT:

Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	READ VALUE OF INTELLIGENT TESTER (STA SIGNAL)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Starter SIG.
(d) Check the result when the ignition switch is turned to the ON and START positions.

Result

Ignition Switch Position	ON	START
STA Signal	OFF	ON

NG → GO TO STEP 2

OK →

REPLACE ECM

2 INSPECT PARK/NEUTRAL POSITION SWITCH ASSEMBLY

(a) Check the park/neutral position switch assembly.
OK:
When the shift lever is in the N position, the park/neutral position switch is ON.
When the shift lever is in the D position, the park/neutral position switch is OFF.
HINT:
For vehicles with the manual transaxle, proceed to step 4.

NG → **REPLACE PARK/NEUTRAL POSITION SWITCH ASSEMBLY**

OK →

3 READ VALUE OF INTELLIGENT TESTER (STA SIGNAL)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Starter SIG.
(d) Check the result when the ignition switch is turned to the ON and START positions.

Result

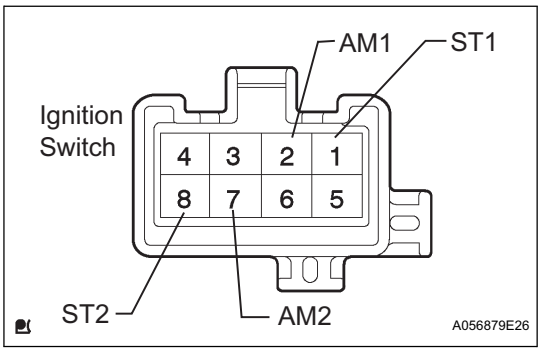
Ignition Switch Position	ON	START
STA Signal	OFF	ON

NG → GO TO STEP 4

OK →

END

4	INSPECT IGNITION SWITCH ASSEMBLY



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

Standard resistance

Switch Condition	Tester Condition	Specified Condition
LOCK	1-2, 7-8	10 kΩ or higher
START	1-2, 7-8	Below 1 Ω

NG → **REPAIR OR REPLACE IGNITION SWITCH ASSEMBLY**

OK

5	READ VALUE OF INTELLIGENT TESTER (STA SIGNAL)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Starter SIG.
(d) Check the result when the ignition switch is turned to the ON and START positions.

Result

Ignition Switch Position	ON	START
STA Signal	OFF	ON

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

OK

END

DTC	P2102	Throttle Actuator Control Motor Circuit Low

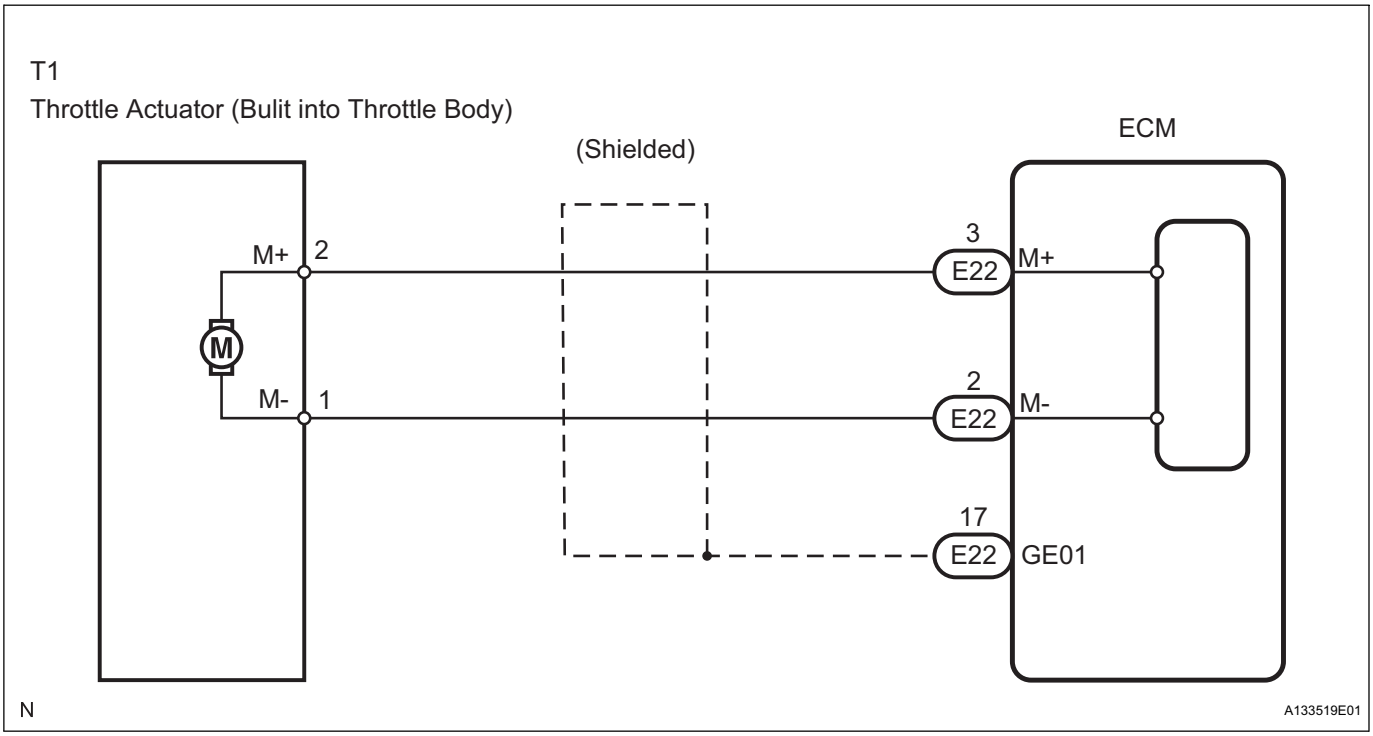
DTC	P2103	Throttle Actuator Control Motor Circuit High

DESCRIPTION

The throttle actuator is operated by the ECM and it opens and closes the throttle valve.
The opening angle of the throttle valve is detected by the throttle position sensor which is mounted on the throttle body. The throttle position sensor provides feedback to the ECM. This feedback allows the ECM to control the throttle actuator and monitor the throttle opening angle in response to driver inputs.
HINT:
This Electronic Throttle Control System (ETCS) does not use a throttle cable.

DTC No.	DTC Detection Condition	Trouble Area
P2102	Conditions (a) and (b) continue for 2.0 seconds: (a) Throttle control motor output duty 80% or more (b) Throttle control motor current 0.5 A or less (1 trip detection logic)	• Open in throttle actuator circuit • Throttle actuator • ECM
P2103	Either of following conditions is met: • Hybrid IC diagnosis signal fail • Hybrid IC current limiter port fail (1 trip detection logic)	• Short in throttle actuator circuit • Throttle actuator • Throttle valve • Throttle body assembly • ECM

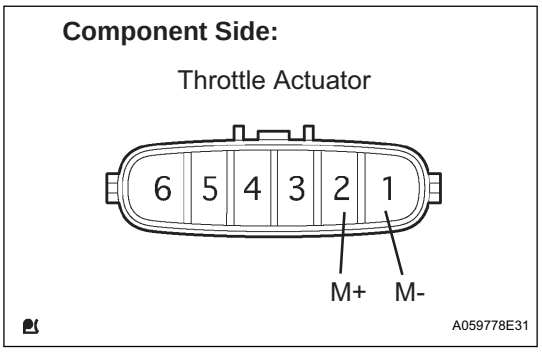
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1 INSPECT THROTTLE BODY ASSEMBLY (THROTTLE ACTUATOR)



(a) Disconnect the T1 throttle actuator connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

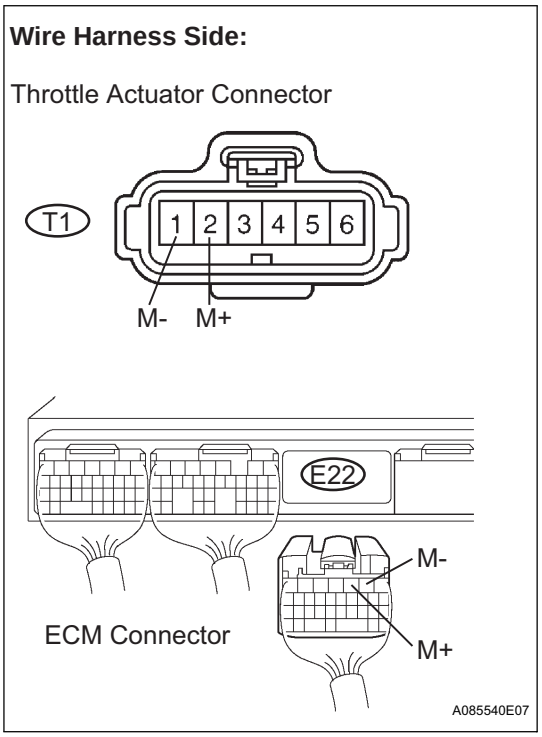
Tester Connection	Specified Condition
T1-2 (M+) - T1-1 (M-)	0.3 to 100 Ω (20°C (68°F))

(c) Connect the connector.

NG → **REPLACE THROTTLE BODY ASSEMBLY**

OK

2 CHECK HARNESS AND CONNECTOR (THROTTLE ACTUATOR - ECM)



(a) Disconnect the T1 throttle actuator connector.
(b) Disconnect the E22 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
T1-2 (M+) - E22-3 (M+) T1-1 (M-) - E22-2 (M-)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
T1-2 (M+) or E22-3 (M+) - Body ground T1-1 (M-) or E22-2 (M-) - Body ground	10 kΩ or higher

(d) Connect the connectors.

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

OK

3 INSPECT THROTTLE BODY ASSEMBLY

(a) Visually check between the throttle valve and the housing for foreign objects.
Also, check if the valve can open and close smoothly.

OK:

The throttle valve is not contaminated by foreign objects and can move smoothly.

NG → REMOVE FOREIGN OBJECT AND CLEAN THROTTLE BODY

OK

REPLACE ECM

DTC	P2111	Throttle Actuator Control System - Stuck Open

DTC	P2112	Throttle Actuator Control System - Stuck Closed

DESCRIPTION

The throttle actuator is operated by the ECM in response to the driving conditions. The throttle actuator opens and closes the throttle using an electric motor and gears. The throttle position sensor is mounted on the throttle body, to detect the opening angle of the throttle valve. This position signal is used as feedback by the ECM to verify correct control of the throttle valve. If a malfunction is detected, the ECM shuts down power to the throttle valve, and the throttle valve will return to its prescribed initial position due to the force of the return spring. Electronic control of the throttle will be cancelled until the problem is no longer present, and the ignition switch has been turned off.

HINT:

This Electronic Throttle Control System (ETCS) does not use a throttle cable.

DTC No.	DTC Detection Condition	Trouble Area
P2111	Throttle actuator locked while ECM is commanding it to close (1 trip detection logic)	• Throttle actuator circuit • Throttle actuator • Throttle body assembly • Throttle valve
P2112	Throttle actuator locked while ECM is commanding it to open (1 trip detection logic)	Same as DTC P2111

MONITOR DESCRIPTION

The ECM concludes that there is a malfunction of the ETCS when the throttle valve remains at a fixed angle despite high drive current from the ECM. The ECM will turn on the MIL and a DTC will be set.

WIRING DIAGRAM

Refer to DTC P2102 (See page ES-153).

INSPECTION PROCEDURE

HINT:

Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	CHECK OTHER DTC OUTPUT

Result

Display (DTC output)	Proceed to
P2111 or P2112	A
P2111 or P2112 and other DTCs	B

B → GO TO DTC CHART (See page ES-23)

A

2	CHECK THROTTLE BODY ASSEMBLY (VISUALLY CHECK THROTTLE VALVE)

Check for contamination between the throttle valve and the housing. If necessary, clean the throttle body.
And check that the throttle valve moves smoothly.
OK:
The throttle valve is not contaminated by foreign objects and can move smoothly.

NG → **REPAIR OR REPLACE THROTTLE BODY ASSEMBLY**

OK ↓

3	CHECK FOR DTC OUTPUT

(a) Clear the DTC (See page ES-16).
(b) Start the engine, and depress and release the accelerator pedal quickly (fully open and fully close).
(c) Read the DTC.
Result

Display (DTC output)	Proceed to
No DTC	A
P2111 and/or P2112	B

B → **REPLACE ECM**

A ↓

CHECK FOR INTERMITTENT PROBLEMS

DTC	P2118	Throttle Actuator Control Motor Current Range / Performance

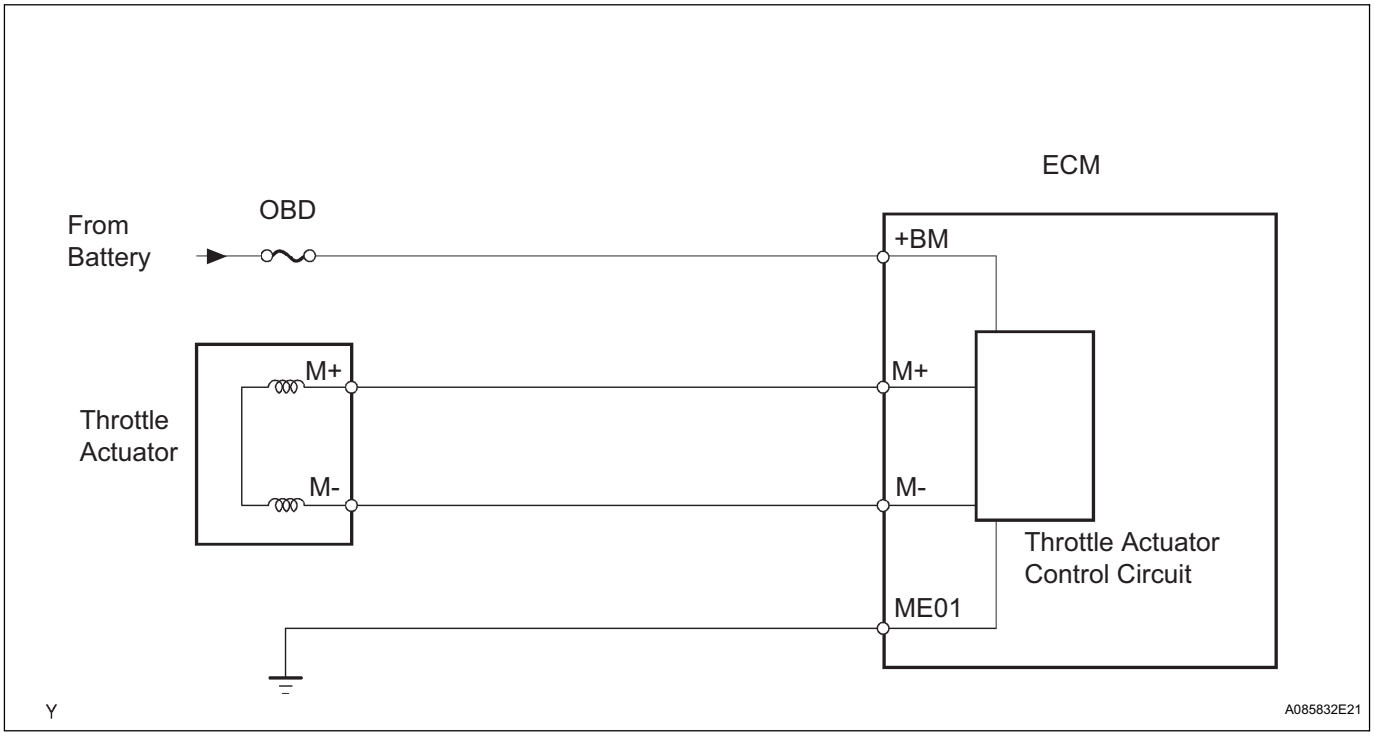
DESCRIPTION

The Electronic Throttle Control System (ETCS) has a dedicated power supply circuit. The voltage (+BM) is monitored, and when the voltage is low (less than 4 V), the ECM determines that a fault is present, and current to the throttle actuator is cut.

When the voltage becomes unstable, the ETCS itself becomes unstable. For this reason, when the voltage is low, the current to the actuator is cut. If repairs are made and the system has returned to normal, turn the ignition switch OFF. The ECM then allows current to flow to the actuator and the actuator can be restarted.

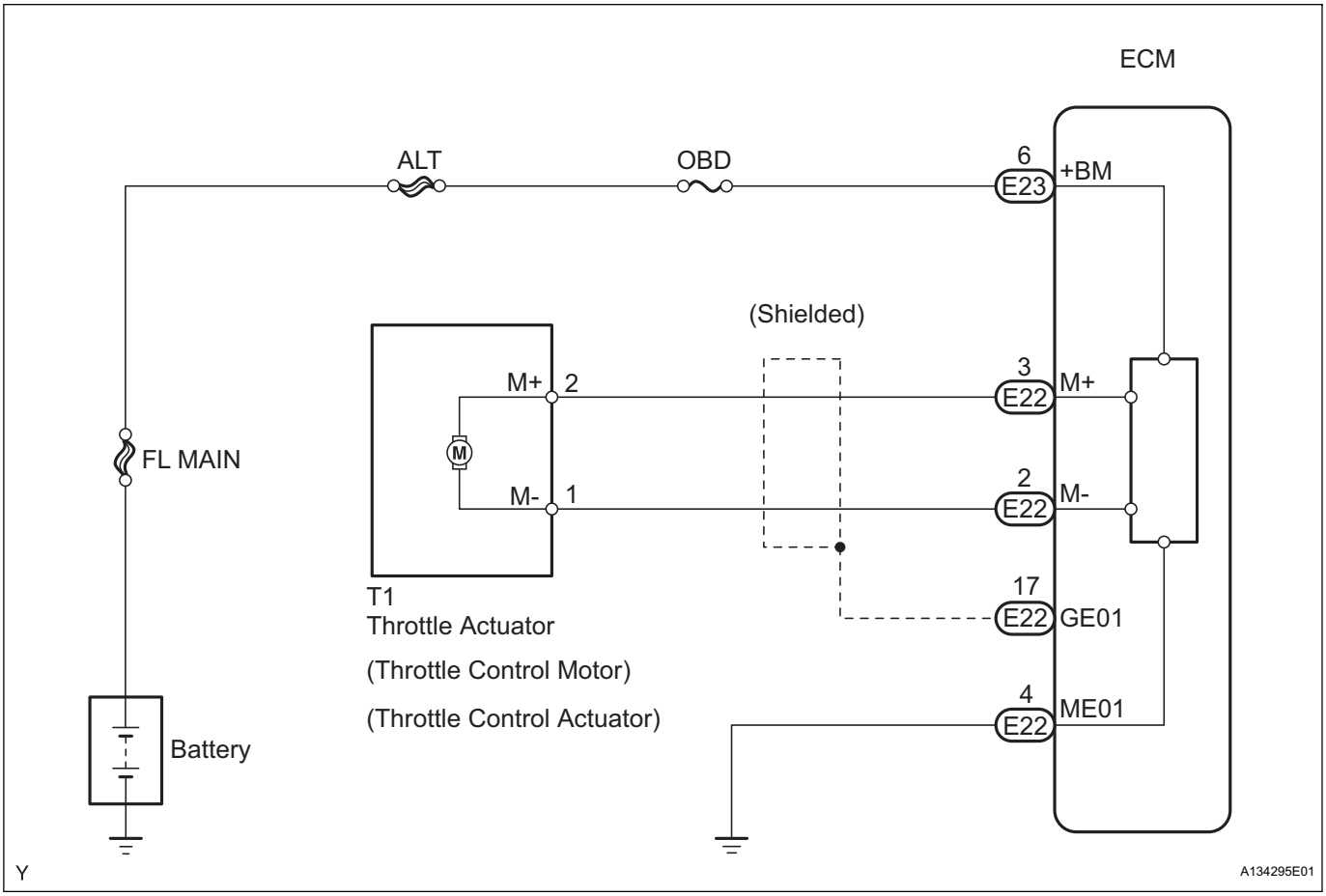
HINT:

This ETCS does not use a throttle cable.



DTC No.	DTC Detection Condition	Trouble Area
P2118	Open in ETCS power source circuit (1 trip detection logic)	• Open in ETCS power source circuit • ETCS fuse • ECM

WIRING DIAGRAM

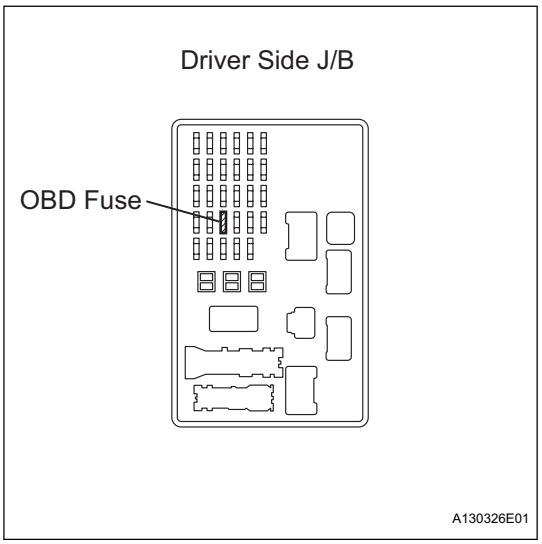


INSPECTION PROCEDURE

HINT:

Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	INSPECT OBD FUSE

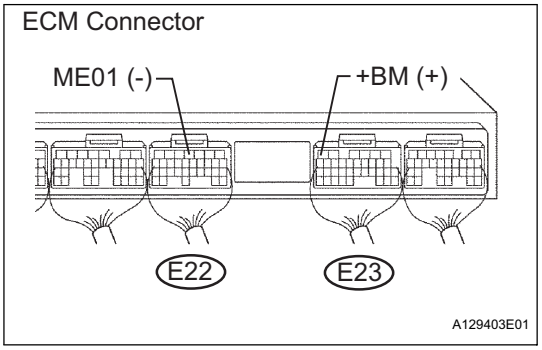


(a) Remove the OBD fuse from the driver side J/B.
(b) Measure the resistance of the OBD fuse.
Standard resistance:
Below 1 Ω
(c) Reinstall the OBD fuse.

NG → **REPLACE OBD FUSE**

OK

2	INSPECT ECM (+BM VOLTAGE)



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

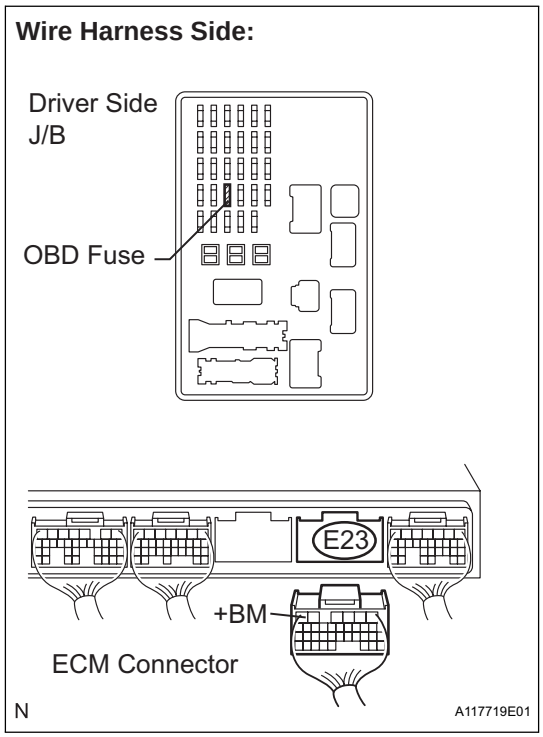
Tester Connection	Specified Condition
E23-6 (+BM) - E22-4 (ME01)	9 to 14 V

NG → **GO TO STEP 3**

OK

REPLACE ECM

3	CHECK HARNESS AND CONNECTOR (ECM - OBD FUSE, OBD FUSE - BATTERY)



(a) Check the wire harness between the OBD fuse and ECM.
(1) Remove the OBD fuse from the driver side J/B.
(2) Disconnect the E23 ECM connector.
(3) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
Driver side J/B OBD fuse - E23-6 (+BM)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
Driver side J/B OBD fuse or E23-6 (+BM) - Body ground	10 kΩ or higher

(4) Reinstall the OBD fuse.
(5) Connect the connector.

(b) Check the wire harness between the OBD fuse and battery.
(1) Remove the OBD fuse from the driver side J/B.
(2) Disconnect the battery negative cable.
(3) Disconnect the battery positive cable.
(4) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
Battery positive cable - Driver side J/B OBD fuse	Below 1 Ω

Check for short

Tester Connection	Specified Condition
Battery positive cable or Driver side J/B OBD fuse - Body ground	10 kΩ or higher

(c) Reinstall the OBD fuse.
(d) Connect the connector.
(e) Connect the battery positive cable.
(f) Connect the battery negative cable.

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

OK

CHECK DRIVER SIDE J/B

DTC	P2119	Throttle Actuator Control Throttle Body Range / Performance

DESCRIPTION

The Electronic Throttle Control System (ETCS) is composed of a throttle actuator that operates the throttle valve, a throttle position sensor that detects the opening angle of the throttle valve, an accelerator pedal position sensor that detects the accelerator pedal position, and the ECM that controls the ETCS system.
The ECM operates the throttle actuator to position the throttle valve for proper response to driver inputs. The throttle position sensor, which is mounted on the throttle body, detects the opening angle of the throttle valve and provides this signal to the ECM so that the ECM can regulate the throttle actuator.

DTC No.	DTC Detection Condition	Trouble Area
P2119	Throttle opening angle continues to vary greatly from target throttle opening angle (1 trip detection logic)	• Electronic throttle control system • ECM

WIRING DIAGRAM

Refer to DTC P2102 (See page ES-153).

INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	CHECK OTHER DTC OUTPUT (IN ADDITION TO DTC P2119)

Display (DTC output)	Proceed to
Only P2119 is output	A
P2119 and other codes are output	B

B → GO TO DTC CHART (See page ES-23)

A

2	CHECK IF DTC OUTPUT REOCCURS

(a) Clear the DTC (See page ES-16).
(b) Run the engine at idle for 15 seconds.
(c) Apply the parking brake and shift the gear to D or 1st gear.
(d) Depress the brake pedal and the accelerator pedal fully for 5 seconds.
(e) Connect the intelligent tester to the DLC3.
(f) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(g) Select the following menu items: Powertrain / Engine and ECT / DTC.

(h) Read the DTC.
HINT:
Actual throttle position (TP) sensor voltage can be confirmed using the intelligent tester.
OK:
No DTC output.

NG → **REPLACE THROTTLE BODY ASSEMBLY**

OK

SYSTEM OK

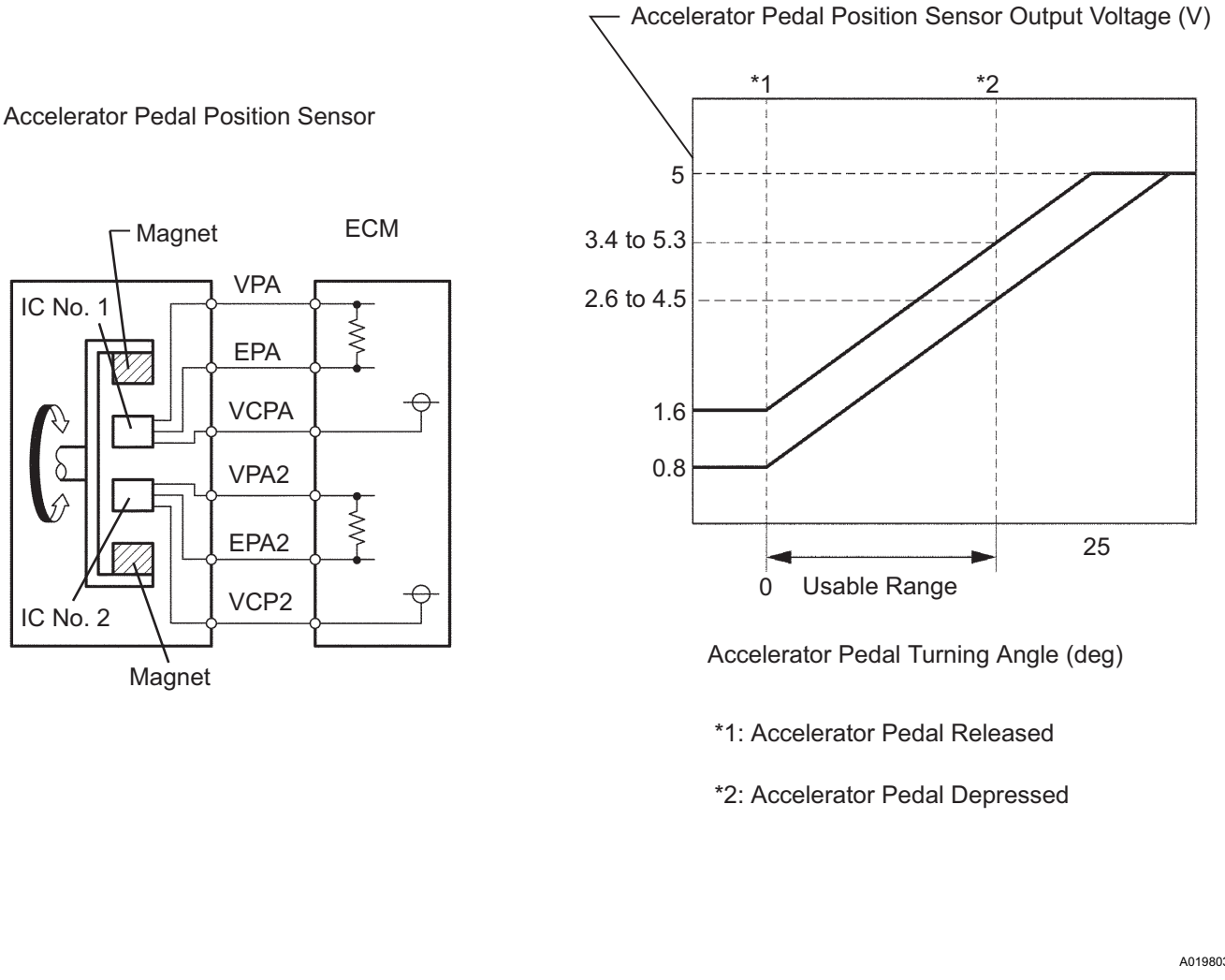
DTC	P2120	Throttle / Pedal Position Sensor / Switch "D" Circuit
DTC	P2122	Throttle / Pedal Position Sensor / Switch "D" Circuit Low Input
DTC	P2123	Throttle / Pedal Position Sensor / Switch "D" Circuit High Input
DTC	P2125	Throttle / Pedal Position Sensor / Switch "E" Circuit
DTC	P2127	Throttle / Pedal Position Sensor / Switch "E" Circuit Low Input
DTC	P2128	Throttle / Pedal Position Sensor / Switch "E" Circuit High Input
DTC	P2138	Throttle / Pedal Position Sensor / Switch "D" / "E" Voltage Correlation

HINT:
This is the repair procedure for the "accelerator pedal position sensor".

DESCRIPTION

HINT:
- This Electronic Throttle Control System (ETCS) does not use a throttle cable.
- This description is for the accelerator pedal position sensor.

The accelerator pedal position sensor is mounted on the accelerator pedal bracket. The accelerator pedal position sensor has 2 sensor elements/signal outputs: VPA and VPA2. VPA is used to detect the actual accelerator pedal angle (used for engine control) and VPA2 is used to detect malfunctions in VPA. Voltage applied to VPA and VPA2 changes between 0 V and 5 V in proportion to the accelerator pedal angle. The ECM monitors the accelerator pedal angle from VPA and VPA2 signal output, and controls the throttle motor based on these signals.



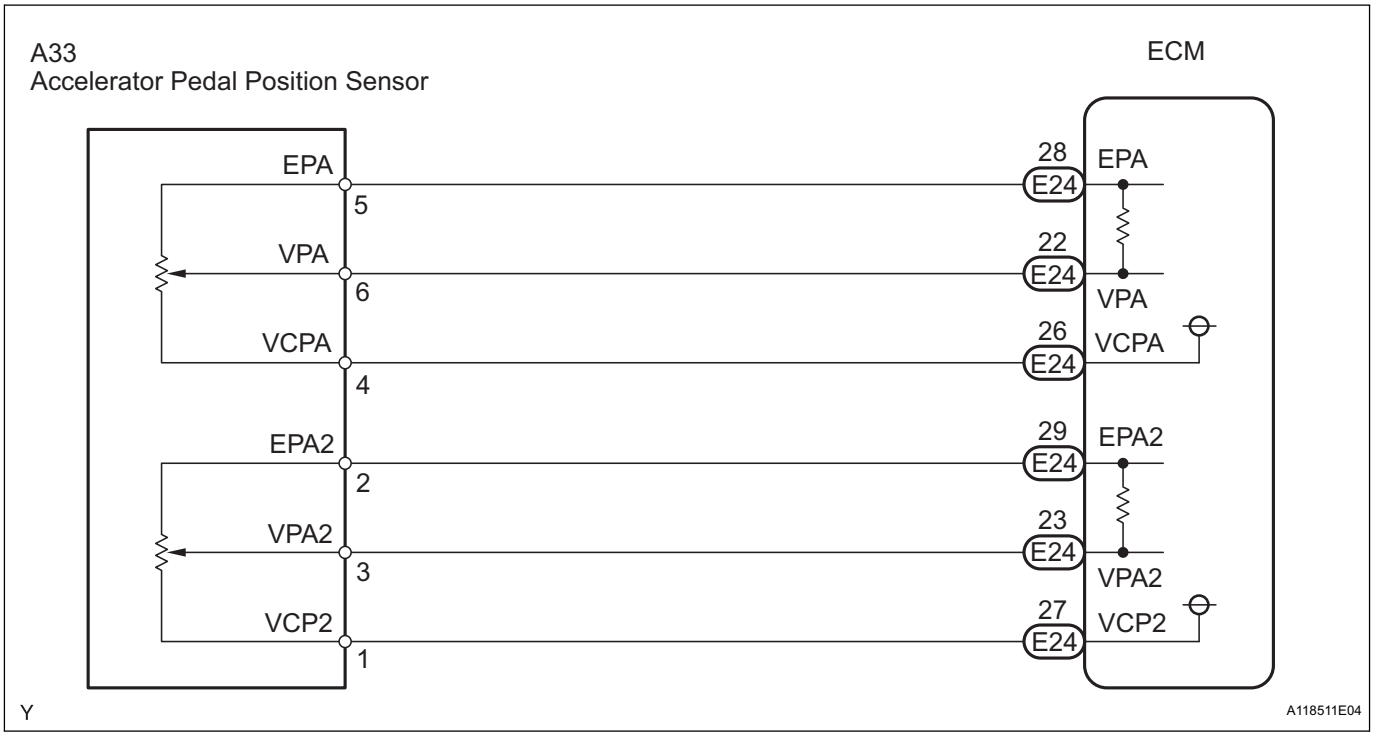
DTC No.	DTC Detection Condition	Trouble Area
P2120	Condition (a) continues for 0.5 seconds or more: (a) VPA is 0.2 V or less and VPA2 is 0.04 V or more; or VPA is 4.8 V or more (1 trip detection logic)	• Accelerator pedal position sensor • ECM
P2122	Condition (a) continues for 0.5 seconds or more when accelerator pedal is released: (a) VPA is 0.2 V or less (1 trip detection logic)	• Accelerator pedal position sensor • Open in VCP1 circuit • Open or ground short in VPA circuit • ECM
P2123	Condition (a) continues for 2.0 seconds or more: (a) VPA is 4.8 V or more (1 trip detection logic)	• Accelerator pedal position sensor • Open in EPA circuit • ECM
P2125	Condition (a) continues for 0.5 seconds or more: (a) VPA2 is 0.5 V or less or VPA2 is 4.8 V or more (1 trip detection logic)	• Accelerator pedal position sensor • ECM
P2127	Condition (a) continues for 0.5 seconds or more when accelerator pedal is released: (a) VPA2 is 0.5 V or less and VPA is 0.04 V or more (1 trip detection logic)	• Accelerator pedal position sensor • Open in VCP2 circuit • Open or ground short in VPA2 circuit • ECM
P2128	Conditions (a) and (b) continue for 2.0 seconds or more: (a) VPA2 is 4.8 V or more (b) VPA is 0.2 V or more and VPA is 3.45 V or less (1 trip detection logic)	• Accelerator pedal position sensor • Open in EPA2 circuit • ECM

DTC No.	DTC Detection Condition	Trouble Area
P2138	Condition (a) or (b) continues for 2.0 seconds or more: (a) Difference between VPA and VPA2 is 0.02 V or less (b) VPA is 0.4 V or less and VPA2 is 1.2 V or less (1 trip detection logic)	• VPA and VPA2 circuits are short circuit • Accelerator pedal position sensor • ECM

HINT:
After confirming DTCs P2120, P2122, P2123, P2125, P2127, P2128 and P2138, use the intelligent tester to confirm the accelerator pedal position sensor output voltage.

Trouble Area	Accelerator pedal position expressed as voltage output			
	Accelerator pedal released		Accelerator pedal depressed	
	ACCEL POS #1	ACCEL POS #2	ACCEL POS #1	ACCEL POS #2
VCP circuit open	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V
VPA circuit open or ground short	0 to 0.2 V	1.2 to 2.0 V	0 to 0.2 V	3.4 to 5.3 V
VPA2 circuit open or ground short	0.5 to 1.1 V	0 to 0.2 V	2.6 to 4.5 V	0 to 0.2 V
EPA circuit open	4.5 to 5.5 V	4.5 to 5.5 V	4.5 to 5.5 V	4.5 to 5.5 V

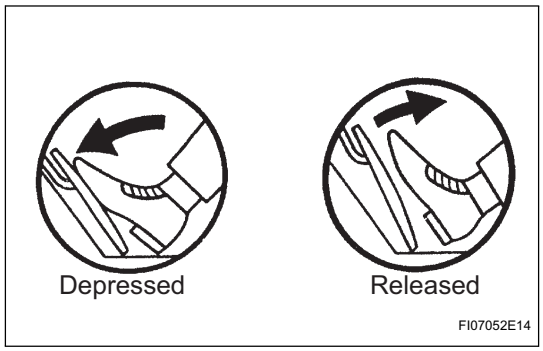
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	READ VALUE OF INTELLIGENT TESTER (ACCELERATOR POS NO. 1, ACCELERATOR POS NO. 2)



(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Data List / Accelerator POS No. 1 and Accelerator POS No. 2. Read the values.

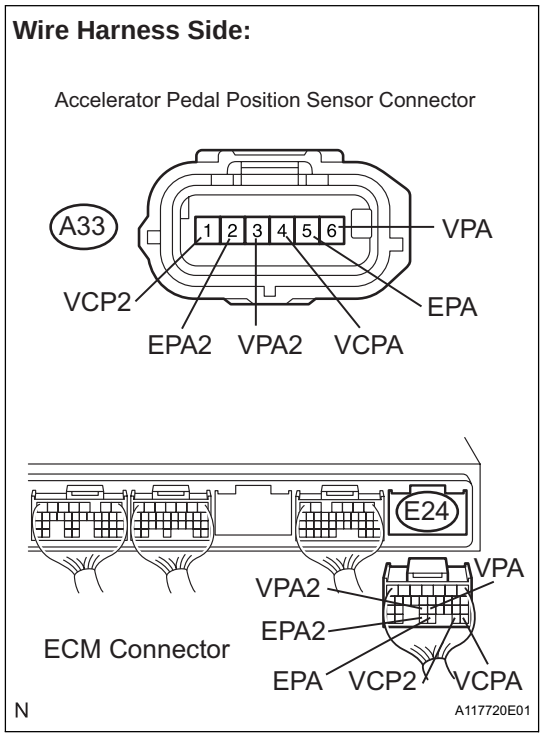
Standard voltage

Accelerator Pedal	ACCEL POS #1	ACCEL POS #2
Released	0.5 to 1.1 V	1.2 to 2.0 V
Depressed	2.6 to 4.5 V	3.4 to 5.3 V

OK → **GO TO STEP 5**

NG

2	CHECK HARNESS AND CONNECTOR (ACCELERATOR PEDAL POSITION SENSOR - ECM)



(a) Disconnect the A33 sensor connector.
(b) Disconnect the E24 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
A33-6 (VPA) - E24-22 (VPA) A33-5 (EPA) - E24-28 (EPA) A33-4 (VCPA) - E24-26 (VCPA) A33-3 (VPA2) - E24-23 (VPA2) A33-2 (EPA2) - E24-29 (EPA2) A33-1 (VCP2) - E24-27 (VCP2)	Below 1 Ω

Check for short

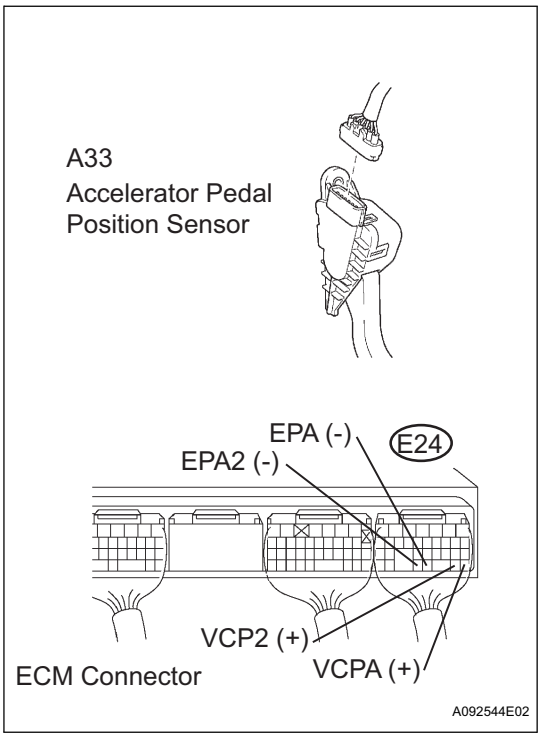
Tester Connection	Specified Condition
A33-6 (VPA) or E24-22 (VPA) - Body ground A33-5 (EPA) or E24-28 (EPA) - Body ground A33-4 (VCPA) or E24-26 (VCPA) - Body ground A33-3 (VPA2) or E24-23 (VPA2) - Body ground A33-2 (EPA2) or E24-29 (EPA2) - Body ground A33-1 (VCP2) or E24-27 (VCP2) - Body ground	10 kΩ or higher

(d) Connect the connectors.

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

OK

3	INSPECT ECM (VCPA AND VCP2 VOLTAGE)



(a) Disconnect the A33 sensor connector.
(b) Turn the ignition switch to the ON position.
(c) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Specified Condition
E24-26 (VCPA) - E24-28 (EPA) E24-27 (VCP2) - E24-29 (EPA2)	4.5 to 5.5 V

(d) Connector the connector.

NG → REPLACE ECM

OK

4	REPLACE ACCELERATOR PEDAL POSITION SENSOR

NEXT

5	READ OUTPUT DTC (ACCELERATOR PEDAL POSITION SENSOR DTCS ARE OUTPUT AGAIN)

(a) Clear the DTC (See page ES-16).
(b) Start the engine.
(c) Run the engine at idle for 15 seconds or more.
(d) Read the DTC.

Result

Display (DTC Output)	Proceed to
P2120, P2122, P2123, P2125, P2127, P2128 and/or P2138 are output again	A
No DTC output	B

B → SYSTEM OK

A

REPLACE ECM

DTC	P2121	Throttle / Pedal Position Sensor / Switch "D" Circuit Range / Performance

HINT:
This is the repair procedure for the "accelerator pedal position sensor".

DESCRIPTION

Refer to DTC P2120 (See page ES-164).

DTC No.	DTC Detection Condition	Trouble Area
P2121	Condition (a) continues for 0.5 seconds: (a) Difference between VPA and VPA2 deviates from standard (1 trip detection logic)	• Open or short in accelerator pedal position sensor circuit • Accelerator pedal position sensor • ECM

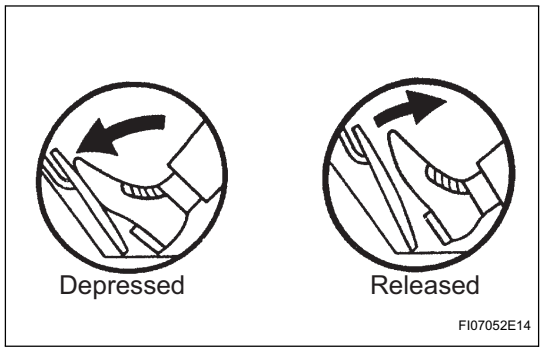
WIRING DIAGRAM

Refer to DTC P2120 (See page ES-166).

INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	READ VALUE OF INTELLIGENT TESTER (ACCELERATOR POS NO. 1, ACCELERATOR POS NO. 2)



(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Data List / Accelerator POS No. 1 and Accelerator POS No. 2. Read the values.

Standard voltage

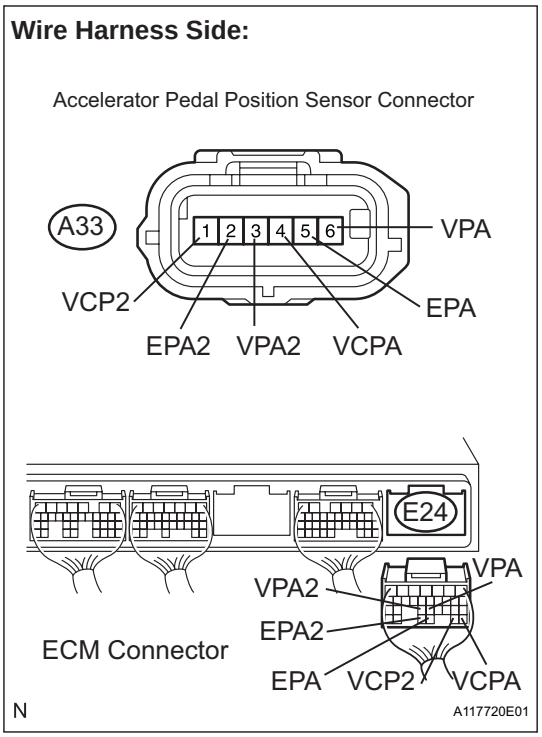
Accelerator Pedal	ACCEL POS #1	ACCEL POS #2
Released	0.5 to 1.1 V	1.2 to 2.0 V
Depressed	2.6 to 4.5 V	3.4 to 5.3 V

NG → GO TO STEP 2

OK →

REPLACE ECM

2	CHECK HARNESS AND CONNECTOR (ACCELERATOR PEDAL POSITION SENSOR - ECM)



(a) Disconnect the A33 sensor connector.
(b) Disconnect the E24 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
A33-6 (VPA) - E24-22 (VPA) A33-5 (EPA) - E24-28 (EPA) A33-4 (VCPA) - E24-26 (VCPA) A33-3 (VPA2) - E24-23 (VPA2) A33-2 (EPA2) - E24-29 (EPA2) A33-1 (VCP2) - E24-27 (VCP2)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
A33-6 (VPA) or E24-22 (VPA) - Body ground A33-5 (EPA) or E24-28 (EPA) - Body ground A33-4 (VCPA) or E24-26 (VCPA) - Body ground A33-3 (VPA2) or E24-23 (VPA2) - Body ground A33-2 (EPA2) or E24-29 (EPA2) - Body ground A33-1 (VCP2) or E24-27 (VCP2) - Body ground	10 kΩ or higher

(d) Connect the connectors.

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

OK →

REPLACE ACCELERATOR PEDAL POSITION SENSOR

DTC	P2195	Oxygen (A/F) Sensor Signal Stuck Lean (Bank 1 Sensor 1)

DTC	P2196	Oxygen (A/F) Sensor Signal Stuck Rich (Bank 1 Sensor 1)

DESCRIPTION

HINT:

These DTCs are related to the A/F sensor.

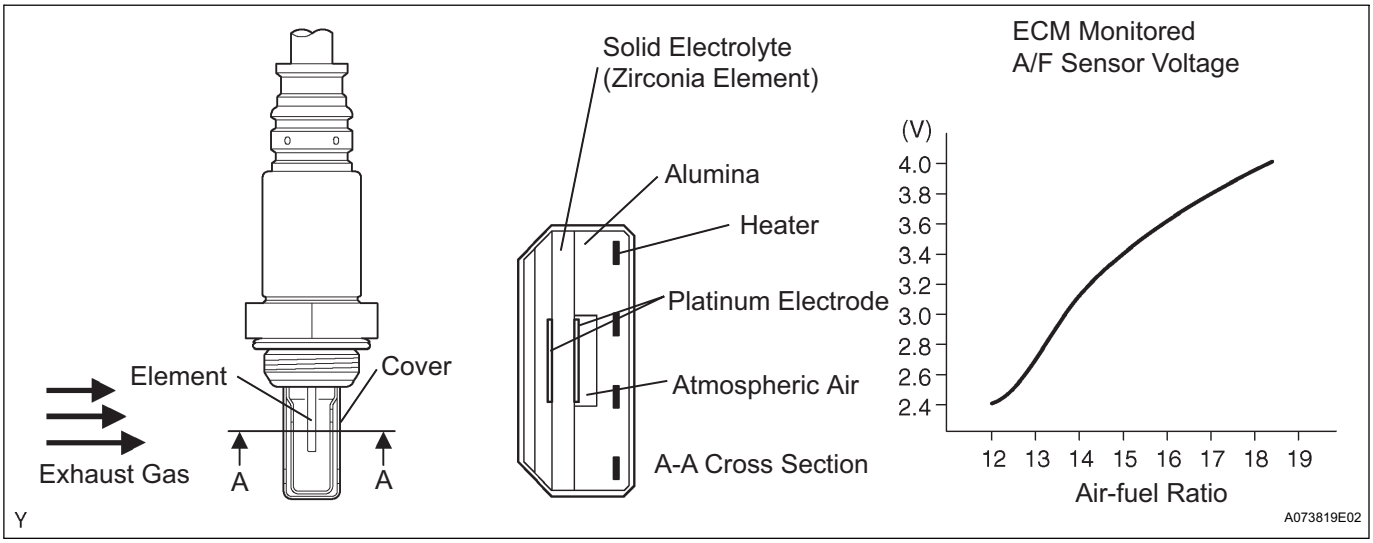
The Air-Fuel Ratio (A/F) sensor generates a voltage* in response to the actual air-fuel ratio. The sensor output voltage is used to provide feedback for the ECM in order that the ECM controls the air-fuel ratio. Using the sensor output voltage, the ECM determines the deviation from the stoichiometric air-fuel ratio, and regulates the injection time properly. If the A/F sensor is malfunctioning, the ECM is unable to control the air-fuel ratio accurately.

The A/F sensor is equipped with a heater which heats the zirconia element. The heater is also controlled by the ECM. When the intake air volume is low (the temperature of the exhaust gas is low), a current flows to the heater to heat the sensor to facilitate the detection of accurate oxygen concentration.

The A/F sensor is a planar type. Compared to the conventional type, the sensor and heater portions are narrower. The heat of the heater is conducted to the zirconia element through the alumina to zirconia, therefore sensor activation is accelerated.

To obtain a high purification rate of carbon monoxide (CO), hydrocarbon (HC) and nitrogen oxides (NOx) components of the exhaust gas, the Three-Way Catalytic Converter (TWC) is used. The TWC is most efficient when the air-fuel ratio is maintained near the stoichiometric air-fuel ratio.

*: The voltage value changes inside the ECM only.



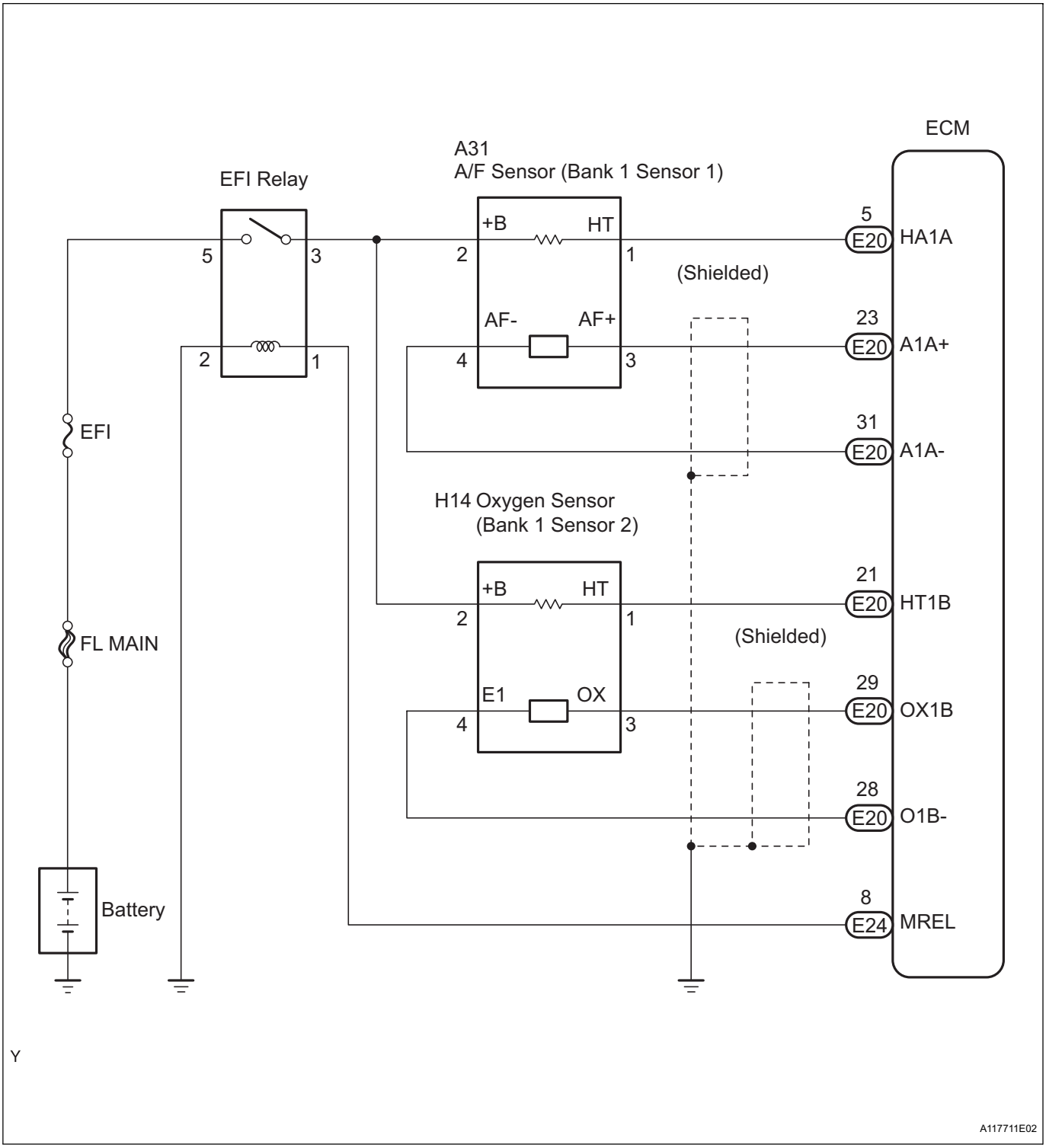
DTC No.	DTC Detection Condition	Trouble Area
P2195	Conditions (a) and (b) continue for 2 seconds or more: (a) A/F sensor voltage is more than 3.8 V (b) Rear oxygen sensor voltage is 0.15 V or more (2 trip detection logic)	• Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor (sensor 1) heater • EFI relay • A/F sensor heater and relay circuit • Air induction system • Fuel pressure • Injector • ECM

DTC No.	DTC Detection Condition	Trouble Area
P2196	Conditions (a) and (b) continue for 2 seconds or more: (a) A/F sensor voltage is less than 2.8 V (b) Heated oxygen sensor voltage is less than 0.85 V (2 trip detection logic)	• Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor (sensor 1) heater • EFI relay • A/F sensor heater and relay circuit • Air induction system • Fuel pressure • Injector • ECM

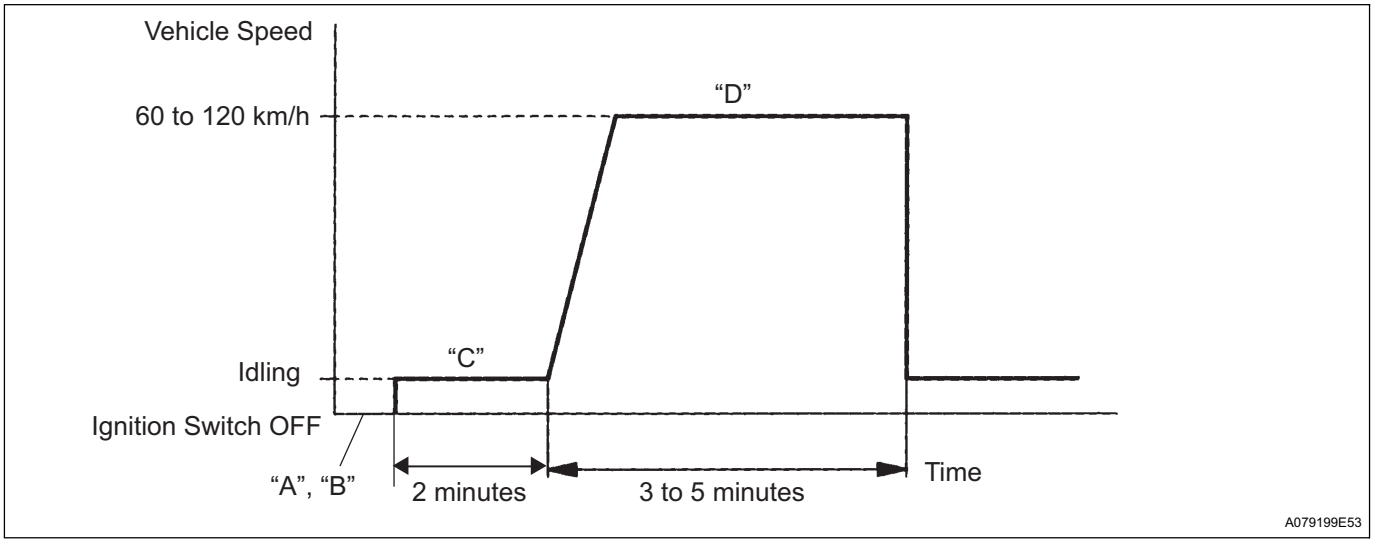
HINT:

- Sensor 1 refers to the sensor mounted in front of the TWC and is located near the engine assembly.
- Sensor 2 refers to the sensor mounted behind the TWC and is located far from the engine assembly.
- When DTC P2195 and/or P2196 is detected, check the A/F sensor output voltage (AFS B1 S1) by selecting Powertrain / Engine and ECT / Data List on the intelligent tester.
- The short-term fuel trim value can also be read using the intelligent tester.
- The ECM controls the voltage of the A1A+ and A1A- terminals of the ECM to the fixed voltage. Therefore, the A/F sensor output voltage cannot be confirmed without the intelligent tester.

WIRING DIAGRAM



CONFIRMATION DRIVING PATTERN



1. Connect the intelligent tester to the DLC3. (Procedure "A")
2. Turn the ignition switch to the ON position and turn the intelligent tester ON. (Procedure "B")
3. Switch the ECM from normal mode to check mode using the intelligent tester. (Procedure "C")
4. Start the engine and warm it up with all the accessories switched OFF. (Procedure "D")
5. Drive the vehicle at 60 to 120 km/h and engine speed of 1,400 to 3,200 rpm for 3 to 5 minutes. (Procedure "E")

HINT:
If a malfunction exists, the MIL will illuminate during procedure "D".

NOTICE:
If the conditions in this test are not strictly followed, no malfunction will be detected. If you do not have the intelligent tester, turn the ignition switch OFF after performing procedures "C" and "D", then perform procedures "C" and "D" again.

INSPECTION PROCEDURE

HINT:
Intelligent tester only:
Malfunctioning areas can be found by performing the Active Test / A/F Control operation. The A/F Control operation can determine if the A/F sensor, heated oxygen sensor or other potential trouble areas are malfunctioning or not.

1. Perform Active Test using the intelligent tester.

HINT:
The A/F Control operation lowers the injection volume by 12.5 % or increases the injection volume by 25 %.

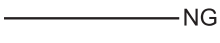
(a) Connect the intelligent tester to the DLC3.
(b) Start the engine and turn the intelligent tester ON.
(c) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds.
(d) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.
(e) Select the following monitor items: AFS B1 S1 and O2S B1 S2.

(f) Perform the A/F Control operation with the engine in an idling condition (press the right or left button).

Result:

The A/F sensor reacts in accordance with increase and decrease of the injection volume:
+25 % → Rich output: Less than 3.0 V
-12.5 % → Lean output: More than 3.35 V
The heated oxygen sensor reacts in accordance with increase and decrease of the injection volume:
+25 % → Rich output: More than 0.55 V
-12.5 % → Lean output: Less than 0.4 V

NOTICE:
The A/F sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

Case	Output Voltage of A/F Sensor (Sensor 1)		Output Voltage of Heated Oxygen Sensor (Sensor 2)		Main Suspected Trouble Area
1	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		-
	Output Voltage More than 3.35 V Less than 3.0 V		Output Voltage More than 0.55 V Less than 0.4 V		
2	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		A/F sensor (A/F sensor, sensor heater, sensor circuit)
	Output Voltage Almost no reaction		Output Voltage More than 0.55 V Less than 0.4 V		
3	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		Heated oxygen sensor (Heated oxygen sensor, sensor heater, sensor circuit)
	Output Voltage More than 3.35 V Less than 3.0 V		Output Voltage Almost no reaction		
4	Injection volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		Extremely rich or lean actual air-fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)
	Output Voltage Almost no reaction		Output Voltage Almost no reaction		

Following A/F Control procedure enables the technician to check and graph the voltage output of both A/F sensor and heated oxygen sensor.
To display the graph, select the following menu items on the tester: View / Line graph.
HINT:

- Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.
- A low A/F sensor voltage could be caused by a rich air-fuel mixture. Check for conditions that would cause the engine to run rich.

- A high A/F sensor voltage could be caused by a lean air-fuel mixture. Check for conditions that would cause the engine to run lean.
- This DTC may be output if the vehicle runs out of fuel.

1	CHECK OTHER DTC OUTPUT (IN ADDITION TO A/F SENSOR DTC)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
P2195 and/or P2196	A
P2195, P2196 and other DTCs	B

HINT:
If any DTCs other than P2195 and/or P2196 are output, perform troubleshooting for those DTCs first.

B → **GO TO DTC CHART (See page ES-23)**

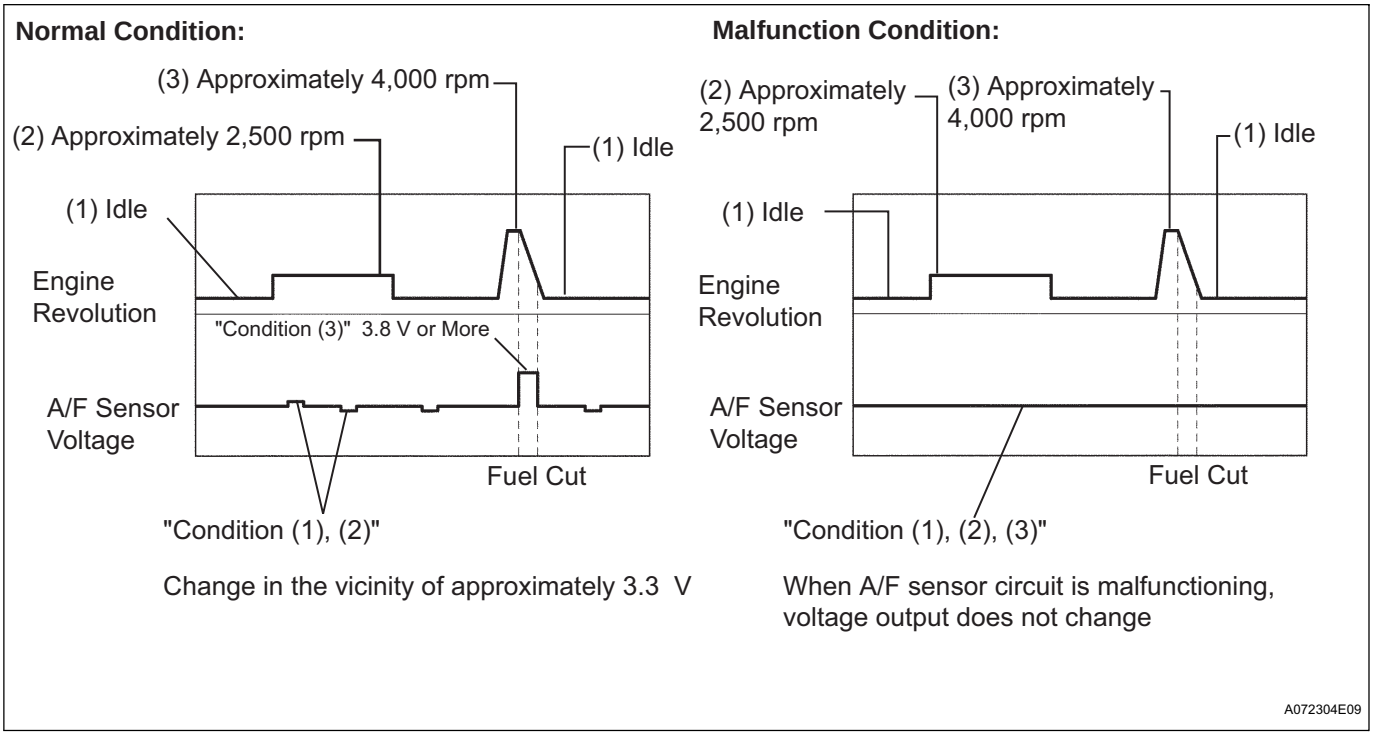
A

2	READ VALUE OF INTELLIGENT TESTER (OUTPUT VOLTAGE OF A/F SENSOR)

(a) Connect the intelligent tester to the DLC3.
(b) Start the engine and turn the intelligent tester ON.
(c) Warm up the A/F sensor at 2,500 rpm for approximately 90 seconds.
(d) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Data List.
(e) Select the following monitor items: AFS B1 S1 and Engine Speed.
(f) Monitor the A/F sensor voltage carefully.
(g) Check the A/F sensor voltage under the following conditions:
(1) Allow the engine to idle for 30 seconds. (Condition 1)
(2) Run the engine at approximately 2,500 rpm (where the engine RPM is not suddenly changed). (Condition 2)
(3) Raise the engine speed to 4,000 rpm and quickly release the accelerator pedal so that the throttle valve is fully closed. (Condition 3)

Standard:

Conditions (1) and (2)
The voltage changes in the vicinity of 3.3 V (between approximately 3.1 and 3.5 V) as shown in the illustration on the next page.
Condition (3)
The voltage increases to 3.8 V or more during engine deceleration (when fuel is cut) as shown in the illustration on the next page.



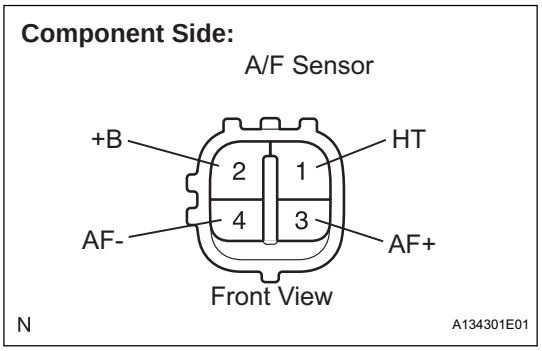
HINT:

- Whenever the output voltage of the A/F sensor remains at approximately 3.3 V (see diagram Malfunction Condition) under any condition as well as the above conditions, the A/F sensor may have an open circuit. (This will also happen when the A/F sensor heater has an open circuit.)
- Whenever the output voltage of the A/F sensor remains at a certain value of approximately 3.8 V or more, or 2.8 V or less (see diagram Malfunction Condition) under any condition as well as the above conditions, the A/F sensor may have a short circuit.
- The ECM will stop fuel injection (fuel cut) during engine deceleration. This will cause a lean condition and should result in a momentary increase in the A/F sensor voltage output.
- The ECM must establish a closed throttle position learned value to perform fuel cut. If the battery terminal was reconnected, the vehicle must be driven at over 16 km/h to allow the ECM to learn the closed throttle position.
- When the vehicle is driven:
  The output voltage of the A/F sensor may be below 2.8 V during fuel enrichment. For the vehicle, this translates to a sudden increase in speed with the accelerator pedal fully depressed when trying to overtake another vehicle. The A/F sensor is functioning normally.
- The A/F sensor is a current output element, therefore the current is converted into voltage inside the ECM. If measuring voltage at the connectors of the A/F sensor or ECM, you will obtain a constant voltage.

OK → GO TO STEP 12

NG

3 INSPECT AIR FUEL RATIO SENSOR (RESISTANCE OF A/F SENSOR HEATER)



(a) Disconnect the A31 A/F sensor connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

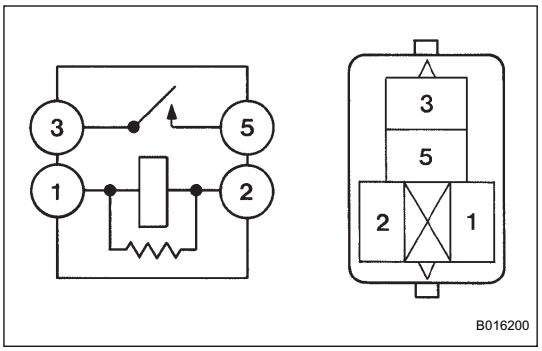
Tester Connection	Specified Condition
1 (HT) - 2 (+B)	2.16 to 2.9 Ω at 20°C (68°F)

(c) Connect the connector.

NG → REPLACE AIR FUEL RATIO SENSOR

OK

4 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room J/B.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

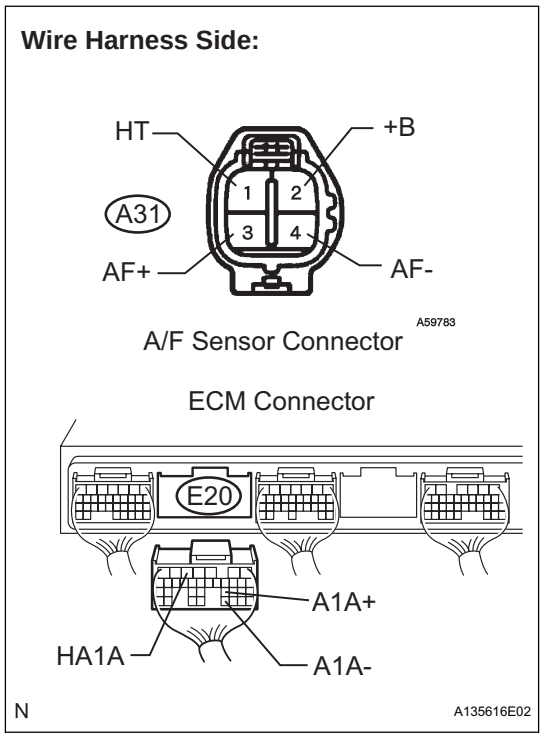
Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the EFI relay.

NG → REPAIR OR REPLACE EFI RELAY

OK

5 CHECK HARNESS AND CONNECTOR (A/F SENSOR - ECM)



(a) Disconnect the A31 A/F sensor connector.
(b) Disconnect the E20 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

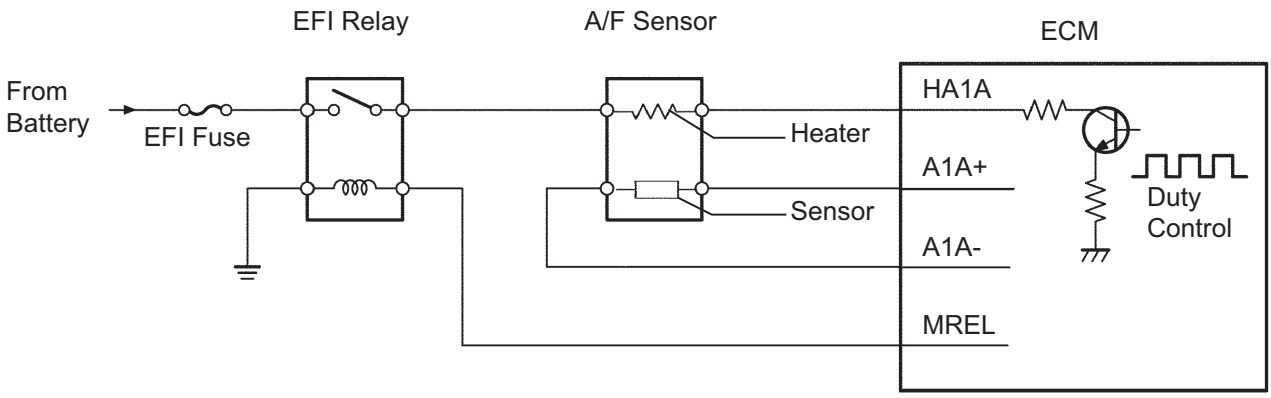
Tester Connection	Specified Condition
A31-1 (HT) - E20-5 (HA1A)	Below 1 Ω
A31-3 (AF+) - E20-23 (A1A+)	Below 1 Ω
A31-4 (AF-) - E20-31 (A1A-)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
A31-1 (HT) or E20-5 (HA1A) - Body ground	10 kΩ or higher
A31-3 (AF+) or E20-23 (A1A+) - Body ground	10 kΩ or higher
A31-4 (AF-) or E20-31 (A1A-) - Body ground	10 kΩ or higher

(d) Connect the connectors.

Reference:



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

OK

6 CHECK AIR INDUCTION SYSTEM

(a) Check for vacuum leaks in the air induction system.

OK:

No leak in the air induction system

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

7 CHECK FUEL PRESSURE

(a) Check the fuel pressure (high or low pressure).

Standard

Item	Specified Condition
Fuel Pressure	304 to 343 kPa (3.1 to 3.5 kgf cm^2, 44 to 55 psi)

NG → REPAIR OR REPLACE FUEL SYSTEM

OK

8 INSPECT FUEL INJECTOR ASSEMBLY

Standard

Item	Specified Condition
Injection Volume	76 to 92 cm^3 (4.6 to 5.6 cu in)/15 seconds
Difference between each injector	16 cm^3 (1.0 cu in) or less

NG → REPLACE FUEL INJECTOR ASSEMBLY

OK

9 REPLACE AIR FUEL RATIO SENSOR

NEXT

10 PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

NEXT

11 CHECK IF DTC OUTPUT RECURS (A/F SENSOR DTCS)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
No output	A
P2195 and/or P2196	B

B → **REPLACE ECM**

A

END

12 PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

NEXT

13 CHECK IF DTC OUTPUT RECURS (A/F SENSOR DTCS)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
P2195 and/or P2196	A
No output	B

B → **GO TO STEP 17**

A

14 REPLACE AIR FUEL RATIO SENSOR

NEXT

15 PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

NEXT

16	CHECK IF DTC OUTPUT RECURS (A/F SENSOR DTCS)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
No output	A
P2195 and/or P2196	B

B → REPLACE ECM

A

END

17	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

(a) Has the vehicle run out of fuel in the past?

NO → CHECK FOR INTERMITTENT PROBLEMS

YES

DTCS ARE CAUSED BY RUNNING OUT OF FUEL

DTC	P2238	Oxygen (A/F) Sensor Pumping Current Circuit Low (Bank 1 Sensor 1)
DTC	P2239	Oxygen (A/F) Sensor Pumping Current Circuit High (Bank 1 Sensor 1)
DTC	P2252	Oxygen (A/F) Sensor Reference Ground Circuit Low (Bank 1 Sensor 1)
DTC	P2253	Oxygen (A/F) Sensor Reference Ground Circuit High (Bank 1 Sensor 1)

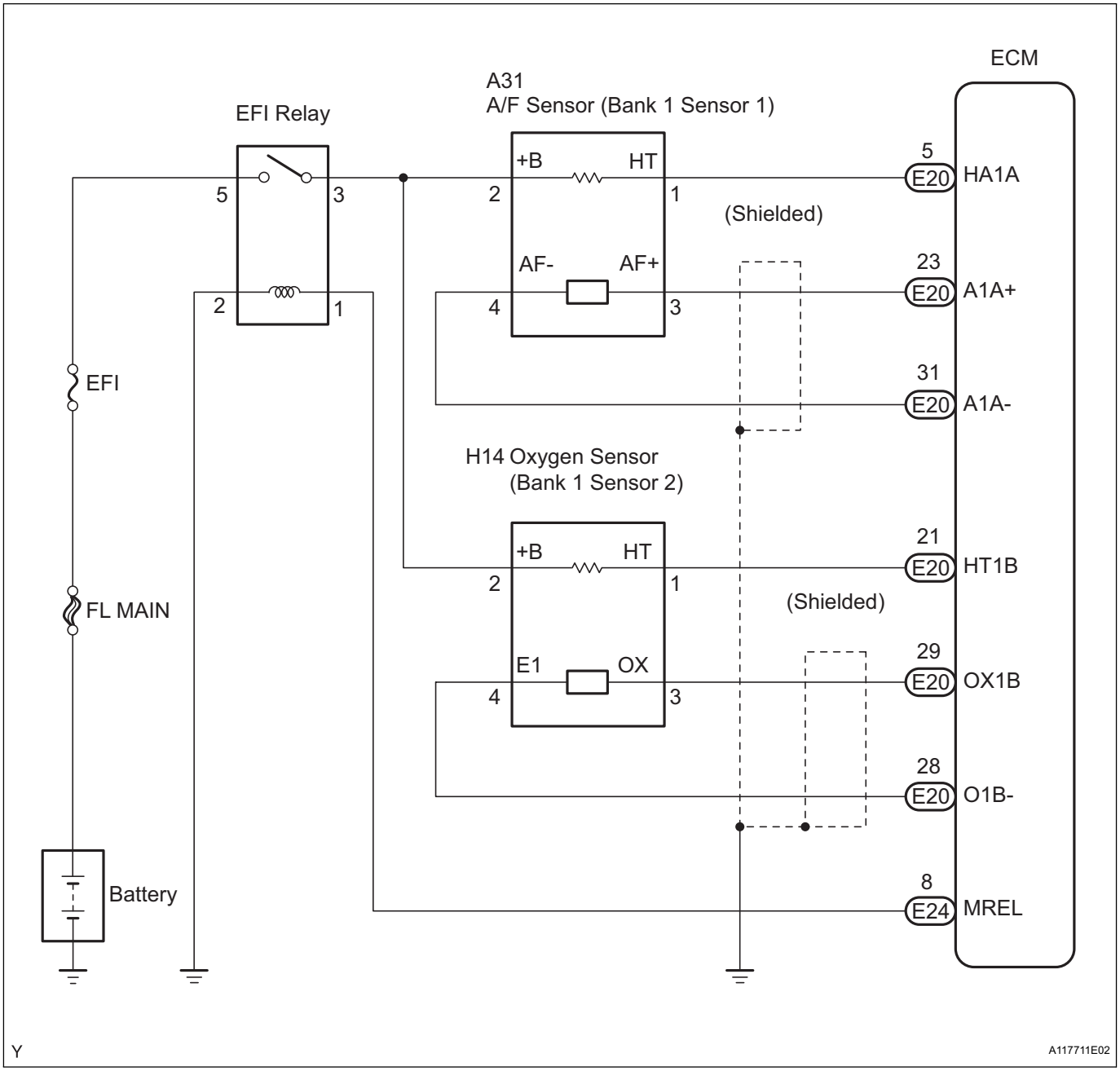
DESCRIPTION

HINT:

These DTCs are set when the A/F sensor has a malfunction, although the caption is the oxygen sensor. Refer to DTC P2195 (See page ES-171).

DTC No.	DTC Detection Condition	Trouble Area
P2238	• Condition (a) or (b) continues for 5.0 seconds or more: (a) AF+ is 0.5 V or less (b) (AF+) - (AF-) is 0.8 V or more • A/F sensor admittance: Less than 0.022 1/Ω (1 trip detection logic)	• Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor (sensor 1) heater • EFI relay • A/F sensor (sensor 1) heater and relay circuit • ECM
P2239	Condition (a) or (b) continues for 5.0 seconds or more: (a) AF+ is more than 4.5 V (b) (AF+) - (AF-) is more than 0.8 V (1 trip detection logic)	• Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor (sensor 1) heater • EFI relay • A/F sensor (sensor 1) heater and relay circuit • ECM
P2252	AF- is 0.5 V or less for 5.0 seconds or more (1 trip detection logic)	• Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor (sensor 1) heater • EFI relay • A/F sensor (sensor 1) heater and relay circuit • ECM
P2253	AF- is more than 4.5 V for 5.0 seconds or more (1 trip detection logic)	• Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor (sensor 1) heater • EFI relay • A/F sensor (sensor 1) heater and relay circuit • ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Intelligent tester only:
Malfunctioning areas can be found by performing the Active Test / A/F Control operation. The A/F Control operation can determine if the A/F sensor, heated oxygen sensor or other potential trouble areas are malfunctioning or not.

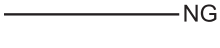
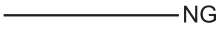
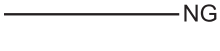
1. **Perform Active Test using the intelligent tester.**
   HINT:
   The A/F Control operation lowers the injection volume by 12.5 % or increases the injection volume by 25 %.
   (a) Connect the intelligent tester to the DLC3.
   (b) Start the engine and turn the intelligent tester ON.
   (c) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds.

(d) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.
(e) Select the following monitor items: AFS B1 S1 and O2S B1 S2.
(f) Perform the A/F Control operation with the engine in an idling condition (press the right or left button).

Result:

The A/F sensor reacts in accordance with increase and decrease of the injection volume:
+25 % → Rich output: Less than 3.0 V
-12.5 % → Lean output: More than 3.35 V
The heated oxygen sensor reacts in accordance with increase and decrease of the injection volume:
+25 % → Rich output: More than 0.55 V
-12.5 % → Lean output: Less than 0.4 V

NOTICE:
The A/F sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

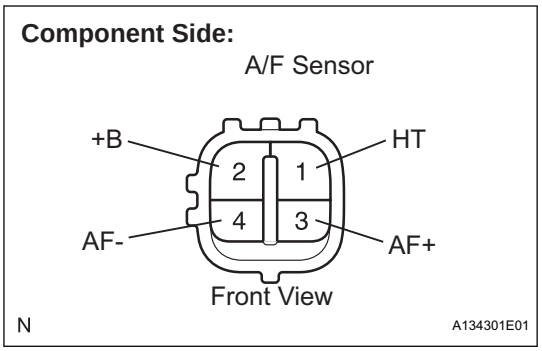
Case	Output Voltage of A/F Sensor (Sensor 1)		Output Voltage of Heated Oxygen Sensor (Sensor 2)		Main Suspected Trouble Area
1	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		-
	Output Voltage More than 3.35 V Less than 3.0 V		Output Voltage More than 0.55 V Less than 0.4 V		
2	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		A/F sensor (A/F sensor, sensor heater, sensor circuit)
	Output Voltage Almost no reaction		Output Voltage More than 0.55 V Less than 0.4 V		
3	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		Heated oxygen sensor (Heated oxygen sensor, sensor heater, sensor circuit)
	Output Voltage More than 3.35 V Less than 3.0 V		Output Voltage Almost no reaction		
4	Injection volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		Extremely rich or lean actual air-fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)
	Output Voltage Almost no reaction		Output Voltage Almost no reaction		

Following A/F Control procedure enables the technician to check and graph the voltage output of both A/F sensor and heated oxygen sensor.
To display the graph, select the following menu items on the tester: View / Line graph.
HINT:

- Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

- A low A/F sensor voltage could be caused by a rich air-fuel mixture. Check the conditions that would cause the engine to run rich .
- A high A/F sensor voltage could be caused by a lean air-fuel mixture. Check the conditions that would cause the engine to run lean .

1 INSPECT AIR FUEL RATIO SENSOR (RESISTANCE OF A/F SENSOR HEATER)



(a) Disconnect the A31 A/F sensor connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

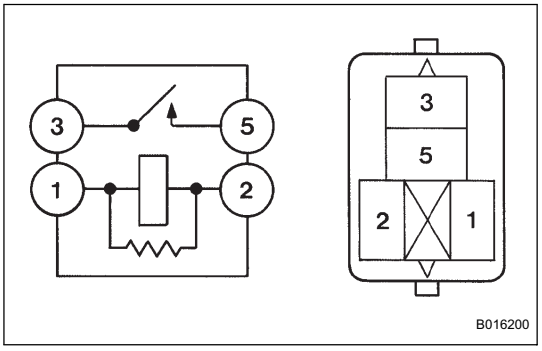
Tester Connection	Specified Condition
1 (HT) - 2 (+B)	2.16 to 2.9 Ω at 20°C (68°F)

(c) Connect the connector.

NG → **REPLACE AIR FUEL RATIO SENSOR**

OK

2 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room J/B.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

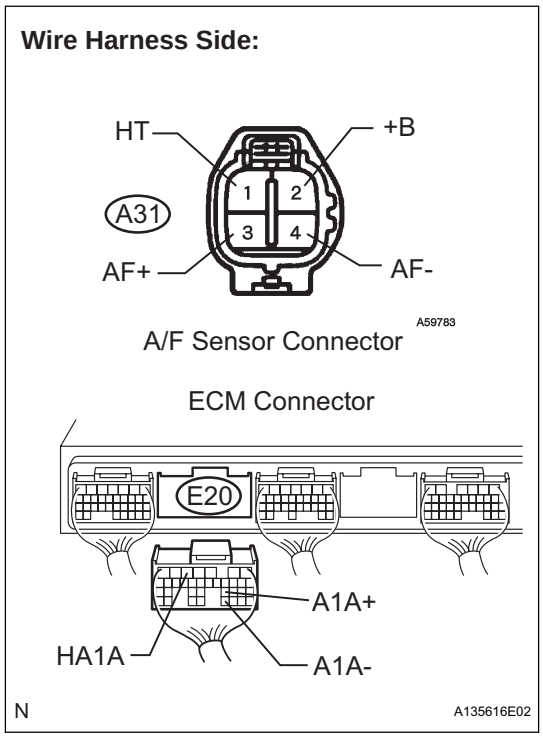
Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the EFI relay.

NG → **REPLACE EFI RELAY**

OK

3 CHECK HARNESS AND CONNECTOR (A/F SENSOR - ECM)



(a) Disconnect the A31 A/F sensor connector.
(b) Disconnect the E20 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

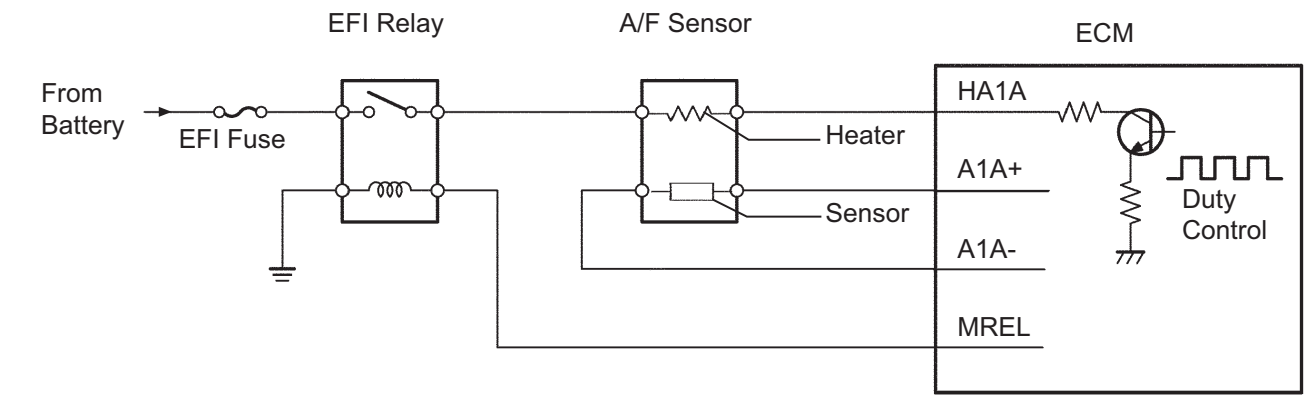
Tester Connection	Specified Condition
A31-1 (HT) - E20-5 (HA1A)	Below 1 Ω
A31-3 (AF+) - E20-23 (A1A+)	Below 1 Ω
A31-4 (AF-) - E20-31 (A1A-)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
A31-1 (HT) or E20-5 (HA1A) - Body ground	10 kΩ or higher
A31-3 (AF+) or E20-23 (A1A+) - Body ground	10 kΩ or higher
A31-4 (AF-) or E20-31 (A1A-) - Body ground	10 kΩ or higher

(d) Connect the connectors.

Reference:



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

OK →

REPLACE ECM

DTC	P2A00	A/F Sensor Circuit Slow Response (Bank 1 Sensor 1)

DESCRIPTION

Refer to DTC P2195 (See page ES-171).

DTC No.	DTC Detection Condition	Trouble Area
P2A00	In conditions (a), (b) and (c), when the A/F sensor output voltage changing value is below the regular changing value against the fuel trim changing value, the ECM judges that A/F sensor circuit has slow response: (2 trip detection logic) (a) After engine is warmed up (b) During vehicle driving at engine speed of 1,400 rpm or more (c) Vehicle speed 60 km/h (38 mph) or more (2 trip detection logic)	• Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor (sensor 1) heater • EFI relay • A/F sensor heater and relay circuit • Air induction system • Fuel pressure • Injector • ECM

HINT:
Sensor 1 refers to the sensor closest to the engine assembly.

WIRING DIAGRAM

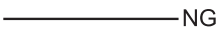
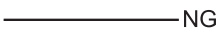
HINT:
Refer to DTC P2195 (See page ES-171).

INSPECTION PROCEDURE

HINT:
Intelligent tester only:
Malfunctioning areas can be found by performing the Active Test / A/F Control operation. The A/F Control operation can determine if the A/F sensor, heated oxygen sensor or other potential trouble areas are malfunctioning or not.

1. **Perform Active Test using the intelligent tester.**
   HINT:
   The A/F Control operation lowers the injection volume by 12.5 % or increases the injection volume by 25 %.
   (a) Connect the intelligent tester to the DLC3.
   (b) Start the engine and turn the intelligent tester ON.
   (c) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds.
   (d) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.
   (e) Select the following monitor items: AFS B1 S1 and O2S B1 S2.
   (f) Perform the A/F Control operation with the engine in an idling condition (press the right or left button).
   Result:
   The A/F sensor reacts in accordance with increase and decrease of the injection volume:
   +25 % → Rich output: Less than 3.0 V
   -12.5 % → Lean output: More than 3.35 V
   The heated oxygen sensor reacts in accordance with increase and decrease of the injection volume:
   +25 % → Rich output: More than 0.55 V
   -12.5 % → Lean output: Less than 0.4 V

NOTICE:
The A/F sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

Case	Output Voltage of A/F Sensor (Sensor 1)		Output Voltage of Heated Oxygen Sensor (Sensor 2)		Main Suspected Trouble Area
1	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		-
	Output Voltage More than 3.35 V Less than 3.0 V		Output Voltage More than 0.55 V Less than 0.4 V		
2	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		A/F sensor (A/F sensor, sensor heater, sensor circuit)
	Output Voltage Almost no reaction		Output Voltage More than 0.55 V Less than 0.4 V		
3	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		Heated oxygen sensor (Heated oxygen sensor, sensor heater, sensor circuit)
	Output Voltage More than 3.35 V Less than 3.0 V		Output Voltage Almost no reaction		
4	Injection volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		Extremely rich or lean actual air-fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)
	Output Voltage Almost no reaction		Output Voltage Almost no reaction		

Following A/F Control procedure enables the technician to check and graph the voltage output of both A/F sensor and heated oxygen sensor.
To display the graph, select the following menu items on the tester: View / Line graph.
HINT:

- DTC P2A00 may also be detected when the air-fuel ratio is stuck rich or lean.
- A low A/F sensor voltage could be caused by a rich air-fuel mixture. Check for conditions that would cause the engine to run rich.
- A high A/F sensor voltage could be caused by a lean air-fuel mixture. Check for conditions that would cause the engine to run lean.
- Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air/fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.
- This DTC may be output if the vehicle runs out of fuel.

1	CHECK OTHER DTC OUTPUT (IN ADDITION TO A/F SENSOR DTC)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
Only P2A00	A
P2A00 and other DTCs	B

HINT:
If any DTCs other than P2A00 are output, perform troubleshooting for those DTCs first.

B → **GO TO DTC CHART (See page ES-23)**

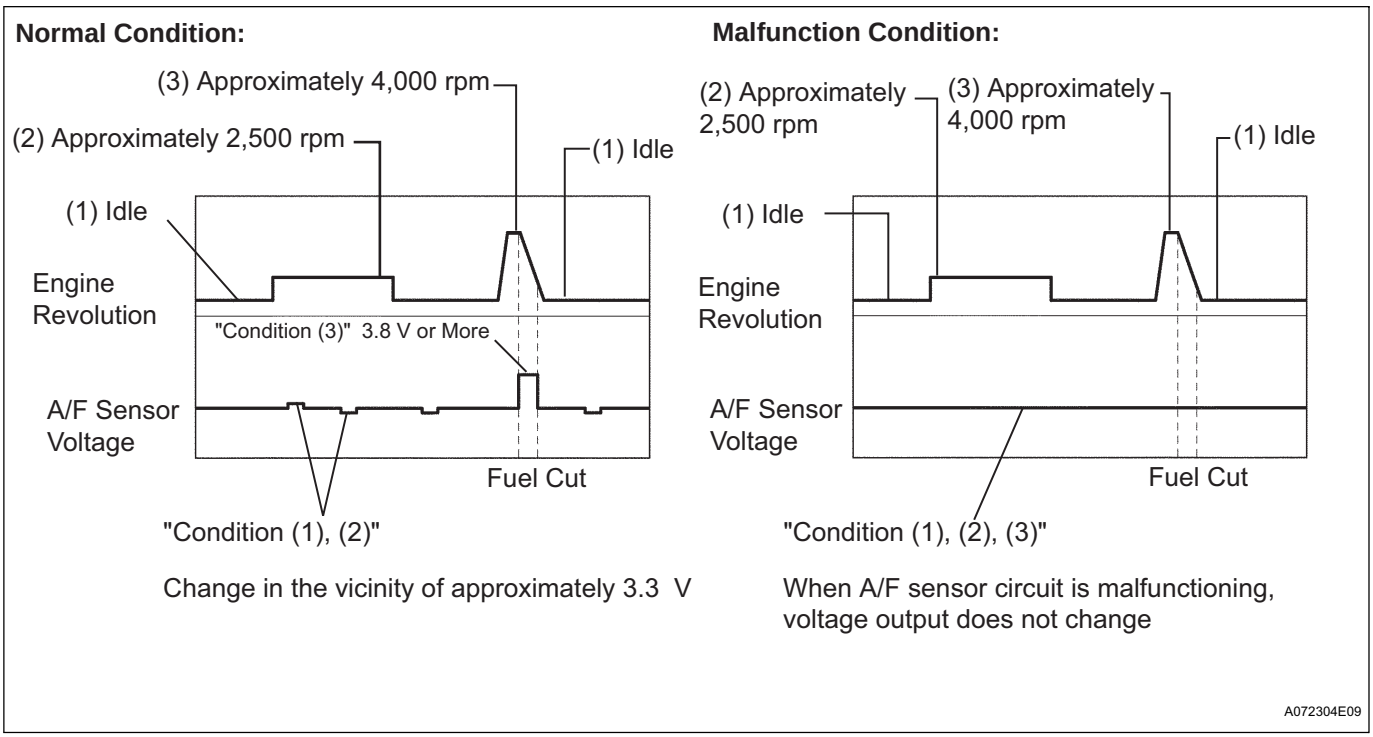
A

2	READ VALUE OF INTELLIGENT TESTER (OUTPUT VOLTAGE OF A/F SENSOR)

(a) Connect the intelligent tester to the DLC3.
(b) Start the engine and turn the intelligent tester ON.
(c) Warm up the A/F sensor with the engine at 2,500 rpm for approximately 90 seconds.
(d) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Data List.
(e) Select the following monitor items: AFS B1 S1 and Engine Speed.
(f) Monitor the A/F sensor voltage carefully.
(g) Check the A/F sensor voltage under the following conditions:
  (1) Allow the engine to idle for 30 seconds. (Condition 1)
  (2) Run the engine at approximately 2,500 rpm (where the engine RPM is not suddenly changed). (Condition 2)
  (3) Raise the engine speed to 4,000 rpm and quickly release the accelerator pedal so that the throttle valve is fully closed. (Condition 3)

  Standard:

  Conditions (1) and (2)
  The voltage changes in the vicinity of 3.3 V (0.66 V*) (between approximately 3.1 and 3.5 V) as shown in the illustration on the next page.
  Condition (3)
  The voltage increases to 3.8 V (0.76 V*) or more during engine deceleration (when fuel is cut) as shown in the illustration on the next page.
  ***: The voltage when not using the intelligent tester**



HINT:

- Whenever the output voltage of the A/F sensor remains at approximately 3.3 V (0.660 V*) (see diagram Malfunction Condition) under any condition as well as the above conditions, the A/F sensor may have an open circuit. (This will also happen when the A/F sensor heater has an open circuit.)
- Whenever the output voltage of the A/F sensor remains at a certain value of approximately 3.8 V (0.76 V*) or more, or 2.8 V (0.56 V*) or less (see diagram Malfunction Condition) under any condition as well as the above conditions, the A/F sensor may have a short circuit.
- The ECM will stop fuel injection (fuel cut) during engine deceleration. This will cause a lean condition and should result in a momentary increase in the A/F sensor voltage output.
- The ECM must establish a closed throttle position learned value to perform fuel cut. If the battery terminal was reconnected, the vehicle must be driven at over 16 km/h to allow the ECM to learn the closed throttle position.
- When the vehicle is driven:
  The output voltage of the A/F sensor may be below 2.8 V (0.76 V*) during fuel enrichment. For the vehicle, this translates to a sudden increase in speed with the accelerator pedal fully depressed when trying to overtake another vehicle. The A/F sensor is functioning normally.

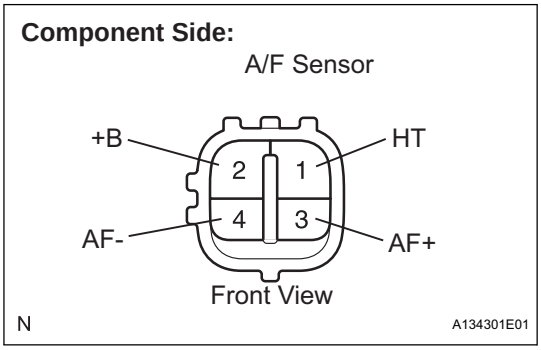
- The A/F sensor is a current output element, therefore the current is converted into voltage inside the ECM. If measuring voltage at the connectors of the A/F sensor or ECM, you will obtain a constant voltage.

*: When not using the intelligent tester.

OK → GO TO STEP 12

NG

3 INSPECT AIR FUEL RATIO SENSOR (RESISTANCE OF A/F SENSOR HEATER)



(a) Disconnect the A31 A/F sensor connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

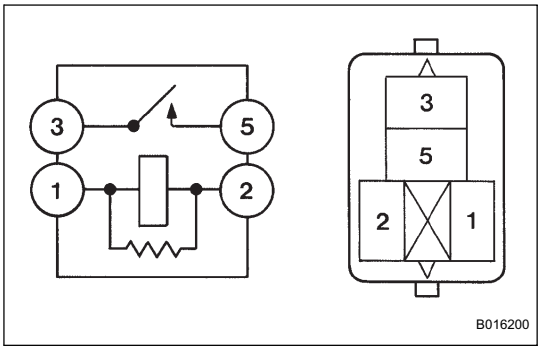
Tester Connection	Specified Condition
1 (HT) - 2 (+B)	2.16 to 2.9 Ω at 20°C (68°F)

(c) Connect the connector.

NG → REPLACE AIR FUEL RATIO SENSOR

OK

4 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room J/B.
(b) Measure the resistance of the EFI relay.

Standard resistance

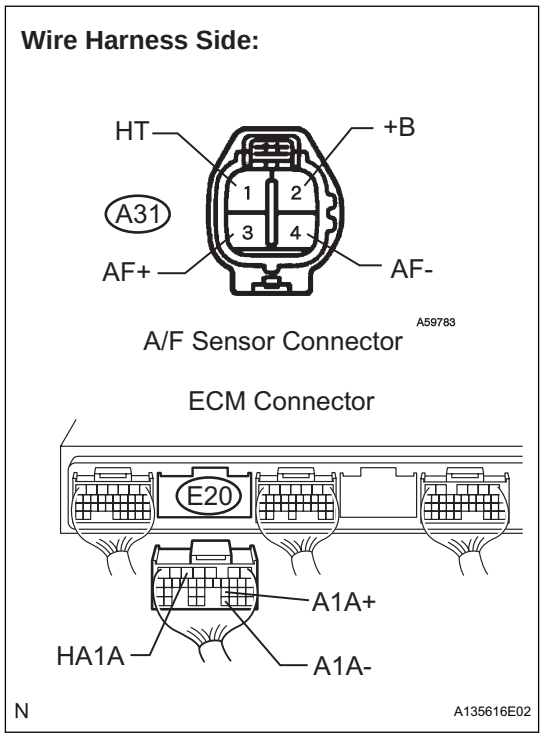
Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the EFI relay.

NG → REPLACE EFI RELAY

OK

5 CHECK HARNESS AND CONNECTOR (A/F SENSOR - ECM)



(a) Disconnect the A31 A/F sensor connector.
(b) Disconnect the E20 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

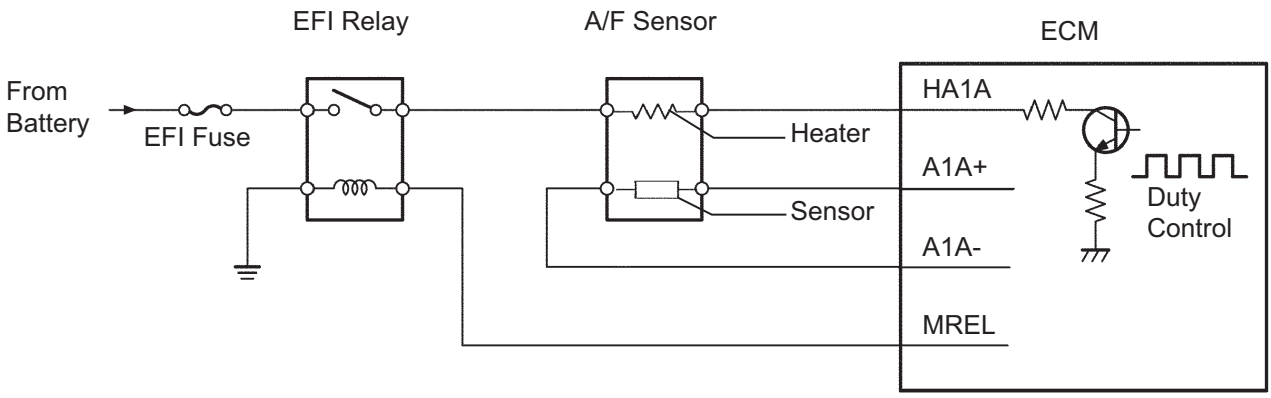
Tester Connection	Specified Condition
A31-1 (HT) - E20-5 (HA1A)	Below 1 Ω
A31-3 (AF+) - E20-23 (A1A+)	Below 1 Ω
A31-4 (AF-) - E20-31 (A1A-)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
A31-1 (HT) or E20-5 (HA1A) - Body ground	10 kΩ or higher
A31-3 (AF+) or E20-23 (A1A+) - Body ground	10 kΩ or higher
A31-4 (AF-) or E20-31 (A1A-) - Body ground	10 kΩ or higher

(d) Connect the connectors.

Reference:



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

OK

6 CHECK AIR INDUCTION SYSTEM

(a) Check for vacuum leaks in the air induction system.

OK:

No leak in the air induction system

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

7 CHECK FUEL PRESSURE

(a) Check the fuel pressure (high or low pressure).

Standard

Item	Specified Condition
Fuel Pressure	304 to 343 kPa (3.1 to 3.5 kgf cm^2, 44 to 55 psi)

NG → REPAIR OR REPLACE FUEL SYSTEM

OK

8 INSPECT FUEL INJECTOR ASSEMBLY

Standard

Item	Specified Condition
Injection Volume	76 to 92 cm^3 (4.6 to 5.6 cu in)/15 seconds
Difference between each injector	16 cm^3 (1.0 cu in) or less

NG → REPLACE FUEL INJECTOR ASSEMBLY

OK

9 REPLACE AIR FUEL RATIO SENSOR

NEXT

10 PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern (See page ES-16).

NEXT

11 CHECK IF DTC OUTPUT RECURS (A/F SENSOR DTCS)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
No output	A
P2A00	B

B → REPLACE ECM

A

END

12 PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern (See page ES-16).

NEXT

13 CHECK IF DTC OUTPUT RECURS (A/F SENSOR DTCS)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester on.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
P2A00	A
No output	B

B → GO TO STEP 17

A

14 REPLACE AIR FUEL RATIO SENSOR

NEXT

15 PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern (See page ES-16).

NEXT

16	CHECK IF DTC OUTPUT RECURS (A/F SENSOR DTCS)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
No output	A
P2A00	B

B → REPLACE ECM

A → END

17	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

NO → DTC IS CAUSED BY RUNNING OUT OF FUEL

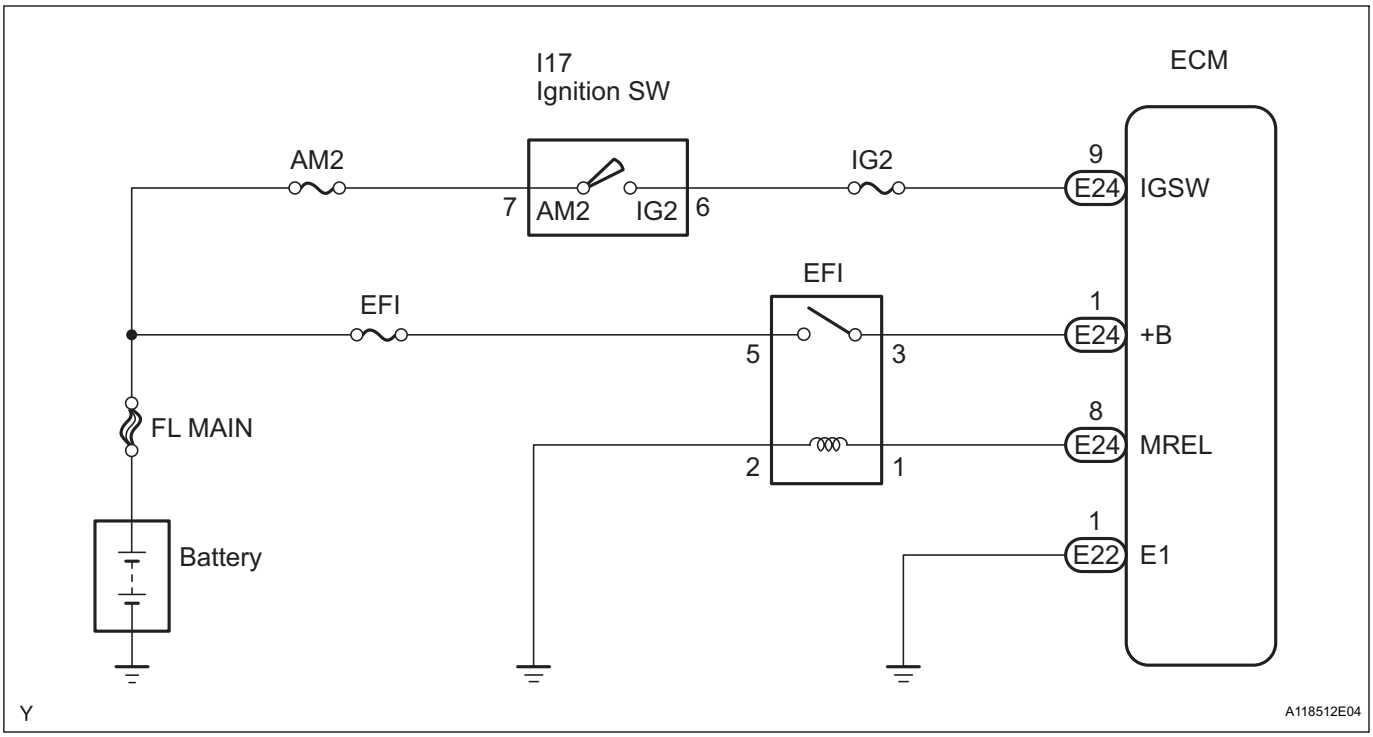
YES → CHECK FOR INTERMITTENT PROBLEMS

ECM Power Source Circuit

DESCRIPTION

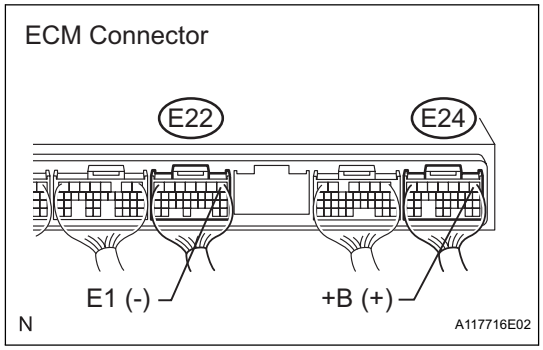
When the ignition switch is turned to the ON position, the battery voltage is applied to terminal IGSW of the ECM. The ECM "MREL" output signal causes a current to flow to the coil, closing the contacts of the EFI relay and supplying power to terminal +B of the ECM.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	INSPECT ECM (+B VOLTAGE)



(a) Turn the ignition switch to the ON position.
(b) Measure the voltage according to the value(s) in the table below.

Standard voltage

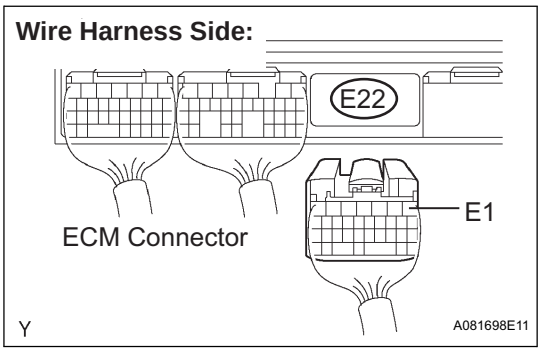
Tester Connection	Specified Condition
+B (E24-1) - E1 (E22-1)	9 to 14 V

NG → **GO TO STEP 2**

OK →

PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE
(See page ES-11)

2 CHECK HARNESS AND CONNECTOR (ECM - BODY GROUND)



(a) Disconnect the negative (-) battery cable.
(b) Disconnect the E22 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.
Standard resistance:
Check for open

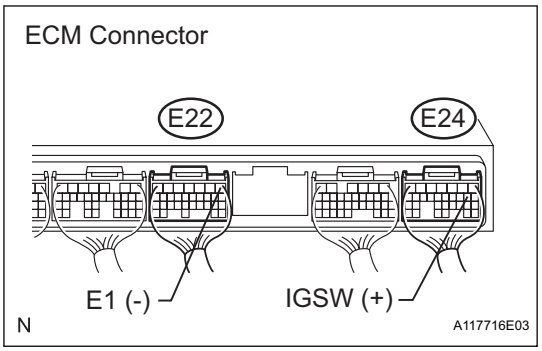
Tester Connection	Specified Condition
E1 (E22-1) - Body ground	Below 1 Ω

(d) Connect the connector.
(e) Reconnect the negative battery cable.

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

OK

3 INSPECT ECM (IGSW VOLTAGE)



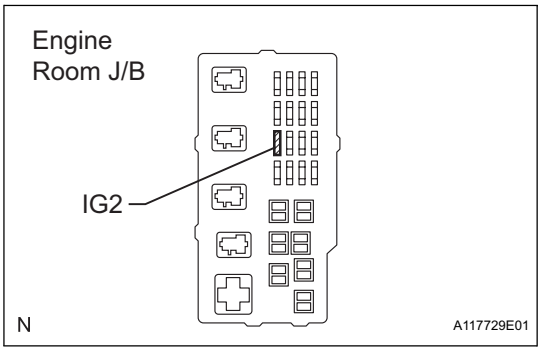
(a) Turn the ignition switch to the ON position.
(b) Measure the voltage according to the value(s) in the table below.
Standard voltage

Tester Connection	Specified Condition
IGSW (E24-9) - E1 (E22-1)	9 to 14 V

OK → **GO TO STEP 5**

NG

4 CHECK IG2 FUSE



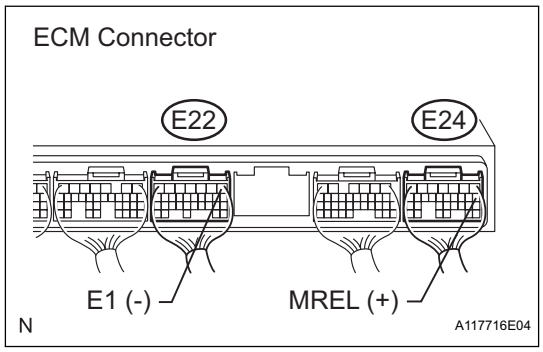
(a) Remove the IG2 fuse from the engine room J/B.
(b) Measure the resistance of the IG2 fuse.
Standard resistance:
Below 1 Ω
(c) Reinstall the IG2 fuse.

NG → **REPLACE IG2 FUSE**

OK

CHECK AND REPLACE HARNESS AND CONNECTOR (BATTERY - ECM)

5 INSPECT ECM (MREL VOLTAGE)



(a) Turn the ignition switch to the ON position.
(b) Measure the voltage according to the value(s) in the table below.

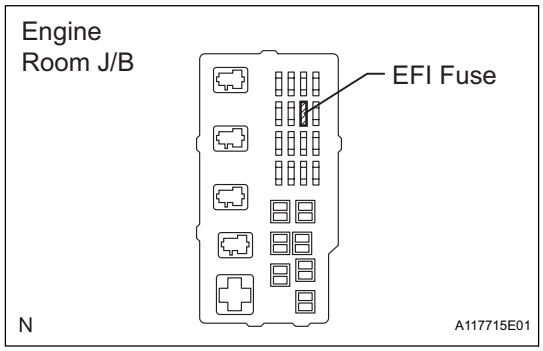
Standard voltage

Tester Connection	Specified Condition
MREL (E24-8) - E1 (E22-1)	9 to 14 V

NG → **REPLACE ECM**

OK

6 CHECK EFI FUSE



(a) Remove the EFI fuse from the engine room J/B.
(b) Measure the resistance of the EFI fuse.

Standard resistance:

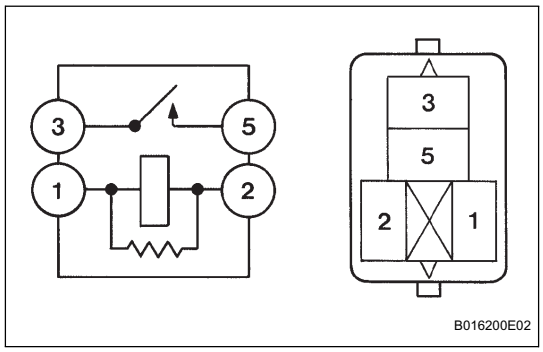
Below 1 Ω

(c) Reinstall the EFI fuse.

NG → **REPLACE EFI FUSE**

OK

7 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room J/B.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

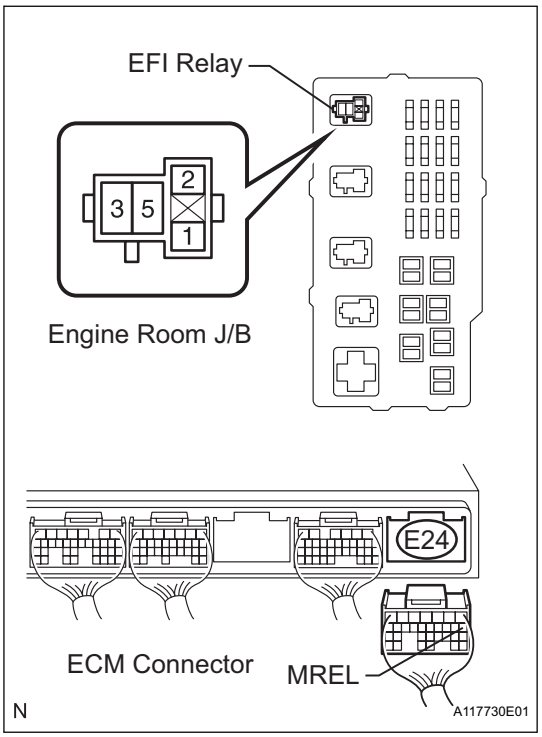
Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the EFI relay.

NG → **REPLACE EFI RELAY**

OK

8	CHECK HARNESS AND CONNECTOR (EFI RELAY - ECM, EFI RELAY - BODY GROUND)



(a) Check the harness and connectors between the EFI relay and the ECM connector.
(1) Remove the EFI relay from the engine room J/B.
(2) Disconnect the E24 ECM connector.
(3) Measure the resistance according to the value(s) in the table below.
Standard resistance:
Check for open

Tester Connection	Specified Condition
Engine room J/B EFI relay terminal 1 - E24-8 (MREL)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
Engine room J/B EFI relay terminal 1 or E24-8 (MREL) - Body ground	10 kΩ or higher

(4) Reinstall the EFI relay.
(5) Connect the connector.

(b) Check the harness and connector between the EFI relay and body ground.
(1) Remove the EFI relay from the engine room J/B.
(2) Measure the resistance according to the value(s) in the table below.
Standard resistance:
Check for open

Tester Connection	Specified Condition
Engine room J/B EFI relay terminal 2 - Body ground	Below 1 Ω

(3) Reinstall the EFI relay.

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

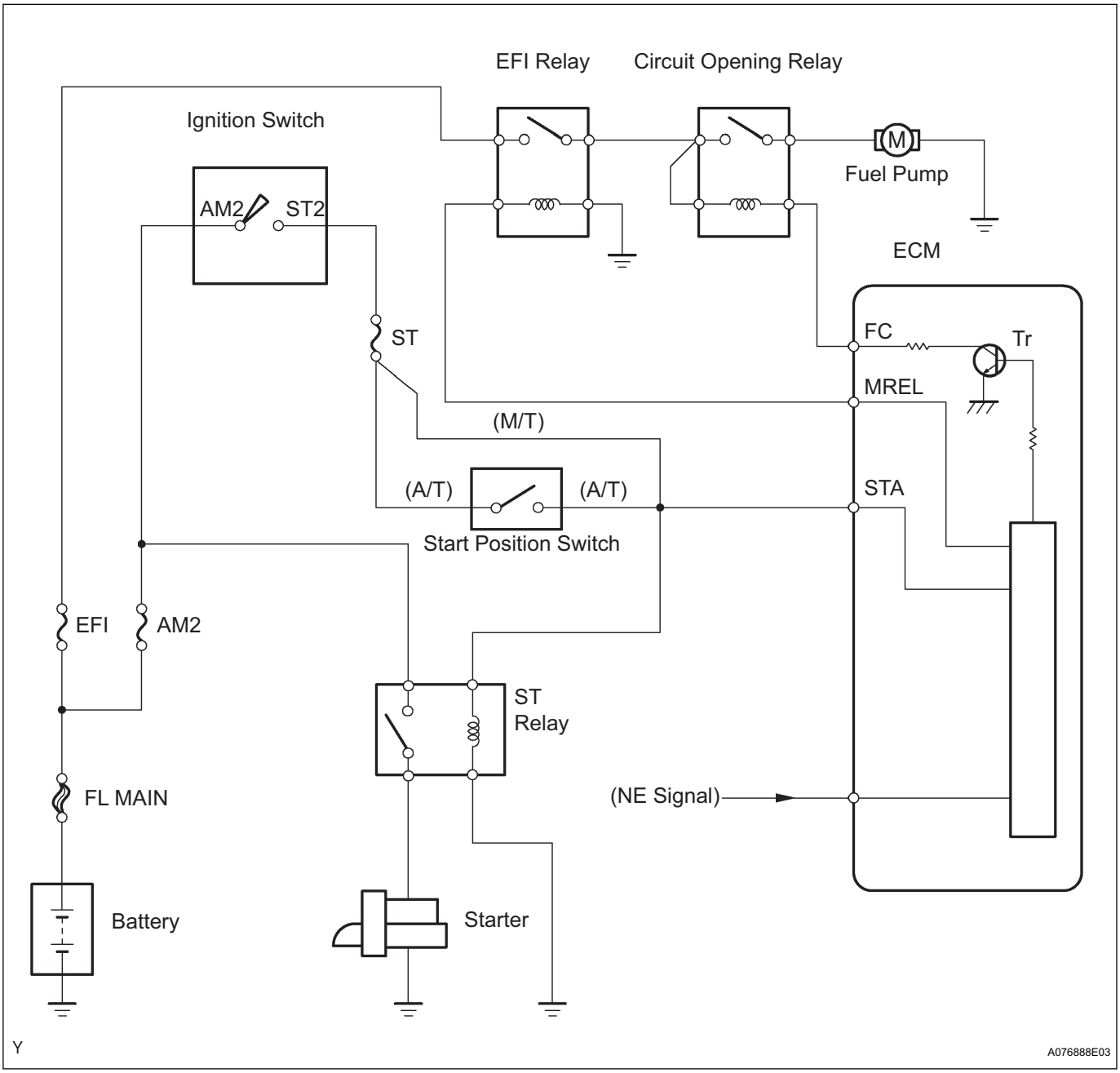
OK →

CHECK AND REPLACE HARNESS AND CONNECTOR (TERMINAL +B OF ECM - BATTERY POSITIVE TERMINAL)

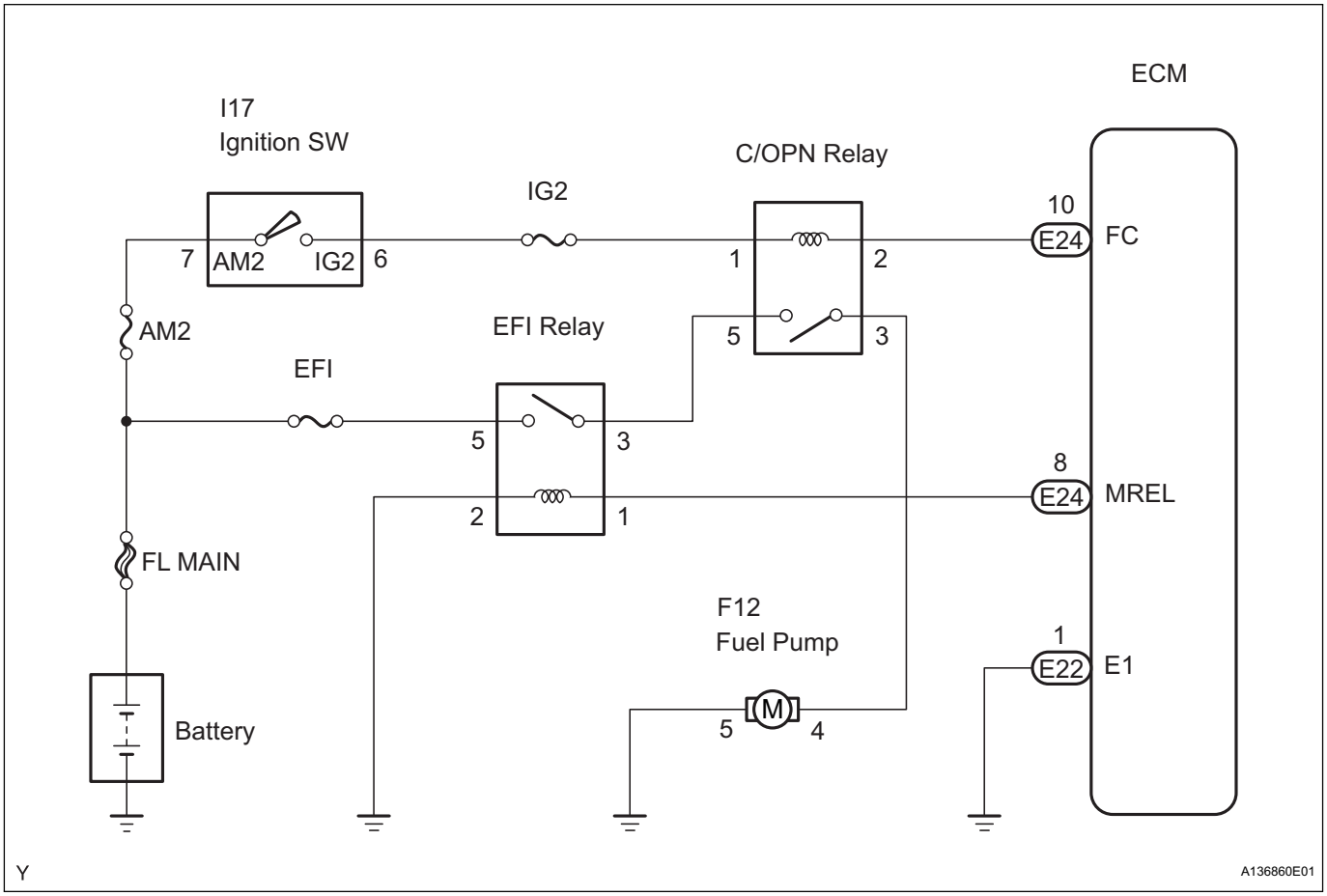
Fuel Pump Control Circuit

DESCRIPTION

In the diagram below, when the engine is cranked, a current flows from terminal ST2 of the ignition switch to the starter relay coil and also a current flows to terminal STA of the ECM (STA signal).
When the STA signal and NE signal are transmitted to the ECM, the power transistor (Tr) is turned ON, a current flows to the coil of the circuit opening relay, the relay switches on, the power is supplied to the fuel pump and the fuel pump operates.
While the NE signal is generated (when the engine is running), the ECM keeps Tr ON (circuit opening relay ON) and the fuel pump also keeps operating.



WIRING DIAGRAM



INSPECTION PROCEDURE

1	**PERFORM ACTIVE TEST BY INTELLIGENT TESTER (OPERATE CIRCUIT OPENING RELAY)**

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Active Test / Fuel Pump Relay.
(d) Check the operation of the relay while operating it using the intelligent tester.
Standard:
Operating sounds can be heard from the relay.

NG → **GO TO STEP 2**

OK

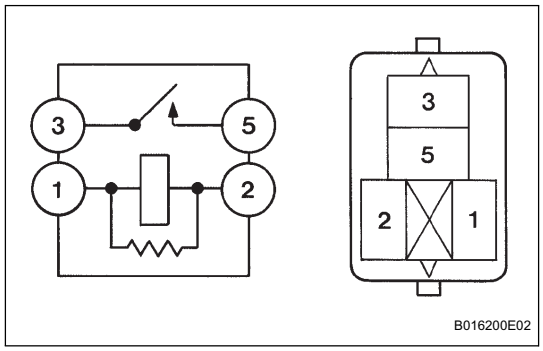
PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE
(See page ES-11)

2	CHECK ECM POWER SOURCE CIRCUIT

NG → REPAIR OR REPLACE ECM POWER SOURCE CIRCUIT

OK

3	INSPECT C/OPN RELAY



(a) Remove the C/OPN relay.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

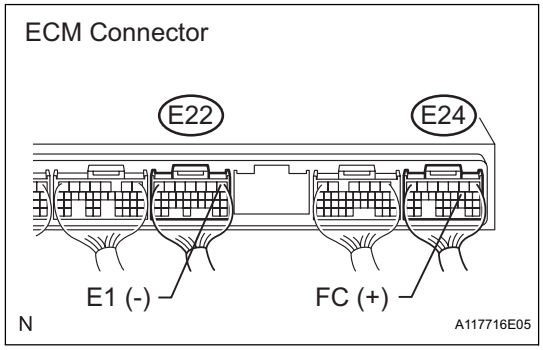
Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the C/OPN relay.

NG → REPLACE C/OPN RELAY

OK

4	INSPECT ECM (FC VOLTAGE)



(a) Turn the ignition switch to the ON position.
(b) Measure the voltage according to the value(s) in the table below.

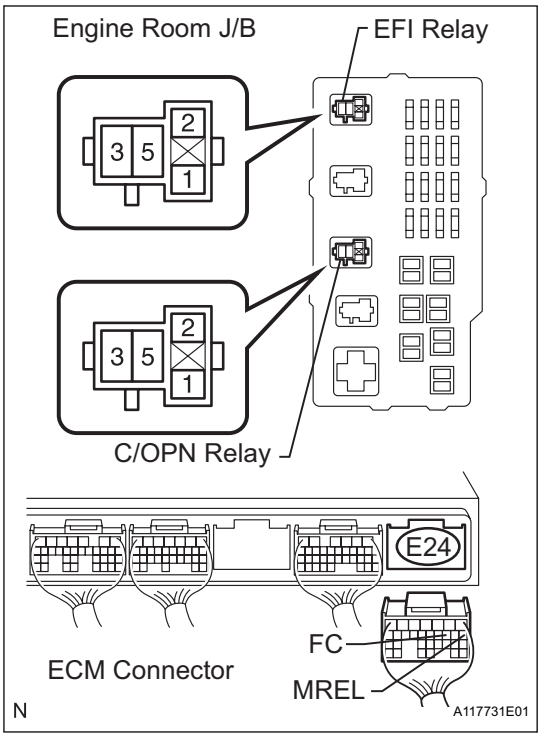
Standard voltage

Tester Connection	Specified Condition
FC (E24-10) - E1 (E22-1)	9 to 14 V

OK → GO TO STEP 6

NG

5	CHECK HARNESS AND CONNECTOR (EFI RELAY - ECM, C/OPN RELAY - ECM, EFI RELAY - C/OPN RELAY)



(a) Remove the EFI relay and C/OPN relay from the engine room J/B.
(b) Disconnect the E24 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
Engine room J/B EFI relay terminal 1 - E24-8 (MREL)	Below 1 Ω
Engine room J/B C/OPN relay terminal 2 - E24-10 (FC)	Below 1 Ω
Engine room J/B EFI relay terminal 3 - Engine room J/B C/OPN relay terminal 5	Below 1 Ω

Check for short

Tester Connection	Specified Condition
Engine room J/B EFI relay terminal 1 or E24-8 (MREL) - Body ground	10 kΩ or higher
Engine room J/B C/OPN relay terminal 2 or E24-10 (FC) - Body ground	10 kΩ or higher
Engine room J/B EFI relay terminal 3 - Engine room J/B C/OPN relay terminal 5 - Body ground	10 kΩ or higher

(d) Reinstall the EFI relay.
(e) Reinstall the C/OPN relay.
(f) Connect the connector.

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

OK

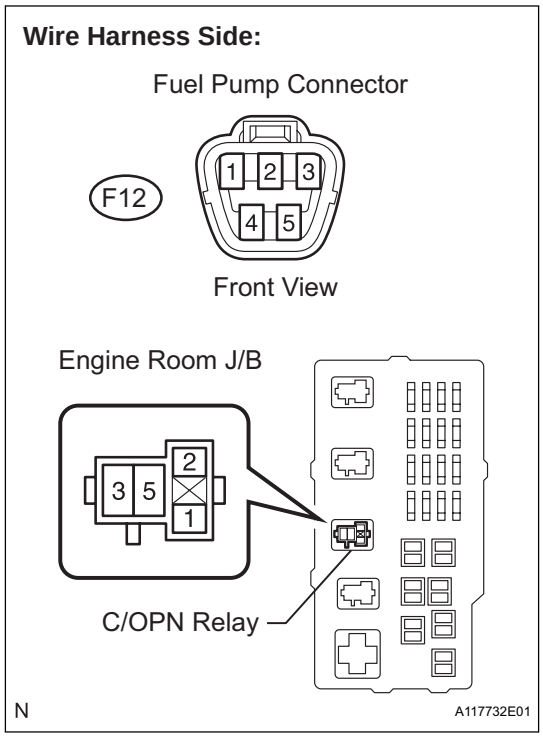
REPLACE ECM

6	INSPECT FUEL PUMP

NG → **REPAIR OR REPLACE FUEL PUMP**

OK

7	CHECK HARNESS AND CONNECTOR (C/OPN RELAY - FUEL PUMP, FUEL PUMP - BODY GROUND)



(a) Remove the C/OPN relay from the engine room J/B.
(b) Disconnect the F12 fuel pump connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
Engine room J/B C/OPN relay terminal 3 - F12-4 (Fuel pump)	Below 1 Ω
F12-5 (Fuel pump) - Body ground	Below 1 Ω

Check for short

Tester Connection	Specified Condition
Engine room J/B C/OPN relay terminal 3 or F12-4 (Fuel pump) - Body ground	10 kΩ or higher

(d) Reinstall the C/OPN relay.
(e) Connect the connector.

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

OK

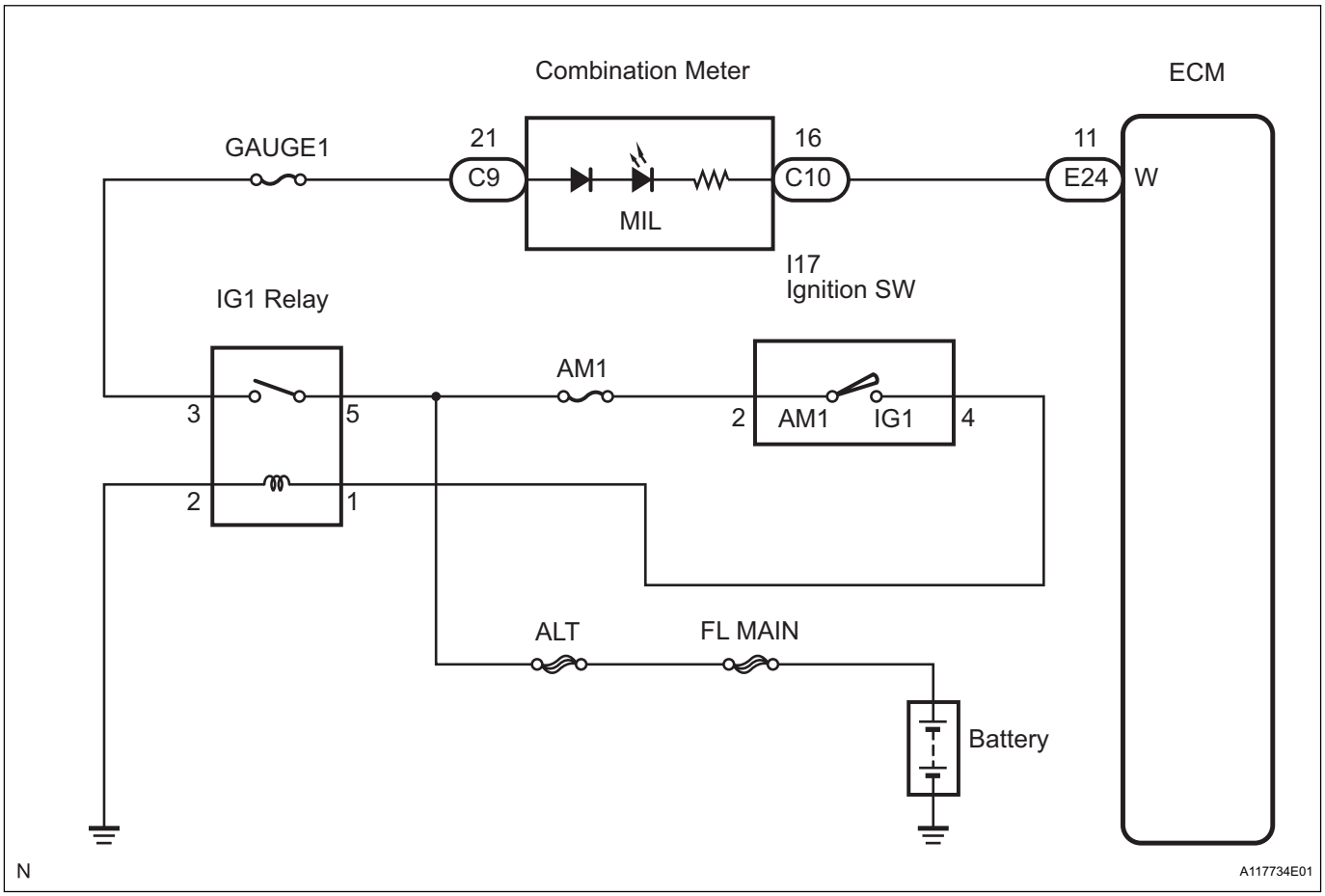
REPLACE ECM

MIL Circuit

DESCRIPTION

The MIL (Malfunction Indicator Lamp) is used to indicate that the ECM detects vehicle malfunctions. By turning the ignition switch to the ON position, the power is supplied to the MIL circuit, and the ECM provides the circuit ground that illuminates the MIL.
Operation of the MIL should be checked visually:
When the ignition switch is first turned to the ON position, the MIL should be illuminated. If it is always OFF or ON, use the intelligent tester and follow the procedure below to determine the cause of the problem.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Troubleshoot each trouble symptom in accordance with the chart below.
Reference:

Result	Proceed To
MIL remains on	Start inspection from step 1
MIL is not illuminated	Start inspection from step 3

1	CHECK IF MIL TURNS OFF

(a) Connect the intelligent tester to the DLC3.

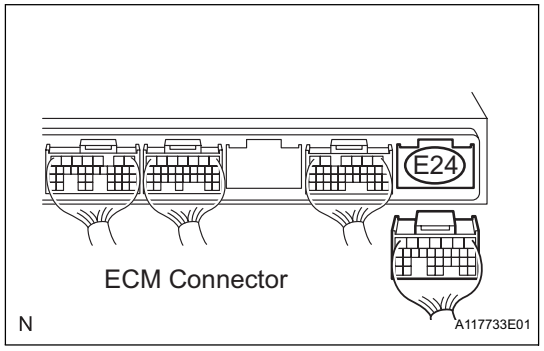
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Check if DTCs have been stored. Note down if there are DTCs.
(e) Select the following menu items: Powertrain / Engine and ECT / DTC / Clear.
(f) Clear the DTC(s).
(g) Check if the MIL turns off.
Standard:
The MIL turns off.

NG → **GO TO STEP 2**

OK

REPAIR CIRCUIT INDICATED BY OUTPUT DTC

2	CHECK HARNESS AND CONNECTOR (CHECK FOR SHORT IN WIRE HARNESS)



(a) Disconnect the E24 ECM connector.
(b) Turn the ignition switch to the ON position.
(c) Check that the MIL is not illuminated.
Standard:
The MIL is not illuminated.
(d) Connect the connector.

NG → **CHECK AND REPLACE HARNESS AND CONNECTOR**

OK

REPLACE ECM

3	CHECK IF MIL ILLUMINATES

(a) Check if the MIL illuminates when turning the ignition switch to the ON position.
Standard:
The MIL illuminates.

NG → **GO TO STEP 4**

OK

NORMAL

4	INSPECT COMBINATION METER ASSEMBLY (MIL CIRCUIT)

(a) See the combination meter troubleshooting procedure.

NG → REPAIR OR REPLACE COMBINATION METER ASSEMBLY

OK

CHECK AND REPLACE HARNESS AND CONNECTOR (COMBINATION METER - ECM)

1MZ-FE ENGINE CONTROL SYSTEM

SFI SYSTEM

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DTC P0101 Mass Air Flow Circuit Range / Performance Problem ES-39
DTC P0110 Intake Air Temperature Circuit Malfunction ES-40
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DTC P0125 Insufficient Coolant Temperature for Closed Loop Fuel Control ES-55
DTC P0136 Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2) ES-65
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DTC P0171 System Too Lean (Bank 1) ES-71
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DTC P0301 Cylinder 1 Misfire Detected ES-80
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DTC P0305 Cylinder 5 Misfire Detected ES-80
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DTC P0325 Knock Sensor 1 Circuit ES-95
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DTC P0335 Crankshaft Position Sensor "A" Circuit ES-99
DTC P0340 Camshaft Position Sensor "A" Circuit (Bank 1 Sensor) ES-102
DTC P0401 Exhaust Gas Recirculation Flow Insufficient Detected ES-105
DTC P0402 Exhaust Gas Recirculation Flow Excessive Detected ES-113
DTC P0420 Catalyst System Efficiency Below Threshold (Bank 1) ES-116
DTC P0443 Evaporative Emission Control System Purge Control Valve Circuit ES-121
DTC P0500 Vehicle Speed Sensor "A" ES-125
DTC P0505 Idle Control System Malfunction ES-127

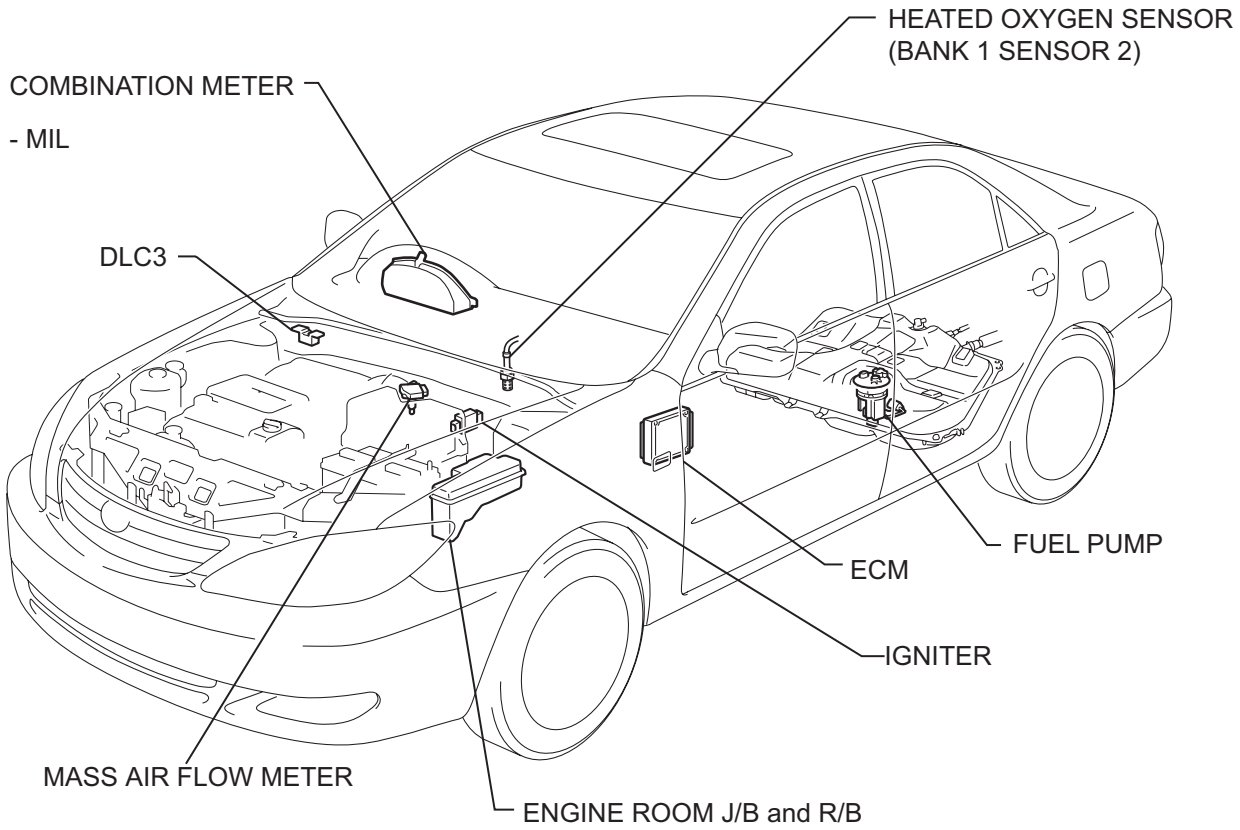
DTC P1130 A/F Sensor Circuit Range / Performance Malfunction (Bank 1 Sensor 1) ES-132
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DTC P1133 A/F Sensor Circuit Response Malfunction (Bank 1 Sensor 1) ES-139
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DTC P1135 A/F Sensor Heater Circuit Malfunction (Bank 1 Sensor 1) . . ES-146
DTC P1155 A/F Sensor Heater Circuit Malfunction (Bank 2 Sensor 1) . . ES-146
DTC P1300 Igniter Circuit Malfunction (No. 1) ES-149
DTC P1335 Crankshaft Position Sensor Circuit Malfunction (During Engine Running) ES-155
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ECM Power Source Circuit ES-169
Fuel Pump Control Circuit ES-173
Starter Signal Circuit ES-178
MIL Circuit ES-181

SFI SYSTEM

PRECAUTION

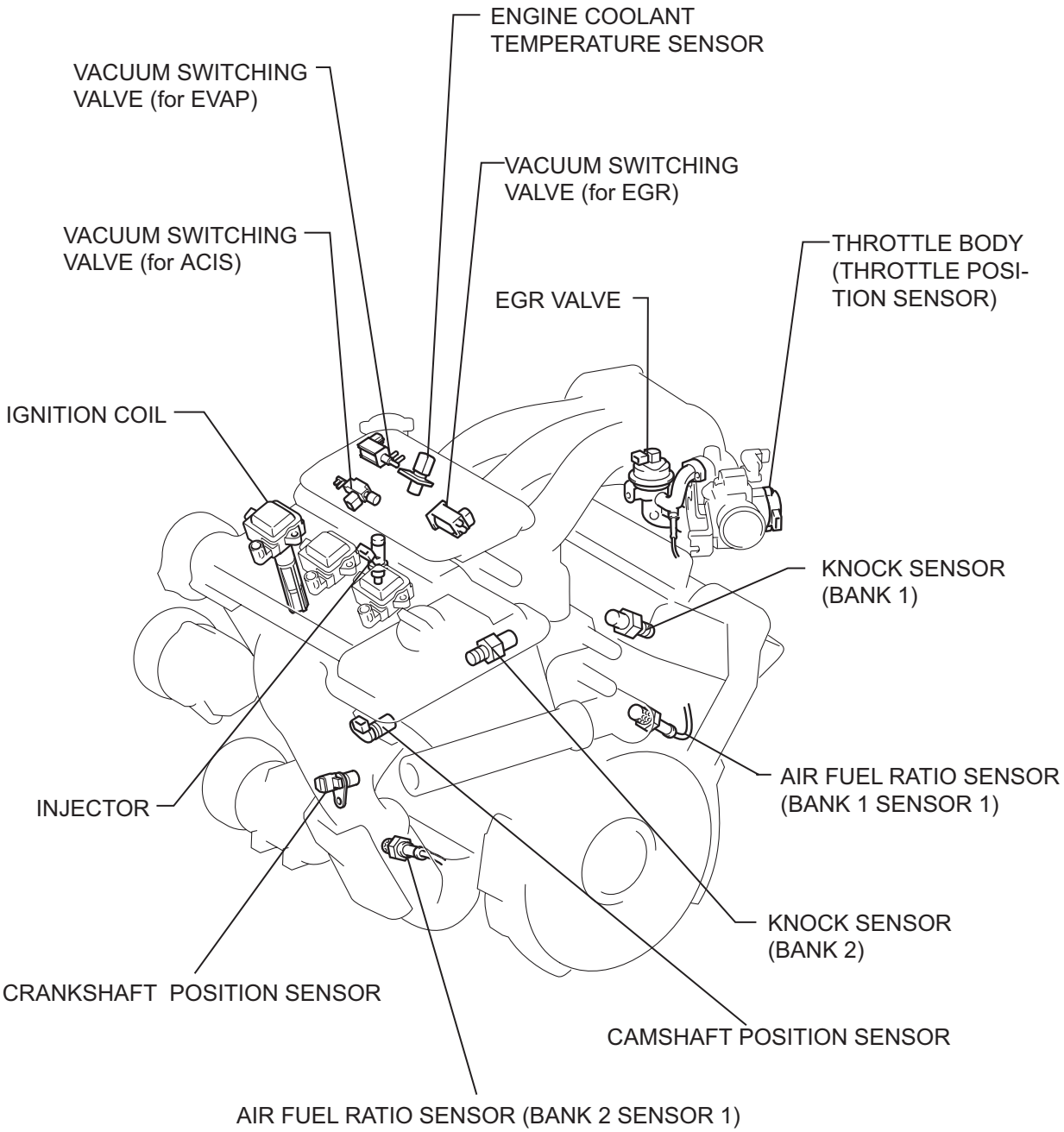
NOTICE:
Perform the RESET MEMORY (AT initialisation) operation after replacing the automatic transaxle assembly, engine assembly or ECM.
HINT:
Initialisation cannot be completed just by removing the battery cable.

PARTS LOCATION



Y

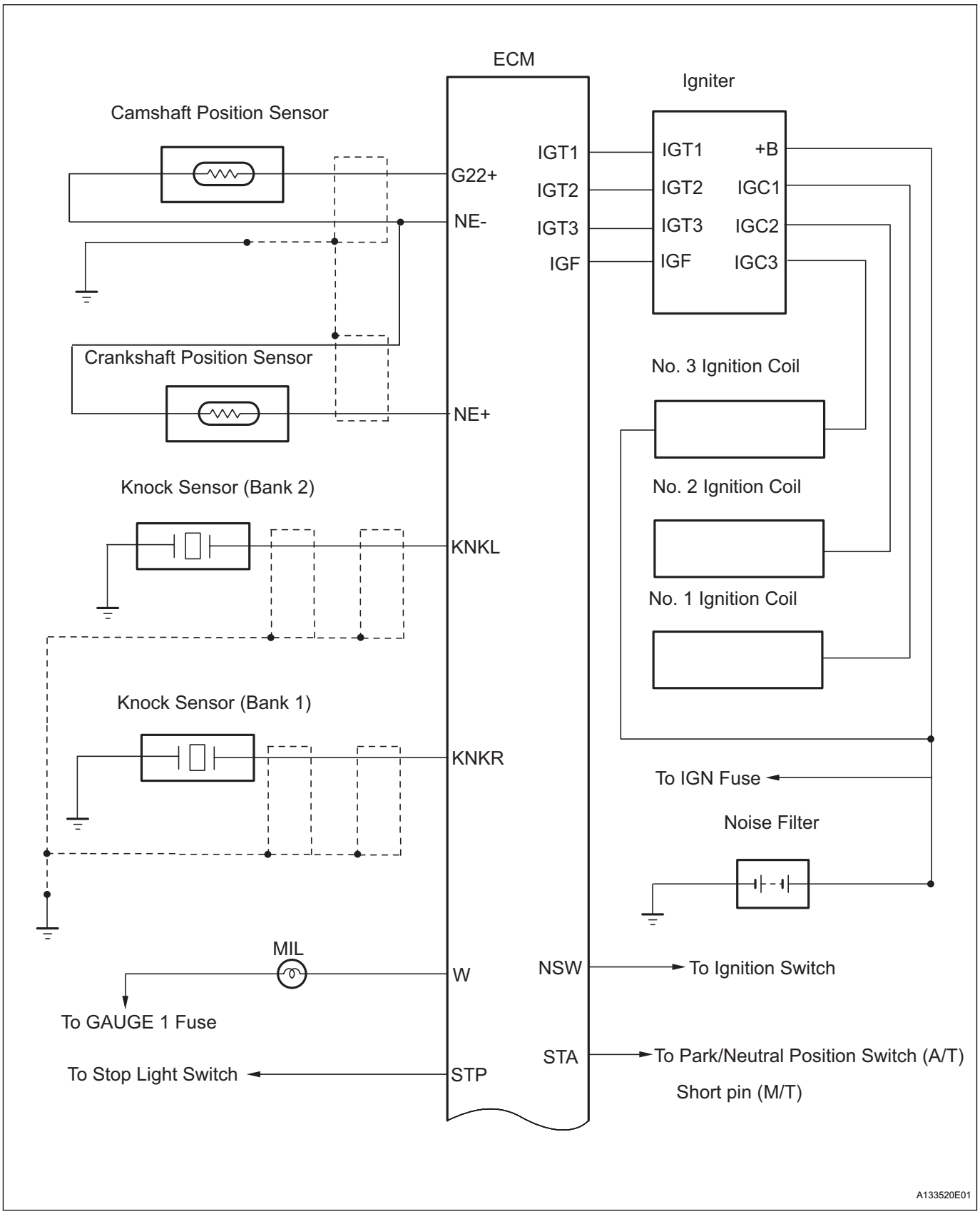
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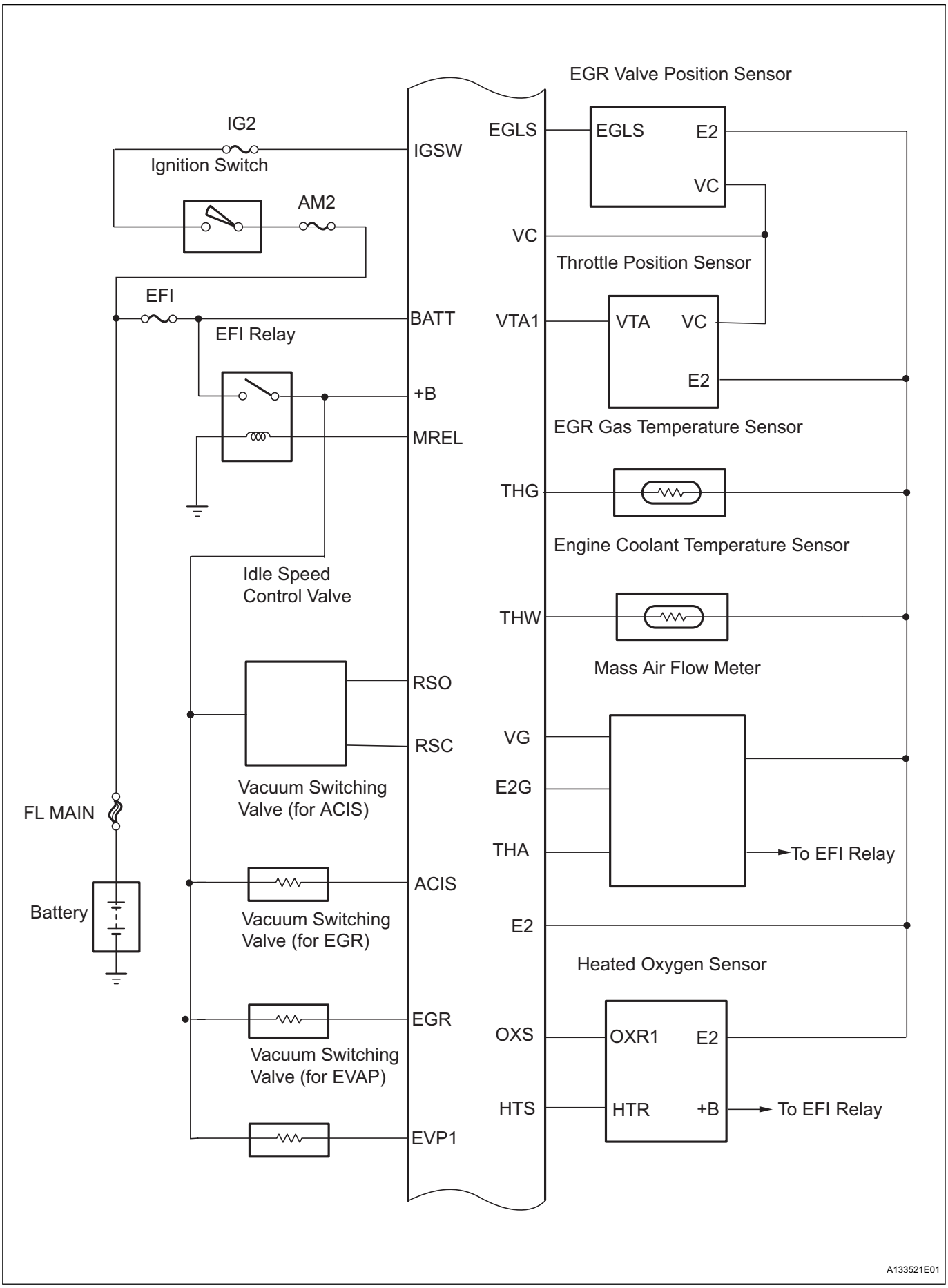


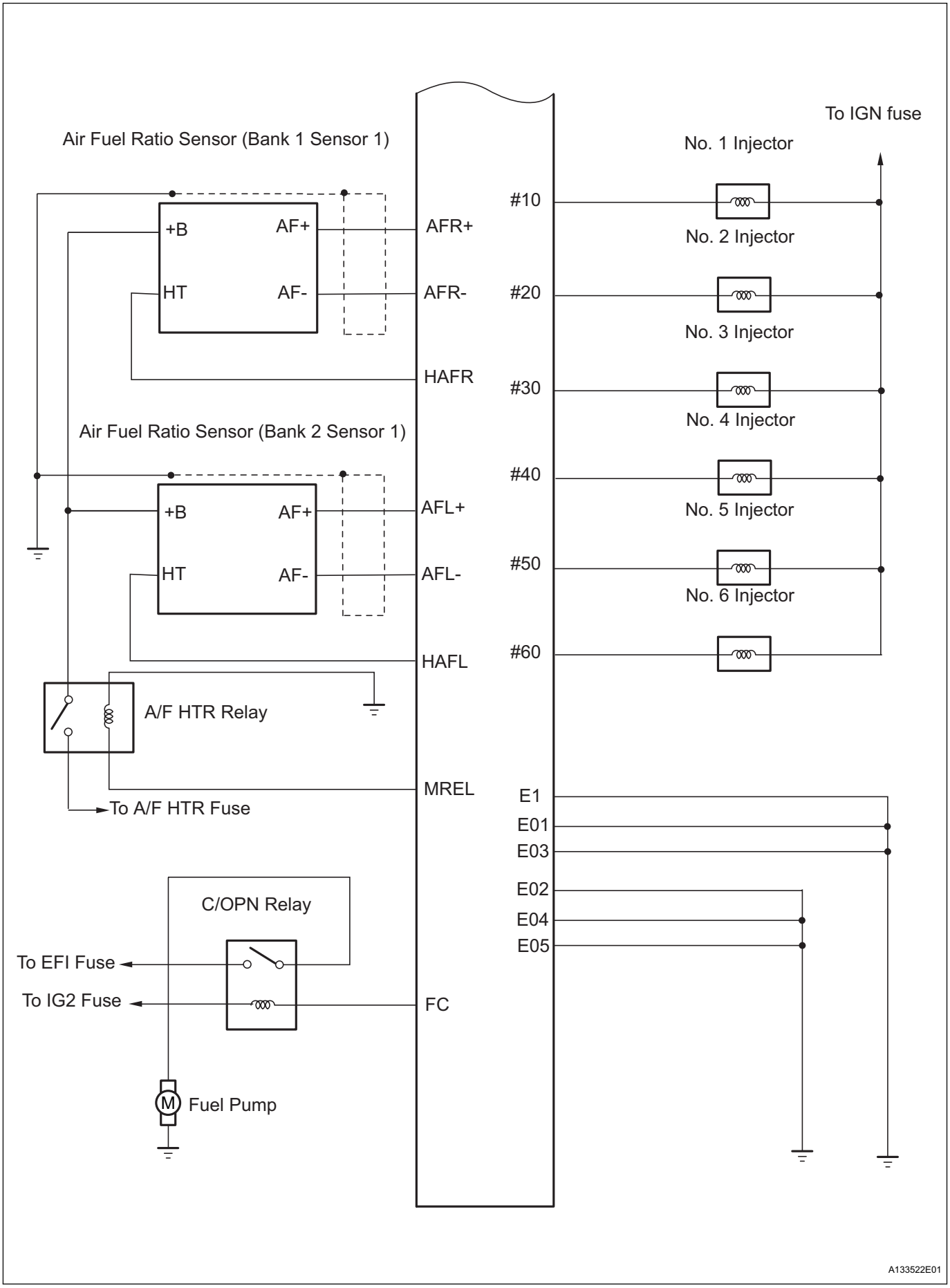
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A133064E01

SYSTEM DIAGRAM




EGR Valve Position Sensor
IG2
Ignition Switch
IGSW
EGLS
EGLS
E2
VC
AM2
VC
Throttle Position Sensor
EFI
BATT
VTA1
VTA
VC
E2
EFI Relay
+B
MREL
EGR Gas Temperature Sensor
THG
Engine Coolant Temperature Sensor
Idle Speed
Control Valve
THW
Mass Air Flow Meter
RSO
RSC
VG
E2G
THA
To EFI Relay
Vacuum Switching
Valve (for ACIS)
FL MAIN
ACIS
Battery
Vacuum Switching
Valve (for EGR)
E2
Heated Oxygen Sensor
EGR
OXS
OXR1
E2
Vacuum Switching
Valve (for EVAP)
HTS
HTR
+B
To EFI Relay
EVP1
A133521E01


Air Fuel Ratio Sensor (Bank 1 Sensor 1)
+B
AF+
HT
AF-
AFR+
AFR-
HAFR
Air Fuel Ratio Sensor (Bank 2 Sensor 1)
+B
AF+
HT
AF-
AFL+
AFL-
HAFL
A/F HTR Relay
MREL
To A/F HTR Fuse
C/OPN Relay
To EFI Fuse
To IG2 Fuse
FC
M
Fuel Pump
To IGN fuse
No. 1 Injector
No. 2 Injector
No. 3 Injector
No. 4 Injector
No. 5 Injector
No. 6 Injector
#10
#20
#30
#40
#50
#60
E1
E01
E03
E02
E04
E05
A133522E01

HOW TO PROCEED WITH TROUBLESHOOTING

The intelligent tester is used in steps 3, 4, 5, 7 and 10.

1	VEHICLE BROUGHT TO WORKSHOP

NEXT

2	CUSTOMER PROBLEM ANALYSIS

NEXT

3	CONNECT INTELLIGENT TESTER TO DLC3

HINT:
If the display indicates a communication fault in the tester, inspect the DLC3.

NEXT

4	CHECK DTC AND FREEZE FRAME DATA

HINT:
Record or print DTCs and freeze frame data, if needed.

NEXT

5	CLEAR DTC AND FREEZE FRAME DATA

NEXT

6	CONDUCT VISUAL INSPECTION

NEXT

7	SET CHECK MODE DIAGNOSIS

NEXT

8	CONFIRM PROBLEM SYMPTOMS

HINT:
If the engine does not start, perform steps 10 and 12 first.

Result

Result	Proceed To
Malfunction does not occur	A
Malfunction occurs	B

B → GO TO STEP 10

A

9	SIMULATE SYMPTOMS

NEXT

10	CHECK DTC

Result

Result	Proceed To
Trouble code	A
No code	B

B → GO TO STEP 12

A

11	REFER TO DTC CHART

NEXT

GO TO STEP 14

12	CONDUCT BASIC INSPECTION

Result

Result	Proceed To
Wrong parts not confirmed	A
Wrong parts confirmed	B

B → GO TO STEP 17

A

13	REFER TO PROBLEM SYMPTOMS TABLE

Result

Result	Proceed To
Wrong circuit confirmed	A

Result	Proceed To
Wrong parts confirmed	B

B → GO TO STEP 17

A

14	CHECK ECM POWER SOURCE CIRCUIT

NEXT

15	CONDUCT CIRCUIT INSPECTION

Result

Result	Proceed To
Malfunction not confirmed	A
Malfunction confirmed	B

B → GO TO STEP 18

A

16	CHECK FOR INTERMITTENT PROBLEMS

NEXT

GO TO STEP 18

17	CONDUCT PARTS INSPECTION

NEXT

18	IDENTIFY PROBLEM

NEXT

19	ADJUST AND/OR REPAIR

NEXT

20	CONDUCT CONFIRMATION TEST

NEXT

END

CHECK FOR INTERMITTENT PROBLEMS

HINT:
Intelligent tester only:
Inspect the vehicle's ECM using check mode. Intermittent problems are easier to detect with the intelligent tester when the ECM is in check mode. In check mode, the ECM uses 1 trip detection logic, which has a higher sensitivity to malfunctions than normal mode (default) using 2 trip detection logic.

1. Clear the DTCs (See page ES-17).
2. Switch the ECM from normal mode to check mode using the intelligent tester (See page ES-18).
3. Perform a simulation test (See page IN-28).
4. Check the connector(s) and terminal(s) (See page IN-23).
5. Wiggle the harness(es) and connector(s) (See page IN-23).

BASIC INSPECTION

When a malfunction is not confirmed in the DTC check, troubleshooting should be carried out in all the circuits considered possible causes of the problem. In many cases, by carrying out the basic engine check shown in the following flowchart, the location of the problem can be found quickly and efficiently. Therefore, performing this check is essential in engine troubleshooting.

1	CHECK BATTERY VOLTAGE

NOTICE:
Carry out this check with the engine stopped and the ignition switch off.
Result

Result	Proceed To
11 V or more	OK
Below 11 V	NG

NG → CHARGE OR REPLACE BATTERY

OK

2	CHECK IF ENGINE CRANKS

NG → PROCEED TO PROBLEM SYMPTOMS TABLE

OK

3	CHECK IF ENGINE STARTS

NG → GO TO STEP 6

OK

4	CHECK AIR FILTER

(a) Visually check if the air filter is not contaminated with dirt or oil.

NG → REPLACE AIR FILTER

OK

5	CHECK IDLING SPEED

NG → PROCEED TO PROBLEM SYMPTOMS TABLE

OK

6	CHECK FUEL PRESSURE

NG → PROCEED TO TROUBLESHOOT

OK

7	CHECK FOR SPARK

NG → PROCEED TO TROUBLESHOOT

OK

PROCEED TO PROBLEM SYMPTOMS TABLE

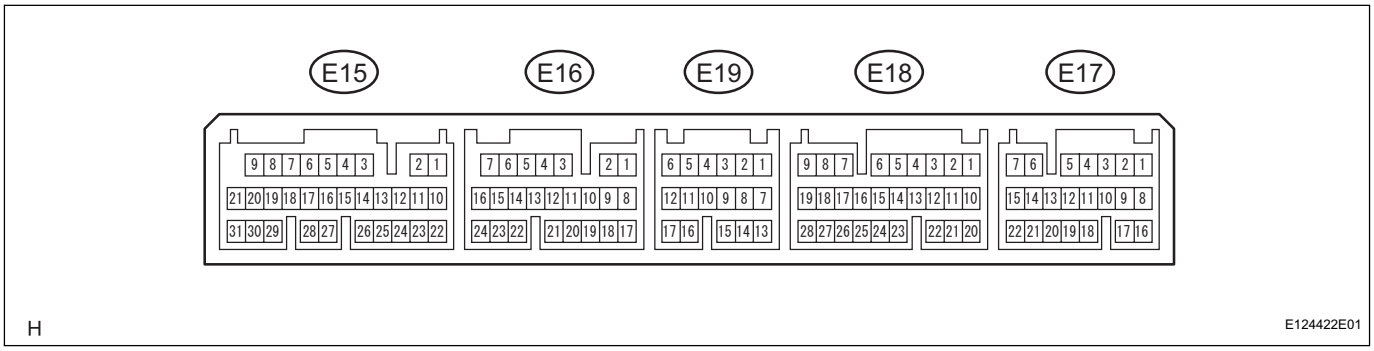
PROBLEM SYMPTOMS TABLE

SFI SYSTEM

When the malfunction is not confirmed in the diagnostic trouble code check and the problem still cannot be confirmed in the basic inspection, use this table and troubleshoot according to the priority order given below.

Symptom	Suspected Area	See Page
Engine does not crank (Does not start)	1. Starter	-
	2. Starter relay	-
	3. Park/Neutral position switch	-
No initial combustion (Does not start)	1. ECM power source circuit	ES-169
	2. Fuel pump control circuit	ES-173
	3. ECM	-
No complete combustion (Does not start)	Fuel pump control circuit	ES-173
Engine cranks normally but difficult to start	1. Starter signal circuit	ES-178
	2. Fuel pump control circuit	ES-173
	3. Compression	-
Difficult to start with cold engine	1. Starter signal circuit	ES-178
	2. Fuel pump control circuit	ES-173
Difficult to start with hot engine	1. Starter signal circuit	ES-178
	2. Fuel pump control circuit	ES-173
High engine idle speed (Poor idling)	1. A/C signal circuit (Compressor circuit)	-
	2. ECM power source circuit	ES-169
Low engine idle speed (Poor idling)	1. A/C signal circuit (Compressor circuit)	-
	2. ECM power source circuit	ES-169
Rough idling (Poor idling)	1. Compression	-
	2. Fuel pump control circuit	ES-173
Hunting (Poor idling)	1. ECM power souce circuit	ES-169
	2. Fuel pump control circuit	ES-173
Hesitation / Poor acceleration (Poor driveability)	1. Fuel pump control circuit	ES-173
	2. A/T faulty	-
Surging (Poor driveability)	Fuel pump control circuit	ES-173
Engine stalls soon after starting	Fuel pump control circuit	ES-173
Engine stalls during A/C operation	1. A/C signal circuit (Compressor circuit)	-
	2. ECM	-

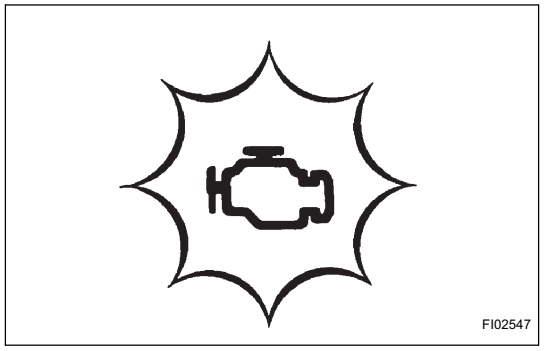
TERMINALS OF ECM



HINT:
Each ECM terminal's standard voltage is shown in the table below. In the table, first follow the information under "Condition". Next look under "Symbols (Terminal No.)" for the terminals to be inspected. The standard voltage between the terminals is shown under "STD voltage (V)". Use the illustration above as a reference for the ECM terminals.

Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	STD Voltage (V)
BATT (E17-1) - E1 (E16-17)	B-Y - W-B	Battery (for measuring the battery voltage and for the ECM memory)	Always	9 to 14
IGSW (E17-2) - E1 (E16-17)	B-R - W-B	Ignition switch	IG switch ON	9 to 14
+B (E17-16) - E1 (E16-17)	B-R - W-B	Power source of ECM	IG switch ON	9 to 14
MREL (E17-8) - E1 (E16-17)	L-B - W-B	EFI relay	IG switch ON	9 to 14
VC (E16-2) - E2 (E16-18)	Y - BR	Power source of sensor (a specific voltage)	IG switch ON	4.5 to 5.5
VG (E16-10) - E2G (E16-19)	P - L-W	Mass air flow sensor	Idling, shift lever position P or N position, A/C switch OFF	0.5 to 3.0
THA (E16-22) - E2 (E16-18)	L-B - BR	Intake air temperature sensor	Idling, Intake air temp. 20°C (68°F)	0.5 to 3.4
THW (E16-14) - E2 (E16-18)	G-B - BR	Engine coolant temperature sensor	Idling, engine coolant temp. 80°C (176°F)	0.2 to 1.0
THG (E16-13) - E2 (E16-18)	G-Y - BR	EGR gas temperature sensor	IG switch ON	4.5 to 5.5
VTA1 (E16-23) - E2 (E16-18)	L-W - BR	Throttle position sensor (for the engine control)	IG switch ON, accelerator pedal released	0.5 to 1.2
VTA1 (E16-23) - E2 (E16-18)	L-W - BR	Throttle position sensor (for the engine control)	IG switch ON, accelerator pedal depressed	3.2 to 4.8
HAFR (E16-3) - E04 (E16-1) HAFL (E16-4) - E05 (E16-8)	L - W-B Y - W-B	A/F sensor heater	Idling	Below 3.0
HAFR (E16-3) - E04 (E16-1) HAFL (E16-4) - E05 (E16-8)	L - W-B Y - W-B	A/F sensor heater	IG switch ON	9 to 14
AFR+ (E16-11) - E1 (E16-17)	O - W-B	A/F sensor	IG switch ON	3.0 to 3.6
AFL+ (E16-12) - E1 (E16-17)	B - W-B	A/F sensor	IG switch ON	3.0 to 3.6
AFR- (E16-20) - E1 (E16-17)	W - W-B	A/F sensor	IG switch ON	2.7 to 3.3
AFL- (E16-21) - E1 (E16-17)	W - W-B	A/F sensor	IG switch ON	2.7 to 3.3
HTS (E18-9) - E2 (E16-18)	W - BR	Heated oxygen sensor heater	Idling	Below 3.0
HTS (E18-9) - E2 (E16-18)	W - BR	Heated oxygen sensor heater	IG switch ON	9 to 14
OXS (E18-8) - E2 (E16-18)	B - BR	Heated oxygen sensor	Maintain engine speed at 2,500 rpm for 2 minutes after warming up	Pulse generation
#10 (E16-5) - E01 (E15-21) #20 (E16-6) - E01 (E15-21) #30 (E15-1) - E01 (E15-21) #40 (E15-2) - E01 (E15-21) #50 (E15-3) - E01 (E15-21) #60 (E15-4) - E01 (E15-21)	L - W-B R - W-B Y - W-B W - W-B R-L - W-B G - W-B	Injector	IG switch ON	9 to 14
#10 (E16-5) - E01 (E15-21) #20 (E16-6) - E01 (E15-21) #30 (E15-1) - E01 (E15-21) #40 (E15-2) - E01 (E15-21) #50 (E15-3) - E01 (E15-21) #60 (E15-4) - E01 (E15-21)	L - W-B R - W-B Y - W-B W - W-B R-L - W-B G - W-B	Injector	Idling	Pulse generation (See page ES-80)
KNKR (E15-27) - E1 (E16-17)	B - W-B	Knock sensor	Maintain engine speed at 4,000 rpm after warming up	Pulse generation (See page ES-95)
KNKL (E15-28) - E1 (E16-17)	W - W-B	Knock sensor	Maintain engine speed at 4,000 rpm after warming up	Pulse generation (See page ES-95)

Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	STD Voltage (V)
G22+ (E15-10) - NE- (E16-24)	B-W - G	Camshaft position sensor	Idling	Pulse generation (See page ES-102)
NE+ (E16-16) - NE- (E16-24)	R - G	Crankshaft position sensor	Idling	Pulse generation (See page ES-99)
IGT1 (E15-11) - E1 (E16-17) IGT2 (E15-12) - E1 (E16-17) IGT3 (E15-13) - E1 (E16-17)	GR - W-B BR-Y - W-B LG-B - W-B	Ignition coil with igniter (ignition signal)	Idling	Pulse generation (See page ES-149)
IGF (E15-25) - E1 (E16-17)	W-R - W-B	Ignition coil igniter (ignition confirmation signal)	IG switch ON	4.5 to 5.5
IGF (E15-25) - E1 (E16-17)	W-R - W-B	Ignition coil igniter (ignition confirmation signal)	Idling	Pulse generation (See page ES-149)
EVP1 (E16-7) - E1 (E16-17)	LG - W-B	VSV for EVAP	IG switch ON	9 to 14
ACIS (E15-17) - E1 (E16-17)	R-Y - W-B	VSV for ACIS	IG switch ON	9 to 14
SPD (E18-22) - E1 (E16-17)	V-W - W-B	Speed signal from combination meter	IG switch ON, rotate driving wheel slowly	Pulse generation (See page ES-125)
STA (E17-7) - E1 (E16-17)	B-W - W-B	Starter signal	Cranking	6 or higher
STP (E17-15) - E1 (E16-17)	G-W - W-B	Stop light switch	Brake pedal is depressed	7.5 to 14
STP (E17-15) - E1 (E16-17)	G-W - W-B	Stop light switch	Brake pedal is released	Below 1.5
NSW (E18-20) - E1 (E16-17)	B-O - W-B	Park/neutral position switch	IG switch ON, shift position in P, N	0 to 3.0
NSW (E18-20) - E1 (E16-17)	B-O - W-B	Park/neutral position switch	IG switch ON, other shift position in P, N	9 to 14
FC (E17-3) - E1 (E16-17)	G-R - W-B	Fuel pump control	IG switch ON	9 to 14
FC (E17-3) - E1 (E16-17)	G-R - W-B	Fuel pump control	Idling	0 to 3
W (E17-6) - E1 (E16-17)	G-R - W-B	MIL	IG switch ON	Below 3.0
W (E17-6) - E1 (E16-17)	G-R - W-B	MIL	Idling	9 to 14
ELS (E17-19) - E1 (E16-17)	G - W-B	Tail light switch	Tail light switch ON	7.5 to 14
ELS (E17-19) - E1 (E16-17)	G - W-B	Tail light switch	Tail light switch OFF	0 to 1.5
ELS2 (E17-18) - E1 (E16-17)	B-Y - W-B	Electric load	Power outlet OFF	0 to 1.5
ELS2 (E17-18) - E1 (E16-17)	B-Y - W-B	Electric load	Power outlet ON	7.5 to 14
TC (E15-6) - E1 (E16-17)	P-B - W-B	Terminal TC of DLC3	IG switch ON	9 to 14
SIL (E16-11) - E1 (E16-17)	W - W-B	Terminal SIL of DLC3	During gear change	Pulse generation
TACH (E18-27) - E1 (E16-17)	B-O - W-B	Engine speed	Idling	Pulse generation
RSO (E15-16) - E01 (E15-21)	R-W - W-B	Idle speed control valve	IG switch ON, disconnect E15 ECM connector	9 to 14
RSC E15-15) - E01 (E15-21)	Y-B - W-B	Idle speed control valve	IG switch ON, disconnect E15 ECM connector	9 to 14
EGR (E15-18) - E1 (E16-17)	Y-G - W-B	VSV for ACM	IG switch ON	9 to 14
EGLS (E15-22) - E1 (E16-17)	W-G - W-B	EGR valve position sensor	IG switch ON, apply vacuum 0 kPa (0 mmHg)	0.4 - 1.6
EGLS (E15-22) - E1 (E16-17)	W-G - W-B	EGR valve position sensor	IG switch ON, apply vacuum 17.3 kPa (130 mmHg)	3.2 to 5.1
PS (E16-9) - E1 (E16-17)	R-B - W-B	P/S pressure switch	IG switch ON	9 to 14
ACT (E18-13) - E1 (E16-17)	L - W-B	A/C compressor operation signal	A/C switch OFF	9 to 14
ACT (E18-13) - E1 (E16-17)	L - W-B	A/C compressor operation signal	A/C switch ON at idling	Below 2.0
A/C (E18-25) - E1 (E16-17)	L-R - W-B	A/C compressor operation signal	A/C switch OFF	9 to 14
A/C (E18-25) - E1 (E16-17)	L-R - W-B	A/C compressor operation signal	A/C switch ON at idling	Below 2.0

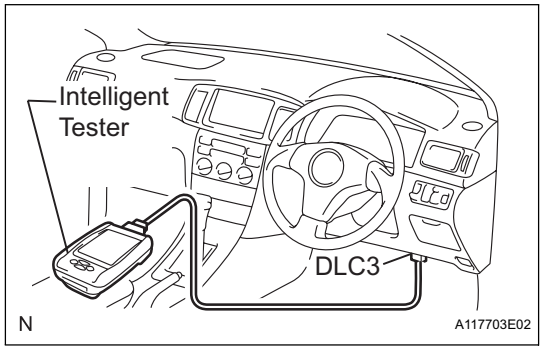


DIAGNOSIS SYSTEM

1. DESCRIPTION

(a) When troubleshooting Euro-OBD vehicles, the only difference from the usual troubleshooting procedure is that you connect an OBD scan tool (complying with ISO 15031-4) or the intelligent tester to the vehicle, and read the various data output from the vehicle's ECM.

(b) Euro-OBD regulations require that the vehicle's on-board computer illuminates the MIL (Malfunction Indicator Lamp) on the instrument panel when the computer detects a malfunction in: 1) the emission control systems and components, or 2) the powertrain control components (which affect vehicle emissions), or 3) the computer. In addition, the applicable DTCs (Diagnostic Trouble Codes) prescribed by ISO 15031-4 are recorded in the ECM memory (See page ES-23).
If the malfunction does not recur in 3 consecutive trips, the MIL turns off automatically but the DTCs remain recorded in the ECM memory.

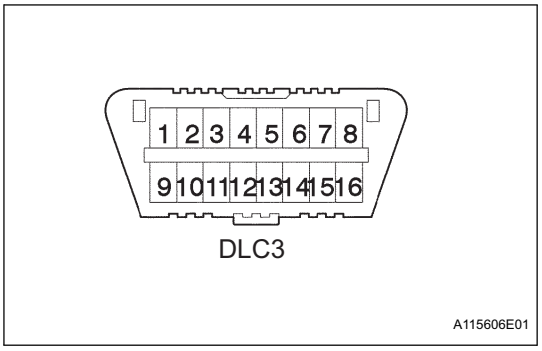


(c) To check the DTCs, connect the OBD scan tool or intelligent tester to the DLC3 (Data Link Connector 3) on the vehicle. The OBD scan tool or intelligent tester also enables you to erase the DTCs and check the freeze frame data and various forms of engine data. (See the instruction manual for the intelligent tester).

(d) The diagnosis system operates in normal mode during normal vehicle use. In normal mode, 2 trip detection logic* is used to ensure accurate detection of malfunctions. Check mode is also available to technicians as an option. In check mode, 1 trip detection logic is used for simulating malfunction symptoms and increasing the system's ability to detect malfunctions, including intermittent problems (intelligent tester only) (See page ES-18).

(e) *2 trip detection logic:
When a malfunction is first detected, the malfunction is temporarily stored in the ECM memory (1st trip). If the ignition switch is turned off and then on again, and the same malfunction is detected again, the MIL will illuminate (2nd trip).

(f) Freeze frame data:
The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.



2. CHECK DLC3

(a) The vehicle's ECM uses the ISO 9141-2 (Euro-OBD) communication protocol. The terminal arrangement of the DLC3 complies with ISO 15031-03 and matches the ISO 9141-2 format.

Symbol	Terminal No.	Name	Reference Terminal	Result	Condition
SIL	7	Bus "+" line	5 - Signal ground	Pulse generation	During transmission
CG	4	Chassis ground	Body ground	1 Ω or less	Always
SG	5	Signal ground	Body ground	1 Ω or less	Always
BAT	16	Battery positive	Body ground	9 to 14 V	Always

HINT:
When you use the intelligent tester, first connect the cable of the tester to the DLC3. Next, turn the ignition switch to the ON position. Finally turn the tester ON. If the display informs that a communication error has occurred, there is a problem either with the vehicle or with the tester.

- If communication is normal when the tester is connected to another vehicle, inspect the DLC3 on the original vehicle.
- If communication is still not possible when the tester is connected to another vehicle, the problem is probably in the tester or the cable, so consult the Service Department listed in its instruction manual.

3. INSPECT BATTERY VOLTAGE

(a) Measure the battery voltage.
Standard voltage:
11 to 14 V
If the voltage is below 11 V, recharge the battery.

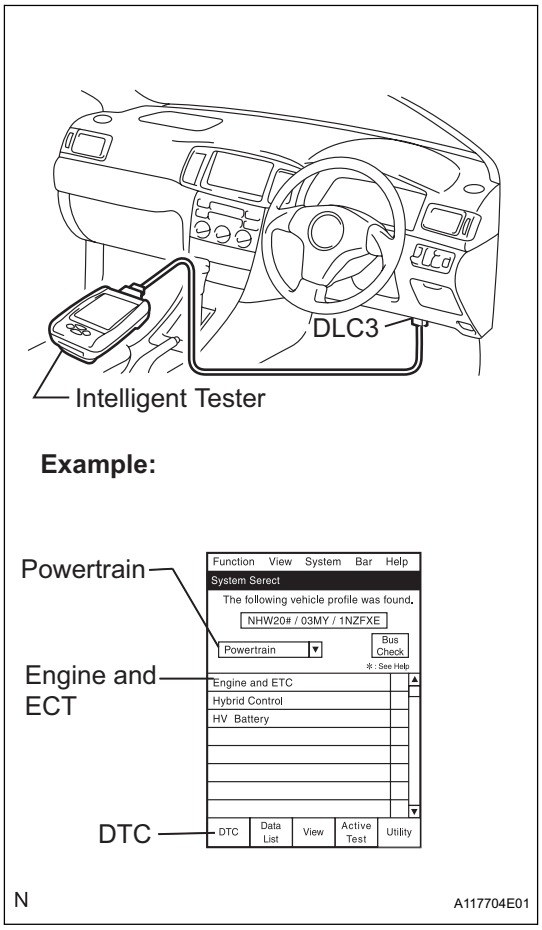
4. CHECK MIL

(a) The MIL illuminates when the ignition switch is turned to the ON position and the engine is not running.
HINT:
If the MIL is not illuminated, check the MIL circuit (See page **ES-181**).

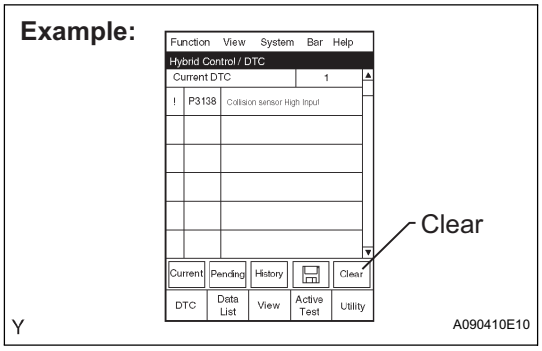
(b) When the engine is started, the MIL should turn off. If the MIL remains on, the diagnosis system has detected a malfunction or abnormality in the system.

DTC CHECK / CLEAR

NOTICE:
Intelligent tester only:
When the diagnosis system is changed from normal mode to check mode or vice-versa, all DTCs and freeze frame data recorded in normal mode will be erased. Before changing modes, always check and make a note of DTCs and freeze frame data.



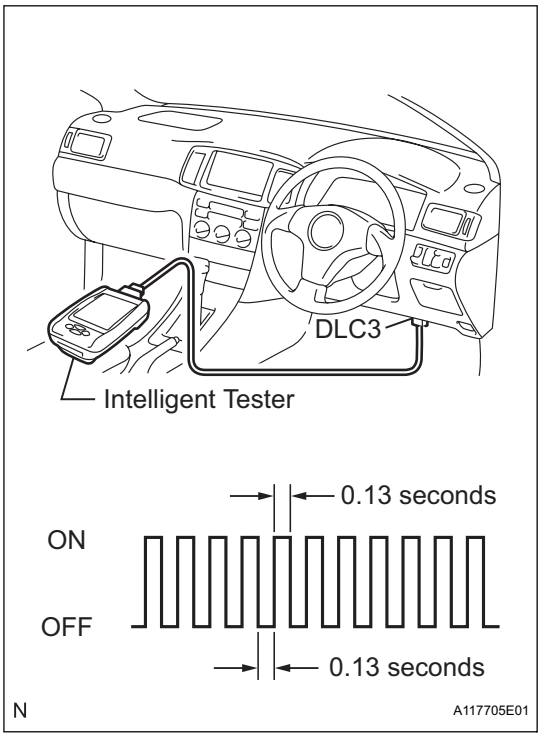
1. **CHECK DTC**
   (a) Connect the intelligent tester to the DLC3.
   (b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
   (c) Select the following menu items: Powertrain / Engine and ECT / DTC.
   (d) Check DTCs and freeze frame data, and then write them down.
   HINT:
   If you need help using the intelligent tester, refer to the instruction manual.
   (e) Confirm the details of the DTCs (See page ES-23).
2. **FREEZE FRAME DATA**
   (a) Connect the intelligent tester to the DLC3.
   (b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
   (c) Read DTCs by selecting the following menu items: Powertrain / Engine and ECT / DTC.
   (d) Select a parameter(s) to check the freeze frame data.
   (e) Note down the DTC(s) and freeze frame data.
   HINT:
   If you need help using the intelligent tester, refer to the instruction manual.



3. **CLEAR DTCS AND FREEZE FRAME DATA (using the intelligent tester)**
   (a) Connect the intelligent tester to the DLC3.
   (b) Turn the ignition switch to the ON position (do not start the engine) and turn the intelligent tester ON.
   (c) Select the following menu items: Powertrain / Engine and ECT / DTC / Clear.
   (d) Erase DTCs and freeze frame data by pressing the YES button on the tester.
   HINT:
   If you need help using the intelligent tester, refer to the instruction manual.
4. **CLEAR DTCS AND FREEZE FRAME DATA (not using the intelligent tester)**
   (a) Remove the EFI and ETCS fuses from the engine room R/B for more than 60 seconds, or disconnect the negative battery cable for more than 60 seconds.

CHECK MODE PROCEDURE

HINT:
Intelligent tester only:
Compared to normal mode, check mode has more sensing ability to detect malfunctions. Furthermore, the same diagnostic items which are detected in normal mode can also be detected in check mode.



1. CHECK MODE PROCEDURE

(a) Make sure that the items below are true.
  (1) Battery voltage 11 V or more.
  (2) Throttle valve fully closed.
  (3) Transmission in the P or N position.
  (4) A/C switched OFF.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(e) Select the following menu items: Powertrain / Engine and ECT / Utility / Check Mode.
(f) Make sure that the MIL flashes as shown in the illustration.
  NOTICE:
  All the recorded DTCs and freeze frame data will be erased if: 1) the intelligent tester is used to change the ECM from normal mode to check mode or vice-versa; or 2) during check mode, the ignition switch is turned from ON to ACC or OFF.
(g) Start the engine (the MIL should turn off).
(h) Simulate the condition of the malfunction described by the customer.
(i) After simulating the malfunction condition, check the DTCs, freeze frame data and other data.
(j) After checking the DTCs, inspect the applicable circuits (See page ES-23).

FAIL-SAFE CHART

If any of the following DTCs are set, the ECM enters fail-safe mode to allow the vehicle to be driven temporarily.

DTC	Component	Fail-Safe Operation	Fail Safe Deactivation Condition
P0100	Mass Air Flow (MAF) Meter	Ignition timing fixed at 10° BTDC	Returned to normal condition
P0110	Intake Air Temperature (IAT) Sensor	Intake air temperature is fixed at 20°C	Returned to normal condition
P0115	Engine Coolant Temperature (ECT) Sensor	VTA is fixed at 0°	Following condition must be repeated at least 2 times consecutively (a) Vehicle speed: 0 km/h VTA 0.1 to 0.95 V
P0141 P1135 P1155	Air Fuel Ratio Sensor Heated Oxygen Sensor	The heater circuit in which an abnormality is detected is turned OFF	Ignition switch OFF
P0325 P0330	Knock sensor	Max. timing retardation	Ignition switch OFF

DTC	Component	Fail-Safe Operation	Fail Safe Deactivation Condition
P1300	Igniter	Fuel cut	IGF signal is detected for 6 consecutive ignition

DATA LIST / ACTIVE TEST

1. READ DATA LIST

HINT:

Using the intelligent tester's Data List allows switch, sensor, actuator, and other item values to be read without removing any parts. Reading the Data List early in troubleshooting is one way to save 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) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch ON.
(e) Turn the tester ON.
(f) Enter the following menus: Powertrain / Engine and ECT / Data List.
(g) Read the Data List on the tester's screen.

Intelligent Tester Display	Measurement Item: Display (Range)	Normal Condition *1	Diagnostic Note
Injector	Injection period of No. 1 cylinder: Min.: 0 ms, Max.: 32.6 ms	1.6 to 2.9 ms: Idling	-
IGN Advance	Ignition timing advance for No. 1 cylinder: Min.: -64°, Max.: 63.5°	BTDC 10 to 25°: Idling (A/C OFF, shift position N)	-
IAC Duty Ratio	Intake air control valve duty ratio: Min.: 0 %, Max.: 99.6 %	27 to 47 %: Idling	-
CALC Load	Calculated load by ECM: Min.: 0%, Max.: 100%	13.1 to 18.7%: idle (A/C OFF and shift position N) 11.7 to 17.3%: 2,500 rpm (A/C OFF and shift position N)	-
AFM	Air flow rate from MAF meter: Min.: 0 g/s, Max.: 665.35 g/s	3.3 to 4.7 g/s: idling 10.4 to 15.4 g/s: 2,500 rpm	If value approximately 0.0 g/s: • Mass air flow meter power source circuit open • VG circuit open or short if value 160.0 g/s or more: • E2G circuit open
Engine SPD	Engine speed: Min.: 0 rpm, Max.: 16,383.75 rpm	650 to 750 rpm: Idle after engine warmed up	-
Coolant Temp	Engine coolant temperature: Min.: -40°C, Max.: 215°C	80 to 95°C (167 to 203°F): engine warmed up	• -40°C (-40°F): ECT sensor circuit open • 140°C (284°F) or more: ECT sensor circuit shorted
Intake Air	Intake air temperature: Min.: -40°C, Max.: 214°C	Equivalent to ambient air temperature	• If value -40°C (-40°F): sensor circuit open • If value 140°C (284°F): sensor circuit shorted
Throttle POS	Output voltage of throttle position sensor calculated as a percentage 0 V → 0%, 5 V → 100%	7 to 11%: throttle fully closed 65 to 75%: throttle fully open	-

Intelligent Tester Display	Measurement Item: Display (Range)	Normal Condition *1	Diagnostic Note
IDL ISG	Whether or not throttle position sensor detecting idle: ON or OFF	ON: Idling	-
Vehicle SPD	Vehicle speed: Min.: 0 km/h, Max.: 255 km/h	Actual vehicle load	Same as speedometer indication
O2S B1 S2	Heated oxygen sensor output voltage for bank 1 sensor 2: Min.: 0 V, Max.: 1.275 V	0.1 to 0.9 V: Driving 50 km/h	Performing Control the Injection Volume or Control the Injection Volume for A/F sensor function of Active Test enables technician to check output voltage of sensor
AFS B1 S1	A/F sensor output voltage for bank 1 sensor 1: Min.: 0 V, Max.: 7.999 V	2.8 to 3.8 V: Idling	Performing Control the Injection Volume or Control the Injection Volume for A/F sensor function of Active Test enables technician to check output voltage of sensor
AFS B2 S1	A/F sensor output voltage for bank 2 sensor 1: Min.: 0 V, Max.: 7.999 V	2.8 to 3.8 V: Idling	Performing Control the Injection Volume or Control the Injection Volume for A/F sensor function of Active Test enables technician to check output voltage of sensor
EGR Gas	EGR gas temperature: Min.: 0°C, Max.: 159.4°C	Not immediately after driving 5 to 150°C (41 to 302°F)	-
Short FT #1	Short-term fuel trim of bank 1: Min.: -100%, Max.: 99.22%	0 +- 20%	Short-term fuel compensation used to maintain air-fuel ratio at stoichiometric air-fuel ratio
Long FT #1	Long-term fuel trim of bank 1: Min.: -100%, Max.: 99.22%	0 +- 20%	Overall fuel compensation carried out in long-term to compensate continual deviation of short-term fuel trim from central value
Total FT #1	Total fuel trim (bank 1): Min.: 0.5, Max.: 1.496	0.8 to 1.2 at idle	Below 1.0: Fuel trim is lean 1.0 or more: Fuel trim is rich
Short FT #2	Short-term fuel trim of bank 2: Min.: -100%, Max.: 99.22%	0 +- 20%	Short-term fuel compensation used to maintain air-fuel ratio at stoichiometric air-fuel ratio
Long FT #2	Long-term fuel trim of bank 1: Min.: -100%, Max.: 99.22%	0 +- 20%	Overall fuel compensation carried out in long-term to compensate continual deviation of short-term fuel trim from central value
Total FT #2	Total fuel trim (bank 2): Min.: 0.5, Max.: 1.496	0.8 to 1.2 at idle	Below 1.0: Fuel trim is lean 1.0 or more: Fuel trim is rich
O2FT B1 S2	Short-term fuel trim associated with bank 1 sensor 2: Min.: -100%, Max.: 99.2%	-	Same as Short FT #1
AF FT B1 S1	Short-term fuel trim associated with bank 1 sensor 1: Min.: 0, Max.: 1.999	• Value less than 1 (0.000 to 0.999) = Lean • Stoichiometric air-fuel ratio = 1 • Value greater than 1 (1.001 to 1.999) = Rich	-
AF FT B2 S1	Short-term fuel trim associated with bank 2 sensor 1: Min.: 0, Max.: 1.999	• Value less than 1 (0.000 to 0.999) = Lean • Stoichiometric air-fuel ratio = 1 • Value greater than 1 (1.001 to 1.999) = Rich	-

Intelligent Tester Display	Measurement Item: Display (Range)	Normal Condition *1	Diagnostic Note
Fuel SYS #1	Fuel system status (Bank 1): OL, CL, OL DRIVE, OL FAULT, CL FAULT	CL: Idling after engine warmed up	• OL (Open Loop): Has not yet satisfied conditions to go closed loop • CL (Closed Loop): Using heated oxygen sensor as feedback for fuel control • OL DRIVE: Open loop due to driving conditions (fuel enrichment) • OL FAULT: Open loop due to detected system fault • CL FAULT: Closed loop but heated oxygen sensor, which is used for fuel control, is malfunctioning
Fuel SYS #2	Fuel system status (Bank 2): OL, CL, OL DRIVE, OL FAULT, CL FAULT	CL: Idling after engine warmed up	• OL (Open Loop): Has not yet satisfied conditions to go closed loop • CL (Closed Loop): Using heated oxygen sensor as feedback for fuel control • OL DRIVE: Open loop due to driving conditions (fuel enrichment) • OL FAULT: Open loop due to detected system fault • CL FAULT: Closed loop but heated oxygen sensor, which is used for fuel control, is malfunctioning
FC IDL	Fuel cut idle: Fuel cut when throttle valve fully closed, during deceleration ON or OFF	Fuel cut operating: ON	-
MIL Status	MIL status: ON or OFF	MIL ON: ON	-
Starter SIG	Starter signal: ON or OFF	ON: Cranking	-
A/C Signal	A/C signal: ON or OFF	ON: A/C ON	-
PNP SW	PNP switch: ON or OFF	ON: Shift position is P or N	For automatic transmission
Electrical Load SIG	Electrical load signal: ON or OFF	ON: Headlights or defogger turned ON	-
Stop Light SW	Stop light switch: ON or OFF	ON: Brake pedal depressed	-
PS Oil Press SW	Power steering oil pressure switch signal: ON or OFF	While turning the steering wheel: ON While not turning the steering wheel: OFF	Idle-up control is performed when PS is ON
PS Signal	Power steering signal: ON or OFF	When steering wheel is turned	This signal is usually ON until the ignition switch is turned OFF
A/C Cut SIG	A/C cut signal: ON or OFF	A/C switch OFF: ON	-
EGR System	EGR system operating condition: ON or OFF	Idling: OFF	-
Intake CTL VSV1	VSV status for intake control: ON or OFF	VSV operation: ON	-
EVAP Purge VSV	VSV status for EVAP control: ON or OFF	-	Active Test support data
Fuel Pump	Fuel pump status: ON or OFF	-	Active Test support data
Ignition	Ignition counter: Min.: 0, Max.: 800	0 to 800	-
Cylinder #1 Misfire Rate	Misfire ratio of cylinder #1: Min.: 0, Max.: 255	0	-

Intelligent Tester Display	Measurement Item: Display (Range)	Normal Condition *1	Diagnostic Note
Cylinder #2 Misfire Rate	Misfire ratio of cylinder #2: Min.: 0, Max.: 255	0	-
Cylinder #3 Misfire Rate	Misfire ratio of cylinder #3: Min.: 0, Max.: 255	0	-
Cylinder #4 Misfire Rate	Misfire ratio of cylinder #4: Min.: 0, Max.: 255	0	-
Cylinder #5 Misfire Rate	Misfire ratio of cylinder #5: Min.: 0, Max.: 255	0	-
Cylinder #6 Misfire Rate	Misfire ratio of cylinder #6: Min.: 0, Max.: 255	0	-
MISFIRE	Average engine RPM when misfire detected: Min.: 0 rpm, Max.: 6,375 rpm	-	-
MISFIRE LOAD	Average engine load when misfire detected: Min.: 0 g/rev, Max.: 3.98 g/rev	-	-
FC TAU	Fuel cut TAU: Fuel cut during very light load: ON or OFF	ON: Fuel cut operating	Fuel cut being performed under very light load to prevent engine combustion from becoming incomplete
#Codes	#Codes: Min.: 0, Max.: 255	-	Number of detected DTCs
Check Mode	Check mode: 0: OFF, 1: ON	ON: Check mode ON	See page ES-18
OXS1 Test	Check mode result for heated oxygen sensor (bank 1): 0: COMPL, 1: INCMPL	-	-
AF2 Test	Check mode result for air-fuel ratio sensor (bank 2): 0: COMPL, 1: INCMPL	-	-
AF1 Test)	Check mode result for air-fuel ratio sensor (bank 1): 0: COMPL, 1: INCMPL	-	-
Distance after MIL ON	MIL ON run distance: Min.: 0 km, Max.: 65,535 km	Distance after DTC detected	-

HINT:
*1: If no conditions are specifically stated for "Idling", it means the shift lever is on N or P, the A/C switch is OFF and all accessory switches are OFF.

2. PERFORM ACTIVE TEST

HINT:
Performing the intelligent tester's Active Test allows relay, VSV, actuator and other items to be operated without removing any parts. Performing the Active Test early in troubleshooting is one way to save time.
The Data List can be displayed during the Active Test.

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch ON.
(e) Turn the tester ON.
(f) Enter the following menus: Powertrain / Engine and ECT / Active Test.
(g) According to the display on the tester, perform the Active Test.

Intelligent Tester Display	Test Details	Control Range	Diagnostic Note
Control the Injection Volume	Change injection volume	-12.5% to 24.8%	• All injectors tested at same time • Perform test at 3,000 rpm or less • Injection volume can be changed in 1% graduations within control range
Control the air fuel ratio	Change injection volume	Lower by -12.5% or increases by 25%	• Perform test at 3,000 rpm or less • Control the injection volume for A/F sensor enables checking and graphing of air fuel ratio (A/F) sensor and heated oxygen sensor voltage outputs
Control the IAC duty ratio	Change IAC duty ratio	11 to 90%	Confirm that the Vehicle is Stopped, Engine Idling and Battery Voltage is 8.5V or more.
Control the A/C cut signal	Control the A/C cut signal	ON/OFF	-
Control the EGR system	Control the EGR system	ON/OFF	-
Activate the intake control VSV1	VSV for ACIS	ON/OFF	-
Control the fuel pump speed	Fuel pump speed control	ON (low speed)/OFF (high speed)	Confirm that the Engine is Stopped
Activate the purge VSV	Purge VSV	ON/OFF	-
Control the fuel cut prohibit condition	Prohibit idling fuel cut control	ON/OFF	-
Connect the TC and TE1	Turn on and off TC and TE1 connection	ON/OFF	ON: TC and TE1 connected OFF: TC and TE1 disconnected

DIAGNOSTIC TROUBLE CODE CHART

HINT:
Parameters listed in the chart may not be exactly the same as your readings due to factors such as the type of the instrument.
If a DTC is displayed during the DTC check in check mode, check the circuit for the DTC listed in the table below. For details of each DTC, refer to the "See page" column for the respective "DTC No." in this chart.
*: MIL flashes when a catalyst damaged misfire is detected.

DTC No.	Detection Item	Trouble Area	MIL	Memory	See Page
P0100	Mass or Volume Air Flow Circuit	1. Open or short in mass air flow meter circuit 2. Mass air flow meter 3. ECM	Comes on	DTC stored	ES-33
P0101	Mass Air Flow Circuit Range / Performance Problem	1. Mass air flow meter	Comes on	DTC stored	ES-39
P0110	Intake Air Temperature Circuit Malfunction	1. Open or short in intake air temperature sensor circuit 2. Intake air temperature sensor (built into mass air flow meter) 3. ECM	Comes on	DTC stored	ES-40

DTC No.	Detection Item	Trouble Area	MIL	Memory	See Page
P0115	Engine Coolant Temperature Circuit Malfunction	1. Open or short in engine coolant temperature sensor circuit 2. Engine coolant temperature sensor 3. ECM	Comes on	DTC stored	ES-44
P0116	Engine Coolant Temperature Circuit Range / Performance Problem	1. Engine coolant temperature sensor 2. Cooling system 3. Thermostat	Comes on	DTC stored	ES-48
P0120	Throttle / Pedal Position Sensor / Switch "A" Circuit	1. Open or short in throttle position sensor circuit 2. Throttle body (throttle position sensor) 3. ECM	Comes on	DTC stored	ES-50
P0121	Throttle / Pedal Position Sensor / Switch "A" Circuit Range / Performance Problem	1. Throttle body (throttle position sensor)	Comes on	DTC stored	ES-54
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	1. Open or short in A/F sensor circuit 2. A/F sensor 3. Air induction system 4. Fuel pressure 5. Injector 6. EGR system 7. Gas leakage from exhaust system 8. ECM	Comes on	DTC stored	ES-55
P0136	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)	1. Open or short in heated oxygen sensor circuit 2. Heated oxygen sensor	Comes on	DTC stored	ES-65
P0141	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)	1. Open or short in heated oxygen sensor circuit 2. Heated oxygen sensor 3. ECM	Comes on	DTC stored	ES-68
P0171	System Too Lean (Bank 1)	1. Air induction system 2. Injector blockage 3. Mass air flow (MAF) meter 4. Engine coolant temperature (ECT) sensor 5. Fuel pressure 6. Gas leakage from exhaust system 7. Open or short in A/F sensor circuit 8. A/F sensor 9. A/F sensor relay 10. PCV valve and hose 11. PCV hose connections 12. ECM	Comes on	DTC stored	ES-71

DTC No.	Detection Item	Trouble Area	MIL	Memory	See Page
P0172	System Too Rich (Bank 1)	1. Injector leakage or blockage 2. Mass air flow (MAF) meter 3. Engine coolant temperature (ECT) sensor 4. Ignition system 5. Fuel pressure 6. Gas leakage from exhaust system 7. Open or short in A/F sensor circuit 8. A/F sensor 9. A/F sensor relay 10. ECM	Comes on	DTC stored	ES-71
P0174	System Too Lean (Bank 2)	1. Air induction system 2. Injector blockage 3. Mass air flow (MAF) meter 4. Engine coolant temperature (ECT) sensor 5. Fuel pressure 6. EGR system 7. Open or short in A/F sensor circuit 8. A/F sensor 9. A/F sensor relay 10. PCV valve and hose 11. PCV hose connections 12. ECM	Comes on	DTC stored	ES-71
P0175	System Too Rich (Bank 2)	1. Injector leakage or blockage 2. Mass air flow (MAF) meter 3. Engine coolant temperature (ECT) sensor 4. Ignition system 5. Fuel pressure 6. Gas leakage from exhaust system 7. Open or short in A/F sensor circuit 8. A/F sensor 9. A/F sensor relay 10. ECM	Comes on	DTC stored	ES-71

DTC No.	Detection Item	Trouble Area	MIL	Memory	See Page
P0300	Random / Multiple Cylinder Misfire Detected	1. Open or short in engine wire harness 2. Connector connection 3. Vacuum hose connections 4. Ignition system 5. Injector 6. Fuel pressure 7. EGR system 8. Mass air flow (MAF) meter 9. Engine coolant temperature (ECT) sensor 10. Compression pressure 11. Valve clearance 12. Valve timing 13. PCV valve and hose 14. PCV hose connections 15. Air induction system 16. ECM	Comes on*	DTC stored	ES-80
P0301	Cylinder 1 Misfire Detected	1. Open or short in engine wire harness 2. Connector connection 3. Vacuum hose connections 4. Ignition system 5. Injector 6. Fuel pressure 7. EGR system 8. Mass air flow (MAF) meter 9. Engine coolant temperature (ECT) sensor 10. Compression pressure 11. Valve clearance 12. Valve timing 13. PCV valve and hose 14. PCV hose connections 15. Air induction system 16. ECM	Comes on*	DTC stored	ES-80

DTC No.	Detection Item	Trouble Area	MIL	Memory	See Page
P0302	Cylinder 2 Misfire Detected	1. Open or short in engine wire harness 2. Connector connection 3. Vacuum hose connections 4. Ignition system 5. Injector 6. Fuel pressure 7. EGR system 8. Mass air flow (MAF) meter 9. Engine coolant temperature (ECT) sensor 10. Compression pressure 11. Valve clearance 12. Valve timing 13. PCV valve and hose 14. PCV hose connections 15. Air induction system 16. ECM	Comes on*	DTC stored	ES-80
P0303	Cylinder 3 Misfire Detected	1. Open or short in engine wire harness 2. Connector connection 3. Vacuum hose connections 4. Ignition system 5. Injector 6. Fuel pressure 7. EGR system 8. Mass air flow (MAF) meter 9. Engine coolant temperature (ECT) sensor 10. Compression pressure 11. Valve clearance 12. Valve timing 13. PCV valve and hose 14. PCV hose connections 15. Air induction system 16. ECM	Comes on*	DTC stored	ES-80

DTC No.	Detection Item	Trouble Area	MIL	Memory	See Page
P0304	Cylinder 4 Misfire Detected	1. Open or short in engine wire harness 2. Connector connection 3. Vacuum hose connections 4. Ignition system 5. Injector 6. Fuel pressure 7. EGR system 8. Mass air flow (MAF) meter 9. Engine coolant temperature (ECT) sensor 10. Compression pressure 11. Valve clearance 12. Valve timing 13. PCV valve and hose 14. PCV hose connections 15. Air induction system 16. ECM	Comes on*	DTC stored	ES-80
P0305	Cylinder 5 Misfire Detected	1. Open or short in engine wire harness 2. Connector connection 3. Vacuum hose connections 4. Ignition system 5. Injector 6. Fuel pressure 7. EGR system 8. Mass air flow (MAF) meter 9. Engine coolant temperature (ECT) sensor 10. Compression pressure 11. Valve clearance 12. Valve timing 13. PCV valve and hose 14. PCV hose connections 15. Air induction system 16. ECM	Comes on*	DTC stored	ES-80

DTC No.	Detection Item	Trouble Area	MIL	Memory	See Page
P0306	Cylinder 6 Misfire Detected	1. Open or short in engine wire harness 2. Connector connection 3. Vacuum hose connections 4. Ignition system 5. Injector 6. Fuel pressure 7. EGR system 8. Mass air flow (MAF) meter 9. Engine coolant temperature (ECT) sensor 10. Compression pressure 11. Valve clearance 12. Valve timing 13. PCV valve and hose 14. PCV hose connections 15. Air induction system 16. ECM	Comes on*	DTC stored	ES-80
P0325	Knock Sensor 1 Circuit	1. Open or short in No. 1 knock sensor circuit 2. No. 1 knock sensor 3. ECM	Comes on	DTC stored	ES-95
P0330	Knock Sensor 2 Circuit	1. Open or short in No. 2 knock sensor circuit 2. No. 2 knock sensor 3. ECM	Comes on	DTC stored	ES-95
P0335	Crankshaft Position Sensor "A" Circuit	1. Open or short in crankshaft position sensor circuit 2. Crankshaft position sensor 3. Crankshaft timing pulley 4. ECM	Comes on	DTC stored	ES-99
P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)	1. Open or short in camshaft position sensor circuit 2. Crank position sensor 3. Camshaft timing gear 4. ECM	Comes on	DTC stored	ES-102

DTC No.	Detection Item	Trouble Area	MIL	Memory	See Page
P0401	Exhaust Gas Recirculation Flow Insufficient Detected	1. Open or short in EGR gas temperature sensor circuit 2. EGR gas temperature sensor 3. Vacuum hose disconnected or blocked 4. Open in VSV circuit for EGR 5. VSV for EGR 6. EGR system 7. EGR valve (stuck closed) 8. Vacuum control valve 9. ECM	Comes on	DTC stored	ES-105
P0402	Exhaust Gas Recirculation Flow Excessive Detected	1. Vacuum hose disconnected or blocked 2. Short in VSV circuit for EGR 3. VSV for EGR 4. EGR valve stuck open 5. Open or short in EGR valve position sensor circuit 6. EGR valve position sensor 7. ECM	Comes on	DTC stored	ES-113
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	1. Gas leakage from exhaust system 2. A/F sensor (bank 1 sensor 1) 3. HO2 sensor (bank 1 sensor 2) 4. Three-Way Catalytic Converter (TWC) (Exhaust manifold)	Comes on	DTC stored	ES-116
P0443	Evaporative Emission Control System Purge Control Valve Circuit	1. Open or short in EVAP VSV circuit 2. EVAP VSV 3. ECM	Comes on	DTC stored	ES-121
P0500	Vehicle Speed Sensor "A"	1. Combination meter 2. Open or short in vehicle speed sensor circuit 3. Vehicle speed sensor 4. ECM 5. Skid control ECU	Comes on	DTC stored	ES-125
P0505	Idle Control System Malfunction	1. Open or short in ISC valve circuit 2. ISC valve is stuck or closed 3. Open or short in A/C signal circuit 4. Air induction system 5. ECM	Comes on	DTC stored	ES-127

DTC No.	Detection Item	Trouble Area	MIL	Memory	See Page
P1130	A/F Sensor Circuit Range / Performance Malfunction (Bank 1 Sensor 1)	1. Open or short in A/F sensor circuit 2. A/F sensor (sensor 1) 3. Air induction system 4. EGR system 5. Fuel pressure 6. Injector 7. ECM	Comes on	DTC stored	ES-132
P1133	A/F Sensor Circuit Response Malfunction (Bank 1 Sensor 1)	1. Open or short in A/F sensor circuit 2. A/F sensor (sensor 1) 3. Air induction system 4. EGR system 5. Fuel pressure 6. Injector 7. ECM	Comes on	DTC stored	ES-139
P1135	A/F Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)	1. Open or short in A/F sensor circuit 2. A/F sensor (sensor 1) 3. ECM	-	DTC stored	ES-146
P1150	A/F Sensor Circuit Range / Performance Malfunction (Bank 2 Sensor 1)	1. Open or short in A/F sensor circuit 2. A/F sensor (sensor 1) 3. Air induction system 4. EGR system 5. Fuel pressure 6. Injector 7. ECM	Comes on	DTC stored	ES-132
P1153	A/F Sensor Circuit Response Malfunction (Bank 2 Sensor 1)	1. Open or short in A/F sensor circuit 2. A/F sensor (sensor 1) 3. Air induction system 4. EGR system 5. Fuel pressure 6. Injector 7. ECM	Comes on	DTC stored	ES-139
P1155	A/F Sensor Heater Circuit Malfunction (Bank 2 Sensor 1)	1. Open or short in A/F sensor circuit 2. A/F sensor (sensor 1) 3. ECM	Comes on	DTC stored	ES-146
P1300	Igniter Circuit Malfunction (No. 1)	1. Ignition system 2. Open or short in IGF or IGT circuit from igniter to ECM 3. Igniter 4. ECM	Comes on	DTC stored	ES-149
P1335	Crankshaft Position Sensor Circuit Malfunction (During Engine Running)	1. Open or short in crankshaft position sensor circuit 2. Crankshaft position sensor 3. Crankshaft timing pulley 4. ECM	Comes on	DTC stored	ES-155

DTC No.	Detection Item	Trouble Area	MIL	Memory	See Page
P1410	EGR Valve Position Sensor Circuit Malfunction	1. Open or short in EGR valve position sensor circuit 2. EGR valve position sensor 3. ECM	Comes on	DTC stored	ES-156
P1411	EGR Valve Position Sensor Circuit Range / Performance Problem	1. EGR valve position sensor	Comes on	DTC stored	ES-159
P1520	Stop Light Switch Circuit Malfunction	1. Short in stop light switch signal circuit 2. Stop light switch 3. ECM	Comes on	DTC stored	ES-160
P1600	ECM BATT Malfunction	1. Open in back up power source circuit 2. ECM	Comes on	DTC stored	ES-163
P1651	VSV for ACIS Circuit Malfunction	1. Open or short in ACIS VSV circuit 2. ACIS VSV 3. ECM	Comes on	DTC stored	ES-166

DTC	P0100	Mass or Volume Air Flow Circuit

DESCRIPTION

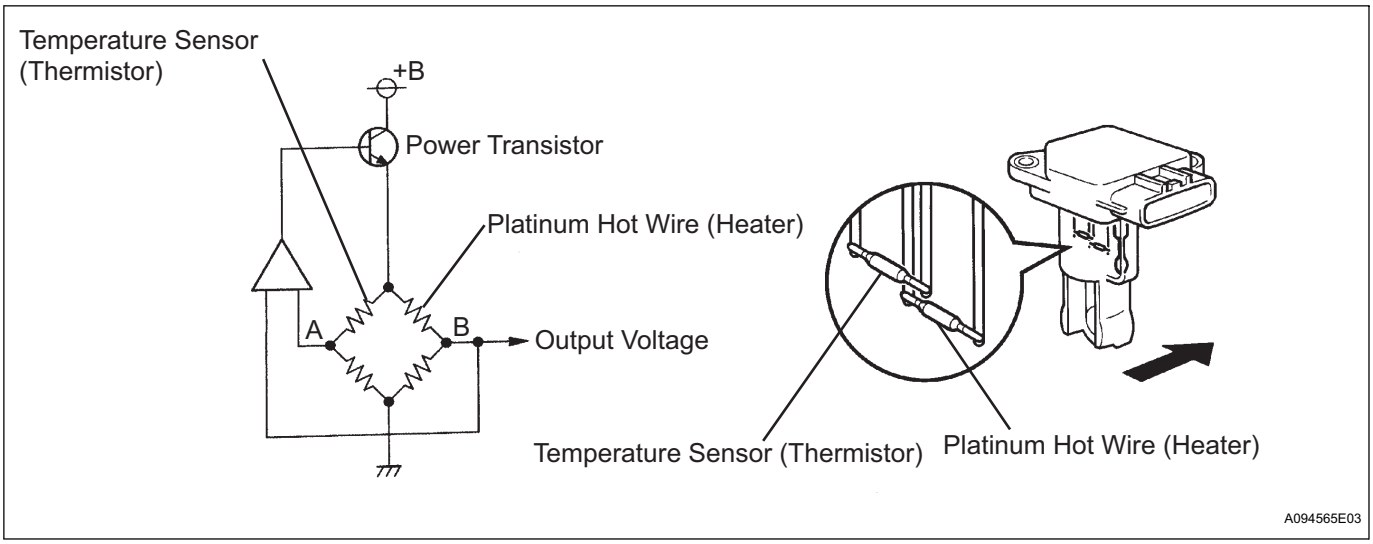
The Mass Air Flow (MAF) meter measures the amount of air flowing through the throttle valve. The ECM uses this information to determine the fuel injection time and provide the proper air fuel ratio. Inside the MAF meter, there is a heated platinum wire exposed to the flow of intake air.

By applying a specific current to the wire, the ECM heats this wire to a given temperature. The flow of incoming air cools the wire and an internal thermistor, changing their resistance. To maintain a constant current value, the ECM varies the voltage applied to these components in the MAF meter. The voltage level is proportional to the air flow through the sensor. The ECM interprets this voltage as the intake air mass.

The circuit is constructed so that the platinum hot wire and temperature sensor provide a bridge circuit, with the power transistor controlled so that the potential of A and B remains equal to maintain the set temperature.

HINT:

When any of these DTC is set, the ECM enters fail-safe mode. During fail-safe mode, the ignition timing is calculated by the ECM, according to the engine RPM and throttle valve position. Fail-safe mode continues until a pass condition is detected.



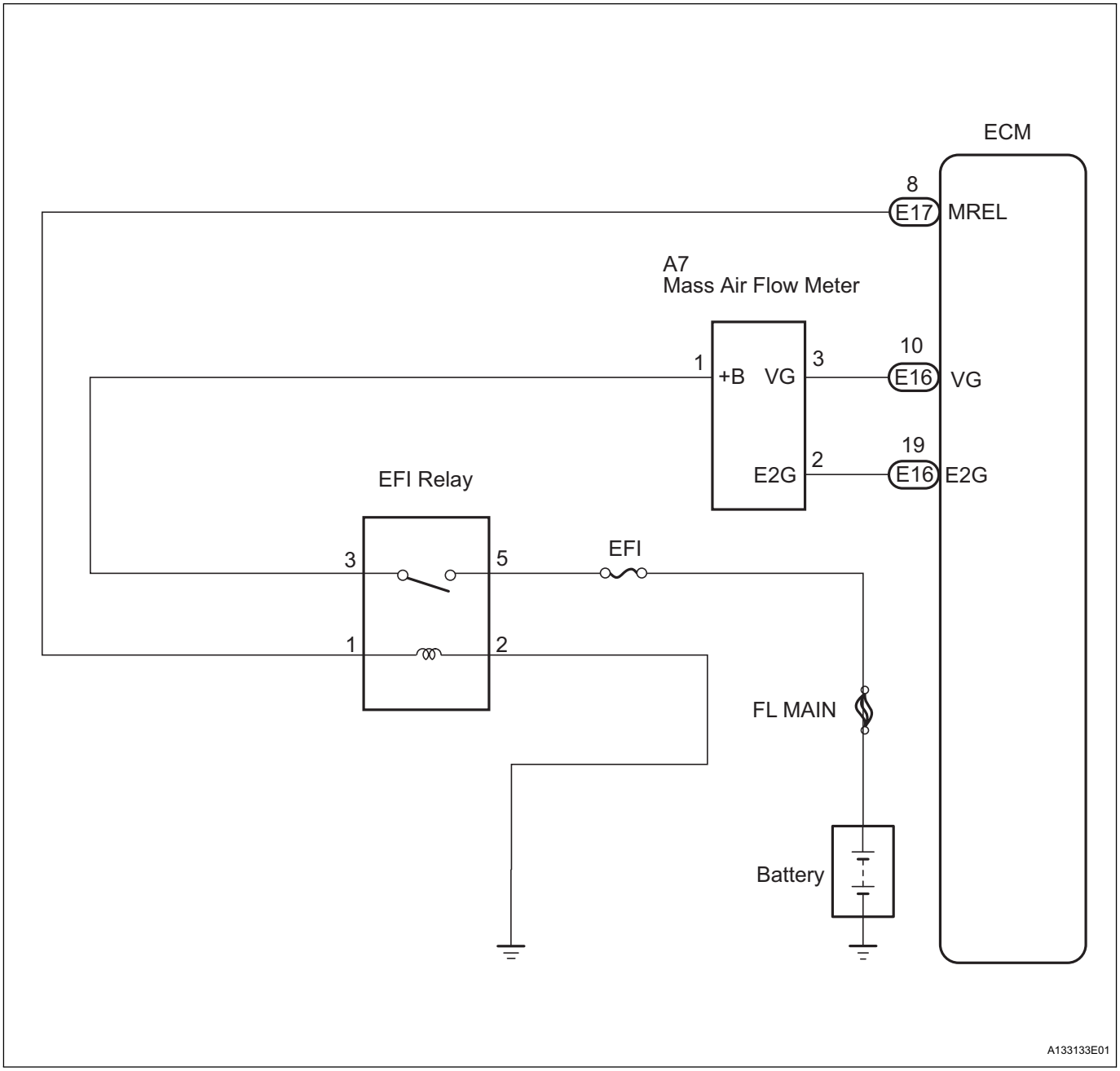
DTC No.	DTC Detection Condition	Trouble Area
P0100	When mass air flow meter circuit has an open or a short for more than 3 seconds with an engine speed of less than 4,000 rpm	• Open or short in mass air flow meter circuit • Mass air flow meter • ECM

HINT:

When DTC P100 is detected, check the air-fuel ratio by selecting Powertrain / Engine and ECT / Data list / AFM on the intelligent tester.

Air Flow Value (gm/s)	Malfunction
Approx. 0.0	• Open in mass air flow meter power source circuit • Open or short in VG circuit
271.0 or more	• Open in E2G circuit

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored.
When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	**READ VALUE OF INTELLIGENT TESTER (MASS AIR FLOW RATE)**

(a) Connect the intelligent tester to the DLC3.
(b) Start the engine.
(c) Turn the intelligent tester ON.

(d) Select the following menu items: Powertrain / Engine and ECT / Data List / AFM.
(e) Read the value.
Result

Air Flow Rate (gm/s)	Proceed to
0.0	A
271.0 or more	B
MAF rate greater than 1 but less than 270.0*	C

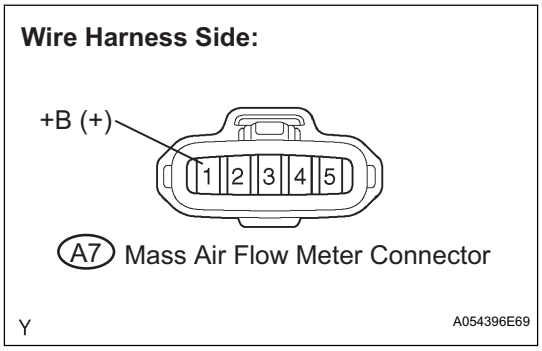
HINT:
*: The value must change when the throttle valve is opened or closed.

B → GO TO STEP 6

C → CHECK FOR INTERMITTENT PROBLEMS

A

2 INSPECT MASS AIR FLOW METER (POWER SOURCE VOLTAGE)



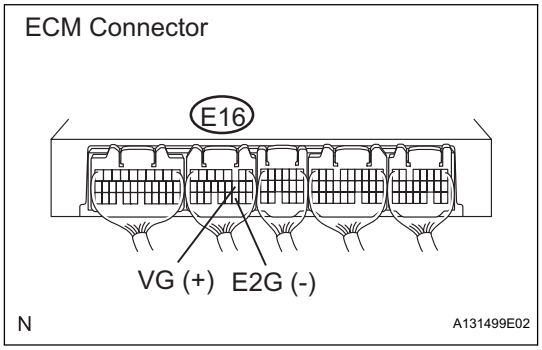
(a) Turn the ignition switch ON.
(b) Disconnect the A7 mass air flow meter connector.
(c) Measure the voltage of the wire harness side connector.
Standard voltage

Tester Connection	Specified Condition
A7-1 (+B) - Body ground	9 to 14 V

NG → GO TO STEP 5

OK

3 INSPECT ECM (VG VOLTAGE)



(a) Start the engine.
(b) Measure the voltage of the E16 ECM connector.
HINT:
The shift position should be P or N and the A/C switch should be turned OFF.
Standard voltage

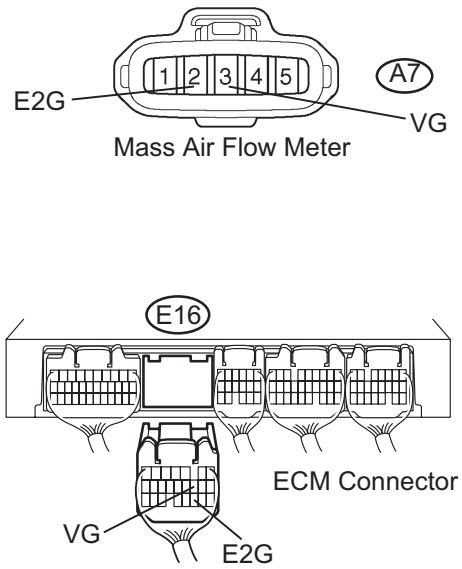
Tester Connection	Condition	Specified Condition
E16-10 (VG) - E16-19 (E2G)	Engine is idling	0.5 to 3.0 V

OK → REPLACE ECM

NG

4	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)

Wire Harness Side:



(a) Disconnect the A7 mass air flow meter connector.
(b) Disconnect the E16 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard resistance

Tester Connection	Specified Condition
A7-3 (VG) - E16-10 (VG) A7-2 (E2G) - E16-19 (E2G)	Below 1 Ω
A7-3 (VG) or E16-10 (VG) - Body ground	10 kΩ or higher
A7-2 (E2G) or E16-19 (E2G) - Body ground	10 kΩ or higher

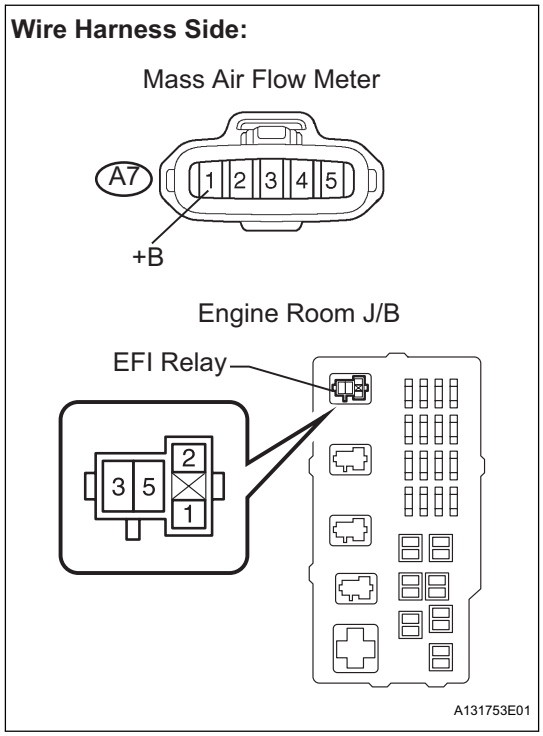
(d) Reconnect the mass air flow meter connector and ECM connector.

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

OK

REPLACE MASS AIR FLOW METER

5 CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - EFI RELAY)



(a) Disconnect the A7 mass air flow meter connector.
(b) Remove the EFI relay from the engine room J/B.
(c) Measure the resistance of the wire harness side connectors.

Standard resistance

Tester Connection	Specified Condition
A7-1 (+B) - EFI relay terminal 3	Below 1 Ω
A7-1 (+B) or EFI relay terminal 3 - Body ground	10 kΩ or higher

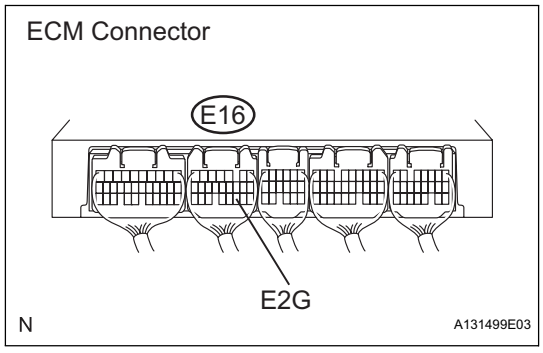
(d) Reconnect the mass air flow meter connector.
(e) Reinstall the EFI relay.

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

OK

INSPECT ECM POWER SOURCE CIRCUIT

6 INSPECT ECM (SENSOR GROUND)



(a) Measure the resistance of the ECM connector.

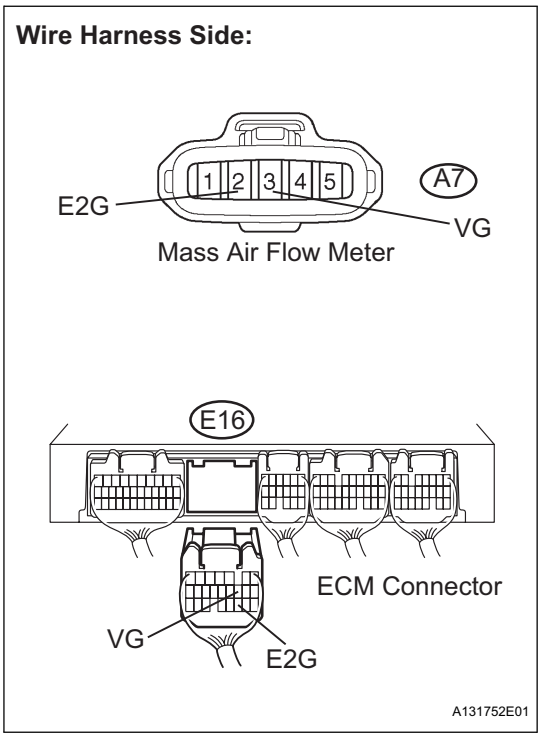
Standard resistance

Tester Connection	Specified Condition
E16-19 (E2G) - Body ground	Below 1 Ω

NG → **REPLACE ECM**

OK

7	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)



(a) Disconnect the A7 mass air flow meter connector.
(b) Disconnect the E16 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard resistance

Tester Connection	Specified Condition
A7-3 (VG) - E16-10 (VG) A7-2 (E2G) - E16-19 (E2G)	Below 1 Ω
A7-3 (VG) or E16-10 (VG) - Body ground A7-2 (E2G) or E16-19 (E2G) - Body ground	10 kΩ or higher

(d) Reconnect the mass air flow meter connector and ECM connector.

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

OK

REPLACE MASS AIR FLOW METER

DTC	P0101	Mass Air Flow Circuit Range / Performance Problem

DESCRIPTION

Refer to DTC P0100 (See page ES-33).

DTC NO.	DTC Detection Condition	Trouble Area
P0101	• High voltage Conditions (a), (b), (c) and (d) continue for 10 seconds or more (2 trip detection logic) (a) Engine speed is less than 900 rpm (b) Throttle valve is fully closed (c) Voltage output of mass air flow meter is more than 2.2 V (d) Engine coolant temperature is 70°C (158°F) or more • Low voltage Conditions (a), (b) and (c) continue for 10 seconds or more (2 trip detection logic) (a) Engine speed is 1,500 rpm or more (b) Voltage output of VTA is 0.63 V or more (c) Voltage output of mass air flow meter is less than 1.06 V	Mass air flow meter

WIRING DIAGRAM

Refer to DTC P0100 (See page ES-34).

INSPECTION PROCEDURE

1 CHECK DTC OUTPUT

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / DTC.
(e) Read DTCs.

Result

Display (DTC output)	Proceed to
Only P0101	A
P0101 and other DTCs	B

HINT:
If any DTCs other than P0101 are output, troubleshoot these DTCs first.

B → **GO TO DTC CHART (See page ES-23)**

A →

REPLACE MASS AIR FLOW METER SUB-ASSEMBLY

DTC	P0110	Intake Air Temperature Circuit Malfunction

DESCRIPTION

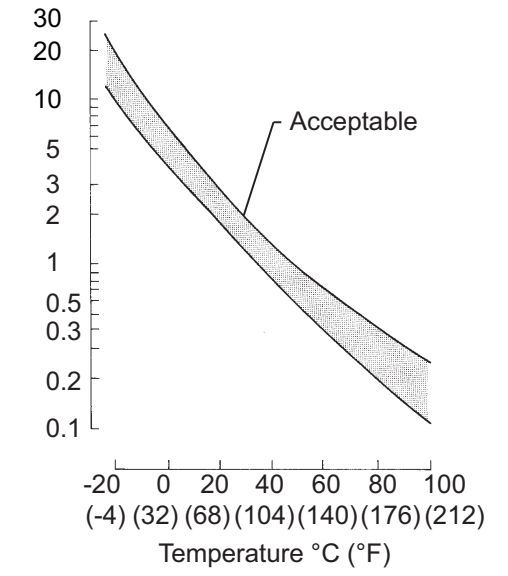
The Intake Air Temperature (IAT) sensor, mounted on the Mass Air Flow (MAF) meter, monitors the IAT. The IAT sensor has a built in thermistor with a resistance that varies according to the temperature of the intake air. As the IAT becomes lower, the resistance of the thermistor increases. As the IAT becomes higher, the resistance drops. These variations in resistance are transmitted to the ECM (Included in ECM) as voltage changes (See Fig. 1).

The IAT sensor is powered by a 5 V supply from the THA terminal of the ECM, via resistor R. Resistor R and the IAT sensor are connected in series. When the resistance value of the IAT sensor changes, according to changes in the IAT, the voltage at terminal THA also varies. Based on this signal, the ECM increases the fuel injection volume when the engine is cold to improve driveability.

HINT:

When any of DTC P0110 is set, the ECM enters fail-safe mode. During fail-safe mode, the IAT is estimated to be 20°C (68°F) by the ECM. Fail-safe mode continues until a pass condition is detected.

Fig. 1



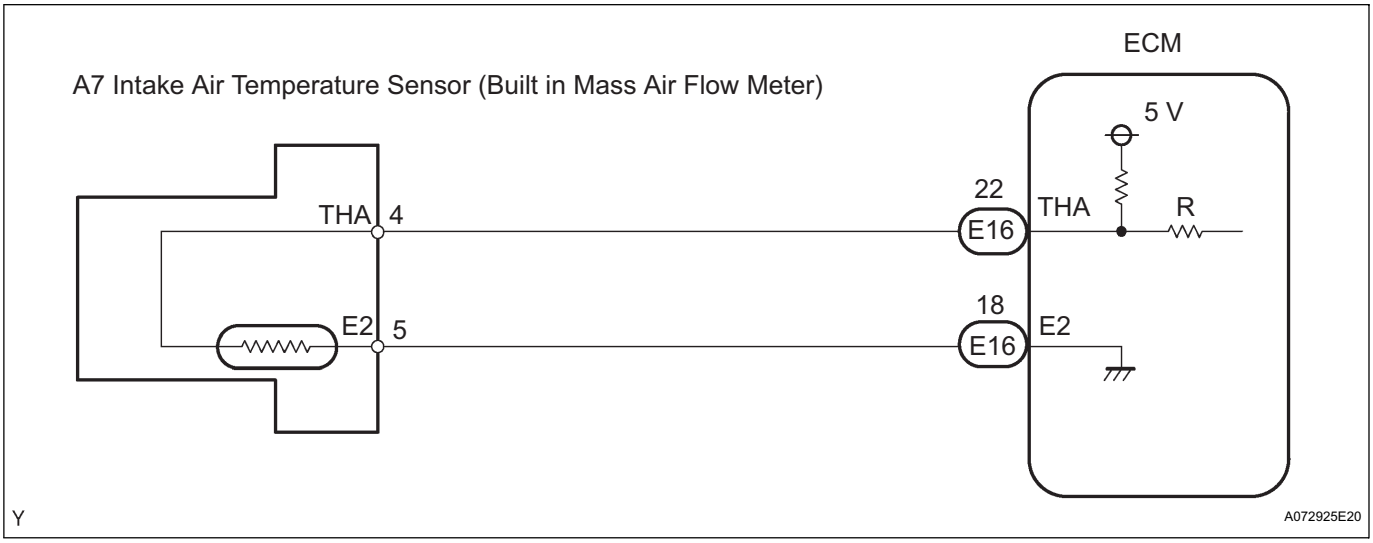
DTC No.	Proceed to	DTC Detection Condition	Trouble Area
P0110	Step 1	Open or short in Intake Air Temperature (IAT) sensor circuit for 0.5 seconds (1 trip detection logic)	• Open or short in IAT sensor circuit • IAT sensor (built into MAF meter) • ECM

HINT:

When DTC P0110, P0112 or P0113 is detected, check the intake air temperature by selecting Powertrain / Engine and ECT / Data List / Intake air on the intelligent tester.

Temperature Displayed	Malfunction
-40°C (-40°F)	Open circuit
140°C (284°F) or higher	Short circuit

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTCs relating to different systems are output, and they share terminal E2 as their ground, check this ground circuit first.
- Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	READ VALUE OF INTELLIGENT TESTER (INTAKE AIR TEMPERATURE)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / Data List / Intake Air.
(e) Read the values.

Standard:

Same as actual Intake Air Temperature (IAT).

Result

Temperature Displayed	Proceed to
-40 °C (-40°F)	A
140°C (284°F) or higher	B
Same as actual IAT	C

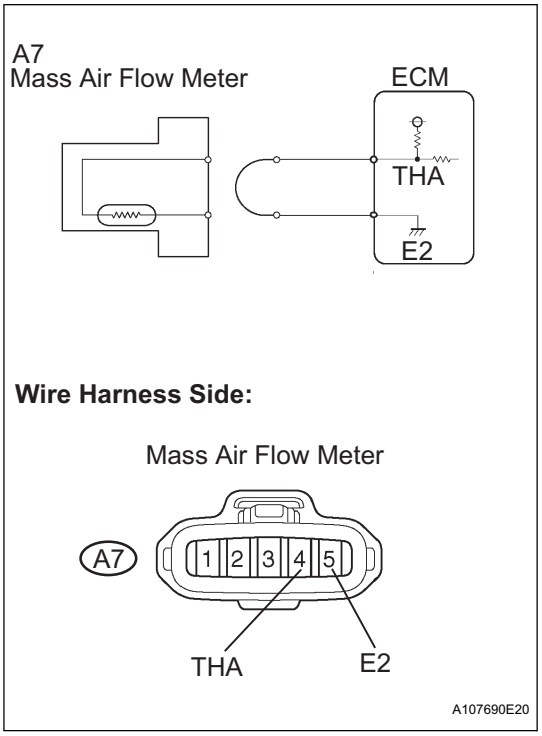
HINT:

- If there is an open circuit, the intelligent tester indicates -40°C (-40°F).
- If there is a short circuit, the intelligent tester indicates 140°C (284°F) or higher.

B	GO TO STEP 4
C	CHECK FOR INTERMITTENT PROBLEMS

A

2 READ VALUE OF INTELLIGENT TESTER (CHECK FOR OPEN IN WIRE HARNESS)

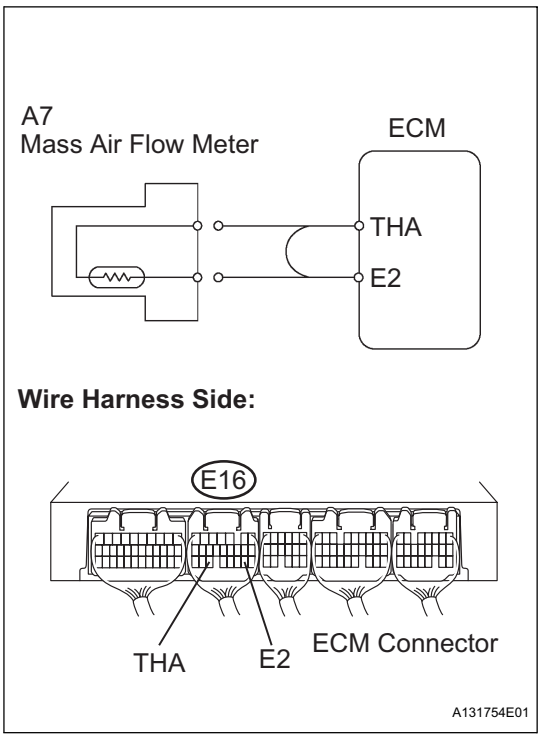


(a) Disconnect the A7 mass air flow meter connector.
(b) Connect terminals THA and E2 of the mass air flow meter wire harness side connector.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch ON.
(e) Turn the intelligent tester ON.
(f) Select the following menu items: Powertrain / Engine and ECT / Data List / Intake Air.
(g) Read the values.
Standard temperature:
140°C (284°F) or higher
(h) Reconnect the mass air flow meter connector.

OK → **REPLACE MASS AIR FLOW METER ASSEMBLY**

NG

3 READ VALUE OF INTELLIGENT TESTER (CHECK FOR OPEN IN ECM)



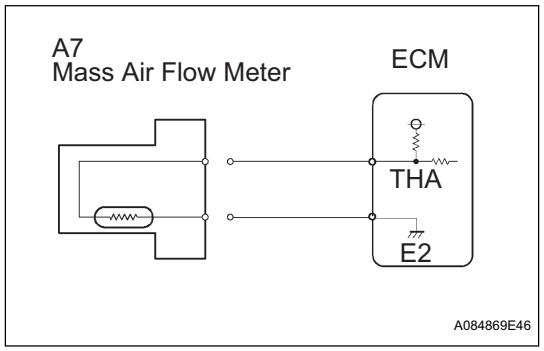
(a) Disconnect the A7 mass air flow meter connector.
(b) Connect terminals THA and E2 of the E16 ECM connector.
HINT:
Before checking, do visual and contact pressure checks on the ECM connector.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch ON.
(e) Turn the intelligent tester ON.
(f) Select the following menu items: Powertrain / Engine and ECT / Data List / intake Air.
(g) Read the values.
Standard temperature:
140°C (284°F) or higher
(h) Reconnect the mass air flow meter connector.

OK → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

NG

REPLACE ECM

4	READ VALUE OF INTELLIGENT TESTER (CHECK FOR SHORT IN WIRE HARNESS)

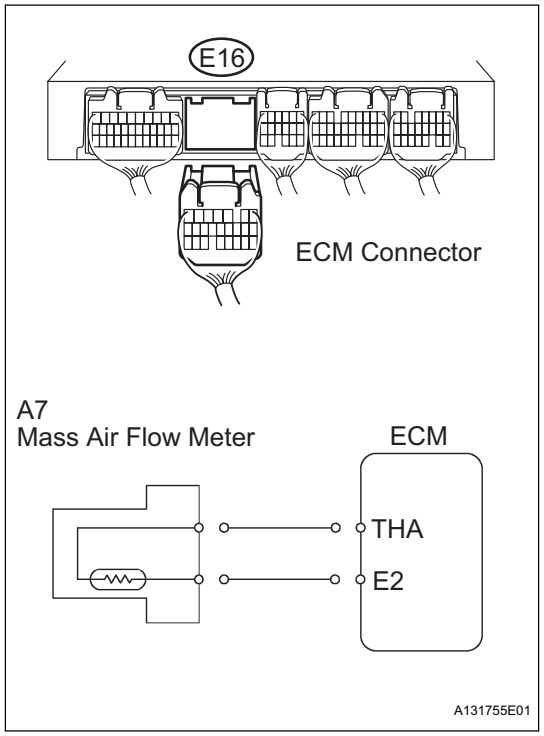


(a) Disconnect the A7 mass air flow meter connector.
(b) Connect the intelligent tester to the DLC3.
(c) Turn the ignition switch ON.
(d) Turn the tester ON.
(e) Select the following menu items: Powertrain / Engine and ECT / Data List / Intake Air.
(f) Read the values.
Standard:
-40°C (-40°F)
(g) Reconnect the mass air flow meter connector.

OK → **REPLACE MASS AIR FLOW METER**

NG

5	READ VALUE OF INTELLIGENT TESTER (CHECK FOR SHORT IN ECM)



(a) Disconnect the E16 ECM connector.
(b) Connect the intelligent tester to the DLC3.
(c) Turn the ignition switch ON.
(d) Turn the intelligent tester ON.
(e) Select the following menu items: Powertrain / Engine and ECT / Data List / Intake Air.
(f) Read the values.
Standard:
-40°C (-40°F)
(g) Reconnect the ECM connector.

OK → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

NG

REPLACE ECM

DTC	P0115	Engine Coolant Temperature Circuit Malfunction

DESCRIPTION

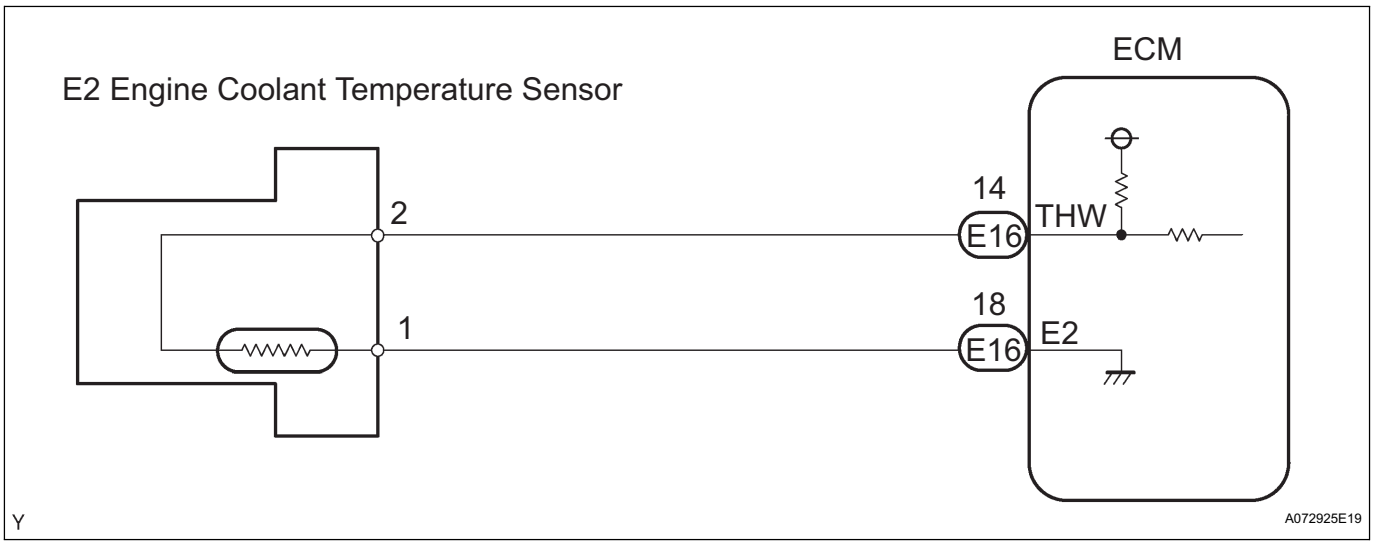
A thermistor built into the water temperature sensor changes the resistance value according to the water temperature.
The structure of the sensor and connection to the ECM is the same as the one of the air temperature sensor.

DTC No.	Proceed to	DTC Detection Condition	Trouble Area
P0115	Step 1	Open or short in Engine Coolant Temperature (ECT) sensor circuit for 0.5 seconds (1 trip detection logic)	• Open or short in ECT sensor circuit • ECT sensor • ECM

HINT:
When DTC P0115, P0117 or P0118 is detected, check the engine coolant temperature by selecting Powertrain / Engine and ECT / Data List / Coolant Temp on the intelligent tester.

Temperature Displayed	Malfunction
-40°C (-40°F)	Open circuit
140°C (284°F) or higher	Short circuit

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
- If other DTCs relating to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.
- Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	READ VALUE OF INTELLIGENT TESTER (ENGINE COOLANT TEMPERATURE)

(a) Connect the intelligent tester to the DLC3.

(b) Turn the ignition switch ON.
(c) Turn the tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / Data List / Coolant Temp.
(e) Read the values.
Standard:
Same as actual engine coolant temperature (ECT).

Result

Temperature Displayed	Proceed to
-40°C (-40°F)	A
140°C (284°F) or higher	B
Same as actual ECT	C

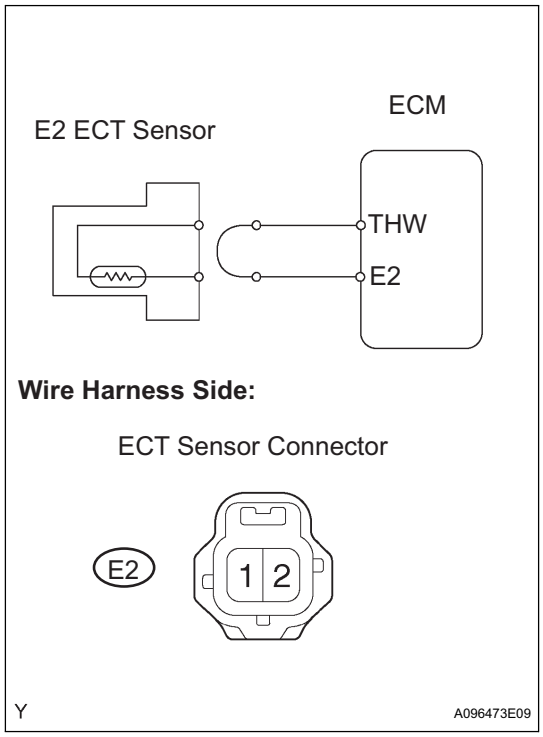
HINT:
- If there is an open circuit, the intelligent tester indicates -40°C (-40°F).
- If there is a short circuit, the intelligent tester indicates 140°C (284°F) or higher.

B → **GO TO STEP 4**

C → **CHECK FOR INTERMITTENT PROBLEMS**

A

2 READ VALUE OF INTELLIGENT TESTER (CHECK FOR OPEN IN WIRE HARNESS)

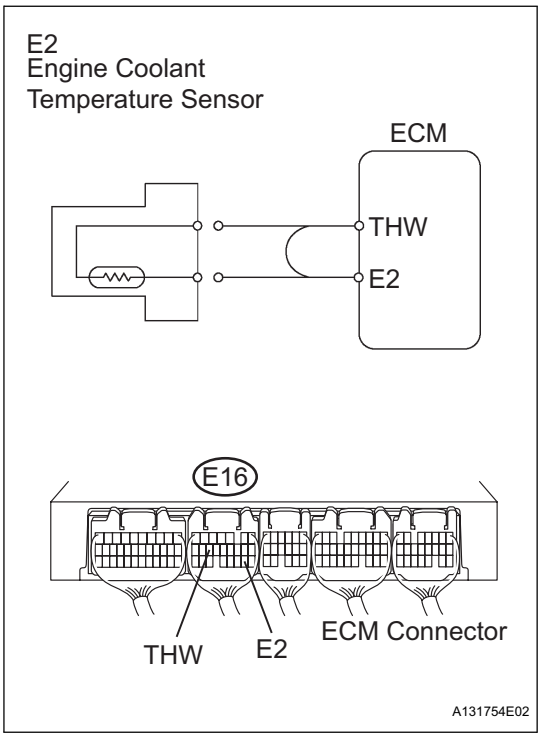


(a) Disconnect the E2 ECT sensor connector.
(b) Connect terminals 1 and 2 of the E2 engine coolant temperature sensor wire harness side connector.
(c) Turn the ignition switch ON.
(d) Turn the intelligent tester ON.
(e) Select the following menu items: Powertrain / Engine and ECT / Data List / Coolant Temp.
(f) Read the values.
OK:
Temperature value: 140°C (284°F) or more
(g) Reconnect the engine coolant temperature sensor connector.

OK → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

NG

3	READ VALUE OF INTELLIGENT TESTER (CHECK FOR OPEN IN ECM)



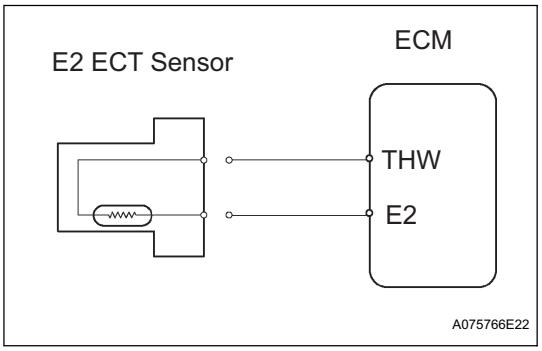
(a) Disconnect the E2 ECT sensor connector.
(b) Connect terminals THW and E2 of the E16 ECM connector.
HINT:
Before checking, do a visual and contact pressure check for the ECM connector.
(c) Turn the ignition switch ON.
(d) Turn the intelligent tester ON.
(e) Select the following menu items: Powertrain / Engine and ECT / Data List / Coolant Temp.
(f) Read the values.
OK:
Temperature value: 140°C (284°F) or more
(g) Reconnect the engine coolant temperature sensor connector.

OK → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

NG

REPLACE ECM

4	READ VALUE OF INTELLIGENT TESTER (CHECK FOR SHORT IN WIRE HARNESS)

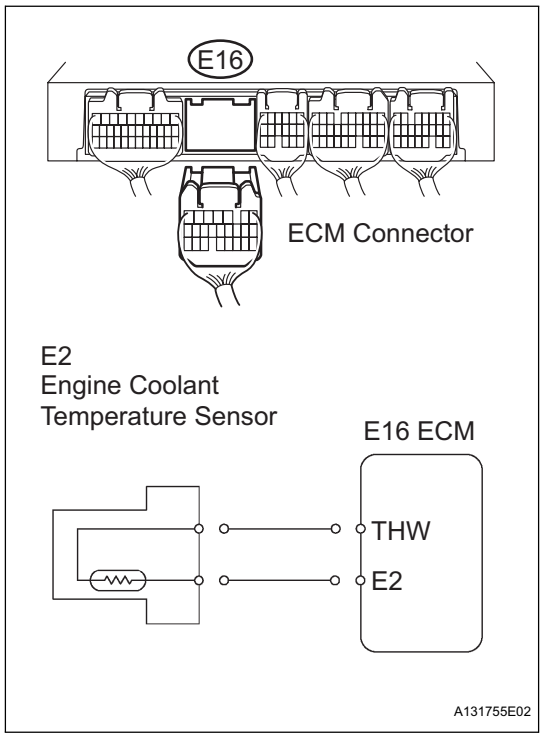


(a) Disconnect the E2 engine coolant temperature sensor connector.
(b) Connect the intelligent tester to the DLC3.
(c) Turn the ignition switch ON.
(d) Turn the intelligent tester ON.
(e) Select the following menu items: Powertrain / Engine and ECT / Data List / Coolant Temp.
(f) Read the values.
OK:
Temperature value: -40°C (-40°F)
(g) Reconnect the engine coolant temperature sensor connector.

OK → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

NG

5	READ VALUE OF INTELLIGENT TESTER (CHECK FOR SHORT IN ECM)



(a) Disconnect the E16 ECM connector.
(b) Disconnect the E2 engine coolant temperature sensor connector.
(c) Turn the ignition switch ON.
(d) Turn the intelligent tester ON.
(e) Select the following menu items: Powertrain / Engine and ECT / Data List / Coolant Temp.
(f) Read the values.
OK:
Temperature value: -40°C (-40°F)
(g) Reconnect the ECM connector and engine coolant temperature sensor connector.

OK → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

NG

REPLACE ECM

DTC	P0116	Engine Coolant Temperature Circuit Range / Performance Problem

DESCRIPTION

A thermistor built into the water temperature sensor changes the resistance value according to the water temperature.
The structure of the sensor and connection to the ECM is the same as the one of the air temperature sensor.

DTC No.	DTC Detection Condition	Trouble Area
P0116	In case that reading value of water temp. sensor will not change more than 1°C (1.8°F) even after repeating 6 trips (detection logic) of adjusting speed pattern with ECT more than 60°C (140°F) when starting engine	• Engine coolant temperature sensor • Cooling system • Thermostat

WIRING DIAGRAM

Refer to DTC P0115 (See page ES-44)

INSPECTION PROCEDURE

HINT:

- If DTCs P0115 and P0116 are output simultaneously, engine coolant temperature sensor circuit may be open. Perform troubleshooting of DTC P0115 first.
- Read freeze frame data using intelligent tester as freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air-fuel ratio was lean or rich, etc. at the time of the malfunction.

1	CHECK DTC OUTPUT

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / DTC.
(e) Read DTCs.

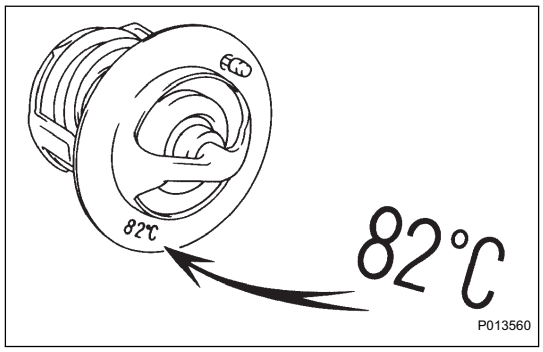
Result

Display (DTC Output)	Proceed to
P0116	A
P0116 and other DTCs	B

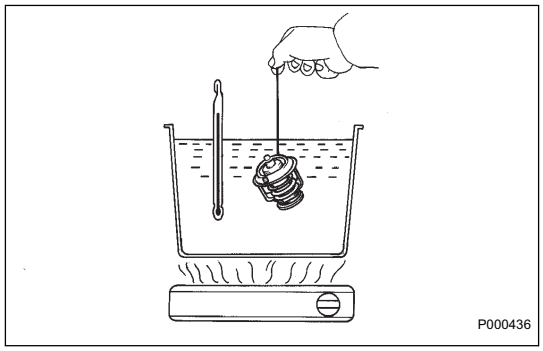
B → GO TO DTC CHART (See page ES-23)

A

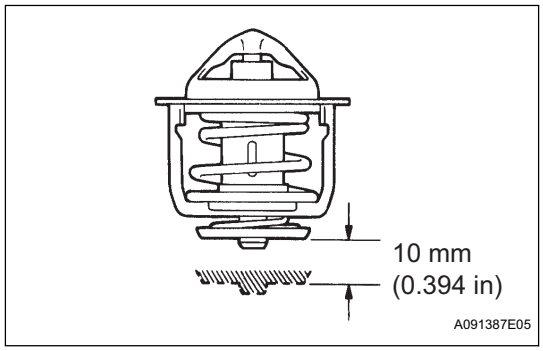
2	INSPECT THERMOSTAT



(a) Inspect the thermostat.
HINT:
The thermostat is numbered with the valve opening temperature.



(b) Immerse the thermostat in water and gradually heat the water.
(c) Check the valve opening temperature.
Valve opening temperature:
80 to 84°C (176 to 183°F)



(d) Check the valve lift.
Valve lift:
10.0 mm (0.394 in) or more
(e) Check that the valve is fully closed when the thermostat is at low temperatures (below 40°C (104°F)).

NG → **REPLACE THERMOSTAT**

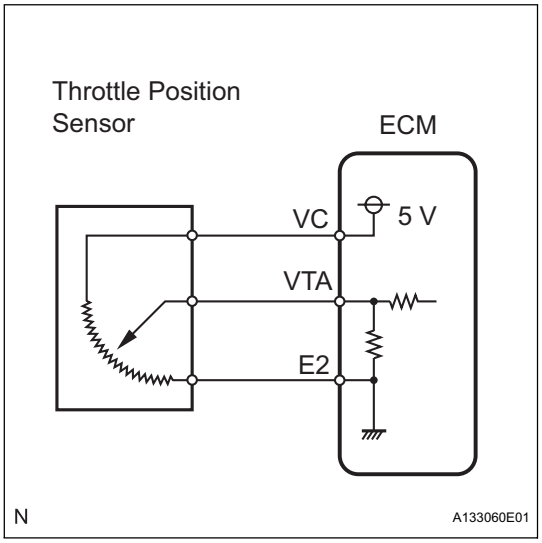
OK

REPLACE ENGINE COOLANT TEMPERATURE SENSOR

DTC	P0120	Throttle / Pedal Position Sensor / Switch "A" Circuit

DESCRIPTION

The throttle position sensor is mounted in the throttle body and detects the throttle valve opening angle. When the throttle valve is fully closed, a voltage of approximately 0.7 V is applied to terminal VTA1 of the ECM. The voltage applied to terminal VTA1 of the ECM increases in proportion to the opening angle of the throttle valve and becomes approximately 2.7 to 5.2 V when the throttle valve is fully opened. The ECM judges the vehicle driving conditions from these signals input from terminal VTA1 and uses them to decide the air-fuel ratio correction, power increase correction and fuel-cut control, etc.

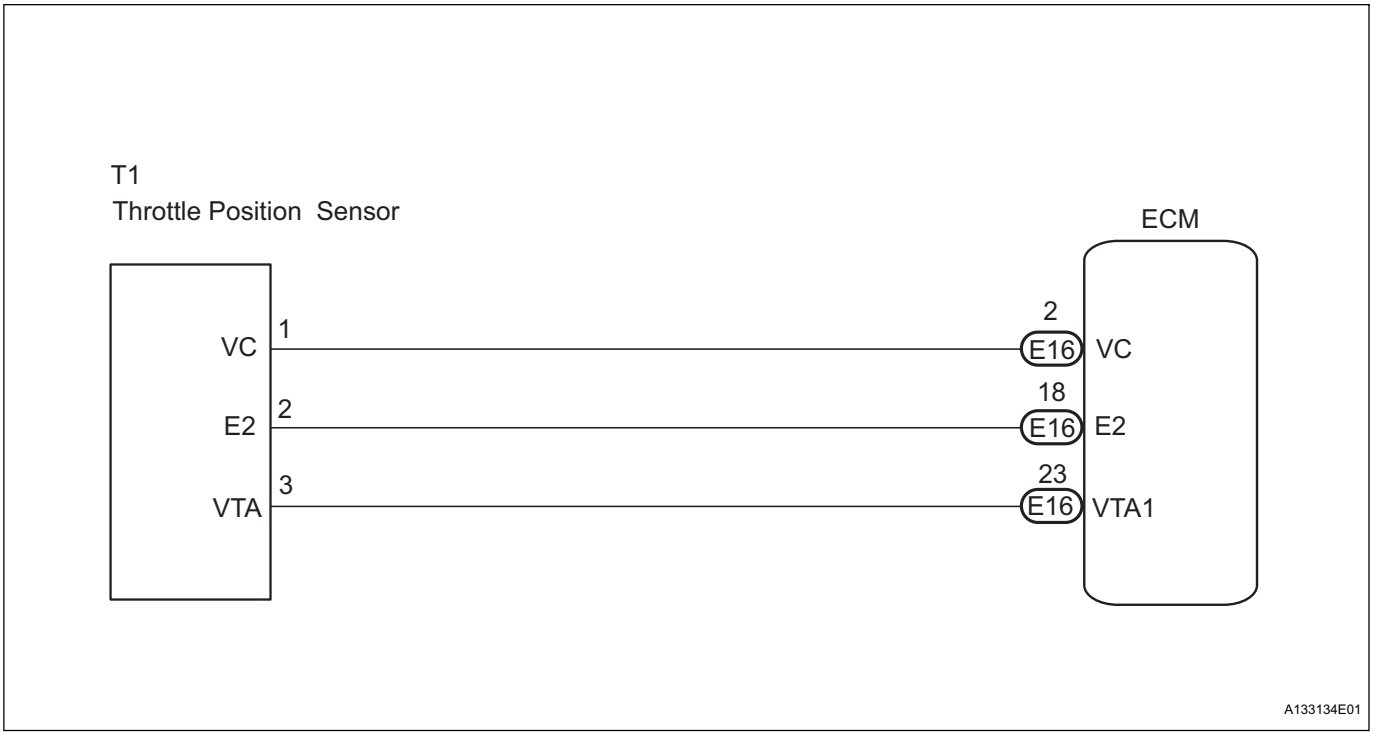


DTC No.	DTC Detecting Condition	Trouble Area
P0120	One of the following conditions is met (a) VTA1 less than 0.1 V (b) VTA1 more than 4.9 V	• Open or short in throttle position sensor circuit • Throttle position senor • ECM

HINT:
After confirming DTC P0120, use the intelligent tester to confirm the throttle valve opening percentage and closed throttle position sensor.

Throttle valve opening position expressed as percentage		
Throttle valve fully closed	Throttle valve fully open	
0 %	0 %	• VC circuit open • VTA1 circuit open or short
100 %	100 %	E2 circuit open

WIRING DIAGRAM

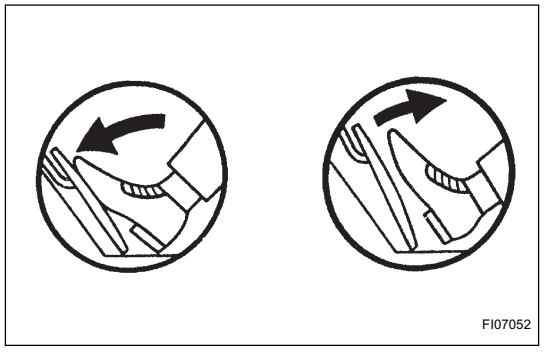


INSPECTION PROCEDURE

HINT:

- If DTCs P0110, P0115, P0120 and P1410 are output simultaneously, E2 (sensor ground) may be open.
- Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	READ VALUE OF INTELLIGENT TESTER



(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / Data List / Throttle POS.
(e) Read the values.

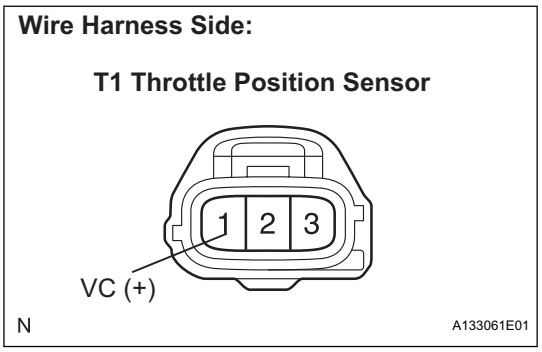
OK

Throttle Valve	Throttle Valve Opening Position Expressed as Percentage
Fully open	Approx. 75 %
Fully closed	Approx. 10 %

NG → **CHECK FOR INTERMITTENT PROBLEMS**

OK

2 INSPECT THROTTLE POSITION SENSOR (VC VOLTAGE)



(a) Disconnect the T1 throttle position sensor connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage between the terminals.

Standard voltage

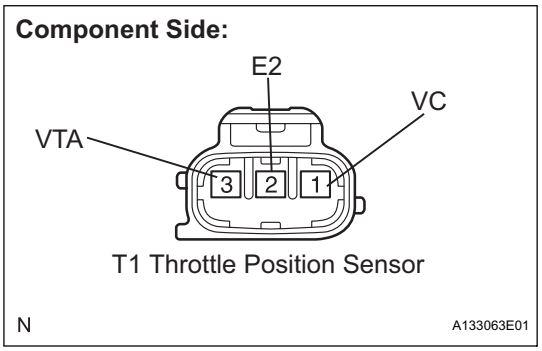
Tester Connection	Specified Condition
T1-1 (VC) - Body ground	4.5 to 5.5 V

(d) Reconnect the throttle position sensor connector.

NG → **GO TO STEP 5**

OK

3 INSPECT THROTTLE POSITION SENSOR



(a) Disconnect the T1 throttle position sensor connector.
(b) Disconnect the vacuum hose from the throttle body.
(c) Apply vacuum to the throttle opener.
(d) Using an ohmmeter, measure the resistance between the terminals.

Standard resistance

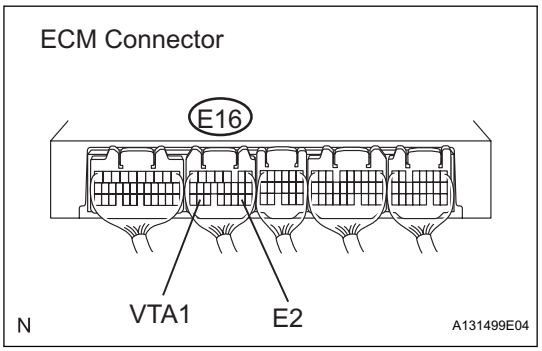
Tester Connection	Throttle Valve Condition	Specified Condition
T1-3 (VTA) - T1-2 (E2)	Fully closed	0.2 to 6.3 kΩ
T1-3 (VTA) - T1-2 (E2)	Fully open	2.0 to 10.2 kΩ
T1-1 (VC) - T1-2 (E2)	Always	2.5 to 5.9 kΩ

(e) Reconnect the vacuum hose to the throttle body.
(f) Reconnect the throttle position sensor connector.

NG → **REPLACE THROTTLE POSITION SENSOR**

OK

4 INSPECT ECM (VTA1 VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage between the terminals.

Standard voltage

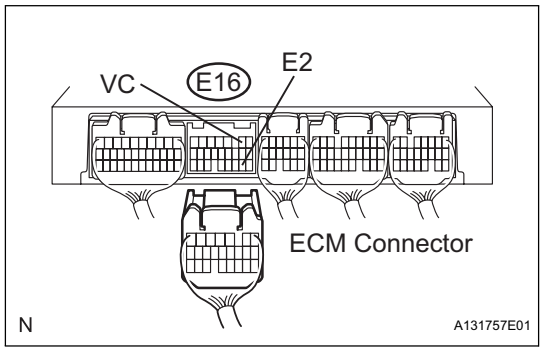
Tester Connection	Throttle Valve Condition	Specified Condition
E16-23 (VTA1) - E16-18 (E2)	Fully closed	0.3 to 1.0 V
E16-23 (VTA1) - E16-18 (E2)	Fully open	2.7 to 5.2 V

NG → **CHECK HARNESS AND CONNECTOR (VTA CIRCUIT)**

OK

REPLACE ECM

5 INSPECT ECM (VC VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage between the terminals.
Standard voltage

Tester Connection	Specified Condition
E16-2 (VC) - E16-18 (E2)	4.5 to 5.5 V

NG → **REPLACE ECM**

OK

CHECK HARNESS AND CONNECTOR (VC CIRCUIT)

DTC	P0121	Throttle / Pedal Position Sensor / Switch "A" Circuit Range / Performance Problem

DESCRIPTION

Refer to DTC P0120 (See page ES-50).

DTC No.	DTC Detection Condition	Trouble Area
P0121	After vehicle speed has exceeded 30 km/h even once, output value of throttle position sensor is out of applicable range while vehicle speed is between 30 km/h and 0 km/h (2 trip detection logic).	Throttle position sensor

INSPECTION PROCEDURE

Intelligent tester

HINT:

Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	REPLACE THROTTLE POSITION SENSOR

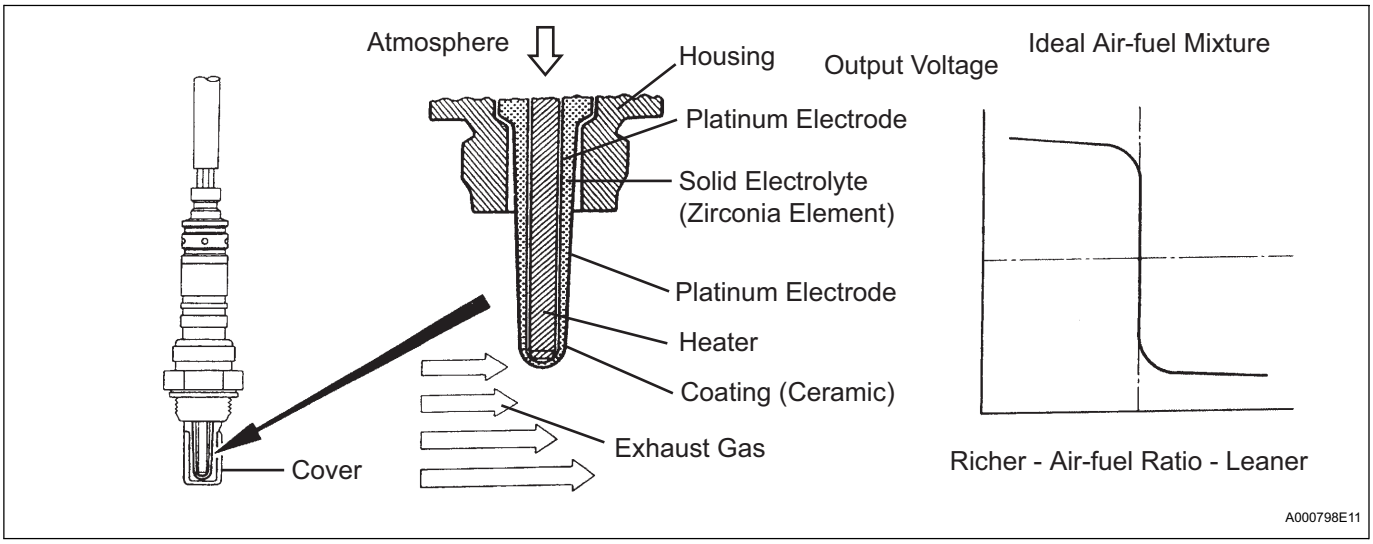
NEXT

END

DTC	P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control

DESCRIPTION

A three-way catalytic converter (TWC) is used in order to convert the carbon monoxide (CO), hydrocarbons (HC), and nitrogen oxides (Nox) into less harmful substances. To allow the TWC to function effectively, it is necessary to keep the air-fuel ratio of the engine near the stoichiometric air-fuel ratio.
The voltage output by a heated oxygen sensor changes suddenly in the vicinity of the stoichiometric air-fuel ratio. This voltage change is used to detect the oxygen concentration in the exhaust gas, and to provide feedback that the ECM can use to control the air-fuel ratio.
When the air-fuel ratio is lean, the oxygen content in the exhaust gas is high.
The output of the oxygen sensor will be low (less than 0.45 volts). This low voltage is used by the ECM to determine that the air-fuel ratio is on the lean side of a stoichiometric ratio.
When the air-fuel ratio is rich, the oxygen content in the exhaust gas is low. The output of the oxygen sensor will be high (more than 0.45 volts). This high voltage is used by the ECM to determine that the air-fuel ratio is on the rich side of a stoichiometric ratio.
Based on the voltage output by the heated oxygen sensor, the ECM judges whether the air-fuel ratio is rich or lean, and makes adjustments to the injection duration to compensate. If the heated oxygen sensor malfunctions, and an abnormal voltage is output, the ECM will be unable to perform accurate air-fuel ratio control.
The heated oxygen sensor includes a heater for the zirconia element. The heater is controlled by the ECM. When the intake air volume is low, the temperature of the exhaust gas will be low. At this time, current is provided to the heater to allow accurate oxygen concentration detection.



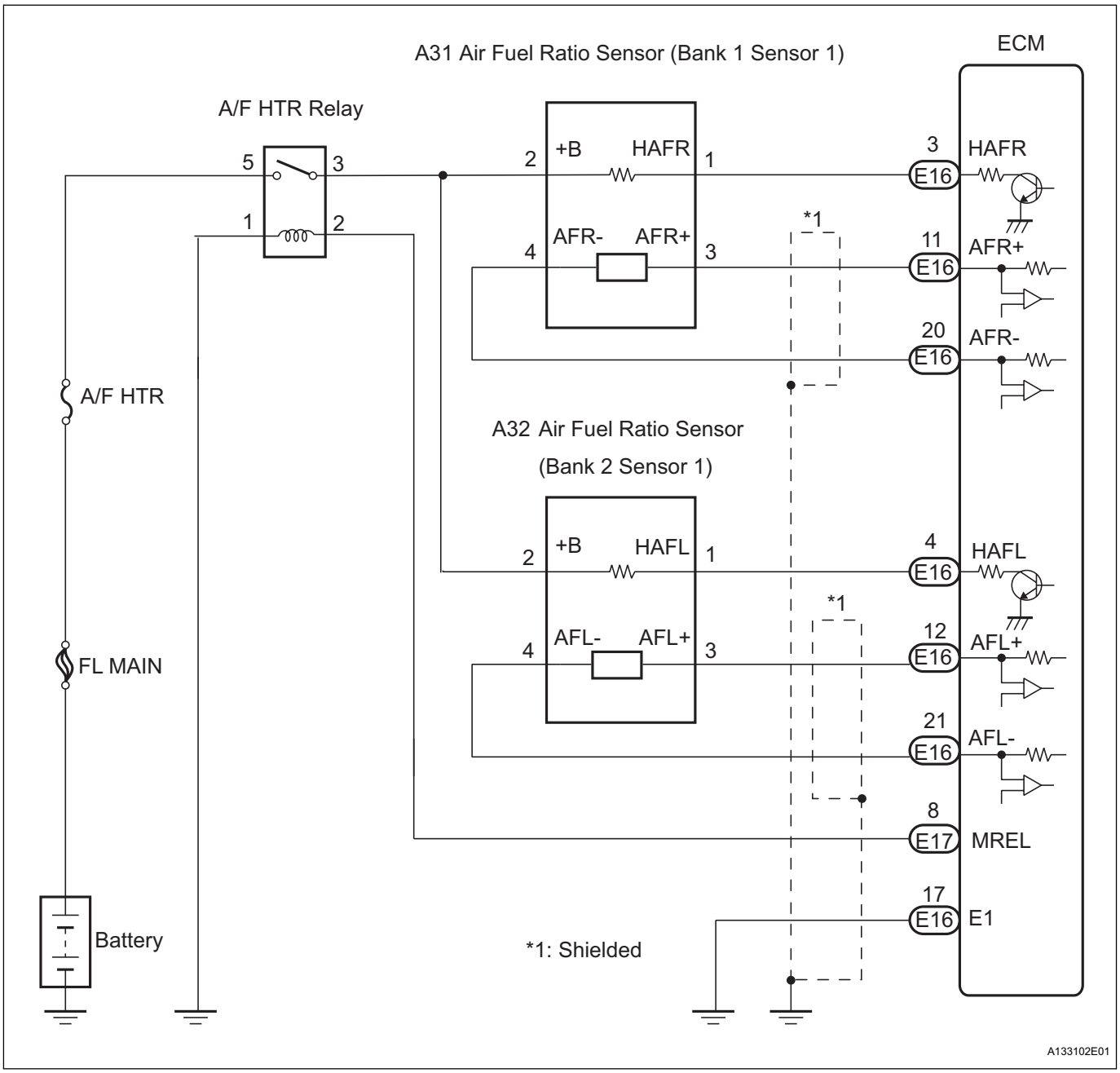
DTC No.	DTC Detecting Condition	Trouble Area
P0125	After engine is warmed up, A/F sensor output* does not change when conditions (a), (b), (c) and (d) continue for at least 1.5 minutes: *: Output value changes at inside of the ECM only (a) Engine speed: 1,500 rpm or more (b) Vehicle speed: 40 to 100 km/h (c) Throttle valve is not fully closed 140 seconds or more after starting engine	• Open or short in A/F sensor (sensor1) circuit • A/F sensor (sensor 1) • Air induction system • Fuel pressure • Injector • EGR system • Gas leakage from exhaust system • ECM

HINT:

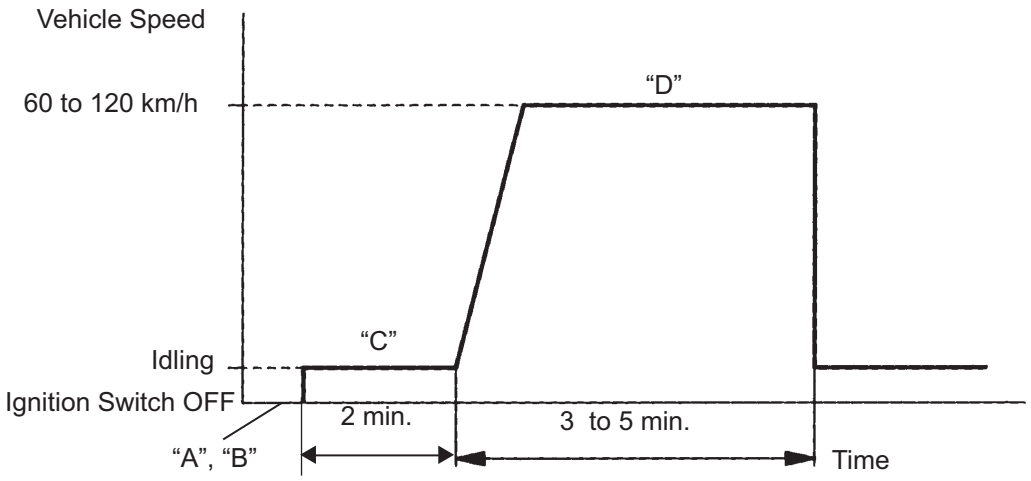
- After confirming DTC P0125, use the intelligent tester to confirm voltage output of the A/F sensor (sensor 1) from the CURRENT DATA.

- The ECM controls the voltage of the AFR+, AFL+, AFR- and AFL- terminals of the ECM to the fixed voltage. Therefore, it is impossible to confirm the A/F sensor output voltage without the intelligent tester.

WIRING DIAGRAM



CONFIRMATION DRIVING PATTERN



1. **Connect the intelligent tester to the DLC3 (Procedure "A").**
2. **Switch the intelligent tester from the normal mode to the check mode (See page ES-18) (Procedure "B").**
3. **Start the engine and warm it up with all the accessory switches OFF (Procedure "C").**
4. **Drive the vehicle at 60 to 120 km/h and engine speed at 1,400 to 3,200 rpm for 3 to 5 minutes (Procedure "D").**

HINT:
If a malfunction exists, the MIL will be illuminated during procedure "D".

NOTICE:
If the conditions in this test are not strictly followed, a malfunction will not be detected. If you do not have a intelligent tester, turn the ignition switch OFF after performing procedure "C" and "D" , then perform procedure "C" and "D" again.

INSPECTION PROCEDURE

HINT:
Intelligent tester only:
Malfunctioning areas can be found by performing the Active Test / A/F Control operation. The A/F Control operation can determine if the A/F sensor, heated oxygen sensor or other potential trouble areas are malfunctioning or not.

1	CHECK DTC OUTPUT (IN ADDITION TO DTC P0125)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / DTC.
(e) Read DTCs.

Result

Display (DTC output)	Proceed To
P0125	A
P0125 and other DTCs	B

HINT:
If any DTCs other than P0125 are output, perform troubleshooting for these DTCs first.

B → GO TO DTC CHART (See page ES-23)

A

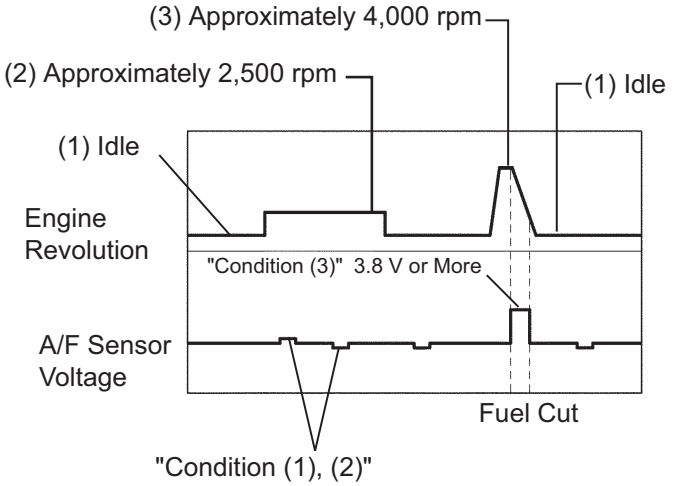
2	READ VALUE OF INTELLIGENT TESTER (OUTPUT VOLTAGE OF A/F SENSOR)

(a) Connect the intelligent tester to the DLC3.
(b) Start the engine and turn the intelligent tester ON.
(c) Warm up the A/F sensor at 2,500 rpm for approximately 90 seconds.
(d) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Data List.
(e) Select the monitor items: AFS B1 S1 and Engine Speed.
(f) Monitor the A/F sensor voltage carefully.
(g) Check the A/F sensor voltage under the following conditions:
  (1) Allow the engine to idle for 30 seconds (Condition 1).
  (2) Run the engine at approximately 2,500 rpm (where the engine RPM is not suddenly changed) (Condition 2).
  (3) Raise the engine speed to 4,000 rpm and quickly release the accelerator pedal so that the throttle valve is fully closed (Condition 3).

Standard:

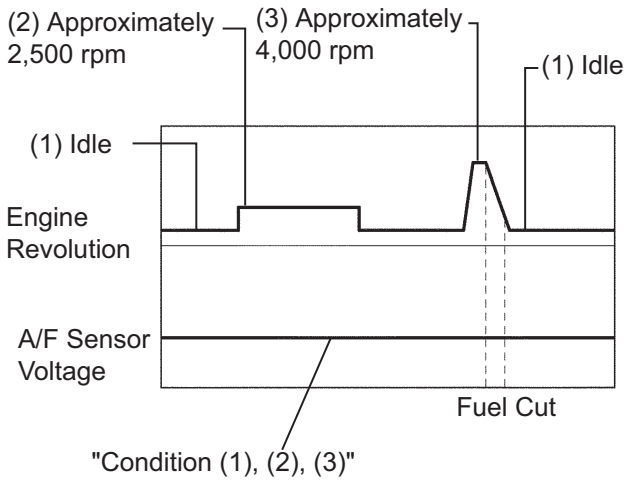
Condition (1) and (2)
The voltage changes in the vicinity of 3.3 V (between approximately 3.1 and 3.5 V) as shown in the illustration.
Condition (3)
The voltage increases to 3.8 V or more during engine deceleration (when fuel is cut) as shown in the illustration.

Normal Condition:



Change in the vicinity of approximately 3.3 V

Malfunction Condition:



When A/F sensor circuit is malfunctioning, voltage output does not change

A072304E09

HINT:

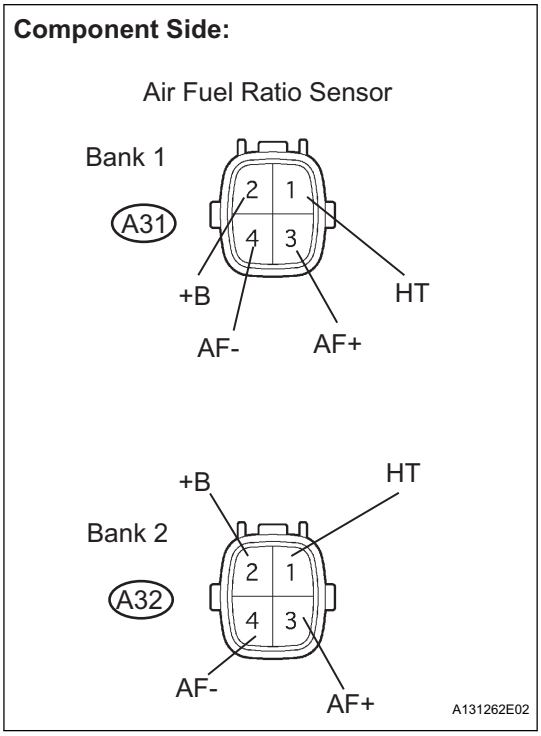
- Whenever the output voltage of the A/F sensor remains at approximately 3.3 V (see diagram Malfunction Condition) under any condition as well as the above conditions, the A/F sensor may have an open circuit. (This will happen also when the A/F sensor heater has an open circuit.)
- Whenever the output voltage of the A/F sensor remains at a certain value of approximately 3.8 V or more, or 2.8 V or less (see diagram Malfunction Condition) under any condition as well as the above conditions, the A/F sensor may have a short circuit.
- The ECM will stop fuel injection (fuel cut) during engine deceleration. This will cause lean condition and should result in a momentary increase in the A/F sensor voltage output.
- The ECM must establish a closed throttle position learned value to perform fuel cut. If the battery terminal was reconnected, the vehicle must be driven at over 16 km/h to allow the ECM to lean the closed throttle position.
- When the vehicle is driven:
  The output voltage of the A/F sensor may be below 2.8 V during fuel enrichment. For the vehicle, this translates to a sudden increase in speed with the accelerator pedal fully depressed when trying to overtake another vehicle. The A/F sensor is functioning normally.
- The A/F sensor is a current output element, therefore the current is converted into voltage inside the ECM.
  If measuring voltage at the connectors of the A/F sensor or ECM, you will obtain a constant voltage.

OK	**GO TO STEP 14**

NG

3 INSPECT AIR FUEL RATIO SENSOR (RESISTANCE OF A/F SENSOR HEATER)

Component Side:



(a) Disconnect the A31 or A32 air fuel ratio sensor connector.

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

Standard resistance

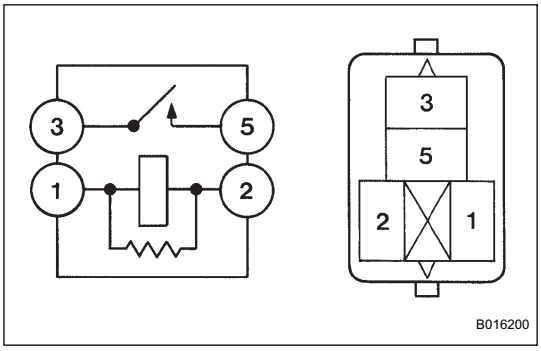
Tester Connection	Condition	Specified Condition
+B (A31-2) - HT (A31-1)	20°C (68°F)	0.8 to 1.4 Ω
+B (A31-2) - AF- (A31-4)	Always	10 kΩ or higher
+B (A32-2) - HT (A32-1)	20°C (68°F)	0.8 to 1.4 Ω
+B (A32-2) - AF- (A32-4)	Always	10 kΩ or higher

(c) Reconnect the air fuel ratio sensor connector.

NG → REPLACE AIR FUEL RATIO SENSOR

OK

4 INSPECT AIR FUEL RATIO SENSOR RELAY



(a) Remove the A/F relay from the No. 2 engine room R/B.

(b) Measure the resistance of the A/F relay.

Standard resistance

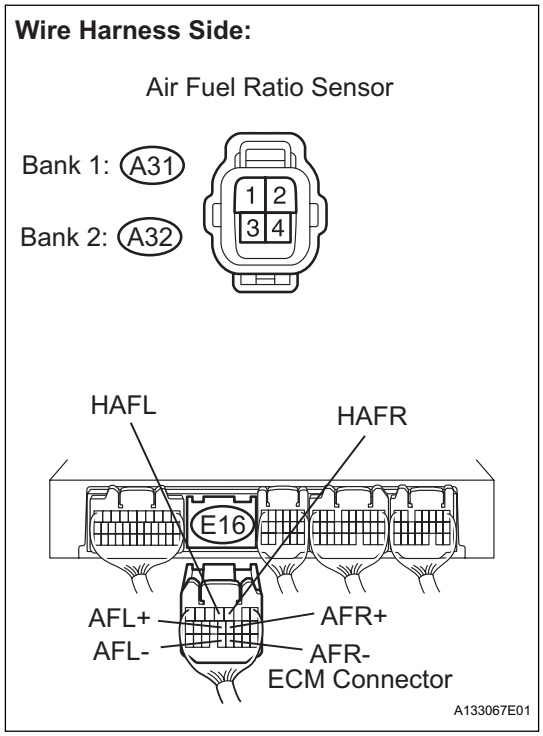
Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the A/F relay.

NG → REPLACE AIR FUEL RATIO SENSOR RELAY

OK

5	CHECK HARNESS AND CONNECTOR (A/F SENSOR - ECM)



(a) Disconnect the A31 and A32 air fuel ratio sensor connectors.
(b) Disconnect the E16 ECM connector.
(c) Measure the resistance between the terminals.
Standard resistance

Tester Connection	Specified Condition
AFR+ (E16-11) - AFR+ (A31-3)	Below 1 Ω
AFR- (E16-20) - AFR- (A31-4)	Below 1 Ω
HAFR (E16-3) - HAFR (A31-1)	Below 1 Ω
AFL+ (E16-12) - AFL+ (A32-3)	Below 1 Ω
AFL- (E16-21) - AFL- (A32-4)	Below 1 Ω
HAFL (E16-4) - HAFL (A32-1)	Below 1 Ω
AFR+ (E16-11) or AFR+ (A31-3) - Body ground	10 kΩ or higher
AFR- (E16-20) or AFR- (A31-4) - Body ground	10 kΩ or higher
HAFR (E16-3) or HAFR (A31-1) - Body ground	10 kΩ or higher
AFL+ (E16-12) or AFL+ (A32-3) - Body ground	10 kΩ or higher
AFL- (E16-21) or AFL- (A32-4) - Body ground	10 kΩ or higher
HAFL (E16-4) or HAFL (A32-1) - Body ground	10 kΩ or higher

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

OK

6	CHECK AIR INDUCTION SYSTEM

(a) Check for vacuum leaks in the air induction system.
OK:
No leak in the air induction system

NG → **REPAIR OR REPLACE AIR INDUCTION SYSTEM**

OK

7	CHECK EGR SYSTEM

NG → **REPAIR OR REPLACE EGR SYSTEM**

OK

8	CHECK FUEL PRESSURE

(a) Check the fuel pressure (high or low pressure).

Standard

Item	Specified Condition
Fuel pressure	304 to 343 kPa (3.1 to 3.5 kgf cm^2, 44 to 55 psi)

NG → REPAIR OR REPLACE FUEL SYSTEM

OK

9	INSPECT FUEL INJECTOR ASSEMBLY

Standard

Item	Specified Condition
Injection Volume	60 to 73 cm^3 (3.7 to 4.5 cu in)
Difference between each injector	13 cm^3 (0.8 cu in)

NG → REPLACE FUEL INJECTOR ASSEMBLY

OK

10	CHECK FOR EXHAUST GAS LEAKAGE

(a) Check for exhaust gas leaks in the exhaust system.
OK:
No leak in the exhaust system

NG → REPLACE EXHAUST GAS LEAKAGE POINT

OK

11	REPLACE AIR FUEL RATIO SENSOR

NEXT

12	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

NEXT

13	CHECK IF DTC RECURS (DTC P0125)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.

(c) Turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / DTC.
(e) Read DTCs.

Result

Display (DTC output)	Proceed To
No output	A
P0125	B

B → **REPLACE ECM**

A

END

14 PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

NEXT

15 CHECK IF DTC RECURS (DTC P0125)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / DTC.
(e) Read DTCs.

Result

Display (DTC output)	Proceed To
No output	A
P0125	B

B → **GO TO STEP 19**

A

16 REPLACE AIR FUEL RATIO SENSOR

NEXT

17 PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

NEXT

18	CHECK IF DTC RECURS (DTC P0125)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / DTC.
(e) Read DTCs.

Result

Display (DTC output)	Proceed To
No output	A
P0125	B

B → REPLACE ECM

A

END

19	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

(a) Has the vehicle run out of fuel in the past?

NO → CHECK FOR INTERMITTENT PROBLEMS

YES

DTC CAUSED BY RUNNING OUT OF FUEL

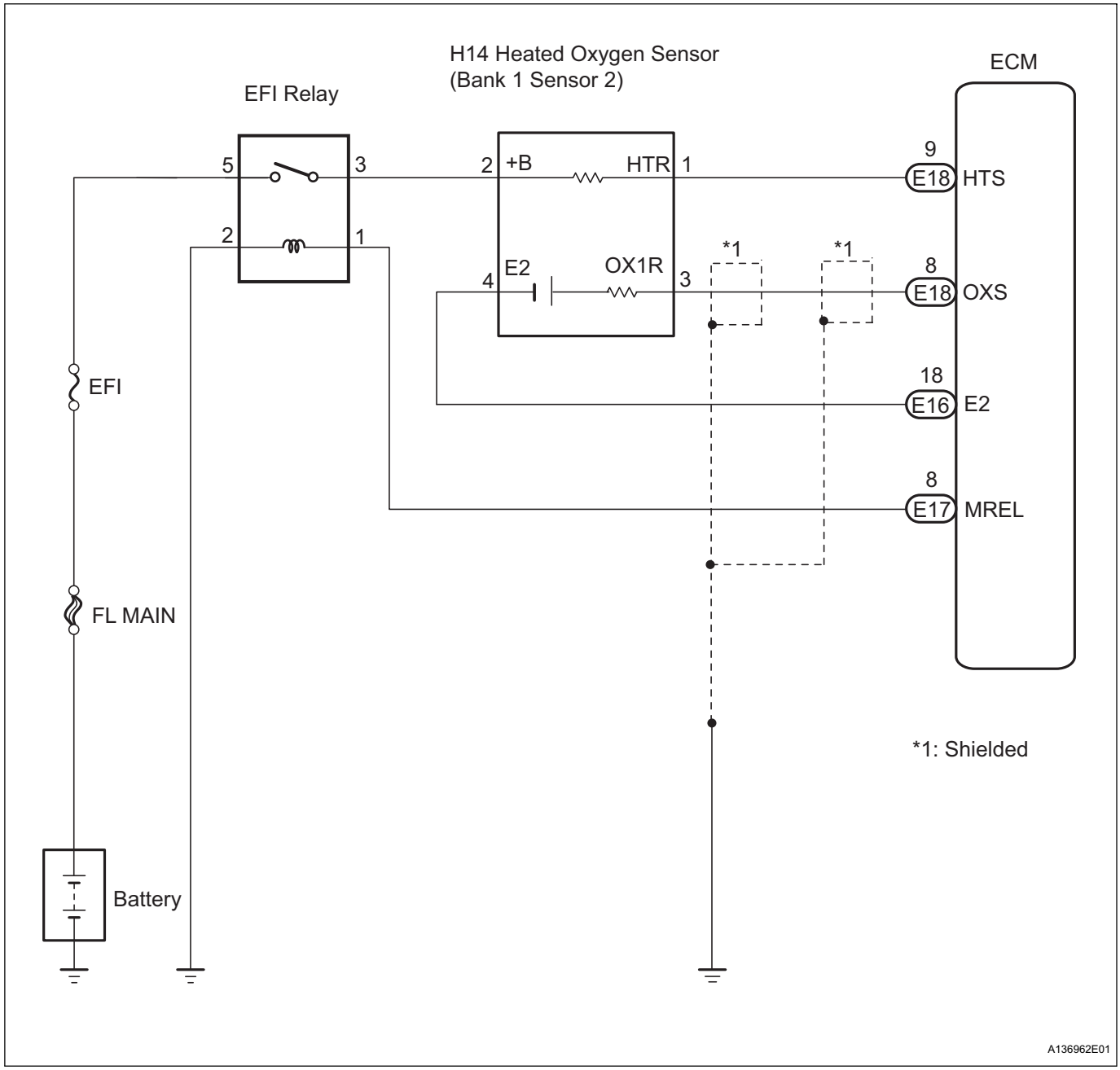
DTC	P0136	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)

DESCRIPTION

Refer to DTC P0125 (See page ES-55).

DTC No.	DTC Detection Condition	Trouble Area
P0136	Output voltage of heated oxygen sensor remains at 0.4 V or more or 0.6 V or less when vehicle is driven at 50 km/h or more after engine is warmed up (2 trip detection logic).	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Intelligent tester only:
Malfunctioning areas can be found by performing the Active Test / A/F Control operation. The A/F Control operation can determine if the A/F sensor, heated oxygen sensor or other potential trouble areas are malfunctioning or not.

1	CHECK FOR DTC OUTPUT

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / DTC.
(e) Read DTCs.

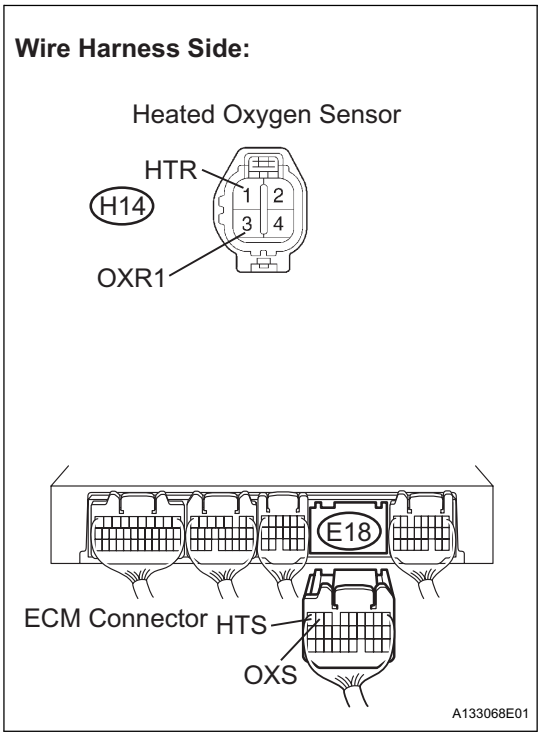
Result

Display (DTC output)	Proceed To
P0125	A
P0125 and other DTCs	B

B → GO TO DTC CHART (See page ES-23)

A

2	CHECK HARNESS AND CONNECTOR (ECM - OXYGEN SENSOR)



(a) Disconnect the H14 oxygen sensor connector.
(b) Disconnect the E18 ECM connector.
(c) Measure the resistance between the terminals.
Standard resistance

Tester Connection	Specified Condition
OXS (E18-8) - OXR1 (H14-3)	Below 1 Ω
HTS (E18-9) - HTR (H14-1)	Below 1 Ω
OXS (E18-8) or OXR1 (H14-3) - Body ground	10 kΩ or higher
HTS (E18-9) or HTR (H14-1) - Body ground	10 kΩ or higher

(d) Reconnect the oxygen sensor connector.
(e) Reconnect the ECM connector.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

3	CHECK OXYGEN SENSOR

(a) Connect the intelligent tester to the DLC3.
(b) Warm up the engine.
(c) Turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / O2S B1 S2.
(e) Check the oxygen sensor voltage.
Heated oxygen sensor output voltage:
Alternates between 0.4 V or less and 0.6 V or more

OK → **CHECK CONNECTOR CONNECTION CONDITION**

NG

REPLACE OXYGEN SENSOR

DTC	P0141	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)

DESCRIPTION

Refer to DTC P0125 (See page ES-55).

DTC No.	DTC Detection Connection	Trouble Area
P0141	• When heater operates, heater current exceeds 2.35 A (2 trip detection logic) • Heater current of 0.2 A or less when heater operates (2 trip detection logic)	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor • ECM

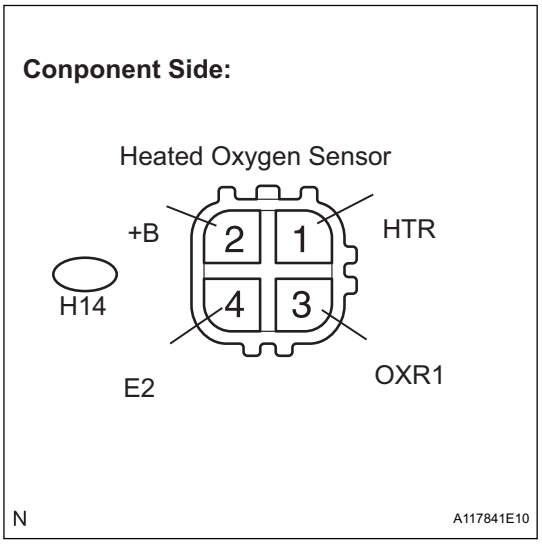
WIRING DIAGRAM

Refer to DTC P0136 (See Page ES-65).

INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	INSPECT HEATED OXYGEN SENSOR



(a) Disconnect the H14 heated oxygen sensor connector.
(b) Measure the resistance between the terminals.
Standard resistance

Tester Connection	Condition	Specified Condition
HTR (H14-1) - +B (H14-2)	20°C (68°F)	11 to 16 Ω

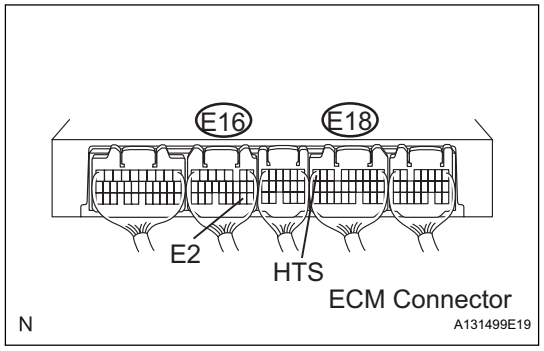
(c) Reconnect the oxygen sensor connector.

NG → REPLACE HEATED OXYGEN SENSOR

OK

2	INSPECT ECM

(a) Turn the ignition ON.



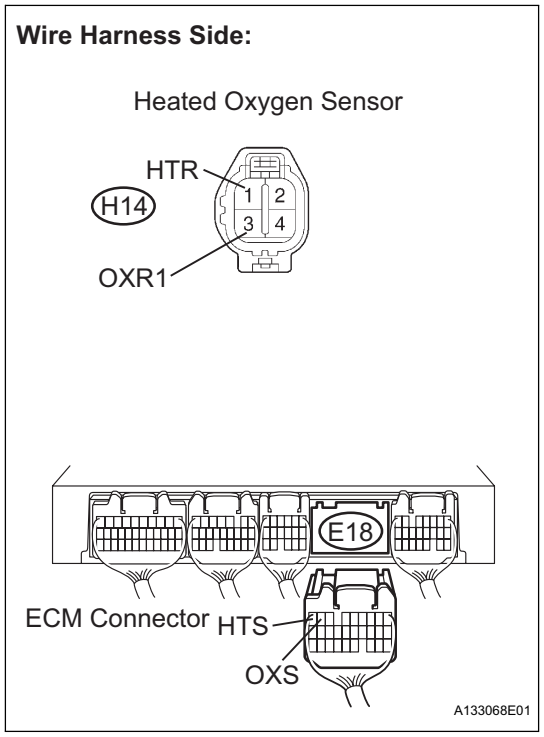
(b) Measure the voltage between the terminals.
Standard voltage

Tester Connection	Specified Condition
HTS (E18-9) - E2 (E16-18)	9 to 14 V

OK → **REPLACE ECM**

NG

3 CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - ECM)



(a) Disconnect the H14 oxygen sensor connector.
(b) Disconnect the E18 ECM connector.
(c) Measure the resistance between the terminals.
Standard resistance

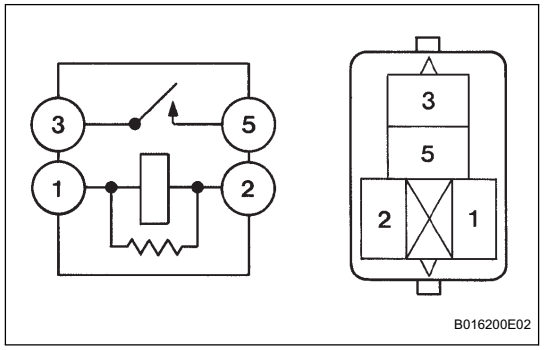
Tester Connection	Specified Condition
OXS (E18-8) - OXR1 (H14-3)	Below 1 Ω
HTS (E18-9) - HTR (H14-1)	Below 1 Ω
OXS (E18-8) or OXR1 (H14-3) - Body ground	10 kΩ or higher
HTS (E18-9) or HTR (H14-1) - Body ground	10 kΩ or higher

(d) Reconnect the heated oxygen sensor connector.
(e) Reconnect the ECM connector.

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

OK

4 CHECK EFI RELAY



(a) Remove the EFI relay from the engine room J/B.
(b) Measure the resistance according to the value(s) in the table below.
Standard resistance

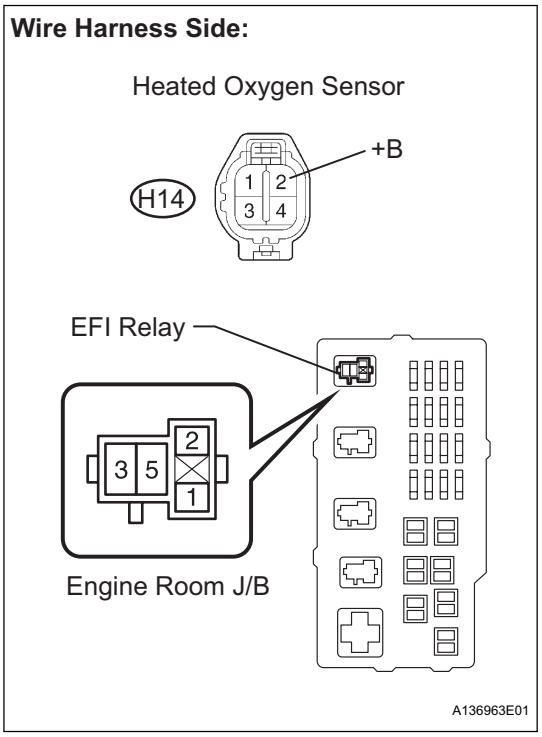
Tester Connection	Specified Condition
3-5	10 kΩ or higher
3-5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the EFI relay.

NG → REPLACE EFI RELAY

OK

5	CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - IGNITION SWITCH)



(a) Remove the EFI relay from the engine room J/B.
(b) Disconnect the H14 heated oxygen sensor connector.
(c) Measure the resistance between the terminals.

Standard resistance (Check for open)

Tester Connection	Specified Condition
+B (H14-2) - Engine room J/B EFI relay terminal 3	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
+B (H14-2) or Engine room J/B EFI relay terminal 3 - Body ground	10 kΩ or higher

(d) Reconnect the heated oxygen sensor connector.
(e) Reinstall the EFI relay.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM

DTC	P0171	System Too Lean (Bank 1)

DTC	P0172	System Too Rich (Bank 1)

DTC	P0174	System Too Lean (Bank 2)

DTC	P0175	System Too Rich (Bank 2)

DESCRIPTION

Fuel trim is related to the feedback compensation value, not to the basic injection time. Fuel trim includes short-term fuel trim and long-term fuel trim. Short-term fuel trim is the short-term fuel compensation used to maintain the air-fuel ratio at its ideal theoretical value.

The signal from the A/F sensor is approximately proportional to the existing air-fuel ratio, and the ECM compares it with the ideal theoretical value. The ECM reduces fuel volume immediately if the air-fuel ratio is RICH and increases fuel volume if it is LEAN.

Long-term fuel trim compensates for the deviation from the central value of the short-term fuel trim stored UP by each engine tolerance, and the deviation from the central value due to the passage of time and changes of environment.

If both the short-term fuel trim and long-term fuel trim exceed a certain value, it is detected as a malfunction and the MIL lights up.

DTC No.	DTC Detection Condition	Trouble Area
P0171 P0174	With warm engine and stable air-fuel ratio feedback, fuel trim considerably in error to lean side (2 trip detection logic)	• Air induction system • Injector blockage • Mass Air Flow (MAF) meter • Engine Coolant Temperature (ECT) sensor • Fuel pressure • Gas leakage from exhaust system • Open or short in air fuel ratio (sensor 1) circuit • Air fuel ratio (bank 1 sensor 1) • EFI relay • PCV valve and hose • PCV hose connections • ECM
P0172 P0175	With warm engine and stable air-fuel ratio feedback, fuel trim considerably in error to rich side (2 trip detection logic)	• Injector leakage or blockage • MAF meter • ECT sensor • Ignition system • Fuel pressure • Gas leakage from exhaust system • Open or short in air fuel ratio sensor (sensor 1) circuit • Air fuel ratio (sensor 1) • EFI relay • ECM

HINT:

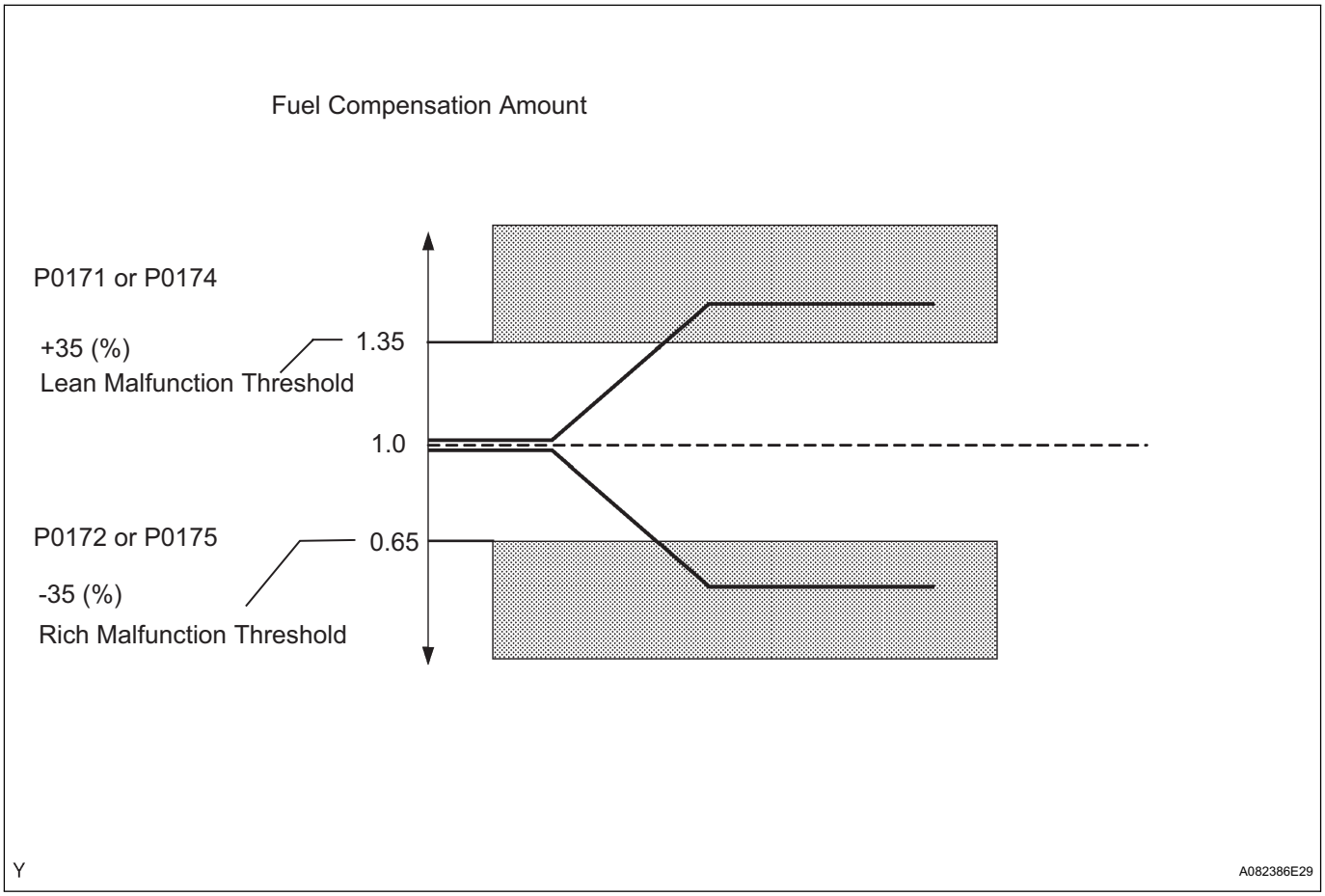
- When the DTC P0171 or P0174 is recorded, the actual air-fuel ratio is on the lean side. When DTC P0172 or P0175 is recorded, the actual air-fuel ratio is on the rich side.
- If the vehicle runs out of fuel, the air-fuel ratio is lean and DTC P0171 or P0174 may be set. The MIL is then illuminated.
- When the total of the short-term and long-term fuel trim values is within the malfunction threshold (and the engine coolant temperature is more than 75°C [167°F]), the system is functioning normally.

MONITOR DESCRIPTION

Under closed loop fuel control, fuel injection volumes that deviate from those estimated by the ECM cause changes in the long-term fuel trim compensation value. The long-term fuel trim is adjusted when there are persistent deviations in the short-term fuel trim values. Deviations from the ECM's estimated fuel injection volumes also affect the average fuel trim learning value, which is a combination of the average short-term fuel trim (fuel feedback compensation value) and the average long-term fuel trim (learning value of the air-fuel ratio). If the average fuel trim learning value exceeds the malfunction thresholds, the ECM interprets this as a fault in the fuel system and sets a DTC.

Example:

When the average fuel trim learning value is more than +35% or less than -35%, the ECM interprets this as a fuel system malfunction.



WIRING DIAGRAM

Refer to DTC P0125 (See page **ES-56**).

INSPECTION PROCEDURE

HINT:

Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	**CHECK OTHER DTC OUTPUT (IN ADDITION TO DTC P017, P0172, P0174 OR P0175)**

(a) Connect the intelligent tester to the DLC3.

(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
P0171, P0172, P0174 and/or P0175	A
P0171, P0172, P0174 and/or P0175 and other DTCs	B

HINT:
If any DTCs other than P0171, P0172, P0174 and/or P0175 are output, troubleshoot those DTCs first.

B → **GO TO DTC CHART (See page ES-23)**

A

2 CHECK CONNECTION OF PCV HOSE

OK:
The PCV hose is connected correctly and not damaged.

NG → **REPAIR OR REPLACE PCV HOSE**

OK

3 CHECK AIR INDUCTION SYSTEM

(a) Check for vacuum leaks in the air induction system.

NG → **REPAIR OR REPLACE AIR INDUCTION SYSTEM**

OK

4 PERFORM ACTIVE TEST BY INTELLIGENT TESTER (A/F CONTROL)

(a) Connect the intelligent tester to the DLC3.
(b) Start the engine and turn the intelligent tester ON.
(c) Warm up the engine at an engine speed of 2,500 rpm for approximately 90 seconds.
(d) Select the following menu items: Powertrain / Engine and ECT / Active Test / Injector Volume.
(e) Perform the Injector Volume operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume).
(f) Monitor the voltage output of the air fuel ratio sensors (AFS B1S1 and AFS B2S1, O2S B1S2) displayed on the tester.
HINT:
- The Injection Volume operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.

- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

Standard

Tester Display (Sensor)	Injection Volumes	Status	Voltages
AFS B1S1 AFS B2S1 (A/F)	+25%	Rich	More than 0.55
AFS B1S1 AFS B2S1 (Front HO2 Sensor)	-12.5%	Lean	Less than 0.4
O2S B1S2 (Rear HO2 Sensor)	+25%	Rich	More than 0.55
O2S B1S2 (Rear HO2 Sensor)	-12.5%	Lean	Less than 0.4

Result

Status AFS B1S1 or AFS B2S11	Status O2S B1S2	A/F Condition and A/F sensor Condition	Misfires	Suspected Trouble Areas	Proceed To
Lean/Rich	Lean/Rich	Normal	-	-	C
Lean	Lean	Actual air-fuel ratio lean	May occur	• Ventilation valve and hose • Ventilation hose connections • Injector blockage • Gas leakage from exhaust system • Air induction system • Fuel pressure • Mass Air Flow (MAF) meter • Engine Coolant Temperature (ECT) sensor	A
Rich	Rich	Actual air-fuel ratio rich	-	• Injector leakage or blockage • Gas leakage from exhaust system • Ignition system • Fuel pressure • MAF meter • ECT sensor	A
Lean	Lean/Rich	A/F sensor malfunction	-	• A/F sensor	B
Rich	Lean/Rich	A/F sensor malfunction	-	• A/F sensor	B

Lean: During Injection Volume, both the front and rear HO2 sensor output voltages (O2S) are consistently less than 0.4 V.
Rich: During Injection Volume, both of the O2S voltages are consistently more than 0.5 V.

B → GO TO STEP 10

C → GO TO STEP 14

A

5	READ VALUE OF INTELLIGENT TESTER (COOLANT TEMP)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Coolant Temp.
(d) Read the Coolant Temp twice, when the engine is cold and also when warmed up.
Standard:
With cold engine: Same as ambient air temperature.
With warm engine: 75°C to 95°C (167°F to 203°F)

NG → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK

6	READ VALUE OF INTELLIGENT TESTER (MAF)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / AFM and Coolant Temp.
(d) Allow the engine to idle until the Coolant Temp reaches 75°C (167°F).
(e) Read the AFM with the engine in an idling condition and at an engine speed of 2,500 rpm.
Standard:
MAF while engine idling: 1.4 g/sec. to 2.3 g/sec. (A/C: OFF).
MAF at engine speed of 2,500 rpm: 5.4 g/sec. to 7.9 g/sec. (A/C: OFF).

NG → **REPLACE MASS AIR FLOW METER**

OK

7	CHECK FUEL PRESSURE

(a) Check the fuel pressure (high or low pressure).

Standard

Item	Specified Condition
Fuel pressure	304 to 343 kPa (3.1 to 3.5 kgf cm^2, 44 to 55 psi)

NG → **REPAIR OR REPLACE FUEL SYSTEM**

OK

8	CHECK FOR EXHAUST GAS LEAKAGE

NG → REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT

OK

9	CHECK FOR SPARK

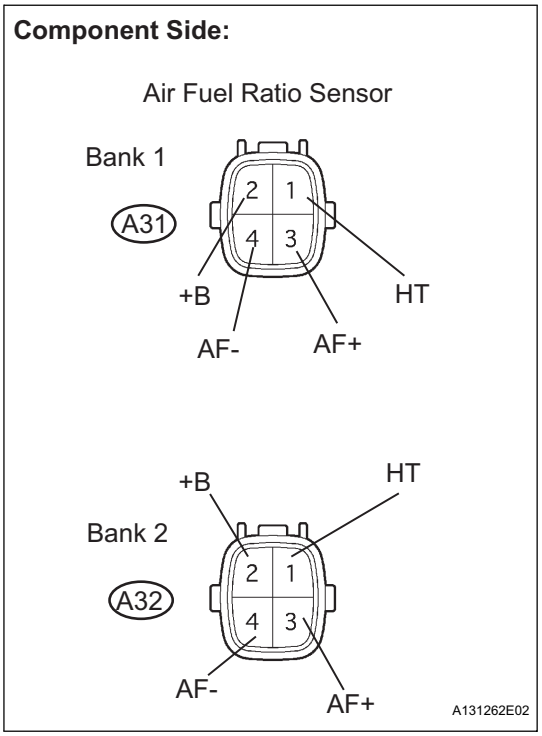
HINT:
If the spark plugs or ignition system malfunctions, engine misfire may occur. The misfire count can be read using the intelligent tester. Select the following menu items: Powertrain / Engine and ECT / Data List / Cylinder #1, #2, #3, #4 Misfire Rate.

NG → REPAIR OR REPLACE IGNITION SYSTEM

OK

10	INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)

Component Side:



(a) Disconnect the A31 and A32 air fuel ratio sensor connector.

(b) Measure the resistance between the terminals of the air fuel ratio sensor connector.

Standard resistance

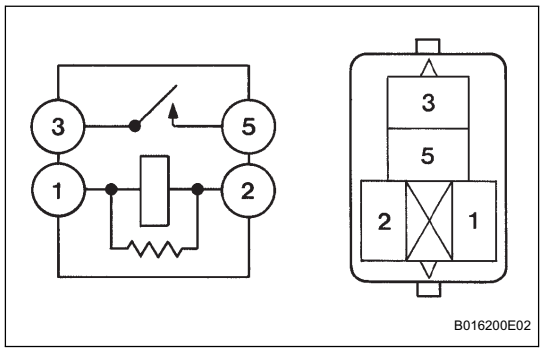
Tester Connection	Condition	Specified Condition
+B (A31-2) - HT (A31-1)	20°C (68°F)	0.8 to 1.4 Ω
+B (A31-2) - AF- (A31-4)	Always	10 kΩ or higher
+B (A32-2) - HT (A32-1)	20°C (68°F)	0.8 to 1.4 Ω
+B (A32-2) - AF- (A32-4)	Always	10 kΩ or higher

(c) Reconnect the air fuel ratio sensor connector.

NG → REPLACE HEATED OXYGEN SENSOR

OK

11 INSPECT AIR FUEL RATIO SENSOR RELAY



(a) Remove the A/F relay from the No. 2 engine room R/B.
(b) Measure the A/F relay resistance.
Standard resistance

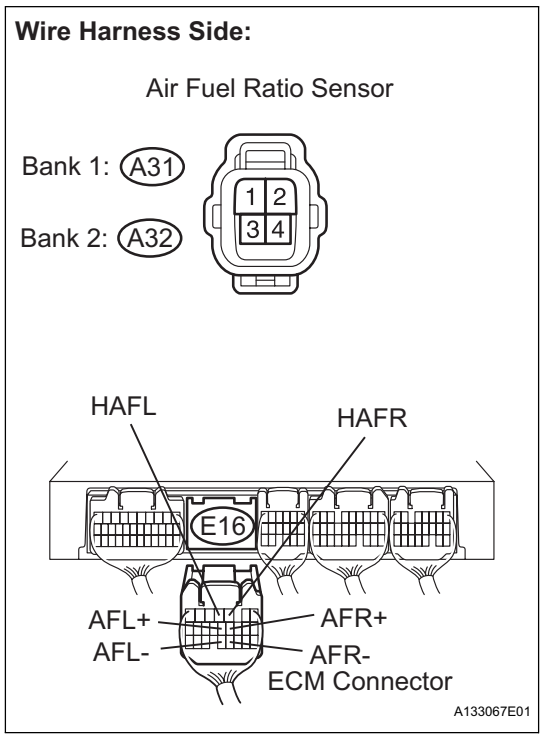
Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the A/F relay.

NG → **REPLACE AIR FUEL RATIO SENSOR RELAY**

OK

12 CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)



(a) Disconnect the A31 and A32 air fuel ratio sensor connectors.
(b) Disconnect the E16 ECM connector.
(c) Measure the resistance between the terminals.
Standard resistance

Tester Connection	Specified Condition
AFR+ (E16-11) - AFR+ (A31-3)	Below 1 Ω
AFR- (E16-20) - AFR- (A31-4)	Below 1 Ω
HAFR (E16-3) - HAFR (A31-1)	Below 1 Ω
AFL+ (E16-12) - AFL+ (A32-3)	Below 1 Ω
AFL- (E16-21) - AFL- (A32-4)	Below 1 Ω
HAFL (E16-4) - HAFL (A32-1)	Below 1 Ω
AFR+ (E16-11) or AFR+ (A31-3) - Body ground	10 kΩ or higher
AFR- (E16-20) or AFR- (A31-4) - Body ground	10 kΩ or higher
HAFR (E16-3) or HAFR (A31-1) - Body ground	10 kΩ or higher
AFL+ (E16-12) or AFL+ (A32-3) - Body ground	10 kΩ or higher
AFL- (E16-21) or AFL- (A32-4) - Body ground	10 kΩ or higher
HAFL (E16-4) or HAFL (A32-1) - Body ground	10 kΩ or higher

(d) Reconnect the air fuel ratio sensor connectors.
(e) Reconnect the ECM connector.

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

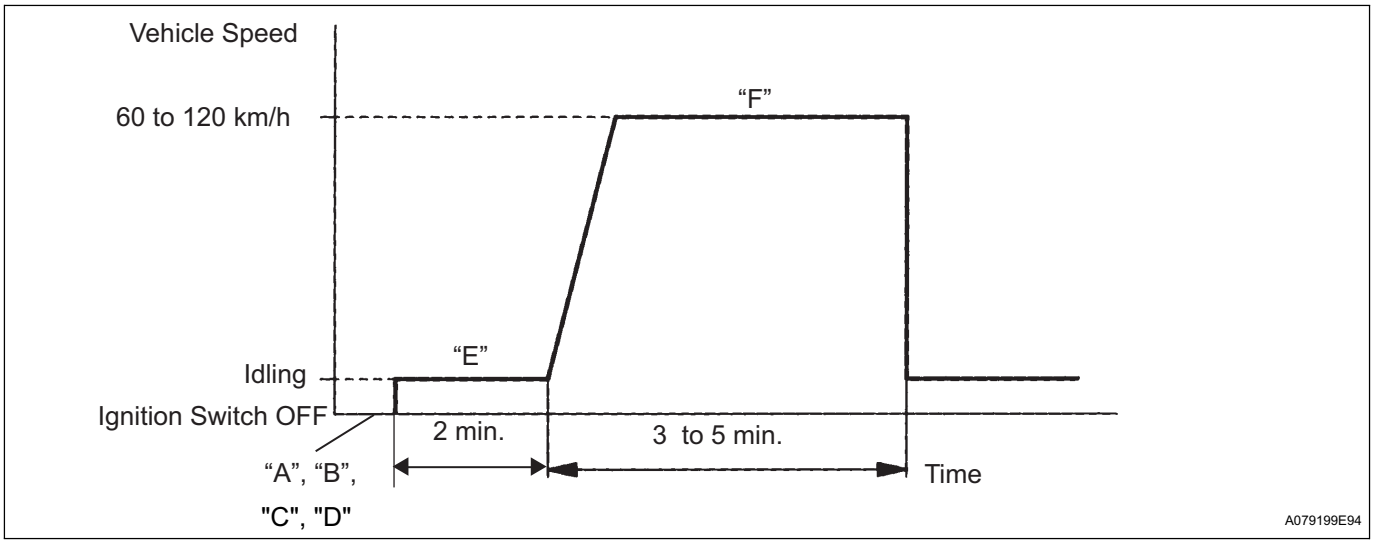
OK

13	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor.

NEXT

14	PERFORM CONFIRMATION DRIVING PATTERN



1. Connect the intelligent tester to the DLC3 (Procedure "A").
2. Turn the ignition switch to the ON position and turn the intelligent tester ON (Procedure "B").
3. Clear DTCs (Procedure "C") (See page ES-17).
4. Switch the ECM from normal mode to check mode using the intelligent tester (Procedure "D") (See page ES-18).
5. Start the engine and warm it up with all the accessories switched OFF (Procedure "E").
6. Drive the vehicle at between 60 and 120 km/h and at an engine speed of between 1,400 and 3,200 rpm for 3 to 5 minutes (Procedure "F").
   NOTICE:
   If the conditions in this test are not strictly followed, no malfunction will be detected.
   If you do not have an intelligent tester, turn the ignition switch OFF after performing procedure "E" and "F", then perform procedure "F" again.

NEXT

15	CHECK IF DTC OUTPUT RECURS (DTC P0171, P0172, P0174 OR P0175)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and the turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed To
P0171, P0172, P0174 and/or P0175	A
P0171, P0172, P0174 and/or P0175 and other DTCs	B

B → GO TO STEP 5

A

END

DTC	P0300	Random / Multiple Cylinder Misfire Detected
DTC	P0301	Cylinder 1 Misfire Detected
DTC	P0302	Cylinder 2 Misfire Detected
DTC	P0303	Cylinder 3 Misfire Detected
DTC	P0304	Cylinder 4 Misfire Detected
DTC	P0305	Cylinder 5 Misfire Detected
DTC	P0306	Cylinder 6 Misfire Detected

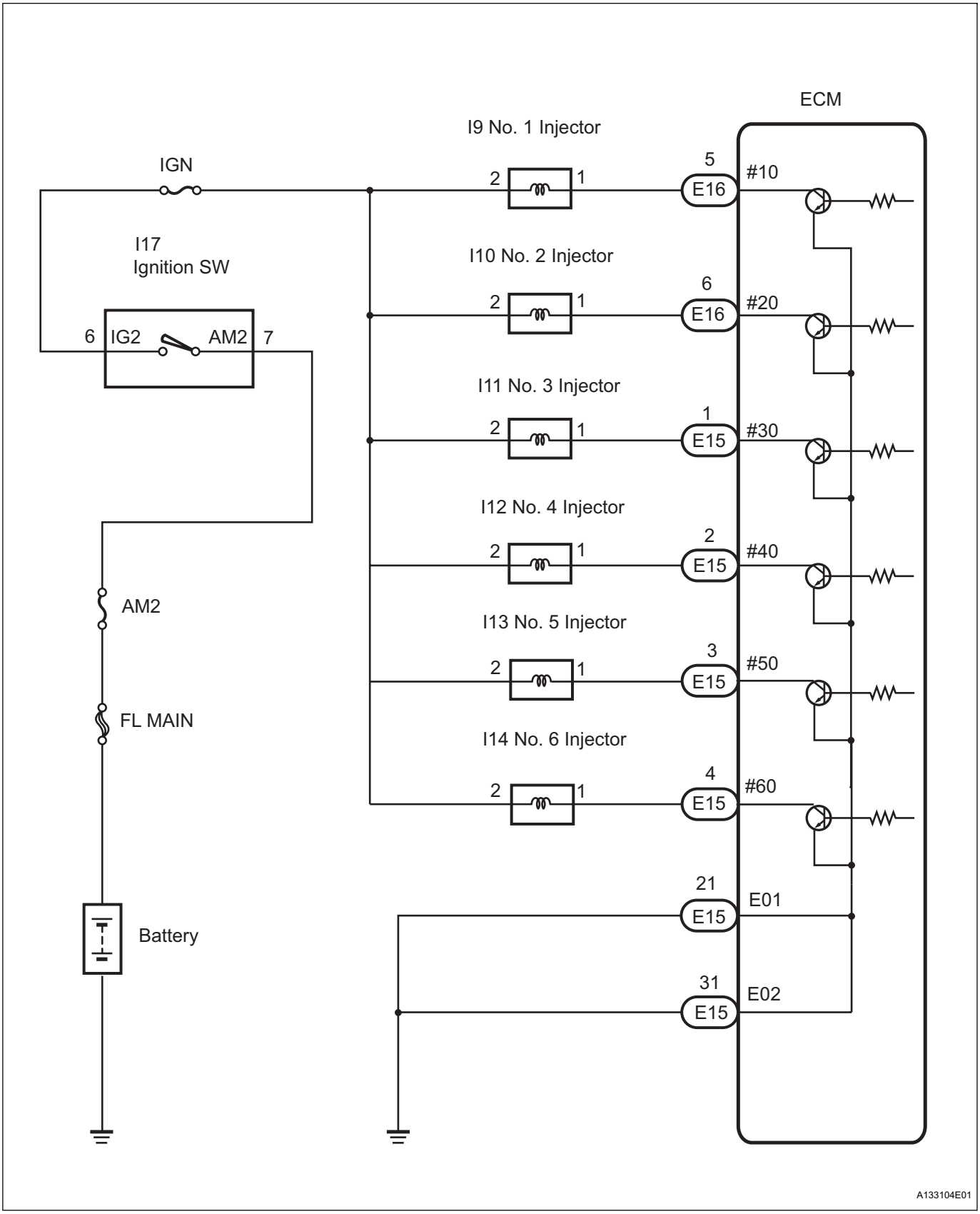
DESCRIPTION

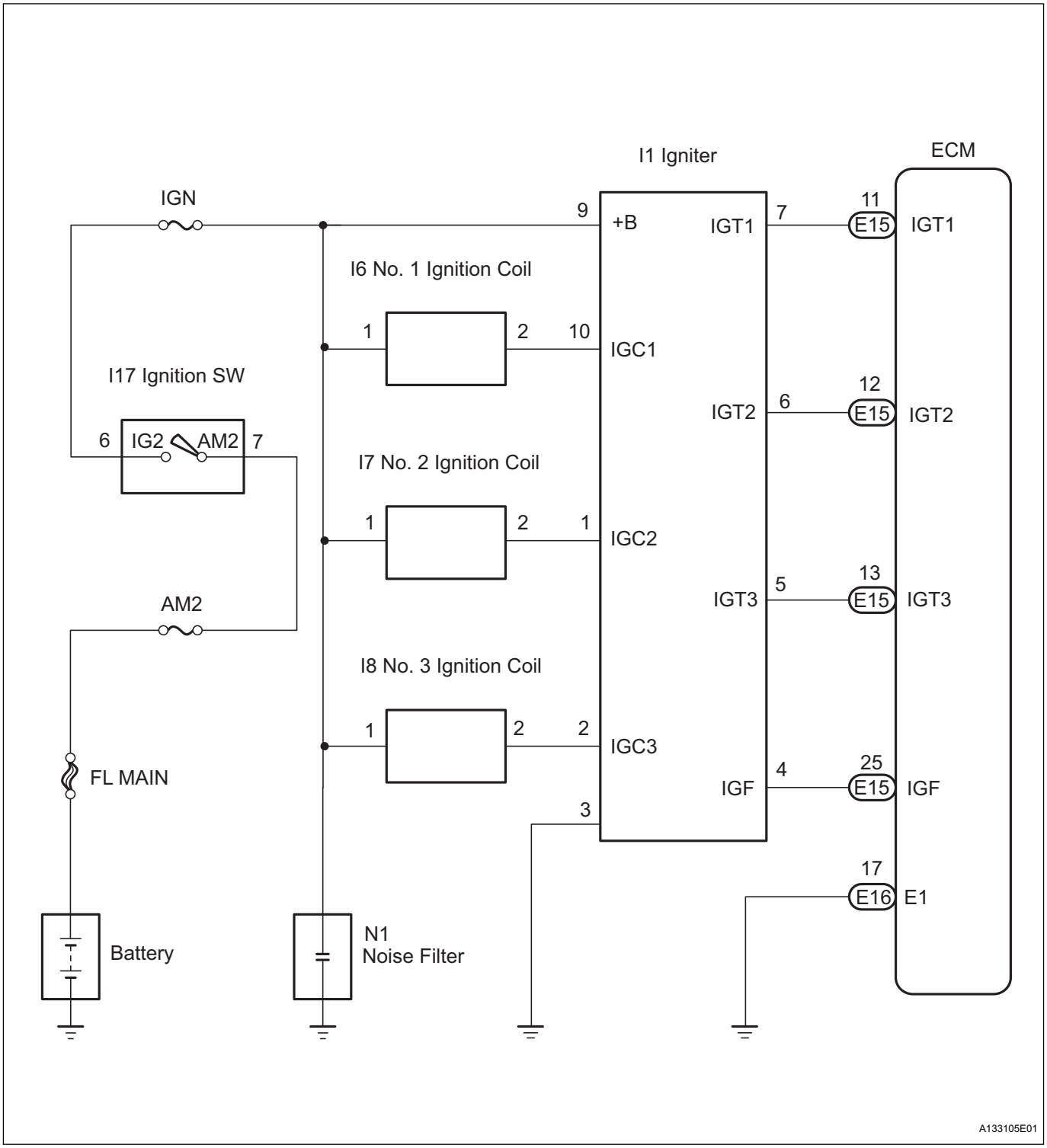
Misfire: The ECM uses the crankshaft position sensor and camshaft position sensor to monitor changes in the crankshaft rotation of each cylinder.
The ECM counts the number of indicating that misfire has occurred. When the misfire rate equals to or exceeds the count of indicating that the engine condition has deteriorated, the MIL lights up.
If the misfire rate is very high and the driving conditions cause the catalyst to overheat, the MIL shows an occurrence of misfire by blinking.

DTC No.	DTC Detection Condition	Trouble Area
P0300	Misfiring of random cylinders is detected during any particular 200 or 1,000 revolutions	• Open or short in engine wire harness • Connector connection • Vacuum hose connections • Ignition system • Injector • Fuel pressure • EGR system • Mass Air Flow (MAF) meter • Engine Coolant Temperature (ECT) sensor • Compression pressure • Valve clearance • Valve timing • PCV valve and hose • PCV hose connections • Air induction system • ECM
P0301 P0302 P0303 P0304 P0305 P0306	Either of the following conditions is met (a) For any particular 200 revolutions of engine, misfiring is detected which can cause catalyst to overheat (This causes MIL to blink) (b) For any particular 1,000 revolutions of engine, misfiring is detected which causes a deterioration in emission (2 trip detection logic)	

When DTCs for misfiring cylinders are randomly set, but DTC P0300 is not set, it indicates that misfires have been detected in different cylinders at different times. DTC P0300 is only set when several misfiring cylinders are detected at the same time.

WIRING DIAGRAM





CONFIRMATION DRIVING PATTERN

1. Connect the intelligent tester to the DLC3.
2. Turn the ignition switch to the ON position and turn the intelligent tester ON.
3. Note down the DTC(s) and freeze frame data.
4. Switch the ECM from normal mode to check mode using the intelligent tester.
5. Check the misfire counter values for each cylinder when idling. If the misfire counter value indicates 0, perform the following procedure of the confirmation driving pattern.

6. Drive the vehicle several times under an engine speed (Engine Speed), engine load (Calculate Load) and other condition stored in the freeze frame data.
   If you have no intelligent tester, turn the ignition switch off after the symptom is simulated once. Then repeat the simulation process again.
   HINT:
   In order to memorise the misfire DTCs, it is necessary to drive around Misfire RPM and Misfire Load in Data List for the following period of time. Do not turn the ignition switch off. Turning the ignition switch off switches the diagnosis system from check mode to normal mode. So all DTCs and other data will be erased.

Engine Speed	Time
Idling	5 minutes and 45 seconds or more
1,000 rpm	4 minutes or more
2,000 rpm	2 minute and 30 seconds or more
3,000 rpm	1 minute and 30 seconds or more

7. Check if there is DTC(s) to verify whether misfires have occurred. If DTC(s) is present, record the DTC(s) and freeze frame data.
8. Turn the ignition switch off and wait for at least 5 seconds.

INSPECTION PROCEDURE

HINT:

- If any DTCs other than the misfire DTCs are set simultaneously, first perform troubleshooting for them.
- If a misfire does not occur when the vehicle is brought to a workshop, a misfire can be confirmed by reproducing the condition of the freeze frame data. Also, after finishing repairs, confirm that misfires do not recur (see the confirmation driving pattern).
- Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.
- On 6 cylinder engines, misfiring cylinder identification cannot be identified at a high engine speed and only a general misfire DTC P0300 is stored instead of the individual misfiring cylinder DTCs (P0301 to P0306).
  If a misfire starts in a high engine speed area or a misfire occurs only in a high engine speed area, only DTC P0300 may be stored.
  When only a general misfire DTC P0300 is stored:
- Erase the general misfire DTC from the ECM using the intelligent tester.
- Start the engine and perform the confirmation driving pattern.
- Check the value of the misfire ratio for each cylinder. Or check the DTC(s).
- Perform repairs on the cylinder that has a high misfire ratio. Or repair the cylinder indicated by the DTC.
- After finishing repairs, perform the confirmation driving pattern again and confirm that no misfire occurs.
- When either of Short FT #1 or Long FT #1 in the freeze frame data is out of the range of +-20 %, there is a possibility that the air-fuel ratio is becoming rich (-20 % or less) or lean (+20 % or more).
- When Coolant Temp in the freeze frame data is less than 80°C (176°F), there is a possibility that misfires occur only during engine warm-up.
- If a misfire cannot be reproduced, the following reasons may apply: 1) the vehicle has low fuel, 2) improper fuel is being used, and 3) the ignition plug has been contaminated.
- Be sure to check the misfire counter value after repairs.

1	CHECK ANY OTHER DTC OUTPUT (IN ADDITION TO MISFIRE DTCS)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the tester ON.
(d) Enter the following menus: Power train / Engine and ECT / DTC.
(e) Read DTCs.

Result

Display (DTC output)	Proceed to
P0300, P0301, P0302, P0303, P0304, P0305 and/or P0306	A
P0300, P0301, P0302, P0303, P0304, P0305 and/or P0306 and other DTCs	B

HINT:
If any DTCs other than P0300, P0301, P0302, P0303, P0304, P0305 and P0306 are output, troubleshoot those DTCs first.

B → **GO TO DTC CHART (See page ES-23)**

A

2	CHECK CONNECTOR CONNECTION CONDITION

(a) Check the connection condition of the wire harness and connector.
OK:
Connectors are connected correctly.

NG → **REPAIR CONNECTOR CONNECTION CONDITION**

OK

3	CHECK VACUUM HOSE

(a) Check the connection and blockage of the vacuum hose.
OK:
Vacuum hose is connected correctly and is not damaged.

MG → **REPAIR OR REPLACE VACUUM HOSE**

OK

4	CHECK PCV HOSE (CONNECTION)

OK:
PCV hose is connected correctly and is not damaged.

NG → **REPAIR OR REPLACE PCV HOSE**

OK

5	READ VALUE OF INTELLIGENT TESTER (NUMBER OF MISFIRING CYLINDERS)

(a) Connect the intelligent tester.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester ON.
(d) Start the engine.
(e) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Data List / Cylinder #1 Misfire Rate - Cylinder #6 Misfire Rate.
(f) Check the number of misfiring cylinders on the intelligent tester.
HINT:
When a misfire is not reproduced, proceed to the next step based on the stored DTC.

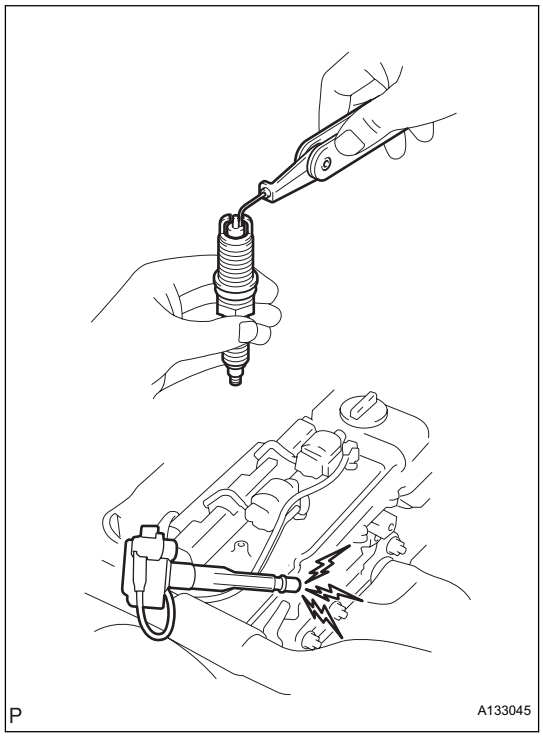
Result

High Misfire Rate Cylinder	Proceed To
1 or 2 cylinder	A
More than 3 cylinder	B

B → GO TO STEP 22

A

6	CHECK FOR SPARK



(a) Remove the ignition coil assembly.
(b) Remove the spark plug.
(c) Check the spark plug type.
Recommended spark plug

Supplier	Type
DENSO	PK20TR11
NGK	BKR6EKPB11

(d) Check the spark plug electrode gap.
Standard:
1.1 mm (0.043 in)
NOTICE:
If adjusting the gap of a new spark plug, bend only the ground electrode. Do not touch the tip. Never attempt to adjust the gap of a used plug.
(e) Check the electrode for carbon deposits.
(f) Perform a spark test.
CAUTION:
Absolutely disconnect each injector connector.
NOTICE:
Do not crank the engine for more than 10 seconds.
(1) Install the spark plug to the ignition coil, and connect the ignition coil connector.
(2) Disconnect the injector connector.
(3) Ground the spark plug.

(4) Check if a spark occurs while the engine is being cranked.
OK:
A spark jumps across the electrode gap.

(g) Reinstall the spark plug.
(h) Reinstall the ignition coil assembly.

OK	GO TO STEP 15

NG

7	INSTALL A NEW SPARK PLUG AND CHECK FOR SPARK

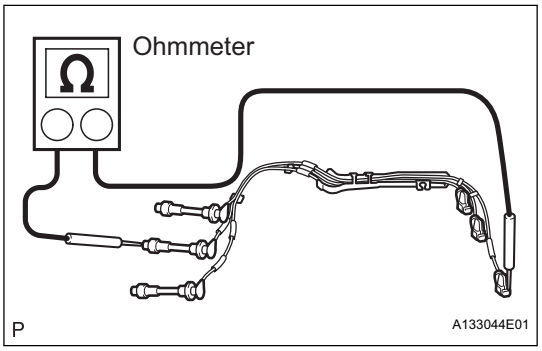
(a) Change the spark plug with a normal spark plug.
(b) Perform a spark test.
CAUTION:
Absolutely disconnect each injector connector.
NOTICE:
Do not crank the engine for more than 10 seconds.
(1) Install the spark plug to the ignition coil, and connect the ignition coil connector.
(2) Disconnect the injector connector.
(3) Ground the spark plug.
(4) Check if a spark occurs while the engine is being cranked.
OK:
A spark jumps across the electrode gap.

NG	GO TO STEP 8

OK

REPLACE SPARK PLUG

8	INSPECT SPARK PLUG RESISTIVE CORD



(a) Remove the spark plug resistive cords.
(b) Using an ohmmeter, measure the resistance between the terminals.
Standard resistance

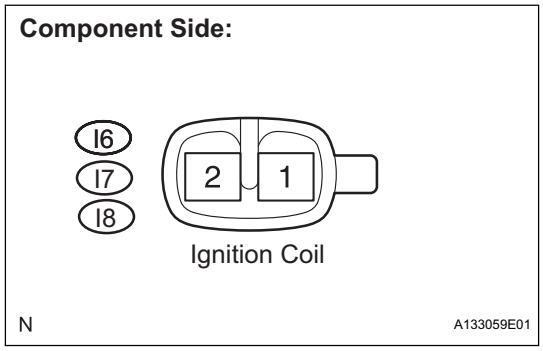
Code No.	Specified Condition
No. 1 spark plug resistive cord	8.87 to 20.51 kΩ
No. 2 spark plug resistive cord	11.28 to 25.82 kΩ
No. 3 spark plug resistive cord	10.02 to 23.04 kΩ

(c) Reinstall the spark plug resistive cords.

NG	REPLACE SPARK PLUG RESISTIVE CORD

OK

9 INSPECT IGNITION COIL ASSEMBLY

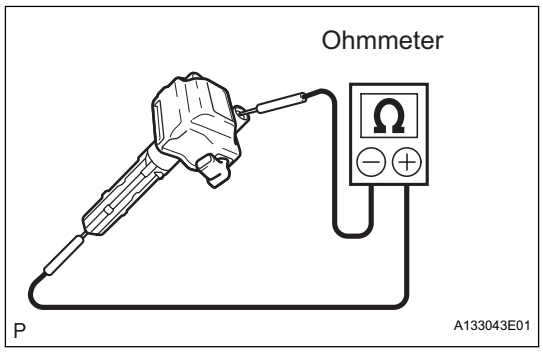


(a) Disconnect the I6, I7 and I8 ignition coil connectors.
(b) Measure the primary coil resistance between the terminals.

Standard resistance

Connector Condition	Condition	Specified Condition
I6-1 - I6-2	20°C (68°F)	0.76 to 0.84 Ω
I7-1 - I7-2	20°C (68°F)	0.76 to 0.84 Ω
I8-1 - I8-2	20°C (68°F)	0.76 to 0.84 Ω

(c) Remove the ignition coil.



(d) Measure the secondary resistance between the terminals.

Standard resistance

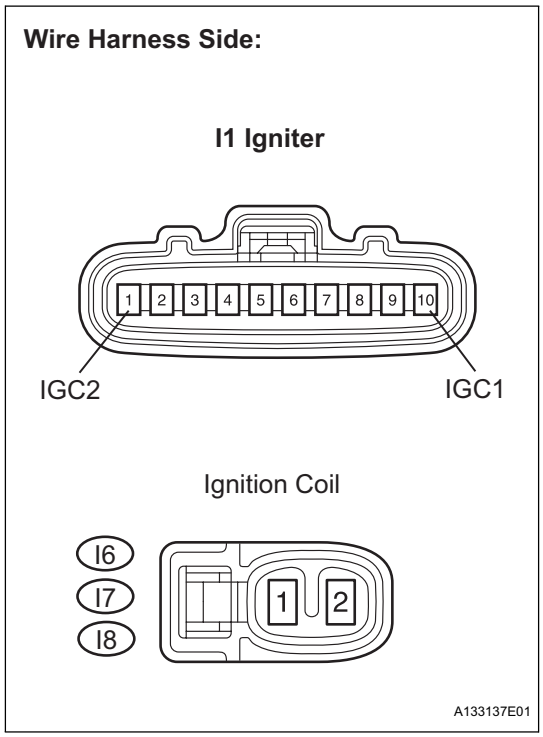
Tester Connection	Condition	Specified Condition
Spark plug side - Resistive cord side	20°C (68°F)	11.7 to 13.3 kΩ

(e) Reinstall the ignition coil.
(f) Reconnect the ignition coil connectors.

NG → **REPLACE IGNITION COIL ASSEMBLY**

OK

10 CHECK HARNESS AND CONNECTOR (IGNITION COIL - IGNITER)



(a) Disconnect the I1 igniter connector.
(b) Disconnect the I6, I7 and I8 ignition coil connectors.
(c) Measure the resistance between the terminals.

Standard resistance

Tester Connection	Specified Condition
IGC1 (I1-10) - I6-2	Below 1 Ω
IGC2 (I1-1) - I7-2	Below 1 Ω
IGC2 (I1-1) - I8-2	Below 1 Ω
IGC1 (I1-10) or I6-2 - Body ground	10 kΩ or higher
IGC2 (I1-1) or I7-2 - Body ground	10 kΩ or higher
IGC2 (I1-1) or I8-2 - Body ground	10 kΩ or higher

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

OK

11	CHECK HARNESS AND CONNECTOR (IGNITION COIL - ENGINE ROOM J/B)

(a) Disconnect the I6, I7 and I8 ignition coil connectors.
(b) Remove the IGN fuse from the engine room J/B.
(c) Measure the resistance between the terminals.

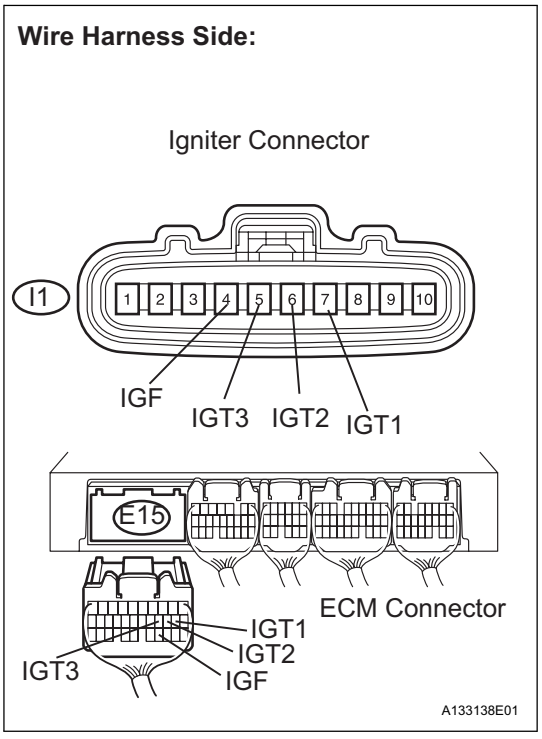
Standard resistance

Tester Connection	Specified Condition
I6-1 - Engine room J/B IGN fuse	Below 1 Ω
I7-1 - Engine room J/B IGN fuse	Below 1 Ω
I8-1 - Engine room J/B IGN fuse	Below 1 Ω
I6-1 or Engine room J/B IGN fuse - Body ground	10 kΩ or higher
I7-1 or Engine room J/B IGN fuse - Body ground	10 kΩ or higher
I8-1 or Engine room J/B IGN fuse	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

12	CHECK HARNESS AND CONNECTOR (ECM - IGNITER)



(a) Disconnect the E15 ECM connector.
(b) Disconnect the I1 igniter connector.
(c) Measure the resistance between the terminals.

Standard resistance

Tester Connection	Specified Condition
IGT1 (E15-11) - IGT1 (I1-7)	Below 1 Ω
IGT2 (E15-12) - IGT2 (I1-6)	Below 1 Ω
IGT3 (E15-13) - IGT3 (I1-5)	Below 1 Ω
IGF (E15-25) - IGF (I1-4)	Below 1 Ω
IGT1 (E15-11) or IGT1 (I1-7) - Body ground	10 kΩ or higher
IGT2 (E15-12) or IGT2 (I1-6) - Body ground	10 kΩ or higher
IGT3 (E15-13) or IGT3 (I1-5) - Body ground	10 kΩ or higher
IGF (E15-25) or IGF (I1-4) - Body ground	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

13	INSPECT ECM (IGF VOLTAGE)

(a) Disconnect the I1 igniter connector.
(b) Turn the ignition switch ON.

(c) Measure the voltage between the terminals.
Standard voltage

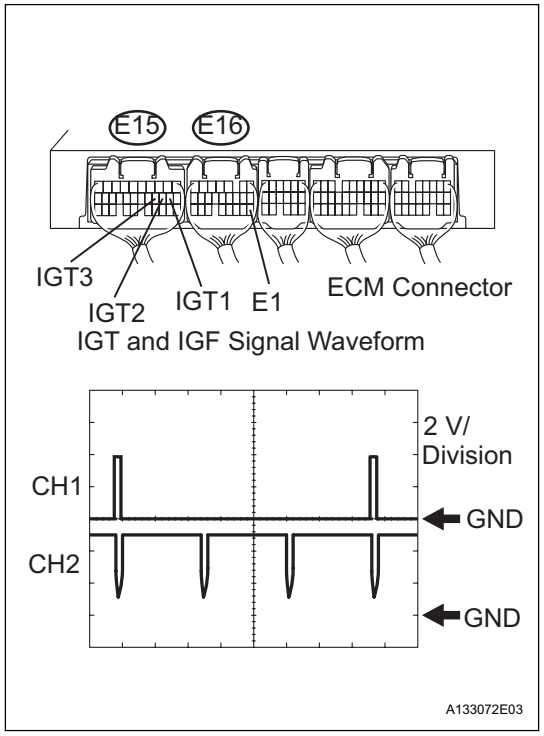
Tester Connection	Specified Condition
IGF (E15-25) - E1 (E16-17)	4.5 to 5.5 V

(d) Reconnect the igniter connector.

NG → **REPLACE ECM**

OK

14 INSPECT ECM (IGT1, IGT2 OR IGT3 VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage between the applicable terminals of the E15 and E16 ECM connectors.
Standard voltage

Tester Connection	Specified Condition
IGT1 (E15-11) - E1 (E16-17)	0.1 to 4.5 V
IGT2 (E15-12) - E1 (E16-17)	0.1 to 4.5 V
IGT3 (E15-13) - E1 (E16-17)	0.1 to 4.5 V

(c) Disconnect the I1 igniter connector.
(d) Measure the voltage of the ECM connector when the engine is cranked.
Standard voltage

Tester Connection	Specified Condition
IGT1 (E15-11) - E1 (E16-17)	4.5 V or more
IGT2 (E15-12) - E1 (E16-17)	4.5 V or more
IGT3 (E15-13) - E1 (E16-17)	4.5 V or more

HINT:
Reference:
Inspection using the oscilloscope. During cranking or idling, check the waveform of the ECM connectors.
Standard

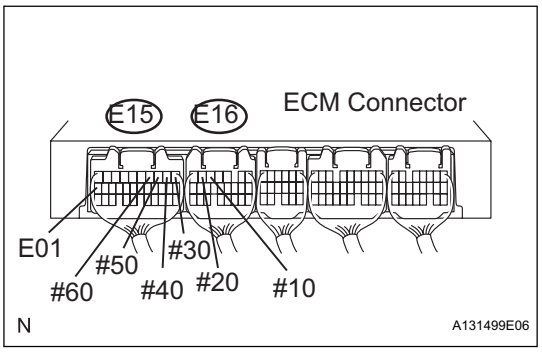
Tester Connection	Specified Condition
IGT1 (E15-11) - E1 (E16-17)	Correct waveform appears as shown
IGT2 (E15-12) - E1 (E16-17)	Correct waveform appears as shown
IGT3 (E15-13) - E1 (E16-17)	Correct waveform appears as shown

NG → **REPLACE ECM**

OK

REPLACE IGNITER ASSEMBLY

15 INSPECT ECM (#10, #20, #30, #40, #50 or #60 VOLTAGE)

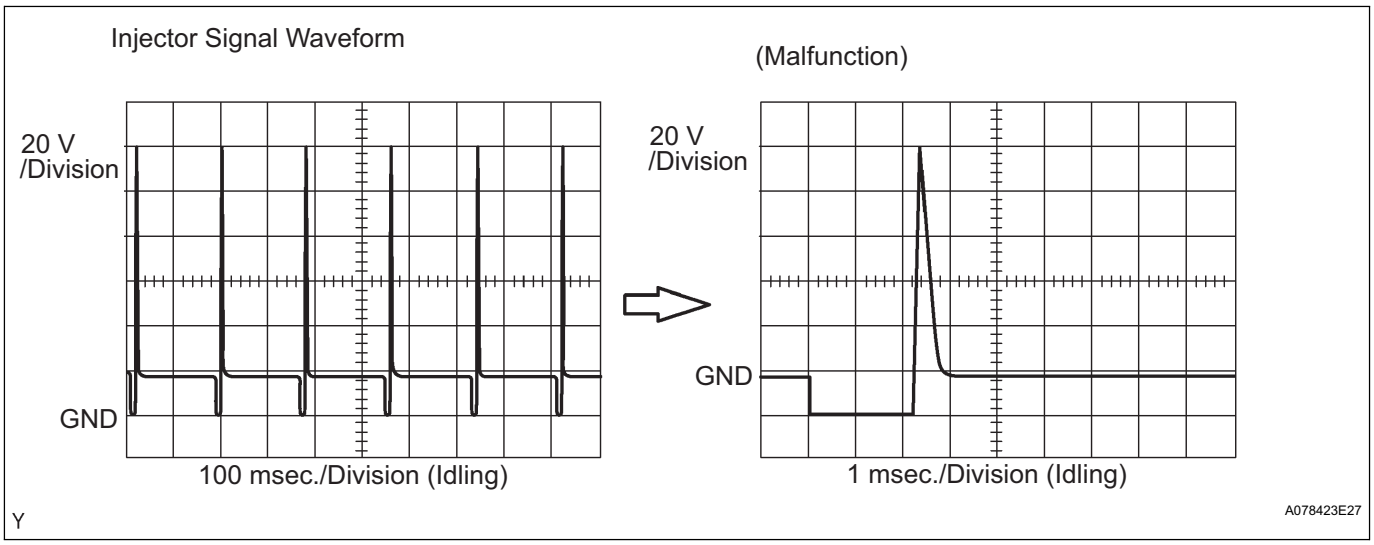


(a) Turn the ignition switch ON.
(b) Measure the voltage between the applicable terminals of E15 and E16 ECM connectors.
Standard voltage

Tester Connection	Specified Condition
#10 (E16-5) - E01 (E15-21)	9 to14 V
#20 (E16-6) - E01 (E15-21)	9 to14 V
#30 (E15-1) - E01 (E15-21)	9 to14 V
#40 (E15-2) - E01 (E15-21)	9 to14 V
#50 (E15-3) - E01 (E15-21)	9 to14 V
#60 (E15-4) - E01 (E15-21)	9 to14 V

HINT:
Reference: Inspection using the oscilloscope. During cranking or idling, check the waveform between the terminals of the ECM connector.

Tester Connection	Condition	Specified Condition
#10 to #60	Engine idling	Correct waveform appears as shown



OK → GO TO STEP 18

NG

16 INSPECT FUEL INJECTOR ASSEMBLY

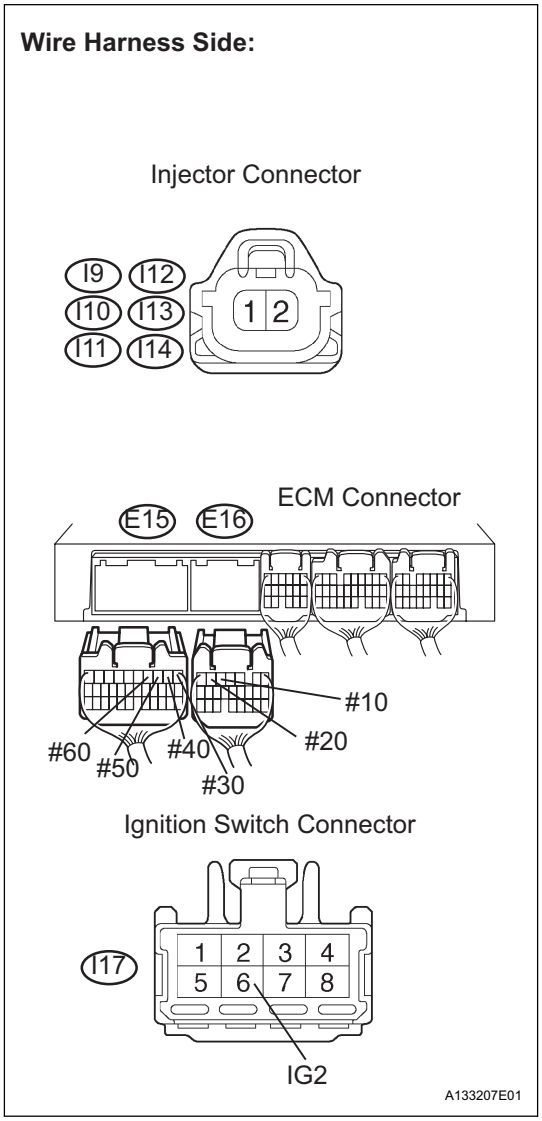
(a) Remove the injector.
(b) Measure the resistance between the terminals.
Standard resistance

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	13.4 to 14.2 Ω

NG → REPLACE FUEL INJECTOR ASSEMBLY

OK

17 CHECK HARNESS AND CONNECTOR (INJECTOR - ECM, INJECTOR - IGNITION SWITCH)



(a) Check the harness and connector between the injector connector and the ECM connector.
   (1) Disconnect the I9, I10, I11, I12, I13 or I14 injector connector.
   (2) Disconnect the E15 and E16 ECM connectors.
   (3) Measure the resistance between the terminals.
   Standard resistance

Tester Connection	Specified Condition
No. 1 injector (I9-1) - #10 (E16-5)	Below 1 Ω
No. 2 injector (I10-1) - #20 (E16-6)	Below 1 Ω
No. 3 injector (I11-1) - #30 (E15-1)	Below 1 Ω
No. 4 injector (I12-1) - #40 (E15-2)	Below 1 Ω
No. 5 injector (I13-1) - #50 (E15-3)	Below 1 Ω
No. 6 injector (I14-1) - #60 (E15-4)	Below 1 Ω
No. 1 injector (I9-1) or #10 (E16-5) - Body ground	10 kΩ or higher
No. 2 injector (I10-1) or #20 (E16-6) - Body ground	10 kΩ or higher
No. 3 injector (I11-1) or #30 (E15-1) - Body ground	10 kΩ or higher
No. 4 injector (I12-1) or #40 (E15-2) - Body ground	10 kΩ or higher
No. 5 injector (I13-1) or #50 (E15-3) - Body ground	10 kΩ or higher
No. 6 injector (I14-1) or #60 (E15-4) - Body ground	10 kΩ or higher

   (4) Reconnect the injector connector.
   (5) Reconnect the ECM connectors.

(b) Check the harness and the connector between the injector connector and the ignition switch connector.
   (1) Disconnect the I9, I10, I11, I12, I13 or I14 injector connector.
   (2) Disconnect the I17 ignition switch connector.
   (3) Measure the resistance between the terminals.
   Standard resistance

Tester Connection	Specified Condition
No. 1 injector (I9-1) - IG2 (I17-6)	Below 1 Ω
No. 2 injector (I10-1) - IG2 (I17-6)	Below 1 Ω
No. 3 injector (I11-1) - IG2 (I17-6)	Below 1 Ω
No. 4 injector (I12-1) - IG2 (I17-6))	Below 1 Ω
No. 5 injector (I13-1) - IG2 (I17-6)	Below 1 Ω
No. 6 injector (I14-1) - IG2 (I17-6)	Below 1 Ω
No. 1 injector (I9-1) or IG2 (I17-6) - Body ground	10 kΩ or higher
No. 2 injector (I10-1) or IG2 (I17-6) - Body ground	10 kΩ or higher
No. 3 injector (I11-1) or IG2 (I17-6) - Body ground	10 kΩ or higher

Tester Connection	Specified Condition
No. 4 injector (I12-1) or IG2 (I17-6) - Body ground	10 kΩ or higher
No. 5 injector (I13-1) or IG2 (I17-6) - Body ground	10 kΩ or higher
No. 6 injector (I14-1) or IG2 (I17-6) - Body ground	10 kΩ or higher

(4) Reconnect the ignition switch connector.
(5) Reconnect the injector connector.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

18 INSPECT FUEL INJECTOR ASSEMBLY (INJECTION VOLUME)

(a) Inspect the fuel injector assembly.

Standard

Injection Volume	Difference between each injector
60 to 73 cm^3 (3.7 to 4.5 cu in)	13 cm^3 (0.8 cu in)

NG → REPLACE FUEL INJECTOR ASSEMBLY

OK

19 CHECK CYLINDER COMPRESSION PRESSURE

(a) Inspect cylinder compression pressure.

Compression Pressure	Minimum Pressure	Difference between each cylinder
1.5 Mpa (15.3 kgf cm^2, 218 psi)	1.0 Mpa (10.2 kgf cm^2, 145 psi)	100 kPa (1.0 kgf cm^2, 15 psi)

NG → REPAIR OR REPLACE ENGINE TO DETERMINE CAUSE OF LOW COMPRESSION

OK

20 CHECK VALVE CLEARANCE (MISFIRING CYLINDER)

(a) Inspect the valve clearance.

Standard (Cold)

Item	Specified Condition
Intake	0.15 to 0.25 mm (0.0059 to 0.0098 in)
Exhaust	0.25 to 0.35 mm (0.0098 to 0.1138 in)

NG → ADJUST VALVE CLEARANCE

OK

21	READ VALUE OF INTELLIGENT TESTER (NUMBER OF MISFIRE CYLINDER)

HINT:
- If the result of step 5 is "1 or 2 cylinders", proceed to A.
- If the result of step 5 is "more than 3 cylinders", proceed to B.

B → **CHECK FOR INTERMITTENT PROBLEMS**

A

22	CHECK VALVE TIMING

(a) Check for looseness or jumping teeth of the timing belt.
OK:
The matchmarks of the crankshaft pulley and camshaft pulley are aligning.

NG → **ADJUST VALVE TIMING**

OK

23	CHECK FUEL PRESSURE

(a) Check the fuel pressure.
Standard:
304 to 343 kPa (3.1 to 3.5 kgf cm^2, 44 to 55 psi)

NG → **CHECK AND REPLACE FUEL PUMP, PRESSURE REGULATOR, FUEL PIPE LINE AND FILTER**

OK

24	READ VALUE OF INTELLIGENT TESTER

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester ON.
(d) Check the intake air temperature.
  (1) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Data List / Intake Air.
(e) Check the mass air flow rate.
  (1) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Data List / AFM.
  (2) Read the values.

Standard

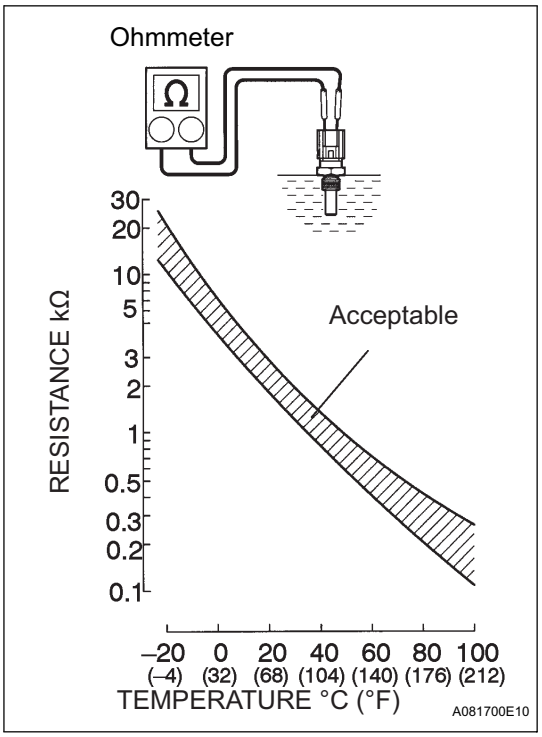
Condition	Air Flow Rate (gm/s)
Ignition switch ON (do not start engine)	0
Idling	4 to 6

Condition	Air Flow Rate (gm/s)
Running without load (2,500 rpm)	13 to 20
Idling to quickly accelerating	Air flow rate fluctuates

NG → REPLACE MASS AIR FLOW METER

OK

25 INSPECT ENGINE COOLANT TEMPERATURE SENSOR



(a) Remove the engine coolant temperature sensor.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	2.32 to 2.59 kΩ
1 - 2	80°C (176°F)	0.310 to 0.326 kΩ

NOTICE:
When checking the engine coolant temperature sensor in water, be careful not to allow water to contact the terminals. After performing the check, dry the sensor.
HINT:
Alternate procedure: Connect an ohmmeter to the installed engine coolant temperature sensor and read the resistance. Use an infrared thermometer to measure the engine temperature in the immediate vicinity of the sensor. Compare these values to the resistance/temperature graph. Change the engine temperature (warm up or allow to cool down) and repeat the test.

NG → REPLACE ENGINE COOLANT TEMPERATURE SENSOR

OK

26 READ VALUE OF INTELLIGENT TESTER (NUMBER OF MISFIRING CYLINDER)

HINT:
- If the result of step 5 is "1 or 2 cylinders", proceed to A.
- If the result of step 5 is "more than 3 cylinders", proceed to B.

B → GO TO STEP 6

A

CHECK FOR INTERMITTENT PROBLEMS

DTC	P0325	Knock Sensor 1 Circuit

DTC	P0330	Knock Sensor 2 Circuit

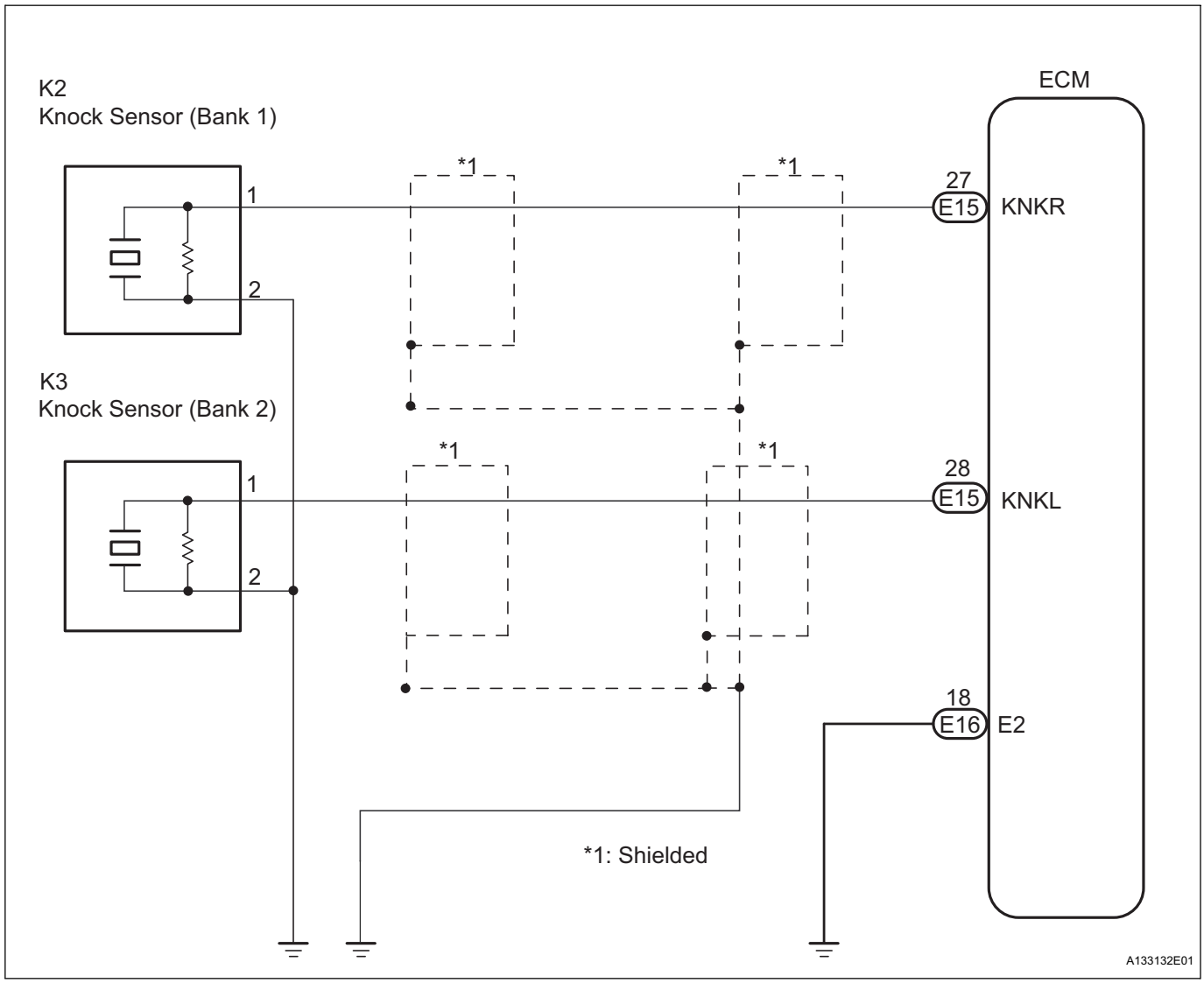
DESCRIPTION

Each of the knock sensors is fitted to the right bank and left bank of the cylinder block to detect engine knocking. This sensor contains a piezoelectric element which generates a voltage when it becomes deformed, which occurs when the cylinder block vibrates due to knocking. If engine knocking occurs, ignition timing is retarded to suppress it.

DTC No.	DTC Detection Condition	Trouble Area
P0325	No signal sensor of No. 1 knock sensor to ECM at an engine speed of between 2,000 and 5,600 rpm	• Open or short in No. 1 knock sensor circuit • No. 1 knock sensor • ECM
P0330	No signal sensor of No. 2 knock sensor to ECM at an engine speed of between 2,000 and 5,600 rpm	• Open or short in No. 2 knock sensor circuit • No. 2 knock sensor • ECM

If the ECM detects the above diagnosis condition, it operates the fail-safe function in which the corrective retard angle value is set to the maximum value.

WIRING DIAGRAM



INSPECTION PROCEDURE

- DTC P0325 is for the right bank knock sensor circuit.
- DTC P0330 is for the left bank knock sensor circuit.
- Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	CHECK DTC OUTPUT

(a) Clear the DTC(s) (See page ES-17).
(b) Warm up the engine.
(c) Run the engine at 3,000 rpm for 10 seconds or more.
(d) Connect the intelligent tester to the DLC3.
(e) Turn the ignition switch ON.
(f) Turn the intelligent tester ON.
(g) Select the following menu items: Powertrain / Engine and ECT / DTC.
(h) Read the DTCs.

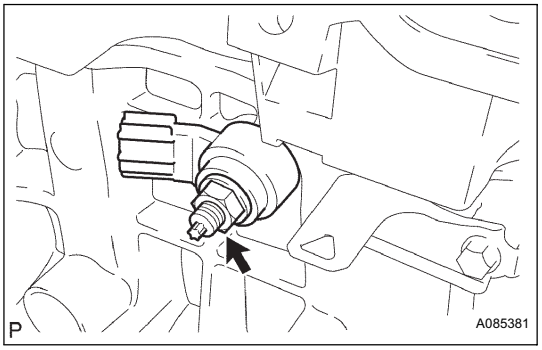
Result

Display (DTC output)	Proceed to
P0325 and/or P0330	A
No output	B

B → CHECK FOR INTERMITTENT PROBLEMS

A

2	INSPECT KNOCK CONTROL SENSOR

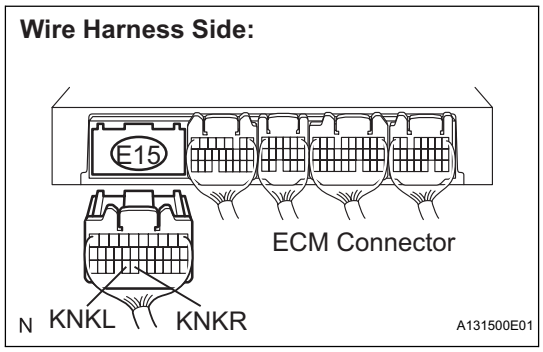


(a) Check the knock sensor installation.
Torque:
15 to 25 Nm (153 to 255 kgf cm, 11 to 18 lbf ft)

NG → TIGHTEN SENSOR

OK

3 CHECK HARNESS AND CONNECTOR (ECM - KNOCK CONTROL SENSOR)



(a) Disconnect the E15 ECM connector.
(b) Measure the resistance between the terminals of the E15 ECM connector.
Standard resistance

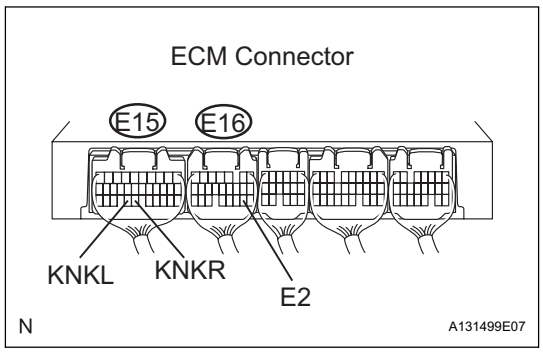
Tester Connection	Condition	Specified Condition
KNKR (E15-27) - Body ground	20°C (68°F)	120 to 280 kΩ
KNKL (E15-28) - Body ground	20°C (68°F)	120 to 280 kΩ

(c) Connect the ECM connector.

NG → GO TO STEP 5

OK

4 INSPECT ECM (KNK1 AND KNK2 VOLTAGE)



(a) Disconnect the K2 and K3 knock sensor connectors.
(b) Turn the ignition switch ON.
(c) Measure the voltage between the terminals.
Standard voltage

Tester Connection	Specified Condition
KNKR (E15-27) - E2 (E16-18)	4.5 to 5.5 V
KNKL (E15-28) - E2 (E16-18)	4.5 to 5.5 V

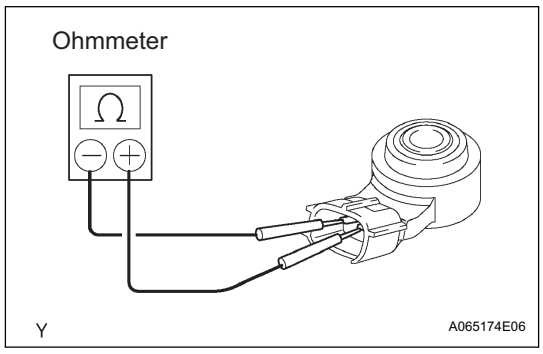
NOTICE:
Fault may be intermittent. Check the wire harness and connector carefully.

NG → REPLACE ECM

OK

CHECK FOR INTERMITTENT PROBLEMS

5 INSPECT KNOCK CONTROL SENSOR



(a) Remove the knock sensor.
(b) Measure the resistance between the terminals.
Standard resistance

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	120 to 280 kΩ
1 - 2	20°C (68°F)	120 to 280 kΩ

(c) Reinstall the knock sensor.

NG → REPLACE KNOCK CONTROL SENSOR

OK

REPAIR OR REPLACE WIRE HARNESS BETWEEN KNOCK SENSOR AND ECM

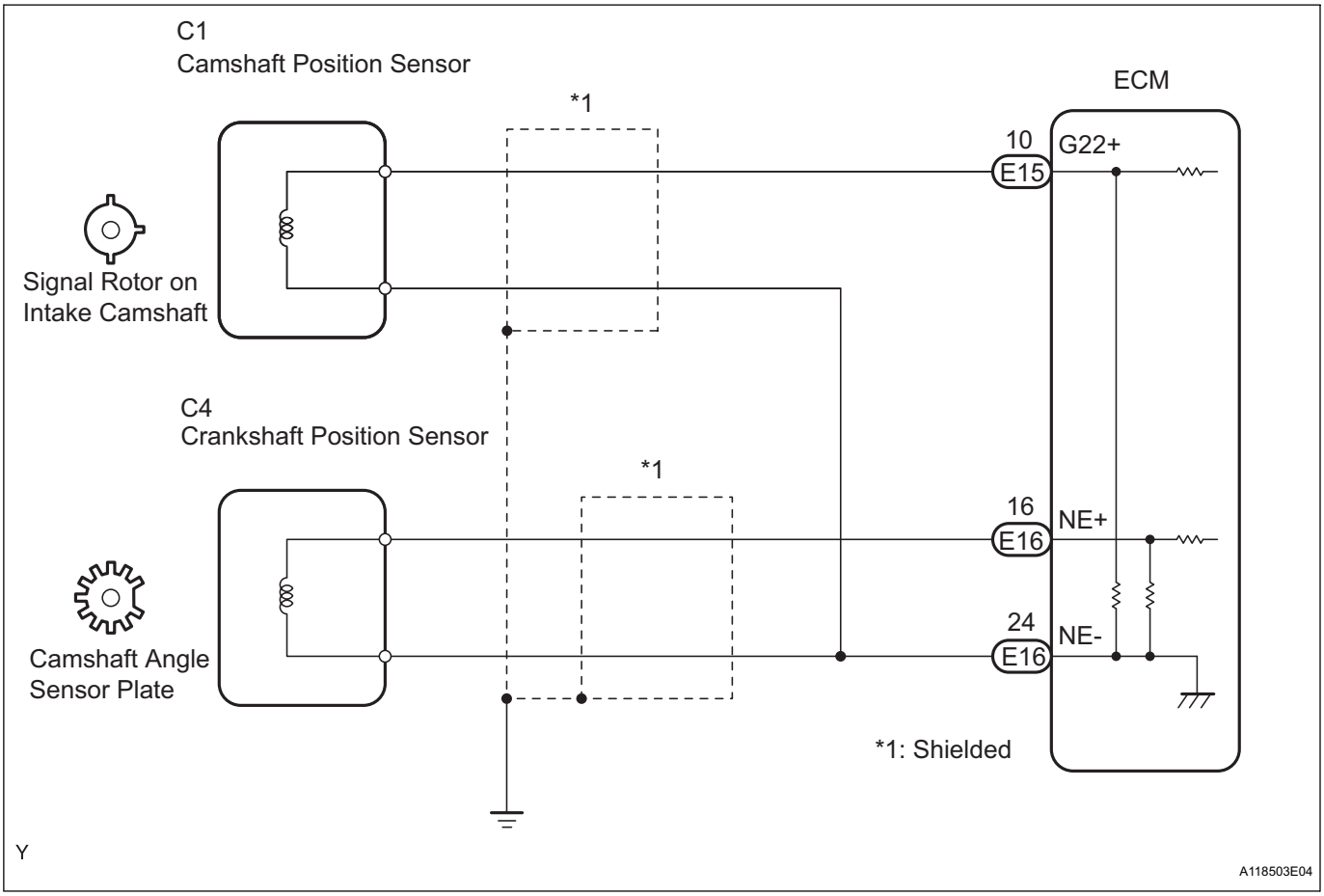
DTC	P0335	Crankshaft Position Sensor "A" Circuit

DESCRIPTION

The crankshaft position sensor (NE signal) consists of a magnet, iron core and pickup coil.
The NE signal plate has 34 teeth and is installed the crankshaft timing pulley. The NE signal sensor generates 34 signals at every revolution. The engine ECM detects the crankshaft angle and the engine speed based on the NE signals, and the cylinder detection based on the combination of the G22 and NE signals.

DTC No.	DTC Detecting Condition	Trouble Area
P0335	• No crankshaft position sensor signal to ECM while cranking (2 trip detection logic) • No crankshaft position sensor signal to ECM at an engine speed of 600 rpm or more (2 trip detection logic)	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Crankshaft timing pulley • ECM

WIRING DIAGRAM



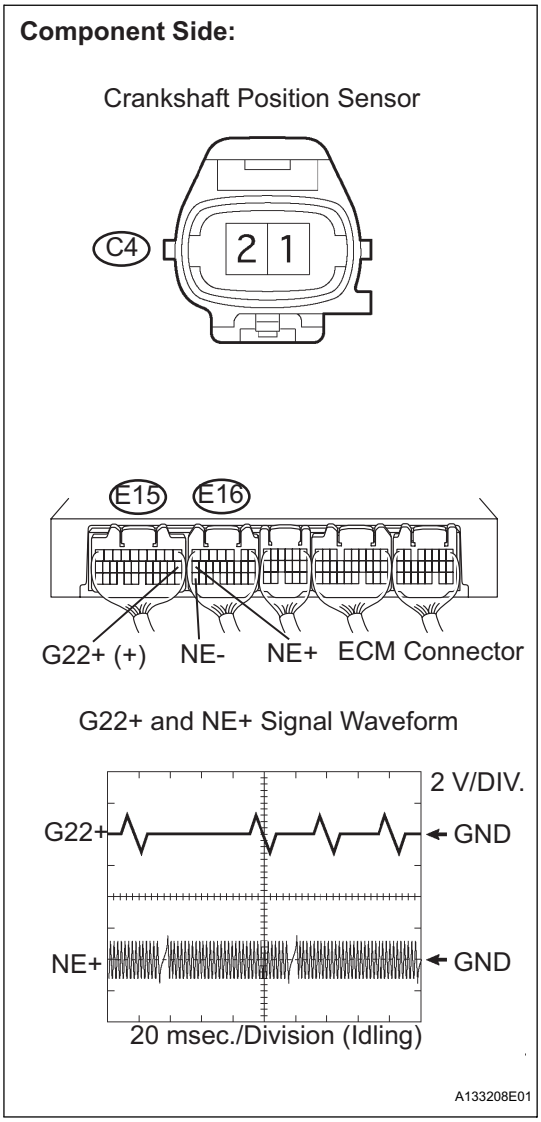
INSPECTION PROCEDURE

HINT:

- Perform troubleshooting of DTC P0335 first. If no trouble is found, troubleshoot the following mechanical systems.
- Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	INSPECT CRANK POSITION SENSOR (RESISTANCE)

Component Side:



(a) Disconnect the C4 crankshaft position sensor connector.
(b) Measure the resistance between the terminals of the crankshaft position sensor.

Standard resistance

Tester Connection	Condition	Specified Condition
1 - 2	Cold	1,630 to 2,740 Ω
1 - 2	Hot	2,065 to 3,225 Ω

HINT:
Terms "cold" and "hot" refer to the temperature of the coils.
"Cold" means approximately -10 to 50°C (14 to 122°F).
"Hot" means approximately 50 to 100°C (122 to 212°F).

(c) Reconnect the crankshaft position sensor.

HINT:
Reference:
Inspection using an oscilloscope. During cranking or idling, check the waveform between terminals E15 and E16 ECM connectors.

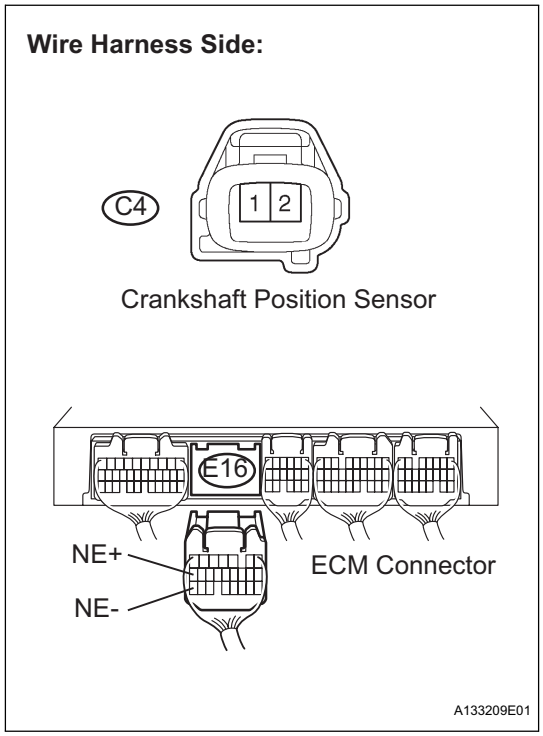
Standard

Specified Condition
Correct waveform appears as shown in the illustration

NG → **REPLACE CRANK POSITION SENSOR**

OK

2	CHECK HARNESS AND CONNECTOR (ECM - CRANK POSITION SENSOR)



(a) Disconnect the C4 crankshaft position sensor connector.
(b) Disconnect the E16 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard resistance:

Check for open

Tester Connection	Specified Condition
C4-1 - E16-16 (NE+) C4-2 - E16-24 (NE-)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
C4-1 or E16-16 (NE+) - Body ground C4-2 or E16-24 (NE-) - Body ground	10 kΩ or higher

(d) Reconnect the crankshaft position sensor connector and ECM connector.

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

OK

3	CHECK CRANK POSITION SENSOR

(a) Check the crankshaft position sensor installation.

OK:

Sensor is installed correctly.

NG → **TIGHTEN CRANKSHAFT POSITION SENSOR**

OK

4	CHECK CRANKSHAFT TIMING PULLEY

(a) Check the teeth of the sensor plate.

OK:

The pulley does not have any cracks or deformation.

NG → **REPLACE CRANKSHAFT TIMING PULLEY**

OK

REPLACE ECM

DTC	P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)

DESCRIPTION

The camshaft position sensor (G signal) consists of a magnet, iron core and pickup coil, and is mounted onto the intake side of the cylinder head. The timing rotor is integrated with the left bank exhaust camshaft.

Each time when the camshaft rotates, the air gap between the camshaft position sensor and the protrusion integrated onto the camshaft is varied. This causes the magnetic flux passing through the pickup coil to increase and decrease, generating an electromotive force. Since the voltage is generated when the camshaft protrusion approaches the pickup coil and when it departs, the alternating electrical current is produced.

The NE signal plate has 34 teeth and is mounted on the crankshaft. The NE signal sensor generates 34 signals at every engine revolution. The ECM detects the crankshaft angle based on the G signal and the actual crankshaft angel and the engine speed by the NE signal.

DTC No.	DTC Detecting Condition	Trouble Area
P0340	• No crank position sensor signal to ECM while cranking (2 trip detection logic) • No crank position sensor signal to ECM at an engine speed of 600 rpm or more	• Open or short in camshaft position sensor circuit • Crank position sensor • Camshaft timing gear • ECM

WIRING DIAGRAM

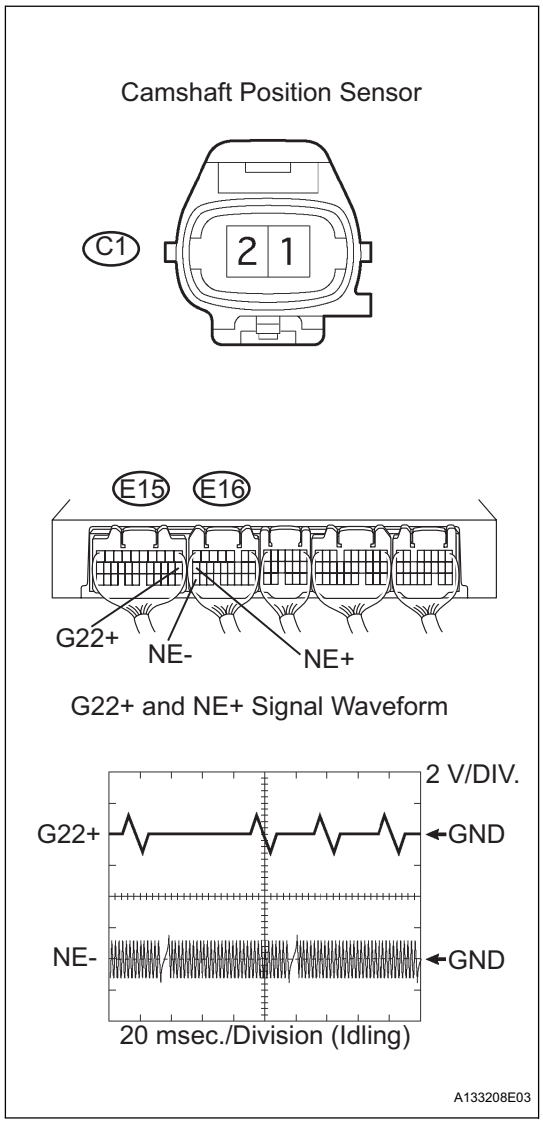
Refer to DTC P0335 (See page **ES-99**).

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	INSPECT CAMSHAFT POSITION SENSOR



(a) Disconnect the C1 camshaft position sensor connector.

(b) Measure the resistance between the terminals.

Standard resistance

Tester Connection	Condition	Specified Condition
1 - 2	Cold	835 to 1,400 Ω
1 - 2	Hot	1,060 to 1,645 Ω

NOTICE:
In the above section the terms "cold" and "hot" refer to the temperature of the coils. "Cold" means approximately -10 to 50°C (14 to 122°F). "Hot" means approximately 50 to 100°C (122 to 212°F).

(c) Connect the connector.

HINT:

Reference:

Inspection using an oscilloscope. During cranking or idling, check the waveform between the terminal of the E15 and E16 ECM connectors.

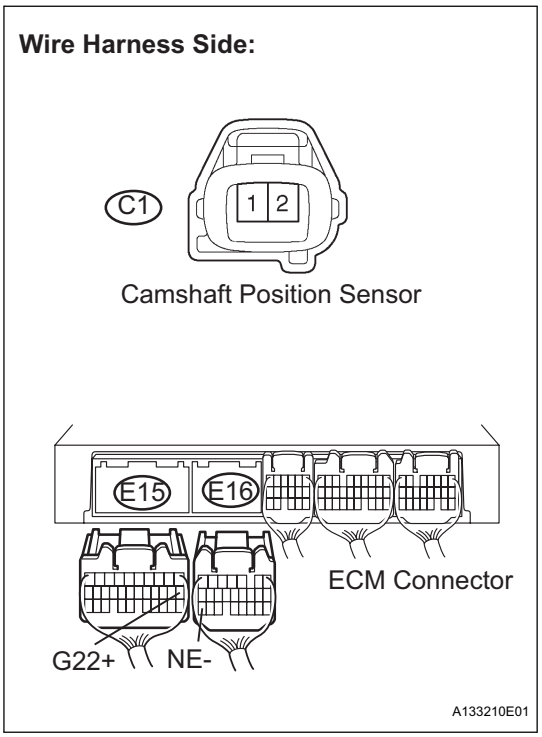
Standard

Tester Connection	Specified Condition
G22+ (E15-10) - NE- (E16-24)	Correct waveform appears as shown
NE+ (E16-16) - NE- (E16-24)	Correct waveform appears as shown

NG → **REPLACE CAMSHAFT POSITION SENSOR**

OK

2	CHECK HARNESS AND CONNECTOR



(a) Disconnect the C1 camshaft position sensor.
(b) Disconnect the E15 and E16 ECM connectors.
(c) Measure the resistance between the terminals.
Standard resistance

Tester Connection	Specified Condition
C1-1 - G22+ (E15-10)	Below 1 Ω
C1-2 - NE- (E16-24)	Below 1 Ω
C1-1 or G22+ (E15-10) - Body ground	10 kΩ or higher
C1-2 or NE- (E16-24) - Body ground	10 kΩ or higher

(d) Reconnect the ECM connector.
(e) Reconnect the camshaft position sensor connector.

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

OK

3	CHECK CAMSHAFT POSITION SENSOR

(a) Check the sensor installation.
OK:
Sensor is installed correctly.

NG → **TIGHTEN CAMSHAFT POSITION SENSOR**

OK

4	CHECK CAMSHAFT TIMING PULLEY

(a) Check the teeth of the camshaft timing pulley.
OK:
The pulley does not have any cracks or deformation.

NG → **REPLACE CAMSHAFT TIMING PULLEY**

OK

REPLACE ECM

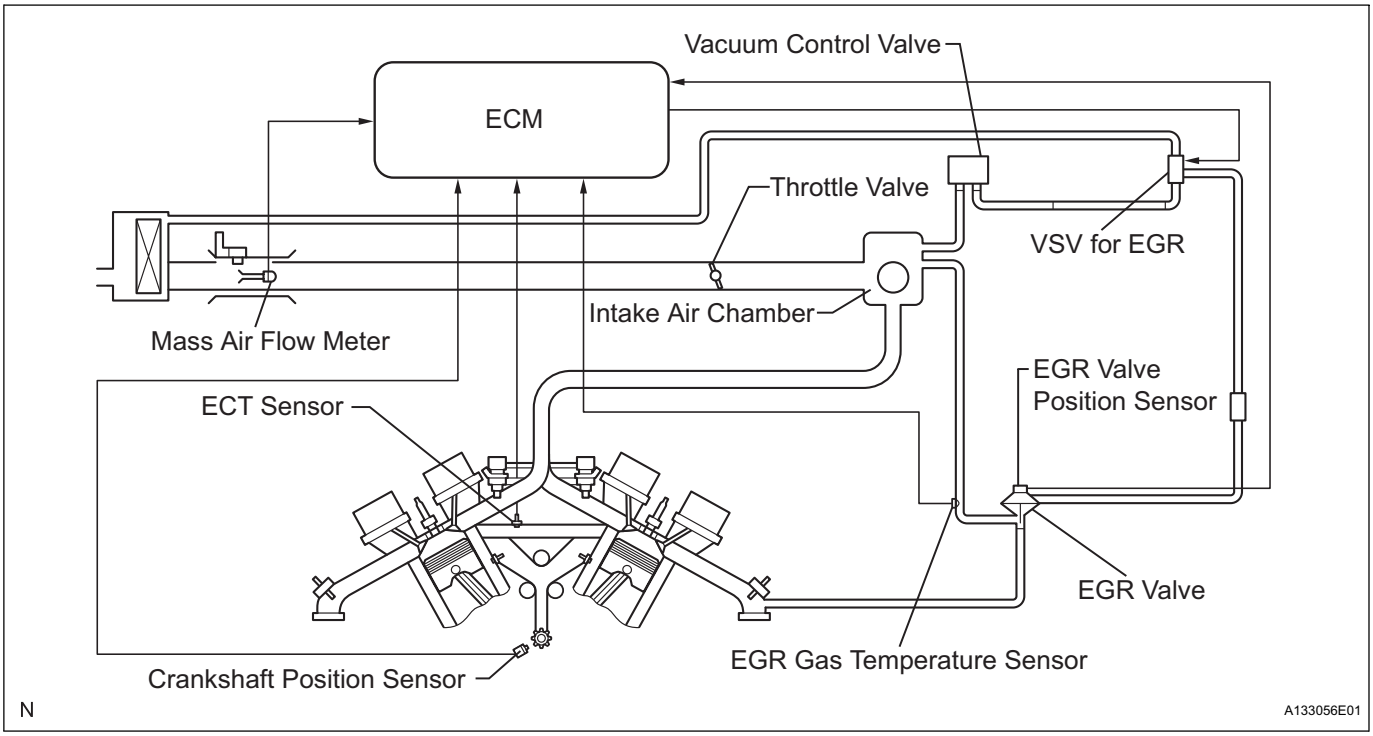
DTC	P0401	Exhaust Gas Recirculation Flow Insufficient Detected

DESCRIPTION

The EGR system recirculates exhaust gas, which is controlled to the proper quantity to suit the driving conditions, into the intake air mixture so as to slow down the combusion, reduce the combusion temperature and reduce NOx emissions.

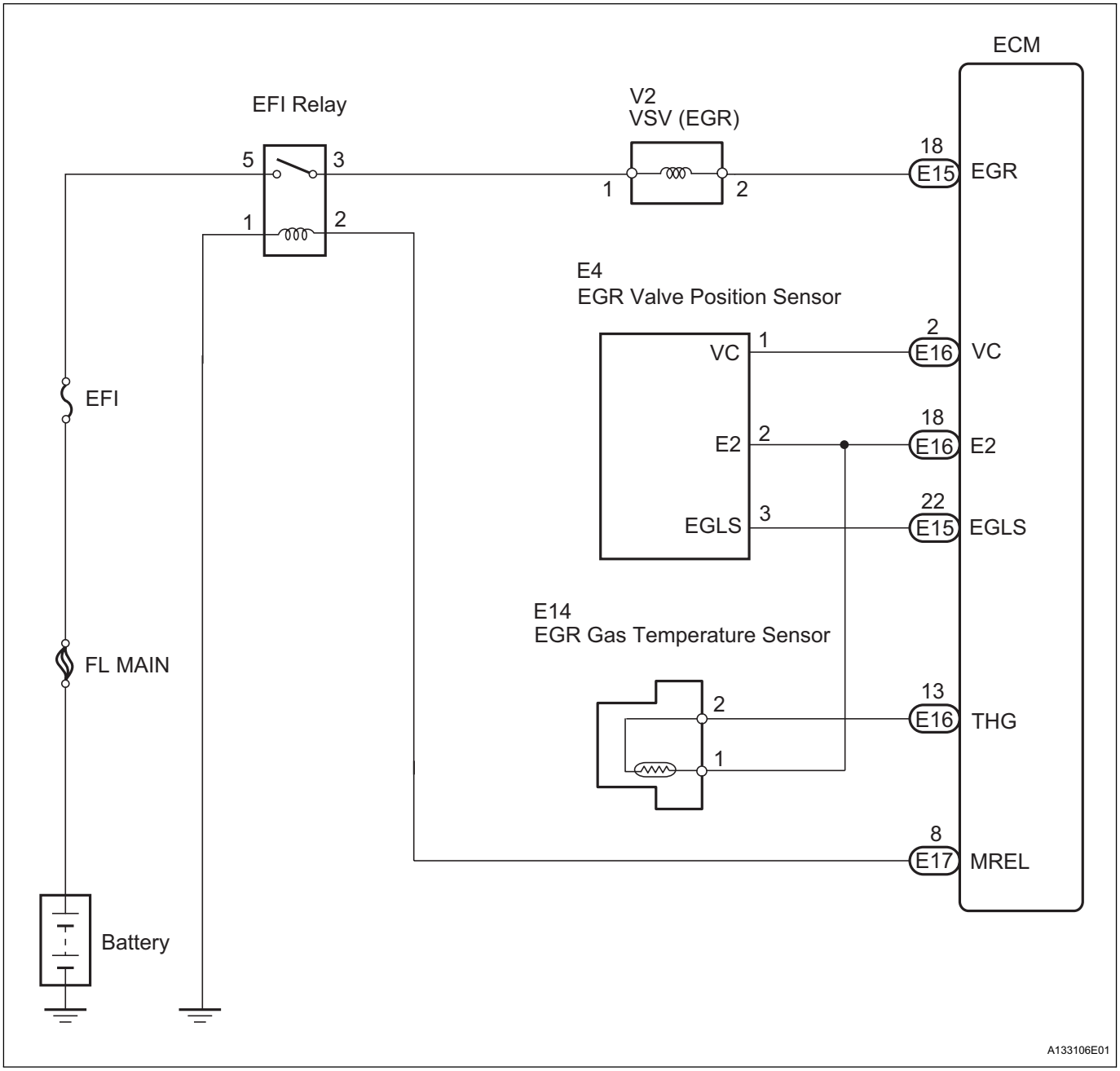
The lift amount of the EGR valve is controlled by the vacuum which is regulated by the duty-VSV operated by the ECM. The lift amount of the EGR valve is detected by the EGR valve position sensor which is mounted on the EGR valve and it provides feedback to the ECM to control the lift amount of the EGR valve in response to engine operating conditions.

- Before the engine is warmed up
- During deceleration (throttle valve closed)
- Light engine load (very small amount of intake air)
- Engine speed over 4,000 rpm

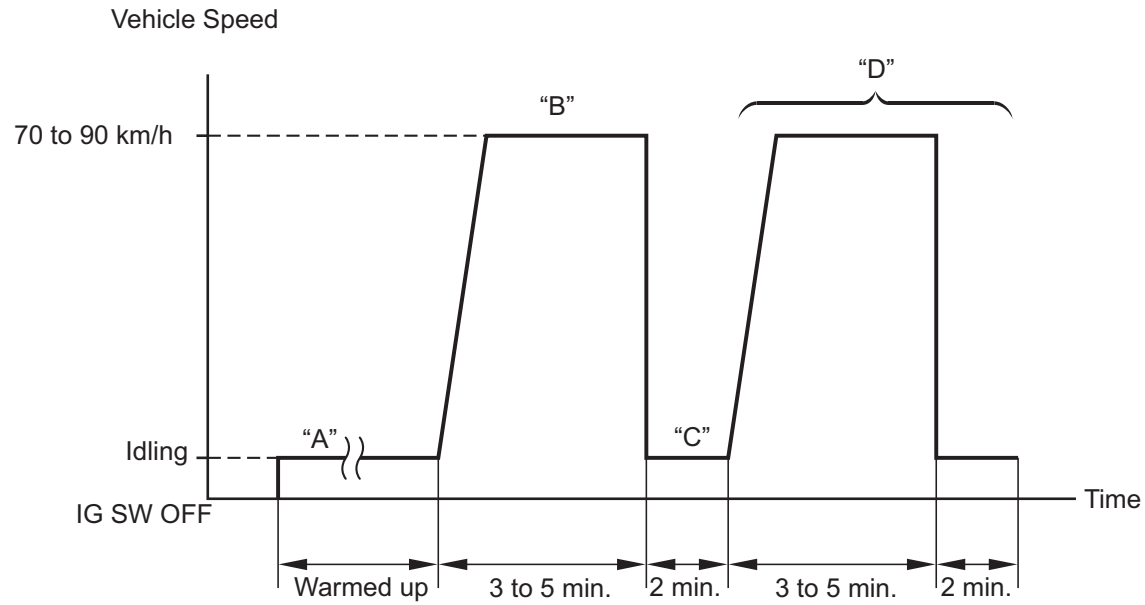


DTC No.	DTC Detection Condition	Trouble Area
P0401	After engine is warmed up and run at 80 km/h for 3 to 5 minutes. EGR gas temperature sensor valve does not exceed 35°C (95°F) above ambient air temperature. (2 trip detection logic)	• Open or short in EGR gas temperature sensor circuit • EGR gas temperature sensor • Vacuum hose disconnected or blocked • Open in VSV circuit for EGR • VSV for EGR • EGR system • EGR valve (stuck closed) • Vacuum control valve • ECM

WIRING DIAGRAM



CONFIRMATION DRIVING PATTERN



1. **Connect the intelligent tester to the DLC3.**
2. **Turn the ignition switch to the ON position and turn the intelligent tester ON.**
3. **Switch the ECM from normal mode to check mode using the intelligent tester.**
4. **Start and warm up the engine with all the accessories switched OFF (Procedure "A").**
5. **Drive the vehicle at 70 to 90 km/h for 3 minutes or more (Procedure "B").**
6. **Stop the vehicle and allow the engine to idle for about 2 minutes (Procedure "C").**
7. **Repeat the procedures "B" and "C" at least 1 time in one driving cycle (Procedure "D")..**
8. **Perform procedures "A" to "D" again.**

INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	READ VALUE OF INTELLIGENT TESTER (EGR GAS TEMPERATURE)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / Data List / EGR Gas.
(e) Read the value.
Temperature value:
5 to 150°C (41 to 302°F) (Not immediately after driving)

Result

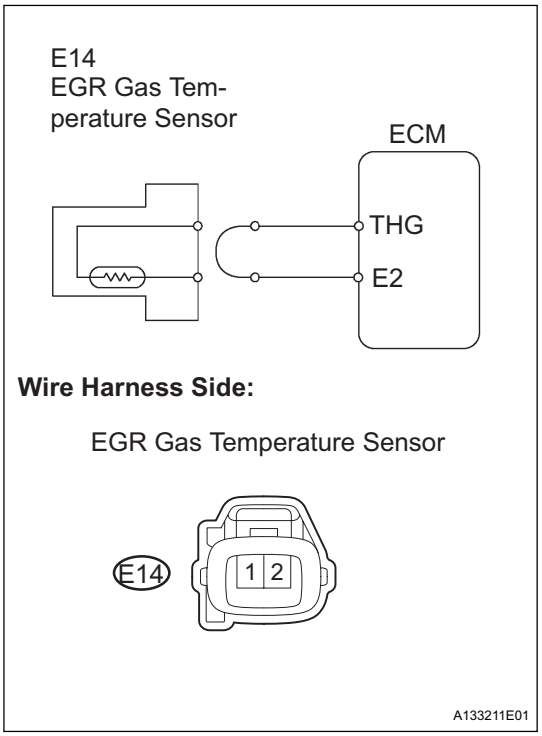
Temperature Displayed	Proceed To
159.3°C (318.7°F)	A
3.1°C (37.6°F)	B
OK (Same as the actual EGR temperature)	C

B → GO TO STEP 3

C → GO TO STEP 6

A

2 READ VALUE OF INTELLIGENT TESTER (CHECK FOR OPEN IN WIRE HARNESS)

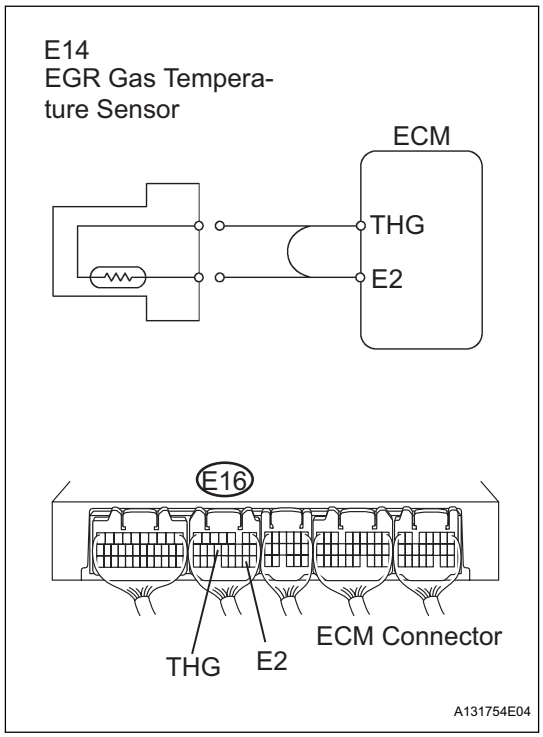


(a) Confirm good connection at the sensor.
(b) Disconnect the E14 EGR gas temperature sensor connector.
(c) Connect terminals 1 and 2 of the EGR gas temperature sensor.
(d) Connect the intelligent tester to the DLC3.
(e) Turn the intelligent tester ON.
(f) Select the following menu items: Powertrain / Engine and ECT / Data List / EGR Gas.
(g) Read the value.
Temperature value:
159.3°C (318.7°F)
(h) Reconnect the EGR gas temperature sensor connector.

OK → **REPLACE EGR GAS TEMPERATURE SENSOR**

NG

3	READ VALUE OF INTELLIGENT TESTER (CHECK FOR OPEN IN ECM)



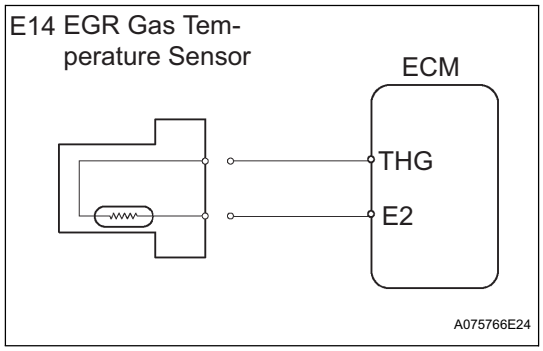
(a) Confirm good connection at the ECM.
(b) Disconnect the E14 EGR gas temperature sensor connector.
(c) Connect terminals THG and E2 of the E16 ECM connector.
HINT:
Before checking, do visual and contact pressure checks on the ECM connector.
(d) Connect the intelligent tester to the DLC3.
(e) Turn the ignition switch ON.
(f) Turn the intelligent tester ON.
(g) Select the following menu items: Powertrain / Engine and ECT / Data List / EGR Gas.
(h) Read the value.
Temperature value:
159.3°C (318.7°F)
(i) Reconnect the EGR gas temperature sensor connector.

NG → **REPLACE ECM**

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

4	READ VALUE OF INTELLIGENT TESTER (CHECK FOR SHORT IN WIRE HARNESS)

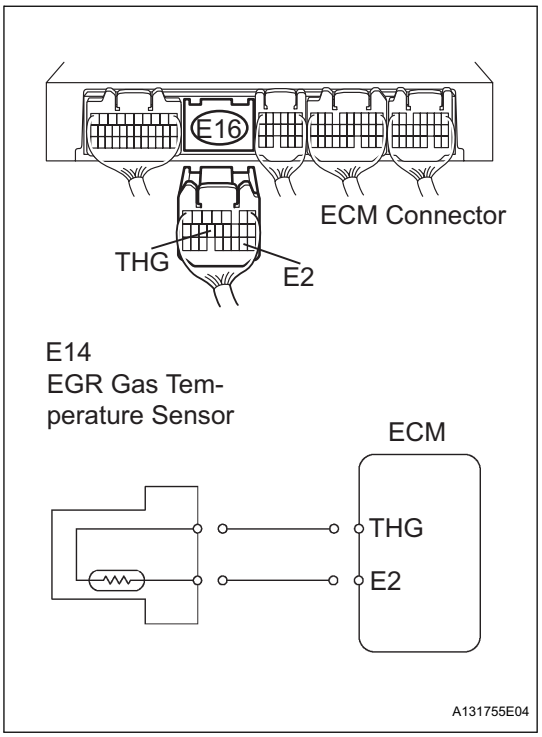


(a) Disconnect the E14 EGR gas temperature sensor connector.
(b) Connect the intelligent tester to the DLC3.
(c) Turn the ignition switch ON.
(d) Turn the intelligent tester ON.
(e) Select the following menu items: Powertrain / Engine and ECT / Data List / EGR Gas.
(f) Read the value.
Temperature value:
3.1°C (37.6°F)
(g) Reconnect the EGR gas temperature sensor connector.

OK → **REPLACE EGR GAS TEMPERATURE SENSOR**

NG

5	READ VALUE OF INTELLIGENT TESTER (CHECK FOR SHORT IN ECM)



(a) Disconnect the E14 EGR gas temperature sensor connector.
(b) Disconnect the E16 ECM connector.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch ON.
(e) Turn the intelligent tester ON.
(f) Select the following menu items: Powertrain / Engine and ECT / Data List / EGR Gas.
(g) Read the value.
Temperature value:
3.1°C (37.6°F)
(h) Reconnect the EGR gas temperature sensor connector and ECM connector.

NG → **REPLACE ECM**

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

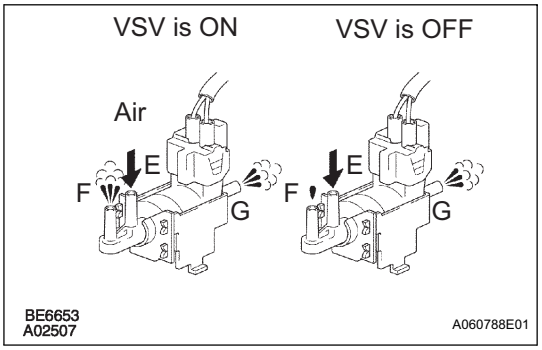
6	CHECK VACUUM HOSE

(a) Check connection and blockage of the vacuum hose.

NG → **REPAIR OR REPLACE VACUUM HOSE**

OK

7	CHECK NO. 1 VACUUM SWITCHING VALVE



(a) Disconnect the vacuum hose of the EGR VSV.
(b) Connect the intelligent tester to the DLC3.
(c) Start the engine and turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / Active Test / EGR System. Press the right or left button.
(e) Check the VSV operation when it is operated by the intelligent tester.

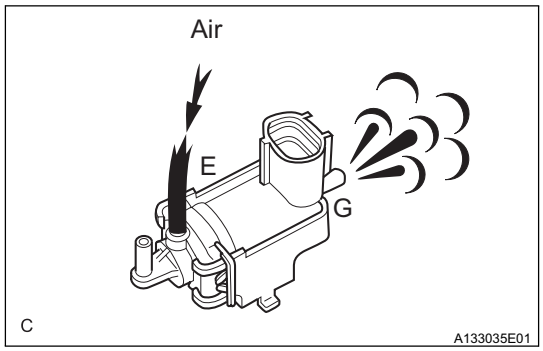
Tester Operation	Specified Condition
VSV is ON	Air flows out from port E through ports F and G

Tester Operation	Specified Condition
VSV is OFF	Air flows out from port E through port G

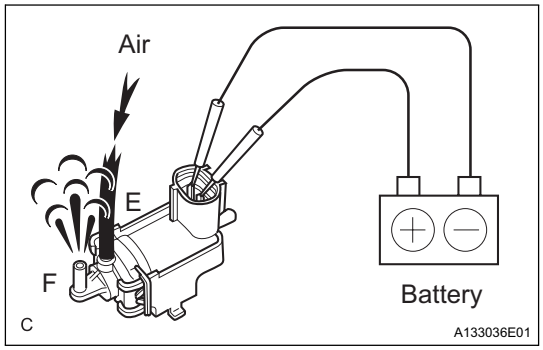
OK → GO TO STEP 9

NG

8 CHECK NO. 1 VACUUM SWITCHING VALVE (OPERATION)



(a) Remove the No. 1 vacuum switching valve.
(b) Check that air flows from port E to port G.



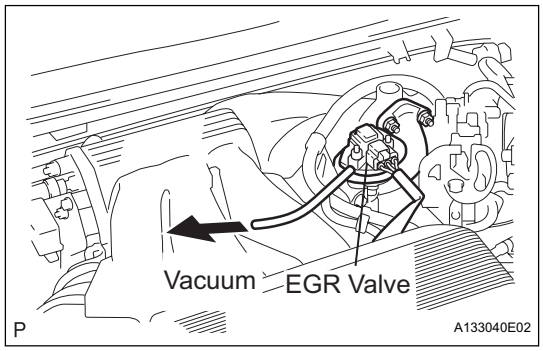
(c) Apply battery positive voltage across the terminals.
(d) Check that air flows from port E to F.

NG → REPLACE NO. 1 VACUUM SWITCHING VALVE

OK

CHECK HARNESS AND CONNECTOR (ENGINE ROOM J/B - ECM)

9 CHECK EGR VALVE ASSEMBLY

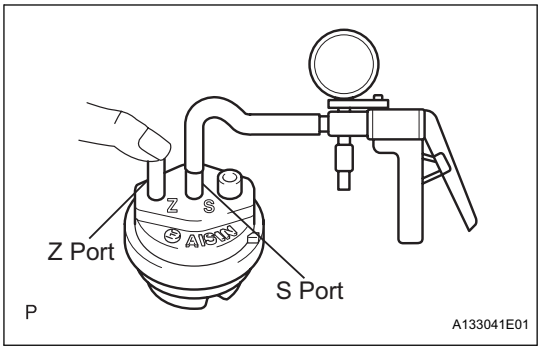


(a) Disconnect the vacuum hose.
(b) Start the engine.
(c) Check whether the engine stalls when applying vacuum to the EGR valve.
OK:
Engine runs rough or stalls

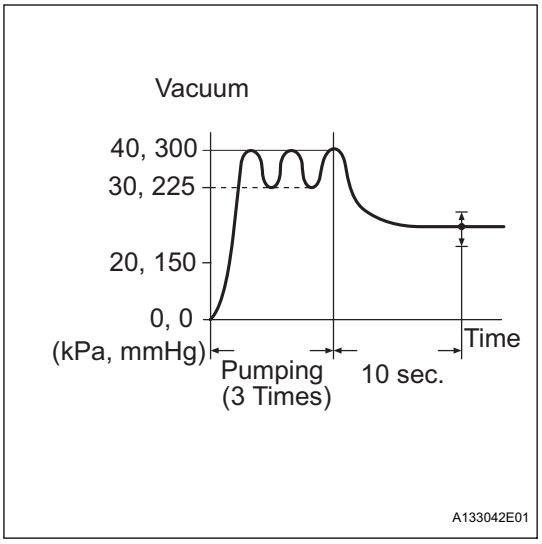
NG → REPLACE EGR VALVE ASSEMBLY

OK

10	CHECK VACUUM CONTROL VALVE



(a) Remove the vacuum control valve.
(b) Connect the hand-held vacuum pump to port S of the VCV.
(c) Plug port Z completely with fingers.



(d) Perform pumping 3 times and apply vacuum as shown in the illustration.
(e) Stop pumping and check the indicated value of the Hand-Held Vacuum Pump after about 10 seconds.
Standard value:
15 to 24 kPa (112 to 180 mmHg)

NG → **REPLACE VACUUM CONTROL VALVE**

OK

REPLACE ECM

DTC	P0402	Exhaust Gas Recirculation Flow Excessive Detected

DESCRIPTION

Refer to DTC P0401 (See page ES-105).

DTC No.	DTC Detection Condition	Trouble Area
P0402	When EGR cutoff, lift amount of EGR valve is 2.6 mm (0.1 in) or more. (2 trip detection logic)	• Vacuum hose disconnected or blocked • Short in VSV circuit for EGR • VSV for EGR • EGR valve stuck open • Open or short in EGR valve position sensor circuit • EGR valve position sensor • ECM

WIRING DIAGRAM

Refer to DTC P0401 (See page ES-106).

INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

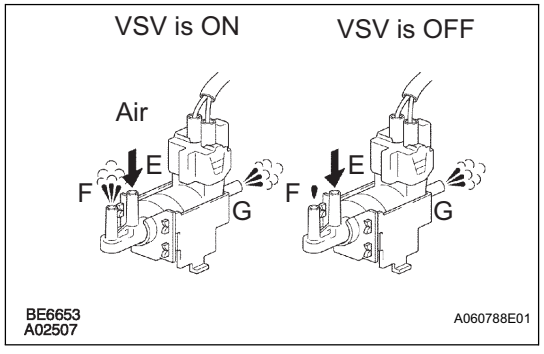
1	CHECK VACUUM HOSE (CONNECTION AND BLOCKAGE)

(a) Check connection and blockage of the vacuum hose.

NG → REPLACE ECM

OK

2	PERFORM ACTIVE TEST BY NO. 1 VACUUM SWITCHING VALVE



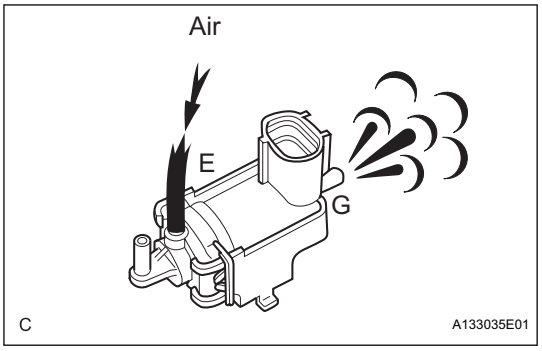
(a) Disconnect the vacuum hose of the EGR VSV.
(b) Connect the intelligent tester to the DLC3.
(c) Start the engine and turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / Active Test / EGR VSV. Press the right or left button.
(e) Check the VSV operation when it is operated by the intelligent tester.
(f) Reconnect the vacuum hose.

OK → GO TO STEP 6

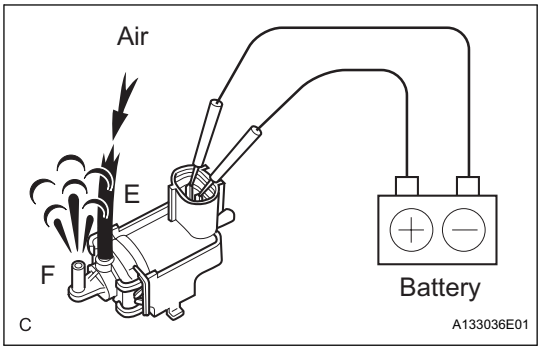
NG

3	CHECK NO. 1 VACUUM SWITCHING VALVE (OPERATION)

(a) Remove the No. 1 vacuum switching valve.



(b) Check that air flows from port E to port G.



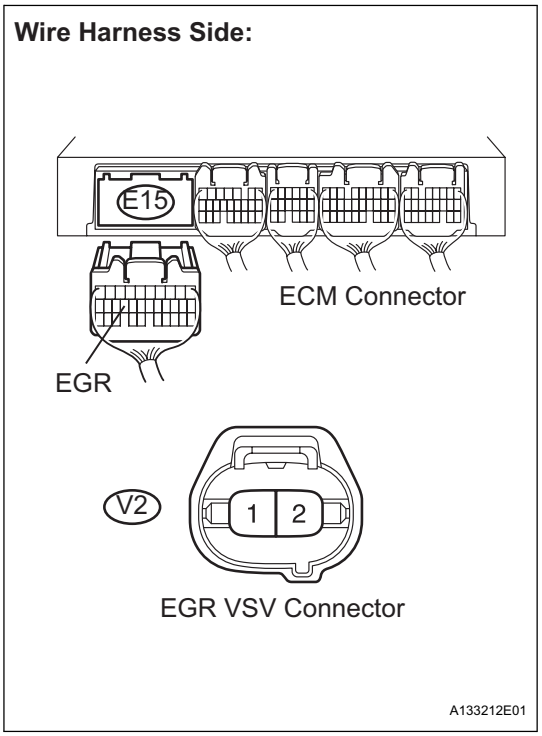
(c) Apply the battery positive across the terminals.
(d) Check that air flows from port E to port F.
(e) Install the No. 1 vacuum switching valve.

NG → **REPLACE NO. 1 VACUUM SWITCHING VALVE**

OK

4 CHECK HARNESS AND CONNECTOR (VSV (EGR) - ECM)

Wire Harness Side:



(a) Disconnect the V2 vacuum switching valve connector.
(b) Disconnect the E15 ECM connector.
(c) Measure the resistance between the terminals.
Standard resistance

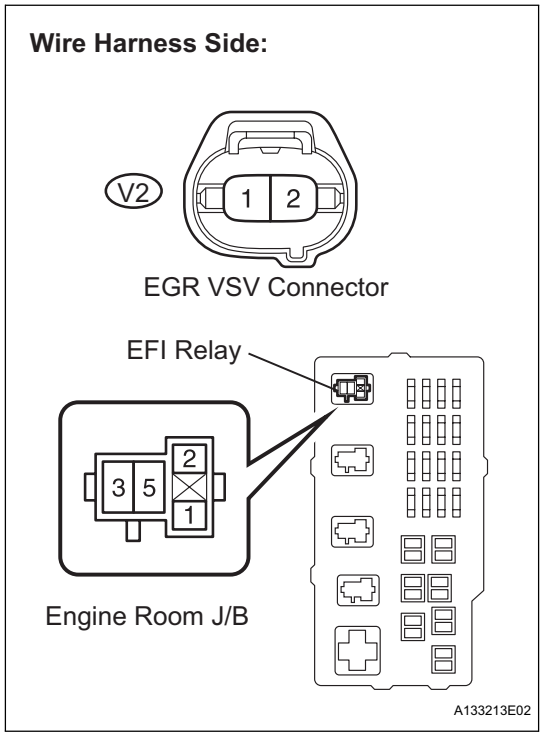
Tester Connection	Specified Condition
V2-2 (EGR VSV) - EGR (E15-18)	Below 1 Ω
V2-2 (EGR VSV) or EGR (E15-18) - Body ground	10 kΩ or higher

(d) Connect the VSV and ECM connectors.

NG → **REPAIR OR REPLACE VACUUM HOSE**

OK

5	CHECK HARNESS AND CONNECTOR (EFI RELAY - VSV (EGR))



(a) Remove the EFI relay from the engine room J/B.
(b) Disconnect the V2 No. 1 vacuum switching valve connector.
(c) Measure the resistance between the terminals.

Standard resistance

Tester Connection	Specified Condition
V2-1 (EGR VSV) - Engine room J/B EFI relay terminal 3	Below 1 Ω
V2-1 (EGR VSV) or Engine room J/B EFI relay - Body ground	10 kΩ or higher

(d) Reinstall the EFI relay.
(e) Connect the VSV connector.

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

OK

CHECK ECM POWER SOURCE CIRCUIT

6	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly.
(b) Check for sticking and heavy carbon deposits.

NG → **REPLACE EGR VALVE ASSEMBLY**

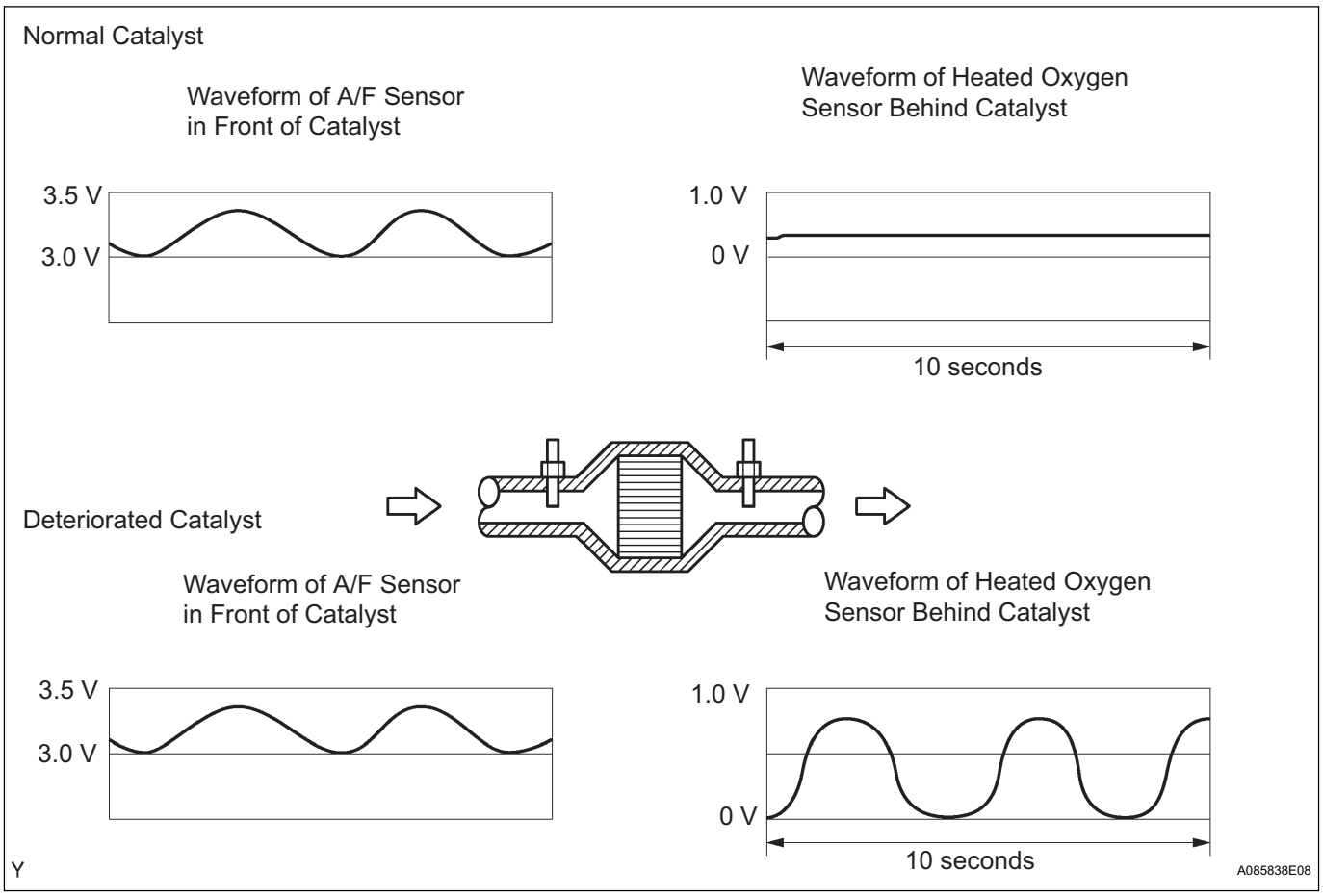
OK

REPLACE ECM

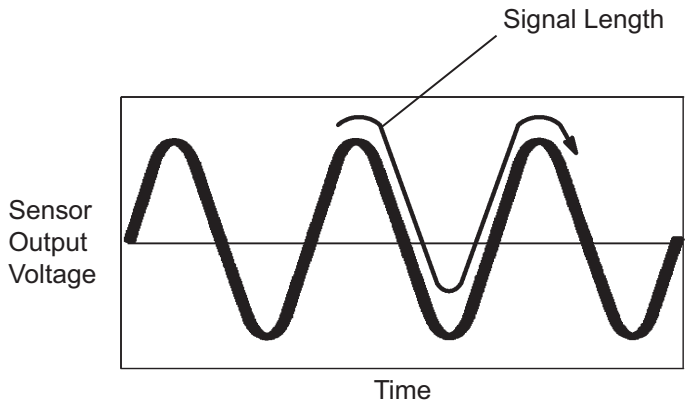
DTC	P0420	Catalyst System Efficiency Below Threshold (Bank 1)

DESCRIPTION

The ECM uses the two sensors, mounted in front of and behind the Three-way Catalytic Converter (TWC), to monitor its efficiency.
The first sensor, the Air-Fuel Ratio (A/F) sensor (sensor 1), sends pre-catalyst information to the ECM. The second sensor, the Heated Oxygen (HO2) sensor (sensor 2), sends post-catalyst information to the ECM. The ECM compares the information transmitted by these two sensors to determine the efficiency of the TWC performance and its ability to store oxygen.
When the TWC is functioning properly, the variation in the oxygen concentration in the exhaust gas, after it has passed through the TWC, is small. As a result, the voltage output of sensor 2 slowly alternates between the rich and lean signal voltages (shown in the illustration below). As the TWC performance efficiency deteriorates, its oxygen storage capacity decreases, and the variation in the oxygen concentration in the exhaust gas increases. As a result, the sensor voltage output fluctuates frequently. While the catalyst monitor is running, the ECM measures the signal length of both sensors 1 and 2, and calculates the ratio of the signal lengths to determine the extent of the TWC deterioration. If the deterioration level exceeds the preset threshold, the ECM interprets this as a TWC malfunction. The ECM then illuminates the MIL and sets the DTC.



Heated Oxygen Sensor Signal Length



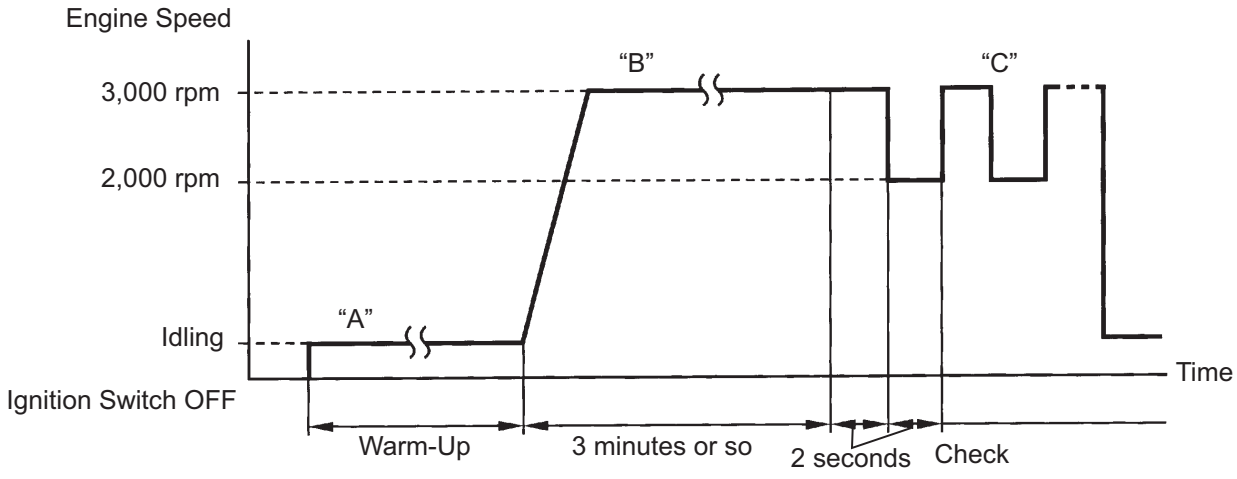
A082718E04

DTC No.	DTC Detection Condition	Trouble Area
P0420	After engine and catalyst are warmed up, and while vehicle is driven within set vehicle and engine speed ranges: Waveform of heated oxygen sensor (bank 1 sensor 2) alternates frequently between rich and lean (2 trip detection logic)	• Gas leakage from exhaust system • A/F sensor (bank 1 sensor 1) • HO2 sensor (bank 1 sensor 2) • Three-Way Catalytic Converter (TWC) (Exhaust manifold)

HINT:
- Bank 1 refers to the bank that includes cylinder No. 1.
- Bank 2 refers to the bank that does not include cylinder No. 1.
- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.

CONFIRMATION DRIVING PATTERN

HINT:
Perform the operation with the engine speeds and time durations described below prior to checking the waveforms of the A/F and HO2 sensors. This is in order to activate the sensors sufficiently to obtain the appropriate inspection results.



A089866E01

1. Start the engine and warm it up with all the accessories switched OFF until the engine coolant temperature becomes stable. (Procedure "A")
2. Run the engine at 2,500 to 3,000 rpm for about 3 minutes. (Procedure "B")

3. Rev up the engine at 3,000 rpm for 2 seconds and at 2,000 rpm for 2 seconds alternately. (Procedure "C").

INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was LEAN or RICH, and other data from the time the malfunction occurred.

1	CHECK OTHER DTCS OUTPUT (IN ADDITION TO DTC P0420)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result

Display (DTC output)	Proceed to
P0420	A
P0420 and other DTCs	B

HINT:
If any DTCs other than P0420 or P0430 are output, troubleshoot those DTCs first.

B → GO TO DTC CHART (See page ES-23)

A

2	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (A/F CONTROL)

1. Connect the intelligent tester to the DLC3.
2. Start the engine and turn the tester ON.
3. Warm up the engine at an engine speed of 2,500 rpm for approximately 90 seconds.
4. On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.
5. Perform the A/F CONTROL operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume.).
6. Monitor the output voltages of the A/F and HO2 sensors (AFS B1S1 and O2S B1S2 or AFS B2S1 and O2S B1S2) displayed on the tester.

HINT:
- The A/F CONTROL operation lowers the fuel injection volume by 12.5 % or increases the injection volume by 25 %.

- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

Standard

Tester Display (Sensor)	Injection Volume	Status	Voltage
AFS B1S1 or AFS B2S1 (A/F)	+25 %	Rich	Less than 3.0
AFS B1S1 or AFS B2S1 (A/F)	-12.5 %	Lean	More than 3.35
O2S B1S2 (HO2)	+25 %	Rich	More than 0.55
O2S B1S2 (HO2)	-12.5 %	Lean	Less than 0.4

Result

Status AFS B1S1 or AFS B2S1	Status O2S B1S2	A/F Condition and A/F and HO2 Sensor Conditions	Misfire	Main Suspected Trouble Areas	Proceed to
Lean/Rich	Lean/Rich	Normal	-	• Three-Way Catalytic Converter (TWC) • Gas leakage from exhaust system	A
Lean	Lean/Rich	A/F sensor malfunction	-	• A/F sensor	B
Rich	Lean/Rich	A/F sensor malfunction	May occur	• A/F sensor	B
Lean/Rich	Lean	HO2 sensor malfunction	-	• HO2 sensor • Gas leakage from exhaust system	C
Lean/Rich	Rich	HO2 sensor malfunction	-	• HO2 sensor • Gas leakage from exhaust system	C
Lean	Lean	Actual air-fuel ratio lean	May occur	• Extremely rich or lean actual air-fuel ratio • Gas leakage from exhaust system	A
Rich	Rich	Actual air-fuel ratio lean	-	• Extremely rich or lean actual air-fuel ratio • Gas leakage from exhaust system	A

Lean: During A/F CONTROL, the A/F sensor output voltage (AFS) is consistently more than 3.35 V, and the HO2 sensor output voltage (O2S) is consistently less than 0.4 V.
Rich: During A/F CONTROL, the AFS is consistently less than 3.0 V, and the O2S is consistently more than 0.55 V.
Lean/Rich: During A/F CONTROL of the ACTIVE TEST, the output voltage of the HO2 sensor alternates correctly.

B → **CHECK AND REPLACE AIR FUEL RATIO SENSOR**

C → CHECK AND REPLACE HEATED OXYGEN SENSOR, AND CHECK AND REPAIR EXHAUST GAS LEAKAGE

A

3	CHECK FOR EXHAUST GAS LEAKAGE

OK:
No gas leakage.

NG → REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT

OK

REPLACE THREE-WAY CATALYTIC CONVERTER (EXHAUST MANIFOLD LH OR RH)

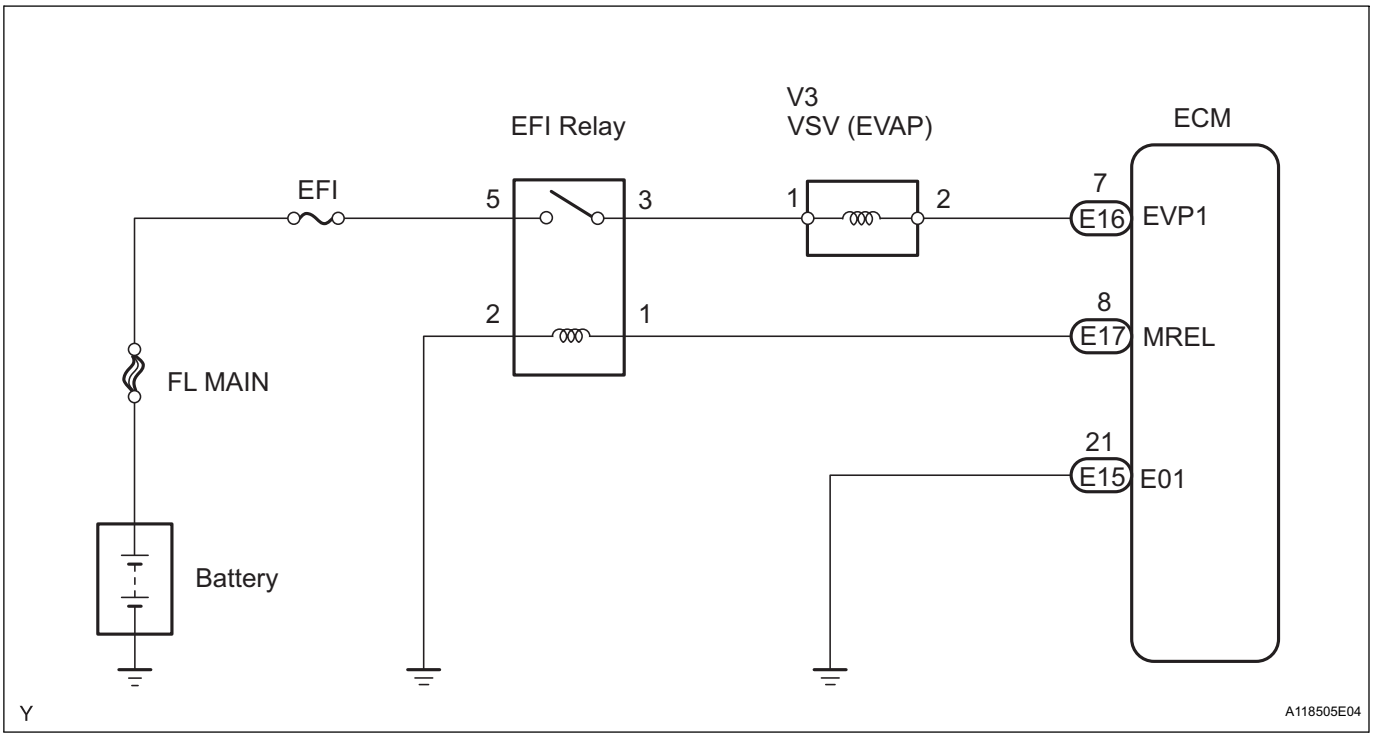
DTC	P0443	Evaporative Emission Control System Purge Control Valve Circuit

DESCRIPTION

In order to reduce hydrocarbon (HC) emissions, evaporated fuel from the fuel tank is routed through the charcoal canister to the intake manifold for combustion in the cylinders.
The ECM changes the duty signal to the EVAP VSV so that the intake of HC emissions is appropriate for the driving conditions (engine load, engine speed, vehicle speed, etc.) after the engine is warmed up.

DTC No.	DTC Detection Condition	Trouble Area
P0443	Proper response to ECM command does not occur (1 trip detection logic)	• Open or short in EVAP VSV circuit • EVAP VSV • ECM

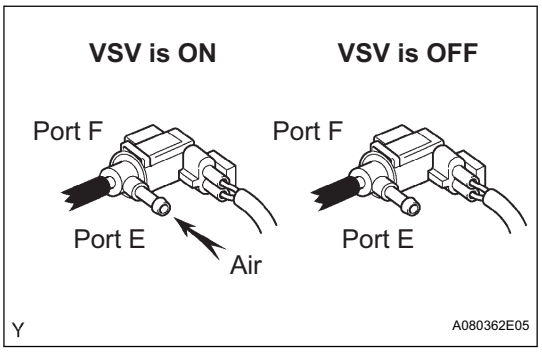
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1 **PERFORM ACTIVE TEST BY INTELLIGENT TESTER (EVAP VSV)**



(a) Disconnect the vacuum hose of the EVAP VSV.
(b) Connect the intelligent tester to the DLC3.
(c) Start the engine and turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / Active Test / Purge VSV. Press the right or left button.
(e) Check if the disconnected port applies suction to your finger when operating the EVAP VSV using the intelligent tester.
Standard

Tester Operation	Specified Condition
VSV is ON	Applies suction to your finger
VSV is OFF	Applies no suction to your finger

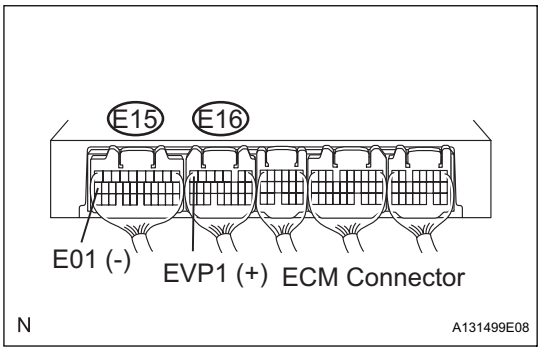
(f) Reconnect the vacuum hose.

NG → **GO TO STEP 2**

OK

CHECK FOR INTERMITTENT PROBLEMS

2 **INSPECT ECM (EVP1 VOLTAGE)**



(a) Turn the ignition switch to the ON position.
(b) Measure the voltage between the terminals of the E15 and E16 ECM connectors.
Standard voltage

Tester Connection	Specified Condition
EVP1 (E16-7) - E01 (E15-21)	9 to 14 V

NG → **GO TO STEP 3**

OK

REPLACE ECM

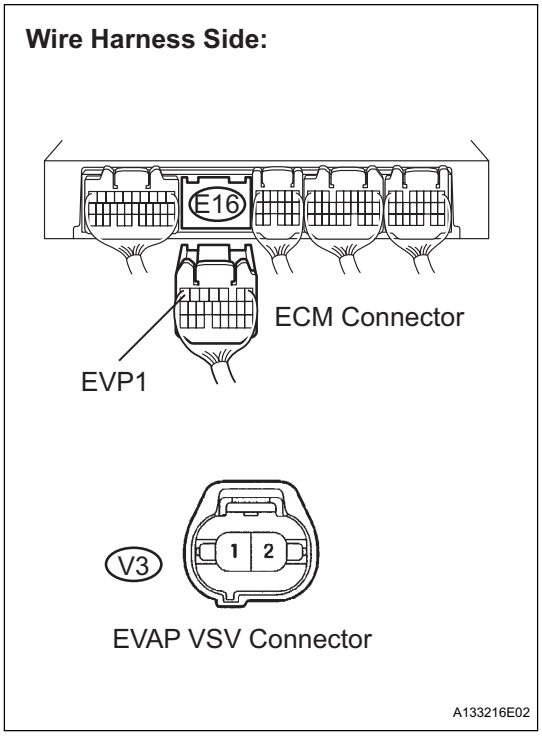
3 **CHECK OPERATION OF EVAP VSV**

OK:
Air flows when the battery voltage is applied to the EVAP VSV.

NG → **REPLACE EVAP VSV**

OK

4 CHECK HARNESS AND CONNECTOR (ECM - EVAP VSV)



(a) Disconnect the E16 ECM connector.
(b) Disconnect the V3 EVAP VSV connector.
(c) Measure the resistance.
Standard resistance:
Check for open

Tester Connection	Specified Condition
EVAP VSV (V3-1) - EVP1 (E16-7)	Below 1 Ω

Check for short

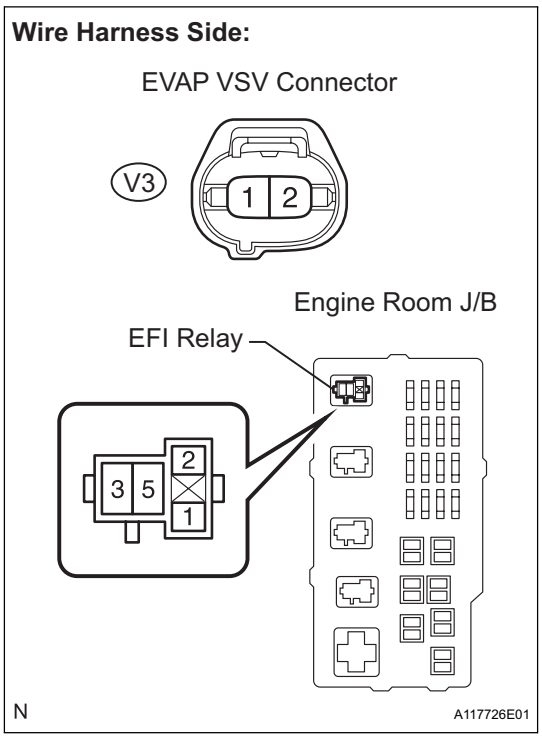
Tester Connection	Specified Condition
EVAP VSV (V3-1) or EVP1 (E16-7) - Body ground	10 kΩ or higher

(d) Reconnect the ECM connector.
(e) Reconnect the EVAP VSV connector.

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

OK

5 CHECK HARNESS AND CONNECTOR (EFI RELAY - EVAP VSV)



(a) Remove the EFI relay from the engine room J/B.
(b) Disconnect the V3 EVAP VSV connector.
(c) Measure the resistance.
Standard resistance:
Check for open

Tester Connection	Specified Condition
EVAP VSV (V3-2) - EFI relay (3)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
EVAP VSV (V3-2) or EFI relay (3) - Body ground	10 kΩ or higher

(d) Reinstall the EFI relay.
(e) Reconnect the EVAP VSV connector.

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

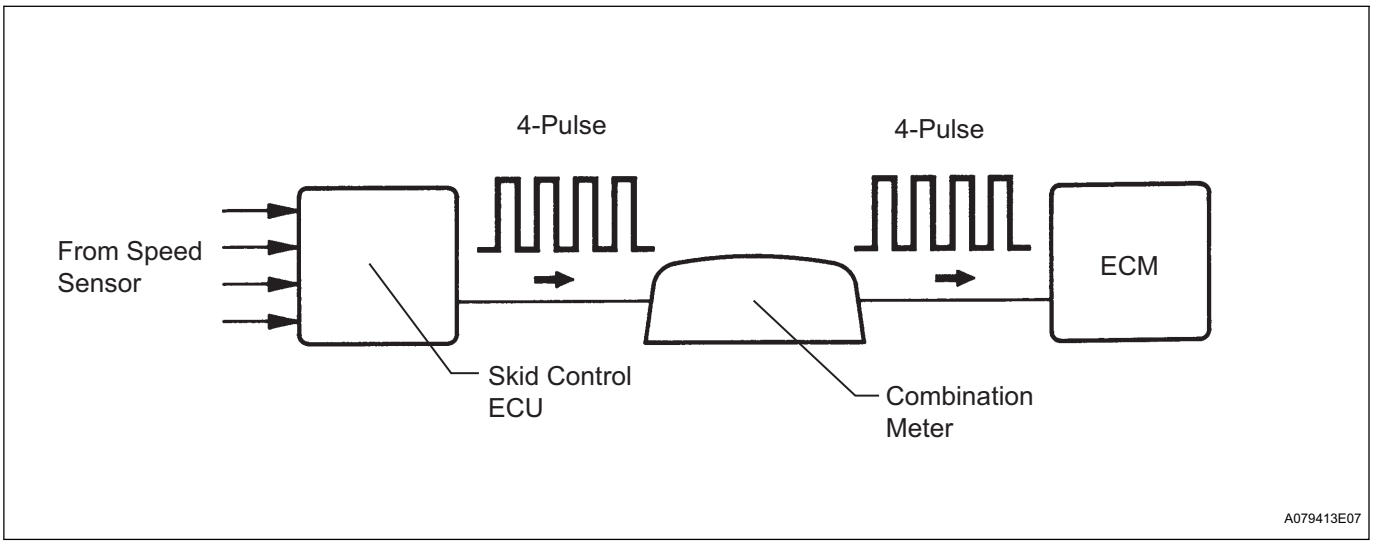
OK

INSPECT ECM POWER SOURCE CIRCUIT

DTC	P0500	Vehicle Speed Sensor "A"

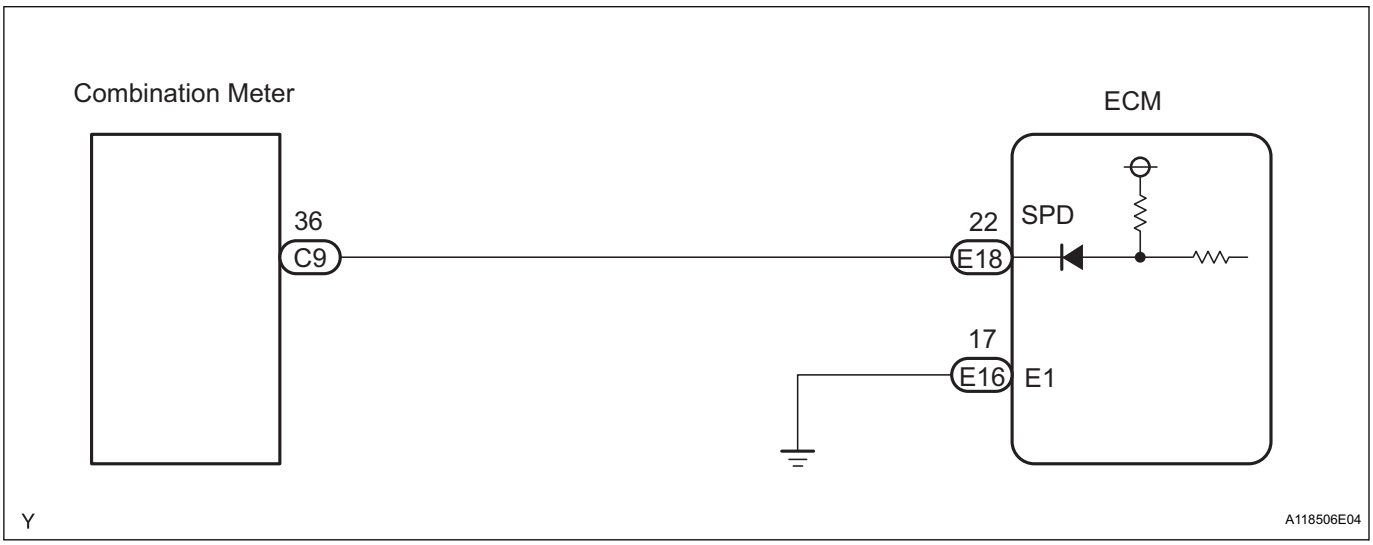
DESCRIPTION

The speed sensor detects the wheel speed and sends the appropriate signals to the skid control ECU. The skid control ECU converts these wheel speed signals into a 4-pulse signal and outputs it to the ECM via the combination meter. The ECM determines the vehicle speed based on the frequency of these pulse signals.



DTC No.	Trouble Area
P0500	• Combination meter • Open or short in vehicle speed sensor circuit • Vehicle speed sensor • ECM • Skid control ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

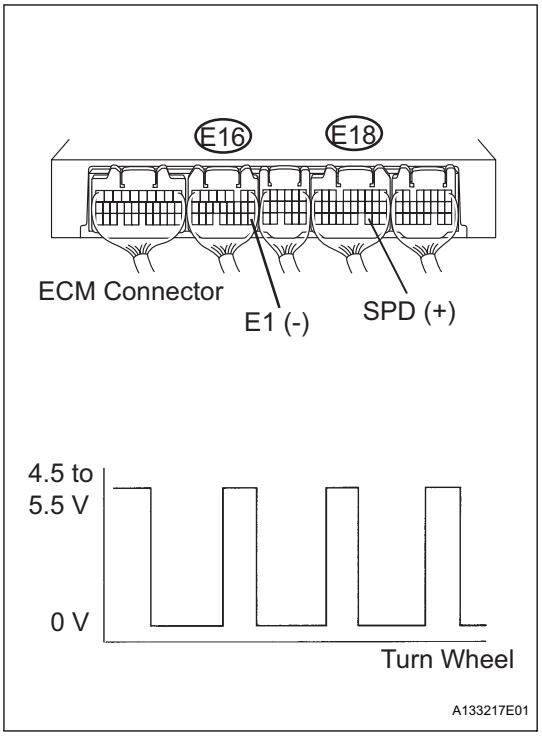
1	CHECK SPEEDOMETER (OPERATION)

(a) Drive the vehicle and check if the operation of the speedometer in the combination meter is normal.
HINT:
The vehicle speed sensor operates normally if the speedometer display is normal.

NG → CHECK SPEEDOMETER CIRCUIT

OK

2	INSPECT ECM (SPD VOLTAGE)



(a) Shift the lever to the neutral position.
(b) Jack up the vehicle.
(c) Turn the ignition switch ON.
(d) Measure the voltage of the ECM connectors as the wheel is turned slowly.
Standard voltage

Tester Connection	Specified Condition
SPD (E18-22) - E1 (E16-17)	Generated intermittently

OK → REPAIR OR REPLACE HARNESS OR CONNECTOR

NG

REPLACE ECM

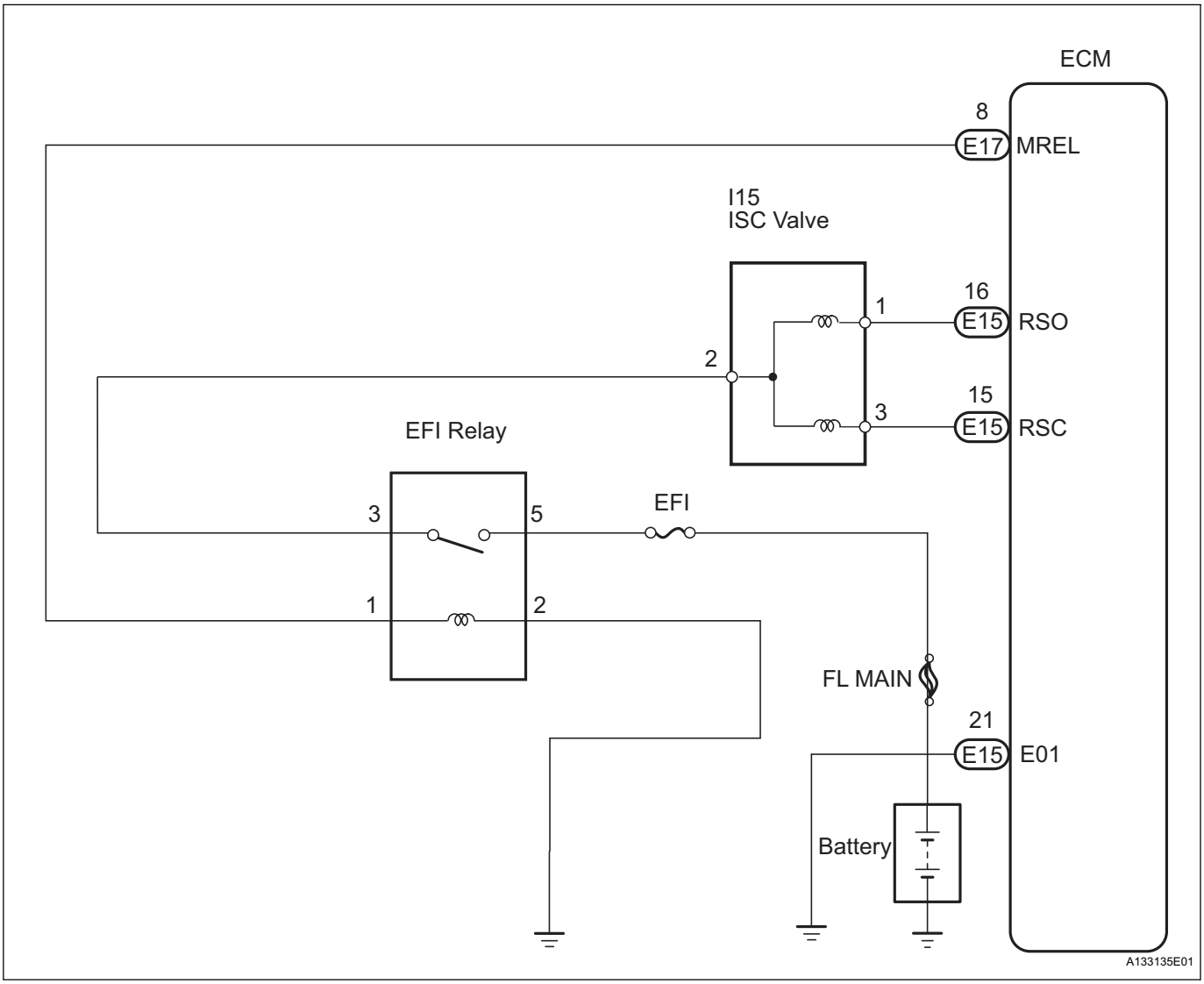
DTC	P0505	Idle Control System Malfunction

DESCRIPTION

The rotary solenoid type ISC valve is located in front of the intake air chamber and intake air bypassing the throttle valve is directed to the ISC valve through a passage.
In this way the intake air volume bypassing the throttle valve is regulated, controlling the engine speed.
The ECM operates only the ISC valve to perform idle-up and provide feedback for the target idling speed.

DTC No.	DTC Detection Condition	Trouble Area
P0505	Idle speed continues to vary greatly from target speed (2 trip detection logic)	• Open or short in ISC valve circuit • ISC valve is stuck or closed • Open or short in A/C signal circuit • Air induction system • ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

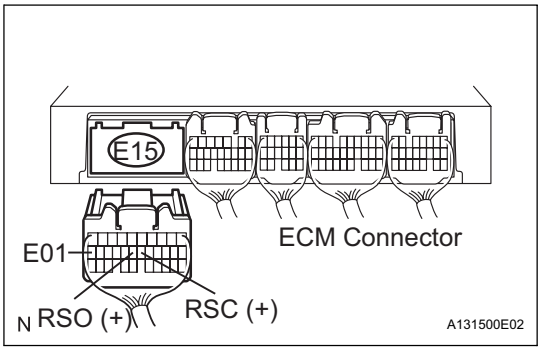
1	CHECK IDLE SPEED

(a) Warm up and stop the engine.
(b) Connect the intelligent tester to the DLC3.
NOTICE:
Switch off all accessories and A/C before connecting the intelligent tester.
(c) Race the engine at an engine speed of 2,500 rpm for approx. 90 seconds.
(d) Turn the intelligent tester ON.
(e) Select the following menu items: Powertrain / Engine and ECT / Active Test / TE1.
(f) Select the following menu items: Powertrain / Engine and ECT / Data List / Engine SPD.
(g) Check the difference of the engine speed between the ones, less than 5 seconds and more than 5 seconds after ACTIVE TEST TE1.
Difference engine speed:
More than 100 rpm

OK → **GO TO STEP 7**

NG

2	INSPECT IDLE SPEED CONTROL VALVE ASSEMBLY (RSO AND RSC VOLTAGE)



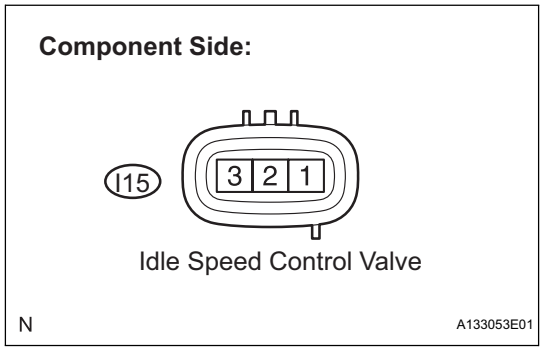
(a) Disconnect the E15 ECM connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage between the terminals.
Standard voltage

Tester Connection	Specified Condition
RSO (E15-16) - E01 (E15-21)	9 to 14 V
RSC (E15-15) - E01 (E15-21)	9 to 14 V

OK → **GO TO STEP 6**

NG

3 INSPECT IDLE SPEED CONTROL VALVE ASSEMBLY (RESISTANCE)



(a) Disconnect the I15 idle speed control valve connector.
(b) Measure the resistance between the terminals.
Standard resistance

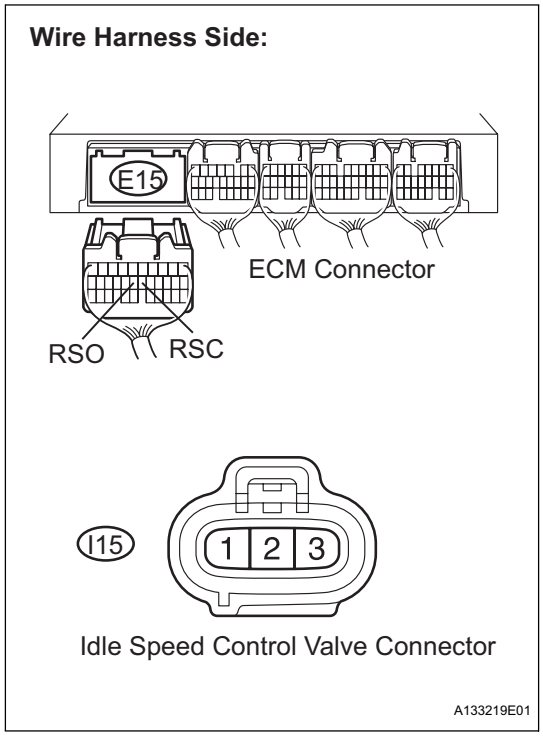
Tester Connection	Condition	Specified Condition
I15-1 - I15-3 I15-2 - I15-3	Cold	17.0 to 25.0 Ω
I15-1 - I15-3 I15-2 - I15-3	Hot	21.5 to 29.5 Ω

(c) Reconnect the idle speed control valve connector.

NG → **REPLACE IDLE SPEED CONTROL VALVE ASSEMBLY**

OK

4 CHECK HARNESS AND CONNECTOR (ISC - ECM)



(a) Disconnect the I15 ISC connector.
(b) Disconnect the E15 ECM connector.
(c) Measure the resistance between the terminals.
Standard resistance

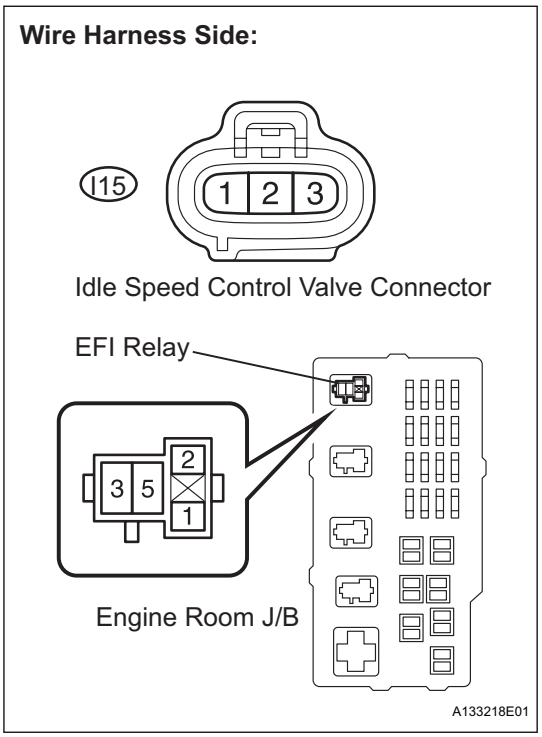
Tester Connection	Specified Condition
RSC (E15-15) - I15-3	Below 1 Ω
RSO (E15-16) - I15-1	Below 1 Ω
RSC (E15-15) or I15-3	10 kΩ or higher
RSO (E15-16) or I15-1	10 kΩ or higher

(d) Connect the ISC and ECM connectors.

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

OK

5	CHECK HARNESS AND CONNECTOR (ISC - EFI RELAY)



(a) Remove the EFI relay from the engine room J/B.
(b) Disconnect the I15 ISC connector.
(c) Measure the resistance between the terminals.

Standard resistance

Tester Connection	Specified Condition
I15-2 - Engine room J/B EFI relay terminal 3	Below 1 Ω
I15-2 or Engine room J/B EFI relay terminal 3 - Body ground	10 kΩ or higher

(d) Connect the ISC connector.
(e) Install the EFI relay.

OK → **GO TO STEP 6**

NG

CHECK ECM POWER SOURCE CIRCUIT

6	CHECK IDLE SPEED CONTROL VALVE ASSEMBLY (BLOCKAGE)

(a) Remove the idle speed control valve assembly.
(b) Check for blockage of the idle speed control valve and the passage to bypass throttle valve.

Blockage Point	Proceed to
No blockage	A
Blockage of idle speed control valve side	B
Blockage of throttle body side	C

B → **REPAIR OR REPLACE IDLE SPEED CONTROL VALVE ASSEMBLY**

C → **REPAIR OR REPLACE THROTTLE BODY ASSEMBLY**

A

REPLACE ECM

7	CHECK A/C SIGNAL CIRCUIT

(a) Check the A/C signal circuit.
OK:
A/C signal is OK

NG → **REPAIR OR REPLACE A/C SIGNAL CIRCUIT**

OK ↓

CHECK AIR INDUCTION SYSTEM

DTC	P1130	A/F Sensor Circuit Range / Performance Malfunction (Bank 1 Sensor 1)

DTC	P1150	A/F Sensor Circuit Range / Performance Malfunction (Bank 2 Sensor 1)

DESCRIPTION

Refer to DTC P0125 (See page ES-55).

DTC No.	DTC Detection Condition	Trouble Area
P1130 P1150	Either of the following condition is met (a) Output voltage* of A/F sensor remains at 3.8 V or more, or 2.8 V or less, during engine running after engine is warmed up (2 trip detection logic) (b) Output voltage* of A/F sensor does not change from 3.30 V, during engine running after engine is warmed up (2 trip detection logic)	• Open or short in A/F sensor circuit • A/F sensor (sensor 1) • Air induction system • EGR system • Fuel pressure • Injector • ECM

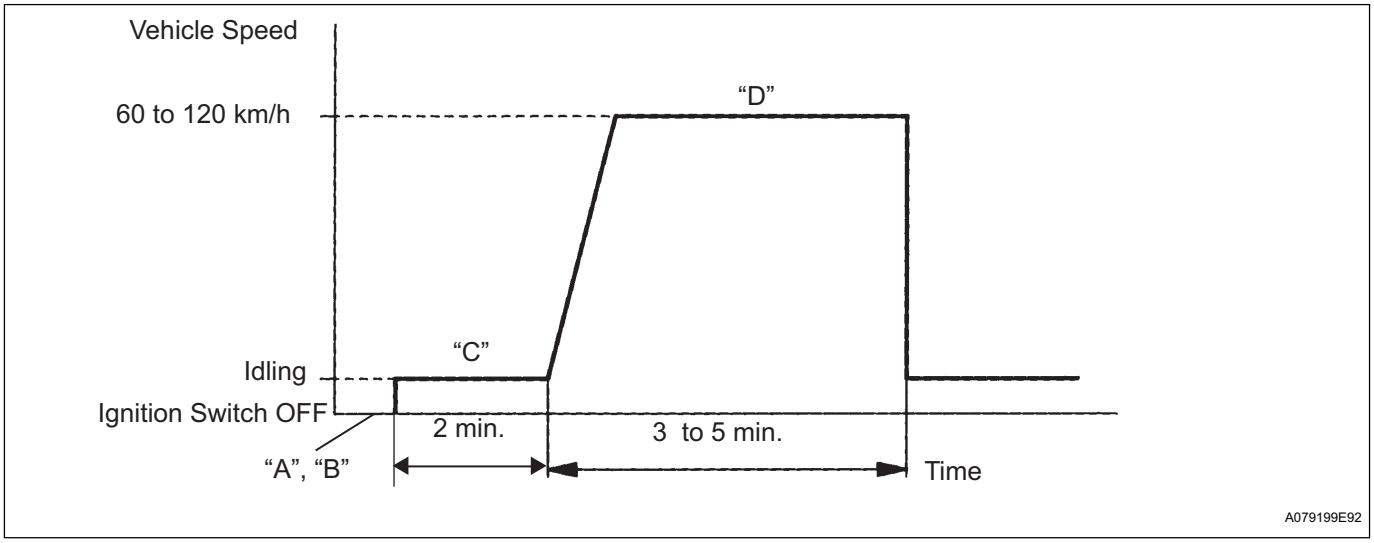
HINT:

- Sensor 1 refers to the sensor near the engine assembly.
- When DTC P1130 is detected, confirm the output voltage of the air fuel ratio sensor (sensor 1) in the Data List using the intelligent tester. If the voltage output of the air fuel ratio sensor is less than 0.1 V, the air fuel ratio sensor circuit may be open or short.

WIRING DIAGRAM

Refer to DTC P0125 (See page ES-56).

CONFIRMATION DRIVING PATTERN



1. **Connect the intelligent tester to the DLC3 (Procedure "A").**
2. **Switch the intelligent tester from the normal mode to the check mode (See page ES-18) (Procedure "B").**
3. **Start the engine and warm it up with all the accessory switches OFF (Procedure "C").**
4. **Drive the vehicle at 60 to 120 km/h and engine speed of 1,400 to 3,200 rpm for 3 to 5 minutes (Procedure "D").**

HINT:

If a malfunction exists, the MIL will be illuminated during procedure "D".

NOTICE:
If the conditions in this test are not strictly followed, a malfunction will not be detected. If you do not have an intelligent tester, turn the ignition switch OFF after performing procedure "C" and "D" , then perform procedure "C" and "D" again.

INSPECTION PROCEDURE

Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	CHECK DTC OUTPUT

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / DTC.
(e) Read DTCs.

Result

Display (DTC output)	Proceed to
P1130 and/or P1150	A
P1130 and/or P1150 and other DTCs	B

B → **GO TO DTC CHART (See page ES-23)**

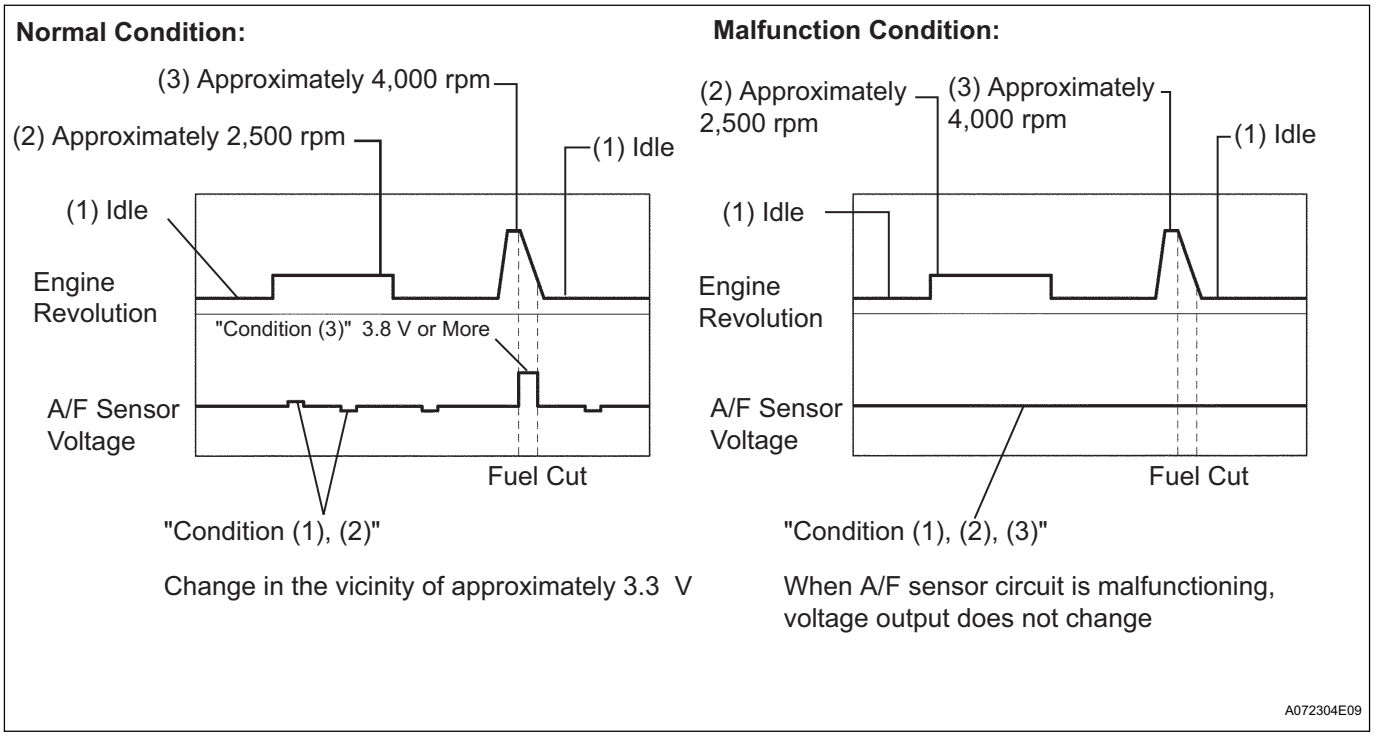
A

2	READ VALUE OF INTELLIGENT TESTER

(a) Connect the intelligent tester to the DLC3.
(b) Start the engine and turn the intelligent tester ON.
(c) Warm up the A/F sensor at 2,500 rpm for approximately 90 seconds.
(d) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Data List.
(e) Select the following monitor items: AFS B1 S1 and Engine Speed.
(f) Monitor the A/F sensor voltage carefully.
(g) Check the A/F sensor voltage under the following conditions:
  (1) Allow the engine to idle for 30 seconds (Condition 1).
  (2) Run the engine at approximately 2,500 rpm (where the engine RPM is not suddenly changed) (Condition 2).
  (3) Raise the engine speed to 4,000 rpm and quickly release the accelerator pedal so that the throttle valve is fully closed (Condition 3).

Standard:
Condition (1) and (2)

The voltage changes in the vicinity of 3.3 V (between approximately 3.1 and 3.5 V) as shown in the illustration.
Condition (3)
The voltage increases to 3.8 V or more during engine deceleration (when fuel is cut) as shown in the illustration.



HINT:

- Whenever the output voltage of the A/F sensor remains at approximately 3.3 V (see diagram, Malfunction Condition) under any condition as well as the above conditions, the A/F sensor may have an open circuit. (This will also happen when the A/F sensor heater has an open circuit.)
- Whenever the output voltage of the A/F sensor remains at a certain value of approximately 3.8 V or more, or 2.8 V or less (see diagram, Malfunction Condition) under any condition as well as the above conditions, the A/F sensor may have a short circuit.
- The ECM will stop fuel injection (fuel cut) during engine deceleration. This will cause lean condition and should result in a momentary increase in the A/F sensor voltage output.
- The ECM must establish a closed throttle position learned value to perform fuel cut. If the battery terminal was reconnected, the vehicle must be driven at over 16 km/h to allow the ECM to learn the closed throttle position.

- When the vehicle is driven:
  The output voltage of the A/F sensor may be below 2.8 V during fuel enrichment. For the vehicle, this translates to a sudden increase in speed with the accelerator pedal fully depressed when trying to overtake another vehicle. The A/F sensor is functioning normally.
- The A/F sensor is a current output element, therefore the current is converted into voltage inside the ECM.
  If measuring voltage at the connectors of the A/F sensor or ECM, you will obtain a constant voltage.

OK → **GO TO STEP 12**

NG

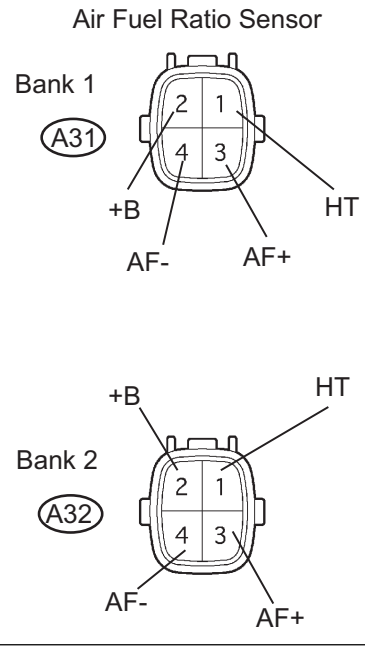
3 CHECK PCV HOSE

NG → **REPAIR OR REPLACE PCV HOSE**

OK

4 INSPECT AIR FUEL RATIO SENSOR

Component Side:



(a) Disconnect the A31 or A32 air fuel ratio sensor connector.

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

Standard resistance

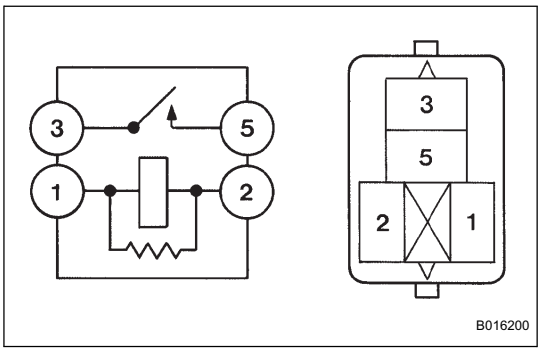
Tester Connection	Condition	Specified Condition
+B (A31-2) - HT (A31-1)	20°C (68°F)	0.8 to 1.4 Ω
+B (A31-2) - AF- (A31-4)	Always	10 kΩ or higher
+B (A32-2) - HT (A32-1)	20°C (68°F)	0.8 to 1.4 Ω
+B (A32-2) - AF- (A32-4)	Always	10 kΩ or higher

(c) Reconnect the air fuel ratio sensor connector.

NG → **REPLACE AIR FUEL RATIO SENSOR**

OK

5 INSPECT AIR FUEL RATIO SENSOR RELAY



(a) Remove the A/F relay from the No. 2 engine room R/B.
(b) Measure the resistance of the A/F relay.
Standard resistance

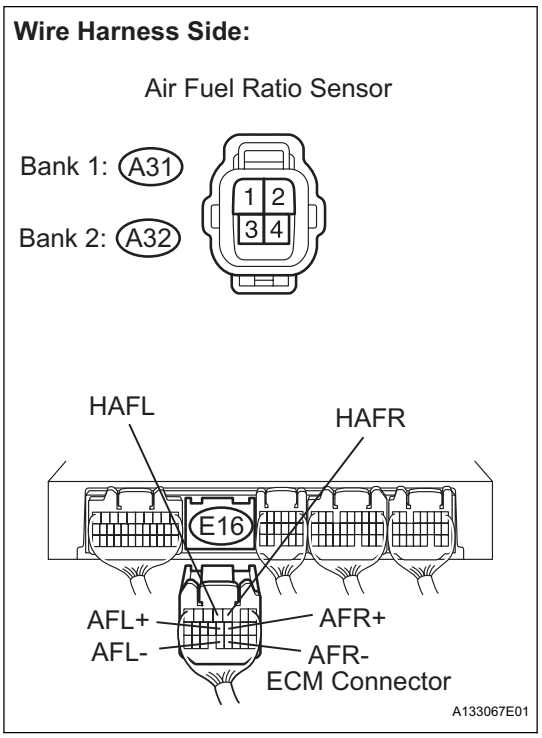
Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	below 1 Ω (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the A/F relay.

NG → REPLACE AIR FUEL RATIO SENSOR RELAY

OK

6 CHECK HARNESS AND CONNECTOR (ECM - AIR FUEL RATIO SENSOR)



(a) Disconnect the A31 and A32 air fuel ratio sensor connectors.
(b) Disconnect the E16 ECM connector.
(c) Measure the resistance between the terminals.
Standard resistance

Tester Connection	Specified Condition
AFR+ (E16-11) - AFR+ (A31-3)	Below 1 Ω
AFR- (E16-20) - AFR- (A31-4)	Below 1 Ω
HAFR (E16-3) - HAFR (A31-1)	Below 1 Ω
AFL+ (E16-12) - AFL+ (A32-3)	Below 1 Ω
AFL- (E16-21) - AFL- (A32-4)	Below 1 Ω
HAFL (E16-4) - HAFL (A32-1)	Below 1 Ω
AFR+ (E16-11) or AFR+ (A31-3) - Body ground	10 kΩ or higher
AFR- (E16-20) or AFR- (A31-4) - Body ground	10 kΩ or higher
HAFR (E16-3) or HAFR (A31-1) - Body ground	10 kΩ or higher
AFL+ (E16-12) or AFL+ (A32-3) - Body ground	10 kΩ or higher
AFL- (E16-21) or AFL- (A32-4) - Body ground	10 kΩ or higher
HAFL (E16-4) or HAFL (A32-1) - Body ground	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

7 CHECK EGR SYSTEM

NG → REPAIR OR REPLACE EGR SYSTEM

OK

8	CHECK AIR INDUCTION SYSTEM

(a) Check for vacuum leaks in the air induction system.
OK:
No leak in the air induction system

NG → **REPAIR OR REPLACE AIR INDUCTION SYSTEM**

OK

9	CHECK FUEL PRESSURE

(a) Check the fuel pressure (high or low pressure).

Standard

Item	Specified Condition
Fuel pressure	304 to 343 kPa (3.1 to 3.5 kgf cm^2, 44 to 45 psi)

NG → **REPAIR OR REPLACE FUEL SYSTEM**

OK

10	INSPECT FUEL INJECTOR ASSEMBLY

Standard

Item	Specified Condition
Injection Volume	60 to 73 cm^3 (3.7 to 4.5 cu in)
Difference between each injector	13 cm^3 (0.8 cu in)

NG → **REPLACE FUEL INJECTOR ASSEMBLY**

OK

11	CHECK FOR EXHAUST GAS LEAKAGE

(a) Check for exhaust gas leaks in the exhaust system.
OK:
No leak in the exhaust system

NG → **REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT**

OK

REPLACE AIR FUEL RATIO SENSOR

12	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

NEXT

13	CHECK DTC OUTPUT

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / DTC.
(e) Read DTCs.

Result

Display (DTC output)	Proceed to
No output	A
P1130 and/or P1150	B

B → REPLACE ECM

A

14	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

(a) Has the vehicle run out of fuel in the past?

NO → CHECK FOR INTERMITTENT PROBLEMS

YES

DTC CAUSED BY RUNNING OUT OF FUEL

DTC	P1133	A/F Sensor Circuit Response Malfunction (Bank 1 Sensor 1)

DTC	P1153	A/F Sensor Circuit Response Malfunction (Bank 2 Sensor 1)

DESCRIPTION

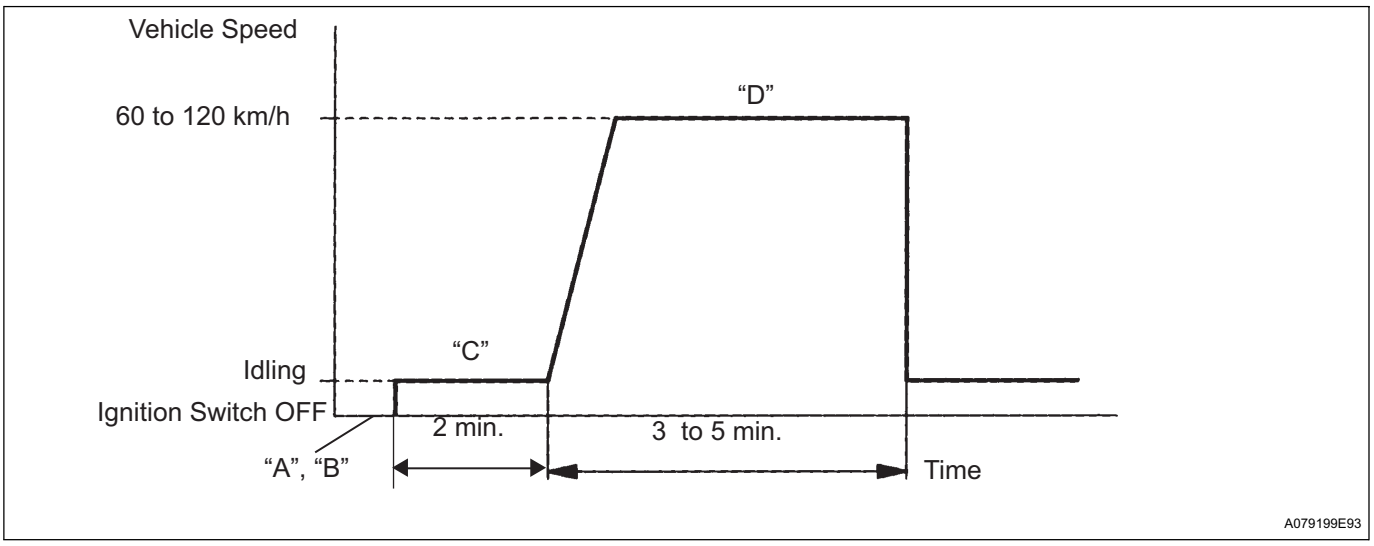
Refer to DTC P0125 (See page ES-55).

DTC No.	DTC Detection Condition	Trouble Area
P1133 P1153	After engine is warmed up and during vehicle driving at an engine speed of 1,400 rpm or more and vehicle speed of 60 km/h or more, response characteristics of air-fuel ratio sensor becomes determined. (2 trip detection logic)	• Open or short in air-fuel ratio sensor circuit • Air-fuel ratio sensor • Air induction system • EGR system • Fuel pressure • Injector • ECM

WIRING DIAGRAM

Refer to DTC P0125 (See page ES-56).

CONFIRMATION DRIVING PATTERN



1. **Connect the intelligent tester to the DLC3 (Procedure "A").**
2. **Switch the intelligent tester from the normal mode to the check mode (See page ES-18) (Procedure "B").**
3. **Start the engine and warm it up with all the accessory switches OFF (Procedure "C").**
4. **Drive the vehicle at 60 to 120 km/h and engine speed of 1,400 to 3,200 rpm for 3 to 5 minutes (Procedure "D").**

HINT:

If a malfunction exists, the MIL will be illuminated during procedure "D".

NOTICE:

If the conditions in this test are not strictly followed, a malfunction will not be detected. If you do not have an intelligent tester, turn the ignition switch OFF after performing procedure "C" and "D" , then perform procedure "C" and "D" again.

INSPECTION PROCEDURE

HINT:
When freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	CHECK DTC OUTPUT

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / DTC.
(e) Read DTCs.

Result

Display (DTC output)	Proceed to
P1133 and/or P1153	A
P1133 and/or P1153 and other DTCs	B

B → GO TO DTC CHART (See page ES-23)

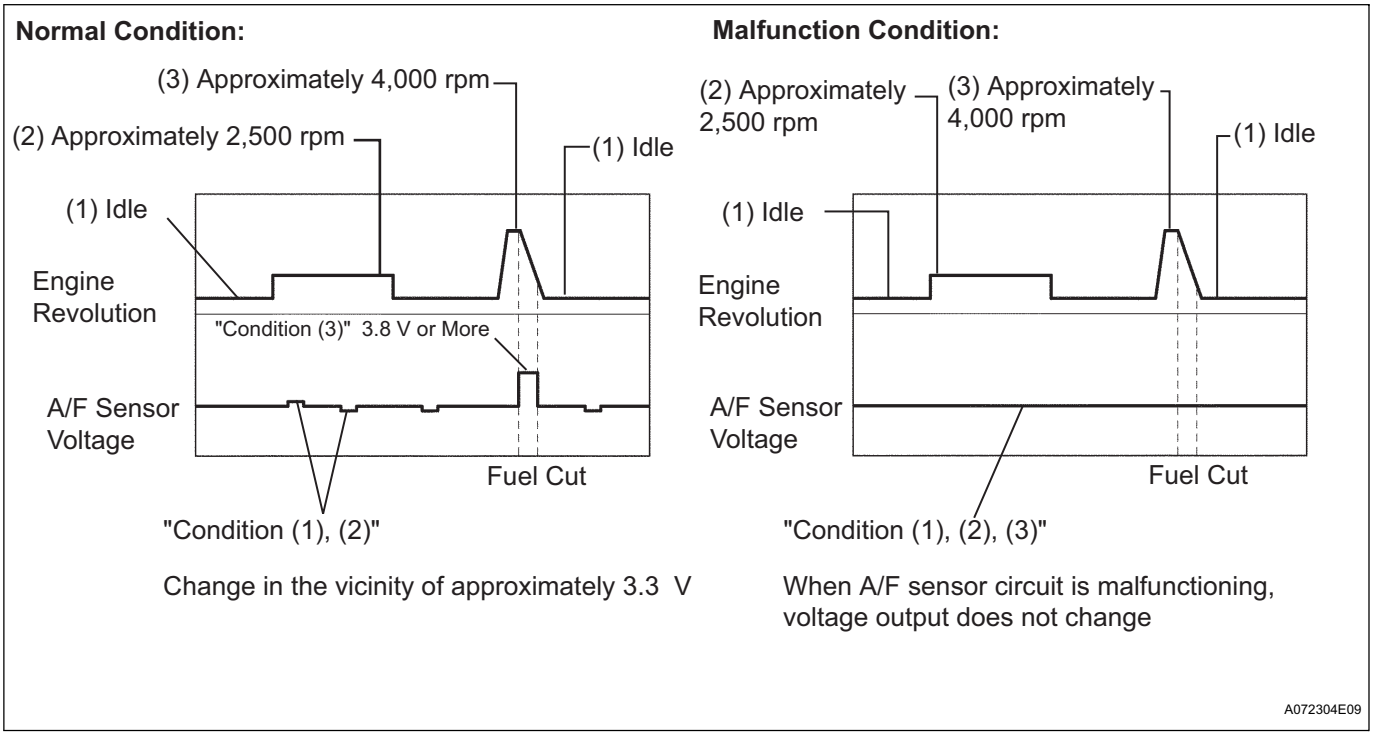
A

2	READ VALUE OF INTELLIGENT TESTER

(a) Connect the intelligent tester to the DLC3.
(b) Start the engine and turn the intelligent tester ON.
(c) Warm up the A/F sensor at 2,500 rpm for approximately 90 seconds.
(d) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Data List.
(e) Select the monitor items: AFS B1 S1 and Engine Speed.
(f) Monitor the A/F sensor voltage carefully.
(g) Check the A/F sensor voltage under the following conditions:
  (1) Allow the engine to idle for 30 seconds (Condition 1).
  (2) Run the engine at approximately 2,500 rpm (where the engine RPM is not suddenly changed) (Condition 2).
  (3) Raise the engine speed to 4,000 rpm and quickly release the accelerator pedal so that the throttle valve is fully closed (Condition 3).

Standard:
Condition (1) and (2)
The voltage changes in the vicinity of 3.3 V (between approximately 3.1 to 3.5 V) as shown in the illustration.
Condition (3)

The voltage increases to 3.8 V or more during engine deceleration (when fuel is cut) as shown in the illustration.



HINT:

- Whenever the output voltage of the A/F sensor remains at approximately 3.3 V (see diagram, Malfunction Condition) under any condition as well as the above conditions, the A/F sensor may have an open circuit. (This will also happen when the A/F sensor heater has an open circuit.)
- Whenever the output voltage of the A/F sensor remains at a certain value of approximately 3.8 V or more, or 2.8 V or less (see diagram, Malfunction Condition) under any condition as well as the above conditions, the A/F sensor may have a short circuit.
- The ECM will stop fuel injection (fuel cut) during engine deceleration. This will cause lean condition and should result in a momentary increase in the A/F sensor voltage output.
- The ECM must establish a closed throttle position learned value to perform fuel cut. If the battery terminal was reconnected, the vehicle must be driven at over 16 km/h to allow the ECM to learn the closed throttle position.
- When the vehicle is driven:
  The output voltage of the A/F sensor may be below 2.8 V during fuel enrichment. For the vehicle, this translates to a sudden increase in speed with the accelerator pedal fully depressed when trying to overtake another vehicle. The A/F sensor is functioning normally.

- The A/F sensor is a current output element, therefore the current is converted into voltage inside the ECM.
  If measuring voltage at the connectors of the A/F sensor or ECM, you will obtain a constant voltage.

OK → GO TO STEP 12

NG

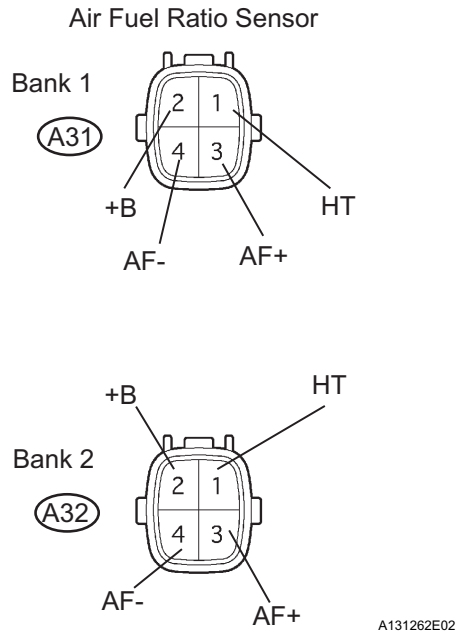
3	CHECK PCV HOSE

NG → REPAIR OR REPLACE PCV HOSE

OK

4	INSPECT AIR FUEL RATIO SENSOR

Component Side:



(a) Disconnect the A31 or A32 air fuel ratio sensor connector.

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

Standard resistance

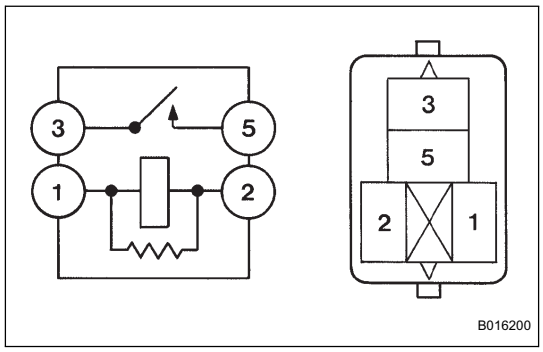
Tester Connection	Condition	Specified Condition
+B (A31-2) - HT (A31-1)	20°C (68°F)	0.8 to 1.4 Ω
+B (A31-2) - AF- (A31-4)	Always	10 kΩ or higher
+B (A32-2) - HT (A32-1)	20°C (68°F)	0.8 to 1.4 Ω
+B (A32-2) - AF- (A32-4)	Always	10 kΩ or higher

(c) Reconnect the air fuel ratio sensor connector.

NG → REPLACE AIR FUEL RATIO SENSOR

OK

5 INSPECT AIR FUEL RATIO SENSOR RELAY



(a) Remove the A/F relay from the engine room No. 2 R/B.
(b) Measure the resistance of the A/F relay.
Standard resistance

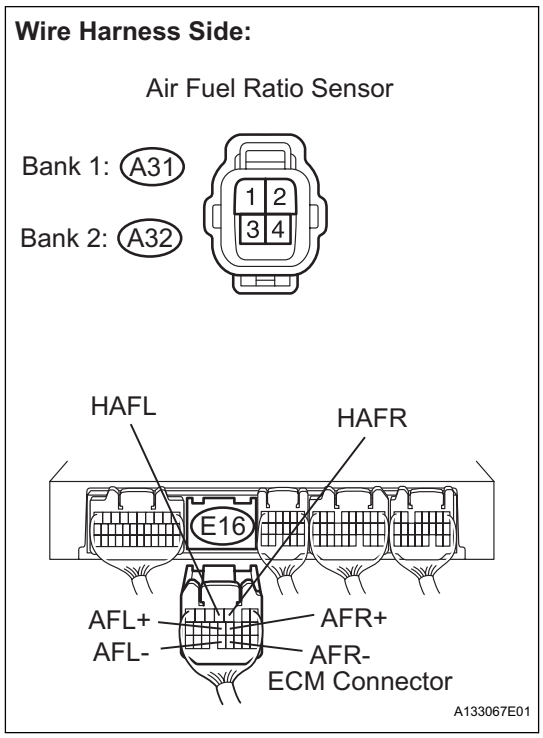
Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	below 1 Ω (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the A/F relay.

NG → REPLACE AIR FUEL RATIO SENSOR RELAY

OK

6 CHECK HARNESS AND CONNECTOR (ECM - AIR FUEL RATIO SENSOR)



(a) Disconnect the A31 and A32 air fuel ratio sensor connectors.
(b) Disconnect the E16 ECM connector.
(c) Measure the resistance between the terminals.
Standard resistance

Tester Connection	Specified Condition
AFR+ (E16-11) - AFR+ (A31-3)	Below 1 Ω
AFR- (E16-20) - AFR- (A31-4)	Below 1 Ω
HAFR (E16-3) - HAFR (A31-1)	Below 1 Ω
AFL+ (E16-12) - AFL+ (A32-3)	Below 1 Ω
AFL- (E16-21) - AFL- (A32-4)	Below 1 Ω
HAFL (E16-4) - HAFL (A32-1)	Below 1 Ω
AFR+ (E16-11) or AFR+ (A31-3) - Body ground	10 kΩ or higher
AFR- (E16-20) or AFR- (A31-4) - Body ground	10 kΩ or higher
HAFR (E16-3) or HAFR (A31-1) - Body ground	10 kΩ or higher
AFL+ (E16-12) or AFL+ (A32-3) - Body ground	10 kΩ or higher
AFL- (E16-21) or AFL- (A32-4) - Body ground	10 kΩ or higher
HAFL (E16-4) or HAFL (A32-1) - Body ground	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

7 CHECK AIR INDUCTION SYSTEM

(a) Check for vacuum leaks in the air induction system.

OK:
No leak in the air induction system

NG → **REPAIR OR REPLACE AIR INDUCTION SYSTEM**

OK ↓

8	CHECK EGR SYSTEM

NG → **REPAIR OR REPLACE EGR SYSTEM**

OK ↓

9	CHECK FUEL PRESSURE

(a) Check the fuel pressure (high or low pressure).

Standard

Item	Specified Condition
Fuel pressure	304 to 343 kPa (3.1 to 3.5 kgf cm^2, 44 to 55 psi)

NG → **REPAIR OR REPLACE FUEL SYSTEM**

OK ↓

10	INSPECT INJECTOR ASSEMBLY

Standard

Item	Specified Condition
Injection Volume	60 to 73 cm^3 (3.7 to 4.5 cu in)
Difference between each injector	13 cm^3 (0.8 cu in)

NG → **REPAIR INJECTOR ASSEMBLY**

OK ↓

11	CHECK FOR EXHAUST GAS LEAKAGE

(a) Check for exhaust gas leaks in the exhaust system.
OK:
No leak in the exhaust system

NG → **REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT**

OK ↓

REPLACE AIR FUEL RATIO SENSOR

12	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

NEXT

13	CHECK DTC OUTPUT

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / DTC.
(e) Read DTCs.

Result

Display (DTC output)	Proceed to
No output	A
P1133 and/or P1153	B

B → REPLACE ECM

A

14	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

(a) Has the vehicle run out of the fuel in the past?

NO → CHECK FOR INTERMITTENT PROBLEMS

YES

DTC CAUSED BY RUNNING OUT OF FUEL

DTC	P1135	A/F Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)

DTC	P1155	A/F Sensor Heater Circuit Malfunction (Bank 2 Sensor 1)

DESCRIPTION

Refer to DTC P0125 (See page ES-55).

DTC No.	DTC Detection Condition	Trouble Area
P1135 P1155	Either of the following conditions is met: (a) When heater operates, heater current exceeds 8A (2 trip detection logic) (b) Heater current is 0.25A or less when heater operates (2 trip detection logic)	• Open or short in air-fuel ratio sensor • Air-fuel ratio sensor • ECM

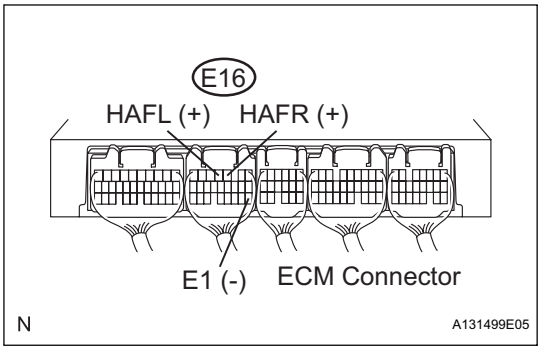
WIRING DIAGRAM

Refer to DTC P0125 (See page ES-56).

INSPECTION PROCEDURE

Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	INSPECT ECM (HAFR AND HAFL VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage between the terminals.

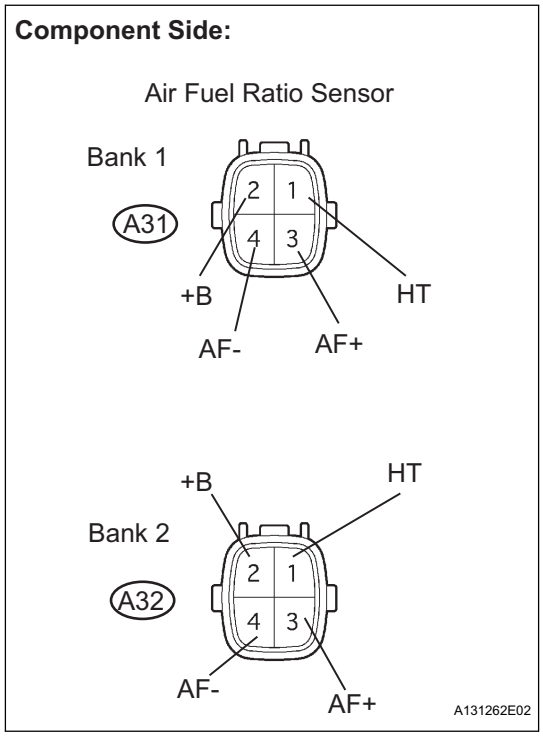
Standard voltage

Tester Connection	Specified Condition
HAFR (E16-3) - E1 (E16-17)	9 to 14 V
HAFL (E16-4) - E1 (E16-17)	9 to 14 V

NG → CHECK ECM POWER SOURCE CIRCUIT

OK

2 INSPECT AIR FUEL RATIO SENSOR



(a) Disconnect the A31 or A32 air fuel ratio sensor connector.

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

Standard resistance

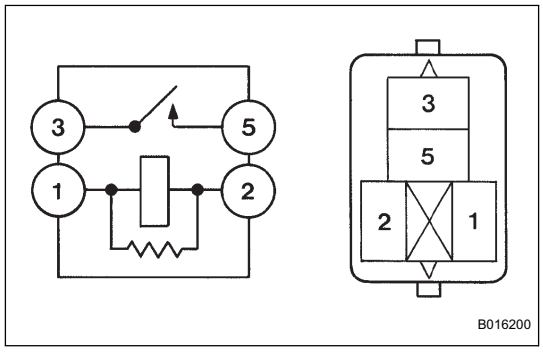
Tester Connection	Condition	Specified Condition
+B (A31-2) - HT (A31-1)	20°C (68°F)	0.8 to 1.4 Ω
+B (A31-2) - AF- (A31-4)	Always	10 kΩ or higher
+B (A32-2) - HT (A32-1)	20°C (68°F)	0.8 to 1.4 Ω
+B (A32-2) - AF- (A32-4)	Always	10 kΩ or higher

(c) Reconnect the air fuel ratio sensor connector.

NG → **REPLACE AIR FUEL RATIO SENSOR**

OK

3 INSPECT AIR FUEL RATIO SENSOR RELAY



(a) Remove the A/F relay from the No. 2 engine room R/B.

(b) Measure the A/F relay resistance.

Standard resistance

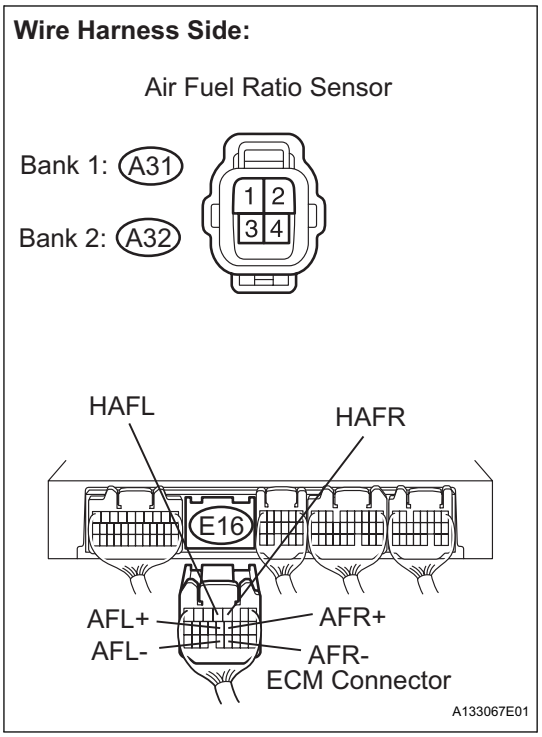
Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (when battery voltage applied to terminals 1 and 2)

(c) Reinstall the A/F relay.

NG → **REPLACE AIR FUEL RATIO SENSOR RELAY**

OK

4	CHECK HARNESS AND CONNECTOR (ECM - A/F, A/F SENSOR - A/F SENSOR HEATER RELAY)



(a) Disconnect the A31 and A32 air fuel ratio sensor connectors.
(b) Disconnect the E16 ECM connector.
(c) Measure the resistance between the terminals.
Standard resistance

Tester Connection	Specified Condition
AFR+ (E16-11) - AFR+ (A31-3)	Below 1 Ω
AFR- (E16-20) - AFR- (A31-4)	Below 1 Ω
HAFR (E16-3) - HAFR (A31-1)	Below 1 Ω
AFL+ (E16-12) - AFL+ (A32-3)	Below 1 Ω
AFL- (E16-21) - AFL- (A32-4)	Below 1 Ω
HAFL (E16-4) - HAFL (A32-1)	Below 1 Ω
AFR+ (E16-11) or AFR+ (A31-3) - Body ground	10 kΩ or higher
AFR- (E16-20) or AFR- (A31-4) - Body ground	10 kΩ or higher
HAFR (E16-3) or HAFR (A31-1) - Body ground	10 kΩ or higher
AFL+ (E16-12) or AFL+ (A32-3) - Body ground	10 kΩ or higher
AFL- (E16-21) or AFL- (A32-4) - Body ground	10 kΩ or higher
HAFL (E16-4) or HAFL (A32-1) - Body ground	10 kΩ or higher

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

OK

REPLACE ECM

DTC	P1300	Igniter Circuit Malfunction (No. 1)

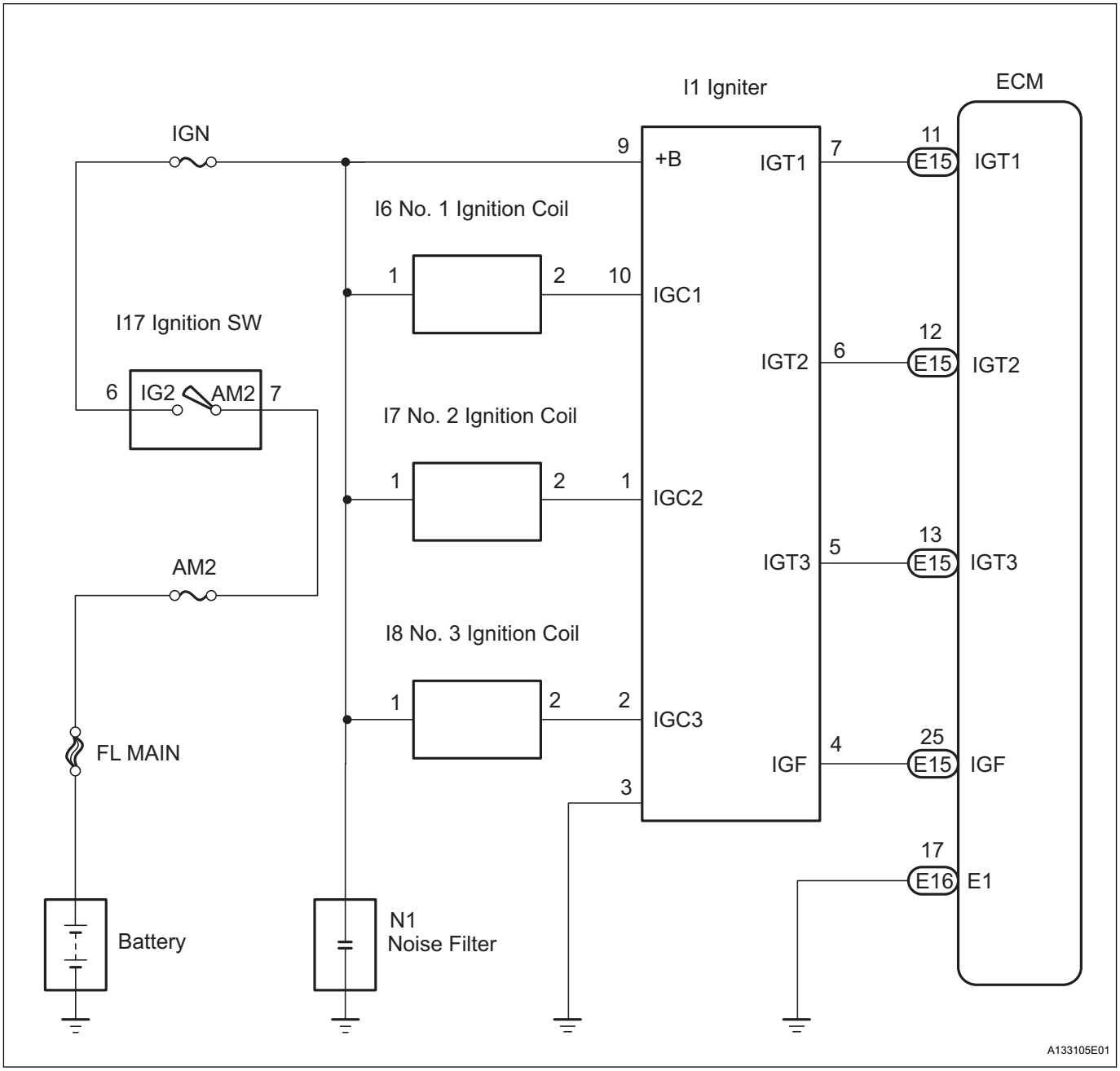
DESCRIPTION

A Direct Ignition System (DIS) has been adopted. The DIS improves the ignition timing accuracy, reduces high-voltage loss, and enhances the overall reliability of the ignition system by eliminating the distributor. The DIS is a 2-cylinder simultaneous ignition system which ignites 2 cylinders simultaneously with one ignition coil. In the 2-cylinder simultaneous ignition system, each of the 2 spark plugs is connected to the end of the secondary winding. High voltage generated in the secondary winding is applied directly to the spark plugs. The spark of the 2 spark plugs pass simultaneously from the centre electrode to the ground electrode.

The ECM determines ignition timing and outputs the ignition signal (IGT) for each cylinder. Based on IGT signal, the igniter controls the primary ignition signal (IGC) for all ignition coils. At the same time, the igniter also sends an ignition confirmation signal (IGF) as a fail-safe measure to the ECM.

DTC NO.	DTC Detection Condition	Trouble Area
P1300	Condition below is repeated 3 times consecutively while 6 IGT signals being output consecutively when engine is running. IGF signal is not input to ECM for 2 or more ignitions.	• Ignition system • Open or short in IGF or IGT circuit from igniter to ECM • Igniter • ECM

WIRING DIAGRAM

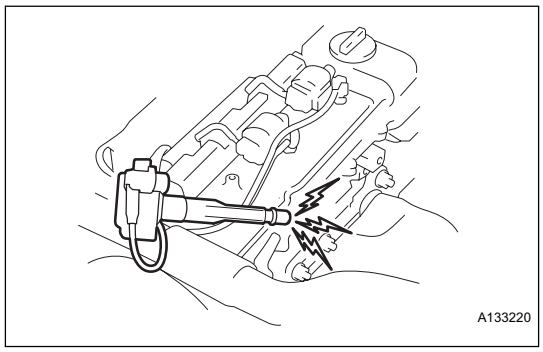


INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	CHECK SPARK PLUG

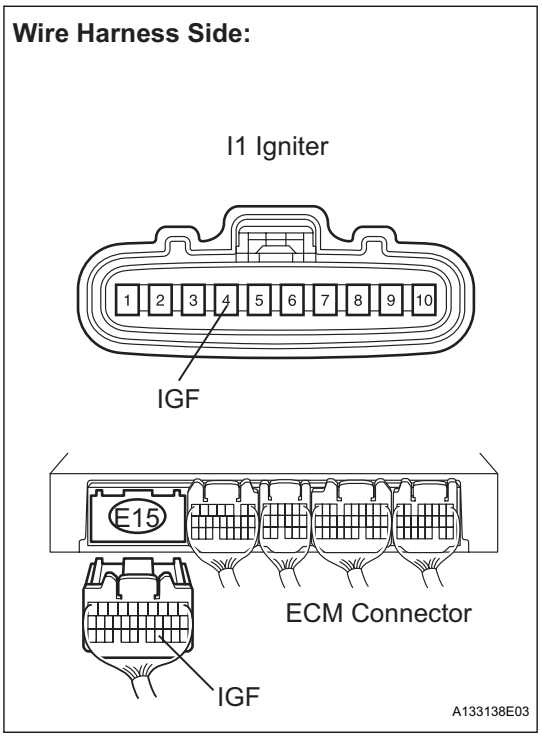


(a) Remove the ignition coil assembly.
(b) Remove the spark plug.
(c) Check the spark plug type.
(d) Check the spark plug electrode gap.
Standard:
1.1 mm (0.043 in)
NOTICE:
If adjusting the gap of a new spark plug, bend only the base of the ground electrode. Do not touch the tip. Never attempt to adjust the gap on a used plug.
(e) Check the electrode for carbon deposits.
(f) Perform a spark test.
CAUTION:
Absolutely disconnect each injector connectors.
NOTICE:
Do not crank the engine for more than 2 seconds.
(1) Install the spark plug to the ignition coil, and connect the ignition coil connector.
(2) Disconnect injector connector.
(3) Hold the end about 12.5 mm (0.5 in) from the ground.
(4) Check if a spark occurs while the engine is being cranked.
OK:
A spark jumps across the electrode gap.
(g) Reinstall the spark plug.
(h) Reinstall the ignition coil assembly.

NG → **GO TO STEP 4**

OK

2 CHECK HARNESS AND CONNECTOR (ECM - IGNITER)



(a) Disconnect the E15 ECM connector.
(b) Disconnect the I1 igniter connector.
(c) Measure the resistance of the wire harness side connectors.

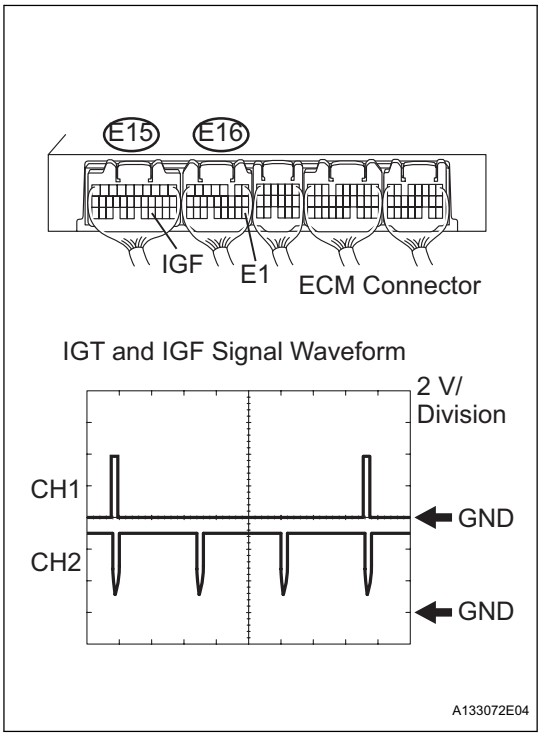
Standard resistance

Tester Connection	Specified Condition
IGF (E15-25) - IGF (I1-4)	Below 1 Ω
IGF (E15-25) or IGF (I1-4) - Body ground	10 kΩ or higher

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

OK

3 INSPECT ECM TERMINAL VOLTAGE (IGF VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage between the terminals of the E15 and E16 ECM connectors.

Standard voltage

Tester Connection	Specified Condition
IGF (E15-25) - E1 (E16-17)	9 to 14 V

HINT:
Inspection using an oscilloscope. During cranking or idling, check the waveform of the ECM connectors.

Standard

Tester Connection	Specified Condition
IGF (E15-25) - E1 (E16-17)	Correct waveform appears as shown

NG → **REPLACE ECM**

OK

REPLACE IGNITER ASSEMBLY

4 CHECK HARNESS AND CONNECTOR (ECM (IGT TERMINAL) - IGNITER)

(a) Disconnect the E15 ECM connector.
(b) Disconnect the I1 igniter connector.
(c) Measure the resistance of the wire harness side connectors.

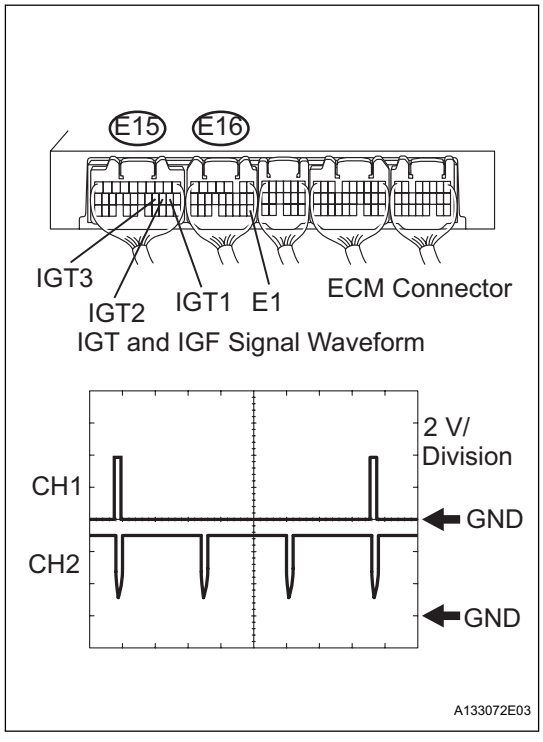
Standard resistance

Tester Connection	Specified Condition
IGT1 (E15-11) - IGT1 (I1-7)	Below 1 Ω
IGT2 (E15-12) - IGT2 (I1-6)	Below 1 Ω
IGT3 (E15-13) - IGT3 (I1-5)	Below 1 Ω
IGT1 (E15-11) or IGT1 (I1-7) - Body ground	10 kΩ or higher
IGT2 (E15-12) or IGT2 (I1-6) - Body ground	10 kΩ or higher
IGT3 (E15-13) or IGT3 (I1-5) - Body ground	10 kΩ or higher

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

OK

5 INSPECT ECM TERMINAL VOLTAGE (IGT1, IGT2, IGT3 VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage between the applicable terminals of the E15 and E16 ECM connectors.

Standard voltage

Tester Connection	Specified Condition
IGT1 (E15-11) - E1 (E16-17)	0.1 to 4.5 V
IGT2 (E15-12) - E1 (E16-17)	0.1 to 4.5 V
IGT3 (E15-13) - E1 (E16-17)	0.1 to 4.5 V

(c) Disconnect the I1 igniter connector.
(d) Measure the voltage of the ECM connector when the engine is cranked.

Standard voltage

Tester Connection	Specified Condition
IGT1 (E15-11) - E1 (E16-17)	4.5 V or more
IGT2 (E15-12) - E1 (E16-17)	4.5 V or more
IGT3 (E15-13) - E1 (E16-17)	4.5 V or more

HINT:
Reference:
Inspection using the oscilloscope. During cranking or idling, check the waveform of the ECM connectors.

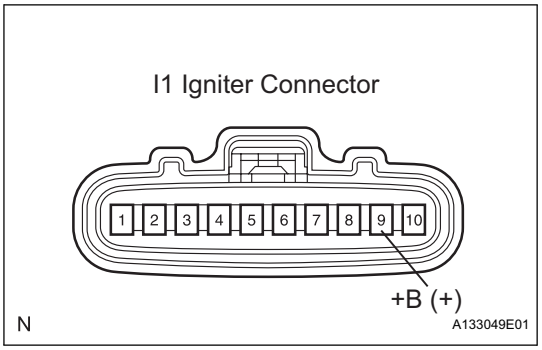
Standard

Tester Connection	Specified Condition
IGT1 (E15-11) - E1 (E16-17)	Correct waveform appears as shown
IGT2 (E15-12) - E1 (E16-17)	Correct waveform appears as shown
IGT3 (E15-13) - E1 (E16-17)	Correct waveform appears as shown

NG → **REPLACE ECM**

OK

6 INSPECT IGNITER TERMINAL VOLTAGE



(a) Turn the ignition switch ON.
(b) Disconnect the I1 igniter connector.
(c) Measure the voltage between the terminals.

Standard voltage

Tester Connection	Specified Condition
+B (I1-9) - Body ground	9 to 14 V

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

OK

REPLACE IGNITER ASSEMBLY

DTC	P1335	Crankshaft Position Sensor Circuit Malfunction (During Engine Running)

DESCRIPTION

Refer to DTC P0335 (See page ES-99).

DTC No.	DTC Detection Condition	Trouble Area
P1335	No crankshaft position sensor signal to ECM with an engine speed of 1,000 rpm or more	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Crankshaft timing pulley • ECM

WIRING DIAGRAM

Refer to DTC P0335 (See page ES-99).

INSPECTION PROCEDURE

Refer to DTC P0335 (See page ES-99).

HINT:

Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

DTC	P1410	EGR Valve Position Sensor Circuit Malfunction

DESCRIPTION

The EGR valve position sensor is mounted on the EGR valve and detects the lift amount of the EGR valve. The lift amount of the EGR valve which is detected by the EGR valve position sensor provides feedback to the ECM to control the lift amount of the EGR valve in response to engine operating conditions.

DTC No.	DTC Detecting Condition	Trouble Area
P1410	Open or short in EGR valve position sensor circuit 2 trip detection logic	• Open or short in EGR valve position sensor circuit • EGR valve position sensor • ECM

WIRING DIAGRAM

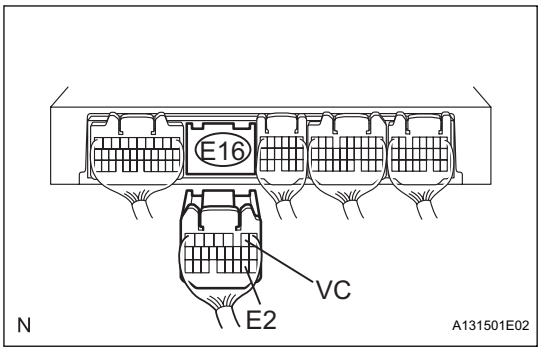
Refer to DTC P0401 (See page **ES-106**).

INSPECTION PROCEDURE

HINT:

- If DTCs P0110, P0115, P0120 and P1410 are output simultaneously, E2 (sensor ground) may be open.
- Read freeze frame data using intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	INSPECT ECM (VC VOLTAGE)



(a) Disconnect the E16 ECM connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage between the terminals of the E16 ECM connector.

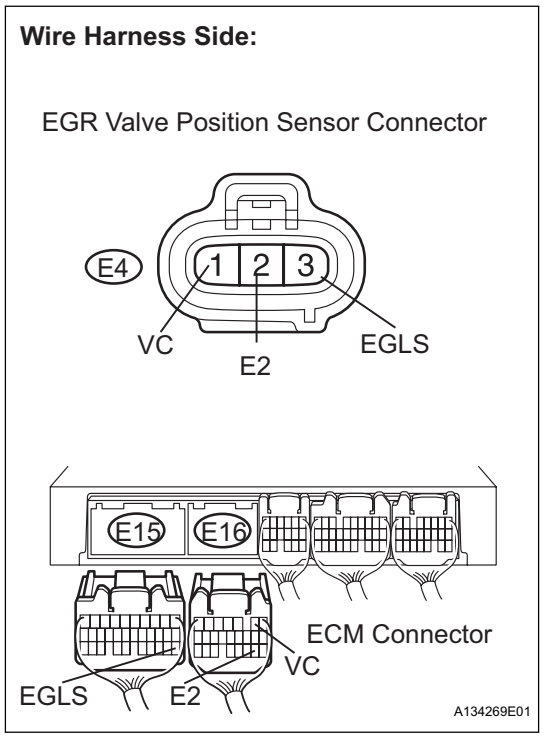
Standard voltage

Tester Connection	Specified Condition
VC (E16-2) - E2 (E16-18)	4.5 to 5.5 V

NG → **CHECK ECM POWER SOURCE CIRCUIT**

OK

2 CHECK HARNESS AND CONNECTOR (EGR VALVE POSITION SENSOR - ECM)



(a) Disconnect the E4 EGR valve position sensor connector.
(b) Disconnect the E15 and E16 ECM connectors.
(c) Measure the resistance between the terminals.

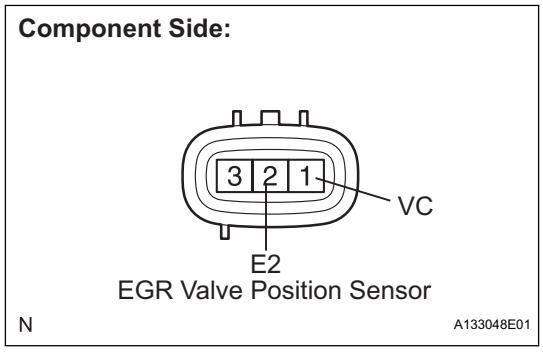
Standard resistance

Tester Connection	Specified Condition
VC (E4-1) - VC (E16-2)	Below 1 Ω
E2 (E4-2) - E2 (E16-18)	Below 1 Ω
EGLS (E4-3) - EGLS (E15-22)	Below 1 Ω
VC (E4-1) or VC (E16-2) - Body ground	10 kΩ or higher
E2 (E4-2) or E2 (E16-18) - Body ground	10 kΩ or higher
EGLS (E4-3) or EGLS (E15-22) - Body ground	10 kΩ or higher

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

OK

3 INSPECT EGR VALVE POSITION SENSOR



(a) Disconnect the E4 EGR valve position sensor connector.
(b) Measure the resistance between the terminals.

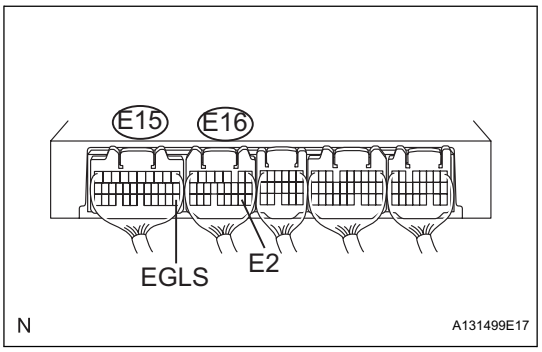
Standard resistance

Tester Connection	Condition	Specified Condition
VC (E4-1) - E2 (E4-2)	Always	1.5 to 4.3 kΩ

NG → **REPLACE EGR VALVE POSITION SENSOR**

OK

4	INSPECT ECM (EGLS VOLTAGE)



(a) Disconnect the vacuum hose from the EGR valve.
(b) Connect the hand-held vacuum pump to the EGR valve.
(c) Turn the ignition switch ON.
(d) Measure the voltage between the terminals.

Standard voltage

Tester Connection	EGR Valve Condition	Vacuum	Specified Condition
EGLS (E15-22) - E2 (E16-18)	Fully closed	0 kPa (0 mmHg)	0.4 to 1.6 V
EGLS (E15-22) - E2 (E16-18)	Fully open	17.3 kPa (130 mmHg)	3.2 to 5.1 V

OK → SYSTEM IS OK

NG → REPLACE ECM

DTC	P1411	EGR Valve Position Sensor Circuit Range / Performance Problem

DESCRIPTION

Refer to DTC P1410 (See page ES-156).

DTC No.	DTC Detection Condition	Trouble Area
P1411	Conditions (a) and (b) continue for 500 msec. or more: (2 trip detection logic) (a) Engine coolant temperature is less than 5°C (41°F) (b) EGLS voltage is less than 0.354 V, or 1.65 V or more	EGR valve position sensor

INSPECTION PROCEDURE

Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	CHECK OTHER DTC OUTPUT (IN ADDITION TO DTC P1411)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / DTC.
(e) Read DTCs.

Result

Display (DTC output)	Proceed To
P1411	A
P1411 and other DTCs	B

HINT:
If any DTCs other than P1411 are output, troubleshoot those DTCs first.

B → GO TO DTC CHART (See page ES-23)

A

REPLACE EGR VALVE POSITION SENSOR

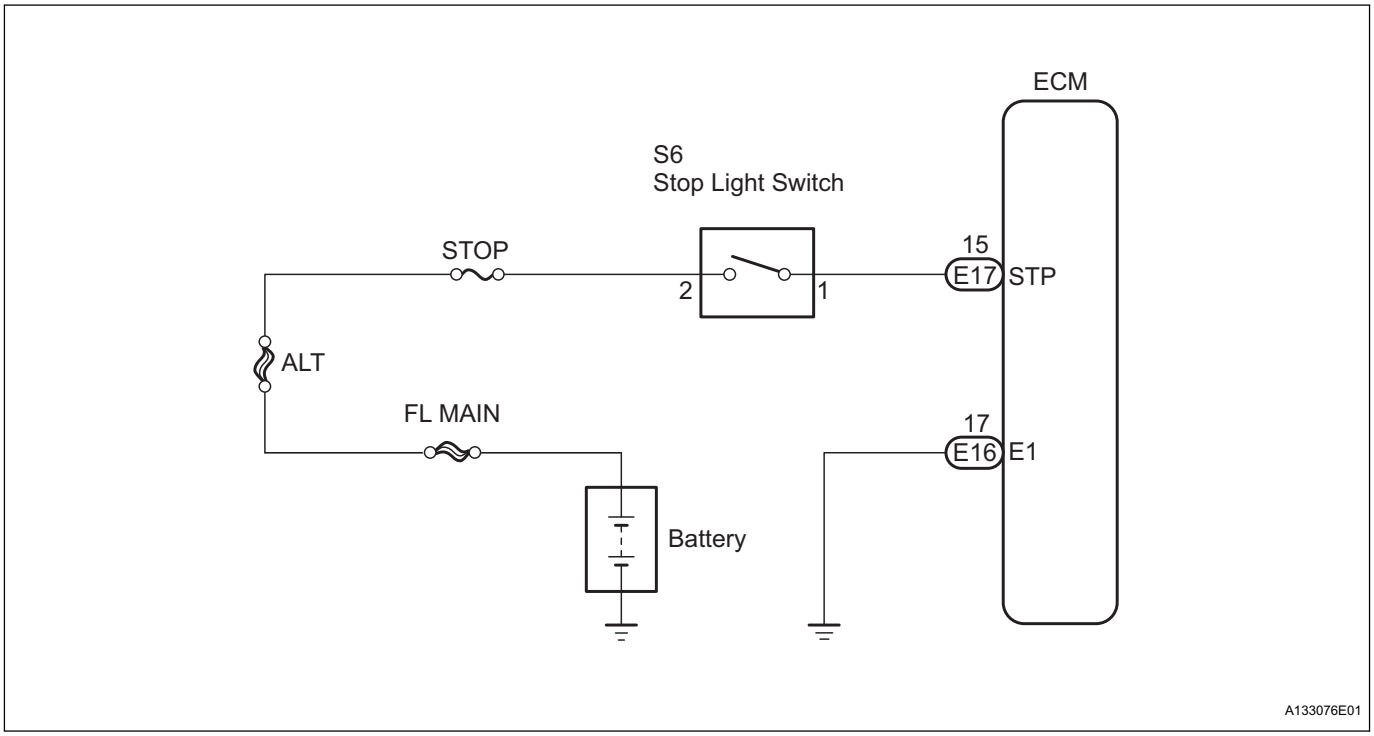
DTC	P1520	Stop Light Switch Circuit Malfunction

DESCRIPTION

This signal is used to detect when the brakes have been applied. The STP signal voltage is the same as the voltage supplied to the stop lights.
The STP signal is used mainly to control the fuel cut-off engine speed (The fuel cut-off engine speed is reduced slightly when the vehicle is braking.).

DTC No.	DTC Detection Condition	Trouble Area
P1520	Stop light switch does not turn off when repeating driving at 30 km or more 18 times or more after depressing brake (2 trip detection logic)	• Short in stop light switch signal circuit • Stop light switch • ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read the freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

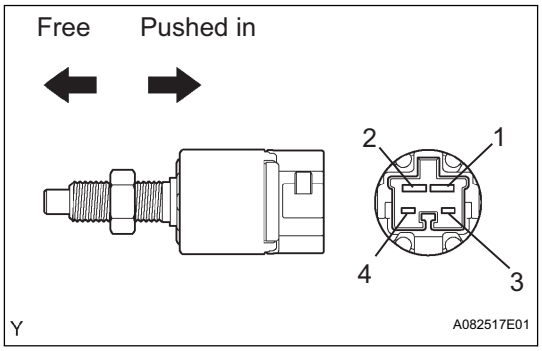
1	CHECK STOP LIGHT (OPERATION)

(a) Check if the stop lights turn on and off normally when the brake pedal is depressed and released.
OK:
The stop lights turn on when you depress the brake pedal.

OK → CHECK FOR INTERMITTENT PROBLEMS

NG

2 INSPECT STOP LIGHT SWITCH ASSEMBLY



(a) Measure the resistance between the switch terminals.
Standard resistance

Switch Condition	Tester Connection	Specified Condition
Switch pin free	1 - 2	Below 1 Ω
Switch pin pushed in	1 - 2	10 kΩ or higher

NG → REPLACE STOP LIGHT SWITCH ASSEMBLY

OK

3 READ VALUE OF INTELLIGENT TESTER

(a) Turn the ignition switch ON.
(b) On the intelligent tester, select the following menu items: Powertrain / Engine and ECT / Data List / Stop Light Switch. Read the value.

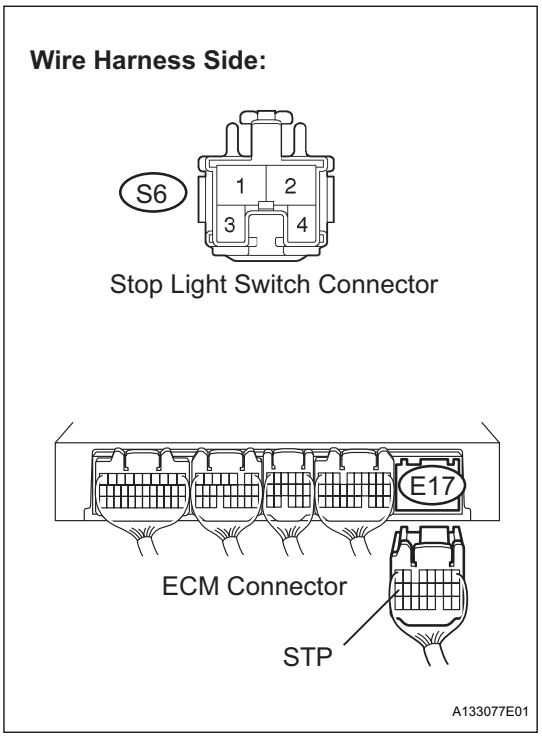
Standard

Brake Pedal Condition	Specified Condition
Depressed	STP Signal ON
Released	STP Signal OFF

OK → CHECK FOR INTERMITTENT PROBLEMS

NG

4	CHECK HARNESS AND CONNECTOR (ECM - STOP LIGHT SWITCH)



(a) Disconnect the S6 stop light switch connector.
(b) Disconnect the E17 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard resistance:

Check for open

Tester Connection	Specified Condition
S6-1 - E17-15 (STP)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
S6-1 or E17-15 (STP) - Body ground	10 kΩ or higher

(d) Connect the connectors.

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

OK

REPLACE ECM

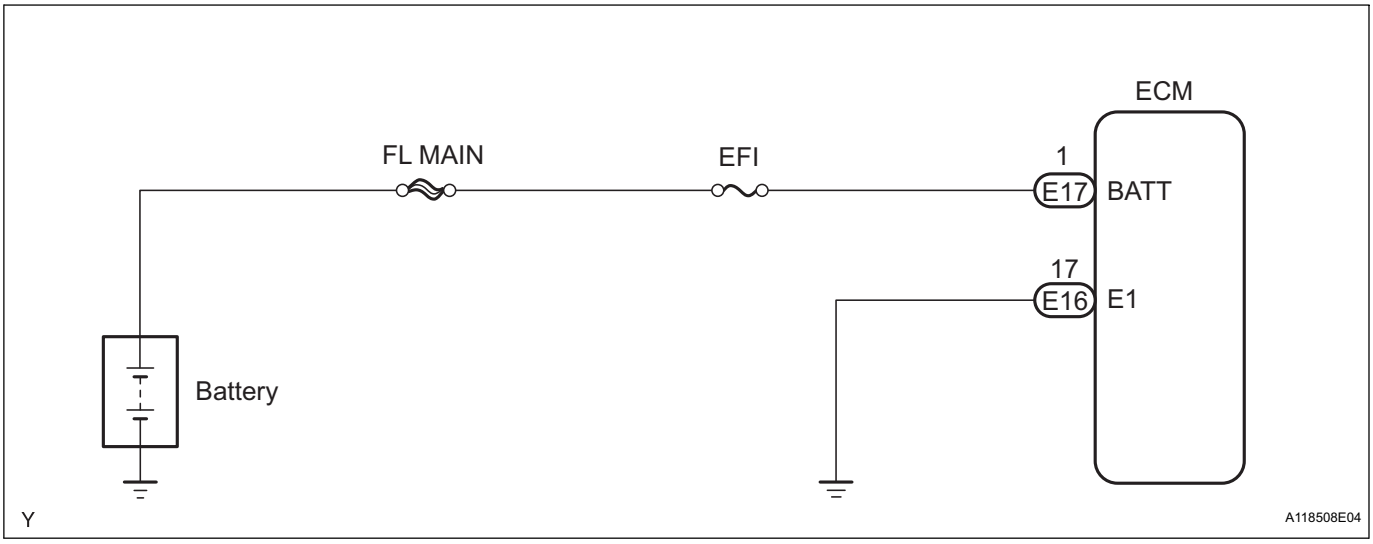
DTC	P1600	ECM BATT Malfunction

DESCRIPTION

Battery positive voltage is supplied to terminal BATT of the ECM even when the ignition switch is OFF for the DTC memory and air-fuel ratio adaptive control value memory, etc.

DTC No.	DTC Detection Condition	Trouble Area
P1600	Open in back up power source circuit	• Open in back up power source circuit • ECM

WIRING DIAGRAM

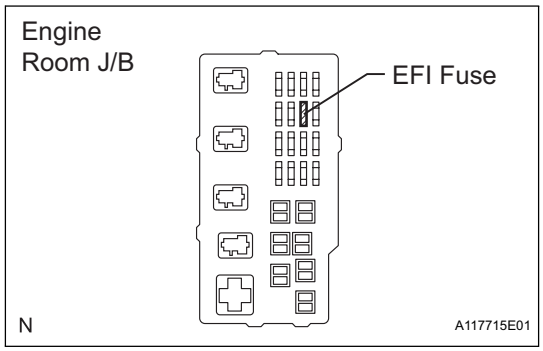


INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

1	INSPECT EFI FUSE

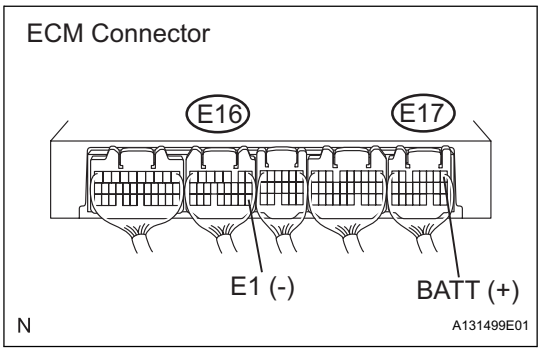


(a) Remove the EFI fuse from the engine room J/B.
(b) Measure the resistance of the EFI fuse.
Standard resistance:
Below 1 Ω
(c) Reinstall the EFI fuse.

NG → **REPLACE EFI FUSE**

OK

2 INSPECT ECM



(a) Measure the voltage of the ECM connectors.
Standard voltage

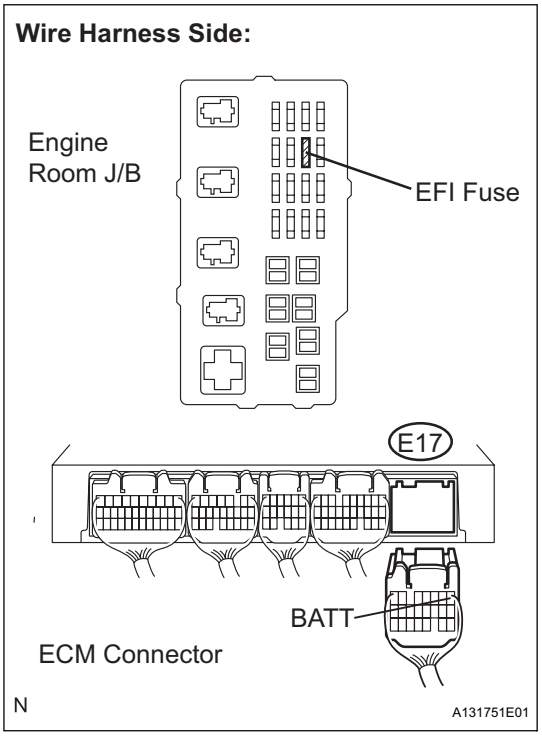
Tester Connection	Specified Condition
BATT (E17-1) - E1 (E16-17)	9 to 14 V

NG → **GO TO STEP 3**

OK

REPLACE ECM

3 CHECK HARNESS AND CONNECTOR (ECM - EFI FUSE, EFI FUSE - BATTERY)



(a) Check the wire harness between the EFI fuse and ECM.
(1) Remove the EFI fuse from the engine room J/B.
(2) Disconnect the battery negative cable.
(3) Disconnect the E17 ECM connector.
(4) Measure the resistance of the wire harness side connectors.
Standard resistance

Tester Connection	Specified Condition
Engine room J/B EFI fuse - BATT (E17-1)	Below 1 Ω
Engine room J/B EFI fuse or BATT (E17-1) - Body ground	10 kΩ or higher

(5) Reinstall the EFI fuse.
(6) Reconnect the ECM connector.
(7) Reconnect the battery negative cable.

(b) Check the wire harness between the EFI fuse and battery.
(1) Remove the EFI fuse from the engine room J/B.
(2) Disconnect the battery negative cable.
(3) Disconnect the battery positive cable.
(4) Measure the resistance of the wire harness side connectors.
Standard resistance

Tester Connection	Specified Condition
Battery positive cable - Engine room J/B EFI fuse	Below 1 Ω
Battery positive cable or Engine room J/B EFI fuse - Body ground	10 kΩ or higher

(5) Reinstall the EFI fuse.
(6) Connect the battery positive cable.
(7) Connect the battery negative cable.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

CHECK AND REPLACE ENGINE ROOM J/B

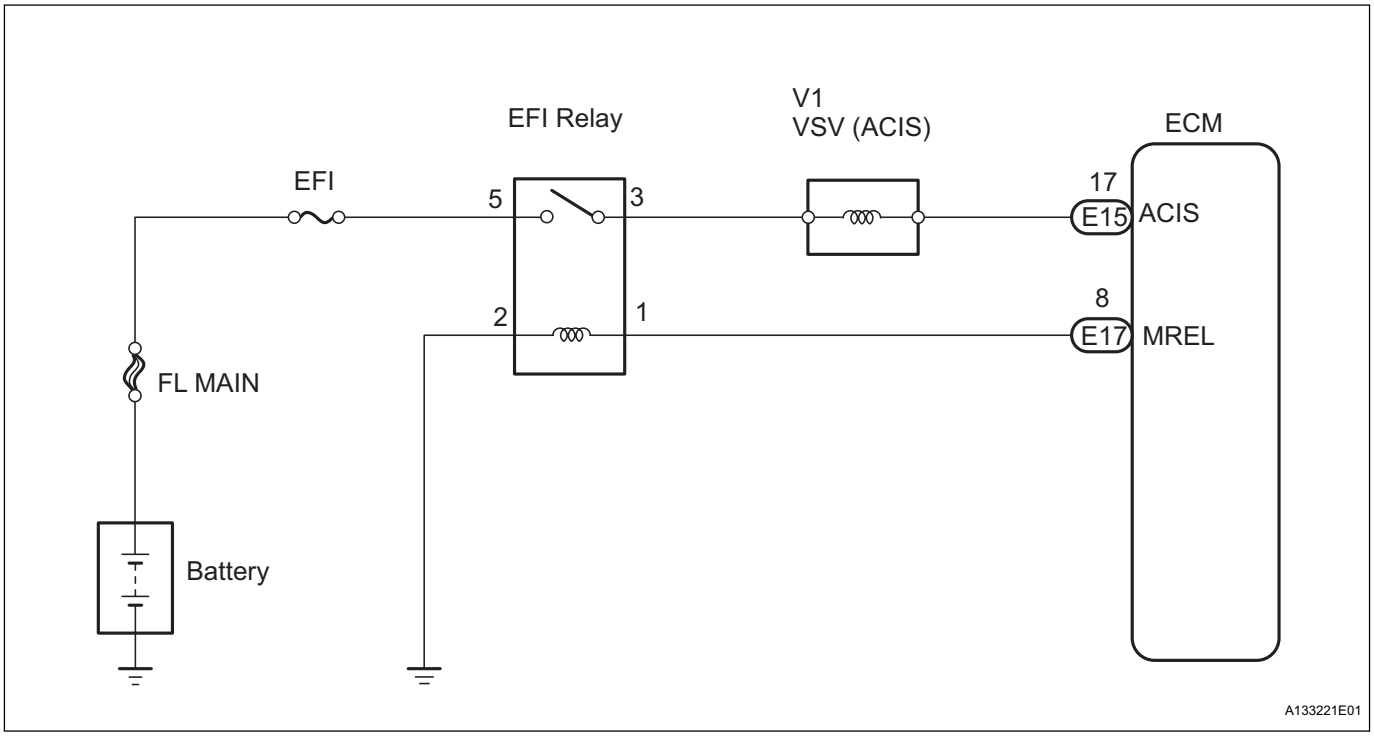
DTC	P1651	VSV for ACIS Circuit Malfunction

DESCRIPTION

This circuit opens and closes the Intake Air Control Valve (IACV) in response to the engine load in order to increase the intake efficiency (ACIS: Acoustic Control Induction System).
When the engine speed is 3,700 rpm or less and the throttle valve opening angle is 60° or more, the ECM turns the VSV ON and closes the IACV. At all other times, the VSV is OFF, so the IACV is open.

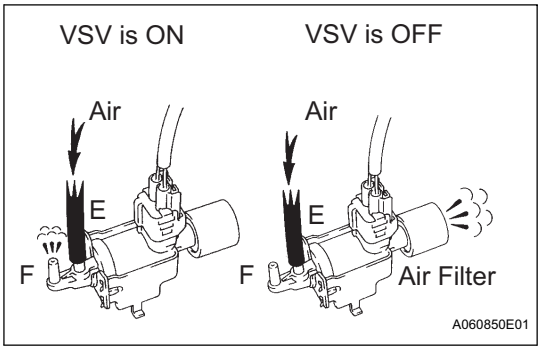
DTC No.	DTC Detection Condition	Trouble Area
P1651	Proper response to engine ECU commanded does not occur (2 trip detection logic)	• Open or short in ACIS VSV circuit • ACIS VSV • ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

1	PERFORM ACTIVE TEST BY INTELLIGENT TESTER

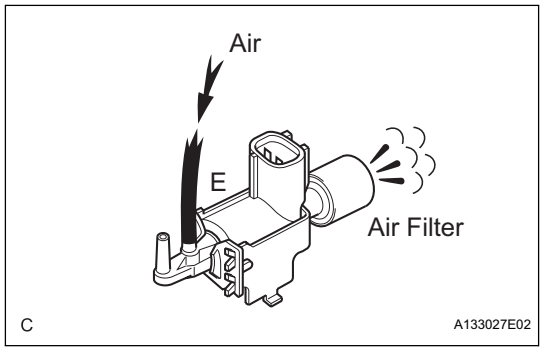


(a) Disconnect the vacuum hose of the ACIS VSV.
(b) Connect the intelligent tester to the DLC3.
(c) Start the engine and turn the intelligent tester ON.
(d) Select the following menu items: Powertrain / Engine and ECT / Active Test / ACIS VSV. Press the right or left button.
(e) Check the VSV operation when it is operated by the intelligent tester.
(f) Reconnect the vacuum hose.

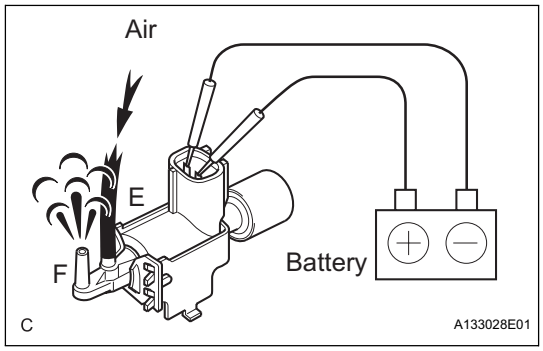
OK	INSPECT VACUUM TANK

NG

2 CHECK VACUUM SWITCHING VALVE (FOR ACIS)



(a) Remove the vacuum switching valve.
(b) Check that air flows from port E to the filter.

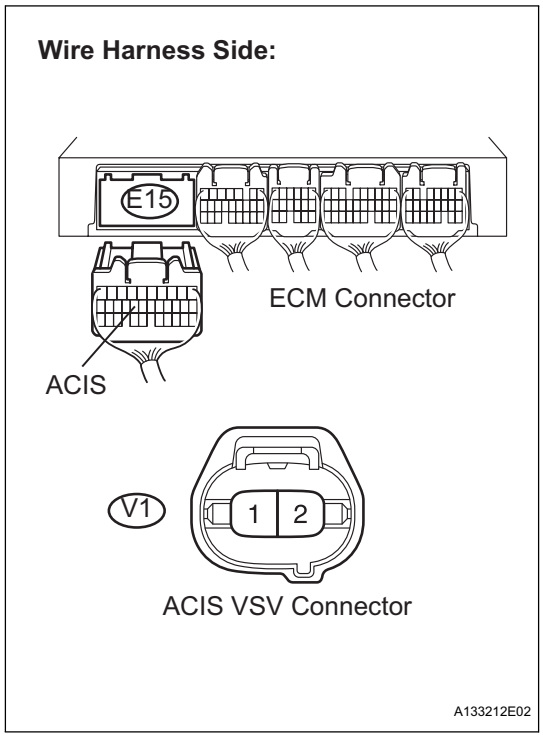


(c) Apply battery positive voltage across the terminals.
(d) Check that air flows from port E to F.

NG → **REPLACE VACUUM SWITCHING VALVE (FOR ACIS)**

OK

3 CHECK HARNESS AND CONNECTOR (VSV - ECM)



(a) Disconnect the V1 vacuum switching valve connector.
(b) Disconnect the E15 ECM connector.
(c) Measure the resistance between the terminals.

Standard resistance

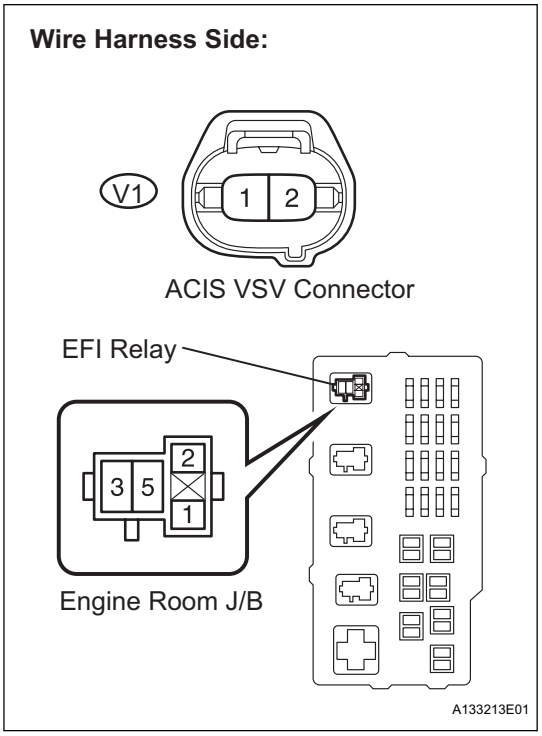
Tester Connection	Specified Condition
ACIS (E15-17) - V1-2	Below 1 Ω
ACIS (E15-17) or V1-2 - Body ground	10 kΩ or higher

(d) Reconnect the connectors.

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

OK

4	CHECK HARNESS AND CONNECTOR (VSV - EFI RELAY)



(a) Remove the EFI relay from the engine room J/B.
(b) Disconnect the V1 vacuum switching valve connector.
(c) Measure the resistance between the terminals.

Standard resistance

Tester Connection	Specified Condition
V1-1 - Engine room J/B EFI relay terminal 3	Below 1 Ω
V1-1 or Engine room J/B EFI relay terminal 3 - Body ground	10 kΩ or higher

(d) Reconnect the connector.
(e) Install the EFI relay.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

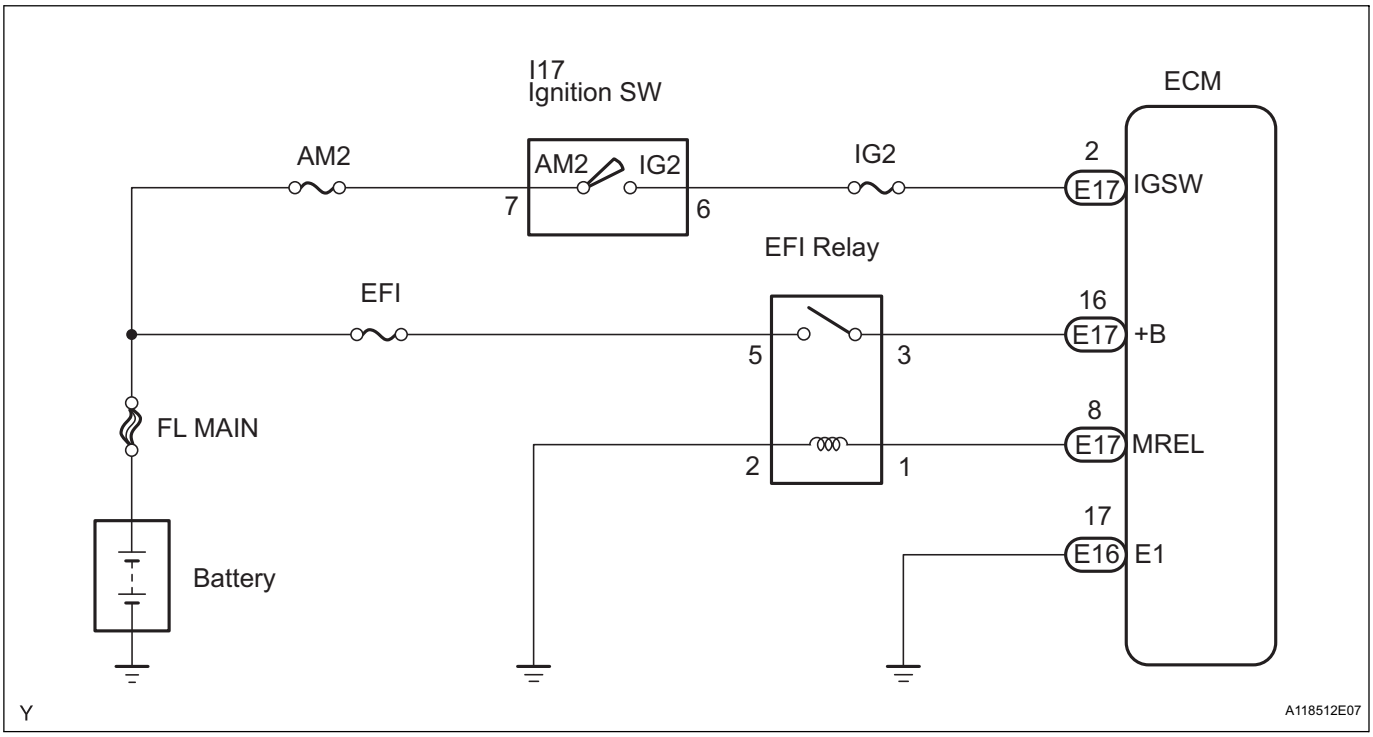
CHECK AND REPLACE ECM

ECM Power Source Circuit

DESCRIPTION

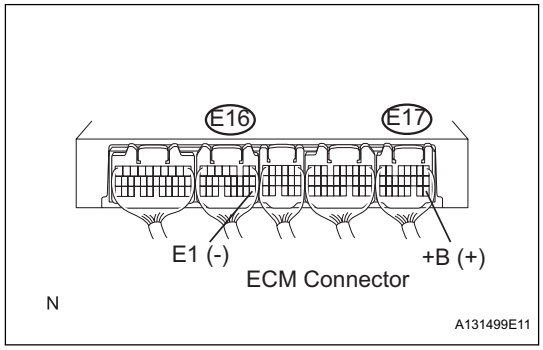
When the ignition switch is turned ON, battery positive voltage is applied to terminal IGSW of the ECM and the EFI main relay control circuit in the ECM sends a signal to terminal MREL of the ECM, switching on the EFI main relay.
This signal causes current to flow to the coil, closing the contact of the EFI main relay and supplying power to terminal +B of the ECM.
If the ignition switch is turned off, the ECM continues to switch on the EFI main relay for a maximum of 2 seconds for the initial setting of the ISC valve.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	INSPECT ECM (+B VOLTAGE)



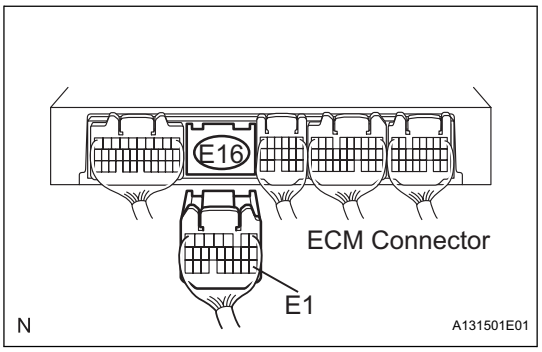
(a) Turn the ignition switch to the ON position.
(b) Measure the voltage between the terminals.
Standard voltage

Tester Connection	Specified Condition
+B (E17-16) - E1 (E16-17)	9 to 14 V

OK → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (See page ES-12)**

NG

2 CHECK HARNESS AND CONNECTOR (ECM BODY GROUND)



(a) Disconnect the negative (-) battery cable.
(b) Disconnect the E16 ECM connector.
(c) Measure the resistance.
Standard resistance

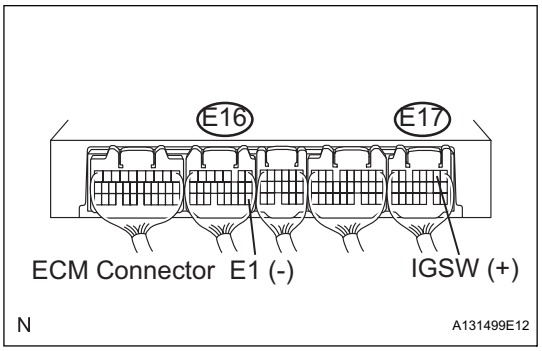
Tester Connection	Specified Condition
E1 (E16-17) - Body ground	Below 1 Ω

(d) Reconnect the ECM connector.
(e) Reconnect the negative battery cable.

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

OK

3 INSPECT ECM (IGSW VOLTAGE)



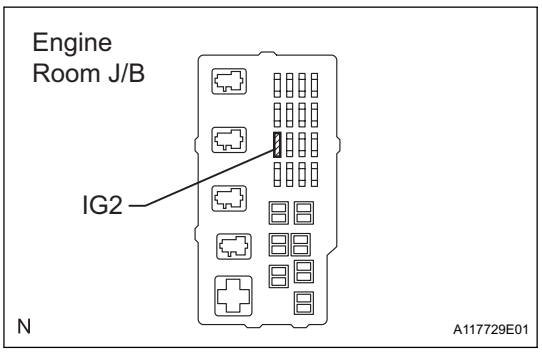
(a) Turn the ignition switch to the ON position.
(b) Measure the voltage between the terminals.
Standard voltage

Tester Connection	Specified Condition
IGSW (E17-2) - E1 (E16-17)	9 to 14 V

OK → **GO TO STEP 5**

NG

4 CHECK IG2 FUSE



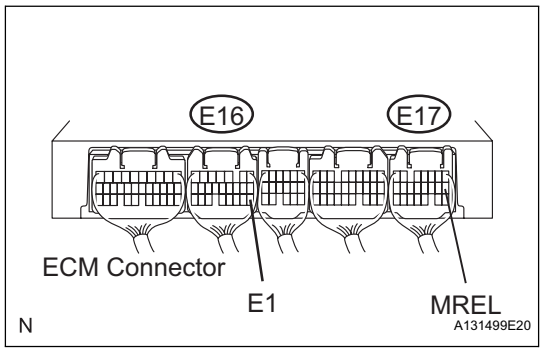
(a) Remove the IG2 fuse from the engine room J/B.
(b) Measure the IG2 fuse resistance.
Standard resistance:
Below 1 Ω
(c) Reinstall the IG2 fuse.

NG → **REPLACE IG2 FUSE**

OK

CHECK AND REPLACE HARNESS AND CONNECTOR (BATTERY - ECM)

5 INSPECT ECM (MREL VOLTAGE)



(a) Turn the ignition switch to the ON position.
(b) Measure the voltage according to the value(s) in the table below.

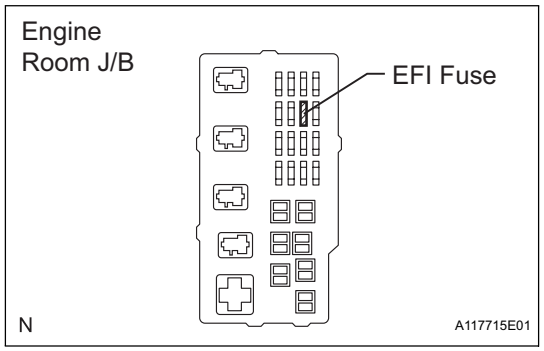
Standard voltage

Tester Connection	Specified Condition
MREL (E17-8) - E1 (E16-17)	9 to 14 V

NG → **REPLACE ECM**

OK

6 CHECK EFI FUSE



(a) Remove the EFI fuse from the engine room J/B.
(b) Measure the resistance of the EFI fuse.

Standard resistance:

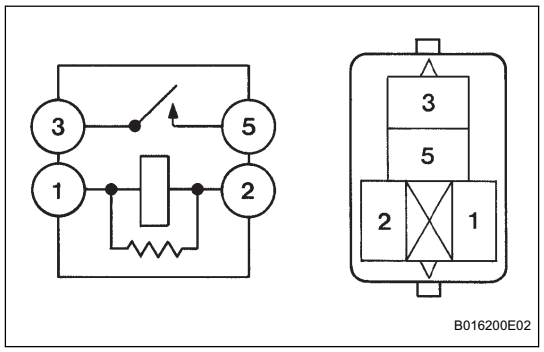
Below 1 Ω

(c) Reinstall the EFI fuse.

NG → **REPLACE EFI FUSE**

OK

7 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room J/B.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

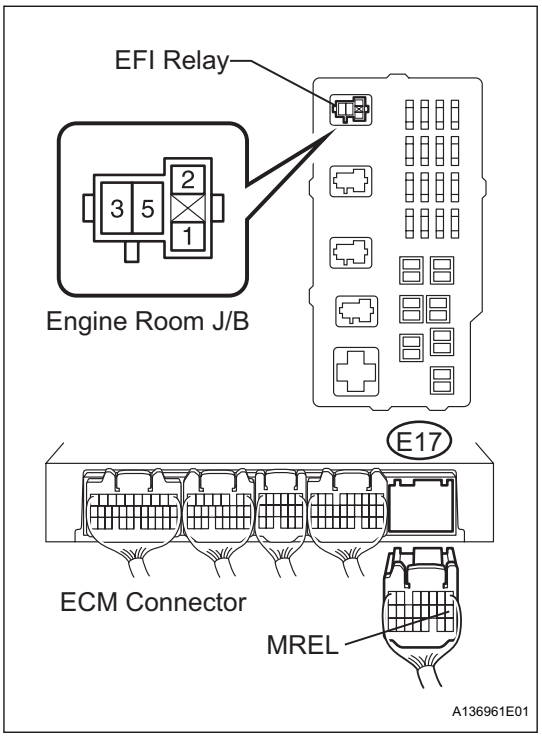
Specified Condition	Tester Connection
3-5	10 kΩ or higher
3-5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the EFI relay.

NG → **REPLACE EFI RELAY**

OK

8	CHECK HARNESS AND CONNECTOR (EFI RELAY - ECM, EFI RELAY BODY GROUND)



(a) Check the harness and connectors between the EFI relay and the ECM connector.
(1) Remove the EFI relay from the engine room J/B.
(2) Disconnect the E17 ECM connector.
(3) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
Engine room J/B EFI relay terminal 1 - E17-8 (MREL)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
Engine room J/B EFI relay terminal 1 or E17-8 (MREL) - Body ground	10 kΩ or higher

(4) Reinstall the EFI relay.
(5) Reconnect the ECM connector

(b) Check the harness and connector between the EFI relay and body ground.
(1) Remove the EFI relay from the engine room J/B.
(2) Measure the resistance according to the value(s) inn the table below.

Standard resistance

Tester Connection	Specified Condition
Engine room J/B EFI relay terminal 2 - Body ground	Below 1 Ω

(3) Reinstall the EFI relay.

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

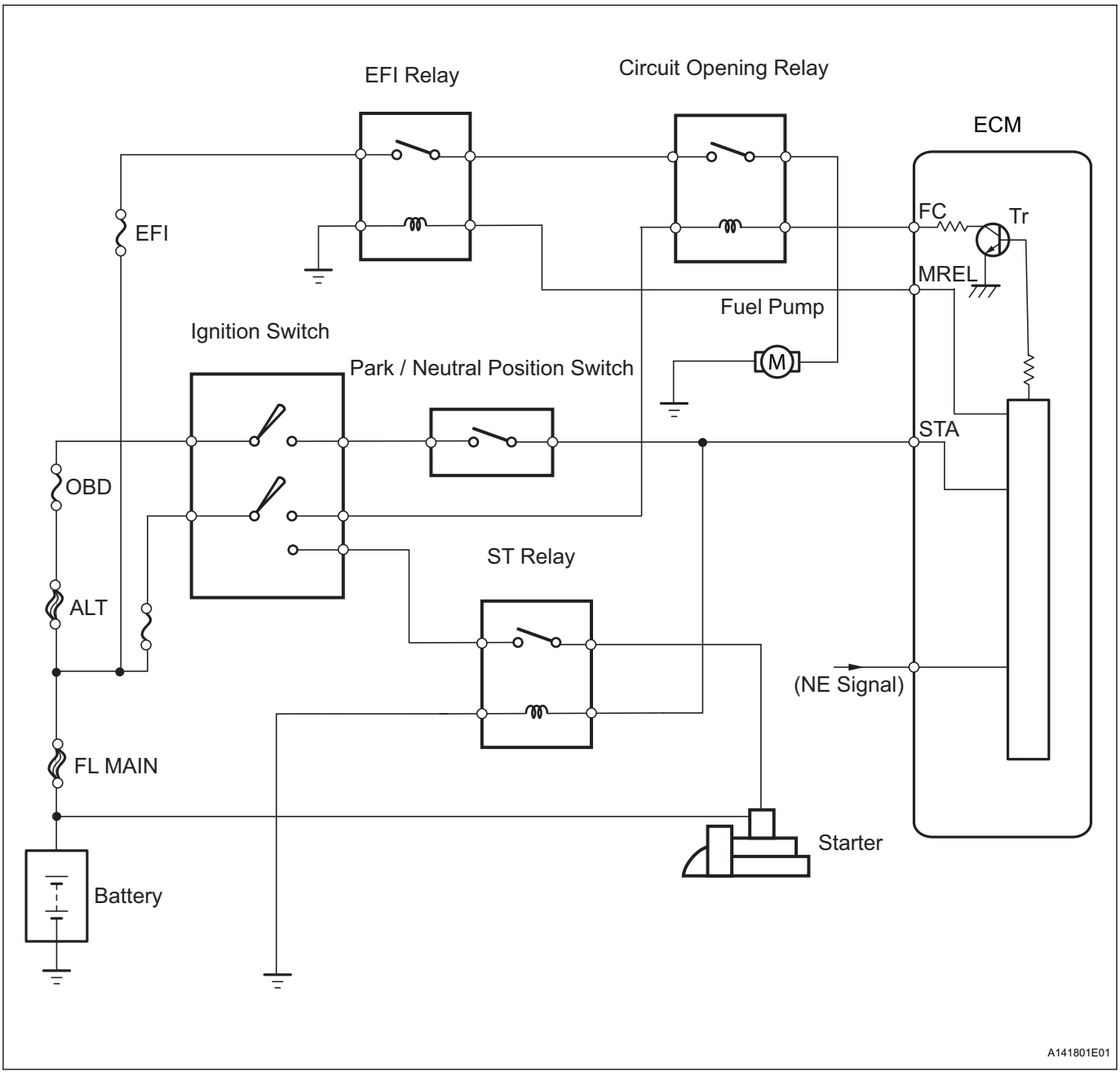
OK

CHECK AND REPLACE HARNESS AND CONNECTOR (TERMINAL +B OF ECM - BATTERY POSITIVE TERMINAL)

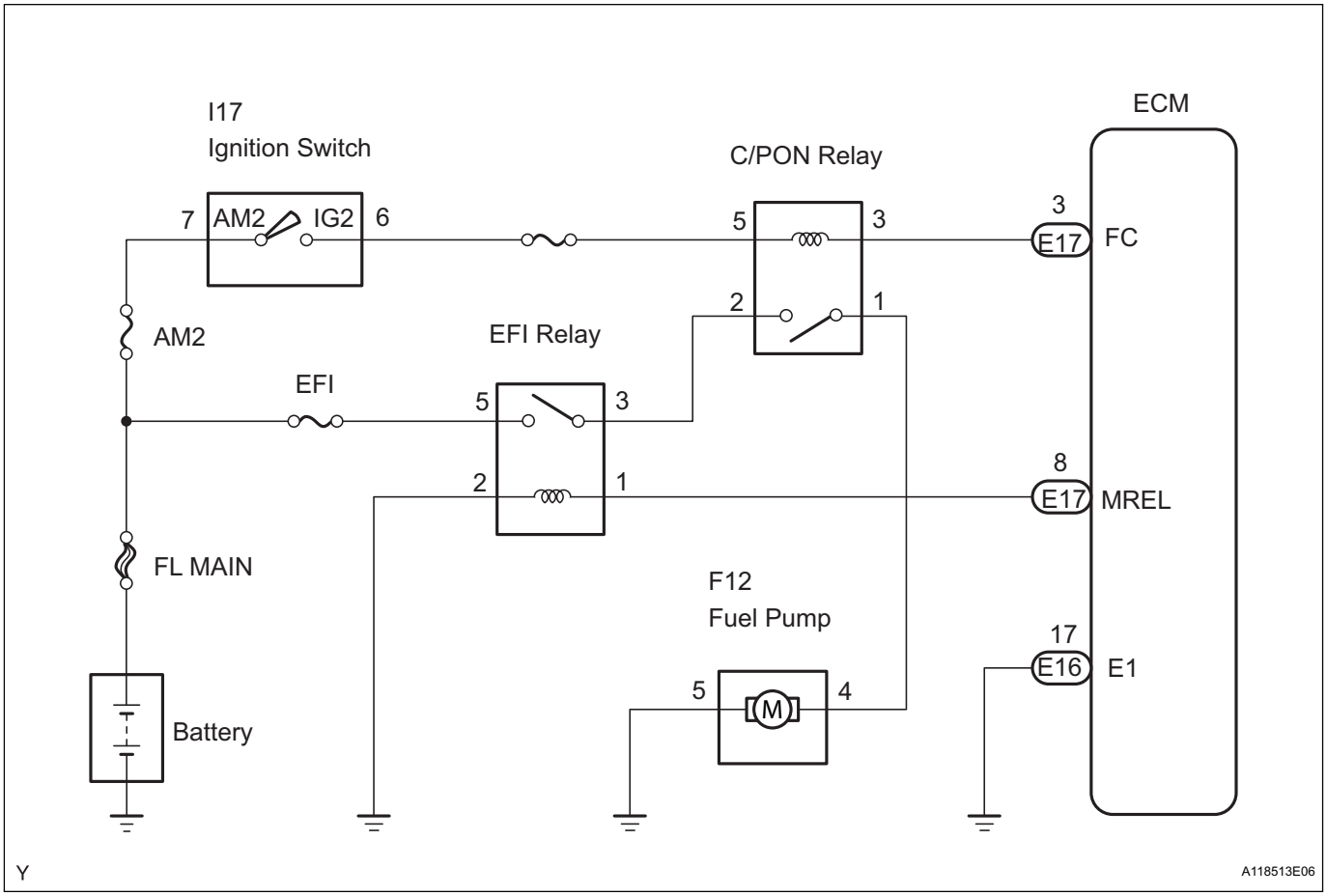
Fuel Pump Control Circuit

DESCRIPTION

In the diagram below, when the engine is cranked, a current flows from terminal ST2 of the ignition switch to the starter relay coil and also a current flows to terminal STA of the ECM (STA signal).
When the STA signal and NE signal are transmitted to the ECM, the power transistor (Tr) is turned ON, a current flows to the coil of the circuit opening relay, the relay switches on, the power is supplied to the fuel pump and the fuel pump operates.
While the NE signal is generated (when engine is running), the ECM keeps Tr ON (circuit opening relay ON) and the fuel pump also keeps operating.



WIRING DIAGRAM



INSPECTION PROCEDURE

1	**PERFORM ACTIVE TEST BY INTELLIGENT TESTER (OPERATE CIRCUIT OPENING RELAY)**

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Active Test / Fuel Pump Speed.
(d) Check the operation of the relay while operating it using the intelligent tester.
Standard:
Operating sounds can be heard from the relay.

NG → **GO TO STEP 2**

OK

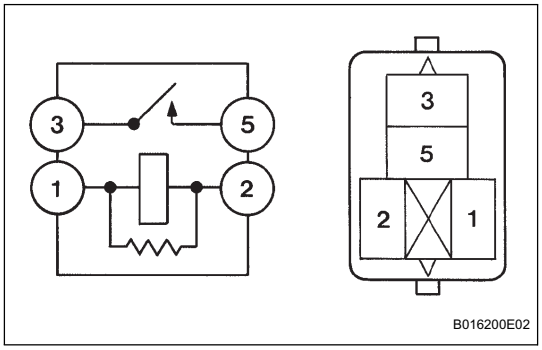
PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE
(See page ES-12)

2	CHECK ECM POWER SOURCE CIRCUIT

NG → REPAIR OR REPLACE ECM POWER SOURCE CIRCUIT

OK

3	INSPECT C/OPN RELAY



(a) Remove the C/OPN relay.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

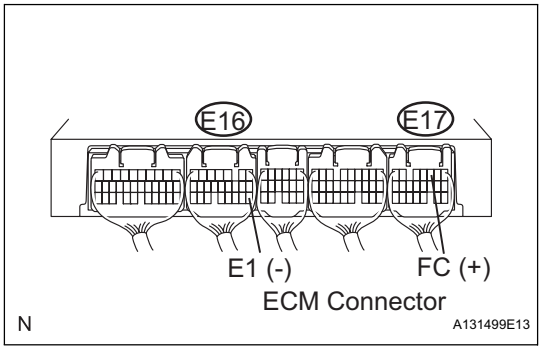
Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the C/OPN relay.

NG → REPLACE C/OPN RELAY

OK

4	INSPECT ECM (FC VOLTAGE)



(a) Turn the ignition switch to the ON position.
(b) Measure the voltage according to the value(s) in the table below.

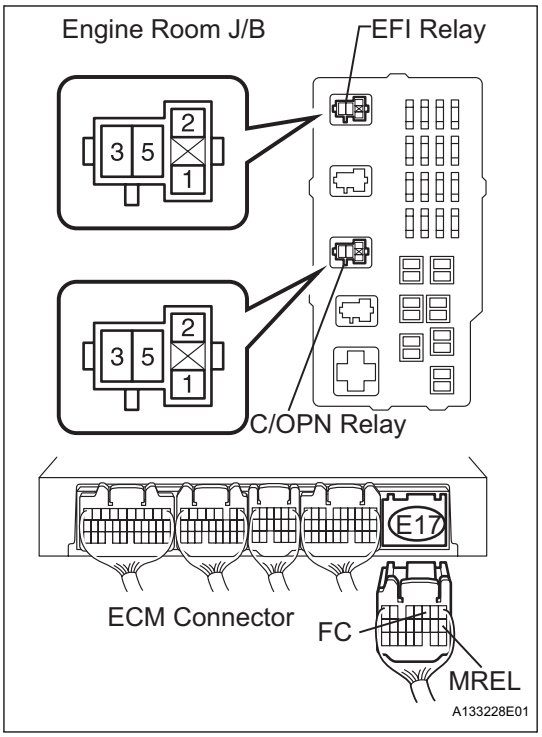
Standard voltage

Tester Connection	Specified Condition
FC (E17-3) - E1 (E16-17)	9 to 14 V

OK → GO TO STEP 6

NG

5	CHECK HARNESS AND CONNECTOR (EFI RELAY - ECM, C/OPN RELAY - ECM, EFI RELAY - C/OPN RELAY)



(a) Remove the EFI relay and C/OPN relay from the engine room J/B.
(b) Disconnect the E17 ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
Engine room J/B EFI relay terminal 1 - E17-8 (MREL)	Below 1 Ω
Engine room J/B C/OPN relay terminal 2 - E17-3 (FC)	Below 1 Ω
Engine room J/B EFI relay terminal 3 - Engine room J/B C/OPN relay terminal 5	Below 1 Ω

Check for short

Tester Connection	Specified Condition
Engine room J/B EFI relay terminal 1 or E17-8 (MREL) - Body ground	10 kΩ or higher
Engine room J/B C/OPN relay terminal 2 or E17-3 (FC) - Body ground	10 kΩ or higher
Engine room J/B EFI relay terminal 3 - Engine room J/B C/OPN relay terminal 5 - Body ground	10 kΩ or higher

(d) Reinstall the EFI relay.
(e) Reinstall the C/OPN relay.
(f) Connect the connector.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

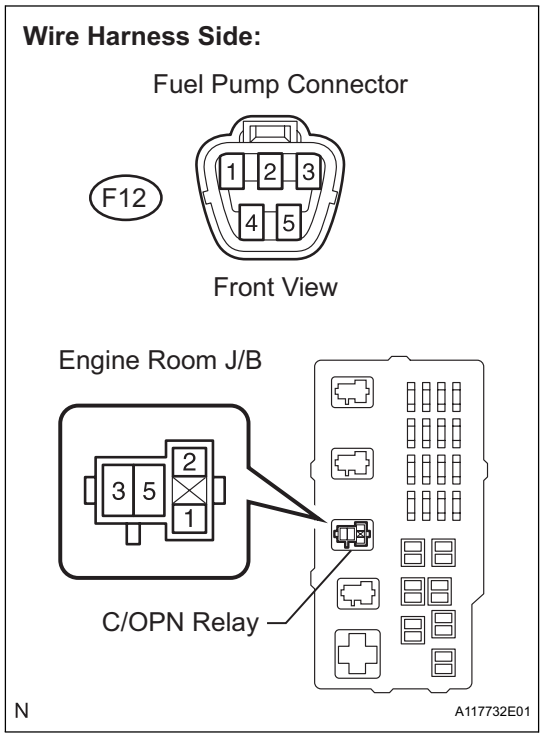
REPLACE ECM

6	INSPECT FUEL PUMP

NG → REPAIR OR REPLACE FUEL PUMP

OK

7	CHECK HARNESS AND CONNECTOR (C/OPN RELAY - FUEL PUMP, FUEL PUMP - BODY GROUND)



(a) Remove the C/OPN relay from the engine room J/B.
(b) Disconnect the F12 fuel pump connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

Tester Connection	Specified Condition
Engine room J/B C/OPN relay terminal 3 - F12-4 (Fuel pump)	Below 1 Ω
F12-5 (Fuel pump) - Body ground	Below 1 Ω

Check for short

Tester Connection	Specified Condition
Engine room J/B C/OPN relay terminal 3 or F12-4 (Fuel pump) - Body ground	10 kΩ or higher

(d) Reinstall the C/OPN relay.
(e) Connect the connector.

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

OK

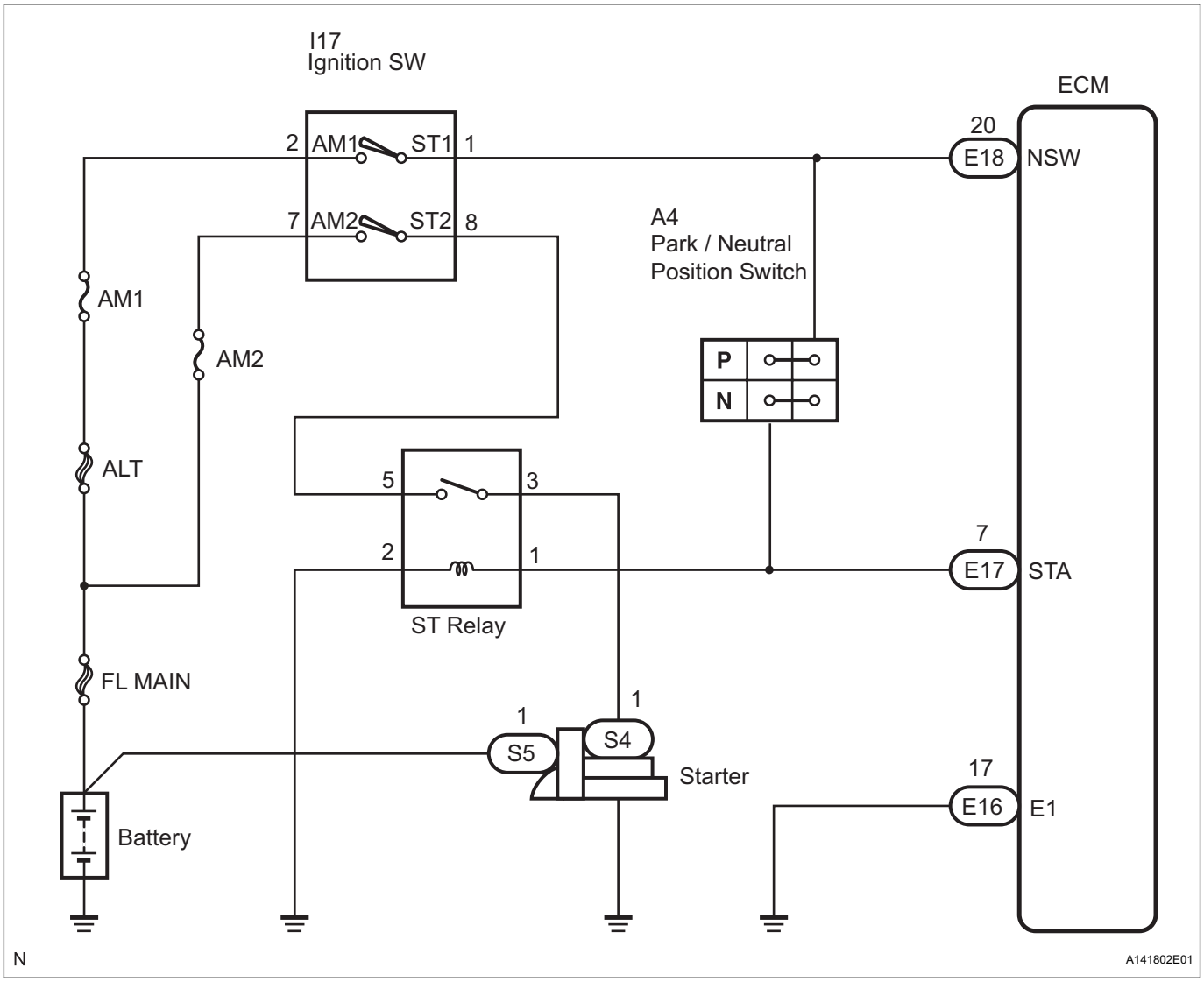
REPLACE ECM

Starter Signal Circuit

DESCRIPTION

When the engine is cranked, the intake air flow is slow, so fuel vaporisation is poor. A rich mixture is therefore necessary in order to achieve good startability. While the engine is being cranked, the battery positive voltage is applied to terminal STA of the ECM. The starter signal is mainly used to increase the fuel injection volume for the starting injection control and after-start injection control.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

This diagnostic chart is based on the premise that the engine is cranked normally. If the engine is not cranked, proceed to the problem symptoms table (See page **ES-12**).

1	**READ VALUE OF INTELLIGENT TESTER (STA SIGNAL)**

(a) Connect the intelligent tester to the DLC3.

(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Starter SIG.
(d) Check the result when the ignition switch is turned to the ON and START positions.

Result

Ignition Switch Position	ON	START
STA Signal	OFF	ON

NG → **GO TO STEP 2**

OK →

REPLACE ECM

2 INSPECT PARK/NEUTRAL POSITION SWITCH

(a) Check the park/neutral position switch.
OK:
When the shift lever is in the N position, the park/neutral position switch is ON.
When the shift lever is in the D position, the park/neutral position switch is OFF.

NG → **REPLACE PARK NEUTRAL POSITION SWITCH**

OK →

3 READ VALUE OF INTELLIGENT TESTER (STA SIGNAL)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Starter SIG.
(d) Check the result when the ignition switch is turned to the ON and START positions.

Result

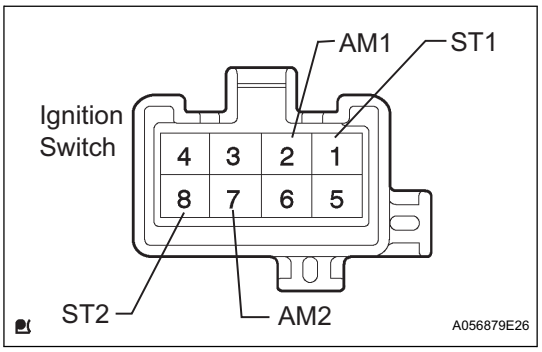
Ignition Switch Position	ON	START
STA Signal	OFF	ON

NG → **GO TO STEP 4**

OK →

END

4	INSPECT IGNITION SWITCH ASSEMBLY



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

Standard resistance

Switch Condition	Tester Connection	Specified Condition
LOCK	1-2, 7-8	10 kΩ or higher
START	1-2, 7-8	Below 1 Ω

NG → **REPAIR OR REPLACE IGNITION SWITCH ASSEMBLY**

OK

5	READ VALUE OF INTELLIGENT TESTER

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Starter SIG.
(d) Check the result when the ignition switch is turned to the ON and START positions.

Result

Ignition Switch Position	ON	START
STA Signal	OFF	ON

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

OK

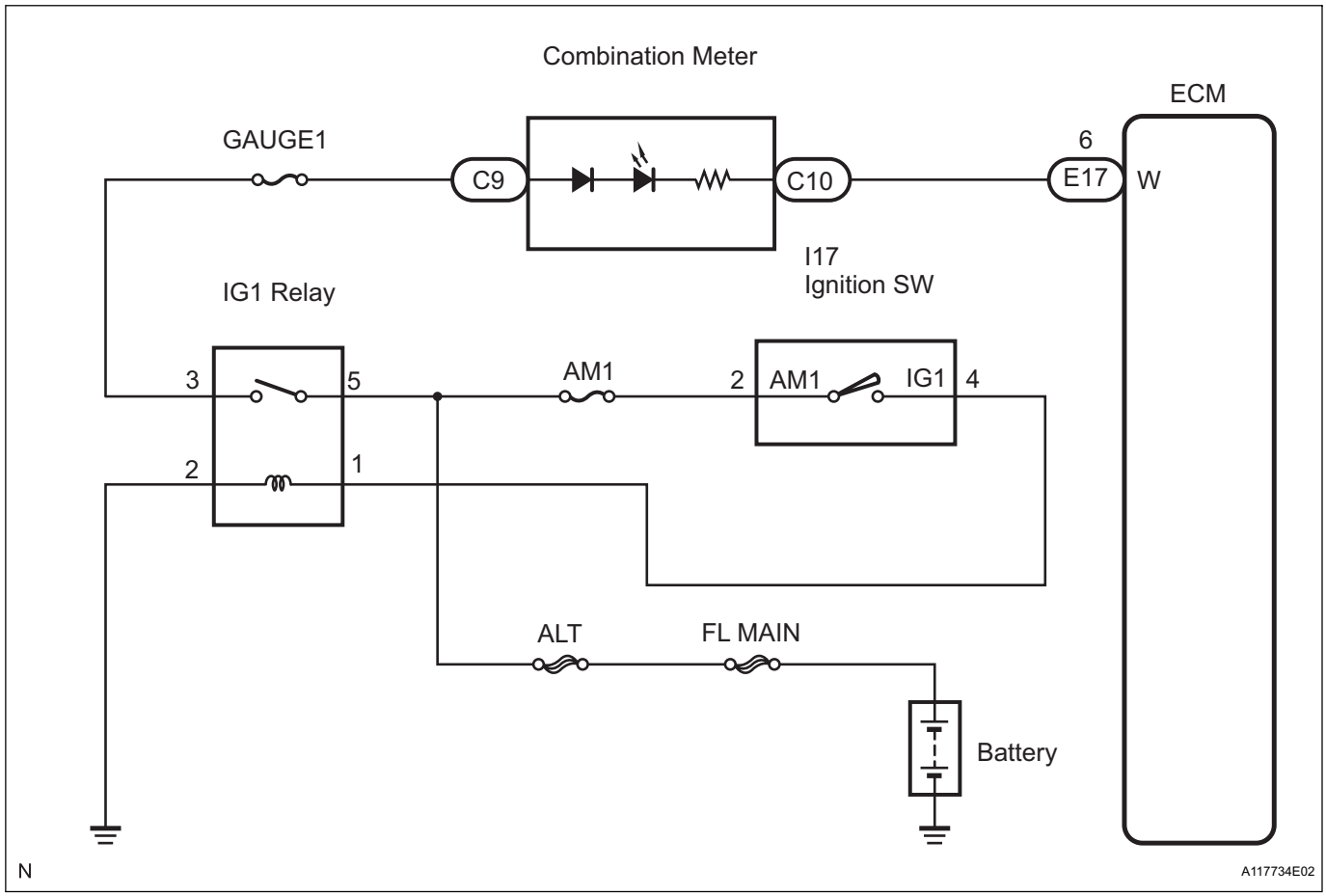
END

MIL Circuit

DESCRIPTION

The MIL (Malfunction Indicator Lamp) is used to indicate that the ECM detects vehicle malfunctions.
By turning the ignition switch to the ON position, the power is supplied to the MIL circuit, and the ECM provides the circuit ground, and then the MIL is illuminated.
Operation of the MIL should be checked visually:
When the ignition switch is first turned to the ON position, the MIL should be illuminated. If it is always OFF or ON, use the intelligent tester and follow the procedure below to determine the cause of the problem.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Troubleshoot each trouble symptom in accordance with the chart below.
Reference:

Result	Proceed To
MIL remains on	Start inspection from step 1
MIL is not illuminated	Start inspection from step 3

1	CHECK IF MIL TURNS OFF

(a) Connect the intelligent tester to the DLC3.

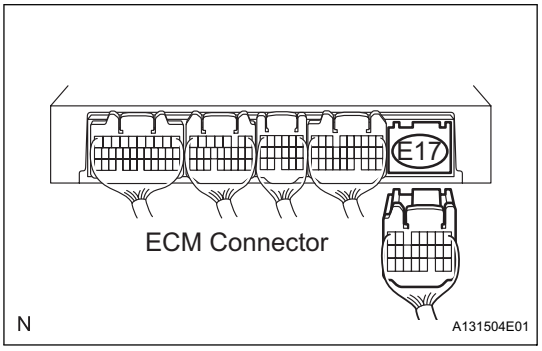
(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Check if DTCs have been stored. Note down if there are DTCs.
(e) Select the following menu items: Powertrain / Engine and ECT / DTC / Clear.
(f) Clear the DTC(s).
(g) Check if the MIL turns off.
Standard:
The MIL turns off.

NG → **GO TO STEP 2**

OK

REPAIR CIRCUIT INDICATED BY OUTPUT DTC

2 CHECK HARNESS AND CONNECTOR (CHECK FOR SHORT IN WIRE HARNESS)



(a) Disconnect the E17 ECM connector.
(b) Turn the ignition switch to the ON position.
(c) Check that the MIL is not illuminated.
Standard:
The MIL is not illuminated.
(d) Connect the connector.

NG → **CHECK AND REPLACE HARNESS AND CONNECTOR**

OK

REPLACE ECM

3 CHECK IF MIL ILLUMINATES

(a) Check if the MIL illuminates when turning the ignition switch to the ON position.
Standard:
The MIL is illuminated.

NG → **GO TO STEP 4**

OK

NORMAL

4	INSPECT COMBINATION METER ASSEMBLY (MIL CIRCUIT)

(a) See the combination meter troubleshooting procedure.

NG → **REPAIR OR REPLACE COMBINATION METER ASSEMBLY**

OK

CHECK AND REPLACE HARNESS AND CONNECTOR (COMBINATION METER - ECM)

2AZ-FE ENGINE MECHANICAL

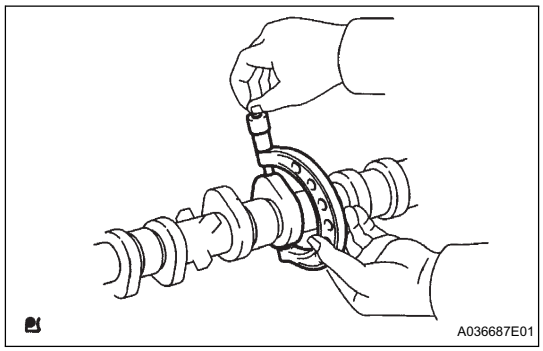
CYLINDER HEAD
INSPECTION EM-1

CYLINDER HEAD

INSPECTION

1. INSPECT CAMSHAFT

(a) Remove the camshaft (See page 14-106).



(b) Inspect the cam lobes.

(1) Using a micrometer, measure the cam lobe height.

Standard cam lobe height:
46.709 to 46.809 mm (1.8389 to 1.8429 in)
Minimum cam lobe height:
46.599 mm (1.8346 in)

If the cam lobe height is less than the minimum, replace the camshaft.

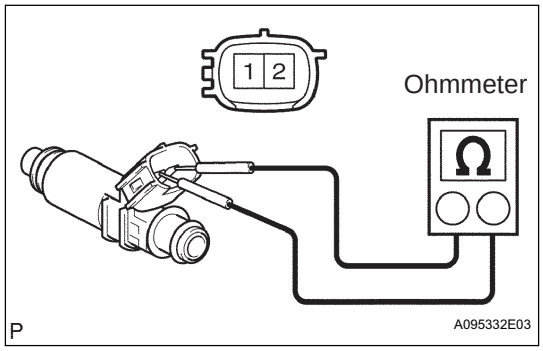
(c) Install the camshaft (See page 14-106).

2AZ-FE FUEL

FUEL INJECTOR
INSPECTION FU-1

FUEL INJECTOR

INSPECTION



1. REMOVE FUEL INJECTOR ASSEMBLY

(a) Measure the resistance between the injector terminals.

Standard resistance:

11.6 to 12.4 Ω at 20°C (68°F)

If the result is not as specified, replace the injector.

(b) Inspect the injector injection.

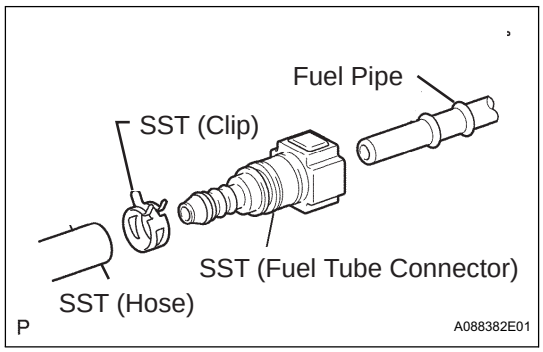
CAUTION:

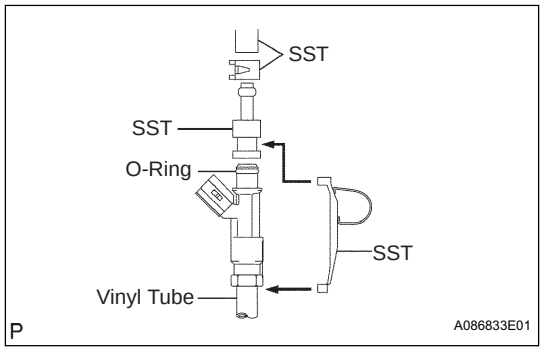
Keep the injector away from any ignition sources such as sparks while testing.

(1) Install the fuel tube connector to SST (hose). Then connect the tube connector to the fuel pipe (vehicle side).

SST 09268-31011 (09268-41500, 90467-13001, 95336-08070)

(2) Install the O-ring to the fuel injector.





(3) Connect SST (adapter and hose) to the injector, and hold the injector and union with SST (clamp).

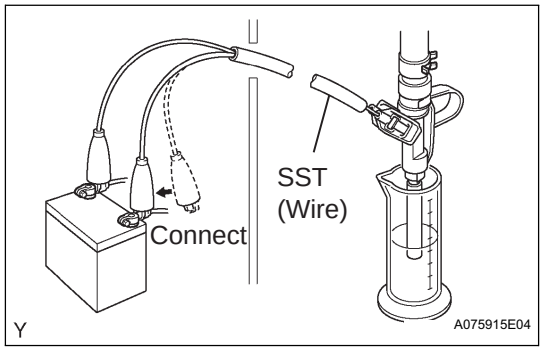
SST 09268-31011 (90467-13001, 09268-41110, 09268-41300)

(4) Put the injector into the graduated cylinder.

CAUTION:

Install a suitable vinyl tube onto the injector to contain fuel spray.

(5) Operate the fuel pump.



(6) Connect SST (wire) to the injector and the battery for 15 seconds, and measure the injection volume with the graduated cylinder. Test each injector 2 or 3 times.

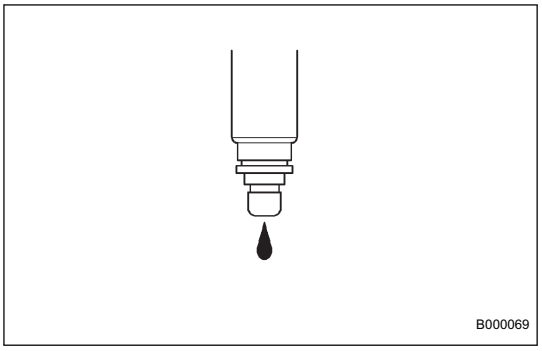
SST 09842-30080

Standard injection volume:

76 to 92 cm^3 (4.6 to 5.6 cu in) per 15 seconds

Standard difference between each injector:

16 cm^3 (1.0 cu in) or less



(c) Inspect the fuel leakage.
(1) Disconnect the SST (wire) tester probes from the battery and check the fuel leakage from the injector.
Standard fuel drop:
1 drop or less per 12 minutes
(2) Turn the ignition switch off.
(3) Disconnect the cable from the negative (-) battery terminal.
(4) Remove the SST.
(5) Disconnect the intelligent tester from the DLC3.
(6) Reconnect the fuel inlet hose (rear fuel pipe) to the fuel main tube.

A541E AUTOMATIC TRANSAXLE

AUTOMATIC TRANSAXLE SYSTEM

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AUTOMATIC TRANSAXLE SYSTEM

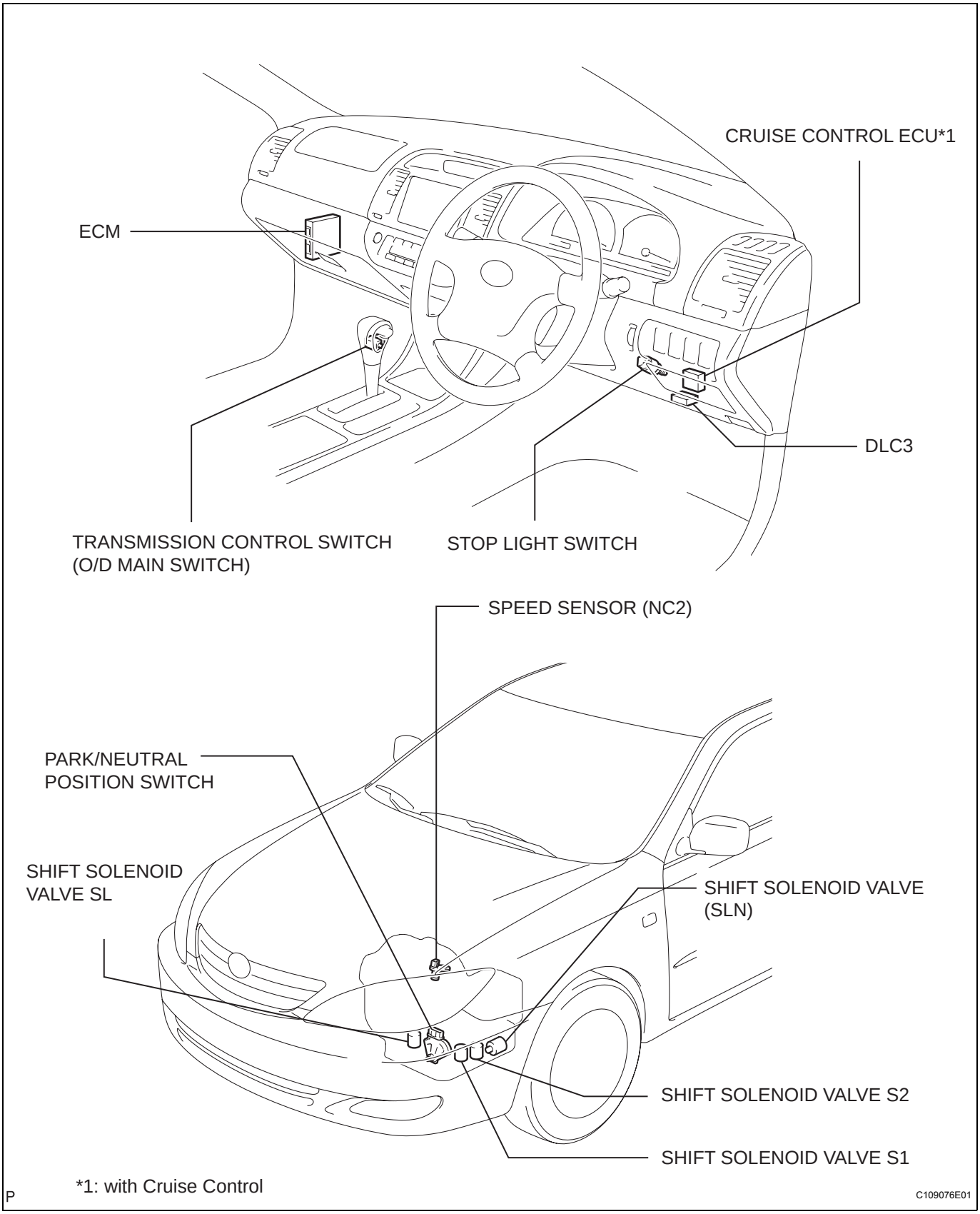
PRECAUTION

NOTICE:
Perform the RESET MEMORY (AT initialisation) when replacing the automatic transaxle assembly, engine assembly or ECM (See page AX-13).
HINT:
RESET MEMORY cannot be completed by only disconnecting the battery cable.

DEFINITION OF TERMS

Term	Definition
Monitor description	Description of what the ECM monitors and how it detects malfunctions (monitoring purpose and its details).

PARTS LOCATION



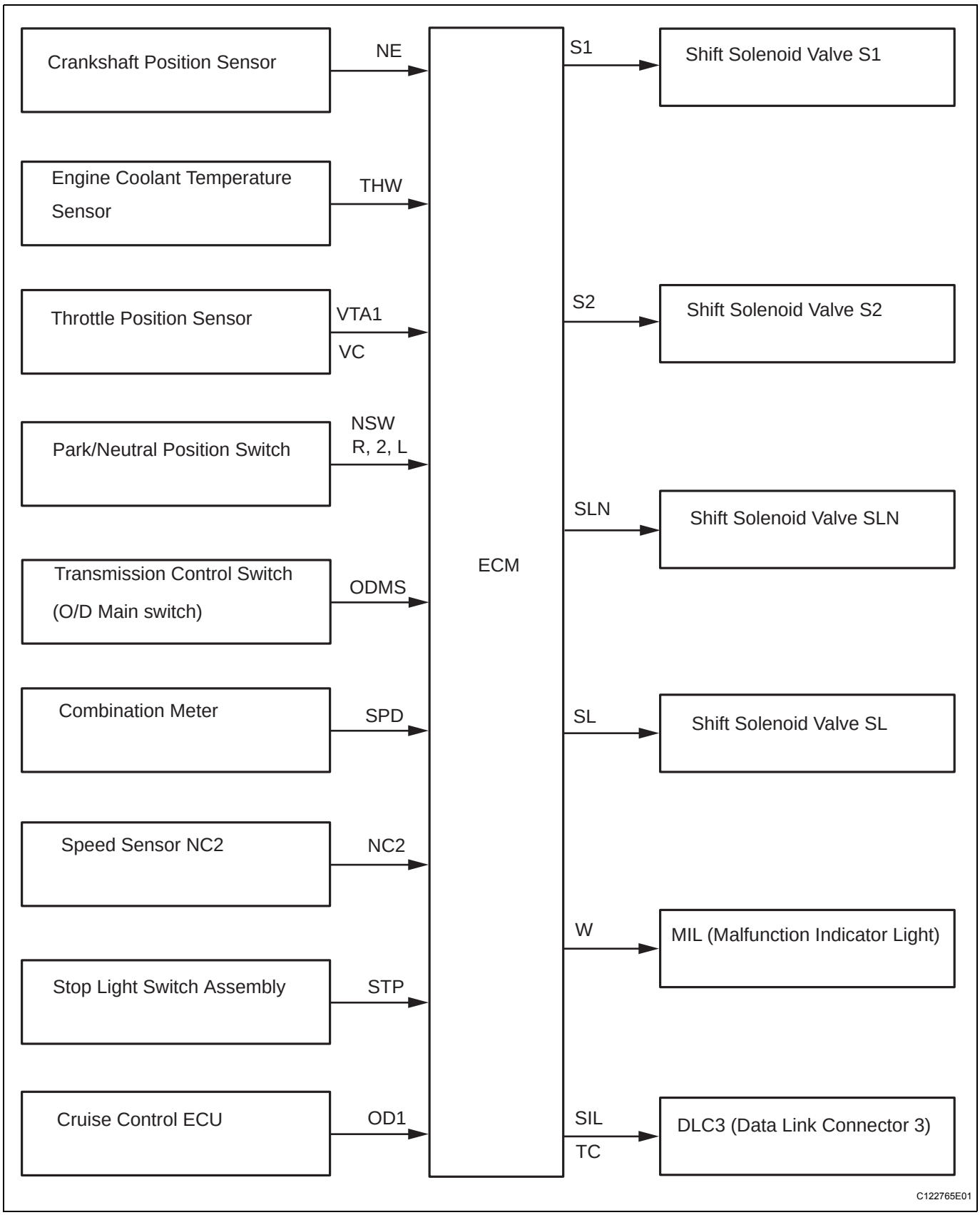
*1: with Cruise Control

P

C109076E01

SYSTEM DIAGRAM

The configuration of the electronic control system in the A541E automatic transaxles is as shown in the following chart.



SYSTEM DESCRIPTION

1. SYSTEM DESCRIPTION

(a) The ECT (Electronic controlled automatic transmission/transaxle) is an automatic transmission/transaxle that electronically controls shift timing using the ECM. The ECM detects electrical signals that indicate engine and driving conditions, and controls the shift point, based on driver habits and road conditions. As a result, fuel efficiency and power transmission performance are improved.
Shift shock has been reduced by controlling the engine and transmission simultaneously.
In addition, the ECT has features such as:
- Diagnostic function
- Fail-safe function when a malfunction occurs

HOW TO PROCEED WITH TROUBLESHOOTING

HINT:
- *: Use the intelligent tester.

1	VEHICLE BROUGHT TO WORKSHOP

NEXT

2	CUSTOMER PROBLEM ANALYSIS

NEXT

3	INSPECT BATTERY VOLTAGE

Standard voltage:
11 to 14 V
If the voltage is below 11 V, recharge or replace the battery before proceeding.

NEXT

4	CONNECT INTELLIGENT TESTER TO DLC3*

NEXT

5	CHECK AND CLEAR DTCS AND FREEZE FRAME DATA*

(a) Refer to the DTC CHECK/CLEAR (See page **AX-22**).

NEXT

6	VISUAL INSPECTION

NEXT

7	SETTING CHECK MODE DIAGNOSIS*

(a) Refer to the CHECK MODE PROCEDURE (See page AX-24).

NEXT

8	PROBLEM SYMPTOM CONFIRMATION

(a) Refer to the ROAD TEST (See page AX-8).

Result

Result	Proceed to
Symptom does not occur	A
Symptom occurs	B

B → GO TO STEP 10

A

9	SYMPTOM SIMULATION

(a) Refer to the ELECTRONIC CIRCUIT INSPECTION PROCEDURE (See page IN-28).

NEXT

10	DTC CHECK*

(a) Refer to the DTC CHECK/CLEAR (See page AX-22).

Result

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

B → GO TO STEP 19

A

11	BASIC INSPECTION

(a) Refer to the AUTOMATIC TRANSMISSION FLUID (See page 40-1).

(b) Refer to the PARK/NEUTRAL POSITION SWITCH (See page AX-51).
(c) Refer to the SHIFT LEVER ASSEMBLY (See page 40-55).

NG → GO TO STEP 22

OK

12	MECHANICAL SYSTEM TEST

(a) Refer to the MECHANICAL SYSTEM TEST (See page AX-10).

NG → GO TO STEP 18

OK

13	HYDRAULIC TEST

(a) Refer to the HYDRAULIC TEST (See page AX-11).

NG → GO TO STEP 18

OK

14	MANUAL SHIFTING TEST

(a) Refer to the MANUAL SHIFTING TEST (See page AX-12).

NG → GO TO STEP 16

OK

15	PROBLEM SYMPTOMS TABLE CHAPTER 1

(a) Refer to the PROBLEM SYMPTOMS TABLE (See page AX-16).

NG → GO TO STEP 20

OK

16	PROBLEM SYMPTOMS TABLE CHAPTER 2

(a) Refer to the PROBLEM SYMPTOMS TABLE (See page AX-16).

NEXT

17	PROBLEM SYMPTOMS TABLE CHAPTER 3

(a) Refer to the PROBLEM SYMPTOMS TABLE (See page AX-16).

NEXT

18	PART INSPECTION

NEXT → GO TO STEP 22

19	DTC CHART

(a) Refer to the DIAGNOSTIC TROUBLE CODE CHART (See page AX-27).

NEXT

20	CIRCUIT INSPECTION

NEXT

21	IDENTIFICATION OF PROBLEM

NEXT

22	REPAIR OR REPLACE

NEXT

23	CONFIRMATION TEST

NEXT

END

ROAD TEST

1. **PROBLEM SYMPTOM CONFIRMATION**
   (a) Based on the result of the customer problem analysis, try to reproduce the symptoms. If the problem is that the transaxle does not shift up or down, or the shift point is too high or too low, conduct the following road test referring to the automatic shift schedule and simulate the problem symptoms.

2. **ROAD TEST**
   NOTICE:
   Perform the test at the normal operating ATF (Automatic Transmission Fluid) temperature of 50 to 80°C (122 to 176°F).
   (a) D position test:
   Shift into the D position and fully depress the accelerator pedal and check the following points.
   (1) Check up-shift operation.
   Check that the 1 → 2, 2 → 3 and 3 → O/D up-shifts take place, and that the shift points conform to the automatic shift schedule (See page SS-6).
   HINT:
   O/D Gear Up-shift Prohibition Control
   • Engine coolant temperature is 60°C (140°F) or less and vehicle speed is 70 km/h or less.
   O/D Gear Lock-up Prohibition Control
   • Brake pedal is depressed.
   • Accelerator pedal is released.
   • Engine coolant temperature is 60°C (140°F) or less.
   (2) Check for shift shock and slip.
   Check for shock and slip at the 1 → 2, 2 → 3 and 3 → O/D up-shifts.
   (3) Check for abnormal noise and vibration.
   Check for abnormal noise and vibration when up-shifting from 1 → 2, 2 → 3 and 3 → O/D while driving with the shift lever in the D position, and check while driving in the lock-up condition.
   HINT:
   The check for the cause of abnormal noise and vibration must be done thoroughly as it could also be due to loss of balance in the differential, torque converter clutch, etc.
   (4) Check kick-down operation.
   Check vehicle speeds when the 2 → 1, 3 → 2 and O/D → 3 kick-downs take place while driving with the shift lever in the D position. Confirm that each speed is within the applicable vehicle speed range indicated in the automatic shift schedule (See page SS-6).
   (5) Check for abnormal shock and slip at kick-down.

(6) Check the lock-up mechanism.
- Drive the vehicle with the shift lever in the D position (O/D gear) at a steady speed (lock-up ON).
- Lightly depress the accelerator pedal and check that the engine speed does not change abruptly.

HINT:
- There is no lock-up function in the 1st and 2nd gears.
- If there is a big jump in engine speed, there is no lock-up.

(b) 2 position test:
Shift into the 2 position and fully depress the accelerator pedal and check the following points.
(1) Check up-shift operation.
Check that the 1 → 2 up-shift takes place and that the shift point conforms to the automatic shift schedule (See page **SS-6**).
HINT:
There is no 3rd up-shift and lock-up in the 2 position.
(2) Check engine braking.
While running in the 2 position and 2nd gear, release the accelerator pedal and check the engine braking effect.
(3) Check for abnormal noise during acceleration and deceleration, and for shock at up-shift and down-shift.

(c) L position test:
Shift into the L position and fully depress the accelerator pedal and check the following points.
(1) Check no up-shift.
While running in the L position, check that there is no up-shift to 2nd gear.
HINT:
There is no lock-up in the L position.
(2) Check engine braking.
While running in the L position, release the accelerator pedal and check the engine braking effect.
(3) Check for abnormal noise during acceleration and deceleration.

(d) R position test:
Shift into the R position, lightly depress the accelerator pedal, and check that the vehicle moves backward without any abnormal noise or vibration.
CAUTION:
Before conducting this test, ensure that the test area is free from people and obstruction.

(e) P position test:
Stop the vehicle on a slope (more than 5°) and after shifting into the P position, release the parking brake. Then, check that the parking lock pawl holds the vehicle in place.

MECHANICAL SYSTEM TESTS

1. PERFORM MECHANICAL SYSTEM TESTS

(a) Measure the stall speed.
The object of this test is to check the overall performance of the transaxle and engine by measuring the stall speeds in the D position.
NOTICE:
- **Driving test should be done on a paved road.**
- **Perform the test at the normal operating ATF (Automatic Transmission Fluid) temperature of 50 to 80°C (122 to 176°F).**
- **Do not continuously run this test for longer than 5 seconds.**
- **To ensure safety, do this test in a wide, clear level area which provides good traction.**
- **The stall test should always be carried out in pairs. One technician should observe the conditions of wheels or wheel stoppers outside the vehicle while the other is doing the test.**

(1) Chock the 4 wheels.
(2) Connect an intelligent tester to the DLC3.
(3) Fully apply the parking brake.
(4) Keep your left foot pressing firmly on the brake pedal.
(5) Start the engine.
(6) Shift into the D position. Press all the way down on the accelerator pedal with your right foot.
(7) Quickly read the stall speed at this time.
Stall speed:
2,450 to 2,750 rpm

Evaluation:

Problem	Possible Cause
(a) Engine stall speed is low in D position	• Engine power output may be insufficient • Stator one-way clutch is not operating properly HINT: If the value is less than the specified value by 600 rpm or more, the torque converter could be faulty.
(b) Engine stall speed is high in D position	• Line pressure is too low • Forward clutch slipping • O/D clutch slipping • O/D one-way clutch is not operating properly • No. 2 one-way clutch is not operating properly • Improper fluid level • Throttle cable

(b) Measure the time lag.

(1) When the shift lever is shifted while the engine is idling, there will be a certain time lapse or lag before the shock can be felt. This is used for checking the condition of the clutch and brake.

NOTICE:

- **Perform the test at the normal operating ATF (Automatic Transmission Fluid) temperature of 50 to 80°C (122 to 176°F).**
- **Be sure to allow 1 minute interval between tests.**
- **Perform the test three times, and measure the time lags. Calculate the average value of the three time lags.**

(2) Connect an intelligent tester to the DLC3.

(3) Fully apply the parking brake.

(4) Start and warm up the engine and check idle speed.

Idle speed:

Approx. 700 rpm (in the N position and A/C OFF)

(5) Shift the lever from N to D position. Using a stop watch, measure the time from when the lever is shifted to when the shock is felt.

Time lag:

N → D less than 1.2 seconds

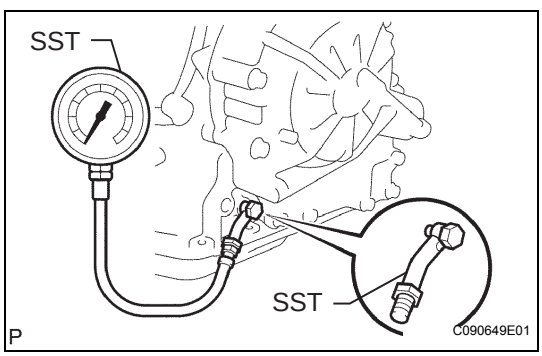
(6) In the same way, measure the time lag for N → R.

Time lag:

N → R less than 1.5 seconds

Evaluation (If N → D or N → R time lag is longer than the specified):

Problem	Possible Cause
N → D time lag is longer	• Line pressure is too low • Forward clutch worn • O/D one-way clutch is not operating properly
N → R time lag is longer	• Line pressure is too low • Direct clutch worn • 1st and reverse brake worn • O/D one-way clutch is not operating properly



HYDRAULIC TEST

1. PERFORM HYDRAULIC TEST

(a) Measure the line pressure.

NOTICE:

- **Perform the test at the normal operating ATF (Automatic Transmission Fluid) temperature of 50 to 80°C (122 to 176°F).**
- **The line pressure test should always be carried out in pairs. One technician should observe the conditions of wheels or wheel stoppers outside the vehicle while the other is performing the test.**
- **Make sure that the SST hose does not interfere with the exhaust pipe.**

- **This check must be performed after checking and adjusting the engine.**
- **Perform this check while the A/C is OFF.**
- **When conducting stall test, do not continue more than 5 seconds.**

(1) Warm up the ATF.
(2) Remove the test plug on the left side of the transaxle case and connect SST.
SST 09992-00095 (09992-00231, 09992-00271)
(3) Fully apply the parking brake and chock the 4 wheels.
(4) Connect an intelligent tester to the DLC3.
(5) Start the engine and check idle speed.
(6) Keep your left foot pressing firmly on the brake pedal and shift into the D position.
(7) Measure the line pressure when the engine is idling.
(8) Depress the accelerator pedal all the way down. Quickly read the highest line pressure when engine speed reaches stall speed.
(9) In the same way, perform the test in the R position.

Specified line pressure:

Condition	D Position kPa (kgf cm^2, psi)	R Position kPa (kgf cm^2, psi)
Idling	401 to 461 kPa (4.1 to 4.7 kgf cm^2, 58 to 66 psi)	804 to 882 kPa (8.2 to 9.0 kgf cm^2, 117 to 128 psi)
Stall test	1,138 to 1,236 kPa (11.6 to 12.6 kgf cm^2, 165 to 179 psi)	1,716 to 1,854 kPa (17.5 to 18.9 kgf cm^2, 249 to 269 psi)

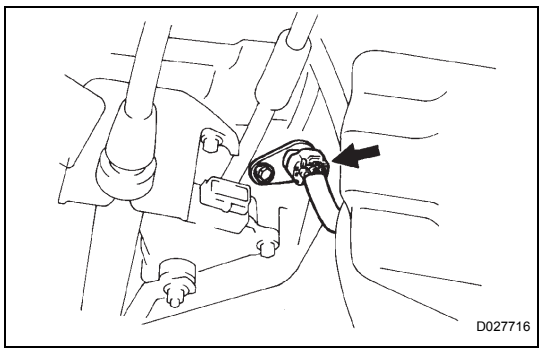
Evaluation:

Problem	Possible Cause
Measured values at all positions are higher	• Throttle cable out of adjustment • Throttle valve defective • Regulator valve defective
Measured values at all positions are lower	• Throttle cable out of adjustment • Throttle valve defective • Regulator valve defective • Oil pump defective • O/D direct clutch defective
Pressure is low in the D position only	• D position circuit fluid leak • Forward clutch defective
Pressure is low in the R position only	• R position circuit fluid leak • Direct clutch defective • 1st and reverse brake defective

MANUAL SHIFTING TEST

1. PERFORM MANUAL SHIFTING TEST

HINT:
- With this test, it can be determined whether the trouble occurs in the electrical circuit or is a mechanical problem in the transaxle.
- If any abnormalities are found in the following test, the problem is in the transaxle itself.



(a) Disconnect the transmission wire connector.
(b) Inspect the manual driving operation.
Check that the shift and gear positions correspond to the table below.
Check that the gear change corresponds to the shift position.

Shift Position	Gear Position
D	O/D
2	O/D
L	1st
R	Reverse
P	Pawl Lock

HINT:
If the gear positions of the L, 2 and D are difficult to distinguish, perform a road test (See page AX-8).
If any abnormality is found in the above test, the problem is in the transaxle itself.
(c) Connect the transmission wire connector.
(d) Clear the DTC (See page AX-22).

INITIALISATION

1. RESET MEMORY

NOTICE:

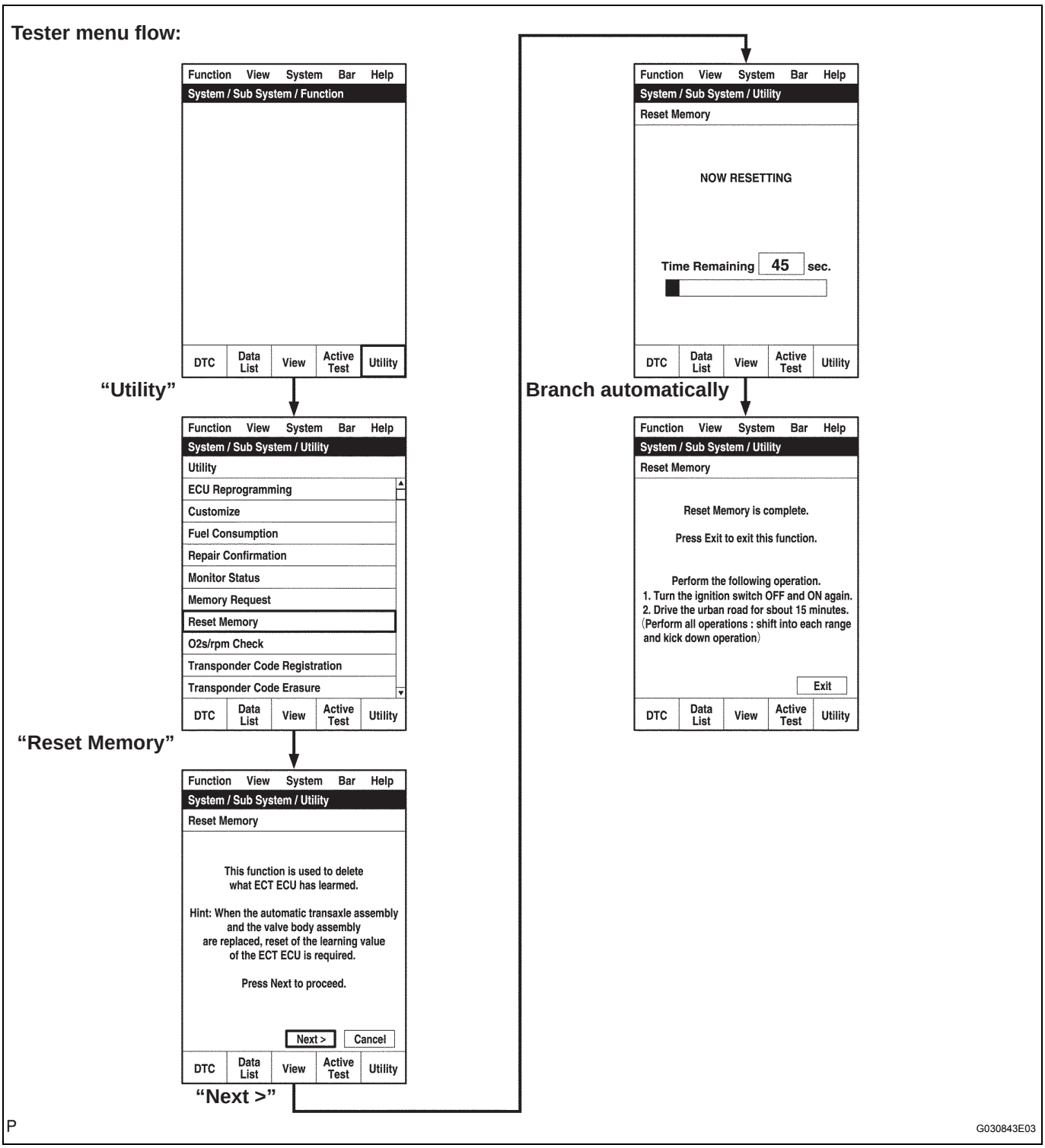
- **Perform the RESET MEMORY (AT initialisation) when replacing the automatic transaxle assembly, engine assembly or ECM.**
- **The RESET MEMORY can be performed only with the intelligent tester.**

HINT:
The ECM memorises the condition that the ECT controls the automatic transaxle assembly and engine assembly according to those characteristics. Therefore, when the automatic transaxle assembly, engine assembly, or ECM has been replaced, it is necessary to reset the memory so that the ECM can memorise the new information.
Reset procedure is as follows:
(a) Turn the ignition switch OFF.
(b) Connect the intelligent tester to the DLC3.
(c) Turn the ignition switch to the ON position.
(d) Turn the intelligent tester main switch ON.
(e) Perform the reset memory procedure from the main menu.

CAUTION:
After performing the RESET MEMORY, be sure to perform the ROAD TEST (See page AX-8) described earlier.

HINT:
The ECM learns by performing the ROAD TEST.

(1) Tester menu flow:



MONITOR DRIVE PATTERN

1. MONITOR DRIVE PATTERN FOR ECT TEST

(a) Perform this drive pattern as one method to simulate the detection conditions of the ECT malfunctions. (The DTCs may not be detected due to the actual driving conditions. Some codes may not be detected through this drive pattern.)

HINT:

Preparation for driving

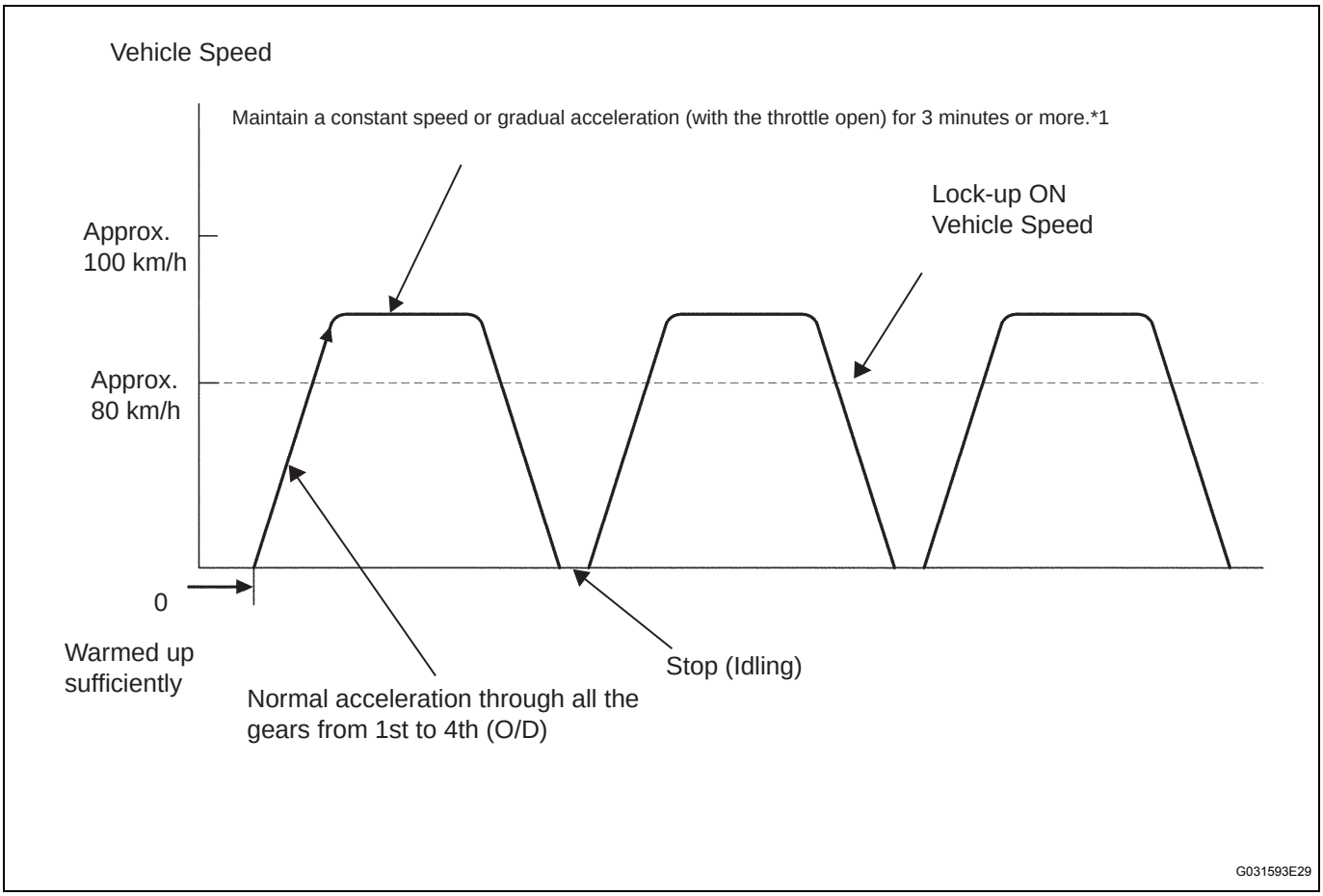
- Warm up the engine sufficiently. (Engine coolant temperature is 60°C (140°F) or higher.)
- Drive the vehicle when the atmospheric temperature is -10°C (14°F) or higher. (Malfunction is not detected when the atmospheric temperature is less than -10°C (14°F).)

Driving note

- Drive the vehicle through all gears. Stop → 1st → 2nd → 3rd → 4th (O/D) → 4th (lock-up ON).
- Repeat the above driving pattern three times or more.

NOTICE:

- **When using the intelligent tester, monitor status can be found in the "Powertrain / Engine and ECT / Data List".**
- **In the event that the drive pattern must be interrupted (possibly due to traffic conditions or other factors), the drive pattern can be resumed and, in most cases, the monitor can be completed.**
- **Perform this drive pattern on a level road as much as possible and strictly observe the posted speed limits and traffic laws while driving.**



HINT:
*1: Drive at such a speed in the uppermost gear to engage lock-up. The vehicle can be driven at a speed lower than that in the above diagram under the lock-up condition.

PROBLEM SYMPTOMS TABLE

HINT:
If a normal code is displayed during the diagnostic trouble code check although the trouble still occurs, check the electrical circuits for each symptom in the order given in the charts on the following pages and proceed to the page given for troubleshooting.
The Matrix Chart is divided into 3 chapters.
Chapter 1:
Refer to the table below when the cause is considered to be electrical.
If the instruction "Proceed to next circuit inspection shown on matrix chart" is given in the flow chart of each circuit, proceed to the circuit with the next highest number in the table to continue the check.
If the trouble still occurs even though there are no abnormalities in any of the other circuits, check and replace the ECM.

1. Chapter 1: Electronic Circuit Matrix Chart

Symptom	Suspected Area	See Page
No up-shift (A particular gear, from 1st to 3rd gear, is not up-shifted)	ECM	IN-23
No up-shift (3rd to O/D)	1. O/D main switch circuit	AX-55
	2. O/D cancel signal circuit *1	AX-57
	3. Electronically controlled transmission communication circuit *1	CC-6
	4. ECM	IN-23
No down-shift (O/D to 3rd)	1. O/D main switch circuit	AX-55
	2. O/D cancel signal circuit *1	AX-57
	3. Electronically controlled transmission communication circuit *1	CC-6
	4. ECM	IN-23
No down-shift (A particular gear, from 1st to 3rd gear, is not down-shifted)	ECM	IN-23
No lock-up	ECM	IN-23
No lock-up OFF	ECM	IN-23
Shift point too high or too low	ECM	IN-23
Up-shift to 2nd while in L position	1. Park / neutral position switch circuit	AX-51
	2. ECM	IN-23
Up-shift to 3rd while in 2 position	1. Park / neutral position switch circuit	AX-51
	2. ECM	IN-23
Up-shift to O/D from 3rd while O/D main switch is OFF	1. O/D main switch circuit	AX-55
	2. O/D cancel signal circuit *1	AX-57
	3. Electronically controlled transmission communication circuit *1	CC-6
	4. ECM	IN-23
Up-shift to O/D from 3rd while engine is cold	ECM	IN-23
Harsh engagement (N to D)	ECM	IN-23
Harsh engagement (Lock-up)	ECM	IN-23
Harsh engagement (Any driving range)	ECM	IN-23
Poor acceleration	ECM	IN-23
No kick-down	ECM	IN-23
Engine stalls when starting off or stopping	ECM	IN-23

2. Chapter 2: On-Vehicle Repair

Symptom	Suspected Area	See Page
Vehicle does not move in any forward range and reverse range	1. Manual valve	*2
	2. Throttle valve	*2
	3. Primary regulator valve	*2
	4. Off-vehicle repair matrix chart	-
Vehicle does not move in R position	Off-vehicle repair matrix chart	-
No up-shift (1st to 2nd)	1. Valve body assembly	*2
	2. Off-vehicle repair matrix chart	-
No up-shift (2nd to 3rd)	1. Valve body assembly	*2
	2. Off-vehicle repair matrix chart	-
No up-shift (3rd to O/D)	1. Valve body assembly	*2
	2. Off-vehicle repair matrix chart	-
No down-shift (O/D to 3rd)	Valve body assembly	*2
No down-shift (3rd to 2nd)	Valve body assembly	*2
No down-shift (2nd to 1st)	Valve body assembly	*2

Symptom	Suspected Area	See Page
No lock-up or no lock-up OFF	1. Lock-up relay valve	*2
	2. Off-vehicle repair matrix chart	-
Harsh engagement (N to D)	1. C1 accumulator	*2
	2. Valve body assembly	*2
	3. Off-vehicle repair matrix chart	-
Harsh engagement (N to R)	1. C2 accumulator	*2
	2. Valve body assembly	*2
	3. Off-vehicle repair matrix chart	-
Harsh engagement (Lock-up)	1. Lock-up relay valve	*2
	2. Off-vehicle repair matrix chart	-
Harsh engagement (1st to 2nd to 3rd to O/D)	1. Throttle valve	*2
	2. Valve body assembly	*2
Harsh engagement (2nd to 3rd)	1. C2 accumulator	*2
	2. Valve body assembly	*2
Harsh engagement (3rd to O/D)	1. B0 accumulator	*2
	2. Valve body assembly	*2
Harsh engagement (O/D to 3rd)	1. C0 accumulator	*2
	2. B0 accumulator	*2
	3. Valve body assembly	*2
Slip or shudder (Forward and reverse)	1. Throttle valve	*2
	2. Oil strainer	*2
	3. Off-vehicle repair matrix chart	-
No engine braking (1st: L position)	1. Valve body assembly	*2
	2. Off-vehicle repair matrix chart	-
No engine braking (2nd: 2 position)	1. Valve body assembly	*2
	2. Off-vehicle repair matrix chart	-
No kick-down	Valve body assembly	*2
Shift point too high or too low	Throttle cable	*2

3. Chapter 3: Off-Vehicle Repair

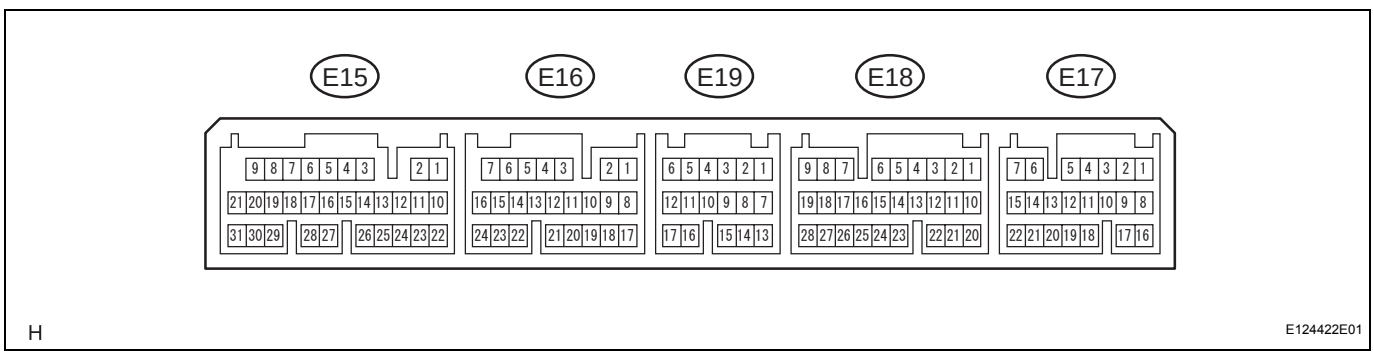
Symptom	Suspected Area	See Page
Vehicle does not move in any forward position and reverse range	1. Front and rear planetary gear	*2
	2. O/D planetary gear	*2
	3. O/D one-way clutch (F0)	*2
	4. O/D direct clutch (C0)	*2
	5. Forward clutch (C1)	*2
	6. O/D brake (B0)	*2
Vehicle does not move in R position	1. Front and rear planetary gear unit	*2
	2. Direct clutch (C2)	*2
	3. O/D direct clutch (C0)	*2
	4. 1st and reverse brake (B3)	*2
No up-shift (1st to 2nd)	1. No. 1 one-way clutch (F1)	*2
	2. 2nd brake (B2)	*2
No up-shift (2nd to 3rd)	Direct clutch (C2)	*2
No up-shift (3rd to O/D)	O/D brake (B0)	*2
No lock-up or no lock-up OFF	Torque converter clutch	*2
Harsh engagement (N to D)	1. Forward clutch (C1)	*2
	2. O/D one-way clutch (F0)	*2
	3. No. 2 one-way clutch (F2)	*2

Symptom	Suspected Area	See Page
Harsh engagement (N to R)	1. Direct clutch (C2)	*2
	2. 1st and reverse brake (B3)	*2
Harsh engagement (Lock-up)	Torque converter clutch	*2
Slip or shudder (Forward range: After warm-up)	1. Torque converter clutch	*2
	2. O/D direct clutch (C0)	*2
	3. Forward clutch (C1)	*2
	4. O/D one-way clutch (F0)	*2
Slip or shudder (R position)	1. Direct clutch (C2)	*2
	2. 1st and reverse brake (B3)	*2
	3. O/D direct clutch (C0)	*2
Slip or shudder (1st)	No. 2 one-way clutch (F2)	*2
Slip or shudder (2nd)	1. No. 1 one-way clutch (F1)	*2
	2. 2nd brake (B2)	*2
Slip or shudder (3rd)	Direct clutch (C2)	*2
Slip or shudder (O/D)	O/D brake (B0)	*2
No engine braking (1st to 3rd: D position)	2nd brake (B2)	*2
No engine braking (1st: L position)	1st and reverse brake (B3)	*2
No engine braking (2nd: 2 position)	2nd coast brake (B1)	*2
Poor acceleration (All position)	1. Torque converter clutch	*2
	2. O/D planetary gear	*2
Poor acceleration (O/D)	1. O/D direct clutch (C0)	*2
	2. O/D planetary gear	*2
Large shift shock or engine stalls when starting off or stopping	Torque converter clutch	*2

HINT:
*1: with Cruise Control
*2: CAMRY Repair Manual Pub. No. AA-CDRM010

TERMINALS OF ECM

1. ECM



HINT:
Standard voltage of each ECM terminal is shown in the table below.
In the table, first follow the information under "Condition". Look under "Symbols (Terminal No.)" for the terminals to be inspected. The standard voltage between the terminals is shown under "Specific Condition".
Use the illustration above as a reference for the ECM terminals.

Symbols (Terminal No.)	Wiring Color	Condition	Specified Condition
SLN+ (E15-20) - SLN- (E15-19)	W-L - B-Y	IG switch ON	10 to 14 V
S1 (E15-7) - E1 (E16-17)	V - W-B	IG switch ON	Below 1 V
		1st or 2nd gear	10 to 14 V
		3rd or O/D gear	Below 1 V
NSW (E18-20) - E1 (E16-17)	B-O - W-B	IG switch ON and shift lever P or N position	Below 2 V
		IG switch ON and shift lever in any position other than P or N position	10 to 14 V
S2 (E15-8) - E1 (E16-17)	L-B - W-B	IG switch ON	Below 1 V
		2nd or 3rd gear	10 to 14 V
		1st or O/D gear	Below 1 V
SL (E15-9) - E1 (E16-17)	P-L - W-B	IG switch ON	Below 1 V
		Vehicle driving under lock-up range	10 to 14 V
NC2+ (E15-14) - NC2- (E15-26)	LG - L	Engine is running	Below 1 V and 4 to 5 V
L (E18-12) - E1 (E16-17)	Y - W-B	IG switch ON and shift lever L position	10 to 14 V
		IG switch ON and shift lever in any position other than L position	Below 1 V
ODLP (E17-9) - E1 (E16-17)	O - W-B	O/D main switch ON (O/D OFF)	Below 3 V
		O/D main switch OFF (O/D ON)	9 to 14 V
OD1 *1 (E18-24) - E1 (E16-17)	Y-R *1 - W-B	IG switch ON	10 to 14 V
2 (E18-3) - E1 (E16-17)	L-W - W-B	IG switch ON and shift lever 2 position	10 to 14 V
		IG switch ON and shift lever in any position other than 2 position	Below 1 V
SPD (E18-22) - E1 (E16-17)	V-W - W-B	IG switch ON	4.5 to 5.5 V
R (E18-2) - E1 (E16-17)	R-B - W-B	IG switch ON and shift lever R position	10 to 14 V
		IG switch ON and shift lever in any position other than R position	Below 1 V
ODMS (E15-23) - E1 (E16-17)	G-O - W-B	IG switch ON	10 to 14 V
		IG switch ON and press continuously O/D main switch	Below 1 V

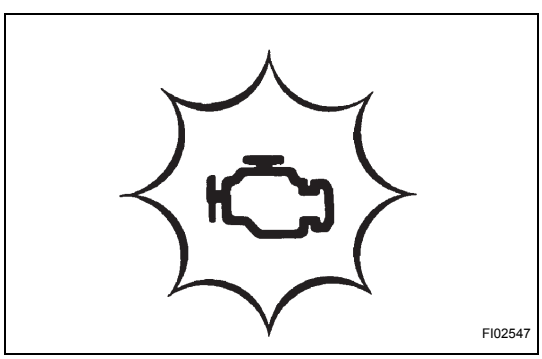
*1: with Cruise Control

DIAGNOSIS SYSTEM

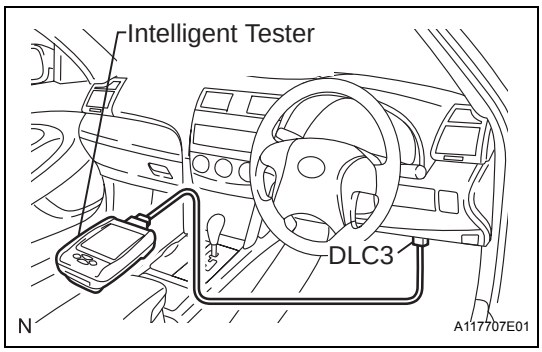
1. DESCRIPTION

(a) When troubleshooting Europe On-Board Diagnostic (Euro-OBD) vehicles, the vehicle must be connected to an OBD scan tool (complying with ISO 15031-4). Various data output from the vehicle's ECM can then be read.

(b) Euro-OBD regulations require that the vehicle's on-board computer illuminates the Malfunction Indicator Lamp (MIL) on the instrument panel when the computer detects a malfunction in:
(1) The emission control system/components.
(2) The powertrain control components (which affect vehicle emissions).



(3) The computer.
In addition, the applicable Diagnostic Trouble Codes (DTCs) prescribed by ISO 15031-4 are recorded in the ECM memory.
If the malfunction does not reoccur in 3 consecutive trips, the MIL turns off automatically but the DTCs remain recorded in the ECM memory.



(c) To check DTCs, connect the intelligent tester to the Data Link Connector 3 (DLC3) of the vehicle.
The tester displays DTCs, the freeze frame data and a variety of the engine data.
The DTCs and freeze frame data can be erased with the tester (See page AX-22).

2. NORMAL MODE AND CHECK MODE

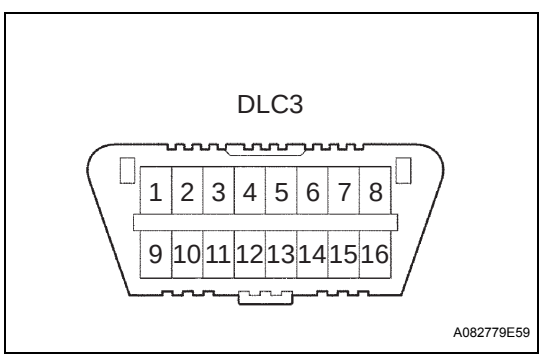
The diagnosis system operates in "normal mode" during normal vehicle use. In normal mode, "2 trip detection logic" is used to ensure accurate detection of malfunctions. "Check mode" is also available to technicians as an option. In check mode, "1-trip detection logic" is used for simulating malfunction symptoms and increasing the system's ability to detect malfunctions, including intermittent malfunctions (intelligent tester only).

3. 2-TRIP DETECTION LOGIC

(a) When a malfunction is first detected, the malfunction is temporarily stored in the ECM memory (1st trip). If the ignition switch is turned OFF and then ON again, and the same malfunction is detected again, the MIL will illuminate.

4. FREEZE FRAME DATA

(a) The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air/fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.



5. DLC3 (Data Link Connector 3)

(a) The vehicle's ECM uses the ISO 9141-2 (Euro-OBD) communication protocol. The terminal arrangement of the DLC3 complies with ISO 15031-4 and matches the ISO 9141-2 format.
HINT:
When you use the intelligent tester, first connect the cable of the tester to the DLC3. Next, turn the ignition switch to the ON position. Finally turn the tester ON. If the screen displays NO INFORMATION AVAILABLE and bus check is also failed, a problem exists in the vehicle, the tester or the tester cable.

If the communication is normal when the tester is connected to another vehicle, inspect the DLC3 on the original vehicle.
If the communication is still impossible when the tester is connected to another vehicle, the problem is probably in the tester itself. Consult the Service Department listed in the tester's instruction manual.

Symbol	Terminal No.	Name	Reference Terminal	Result	Condition
SIL	7	Bus "+" line	5 - Signal ground	Pulse generation	During transmission
CG	4	Chassis ground	Body ground	1 Ω or less	Always
SG	5	Signal ground	Body ground	1 Ω or less	Always
BAT	16	Battery positive	Body ground	9 to 14 V	Always

6. INSPECT BATTERY VOLTAGE

Battery Voltage:

11 to 14 V

(a) If voltage is below 11 V, replace the battery before proceeding.

7. CHECK MIL

(a) Check that the MIL illuminates when turning the ignition switch to the ON position.
If the MIL does not illuminate, there is a problem in the MIL circuit (See page **ES-181**).

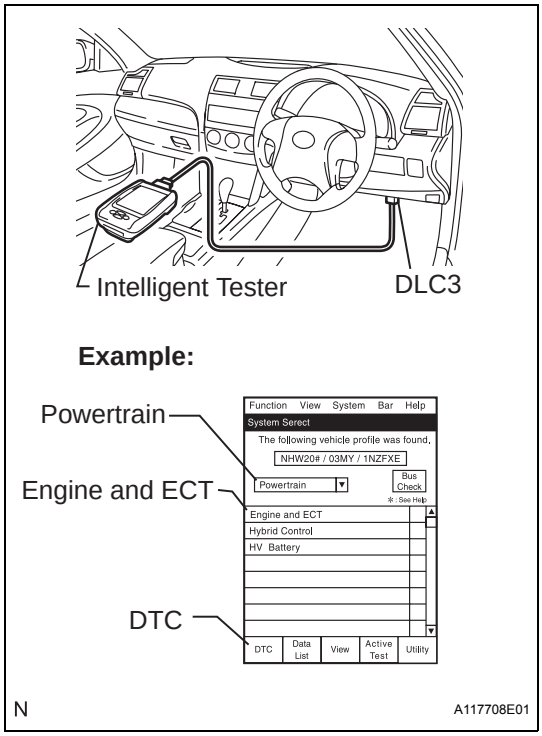
(b) When the engine is started, the MIL should turn OFF.

DTC CHECK / CLEAR

NOTICE:

Intelligent tester only:

When the diagnosis system is changed from normal mode to check mode, or vice versa, all the DTCs and freeze frame data recorded in normal mode will be erased. Before changing modes, always check and make a note of any DTCs and freeze frame data.



1. **CHECK DTC**

(a) DTCs which are stored in the ECM can be displayed with the intelligent tester.
The intelligent tester can display pending DTCs and current DTCs. Some DTCs are not stored if the ECM does not detect a malfunction during consecutive driving. However, the malfunction detected during a driving is stored as a pending DTC.

(1) Connect the intelligent tester to the DLC3.

(2) Turn the ignition switch to the ON position and turn the intelligent tester ON.

(3) Enter the following menus: Powertrain / Engine and ECT / DTC.

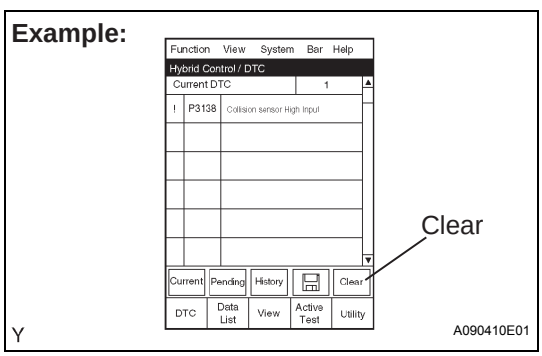
(4) Check and make a note of DTCs and freeze frame data.

(5) Confirm the details of the DTCs (See page AX-25).

NOTICE:

When simulating a symptom with the tester to check the DTCs, use the normal mode. For codes on DIAGNOSTIC TROUBLE CODE CHART which are subject to "2-trip detection logic", perform the following actions.

Turn the ignition switch off after the symptom is simulated once. Then repeat the simulation process again. When the problem has been simulated twice, the MIL illuminates and the DTCs are recorded in the ECM.



2. **CLEAR DTCS AND FREEZE FRAME DATA (using intelligent tester)**

(a) Connect the intelligent tester to the DLC3.

(b) Turn the ignition switch to the ON position (do not start the engine) and turn the intelligent tester ON.

(c) Enter the following menus: Powertrain / Engine and ECT / DTC / Clear (*1).

(d) Erase DTCs and freeze frame data by pressing YES on the tester.

(e) Turn off the ignition and then turn it on again, and check that the monitor is not displaying any DTCs. If any DTCs are displayed, repeat from step (*1).

3. **CLEAR DTCS AND FREEZE FRAME DATA (without using intelligent tester)**

(a) Perform either one of the following operations.

(1) Disconnect the battery negative (-) terminal for 1 minute or more.

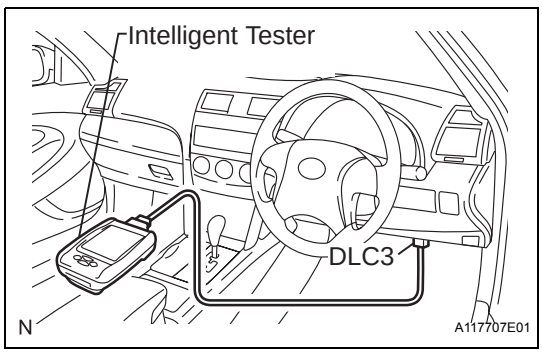
(2) Remove the EFI fuses from the engine room R/B for 1 minute or more.
However, if you disconnect the battery terminal, perform the "INITIALISE" procedure.

CHECK MODE PROCEDURE

HINT:
Intelligent tester only

1. DESCRIPTION

(a) Check mode has a higher sensitivity to malfunctions and can detect malfunctions that normal mode cannot detect. Check mode can also detect all the malfunctions that normal mode can detect. In check mode, DTCs are detected with 1-trip detection logic.



2. CHECK MODE PROCEDURE

(a) Make sure that the following items are satisfied:
(1) Battery voltage is 11 V or more
(2) Throttle valve is fully closed
(3) Transmission is in the P or N position
(4) A/C is switched OFF

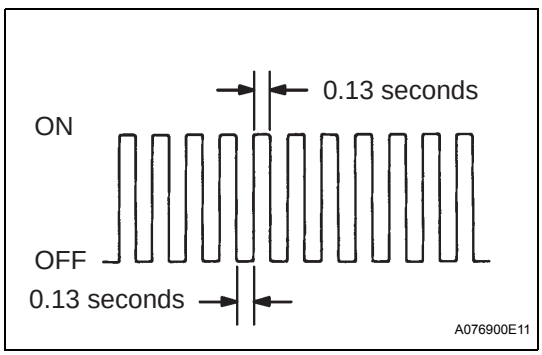
(b) Turn the ignition switch OFF.

(c) Connect the intelligent tester to the DLC3.

(d) Turn the ignition switch to the ON position.

(e) Turn the intelligent tester ON.

(f) Enter the following menus: Utility / Check Mode.



(g) Change the ECM to check mode. Make sure the MIL flashes as shown in the illustration.
NOTICE:
All DTCs and freeze frame data recorded will be erased if: 1) the intelligent tester is used to change the ECM from normal mode to check mode or vice versa; or 2) during check mode, the ignition switch is turned from the ON to ACC or LOCK position.
Before check mode, make notes of the DTCs and freeze frame data.

(h) Start the engine. The MIL should turn off after the engine starts.

(i) Perform "MONITOR DRIVE PATTERN" for the ECT test (See page AX-15).
(Or, simulate the conditions of the malfunction described by the customer).

(j) After simulating the malfunction conditions, use the intelligent tester diagnosis selector to check the DTC and freeze frame data.

FAIL-SAFE CHART

1. FAIL-SAFE

This function minimises the loss of the ECT functions when any malfunction occurs in a sensor or solenoid.

(a) Shift solenoid valve SL:
When the solenoid valve SL has a malfunction, the current to the solenoid valve is stopped.
This stops lock-up control, then fuel economy decreases.

(b) Shift solenoid valve S1 and S2:
Fail safe function:
If either of the shift solenoid valve circuits develops an open or short, the ECM turns the other shift solenoid on and off in order to shift the gear positions as shown in the table below.
Manual shifting as shown in the table below must be done (In case of a short circuit, the ECM stops sending the current to the short circuited solenoid).
Even if starting the engine in the fail-safe mode, the gear position remains in the same position.
HINT:
- *1: Actual gear shift (gear position) under fail-safe operation.
- OFF: OFF (the ECM stops sending current to a malfunctioning solenoid valve)

Position	NORMAL			SHIFT SOLENOID S1 MALFUNCTIONING		
	Solenoid valve		Gear	Solenoid valve		Gear*1
	S1	S2		S1	S2	
D	ON	OFF	1st	X	ON	3rd
	ON	ON	2nd	X	ON	3rd
	OFF	ON	3rd	X	ON	3rd
	OFF	OFF	O/D	X	OFF	O/D
2	ON	OFF	1st	X	ON	3rd
	ON	ON	2nd	X	ON	3rd
	OFF	ON	3rd	X	ON	3rd
L	ON	OFF	1st	X	OFF	1st
	ON	ON	2nd	X	ON	2nd

Position	SHIFT SOLENOID S2 MALFUNCTIONING			BOTH SOLENOIDS MALFUNCTIONING
	Solenoid valve		Gear*1	Gear when shift selector is manually operated
	S1	S2		
D	ON	X	1st	O/D
	OFF	X	O/D	O/D
	OFF	X	O/D	O/D
	OFF	X	O/D	O/D
2	ON	X	1st	O/D
	OFF	X	O/D	O/D
	OFF	X	O/D	O/D
L	ON	X	1st	1st
	ON	X	1st	1st

DATA LIST / ACTIVE TEST

1. DATA LIST

HINT:
Using the intelligent tester Data List allows switch, sensor, actuator and other item values to be read without removing any parts. Reading the Data List early in troubleshooting is one way to shorten labor 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) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn ON the tester.
(f) Select the items "Enter / Powertrain / Engine and ECT / Data List".
(g) Follow the instructions on the tester and read the Data List.

Item	Measurement Item/ Range (display)	Normal Condition	Diagnostic Note
Stop Light SW	Stop Light Switch Status/ ON or OFF	• Brake pedal is depressed: ON • Brake pedal is released: OFF	-
PNP SW	PNP Switch Status/ ON or OFF	Shift lever position is; P and N: ON Except P and N: OFF	When the shift lever position displayed on the intelligent tester differs from the actual position, adjustment of the PNP switch or the shift cable may be incorrect. HINT: When the failure still occurs even after adjusting these parts, see page AX-51.
Reverse	PNP Switch Status/ ON or OFF	Shift lever position is; R: ON Except R: OFF	When the shift lever position displayed on the intelligent tester differs from the actual position, adjustment of the PNP switch or the shift cable may be incorrect. HINT: When the failure still occurs even after adjusting these parts, see page AX-51.
2nd	PNP Switch Status/ ON or OFF	Shift lever position is; 2: ON Except 2: OFF	When the shift lever position displayed on the intelligent tester differs from the actual position, adjustment of the PNP switch or the shift cable may be incorrect. HINT: When the failure still occurs even after adjusting these parts, see page AX-51.
Low	PNP Switch Status/ ON or OFF	Shift lever position is; L: ON Except L: OFF	When the shift lever position displayed on the intelligent tester differs from the actual position, adjustment of the PNP switch or the shift cable may be incorrect. HINT: When the failure still occurs even after adjusting these parts, see page AX-51.
Overdrive Cut SW 2	O/D Main Switch Status/ ON or OFF	• IG SW ON: ON ↓ • O/D SW Push: OFF ↓ • O/D SW Push: ON	-
Overdrive Cut SW 1	Curuise Control System O/D Cancel Signal/ ON or OFF	• O/D cancel signal input: ON • O/D cancel signal not input: OFF	-

Item	Measurement Item/ Range (display)	Normal Condition	Diagnostic Note
Shift	Actual Gear Positions/ 1st, 2nd, 3rd or 4th (O/D)	Shift lever position is; • L: 1st • 2: 1st or 2nd • D (O/D OFF): 1st, 2nd or 3rd • D (O/D ON): 1st, 2nd, 3rd or 4th (O/D)	-
Lock Up SOL	Shift Solenoid SL Status/ ON or OFF	• Lock Up: ON • Except Lock Up: OFF	-
Solenoid (SLN)	Solenoid SLN Status/ ON or OFF	• Shift solenoid SLN ON: ON • Shift solenoid SLN OFF: OFF	-
SPD (NC2)	Counter Gear Speed/ display: 50 r/min	HINT: 4th when the shift lever position is D (After warming up the engine); • Intermediate shaft speed (NC2) becomes close to the engine speed.	-

2. ACTIVE TEST

HINT:

Performing the Active Test allows a relay, Vacuum Switching Valve (VSV), actuator and other items to be operated without removing any parts. Performing the Active Test early in troubleshooting is one way to shorten labor time. The Data List can be displayed during the Active Test.

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn ON the tester.
(f) Select the items "Enter / Powertrain / Engine and ECT / Active Test".
(g) Follow the instructions on the tester and read the Active Test.

Item	Test Details	Diagnostic Note
Shift	[Test Details] Operate the shift solenoid valve and set each shift position by yourself. [Vehicle Condition] • IDL: ON • Less than 50 km/h [Others] • Press "→" button: Shift up • Press "←" button: Shift down	Possible to check the operation of the shift solenoid valves.
Lock Up Solenoid	[Test Details] Control the shift solenoid SL to set the automatic transaxle to the lock-up condition. [Vehicle Condition] Vehicle Speed: 60 km/h (36 mph) or more	Possible to check the SL operation.

DIAGNOSTIC TROUBLE CODE CHART

If a DTC is displayed during the DTC check, check the parts listed in the table below and proceed to the page given.

HINT:

- *1: MIL (Malfunction Indicator Lamp) comes on
- *2: "DTC stored" mark means ECM memorizes a trouble code if the ECM detects the DTC detection condition.

- These DTCs may be output when the clutch, brake and gear components etc. inside the automatic transmission are damaged.

AUTOMATIC TRANSMISSION SYSTEM:

DTC No.	Detection Item	Trouble Area	MIL *1	Memory *2	See Page
P0750	Shift Solenoid "A" Malfunction (Shift Solenoid Valve S1)	1. Shift solenoid valve S1 remains open or closed 2. Valve body is blocked 3. Automatic transaxle (clutch, brake or gear etc.)	Comes on	DTC stored	AX-30
P0753	Shift Solenoid "A" Electrical (Shift Solenoid Valve S1)	1. Open or short in shift solenoid valve S1 circuit 2. Shift solenoid valve S1 3. ECM	Comes on	DTC stored	AX-32
P0755	Shift Solenoid "B" Malfunction (Shift Solenoid Valve S2)	1. Shift solenoid valve S2 remains open or closed 2. Valve body is blocked 3. Automatic transaxle (clutch, brake or gear etc.)	Comes on	DTC stored	AX-35
P0758	Shift Solenoid "B" Electrical (Shift Solenoid Valve S2)	1. Open or short in shift solenoid valve S2 circuit 2. Shift solenoid valve S2 3. ECM	Comes on	DTC stored	AX-32
P0770	Shift Solenoid "E" Malfunction (Shift Solenoid Valve SL)	1. Shift solenoid valve SL remains open or closed 2. Valve body is blocked 3. Torque converter clutch 4. Automatic transaxle (clutch, brake or gear etc.) 5. Line pressure is too low	Comes on	DTC stored	AX-37
P0773	Shift Solenoid "E" Electrical (Shift Solenoid Valve SL)	1. Open or short in shift solenoid valve SL circuit 2. Shift solenoid valve SL 3. ECM	Comes on	DTC stored	AX-42
P1705	NC2 Revolution Sensor Circuit Malfunction	1. Open or short in direct clutch speed sensor (NC2) circuit 2. Speed sensor (NC2) 3. ECM	Comes on	DTC stored	AX-44
P1765	Linear Solenoid for Accumulator Pressure Control Circuit Malfunction	1. Open or short in shift solenoid valve (SLN) circuit 2. Shift solenoid valve (SLN) 3. ECM	Comes on	DTC stored	AX-47

DTC No.	Detection Item	Trouble Area	MIL *1	Memory *2	See Page
P1780	Park / Neutral Position Switch Malfunction	1. Open or short in park / neutral position switch circuit 2. Park / neutral position switch 3. ECM	Comes on	DTC stored	AX-51

DTC	P0750	Shift Solenoid "A" Malfunction (Shift Solenoid Valve S1)

SYSTEM DESCRIPTION

The ECM uses signals from the vehicle speed sensor to detect the actual gear position (1st, 2nd, 3rd or 4th (O/D) gear).
Then the ECM compares the actual gear position with the shift schedule in the ECM memory to detect mechanical problems of the shift solenoid valves, valve body or automatic transaxle (clutch, brake gear etc.).

DTC No.	DTC Detection Condition	Trouble Area
P0750	The gear required by the ECM does not match the actual gear position when driving (2-trip detection logic)	• Shift solenoid valve S1 remains open or closed • Valve body is blocked • Automatic transaxle (clutch, brake or gear etc.)

INSPECTION PROCEDURE

1	CHECK DTC OUTPUT (IN ADDITION TO DTC P0750)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) Turn ON the tester.
(d) Select the items "Powertrain / Engine and ECT / DTC / Current or Pending".
(e) Read the DTCs using the intelligent tester.

Result

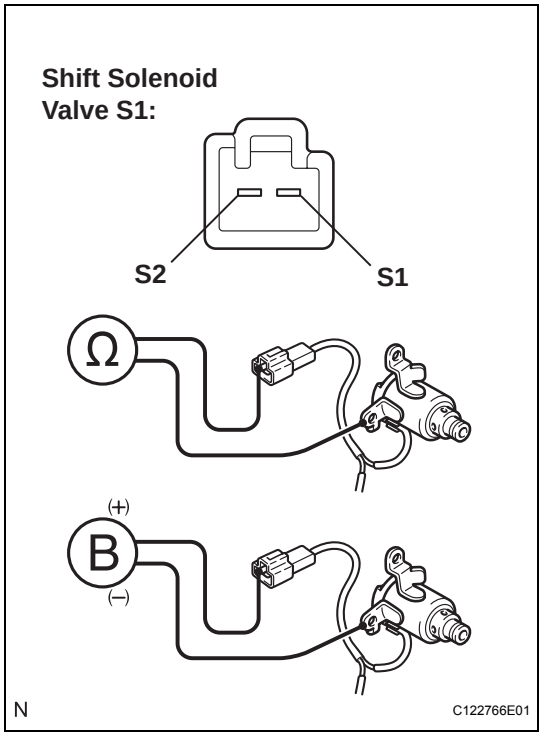
Display (DTC Output)	Proceed To
Only "P0750" is output	A
"P0750" and other DTCs are output	B

HINT:
If any other codes besides "P0750" are output, perform troubleshooting for those DTCs first.

B → GO TO DTC CHART (See page AX-27)

A

2	INSPECT TRANSMISSION SOLENOID ASSEMBLY



(a) Remove the shift solenoid valve S1.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
Solenoid Connector (S1) - Solenoid Body (S1)	11 to 15 Ω

(c) Connect the positive (+) lead to the terminal of the solenoid connector, and the negative (-) lead to the solenoid body.

OK:

The solenoid makes an operating sound.

NG → **REPLACE TRANSMISSION SOLENOID ASSEMBLY**

OK

3	INSPECT TRANSMISSION VALVE BODY ASSEMBLY

OK:

There are no foreign objects on each valve and they operate smoothly.

NG → **REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY**

OK

REPAIR OR REPLACE AUTOMATIC TRANSAXLE ASSEMBLY

DTC	P0753	Shift Solenoid "A" Electrical (Shift Solenoid Valve S1)

DTC	P0758	Shift Solenoid "B" Electrical (Shift Solenoid Valve S2)

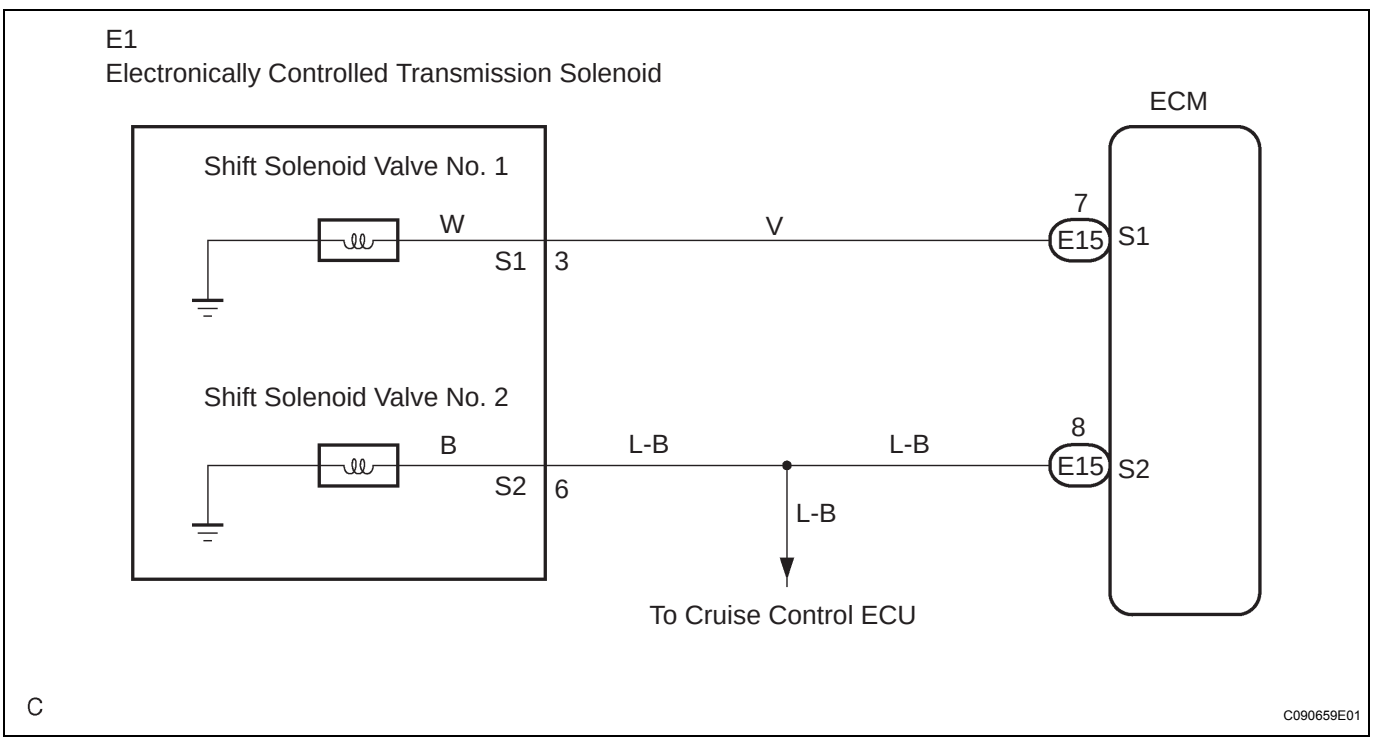
DESCRIPTION

Shifting from 1st to O/D is performed in combination with ON and OFF operation of the shift solenoid valves (S1 and S2) which is controlled by the ECM. If an open or short circuit occurs in either of the shift solenoid valves, the ECM controls the remaining normal shift solenoid valve to allow the vehicle to be operated smoothly (fail safe function).

DTC No.	DTC Detection Condition	Trouble Area
P0753 P0758	ECM checks for an open or short circuit in shift solenoid valves No. 1 and No. 2 circuit when it changes. After ECM detects condition (a) or (b) continuously 8 times or more in a trip and the MIL comes on. (a) When solenoid is energised, solenoid resistance is 8 Ω or less and it is counted. (b) When solenoid is not energised, solenoid resistance is 100 kΩ or more and it is counted.	• Open or short in shift solenoid valve S1/S2 circuit • Shift solenoid valve S1/S2 • ECM

HINT:
Check the shift solenoid valve S1 when DTC P0753 is output and check the shift solenoid valve S2 when DTC P0758 is output.

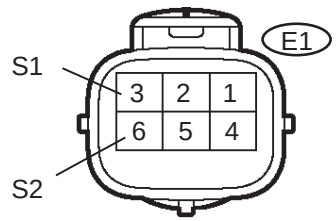
WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT TRANSMISSION WIRE

Connector Front View:



Transmission Wire Side

D025254E01

(a) Disconnect the transmission wire connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

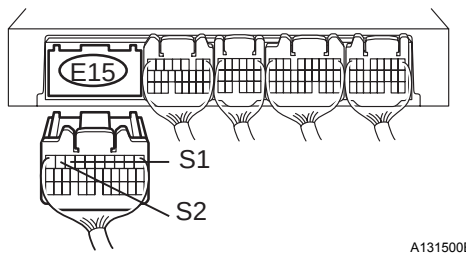
Tester Connection	Specified Condition 20°C (68°F)
3 - Body ground	11 to 15 Ω
6 - Body ground	11 to 15 Ω

NG → GO TO STEP 3

OK

2 CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)

ECM:



N

A131500E04

(a) Connect the transmission connector to the transaxle.
(b) Disconnect the connector from the ECM.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

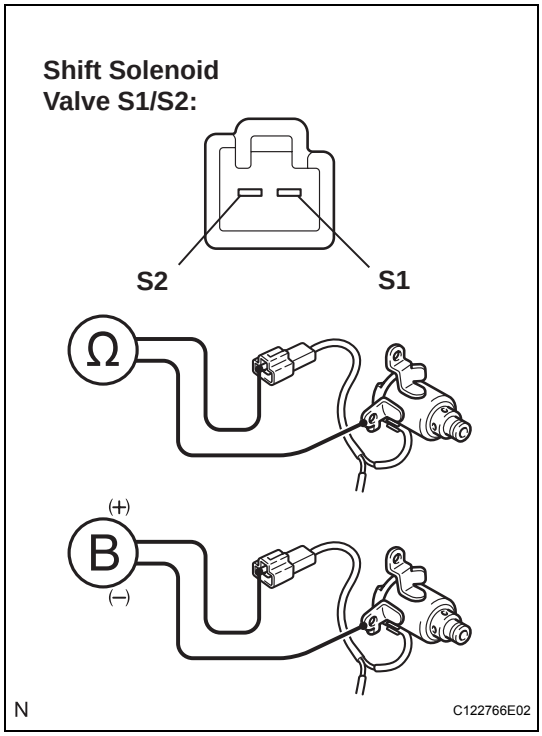
Tester Connection	Specified Condition 20°C (68°F)
E15-7 (S1) - Body ground	11 to 15 Ω
E15-8 (S2) - Body ground	11 to 15 Ω

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM

3	INSPECT TRANSMISSION SOLENOID ASSEMBLY (S1 AND S2)



(a) Remove the shift solenoid valves S1 and S2.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
Solenoid Connector (S1/S2) - Solenoid Body (S1/S2)	11 to 15 Ω

(c) Connect the positive (+) lead to the terminal of the solenoid connector, and the negative (-) lead to the solenoid body.

OK:

The solenoid makes an operating sound.

NG → **REPLACE TRANSMISSION SOLENOID ASSEMBLY**

OK

REPAIR OR REPLACE AUTOMATIC TRANSAXLE ASSEMBLY

DTC	P0755	Shift Solenoid "B" Malfunction (Shift Solenoid Valve S2)

SYSTEM DESCRIPTION

The ECM uses signals from the vehicle speed sensor to detect the actual gear position (1st, 2nd, 3rd or 4th (O/D) gear).
Then the ECM compares the actual gear position with the shift schedule in the ECM memory to detect mechanical problems of the shift solenoid valves, valve body or automatic transaxle (clutch, brake or gear etc.).

DTC No.	DTC Detection Condition	Trouble Area
P0755	The gear required by the ECM does not match the actual gear position when driving (2-trip detection logic)	• Shift solenoid valve S2 remains open or closed • Valve body is blocked • Automatic transaxle (clutch, brake or gear etc.)

INSPECTION PROCEDURE

1	CHECK DTC OUTPUT (IN ADDITION TO DTC P0755)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) Turn on the tester.
(d) Select the items "Powertrain / Engine and ECT / DTC / Current or Pending".
(e) Read the DTCs using the intelligent tester.

Result

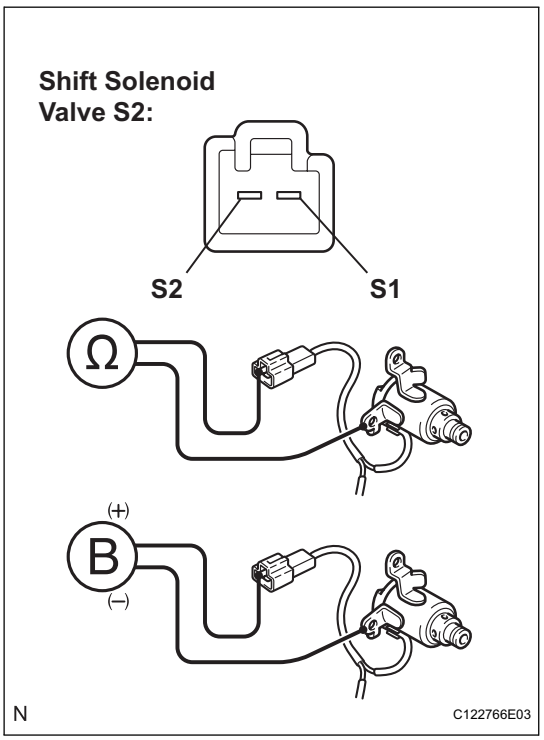
Display (DTC output)	Proceed To
Only "P0755" is output	A
"P0755" and other DTCs are output	B

HINT:
If any other codes besides "P0755" are output, perform troubleshooting for those DTCs first.

B → GO TO DTC CHART (See page AX-27)

A

2	INSPECT TRANSMISSION SOLENOID ASSEMBLY



(a) Remove the shift solenoid valve.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
Solenoid Connector (S2) - Solenoid Body (S2)	11 to 15 Ω

(c) Connect the positive (+) lead to the terminal of the solenoid connector, and the negative (-) lead to the solenoid body.

OK:

The solenoid makes an operating sound.

NG → **REPLACE TRANSMISSION SOLENOID ASSEMBLY**

OK

3	INSPECT TRANSMISSION VALVE BODY ASSEMBLY

OK:

There are no foreign objects on each valve and they operate smoothly.

NG → **REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY**

OK

REPAIR OR REPLACE AUTOMATIC TRANSAXLE ASSEMBLY

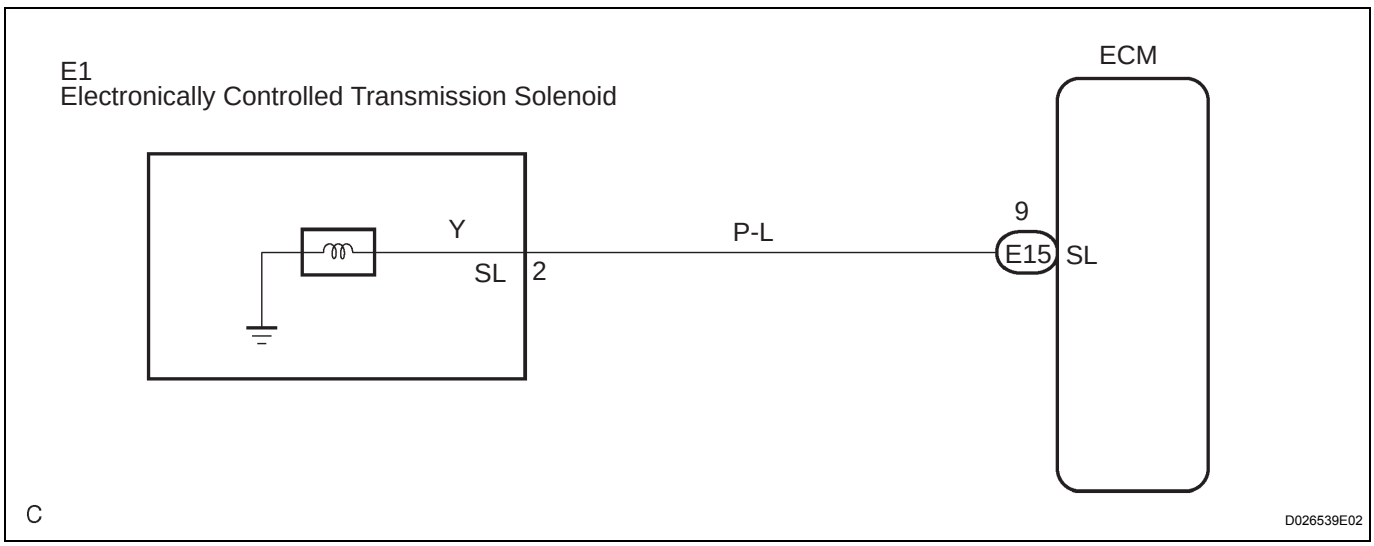
DTC	P0770	Shift Solenoid "E" Malfunction (Shift Solenoid Valve SL)

SYSTEM DESCRIPTION

The ECM uses the signals from the throttle position sensor, air-flow meter, direct clutch speed sensor and crankshaft position sensor to monitor the engagement condition of the lock-up clutch.
Then the ECM compares the engagement condition of the lock-up clutch with the lock-up schedule in the ECM memory to detect mechanical problems of the shift solenoid valve SL, valve body and torque converter clutch.

DTC No.	DTC Detection Condition	Trouble Area
P0770	• Lock-up does not occur when driving in lock-up range • Lock-up remains ON in lock-up OFF range (2-trip detection logic)	• Shift solenoid valve SL remains open or closed • Valve body is blocked • Torque converter clutch • Automatic transaxle (clutch, brake or gear etc.) • Line pressure is too low

WIRING DIAGRAM



INSPECTION PROCEDURE

1. ACTIVE TEST

HINT:
Performing the Active Test allows a relay, Vacuum Switching Valve (VSV), actuator and other items to be operated without removing any parts. Performing the Active Test early in troubleshooting is one way to shorten labor time.
The Data List can be displayed during the Active Test.

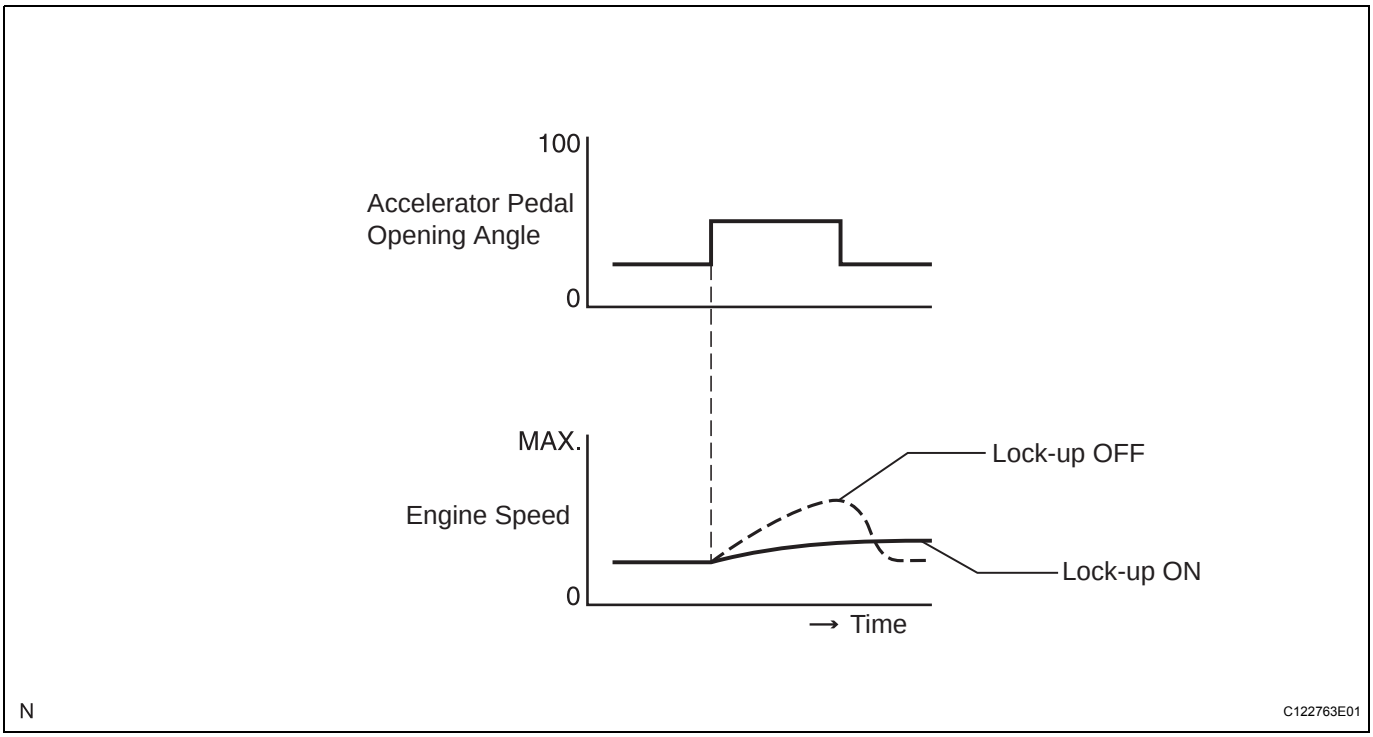
(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn ON the tester.
(f) Select the items "Enter / Powertrain / Engine and ECT / Active Test".

(g) Follow the instructions on the tester and read the Active Test.

Item	Test Details	Diagnostic Note
Control the Lock Up	[Test Details] Control the shift solenoid SL to set the automatic transaxle to the lock-up condition. [Vehicle Condition] Vehicle Speed: 58 km/h or more	Possible to check the SL operation.

HINT:
- This test can be conducted when the vehicle speed is 58 km/h or more.
- This test can be conducted in the 3rd or O/D gear.

(h) Lightly depress the accelerator pedal and check that the engine speed does not change abruptly.



HINT:
- When changing the accelerator pedal opening angle while driving, if the engine speed does not change, lock-up is on.
- Slowly release, but not fully, the accelerator pedal in order to decelerate. (Fully releasing the pedal will close the throttle valve and lock-up may be turned off.)

1	CHECK DTC OUTPUT (IN ADDITION TO DTC P0770)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) Turn ON the tester.
(d) Select the items "Powertrain / Engine and ECT / DTC / Current or Pending".
(e) Read the DTCs using the intelligent tester.

Result

Display (DTC output)	Proceed To
Only "P0770" is output	A
"P0770" and other DTCs are output	B

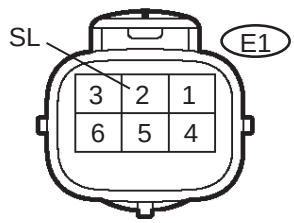
HINT:
If any other codes besides "P0770" are output, perform troubleshooting for those DTCs first.

B → GO TO DTC CHART (See page AX-27)

A

2 INSPECT TRANSMISSION WIRE (SL)

Connector Front View:



Transmission Wire Side

D025254E02

(a) Disconnect the transmission wire connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

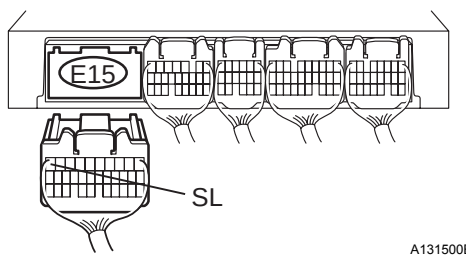
Tester Connection	Specified Condition 20°C (68°F)
2 - Body ground	11 to 15 Ω

NG → GO TO STEP 4

OK

3 CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)

ECM:



N

A131500E05

(a) Connect the transmission wire connector.
(b) Disconnect the ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

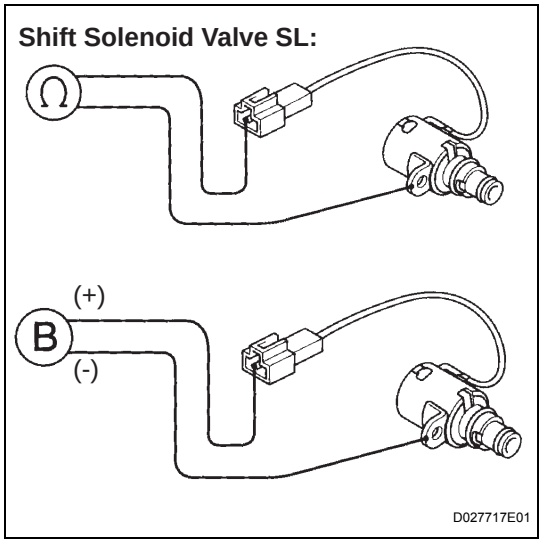
Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
E15-9 (SL) - Body ground	11 to 15 Ω

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

4	INSPECT SHIFT SOLENOID VALVE SL



(a) Remove the shift solenoid valves SL.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
Solenoid Connector (SL) - Solenoid Body (SL)	11 to 15 Ω

(c) Connect the positive (+) lead to the terminal of the solenoid connector, and the negative (-) lead to the solenoid body.

OK:

The solenoid valve makes an operating sound.

NG → **REPLACE SHIFT SOLENOID VALVE SL**

OK ↓

5	CHECK TRANSMISSION WIRE

OK:

The connectors and pins are securely installed.
There is no open or short on the wire harness.

NG → **REPAIR OR REPLACE AUTOMATIC TRANSAXLE ASSEMBLY**

OK ↓

6	INSPECT TRANSMISSION VALVE BODY ASSEMBLY

OK:

There are no foreign objects on each valve and they operate smoothly.

NG → **REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY**

OK ↓

7	INSPECT TORQUE CONVERTER CLUTCH ASSEMBLY

OK:

The torque converter clutch operates normally.

NG → **REPLACE TORQUE CONVERTER CLUTCH ASSEMBLY**

OK

REPAIR AUTOMATIC TRANSAXLE ASSEMBLY

DTC	P0773	Shift Solenoid "E" Electrical (Shift Solenoid Valve SL)

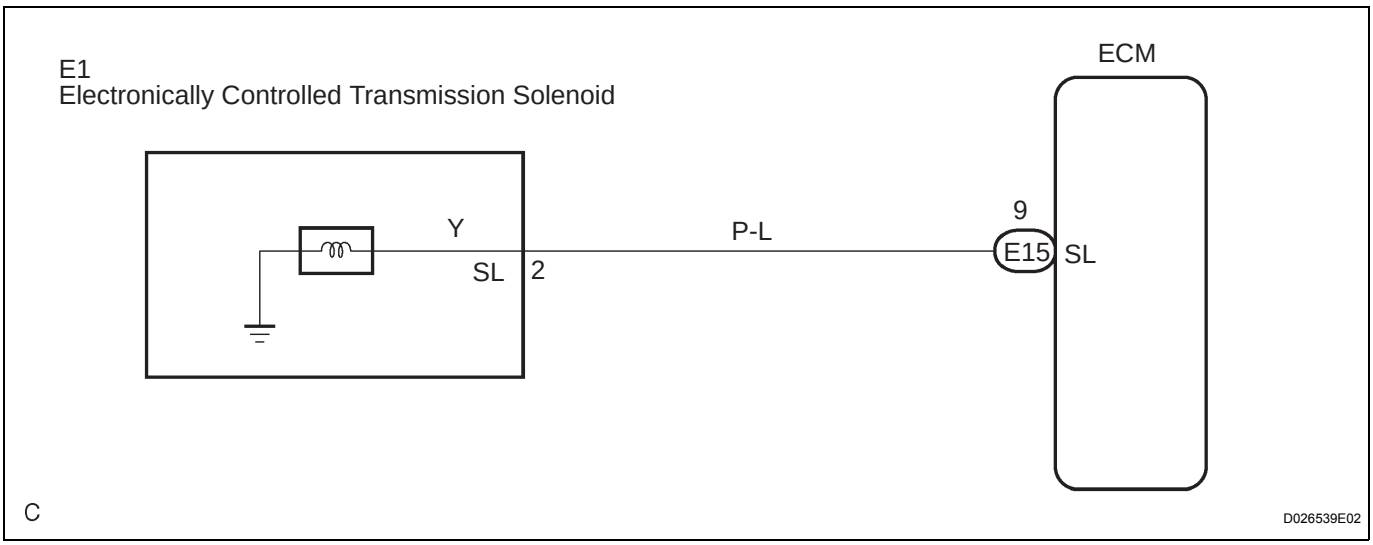
DESCRIPTION

The shift solenoid valve SL is turned ON and OFF by signals from the ECM in order to control the hydraulic pressure and operation of the lock-up relay valve, which then controls operation of the lock-up clutch.

DTC No.	DTC Detection Condition	Trouble Area
P0773	Either (a) or (b) is detected at 1 time: (2-trip detection logic) (a) Solenoid resistance is 8 Ω or less (short circuit) when solenoid is energised (b) Solenoid resistance is 100 kΩ or more (open circuit) when solenoid is not energised	• Open or short in shift solenoid valve SL circuit • Shift solenoid valve SL • ECM

Fail safe function:
If the ECM detects a malfunction, it turns the shift solenoid valve SL OFF.

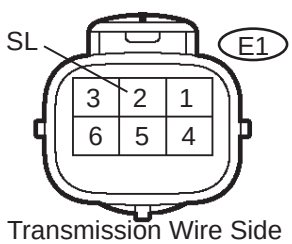
WIRING DIAGRAM



INSPECTION PROCEDURE

1	INSPECT TRANSMISSION WIRE (SL)

Connector Front View:



(a) Disconnect the transmission wire connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.

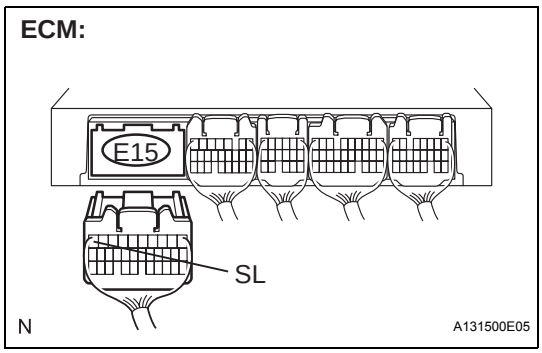
Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
2 - Body ground	11 to 15 Ω

NG	GO TO STEP 3

OK

2	CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)



(a) Connect the transmission connector to the transaxle.
(b) Disconnect the connector from the ECM.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

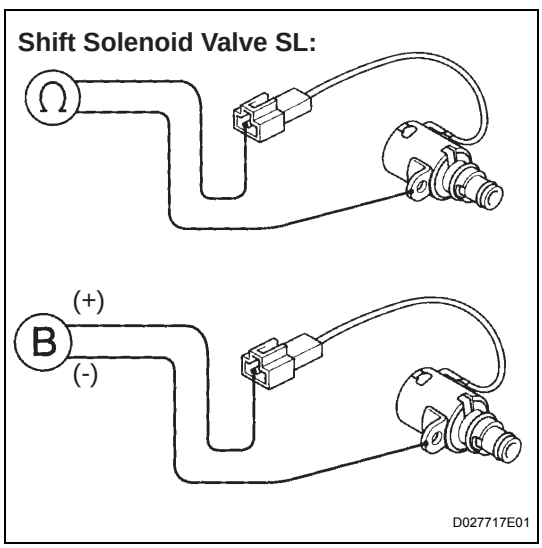
Tester Connection	Specified Condition 20°C (68°F)
E15-9 (SL) - Body ground	11 to 15 Ω

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

OK

REPLACE ECM

3	INSPECT SHIFT SOLENOID VALVE SL



(a) Remove the shift solenoid valve SL.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
Solenoid Connector (SL) - Solenoid Body (SL)	11 to 15 Ω

(c) Connect the positive (+) lead to the terminal of the solenoid connector, and the negative (-) lead to the solenoid body.

OK:

The solenoid makes an operating sound.

NG → **REPLACE SHIFT SOLENOID VALVE SL**

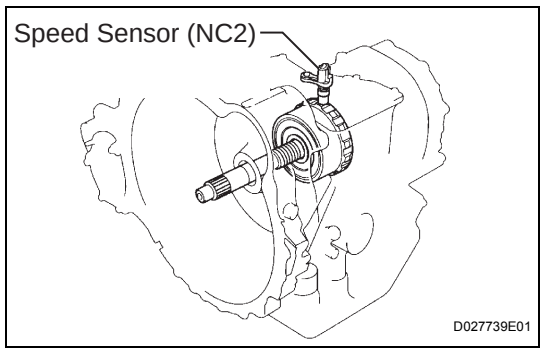
OK

REPAIR OR REPLACE TRANSMISSION WIRE

DTC	P1705	NC2 Revolution Sensor Circuit Malfunction

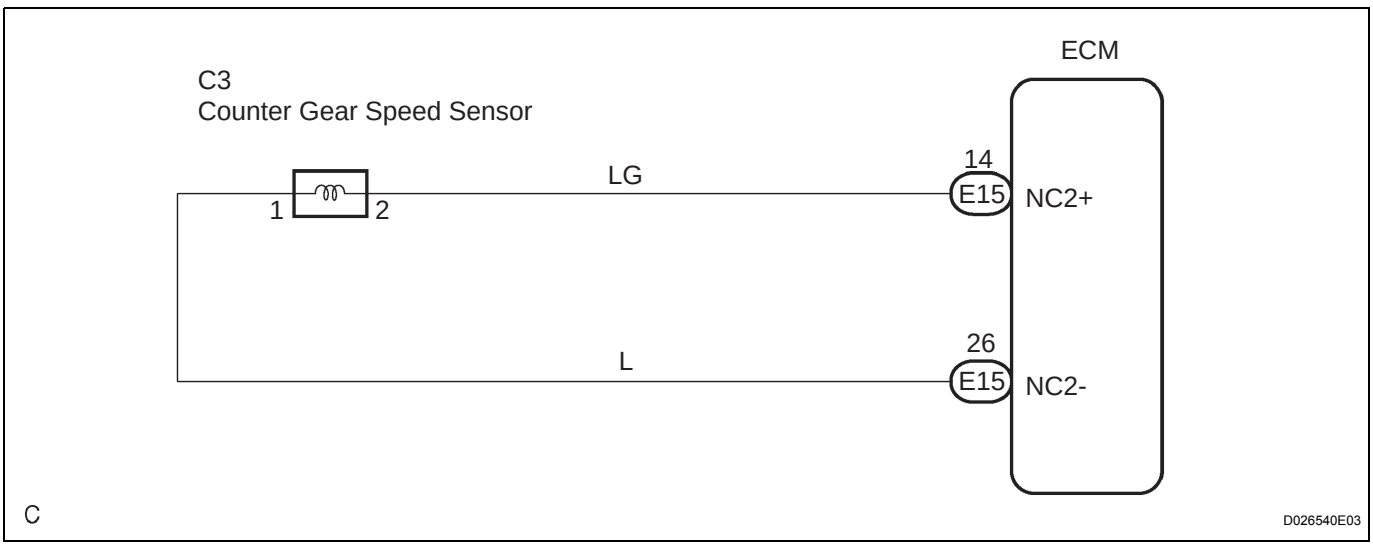
DESCRIPTION

This sensor detects the rotation speed of the direct clutch drum.
By comparing the direct clutch speed signal and the vehicle speed sensor signal, the ECM detects the shift timing of the gears and appropriately controls the engine torque and hydraulic pressure in response to various conditions, thus performing smooth gear shifting.



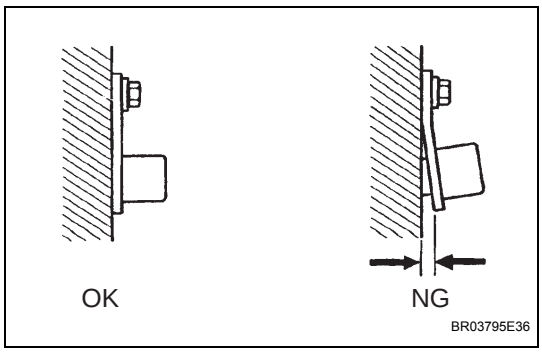
DTC No.	DTC Detection Condition	Trouble Area
P1705	The ECM detects conditions (a), (b), (c), (d), (e) and (f) continuity for 4 sec. or more (2-trip detection logic). (a) Vehicle speed: 32 km/h or more (b) 3rd or 4th gear (c) NC2 < 300 rpm (d) Park / neutral position switch: OFF (e) Solenoid valves and vehicle speed sensor are normal (f) L position: OFF	• Open or short in direct clutch speed sensor circuit • Speed sensor (NC2) • ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT SPEED SENSOR INSTALLATION



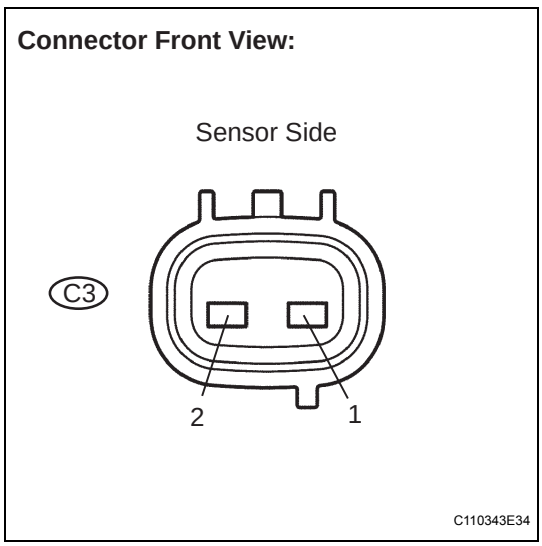
(a) Check the speed sensor installation.
OK:
The installation bolt is tightened properly and there is no clearance between the sensor and transaxle case.

NG → **REPLACE SPEED SENSOR (NC2)**

OK

2 INSPECT SPEED SENSOR (NC2)

Connector Front View:



(a) Disconnect the speed sensor connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.
Standard resistance:
TOYOTA made

Tester Connection	Specified Condition 20°C (68°F)
1 - 2	500 to 620 Ω

AISIN made

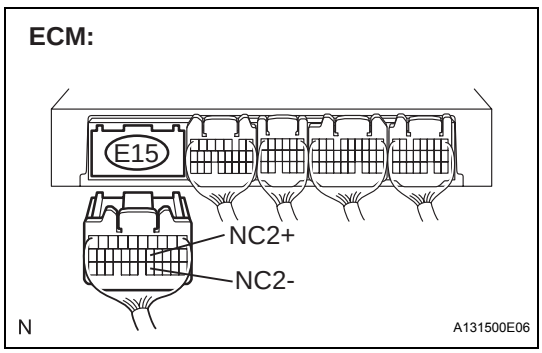
Tester Connection	Specified Condition 20°C (68°F)
1 - 2	560 to 680 Ω

NG → **REPLACE SPEED SENSOR (NC2)**

OK

3 CHECK HARNESS AND CONNECTOR

ECM:



(a) Connect the speed sensor connector.
(b) Disconnect the ECM connector.
(c) Measure the resistance according to the value(s) in the table below.
Standard resistance:
TOYOTA made

Tester Connection	Specified Condition 20°C (68°F)
E15-14 (NC2+) - E15-26 (NC2-)	500 to 620 Ω

AISIN made

Tester Connection	Specified Condition 20°C (68°F)
E15-14 (NC2+) - E15-26 (NC2-)	560 to 680 Ω

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

Standard resistance (Check for short)

Tester Connection	Specified Condition 20°C (68°F)
E15-14 (NC2+) - Body ground	10 kΩ or higher
E15-26 (NC2-) - Body ground	

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

OK

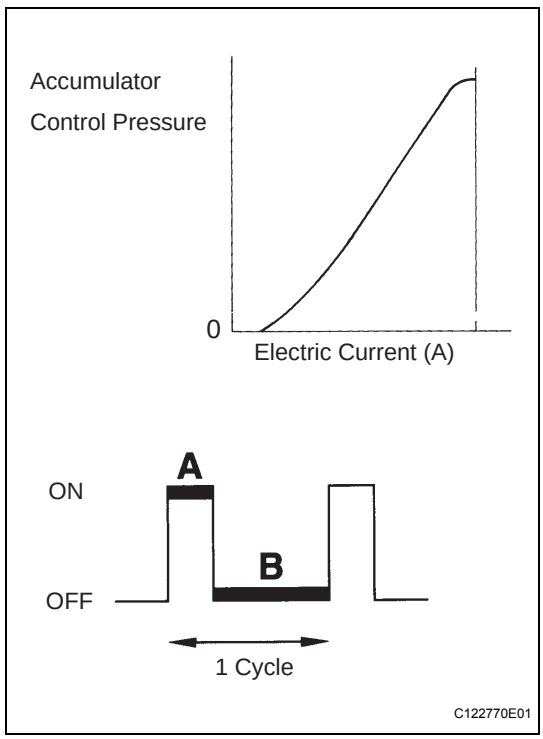
REPLACE ECM

DTC	P1765	Linear Solenoid for Accumulator Pressure Control Circuit Malfunction

DESCRIPTION

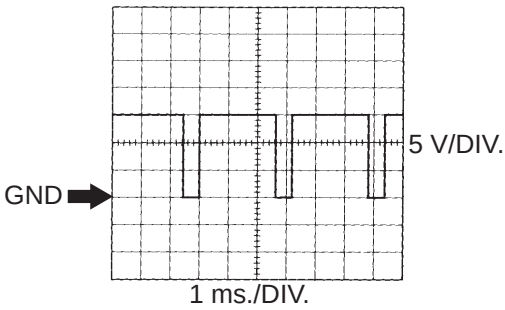
The shift solenoid valve SLN controls the hydraulic pressure acting on the accumulator control valve when gears are shifted and performs smooth gear shifting.
The ECM determines optimum operating pressure according to the signals from the throttle position sensor, vehicle speed sensor and direct clutch speed sensor and controls the volume of current flow to the solenoid valve.
The amount of current to the solenoid is controlled by the (*) duty ratio of ECM output signals, causing a momentary change to the hydraulic pressure acting on the clutches during gear shifting.
When the duty ratio is high, the hydraulic pressure acting on the clutches is low.
(*): Duty Ratio
The duty ratio is the ratio of the period of continuity in one cycle.
For example, if A is the period of continuity in one cycle, and B is the period of non-continuity, then Duty Ratio = A/(A + B) x 100 (%).

DTC No.	DTC Detection Condition	Trouble Area
P1765	After the engine is warmed up, the current flow to the shift solenoid valve SLN for 1 sec. or more under condition (a) or (b): (a) Engine speed: 500 rpm or more (b) Park / neutral position switch: ON (P or N position)	• Open or short in shift solenoid valve (SLN) circuit • Shift solenoid valve (SLN) • ECM

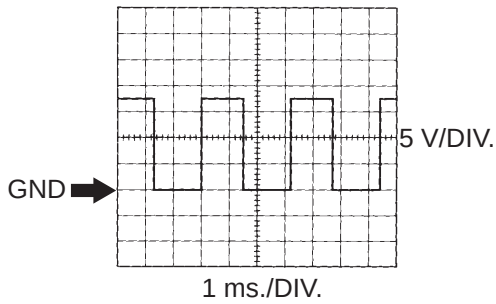


Reference

Waveform between terminals SLN+ and SLN- when the engine is idling.



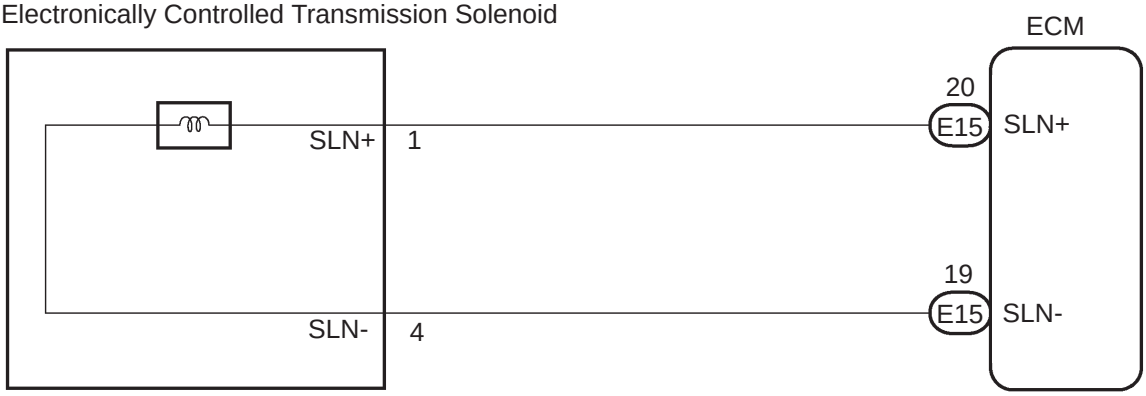
Waveform between terminals SLN+ and SLN- during shift change.



D027741E02

WIRING DIAGRAM

E1 Electronically Controlled Transmission Solenoid



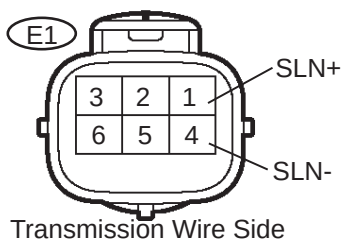
C

A121318E01

INSPECTION PROCEDURE

1	INSPECT TRANSMISSION WIRE (SLN)

Connector Front View:



Transmission Wire Side

D025254E03

(a) Disconnect the transmission wire connector from the transaxle.

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

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
1 (SLN+) - 4 (SLN-)	5.0 to 5.6 Ω

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

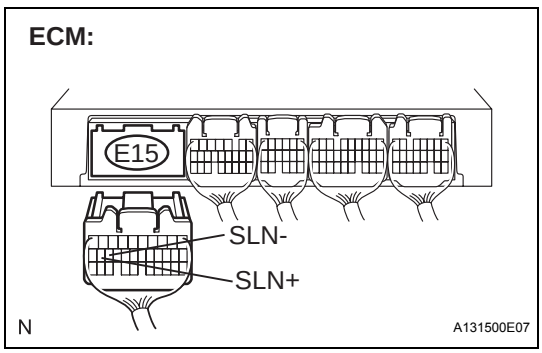
Standard resistance (Check for short)

Tester Connection	Specified Condition 20°C (68°F)
1 (SLN+) - Body ground	10 kΩ or higher
4 (SLN-) - Body ground	

NG → GO TO STEP 3

OK

2 CHECK HARNESS AND CONNECTOR



(a) Connect the transmission wire connector to the transaxle.
(b) Disconnect the ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
E15-20 (SLN+) - E15-19 (SLN-)	5.0 to 5.6 Ω

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

Standard resistance (Check for short)

Tester Connection	Specified Condition 20°C (68°F)
E15-20 (SLN+) - Body ground	10 kΩ or higher
E15-19 (SLN-) - Body ground	

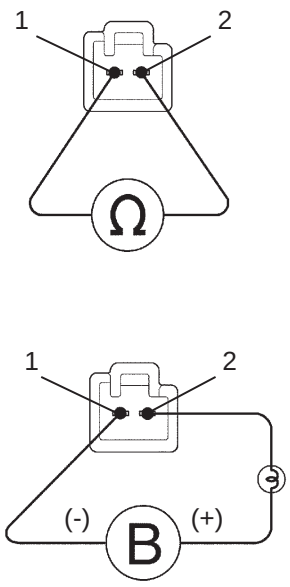
NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM

3	INSPECT SHIFT CONTROL SOLENOID VALVE SLN

Shift Solenoid Valve SLN:



D025466E29

(a) Remove the shift solenoid valve (SLN).
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
1 - 2	5.0 to 5.6 Ω

(c) Connect the positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector, then check the movement of the valve.

OK:

The solenoid makes an operating sound.

NG → **REPLACE SHIFT CONTROL SOLENOID VALVE SLN**

OK

REPAIR OR REPLACE TRANSMISSION WIRE

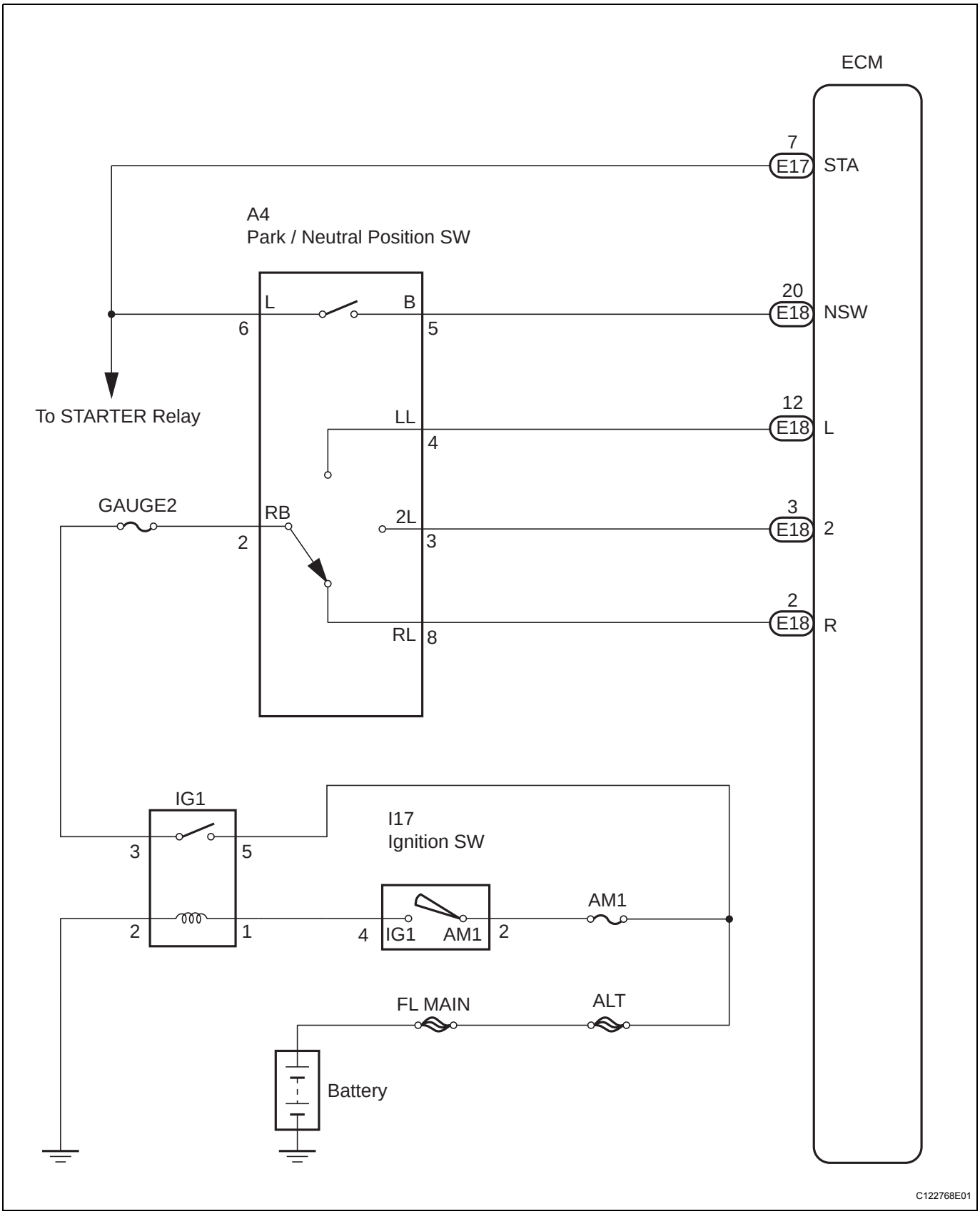
DTC	P1780	Park / Neutral Position Switch Malfunction

DESCRIPTION

The park / neutral position switch detects the shift lever position and sends signals to the ECM.
The ECM receives signals (REVERSE, 2ND and LOW) from the park / neutral position switch.

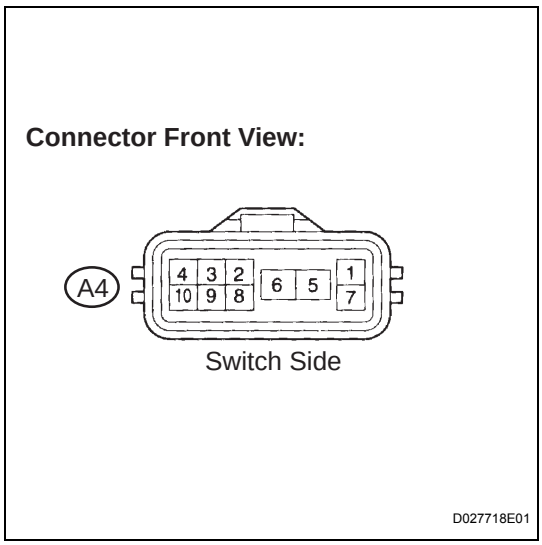
DTC No.	DTC Detection Condition	Trouble Area
P1780	Any 2 or more signals of the following are ON simultaneously (2-trip detection logic): • NSW input signal is • R input signal • 2 input signal • L input signal	• Open or short in park / neutral position switch circuit • Park / neutral position switch • ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT NEUTRAL START SWITCH ASSEMBLY



(a) Disconnect the park / neutral position switch connector.
(b) Gate shift lever type:
Measure the resistance according to the value(s) in the table below when the shift lever is moved to each position.

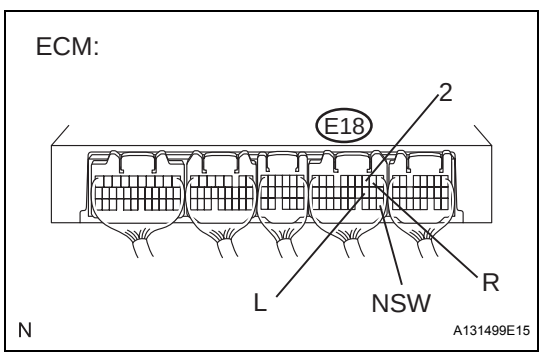
Standard resistance

Tester Connection	Shift Position	Specified Condition
2 - 7 and 5 - 6	P	Below 1 Ω
	Except P	10 kΩ or higher
2 - 8	R	Below 1 Ω
	Except R	10 kΩ or higher
2 - 9 and 5 - 6	N	Below 1 Ω
	Except N	10 kΩ or higher
2 - 10	D	Below 1 Ω
	Except D	10 kΩ or higher
2 - 3	2	Below 1 Ω
	Except 2	10 kΩ or higher
2 - 4	L	Below 1 Ω
	Except L	10 kΩ or higher

NG → REPLACE NEUTRAL START SWITCH ASSEMBLY

OK

2 CHECK HARNESS AND CONNECTOR (PARK/NEUTRAL POSITION SWITCH - ECM)



(a) Connect the park / neutral position switch connector.
(b) Turn the ignition switch to the ON position.
(c) Measure the voltage according to the value(s) in the table below when the shift lever is moved to each position.

Standard voltage

Tester Connection	Shift Position	Specified Condition
E18-20 (NSW) - Body ground	P and N	Below 2 V
	Except P and N	10 to 14 V
E18-2 (R) - Body ground	R	10 to 14 V*
	Except R	Below 1 V
E18-3 (2) - Body ground	2	10 to 14 V
	Except 2	Below 1 V
E18-12 (L) - Body ground	L	10 to 14 V
	Except L	Below 1 V

HINT:
*: The voltage will drop slightly due to lighting up of the back up light.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

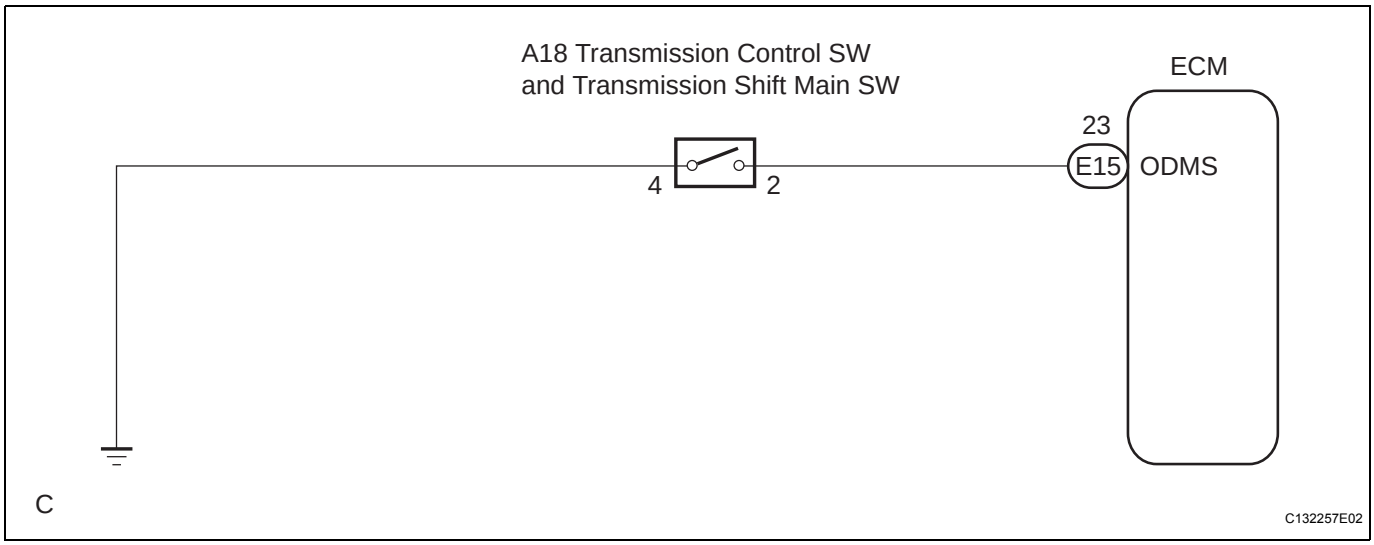
REPLACE ECM

O/D Main Switch Circuit

DESCRIPTION

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

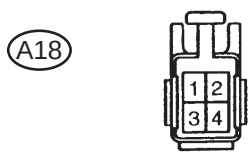
WIRING DIAGRAM



INSPECTION PROCEDURE

1	CHECK HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - BODY GROUND)

Wire Harness Side:
(Connector Front View):



(a) Disconnect the transmission control switch connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

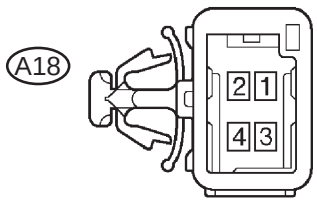
Tester Connection	Specified Condition
4 - Body ground	Below 1 Ω

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

OK

2 INSPECT TRANSMISSION CONTROL SWITCH

Switch Side (Connector Front View):



T C090638E01

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

Standard resistance

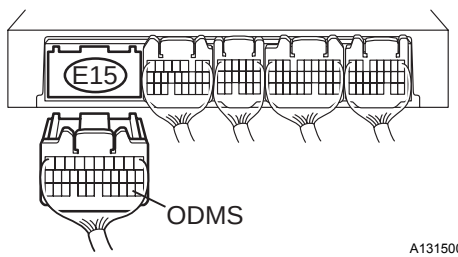
Tester Connection	Switch Condition	Specified Condition
2 - 4	Press transmission control switch	Below 1 Ω
	Release transmission control switch	10 kΩ or higher

NG → **REPLACE TRANSMISSION CONTROL SWITCH**

OK

3 CHECK HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - ECM)

ECM:



N A131500E08

(a) Connect the transmission control switch connector.
(b) Disconnect the ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Switch Condition	Specified Condition
E15-23 (ODMS) - Body ground	Press transmission control switch	Below 1 Ω
	Release transmission control switch	10 kΩ or higher

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

OK

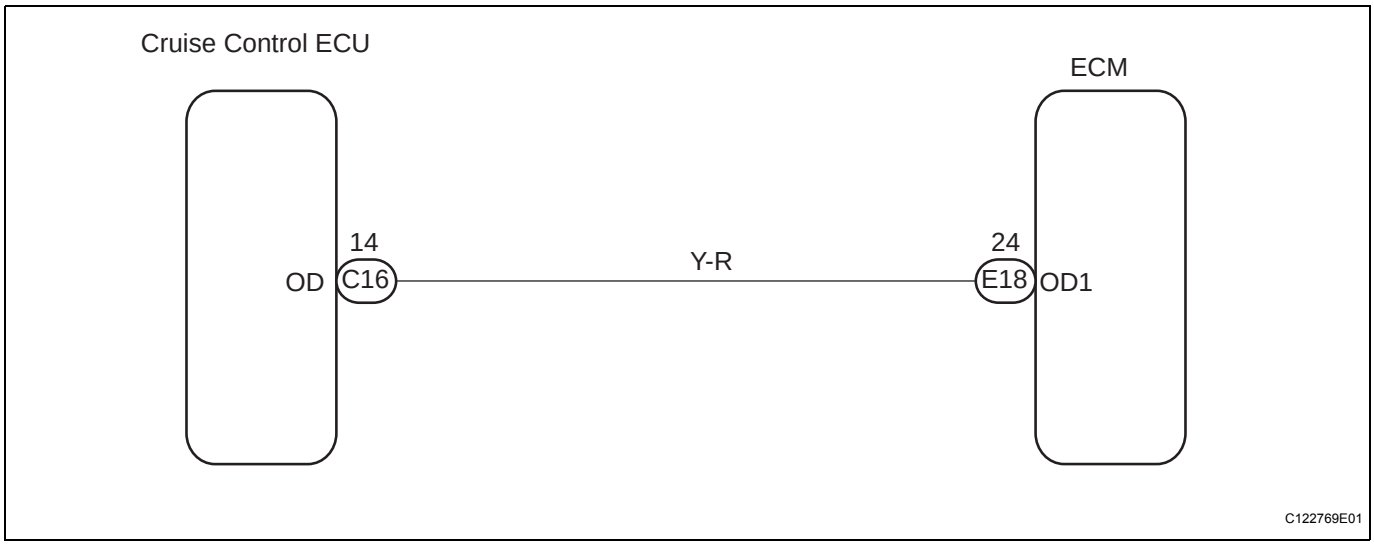
PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE
(See page AX-16)

O/D Cancel Signal Circuit

DESCRIPTION

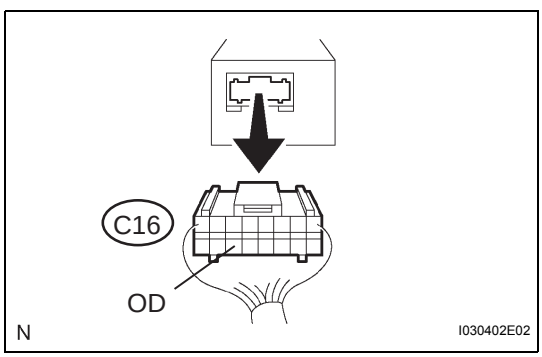
While driving uphill with cruise control activated, overdrive may be prohibited temporarily under some conditions in order to minimize gear shifting and provide smooth cruising.
The cruise control ECU sends O/D cut signals to the ECM as necessary and the ECM cancels overdrive shifting until these signals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

WIRING DIAGRAM



INSPECTION PROCEDURE

1	INSPECT TERMINAL VOLTAGE (OD - BODY GROUND)



(a) Disconnect the cruise control ECU connector.
(b) Turn the ignition switch to the ON position.
(c) Measure the voltage according to the value(s) in the table below.

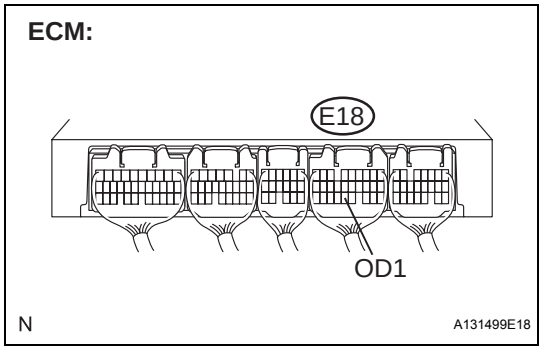
Standard voltage

Tester Connection	Specified Condition
C16-14 (OD) - Body ground	10 to 14 V

OK → REPLACE CRUISE CONTROL ECU

NG

2	INSPECT TERMINAL VOLTAGE (OD1 - BODY GROUND)



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

Standard voltage

Tester Connection	Specified Condition
E18-24 (OD1) - Body ground	10 to 14 V

OK → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

NG

REPLACE ECM

U241E AUTOMATIC TRANSAXLE

AUTOMATIC TRANSAXLE SYSTEM

PRECAUTION AX-1
DEFINITION OF TERMS AX-1
PARTS LOCATION AX-2
SYSTEM DIAGRAM AX-3
SYSTEM DESCRIPTION. AX-4
HOW TO PROCEED WITH TROUBLESHOOTING AX-4
ROAD TEST AX-7
MECHANICAL SYSTEM TESTS AX-10
HYDRAULIC TEST AX-11
MANUAL SHIFTING TEST AX-12
INITIALISATION. AX-13
MONITOR DRIVE PATTERN AX-15
PROBLEM SYMPTOMS TABLE AX-16
TERMINALS OF ECM AX-19
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CHECK MODE PROCEDURE. AX-25
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DATA LIST / ACTIVE TEST. AX-27
DIAGNOSTIC TROUBLE CODE CHART AX-29
DTC P0705 Transmission Range Sensor Circuit Malfunction (PRNDL Input) AX-32
DTC P0710 Transmission Fluid Temperature Sensor "A" Circuit AX-36
DTC P0712 Transmission Fluid Temperature Sensor "A" Circuit Low Input. AX-36
DTC P0713 Transmission Fluid Temperature Sensor "A" Circuit High Input AX-36
DTC P0711 Transmission Fluid Temperature Sensor "A" Performance . AX-40
DTC P0717 Turbine Speed Sensor Circuit No Signal AX-43
DTC P0724 Brake Switch "B" Circuit High AX-46
DTC P0741 Torque Converter Clutch Solenoid Performance (Shift Solenoid Valve DSL) AX-48
DTC P0746 Pressure Control Solenoid "A" Performance (Shift Solenoid Valve SL1) AX-52
DTC P0748 Pressure Control Solenoid "A" Electrical (Shift Solenoid Valve SL1) AX-55
DTC P0766 Shift Solenoid "D" Performance (Shift Solenoid Valve S4). . AX-58
DTC P0776 Pressure Control Solenoid "B" Performance (Shift Solenoid Valve SL2) AX-61
DTC P0778 Pressure Control Solenoid "B" Electrical (Shift Solenoid Valve SL2) AX-64
DTC P0793 Intermediate Shaft Speed Sensor "A" AX-67
DTC P0982 Shift Solenoid "D" Control Circuit Low (Shift Solenoid Valve S4) AX-71
DTC P0983 Shift Solenoid "D" Control Circuit Low (Shift Solenoid Valve S4) AX-71

DTC P2716 Pressure Control Solenoid "D" Electrical (Shift Solenoid Valve SLT) AX-74
DTC P2769 Torque Converter Clutch Solenoid Circuit Low (Shift Solenoid Valve DSL) AX-78
DTC P2770 Torque Converter Clutch Solenoid Circuit High (Shift Solenoid Valve DSL) AX-78
O/D Main Switch Circuit AX-81

AUTOMATIC TRANSAXLE SYSTEM

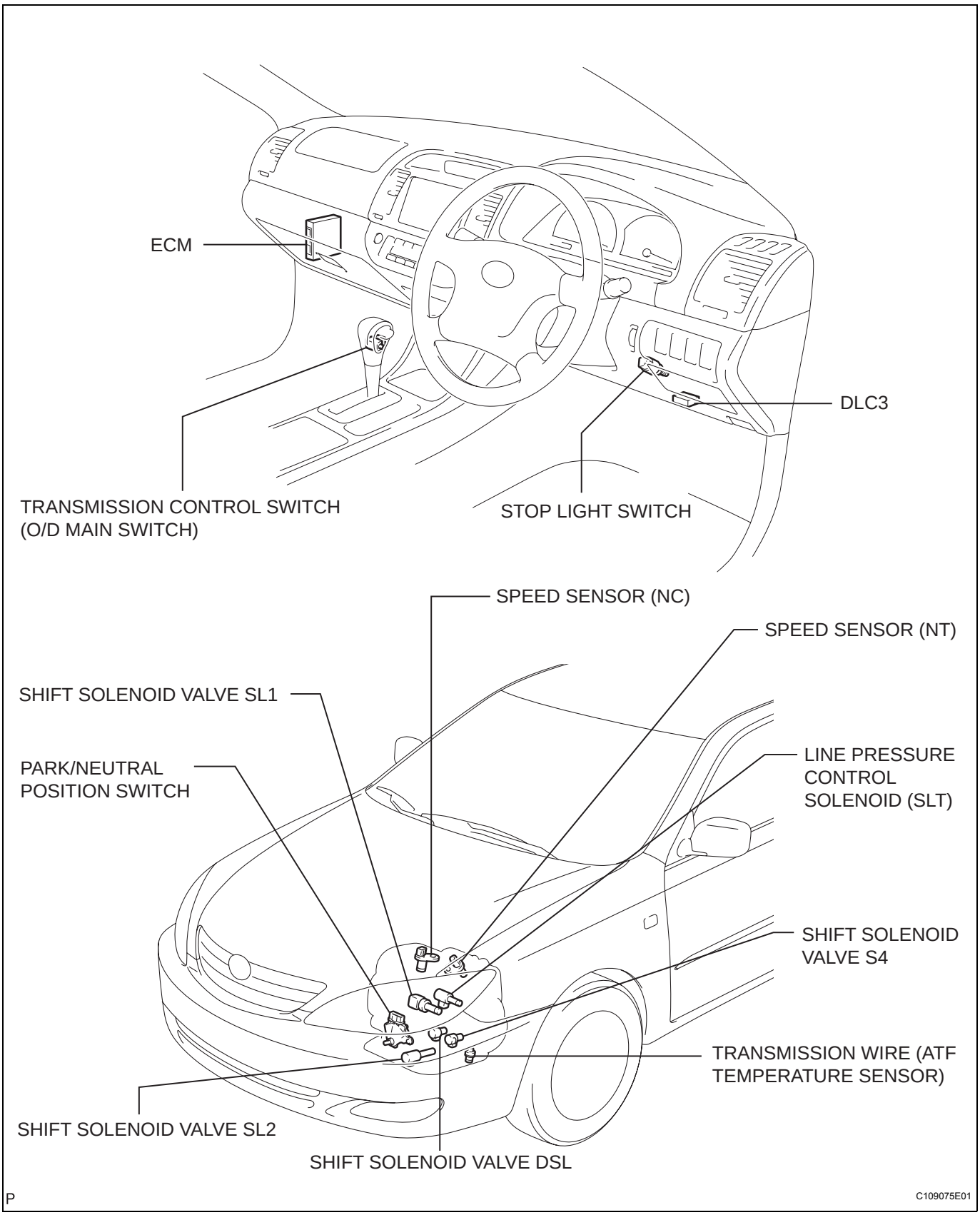
PRECAUTION

NOTICE:
Perform the RESET MEMORY (AT initialisation) when replacing the automatic transaxle assembly, engine assembly or ECM (See page AX-13).
HINT:
RESET MEMORY can not be completed by only disconnecting the battery cable.

DEFINITION OF TERMS

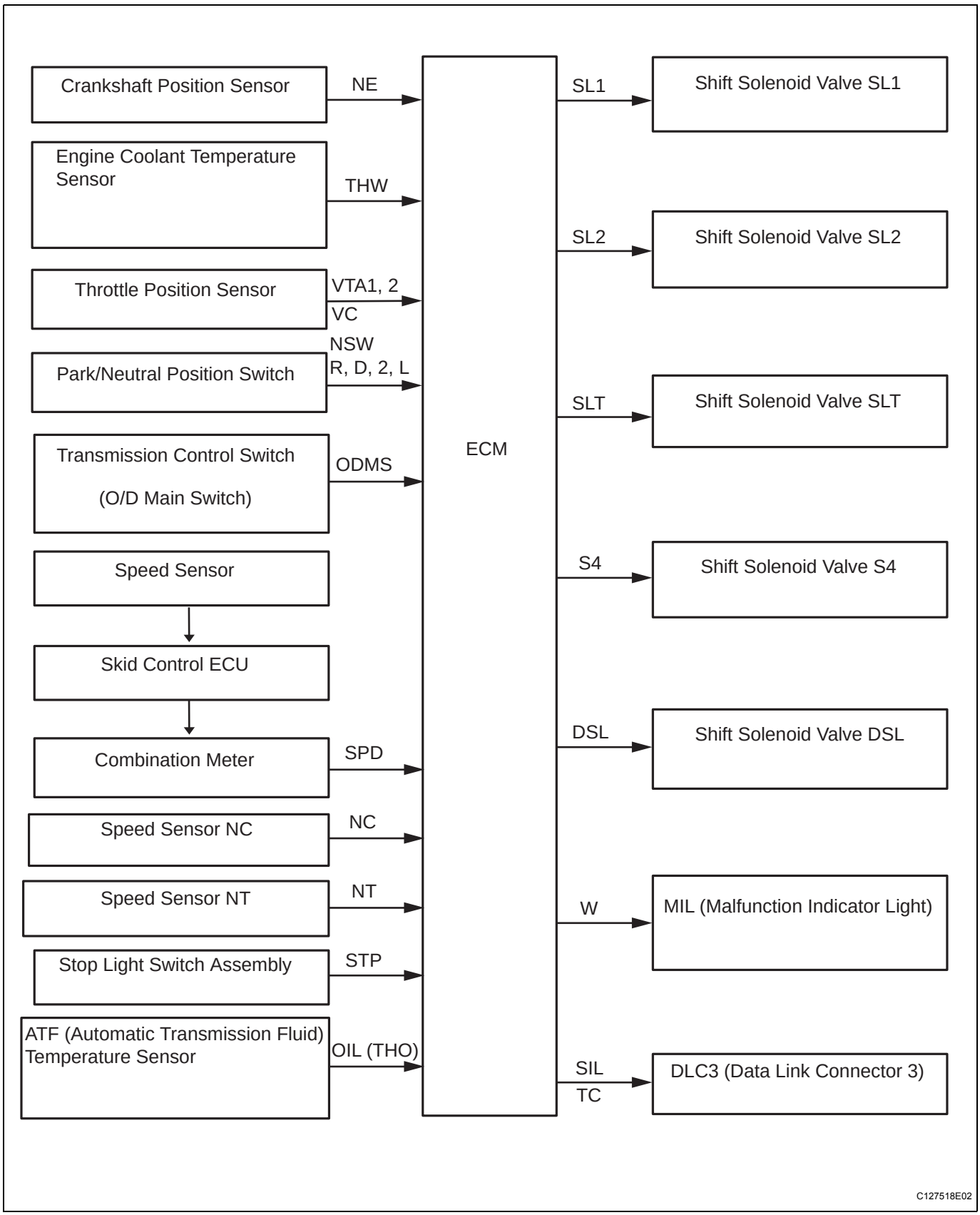
Term	Definition
Monitor description	Description of what the ECM monitors and how it detects malfunctions (monitoring purpose and its details).

PARTS LOCATION



SYSTEM DIAGRAM

The configuration of the electronic control system in the U241E automatic transaxles is as shown in the following chart.



SYSTEM DESCRIPTION

1. SYSTEM DESCRIPTION

(a) The ECT (Electronic controlled automatic transmission/transaxle) is an automatic transmission/transaxle that electronically controls shift timing using the ECM. The ECM detects electrical signals that indicate engine and driving conditions, and controls the shift point, based on driver habits and road conditions. As a result, fuel efficiency and power transmission performance are improved.

Shift shock has been reduced by controlling the engine and transmission simultaneously.

In addition, the ECT has features such as follows:

- Diagnostic function.
- Fail-safe function when a malfunction occurs.

HOW TO PROCEED WITH TROUBLESHOOTING

HINT:

- The ECM of this system is connected to the CAN and multiplex communication system. Therefore, before starting troubleshooting, make sure to check that there is no trouble in the CAN and multiplex communication systems.
- *: Use the intelligent tester.

1	VEHICLE BROUGHT TO WORKSHOP

NEXT

2	CUSTOMER PROBLEM ANALYSIS

NEXT

3	INSPECT BATTERY VOLTAGE

Standard voltage:
11 to 14 V

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

NEXT

4	CONNECT INTELLIGENT TESTER TO DLC3*

NEXT

5	CHECK AND CLEAR DTCS AND FREEZE FRAME DATA*

(a) Refer to the DTC CHECK/CLEAR (See page AX-23).

NEXT

6	VISUAL INSPECTION

NEXT

7	SETTING CHECK MODE DIAGNOSIS*

(a) Refer to the CHECK MODE PROCEDURE (See page AX-25).

NEXT

8	PROBLEM SYMPTOM CONFIRMATION

(a) Refer to the ROAD TEST (See page AX-7).
Result

Result	Proceed to
Symptom does not occur	A
Symptom occurs	B

B → GO TO STEP 10

A

9	SYMPTOM SIMULATION

(a) Refer to the ELECTRONIC CIRCUIT INSPECTION PROCEDURE (See page IN-28).

NEXT

10	DTC CHECK*

(a) Refer to the DTC CHECK / CLEAR (See page AX-23).
Result

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

B → GO TO STEP 18

A

11	BASIC INSPECTION

(a) Refer to the AUTOMATIC TRANSMISSION FLUID (See page 40-1).
(b) Refer to the PARK/NEUTRAL POSITION SWITCH (See page 40-7).
(c) Refer to the SHIFT LEVER ASSEMBLY (See page 40-55).

NG → GO TO STEP 21

OK

12	MECHANICAL SYSTEM TEST

(a) Refer to the MECHANICAL SYSTEM TEST (See page AX-10).

NG → GO TO STEP 17

OK

13	HYDRAULIC TEST

(a) Refer to the HYDRAULIC TEST (See page AX-11).

NG → GO TO STEP 17

OK

14	MANUAL SHIFTING TEST

(a) Refer to the MANUAL SHIFTING TEST (See page AX-12).

NG → GO TO STEP 16

OK

15	PROBLEM SYMPTOMS TABLE CHAPTER 1

(a) Refer to the PROBLEM SYMPTOMS TABLE (See page AX-16).

NG → GO TO STEP 19

OK

16	PROBLEM SYMPTOMS TABLE CHAPTER 2

(a) Refer to the PROBLEM SYMPTOMS TABLE (See page AX-16).

NEXT

17	PART INSPECTION

NEXT → GO TO STEP 21

18	DTC CHART

(a) Refer to the DIAGNOSTIC TROUBLE CODE CHART (See page AX-29).

NEXT

19	CIRCUIT INSPECTION

NEXT

20	IDENTIFICATION OF PROBLEM

NEXT

21	REPAIR OR REPLACE

NEXT

22	CONFIRMATION TEST

NEXT

END

ROAD TEST

1. **PROBLEM SYMPTOM CONFIRMATION**

(a) Based on the result of the customer problem analysis, try to reproduce the symptoms. If the problem is that the transaxle does not shift up, shift down, or the shift point is too high or too low, conduct the following road test referring to the automatic shift schedule and simulate the problem symptoms.

2. ROAD TEST

NOTICE:

Perform the test at the ATF (Automatic Transmission Fluid) temperature 50 to 80°C (122 to 176°F) in the normal operation.

(a) D position test:

Shift into the D position and fully depress the accelerator pedal and check the following points.

(1) Check up-shift operation.

Check that 1 → 2, 2 → 3 and 3 → O/D up-shifts take place, and that the shift points conform to the automatic shift schedule (See page **SS-7**).

HINT:

O/D Gear Up-shift Prohibition Control

- Engine coolant temperature is 55°C (131°F) or less and vehicle speed is at 70 km/h or less.
- ATF temperature is 10°C (50°F) or less.

O/D Gear Lock-up Prohibition Control

- Brake pedal is depressed.
- Accelerator pedal is released.
- Engine coolant temperature is 60°C (140°F) or less.

(2) Check for shift shock and slip.

Check for shock and slip at the 1 → 2, 2 → 3 and 3 → O/D up-shifts.

(3) Check for abnormal noise and vibration.

Check for abnormal noise and vibration when up-shifting from 1 → 2, 2 → 3 and 3 → O/D while driving with the shift lever in the D position, and check while driving in the lock-up condition.

HINT:

The check for the cause of abnormal noise and vibration must be done thoroughly as it could also be due to loss of balance in the differential, torque converter clutch, etc.

(4) Check kick-down operation.

Check vehicle speeds when the 2nd to 1st, 3rd to 2nd and O/D to 3rd kick-downs take place while driving with the shift lever in the D position. Confirm that each speed is within the applicable vehicle speed range indicated in the automatic shift schedule (See page **SS-7**).

(5) Check abnormal shock and slip at kick-down.

(6) Check the lock-up mechanism.

- Drive in D position (O/D gear), at a steady speed (lock-up ON).
- Lightly depress the accelerator pedal and check that the engine speed does not change abruptly.

HINT:

- There is no lock-up function in the 1st and 2nd gear.

- If there is a big jump in engine speed, there is no lock-up.

(b) 2 position test:
Shift into the 2 position and fully depress the accelerator pedal and check the following points.
(1) Check up-shift operation.
Check that the 1 → 2 up-shift takes place and that the shift point conforms to the automatic shift schedule (See page SS-7).
HINT:
There is no 3rd up-shift and lock-up in the 2 position.
(2) Check engine braking.
While running in the 2 position and 2nd gear, release the accelerator pedal and check the engine braking effect.
(3) Check for abnormal noise during acceleration and deceleration, and for shock at up-shift and down-shift.

(c) L position test:
Shift into the L position and fully depress the accelerator pedal and check the following points.
(1) Check no up-shift.
While running in the L position, check that there is no up-shift to 2nd gear.
HINT:
There is no lock-up in the L position.
(2) Check engine braking.
While running in the L position, release the accelerator pedal and check the engine braking effect.
(3) Check for abnormal noise during acceleration and deceleration.

(d) R position test:
Shift into the R position, lightly depress the accelerator pedal, and check that the vehicle moves backward without any abnormal noise or vibration.
CAUTION:
Before conducting this test ensure that the test area is free from people and obstruction.

(e) P position test:
Stop the vehicle on the slope (more than 5°) and after shifting into the P position, release the parking brake. Then, check that the parking lock pawl holds the vehicle in place.

MECHANICAL SYSTEM TESTS

1. PERFORM MECHANICAL SYSTEM TESTS

(a) Measure the stall speed.

The object of this test is to check the overall performance of the transaxle and engine by measuring the stall speeds in the D position.

NOTICE:

- **Driving test should be done on a paved road.**
- **Perform the test at the normal operating ATF (Automatic Transmission Fluid) temperature 50 to 80°C (122 to 176°F).**
- **Do not continuously run this test for longer than 10 seconds.**
- **To ensure safety, do this test in a wide, clear level area which provides good traction.**
- **The stall test should always be carried out in pairs. One technician should observe the wheels or wheel chocks outside the vehicle while the other is doing the test.**

(1) Chock the 4 wheels.

(2) Connect an intelligent tester to the DLC3.

(3) Fully apply the parking brake.

(4) Keep your left foot pressed firmly on the brake pedal.

(5) Start the engine.

(6) Shift into the D position. Press all the way down on the accelerator pedal with your right foot.

(7) Quickly read the stall speed at this time.

Stall speed:

2,550 +- 150 rpm

Evaluation:

Problem	Possible cause
(a) Stall engine speed is low in D position	• Engine power output may be insufficient • Stator one-way clutch not operating properly HINT: If the value is less than the specified value by 600 rpm or more, the torque converter could be faulty.
(b) Stall engine speed is high in D position	• Line pressure is too low • Forward clutch slipping • U/D (Underdrive) clutch slipping • U/D (Underdrive) one-way clutch is not operating properly • No. 2 one-way clutch not operating properly • Improper fluid level

(b) Measure the time lag.

(1) When the shift lever is shifted while the engine is idling, there will be a certain time lapse or lag before the shock can be felt. This is used for checking the condition of the clutch and brake.

NOTICE:

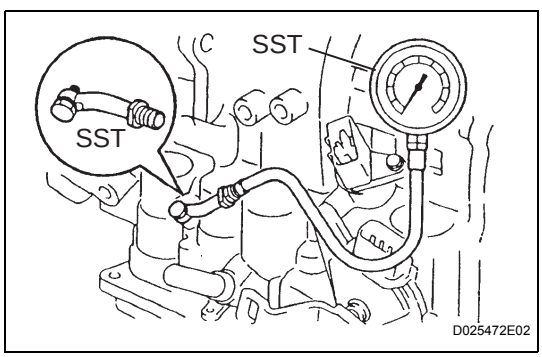
- **Perform the test at the normal operating ATF (Automatic Transmission Fluid) temperature: 50 to 80°C (122 to 176°F).**
- **Be sure to allow 1 minute interval between tests.**

- **Perform the test three times, and measure the time lags. Calculate the average value of the three time lags.**

(2) Connect an intelligent tester to the DLC3.
(3) Fully apply the parking brake.
(4) Start and warm up the engine and check idle speed.
Idle speed:
approx. 700 rpm (In N position and A/C OFF)
(5) Shift the lever from N to D position. Using a stop watch, measure the time from when the lever is shifted until the shock is felt.
Time lag:
N → D less than 1.2 seconds
(6) In the same way, measure the time lag for N → R.
Time lag:
N → R less than 1.5 seconds

Evaluation (If N → D or N → R time lag is longer than the specified):

Problem	Possible Cause
N → D time lag is longer	• Line pressure is too low • Forward clutch worn • No.1 one-way clutch is not operating properly • U/D (Underdrive) one-way clutch is not operating
N → R time lag is longer	• Line pressure is too low • Direct clutch worn • 1st and reverse brake worn • U/D (Underdrive) one-way clutch not operating properly



HYDRAULIC TEST

1. PERFORM HYDRAULIC TEST

(a) Measure the line pressure.
NOTICE:
- **Perform the test at the normal operating ATF (Automatic Transmission Fluid) temperature: 50 to 80°C (122 to 176°F).**
- **The line pressure test should always be carried out in pairs. One technician should observe the wheels or wheel chocks outside the vehicle while the other is performing the test.**
- **Be careful to prevent SST hose from interfering with the exhaust pipe.**
- **This Check must be conducted after checking and adjusting engine.**
- **Perform under condition that A/C is OFF.**
- **When conducting stall test, do not continue more than 10 seconds.**

(1) Warm up the ATF:
(2) Remove the test plug on the front side of the transaxle case and connect SST.
SST 09992-00095 (09992-00231, 09992-00271)

(3) Fully apply the parking brake and chock the 4 wheels.
(4) Connect an intelligent tester to the DLC3.
(5) Start the engine and check idling speed.
(6) Keep your left foot pressing firmly on the brake pedal and shift into D position.
(7) Measure the line pressure when the engine is idling.
(8) Depress the accelerator pedal all the way down. Quickly read the highest line pressure when engine speed reaches stall speed.
(9) In the same way, do the test in R position.

Specified line pressure:

Condition	D Position kPa (kgf cm^2, psi)	R Position kPa (kgf cm^2, psi)
Idling	372 to 412 kPa (3.8 to 4.2 kgf cm^2, 54 to 60 psi)	672 to 742 kPa (6.9 to 7.6 kgf cm^2, 97 to 108 psi)
Stall test	931 to 1,031 kPa (9.5 to 10.5 kgf cm^2, 135 to 150 psi)	1,768 to 1,968 kPa (18.0 to 20.0 kgf cm^2, 256 to 285 psi)

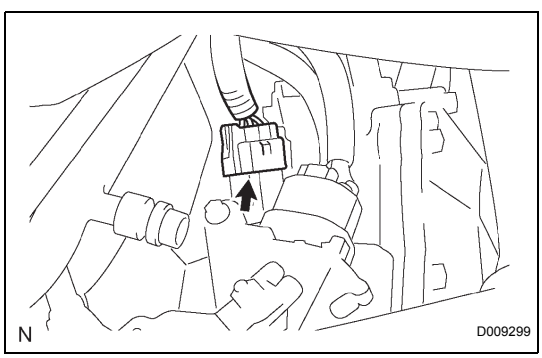
Evaluation:

Problem	Possible Cause
If the measured values at all positions are higher	• Line pressure control solenoid (SLT) defective • Regulator valve detective
If the measured values at all positions are lower	• Line pressure control solenoid (SLT) defective • Regulator valve detective • Oil pump defective • U/D (Underdrive) direct clutch defective
If pressure is low in the D position only	• D position circuit fluid leak • Forward clutch defective
If pressure is low in the R position only	• R position circuit fluid leak • Direct clutch defective • 1st and reverse brake defective

MANUAL SHIFTING TEST

1. PERFORM MANUAL SHIFTING TEST

HINT:
- With this test, it can be determined whether the trouble occurs in the electrical circuit or is a mechanical problem in the transaxle.
- If any abnormalities are found in the following test, the problem is in the transaxle itself.



(a) Disconnect the transmission wire connector.
(b) Inspect the manual driving operation.
Check that the shift and gear positions correspond to the table below.
Check that the gear change corresponds to the shift position.

Shift Position	Gear Position
D	3rd
2	3rd
L	3rd
R	Reverse
P	Pawl Lock

HINT:
If the gear positions of the L, 2 and D are difficult to distinguish, do the following road test (See page AX-7).
If any abnormality is found in the above test, the problem is in the transaxle itself.

(c) Connect the transmission wire connector.
(d) Clear the DTC (See page AX-23).

INITIALISATION

1. RESET MEMORY

NOTICE:

- **Perform the RESET MEMORY (AT initialisation) when replacing the automatic transaxle assembly, engine assembly or ECM.**
- **The RESET MEMORY can be performed only with the intelligent tester.**

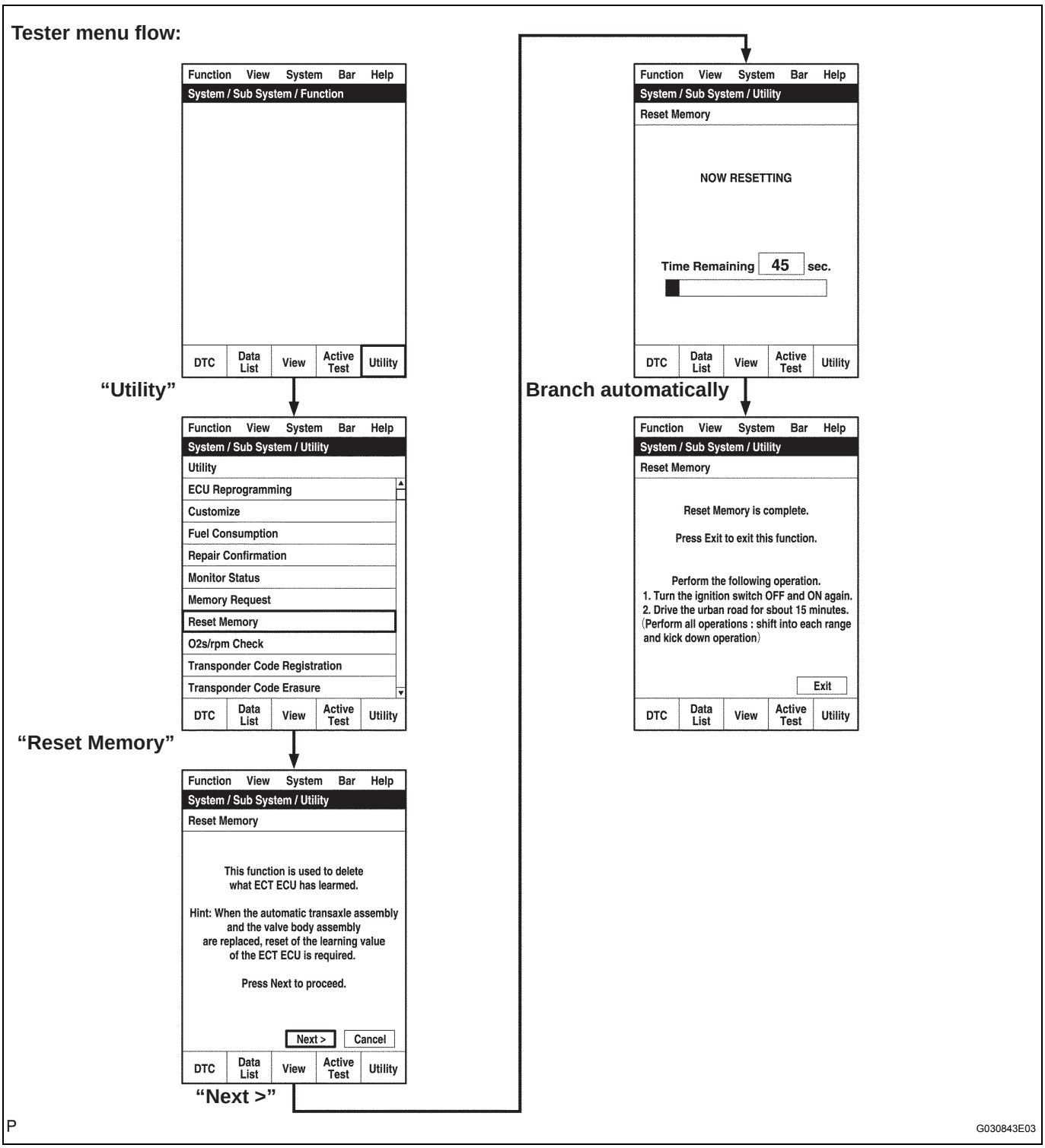
HINT:
The ECM memorises the condition that the ECT controls the automatic transaxle assembly and engine assembly according to those characteristics. Therefore, when the automatic transaxle assembly, engine assembly, or ECM has been replaced, it is necessary to reset the memory so that the ECM can memorize the new information.
Reset procedure is as follows:

(a) Turn the ignition switch OFF.
(b) Connect the intelligent tester to the DLC3.
(c) Turn the ignition switch to the ON position.
(d) Turn the intelligent tester main switch ON.
(e) Perform the reset memory procedure from the main menu.

CAUTION:
After performing the RESET MEMORY, be sure to perform the ROAD TEST (See page AX-7) described earlier.

HINT:
The ECM is learned by performing the ROAD TEST.

(1) Tester menu flow:



MONITOR DRIVE PATTERN

1. MONITOR DRIVE PATTERN FOR ECT TEST

(a) Perform this drive pattern as one method to simulate the detection conditions of the ECT malfunctions. (The DTCs may not be detected due the actual driving conditions. And some codes may not be detected through this drive pattern.)

HINT:

Preparation for driving

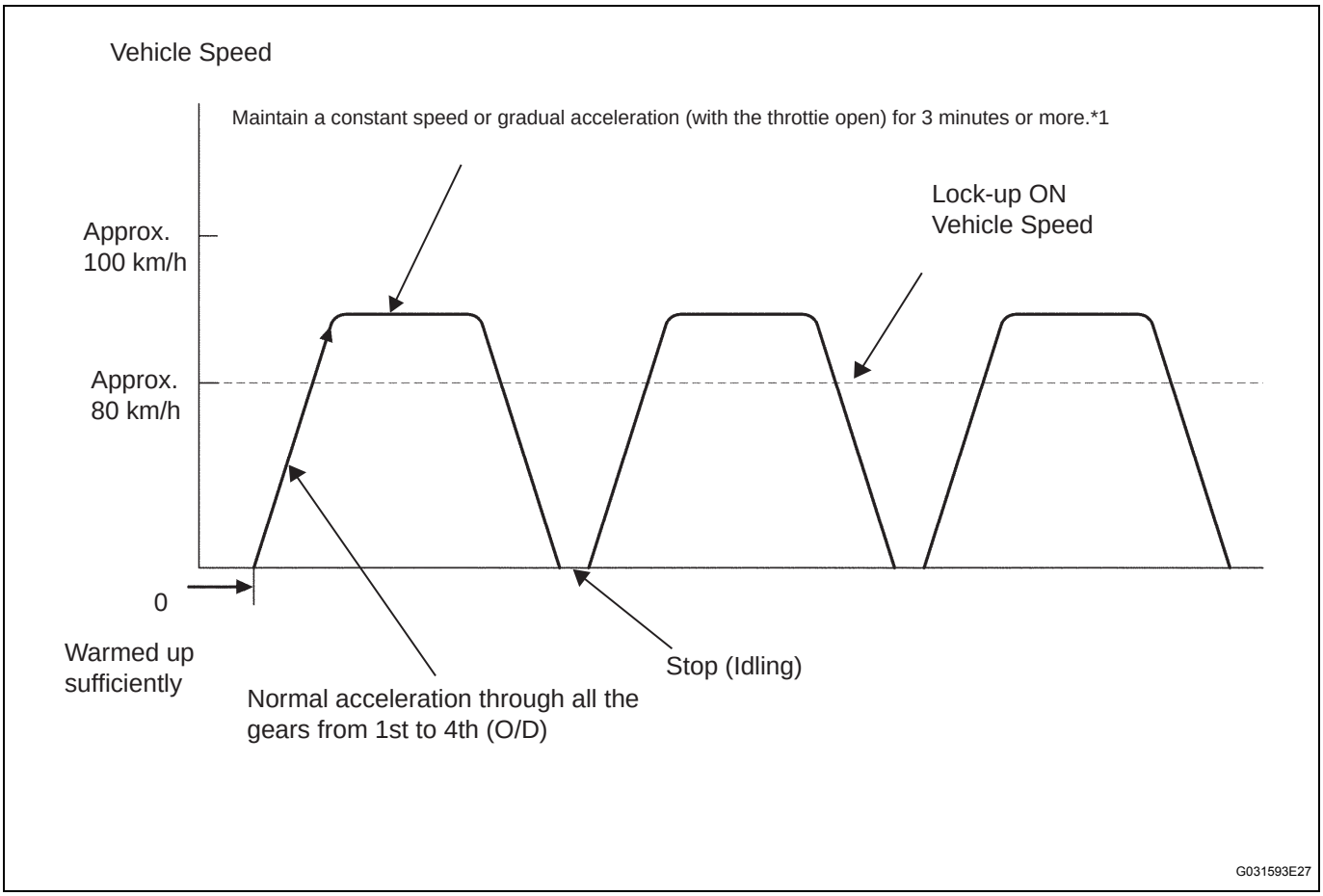
- Warm up the engine sufficiently. (Engine coolant temperature is 60°C (140°F) or higher)
- Drive the vehicle when the atmospheric temperature is -10°C (14°F) or higher. (Malfunction is not detected when the atmospheric temperature is less than -10°C (14°F))

Driving note

- Drive the vehicle through all gears. Stop → 1st → 2nd → 3rd → 4th (O/D) → 4th (lock-up ON).
- Repeat the above driving pattern three times or more.

NOTICE:

- **When using the intelligent tester, monitor status can be found in the "Powertrain / Engine and ECT / Data List".**
- **In the event that the drive pattern must be interrupted (possibly due to traffic conditions or other factors), the drive pattern can be resumed and, in most cases, the monitor can be completed.**
- **Perform this drive pattern on a level road as much as possible and strictly observe the posted speed limits and traffic laws while driving.**



HINT:
*1: Drive at such a speed in the uppermost gear, to engage lock-up. The vehicle can be driven at a speed lower than that in the above diagram under the lock-up condition.
NOTICE:
If necessary to drive the vehicle for approximately 30 minutes to detect DTC P0711 (ATF temperature sensor malfunction).

PROBLEM SYMPTOMS TABLE

HINT:
If a normal code is displayed during the diagnostic trouble code check although the trouble still occurs, check the electrical circuits for each symptom in the order given in the charts on the following pages and proceed to the page given for troubleshooting.
The Matrix Chart is divided into 2 chapters.
Chapter 1:
Refer to the table below when the trouble cause is considered to be electrical.
If the instruction "Proceed to next circuit inspection shown on matrix chart" is given in the flow chart of each circuit, proceed to the circuit with the next highest number in the table to continue the check.

If the trouble still occurs even though there are no abnormalities in any of the other circuits, check and replace the ECM.

1. Chapter 1: Electronic Circuit Matrix Chart

Symptom	Suspected Area	See Page
No up-shift (1st -> 2nd)	ECM	IN-23
No up-shift (2nd -> 3rd)	ECM	IN-23
No up-shift (3rd -> O/D)	1. Transmission control switch (O/D OFF) circuit	AX-81
	2. ECM	IN-23
No down-shift (O/D -> 3rd)	1. Transmission control switch (O/D OFF) circuit	AX-81
	2. ECM	IN-23
No down-shift (3rd -> 2nd)	ECM	IN-23
No down-shift (2nd -> 1st)	ECM	IN-23
No lock-up or No lock-up off	ECM	IN-23
Shift point too high or too low	ECM	IN-23
Up-shift to O/D from 3rd (While O/D main switch is OFF)	1. Transmission control switch (O/D OFF) circuit	AX-81
	2. ECM	IN-23
Up-shift to O/D from 3rd while engine is cold	1. Engine coolant temp. sensor circuit *1	ES-23
	2. ECM	IN-23
Harsh engagement (N -> D)	ECM	IN-23
Harsh engagement (Lock-up)	ECM	IN-23
Harsh engagement (Any driving position)	ECM	IN-23
Poor acceleration	ECM	IN-23
Engine stalls when starting off or stopping	ECM	IN-23
Malfunction in shifting	1. Park/neutral position switch circuit *1	AX-32
	2. ECM	IN-23

HINT:
*1: When the circuit on which mark *1 is detective, a DTC may be output.

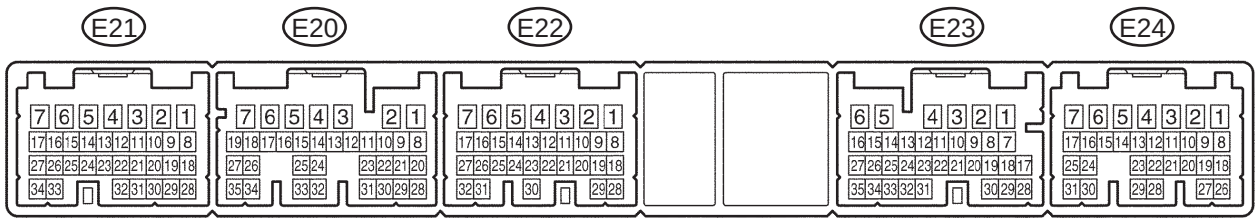
2. Chapter 2: On-Vehicle Repair and Off-Vehicle Repair

Symptom	Suspected Area	See Page
Vehicle does not move in any forward positions and reverse positions	1. Manual valve	-
	2. Primary regulator valve	-
	3. Front and rear planetary gear	-
	4. U/D planetary gear	-
	5. U/D one-way clutch (F2)	-
	6. Forward clutch (C1)	-
	7. U/D brake (B3)	-
Vehicle does not move in R position	1. Front and rear planetary gear unit	-
	2. U/D planetary gear unit	-
	3. Direct clutch (C2)	-
	4. U/D brake (C3)	-
	5. 1st and reverse brake (B2)	-
No up-shift (1st -> 2nd)	1. Valve body assembly	-
	2. No. 1 one-way clutch (F1)	-
	3. 2nd brake (B1)	-
No up-shift (2nd -> 3rd)	1. Valve body assembly	-
	2. Direct clutch (C2)	-
No up-shift (3rd -> O/D)	1. Valve body assembly	-
	2. U/D clutch (C3)	-
No down-shift (O/D -> 3rd)	Valve body assembly	-

Symptom	Suspected Area	See Page
No down-shift (3rd -> 2nd)	Valve body assembly	-
No down-shift (2nd -> 1st)	Valve body assembly	-
No lock-up or No lock-up off	1. Lock-up relay valve	-
	2. Torque converter clutch	-
Harsh engagement (N -> D)	1. C1 accumulator	-
	2. Valve body assembly	-
	3. Forward clutch (C1)	-
	4. U/D one-way clutch (F2)	-
	5. No. 1 one-way clutch (F1)	-
Harsh engagement (N -> R)	1. Valve body assembly	-
	2. Direct clutch (C2)	-
	3. 1st and reverse brake (B2)	-
Harsh engagement (Lock-up)	1. Lock-up relay valve	-
	2. Torque converter clutch	-
Harsh engagement (2nd -> 3rd)	Valve body assembly	-
Harsh engagement (3rd -> O/D)	Valve body assembly	-
Harsh engagement (O/D -> 3rd)	Valve body assembly	-
Slip or shudder (Forward position: After warm-up)	1. Oil strainer	-
	2. Torque converter clutch	-
	3. Forward clutch (C1)	-
	4. Direct clutch (C2)	-
	5. U/D brake (C3)	-
	6. No. 1 one-way clutch (F1)	-
	7. U/D one-way clutch (F2)	-
Slip or shudder (R position)	1. Oil strainer	-
	2. Direct clutch (C2)	-
	3. 1st and reverse brake (B2)	-
Slip or shudder (1st)	No. 1 one-way clutch (F1)	-
Slip or shudder (2nd)	1. U/D one-way clutch (F2)	-
	2. 2nd brake (B1)	-
Slip or shudder (3rd)	Direct clutch (C2)	-
Slip or shudder (O/D)	U/D clutch (C3)	-
No engine braking (1st to 3rd: D position)	U/D brake (B3)	-
No engine braking (1st: L position)	1st and reverse brake (B2)	-
No engine braking (2nd: 2 position)	2nd brake (B1)	-
Poor acceleration (All position)	1. Torque converter clutch	-
	2. U/D planetary gear	-
Poor acceleration (O/D)	1. U/D clutch (C3)	-
	2. U/D planetary gear	-
Large shift shock or engine stalls when starting off or stopping	Torque converter clutch	-
No kick-down	Valve body assembly	-

TERMINALS OF ECM

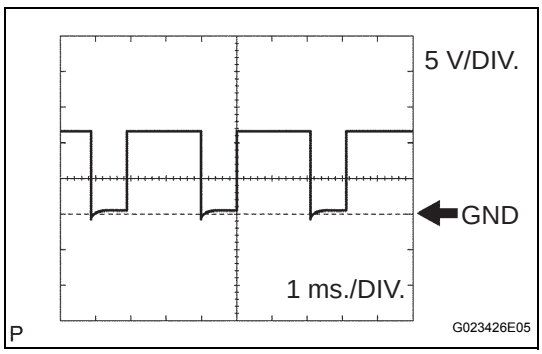
1. ECM



HINT:
Each ECM terminal's standard voltage is shown in the table below.
In the table, first follow the information under "Condition". Look under "Symbols (Terminal No.)" for the terminals to inspected. The standard voltage between the terminals is shown under "Specific Condition".
Use the illustration above as a reference for the ECM terminals.

Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
NSW (E21-16) - E1 (E22-1)	B-O - BR	Park neutral switch signal	IG switch ON and shift lever P and N position	Below 2 V
↑	↑	↑	IG switch ON and shift lever except P and N position	10 to 14 V
DSL (E20-9) - E1 (E22-1)	Y - BR	DSL solenoid signal	Vehicle speed 65 km/h, lock-up (ON to OFF)	Pulse generation (See waveform 2)
S4 (E20-11) - E1 (E22-1)	L-B - BR	S4 solenoid signal	IG switch ON	Below 1 V
↑	↑	↑	O/D gear	10 to 14 V
↑	↑	↑	Except O/D gear	Below 1 V
SL2+ (E20-15) - SL2- (E20-14)	L-Y - L-R	SL2 solenoid signal	Engine idle speed	Pulse generation (See waveform 3)
SL1+ (E20-19) - SL1- (E20-18)	R-B - P	SL1 solenoid signal	Engine idle speed	Pulse generation (See waveform 4)
NC+ (E20-26) - NC- (E20-34)	R - G	Speed sensor (NC) signal	Vehicle speed 30 km/h: (3rd gear) Engine speed 1,400 rpm	Pulse generation (See waveform 5)
NT+ (E20-27) - NT- (E20-35)	B - W	Speed sensor (NT) signal	Vehicle speed 20 km/h	Pulse generation (See waveform 6)
SLT+ (E20-13) - SLT- (E20-12)	Y-R - Y-B	SLT solenoid signal	Engine idle speed	Pulse generation (See waveform 1)
TH01 (E20-32) - E2 (E21-28)	G - BR	ATF temperature sensor signal	ATF temperature: 115°C (239°F) or more	Below 1.5 V
L (E23-8) - E1 (E22-1)	Y - BR	L shift position switch signal	IG switch ON and shift lever L position	10 to 14 V
↑	↑	↑	IG switch ON and shift lever except L position	Below 1 V
2 (E23-9) - E1 (E22-1)	L-W - BR	2 shift position switch signal	IG switch ON and shift lever 2 position	10 to 14 V
↑	↑	↑	IG switch ON and shift lever except 2 position	Below 1 V
D (E23-10) - E1 (E22-1)	W-L - BR	D shift position switch signal	IG switch ON and shift lever D position	10 to 14 V

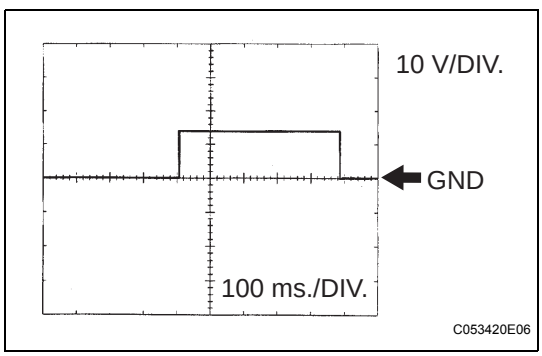
Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
↑	↑	↑	IG switch ON and shift lever except D position	Below 1 V
R (E23-11) - E1 (E22-1)	R-B - BR	R shift position switch signal	IG switch ON and shift lever R position	10 to 14 V
↑	↑	↑	IG switch ON and shift lever except R position	Below 1 V
SPD (E23-17) - E1 (E22-1)	V-W - BR	Speed signal	Vehicle speed 20 km/h	Pulse generation (See waveform 7)
STP (E23-19) - E1 (E22-1)	G-W - BR	Stop light switch signal	Brake pedal is depressed	7.5 to 14 V
↑	↑	↑	Brake pedal is released	Below 1.5 V
ODMS (E24-16) - E1 (E22-1)	G-O - BR	O/D main switch	IG switch ON	10 to 14 V
↑	↑	↑	IG switch ON and press continuously O/D main switch	Below 1 V



(a) Waveform 1

Reference:

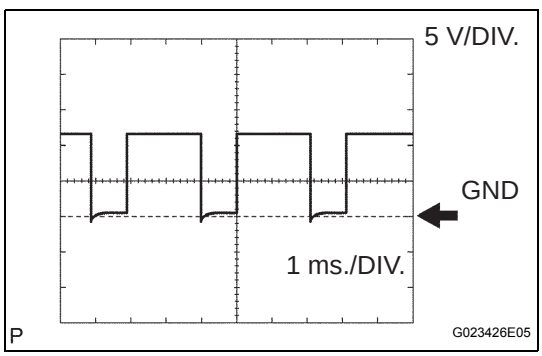
Terminal	SLT+ - SLT-
Tool setting	5 V/DIV., 1 ms./DIV.
Vehicle condition	Engine idle speed



(b) Waveform 2

Reference:

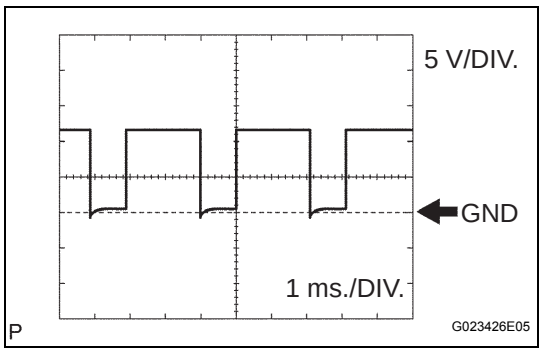
Terminal	DSL - E1
Tool setting	10 V/DIV., 100 ms./DIV.
Vehicle condition	Vehicle speed 65 km/h, lock-up (ON to OFF)



(c) Waveform 3

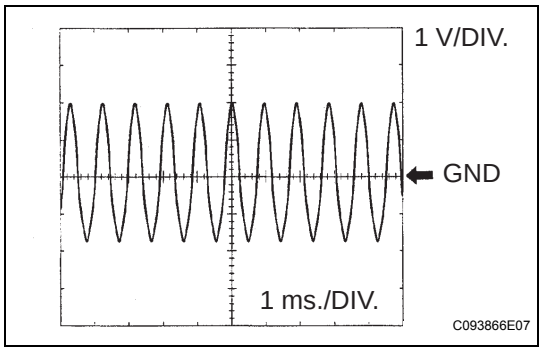
Reference:

Terminal	SL2+ - SL2-
Tool setting	5 V/DIV., 1 ms./DIV.
Vehicle condition	Engine idle speed



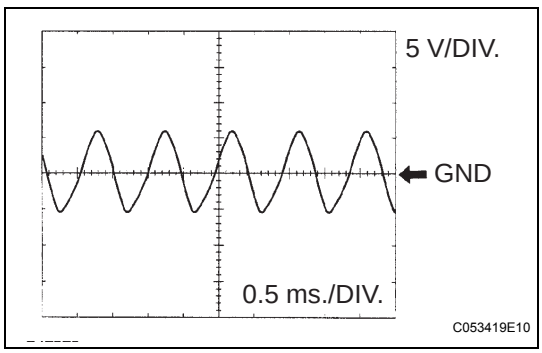
(d) Waveform 4
Reference:

Terminal	SL1+ - SL1-
Tool setting	5 V/DIV., 1 ms./DIV.
Vehicle condition	Engine idle speed



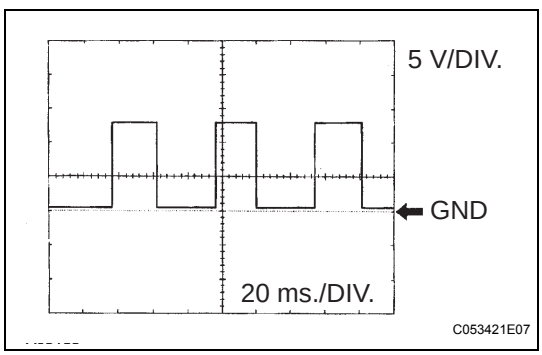
(e) Waveform 5
Reference:

Terminal	NC+ - NC-
Tool setting	1 V/DIV., 1 ms./DIV.
Vehicle condition	Vehicle speed 30 km/h: (3rd gear) Engine speed 1.400 rpm



(f) Waveform 6
Reference:

Terminal	NT+ - NT-
Tool setting	5 V/DIV., 0.5 ms./DIV.
Vehicle condition	Vehicle speed 20 km/h



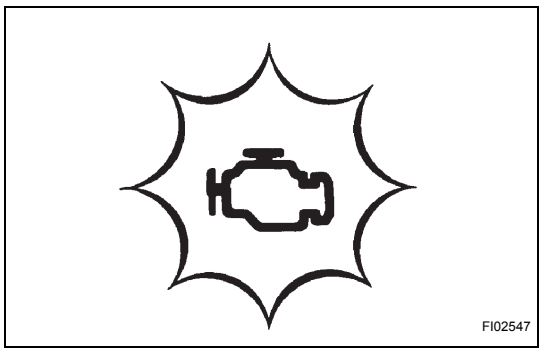
(g) Waveform 7
Reference:

Terminal	SPD - E1
Tool setting	5 V/DIV., 20 ms./DIV.
Vehicle condition	Vehicle speed 20 km/h

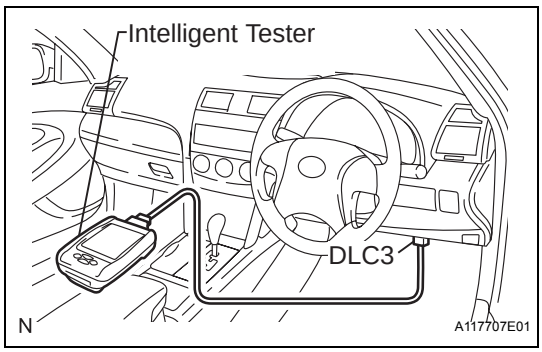
DIAGNOSIS SYSTEM

1. DESCRIPTION

(a) When troubleshooting Europe On-Board Diagnostic (Euro-OBD) vehicles, the vehicle must be connected to an OBD scan tool (complying with ISO 15031-3). Various data output from the vehicle's ECM can then be read.



(b) Euro-OBD regulations require that the vehicle's on-board computer illuminates the Malfunction Indicator Lamp (MIL) on the instrument panel when the computer detects a malfunction in:
(1) The emission control system/components.
(2) The powertrain control components (which affect vehicle emissions).
(3) The computer.
In addition, the applicable Diagnostic Trouble Codes (DTCs) prescribed by ISO 15031-3 are recorded in the ECM memory.
If the malfunction does not reoccur in 3 consecutive trips, the MIL turns off automatically but the DTCs remain recorded in the ECM memory.



(c) To check DTCs, connect the intelligent tester to the Data Link Connector 3 (DLC3) of the vehicle.
The scan tool displays DTCs, the freeze frame data and a variety of the engine data.
The DTCs and freeze frame data can be erased with the scan tool (See page **AX-23**).

2. NORMAL MODE AND CHECK MODE

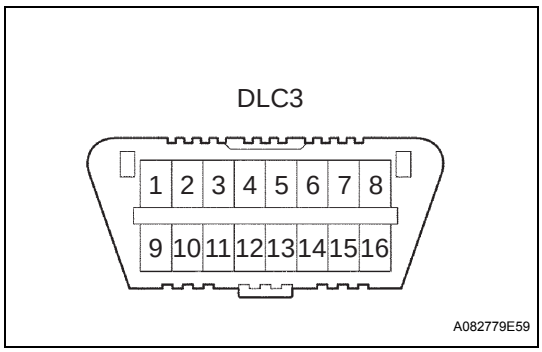
The diagnosis system operates in "normal mode" during normal vehicle use. In normal mode, "2 trip detection logic" is used to ensure accurate detection of malfunctions. "Check mode" is also available to technicians as an option. In check mode, "1-trip detection logic" is used for simulating malfunction symptoms and increasing the system's ability to detect malfunctions, including intermittent malfunctions (intelligent tester only).

3. 2-TRIP DETECTION LOGIC

(a) When a malfunction is first detected, the malfunction is temporarily stored in the ECM memory (1st trip). If the ignition switch is turned OFF and then ON again, and the same malfunction is detected again, the MIL will illuminate.

4. FREEZE FRAME DATA

(a) Freeze frame data records the engine conditions (fuel system, calculated load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air/fuel ratio was Lean or Rich, and other data from the time the malfunction occurred.



5. DLC3 (Data Link Connector 3)

(a) The vehicle's ECM uses the ISO 9141-2 (Euro-OBD) communication protocol. The terminal arrangement of the DLC3 complies with ISO 15031-03 and matches the ISO 9141-2 format.
HINT:
When you use the intelligent tester, first connect the cable of the tester to the DLC3. Next, turn the ignition switch to the ON position. Finally turn the tester ON. If the screen displays NO INFORMATION AVAILABLE and bus check is also failed, a problem exists in the vehicle, the tester or the tester cable.
If the communication is normal when the tool is connected to another vehicle, inspect the DLC3 on the original vehicle.
If the communication is still impossible when the tool is connected to another vehicle, the problem is probably in the tool itself. Consult the Service Department listed in the tool's instruction malfunction.

Symbol	Terminal No.	Name	Reference terminal	Result	Condition
SIL	7	Bus "+" line	5 - Signal ground	Pulse generation	During transmission
CG	4	Chassis ground	Body ground	1 Ω or less	Always
SG	5	Signal ground	Body ground	1 Ω or less	Always
BAT	16	Battery positive	Body ground	9 to 14 V	Always

6. INSPECT BATTERY VOLTAGE

Battery Voltage:
11 to 14 V

(a) If voltage is below 11 V, replace the battery before proceeding.

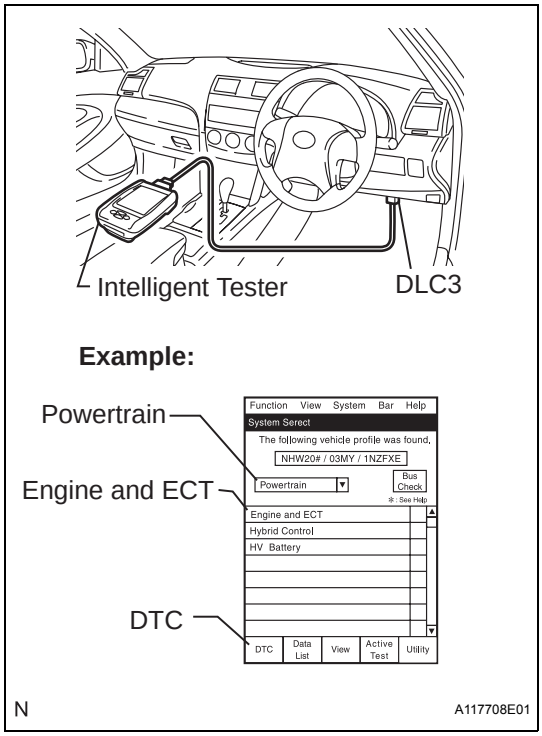
7. CHECK MIL

(a) Check that the MIL illuminates when turning the ignition switch ON.
If the MIL does not illuminate, there is a problem in the MIL circuit (See page **ES-206**).

(b) When the engine is started, the MIL should turn off.

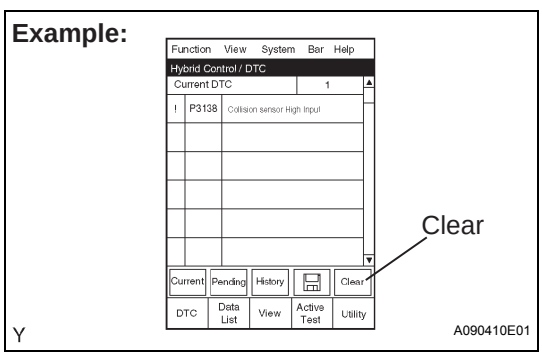
DTC CHECK / CLEAR

NOTICE:
Intelligent tester only:
When the diagnosis system is changed from normal mode to check mode, or vice versa, all the DTCs and freeze frame data recorded in normal mode will be erased. Before changing modes, always check and make a note of any DTCs and freeze frame data.



1. CHECK DTC

(a) DTCs which are stored in the ECM can be displayed with the intelligent tester and generic OBD scan tool.
These scan tools can display pending DTCs and current DTCs. Some DTC aren't stored if the ECM doesn't detect a malfunction during consecutive driving. However, the detected malfunction during once driving is stored as pending DTC.
(1) Connect the intelligent tester to the DLC3.
(2) Turn the ignition switch ON and turn the intelligent tester ON.
(3) Enter the following menus: Powertrain / Engine and ECT / DTC.
(4) Check and make a note of DTCs and freeze frame data.
(5) Confirm the details of the DTCs (See page AX-29).
NOTICE:
When simulating a symptom with the scan tool to check the DTCs, use normal mode. For codes on DIAGNOSTIC TROUBLE CODE CHART which are subject to "2-trip detection logic", perform the following actions.
Turn the ignition switch off after the symptom is simulated once. Then repeat the simulation process again. When the problem has been simulated twice, the MIL illuminates and the DTCs are recorded in the ECM.



2. CLEAR DTCS AND FREEZE FRAME DATA (using intelligent tester)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON (do not start the engine) and turn the intelligent tester ON.
(c) Enter the following menus: Powertrain / Engine and ECT / DTC / Clear (*1).
(d) Erase DTCs and freeze frame data by pressing YES on the tester.
(e) Turn off the ignition and then turn it on again, and check that the monitor is not displaying any DTCs. If any DTCs are displayed, repeat from step (*1).

3. CLEAR DTCS AND FREEZE FRAME DATA (without using intelligent tester)

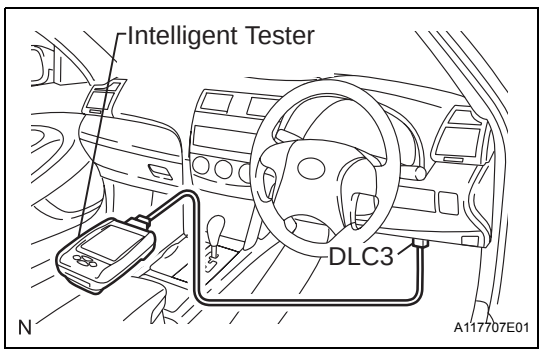
(a) Perform either one of the following operations.
(1) Disconnect the battery negative (-) cable for more than 1 minute.
(2) Remove the EFI fuses from the engine room R/B for 1 minute or more.
However, if you disconnect the battery terminal, perform the "INITIALISE" procedure.

CHECK MODE PROCEDURE

HINT:
Intelligent tester only

1. DESCRIPTION

(a) Check mode has a higher sensitivity to malfunctions and can detect malfunctions that normal mode cannot detect. Check mode can also detect all the malfunctions that normal mode can detect. In check mode, DTCs are detected with 1-trip detection logic.



2. CHECK MODE PROCEDURE

(a) Make sure that the items below are true:
(1) Battery voltage 11 V or more
(2) Throttle valve fully closed
(3) Transmission in the P or N position
(4) A/C switched OFF

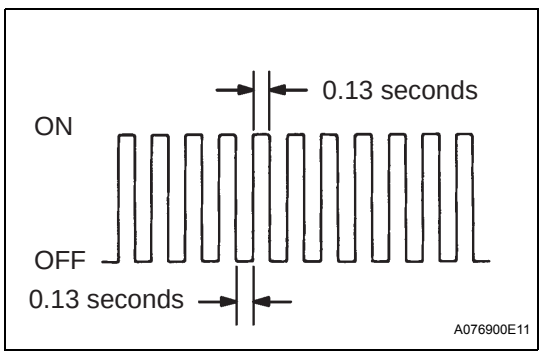
(b) Turn the ignition switch OFF.

(c) Connect the intelligent tester to the DLC3.

(d) Turn the ignition switch to the ON position.

(e) Turn the intelligent tester ON.

(f) Enter the following menus: Utility / Check Mode.



(g) Change the ECM to check mode. Make sure the MIL flashes as shown in the illustration.
NOTICE:
All DTCs and freeze frame data recorded will be erased if: 1) the intelligent tester is used to change the ECM from normal mode to check mode or vice versa; or 2) during check mode, the ignition switch is turned from the ON to ACC or LOCK position.
Before check mode, make notes of the DTCs and freeze frame data.

(h) Start the engine. The MIL should turn off after the engine starts.

(i) Perform "MONITOR DRIVE PATTERN" for the ECT test (See page **AX-15**).
(Or, simulate the conditions of the malfunction described by the customer).

(j) After simulating the malfunction conditions, use the intelligent tester diagnosis selector to check the DTC and freeze frame data.

FAIL-SAFE CHART

1. FAIL-SAFE

This function minimises the loss of the ECT functions when any malfunction occurs in a sensor or solenoid.

(a) ATF (Automatic Transmission Fluid) temperature sensor:
When the ATF temperature sensor has a malfunction, O/D upshift is prohibited.

(b) Counter gear speed sensor NC (Speed sensor NC):
When the counter gear speed sensor has a malfunction, O/D upshift is prohibited.

(c) Shift solenoid valve DSL:
When the solenoid valve DSL has a malfunction, the current to the solenoid valve is stopped.
This stops lock-up control, then fuel economy decreases.

(d) Shift solenoid valve SL1, SL2 and S4:
Fail safe function:
If either of the shift solenoid valve circuits develops an open or short, the ECM turns the other shift solenoid "ON" and "OFF" in order to shift into the gear positions shown in the table below.
Manual shifting as shown in the following table must be done (In case of a short circuit, the ECM stops sending the current to the short circuited solenoid).
Even if starting the engine in the fail-safe mode, the gear position remains in the same position.
HINT:
- *1: Actual gear shift (gear position) under fail-safe operation.
- OFF: OFF (the ECM stops sending current to a malfunctioning solenoid valve)
- →: Condition in the electrical malfunction is shown on the left of "→".
  Condition in the fail-safe mode is shown on the right of "→".

Normal	Solenoid Valve	SL1	ON	OFF	OFF	OFF
		SL2	ON	ON	OFF	OFF
		S4	OFF	OFF	OFF	ON
	Gear Position		1st	2nd	3rd	4th (O/D)
SL1 Malfunction	Solenoid Valve	SL1	OFF			
		SL2	ON	ON	OFF → ON	OFF → ON
		S4	OFF	OFF	OFF → ON	ON
	Gear Position *1		2nd	2nd	3rd	3rd
SL2 Malfunction	Solenoid Valve	SL1	ON → OFF	OFF	OFF	OFF
		SL2	OFF			
		S4	OFF	OFF	OFF	ON
	Gear Position *1		3rd	3rd	3rd	4th (O/D)
S4 Malfunction	Solenoid Valve	SL1	ON	OFF	OFF	OFF
		SL2	ON	ON	OFF	OFF
		SL4	OFF			
	Gear Position *1		1st	2nd	3rd	3rd
SL1 and SL2 Malfunction	Solenoid Valve	SL1	OFF			
		SL2	OFF			
		S4	OFF	OFF	OFF	ON
	Gear Position *1		3rd	3rd	3rd	4th (O/D)
SL1 and S4 Malfunction	Solenoid Valve	SL1	OFF			
		SL2	ON	ON	OFF → ON	OFF → ON
		S4	OFF			
	Gear Position *1		2nd	2nd	2nd	2nd

SL2 and S4 Malfunction	Solenoid Valve	SL1	ON → OFF	OFF	OFF	OFF
		SL2	OFF			
		S4	OFF			
	Gear Position *1		3rd	3rd	3rd	3rd
SL1, SL2 and S4 Malfunction	Solenoid Valve	SL1	OFF			
		SL2	OFF			
		S4	OFF			
	Gear Position *1		3rd	3rd	3rd	3rd

DATA LIST / ACTIVE TEST

1. DATA LIST

HINT:

Using the Intelligent Tester Data List allows switch, sensor, actuator and other item values to be read without removing any parts. Reading the Data List early in troubleshooting is one way to shorten labor 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) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn ON the tester.
(f) Select the item "Enter / Powertrain / Engine and ECT / Data List".
(g) Follow the instructions on the tester and read the Data List.

Item	Measurement Item/ Range (display)	Normal Condition	Diagnostic Note
Stop Light Switch	Stop light switch Status/ ON or OFF	• Brake Pedal is depressed: ON • Brake Pedal is released: OFF	-
PNP SW	PNP switch Status/ ON or OFF	Shift lever position is; P and N: ON Except P and N: OFF	When the shift lever position displayed on the Intelligent tester differs from the actual position, adjustment of the PNP switch or the shift cable may be incorrect. HINT: When the failure still occurs even after adjusting these parts, See page AX-32.
Reverse	PNP switch Status/ ON or OFF	Shift lever position is; R: ON Except R: OFF	↑
Drive	PNP switch Status/ ON or OFF	Shift lever position is; D: ON Except D: OFF	↑
2nd	PNP SW Status/ ON or OFF	Shift lever position is; 2: ON Except 2: OFF	↑
Low	PNP SW Status/ ON or OFF	Shift lever position is; L: ON Except L: OFF	↑

Item	Measurement Item/ Range (display)	Normal Condition	Diagnostic Note
Overdrive Cut Switch 2	O/D SW Status/ON or OFF	• IG SW ON: ON ↓ • O/D SW Push: OFF ↓ • O/D SW Push: ON	-
Shift	Actual Gear Position/ 1st, 2nd, 3rd or 4th (O/D)	Shift lever position is; • L: 1st • 2: 1st or 2nd • D (O/D OFF): 1st, 2nd or 3rd • D (O/D ON): 1st, 2nd, 3rd or 4th (O/D)	-
Lock Up SOL	Lock Up Solenoid Status/ ON or OFF	• Lock Up: ON • Except Lock Up: OFF	-
O/D Cut SOL	O/D Cut Solenoid Status/ ON or OFF	• O/D ON: ON • O/D OFF: OFF	
Solenoid (SLT)	Shift Solenoid SLT Status/ ON or OFF	• Accelerator pedal is depressed: OFF • Accelerator pedal is released: ON	-
A/T Fluid Temp	ATF Temp. Sensor Value/ min.: -40°C (-40°F) max.: 215°C (419°F)	• After Stall Test; Approx. 80°C (176°F) • Equal to ambient temperature when cold soak	If the value is "-40°C (-40°F)" or "215°C (419°F)", ATF temp. sensor circuit is opened or shorted.
SPD (NC)	Counter Gear Speed/ display: 50 r/min	HINT: 4th when shift lever position is D position (After warming up the engine); • Intermediate shaft speed (NC) becomes close to the engine speed.	-

2. ACTIVE TEST

HINT:

Performing the Intelligent Tester Active Test allows relay, Vacuum Switching Valve (VSV), actuator and other items to be operated without removing any parts. Performing the Active Test early in troubleshooting is one way to shorten labor time. The Data List can be displayed during the Active Test.

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn ON the tester.
(f) Select the item "Enter / Powertrain / Engine and ECT / Active Test".
(g) Follow the instructions on the tester and read the Active Test.

Item	Test Details	Diagnostic Note
Shift	[Test Details] Operate the shift solenoid valve and set the each shift position by yourself. [Vehicle Condition] • IDL: ON • Less than 50 km/h [Others] • Press "→" button: Shift up • Press "←" button: Shift down	Possible to check the operation of the shift solenoid valves.

Item	Test Details	Diagnostic Note
Lock Up Solenoid	[Test Details] Control the shift solenoid DSL to set the automatic transaxle to the lock-up condition. [Vehicle Condition] • Throttle valve opening angle: Less than 35% • Vehicle Speed: 58 km/h or more, and 6th gear	Possible to check the DSL operation.
Line Pressure Up Solenoid *	[Test Details] Operate the shift solenoid SLT and raise the line pressure. [Vehicle Condition] • Vehicle Stopped. • IDL: ON HINT: OFF: Line pressure up (When the active test of "Control the Line Pressure Up" is performed, the ECM commands the SLT solenoid to turn off). ON: No action (normal operation)	-

*: "Control the Line Pressure Up" in the ACTIVE TEST is performed to check the line pressure changes by connecting the SST to the automatic transaxle, which is used in the HYDRAULIC TEST (See page AX-11) as well.
HINT:
The pressure values in ACTIVE TEST and HYDRAULIC TEST are different from each other.

DIAGNOSTIC TROUBLE CODE CHART

If a DTC is displayed during the DTC check, check the parts listed in the table below and proceed to the page given.
HINT:
- *1: Comes on MIL (Malfunction Indicator Lamp) light up
- *2: "DTC stored" mark means ECM memorises the malfunction code if the ECM detects the DTC detection condition.
- This DTC may be output when the clutch, brake and gear components etc. inside the automatic transmission are damaged.

AUTOMATIC TRANSMISSION SYSTEM

DTC No.	Detection Item	Trouble Area	MIL *1	Memory *2	See Page
P0705	Transmission Range Sensor Circuit Malfunction (PRNDL Input)	1. Open or short in park/neutral position switch circuit 2. Park/neutral position switch 3. ECM	Comes on	DTC stored	AX-32
P0710	Transmission Fluid Temperature Sensor "A" Circuit	1. Open or short in ATF temperature sensor circuit 2. Transmission wire (ATF temperature sensor) 3. ECM	Comes on	DTC stored	AX-36
P0711	Transmission Fluid Temperature Sensor "A" Performance	1. Transmission wire (ATF temperature sensor)	Comes on	DTC stored	AX-40

DTC No.	Detection Item	Trouble Area	MIL *1	Memory *2	See Page
P0712	Transmission Fluid Temperature Sensor "A" Circuit Low Input	1. Short in ATF temperature sensor circuit 2. Transmission wire (ATF temperature sensor) 3. ECM	Comes on	DTC stored	AX-36
P0713	Transmission Fluid Temperature Sensor "A" Circuit High Input	1. Open in ATF temperature sensor circuit 2. Transmission wire (ATF temperature sensor) 3. ECM	Comes on	DTC stored	AX-36
P0717	Turbine Speed Sensor Circuit No Signal	1. Open or short in transmission revolution sensor NT (speed sensor NT) circuit 2. Transmission revolution sensor NT (speed sensor NT) 3. ECM 4. Automatic transaxle assembly	Comes on	DTC stored	AX-43
P0724	Brake Switch "B" Circuit High	1. Short in stop light switch circuit 2. Stop light switch 3. ECM	Comes on	DTC stored	AX-46
P0741	Torque Converter Clutch Solenoid Performance (Shift Solenoid Valve DSL)	1. Shift solenoid valve DSL remains open or closed 2. Valve body is blocked 3. Torque converter clutch 4. Automatic transaxle (clutch, brake or gear etc.) 5. Line pressure is too low	Comes on	DTC stored	AX-48
P0746	Pressure Control Solenoid "A" Performance (Shift Solenoid Valve SL1)	1. Shift solenoid valve SL1 remains open or closed 2. Valve body is blocked 3. Automatic transaxle (clutch, brake or gear etc.)	Comes on	DTC stored	AX-52
P0748	Pressure Control Solenoid "A" Electrical (Shift Solenoid Valve SL1)	1. Open or short in shift solenoid valve SL1 circuit 2. Shift solenoid valve SL1 3. ECM	Comes on	DTC stored	AX-55
P0766	Shift Solenoid "D" Performance (Shift Solenoid Valve S4)	1. Shift solenoid valve S4 remains open or closed 2. Valve body is blocked (Brake control valve) 3. Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored	AX-58

DTC No.	Detection Item	Trouble Area	MIL *1	Memory *2	See Page
P0776	Pressure Control Solenoid "B" Performance (Shift Solenoid Valve SL2)	1. Shift solenoid valve SL2 remains open or closed 2. Valve body is blocked 3. Automatic transaxle (clutch, brake or gear etc.)	Comes on	DTC stored	AX-61
P0778	Pressure Control Solenoid "B" Electrical (Shift Solenoid Valve SL2)	1. Open or short in shift solenoid valve SL2 circuit 2. Shift solenoid valve SL2 3. ECM	Comes on	DTC stored	AX-64
P0793	Intermediate Shaft Speed Sensor "A"	1. Open or short in transmission revolution sensor NC (speed sensor NC) circuit 2. Transmission revolution sensor NC (speed sensor NC) 3. ECM	Comes on	DTC stored	AX-67
P0982	Shift Solenoid "D" Control Circuit Low (Shift Solenoid Valve S4)	1. Short in shift solenoid valve S4 circuit 2. Shift solenoid valve S4 3. ECM	Comes on	DTC stored	AX-71
P0983	Shift Solenoid "D" Control Circuit High (Shift Solenoid Valve S4)	1. Open in shift solenoid valve S4 circuit 2. Shift solenoid valve S4 3. ECM	Comes on	DTC stored	AX-71
P2716	Pressure Control Solenoid "D" Electrical (Shift Solenoid Valve SLT)	1. Open or short in shift solenoid valve SLT circuit 2. Shift solenoid valve SLT 3. ECM	Comes on	DTC stored	AX-74
P2769	Torque Converter Clutch Solenoid Circuit Low (Shift Solenoid Valve DSL)	1. Short in shift solenoid valve DSL circuit 2. Shift solenoid valve DSL 3. ECM	Comes on	DTC stored	AX-78
P2770	Torque Converter Clutch Solenoid Circuit High (Shift Solenoid Valve DSL)	1. Open in shift solenoid valve DSL circuit 2. Shift solenoid valve DSL 3. ECM	Comes on	DTC stored	AX-78

DTC	P0705	Transmission Range Sensor Circuit Malfunction (PRNDL Input)

DESCRIPTION

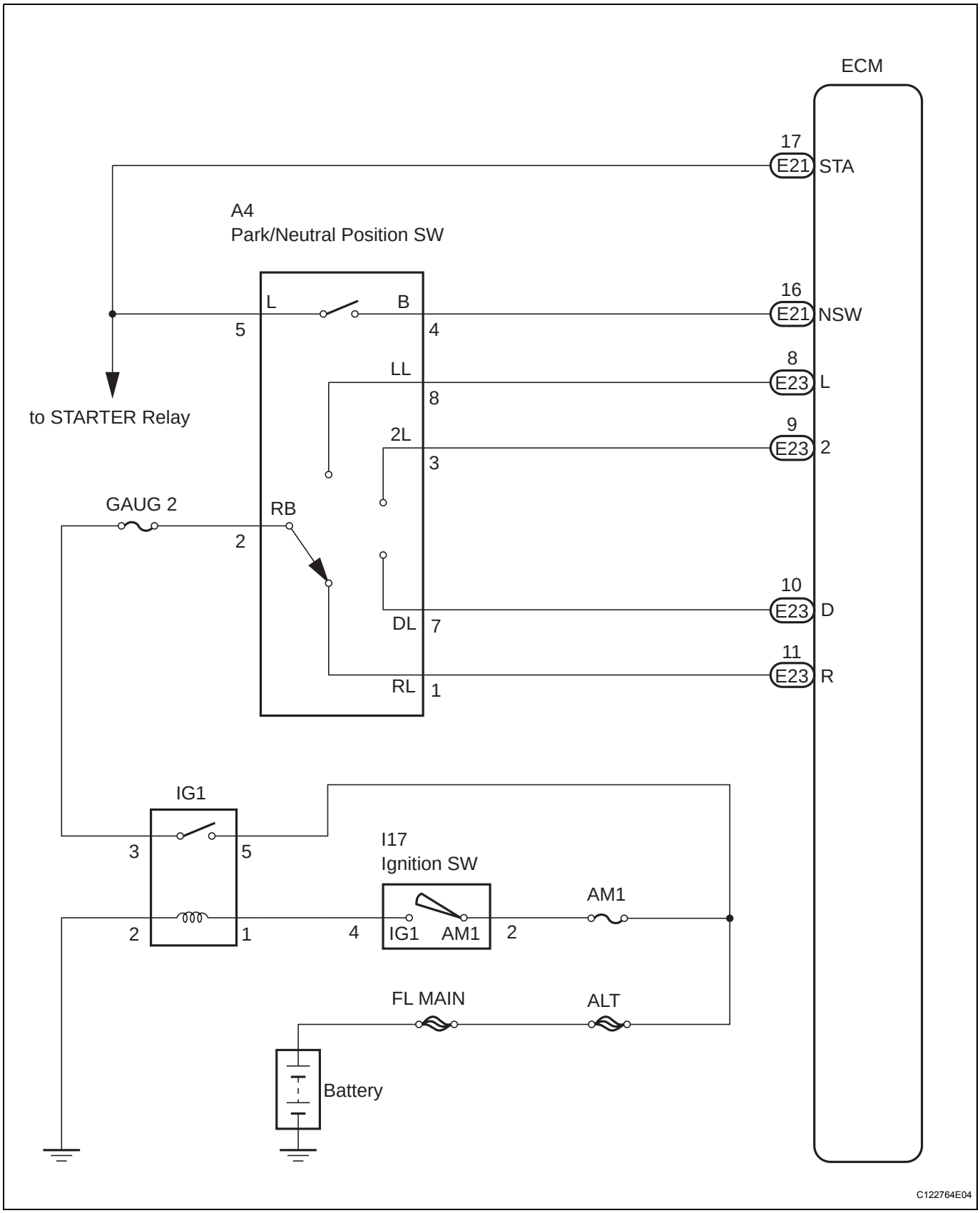
The park/neutral position switch detects the shift lever position and sends signals to the ECM.

DTC No.	DTC Detection Condition	Trouble Area
P0705	(A) Any 2 or more signals of the following are ON simultaneously (2-trip detection logic) • NSW input signal is ON. • R input signal is ON. • D input signal is ON. • 2 input signal is ON. • L input signal is ON. (B) Any 2 or more signals of the following are ON simultaneously (2-trip detection logic) • P input signal is ON. • R input signal is ON. • N input signal is ON. • D input signal is ON. • 2 input signal is ON. • L input signal is ON.	• Open or short in park/neutral position switch circuit • Park/neutral position switch • ECM

MONITOR DESCRIPTION

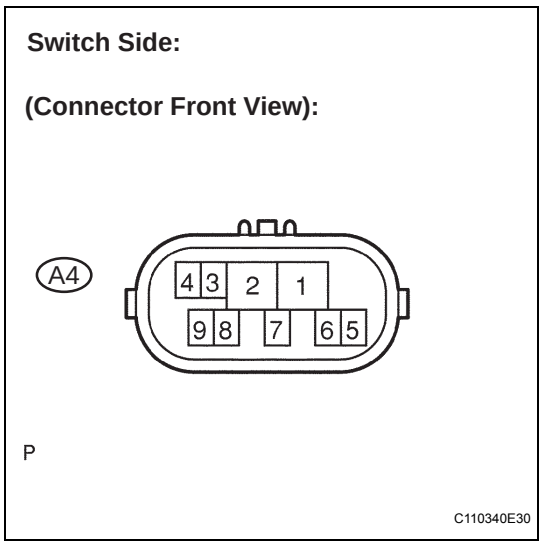
The park/neutral position switch detects the gearshift position and sends a signal to the ECM.
For security, the park/neutral position switch detects the gearshift position so that engine can be started only when the vehicle is in P or N shift position.
When the park/neutral position switch sends more than one signal at a time from switch positions P, R, N, D or 2, the ECM interprets this as a fault in the switch. The ECM will turn on the MIL.

WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT PARK/NEUTRAL POSITION SWITCH ASSEMBLY



(a) Disconnect the park/neutral position switch connector.
(b) Gate shift lever type:
Measure resistance according to the value(s) in the table below when the shift lever is moved to each position.

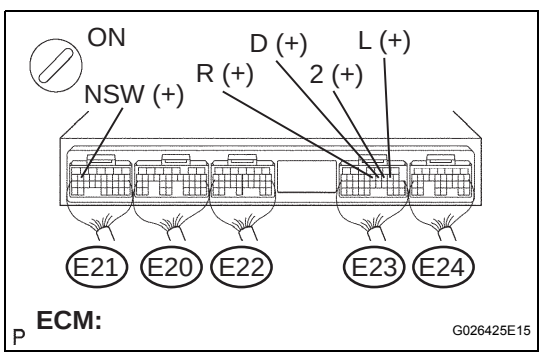
Standard resistance

Shift Position	Tester Connection	Specified Condition
P	2 - 6 and 4 - 5	Below 1 Ω
Except P		10 kΩ or higher
R	2 - 1	Below 1 Ω
Except R		10 kΩ or higher
N	2 - 9 and 4 - 5	Below 1 Ω
Except N		10 kΩ or higher
D	2 - 7	Below 1 Ω
Except D		10 kΩ or higher
2	2 - 3	Below 1 Ω
Except 2		10 kΩ or higher
L	2 - 8	Below 1 Ω
Except L		10 kΩ or higher

NG → REPLACE PARK/NEUTRAL POSITION SWITCH ASSEMBLY

OK

2 CHECK HARNESS AND CONNECTOR (PARK/NEUTRAL POSITION SWITCH - ECM)



(a) Connect the park/neutral position switch connector.
(b) Turn the ignition switch to the ON position, and measure the voltage according to the value(s) in the table below when the shift lever is moved to each position.

Standard voltage

Shift Position	Tester Connection	Specified Condition
P and N	E21-16 (NSW) - Body ground	Below 1 V
Except P and N	↑	10 to 14 V
R	E23- 11 (R) - Body ground	10 to 14 V*
Except R	↑	Below 1 V
D	E23-10 (D) - Body ground	10 to 14 V
Except D	↑	Below 1 V
2	E23-9 (2) - Body ground	10 to 14 V
Except 2	↑	Below 1 V
L	E23-8 (L) - Body ground	10 to 14 V
Except L	↑	Below 1 V

HINT:
*: The voltage will drop slightly due to lighting up of the back up light.

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

OK

REPLACE ECM

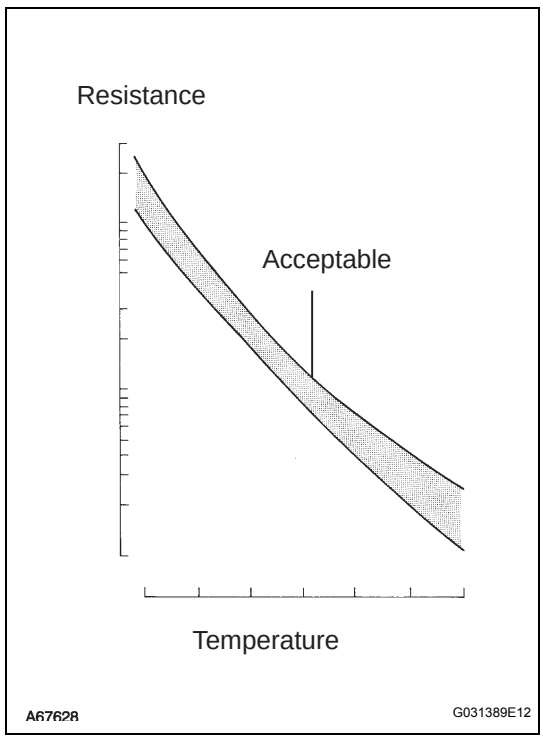
DTC	P0710	Transmission Fluid Temperature Sensor "A" Circuit

DTC	P0712	Transmission Fluid Temperature Sensor "A" Circuit Low Input

DTC	P0713	Transmission Fluid Temperature Sensor "A" Circuit High Input

DESCRIPTION

The ATF (Automatic Transmission Fluid) temperature sensor converts the fluid temperature into a resistance value which is input into the ECM.
The ECM applies a voltage to the temperature sensor through ECM terminal THO1 (THO).
The sensor resistance changes with the transmission fluid temperature. As the temperature becomes higher, the sensor resistance decreases.
One terminal of the sensor is grounded so that the sensor resistance decreases and the voltage goes down as the temperature becomes higher.
The ECM calculates the fluid temperature based on the voltage signal.



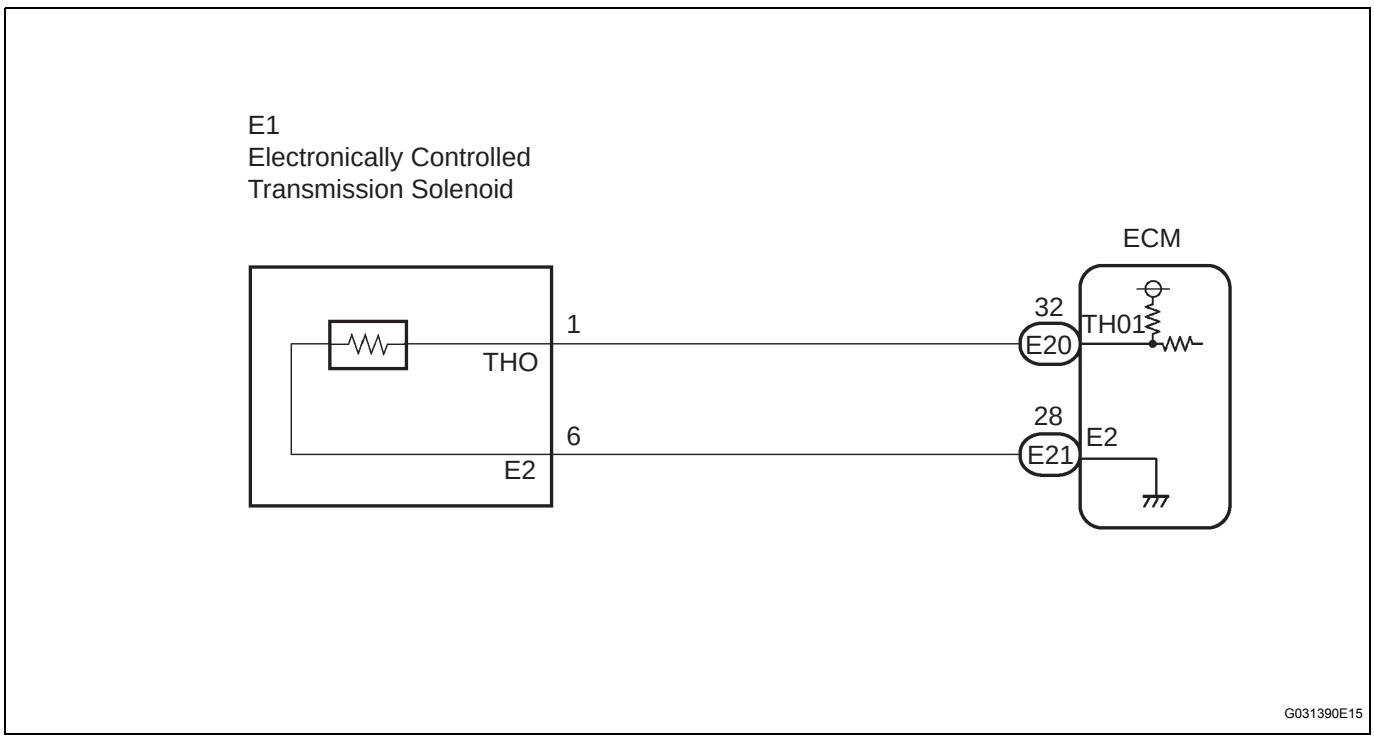
DTC No.	DTC Detection Condition	Trouble Area
P0710	(a) and (b) are detected momentarily within 0.5 sec. when neither P0712 nor P0713 is detected (1-trip detection logic) (a) ATF temperature sensor resistance is less than 79 Ω. (b) ATF temperature sensor resistance is more than 156 kΩ. HINT: Within 0.5 sec., the malfunction switches from (a) to (b) or from (b) to (a)	• Open or short in ATF temperature sensor circuit • Transmission wire (ATF temperature sensor) • ECM

DTC No.	DTC Detection Condition	Trouble Area
P0712	ATF temperature sensor resistance is less than 79 Ω for 0.5 sec. or more (1-trip detection logic)	• Short in ATF temperature sensor circuit • Transmission wire (ATF temperature sensor) • ECM
P0713	ATF temperature sensor resistance is more than 156 kΩ when 15 minutes or more have elapsed after the engine start DTC is detected for 0.5 sec. or more (1-trip detection logic)	• Open in ATF temperature sensor circuit • Transmission wire (ATF temperature sensor) • ECM

MONITOR DESCRIPTION

These DTCs indicate an open or short in the automatic transmission fluid (ATF) temperature sensor (TFT sensor) circuit. The automatic transmission fluid (ATF) temperature sensor converts ATF temperature to an electrical resistance value. Based on the resistance, the ECM determines the ATF temperature, and the ECM detects an open or short circuit in the ATF temperature circuit. If the resistance value of the ATF temperature is less than 79 Ω *1or more than 156 kΩ *2, the ECM interprets this as a fault in the ATF sensor or wiring. The ECM will turn on the MIL and store the DTC.
*1: 150°C (302°F) or more is indicated regardless of the actual ATF temperature.
*2: -40°C (-40°F) is indicated regardless of the actual ATF temperature.
HINT:
The ATF temperature can be checked on the intelligent tester display.

WIRING DIAGRAM



INSPECTION PROCEDURE

1. DATA LIST

HINT:
Using the Intelligent Tester Data List allows switch, sensor, actuator and other item values to be read without removing any parts. Reading the Data List early in troubleshooting is one way to shorten labor 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) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn ON the tester.
(f) Select the item "Enter / Powertrain / Engine and ECT / Data List".
(g) Follow the instructions on the tester and read the Data List.

Item	Measurement Item / Range (display)	Normal Condition
A/T Oil Temperature 1	ATF Temp. Sensor Value/ min.: -40°C (-40°F) max.: 215°C (419°F)	• After Stall Test: Approx. 80°C (176°F) • Equal to ambient temperature when cold soak

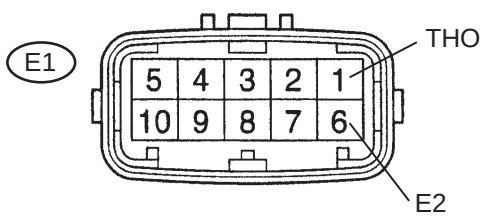
HINT:
When DTC P0712 is output and intelligent tester output is 150°C (302°F) or more, there is a short circuit.
When DTC P0713 is output and intelligent tester output is -40°C (-40°F), there is an open circuit.
Measure the resistance between terminal THO and body ground.

Temperature Displayed	Malfunction
-40°C (-40°F)	Open circuit
150°C (302°F) or more	Short circuit

HINT:
If a circuit related to the ATF temperature sensor becomes open, P0713 is immediately set (in 0.5 seconds).
When P0713 is set, P0711 cannot be detected.
It is not necessary to inspect to the circuit when P0711 is set.

1 INSPECT TRANSMISSION WIRE (ATF TEMPERATURE SENSOR)

Transmission Wire Side (Connector Front View):



(a) Disconnect the transmission wire connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
1 (THO) - 6 (E2)	79 Ω to 156 kΩ
1 (THO) - Body ground	10 kΩ or higher
6 (E2) - Body ground	↑

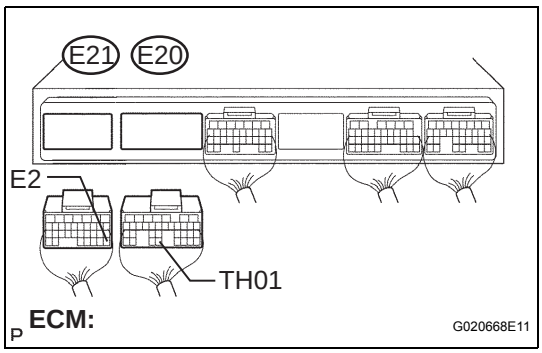
HINT:
If the resistance is out of the specified range with either the ATF temperature shown in the table below, the driveability of the vehicle may decrease.

ATF Temperature	Specified Condition
20°C (68°F)	3 to 4 kΩ
110°C (230°F)	0.22 to 0.28 kΩ

NG → **REPAIR OR REPLACE TRANSMISSION WIRE**

OK

2	CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)



(a) Connect the transmission wire connector to the transaxle.
(b) Disconnect the ECM connectors.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition
E20-32 (TH01) - E21-28 (E2)	79 Ω to 156 kΩ

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

Standard resistance (Check for short)

Tester Connection	Specified Condition
E20-32 (TH01) - Body ground	10 kΩ or higher
E21-28 (E2) - Body ground	

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM

DTC	P0711	Transmission Fluid Temperature Sensor "A" Performance

DESCRIPTION

The ATF (Automatic Transmission Fluid) temperature sensor converts the fluid temperature into a resistance value which is input into the ECM.

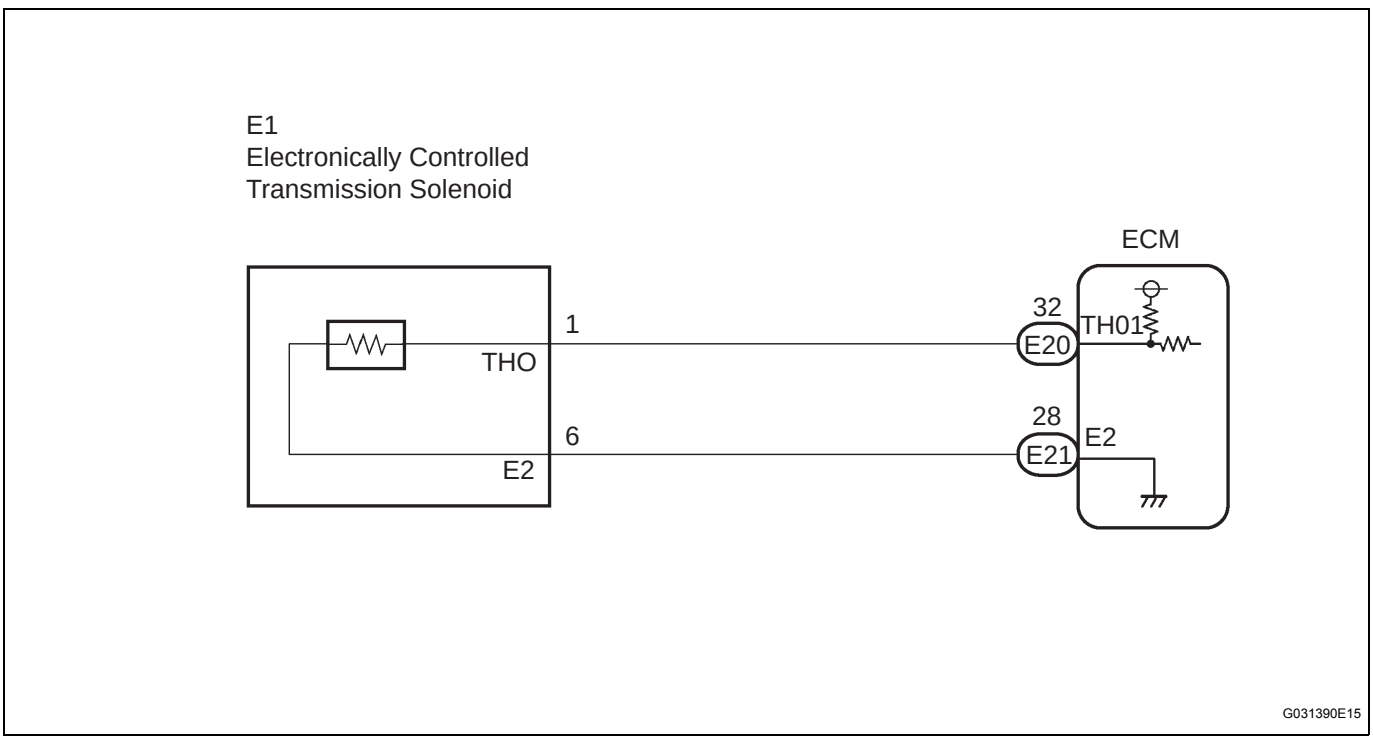
DTC No.	DTC Detection Condition	Trouble Area
P0711	Both (a) and (b) are detected: (2-trip detection logic) (a) After 12 sec. of engine start, temp. of atmosphere and that of engine coolant is more than -15°C (b) After normal driving for over 18 min. and 8 km (5 mile), ATF temp. is less than 10°C (50°F)	• Open or short in ATF temperature sensor circuit • Transmission wire (ATF temperature sensor) • ECM

MONITOR DESCRIPTION

The ATF temperature sensor converts the ATF temperature to an electrical resistance value. Based on the resistance, the ECM determines the ATF temperature and detects an open or short circuit in the ATF temperature circuit.

After running the vehicle for a certain period, the ATF temperature should increase. When the ATF temperature is below 10°C (50°F), the ECM interprets this as a fault, turns on the MIL.

WIRING DIAGRAM



INSPECTION PROCEDURE

1. **DATA LIST**

   HINT:

   Using the Intelligent Tester Data List allows switch, sensor, actuator and other item values to be read without removing any parts. Reading the Data List early in troubleshooting is one way to shorten labor 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) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn ON the tester.
(f) Select the item "Enter / Powertrain / Engine and ECT / Data List".
(g) Follow the instructions on the tester and read the Data List.

Item	Measurement Item / Range (display)	Normal Condition
A/T Oil Temperature 1	ATF Temp. Sensor Value/ min.: -40°C (-40°F) max.: 215°C (419°F)	• After Stall Test: Approx. 80°C (176°F) • Equal to ambient temperature when cold soak

HINT:
When DTC P0712 is output and intelligent tester output is 150°C (302°F) or more, there is a short circuit.
When DTC P0713 is output and intelligent tester output is -40°C (-40°F), there is an open circuit.
Measure the resistance between terminal THO and body ground.

Temperature Displayed	Malfunction
-40°C (-40°F)	Open circuit
150°C (302°F) or more	Short circuit

HINT:
If a circuit related to the ATF temperature sensor becomes open, P0713 is immediately set (in 0.5 seconds).
When P0713 is set, P0711 cannot be detected.
It is not necessary to inspect to the circuit when P0711 is set.

1	CHECK OTHER DTCS OUTPUT (IN ADDITION TO DTC P0711)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) Turn on the tester.
(d) Select the item "Powertrain / Engine and ECT / DTC / Current or Pending".
(e) Read the DTCs using the intelligent tester.

Result

Display (DTC output)	Proceed to
Only "P0711" is output	**A**
"P0711" and other DTCs	**B**

HINT:
If any other codes besides "P0711" are output, perform troubleshooting for those DTCs first.

B → **GO TO DTC CHART (See page AX-29)**

A

2	CHECK TRANSMISSION FLUID LEVEL

OK:
Automatic transmission fluid level is correct.

NG → ADD FLUID

OK ↓

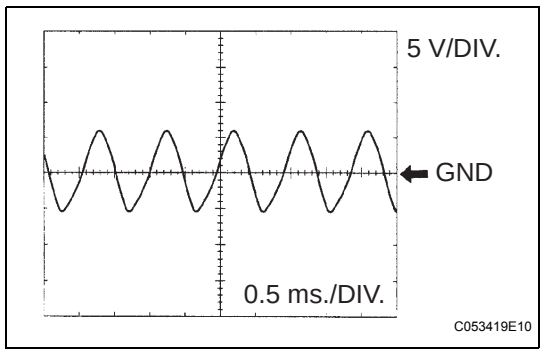
REPLACE TRANSMISSION WIRE (ATF TEMPERATURE SENSOR)

DTC	P0717	Turbine Speed Sensor Circuit No Signal

DESCRIPTION

This sensor detects the rotation speed of the input turbine. By comparing the input turbine speed signal (NT) with the counter gear speed sensor signal (NC), the ECM detects the shift timing of the gears and appropriately controls the engine torque and hydraulic pressure according to various conditions. Thus, providing smooth gear shift.

DTC No.	DTC Detection Condition	Trouble Area
P0717	ECM detects conditions (a), (b) and (c) continuously for 5 sec. or more: (1-trip detection logic) (a) Vehicle speed: 50 km/h or more (b) Park/neutral position switch (NSW, R and L) is OFF (c) Speed sensor (NT): less than 300 rpm	• Open or short in transmission revolution sensor NT (speed sensor NT) circuit • Transmission revolution sensor NT (speed sensor NT) • ECM • Automatic transaxle assembly



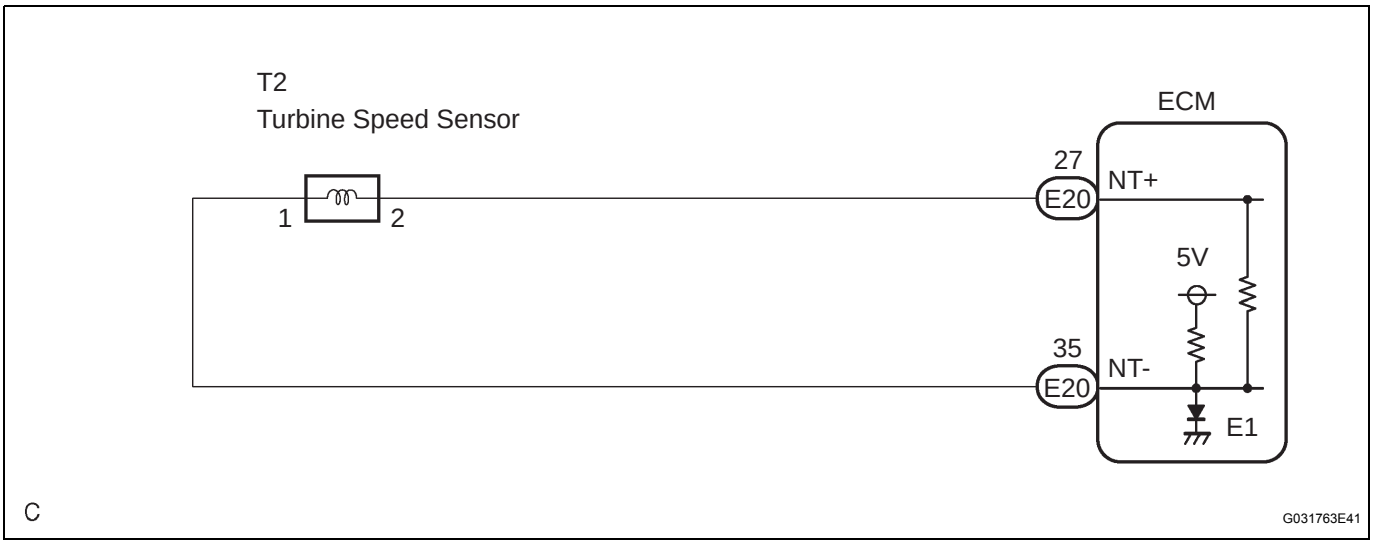
Reference (Using an oscilloscope):
Check the waveform between terminals NT+ and NT- of the ECM connector.
Standard: Refer to the illustration.

Terminal	Tool Setting	Vehicle Condition
NT+ - NT-	5 V/DIV., 0.5 ms./DIV.	Vehicle speed 20 km/h

MONITOR DESCRIPTION

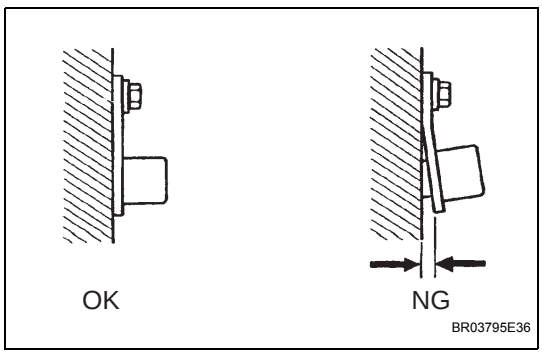
The NT terminal of the ECM detects a revolution signal from the speed sensor (NT) (input RPM). The ECM calculates a gearshift comparing the speed sensor (NT) with the speed sensor (NC).
While the vehicle is operating in 2nd, 3rd, 4th or 5th gear in the shift position of D, if the input shaft revolution is less than 300 rpm *1although the output shaft revolution is more than 1,000 rpm *2, the ECM detects the trouble, illuminates the MIL and stores the DTC.
*1: Pulse is not output or is irregularly output.
*2: The vehicle speed is 50 km/h or more.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	INSPECT SPEED SENSOR INSTALLATION



(a) Check the speed sensor installation.

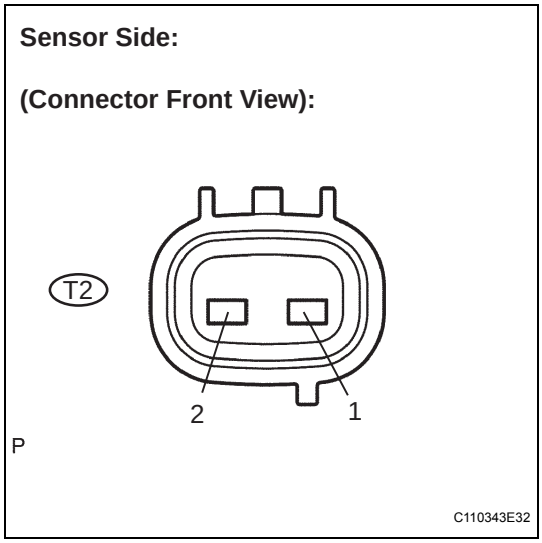
OK:

The installation bolt is tightened properly and there is no clearance between the sensor and transaxle case.

NG → **REPLACE SPEED SENSOR (NT)**

OK

2 INSPECT SPEED SENSOR (NT)



(a) Disconnect the speed sensor connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance:

TOYOTA made

Tester Connection	Specified Condition 20 °C (68 °F)
1 - 2	500 to 620 Ω

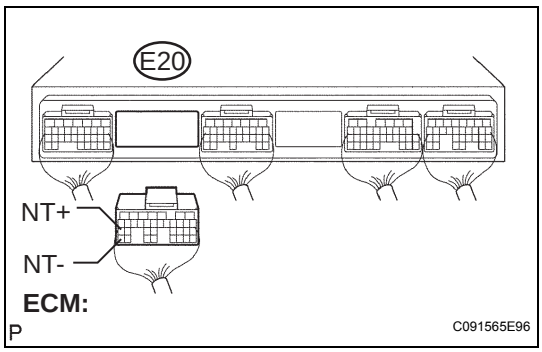
AISIN made

Tester Connection	Specified Condition 20 °C (68 °F)
1 - 2	560 to 680 Ω

NG → **REPLACE SPEED SENSOR (NT)**

OK

3 CHECK HARNESS AND CONNECTOR (SPEED SENSOR - ECM)



(a) Connect the speed sensor connector.
(b) Disconnect the ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

TOYOTA made

Tester Connection	Specified Condition 20°C (68°F)
E20-27 (NT+) - E20-35 (NT-)	500 to 620 Ω

AISIN made

Tester Connection	Specified Condition 20°C (68°F)
E20-27 (NT+) - E20-35 (NT-)	560 to 680 Ω

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

Standard resistance (Check for short)

Tester Connection	Specified Condition
E20-27 (NT+) - Body ground	10 kΩ or higher
E20-35 (NT-) - Body ground	

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

OK

REPLACE ECM

DTC	P0724	Brake Switch "B" Circuit High

DESCRIPTION

The purpose of this circuit is to prevent the engine from stalling while driving in lock-up condition when brakes are suddenly applied.
When the brake pedal is depressed, this switch sends a signals to the ECM. Then the ECM cancels the operation of the lock-up clutch while braking is in progress.

DTC No.	DTC Detection Condition	Trouble Area
P0724	The stop light switch remains ON even when the vehicle is driven in a STOP (less than 3 km/h and GO (30 km/h or more) fashion 5 times. (2-trip detection logic).	• Short in stop light switch circuit • Stop light switch • ECM

MONITOR DESCRIPTION

This DTC indicates that the stop light switch remains on. When the stop light switch remains ON during "stop and go" driving, the ECM interprets this as a fault in the stop light switch and the MIL comes on and the ECM stores the DTC. The vehicle must stop (less than 3 km/h) and go (30 km/h or more) 5 times for two driving cycles in order to detect a malfunction.

WIRING DIAGRAM

(See page ES-139)

INSPECTION PROCEDURE

1	READ VALUE OF DATA LIST

(a) DATA LIST
HINT:
Using the Intelligent Tester Data List allows switch, sensor, actuator and other item values to be read without removing any parts. Reading the Data List early in troubleshooting is one way to shorten labor time.
(1) Turn the ignition switch OFF.
(2) Connect the intelligent tester to the DLC3.
(3) Turn the ignition switch to the ON position.
(4) Turn ON the tester.
(5) Select the item "Enter / Powertrain / Engine and ECT / Data List".
(6) Follow the instructions on the tester and read the Data List.

Standard

Item	Measurement Item / Range (display)	Normal Condition
Stop Light Switch	Stop light SW Status/ ON or OFF	• Brake Pedal is depressed: ON • Brake Pedal is released: OFF

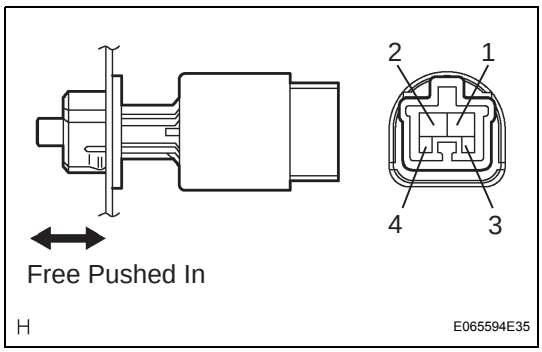
NOTICE:
In the table above, the conditions listed under "Normal Condition" are reference conditions. Do not depend solely on these reference conditions when deciding whether a part is faulty or not.

NG → GO TO STEP 2

OK

GO TO STEP 3

2 INSPECT STOP LIGHT SWITCH ASSEMBLY



(a) Remove the stop light switch assembly.
(b) Measure the resistance according to the value(s) in the table below.

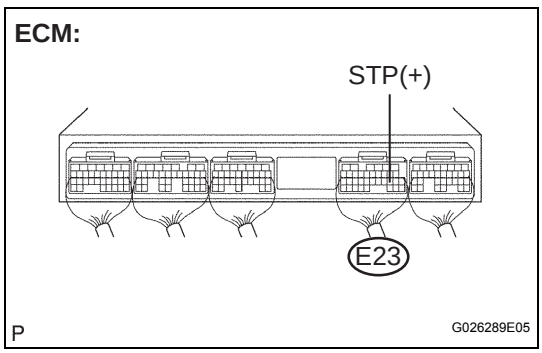
Standard resistance

Switch Position	Tester Connection	Specified Condition
Switch pin free	1 - 2	Below 1 Ω
Switch pin pushed in	↑	10 kΩ or higher
Switch pin free	3 - 4	10 kΩ or higher
Switch pin pushed in	↑	Below 1 Ω

NG → REPLACE STOP LIGHT SWITCH ASSEMBLY

OK

3 CHECK HARNESS AND CONNECTOR (STOP LIGHT SWITCH ASSEMBLY - ECM)



(a) Install the stop light switch assembly.
(b) Measure the voltage according to the value(s) in the table below when the brake pedal is depressed and released.

Standard voltage

Condition	Tester Connection	Specified Condition
Brake pedal is depressed	E23-19 (STP) - Body ground	10 to 14 V
Brake pedal is released		Below 1 V

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM

DTC	P0741	Torque Converter Clutch Solenoid Performance (Shift Solenoid Valve DSL)

SYSTEM DESCRIPTION

The ECM uses the signals from the throttle position sensor, air-flow meter, turbine (input) speed sensor, intermediate (counter) shaft speed sensor and crankshaft position sensor to monitor the engagement condition of the lock-up clutch.
Then the ECM compares the engagement condition of the lock-up clutch with the lock-up schedule in the ECM memory to detect a mechanical problems of the shift solenoid valve DSL, valve body and torque converter clutch.

DTC No.	DTC Detection Condition	Trouble Area
P0741	Lock-up does not occur when driving in lock-up range Lock-up remains ON in lock-up OFF range (2-trip detection logic)	• Shift solenoid valve DSL remains open or closed • Valve body is blocked • Torque converter clutch • Automatic transaxle (clutch, brake or gear etc.) • Line pressure is too low

MONITOR DESCRIPTION

Torque converter lock-up is controlled by the ECM based on the speed sensor (NT), speed sensor (NC), engine rpm, engine load, engine temperature, vehicle speed, transmission temperature, and gear selection. The ECM determines the lock-up status of the torque converter by comparing the engine rpm (NE) to the input turbine rpm (NT). The ECM calculates the actual transmission gear by comparing input turbine rpm (NT) to counter gear rpm (NC). When conditions are appropriate, the ECM requests "lock-up" by applying control voltage to the shift solenoid DSL. When the DSL is turned on, it applies pressure to the lock-up relay valve and locks the torque converter clutch.
If the ECM detects no lock-up after lock-up has been requested or if it detects lock-up when it is not requested, the ECM interprets this as a fault in the shift solenoid valve DSL or lock-up system performance. The ECM will turn on the MIL and store the DTC.
HINT:
Example:
When any of the following is met, the system judges it as a malfunction.

- There is a difference in rotation between the input side (engine speed) and output side (input turbine speed) of the torque converter when the ECM commands lock-up.
  (Engine speed is at least 150 rpm greater than input turbine speed.)
- There is no difference in rotation between the input side (engine speed) and output side (input turbine speed) of the torque converter when the ECM commands lock-up off.
  (The difference between engine speed and input turbine speed is less than 35 rpm.)

INSPECTION PROCEDURE

1. ACTIVE TEST

HINT:
Performing the intelligent tester Active Test allows relay, Vacuum Switching Valve (VSV), actuator and other items to be operated without removing any parts. Performing the Active Test early in troubleshooting is one way to shorten labor time.
The Data List can be displayed during the Active Test.

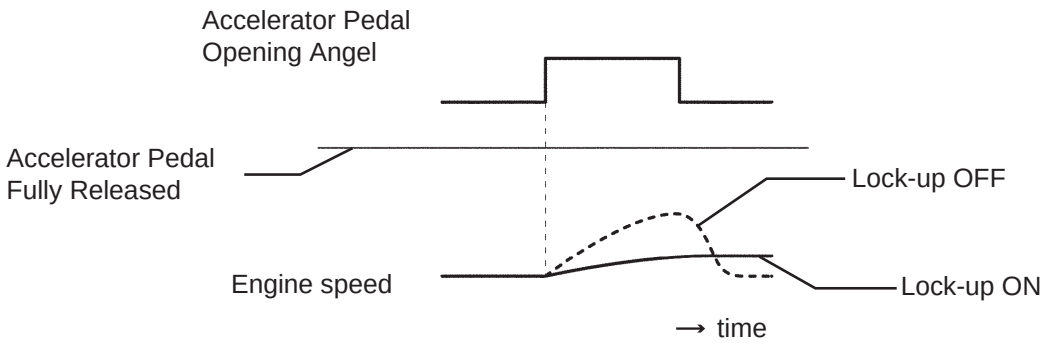
(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester together to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn ON the tester.
(f) Select the item "Enter / Powertrain / Engine and ECT / Active Test".

(g) Follow the instructions on the tester and read the Active Test.

Item	Test Details	Diagnostic Note
Control the Lock Up	[Test Details] Control the shift solenoid DSL to set the automatic transaxle to the lock-up condition. [Vehicle Condition] Vehicle Speed: 58 km/h or more	Possible to check the DSL operation.

HINT:
- This test can be conducted when the vehicle speed is 58 km/h or more.
- This test can be conducted in the 3rd or O/D gear.

(h) Lightly depress the accelerator pedal and check that the engine speed does not change abruptly.
HINT:
- When changing the accelerator pedal opening angle while driving, if the engine speed does not change, lock-up is on.
- Slowly release, but not fully, the accelerator pedal in order to decelerate. (Fully releasing the pedal will close the throttle valve and lock-up may be turned off.)



1	CHECK OTHER DTCS OUTPUT (IN ADDITION TO DTC P0741)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) Turn ON the tester.
(d) Select the item "Powertrain / Engine and ECT / DTC / Current or Pending".
(e) Read the DTCs using the intelligent tester.

Result

Display (DTC output)	Proceed to
Only "P0741" is output	A
"P0741" and other DTCs	B

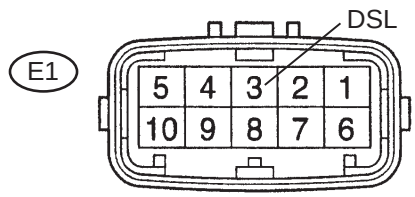
HINT:
If any other codes besides "P0741" are output, perform the troubleshooting for those DTCs first.

B → GO TO DTC CHART (See page AX-29)

A

2 INSPECT TRANSMISSION WIRE (DSL)

Transmission Wire Side (Connector Front View):



(a) Disconnect the transmission wire connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.

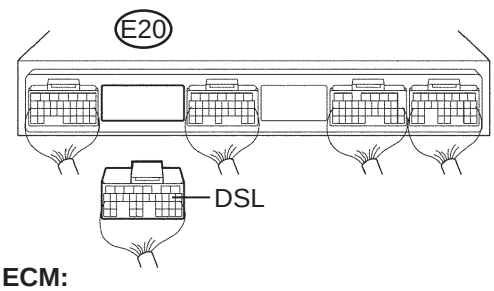
Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
3 - Body ground	11 to 13 Ω

NG → GO TO STEP 4

OK

3 CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)



(a) Connect the transmission wire connector.
(b) Disconnect the ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

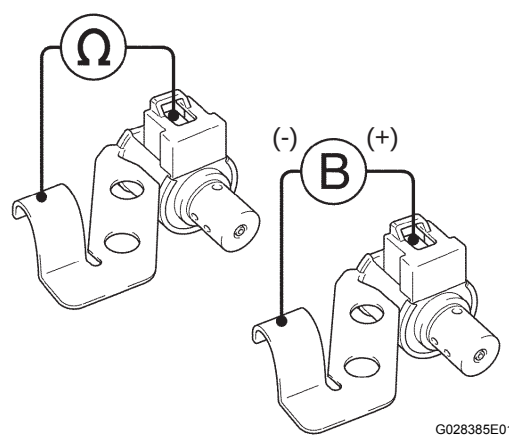
Tester Connection	Specified Condition 20°C (68°F)
E20-9 (DSL) - Body ground	11 to 13 Ω

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

4 INSPECT SHIFT SOLENOID VALVE (DSL)

Shift Solenoid Valve DSL:



(a) Remove the shift solenoid valve DSL.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
Solenoid Connector (DSL) - Solenoid Body (DSL)	11 to 13 Ω

(c) Connect the positive (+) lead to the terminal of the solenoid connector, and the negative (-) lead to the solenoid body.

OK:

The solenoid valve makes an operating sound.

NG → REPLACE SHIFT SOLENOID VALVE (DSL)

OK

5	CHECK TRANSMISSION WIRE

OK:
The connectors and pins are securely installed.
There is no open or short on the wire harness.

NG → REPAIR OR REPLACE TRANSMISSION WIRE

OK

6	INSPECT TRANSMISSION VALVE BODY ASSEMBLY

OK:
There are no foreign objects on each valve and they operate smoothly.

NG → REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY

OK

7	INSPECT TORQUE CONVERTER CLUTCH ASSEMBLY

OK:
The torque converter clutch operates normally.

NG → REPLACE TORQUE CONVERTER CLUTCH ASSEMBLY

OK

REPAIR AUTOMATIC TRANSAXLE ASSEMBLY

DTC	P0746	Pressure Control Solenoid "A" Performance (Shift Solenoid Valve SL1)

SYSTEM DESCRIPTION

The ECM uses signals from the vehicle speed sensor to detect the actual gear position (1st, 2nd, 3rd or 4th gear).
Then the ECM compares the actual gear with the shift schedule in the ECM memory to detect mechanical problems of the shift solenoid valves, valve body or automatic transaxle (clutch, brake or gear etc.).

DTC No.	DTC Detection Condition	Trouble Area
P0746	The gear required by the ECM does not match the actual gear when driving (2-trip detection logic)	• Shift solenoid valve SL1 remains open or closed • Valve body is blocked • Automatic transaxle (clutch, brake or gear etc.)

MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". According to the input shaft revolution, intermediate (counter) shaft revolution and output shaft revolution, the ECM detects the actual gear position (1st, 2nd, 3rd or 4th gear position). When the gear position commanded by the ECM and the actual gear position are not the same, the ECM illuminates the MIL.
HINT:
Example:
When either condition (a) or (b) is met, the ECM detects a malfunction.
(a) The ECM commands the 1st gear, but the actual gear is 2nd.
(b) The ECM commands the 2nd gear, but the actual gear is 1st.

INSPECTION PROCEDURE

1. ACTIVE TEST

HINT:
Performing the intelligent tester Active Test allows relay, Vacuum Switching Valve (VSV), actuator and other items to be operated without removing any parts. Performing the Active Test early in troubleshooting is one way to shorten labor time.
The Data List can be displayed during the Active Test.

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn ON the tester.
(f) Select the item "Enter / Powertrain / Engine and ECT / Active Test".
(g) Follow the instructions on the tester and read the Active Test.
HINT:
While driving, the shift position can be forcibly changed with the intelligent tester.
Comparing the shift position commanded by the ACTIVE TEST with the actual shift position enables you to confirm the problem (See page **AX-25**).

Item	Test Details	Diagnostic Note
Control the Shift Position	[Test Details] Operate the shift solenoid valve and set each shift position by yourself. [Vehicle Condition] Less than 50 km/h [Others] • Press "←" button: Shift up • Press "→" button: Shift down	Possible to check the operation of the shift solenoid valves.

HINT:
• This test can be conducted when the vehicle speed is 50 km/h or less.

- The shift position commanded by the ECM is shown in the DATA LIST (Shift Status) display on the intelligent tester.

1	CHECK OTHER DTCS OUTPUT (IN ADDITION TO DTC P0746)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) Turn ON the tester.
(d) Select the item "Powertrain / Engine and ECT / DTC / Current or Pending".
(e) Read the DTCs using the intelligent tester.

Result

Display (DTC output)	Proceed to
Only "P0746" is output	A
"P0746" and other DTCs	B

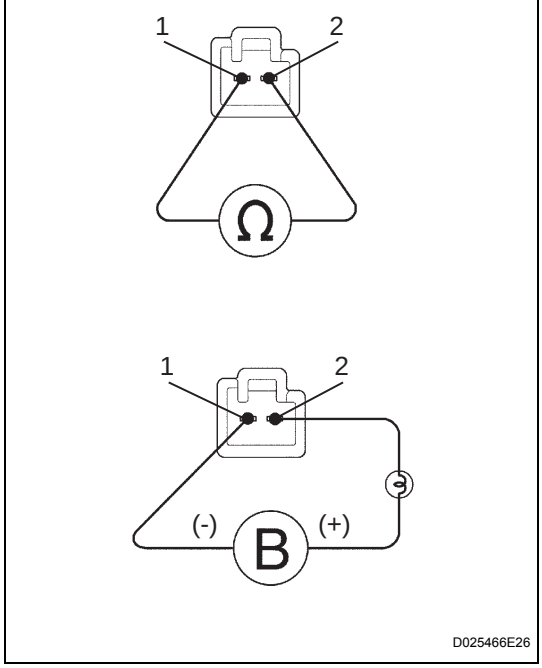
HINT:
If any other codes besides "P0746" are output, perform the troubleshooting for those DTCs first.

B → **GO TO DTC CHART (See page AX-29)**

A

2	INSPECT SHIFT SOLENOID VALVE SL1

Shift Solenoid Valve SL1:



(a) Remove the shift solenoid valve SL1.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
1 - 2	5.0 to 5.6 Ω

(c) Connect the positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector, then check the movement of the valve.

OK:
The solenoid makes an operating sound.

NG → **REPLACE SHIFT SOLENOID VALVE SL1**

OK

3	INSPECT TRANSMISSION VALVE BODY ASSEMBLY

OK:
There are no foreign objects on each valve and they operate smoothly.

NG → REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY

OK

4	INSPECT TORQUE CONVERTER CLUTCH ASSEMBLY

OK:
The torque converter clutch operates normally.

NG → REPLACE TORQUE CONVERTER CLUTCH ASSEMBLY

OK

REPAIR OR REPLACE AUTOMATIC TRANSAXLE ASSEMBLY

DTC	P0748	Pressure Control Solenoid "A" Electrical (Shift Solenoid Valve SL1)

DESCRIPTION

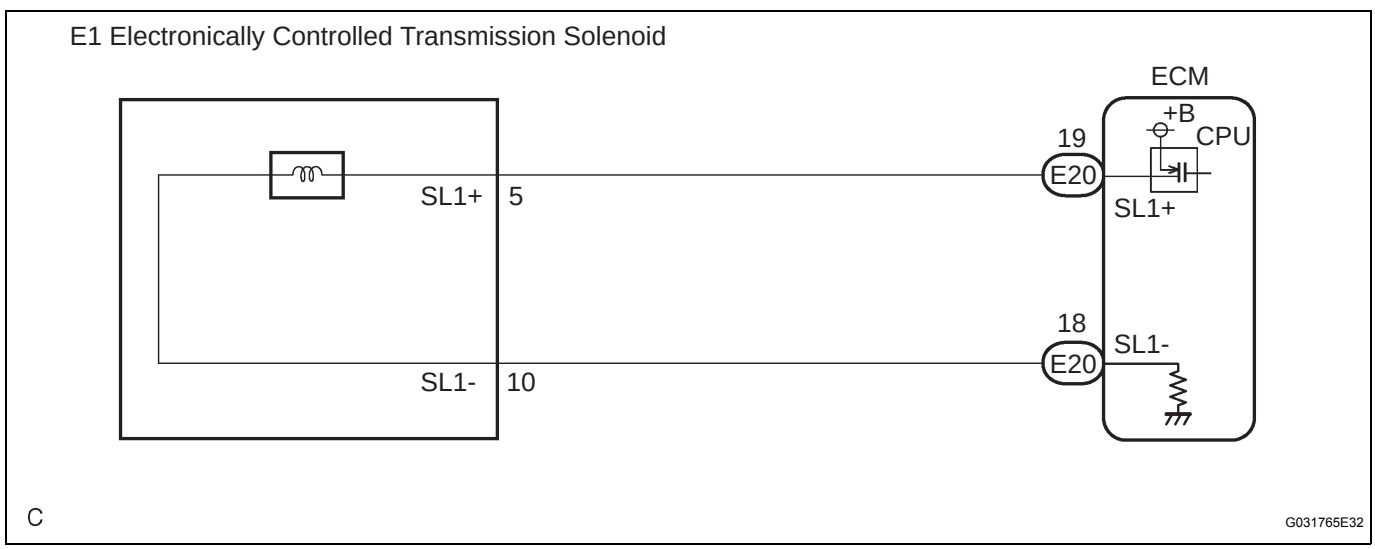
Shifting from 1st to O/D is performed in combination with "ON" and "OFF" operation of the shift solenoid valves SL1 and SL2 which is controlled by the ECM. If an open or short circuit occurs in either of the shift solenoid valves, the ECM controls the remaining normal shift solenoid valve to allow the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

DTC No.	DTC Detection Condition	Trouble Area
P0748	The ECM checks for an open or short in the shift solenoid valve SL1 circuit while driving and shift gears. (1-trip detection logic) • Output signal duty equals to 100 %. (NOTE: SL1 output signal duty is less than 100 % under normal condition.)	• Open or short in shift solenoid valve SL1 circuit • Shift solenoid valve SL1 • ECM

MONITOR DESCRIPTION

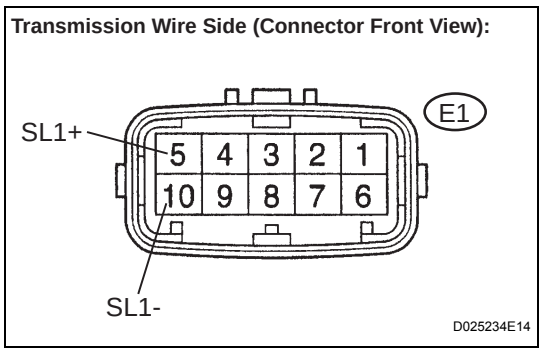
The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". When there is an open or short circuit in any shift solenoid valve circuit, the ECM detects the problem and illuminates the MIL and stores the DTC. And the ECM performs the fail-safe function and turns the other normal shift solenoid valves "ON/OFF" (In case of an open or short circuit, the ECM stops sending current to the circuit.)
(See page AX-25).

WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT TRANSMISSION WIRE (SL1)



(a) Disconnect the transmission wire connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.
Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
5 (SL1+) - 10 (SL1-)	5.0 to 5.6 Ω

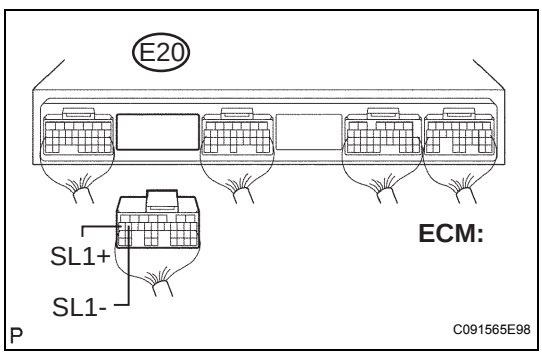
(c) Measure the resistance according to the value(s) in the table below.
Standard resistance (Check for short)

Tester Connection	Specified Condition
SL1+ - Body ground	10 kΩ or higher
SL1- - Body ground	↑

NG → GO TO STEP 3

OK

2 CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)



(a) Connect the transmission connector to the transaxle.
(b) Disconnect the connector from the ECM.
(c) Measure the resistance according to the value(s) in the table below.
Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
E20-19 (SL1+) - E20-18 (SL1-)	5.0 to 5.6 Ω

(d) Measure the resistance according to the value(s) in the table below.
Standard resistance (Check for short)

Tester Connection	Specified Condition
E20-19 (SL1+) - Body ground	10 kΩ or higher
E20-18 (SL1-) - Body ground	

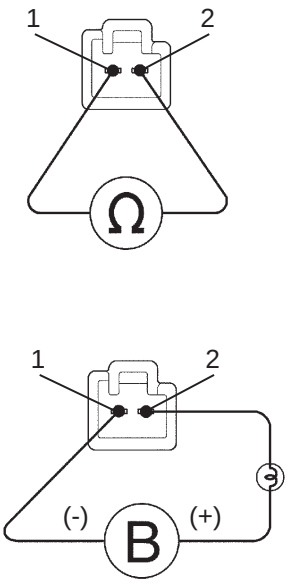
NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM

3	INSPECT SHIFT SOLENOID VALVE SL1

Shift Solenoid Valve SL1:



D025466E26

(a) Remove the shift solenoid valve SL1.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
1 - 2	5.0 to 5.6 Ω

(c) Connect the positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector, then check the movement of the valve.

OK:

The solenoid makes an operating sound.

NG → **REPLACE SHIFT SOLENOID VALVE SL1**

OK

REPAIR OR REPLACE TRANSMISSION WIRE

DTC	P0766	Shift Solenoid "D" Performance (Shift Solenoid Valve S4)

SYSTEM DESCRIPTION

The ECM uses signals from the vehicle speed sensor to detect the actual gear position (1st, 2nd, 3rd or 4th (O/D) gear).
Then the ECM compares the actual gear with the shift schedule in the ECM memory to detect mechanical problems of the shift solenoid valves, valve body or automatic transaxle (clutch, brake or gear etc.).

DTC No.	DTC Detection Condition	Trouble Area
P0766	The gear required by the ECM does not match the actual gear when driving (2-trip detection logic)	• Shift solenoid valve S4 remains open or closed • Valve body is blocked • Automatic transaxle (clutch, brake or gear etc.)

MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". According to the input shaft revolution, intermediate (counter) shaft revolution and output shaft revolution, the ECM detects the actual gear position (1st, 2nd, 3rd or 4th (O/D) gear position). When the gear position commanded by the ECM and the actual gear position are not the same, the ECM illuminates the MIL and stores the DTC.

INSPECTION PROCEDURE

1. ACTIVE TEST

HINT:
Performing the intelligent tester Active Test allows relay, Vacuum Switching Valve (VSV), actuator and other items to be operated without removing any parts. Performing the Active Test early in troubleshooting is one way to shorten labour time.
The Data List can be displayed during the Active Test.

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn ON the tester.
(f) Select the item "Enter / Powertrain / Engine and ECT / Active Test".
(g) Follow the instructions on the tester and read the Active Test.
HINT:
While driving, the shift position can be forcibly changed with the intelligent tester.
Comparing the shift position commanded by the ACTIVE TEST with the actual shift position enables you to confirm the problem (See page **AX-25**).

Item	Test Details	Diagnostic Note
Control the Shift Position	[Test Details] Operate the shift solenoid valve and set each shift position by yourself. [Vehicle Condition] Less than 50 km/h [Others] • Press "→" button: Shift up • Press "←" button: Shift down	Possible to check the operation of the shift solenoid valves.

HINT:
- This test can be conducted when the vehicle speed is 50 km/h or less.
- The shift position commanded by the ECM is shown in the DATA LIST (Shift Status) display on the intelligent tester.

1	CHECK OTHER DTCS OUTPUT (IN ADDITION TO DTC P0766)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) Turn ON the tester.
(d) Select the item "Powertrain / Engine and ECT / DTC / Current or Pending".
(e) Read the DTCs using the intelligent tester.

Result

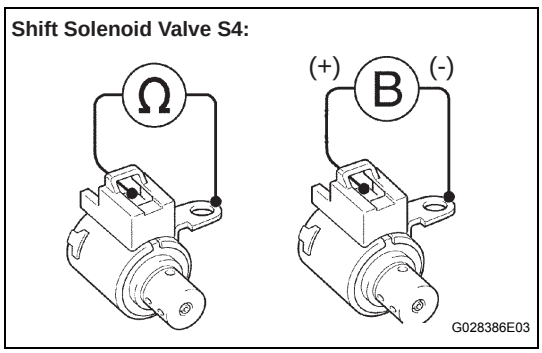
Display (DTC output)	Proceed to
Only "P0766" is output	A
"P0766" and other DTCs	B

HINT:
If any other codes besides "P0766" are output, perform the troubleshooting for those DTCs first.

B → **GO TO DTC CHART (See page AX-29)**

A

2	INSPECT SHIFT SOLENOID VALVE S4



(a) Remove the shift solenoid valve S4.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
Solenoid Connector (S4) - Solenoid Body (S4)	11 to 15 Ω

(c) Connect the positive (+) lead to the terminal of the solenoid connector, and the negative (-) lead to the solenoid body.

OK:
The solenoid makes an operating sound.

NG → **REPLACE SHIFT SOLENOID VALVE S4**

OK

3	INSPECT TRANSMISSION VALVE BODY ASSEMBLY

OK:
There are no foreign objects on each valve and they operate smoothly.

NG → **REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY**

OK

4	INSPECT TORQUE CONVERTER CLUTCH ASSEMBLY

OK:
The torque converter clutch operates normally.

NG → REPLACE TORQUE CONVERTER CLUTCH ASSEMBLY

OK

REPAIR OR REPLACE AUTOMATIC TRANSAXLE ASSEMBLY

DTC	P0776	Pressure Control Solenoid "B" Performance (Shift Solenoid Valve SL2)

SYSTEM DESCRIPTION

The ECM uses signals from the vehicle speed sensor to detect the actual gear position (1st, 2nd, 3rd or 4th (O/D) gear).
Then the ECM compares the actual gear with the shift schedule in the ECM memory to detect mechanical problems of the shift solenoid valves, valve body or automatic transaxle (clutch, brake or gear etc.).

DTC No.	DTC Detection Condition	Trouble Area
P0776	The gear required by the ECM does not match the actual gear when driving (2-trip detection logic)	• Shift solenoid valve SL2 remains open or closed • Valve body is blocked • Automatic transaxle (clutch, brake or gear etc.)

MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". According to the input shaft revolution, intermediate (counter) shaft revolution and output shaft revolution, the ECM detects the actual gear position (1st, 2nd, 3rd or 4th (O/D) gear position). When the gear position commanded by the ECM and the actual gear position are not the same, the ECM illuminates the MIL and stores the DTC.

INSPECTION PROCEDURE

1. ACTIVE TEST

HINT:
Performing the intelligent tester Active Test allows relay, Vacuum Switching Valve (VSV), actuator and other items to be operated without removing any parts. Performing the Active Test early in troubleshooting is one way to shorten labour time.
The Data List can be displayed during the Active Test.

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn ON the tester.
(f) Select the item "Enter / Powertrain / Engine and ECT / Active Test".
(g) Follow the instructions on the tester and read the Active Test.
HINT:
While driving, the shift position can be forcibly changed with the intelligent tester.
Comparing the shift position commanded by the ACTIVE TEST with the actual shift position enables you to confirm the problem (See page **AX-25**).

Item	Test Details	Diagnostic Note
Control the Shift Position	[Test Details] Operate the shift solenoid valve and set each shift position by yourself. [Vehicle Condition] Less than 50 km/h [Others] • Press "→" button: Shift up • Press "←" button: Shift down	Possible to check the operation of the shift solenoid valves.

HINT:
- This test can be conducted when the vehicle speed is 50 km/h or less.
- The shift position commanded by the ECM is shown in the DATA LIST (Shift Status) display on the intelligent tester.

1	CHECK OTHER DTCS OUTPUT (IN ADDITION TO DTC P0776)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) Turn ON the tester.
(d) Select the item "Powertrain / Engine and ECT / DTC / Current or Pending".
(e) Read the DTCs using the intelligent tester.

Result

Display (DTC output)	Proceed to
Only "P0776" is output	A
"P0776" and other DTCs	B

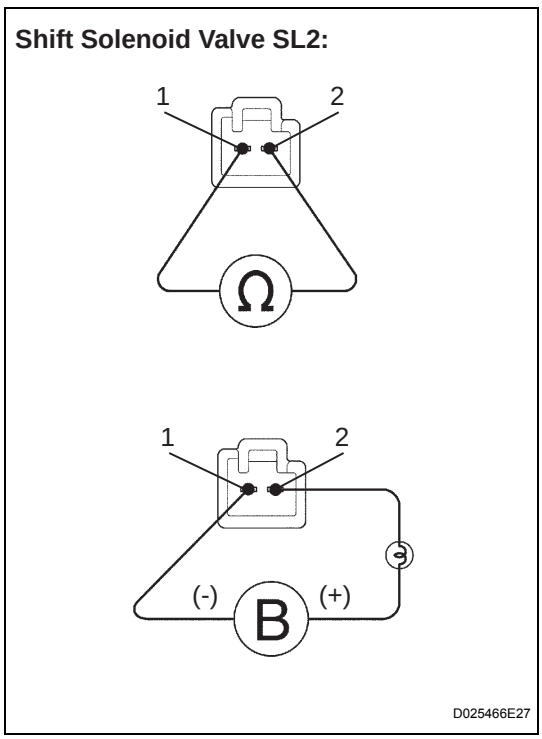
HINT:
If any other codes besides "P0776" are output, perform the troubleshooting for those DTCs first.

B → **GO TO DTC CHART (See page AX-29)**

A

2	INSPECT SHIFT SOLENOID VALVE SL2

Shift Solenoid Valve SL2:



(a) Remove the shift solenoid valve SL2.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
1 - 2	5.0 to 5.6 Ω

(c) Connect the positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector, then check the movement of the valve.

OK:
The solenoid makes an operating sound.

NG → **REPLACE SHIFT SOLENOID VALVE SL2**

OK

3	INSPECT TRANSMISSION VALVE BODY ASSEMBLY

OK:
There are no foreign objects on each valve and they operate smoothly.

NG → REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY

OK

4	INSPECT TORQUE CONVERTER CLUTCH ASSEMBLY

OK:
The torque converter clutch operates normally.

NG → REPLACE TORQUE CONVERTER CLUTCH ASSEMBLY

OK

REPAIR OR REPLACE AUTOMATIC TRANSAXLE ASSEMBLY

DTC	P0778	Pressure Control Solenoid "B" Electrical (Shift Solenoid Valve SL2)

DESCRIPTION

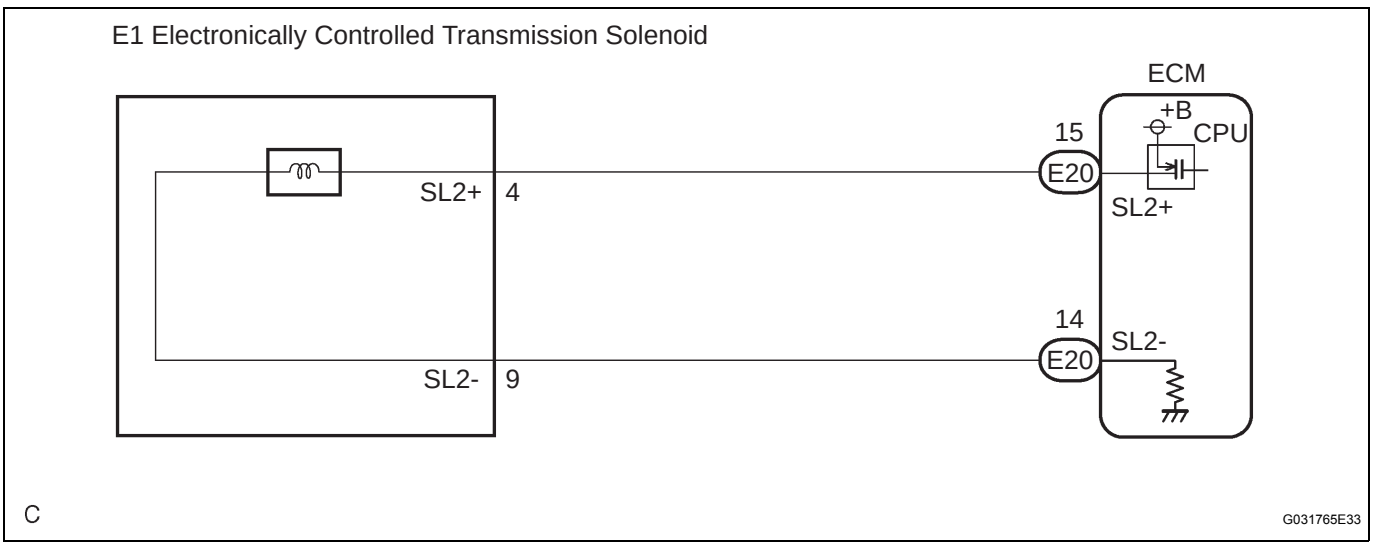
Shifting from 1st to O/D is performed in combination with "ON" and "OFF" operation of the shift solenoid valves SL1 and SL2 which is controlled by the ECM. If an open or short circuit occurs in either of the shift solenoid valves, the ECM controls the remaining normal shift solenoid valve to allow the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

DTC No.	DTC Detection Condition	Trouble Area
P0778	ECM checks for an open or short circuit in shift solenoid valves SL2 (1-trip detection logic) Hybrid IC for solenoid indicates fail.	• Open or short in shift solenoid valve SL2 circuit • Shift solenoid valve SL2 • ECM

MONITOR DESCRIPTION

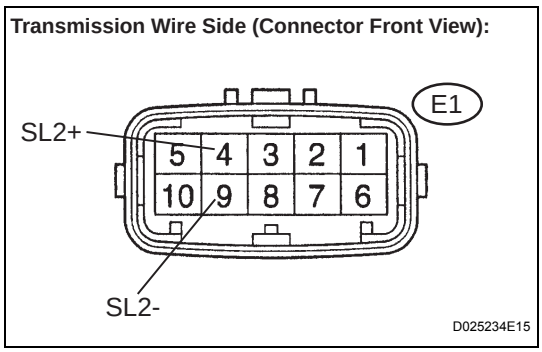
The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". When there is an open or short circuit in any shift solenoid valve circuit, the ECM detects the problem and illuminates the MIL and stores the DTC. And the ECM performs the fail-safe function and turns the other normal shift solenoid valves "ON/OFF" (In case of an open or short circuit, the ECM stops sending current to the circuit.)
(See page **AX-25**).

WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT TRANSMISSION WIRE (SL2)



(a) Disconnect the transmission wire connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
4 (SL2+) - 9 (SL2-)	5.0 to 5.6 Ω

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

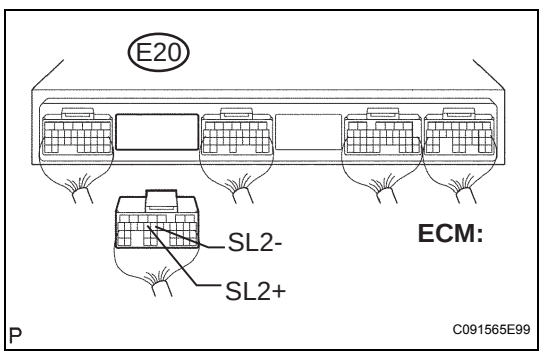
Standard resistance (Check for short)

Tester Connection	Specified Condition
4 (SL2+) - Body ground	10 kΩ or higher
9 (SL2-) - Body ground	↑

NG → GO TO STEP 3

OK

2 CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)



(a) Connect the transmission connector to the transaxle.
(b) Disconnect the connector from the ECM.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
E20-15 (SL2+) - E20-14 (SL2-)	5.0 to 5.6 Ω

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

Standard resistance (Check for short)

Tester Connection	Specified Condition
E20-15 (SL2+) - Body ground	10 kΩ or higher
E20-14 (SL2-) - Body ground	

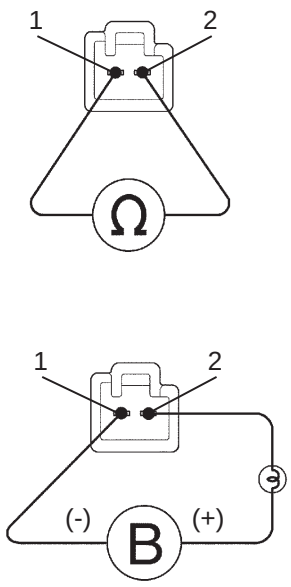
NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM

3	INSPECT SHIFT SOLENOID VALVE SL2

Shift Solenoid Valve SL2:



D025466E27

(a) Remove the shift solenoid valve SL2.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
1 - 2	5.0 to 5.6 Ω

(c) Connect the positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector, then check the movement of the valve.

OK:

The solenoid makes an operating sound.

NG → **REPLACE SHIFT SOLENOID VALVE SL2**

OK

REPAIR OR REPLACE TRANSMISSION WIRE

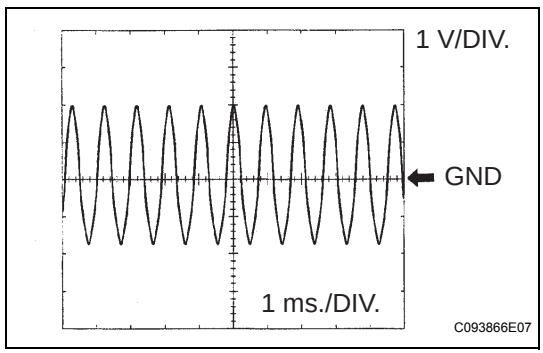
DTC	P0793	Intermediate Shaft Speed Sensor "A"

DESCRIPTION

This sensor detects the rotation speed of the counter gear. By comparing the counter gear speed signal (NC) with the direct clutch speed sensor signal (NT), the ECM detects the shift timing of the gears and appropriately controls the engine torque and hydraulic pressure according to various conditions. Thus smooth gear shifting is performed.

DTC No.	DTC Detection Condition	Trouble Area
P0793	ECM detects conditions (a), (b) and (c) continuously for 5 sec. or more: (1-trip detection logic) (a) Vehicle speed: 50 km/h or more (b) Park/neutral position switch (NSW) is OFF (c) Speed sensor (NC): less than 300 rpm	• Open or short in transmission revolution sensor NC (speed sensor NC) circuit • Transmission revolution sensor NC (speed sensor NC) • ECM

Reference (Using an oscilloscope):
Check the waveform between terminals NC+ and NC- of the ECM connector.



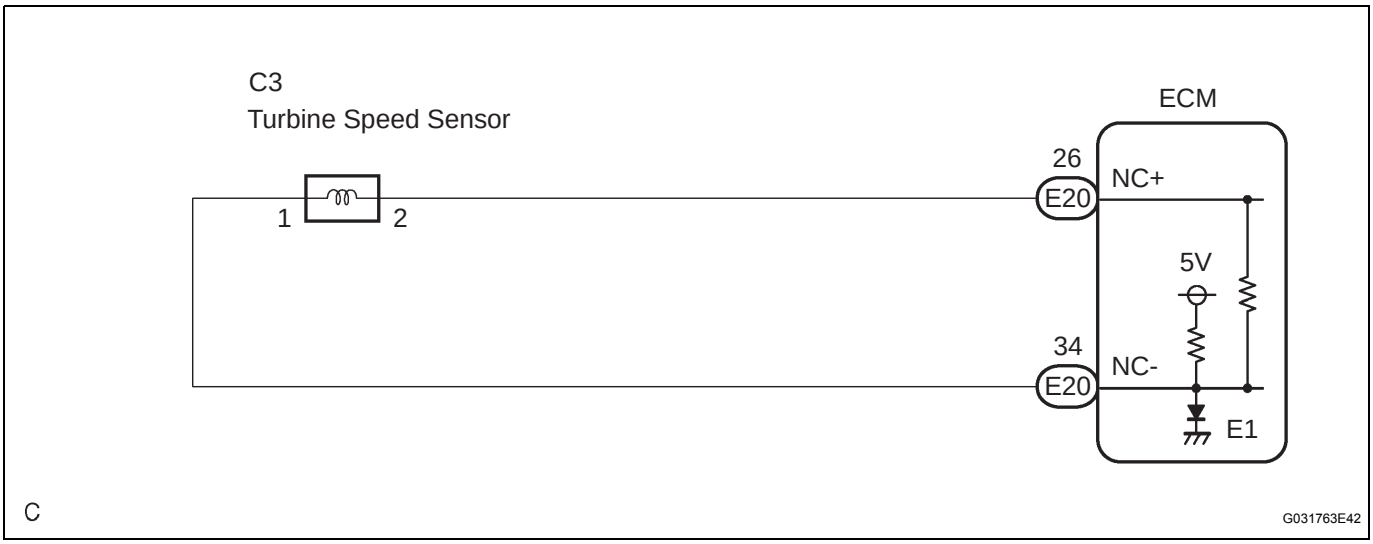
Standard: Refer to the illustration.

Terminal	**NC+ - NC-**
Tool setting	**1 V/DIV., 1ms./DIV.**
Vehicle condition	**Vehicle speed 30 km/h: (3rd gear)** **Engine speed 1,400 rpm**

MONITOR DESCRIPTION

The NC terminal of the ECM detects a revolution signal from the speed sensor (NC) (counter gear rpm). The ECM calculates a gearshift comparing the speed sensor (NT) with the speed sensor (NC).
While the vehicle is operating in 2nd, 3rd or 4th (O/D) gear in the shift position of D, if the counter gear revolution is less than 300 rpm *1 although the output shaft revolution is more than 1,000 rpm *2, the ECM detects the trouble, illuminates the MIL and stores the DTC.
*1: Pulse is not output or is irregularly output.
*2: The vehicle speed is 50 km/h or more.

WIRING DIAGRAM



INSPECTION PROCEDURE

1. DATA LIST

HINT:

Using the intelligent tester Data List allows switch, sensor, actuator and other item values to be read without removing any parts. Reading the Data List early in troubleshooting is one way to shorten labor 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.

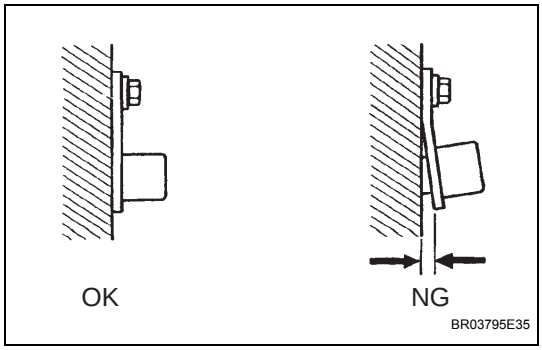
(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn ON the tester.
(f) Select the item "Enter / Powertrain / ECT / Data List".
(g) Follow the instructions on the tester and read the Data List.

Item	Measurement Item/ Range (display)	Normal Condition
SPD (NC)	Counter Gear Speed/ display: 50 r/min	[HINT] 4th when shift lever position is D position (After warming up the engine); • Intermediate shaft speed (NC) becomes close to the engine speed.

HINT:

- SPD (NC) is always 0 while driving:
  Open or short in the sensor or circuit.
- SPD (NC) is always more than 0 and less than 300 rpm while driving the vehicle at 50 km/h or more:
  Sensor trouble, improper installation, or intermittent connection trouble of the circuit.

1 INSPECT SPEED SENSOR INSTALLATION



(a) Check the speed sensor installation.
OK:
The installation bolt is tightened properly and there is no clearance between the sensor and transaxle case.

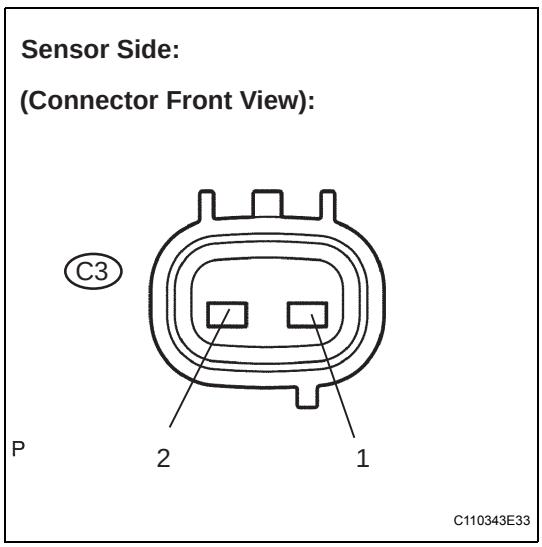
NG → **REPLACE SPEED SENSOR (NC)**

OK

2 INSPECT SPEED SENSOR (NC)

Sensor Side:

(Connector Front View):



(a) Disconnect the speed sensor connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.
Standard resistance:
TOYOTA made

Tester Connection	Specified Condition 20 °C (68 °F)
1 - 2	500 to 620 Ω

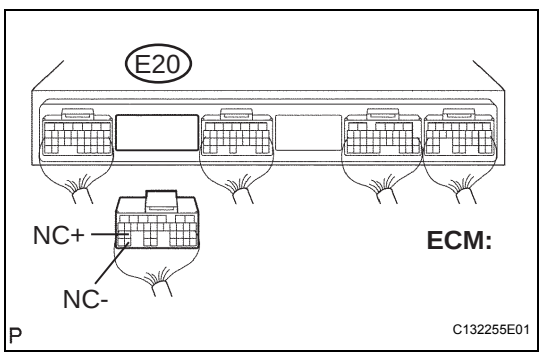
AISIN made

Tester Connection	Specified Condition 20 °C (68 °F)
1 - 2	560 to 680 Ω

NG → **REPLACE SPEED SENSOR (NC)**

OK

3 CHECK HARNESS AND CONNECTOR (SPEED SENSOR - ECM)



(a) Connect the speed sensor connector.
(b) Disconnect the ECM connector.
(c) Measure the resistance according to the value(s) in the table below.
Standard resistance:
TOYOTA made

Tester Connection	Specified Condition 20 °C (68 °F)
E20-26 (NC+) - E20-34 (NC-)	500 to 620 Ω

AISIN made

Tester Connection	Specified Condition 20 °C (68 °F)
E20-26 (NC+) - E20-34 (NC-)	560 to 680 Ω

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

Standard resistance (Check for short)

Tester Connection	Specified Condition
E20-26 (NC+) - Body ground	10 kΩ or higher
E20-34 (NC-) - Body ground	

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

OK

REPLACE ECM

DTC	P0982	Shift Solenoid "D" Control Circuit Low (Shift Solenoid Valve S4)

DTC	P0983	Shift Solenoid "D" Control Circuit High (Shift Solenoid Valve S4)

DESCRIPTION

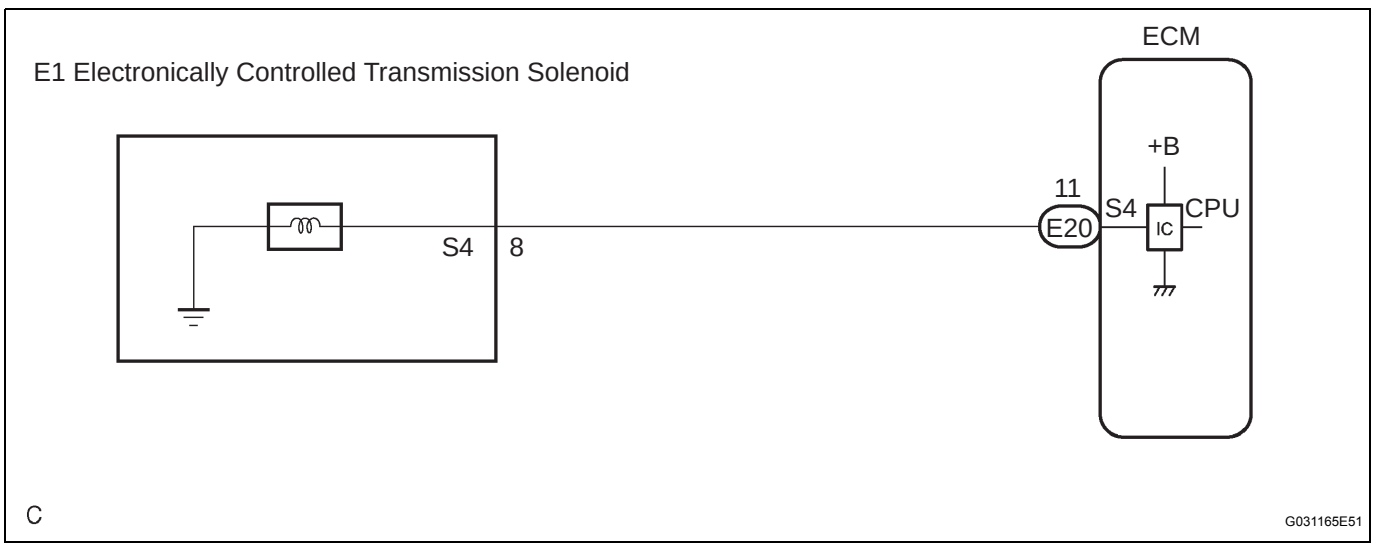
Shifting from 1st to O/D is performed in combination with "ON" and "OFF" operation of the shift solenoid valves SL1 and SL2 which is controlled by the ECM. If an open or short circuit occurs in either of the shift solenoid valves, the ECM controls the remaining normal shift solenoid valve to allow the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

DTC No.	DTC Detection Condition	Trouble Area
P0982	ECM detects short in solenoid valve S4 circuit 2 times when solenoid valve S4 is operated (1-trip detection logic)	• Short in shift solenoid valve S4 circuit • Shift solenoid valve S4 • ECM
P0983	ECM detects open in solenoid valve S4 circuit 2 times when solenoid valve S4 is not operated (1-trip detection logic)	• Open in shift solenoid valve S4 circuit • Shift solenoid valve S4 • ECM

MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". When there is an open or short circuit in any shift solenoid valve circuit, the ECM detects the problem and illuminates the MIL and stores the DTC. And the ECM performs the fail-safe function and turns the other normal shift solenoid valves "ON/OFF" (In case of an open or short circuit, the ECM stops sending current to the circuit.)
(See page AX-25).

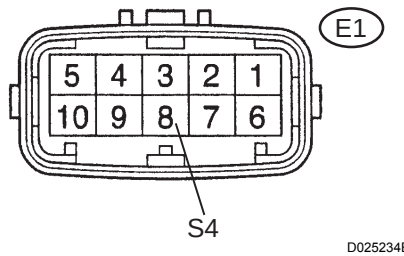
WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT TRANSMISSION WIRE (S4)

Transmission Wire Side (Connector Front View):



(a) Disconnect the transmission wire connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.

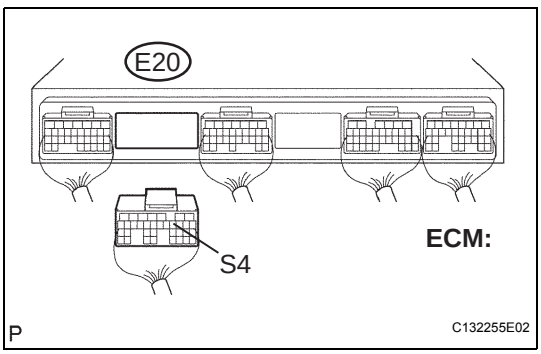
Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
8 - Body ground	11 to 15 Ω

NG → **GO TO STEP 3**

OK

2 CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)



(a) Connect the transmission connector to the transaxle.
(b) Disconnect the connector from the ECM.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
E20-11 (S4) - Body ground	11 to 15 Ω

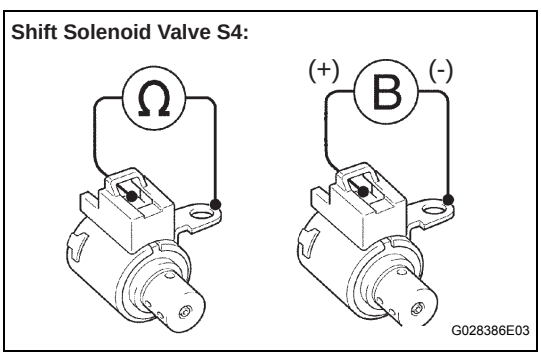
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM

3 INSPECT SHIFT SOLENOID VALVE S4

Shift Solenoid Valve S4:



(a) Remove the shift solenoid valve S4.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
Solenoid Connector (S4) - Solenoid Body (S4)	11 to 15 Ω

(c) Connect the positive (+) lead to the terminal of the solenoid connector, and the negative (-) lead to the solenoid body.

OK:

The solenoid makes an operating sound.

NG → REPLACE SHIFT SOLENOID VALVE S4

OK

REPAIR OR REPLACE TRANSMISSION WIRE

DTC	P2716	Pressure Control Solenoid "D" Electrical (Shift Solenoid Valve SLT)

DESCRIPTION

The linear solenoid valve (SLT) controls the transmission line pressure for smooth transmission operation based on signals from the throttle position sensor and the vehicle speed sensor. The ECM adjusts the duty cycle of the SLT solenoid valve to control hydraulic line pressure coming from the primary regulator valve. Appropriate line pressure assures smooth shifting with varying engine outputs.

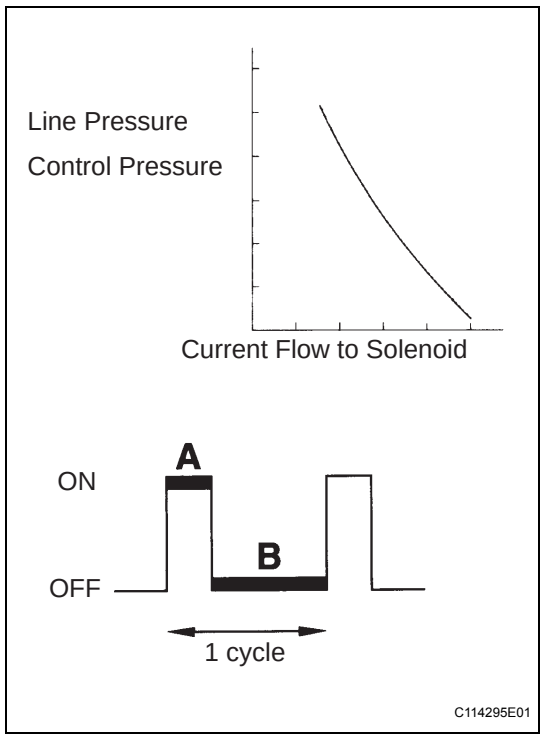
(*): Duty Ratio

The duty ratio is the ratio of the period of continuity in one cycle.

For example, if A is the period of continuity in one cycle, and B is the period of non-continuity, then

Duty Ratio = A/(A + B) x 100(%)

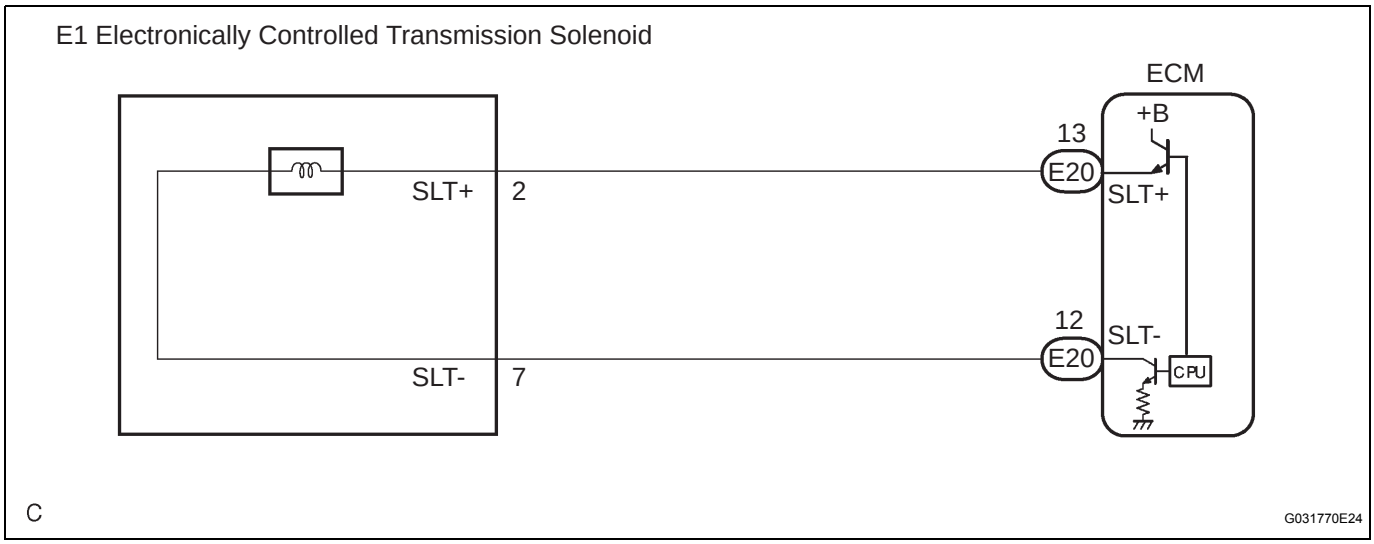
DTC No.	DTC Detection Condition	Trouble Area
P2716	Open or short is detected in shift solenoid valve SLT circuit for 1 second or more while driving (1-trip detecting logic).	• Open or short in shift solenoid valve SLT circuit • Shift solenoid valve SLT • ECM



MONITOR DESCRIPTION

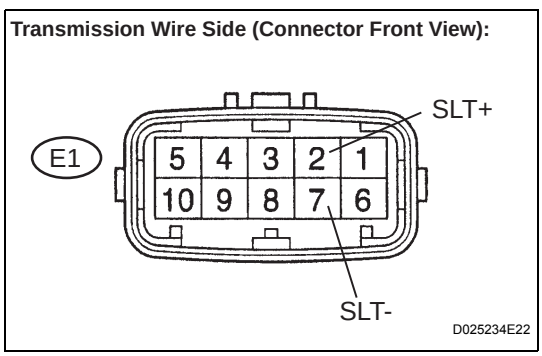
When an open or short circuit in the linear solenoid valve (SLT) circuit is detected, the ECM interprets this as a fault. The ECM will turn on the MIL and store the DTC.

WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT TRANSMISSION WIRE (SLT)



(a) Disconnect the transmission wire connector from the transaxle.

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

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
2 (SLT+) - 7 (SLT-)	5.0 to 5.6 Ω

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

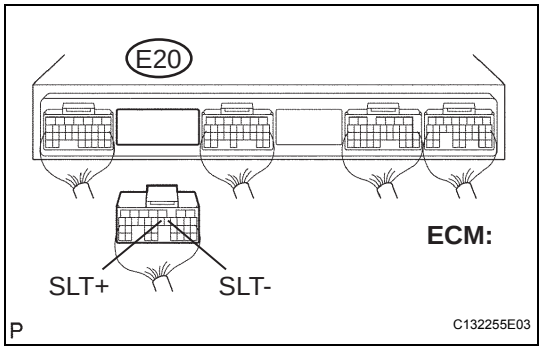
Standard resistance (Check for short)

Tester Connection	Specified Condition
2 (SLT+) - Body ground	10 kΩ or higher
7 (SLT-) - Body ground	↑

NG → **GO TO STEP 3**

OK

2 CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)



(a) Connect the transmission wire connector to the transaxle.
(b) Disconnect the ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
E20-13 (SLT+) - E20-12 (SLT-)	5.0 to 5.6 Ω

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

Standard resistance (Check for short)

Tester Connection	Specified Condition
E20-13 (SLT+) - Body ground	10 kΩ or higher
E20-12 (SLT-) - Body ground	

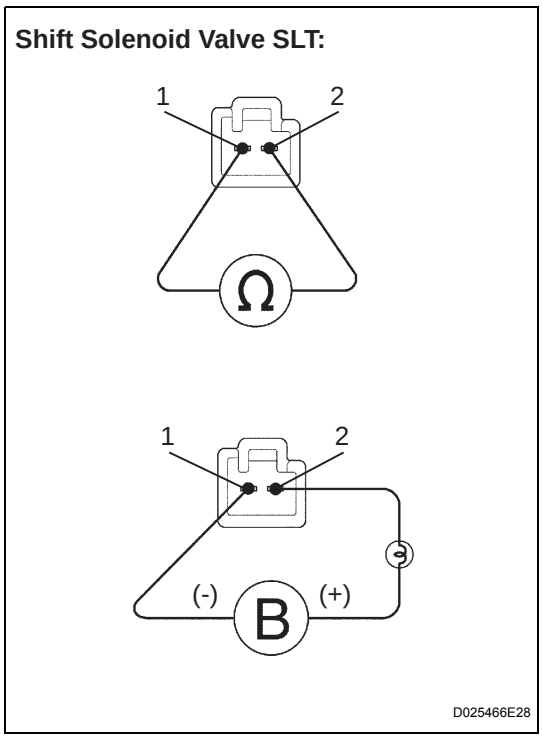
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK →

REPLACE ECM

3 INSPECT SHIFT SOLENOID VALVE SLT

Shift Solenoid Valve SLT:



(a) Remove the shift solenoid valve (SLT).
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
1 - 2	5.0 to 5.6 Ω

(c) Connect the positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector, then check the movement of the valve.

OK:

The solenoid makes an operating sound.

NG → **REPLACE SHIFT SOLENOID VALVE SLT**

OK

REPAIR OR REPLACE TRANSMISSION WIRE

DTC	P2769	Torque Converter Clutch Solenoid Circuit Low (Shift Solenoid Valve DSL)

DTC	P2770	Torque Converter Clutch Solenoid Circuit High (Shift Solenoid Valve DSL)

DESCRIPTION

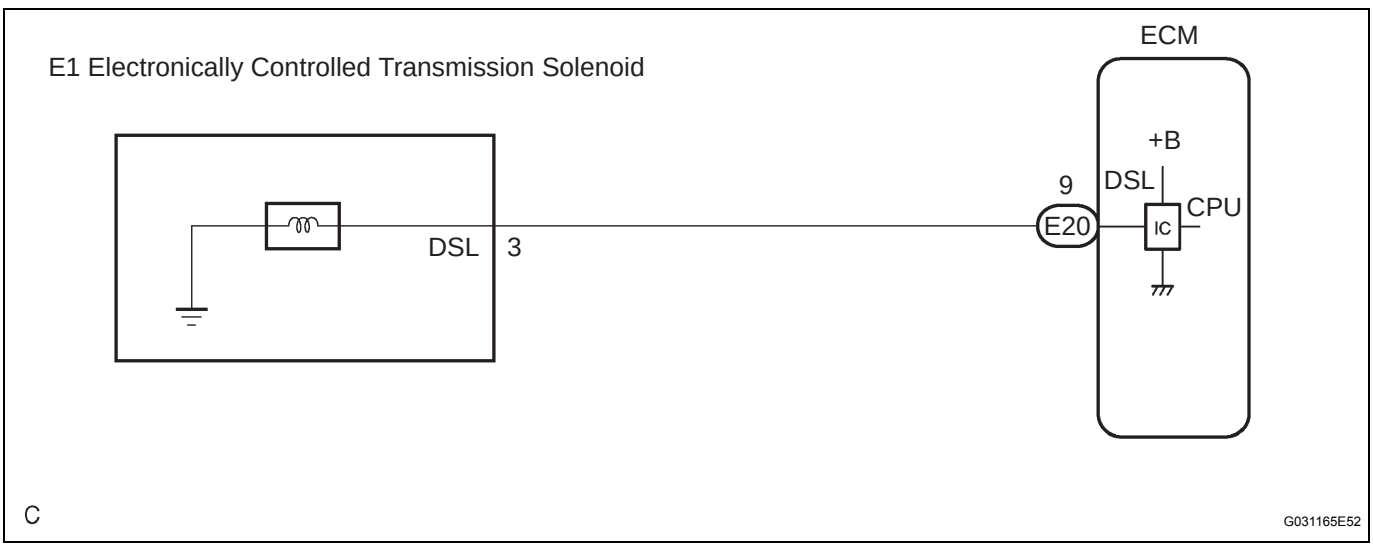
The shift solenoid valve DSL is turned "ON" and "OFF" by signals from the ECM in order to control the hydraulic pressure operation, the lock-up relay valve, which then controls operation of the lock-up clutch.

DTC No.	DTC Detection Condition	Trouble Area
P2769	ECM detects short in solenoid valve DSL circuit (0.1 sec.) when solenoid valve DSL is operated (2-trip detection logic)	• Short in shift solenoid valve DSL circuit • Shift solenoid valve DSL • ECM
P2770	ECM detects open in solenoid valve DSL circuit (0.1 sec.) when solenoid valve DSL is not operated (2-trip detection logic)	• Open in shift solenoid valve DSL circuit • Shift solenoid valve DSL • ECM

MONITOR DESCRIPTION

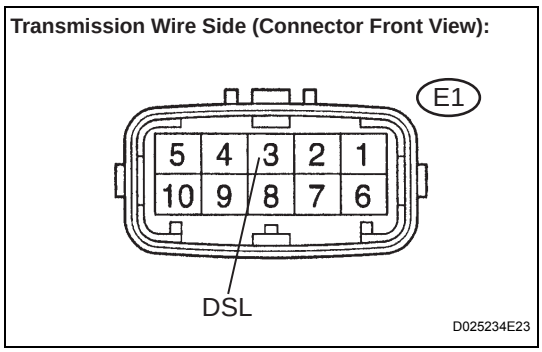
Torque converter lock-up is controlled by the ECM based on engine rpm, engine load, engine temperature, vehicle speed, transmission temperature, and shift range selection. The ECM determines the lock-up status of the torque converter by comparing the engine rpm (NE) to the input turbine rpm (NT). The ECM calculates the actual transmission gear by comparing input turbine rpm (NT) to counter gear rpm (NC). When conditions are appropriate, the ECM requests "lock-up" by applying control voltage to the shift solenoid DSL. When the DSL is opened, it applies pressure to the lock-up relay valve and locks the torque converter clutch. If the ECM detects an open or short in the DSL solenoid circuit, the ECM interprets this as a fault in the DSL solenoid or circuit. The ECM will turn on the MIL and store the DTC.

WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT TRANSMISSION WIRE (DSL)



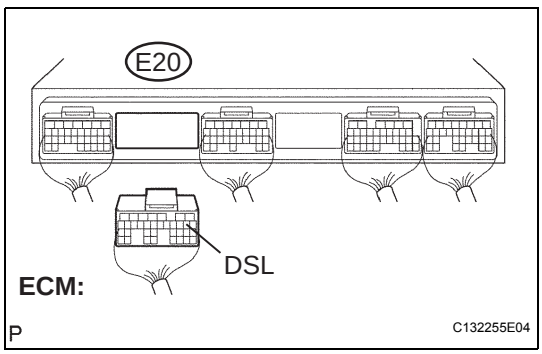
(a) Disconnect the transmission wire connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.
Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
3 - Body ground	11 to 13 Ω

NG → **GO TO STEP 3**

OK

2 CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)



(a) Connect the transmission wire connector.
(b) Disconnect the ECM connector.
(c) Measure the resistance according to the value(s) in the table below.
Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
E20-9 (DSL) - Body ground	11 to 13 Ω

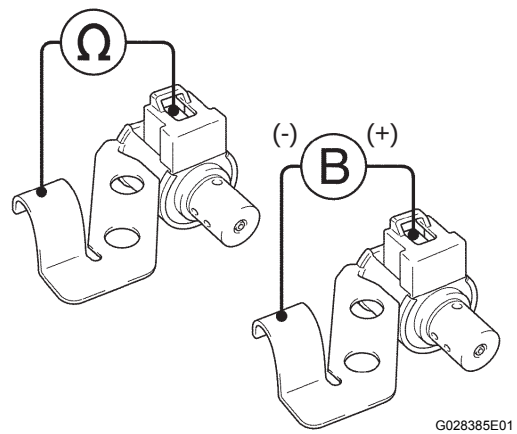
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM

3	INSPECT SHIFT SOLENOID VALVE DSL

Shift Solenoid Valve DSL:



(a) Remove the shift solenoid valve DSL.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Specified Condition 20°C (68°F)
Solenoid Connector (DSL) - Solenoid Body (DSL)	11 to 13 Ω

(c) Connect the positive (+) lead to the terminal of the solenoid connector, and the negative (-) lead to the solenoid body.

OK:

The solenoid valve makes an operating sound.

NG → **REPLACE SHIFT SOLENOID VALVE DSL**

OK

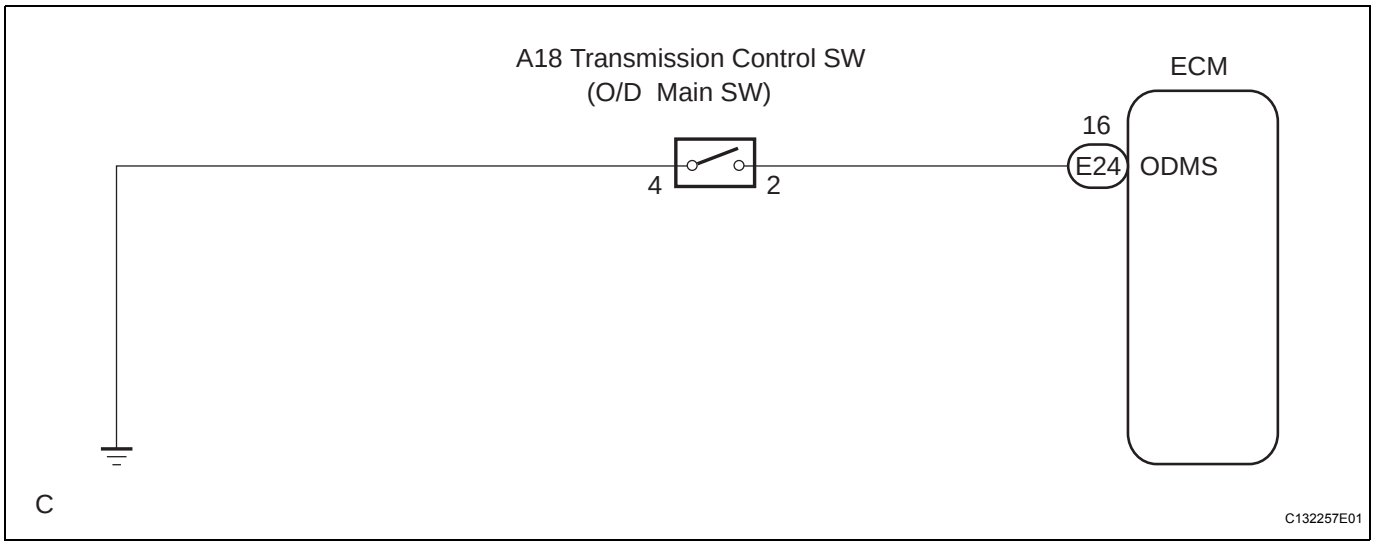
REPAIR OR REPLACE TRANSMISSION WIRE

O/D Main Switch Circuit

DESCRIPTION

The O/D main switch (transmission control switch) is a momentary type switch. When pressing the O/D main switch, the O/D OFF indicator light lights up and the ECM prohibits shifting into O/D, and when pressing it once again, the O/D OFF indicator light goes off and the ECM allows shifting into O/D. Turning the IG switch OFF will reset the O/D OFF indicator light.

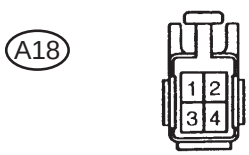
WIRING DIAGRAM



INSPECTION PROCEDURE

1	CHECK HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - BODY GROUND)

Wire Harness Side:
(Connector Front View):



(a) Disconnect the transmission control switch connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

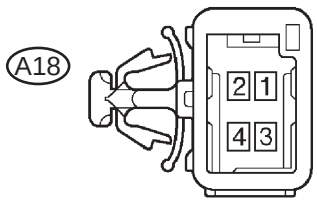
Tester Connection	Specified Condition
4 - Body ground	Below 1 Ω

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

OK

2 INSPECT TRANSMISSION CONTROL SWITCH

Switch Side (Connector Front View):



T C090638E01

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

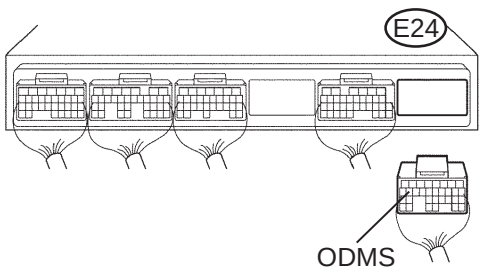
Standard resistance

Switch Condition	Tester Connection	Specified Condition
Press transmission control switch	2 - 4	Below 1 Ω
Release transmission control switch	↑	10 kΩ or higher

NG → **REPLACE TRANSMISSION CONTROL SWITCH**

OK

3 CHECK HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - ECM)



P G025190E04

(a) Connect the transmission control switch connector.
(b) Disconnect the ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

Switch Condition	Tester Connection	Specified Condition
Press transmission control switch	E24-16 (ODMS) - Body ground	Below 1 Ω
Release transmission control switch	↑	10 kΩ or higher

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

OK

PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE

BRAKE CONTROL

ANTI-LOCK BRAKE SYSTEM

PRECAUTION BC-1
PARTS LOCATION BC-2
SYSTEM DIAGRAM BC-4
SYSTEM DESCRIPTION. BC-5
HOW TO PROCEED WITH TROUBLESHOOTING BC-6
TEST MODE PROCEDURE BC-8
PROBLEM SYMPTOMS TABLE BC-11
TERMINALS OF ECU BC-12
DIAGNOSIS SYSTEM BC-13
DTC CHECK / CLEAR. BC-14
FAIL-SAFE CHART BC-15
DIAGNOSTIC TROUBLE CODE CHART BC-15
DTC 11 Open Circuit in ABS Solenoid Relay Circuit. BC-18
DTC 13 Open Circuit in ABS Motor Relay Circuit BC-23
DTC 21 SFR Solenoid Circuit BC-27
DTC 22 SFL Solenoid Circuit BC-27
DTC 23 SRR Solenoid Circuit BC-27
DTC 24 SRL Solenoid Circuit BC-27
DTC 31 Right Front Speed Sensor Circuit BC-30
DTC 32 Left Front Speed Sensor Circuit BC-30
DTC 35 Foreign Matter is Attached on Tip of Right Front Sensor BC-30
DTC 36 Foreign Matter is Attached on Tip of Left Front Sensor BC-30
DTC 71 Low Output Signal of Front Speed Sensor RH BC-30
DTC 72 Low Output Signal of Front Speed Sensor LH BC-30
DTC 75 Abnormal Change in Output Signal of Front Speed Sensor RH. BC-30
DTC 76 Abnormal Change in Output Signal of Front Speed Sensor LH. BC-30
DTC 33 Right Rear Speed Sensor Circuit BC-37
DTC 34 Left Rear Speed Sensor Circuit BC-37
DTC 38 Foreign Matter is Attached on Tip of Right Rear Sensor BC-37
DTC 39 Foreign Matter is Attached on Tip of Left Rear Sensor BC-37
DTC 73 Low Output Signal of Rear Speed Sensor RH BC-37
DTC 74 Low Output Signal of Rear Speed Sensor LH BC-37
DTC 77 Abnormal Change in Output Signal of Rear Speed Sensor RH . BC-37
DTC 78 Abnormal Change in Output Signal of Rear Speed Sensor LH . BC-37
DTC 37 Speed Sensor Rotor Faulty BC-44
DTC 41 Low Battery Positive Voltage or Abnormally High Battery Positive Voltage BC-51
DTC 58 Stop Light Switch Circuit BC-55
DTC 62 Skid Control ECU Malfunction BC-63
ABS Warning Light Remains ON. BC-64
ABS Warning Light Does Not Come ON BC-68
TC and CG Terminal Circuit. BC-70
TS and CG Terminal Circuit. BC-73

ANTI-LOCK BRAKE SYSTEM

PRECAUTION

1. TROUBLESHOOTING PRECAUTIONS

(a) When there is a malfunction with terminal contact points or part installation problems, removal and installation of the suspected problem parts may return the system to normal condition either completely or temporarily.

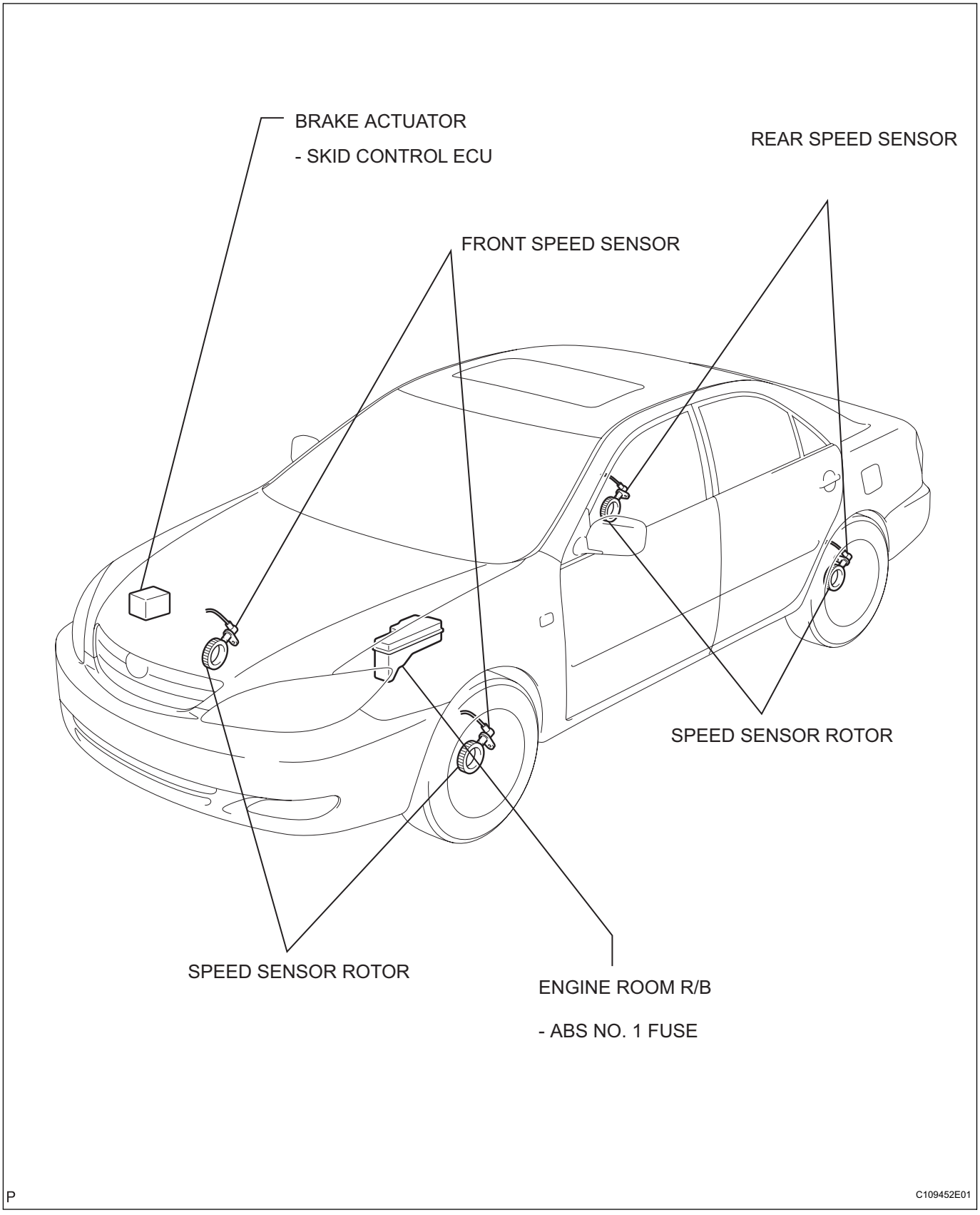
(b) In order to determine the malfunctioning area, be sure to check the conditions at the time the malfunction occurred, such as DTC output and record it before disconnecting each connector or removing and installing parts.

2. HANDLING PRECAUTIONS

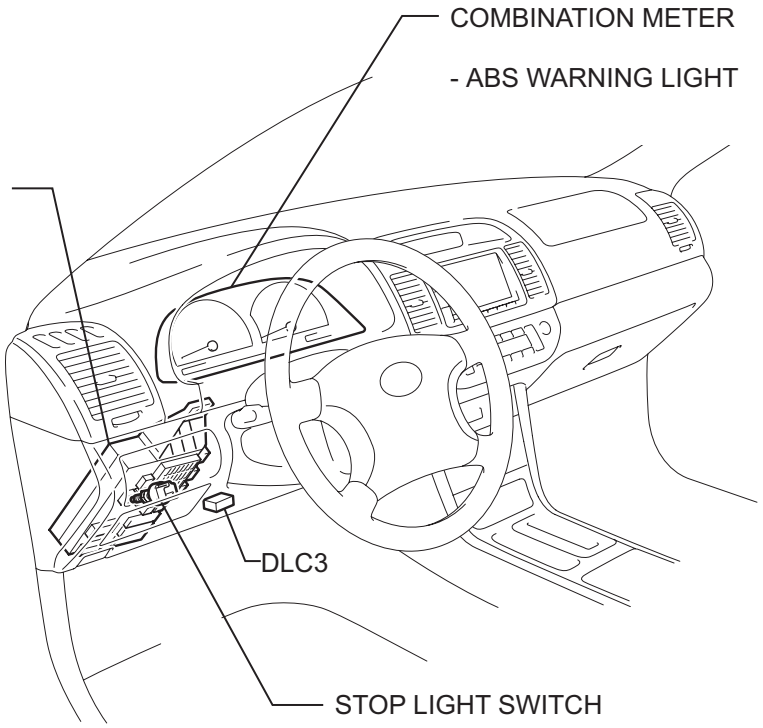
(a) Be sure to remove and install the actuator, each sensor, etc. with the ignition switch off unless it is not specified in the inspection procedure.

(b) When removing and installing the actuator, each sensor, etc., be sure to check that the normal display is output in Test Mode inspection and DTC output inspection after installing all the parts.

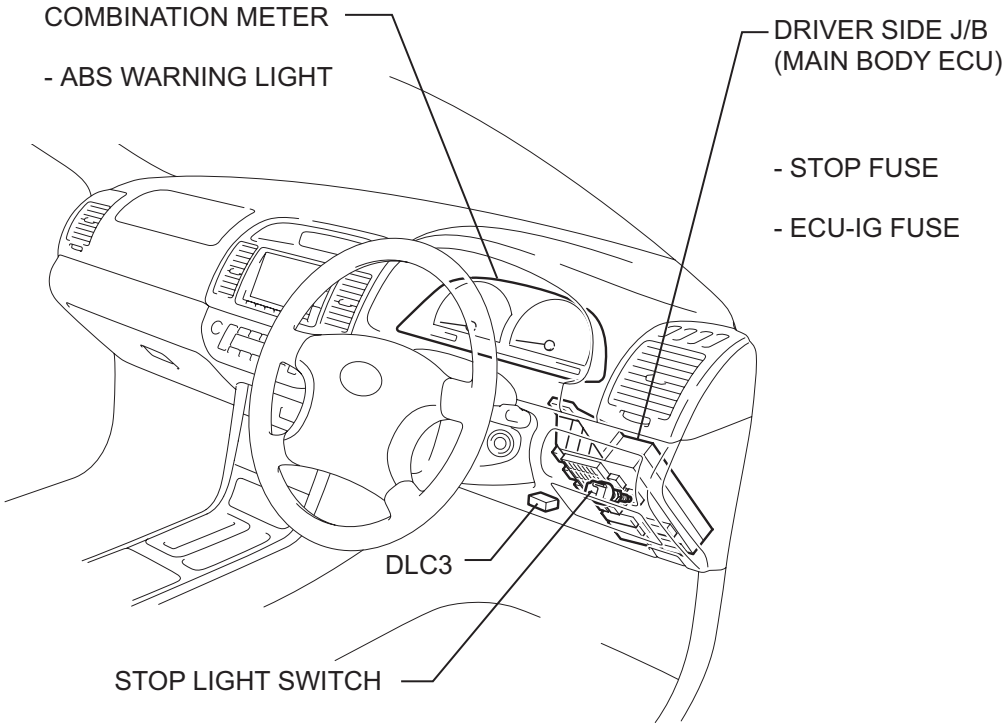
PARTS LOCATION



LHD:



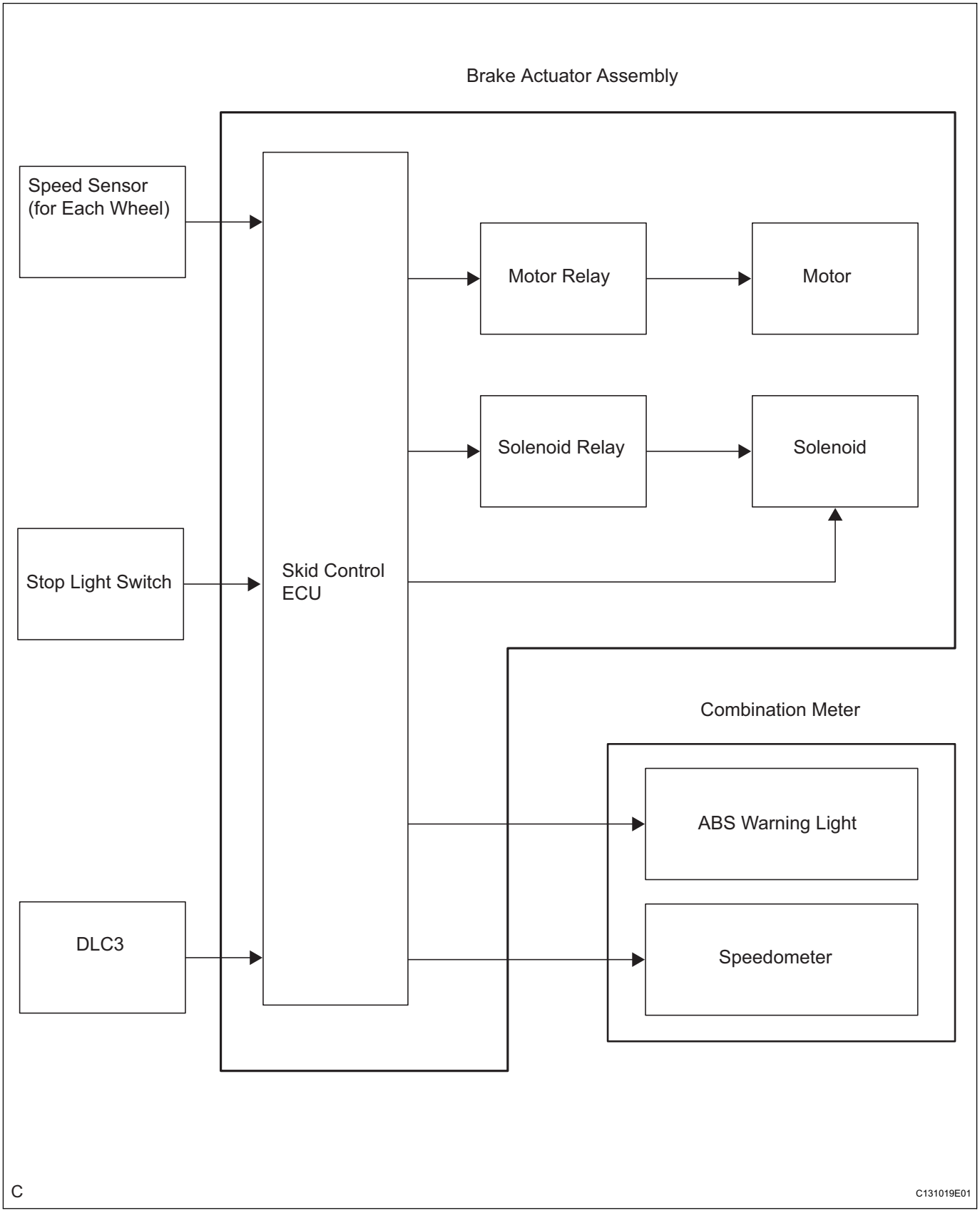
RHD:



P

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SYSTEM DIAGRAM



SYSTEM DESCRIPTION

1. FUNCTION DESCRIPTION

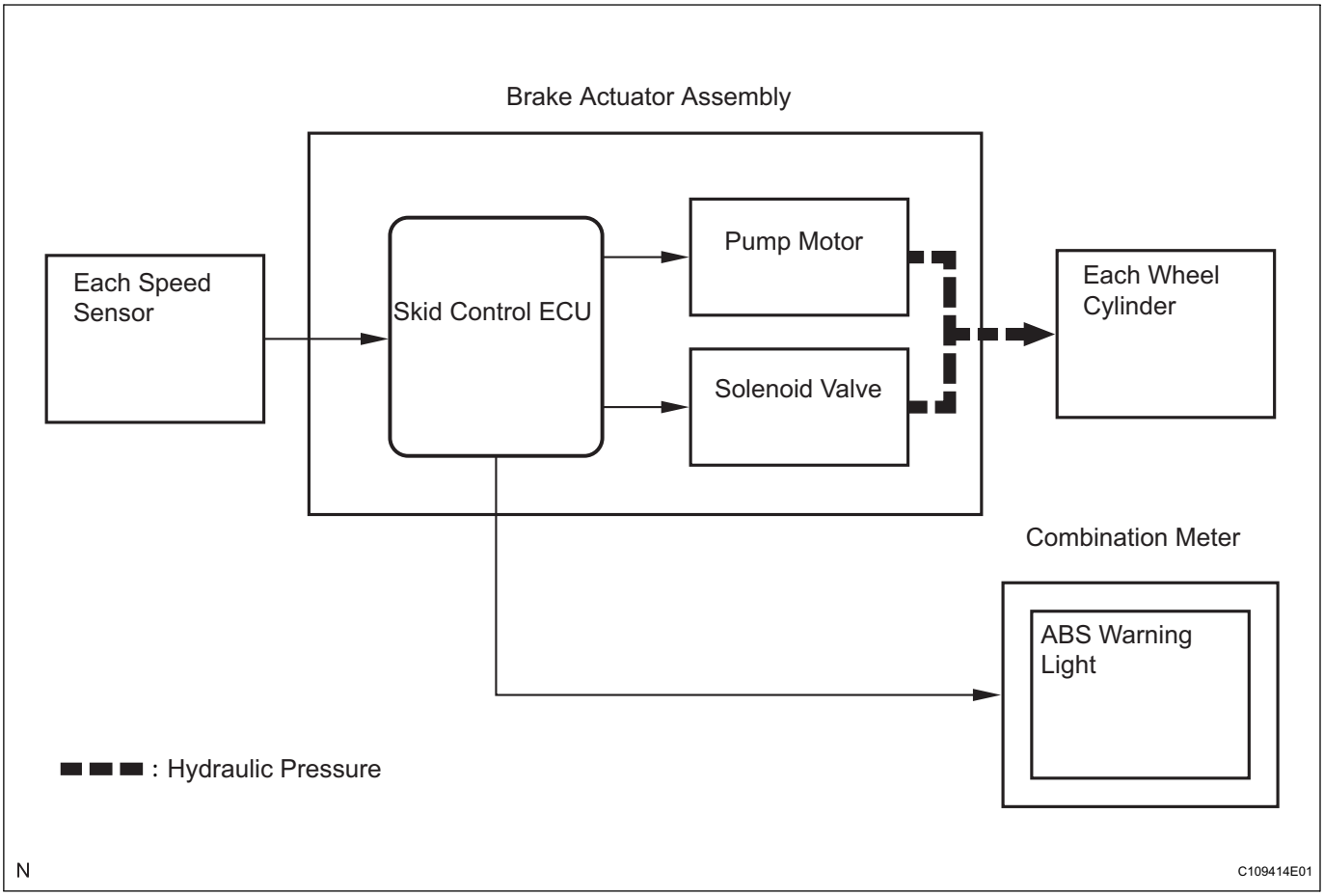
HINT:

The skid control ECU is located within the brake actuator assembly.

(a) ABS

(Anti-lock Brake System)

The ABS helps prevent the wheels from locking when the brakes are applied firmly or when braking on a slippery surface.



Operation description

The skid control ECU detects a wheel lock condition by receiving vehicle speed signals from each speed sensor, and sends control signals to the pump motor and solenoid valve. The pump motor and solenoid valve avoid wheel lock by controlling the hydraulic pressure of each wheel cylinder.

The ABS warning light comes on when the ABS system is malfunctioning.

2. ABS OPERATION

(a) Based on the signals received from the 4 wheel speed sensors, the skid control ECU calculates the speed of each wheel and deceleration, and checks wheel slipping condition. According to the slipping condition, the skid control ECU controls the pressure holding valve and pressure reduction valve in order to adjust the fluid pressure of each wheel cylinder.

3. FAIL SAFE

(a) When a failure occurs in the ABS system, the ABS warning light comes on and operation is prohibited.

4. FUNCTION OF COMPONENTS

Components	Function
Brake actuator assembly	• Composed of the holding solenoid valve, pressure reduction solenoid valve, pump motor, reservoir, etc., and adjusts the brake fluid pressure applied to each wheel cylinder. • Houses the skid control ECU.
Skid control ECU	Calculates brake control in accordance with sensor signals.
Speed sensor	Detects speed of each wheel and inputs the data into the skid control ECU.
Stop light switch	Illuminates the brake light when the brake pedal is depressed. (Sends a brake on signal to the skid control ECU.)
Solenoid relay	• Supplies power to each solenoid. • Housed in the skid control ECU.
Motor relay	• Supplies power to the pump motor. • Housed in the skid control ECU.
ABS warning light	• Comes on to inform the driver that a malfunction in the ABS has occurred. • Blinks to output DTC.

HOW TO PROCEED WITH TROUBLESHOOTING

1	VEHICLE BROUGHT TO WORKSHOP

NEXT

2	CUSTOMER PROBLEM ANALYSIS

(a) Interview and confirm the trouble (See page IN-28).

NEXT

3	CHECK DTC

(a) Check for DTCs and record the DTCs.
(b) Clear the DTCs (See page BC-14).
(c) Recheck for DTCs.
  (1) Reconfirm the DTCs based on the recorded DTCs (See page BC-14).

Result

Condition	Proceed to
DTC is output	A
DTC is not output (Problem symptom does not occur)	B
DTC is not output (Problem symptom occurs)	C

B → GO TO STEP 5

C → GO TO STEP 6

A

4	DIAGNOSTIC TROUBLE CODE CHART

NEXT

GO TO STEP 7

5	SYMPTOM SIMULATION

NEXT

6	PROBLEM SYMPTOMS TABLE

NEXT

7	CIRCUIT INSPECTION

NEXT

8	IDENTIFICATION OF PROBLEM

NEXT

9	REPAIR OR REPLACEMENT

NEXT

10	CONFIRMATION TEST

NEXT

END

ABS Warning Light:

Except Middle East, South Africa:	Middle East, South Africa:
ABS	(ABS)

C

C132741E01

TEST MODE PROCEDURE

1. WARNING LIGHT INITIAL CHECK

(a) When the ignition switch is turned to the ON position, check that the ABS warning light comes on for approximately 2 seconds.
HINT:
If the ECU stores any DTCs, the ABS warning light comes on.
If the indicator remains on or does not come on, proceed to troubleshooting for the light circuit listed below.

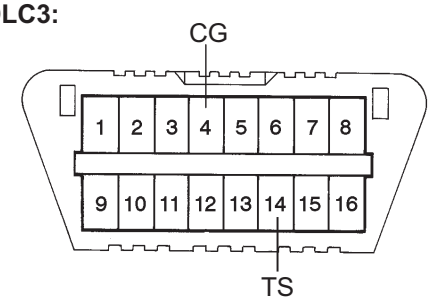
Trouble Area	See Procedure
ABS warning light circuit	BC-64 or BC-68

2. SENSOR CHECK BY TEST MODE (SIGNAL CHECK)

HINT:
- If the ignition switch is turned from the ON to the ACC or LOCK position during Test Mode (signal check), the DTCs of the signal check function will be erased.
- During Test Mode (signal check), the skid control ECU records DTCs if an abnormal sensor signal is received.

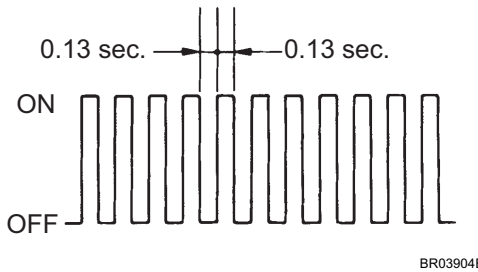
(a) Procedure for Test Mode.
(1) Turn the ignition switch off.
(2) Check that the steering wheel is centered and move the shift lever to the P position (A/T) or apply the parking brake (M/T).
(3) Using SST, connect terminals TS and CG of the DLC3.
SST 09843-18040
(4) Turn the ignition switch to the ON position.

DLC3:



G022987E17

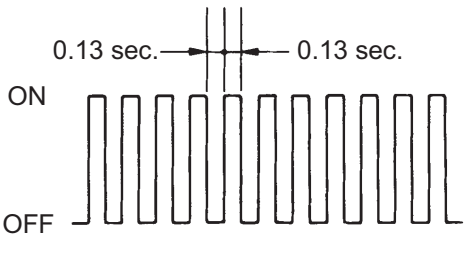
Blinking Pattern in TEST MODE:



(5) Check that the ABS warning light is blinking in the Test Mode blinking pattern.
HINT:
If the ABS warning light does not blink as specified, inspect the TS and CG terminal circuit, and the ABS warning light circuit.

Trouble Area	See Procedure
TS and CG terminal circuit	BC-73
ABS warning light circuit	BC-68

Blinking Pattern in TEST MODE:



(6) Check the ABS sensor.
HINT:
Check that the ABS warning light is blinking in the Test Mode blinking pattern, and perform the check.

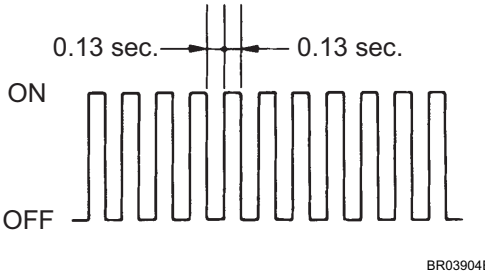
3. SPEED SENSOR CHECK

(a) Check the speed sensor signal.
(1) Drive the vehicle straight ahead.
Accelerate the vehicle to a speed of 45 km/h or more for several seconds and check that the ABS warning light goes off.
HINT:
The sensor check may not be completed if the vehicle has its wheels spun.

(b) Stop the vehicle.
NOTICE:
- **The speed sensor check may not be completed if the speed sensor check is started while turning the steering wheel or spinning the wheels.**
- **After the ABS warning light goes off, if vehicle speed exceeds 80 km/h, a signal check code will be stored again. Accelerate or stop the vehicle before the speed reaches 80 km/h.**
- **If the signal check has not been completed, the ABS warning light blinks while driving and the ABS system does not operate.**

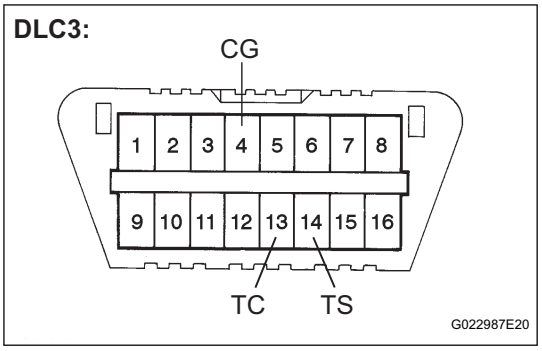
HINT:
When the sensor check has been completed, the ABS warning light goes off while driving and blinks in the Test Mode pattern while stationary.

Blinking Pattern in TEST MODE:



4. END OF SENSOR CHECK

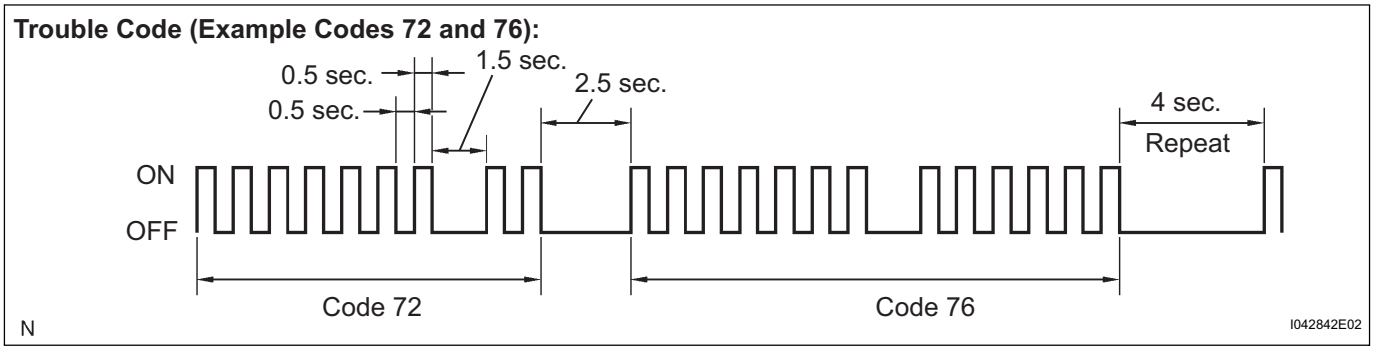
(a) If the sensor check is completed, the ABS warning light blinks (Test Mode) when the vehicle stops and the ABS warning light is off while the vehicle is driving.
NOTICE:
If the sensor check is not completed, the ABS warning light blinks even while the vehicle is driving and the ABS does not operate.



5. READ DTC OF TEST MODE (SIGNAL CHECK) FUNCTION

(a) Using SST, connect terminals TC and CG of the DLC3.
SST 09843-18040

(b) Count the number of times the ABS warning light blinks.



NOTICE:

- **If only the DTCs are displayed, repair the malfunction area and clear the DTCs.**
- **If the DTCs or Test Mode codes (DTC of signal check function) are displayed, repair the malfunction area, clear the DTCs and perform the Test Mode inspection.**

HINT:

- If more than 1 malfunction is detected at the same time, the lowest numbered code will be displayed first.
- See the list of DTC (See procedure "A").

(c) After performing the check, disconnect the SST from terminals TS and CG, and TC and CG of the DLC3 and turn the ignition switch off.

(d) Turn the ignition switch to the ON position.

HINT:

- If the ignition switch is not turned to the ON position after the SST is removed from the DLC3, the previous Test Mode will continue.
- If the ignition switch is turned to the ON position with terminals TS and CG shorted, the previous Test Mode will continue.

6. DTC OF TEST MODE (SIGNAL CHECK) FUNCTION (Procedure "A")

ABS sensor:

Code No.	Diagnosis	Trouble Area
71	Low output signal of front speed sensor RH	• Front speed sensor RH • Sensor installation • Speed sensor rotor
72	Low output signal of front speed sensor LH	• Front speed sensor LH • Sensor installation • Speed sensor rotor

Code No.	Diagnosis	Trouble Area
73	Low output signal of rear speed sensor RH	• Rear speed sensor RH • Sensor installation • Speed sensor rotor
74	Low output signal of rear speed sensor LH	• Rear speed sensor LH • Sensor installation • Speed sensor rotor
75	Abnormal change in output signal of front speed sensor RH	Speed sensor rotor
76	Abnormal change in output signal of front speed sensor LH	Speed sensor rotor
77	Abnormal change in output signal of rear speed sensor RH	Speed sensor rotor
78	Abnormal change in output signal of rear speed sensor LH	Speed sensor rotor

HINT:
The codes in this table are output only in Test Mode (signal check).

PROBLEM SYMPTOMS TABLE

If there are no DTCs output but the problem still occurs, check the circuits for each problem symptom in the order given in the table below and proceed to the relevant troubleshooting page.

NOTICE:
When replacing the brake actuator assembly (skid control ECU), sensor, etc., turn the ignition switch off.

HINT:
- Inspect the fuse and relay before investigating the suspected areas shown in the table below.
- Inspect each malfunction circuit in numerical order for the corresponding symptom.

Anti-lock Brake System:

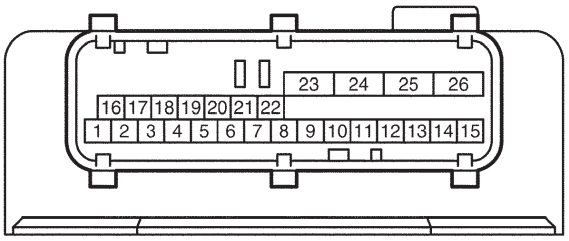
Symptom	Suspected Area	See Page
ABS does not operate	1. Check for DTCs again and make sure that the normal system code is output.	BC-14
	2. IG power source circuit	BC-51
	3. Front speed sensor circuit	BC-30
	4. Rear speed sensor circuit	BC-37
	5. Check the hydraulic circuit for leakage.	-
	6. If the symptoms still occur even after the above circuits in suspected areas are inspected and proved to be normal, replace the brake actuator assembly (skid control ECU).	-
ABS does not operate efficiently	1. Check for DTCs again and make sure that the normal system code is output.	BC-14
	2. Front speed sensor circuit	BC-30
	3. Rear speed sensor circuit	BC-37
	4. Stop light switch circuit	BC-55
	5. Check the hydraulic circuit for leakage.	-
	6. If the symptoms still occur even after the above circuits in suspected areas are inspected and proved to be normal, replace the brake actuator assembly (skid control ECU).	-

Symptom	Suspected Area	See Page
ABS sensor DTC check cannot be done	1. Check for DTCs again and make sure that the normal system code is output.	BC-14
	2. TC and CG terminal circuit	BC-70
	3. If the symptoms still occur even after the above circuits in suspected areas are inspected and proved to be normal, replace the brake actuator assembly (skid control ECU).	-
ABS warning light malfunction (Remains on)	1. ABS warning light circuit	BC-64
	2. Brake actuator assembly (Skid control ECU)	-
ABS warning light malfunction (Does not come on)	1. ABS warning light circuit	BC-68
	2. Brake actuator assembly (Skid control ECU)	-
Sensor check cannot be done	1. TS and CG terminal circuit	BC-73
	2. Brake actuator assembly (Skid control ECU)	-

TERMINALS OF ECU

1. TERMINALS OF ECU

Skid Control ECU:



P

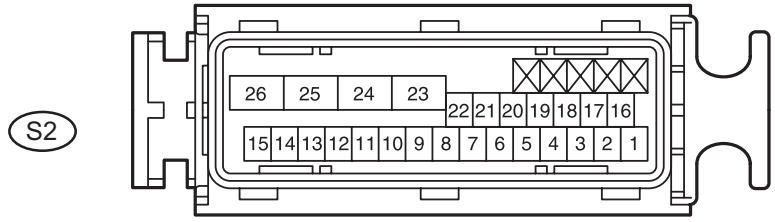
C094402E02

Symbols (Terminal No.)	Terminal Description
IG1 (1)	IG1 power supply
STP (2)	Stop light switch input
TC (4)	Diagnosis switch input
TS (5)	Test mode (signal check) input
RL+ (7)	Rear wheel speed sensor LH input
RL- (8)	Rear wheel speed sensor LH output
FL+ (9)	Front wheel speed sensor LH input
FL- (10)	Front wheel speed sensor LH output
FR+ (11)	Front wheel speed sensor RH input
FR- (12)	Front wheel speed sensor RH output
RR+ (13)	Rear wheel speed sensor RH input
RR- (15)	Rear wheel speed sensor RH output
WA (21)	ABS warning light output
GND1 (23)	Skid control ECU ground
+BM (24)	Power supply for motor
+BS (25)	Power supply for solenoid
GND2 (26)	Skid control ECU ground

2. TERMINAL INSPECTION

(a) Disconnect the connector and measure the voltage or resistance on the wire harness side.

Skid Control ECU Harness Side Connector Front View:



P C113372E02

HINT:
Voltage cannot be measured with the connector connected to the skid control ECU because the connector is watertight.

Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
IG1 (S2-1) - Body ground	B-R - Body ground	IG1 power supply	Ignition switch OFF → ON	Below 1 V → 10 to 14 V
STP (S2-2) - Body ground	G-W - Body ground	Stop light switch input	Stop light switch ON → OFF (Brake pedal depressed → released)	8 to 14 V → Below 1.5 V
GND1 (S2-23) - Body ground	W-B - Body ground	Skid control ECU ground	Always	Below 1 Ω
+BM (S2-24) - Body ground	L - Body ground	Power supply for motor	Always	10 to 14 V
+BS (S2-25) - Body ground	L - Body ground	Power supply for solenoid	Always	10 to 14 V
GND2 (S2-26) - Body ground	W-B - Body ground	Skid control ECU ground	Always	Below 1 Ω

ABS Warning Light:

Except Middle East, South Africa:



Middle East, South Africa:



C C132741E01

DIAGNOSIS SYSTEM

1. DIAGNOSIS

(a) If the ABS control system or skid control ECU detects a malfunction, the ABS warning light will come on to warn the driver.

- The DTCs are simultaneously stored in memory. The DTCs can be read by connecting the SST between the TC and CG terminals of the DLC3 and observing the blinking pattern of the ABS warning light (See page **BC-14**).
- This system has a Test Mode (signal check) function (See page **BC-8**).
- The DTC can be read by observing the blinking pattern of the ABS warning light.

ABS Warning Light:

Except Middle East, South Africa:

ABS

Middle East, South Africa:



C132741E01

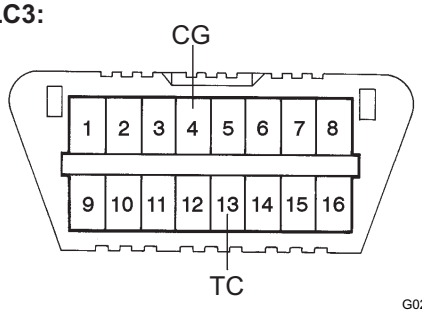
C

2. WARNING LIGHT INITIAL CHECK

(a) When the ignition switch is turned to the ON position, check that the ABS warning light comes on for approximately 2 seconds.
HINT:
If the warning light check result is not normal, proceed to troubleshooting for the ABS warning light circuit.
If the indicator remains on, proceed to troubleshooting for the light circuit below.

Trouble Area	See Procedure
ABS warning light circuit	BC-64

DLC3:



G022986E01

DTC CHECK / CLEAR

1. DTC CHECK/CLEAR

(a) Check for DTCs.

(1) Using SST, connect terminals TC and CG of the DLC3.
SST 09843-18040

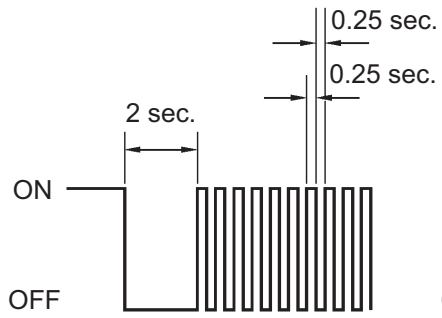
(2) Turn the ignition switch to the ON position.

(3) Read the DTCs from the ABS warning light on the combination meter.
HINT:
If no code appears, inspect the TC and CG terminal circuit and the ABS warning light circuit.

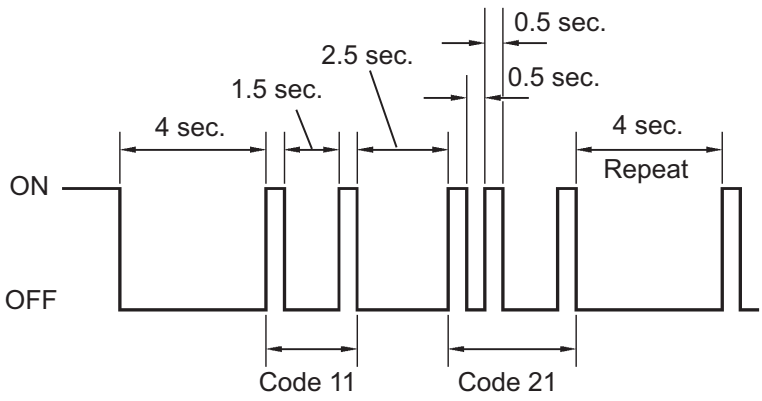
Trouble Area	See Procedure
TC and CG terminal circuit	BC-70
ABS warning light circuit	BC-64 or BC-68

(4) As an example, refer to the chart below for the blinking patterns of the normal system code and trouble codes 11 and 21.

Normal System Code:



Trouble Code (Example Codes 11 and 21):

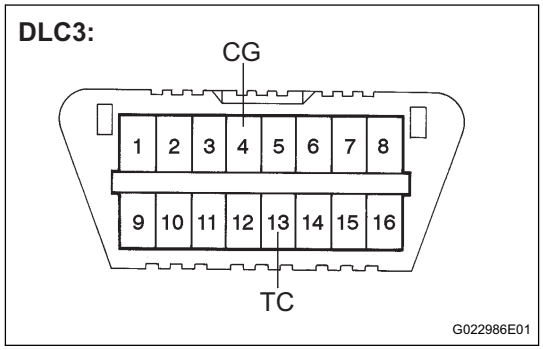


N

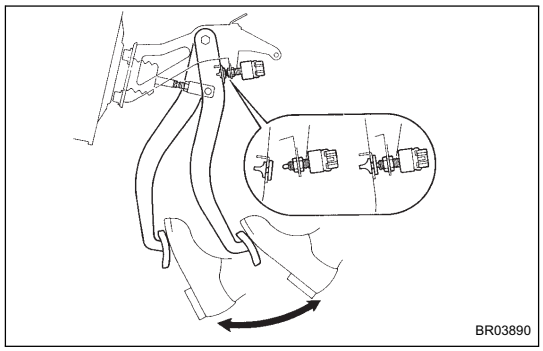
I042843E01

(5) The codes are explained in the code table (See page BC-15).

(6) After completing the check, disconnect terminals TC and CG of the DLC3, and turn off the display. If 2 or more DTCs are detected at the same time, the DTCs will be displayed in ascending order.



(b) Clear the DTCs.
(1) Using SST, connect terminals TC and CG of the DLC3.
SST 09843-18040
(2) Turn the ignition switch to the ON position.



(3) Clear the DTCs stored in the ECU by depressing the brake pedal 8 times or more within 5 seconds.
(4) Check that the warning light indicates the normal system code.
(5) Remove the SST from the terminals of the DLC3.
HINT:
Clearing the DTCs cannot be performed by removing the battery cable or the ECU-IG fuse.

2. END OF DTC CHECK/CLEAR
(a) Turn the ignition switch to the ON position.
(b) Check that the ABS warning light goes off within approximately 3 seconds.

FAIL-SAFE CHART

1. FAIL SAFE OPERATION
- If there is a problem with sensor signals or actuator systems, the skid control ECU prohibits power supply to the brake actuator and terminates ABS control.
- If the ABS components malfunction before starting control, the vehicle immediately stops the ABS operation.
If any of the system components malfunction during control, the vehicle gradually stops ABS control so as not to trigger a sudden change in vehicle condition.
If it is impossible to control the systems, the ABS warning light comes on to inform the driver of the termination of the systems (See page BC-13).
HINT:
If the ABS malfunctions, the brake system will operate normally without ABS control.

DIAGNOSTIC TROUBLE CODE CHART

NOTICE:

Turn the ignition switch OFF before removing parts.

HINT:

- If no abnormality is found when inspecting parts, inspect the skid control ECU and ground points for poor contact.
- If a malfunction code is displayed during the DTC check, check the circuit indicated by the DTC. For details of each code, refer to the page for respective "DTC No." in the DTC chart.
- Inspect the fuse and relay before investigating the trouble areas as shown in the table below.
- When 2 or more DTCs are detected, perform circuit inspection one by one until the problem is identified.

DTC chart of ABS:

DTC No.	Detection Item	Trouble Area	See Page
11	Open Circuit in ABS Solenoid Relay Circuit	1. ABS NO. 1 fuse 2. ABS solenoid relay 3. ABS solenoid relay circuit 4. Brake actuator assembly	BC-18
13	Open Circuit in ABS Motor Relay Circuit	1. ABS NO. 1 fuse 2. ABS motor relay 3. ABS motor relay circuit 4. Brake actuator assembly	BC-23
21	SFR Solenoid Circuit	1. SFRR or SFRH circuit 2. Brake actuator assembly	BC-27
22	SFL Solenoid Circuit	1. SFLR or SFLH circuit 2. Brake actuator assembly	BC-27
23	SRR Solenoid Circuit	1. SRRR or SRRH circuit 2. Brake actuator assembly	BC-27
24	SRL Solenoid Circuit	1. SRLR or SRLH circuit 2. Brake actuator assembly	BC-27
31	Right Front Speed Sensor Circuit	1. Front speed sensor RH 2. Speed sensor circuit 3. Speed sensor rotor 4. Sensor installation 5. Brake actuator assembly (Skid control ECU)	BC-30
32	Left Front Speed Sensor Circuit	1. Front speed sensor LH 2. Speed sensor circuit 3. Speed sensor rotor 4. Sensor installation 5. Brake actuator assembly (Skid control ECU)	BC-30
33	Right Rear Speed Sensor Circuit	1. Rear speed sensor RH 2. Speed sensor circuit 3. Speed sensor rotor 4. Sensor installation 5. Brake actuator assembly (Skid control ECU)	BC-37
34	Left Rear Speed Sensor Circuit	1. Rear speed sensor LH 2. Speed sensor circuit 3. Speed sensor rotor 4. Sensor installation 5. Brake actuator assembly (Skid control ECU)	BC-37
35	Foreign Matter is Attached on Tip of Right Front Sensor	1. Front speed sensor RH 2. Speed sensor circuit 3. Sensor installation	BC-30
36	Foreign Matter is Attached on Tip of Left Front Sensor	1. Front speed sensor LH 2. Speed sensor circuit 3. Sensor installation	BC-30

DTC No.	Detection Item	Trouble Area	See Page
37	Speed Sensor Rotor Faulty	1. Tyre and wheel size 2. Tyre deformation 3. Speed sensor 4. Speed sensor circuit 5. Speed sensor rotor 6. Sensor installation 7. Brake actuator assembly (Skid control ECU)	BC-44
38	Foreign Matter is Attached on Tip of Right Rear Sensor	1. Rear speed sensor RH 2. Speed sensor circuit 3. Sensor installation	BC-37
39	Foreign Matter is Attached on Tip of Left Rear Sensor	1. Rear speed sensor LH 2. Speed sensor circuit 3. Sensor installation	BC-37
41	Low Battery Positive Voltage or Abnormally High Battery Positive Voltage	1. Battery 2. ECU-IG fuse 3. Charging system 4. Power source circuit 5. Internal power supply circuit of the skid control ECU	BC-51
58	Stop Light Switch Circuit	1. STOP fuse 2. Stop light switch 3. Stop light switch circuit 4. Brake actuator assembly (Skid control ECU)	BC-55
62	Skid Control ECU Malfunction	Brake actuator assembly (Skid control ECU)	BC-63

Test Mode DTC of ABS:

DTC No.	Detection Item	Trouble Area	See Page
71	Low Output Signal of Front Speed Sensor RH (Test Mode DTC)	1. Front speed sensor RH 2. Sensor installation 3. Speed sensor rotor	BC-30
72	Low Output Signal of Front Speed Sensor LH (Test Mode DTC)	1. Front speed sensor LH 2. Sensor installation 3. Speed sensor rotor	BC-30
73	Low Output Signal of Rear Speed Sensor RH (Test Mode DTC)	1. Rear speed sensor RH 2. Sensor installation 3. Speed sensor rotor	BC-37
74	Low Output Signal of Rear Speed Sensor LH (Test Mode DTC)	1. Rear speed sensor LH 2. Sensor installation 3. Speed sensor rotor	BC-37
75	Abnormal Change in Output Signal of Front Speed Sensor RH (Test Mode DTC)	Speed sensor rotor	BC-30
76	Abnormal Change in Output Signal of Front Speed Sensor LH (Test Mode DTC)	Speed sensor rotor	BC-30
77	Abnormal Change in Output Signal of Rear Speed Sensor RH (Test Mode DTC)	Speed sensor rotor	BC-37
78	Abnormal Change in Output Signal of Rear Speed Sensor LH (Test Mode DTC)	Speed sensor rotor	BC-37

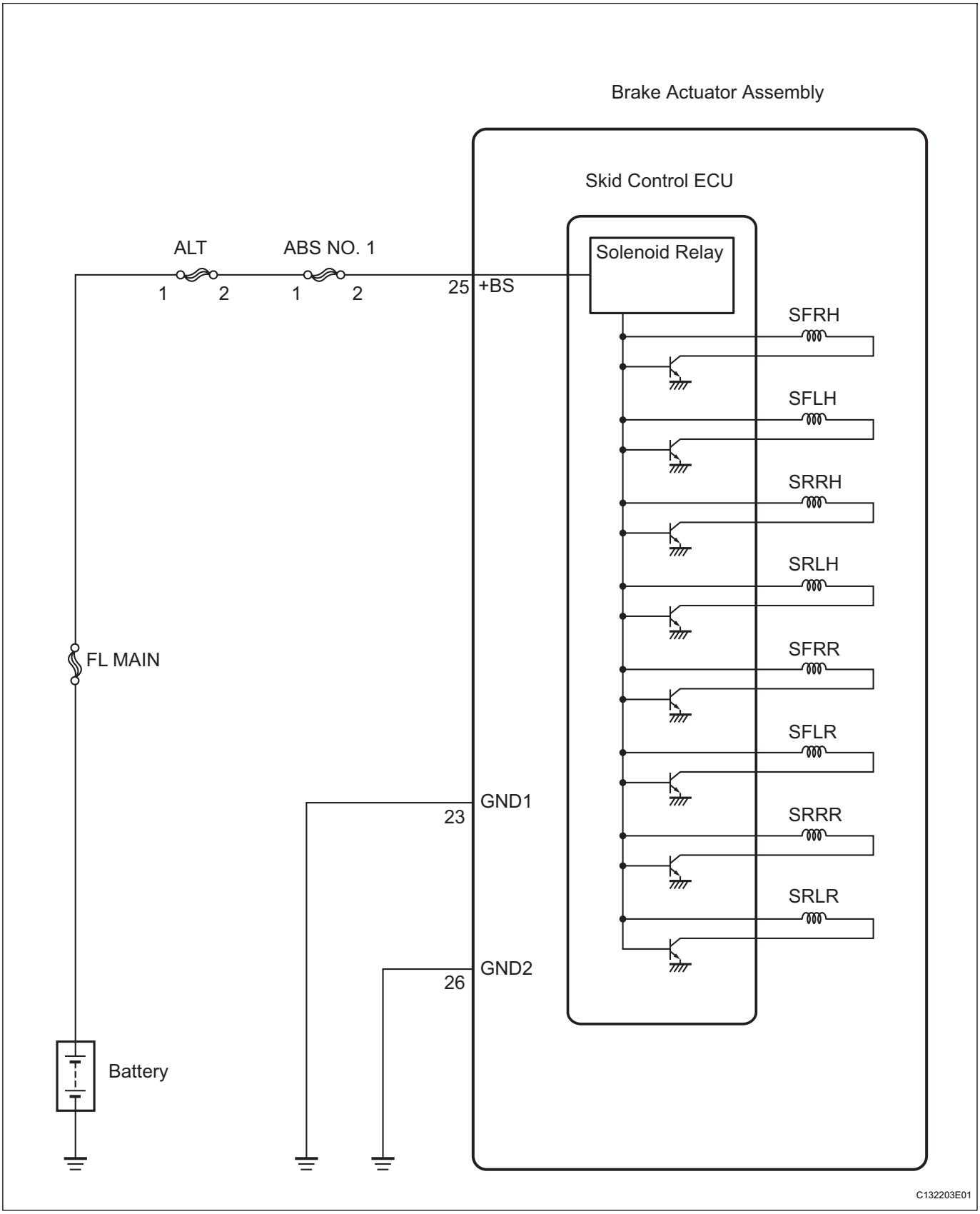
DTC	11	Open Circuit in ABS Solenoid Relay Circuit

DESCRIPTION

This relay supplies power to each ABS solenoid. If the ABS initial check is OK after the ignition switch is turned to the ON position, the skid control ECU will turn the ABS solenoid relay on.

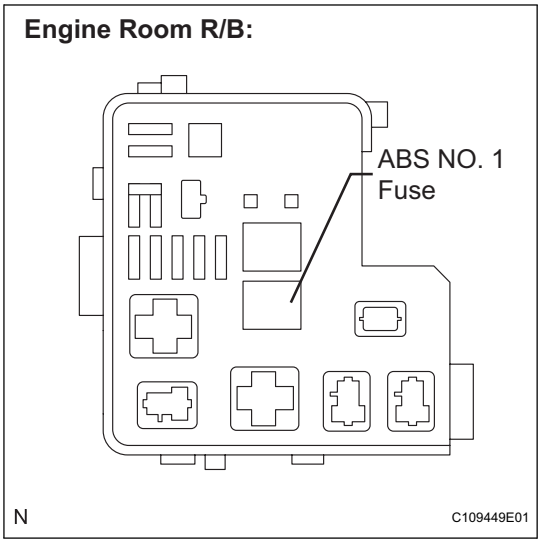
DTC No.	DTC Detection Condition	Trouble Area
11	When any of the following is detected: • 3 or more solenoid valves are found faulty in response and simultaneously valve supply voltage is detected to be abnormal. • Solenoid valve relay is not switched OFF. • Valve relay is stuck in spite of its high valve relay supply voltage.	• ABS NO. 1 fuse • ABS solenoid relay • ABS solenoid relay circuit • Brake actuator assembly

WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT ABS NO. 1 FUSE



(a) Remove the ABS NO. 1 fuse from the engine room R/B.
(b) Measure the resistance according to the value(s) in the table below.

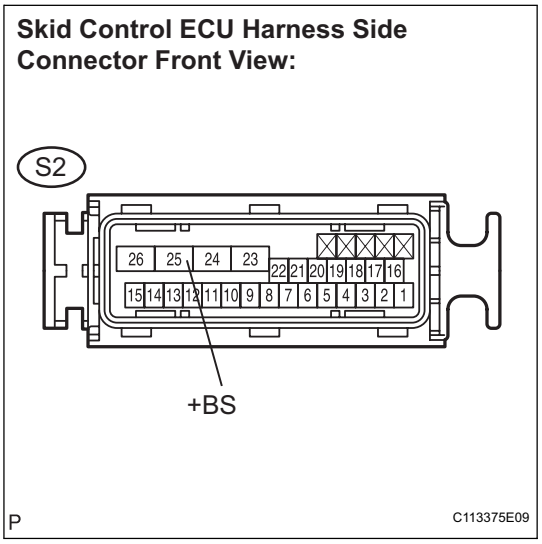
Standard resistance

Tester Connection	Condition	Specified Condition
ABS NO. 1 (60 A) fuse	Always	Below 1 Ω

NG → **REPLACE ABS NO. 1 FUSE**

OK

2 INSPECT SKID CONTROL ECU (+BS TERMINAL)



(a) Install the ABS NO. 1 fuse.
(b) Disconnect the skid control ECU connector.
(c) Measure the voltage according to the value(s) in the table below.

Standard voltage

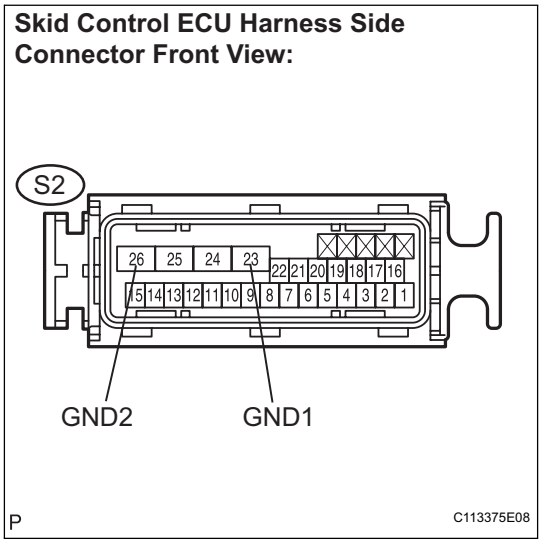
Tester Connection	Condition	Specified Condition
S2-25 (+BS) - Body ground	Always	10 to 14 V

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (+BS CIRCUIT)**

OK

3 INSPECT SKID CONTROL ECU (GND TERMINAL)

Skid Control ECU Harness Side Connector Front View:



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

Standard resistance

Tester Connection	Condition	Specified Condition
S2-23 (GND1) - Body ground	Always	Below 1 Ω
S2-26 (GND2) - Body ground	Always	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (GND CIRCUIT)**

OK

4 RECONFIRM DTC

HINT:
This code is detected when a problem is identified in the brake actuator assembly.
The solenoid circuit is in the brake actuator assembly. Therefore, solenoid circuit inspection and solenoid unit inspection cannot be performed. Be sure to check if the DTC is output before replacing the brake actuator assembly.

(a) Reconnect the skid control ECU connector.
(b) Clear the DTCs (See page BC-14).
(c) Start the engine.
(d) Drive the vehicle at a speed of 6 km/h or more for 30 seconds or more.
(e) Check if the same DTC is recorded (See page BC-14).

Result

Condition	Proceed to
DTC (11) is not output	A
DTC (11) is output	B

HINT:
- If the normal system code is output (the trouble code is not output), slightly jiggle the connectors, wire harnesses, and fuses of the brake actuator assembly (skid control ECU). Make sure that no DTCs are output.
- If any DTCs are output while jiggling a connector or wire harness of the brake actuator assembly (skid control ECU), inspect and repair the connector or wire harness.

B → **REPLACE BRAKE ACTUATOR ASSEMBLY**

A

USE SIMULATION METHOD TO CHECK

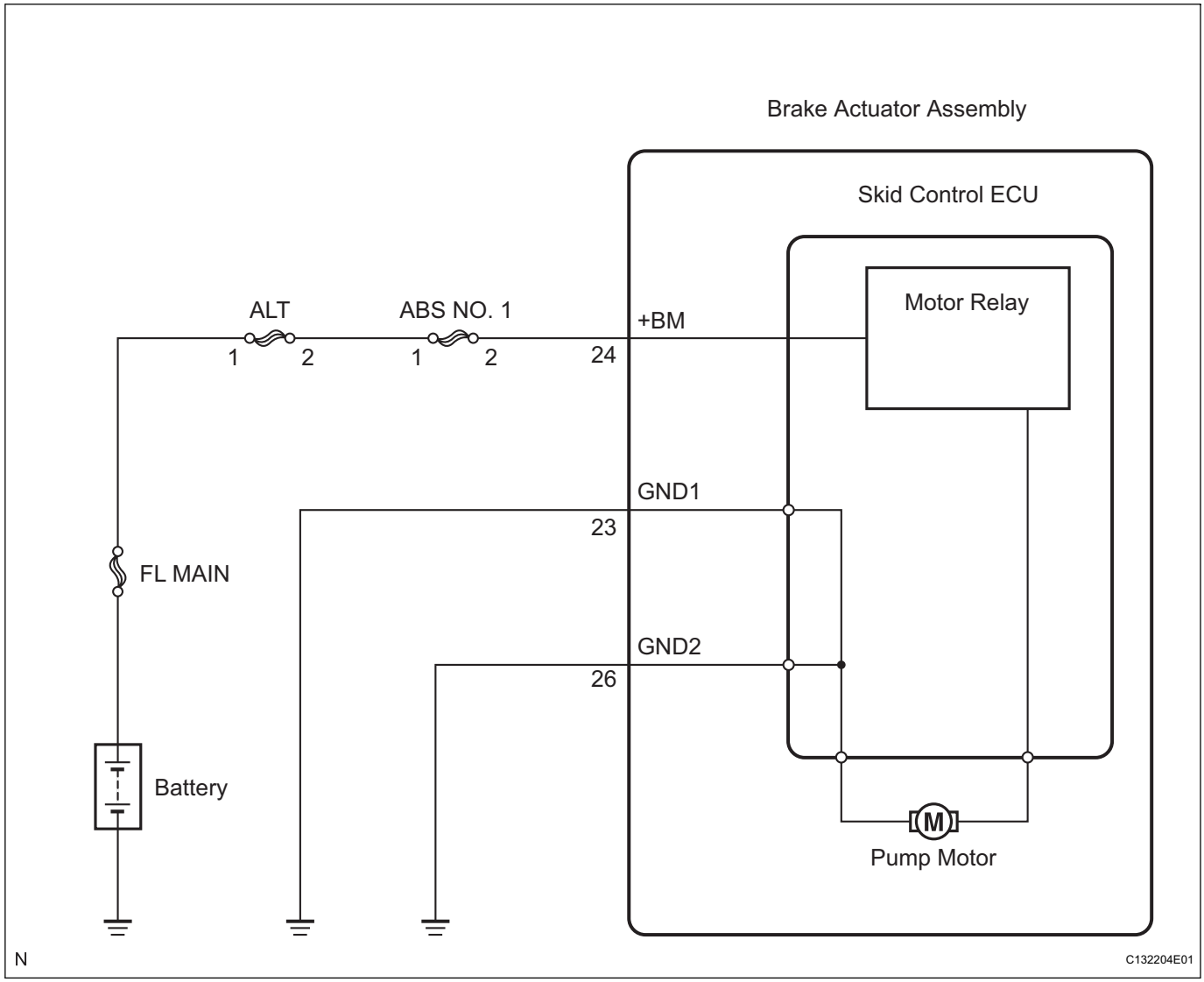
DTC	13	Open Circuit in ABS Motor Relay Circuit

DESCRIPTION

The ABS motor relay supplies power to the ABS pump motor. While the ABS is activated, the ECU turns the motor relay on and operates the ABS pump motor.
If the voltage supplied to the motor relay (+BM) is below the DTCs detection threshold due to low voltage from the battery/alternator, the DTCs may be stored.

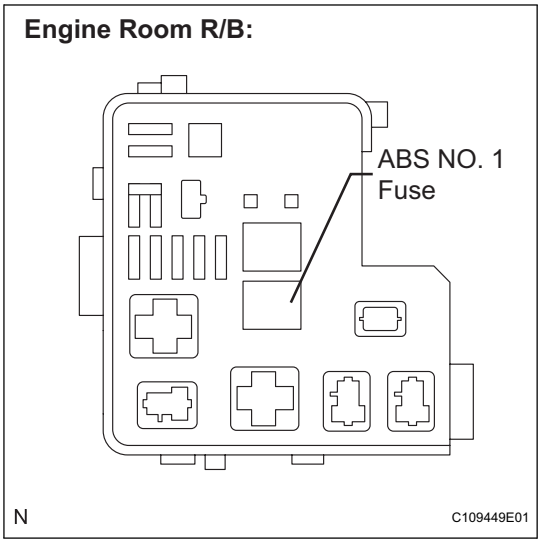
DTC No.	DTC Detection Condition	Trouble Area
13	When any of the following is detected: • After actuation of the motor relay, pump motor voltage is not supplied within 0.4 seconds. • When pump motor voltage is high, motor relay does not actuate for 2.5 seconds or more. • Pump motor voltage remains low for longer than 0.04 seconds and the pump repeats activation for 0.7 seconds 3 times maximum. Since the last activation, the pump motor has been dead because of a short circuit.	• ABS NO. 1 fuse • ABS motor relay • ABS motor relay circuit • Brake actuator assembly

WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT ABS NO. 1 FUSE



(a) Remove the ABS NO. 1 fuse from the engine room R/B.
(b) Measure the resistance according to the value(s) in the table below.

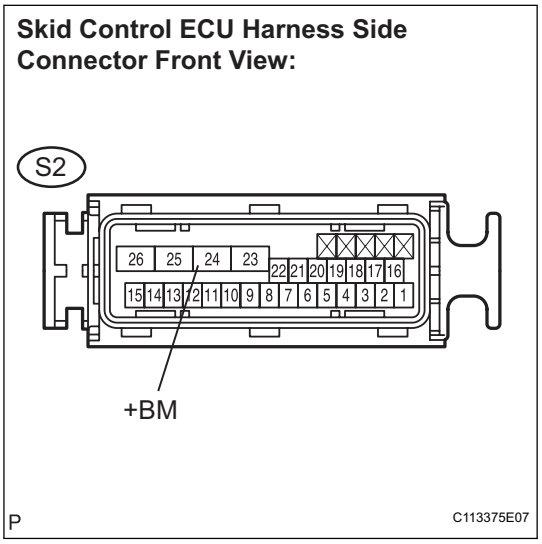
Standard resistance

Tester Connection	Condition	Specified Condition
ABS NO. 1 (60 A) fuse	Always	Below 1 Ω

NG → **REPLACE ABS NO. 1 FUSE**

OK

2 INSPECT SKID CONTROL ECU (+BM TERMINAL)



(a) Install the ABS NO. 1 fuse.
(b) Disconnect the skid control ECU connector.
(c) Measure the voltage according to the value(s) in the table below.

Standard voltage

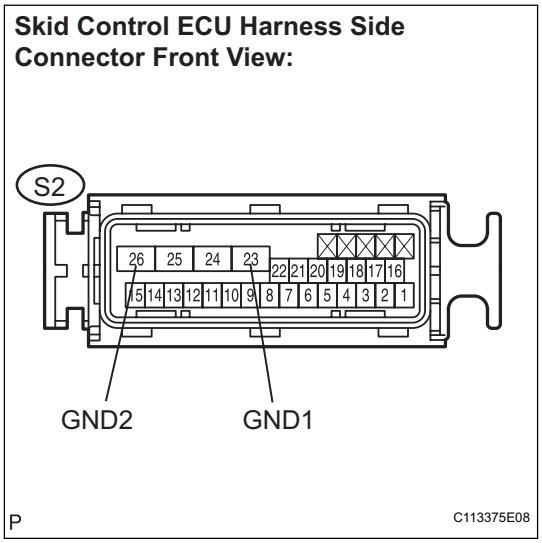
Tester Connection	Condition	Specified Condition
S2-24 (+BM) - Body ground	Always	10 to 14 V

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (+BM CIRCUIT)**

OK

3 INSPECT SKID CONTROL ECU (GND TERMINAL)

Skid Control ECU Harness Side Connector Front View:



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

Standard resistance

Tester Connection	Condition	Specified Condition
S2-23 (GND1) - Body ground	Always	Below 1 Ω
S2-26 (GND2) - Body ground	Always	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (GND CIRCUIT)**

OK

4 RECONFIRM DTC

HINT:
This code is detected when a problem is identified in the brake actuator assembly.
The ABS motor relay is in the brake actuator assembly. Therefore, ABS motor relay inspection and motor relay unit inspection cannot be performed. Be sure to check if the DTC is output before replacing the brake actuator assembly.

(a) Reconnect the skid control ECU connector.
(b) Clear the DTCs (See page BC-14).
(c) Start the engine.
(d) Drive the vehicle at a speed of 6 km/h or more for 30 seconds or more.
(e) Check if the same DTC is recorded (See page BC-14).

Result

Condition	Proceed to
DTC (13) is not output	A
DTC (13) is output	B

HINT:
- If the normal system code is output (the trouble code is not output), slightly jiggle the connectors, wire harness, and fuses of the brake actuator assembly (skid control ECU). Make sure that no DTCs are output.
- If any DTCs are output while jiggling a connector or wire harness of the brake actuator assembly (skid control ECU), inspect and repair the connector or wire harness.

B → **REPLACE BRAKE ACTUATOR ASSEMBLY**

A

USE SIMULATION METHOD TO CHECK

DTC	21	SFR Solenoid Circuit

DTC	22	SFL Solenoid Circuit

DTC	23	SRR Solenoid Circuit

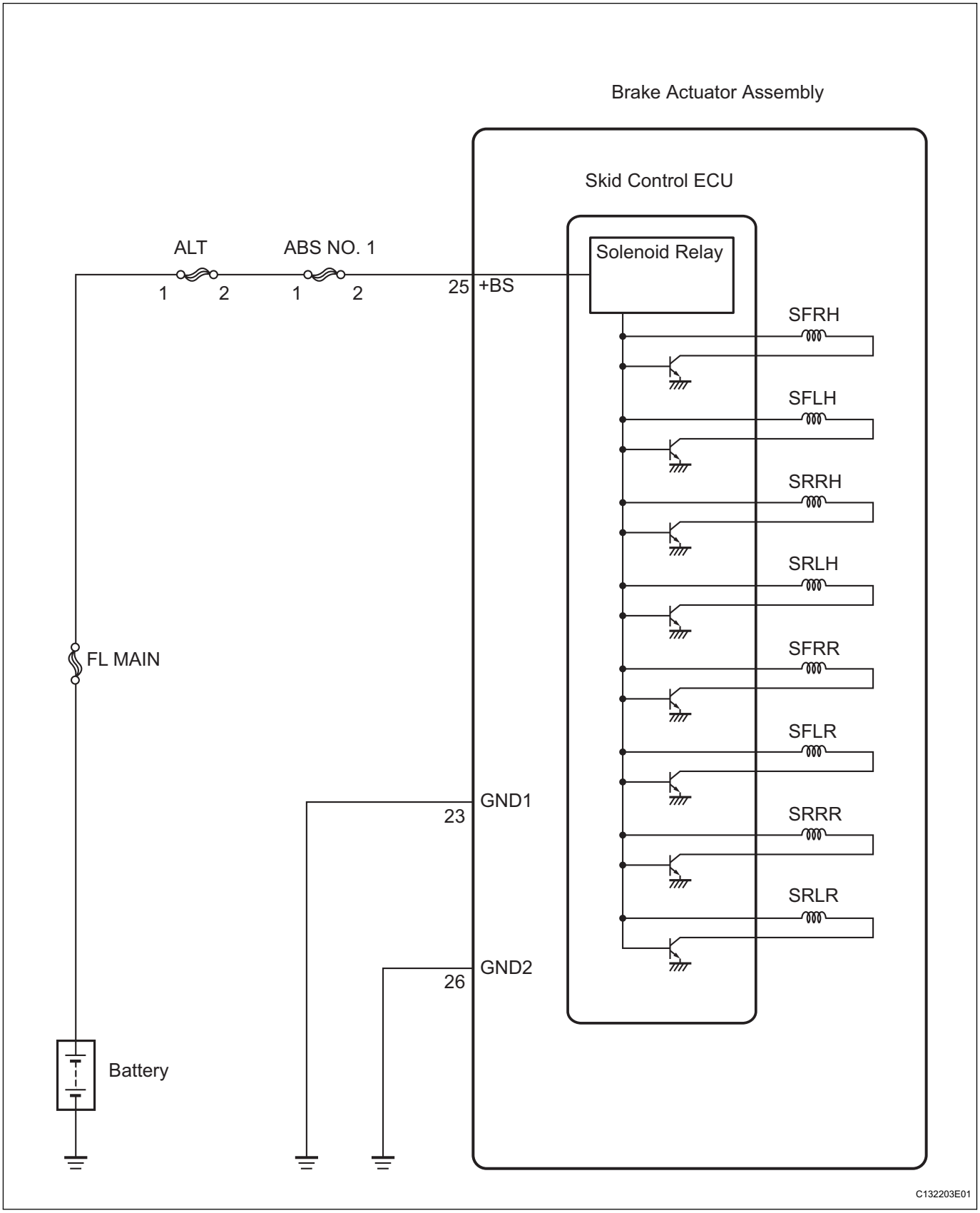
DTC	24	SRL Solenoid Circuit

DESCRIPTION

These solenoids go on when signals are received from the skid control ECU and control the pressure acting on the wheel cylinders thus controlling braking force.

DTC No.	DTC Detection Condition	Trouble Area
21 22 23 24	Solenoid valve signal does not match the check result.	• Each solenoid circuit • Brake actuator assembly

WIRING DIAGRAM



INSPECTION PROCEDURE

1	RECONFIRM DTC

HINT:
These codes are detected when a problem is identified in the brake actuator assembly.
The solenoid circuit is in the brake actuator assembly. Therefore, solenoid circuit inspection and solenoid unit inspection cannot be performed. Be sure to check if the DTC is output before replacing the brake actuator assembly.

(a) Clear the DTCs (See page BC-14).
(b) Start the engine.
(c) Drive the vehicle at a speed of 6 km/h or more for 30 seconds or more.
(d) Check if the same DTC is recorded (See page BC-14).

Result

Condition	Proceed to
DTCs (21, 22, 23 and/or 24) are not output	A
DTCs (21, 22, 23 and/or 24) are output	B

HINT:
- If the normal system code is output (the trouble code is not output), slightly jiggle the connectors, wire harness, and fuses of the brake actuator assembly (skid control ECU). Make sure that no DTCs are output.
- If any DTCs are output while jiggling a connector or wire harness of the brake actuator assembly (skid control ECU), inspect and repair the connector or wire harness.

B → REPLACE BRAKE ACTUATOR ASSEMBLY

A

USE SIMULATION METHOD TO CHECK

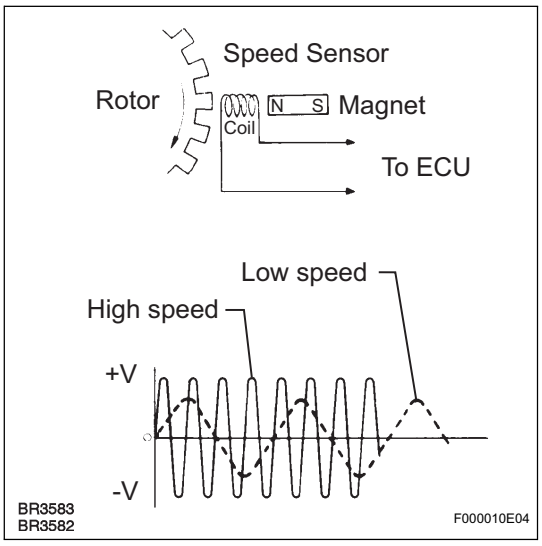
DTC	31	Right Front Speed Sensor Circuit
DTC	32	Left Front Speed Sensor Circuit
DTC	35	Foreign Matter is Attached on Tip of Right Front Sensor
DTC	36	Foreign Matter is Attached on Tip of Left Front Sensor
DTC	71	Low Output Signal of Front Speed Sensor RH (Test Mode DTC)
DTC	72	Low Output Signal of Front Speed Sensor LH (Test Mode DTC)
DTC	75	Abnormal Change in Output Signal of Front Speed Sensor RH (Test Mode DTC)
DTC	76	Abnormal Change in Output Signal of Front Speed Sensor LH (Test Mode DTC)

DESCRIPTION

The speed sensor detects wheel speed and transmits the appropriate signals to the skid control ECU. These signals are used for control of the ABS control system. Each of the front and rear rotors has 48 serrations.

When the rotors rotate, the magnetic field generated by the permanent magnet in the speed sensor induces AC voltage. Since the frequency of this AC voltage changes in direct proportion to the speed of the rotor, the frequency is used by the ECU to detect the speed of each wheel.

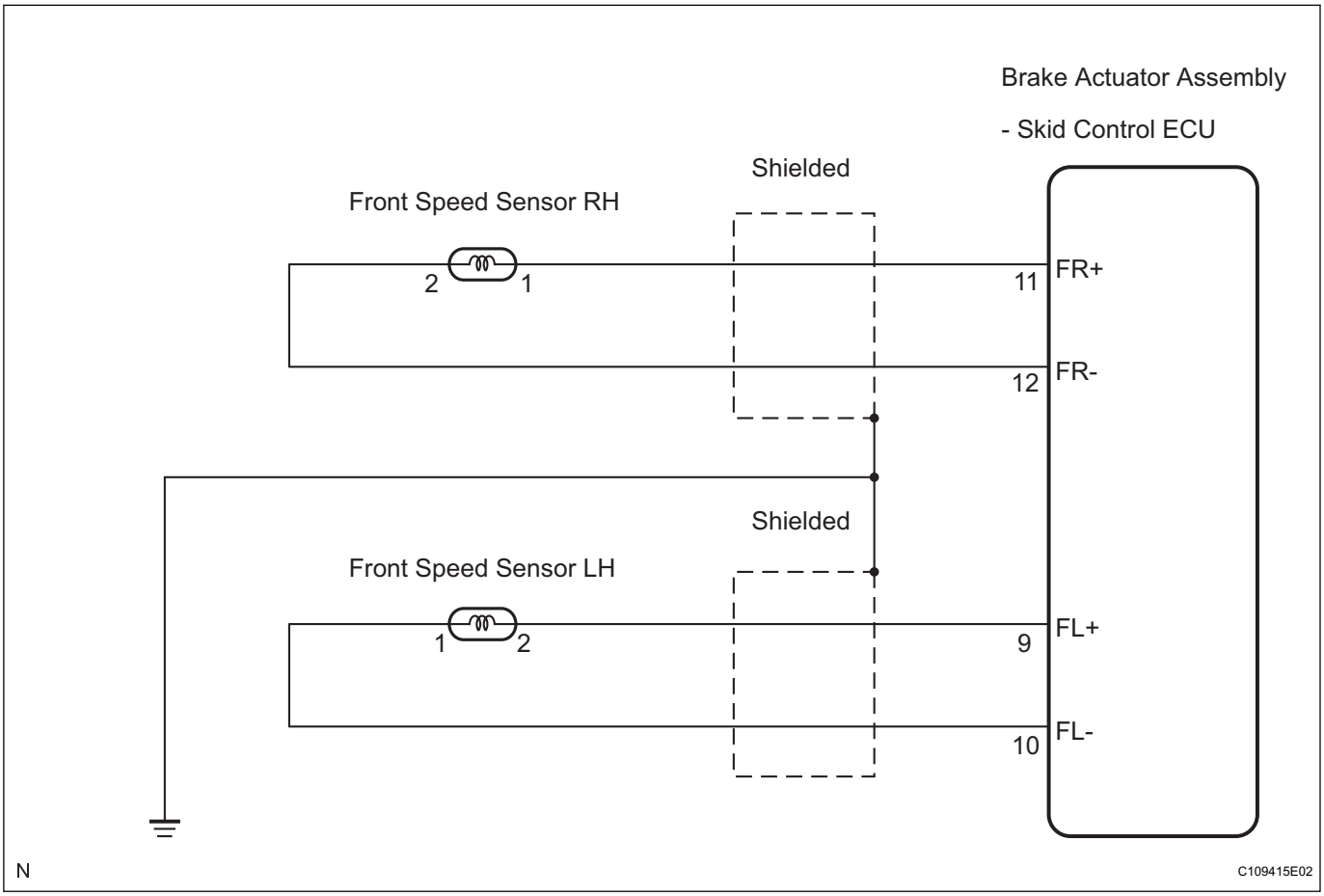
DTCs 71 to 76 can be deleted when the speed sensor sends a vehicle speed signal or the Test Mode ends. DTCs 71 to 76 are output only in the Test Mode.



DTC No.	DTC Detection Condition	Trouble Area
31 32	When either of the following is detected: • Vehicle speed is more than 40 km/h, and pulses are not input for 0.1 seconds. • When the vehicle speed has reached 12 km/h after the initial start or restart, a wheel speed of 0 km/h is detected.	• Front speed sensor RH and/or LH • Speed sensor circuit • Speed sensor rotor • Sensor installation • Brake actuator assembly (Skid control ECU)
35 36	Abnormality in the resistance value of each speed sensor is detected.	• Front speed sensor RH and/or LH • Speed sensor circuit • Sensor installation

HINT:
DTC 31 and 35 are for the front speed sensor RH.
DTC 32 and 36 are for the front speed sensor LH.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	PERFORM TEST MODE (SIGNAL CHECK)

(a) Perform sensor check in Test Mode Procedure (See page BC-8).

OK:

All Test Mode DTCs are not output.

NG	GO TO STEP 3

OK

2	RECONFIRM DTC

(a) Clear the DTCs (See page BC-14).
(b) Start the engine.
(c) Drive the vehicle at a speed of 40 km/h or more for 60 seconds or more.
(d) Check if the same DTC is recorded (See page BC-14).

Result

Condition	Proceed to
DTCs (31, 32, 35 and/or 36) are not output	A
DTCs (31, 32, 35 and/or 36) are output	B

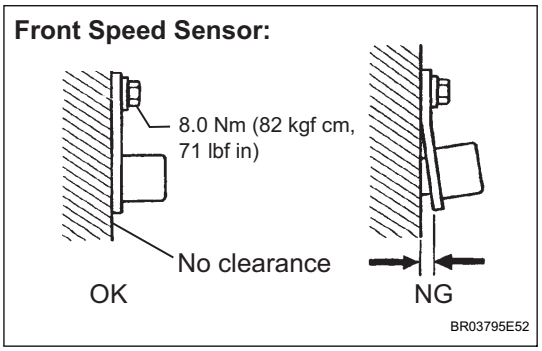
HINT:
If troubleshooting has been carried out according to the Problem Symptoms Table, refer back to the table and proceed to the next step (See page BC-11).

B → GO TO STEP 5

A

USE SIMULATION METHOD TO CHECK

3	CHECK FRONT SPEED SENSOR INSTALLATION



(a) Check the speed sensor installation.
OK:
The installation bolt is tightened properly.
There is no clearance between the sensor and front steering knuckle.

Torque: 8.0 Nm (82 kgf cm, 71 lbf in)

NG → **INSTALL FRONT SPEED SENSOR CORRECTLY**

OK

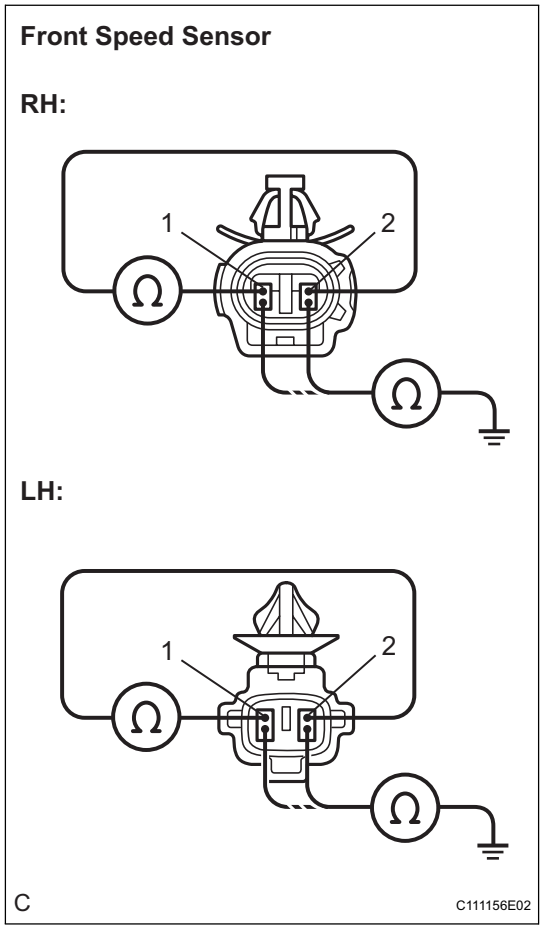
4	CHECK FRONT SPEED SENSOR TIP

(a) Remove the front speed sensor.
(b) Check the speed sensor tip.
OK:
No scratches or foreign matter on the sensor tip.
NOTICE:
Check the speed sensor signal after cleaning/ replacement (See page BC-9).

NG → CLEAN OR REPLACE FRONT SPEED SENSOR

OK

5 INSPECT FRONT SPEED SENSOR



(a) Turn the ignition switch off.
(b) Install the front speed sensor.
(c) Disconnect the front speed sensor connector.
(d) Measure the resistance according to the value(s) in the table below.

Standard resistance:

RH

Tester Connection	Condition	Specified Condition
1 (FR+) - 2 (FR-)	Always	1.4 to 1.8 kΩ at 20°C
1 (FR+) - Body ground	Always	10 kΩ or higher
2 (FR-) - Body ground	Always	10 kΩ or higher

LH

Tester Connection	Condition	Specified Condition
2 (FL+) - 1 (FL-)	Always	1.4 to 1.8 kΩ at 20°C
2 (FL+) - Body ground	Always	10 kΩ or higher
1 (FL-) - Body ground	Always	10 kΩ or higher

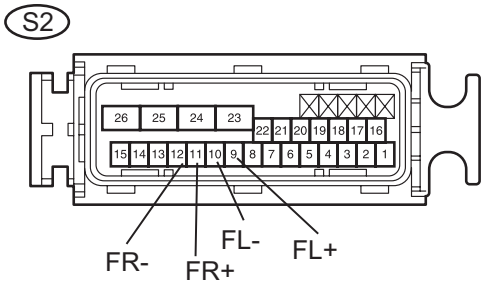
NOTICE:
Check the speed sensor signal after replacement (See page BC-9).

NG → REPLACE FRONT SPEED SENSOR

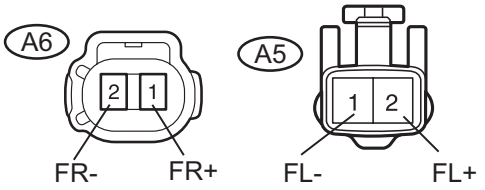
OK

6	CHECK HARNESS AND CONNECTOR (SKID CONTROL ECU - FRONT SPEED SENSOR)

Skid Control ECU Harness Side Connector Front View:



Front Speed Sensor Harness Side Connector Front View:



C131030E01

(a) Disconnect the skid control ECU connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance:

RH

Tester Connection	Condition	Specified Condition
S2-11 (FR+) - A6-1 (FR+)	Always	Below 1 Ω
S2-11 (FR+) - Body ground	Always	10 kΩ or higher
S2-12 (FR-) - A6-2 (FR-)	Always	Below 1 Ω
S2-12 (FR-) - Body ground	Always	10 kΩ or higher

LH

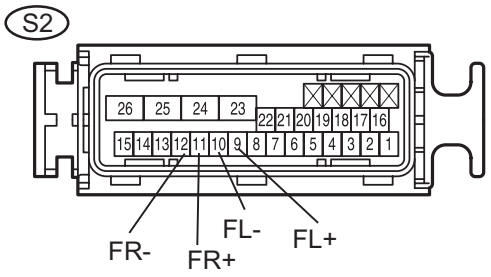
Tester Connection	Condition	Specified Condition
S2-9 (FL+) - A5-2 (FL+)	Always	Below 1 Ω
S2-9 (FL+) - Body ground	Always	10 kΩ or higher
S2-10 (FL-) - A5-1 (FL-)	Always	Below 1 Ω
S2-10 (FL-) - Body ground	Always	10 kΩ or higher

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

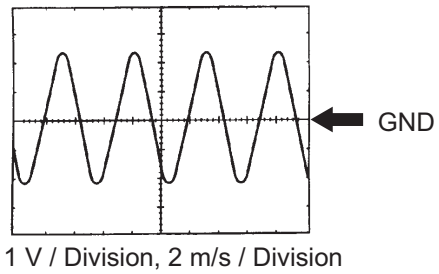
OK

7	CHECK SPEED SENSOR AND SPEED SENSOR ROTOR SERRATIONS

Skid Control ECU Harness Side Connector Front View:



Normal Signal Waveform:



1 V / Division, 2 m/s / Division

C131031E01

(a) Reconnect the front speed sensor connector.
(b) Connect the oscilloscope to the front speed sensor terminal of the skid control ECU.
(c) Check that a waveform is output when the wheels are rotated.

OK:

The same waveform is output from all the 4 wheels and there is no noise or interference in the waveform.

HINT:

- As the vehicle speed (wheel revolution speed) increases, a cycle of the waveform narrows and the fluctuation in the output voltage becomes greater.
- When noise is identified in the waveform on the oscilloscope, error signals are generated due to the speed sensor rotor's scratches, looseness or foreign matter attached to it.

OK → **GO TO STEP 9**

NG

8	CHECK FRONT SPEED SENSOR ROTOR

(a) Remove the front speed sensor rotor.
(b) Check the speed sensor rotor.

OK:

No scratches or foreign matter on the rotors.

NOTICE:

Check the speed sensor signal after cleaning/ replacement (See page BC-9).

NG → **CLEAN OR REPLACE FRONT SPEED SENSOR ROTOR**

OK

9	RECONFIRM DTC

(a) Reconnect the skid control ECU connector.
(b) Install the front speed sensor rotor.
(c) Clear the DTCs (See page BC-14).

(d) Start the engine.
(e) Drive the vehicle at a speed of 40 km/h or more for 60 seconds or more.
(f) Check if the same DTC is recorded (See page BC-14).

Result

Condition	Proceed to
DTCs (31, 32, 35 and/or 36) are output	A
DTCs (31, 32, 35 and/or 36) are not output	B

HINT:
If troubleshooting has been carried out according to the Problem Symptoms Table, refer back to the table and proceed to the next step (See page BC-11).

B → **USE SIMULATION METHOD TO CHECK**

A → **REPLACE BRAKE ACTUATOR ASSEMBLY**

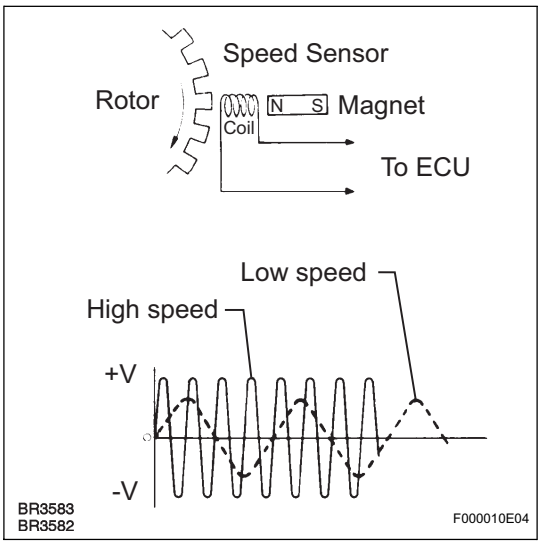
DTC	33	Right Rear Speed Sensor Circuit
DTC	34	Left Rear Speed Sensor Circuit
DTC	38	Foreign Matter is Attached on Tip of Right Rear Sensor
DTC	39	Foreign Matter is Attached on Tip of Left Rear Sensor
DTC	73	Low Output Signal of Rear Speed Sensor RH (Test Mode DTC)
DTC	74	Low Output Signal of Rear Speed Sensor LH (Test Mode DTC)
DTC	77	Abnormal Change in Output Signal of Rear Speed Sensor RH (Test Mode DTC)
DTC	78	Abnormal Change in Output Signal of Rear Speed Sensor LH (Test Mode DTC)

DESCRIPTION

The speed sensor detects wheel speed and transmits the appropriate signals to the skid control ECU. These signals are used for control of the ABS control system. Each of the front and rear rotors has 48 serrations.

When the rotors rotate, the magnetic field generated by the permanent magnet in the speed sensor induces AC voltage. Since the frequency of this AC voltage changes in direct proportion to the speed of the rotor, the frequency is used by the ECU to detect the speed of each wheel.

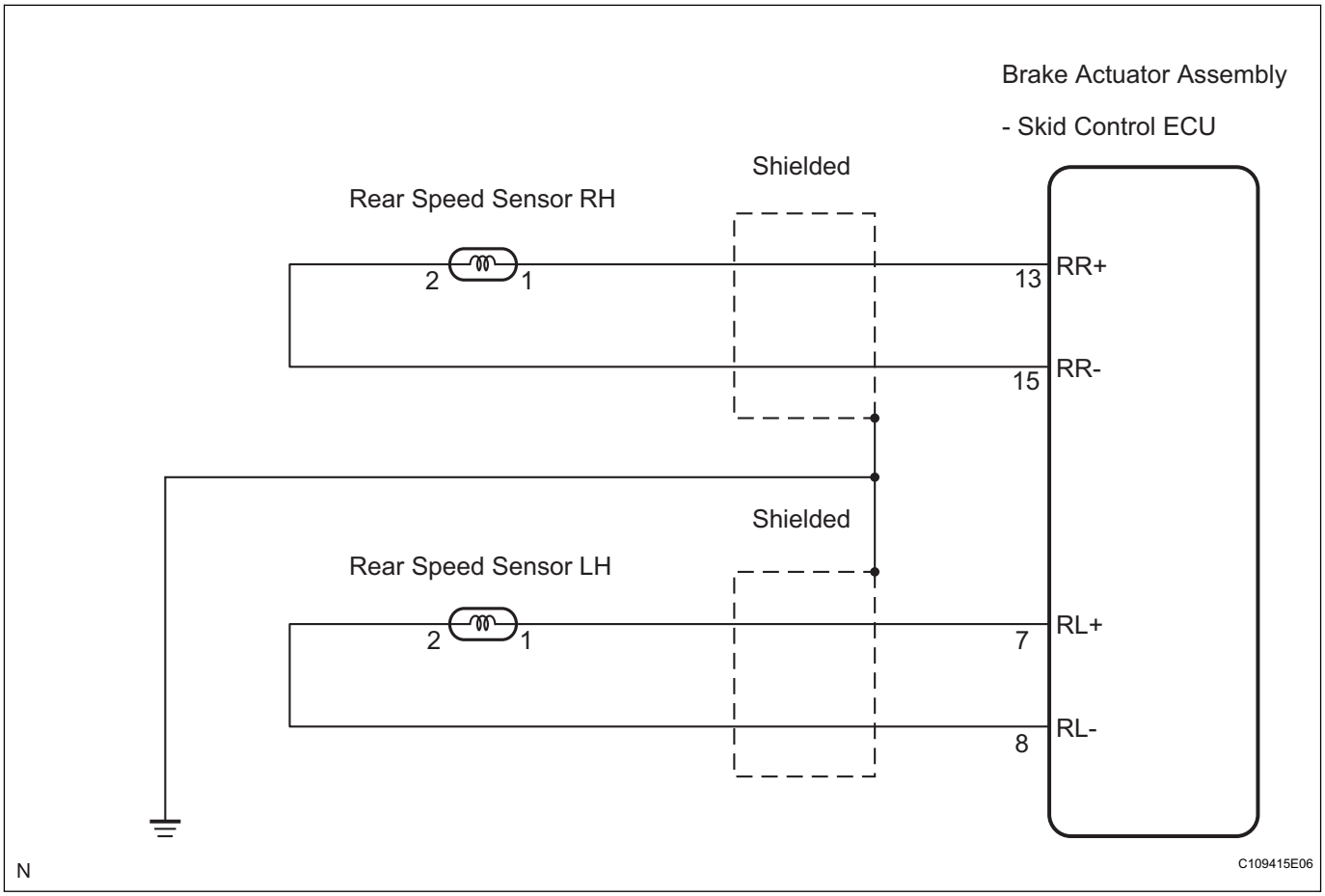
DTCs 73 to 78 can be deleted when the speed sensor sends a vehicle speed signal or the Test Mode ends. DTCs 73 to 78 are output only in the Test Mode.



DTC No.	DTC Detection Condition	Trouble Area
33 34	When either of the following is detected: • Vehicle speed is more than 40 km/h, and pulses are not input for 0.1 seconds. • When the vehicle speed has reached 12 km/h after the initial start or restart, a wheel speed of 0 km/h is detected.	• Rear speed sensor RH and/or LH • Speed sensor circuit • Speed sensor rotor • Sensor installation • Brake actuator assembly (Skid control ECU)
38 39	Abnormality in the resistance value of each speed sensor is detected.	• Rear speed sensor RH and/or LH • Speed sensor circuit • Sensor installation

HINT:
DTC 33 and 38 are for the rear speed sensor RH.
DTC 34 and 39 are for the rear speed sensor LH.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	PERFORM TEST MODE (SIGNAL CHECK)

(a) Perform sensor check in Test Mode Procedure (See page BC-8).

OK:

All Test Mode DTCs are not output.

NG	GO TO STEP 3

OK

2	RECONFIRM DTC

(a) Clear the DTCs (See page BC-14).
(b) Start the engine.
(c) Drive the vehicle at a speed of 40 km/h or more for 60 seconds or more.
(d) Check if the same DTC is recorded (See page BC-14).

Result

Condition	Proceed to
DTCs (33, 34, 38 and/or 39) are not output	A
DTCs (33, 34, 38 and/or 39) are output	B

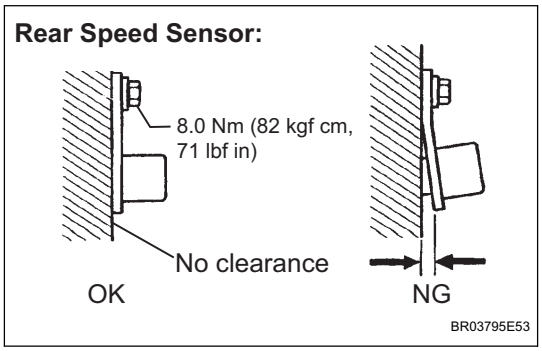
HINT:
If troubleshooting has been carried out according to the Problem Symptoms Table, refer back to the table and proceed to the next step (See page BC-11).

B → GO TO STEP 5

A

USE SIMULATION METHOD TO CHECK

3	CHECK REAR SPEED SENSOR INSTALLATION



(a) Check the speed sensor installation.
OK:
The installation bolt is tightened properly.
There is no clearance between the sensor and rear axle carrier.

Torque: 8.0 Nm (82 kgf cm, 71 lbf in)

NG → **INSTALL REAR SPEED SENSOR CORRECTLY**

OK

4	CHECK REAR SPEED SENSOR TIP

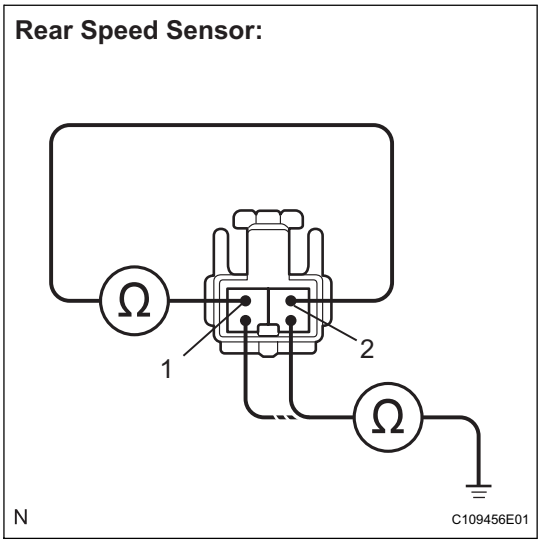
(a) Remove the rear speed sensor.
(b) Check the speed sensor tip.
OK:
No scratches or foreign matter on the sensor tip.
NOTICE:
Check the speed sensor signal after cleaning/ replacement (See page BC-9).

NG → CLEAN OR REPLACE REAR SPEED SENSOR

OK

5 INSPECT REAR SPEED SENSOR

Rear Speed Sensor:



(a) Turn the ignition switch off.
(b) Install the rear speed sensor.
(c) Disconnect the rear speed sensor connector.
(d) Measure the resistance according to the value(s) in the table below.

Standard resistance:

RH

Tester Connection	Condition	Specified Condition
1 (RR+) - 2 (RR-)	Always	1.5 to 1.7 kΩ at 20°C
1 (RR+) - Body ground	Always	10 kΩ or higher
2 (RR-) - Body ground	Always	10 kΩ or higher

LH

Tester Connection	Condition	Specified Condition
1 (RL+) - 2 (RL-)	Always	1.5 to 1.7 kΩ at 20°C
1 (RL+) - Body ground	Always	10 kΩ or higher
2 (RL-) - Body ground	Always	10 kΩ or higher

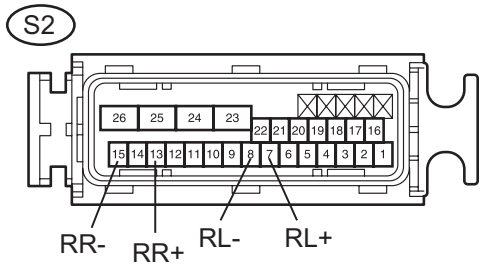
NOTICE:
Check the speed sensor signal after replacement (See page BC-9).

NG → REPLACE REAR SPEED SENSOR

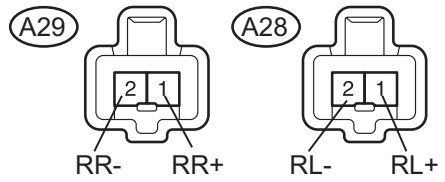
OK

6	CHECK HARNESS AND CONNECTOR (SKID CONTROL ECU - REAR SPEED SENSOR)

Skid Control ECU Harness Side Connector Front View:



Rear Speed Sensor Harness Side Connector Front View:



N C113378E03

OK

(a) Disconnect the skid control ECU connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance:

RH

Tester Connection	Condition	Specified Condition
S2-13 (RR+) - A29-1 (RR+)	Always	Below 1 Ω
S2-13 (RR+) - Body ground	Always	10 kΩ or higher
S2-15 (RR-) - A29-2 (RR-)	Always	Below 1 Ω
S2-15 (RR-) - Body ground	Always	10 kΩ or higher

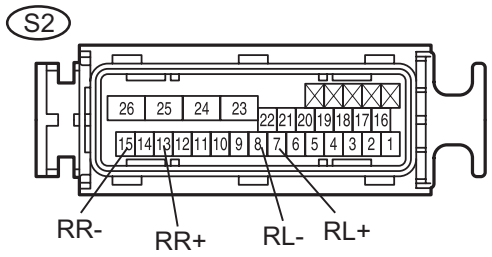
LH

Tester Connection	Condition	Specified Condition
S2-7 (RL+) - A28-1 (RL+)	Always	Below 1 Ω
S2-7 (RL+) - Body ground	Always	10 kΩ or higher
S2-8 (RL-) - A28-2 (RL-)	Always	Below 1 Ω
S2-8 (RL-) - Body ground	Always	10 kΩ or higher

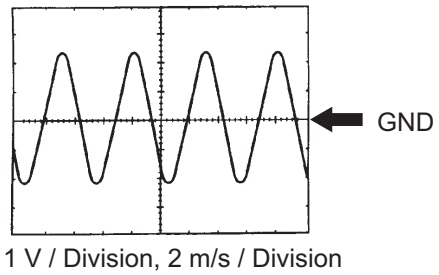
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

7	CHECK SPEED SENSOR AND SPEED SENSOR ROTOR SERRATIONS

Skid Control ECU Harness Side Connector Front View:



Normal Signal Waveform:



C131031E04

(a) Reconnect the rear speed sensor connector.
(b) Connect the oscilloscope to the rear speed sensor terminal of the skid control ECU.
(c) Check that a waveform is output when the wheels are rotated.

OK:

The same waveform is output from all the 4 wheels and there is no noise or interference in the waveform.

HINT:

- As the vehicle speed (wheel revolution speed) increases, a cycle of the waveform narrows and the fluctuation in the output voltage becomes greater.
- When noise is identified in the waveform on the oscilloscope, error signals are generated due to the speed sensor rotor's scratches, looseness or foreign matter attached to it.

OK	GO TO STEP 9

NG

8	CHECK REAR SPEED SENSOR ROTOR

(a) Remove the rear speed sensor rotor.
(b) Check the speed sensor rotor.

OK:

No scratches or foreign matter on the rotors.

NOTICE:

Check the speed sensor signal after cleaning/ replacement (See page BC-9).

NG	CLEAN OR REPLACE REAR SPEED SENSOR ROTOR

OK

9	RECONFIRM DTC

(a) Reconnect the skid control ECU connector.
(b) Install the rear speed sensor rotor.
(c) Clear the DTCs (See page BC-14).

(d) Start the engine.
(e) Drive the vehicle at a speed of 40 km/h or more for 60 seconds or more.
(f) Check if the same DTC is recorded (See page BC-14).

Result

Condition	Proceed to
DTCs (33, 34, 38 and/or 39) are output	A
DTCs (33, 34, 38 and/or 39) are not output	B

HINT:
If troubleshooting has been carried out according to the Problem Symptoms Table, refer back to the table and proceed to the next step (See page BC-11).

B → **USE SIMULATION METHOD TO CHECK**

A → **REPLACE BRAKE ACTUATOR ASSEMBLY**

DTC	37	Speed Sensor Rotor Faulty

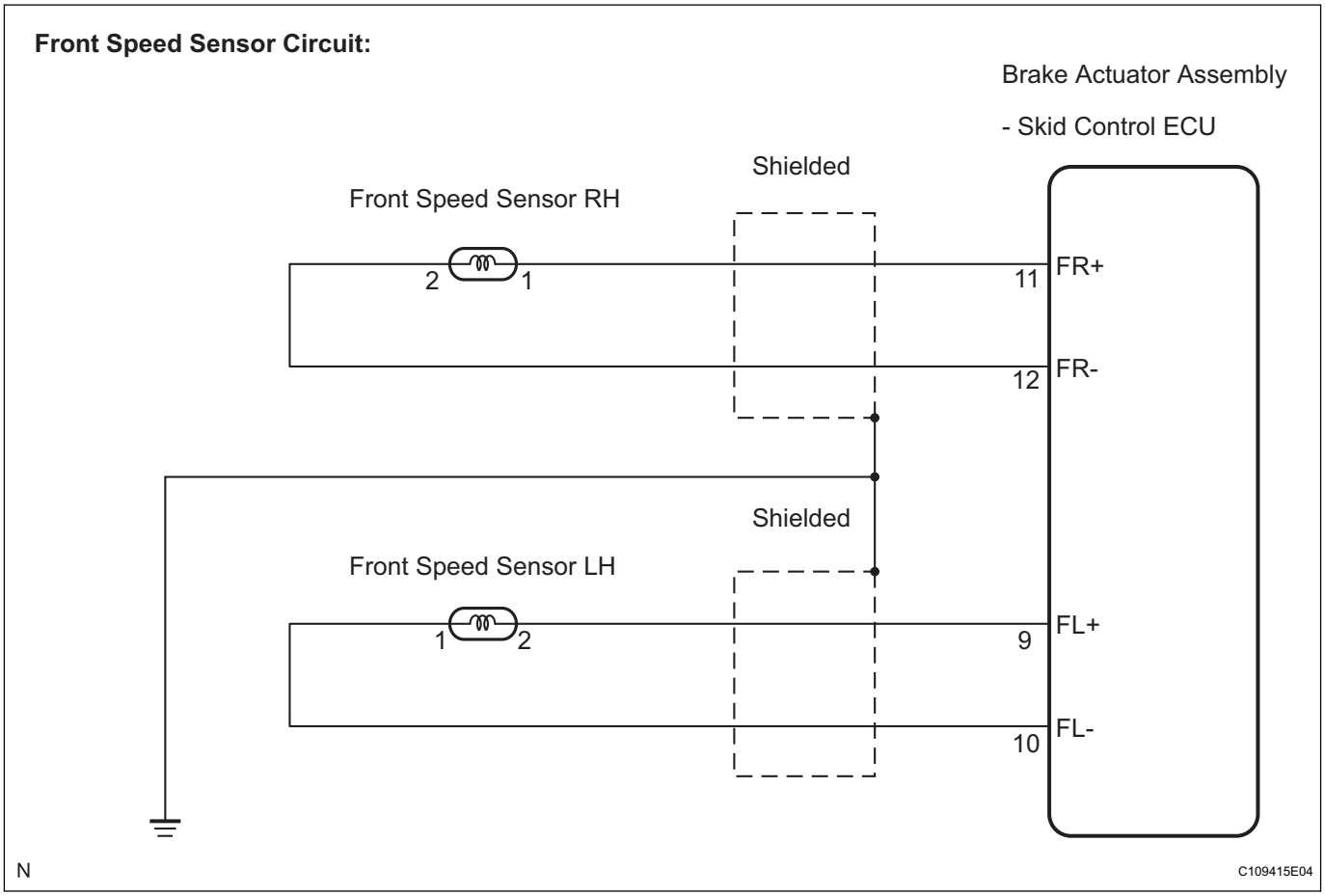
DESCRIPTION

The skid control ECU measures the speed of each wheel by receiving signals from the speed sensors. These signals are used for recognising that all 4 wheels are operating properly. Therefore, all wheel signals must be equal.

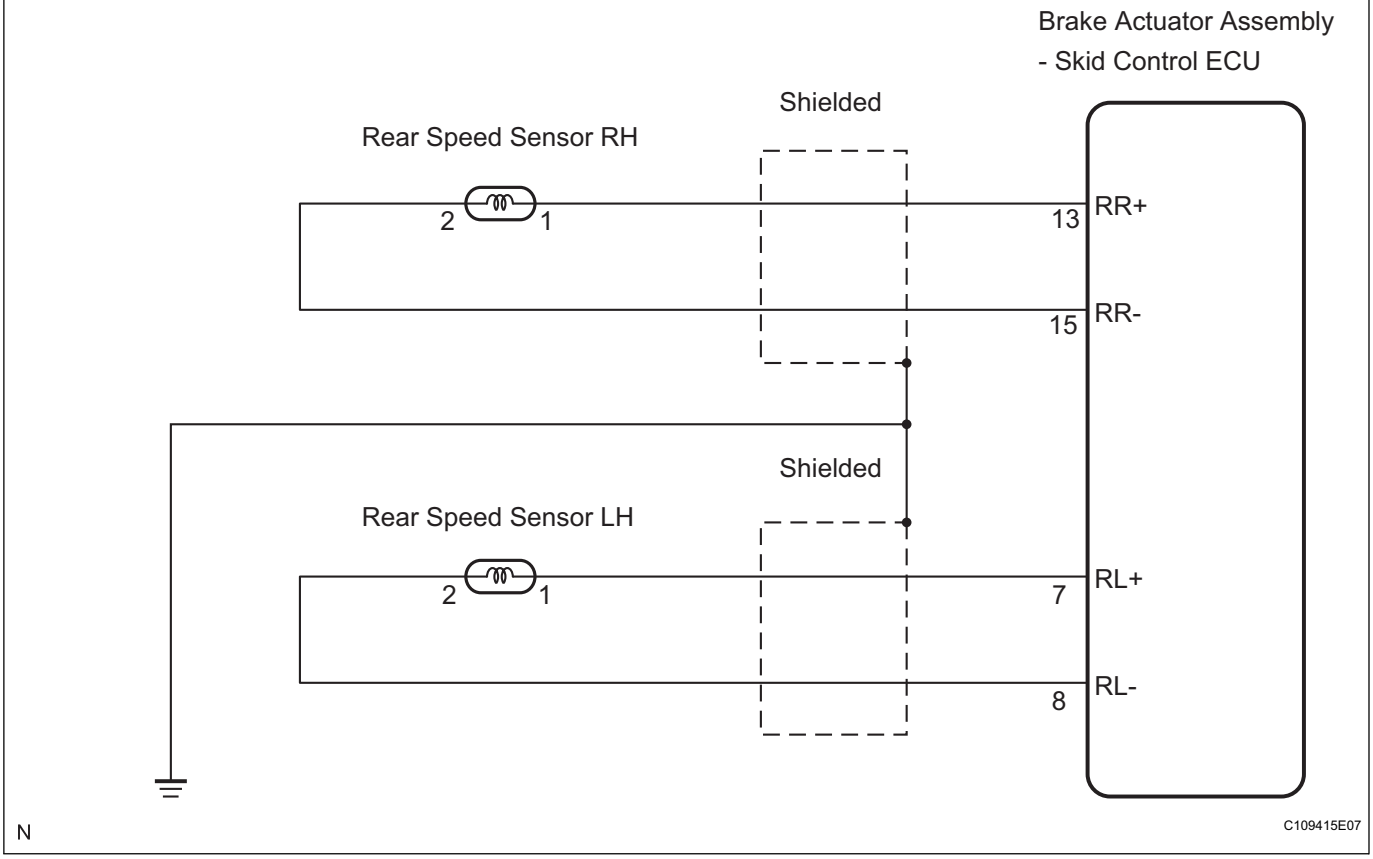
DTC No.	DTC Detection Condition	Trouble Area
37	When any of the following is detected: • Wheel speed difference between the wheels. • Wheel sensor signal failure. • Continuous ABS control for 60 seconds or more.	• Tyre and wheel size • Tyre deformation • Speed sensor • Speed sensor circuit • Speed sensor rotor • Sensor installation • Brake actuator assembly (Skid control ECU)

WIRING DIAGRAM

Front Speed Sensor Circuit:



Rear Speed Sensor Circuit:



INSPECTION PROCEDURE

1	**CHECK TYRES**

(a) Check the size and condition of all 4 tyres.

OK:

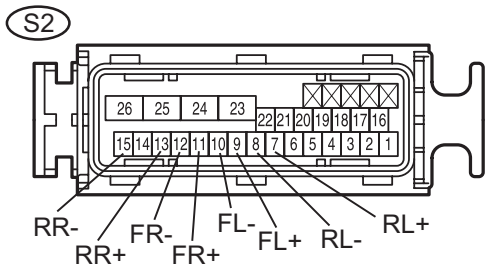
The diameters and air pressure of all 4 tyres are the same

NG → **REPLACE TYRES SO THAT ALL 4 TYRES ARE SAME IN SIZE**

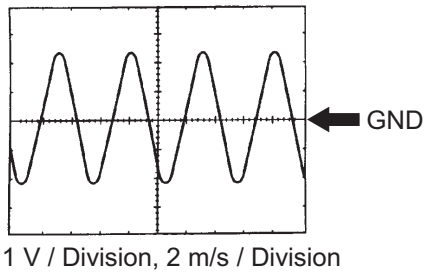
OK

2	CHECK SPEED SENSOR AND SPEED SENSOR ROTOR SERRATIONS

Skid Control ECU Harness Side Connector Front View:



Normal Signal Waveform:



C131031E05

(a) Disconnect the skid control ECU connector.
(b) Connect the oscilloscope to each speed sensor terminal of the skid control ECU.
(c) Check that a waveform is output when the wheels are rotated (by the sensor circuit).
OK:
The same waveform is output from all the 4 wheels and there is no noise or interference in the waveform.
(d) Check that the waveform does not change while jiggling a connector or a wire harness.
OK:
The waveform does not change.
HINT:
- As the vehicle speed (wheel revolution speed) increases, a cycle of the waveform narrows and the fluctuation in the output voltage becomes greater.
- When noise is identified in the waveform on the oscilloscope, error signals are generated due to the speed sensor rotor's scratches, looseness or foreign matter attached to it.

NG → **GO TO STEP 4**

OK

3	RECONFIRM DTC

(a) Reconnect the skid control ECU connector.
(b) Clear the DTCs (See page BC-14).
(c) Start the engine.
(d) Drive the vehicle at a speed of 40 km/h or more for 60 seconds or more.
(e) Check if the same DTC is recorded (See page BC-14).

Result

Condition	Proceed to
DTC (37) is not output	A
DTC (37) is output	B

B → **REPLACE BRAKE ACTUATOR ASSEMBLY**

A

USE SIMULATION METHOD TO CHECK

4	CHECK EACH SPEED SENSOR ROTOR

(a) Remove each speed sensor rotor.
(b) Check the speed sensor rotor.
OK:
No scratches or foreign matter on the rotors.
NOTICE:
Check the speed sensor signal after cleaning/ replacement (See page BC-9).

NG → **CLEAN OR REPLACE EACH SPEED SENSOR ROTOR**

OK

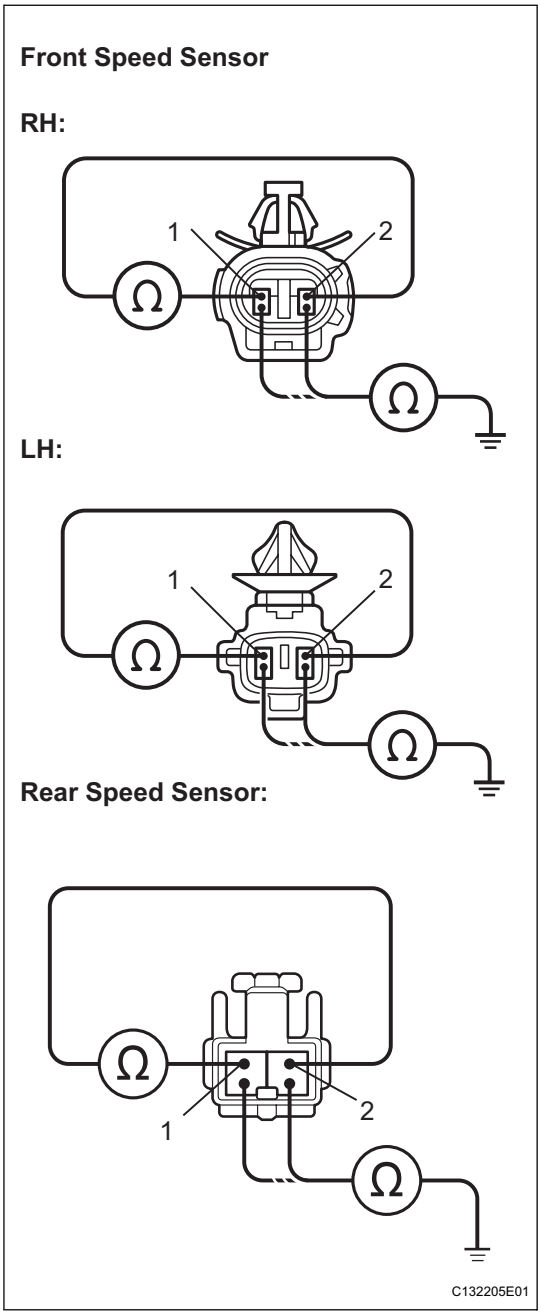
5	CHECK EACH SPEED SENSOR TIP

(a) Remove each speed sensor.
(b) Check the speed sensor tip.
OK:
No scratches or foreign matter on the sensor tip.
NOTICE:
Check the speed sensor signal after cleaning/ replacement (See page BC-9).

NG → **CLEAN OR REPLACE EACH SPEED SENSOR**

OK

6 INSPECT EACH SPEED SENSOR



(a) Install the speed sensor rotor and the speed sensor.
(b) Disconnect each speed sensor connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance:

RH

Tester Connection	Condition	Specified Condition
1 (FR+) - 2 (FR-)	Always	1.4 to 1.8 kΩ at 20°C
1 (FR+) - Body ground	Always	10 kΩ or higher
2 (FR-) - Body ground	Always	10 kΩ or higher
1 (RR+) - 2 (RR-)	Always	1.4 to 1.8 kΩ at 20°C
1 (RR+) - Body ground	Always	10 kΩ or higher
2 (RR-) - Body ground	Always	10 kΩ or higher

LH

Tester Connection	Condition	Specified Condition
2 (FL+) - 1 (FL-)	Always	1.4 to 1.8 kΩ at 20°C
2 (FL+) - Body ground	Always	10 kΩ or higher
1 (FL-) - Body ground	Always	10 kΩ or higher
1 (RL+) - 2 (RL-)	Always	1.4 to 1.8 kΩ at 20°C
1 (RL+) - Body ground	Always	10 kΩ or higher
2 (RL-) - Body ground	Always	10 kΩ or higher

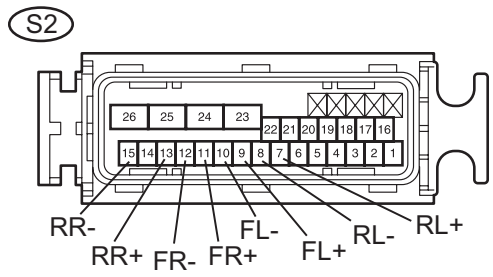
NOTICE:
Check the speed sensor signal after replacement (See page BC-9).

NG → **REPLACE EACH SPEED SENSOR**

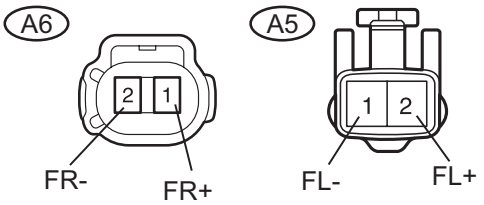
OK

7 CHECK HARNESS AND CONNECTOR (SKID CONTROL ECU - EACH SPEED SENSOR)

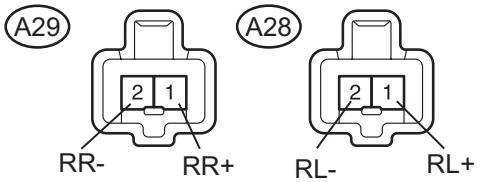
Skid Control ECU Harness Side Connector Front View:



Front Speed Sensor Harness Side Connector Front View:



Rear Speed Sensor Harness Side Connector Front View:



C132206E02

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

Standard resistance:

RH

Tester Connection	Condition	Specified Condition
S2-11 (FR+) - A6-1 (FR+)	Always	Below 1 Ω
S2-11 (FR+) - Body ground	Always	10 kΩ or higher
S2-12 (FR-) - A6-2 (FR-)	Always	Below 1 Ω
S2-12 (FR-) - Body ground	Always	10 kΩ or higher
S2-13 (RR+) - A29-1 (RR+)	Always	Below 1 Ω
S2-13 (RR+) - Body ground	Always	10 kΩ or higher
S2-15 (RR-) - A29-2 (RR-)	Always	Below 1 Ω
S2-15 (RR-) - Body ground	Always	10 kΩ or higher

LH

Tester Connection	Condition	Specified Condition
S2-9 (FL+) - A5-2 (FL+)	Always	Below 1 Ω
S2-9 (FL+) - Body ground	Always	10 kΩ or higher
S2-10 (FL-) - A5-1 (FL-)	Always	Below 1 Ω
S2-10 (FL-) - Body ground	Always	10 kΩ or higher
S2-7 (RL+) - A28-1 (RL+)	Always	Below 1 Ω
S2-7 (RL+) - Body ground	Always	10 kΩ or higher
S2-8 (RL-) - A28-2 (RL-)	Always	Below 1 Ω
S2-8 (RL-) - Body ground	Always	10 kΩ or higher

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

OK

8 RECONFIRM DTC

(a) Reconnect the skid control ECU connector and the speed sensor connector.
(b) Clear the DTCs (See page BC-14).
(c) Start the engine.
(d) Drive the vehicle at a speed of 40 km/h or more for at least 60 seconds.
(e) Check if the same DTC is recorded (See page BC-14).

Result

Condition	Proceed to
DTC (37) is not output	A
DTC (37) is output	B

B → REPLACE BRAKE ACTUATOR ASSEMBLY

A

USE SIMULATION METHOD TO CHECK

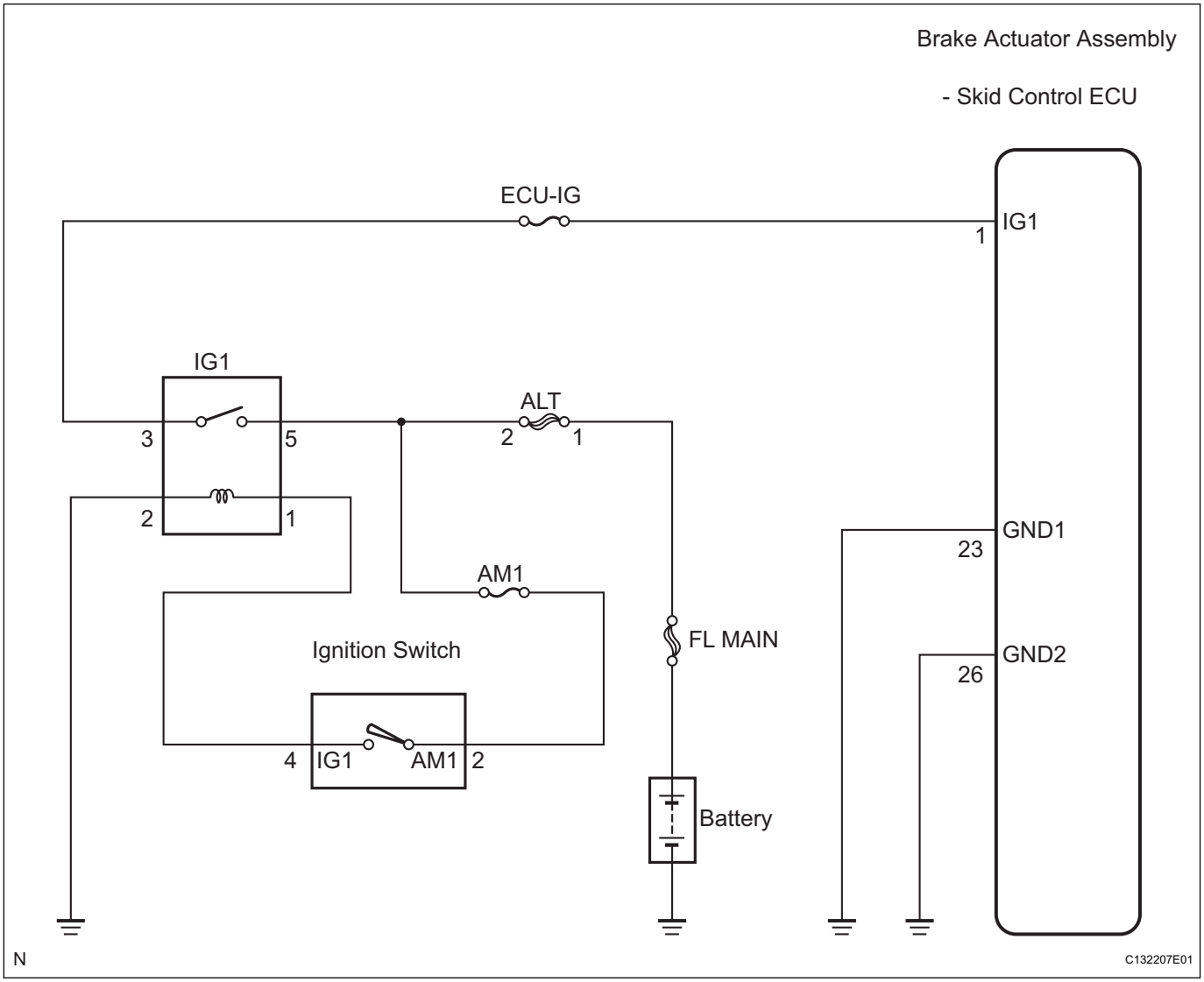
DTC	41	Low Battery Positive Voltage or Abnormally High Battery Positive Voltage

DESCRIPTION

This is the power source of the ECU as well as the actuators.
If a malfunction is detected in the power supply circuit of the brake actuator assembly (skid control ECU), the skid control ECU (housed in the actuator assembly) outputs the DTC and prohibits operation with the fail-safe function.
This DTC is output when the IG1 terminal voltage deviates from the normal condition due to a malfunction in the power supply or charging circuit such as the battery or alternator circuit, etc.
This DTC is cancelled when the IG1 terminal voltage returns to normal (only when the voltage returns to normal from a voltage lower than the specified value).

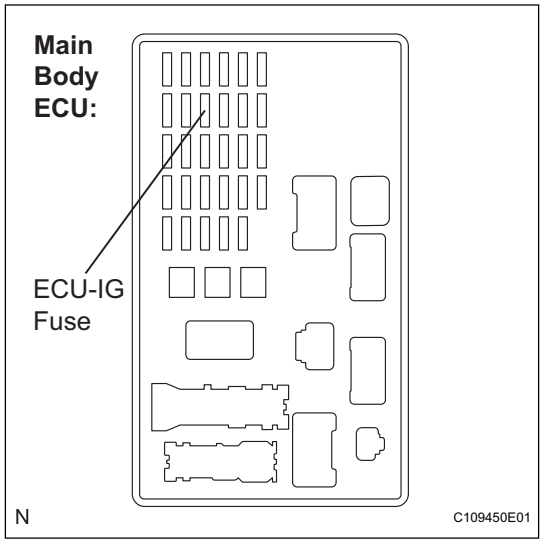
DTC No.	DTC Detection Condition	Trouble Area
41	When vehicle speed is more than 6 km/h, any of the following is detected: • Battery voltage is 17.4 V or more. • Battery voltage is 9.4 V or less when ABS does not operate. • Battery voltage is 8.8 V or less when ABS operates.	• Battery • ECU-IG fuse • Charging system • Power source circuit • Internal power supply circuit of the skid control ECU

WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT ECU-IG FUSE



(a) Remove the ECU-IG fuse from the main body ECU.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Condition	Specified Condition
ECU-IG (10 A) fuse	Always	Below 1 Ω

NG → **REPLACE ECU-IG FUSE**

OK

2 CHECK BATTERY

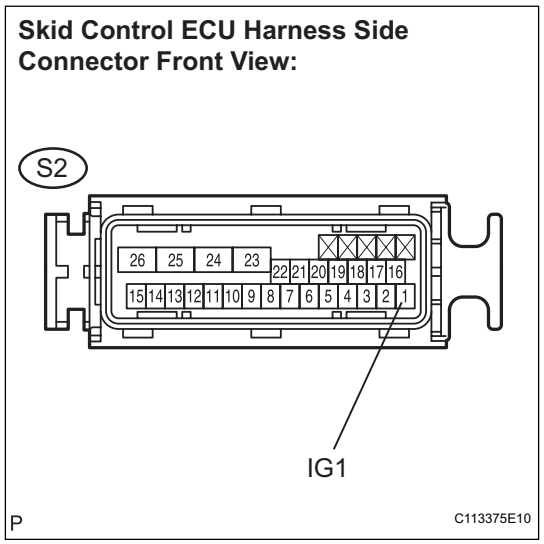
(a) Install the ECU-IG fuse.
(b) Check the battery voltage.

Standard voltage:
11 to 14 V

NG → **CHECK AND REPLACE CHARGING SYSTEM OR BATTERY**

OK

3 INSPECT SKID CONTROL ECU (IG1 TERMINAL)



(a) Disconnect the skid control ECU connector.
(b) Turn the ignition switch to the ON position.
(c) Measure the voltage according to the value(s) in the table below.

Standard voltage

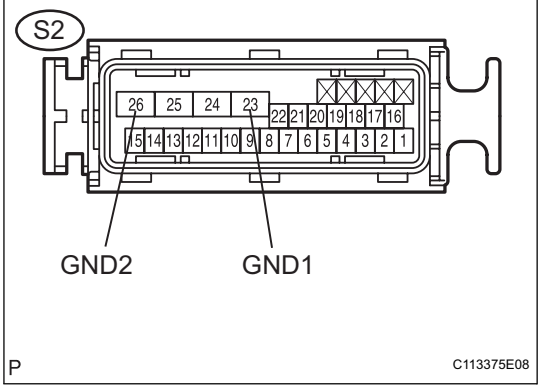
Tester Connection	Condition	Specified Condition
S2-1 (IG1) - Body ground	Ignition switch ON	10 to 14 V

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (IG1 CIRCUIT)**

OK

4 INSPECT SKID CONTROL ECU (GND TERMINAL)

Skid Control ECU Harness Side Connector Front View:



(a) Turn the ignition switch off.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Condition	Specified Condition
S2-23 (GND1) - Body ground	Always	Below 1 Ω
S2-26 (GND2) - Body ground	Always	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (GND CIRCUIT)**

OK

5 RECONFIRM DTC

(a) Reconnect the skid control ECU connector.
(b) Clear the DTCs (See page BC-14).
(c) Turn the ignition switch to the ON position.
(d) Check if the same DTC is recorded (See page BC-14).

Result

Condition	Proceed to
DTC (41) is not output	A
DTC (41) is output	B

HINT:
If troubleshooting has been carried out according to the Problem Symptoms Table, refer back to the table and proceed to the next step before replacing the part (See page BC-11).

B → **REPLACE BRAKE ACTUATOR ASSEMBLY**

A

USE SIMULATION METHOD TO CHECK

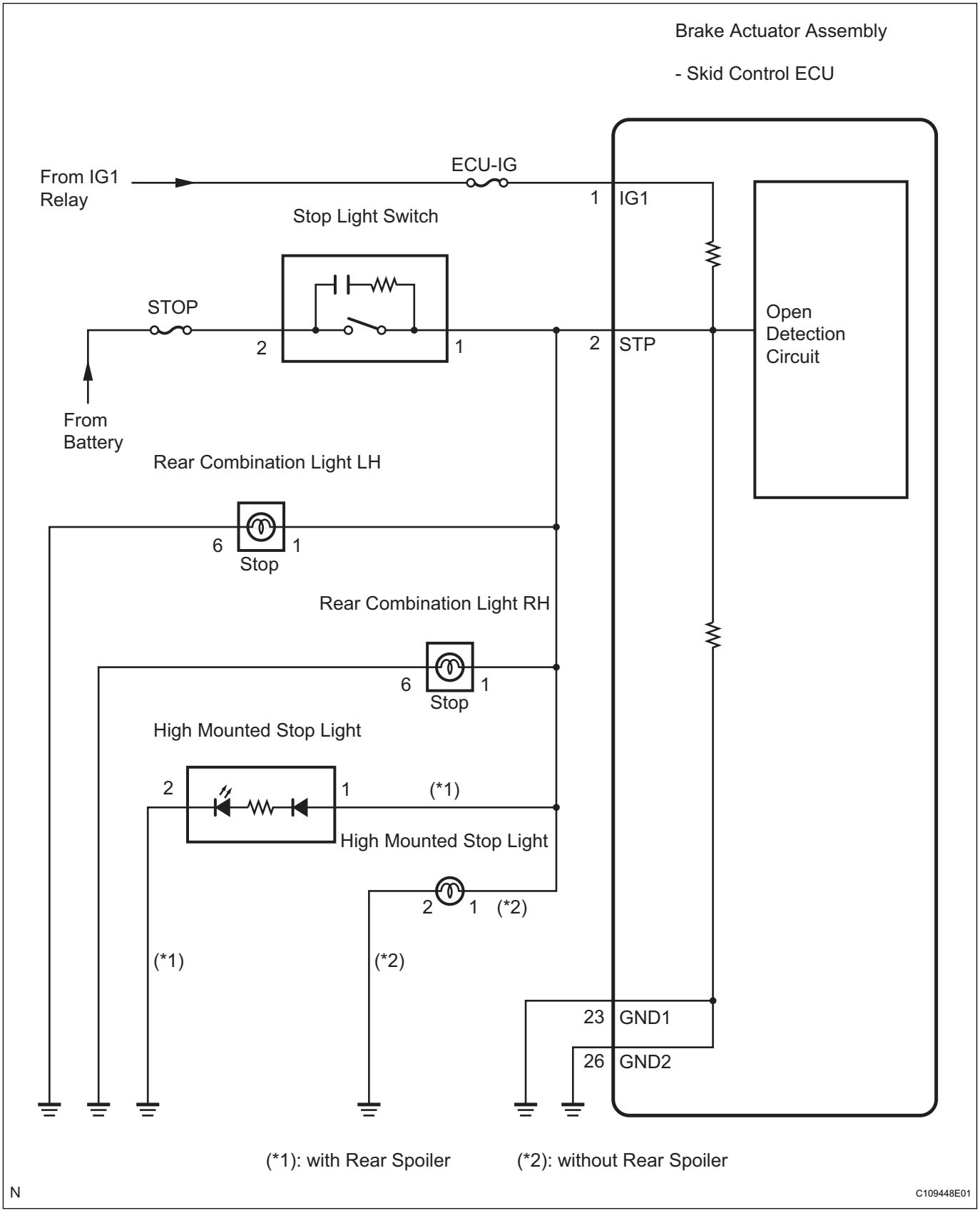
DTC	58	Stop Light Switch Circuit

DESCRIPTION

This circuit recognises brake operation by sending a stop light signal to the skid control ECU.
The skid control ECU has an open detection circuit, which outputs this DTC when detecting an open in the stop light signal input line (STP terminal) or the ground line of the stop light circuit with the stop light switch off (brake pedal not depressed).

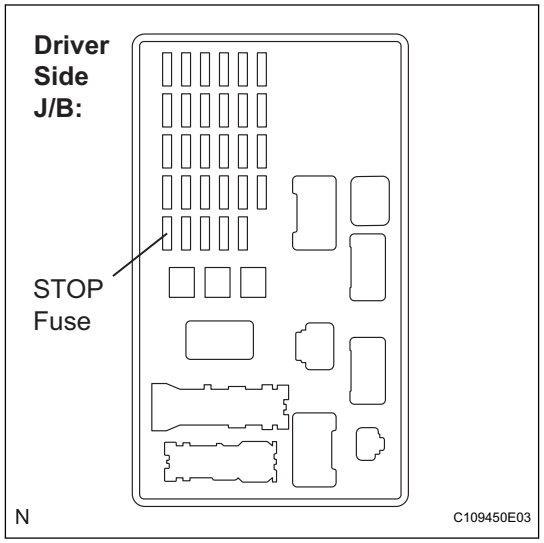
DTC No.	DTC Detection Condition	Trouble Area
58	Stop light switch circuit is open, and stop light switch voltage is 65 % or more and less than 93 % of the battery voltage.	• STOP fuse • Stop light switch • Stop light switch circuit • Brake actuator assembly (Skid control ECU)

WIRING DIAGRAM



INSPECTION PROCEDURE

1	INSPECT STOP FUSE



(a) Remove the STOP fuse from the driver side J/B.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Condition	Specified Condition
STOP (15 A) fuse	Always	Below 1 Ω

NG → **REPLACE STOP FUSE**

OK

2	CHECK STOP LIGHT OPERATION

(a) Install the STOP fuse.
(b) Check that the stop light comes on when the brake pedal is depressed, and goes off when the brake pedal is released.

OK

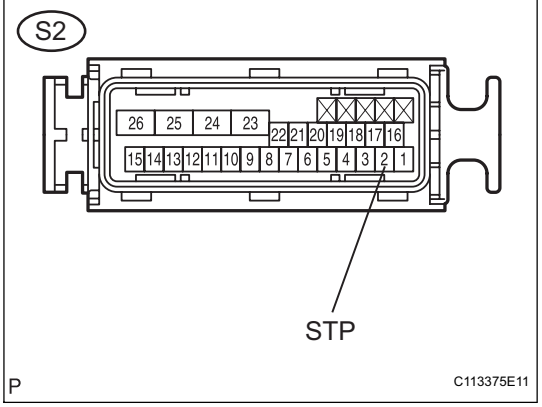
Condition	Illumination Condition
Brake pedal depressed	ON
Brake pedal released	OFF

NG → **GO TO STEP 7**

OK

3 INSPECT SKID CONTROL ECU (STP TERMINAL)

Skid Control ECU Harness Side Connector Front View:



(a) Disconnect the skid control ECU connector.
(b) Measure the voltage according to the value(s) in the table below.

Standard voltage

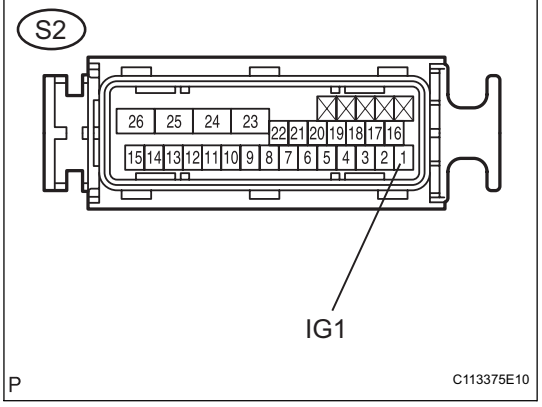
Tester Connection	Switch Condition	Specified Condition
S2-2 (STP) - Body ground	Stop light switch ON (Brake pedal depressed)	8 to 14 V
S2-2 (STP) - Body ground	Stop light switch OFF (Brake pedal released)	Below 1.5 V

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (STP CIRCUIT)**

OK

4 INSPECT SKID CONTROL ECU (IG1 TERMINAL)

Skid Control ECU Harness Side Connector Front View:



(a) Turn the ignition switch to the ON position.
(b) Measure the voltage according to the value(s) in the table below.

Standard voltage

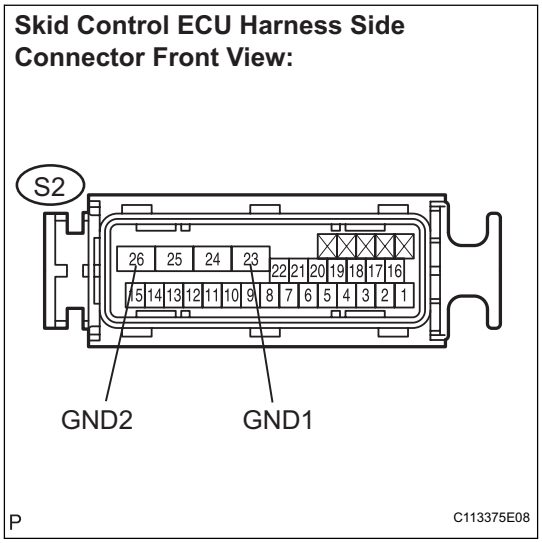
Tester Connection	Condition	Specified Condition
S2-1 (IG1) - Body ground	Ignition switch ON	10 to 14 V

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (IG1 CIRCUIT)**

OK

5 INSPECT SKID CONTROL ECU (GND TERMINAL)

Skid Control ECU Harness Side Connector Front View:



(a) Turn the ignition switch off.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Condition	Specified Condition
S2-23 (GND1) - Body ground	Always	Below 1 Ω
S2-26 (GND2) - Body ground	Always	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (GND CIRCUIT)**

OK

6 RECONFIRM DTC

(a) Reconnect the skid control ECU connector.
(b) Clear the DTCs (See page BC-14).
(c) Start the engine.
(d) Depress the brake pedal several times to test the stop light circuit.
(e) Check if the same DTC is recorded (See page BC-14).

Result

Condition	Proceed to
DTC (58) is not output	A
DTC (58) is output	B

HINT:
If troubleshooting has been carried out according to the Problem Symptoms Table, refer back to the table and proceed to the next step (See page BC-11).

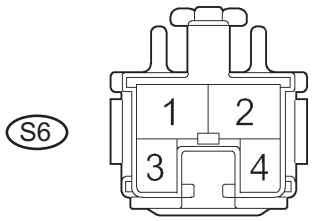
B → **REPLACE BRAKE ACTUATOR ASSEMBLY**

A

USE SIMULATION METHOD TO CHECK

7 INSPECT STOP LIGHT SWITCH (POWER SOURCE TERMINAL)

Stop Light Switch Harness Side Connector Front View:



(a) Disconnect the stop light switch connector.
(b) Measure the voltage according to the value(s) in the table below.

Standard voltage

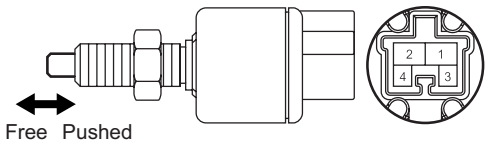
Tester Connection	Condition	Specified Condition
S6-2 - Body ground	Always	10 to 14 V

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (POWER SOURCE CIRCUIT)**

OK

8 INSPECT STOP LIGHT SWITCH

Stop Light Switch:



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

Standard resistance

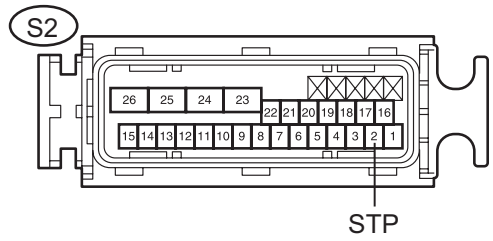
Tester Connection	Condition	Specified Condition
1 - 2	Switch pin free	Below 1 Ω
1 - 2	Switch pin pushed in	10 kΩ or higher

NG → **REPLACE STOP LIGHT SWITCH**

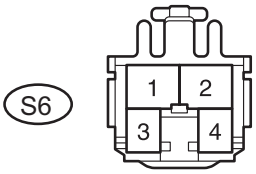
OK

9 CHECK HARNESS AND CONNECTOR (SKID CONTROL ECU - STOP LIGHT SWITCH)

Skid Control ECU Harness Side Connector Front View:



Stop Light Switch Harness Side Connector Front View:



N C113380E02

(a) Disconnect the skid control ECU connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Condition	Specified Condition
S2-2 (STP) - S6-1	Always	Below 1 Ω
S2-2 (STP) - Body ground	Always	10 kΩ or higher

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

OK

10 RECONFIRM DTC

(a) Reconnect the skid control ECU connector and the stop light switch connector.
(b) Clear the DTCs (See page BC-14).
(c) Start the engine.
(d) Depress the brake pedal several times to test the stop light circuit.
(e) Check if the same DTC is recorded (See page BC-14).

Result

Condition	Proceed to
DTC (58) is not output	A
DTC (58) is output	B

HINT:
If troubleshooting has been carried out according to the Problem Symptoms Table, refer back to the table and proceed to the next step (See page BC-11).

B → **REPLACE BRAKE ACTUATOR ASSEMBLY**

A

INSPECT LIGHTING SYSTEM (STOP LIGHT CIRCUIT)

DTC	62	Skid Control ECU Malfunction

DESCRIPTION

The skid control ECU outputs this DTC if malfunctions are found in the circuit inside the computer by self diagnosis.

DTC No.	DTC Detection Condition	Trouble Area
62	Internal failure of the skid control ECU control unit	Brake actuator assembly (Skid control ECU)

INSPECTION PROCEDURE

1	REPLACE BRAKE ACTUATOR ASSEMBLY

(a) Replace the brake actuator assembly (skid control ECU).

NEXT

END

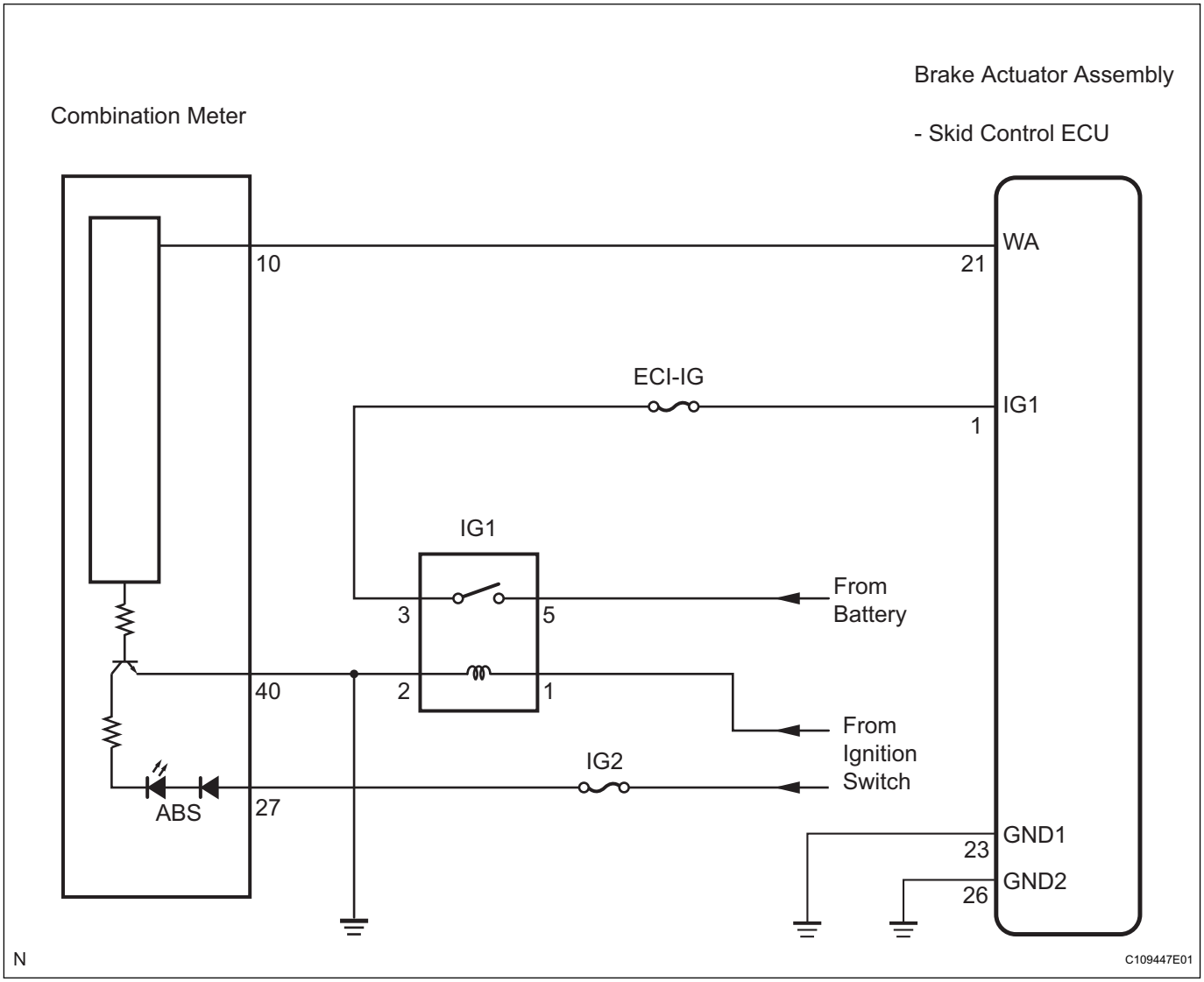
ABS Warning Light Remains ON

DESCRIPTION

If any of the following is detected, the ABS warning light remains on.

- The skid control ECU connectors are disconnected from the skid control ECU.
- There is a malfunction in the skid control ECU internal circuit.
- There is an open in the harness between the combination meter and the skid control ECU.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	CHECK IF SKID CONTROL ECU CONNECTOR IS SECURELY CONNECTED

(a) Check if the skid control ECU connector is securely connected.

OK:

The connector should be securely connected.

NG → CONNECT CONNECTOR TO ECU CORRECTLY

OK

2 CHECK BATTERY

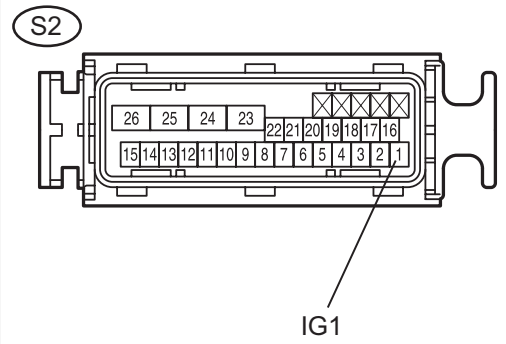
(a) Check the battery voltage.
Standard voltage:
11 to 14 V

NG → CHECK AND REPLACE CHARGING SYSTEM OR BATTERY

OK

3 INSPECT SKID CONTROL ECU (IG1 TERMINAL)

Skid Control ECU Harness Side Connector Front View:



(a) Disconnect the skid control ECU connector.
(b) Turn the ignition switch to the ON position.
(c) Measure the voltage according to the value(s) in the table below.
Standard voltage

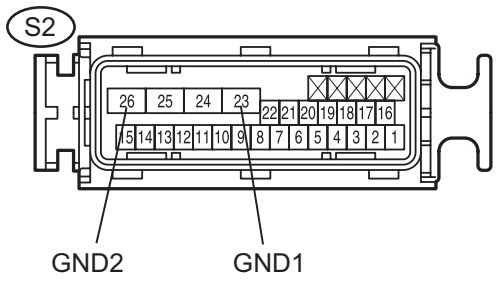
Tester Connection	Condition	Specified Condition
S2-1 (IG1) - Body ground	Ignition switch ON	10 to 14 V

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR (IG1 CIRCUIT)

OK

4 INSPECT SKID CONTROL ECU (GND TERMINAL)

Skid Control ECU Harness Side Connector Front View:



(a) Turn the ignition switch off.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

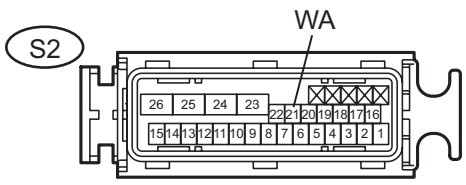
Tester Connection	Condition	Specified Condition
S2-23 (GND1) - Body ground	Always	Below 1 Ω
S2-26 (GND2) - Body ground	Always	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (GND CIRCUIT)**

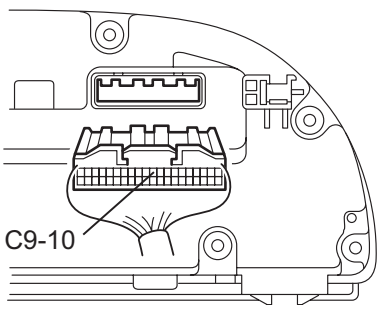
OK

5 CHECK HARNESS AND CONNECTOR (SKID CONTROL ECU - COMBINATION METER ASSEMBLY)

Skid Control ECU Harness Side Connector Front View:



Combination Meter Wire Harness View:



(a) Disconnect the combination meter connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Condition	Specified Condition
S2-21 (WA) - C9-10	Always	Below 1 Ω
S2-21 (WA) - Body ground	Always	10 kΩ or higher

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

OK

6	INSPECT COMBINATION METER ASSEMBLY

(a) Reconnect the skid control ECU connector and the combination meter connector.
(b) Check the combination meter (See page ME-1).

HINT:
If troubleshooting has been carried out according to the Problem Symptoms Table, refer back to the table and proceed to the next step before replacing the part (See page BC-11).

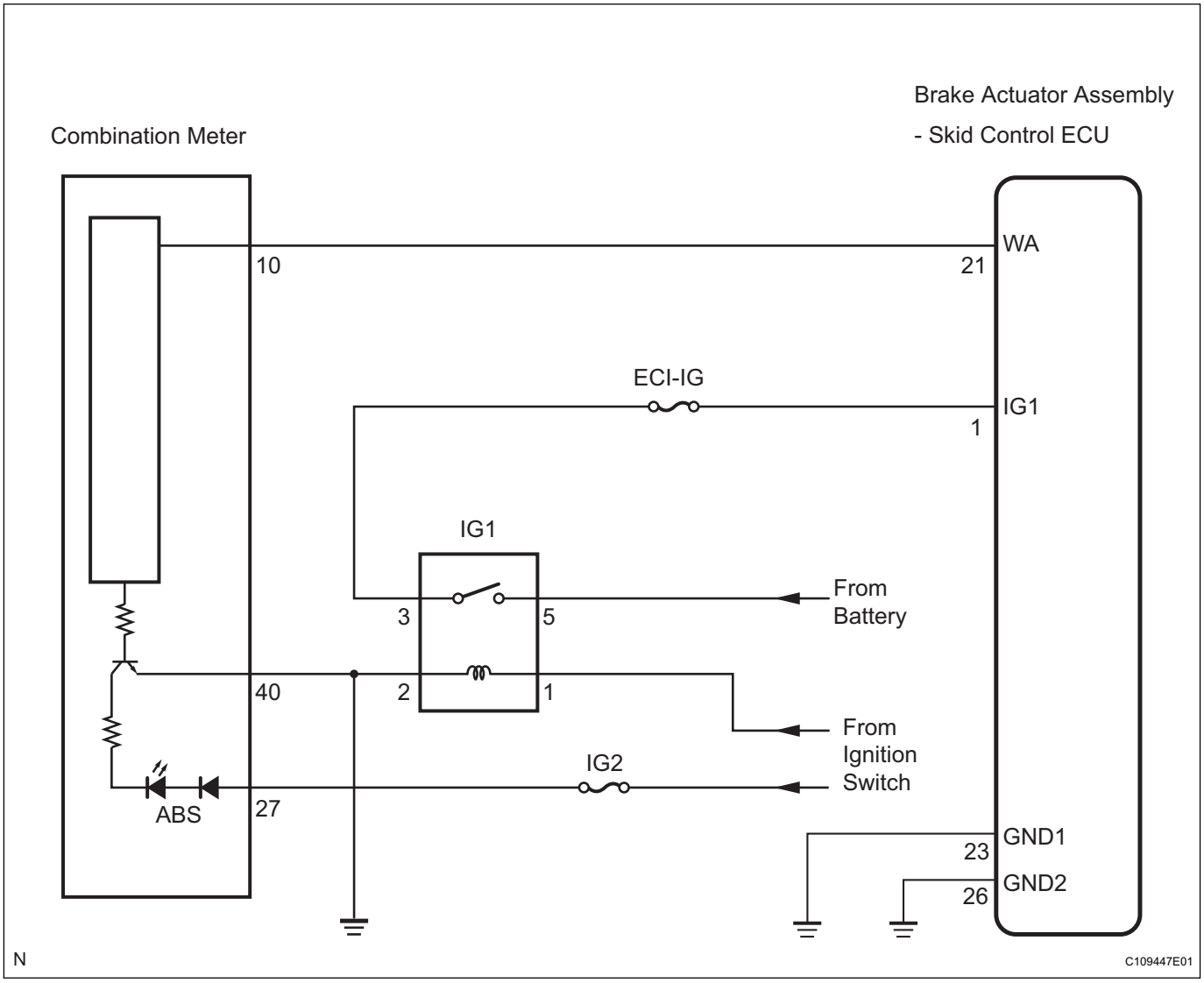
NG → REPLACE COMBINATION METER ASSEMBLY

OK

REPLACE BRAKE ACTUATOR ASSEMBLY

ABS Warning Light Does Not Come ON

WIRING DIAGRAM



INSPECTION PROCEDURE

1	CHECK ABS WARNING LIGHT

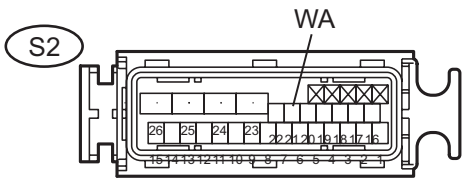
(a) Disconnect the skid control ECU connector.
(b) Turn the ignition switch to the ON position.
(c) Check that the ABS warning light comes on.
OK:
The ABS warning light comes on.
HINT:
If troubleshooting has been carried out according to the Problem Symptoms Table, refer back to the table and proceed to the next step (See page **BC-11**).

OK	REPLACE BRAKE ACTUATOR ASSEMBLY

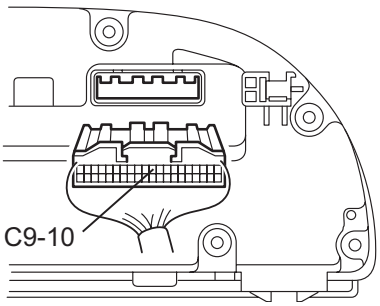
NG

2	CHECK HARNESS AND CONNECTOR (SKID CONTROL ECU - COMBINATION METER ASSEMBLY)

Skid Control ECU Harness Side Connector Front View:



Combination Meter Wire Harness View:



C132208E01

(a) Turn the ignition switch off.
(b) Disconnect the combination meter connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Condition	Specified Condition
S2-21 (WA) - C9-10	Always	Below 1 Ω
S2-21 (WA) - Body ground	Always	10 kΩ or higher

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

OK

3	INSPECT COMBINATION METER ASSEMBLY

(a) Reconnect the skid control ECU connector and the combination meter connector.
(b) Check the combination meter (See page ME-1).

HINT:
If troubleshooting has been carried out according to the Problem Symptoms Table, refer back to the table and proceed to the next step (See page BC-11).

NG → **REPLACE COMBINATION METER ASSEMBLY**

OK

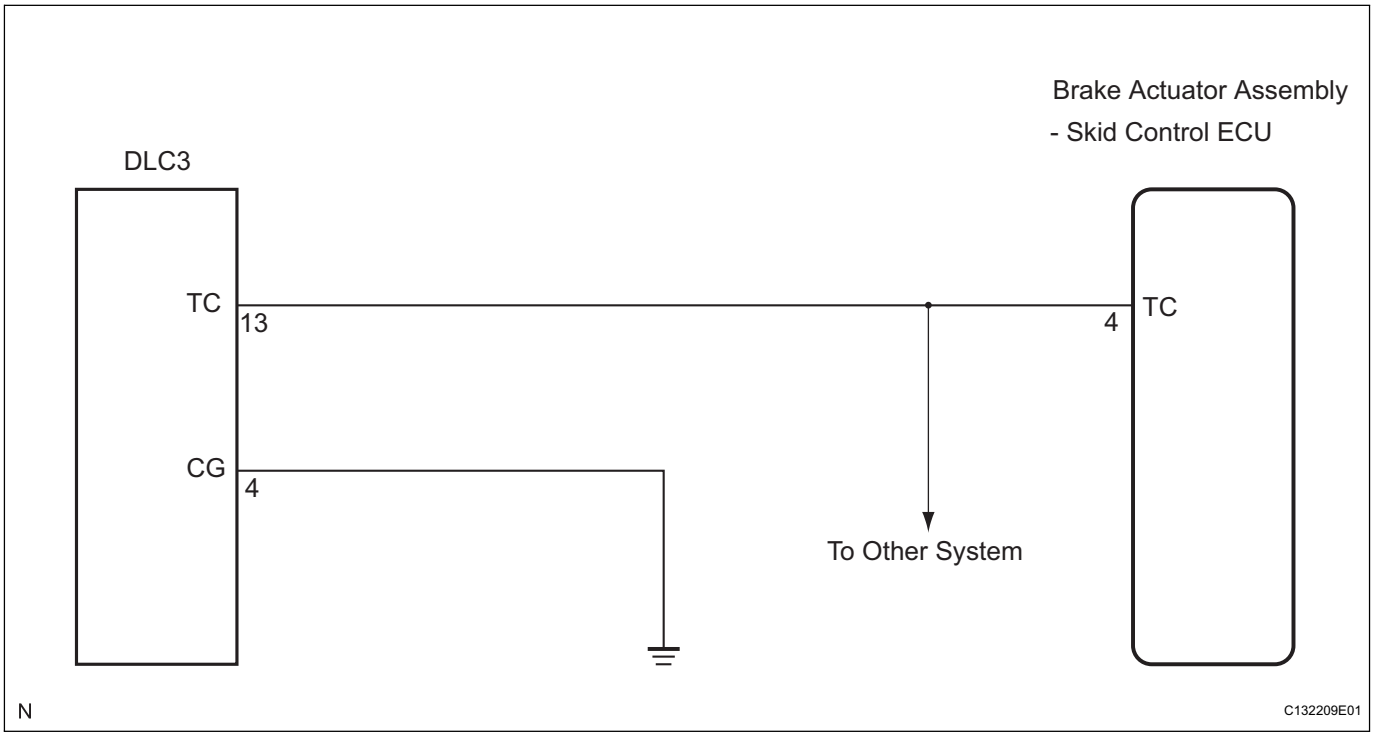
REPLACE BRAKE ACTUATOR ASSEMBLY

TC and CG Terminal Circuit

DESCRIPTION

Connecting terminals TC and CG of the DLC3 causes the skid control ECU to display the DTC by blinking the ABS warning light.
HINT:
When the warning lights continue to blink, a ground short in the wiring of terminal TC of the DLC3 or an internal ground short in one or more ECU is suspected.

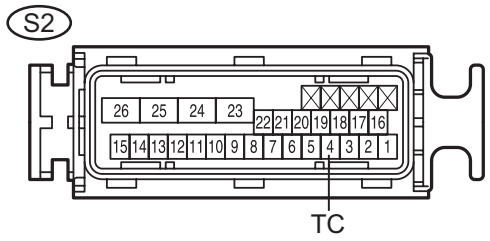
WIRING DIAGRAM



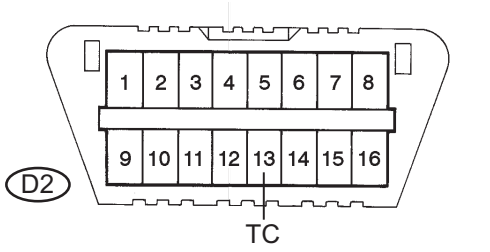
INSPECTION PROCEDURE

1 CHECK HARNESS AND CONNECTOR (SKID CONTROL ECU - TC of DLC3)

Skid Control ECU Harness Side Connector Front View:



DLC3:



C132210E01

(a) Disconnect the skid control ECU connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

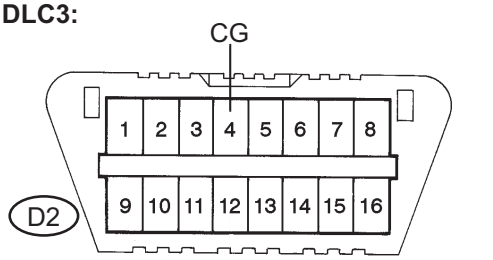
Tester Connection	Condition	Specified Condition
S2-4 (TC) - D2-13 (TC)	Always	Below 1 Ω

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

OK

2 CHECK HARNESS AND CONNECTOR (CG of DLC3 - BODY GROUND)

DLC3:



G022987E10

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

Standard resistance

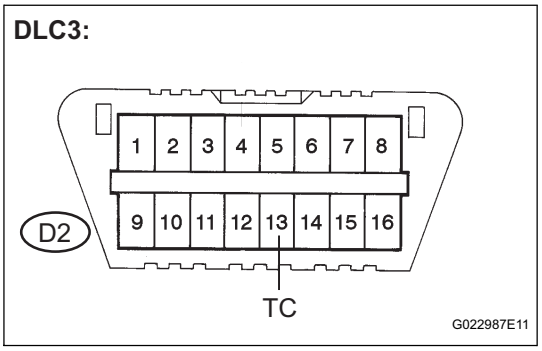
Tester Connection	Condition	Specified Condition
D2-4 (CG) - Body ground	Always	Below 1 Ω

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

OK

3	CHECK HARNESS AND CONNECTOR (TC of DLC3 - BODY GROUND)

DLC3:



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

Standard resistance

Tester Connection	Condition	Specified Condition
D2-13 (TC) - Body ground	Always	10 kΩ or higher

HINT:
If troubleshooting has been carried out according to the Problem Symptoms Table, refer back to the table and proceed to the next step before replacing the part (See page BC-11).

NG → **REPAIR OR REPLACE WIRE HARNESS OR EACH ECU**

OK

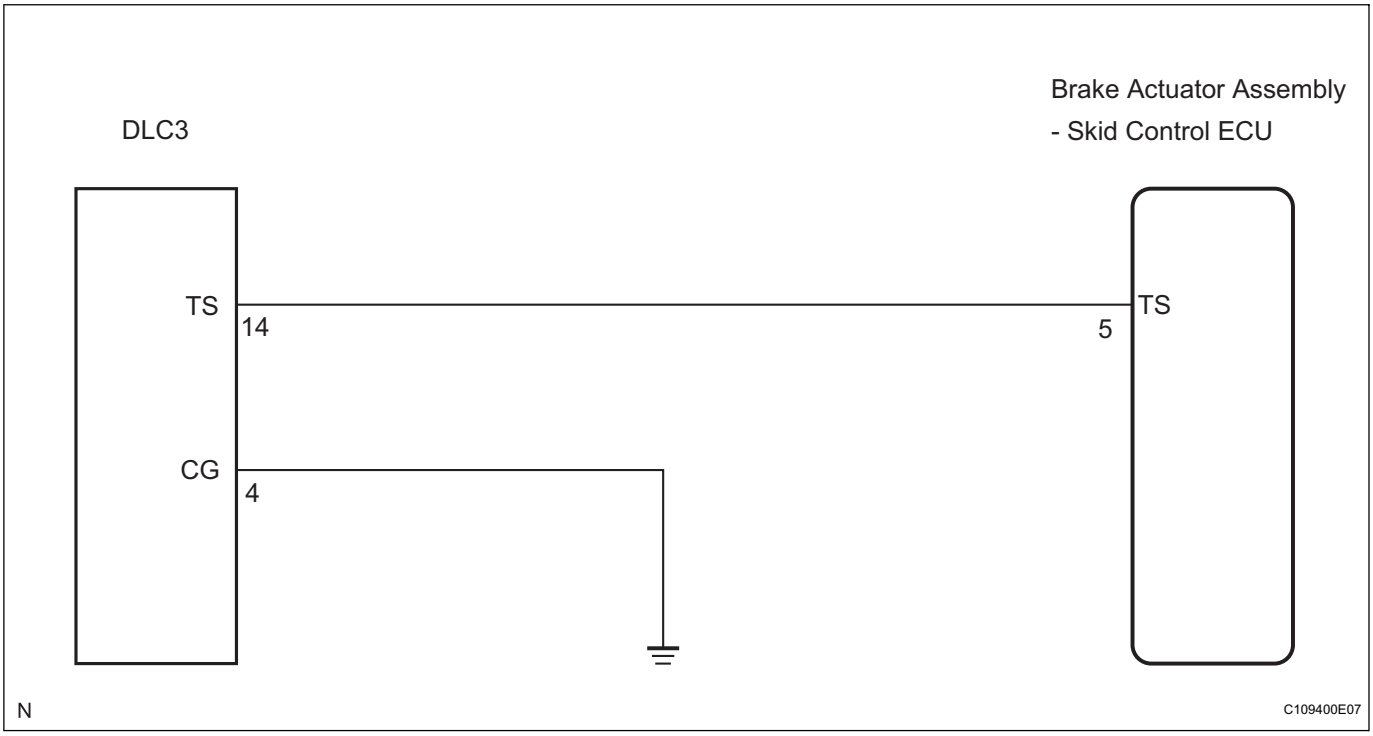
REPLACE BRAKE ACTUATOR ASSEMBLY

TS and CG Terminal Circuit

DESCRIPTION

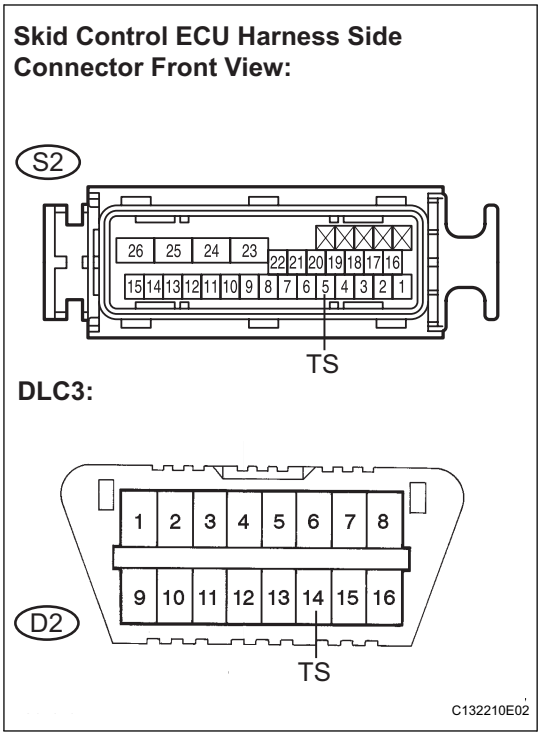
In the Test Mode (signal check), a malfunction of the speed sensor that cannot be detected when the vehicle is stopped is detected while driving.
Transition to the sensor check mode can be performed by connecting terminals TS and CG of the DLC3 and turning the ignition switch from OFF to ON.

WIRING DIAGRAM



INSPECTION PROCEDURE

1 CHECK HARNESS AND CONNECTOR (SKID CONTROL ECU - TS of DLC3)



(a) Disconnect the skid control ECU connector.
(b) Measure the resistance according to the value(s) in the table below.

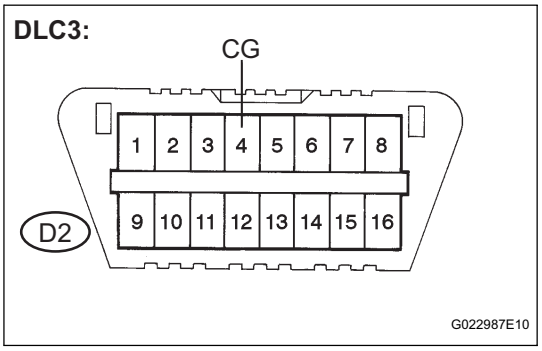
Standard resistance

Tester Connection	Condition	Specified Condition
S2-5 (TS) - D2-14 (TS)	Always	Below 1 Ω

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

OK

2 CHECK HARNESS AND CONNECTOR (CG of DLC3 - BODY GROUND)



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

Standard resistance

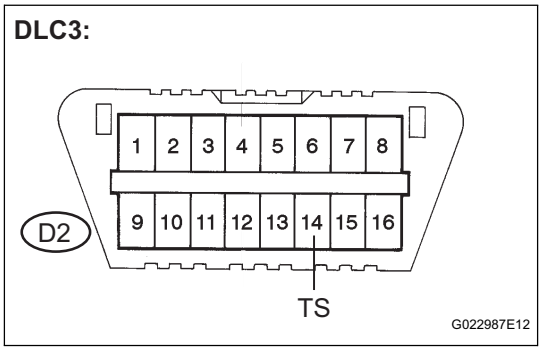
Tester Connection	Condition	Specified Condition
D2-4 (CG) - Body ground	Always	Below 1 Ω

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

OK

3	CHECK HARNESS AND CONNECTOR (TS of DLC3 - BODY GROUND)

DLC3:



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

Standard resistance

Tester Connection	Condition	Specified Condition
D2-14 (TS) - Body ground	Always	10 kΩ or higher

HINT:
If troubleshooting has been carried out according to the Problem Symptoms Table, refer back to the table and proceed to the next step before replacing the part (See page BC-11).

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

OK

REPLACE BRAKE ACTUATOR ASSEMBLY

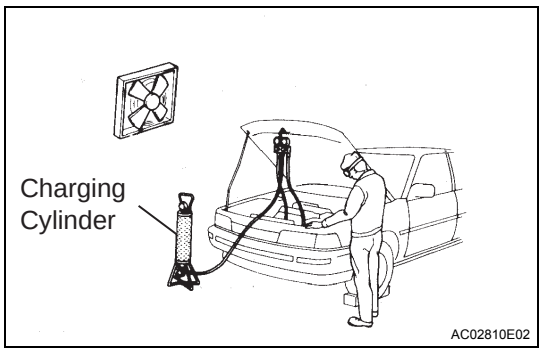
AIR CONDITIONING

AIR CONDITIONING SYSTEM

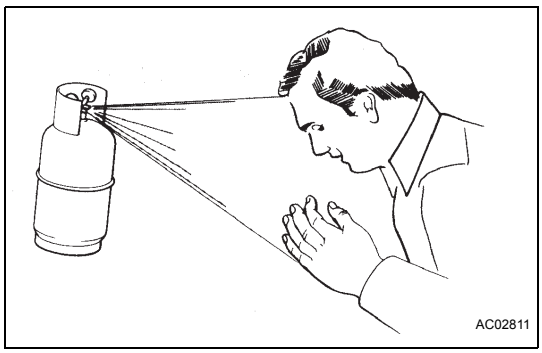
PRECAUTION AC-1
PARTS LOCATION AC-3
HOW TO PROCEED WITH TROUBLESHOOTING AC-4
PROBLEM SYMPTOMS TABLE AC-6
TERMINALS OF ECM AC-6
DIAGNOSTIC TROUBLE CODE CHART AC-9
DTC 14 Engine Coolant Temperature Communication Circuit AC-10
DTC 22 Compressor Lock Sensor Circuit AC-13
Air Conditioning Compressor Magnetic Clutch Circuit AC-22

AIR CONDITIONING SYSTEM

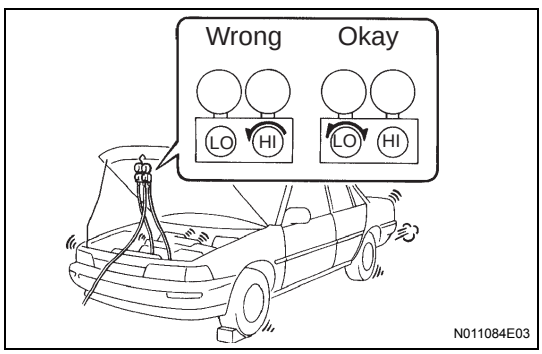
PRECAUTION



1. **DO NOT HANDLE REFRIGERANT IN AN ENCLOSED AREA OR NEAR AN OPEN FLAME**
2. **ALWAYS WEAR EYE PROTECTION**



3. **BE CAREFUL NOT TO GET LIQUID REFRIGERANT IN YOUR EYES OR ON YOUR SKIN**
   If liquid refrigerant gets in your eyes or on your skin:
   (a) Wash the area with lots of cold water.
   CAUTION:
   Do not rub your eyes or skin.
   (b) Apply a clean burns dressing.
   (c) Go immediately to a hospital or see a physician for professional treatment.
4. **NEVER HEAT CONTAINER OR EXPOSE THE CONTAINER TO OPEN FLAME**
5. **BE CAREFUL NOT TO DROP OR DAMAGE CONTAINER**



6. **DO NOT OPERATE COMPRESSOR WITHOUT ENOUGH REFRIGERANT IN REFRIGERANT SYSTEM**
   If there is not enough refrigerant in the A/C system, oil lubrication will be insufficient and the compressor may be damaged.
   Necessary care should be taken to avoid this.
7. **DO NOT OPEN HIGH PRESSURE MANIFOLD VALVE WHILE COMPRESSOR IS OPERATING**
   (a) Open and close only the low pressure valve.
   If the high pressure valve is opened, refrigerant flows in the reverse direction causing the charging cylinder to rupture.
8. **BE CAREFUL NOT TO OVERCHARGE SYSTEM WITH REFRIGERANT**
   If refrigerant is overcharged, it causes problems such as insufficient cooling, poor fuel economy, engine overheating, etc.
9. **DO NOT OPERATE ENGINE AND COMPRESSOR WITH NO REFRIGERANT**
   CAUTION:
   Doing so may damage the inside of the compressor because the compressor parts always move regardless of whether the A/C system is turned on or off.

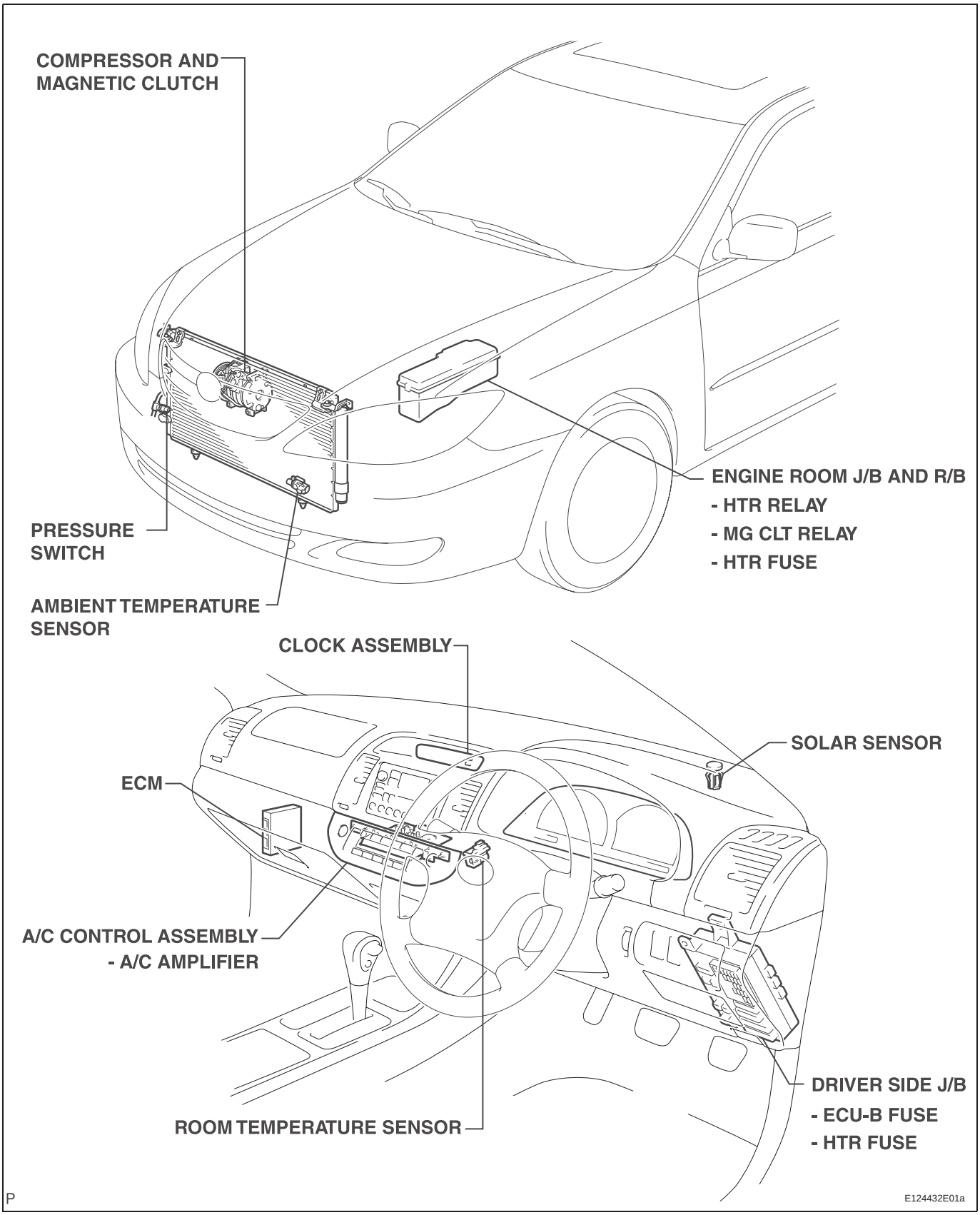
10. SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

(a) This vehicle is equipped with an SRS (Supplemental Restraint System) such as the driver, front passenger, side, and curtain shield air bags. Failure to carry out service operation in the correct sequence could cause the SRS to unexpectedly deploy during servicing, possibly leading to a serious accident. Before servicing (including removal or installation of parts, inspection or replacement), be sure to read the precautionary notices (See page 60-1).

11. GENERAL PRECAUTION

(a) While using the battery during inspection, do not bring the positive and negative tester probes too close to each other as a short circuit may occur.

PARTS LOCATION



HOW TO PROCEED WITH TROUBLESHOOTING

1	VEHICLE BROUGHT TO WORK SHOP

NEXT

2	CUSTOMER PROBLEM ANALYSIS

NEXT

3	CHECK AND CLEAR DTC

4	PROBLEM SYMPTOM CONFIRMATION

→ SYMPTOM OCCUR (GO TO STEP 6)

SYMPTOM DOES NOT OCCUR (GO TO STEP 5)

5	SYMPTOM SIMULATION

NEXT

6	DTC CHECK

→ MALFUNCTION CODE (GO TO STEP 7)

→ NORMAL CODE (GO TO STEP 8)

7	DTC CHART

→ GO TO STEP 10

8	PROBLEM SYMPTOMS TABLE

NEXT

9	ACTUATOR CHECK

NEXT

10	CIRCUIT INSPECTION

NEXT

11	IDENTIFICATION OF PROBLEM

NEXT

12	PARTS INSPECTION

NEXT

13	REPAIR

NEXT

14	CONFIRMATION TEST

NEXT

END

PROBLEM SYMPTOMS TABLE

AIR CONDITIONING SYSTEM:

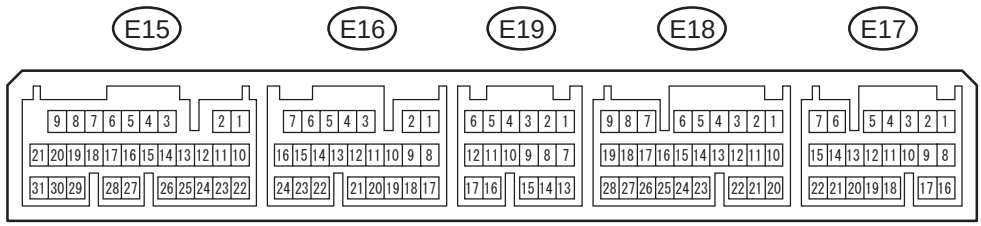
Symptom	Suspected Area	See Page
Temperature Control: No cool air comes out.	1. Volume of refrigerant	55-18
	2. Drive belt tension	55-12
	3. Refrigerant pressure	55-18
	4. Compressor lock sensor circuit	AC-13
	5. Air conditioning compressor and magnetic clutch circuit	AC-22
	6. Pressure switch circuit	05-421
	7. Air mix control servo motor circuit	05-432
	8. Air mix damper position sensor circuit	05-424
	9. Room temperature sensor circuit	05-404
	10. Ambient temperature sensor circuit	05-407
	11. Igniter circuit	05-459
	12. Vehicle speed signal circuit	05-456
	13. A/C amplifier	-
	14. ECM	-
Temperature Control: Out coming air is warmer or cooler than the set temperature or response is slow.	1. Room temperature sensor circuit	05-404
	2. Ambient temperature sensor circuit	05-407
	3. Vehicle speed signal circuit	05-456
	4. Solar sensor circuit	05-415
	5. Air mix damper position sensor circuit	05-424
	6. Air mix control servo motor circuit	05-432
	7. Engine coolant temperature communication circuit	AC-10
	8. A/C amplifier	-
	9. ECM	-
Engine idle up does not occur, or is continuous.	1. Air conditioning compressor and magnetic clutch circuit	AC-22
	2. A/C amplifier	-
	3. ECM	-

TERMINALS OF ECM

1. A/C AMPLIFIER

(See page 05-401)

2. ECM (1MZ-FE)



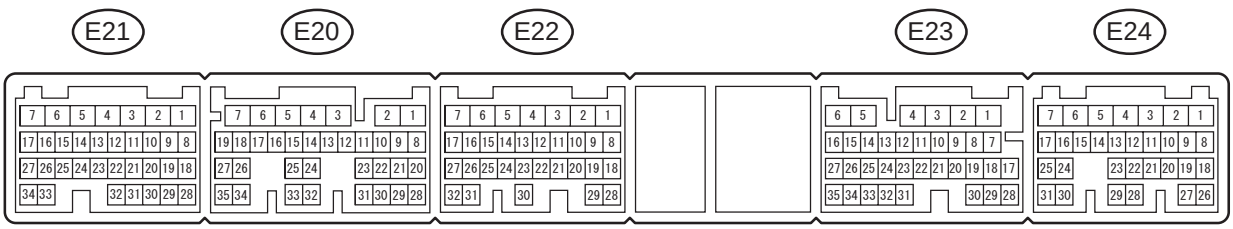
H

E124422E01

HINT:
Check from the rear of the connector while it is connected to the ECM.

Terminal No. (Symbols)	Wiring Color	Terminal Description	Condition	Specified Condition
E18-13 (ACT) - E15-21 (E01)	L - W-B	A/C compressor operation signal	Ignition switch: ON A/C switch: ON Blower switch: LO	10 to 14 V
E18-13 (ACT) - E15-21 (E01)	L - W-B	A/C compressor operation signal	Ignition switch: ON A/C switch: OFF Blower switch: LO	Below 1 V
E18-14 (THWO) - E15-21 (E01)	Y-G - W-B	Engine coolant temperature sensor signal	Ignition switch: ON	Pulse generation (See waveform 1)
E18-25 (A/C) - E15-21 (E01)	L-R - W-B	A/C compressor operation signal	Ignition switch: ON A/C switch: ON Blower switch: LO	Below 1 V
E18-25 (A/C) - E15-21 (E01)	L-R - W-B	A/C compressor operation signal	Ignition switch: ON A/C switch: OFF Blower switch: LO	10 to 14 V
E18-27 (TACH) - E15-21 (E01)	B-O - W-B	Vehicle speed signal	Engine idle speed	Pulse generation (See waveform 3)
E15-21 (E01) - Body ground	W-B - Body ground	Ground for ECM	Always	Below 1 V

3. ECM (2AZ-FE)



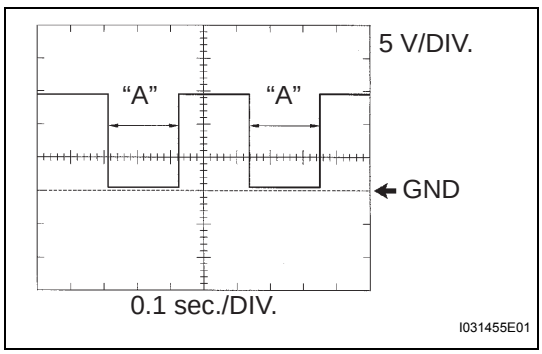
H

E124421E01

HINT:
Check from the rear of the connector while it is connected to the ECM.

Terminal No. (Symbols)	Wiring Color	Terminal Description	Condition	Specified Condition
E22-23 (LCKI) - E22-4 (ME01)	W-L - W-B	A/C lock sensor signal	Ignition switch: ON A/C switch: ON Blower switch: LO	Pulse generation (See waveform 2)
E23-2 (ACMG) - Body ground	L-Y - Body ground	A/C compressor operation signal	Ignition switch: ON A/C switch: ON Blower switch: LO	Below 1 V

Terminal No. (Symbols)	Wiring Color	Terminal Description	Condition	Specified Condition
E23-2 (ACMG) - Body ground	L-Y - Body ground	A/C compressor operation signal	Ignition switch: ON A/C switch: OFF Blower switch: LO	10 to 14 V
E23-14 (THWO) - E22-4 (ME01)	Y-G - W-B	Engine coolant temperature sensor signal	Ignition switch: ON	Pulse generation (See waveform 1)
E23-30 (A/CS) - E22-4 (ME01)	L-W - W-B	A/C compressor operation signal	Ignition switch: ON A/C switch: ON Blower switch: LO	10 to 14 V
E23-30 (A/CS) - E22-4 (ME01)	L-W - W-B	A/C compressor operation signal	Ignition switch: ON A/C switch: OFF Blower switch: LO	Below 1 V
E23-32 (THE) - E22-4 (ME01)	Y-B - W-B	A/C compressor operation signal	Ignition switch: ON A/C switch: ON Blower switch: LO	1.3 to 2.6 V
E23-32 (THE) - E22-4 (ME01)	Y-B - W-B	A/C compressor operation signal	Ignition switch: ON A/C switch: OFF Blower switch: LO	3.7 to 4.5 V
E23-33 (ACLD) - E22-4 (ME01)	L - W-B	A/C lock sensor signal	Ignition switch: ON A/C switch: ON Blower switch: LO	Below 1 V

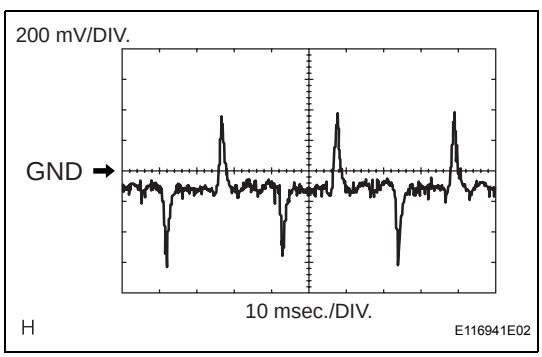


(a) Waveform 1:

Item	Contents
Terminal No. (Symbols)	1MZ-FE: E18-14 (THWO) - E15-21 (E01) 2AZ-FE: E23-14 (THWO) - E22-4 (ME01)
Tool Setting	5 V/DIV., 0.1 s/DIV.
Vehicle Condition	Ignition switch: ON

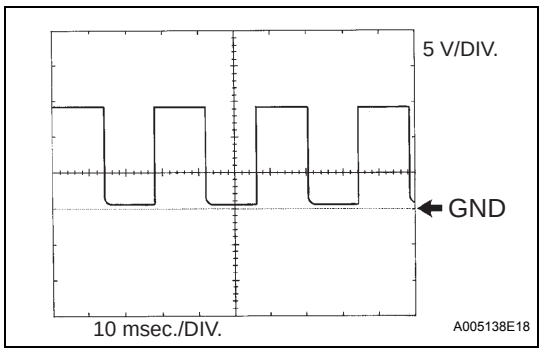
HINT:
The waveform frequency "A" becomes longer as the water temperature becomes higher, as shown in the chart.

Water temperature	Frequency "A"
Below 30°C (86°F)	16 ms
Approx. 75°C (167°F)	102 ms
90°C to 100°C (194°F to 212°F)	102 ms



(b) Waveform 2:

Item	Contents
Terminal No. (Symbols)	2AZ-FE: E22-23 (LCKI) - E22-4 (ME01)
Tool Setting	200 mV/DIV., 10 ms/DIV.
Vehicle Condition	Ignition switch: ON Blower switch: LO A/C switch: ON



(c) Waveform 3:

Item	Contents
Terminal No. (Symbols)	1MZ-FE: E18-27 (TACH) - E15-21 (E01)
Tool Setting	5 V/DIV, 10 ms/DIV
Vehicle Condition	Engine idle speed

DIAGNOSTIC TROUBLE CODE CHART

AIR CONDITIONING SYSTEM:

If any malfunction code is displayed during the DTC check (sensor check), check the circuit listed for that code in the table below (Proceed to the page given for that circuit).

DTC No.	Detection Item	Trouble Area	Memory	See Page
14	Engine Coolant Temperature Communication Circuit	1. ECM 2. Harness or connector between ECM and A/C amplifier 3. A/C amplifier	-	AC-10
22*1	Compressor Lock Sensor Circuit	1MZ-FE: 1. Compressor drive belt 2. Compressor (A/C lock sensor) 3. Harness or connector between ECM and A/C amplifier, between A/C amplifier and compressor (A/C lock sensor) 4. A/C amplifier 5. ECM 2AZ-FE: 1. Compressor drive belt 2. Compressor (A/C lock sensor) 3. Harness or connector between ECM and compressor (A/C lock sensor), between A/C amplifier and ECM 4. A/C amplifier 5. ECM	-	AC-13

HINT:

- For other DTCs, see Pub. No. AA-CDRM010.
- *1: Compressor lock (DTC22) is indicated only for a current occurring malfunction. To confirm DTC 22, perform the following steps.
  (a) With the engine ON, enter the DTC check mode.
  (b) Press the R/F switch to enter the actuator check mode, and set the operation to step No. 3.
  (c) Press the AUTO switch to return to DTC check mode.
  (d) The DTC is displayed after approx. 3 sec.

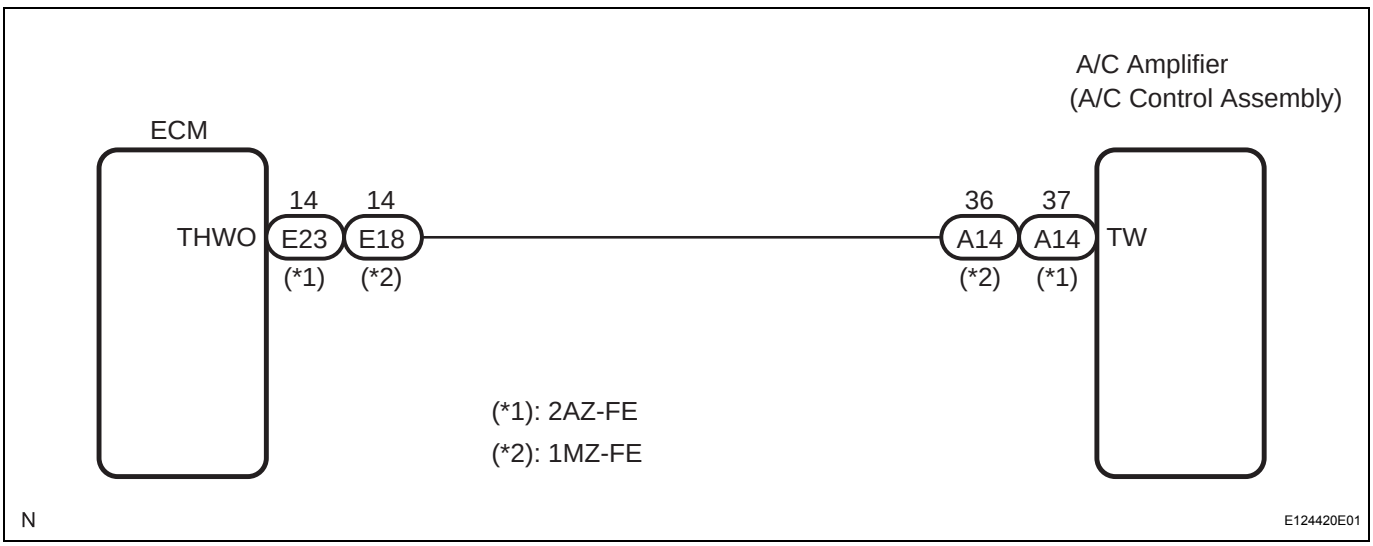
DTC	14	Engine Coolant Temperature Communication Circuit

DESCRIPTION

This sensor detects the temperature and sends the appropriate signals to the A/C amplifier. These signals are used for warm up control when engine is cold.

DTC No.	Detection Item	Trouble Area
14	Open or short in A/C amplifier and ECM circuit.	• ECM • Harness or connector between ECM and A/C amplifier • A/C amplifier

WIRING DIAGRAM



INSPECTION PROCEDURE

1	CHECK DTC OUTPUT (DTC P0115/22)

(a) Check that the DTC P0115/22 is not output.

Result

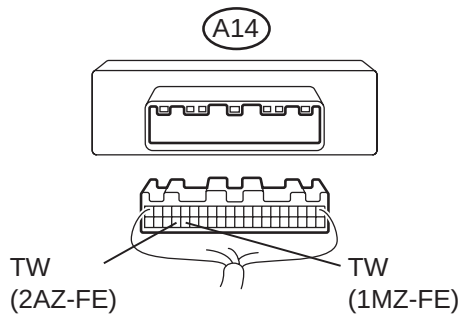
Result	Proceed to
DTC P0115/22 is not output	A
DTC P0115/22 is output	B

B → GO TO SFI SYSTEM

A

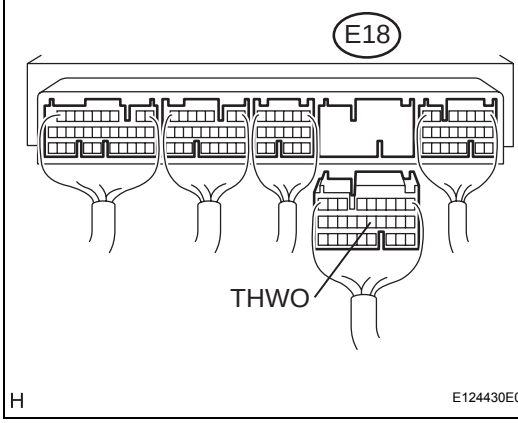
2	CHECK HARNESS AND CONNECTOR (ECM - A/C AMPLIFIER)

Air Conditioning Amplifier Connector Wire Harness View:



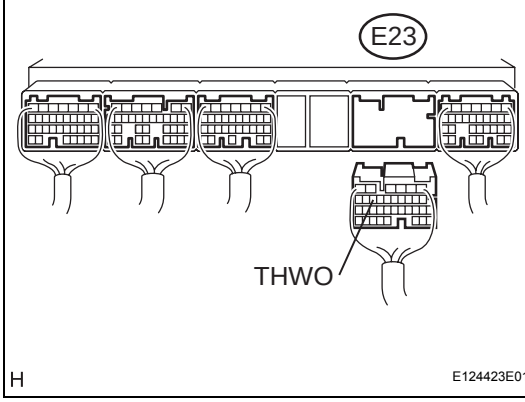
(a) Disconnect the connector from the A/C amplifier.

ECM Connector Wire Harness View (1MZ-FE):



(b) Disconnect the connector from the ECM.

ECM Connector Wire Harness View (2AZ-FE):



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

Standard resistance:

1MZ-FE

Tester Connection (Symbols)	Condition	Specified Condition
E18-14 (THWO) - A14-36 (TW)	Always	Below 1 Ω
E18-14 (THWO) - Body ground	Always	10 kΩ or higher

2AZ-FE

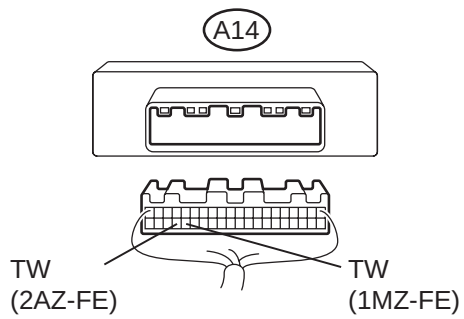
Tester Connection (Symbols)	Condition	Specified Condition
E23-14 (THWO) - A14-37 (TW)	Always	Below 1 Ω
E23-14 (THWO) - Body ground	Always	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

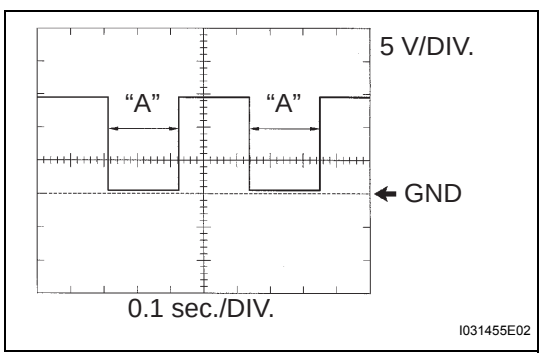
OK

3 INSPECT ECM (ENGINE COOLANT TEMPERATURE SIGNAL)

Air Conditioning Amplifier Connector Wire Harness View:



(a) Reconnect the connector to the ECM.
(b) Turn the ignition switch ON.



(c) Measure the waveform on the A/C amplifier connector side according to the value(s) in the table below.
OK:
Pulse generation
HINT:
- The correct waveform is as shown.
- The waveform frequency "A" become longer as the water temperature becomes higher, as shown in the chart.

Water Temperature	Frequency "A"
Below 30°C (86°F)	16 ms
Approx. 75°C (167°F)	102 ms
90°C to 100°C (194°F to 212°F)	102 ms

NG → REPLACE ECM

OK

REPLACE AIR CONDITIONING AMPLIFIER

DTC	22	Compressor Lock Sensor Circuit

DESCRIPTION

1MZ-FE:

The ECM sends the engine speed signal to the A14-16 terminal of the A/C amplifier. The A/C amplifier reads the difference between compressor speed and engine speed. When the difference becomes too big, the A/C amplifier determines that the compressor locks, and turns the magnetic clutch off.

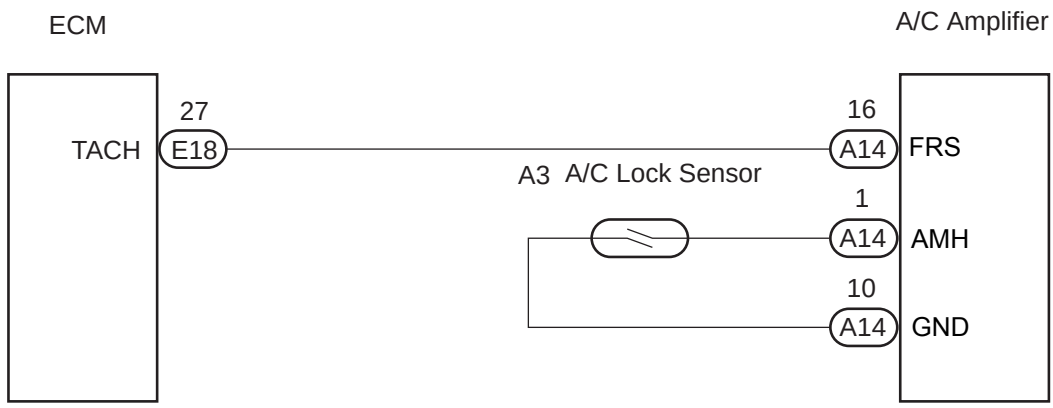
2AZ-FE:

This sensor sends 4 pulses per engine revolution to the A/C amplifier. If the number ratio of the compressor speed divided by the engine speed is smaller than a predetermined value, the A/C amplifier turns the compressor off. And, the indicator flashes at approximately 1 sec. interval.

DTC No.	Detection Item	Trouble Area
22	Open or short in compressor lock sensor circuit. All conditions below are detected for 3 sec. or more (a) Engine speed: 450 rpm or more (b) Ratio between engine and compressor speed deviates 20% or more in comparison with normal operation	**1MZ-FE:** • Compressor and magnetic clutch (A/C lock sensor) • Compressor drive belt • Harness or connector between compressor and magnetic clutch (A/C lock sensor) and A/C amplifier, between ECM and A/C amplifier • A/C amplifier • ECM **2AZ-FE:** • Compressor and magnetic clutch (A/C lock sensor) • Compressor drive belt • Harness or connector between compressor and magnetic clutch (A/C lock sensor) and ECM, between ECM and A/C amplifier • A/C amplifier • ECM

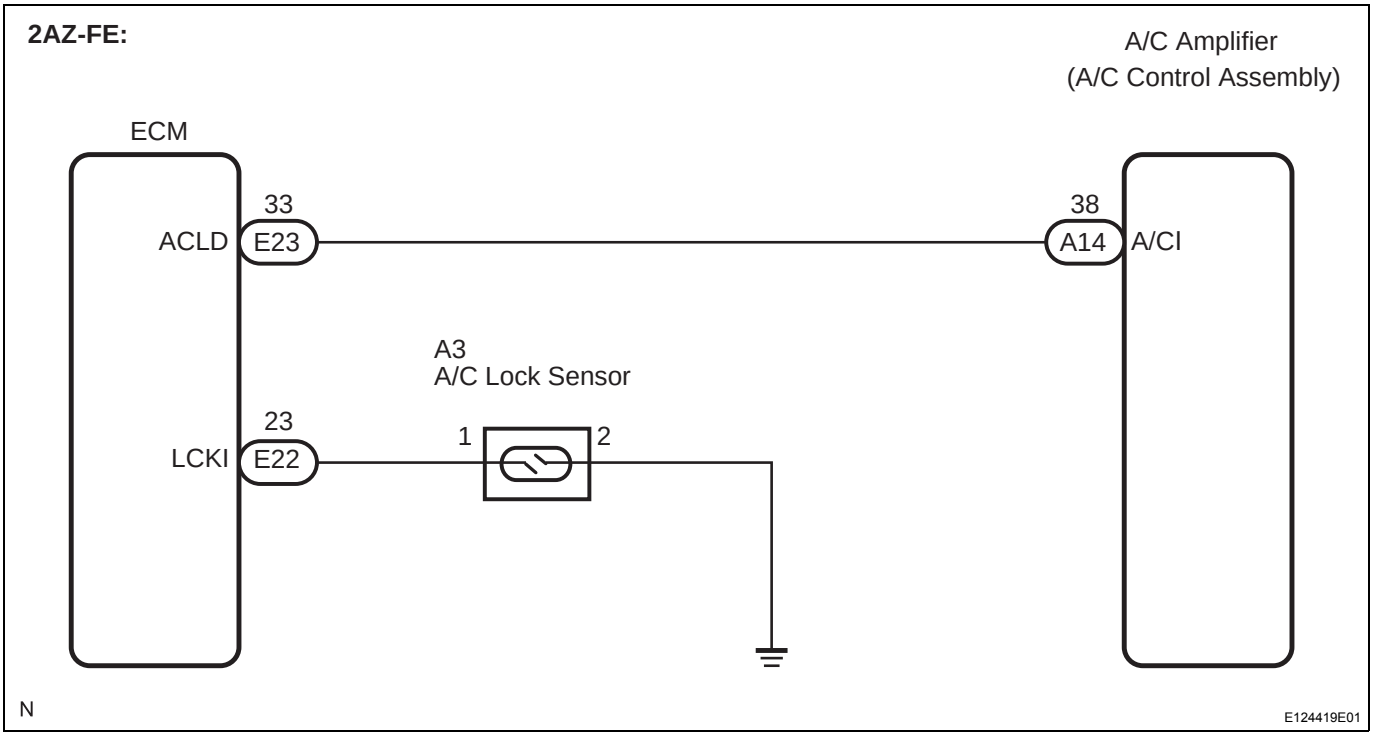
WIRING DIAGRAM

1MZ-FE:



H

E124443E01

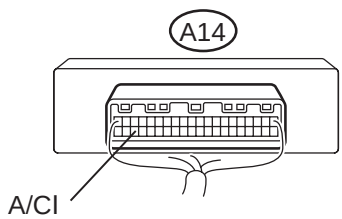


INSPECTION PROCEDURE

2AZ-FE:

1	INSPECT AIR CONDITIONING AMPLIFIER

Air Conditioning Amplifier Connector Wire Harness View:



(a) Remove the A/C amplifier with connector still connected.
(b) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection (Symbols)	Condition	Specified Condition
A14-38 (A/CI) - Body ground	Ignition switch: ON Blower switch: LO A/C switch: ON	Below 1 V

Result

Result	Proceed to
NG	A
OK (When checking from the PROBLEM SYMPTOMS TABLE)	B
OK (When checking from the DTCs)	C

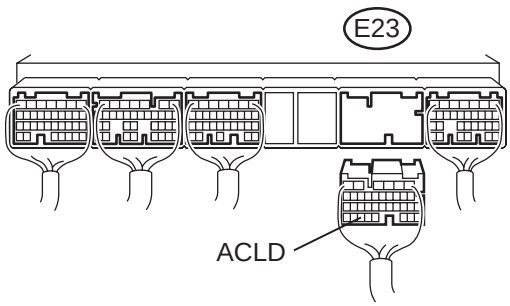
B → PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (See page AC-6)

C → REPLACE AIR CONDITIONING AMPLIFIER

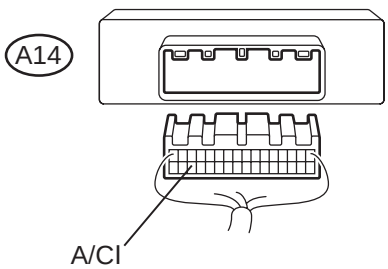
A

2	CHECK HARNESS AND CONNECTOR (ECM - A/C AMPLIFIER)

ECM Connector Wire Harness View:



Air Conditioning Amplifier Connector Wire Harness View:



H E124427E01

(a) Disconnect the connector from the A/C amplifier and the ECM.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

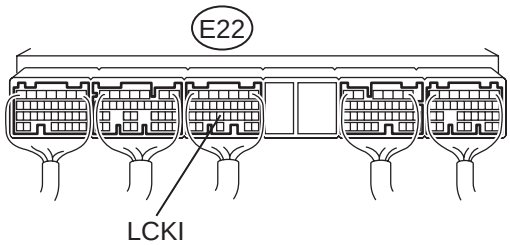
Tester Connection (Symbols)	Condition	Specified Condition
A14-38 (A/CI) - E23-33 (ACLD)	Always	Below 1 Ω
A14-38 (A/CI) - Body ground	Always	10 kΩ or higher

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

OK

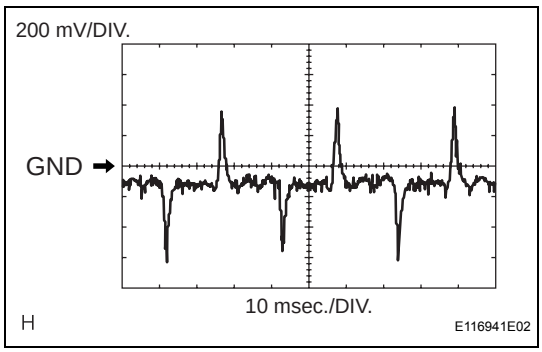
3	INSPECT ECM

ECM Connector Wire Harness View:



H E124424E02

(a) Reconnect the connector to the A/C amplifier.
(b) Reconnect the connector to the ECM.



(c) Measure the waveform of the connector.

Item	Contents
Tool setting	200 mV/DIV., 10 ms/DIV.
Vehicle condition	Ignition switch: ON A/C switch: ON Blower switch: LO

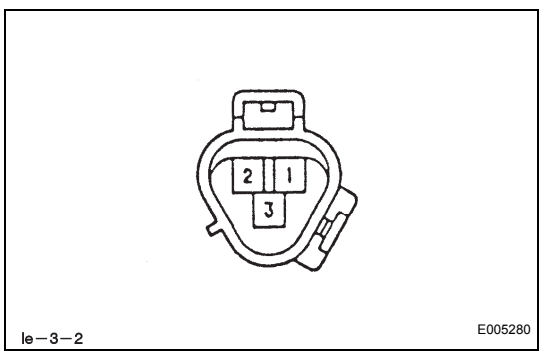
Standard

Tester Connection (Symbols)	Condition	Specified Condition
E22-23 (LCKI) - Body ground	Ignition switch: ON A/C switch: ON Blower switch: LO	Pulse generation

OK → REPLACE ECM

NG

4 INSPECT COMPRESSOR AND MAGNETIC CLUTCH (A/C LOCK SENSOR)



(a) Disconnect the connector from the compressor and magnetic clutch.

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

Standard resistance

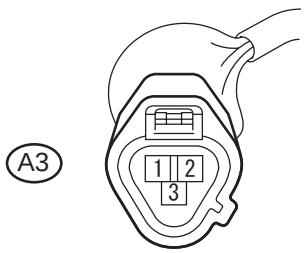
Tester Connection	Condition	Specified Condition
A3-1 - A3-2	Always (at 20°C (68°F))	165 to 205 Ω

NG → REPLACE COMPRESSOR AND MAGNETIC CLUTCH (A/C LOCK SENSOR)

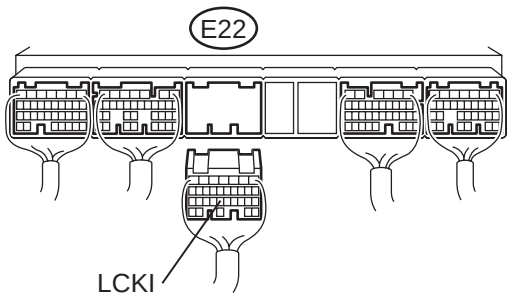
OK

5	CHECK HARNESS AND CONNECTOR (ECM - COMPRESSOR AND MAGNETIC CLUTCH (A/C LOCK SENSOR))

Compressor and Magnetic Clutch Connector Front View:



ECM Connector Wire Harness View:



H E124428E01

(a) Disconnect the connector from the ECM.
(b) Measure the resistance according to the Value(s) in the table below.

Standard resistance

Tester Connection (Symbols)	Condition	Specified Condition
E22-23 (LCKI) - A3-1	Always	Below 1 Ω
E22-23 (LCKI) - Body ground	Always	10 kΩ or higher

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

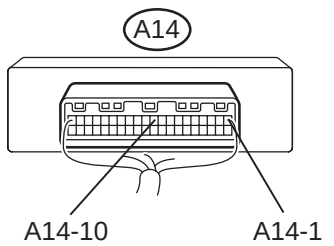
OK

REPAIR OR REPLACE HARNESS OR CONNECTOR (COMPRESSOR AND MAGNETIC CLUTCH (LOCK SENSOR) - BODY GROUND)

1MZ-FE:

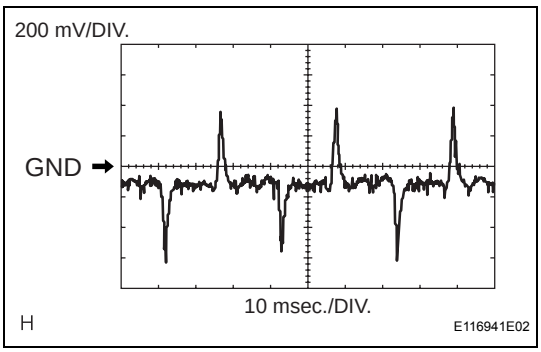
1	INSPECT AIR CONDITIONING AMPLIFIER

Air Conditioning Amplifier Connector Wire Harness View:



H E124425E05

(a) Remove the A/C amplifier with connector still connected.



H E116941E02

(b) Measure the waveform of the connector.

Item	Contents
Tool setting	200 mV/DIV., 10 ms/DIV.
Vehicle condition	Ignition switch: ON A/C switch: ON Blower switch: LO

Standard

Tester Connection	Condition	Specified Condition
A14-1 - A14-10	Ignition switch: ON A/C switch: ON Blower switch: LO	Pulse generation

Result

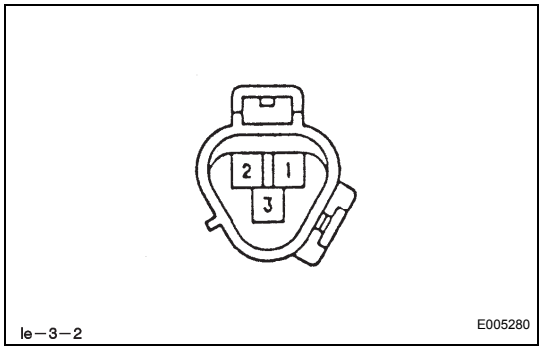
Result	Proceed to
NG	A
OK (When checking from the PROBLEM SYMPTOMS TABLE)	B
OK (When checking from the DTCs)	C

B → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (See page AC-6)**

C → **REPLACE AIR CONDITIONING AMPLIFIER**

A

2	INSPECT COMPRESSOR AND MAGNETIC CLUTCH (A/C LOCK SENSOR)



(a) Disconnect the connector from the compressor and magnetic clutch.

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

Standard resistance

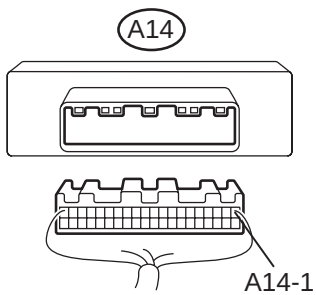
Tester Connection	Condition	Specified Condition
A3-1 - A3-2	Always (at 20°C (68°F))	165 to 205 Ω

NG → **REPLACE COMPRESSOR AND MAGNETIC CLUTCH (A/C LOCK SENSOR)**

OK

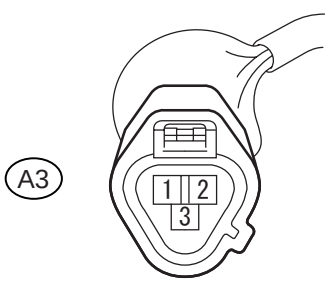
3	CHECK HARNESS AND CONNECTOR (A/C AMPLIFIER - COMPRESSOR AND MAGNETIC CLUTCH (LOCK SENSOR))

Air Conditioning Amplifier Connector Wire Harness View:



(a) Disconnect the connector from the A/C amplifier.

Compressor and Magnetic Clutch Connector Front View:



(b) Measure the resistance according to the table below.

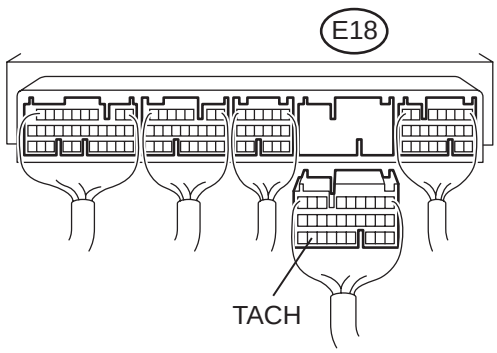
Tester Connection	Condition	Specified Condition
A14-1 - A3-1	Always	Below 1 Ω
A3-1 - Body ground	Always	10 kΩ or higher
A14-10 - A3-2	Always	Below 1 Ω
A3-2 - Body ground	Always	10 kΩ or higher

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

OK

4	CHECK HARNESS AND CONNECTOR (ECM - A/C AMPLIFIER)

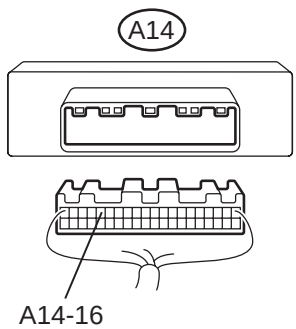
ECM Connector Wire Harness View:



H E124430E02

(a) Disconnect the connector from the ECM.

Air Conditioning Amplifier Connector Wire Harness View:



H E124426E06

(b) Measure the resistance according to the table below.

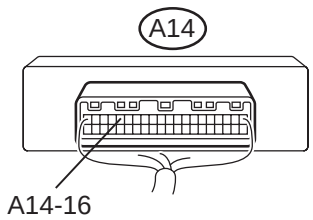
Tester Connection (Symbols)	Condition	Specified Condition
A14-16 - E18-27 (TACH)	Always	Below 1 Ω
A14-16 - Body ground	Always	10 kΩ or higher

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

OK

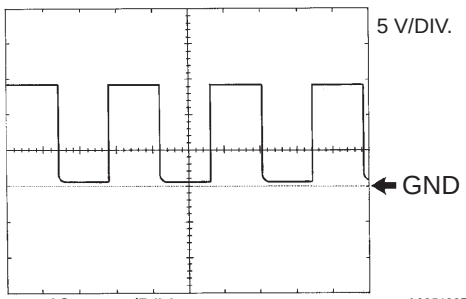
5	INSPECT AIR CONDITIONING AMPLIFIER

Air Conditioning Amplifier Connector Wire Harness View:



H E124425E06

(a) Reconnect the connector to the A/C amplifier.
(b) Reconnect the connector to the ECM.



A005138E18

(c) Measure the waveform of the connector.

Item	Contents
Tool setting	5 V/DIV., 10 ms/DIV.
Vehicle condition	Ignition switch: ON A/C switch: ON Blower switch: LO

Standard

Tester Connection	Condition	Specified Condition
A14-16 - Body ground	Ignition switch: ON A/C switch: ON Blower switch: LO	Pulse generation

NG → REPLACE ECM

OK

REPLACE AIR CONDITIONING AMPLIFIER

Air Conditioning Compressor Magnetic Clutch Circuit

DESCRIPTION

1MZ-FE:

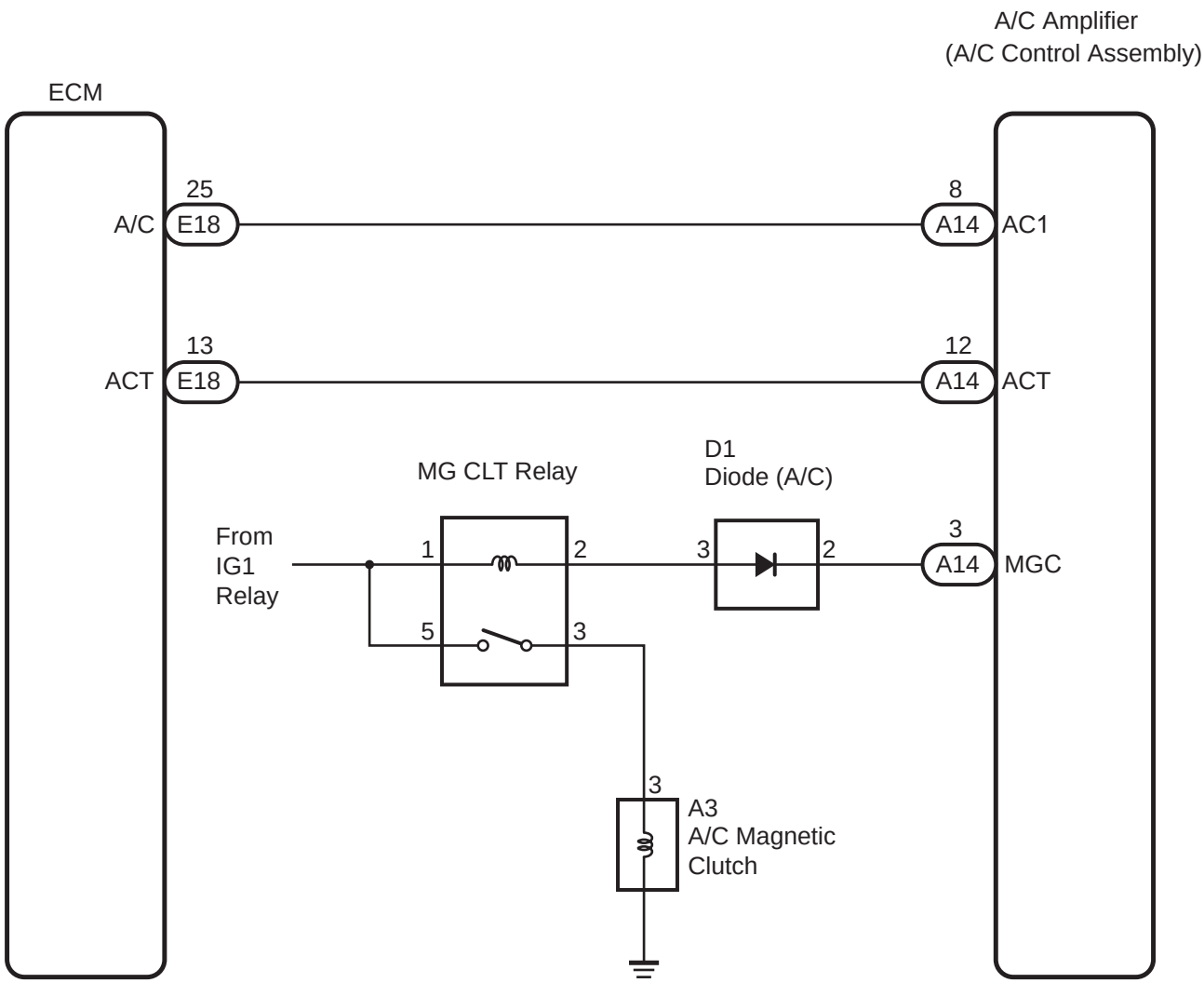
The ECM communicates with the A/C amplifier via the A/C and ACT circuits. If the ECM indicates that conditions allow the operation of the air conditioning system, the A/C amplifier will turn on the magnetic clutch relay.

2AZ-FE:

The A/C amplifier outputs the magnetic clutch ON signal from terminal AC1 to the ECM. The ECM receives the signal and sends it from terminal ACMG to turn the magnetic clutch relay ON. Then, the magnetic clutch is turned ON.

WIRING DIAGRAM

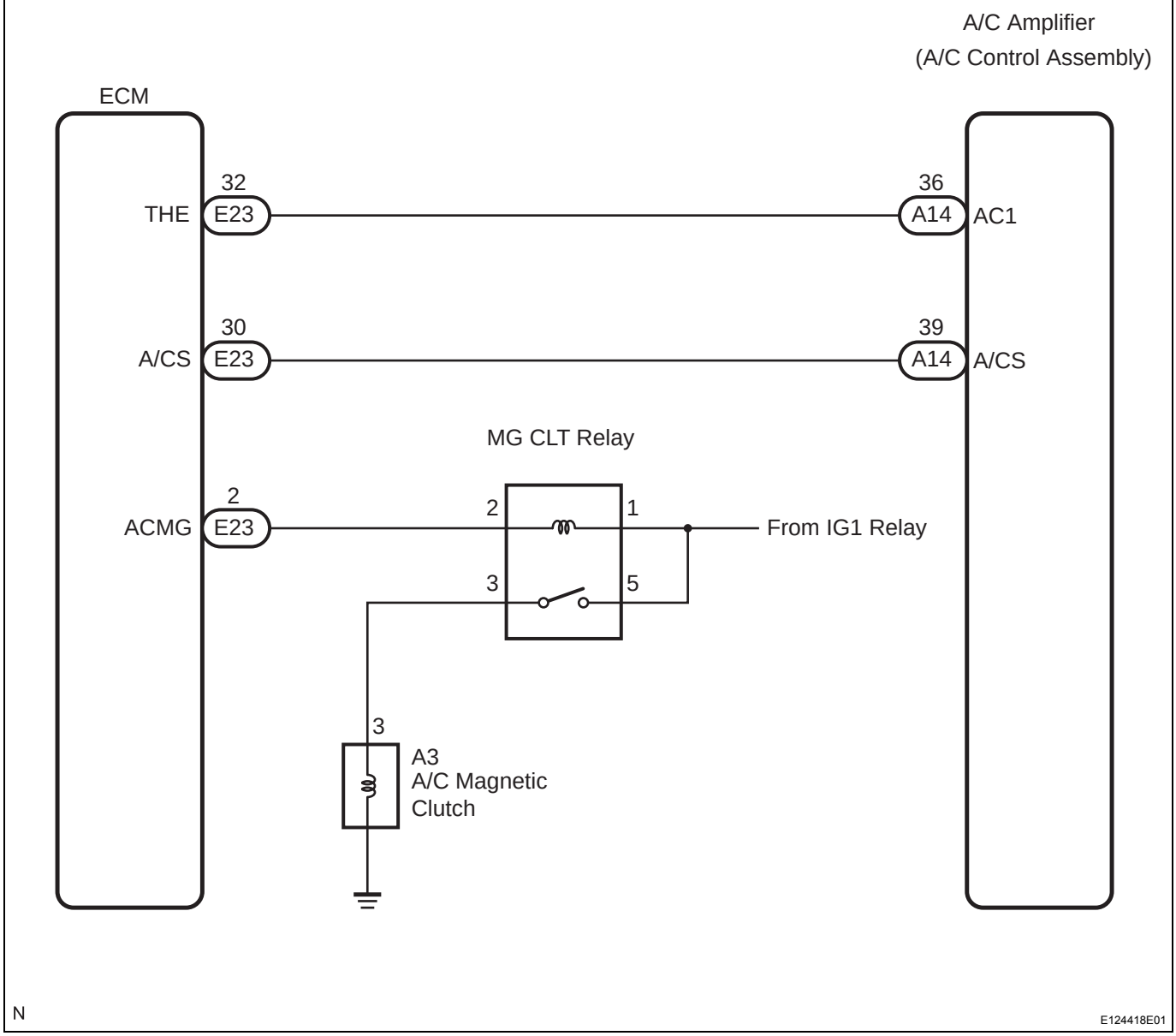
1MZ-FE:



N

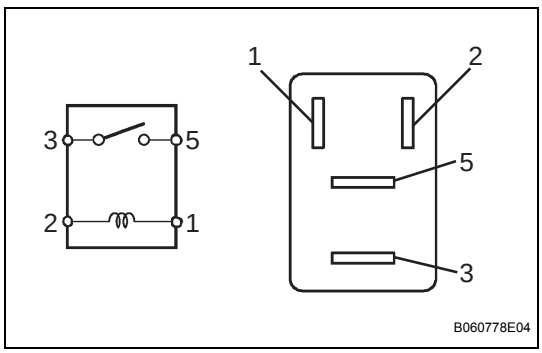
E124417E01

2AZ-FE:


A/C Amplifier
(A/C Control Assembly)
ECM
32
THE
E23
36
A14
AC1
30
A/CS
E23
39
A14
A/CS
MG CLT Relay
2
ACMG
E23
2
1
From IG1 Relay
3
5
3
A3
A/C Magnetic
Clutch
N
E124418E01

INSPECTION PROCEDURE
1MZ-FE:

1 | **INSPECT MAGNETIC CLUTCH RELAY**



(a) Remove the relay from the engine room R/B.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

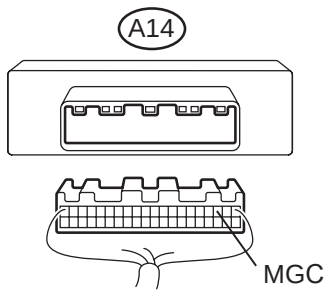
Tester Connection	Condition	Specified Condition
3 - 5	Always	10 kΩ or higher
3 - 5	When battery voltage is applied to terminal 1 and 2.	Below 1 Ω

NG → **REPLACE MAGNETIC CLUTCH RELAY**

OK

2 | **CHECK HARNESS AND CONNECTOR (A/C AMPLIFIER - BATTERY)**

Air Conditioning Amplifier Connector Wire Harness View:



(a) Disconnect the connector from the A/C amplifier.
(b) Measure the voltage according to the value(s) in the table below.

Standard voltage

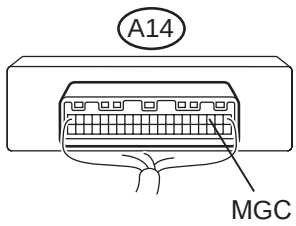
Tester Connection (Symbols)	Condition	Specified Condition
A14-3 (MGC) - Body ground	Ignition switch: ON	10 to 14 V

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

OK

3 INSPECT AIR CONDITIONING AMPLIFIER

Air Conditioning Amplifier Connector Wire Harness View:



H E124425E04

(a) Reconnect the connector to the A/C amplifier.
(b) Measure the voltage according to the value(s) in the table below.

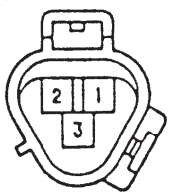
Standard voltage

Tester Connection (Symbols)	Condition	Specified Condition
A14-3 (MGC) - Body ground	Ignition switch: ON A/C switch: OFF	10 to 14 V
A14-3 (MGC) - Body ground	Ignition switch: ON A/C switch: ON	Below 1 V

NG → **GO TO STEP 6**

OK

4 INSPECT COMPRESSOR AND MAGNETIC CLUTCH



Ie–3–2 E005280

(a) Disconnect the connector from the compressor and magnetic clutch.
(b) Connect the positive (+) lead from the battery to terminal 3, check that the following occurs: 1) the magnetic clutch's operating sound can be heard, and 2) the magnetic clutch's hub and rotor lock.

OK:

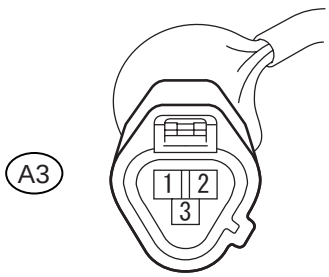
The magnetic clutch's operating sound can be heard.
The magnetic clutch's hub and rotor lock.

NG → **REPLACE COMPRESSOR AND MAGNETIC CLUTCH**

OK

5	CHECK HARNESS AND CONNECTOR (COMPRESSOR AND MAGNETIC CLUTCH - BODY GROUND)

Compressor and Magnetic Clutch Connector Front View:



H E124442E01

(a) Disconnect the connector from the compressor and magnetic clutch.

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

Standard voltage

Tester Connection	Condition	Specified Condition
A3-3 - Body ground	Ignition switch: ON A/C switch: ON	10 to 14 V

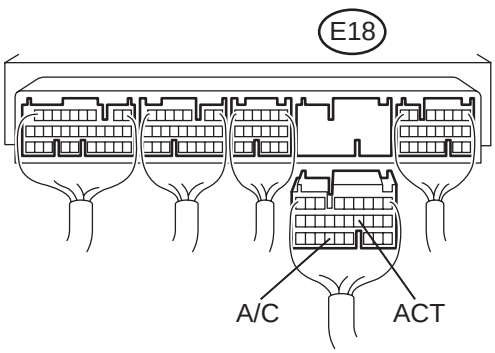
(c) Reconnect the connector to the compressor and magnetic clutch.

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

OK

6	CHECK HARNESS AND CONNECTOR (A/C AMPLIFIER - ECM)

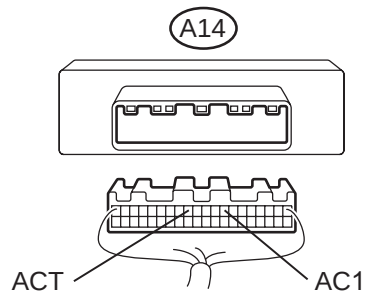
ECM Connector Wire Harness View:



H E124430E04

(a) Disconnect the connector from the ECM.

Air Conditioning Amplifier Connector Wire Harness View:



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

Standard resistance

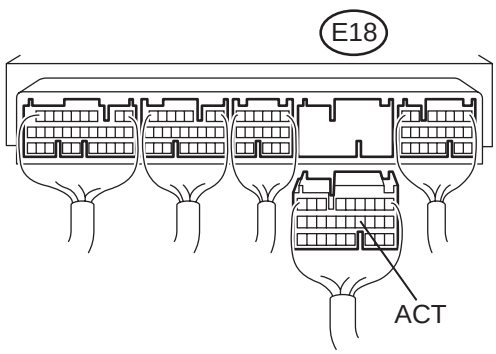
Tester Connection (Symbols)	Condition	Specified Condition
A14-8 (AC1) - E18-25 (A/C)	Always	Below 1 Ω
A14-12 (ACT) - E18-13 (ACT)	Always	Below 1 Ω
A14-8 (AC1) - Body ground	Always	10 kΩ or higher
A14-12 (ACT) - Body ground	Always	10 kΩ or higher

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

OK

7 INSPECT AIR CONDITIONING AMPLIFIER

ECM Connector Wire Harness View:



(a) Reconnect the connector to the A/C amplifier.
(b) Measure the voltage on the ECM connector side according to the value(s) in the table below.

Standard voltage

Tester Connection (Symbols)	Condition	Specified Condition
E18-13 (ACT) - Body ground	Ignition switch: ON A/C switch: ON	10 to 14 V
E18-13 (ACT) - Body ground	Ignition switch: ON A/C switch: OFF	Below 1 V

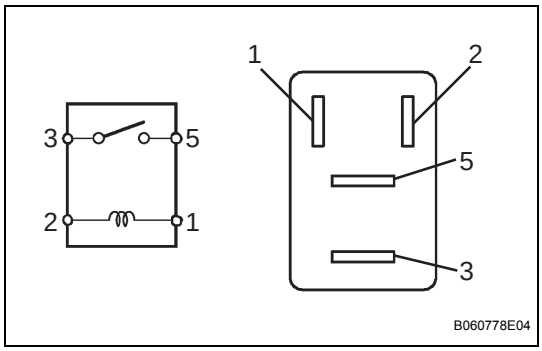
NG → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (See page AC-6)**

OK

REPLACE ECM

2AZ-FE:

1 INSPECT MAGNETIC CLUTCH RELAY



(a) Remove the relay from the engine room R/B.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

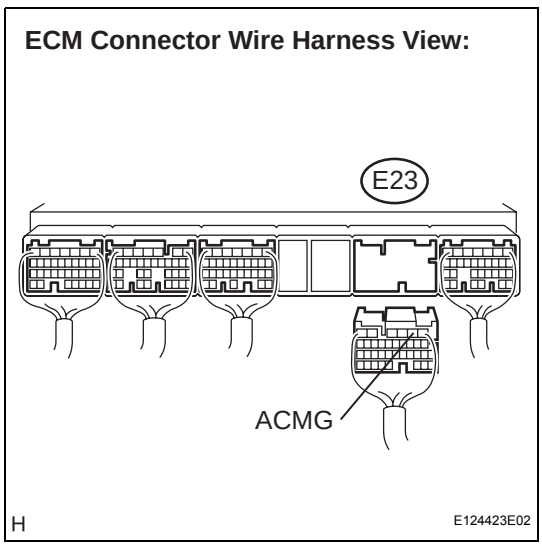
Tester Connection	Condition	Specified Condition
3 - 5	Always	10 kΩ or higher
3 - 5	When apply the battery voltage between 1 and 2.	Below 1 Ω

NG → REPLACE MAGNETIC CLUTCH RELAY

OK

2 CHECK HARNESS AND CONNECTOR (ECM - BATTERY)

ECM Connector Wire Harness View:



(a) Disconnect the connector from the ECM.
(b) Measure the voltage according to the value(s) in the table below.

Standard voltage

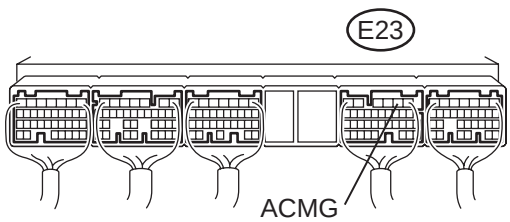
Tester Connection (Symbols)	Condition	Specified Condition
E23-2 (ACMG) - Body ground	Ignition switch: ON	10 to 14 V

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

3	INSPECT ECM

ECM Connector Wire Harness View:



H E124424E01

(a) Reconnect the connector to the ECM.
(b) Measure the voltage according to the value(s) in the table below.

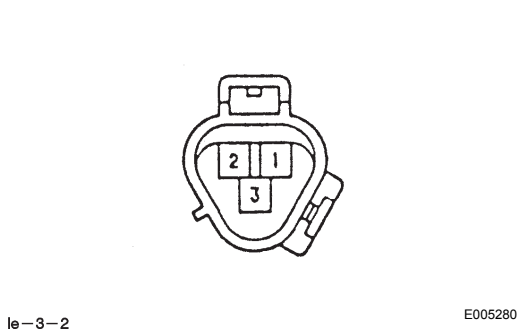
Standard voltage

Tester Connection (Symbols)	Condition	Specified Condition
E23-2 (ACMG) - Body ground	Ignition switch: ON A/C switch: OFF	10 to 14 V
E23-2 (ACMG) - Body ground	Ignition switch: ON A/C switch: ON	Below 1 V

NG → GO TO STEP 13

OK

4	INSPECT COMPRESSOR AND MAGNETIC CLUTCH



Ie–3–2 E005280

(a) Disconnect the connector from the compressor and magnetic clutch.
(b) Connect the positive (+) lead from the battery to terminal 3 and negative (-) lead to body ground.

OK:

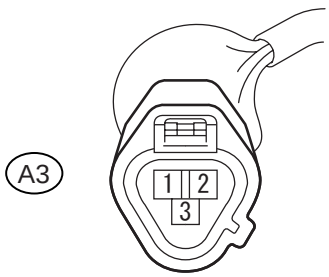
The magnetic clutch's operating sound can be heard.
The magnetic clutch's hub and rotor lock.

NG → REPLACE COMPRESSOR AND MAGNETIC CLUTCH

OK

5	CHECK HARNESS AND CONNECTOR (COMPRESSOR AND MAGNETIC CLUTCH - BODY GROUND)

Compressor and Magnetic Clutch Connector Front View:



H E124442E01

(a) Disconnect the connector from the compressor and magnetic clutch.

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

Standard voltage

Tester Connection	Condition	Specified Condition
A3-3 - Body ground	Ignition switch: ON A/C switch: ON	10 to 14 V

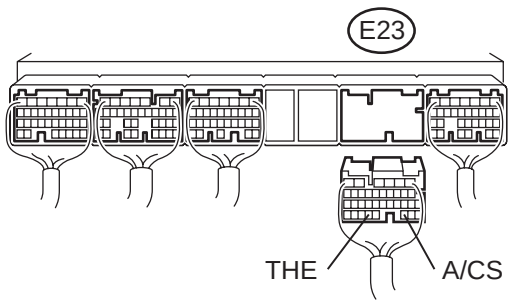
(c) Reconnect the connector to the compressor and magnetic clutch.

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

OK

6	CHECK HARNESS AND CONNECTOR (A/C AMPLIFIER - ECM)

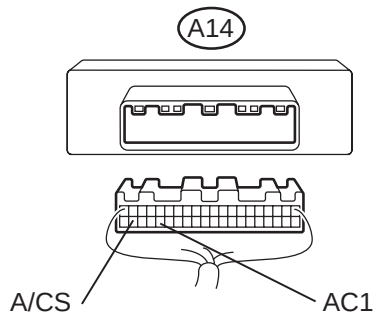
ECM Connector Wire Harness View:



H E124423E03

(a) Disconnect the connector from the ECM and A/C amplifier.

Air Conditioning Amplifier Connector Wire Harness View:



(b) Disconnect the connector from the A/C amplifier.
(c) Measure the resistance according to the value(s) in the table below.

Standard resistance

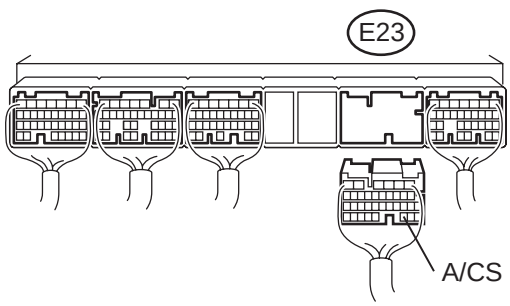
Tester Connection (Symbols)	Condition	Specified Condition
A14-36 (AC1) - E23-32 (THE)	Always	Below 1 Ω
A14-39 (A/CS) - E23-30 (A/CS)	Always	Below 1 Ω
A14-36 (AC1) - Body ground	Always	10 kΩ or higher
A14-39 (A/CS) - Body ground	Always	10 kΩ or higher

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

OK

7 INSPECT AIR CONDITIONING AMPLIFIER

ECM Connector Wire Harness View:



(a) Reconnect the connector to the A/C amplifier.
(b) Measure the voltage on the ECM connector side according to the value(s) in the table below.

Standard voltage

Tester Connection (Symbols)	Condition	Specified Condition
A14-39 (A/CS) - Body ground	Ignition switch: ON A/C switch: ON	10 to 14 V
A14-39 (A/CS) - Body ground	Ignition switch: ON A/C switch: OFF	Below 1 V

NG → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (See page AC-6)**

OK

REPLACE ECM

ENGINE IMMOBILISER

ENGINE IMMOBILISER SYSTEM (2AZ-FE)

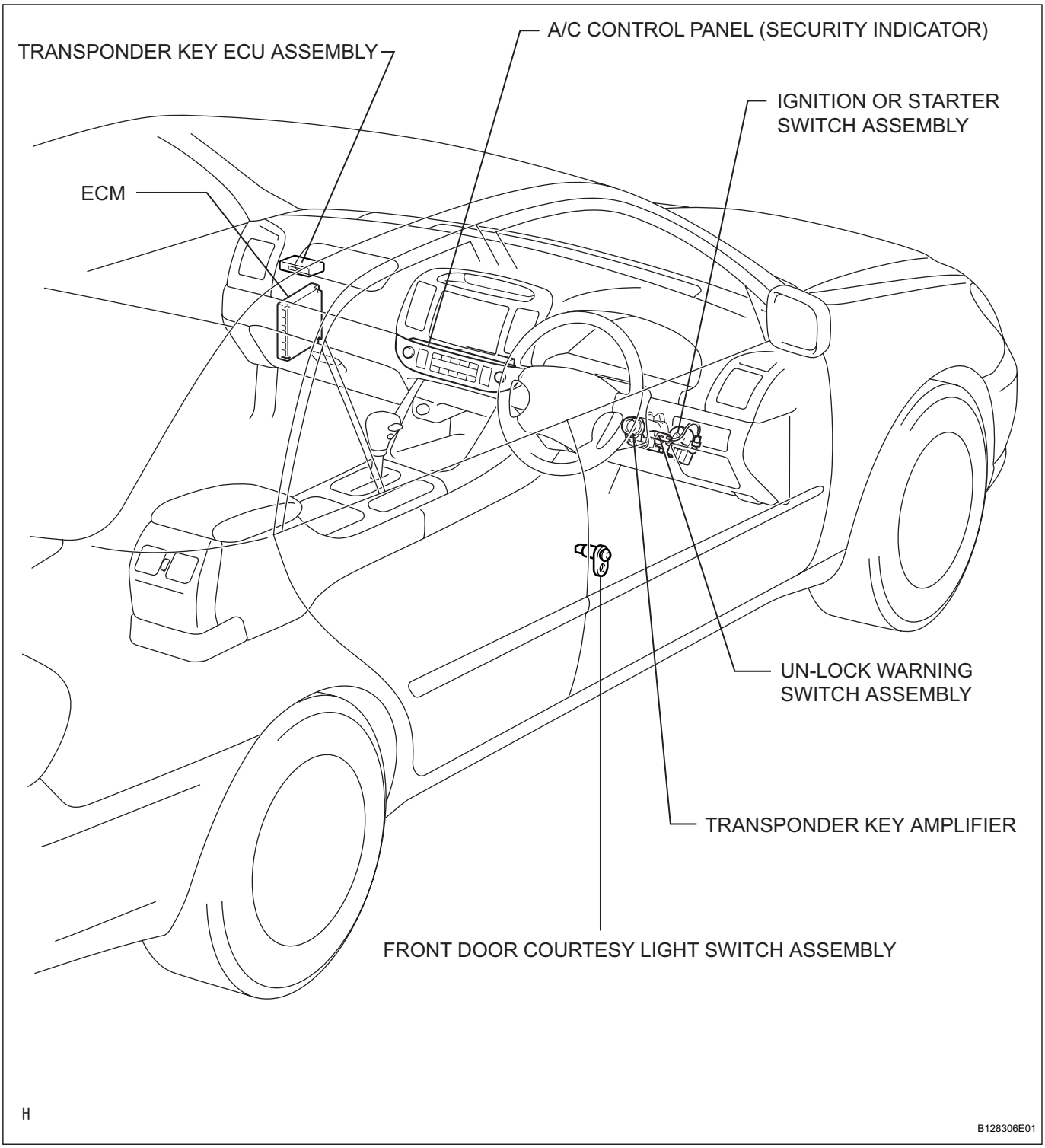
PARTS LOCATION EI-1
SYSTEM DIAGRAM EI-2
SYSTEM DESCRIPTION. EI-3
HOW TO PROCEED WITH TROUBLESHOOTING EI-3
PROBLEM SYMPTOMS TABLE EI-4
TERMINALS OF ECU EI-5
DIAGNOSIS SYSTEM EI-10
DTC CHECK / CLEAR EI-11
DIAGNOSTIC TROUBLE CODE CHART EI-13
DTC 3-1 Unmatched Key Code EI-14
DTC 3-2 No Communication in Immobiliser System EI-15
DTC 3-3 Communication Malfunction EI-18
DTC B2799 Engine Immobiliser System EI-20
IG Signal Circuit EI-22
Security Indicator Light Circuit EI-25
Door Courtesy Switch Circuit EI-28
ECU Power Source Circuit. EI-30
Unlock Warning Switch Circuit EI-32
Diagnosis Circuit EI-35

ENGINE IMMOBILISER SYSTEM (1MZ-FE)

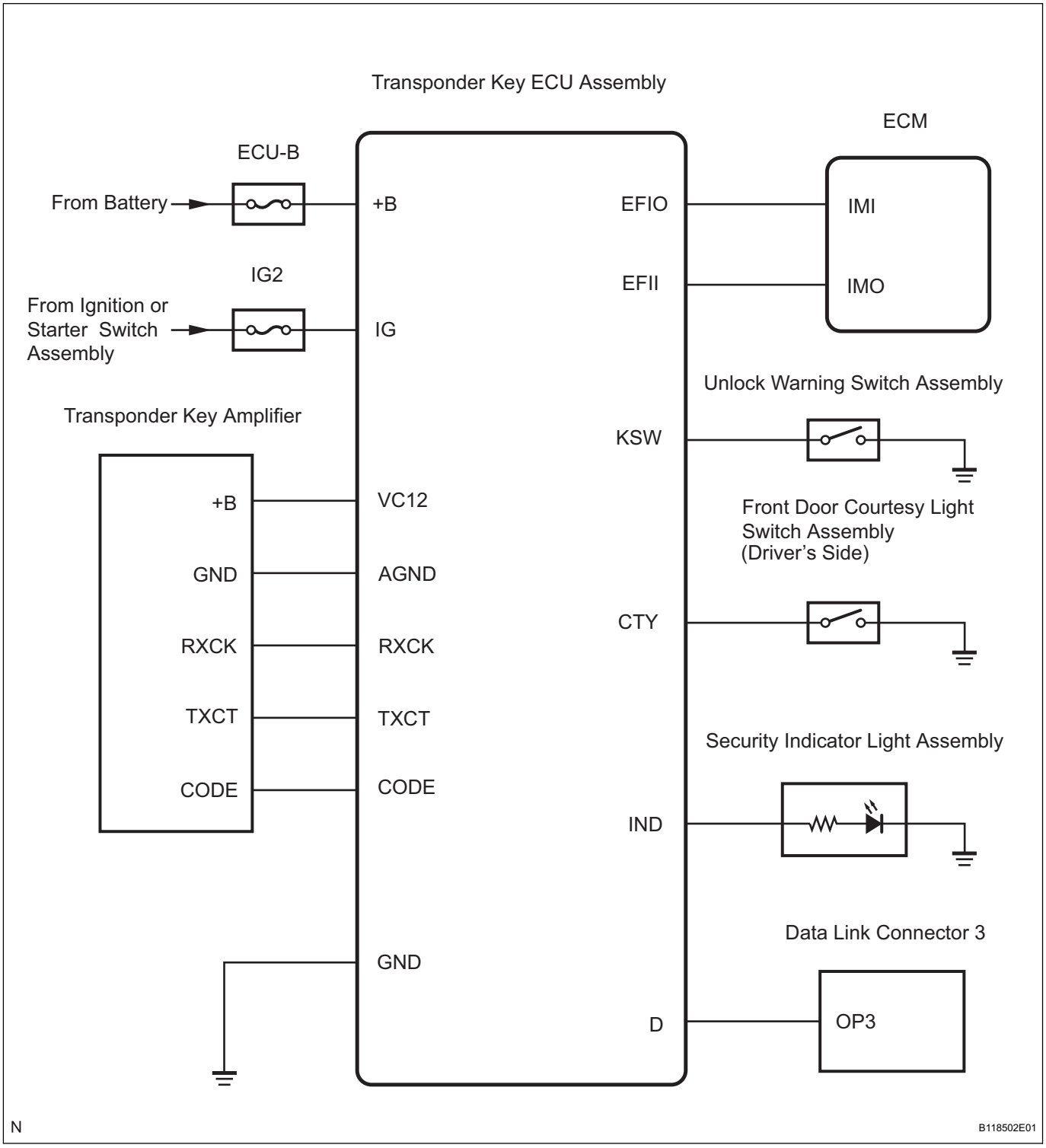
PARTS LOCATION EI-38
HOW TO PROCEED WITH TROUBLESHOOTING EI-38
PROBLEM SYMPTOMS TABLE EI-40
TERMINALS OF ECU EI-40
DIAGNOSIS SYSTEM EI-43
DTC CHECK / CLEAR EI-45
DIAGNOSTIC TROUBLE CODE CHART EI-45
DTC B2795 Unmatched Key Code EI-47
DTC B2796 No Communication in Immobiliser System EI-48
DTC B2798 Communication Malfunction No. 2 . . . . . EI-48
DTC B2797 Communication Malfunction No. 1 . . . . . EI-52
Security Indicator Light Circuit EI-55
Unlock Warning Switch Circuit EI-58

ENGINE IMMOBILISER SYSTEM (2AZ-FE)

PARTS LOCATION



SYSTEM DIAGRAM



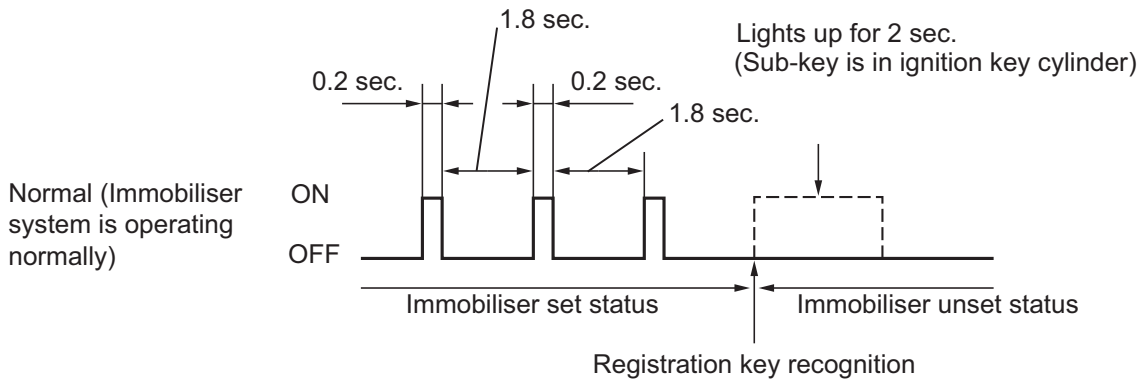
SYSTEM DESCRIPTION

1. SYSTEM DESCRIPTION

(a) The engine immobiliser system is designed to prevent the vehicle from being stolen. This system uses a transponder key ECU assembly that stores the codes of authorised ignition keys. If an attempt is made to start the engine using an unauthorised key, the ECU sends a signal to the ECM to prohibit fuel delivery and ignition, effectively disabling the engine.

(b) The security indicator pattern is shown below (when changing the immobiliser set status to the unset status):

Security Indicator:



HOW TO PROCEED WITH TROUBLESHOOTING

1	VEHICLE BROUGHT TO WORKSHOP

NEXT

2	CRANK ENGINE FOR MORE THAN 10 SECONDS

NEXT

3	CHECK FOR DTC

(a) Check for DTCs and note any codes that are output.
(b) Delete the DTCs.
(c) Recheck for DTCs. Try to output the DTC (SFI system and engine immobiliser system) by reproducing the original activity that caused the DTC to be output.
  (1) If any DTC does not recur, proceed to A.

(2) If the DTC (SFI system) recurs, proceed to B.
(3) If the DTC (engine immobiliser system) recurs, proceed to C.

B → GO TO SFI SYSTEM

C → GO TO DTC CHART (See page E1-13)

A

4 PROBLEM SYMPTOMS TABLE

(a) When the problem is not listed on the problem symptoms table, proceed to A.
(b) When the problem is listed on the problem symptoms table, proceed to B.

B → GO TO STEP 6

A

5 OVERALL ANALYSIS AND TROUBLESHOOTING

(a) Terminals of ECU (See page EI-5)

NEXT

6 ADJUST, REPAIR OR REPLACE

NEXT

7 CONFIRMATION TEST

NEXT

END

PROBLEM SYMPTOMS TABLE

ENGINE IMMOBILISER SYSTEM:

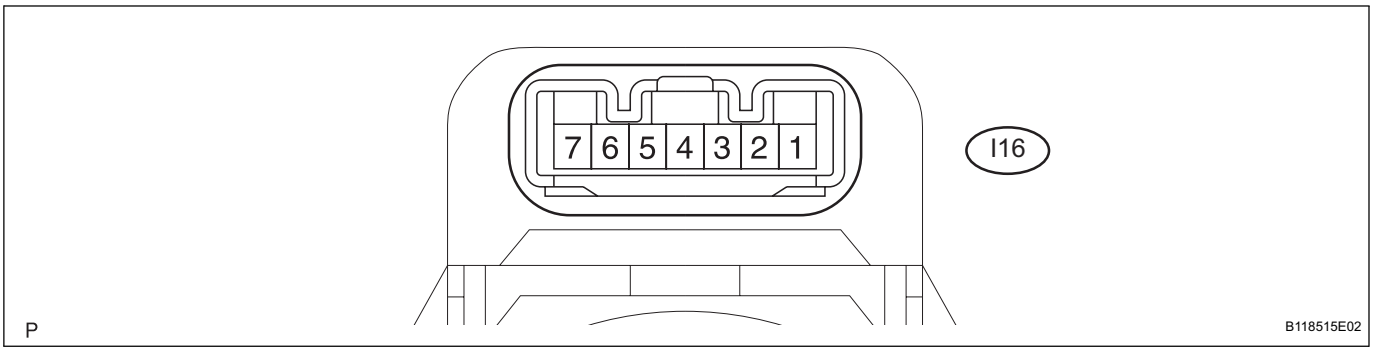
Symptom	Suspected Area	See Page
CODE 1-1 is not output.	1. Unlock warning switch circuit	EI-32
	2. ECU power source circuit	EI-30
	3. Transponder key ECU assembly	-
CODE 1-2 is not output.	1. Door courtesy switch circuit	EI-28
	2. ECU power source circuit	EI-30
	3. Transponder key ECU assembly	-
CODE 1-3 is not output.	1. IG signal circuit	EI-22
	2. ECU power source circuit	EI-30
	3. Transponder key ECU assembly	-

Symptom	Suspected Area	See Page
CODE 2-1 and 2-2 are not output.	1. Key	EI-15
	2. Wire harness	EI-15
	3. Transponder key amplifier	EI-15
	4. Transponder key ECU assembly	-
Unable to register the key.	1. Door courtesy switch circuit	EI-28
	2. IG signal circuit	EI-22
	3. Transponder key ECU assembly	-
Engine does not start.	1. ECU power source circuit	EI-30
	2. IG signal circuit	EI-22
	3. Unlock warning switch circuit	EI-32
	4. Transponder key ECU assembly	-
	5. ECM	-
Security indicator is always ON.	1. Security indicator light circuit	EI-25
	2. ECU power source circuit	EI-30
	3. Transponder key ECU assembly	-
Security indicator is always OFF.	1. Security indicator light circuit	EI-25
	2. ECU power source circuit	EI-30
	3. Transponder key ECU assembly	-
Security indicator is abnormally blinking.	Transponder key ECU assembly	-
No DTCs for the engine immobiliser system are output.	1. ECU power source circuit	EI-30
	2. Diagnosis circuit	EI-35
	3. Transponder key ECU assembly	-

TERMINALS OF ECU

1. CHECK TRANSPONDER KEY AMPLIFIER

(a) Disconnect the I16 amplifier connector and measure the resistance between the terminal of the wire harness side connector and body ground.



Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
AGND (I16-7) - Body ground	BR - Body ground	Ground	Always	Below 1 Ω

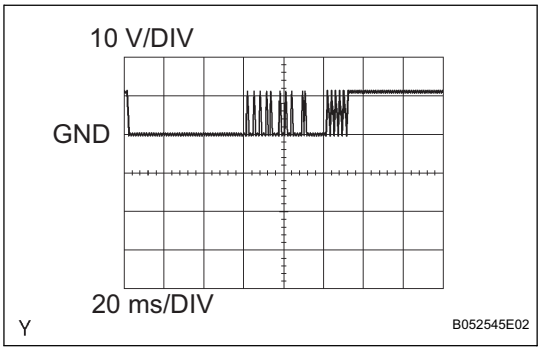
If the result is not as specified, there may be a malfunction on the wire harness side.

(b) Reconnect the I16 amplifier connector and measure the resistance and voltage according to the value(s) in the table below.

Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
VC12 (I16-1) - AGND (I16-7)	B-O - BR	Power source	No key is in ignition key cylinder	Below 1 V
			Key is in ignition key cylinder	10 to 14 V
CODE (I16-4) - AGND (I16-7)	L-B - BR	Demodulated signal of key code data	No key is in ignition key cylinder	Below 1 V
			Key is in ignition key cylinder	Waveform 1
RXCK (I16-3) - AGND (I16-7)	Y - BR	Clock signal synchronized with key code data	No key is in ignition key cylinder	Below 1 V
			Key is in ignition key cylinder	Waveform 2
TXCT (I16-5) - AGND (I16-7)	L-Y - BR	Key code output signal	No key is in ignition key cylinder	Below 1 V
			Key is in ignition key cylinder	Waveform 3
AGND (I16-7) - Body ground	BR - Body ground	Ground	Always	Below 1 Ω

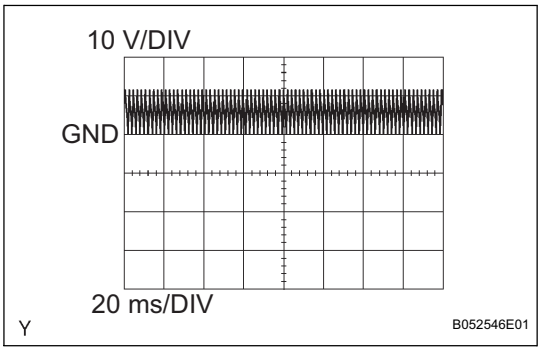
If the result is not as specified, the amplifier may have a malfunction.

(c) Inspect using an oscilloscope.
(1) Waveform 1 (Reference)

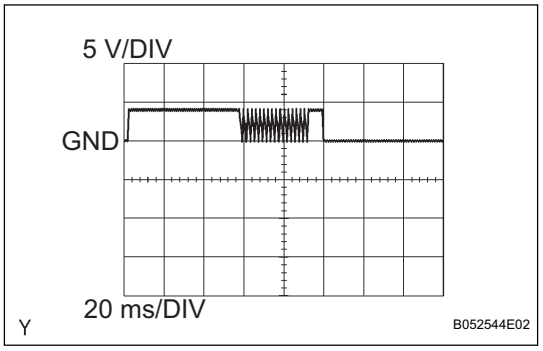


Terminal	CODE - AGND
Tool Setting	10 V/DIV, 20 ms/DIV
Condition	Key is in ignition key cylinder

(2) Waveform 2 (Reference)



Terminal	RXCK - AGND
Tool Setting	10 V/DIV, 20 ms/DIV
Condition	Key is in ignition key cylinder

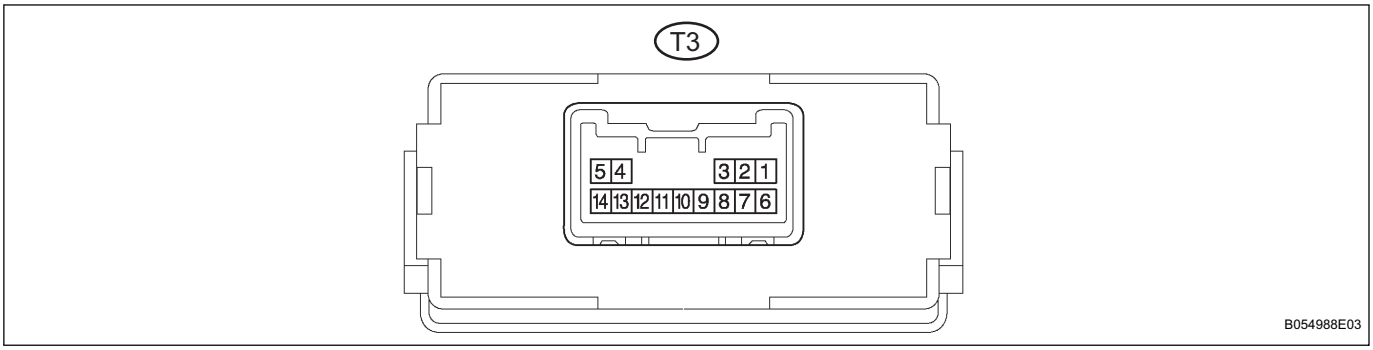


(3) Waveform 3 (Reference)

Terminal	TXCT - AGND
Tool Setting	5 V/DIV, 20 ms/DIV
Condition	Key is in ignition key cylinder

2. CHECK TRANSPONDER KEY ECU ASSEMBLY

(a) Disconnect the T3 ECU connector and measure the resistance and voltage between each terminal of the wire harness side connector.



Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
GND (T3-14) - Body ground	W-B - Body ground	Ground	Always	Below 1 Ω
+B (T3-1) - GND (T3-14)	W-R - W-B	Battery	Always	10 to 14 V
IG (T3-2) - GND (T3-14)	B-O - W-B	Ignition or starter switch signal	Ignition switch ON	10 to 14 V
			Ignition switch OFF	Below 1 V
KSW (T3-9) - GND (T3-14)	L - W-B	Unlock warning switch signal	No key is in ignition key cylinder	10 kΩ or higher
			Key is in ignition key cylinder	Below 1 Ω

If the result is not as specified, there may be a malfunction on the wire harness side.

(b) Reconnect the T3 ECU connector and measure the resistance and voltage according to the value(s) in the table below.

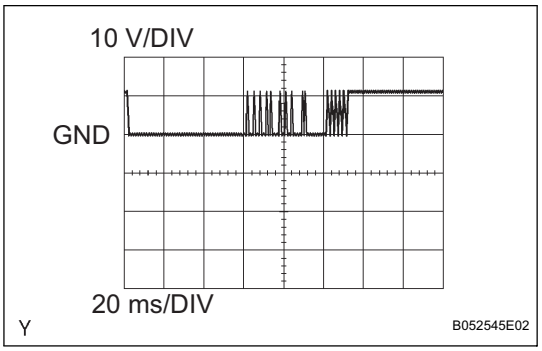
Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
AGND (T3-12) - Body ground	BR - Body ground	Ground	Always	Below 1 Ω
KSW (T3-9) - GND (T3-14)	L - W-B	Unlock warning switch signal	No key is in ignition key cylinder	10 to 14 V
			Key is in ignition key cylinder	Below 1 V
VC12 (T3-6) - GND (T3-14)	B-O - W-B	Power source	No key is in ignition key cylinder	Below 1 V
			Key is in ignition key cylinder	10 to 14 V
CODE (T3-4) - GND (T3-14)	L-B - W-B	Demodulated signal of key code data	No key is in ignition key cylinder	Below 1 V
			Key is in ignition key cylinder	Waveform 1
RXCK (T3-5) - GND (T3-14)	Y - W-B	Clock signal synchronized with key code data	No key is in ignition key cylinder	Below 1 V
			Key is in ignition key cylinder	Waveform 2

Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
TXCT (T3-13) - GND (T3-14)	L-Y - W-B	Key code output signal	No key is in ignition key cylinder	Below 1 V
			Key is in ignition key cylinder	Waveform 3
EFIO (T3-11) - GND (T3-14)	R-B - W-B	ECM output signal	Ignition switch OFF	Below 1 V
			Ignition switch ON	Waveform 4
EFII (T3-10) - GND (T3-14)	L-W - W-B	ECM input signal	Ignition switch OFF	Below 1 V
			Ignition switch ON	Waveform 5
CTY (T3-8) - GND (T3-14)	R-Y - W-B	Door courtesy signal	Switch pushed (Door closed)	10 to 14 V
			Switch free (Door opened)	Below 1 V
IND (T3-7) - GND (T3-14)	V - W-B	Security indicator signal	Security indicator light is on	10 to 14 V
			Security indicator light is off	Below 1 V

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

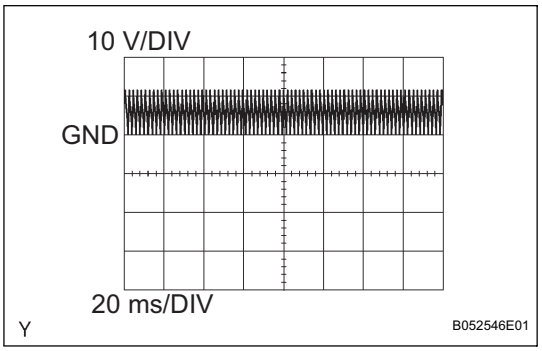
(c) Inspect using an oscilloscope.

(1) Waveform 1 (Reference)



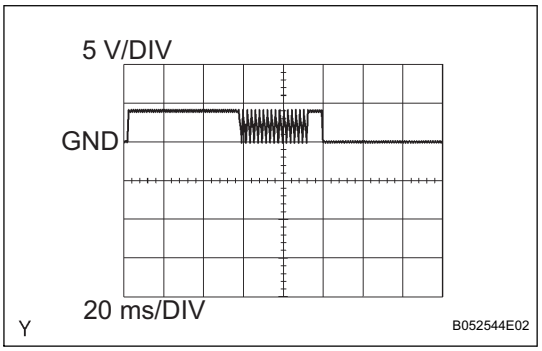
Terminal	CODE - GND
Tool Setting	10 V/DIV, 20 ms/DIV
Condition	Key is in ignition key cylinder

(2) Waveform 2 (Reference)

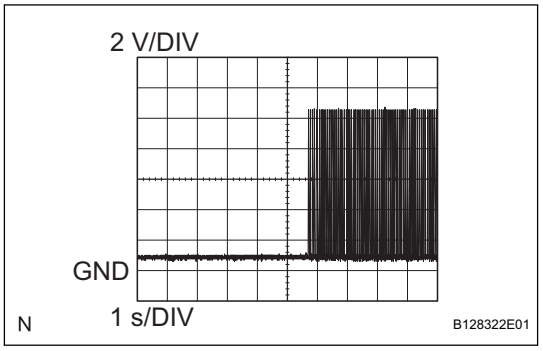


Terminal	RXCK - GND
Tool Setting	10 V/DIV, 20 ms/DIV
Condition	Key is in ignition key cylinder

(3) Waveform 3 (Reference)

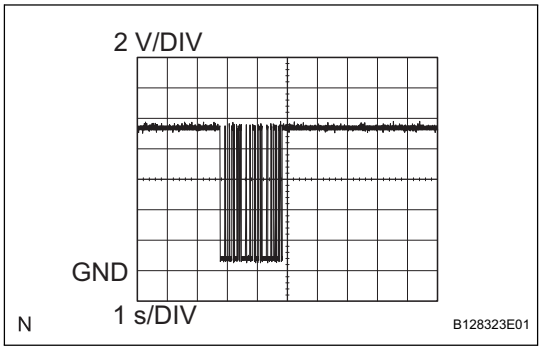


Terminal	TXCT - GND
Tool Setting	5 V/DIV, 20 ms/DIV
Condition	Key is in ignition key cylinder



(4) Waveform 4 (Reference)

Terminal	EFIO - GND
Tool Setting	2 V/DIV, 1 s/DIV
Condition	Ignition switch ON

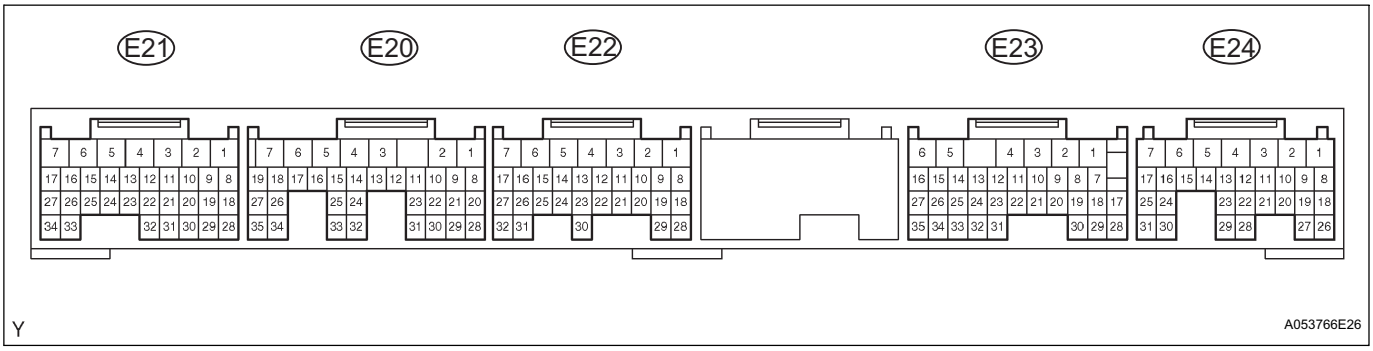


(5) Waveform 5 (Reference)

Terminal	EFII - GND
Tool Setting	2 V/DIV, 1 s/DIV
Condition	Ignition switch ON

3. CHECK ECM

(a) Disconnect the E21 and E22 ECM connectors and measure the resistance between the terminal of the wire harness side connector and body ground.



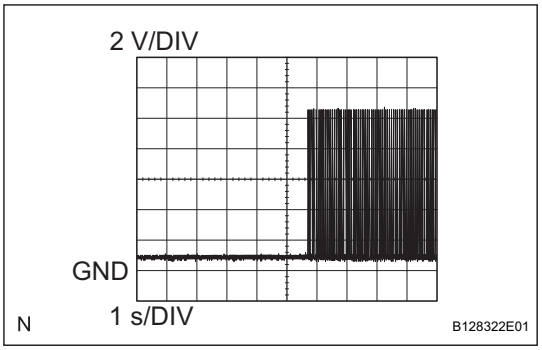
Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
E01 (E21-7) - Body ground	W-B - Body ground	Ground	Always	Below 1 Ω
E1 (E22-1) - Body ground	BR - Body ground	Ground	Always	Below 1 Ω

If the result is not as specified, there may be a malfunction on the wire harness side.

(b) Reconnect the E21 and E22 ECM connectors. Measure the voltage according to the value(s) in the table below.

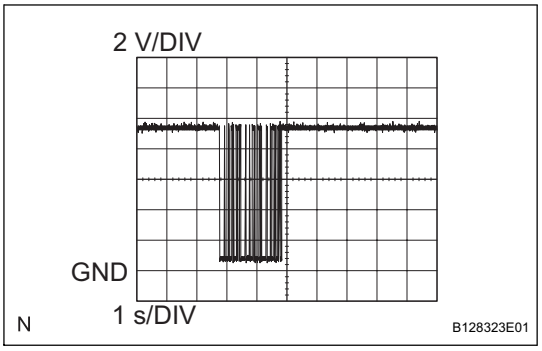
Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
IMI (E23-27) - E1 (E22-1)	R-B - BR	Transponder key ECU input signal	Ignition switch OFF	Below 1 V
			Ignition switch ON	Waveform 1
IMO (E23-26) - E1 (E22-1)	L-W - BR	Transponder key ECU output signal	Ignition switch OFF	Below 1 V
			Ignition switch ON	Waveform 2

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



(c) Inspect using an oscilloscope.
(1) Waveform 1 (Reference)

Terminal	IMI - GND
Tool Setting	2 V/DIV, 1 s/DIV
Condition	Ignition switch ON



(2) Waveform 2 (Reference)

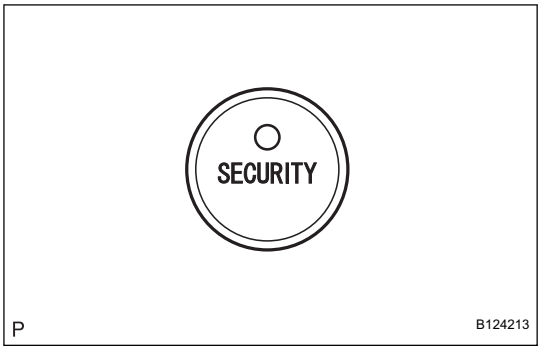
Terminal	IMO - GND
Tool Setting	2 V/DIV, 1 s/DIV
Condition	Ignition switch ON

DIAGNOSIS SYSTEM

1. DESCRIPTION

(a) The ECM controls the vehicle's immobiliser system data. A Diagnostic Trouble Code (DTC) can be read through the vehicle's Data Link Connector 3 (DLC3).

(b) DTC B2799 can be checked using the intelligent tester. This DTC is output from the ECM.



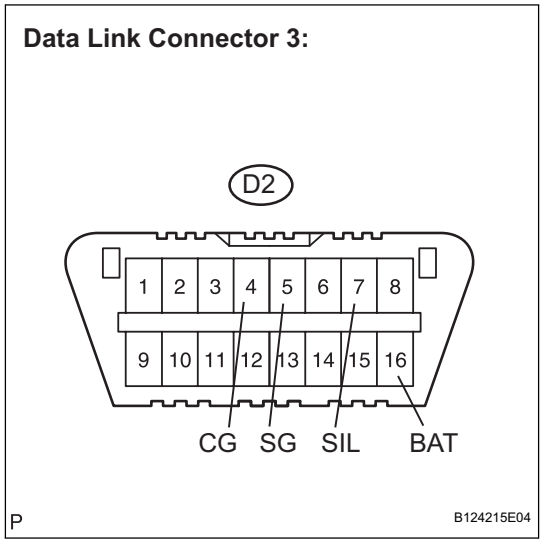
(c) DTCs output from the transponder key ECU assembly can be checked using the SST check wire. There are two types of DTCs, normal code and trouble code.
(1) When a normal code is output:

DTC No.	DTC Detection Condition
1-1	Unlock warning switch ON
1-2	Front door courtesy light switch OFF
1-3	Ignition switch ON
2-1	Immobiliser system is unset with a registered master key
2-2	Immobiliser system is unset with a registered sub key

(2) When a trouble code is output: (See page EI-13)

2. CHECK BATTERY VOLTAGE

(a) Check the battery voltage.
Standard voltage:
10 to 14 V
If the voltage is below 10 V, replace the battery before proceeding to the next step.



3. CHECK DLC3

(a) The vehicle uses ISO 9141-2 (Euro-OBD)/ISO 14230 (M-OBD) for communication protocol. The terminal arrangement of the DLC3 complies with ISO 15031-3 and matches the ISO 9141-2 (Euro-OBD)/ISO 14230 (M-OBD) format.

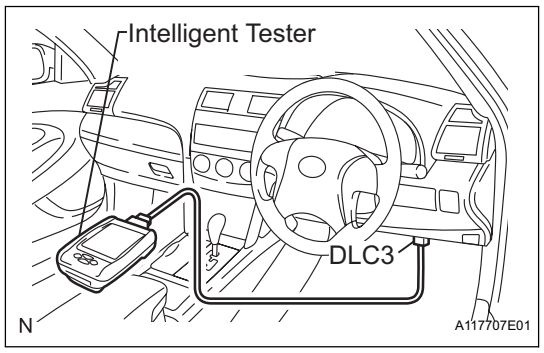
Symbol	Terminal No.	Name	Reference terminal	Result	Condition
SIL	7	Bus "+" line	5 - Signal ground	Pulse generation	During transmission
CG	4	Chassis ground	Body ground	Below 1 Ω	Always
SG	5	Signal ground			
BAT	16	Battery positive		11 to 14 V	

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

HINT:

If the screen displays a communication error message after the cable of the intelligent tester is connected to the DLC3, the ignition switch is turned to the ON position, and the intelligent tester is operated, the problem may be on the vehicle side or the tester side.

- If communication is normal when the tester is connected to another vehicle, inspect the DLC3 on the original vehicle.
- If communication is still impossible when the tester is connected to another vehicle, the problem may be in the tester itself. Consult the Service Department listed in the tester operator's manual.



DTC CHECK / CLEAR

1. CHECK FOR DTC (USING INTELLIGENT TESTER)

(a) Connect the intelligent tester to the DLC3.

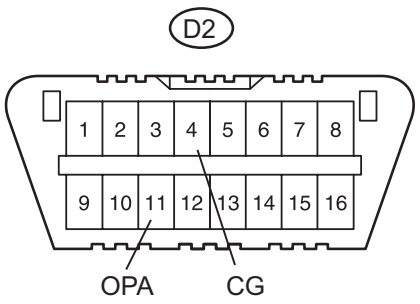
(b) Turn the ignition switch to the ON position.

(c) Read the DTCs by following the directions on the tester screen.

HINT:

- Refer to the intelligent tester operator's manual for further details.
- Only DTC B2799 can be checked using the intelligent tester.

Data Link Connector 3:

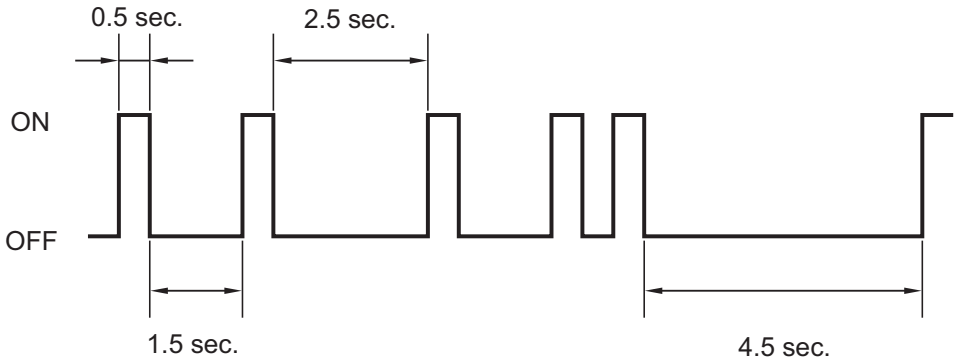


P B124215E05

2. **CHECK FOR DTC (USING SST CHECK WIRE)**
   (a) Using SST check wire, connect terminals OPA and CG of the DLC3.
   SST 09843-18040
   (b) Turn the ignition switch to the ON position.
   (c) Read the DTCs indicated by the blinking of the check security indicator light.

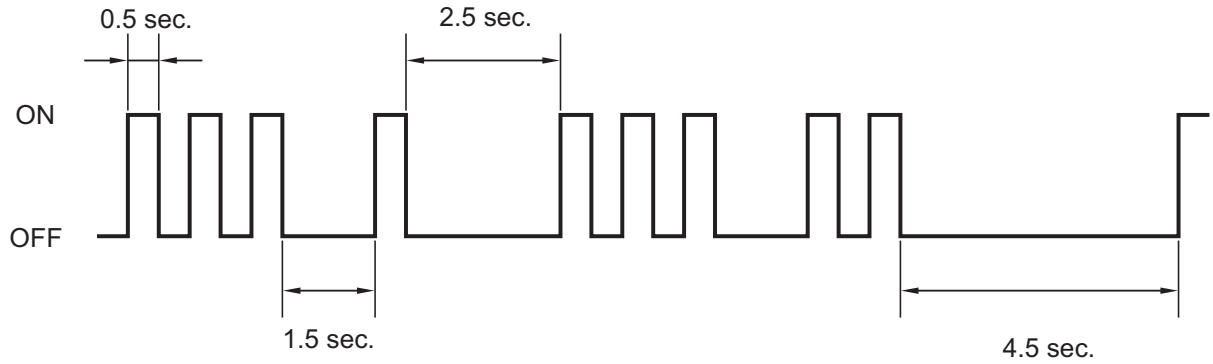
Security Indicator:

Normal Code: 1-1, 1-2, 1-3, 2-1, 2-2



Code 1-1 Code 1-2

Trouble Code: 3-1, 3-2, 3-3



Code 3-1 Code 3-2

N B118505E02

(1) When a normal code is output: (See page EI-10)
(2) When a trouble code is output: (See page EI-13)

3. **CLEAR DTC (USING INTELLIGENT TESTER)**
   (a) Connect the intelligent tester to the DLC3.
   (b) Turn the ignition switch to the ON position.

(c) Clear the DTCs by following the directions on the tester screen.
HINT:
- Refer to the intelligent tester operator's manual for further details.
- Only DTC B2799 can be cleared using the intelligent tester.

4. CLEAR DTC (USING SST CHECK WIRE)

(a) Remove the ECU-B fuse from the driver side J/B for 1 minute or more.

DIAGNOSTIC TROUBLE CODE CHART

TRANSPONDER KEY ECU DIAGNOSTIC TROUBLE CODE CHART:

DTC No.	Detection Item	Trouble Area	See Page
3-1	Unmatched Key Code	Key	EI-14
3-2	No Communication in Immobiliser System	1. Key 2. Wire harness 3. Transponder key amplifier 4. Transponder key ECU assembly	EI-15
3-3	Communication Malfunction	1. Key 2. Transponder key amplifier 3. Transponder key ECU assembly	EI-18

HINT:
- If the key is recognised that it has already been registered or stored, DTC 3-1 will be displayed.
- If another key is attempted to be registered with the specified number of the keys already registered, DTC 3-4 will be displayed.

ECM DIAGNOSTIC TROUBLE CODE CHART:

DTC No.	Detection Item	Trouble Area	See Page
B2799	Engine Immobiliser System	1. Wire harness 2. Transponder key ECU assembly 3. ECM	EI-20

HINT:
The DTC for the immobiliser system is specified above. If other codes are output, check the DTC chart for the engine control system.

DTC	3-1	Unmatched Key Code

DESCRIPTION

This DTC is output when a key with a code that has not been registered in the ECU is inserted into the ignition key cylinder.

DTC No.	DTC Detection Condition	Trouble Area
3-1	Key with unregistered key code is inserted	Key

INSPECTION PROCEDURE

1	RE-REGISTER KEY

(a) Delete the DTCs (See page EI-11).

(b) Re-register the key and insert this key into the ignition key cylinder. Check that the engine starts with this key.

OK:

The engine starts.

NG → **REPLACE KEY**

OK ↓

END

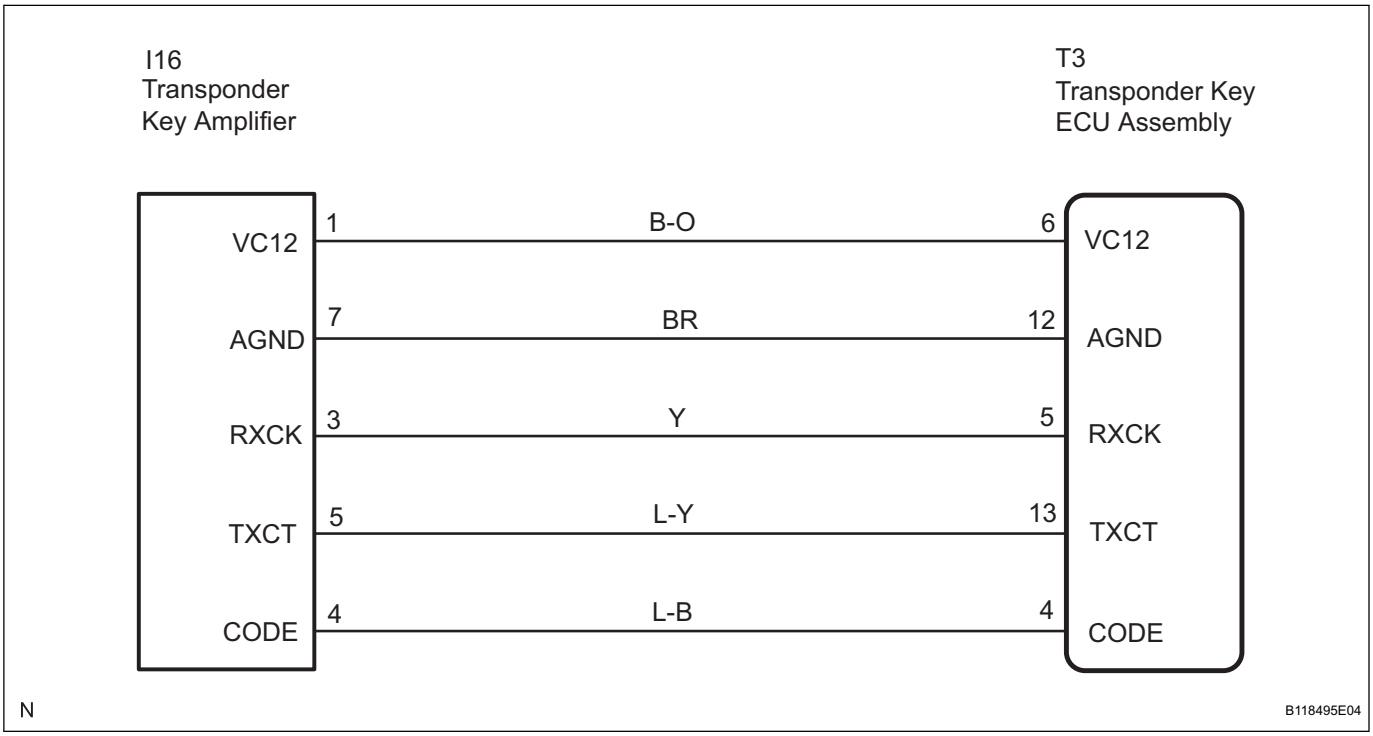
DTC	3-2	No Communication in Immobiliser System

DESCRIPTION

This DTC is output if a key that does not have a transponder chip is inserted into the ignition key cylinder or if communication between the key and transponder key ECU assembly is impossible.

DTC No.	DTC Detection Condition	Trouble Area
3-2	The key code cannot be transmitted	• Key • Wire harness • Transponder key amplifier • Transponder key ECU assembly

WIRING DIAGRAM



INSPECTION PROCEDURE

1	CHECK KEYS

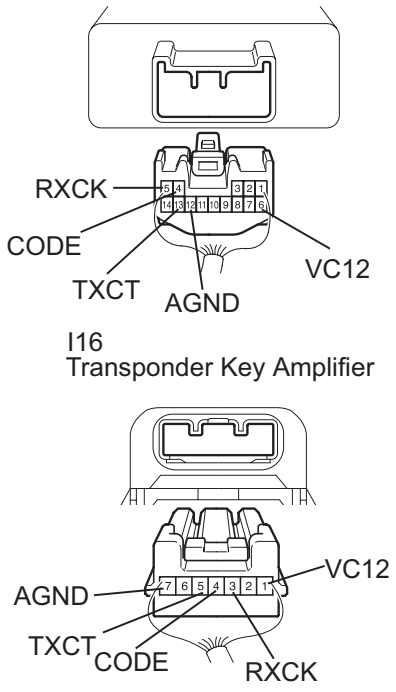
(a) Insert the vehicle's other key into the ignition key cylinder.
(b) Check that the engine starts with this key.
OK:
The engine starts.

OK → **RE-REGISTER OR REPLACE KEYS**

NG

2 CHECK HARNESS AND CONNECTOR (TRANSPONDER KEY ECU - TRANSPONDER KEY AMPLIFIER)

Wire Harness Side Connector Rear View:



(a) Disconnect the T3 ECU and I16 amplifier connectors.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

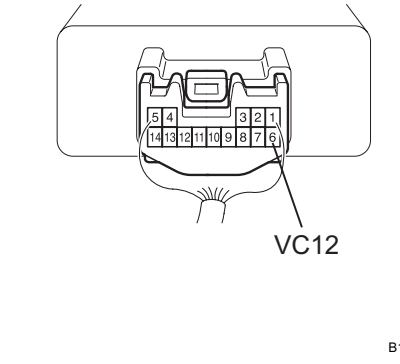
Tester Connection	Condition	Specified Condition
T3-4 (CODE) - I16-4 (CODE)	Always	Below 1 Ω
T3-5 (RXCK) - I16-3 (RXCK)		
T3-6 (VC12) - I16-1 (VC12)		
T3-12 (AGND) - I16-7 (AGND)		
T3-13 (TXCT) - I16-5 (TXCT)		
T3-4 (CODE) - Body ground		10 kΩ or higher
T3-5 (RXCK) - Body ground		
T3-6 (VC12) - Body ground		
T3-12 (AGND) - Body ground		
T3-13 (TXCT) - Body ground		

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

OK

3 INSPECT TRANSPONDER KEY ECU ASSEMBLY (TRANSPONDER KEY AMPLIFIER POWER SOURCE)

Wire Harness Side Connector Rear View:



(a) Reconnect the T3 ECU and I16 amplifier connectors.
(b) Measure the voltage according to the value(s) in the table below.

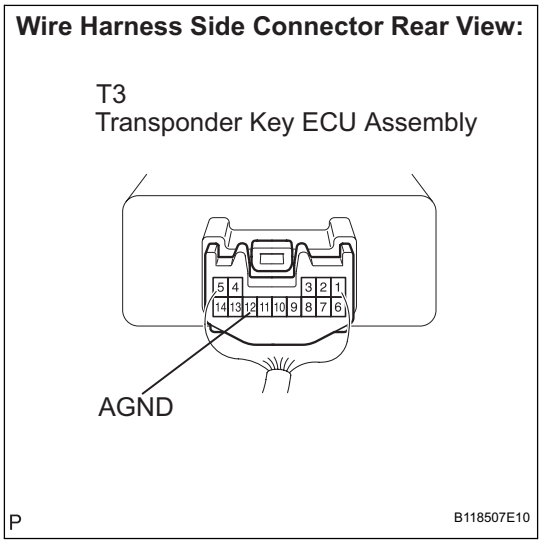
Standard voltage

Tester Connection	Condition	Specified Condition
T3-6 (VC12) - Body ground	No key is in ignition key cylinder	Below 1 V
	Key is in ignition key cylinder	10 to 14 V

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

OK

4	INSPECT TRANSPONDER KEY ECU ASSEMBLY (TRANSPONDER KEY AMPLIFIER - BODY GROUND)



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

Standard resistance

Tester Connection	Condition	Specified Condition
T3-12 (AGND) - Body ground	Always	Below 1 Ω

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

5	CHECK TRANSPONDER KEY AMPLIFIER

(a) After replacing the transponder key amplifier with a normally functioning amplifier, check that the engine starts.

OK:

The engine starts.

NG → REPLACE TRANSPONDER KEY ECU ASSEMBLY

OK

END

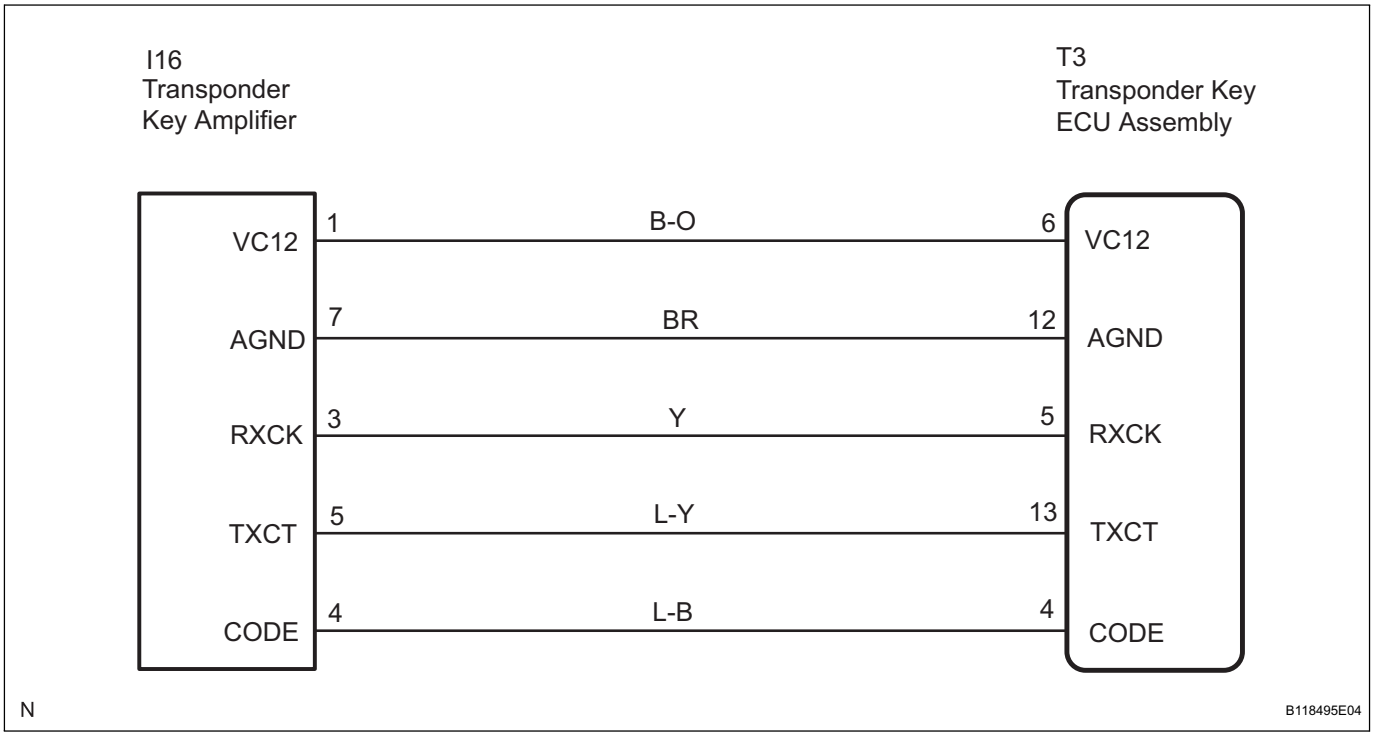
DTC	3-3	Communication Malfunction

DESCRIPTION

This DTC is output if communication between the key and transponder key ECU assembly is impossible.

DTC No.	DTC Detection Condition	Trouble Area
3-3	Key code identification cannot be completed within the specified time	• Key • Transponder key amplifier • Transponder key ECU assembly

WIRING DIAGRAM



INSPECTION PROCEDURE

1	CHECK KEYS

(a) Insert the vehicle's other key into the ignition key cylinder.
(b) Check that the engine starts with this key.
OK:
The engine starts.

OK → **RE-REGISTER OR REPLACE KEYS**

NG

2	CHECK TRANSPONDER KEY AMPLIFIER

(a) After replacing the transponder key amplifier with a normally functioning amplifier, check that the engine starts.

OK:
The engine starts.

NG → **REPLACE TRANSPONDER KEY ECU ASSEMBLY**

OK

END

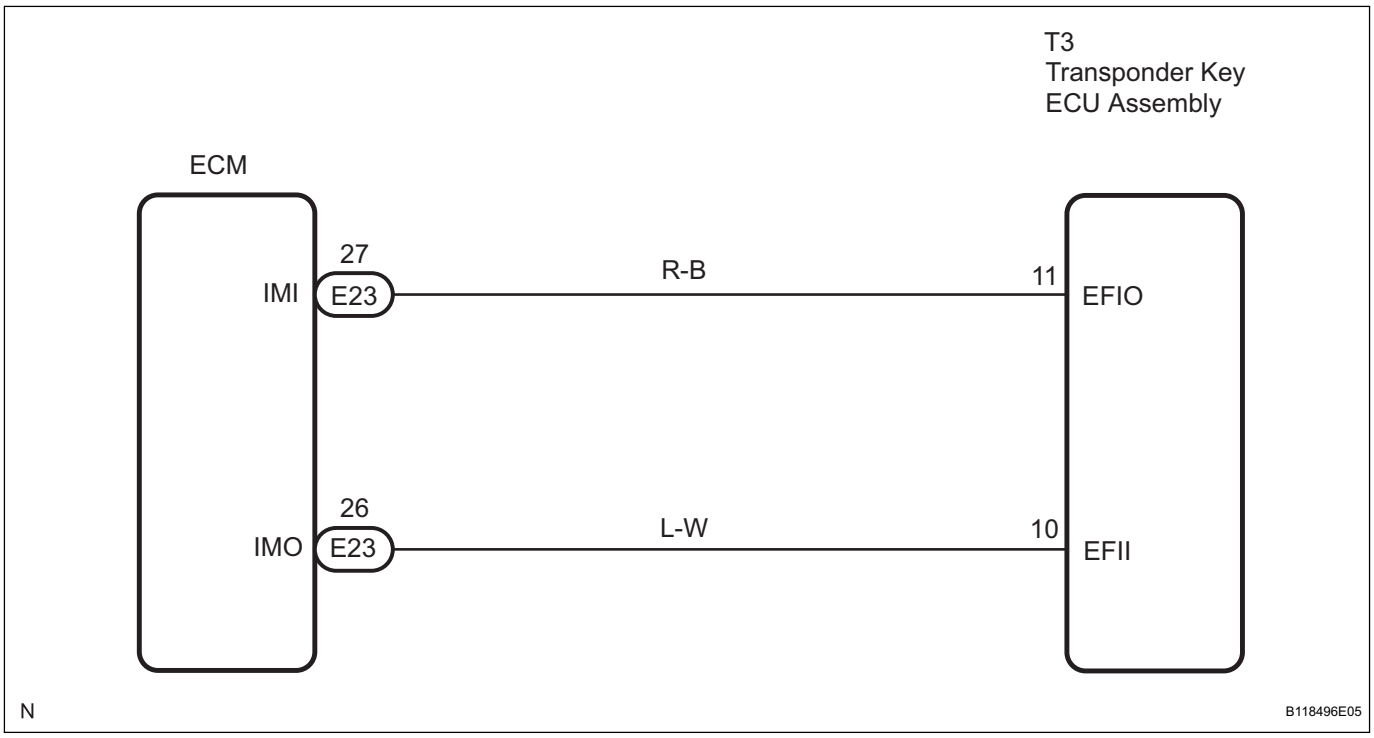
DTC	B2799	Engine Immobiliser System

DESCRIPTION

This DTC is output when the ECM detects errors in communication between the transponder key ECU assembly and the ECM, and in the communication lines.
This DTC is also output when an engine start is attempted while the ECU communication ID between the transponder key ECU and the ECM is different.
Before troubleshooting the DTC, make sure that there is no DTC detected in the transponder key ECU. If there is any key code related DTC detected in the transponder key ECU, repair it first.

DTC No.	DTC Detection Condition	Trouble Area
B2799	• Error in communication between ECM and transponder key ECU assembly, and in communication lines. • Communication ID is different during communication between transponder key ECU assembly and ECM.	• Wire harness • Transponder key ECU assembly • ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

1	RE-REGISTER ECU COMMUNICATION ID

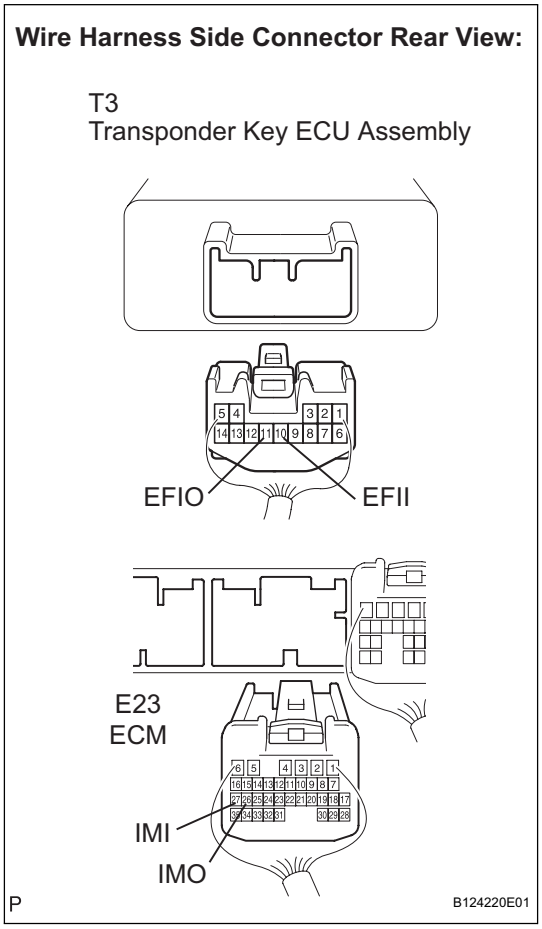
(a) Re-register the ECU communication ID between the transponder key ECU assembly and the ECM.
(b) Check that the engine starts.
OK:
The engine starts.

OK	END

NG

2 CHECK HARNESS AND CONNECTOR (TRANSPONDER KEY ECU - ECM)

Wire Harness Side Connector Rear View:



(a) Disconnect the T3 ECU and E23 ECM connectors.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Condition	Specified Condition
T3-10 (EFII) - E23-26 (IMO)	Always	Below 1 Ω
T3-11 (EFIO) - E23-27 (IMI)		
T3-10 (EFII) - Body ground		10 kΩ or higher
T3-11 (EFIO) - Body ground		

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

3 CHECK TRANSPONDER KEY ECU ASSEMBLY

(a) After replacing the transponder key ECU assembly with a normally functioning transponder key ECU assembly, check that the engine starts.

OK:

The engine starts.

NG → REPLACE ECM

OK

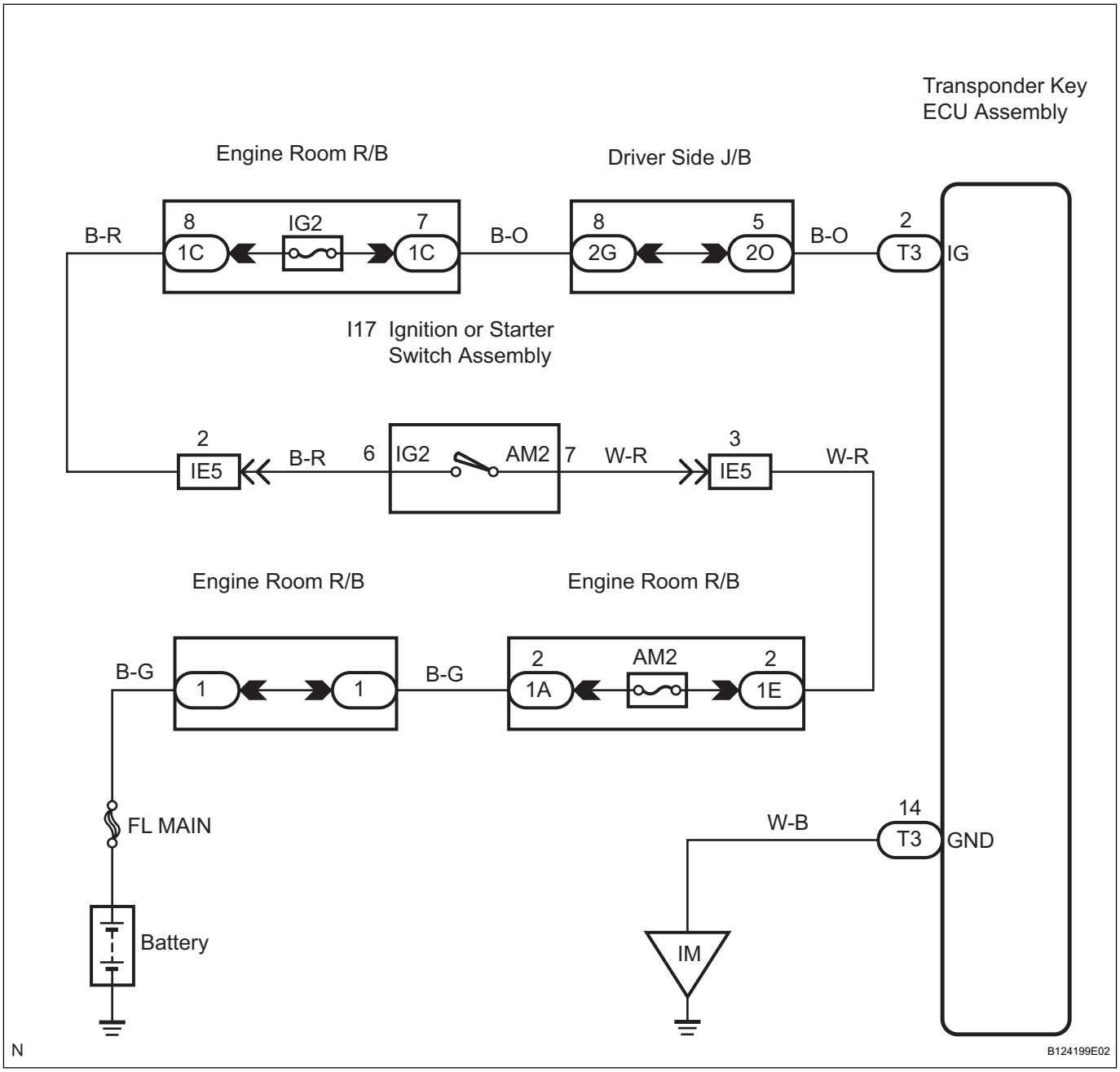
END

IG Signal Circuit

DESCRIPTION

This circuit transmits ignition or starter switch ON/OFF signals to the transponder key ECU assembly. This circuit is also used as the power source if there is an open in the +B terminal circuit.

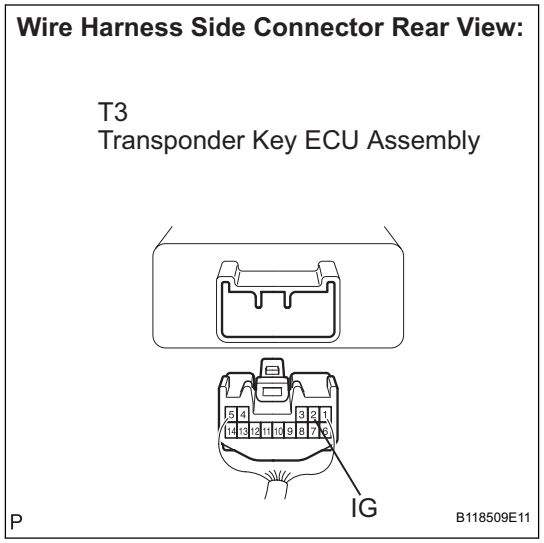
WIRING DIAGRAM



EI

INSPECTION PROCEDURE

1 CHECK HARNESS AND CONNECTOR (TRANSPONDER KEY ECU - BATTERY)



(a) Disconnect the T3 ECU connector.
(b) Measure the voltage according to the value(s) in the table below.

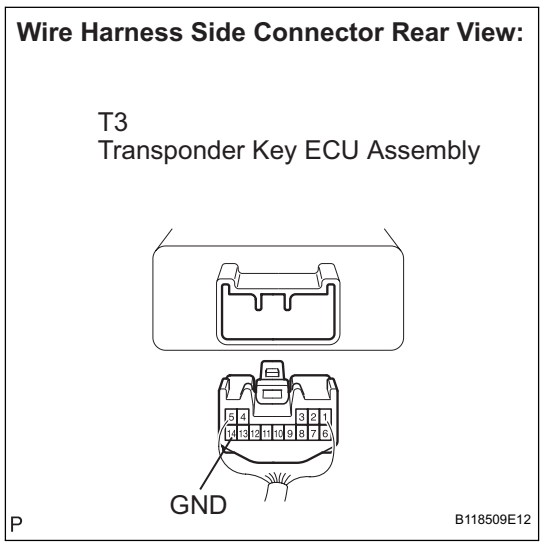
Standard voltage

Tester Connection	Condition	Specified Condition
T3-2 (IG) - Body ground	Ignition switch OFF	Below 1 V
	Ignition switch ON	10 to 14 V

NG → GO TO STEP 3

OK

2 CHECK HARNESS AND CONNECTOR (TRANSPONDER KEY ECU - BODY GROUND)



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

Standard resistance

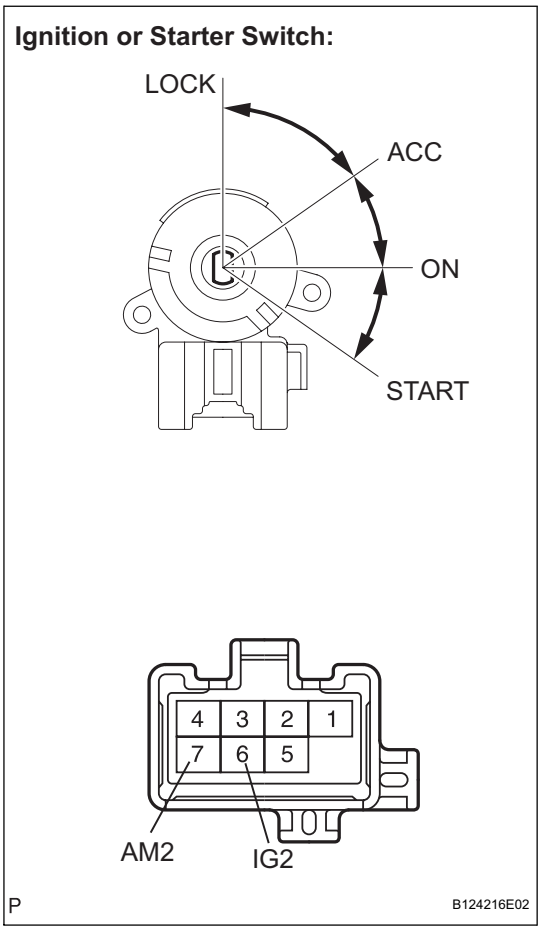
Tester Connection	Condition	Specified Condition
T3-14 (GND) - Body ground	Always	Below 1 Ω

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR (TRANSPONDER KEY ECU - BODY GROUND)

OK

PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE
(See page E1-4)

3	INSPECT IGNITION OR STARTER SWITCH ASSEMBLY



(a) Remove the ignition or starter switch.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Switch Position	Specified Condition
6 - 7	ON	Below 1 Ω

NG → **REPLACE IGNITION OR STARTER SWITCH ASSEMBLY**

OK

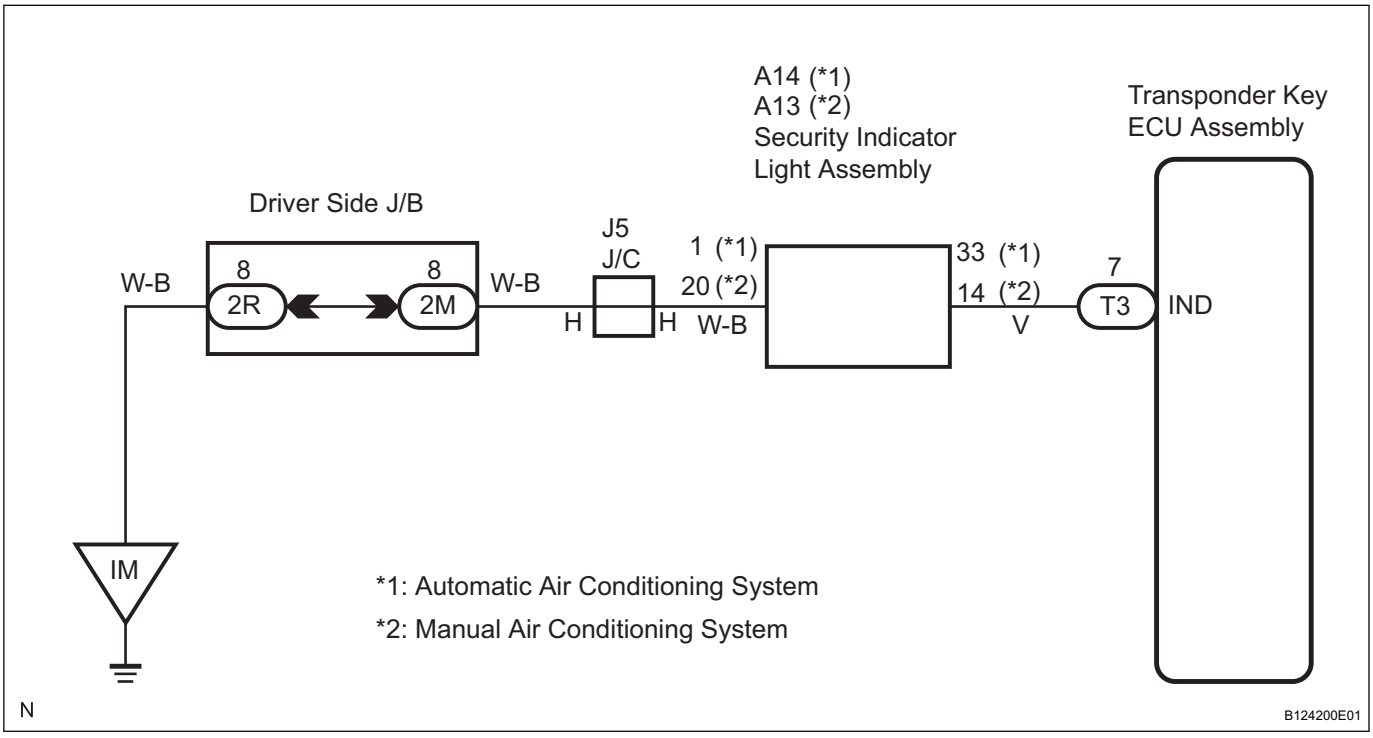
REPAIR OR REPLACE HARNESS OR CONNECTOR (TRANSPONDER KEY ECU - BATTERY)

Security Indicator Light Circuit

DESCRIPTION

When the transponder key is registered, the transponder key ECU assembly outputs the key registration condition by lighting up, blinking or turning off the security indicator.

WIRING DIAGRAM

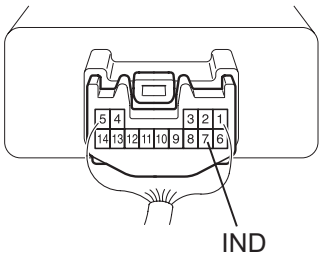


INSPECTION PROCEDURE

1	INSPECT TRANSPONDER KEY ECU ASSEMBLY

Wire Harness Side Connector Rear View:

T3
Transponder Key ECU Assembly



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

Standard voltage

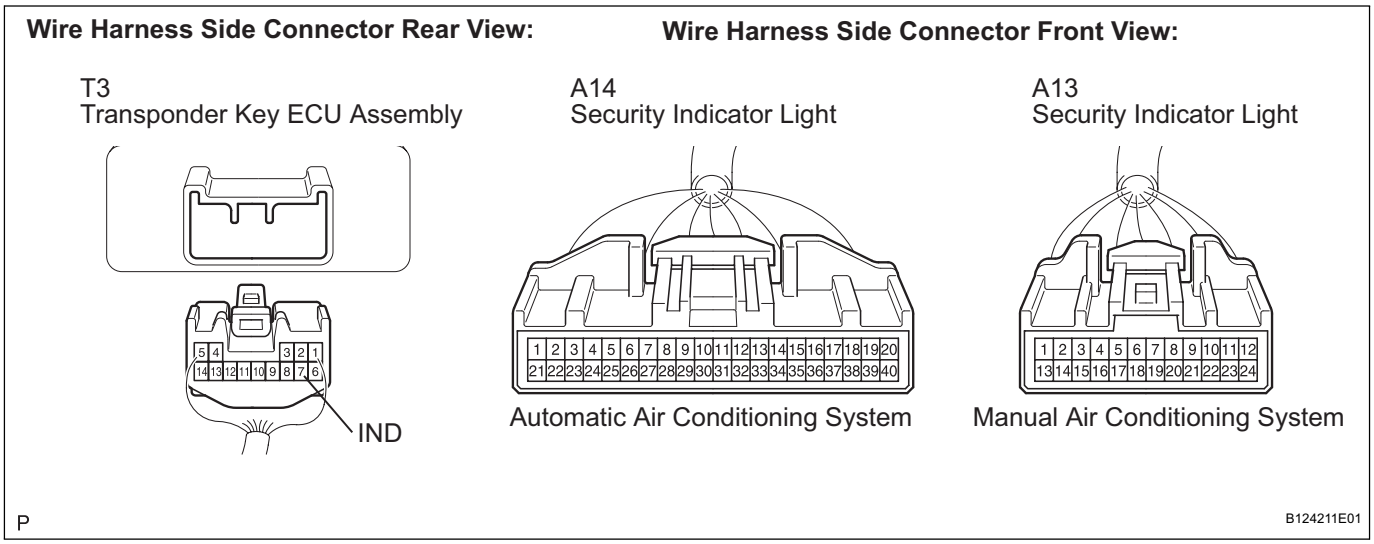
Tester Connection	Condition	Specified Condition
T3-7 (IND) - Body ground	Immobiliser is set (No key is in ignition key cylinder)	Repeats 10 to 14 V and below 1 V

NG → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (See page E1-4)**

OK

2	CHECK HARNESS AND CONNECTOR (TRANSPONDER KEY ECU - SECURITY INDICATOR LIGHT)

(a) Disconnect the T3 ECU and A14 (*1) or A13 (*2) indicator connectors.



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

Standard resistance

Tester Connection	Condition	Specified Condition
T3-7 (IND) - A14-33 (*1) T3-7 (IND) - A13-14 (*2)	Always	Below 1 Ω
T3-7 (IND) - Body ground		10 kΩ or higher

*1: Automatic Air Conditioning System
*2: Manual Air Conditioning System

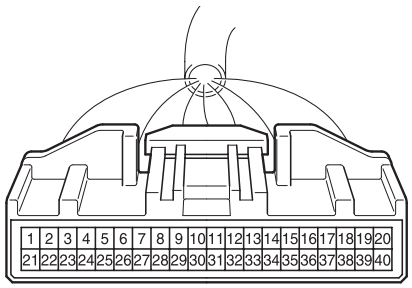
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

3	CHECK HARNESS AND CONNECTOR (SECURITY INDICATOR LIGHT - BODY GROUND)

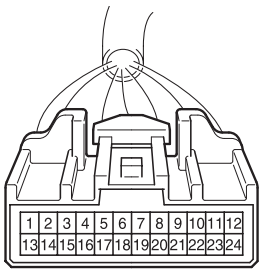
Wire Harness Side Connector Front View:

A14
Security Indicator Light



Automatic Air Conditioning System

A13
Security Indicator Light



Manual Air Conditioning System

P B124212E01

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

Standard resistance

Tester Connection	Condition	Specified Condition
A14-1 (*1) - Body ground A13-20 (*2) - Body ground	Always	Below 1 Ω

*1: Automatic Air Conditioning System
*2: Manual Air Conditioning System

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

OK →

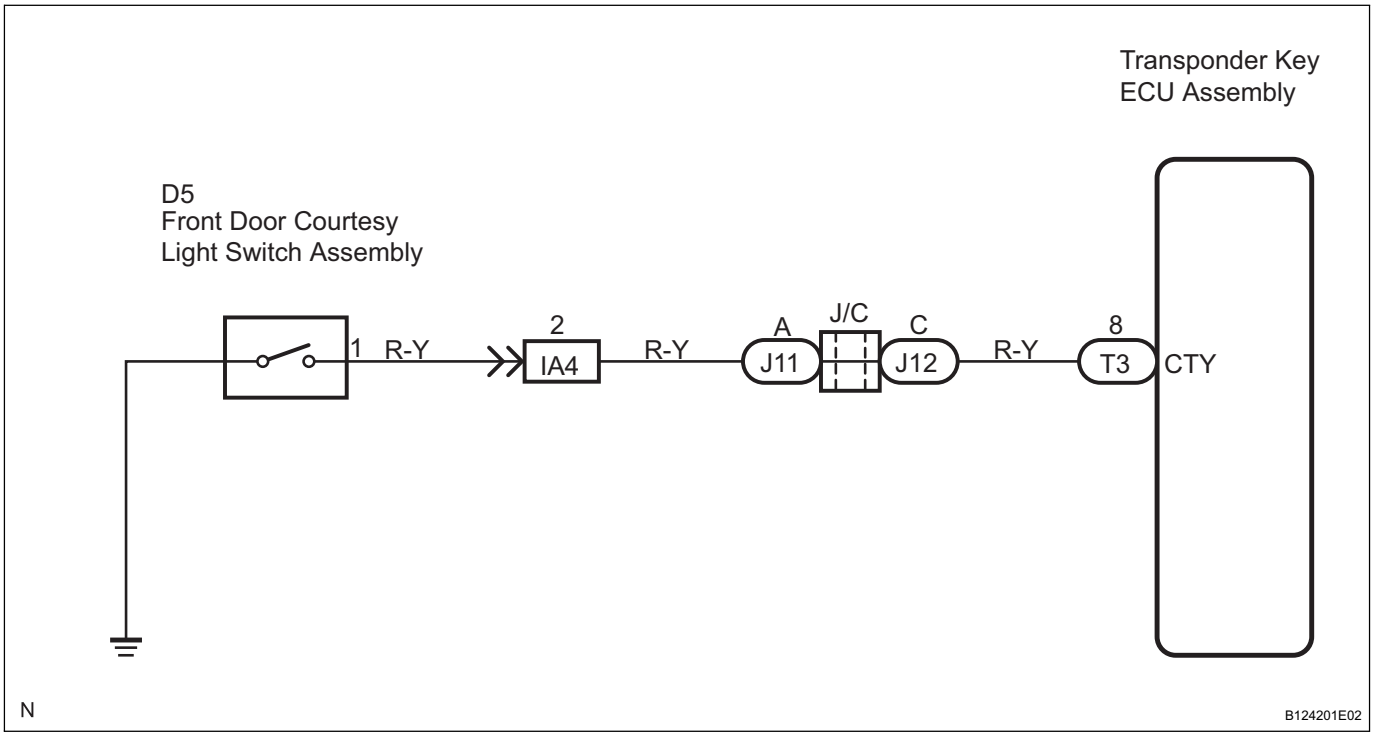
REPLACE SECURITY INDICATOR LIGHT ASSEMBLY

Door Courtesy Switch Circuit

DESCRIPTION

When an additional transponder key is registered, the transponder key ECU assembly detects the front door courtesy light switch open/close signals, and registers the key code using the signals.

WIRING DIAGRAM

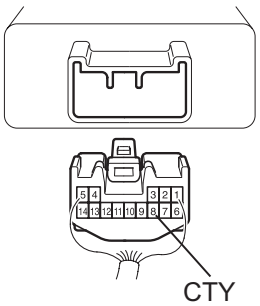


INSPECTION PROCEDURE

1	INSPECT TRANSPONDER KEY ECU ASSEMBLY

Wire Harness Side Connector Rear View:

T3
Transponder Key ECU Assembly



(a) Disconnect the T3 ECU connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

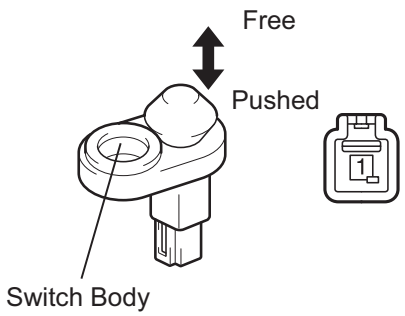
Tester Connection	Switch Condition	Specified Condition
T3-8 (CTY) - Switch Body	Courtesy light switch pushed (Door closed)	10 kΩ or higher
	Courtesy light switch free (Door open)	Below 1 Ω

OK → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (See page E1-4)**

NG

2	INSPECT FRONT DOOR COURTESY LIGHT SWITCH ASSEMBLY

Front Door Courtesy Light Switch Side Connector Front View:



(a) Remove the front door courtesy light switch assembly (Driver's side).

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

Standard resistance

Tester Connection	Switch Condition	Specified Condition
1 - Switch body	Courtesy light switch pushed (Door closed)	10 kΩ or higher
	Courtesy light switch free (Door open)	Below 1 Ω

NG → **REPLACE FRONT DOOR COURTESY LIGHT SWITCH ASSEMBLY**

OK

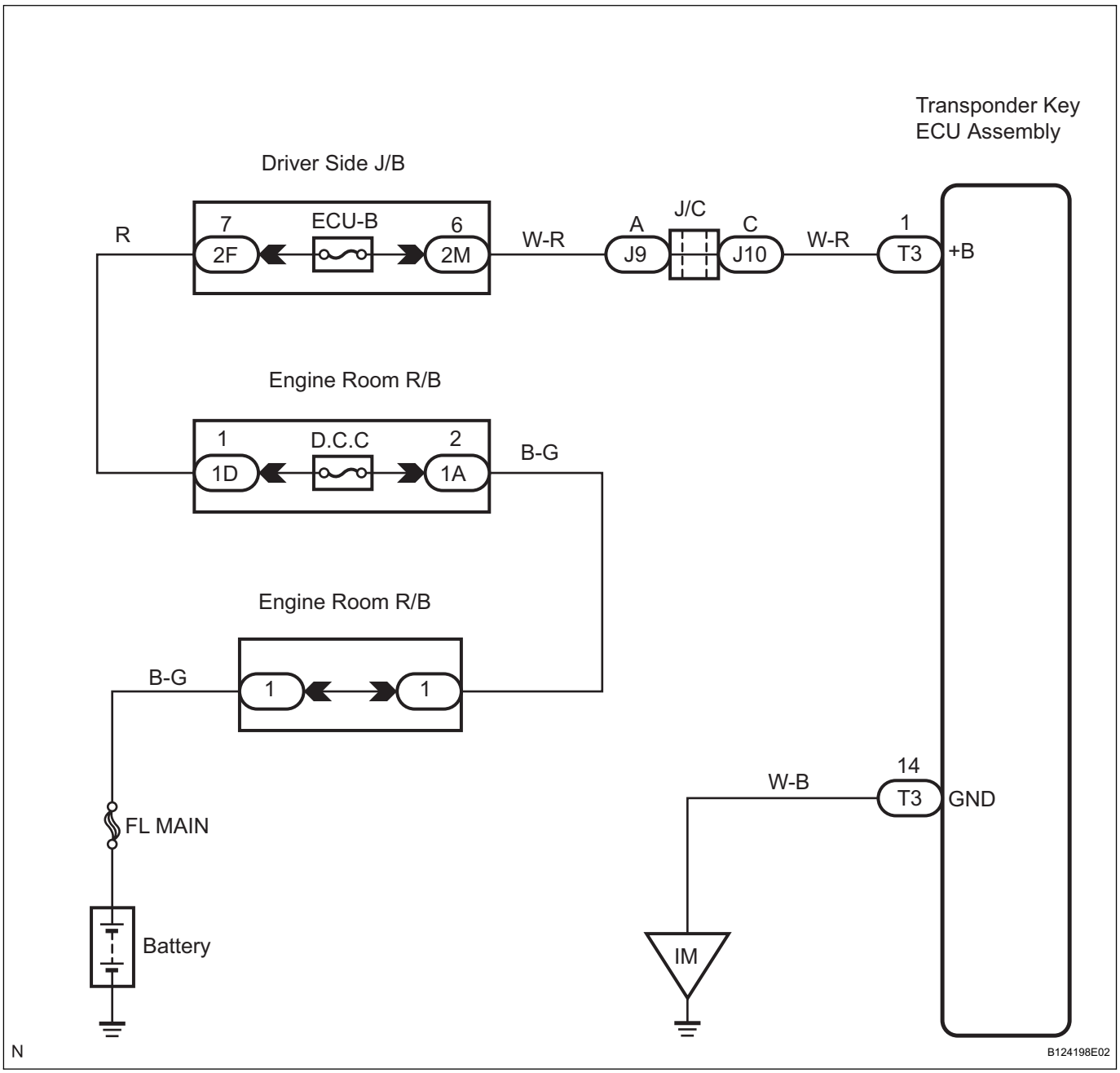
REPAIR OR REPLACE HARNESS OR CONNECTOR

ECU Power Source Circuit

DESCRIPTION

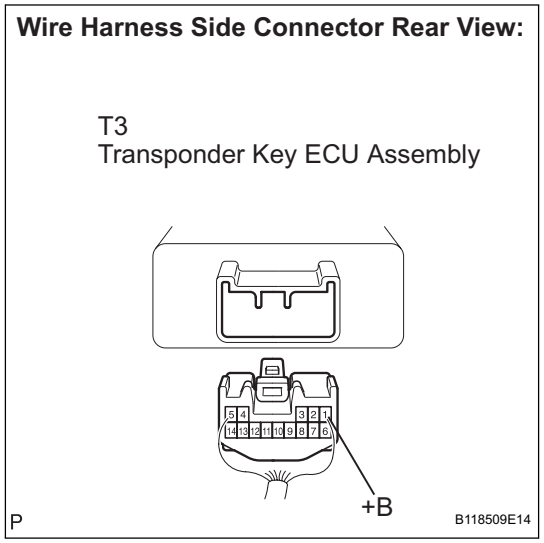
This circuit provides power to operate the transponder key ECU assembly.

WIRING DIAGRAM



INSPECTION PROCEDURE

1 CHECK HARNESS AND CONNECTOR (TRANSPONDER KEY ECU - BATTERY)



(a) Disconnect the T3 ECU connector.
(b) Measure the voltage according to the value(s) in the table below.

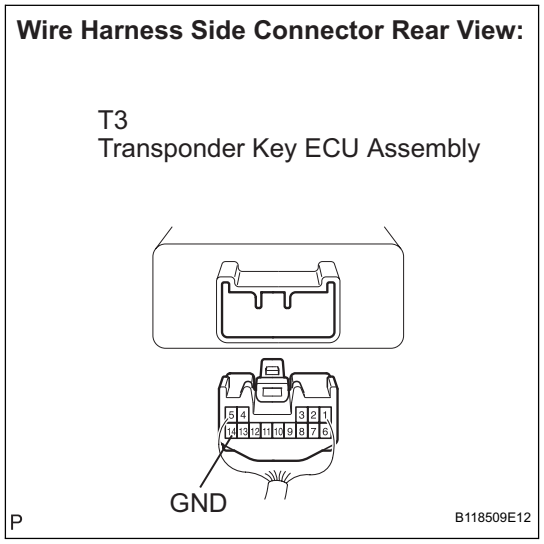
Standard voltage

Tester Connection	Condition	Specified Condition
T3-1 (+B) - Body ground	Always	10 to 14 V

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

OK

2 CHECK HARNESS AND CONNECTOR (TRANSPONDER KEY ECU - BODY GROUND)



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

Standard resistance

Tester Connection	Condition	Specified Condition
T3-14 (GND) - Body ground	Always	Below 1 Ω

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

OK

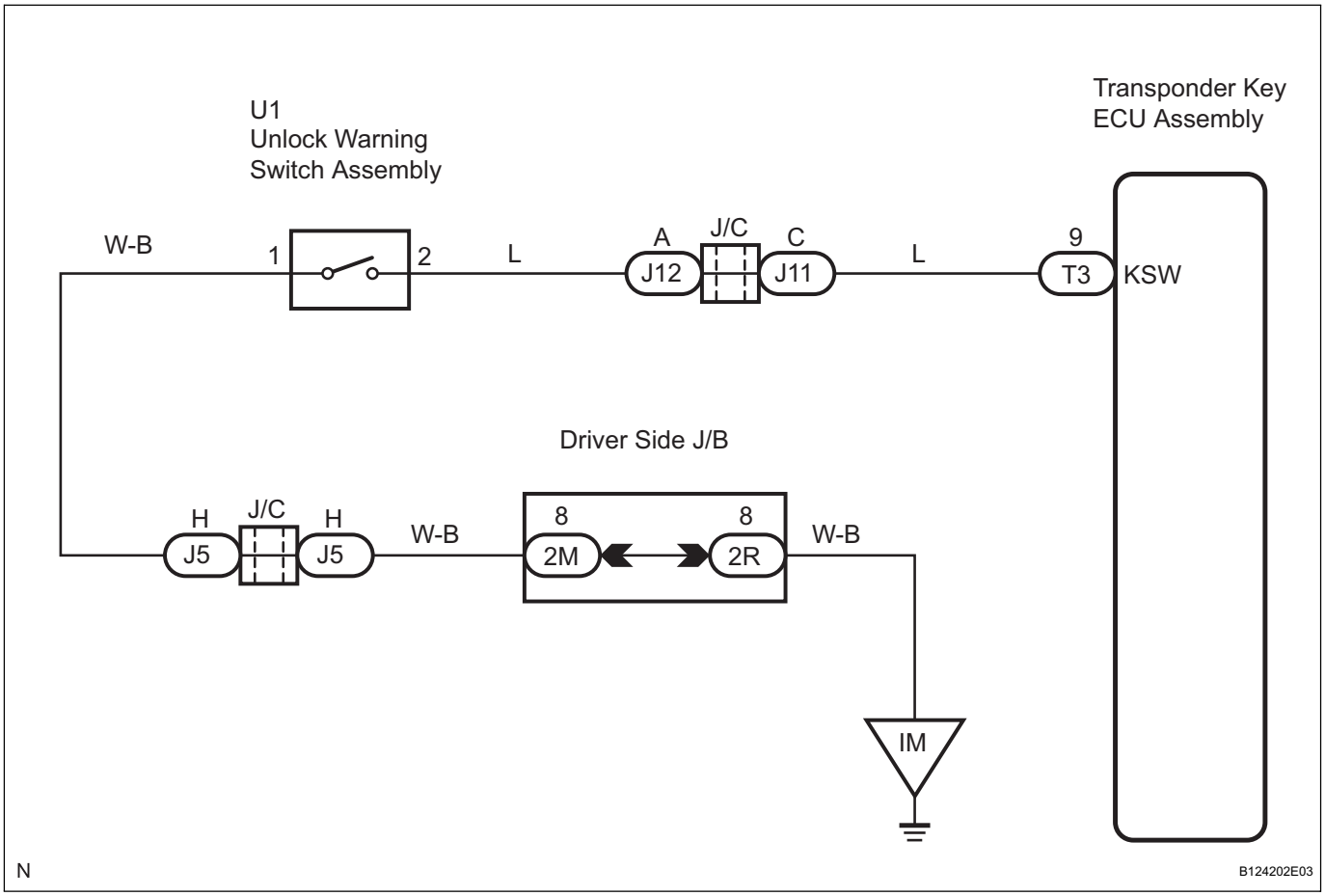
PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE
(See page E1-4)

Unlock Warning Switch Circuit

DESCRIPTION

This circuit is used to send signals indicating whether the key is inserted into the key cylinder. (Input of unlock warning switch ON/OFF signal)

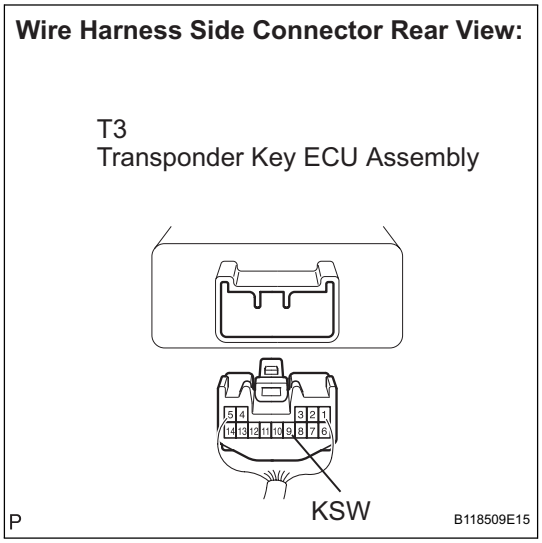
WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT TRANSPONDER KEY ECU ASSEMBLY

Wire Harness Side Connector Rear View:



(a) Disconnect the T3 ECU connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

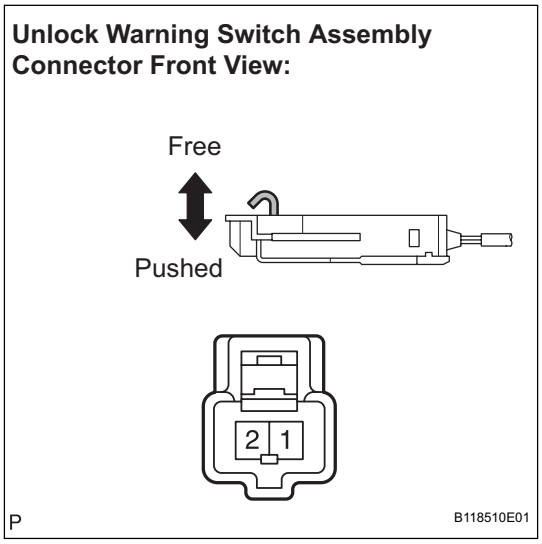
Tester Connection	Condition	Specified Condition
T3-9 (KSW) - Body ground	Key is in ignition key cylinder	Below 1 Ω
	No key is in ignition key cylinder	10 kΩ or higher

OK → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (See page E1-4)**

NG

2 INSPECT UNLOCK WARNING SWITCH ASSEMBLY

Unlock Warning Switch Assembly Connector Front View:



(a) Remove the unlock warning switch assembly.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

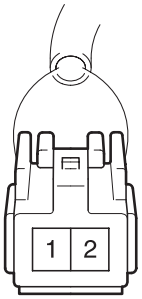
Tester Connection	Switch Position	Specified Condition
1 - 2	Switch pushed (Key inserted)	Below 1 Ω
	Switch free (Key removed)	10 kΩ or higher

NG → **REPLACE UNLOCK WARNING SWITCH ASSEMBLY**

OK

3	CHECK HARNESS AND CONNECTOR (UNLOCK WARNING SWITCH - BODY GROUND)

Wire Harness Side Connector Front View:



U1
Unlock Warning Switch Assembly

P B118511E03

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

Standard resistance

Tester Connection	Condition	Specified Condition
U1-1 - Body ground	Always	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (UNLOCK WARNING SWITCH - BODY GROUND)**

OK

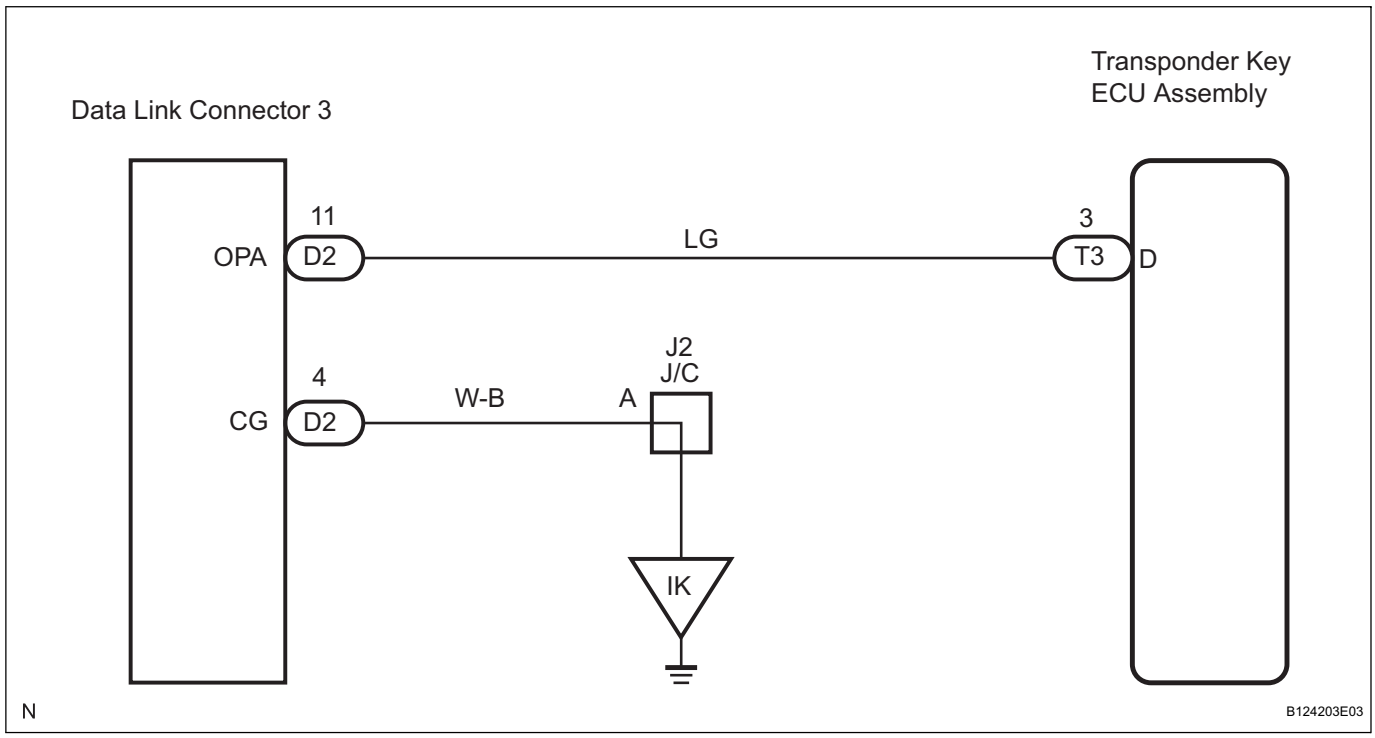
REPAIR OR REPLACE HARNESS OR CONNECTOR (TRANSPONDER KEY ECU - UNLOCK WARNING SWITCH)

Diagnosis Circuit

DESCRIPTION

This circuit is used to read the DTCs that are output from the transponder key ECU assembly.

WIRING DIAGRAM

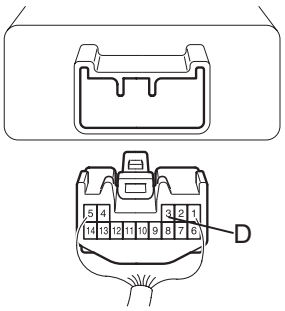


INSPECTION PROCEDURE

1 CHECK HARNESS AND CONNECTOR (TRANSPONDER KEY ECU - DLC3)

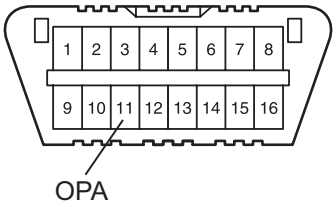
Wire Harness Side Connector Rear View:

T3
Transponder Key ECU Assembly



Wire Harness Side Connector Front View:

D2
Data Link Connector 3



P B124214E03

(a) Disconnect the T3 ECU connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Tester Connection	Condition	Specified Condition
T3-3 (D) - D2-11 (OPA)	Always	Below 1 Ω
T3-3 (D) - Body ground		10 kΩ or higher

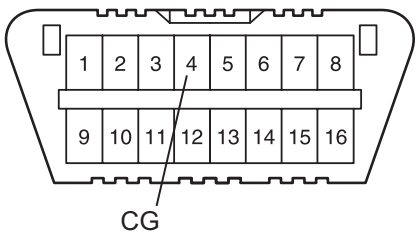
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

2 CHECK HARNESS AND CONNECTOR (DLC3 - BODY GROUND)

Wire Harness Side Connector Front View:

D2
Data Link Connector 3



P B124215E06

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

Standard resistance

Tester Connection	Condition	Specified Condition
D2-4 (CG) - Body ground	Always	Below 1 Ω

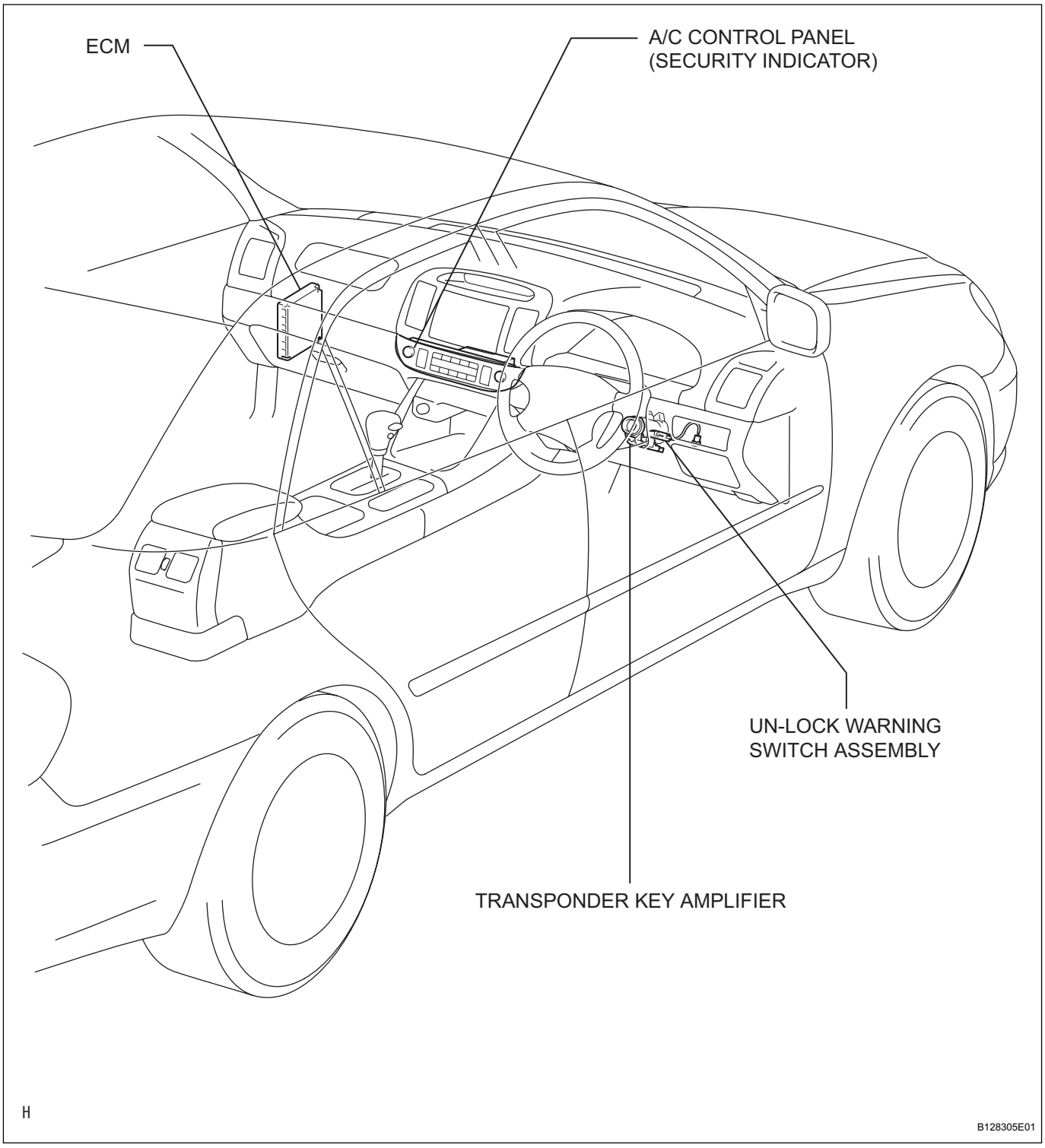
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE
(See page E1-4)

ENGINE IMMOBILISER SYSTEM (1MZ-FE)

PARTS LOCATION



HOW TO PROCEED WITH TROUBLESHOOTING

Troubleshoot in accordance with the procedure in the following pages.

1	VEHICLE BROUGHT IN

NEXT

2	CRANK ENGINE FOR MORE THAN 10 SECONDS

NEXT

3	CHECK DIAGNOSTIC TROUBLE CODE OF ECM

(a) When any of codes B2795, B2796, B2797 and B2798 is output, proceed to "A".
(b) When a code other than B2795, B2796, B2797 and B2798 is output or no code is output, proceed to "B".

B → GO TO SFI SYSTEM

A

4	CHECK DIAGNOSTIC TROUBLE CODE

(a) Check for DTCs and note it if a code is output.
(b) Delete the DTCs.
(c) Check if the DTC will be output again when the problem symptom is simulated based on the noted code.
  (1) If any DTC does not recur, proceed to "A".
  (2) If DTCs recur, proceed to "B".

B → NORMAL

A

5	PROBLEM SYMPTOMS TABLE

(a) When the problem is not listed on the problem symptoms table, proceed to "A".
(b) When the problem is listed on the problem symptoms table, proceed to "B".

B → GO TO STEP 7

A

6	OVERALL ANALYSIS AND TROUBLESHOOTING

(a) Terminals of ECU (See page EI-40).

NEXT

7	ADJUSTMENT, REPAIR OR REPLACE

NEXT

8	CONFIRMATION TEST

NEXT

END

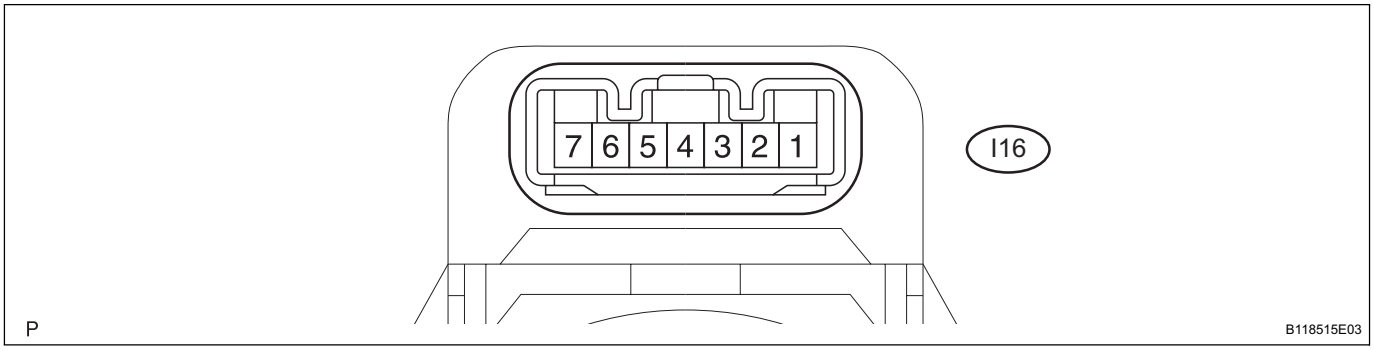
PROBLEM SYMPTOMS TABLE

ENGINE IMMOBILISER SYSTEM:

Symptom	Suspected Area	See Page
Engine does not start	1. Key	EI-47
	2. Unlock warning switch circuit	EI-58
	3. Transponder key amplifier	EI-48
	4. SFI system	ES-7
Security indicator is always ON	1. Security indicator light circuit	EI-55
	2. ECM	-
Security indicator is always OFF	1. Security indicator light circuit	EI-55
	2. ECM	-

TERMINALS OF ECU

1. CHECK TRANSPONDER KEY AMPLIFIER



(a) Disconnect the I16 amplifier connector and measure the resistance between the terminal of the wire harness side connector and body ground.

Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
GND (I16-7) - Body ground	W-B - Body ground	Ground	Always	Below 1 Ω

If the result is not as specified, there may be a malfunction on the wire harness side.

(b) Reconnect the I16 amplifier connector and measure the resistance and voltage according to the value(s) in the table below.

Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
+B (I16-1) - GND (I16-7)	B-R - W-B	Power source	Ignition switch OFF	Below 1 V
			Ignition switch ON	10 to 14 V
CODE (I16-4) - GND (I16-7)	G-W - W-B	Demodulated signal of key code data	Ignition switch OFF	Below 1 V
			Ignition switch ON	Waveform 1
RXCK (I16-3) - GND (I16-7)	R-L - W-B	Clock signal synchronized with key code data	Ignition switch OFF	Below 1 V
			Ignition switch ON	Waveform 2
TXCT (I16-5) - GND (I16-7)	L-Y - W-B	Key code output signal	Ignition switch OFF	Below 1 V
			Ignition switch ON	Waveform 3
GND (I16-7) - Body ground	W-B - Body ground	Ground	Always	Below 1 Ω

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

(c) Inspect using an oscilloscope.

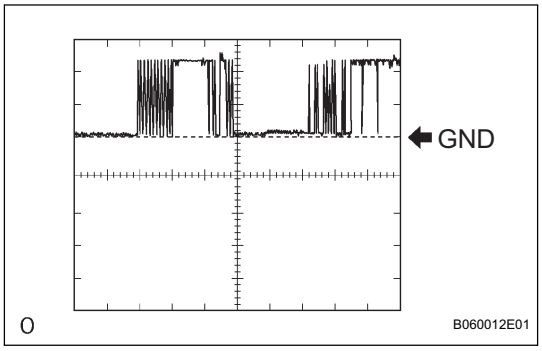
NOTICE:

The waveforms provided as examples do not include noise and chattering.

HINT:

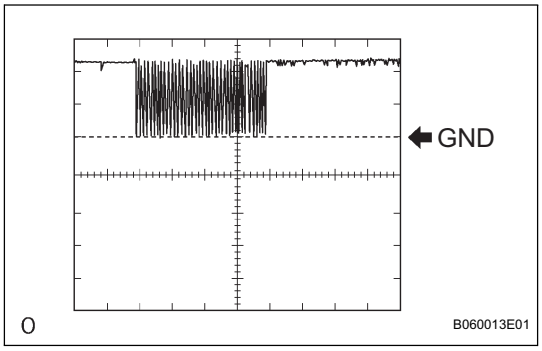
If the result is not as specified, the transponder key amplifier may malfunction.

(1) Waveform 1 (Reference)

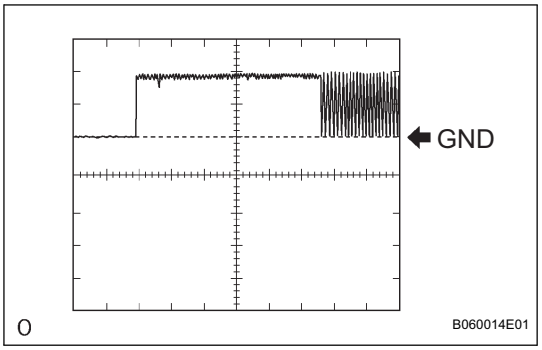


Symbols (Terminal No.)	CODE (I16-4) - GND (I16-7)
Tool setting	5 V/DIV, 10 ms/DIV
Vehicle condition	Ignition switch ON

(2) Waveform 2 (Reference)



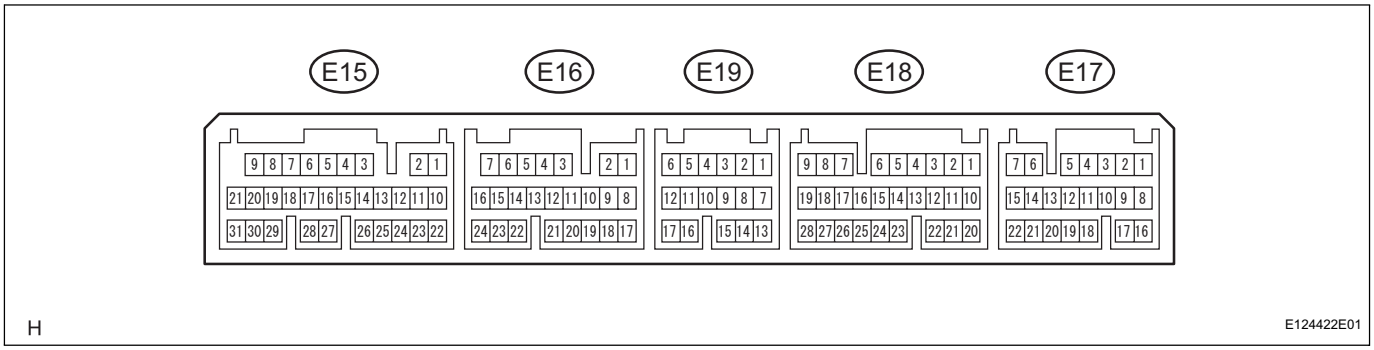
Symbols (Terminal No.)	RXCK (I16-3) - GND (I16-7)
Tool setting	10 V/DIV, 10 ms/DIV
Vehicle condition	Ignition switch ON



(3) Waveform 3 (Reference)

Symbols (Terminal No.)	TXCT (I16-5) - GND (I16-7)
Tool setting	10 V/DIV, 10 ms/DIV
Vehicle condition	Ignition switch ON

2. CHECK ECM



(a) Disconnect the E19 ECM connector and measure the resistance between the terminal of the wire harness side connector and body ground.

Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
KSW (E19-11) - E1 (E16-17)	L - W-B	Unlock warning switch signal	No key is in ignition key cylinder	10 kΩ or higher
			Key is in ignition key cylinder	Below 1 Ω

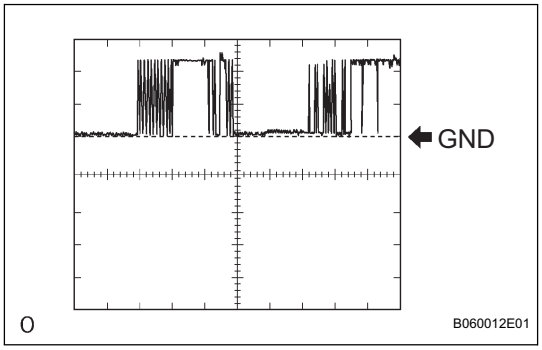
(b) Reconnect the E19 ECM connector and measure the resistance and voltage according to the value(s) in the table below.

Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
CODE (E19-4) - E1 (E16-17)	G-W - W-B	Demodulated signal of key code data	Ignition switch OFF	Below 1 V
			Ignition switch ON	Waveform 1
RXCK (E19-5) - E1 (E16-17)	R-L - W-B	Clock signal synchronized with key code data	Ignition switch OFF	Below 1 V
			Ignition switch ON	Waveform 2
TXCT (E19-10) - E1 (E16-17)	L-Y - W-B	Key code output signal	Ignition switch OFF	Below 1 V
			Ignition switch ON	Waveform 3
IMLD (E19-16) - E1 (E16-17)	B (*1), V (*2) - W-B	Security indicator signal	Security indicator light is on	10 to 14 V
			Security indicator light is off	Below 1 V
KSW (E19-11) - E1 (E16-17)	L - W-B	Unlock warning switch signal	No key is in ignition key cylinder	10 to 14 V
			Key is in ignition key cylinder	Below 1 V
E1 (E16-17) - Body ground	W-B - Body ground	Ground	Always	Below 1 Ω

*1: Automatic air conditioning system
*2: Manual air conditioning system
If the result is not as specified, the ECM may have a malfunction.

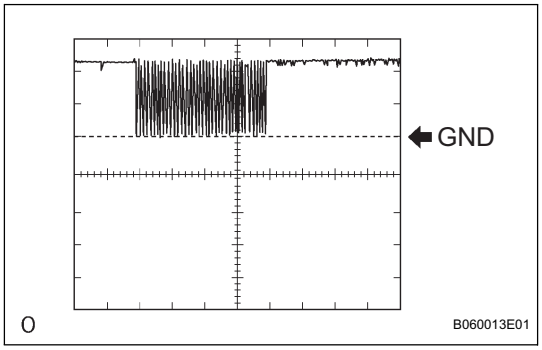
(c) Inspect using an oscilloscope.
NOTICE:
The waveforms provided as examples do not include noise and chattering.
HINT:
If the result is not as specified, the ECM may malfunction.

(1) Waveform 1 (Reference)



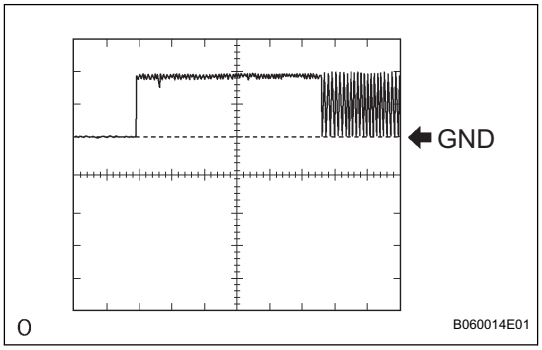
Symbols (Terminal No.)	CODE (E19-4) - E1 (E16-17)
Tool setting	5 V/DIV, 10 ms/DIV
Vehicle condition	Ignition switch ON

(2) Waveform 2 (Reference)



Symbols (Terminal No.)	RXCK (E19-5) - E1 (E16-17)
Tool setting	5 V/DIV, 10 ms/DIV
Vehicle condition	Ignition switch ON

(3) Waveform 3 (Reference)



Symbols (Terminal No.)	TXCT (E19-10) - E1 (E16-17)
Tool setting	2 V/DIV, 10 ms/DIV
Vehicle condition	Ignition switch ON

DIAGNOSIS SYSTEM

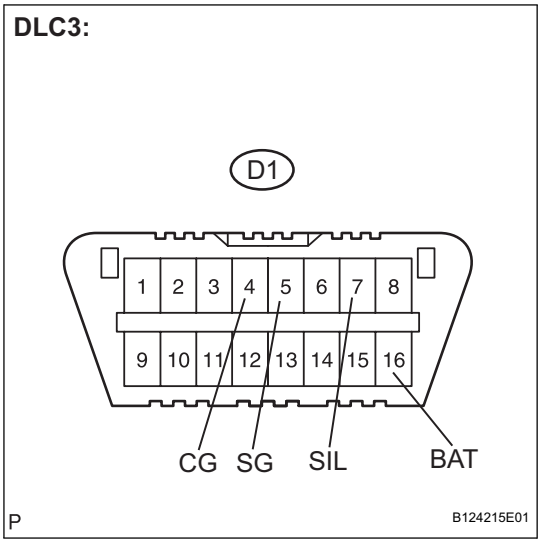
1. DESCRIPTION

(a) The ECM controls the vehicle's immobiliser system data. A Diagnostic Trouble Code (DTC) can be read through the vehicle's Data Link Connector 3 (DLC3).

2. CHECK BATTERY VOLTAGE

(a) Check the battery voltage.
Standard voltage:
10 to 14 V
If the voltage is below 10 V, replace the battery before proceeding to the next step.

DLC3:



3. CHECK DLC3

(a) The vehicle uses ISO 9141-2 (Euro-OBD)/ISO 14230 (M-OBD) for communication protocol. The terminal arrangement of the DLC3 complies with ISO 15031-3 and matches the ISO 9141-2 (Euro-OBD)/ISO 14230 (M-OBD) format.

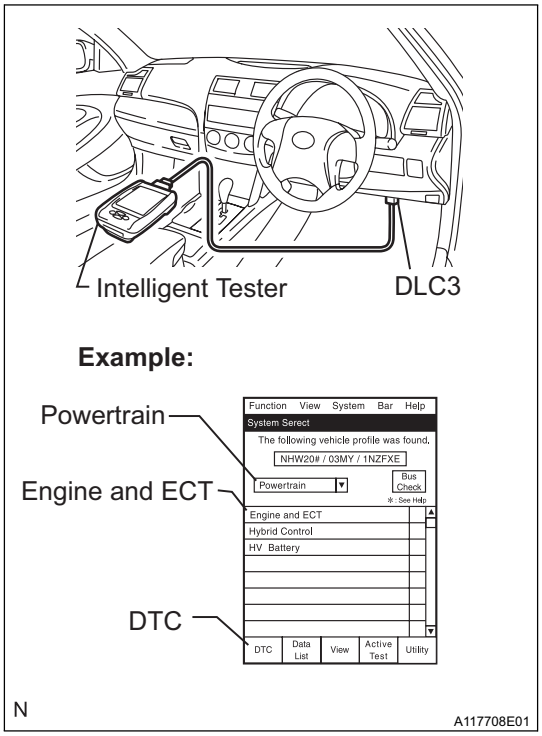
Symbol	Terminal No.	Name	Reference terminal	Result	Condition
SIL	7	Bus "+" line	5 - Signal ground	Pulse generation	During transmission
CG	4	Chassis ground	Body ground	Below 1 Ω	Always
SG	5	Signal ground			
BAT	16	Battery positive		11 to 14 V	

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

HINT:

If the screen displays a communication error message after the cable of the intelligent tester is connected to the DLC3, the ignition switch is turned to the ON position, and the intelligent tester is operated, the problem may be on the vehicle side or the tester side.

- If communication is normal when the tester is connected to another vehicle, inspect the DLC3 on the original vehicle.
- If communication is still impossible when the tester is connected to another vehicle, the problem may be in the tester itself. Consult the Service Department listed in the tester operator's manual.



DTC CHECK / CLEAR

1. CHECK DTC

(a) Connect the intelligent tester to the DLC3.

(b) Turn the ignition switch to the ON position and turn the intelligent tester ON.

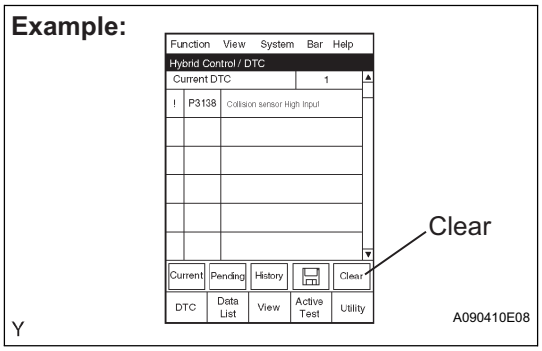
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.

(d) Check DTCs and freeze frame data, and then write them down.

HINT:

If you need help using the intelligent tester, refer to the instruction manual.

(e) Confirm the details of the DTCs (See Diagnostic Trouble Code Chart).



2. CLEAR DTC

(a) Connect the intelligent tester to the DLC3.

(b) Turn the ignition switch to the ON position (do not start the engine) and turn the intelligent tester ON.

(c) Select the following menu items: Powertrain / Engine and ECT / DTC / Clear.

(d) Erase DTCs by pressing the YES button on the tester.

HINT:

If you need help using the intelligent tester, refer to the instruction manual.

DIAGNOSTIC TROUBLE CODE CHART

ENGINE IMMOBILISER SYSTEM:

DTC No.	Detection Item	Trouble Area	See Page
B2795	Unmatched Key Code	Key	EI-47
B2796	No Communication in Immobiliser System	1. Key 2. Transponder key amplifier 3. Wire harness 4. ECM	EI-48
B2797	Communication Malfunction No. 1	1. Key 2. Transponder key amplifier 3. Wire harness 4. ECM	EI-52
B2798	Communication Malfunction No. 2	1. Key 2. Transponder key amplifier 3. Wire harness 4. ECM	EI-48

NOTICE:

- **Codes B2795, B2797 and B2798 may remain as a record that the immobiliser system has activated in the past.**

- **The diagnosis code on the immobiliser system is specified in this chart. If any other code is output, check the diagnostic code chart of the engine control system.**

DTC	B2795	Unmatched Key Code

DESCRIPTION

This DTC is output when an unregistered key is inserted.

DTC No.	DTC Detection Condition	Trouble Area
B2795	Key with different ID code inserted in ignition key cylinder	Key

INSPECTION PROCEDURE

1	RE-REGISTER KEY

(a) Clear the DTC (See page EI-45).

(b) Re-register the key and insert this key into the ignition key cylinder. Check that the engine starts with this key.

OK:

The engine starts.

NG → **REPLACE KEY**

OK

END

DTC	B2796	No Communication in Immobiliser System

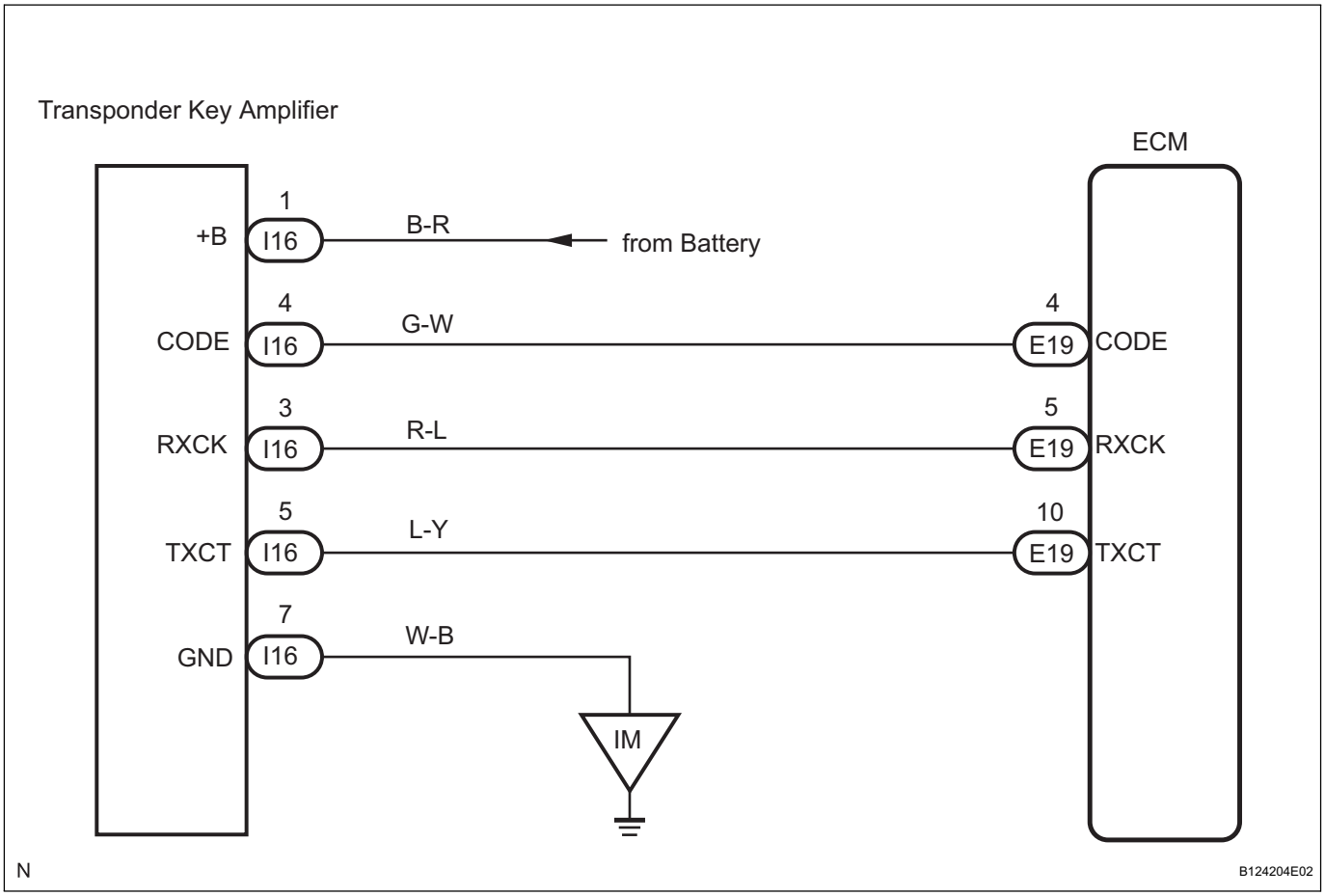
DTC	B2798	Communication Malfunction No. 2

DESCRIPTION

This DTC is output if no communication exists between the key and amplifier when the key is inserted.

DTC No.	DTC Detection Condition	Trouble Area
B2796	No communication	• Key • Transponder key amplifier • Wire harness • ECM
B2798	Communication	• Key • Transponder key amplifier • Wire harness • ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

1	CHECK KEYS

(a) Insert the vehicle's other key into the ignition key cylinder.
(b) Check that the engine starts with this key.

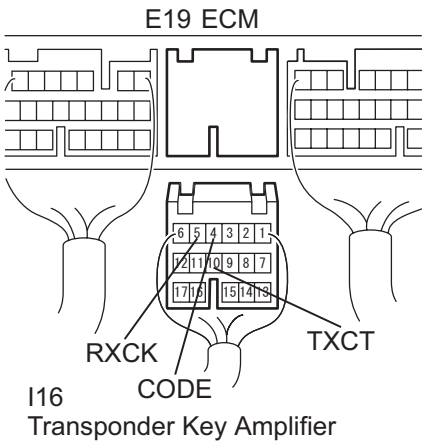
OK:
The engine starts.

NG → **RE-REGISTER OR REPLACE KEY**

OK

2 CHECK HARNESS AND CONNECTOR (ECM - TRANSPONDER KEY AMPLIFIER)

Wire Harness Side Connector Rear View:



(a) Disconnect the E19 ECM and I16 amplifier connectors.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

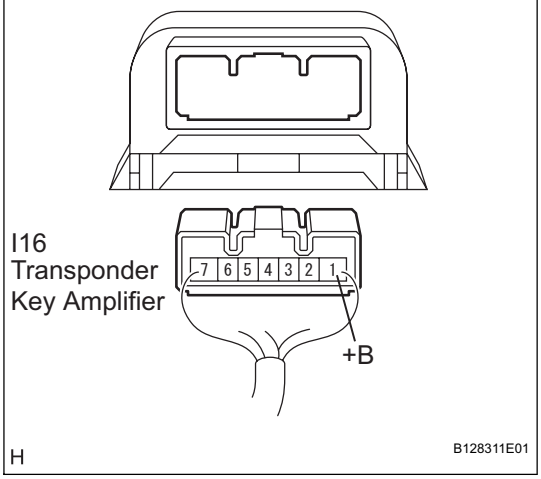
Tester Connection	Specified Condition
E19-4 (CODE) - I16-4 (CODE)	Below 1 Ω
E19-5 (RXCK) - I16-3 (RXCK)	
E19-10 (TXCT) - I16-5 (TXCT)	
E19-4 (CODE) - Body ground	10 kΩ or higher
E19-5 (RXCK) - Body ground	
E19-10 (TXCT) - Body ground	

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

OK

3	CHECK HARNESS AND CONNECTOR (TRANSPONDER KEY AMPLIFIER - BATTERY)

Wire Harness Side Connector Rear View:



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

Standard voltage

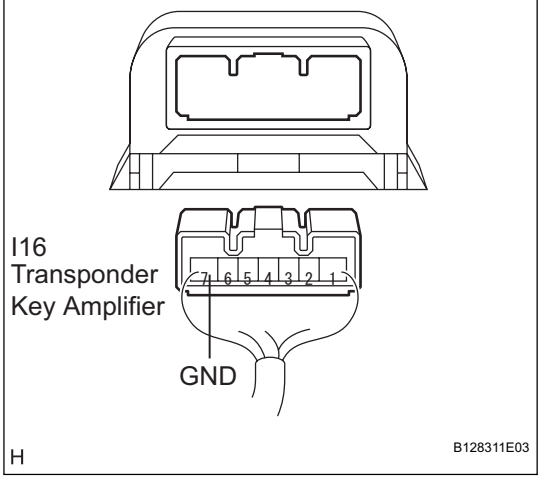
Tester Connection	Condition	Specified Condition
I16-1 (+B) - Body ground	Ignition switch OFF	Below 1 V
	Ignition switch ON	10 to 14 V

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

OK

4	CHECK HARNESS AND CONNECTOR (TRANSPONDER KEY AMPLIFIER - BODY GROUND)

Wire Harness Side Connector Rear View:



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

Standard resistance

Tester Connection	Specified Condition
I16-7 (GND) - Body ground	Below 1 Ω

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

OK

5	INSPECT TRANSPONDER KEY AMPLIFIER

(a) After replacing the transponder key amplifier with a normally functioning amplifier, check that the engine starts.

OK:

The engine starts.

NG → **REPLACE ECM**

OK

END

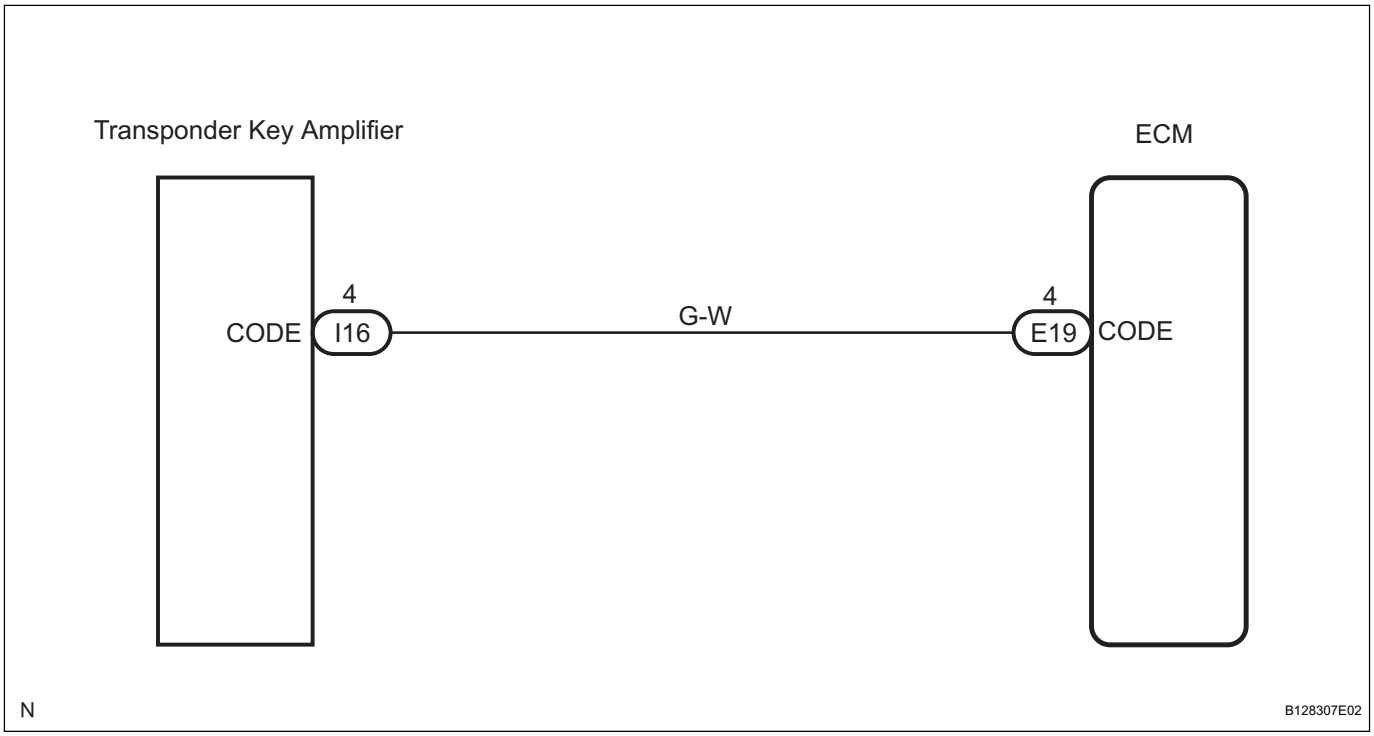
DTC	B2797	Communication Malfunction No. 1

DESCRIPTION

This code is detected when an error occurs in communication.
(Example: Some noise is included in the communication line.)

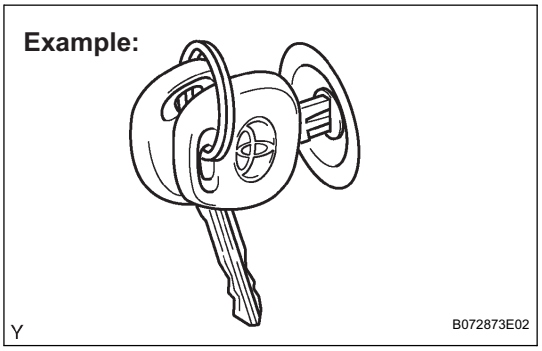
DTC No.	DTC Detection Condition	Trouble Area
B2797	Communication error	• Transponder key amplifier • Key • Wire harness • ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

1	CHECK KEYS



(a) Check whether the ignition key being used is near other ignition keys, as shown in the illustration. Also, check whether the key ring is in contact with the key grip.

Result

Result	Proceed To
Key is near other keys and/or key ring is in contact with key grip	A
Key is near other keys and/or key ring is not in contact with key grip	B

B	GO TO STEP 3

A

2 CHECK DTC OUTPUT

(a) Separate the keys from each other, or remove the key ring.

(b) Clear the DTCs (See page EI-45).

(c) Insert a key into the ignition key cylinder and remove the key. Repeat for all the other keys.

OK:

No code is output.

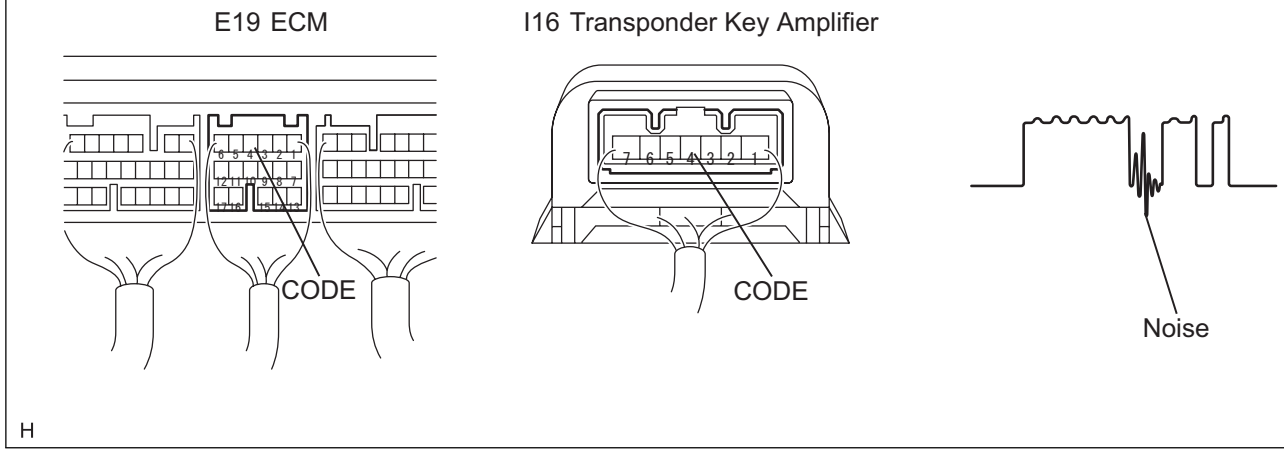
OK → **END**

NG

3 CHECK TRANSPONDER KEY AMPLIFIER

(a) Using an oscilloscope or the intelligent tester, check the waveform between the terminals of the I16 amplifier and E19 ECM connectors.

Wire Harness Side Connector Rear View:



(b) Check that no noise is included in the waveform (an example of noise is shown in the illustration).

Tester Connection	Specified Condition
I16-4 (CODE) - E19-4 (CODE)	No noise is present

NG → **FIND CAUSE OF NOISE AND REMOVE IT**

OK

4 INSPECT TRANSPONDER KEY AMPLIFIER

(a) After replacing the transponder key amplifier with a normally functioning amplifier, check that the engine starts.

OK:
The engine starts.

NG → **REPLACE ECM**

OK

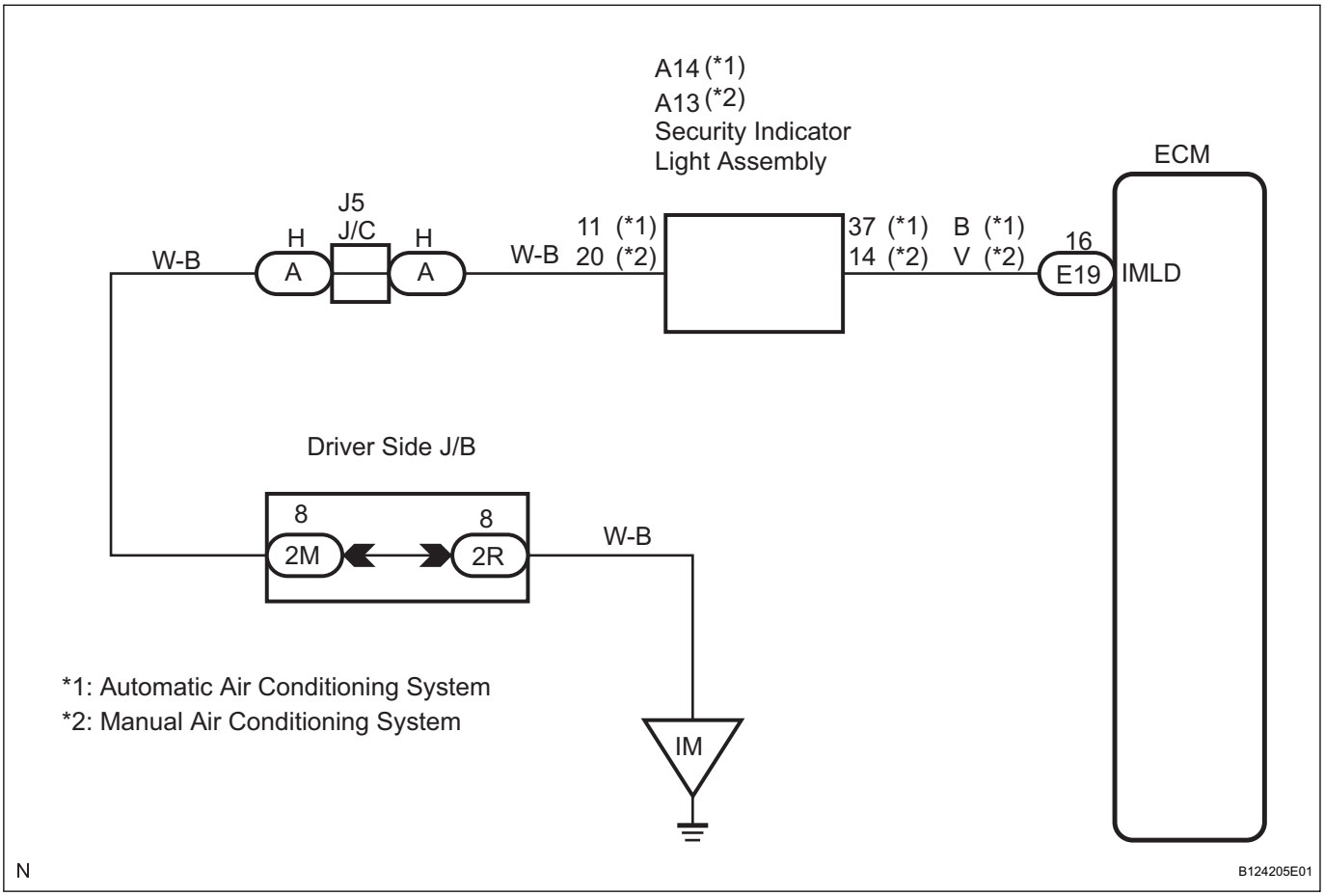
END

Security Indicator Light Circuit

DESCRIPTION

In this circuit, the ECM sends signals to turn on the security indicator light in order to indicate the condition of the immobiliser system.

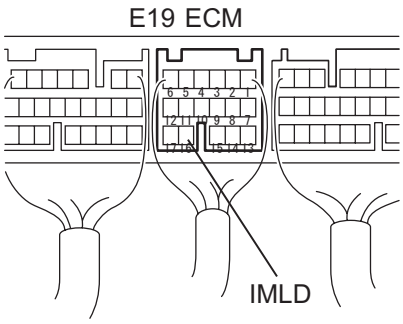
WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT ECM

Wire Harness Side Connector Rear View:



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

Standard voltage

Tester Connection	Condition	Specified Condition
E19-16 (IMLD) - Body ground	Immobiliser is set (No key is in ignition key cylinder)	Repeats 10 to 14 V and below 1 V

NG → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (See page E1-40)**

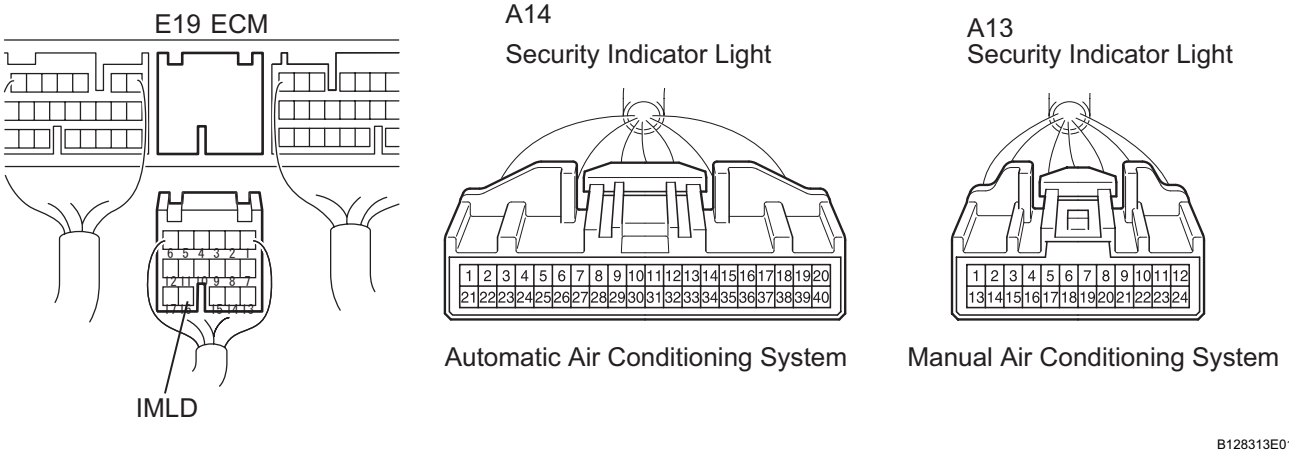
OK

2 CHECK HARNESS AND CONNECTOR (ECM - SECURITY INDICATOR LIGHT)

(a) Disconnect the E19 ECM and A14 (*1) or A13 (*2) indicator connectors.

Wire Harness Side Connector Rear View:

Wire Harness Side Connector Front View:



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

Standard resistance

Tester Connection	Condition	Specified Condition
E19-16 (IMLD) - A14-37 (*1), A13-14 (*2)	Always	Below 1 Ω
E19-16 (IMLD) - Body ground		10 kΩ or higher

*1: Automatic Air Conditioning System
*2: Manual Air Conditioning System

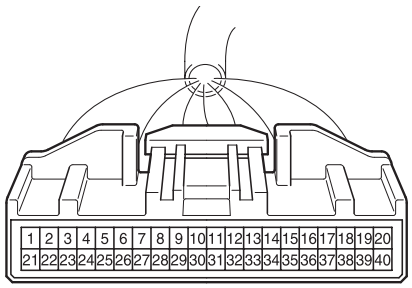
NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

3 CHECK HARNESS AND CONNECTOR (SECURITY INDICATOR LIGHT - BODY GROUND)

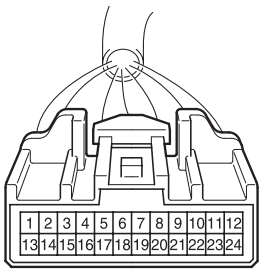
Wire Harness Side Connector Front View:

A14
Security Indicator Light



Automatic Air Conditioning System

A13
Security Indicator Light



Manual Air Conditioning System

P B124212E01

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

Standard resistance

Tester Connection	Condition	Specified Condition
A14-11 (*1), A13-20 (*2) - Body ground	Always	Below 1 Ω

*1: Automatic Air Conditioning System
*2: Manual Air Conditioning System

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

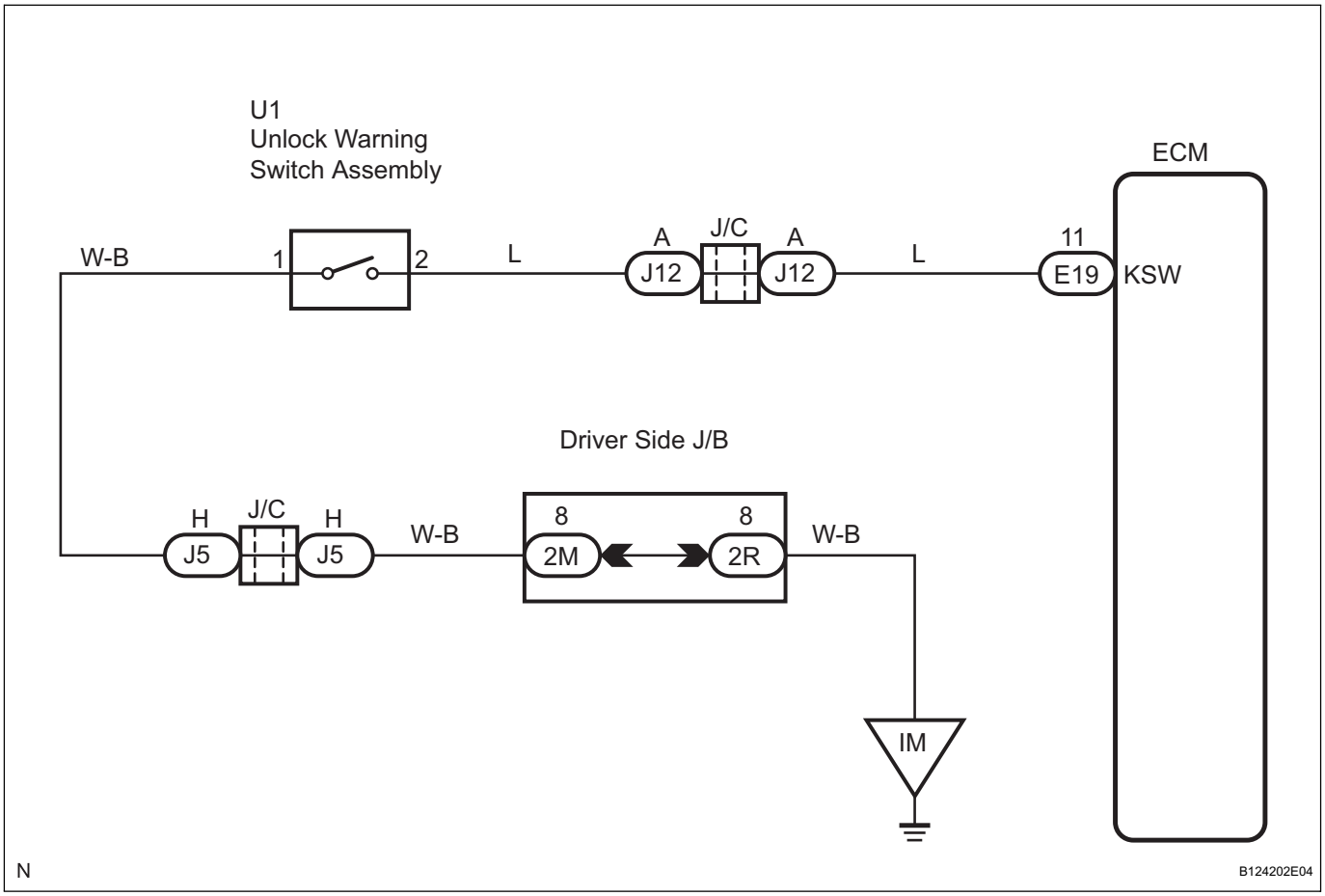
REPLACE SECURITY INDICATOR LIGHT ASSEMBLY

Unlock Warning Switch Circuit

DESCRIPTION

This circuit is used to send signals indicating whether the key is inserted into the key cylinder. (Input of unlock warning switch ON/OFF signal)

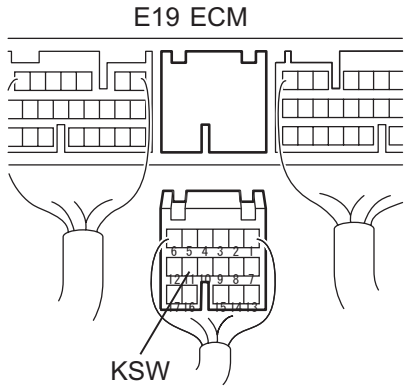
WIRING DIAGRAM



INSPECTION PROCEDURE

1 INSPECT ECM

Wire Harness Side Connector Rear View:



(a) Disconnect the E19 ECM connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

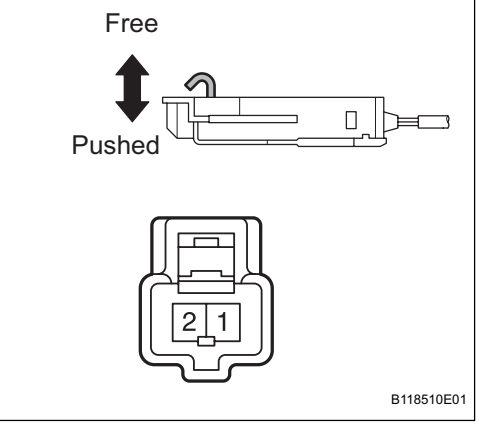
Tester Connection	Condition	Specified Condition
E19-11 (KSW) - Body ground	Key is in ignition key cylinder	Below 1 Ω
	No key is in ignition key cylinder	10 kΩ or higher

OK → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (See page E1-40)**

NG

2 INSPECT UNLOCK WARNING SWITCH ASSEMBLY

Unlock Warning Switch Assembly Connector Front View:



(a) Remove the unlock warning switch assembly.
(b) Measure the resistance according to the value(s) in the table below.

Standard resistance

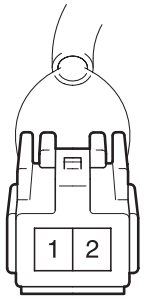
Tester Connection	Switch Position	Specified Condition
1 - 2	Switch pushed (Key inserted)	Below 1 Ω
	Switch free (Key removed)	10 kΩ or higher

NG → **REPLACE UNLOCK WARNING SWITCH ASSEMBLY**

OK

3	CHECK HARNESS AND CONNECTOR (UNLOCK WARNING SWITCH - BODY GROUND)

Wire Harness Side Connector Front View:



U1
Unlock Warning Switch Assembly

P B118511E03

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

Standard resistance

Tester Connection	Condition	Specified Condition
U1-1 - Body ground	Always	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (UNLOCK WARNING SWITCH - BODY GROUND)**

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - UNLOCK WARNING SWITCH)

1MZ-FE CRUISE CONTROL

CRUISE CONTROL SYSTEM

PROBLEM SYMPTOMS TABLE CC-1
DIAGNOSTIC TROUBLE CODE CHART CC-3
DTC 51 Idle Signal Circuit CC-4
Communication Circuit between ECM and Cruise Control ECU CC-6

CRUISE CONTROL SYSTEM

PROBLEM SYMPTOMS TABLE

If a normal code is displayed during the DTC check but the problem still occurs, check the circuits for each problem symptom in the order given in the table below and proceed to the relevant troubleshooting page.

CRUISE CONTROL SYSTEM:

Symptom	Suspected Area	See Page
SET not occurring or CANCEL occurring. (DTC is Normal)	1. Cruise control switch circuit	05-923
	2. Vehicle speed sensor circuit	05-905
	3. Stop light switch circuit	05-909
	4. Park/neutral position switch circuit (A/T), Clutch switch circuit (M/T)	05-915
	5. Actuator motor circuit	05-897
	6. Cruise control cable	82-1
	7. Cruise control ECU assembly	01-30
SET not occurring or CANCEL occurring. (DTC is not output)	1. ECU power source circuit	05-921
	2. Cruise control ECU assembly	01-30
Actual vehicle speed deviates above or below the set speed.	1. Cruise control cable	82-1
	2. Vehicle speed signal abnormal	05-905
	3. Electronically controlled transmission communication circuit (A/T)	05-912
	4. Actuator motor circuit	05-897
	5. Idle signal circuit (Main throttle position sensor)	CC-4
	6. Cruise control ECU assembly	01-30
A/T: Frequent gear shifting between 3rd and O/D when driving on uphill road. (Hunting)	1. Communication circuit between ECM and cruise control ECU	CC-6
	2. Cruise control ECU assembly	01-30
Cruise control is not cancelled even when brake pedal is depressed.	1. Cruise control cable	82-1
	2. Stop light switch circuit	05-909
	3. Actuator motor circuit	05-897
	4. Cruise control ECU assembly	01-30

Symptom	Suspected Area	See Page
A/T: Cruise control is not cancelled even when transmission is shifted to "N" position.	1. Cruise control cable	82-1
	2. Park/neutral position switch circuit	05-915
	3. Actuator motor circuit	05-897
	4. Cruise control ECU assembly	01-30
Control switch does not operate. (SET/COAST, ACC/RES, CANCEL not possible)	1. Cruise control switch circuit	05-923
	2. Cruise control cable	82-1
	3. Actuator motor circuit	05-897
	4. Cruise control ECU assembly	01-30
SET possible at 40 km/h or less, or CANCEL does not operate at 40 km/h or less.	1. Cruise control cable	82-1
	2. Vehicle speed signal abnormal	05-905
	3. Actuator motor circuit	05-897
	4. Cruise control ECU assembly	01-30
Poor response in ACCEL and RESUME modes.	1. Cruise control cable	82-1
	2. Communication circuit between ECM and cruise control ECU	CC-6
	3. Actuator motor circuit	05-897
	4. Cruise control ECU assembly	01-30
A/T: O/D does not RESUME even though the road is not uphill.	1. Communication circuit between ECM and cruise control ECU	CC-6
	2. Cruise control ECU assembly	01-30
DTC memory is erased.	Cruise control ECU assembly	01-30
DTC is not output, or is output when it should not be.	1. Diagnosis circuit	05-929
	2. Cruise control ECU assembly	01-30
Cruise main indicator light remains ON or fails to light up.	1. Cruise main indicator light circuit	05-927
	2. Cruise control ECU assembly	01-30

DIAGNOSTIC TROUBLE CODE CHART

If a malfunction code is displayed during the DTC check, check the circuit listed for that code in the table below and proceed to the appropriate page.

DTC No.	Detection Item	Trouble Area	See Page
51	Idle Signal Circuit	1. Throttle position sensor 2. Idle signal circuit 3. ECM 4. Cruise control ECU assembly	CC-4

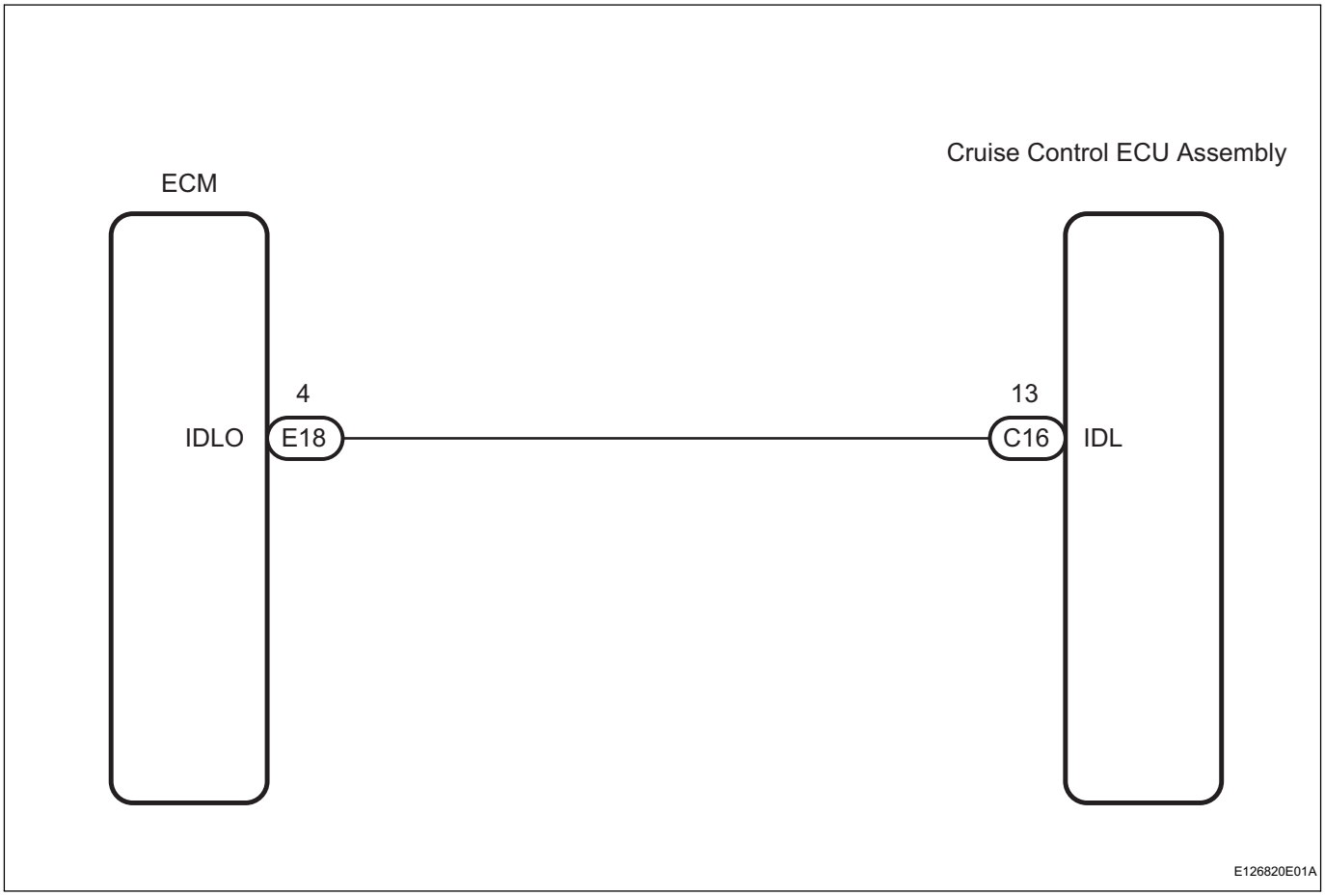
DTC	51	Idle Signal Circuit

DESCRIPTION

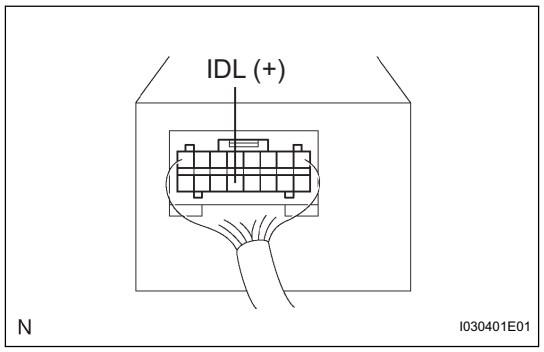
When the idle switch is turned ON, a signal is sent to the cruise control ECU assembly. The cruise control ECU assembly uses this signal to correct the discrepancy between the throttle valve position and the actuator position sensor values to enable accurate cruise control at the set speed. If the idle switch is malfunctioning, problem symptoms also occur in the engine, so also inspect the engine control system.

DTC No.	DTC Detection Condition	Trouble Area
51	Short in idle signal circuit	• Idle signal circuit • ECM • Cruise control ECU assembly

WIRING DIAGRAM



1	INSPECT TERMINAL VOLTAGE



(a) Remove the cruise control ECU assembly with the connector.
(b) Turn the ignition switch to ON.
(c) Measure the voltage between terminal 13 (IDL) of the cruise control ECU assembly connector and body ground when the throttle valve is fully closed and fully opened.

Standard voltage

Throttle Valve Position	Voltage
Fully opened	10 to 16 V
Fully closed	Below 1.5 V

Result

Result	Proceed to
NG	A
OK (When checking from the PROBLEM SYMPTOMS TABLE)	B
OK (When checking from the DTC)	C

B → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (See page CC-1)**

C → **REPLACE CRUISE CONTROL ECU ASSEMBLY**

A

2	CHECK HARNESS AND CONNECTOR (CRUISE CONTROL ECU ASSEMBLY - ECM)

(a) Check for an open or short circuit in the harness and connector between the cruise control ECU assembly and ECM (See page IN-23).

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

OK

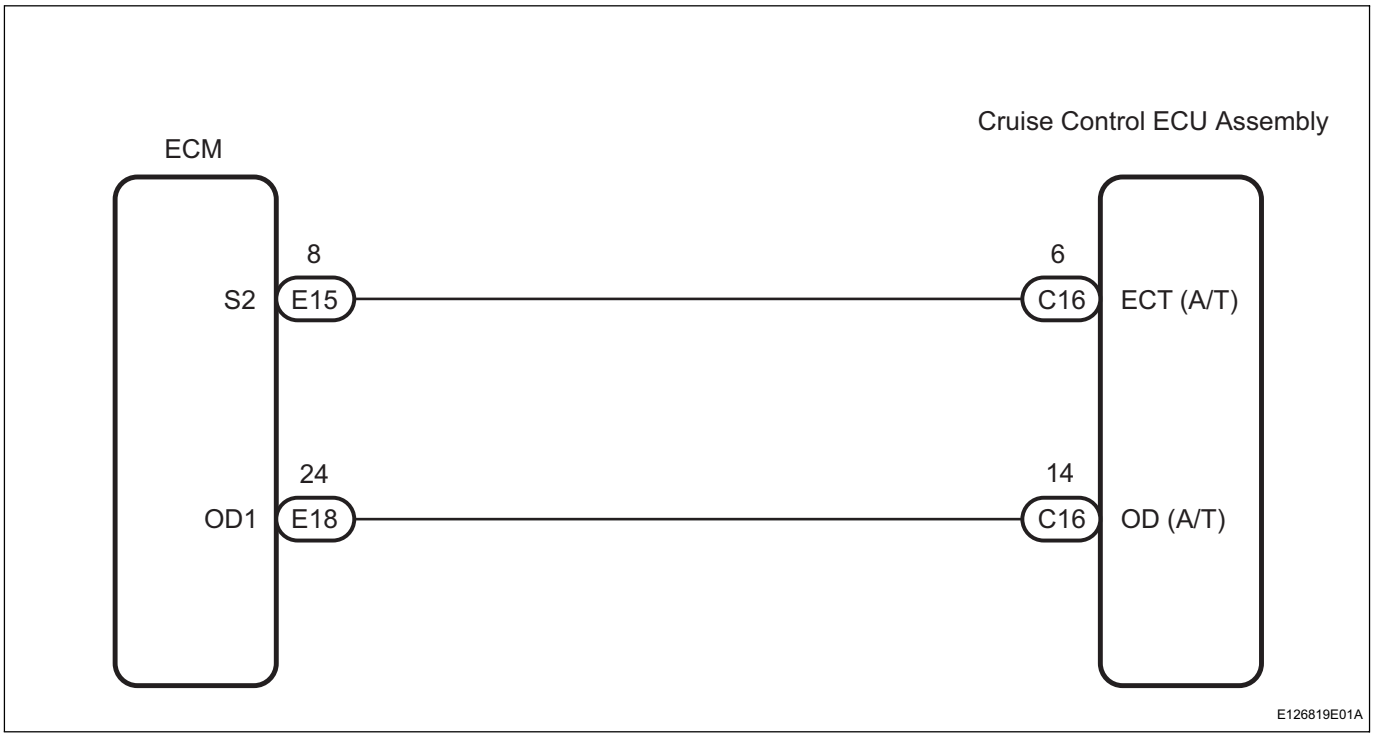
GO TO ENGINE CONTROL SYSTEM

Communication Circuit between ECM and Cruise Control ECU

DESCRIPTION

When down shifting occurs in the electronically controlled transmission while driving uphill using cruise control, the cruise control ECU assembly sends a signal to the ECM to prevent up shifting until the uphill ends. This reduces the number of shifts due to overdrive engaging and disengaging, providing a smooth drive.
Terminal ECT of the cruise control ECU assembly detects the shift change signal (output to electronically controlled transmission No. 2 solenoid) from the ECM.
When the vehicle slows down on an uphill slope and the cruise control ECU receives an overdrive gear position signal via terminal ECT, the ECU will send a signal from terminal OD to the ECM to cut the overdrive until the end of the uphill slope. This reduces the number of gear shifts and also changes gear shift points in the electronically controlled transmission.

WIRING DIAGRAM



INSPECTION PROCEDURE

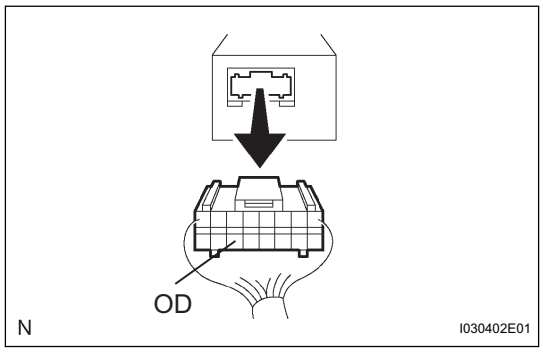
1	CHECK OPERATION (OVERDRIVE)

(a) Drive the vehicle after warming up the engine.
(b) Check that overdrive ON ←→ OFF occurs by an operation of the O/D switch ON ←→ OFF.

NG → **GO TO ELECTRONICALLY CONTROLLED AUTOMATIC TRANSMISSION SYSTEM**

OK

2	INSPECT TERMINAL VOLTAGE

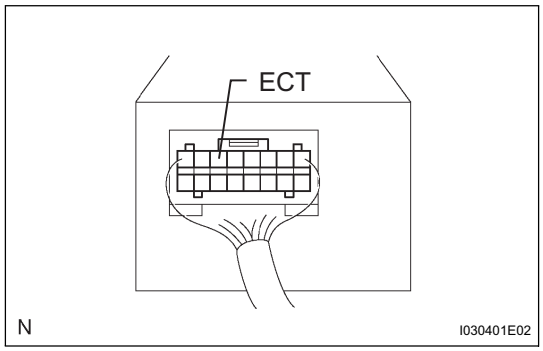


(a) Disconnect the cruise control ECU assembly connector.
(b) Turn the ignition switch to ON.
(c) Measure the voltage between terminal 14 (OD) of the harness side connector of the cruise control ECU assembly and body ground.
Standard voltage:
10 to 16 V

NG → **GO TO STEP 4**

OK

3	INSPECT TERMINAL VOLTAGE (ECT)



(a) Connect the cruise control ECU assembly connector.
(b) Perform the test drive after warming up the engine.
(c) Check the voltage between terminal 6 (ECT) of the cruise control ECU assembly connector and body ground when the O/D switch is ON and OFF.
Standard voltage

O/D Switch Position	Voltage
ON	8 to 16 V
OFF	Below 0.5 V

OK → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (See page CC-1)**

NG

4	CHECK HARNESS AND CONNECTOR (CRUISE CONTROL ECU ASSEMBLY - ECM)

(a) Check for an open or short circuit in the harness and connector between the cruise control ECU assembly and ECM (See page IN-23).

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

OK

REPLACE ECM

METER

METER / GAUGE SYSTEM

HOW TO PROCEED WITH TROUBLESHOOTING ME-1
PROBLEM SYMPTOMS TABLE ME-1
Tachometer Malfunction ME-4
Engine Coolant Temperature Receiver Gauge Malfunction ME-7

METER / GAUGE SYSTEM

HOW TO PROCEED WITH TROUBLESHOOTING

1	VEHICLE BROUGHT TO WORKSHOP

NEXT

2	CUSTOMER PROBLEM ANALYSIS

NEXT

3	PROBLEM SYMPTOM CONFIRMATION

NEXT

4	PROBLEM SYMPTOMS TABLE

NEXT

5	CIRCUIT INSPECTION

NEXT

6	REPAIR OR REPLACE

NEXT

7	CONFIRMATION TEST

NEXT

END

PROBLEM SYMPTOMS TABLE

WHOLE SYSTEM:

Symptom	Suspected Area	See Page
Entire combination meter does not operate.	Combination Meter Circuit	05-782

Symptom	Suspected Area	See Page
Operating light control rheostat does not change brightness	Light Control Rheostat Circuit	05-779
Seat belt warning light for driver seat does not operate.	Driver Side Seat Belt Warning Light Circuit	05-786
Seat belt warning light for passenger seat does not operate.	Passenger Side Seat Belt Warning Light Circuit	05-790

METER GAUGES:

Symptom	Suspected Area	See Page
Speedometer malfunction	Speedometer Circuit	05-770
Tachometer malfunction	Tachometer Circuit	ME-4
Fuel receiver gauge malfunction	Fuel Receiver Gauge Circuit	05-777
Engine coolant temperature receiver gauge malfunction	Engine Coolant Temperature Receiver Gauge Circuit	ME-7

WARNING LIGHTS:

Symptom	Suspected Area	See Page
Check engine warning light does not come on.	1. Wire Harness or Connector	-
	2. MIL Circuit (for 1MZ-FE)	05-127
	3. MIL Circuit (for 2AZ-FE)	ES-206
	4. Combination Meter Assembly	-
Charge warning light does not come on.	1. Wire Harness or Connector	-
	2. ECM (for 1MZ-FE)	05-127
	3. ECM (for 2AZ-FE)	ES-11
	4. Combination Meter Assembly	-
Brake warning light does not come on.	1. Wire Harness or Connector	-
	2. Brake Warning Light Circuit	05-276
	3. Combination Meter Assembly	-
ABS warning light does not come on.	1. Wire Harness or Connector	-
	2. ABS Warning Light Circuit	BC-68
	3. Combination Meter Assembly	-
ABS warning light does not go off.	1. Wire Harness or Connector	-
	2. ABS Warning Light Circuit	BC-64
	3. Combination Meter Assembly	-
Airbag warning light does not come on.	1. Wire Harness or Connector	-
	2. Airbag Warning Light Circuit	05-280
	3. Combination Meter Assembly	-
Airbag warning light does not go off.	1. Wire Harness or Connector	-
	2. Airbag Warning Light Circuit	05-280
	3. Combination Meter Assembly	-
Door open warning light does not come on.	1. Wire Harness or Connector	-
	2. Front Door Courtesy Light Switch	05-587
	3. Body ECU	-
	4. Combination Meter Assembly	-
Fuel level warning light does not come on.	1. Wire Harness or Connector	-
	2. Fuel Sender Gauge Assembly	-
	3. Combination Meter Assembly	-
Low oil pressure warning light does not come on.	1. Wire Harness or Connector	-
	2. Low Oil Pressure Warning Switch	-
	3. Combination Meter Assembly	-

INDICATOR LIGHTS:

Symptom	Suspected Area	See Page
Turn indicator light does not come on.	1. Wire Harness or Connector	-
	2. Lighting System	05-587
	3. Combination Meter Assembly	-
High beam indicator light does not come on.	1. Wire Harness or Connector	-
	2. Lighting System	05-587
	3. Combination Meter Assembly	-
Cruise indicator light does not come on.	1. Wire Harness or Connector	-
	2. Cruise Main Indicator Light Circuit	05-927
	3. Combination Meter Assembly	-
Front fog indicator light does come on. (with front fog light)	1. Wire Harness or Connector	-
	2. Front Fog Light Assembly	05-587
	3. Combination Meter Assembly	-
Speed warning light does not come on. (for Middle-East)	Combination Meter Assembly	-

BUZZER:

Symptom	Suspected Area	See Page
Speed warning buzzer does not operate. (for Middle-East)	Combination Meter Assembly	-
Key reminder warning buzzer does not operate.	Combination Meter Assembly	05-784

MULTI-INFORMATION DISPLAY:

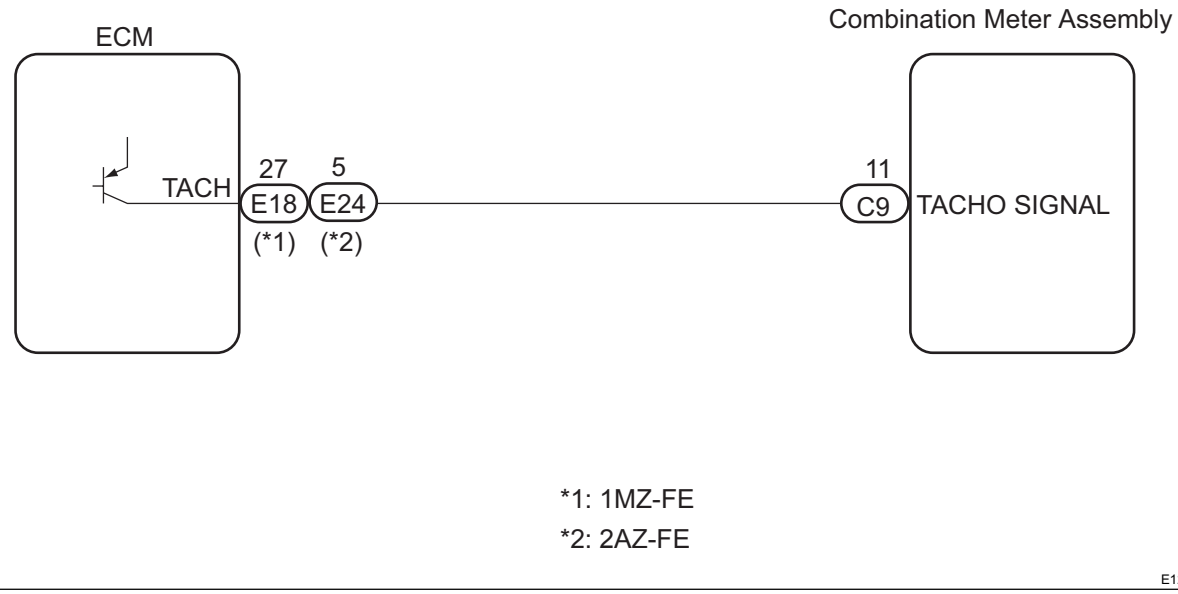
Symptom	Suspected Area	See Page
Clock display malfunction	Combination Meter Assembly	05-792
Outside temperature display malfunction	Combination Meter Assembly	05-794
Average vehicle speed display malfunction	Combination Meter Assembly	05-796
Average fuel consumption/Instantaneous fuel consumption display malfunction	Combination Meter Assembly	05-798
Driving time display malfunction	Combination Meter Assembly	05-802
Possible running distance display malfunction	Combination Meter Assembly	05-805
Multi-information display screen does not change when steering pad switch is operated.	Combination Meter Assembly	05-810

Tachometer Malfunction

DESCRIPTION

When the ignition switch is turned to the ON position, the combination meter assembly communicates with the ECM by the direct line.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	READ VALUE OF INTELLIGENT TESTER

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) Turn the tester ON.
(d) Enter the following menus: Diagnosis / Power Train / Engine / Data Test.
(e) Check the values by referring to the table below.

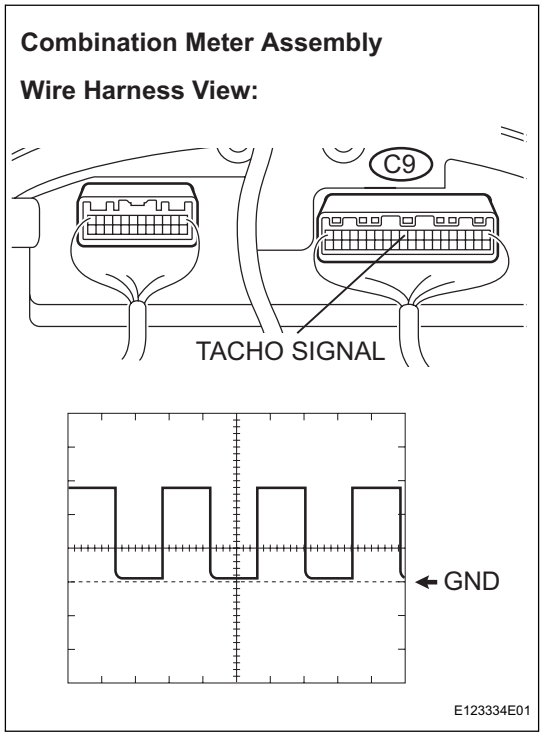
Engine:

Item	Measurement Item/Range (Display)	Normal Condition	Diagnostic Note
Engine Spd	Engine speed/Min.: 0 rpm, max.: 12,750 rpm	Almost same as actual engine speed (When engine is running)	-

NG → **GO TO ENGINE CONTROL SYSTEM**

OK

2	INSPECT COMBINATION METER ASSEMBLY



(a) Check the input signal waveform.
  (1) Remove the combination meter assembly with the connector(s) still connected.
  (2) Connect the oscilloscope to the terminals C9-11 (TACHO SIGNAL) and body ground.
  (3) Start the engine.
  (4) Check the signal waveform according to the condition(s) in the table below.

Item	Condition
Tool Setting	5 V/DIV., 10 ms/DIV.
Vehicle Condition	Engine idle speed

OK:
The waveform is displayed as shown in the illustration.

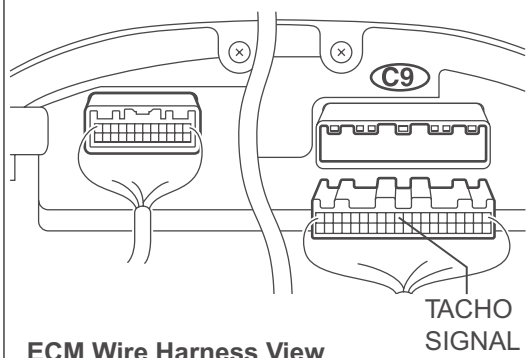
NG → **GO TO STEP 3**

OK

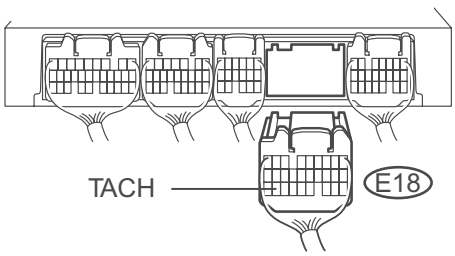
REPLACE COMBINATION METER ASSEMBLY

3	CHECK HARNESS AND CONNECTOR (COMBINATION METER - ECM)

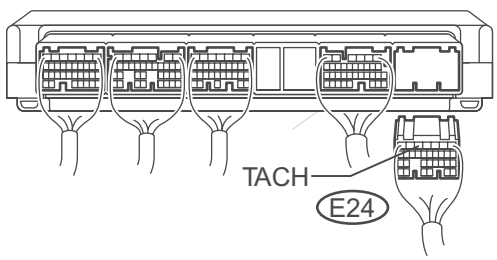
Combination Meter Assembly Wire Harness View:



ECM Wire Harness View (1MZ-FE):



ECM Wire Harness View (2AZ-FE):



E123335E01A

(a) Disconnect the C9 and E18 (*1) / E24 (*2) connectors.

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

Standard resistance

Tester Connection	Condition	Specified Condition
TACH (E18-27) (*1) - TACHO SIGNAL (C9-11)	Always	Below 1 Ω
TACH (E24-5) (*2) - TACHO SIGNAL (C9-11)	Always	Below 1 Ω
TACHO SIGNAL (C9-11) - Body ground	Always	10 kΩ or higher

*1: 1MZ-FE
*2: 2AZ-FE

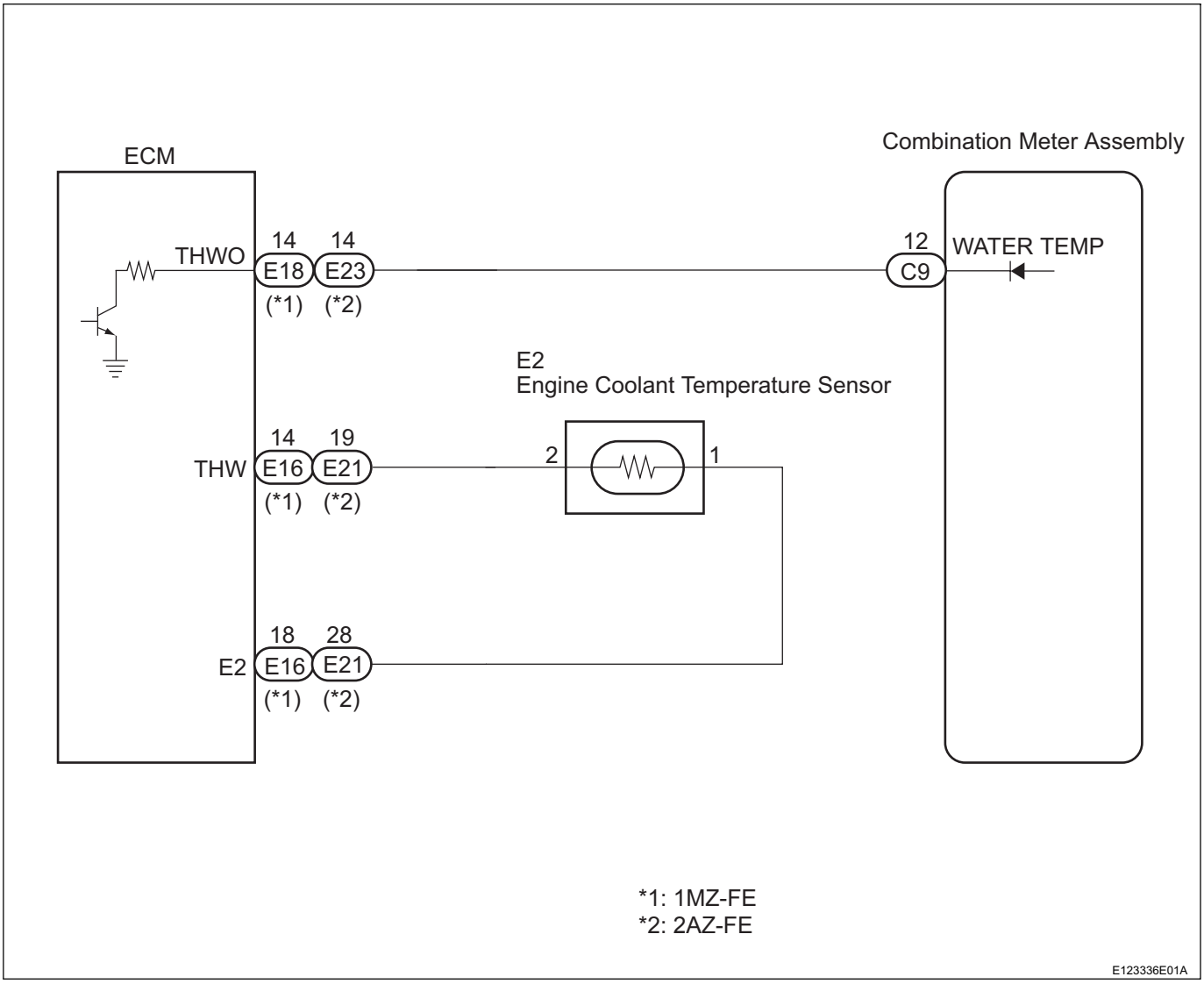
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM

Engine Coolant Temperature Receiver Gauge Malfunction

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

If there is an open or short in the engine coolant temperature sensor circuit, the ECM outputs DTCs.

Perform troubleshooting with the "SFI System" (See page ES-23).

1	CHECK DTC

(a) Check if DTC is output.

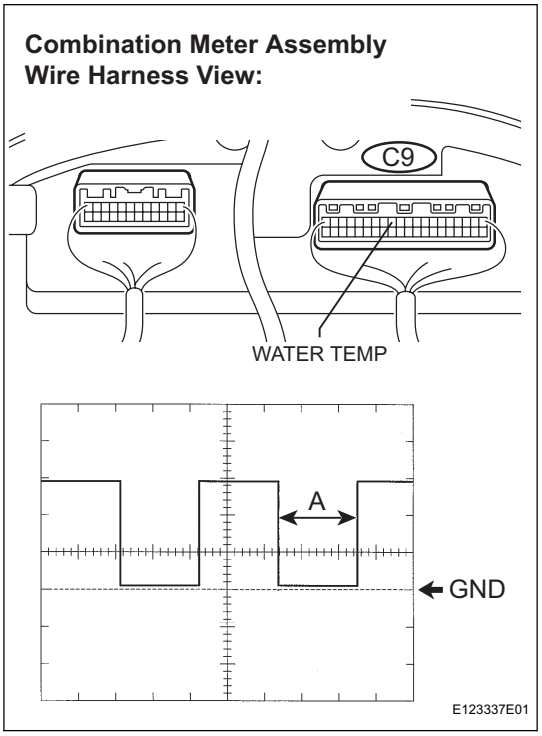
Result

Result	Proceed to
DTC P0115 is not output	A
DTC P0115 is output	B

B → INSPECT COMBINATION METER ASSEMBLY

A

2 **INSPECT COMBINATION METER ASSEMBLY**



(a) Check the input signal waveform.
(1) Remove the combination meter assembly with connectors still connected.
(2) Connect the oscilloscope to the terminal C9-12 (WATER TEMP) and body ground.
(3) Start the engine.
(4) Check the signal waveform according to the condition(s) in the table below.

Item	Condition
Tool setting	5 V/DIV., 100 ms/DIV.
Vehicle condition	Engine idle speed

HINT:
As the coolant temperature rises, the period "A" shown in the illustration becomes longer.

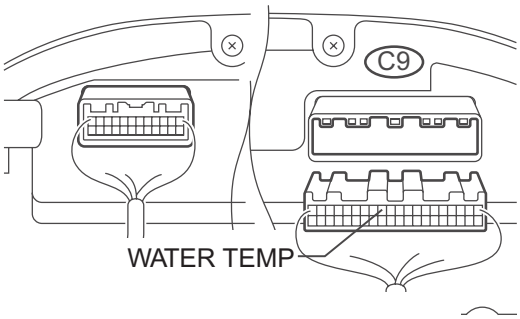
NG → **GO TO STEP 3**

OK

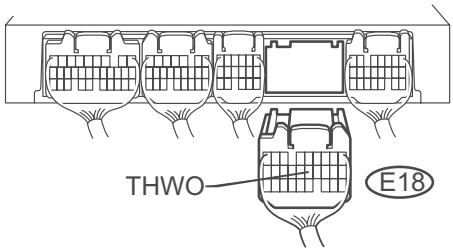
GO TO ENGINE CONTROL SYSTEM

3	CHECK HARNESS AND CONNECTOR (COMBINATION METER - ECM)

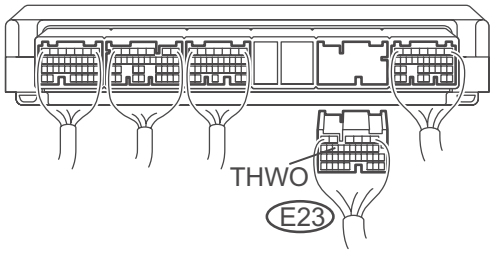
Combination Meter Assembly Wire Harness View:



ECM Wire Harness View (1MZ-FE):



ECM Wire Harness View (2AZ-FE):



E123338E01A

(a) Disconnect the C9 and E18 (*1) / E23 (*2) connectors.

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

Standard resistance

Tester Connection	Condition	Specified Condition
WATER TEMP (C9-12) - THWO (E18-14) (*1)	Always	Below 1 Ω
WATER TEMP (C9-12) - THWO (E23-14) (*2)	Always	Below 1 Ω
WATER TEMP (C9-12) - Body ground	Always	10 kΩ or higher

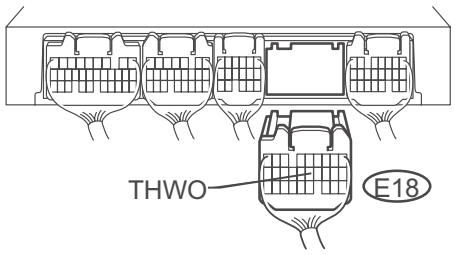
*1: 1MZ-FE
*2: 2AZ-FE

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

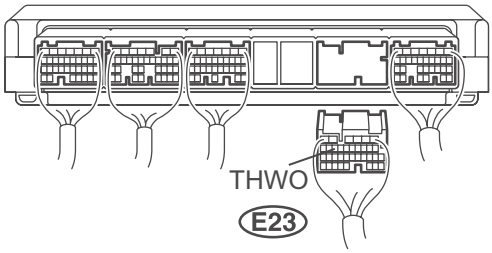
OK

4	INSPECT COMBINATION METER ASSEMBLY

ECM Wire Harness View (1MZ-FE):



ECM Wire Harness View (2AZ-FE):



E123366E01A

(a) Connect the C9 connector.
(b) Measure the voltage according to the value(s) in the table below.

Standard resistance

Tester Connection	Condition	Specified Condition
THWO (E18-14) (*1) - Body ground	Turn the ignition switch to the ON position	10 to 14 V
THWO (E23-14) (*2) - Body ground	Turn the ignition switch to the ON position	10 to 14 V

*1: 1MZ-FE
*2: 2AZ-FE

NG → **REPLACE COMBINATION METER ASSEMBLY**

OK

REPLACE ECM