

<b>DTC</b>	<b>P2120</b>	<b>Throttle / Pedal Position Sensor / Switch "D" Circuit</b>
<b>DTC</b>	<b>P2122</b>	<b>Throttle / Pedal Position Sensor / Switch "D" Circuit Low Input</b>
<b>DTC</b>	<b>P2123</b>	<b>Throttle / Pedal Position Sensor / Switch "D" Circuit High Input</b>
<b>DTC</b>	<b>P2125</b>	<b>Throttle / Pedal Position Sensor / Switch "E" Circuit</b>
<b>DTC</b>	<b>P2127</b>	<b>Throttle / Pedal Position Sensor / Switch "E" Circuit Low Input</b>
<b>DTC</b>	<b>P2128</b>	<b>Throttle / Pedal Position Sensor / Switch "E" Circuit High Input</b>
<b>DTC</b>	<b>P2138</b>	<b>Throttle / Pedal Position Sensor / Switch "D" / "E" Voltage Correlation</b>

**ES****HINT:**

These DTCs relate to the Accelerator Pedal Position (APP) sensor.

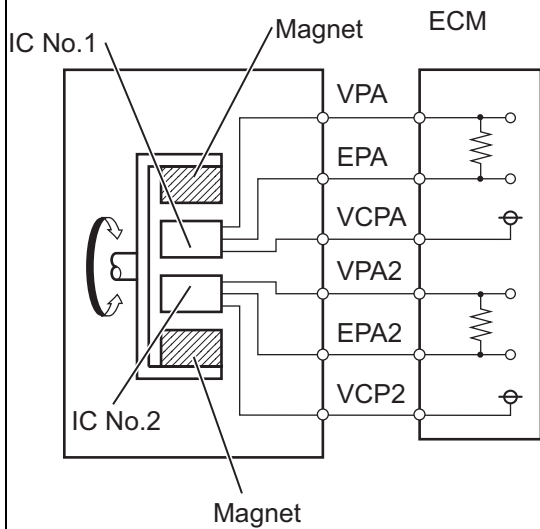
**DESCRIPTION****HINT:**

This ETCS (Electronic Throttle Control System) does not use a throttle cable.

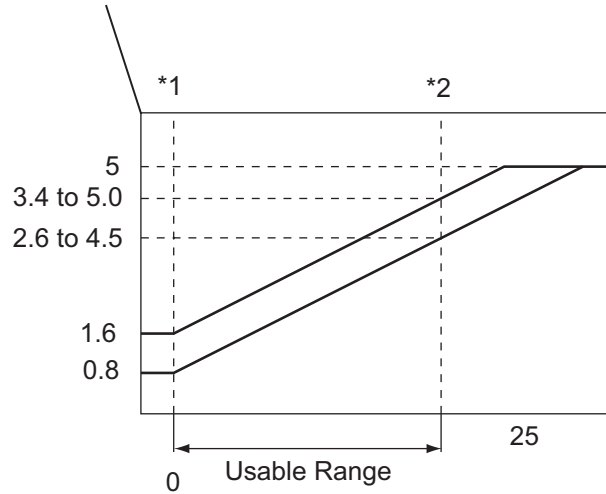
The Accelerator Pedal Position (APP) sensor is mounted on the accelerator pedal bracket and has 2 sensor circuits: VPA (main) and VPA2 (sub). This sensor is a non-contact type, and uses Hall-effect elements, in order to yield accurate signals, even in extreme driving conditions, such as at high speeds as well as very low speeds. The voltage, which is applied to terminals VPA and VPA2 of the ECM, varies between 0 V and 5 V in proportion to the operating angle of the accelerator pedal (throttle valve). A signal from VPA indicates the actual accelerator pedal opening angle (throttle valve opening angle) and is used for engine control. A signal from VPA2 conveys the status of the VPA circuit and is used to check the APP sensor itself.

The ECM monitors the actual accelerator pedal opening angle (throttle valve opening angle) through the signals from VPA and VPA2, and controls the throttle actuator according to these signals.

Accelerator Pedal Position Sensor



Accelerator Pedal Position Sensor Output Voltage (V)



\*1 : Accelerator Pedal Fully Released

\*2 : Accelerator Pedal Fully Depressed

A11589E03

DTC No.	DTC Detection Conditions	Trouble Areas
P2120	VPA fluctuates rapidly beyond upper and lower malfunction thresholds for 0.5 seconds or more (1 trip detection logic)	<ul style="list-style-type: none"> <li>Accelerator Pedal Position (APP) sensor</li> <li>ECM</li> </ul>
P2122	VPA 0.4 V or less for 0.5 seconds or more when accelerator pedal fully released (1 trip detection logic)	<ul style="list-style-type: none"> <li>APP sensor</li> <li>Open in VCP1 circuit</li> <li>Open or ground short in VPA circuit</li> <li>ECM</li> </ul>
P2123	VPA 4.8 V or more for 2.0 seconds or more (1 trip detection logic)	<ul style="list-style-type: none"> <li>APP sensor</li> <li>Open in EPA circuit</li> <li>ECM</li> </ul>
P2125	VPA2 fluctuates rapidly beyond upper and lower malfunction thresholds for 0.5 seconds or more (1 trip detection logic)	<ul style="list-style-type: none"> <li>APP sensor</li> <li>ECM</li> </ul>
P2127	VPA2 1.2 V or less for 0.5 seconds or more when accelerator pedal fully released (1 trip detection logic)	<ul style="list-style-type: none"> <li>APP sensor</li> <li>Open in VCP2 circuit</li> <li>Open or ground short in VPA2 circuit</li> <li>ECM</li> </ul>
P2128	Conditions (a) and (b) continue for 2.0 seconds or more (1 trip detection logic) (a) VPA2 4.8 V or more (b) VPA between 0.4 V and 3.45 V	<ul style="list-style-type: none"> <li>APP sensor</li> <li>Open in EPA2 circuit</li> <li>ECM</li> </ul>
P2138	Condition (a) or (b) continues for 2.0 seconds or more (1 trip detection logic) (a) Difference between VPA and VPA2 0.02 V or less (b) VPA 0.4 V or less and VPA2 1.2 V or less	<ul style="list-style-type: none"> <li>Short between VPA and VPA2 circuits</li> <li>APP sensor</li> <li>ECM</li> </ul>

**HINT:**

When any of these DTCs are set, check the APP sensor voltage by selecting the following menu items on an intelligent tester: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / ACCEL POS #1 and ACCEL POS #2.

Trouble Areas	ACCEL POS #1 When AP Released	ACCEL POS #2 When AP Released	ACCEL POS #1 When AP Depressed	ACCEL POS #2 When AP Depressed
VCP circuit open	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V
Open or ground short in VPA circuit	0 to 0.2 V	1.2 to 2.0 V	0 to 0.2 V	3.4 to 5.0 V
Open or ground short in VPA2 circuit	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 5.0 V	4.5 to 5.0 V	4.5 to 5.0 V	4.5 to 5.0 V
Normal condition	0.5 to 1.1 V	1.2 to 2.0 V	2.6 to 4.5 V	3.4 to 5.0 V

**HINT:**

- Accelerator pedal positions are expressed as voltages.
- AP denotes for Accelerator Pedal.

**ES****MONITOR DESCRIPTION**

When either of the output voltages of VPA or VPA2 deviates from the standard range, or the difference between the output voltages of the 2 sensor circuits is less than the threshold, the ECM determines that there is a malfunction in the APP sensor. The ECM then illuminates the MIL and sets a DTC.

**Example:**

When the output voltage of VPA drops to below 0.4 V for more than 0.5 seconds when the accelerator pedal is fully depressed, DTC P2122 is set.

If the malfunction is not repaired successfully, a DTC is set 2 seconds after the engine is next started.

**MONITOR STRATEGY**

Related DTCs	P2120: Accelerator Pedal Position (APP) sensor 1 range check (fluctuating) P2122: APP sensor 1 range check (low voltage) P2123: APP sensor 1 range check (high voltage) P2125: APP sensor 2 range check (fluctuating) P2127: APP sensor 2 range check (low voltage) P2128: APP sensor 2 range check (high voltage) P2138: APP sensor range check (correlation)
Required Sensors/Components (Main)	APP sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds: P2120, P2122, P2125 and P2127 2.0 seconds: P2123, P2128 and P2138
MIL Operation	Immediate
Sequence of Operation	None

**TYPICAL ENABLING CONDITIONS**

Monitor runs whenever following DTCs not present	None
Ignition switch	ON
Electronic throttle actuator power	ON

**TYPICAL MALFUNCTION THRESHOLDS****P2120:**

Either of the following conditions is met:	Condition 1 or 2
1. VPA1 voltage when VPA2 voltage is V or more	0.4 V or less
2. VPA1 voltage	4.8 V or more

**P2122:**

VPA1 voltage when VPA2 voltage is 0.04 V or more	0.4 V or less
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**P2123:**

VPA1 voltage	4.8 V or more
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**P2125:**

Either of the following conditions is met:	Condition 1 or 2
1. VPA2 voltage when VPA1 is 0.04 V or more	1.2 V or less
2. VPA2 voltage when VPA1 is 0.4 to 3.45 V	4.8 V or more

**P2127:**

VPA2 voltage when VPA1 0.04 V or more	1.2 V or less
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**P2128:**

VPA2 voltage when VPA1 0.4 to 3.45 V	4.8 V or more
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**P2138:**

Either of following conditions A or B met:	-
Condition A	-
Difference between VPA1 and VPA 2 voltages	0.02 V or less
Condition B	-
VPA1 voltage	0.4 V or less
VPA2 voltage	1.2 V or less

**COMPONENT OPERATING RANGE**

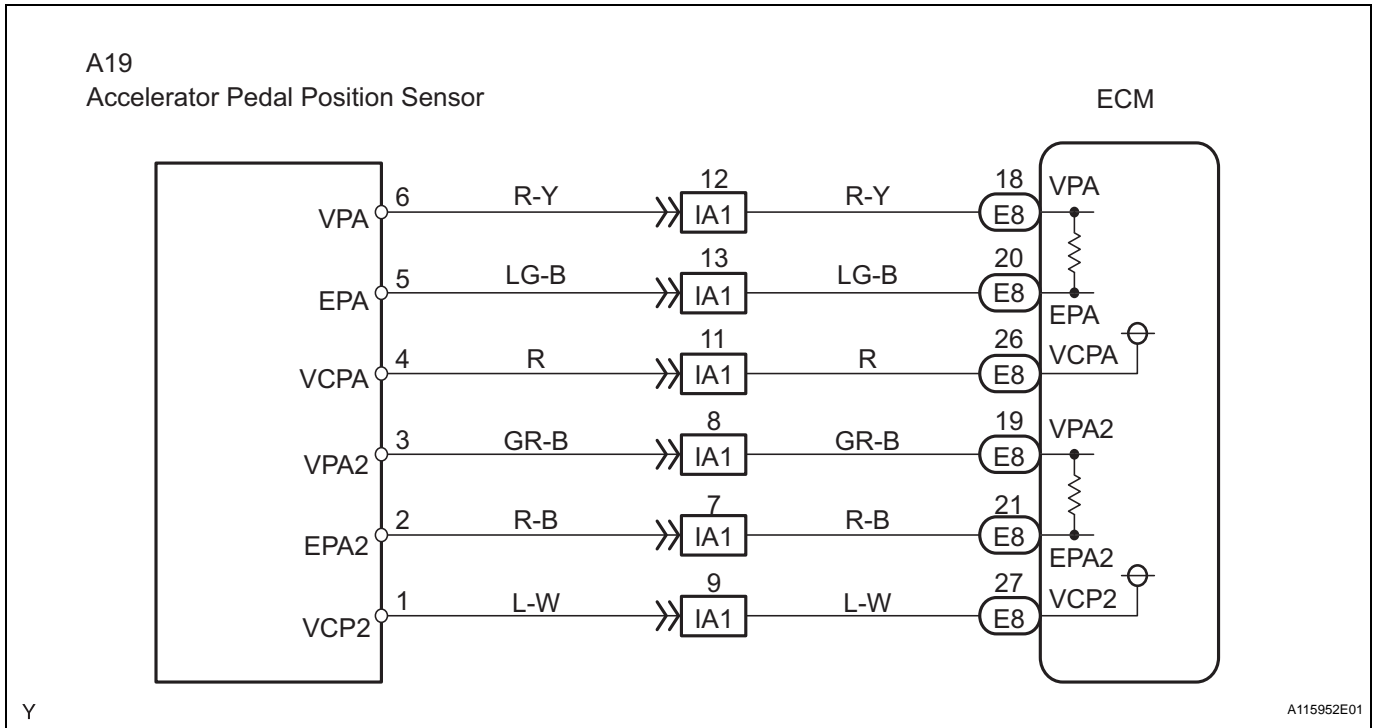
VPA1 voltage	0.4 V to 4.8 V
VPA2 voltage	1.2 V to 4.8 V

**FAIL-SAFE**

When any of DTCs P2120, P2121, P2122, P2123, P2125, P2127, P2128 and P2138 are set, the ECM enters fail-safe mode. If either of the 2 sensor circuits malfunctions, the ECM uses the remaining circuit to calculate the accelerator pedal position to allow the vehicle to continue driving. If both of the circuits malfunction, the ECM regards the accelerator pedal as being released. As a result, the throttle valve is closed and the engine idles.

Fail-safe mode continues until a pass condition is detected, and the ignition switch is turned OFF.

**WIRING DIAGRAM**

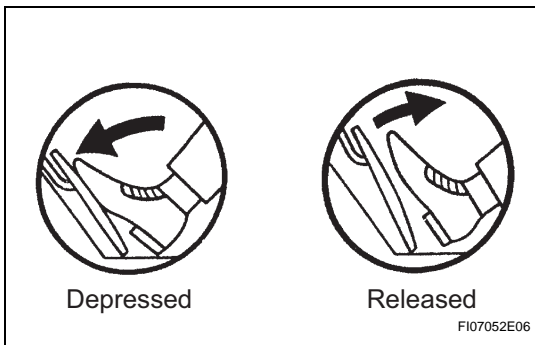


**ES**

**HINT:**

Read freeze frame data using an intelligent tester. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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 READ VALUE OF INTELLIGENT TESTER (ACCEL POS #1 AND ACCEL POS #2)**



- (a) Connect an intelligent tester to the DLC3.
- (b) Turn the ignition switch ON and turn the tester ON.
- (c) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / ACCEL POS #1 and ACCEL POS #2.
- (d) Read the value displayed on the tester.

**Standard Voltage**

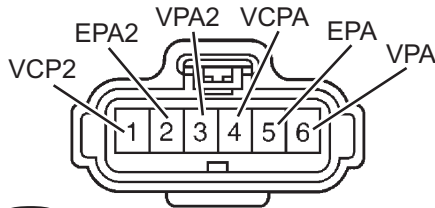
Accelerator Pedal Operations	ACCEL POS #1 (AP#1)	ACCEL POS #2 (AP#2)
Released	0.5 to 1.1 V	1.2 to 2.0 V
Depressed	2.6 to 4.5 V	3.4 to 5.0 V

OK **Go to step 5**

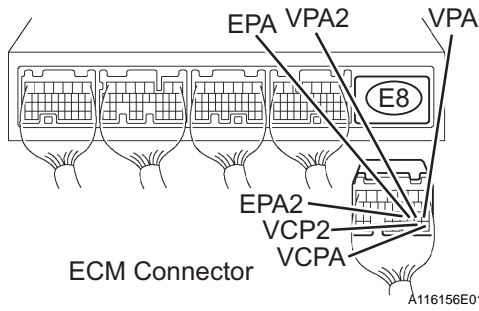
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**2 CHECK HARNESS AND CONNECTOR (ACCELERATOR PEDAL POSITION SENSOR - ECM)**

Wire Harness Side:



(A19) Accelerator Pedal Position Sensor Connector



ECM Connector

- (a) Disconnect the A19 Accelerator Pedal Position (APP) sensor connector.
- (b) Disconnect the E8 ECM connector.
- (c) Check the resistance.

**Standard Resistance (Check for open)**

Tester Connections	Specified Conditions
VPA (A19-6) - VPA (E8-18)	<b>Below 1 Ω</b>
EPA (A19-5) - EPA (E8-20)	
VCPA (A19-4) - VCPA (E8-26)	
VPA2 (A19-3) - VPA2 (E8-19)	
EPA2 (A19-2) - EPA2 (E8-21)	
VCP2 (A19-1) - VCP2 (E8-27)	

**Standard Resistance (Check for short)**

Tester Connections	Specified Conditions
VPA (A19-6) or VPA (E8-18) - Body ground	<b>10 kΩ or higher</b>
EPA (A19-5) or EPA (E8-20) - Body ground	
VCPA (A19-4) or VCPA (E8-26) - Body ground	
VPA2 (A19-3) or VPA2 (E8-19) - Body ground	
EPA2 (A19-2) or EPA2 (E8-21) - Body ground	
VCP2 (A19-1) or VCP2 (E8-27) - Body ground	

- (d) Reconnect the APP sensor connector.
- (e) Reconnect the ECM connector.

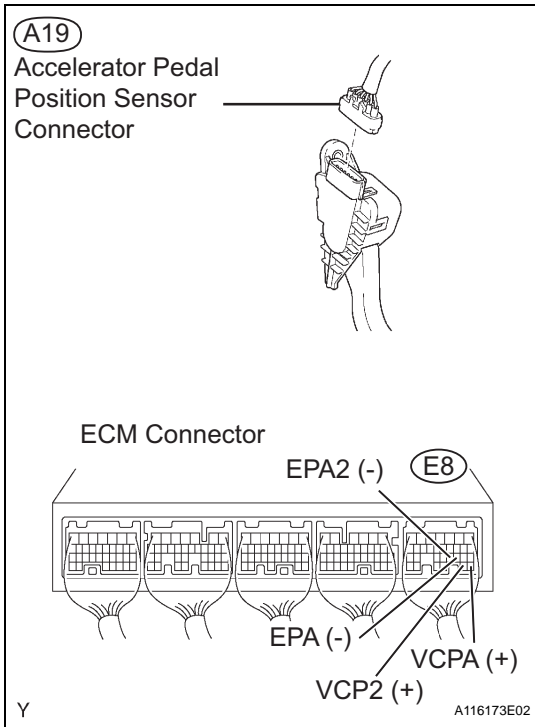
**NG**

**REPAIR OR REPLACE HARNESS OR CONNECTOR**

**OK**

**ES**

**3 INSPECT ECM (VCPA AND VCP2 VOLTAGE)**



- (a) Disconnect the A19 APP sensor connector.
- (b) Turn the ignition switch ON.
- (c) Measure the voltage between the terminals of the E8 ECM connector.

**Standard Voltage**

Tester Connections	Specified Conditions
VCPA (E8-26) - EPA (E8-20)	4.5 to 5.0 V
VCP2 (E8-27) - EPA2 (E8-21)	

- (d) Reconnect the APP sensor connector.

**NG** → **REPLACE ECM**

**OK**

**4 REPLACE ACCELERATOR PEDAL ROD ASSEMBLY**

**NEXT**

**5 CHECK WHETHER DTC OUTPUT RECURS (ACCELERATOR PEDAL POSITION SENSOR DTCS)**

- (a) Connect an intelligent tester to the DLC3.
- (b) Turn the ignition switch ON and turn the tester ON.
- (c) Clear DTCs (See page ES-38).
- (d) Start the engine.
- (e) Allow the engine to idle for 15 seconds.
- (f) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
- (g) Read DTCs.

**Result**

Display (DTC Output)	Proceed To
P2120, P2122, P2123, P2125, P2127, P2128 and/or P2138	A
No output	B

**B** → **SYSTEM OK**



REPLACE ECM