DICTK–01

DTC	P2 120/19	Throttle/Pedal Position Sensor/Switch ”D” Circuit

DTC	P2 122/19	Throttle/Pedal Position Sensor/Switch ”D” Circuit Low Input

DTC	P2 123/19	Throttle/Pedal Position Sensor/Switch ”D” Circuit High Input

DTC	P2 125/19	Throttle/Pedal Position Sensor/Switch ”E” Circuit

DTC	P2 127/19	Throttle/Pedal Position Sensor/Switch ”E” Circuit Low Input

DTC	P2 128/19	Throttle/Pedal Position Sensor/Switch ”E” Circuit High Input

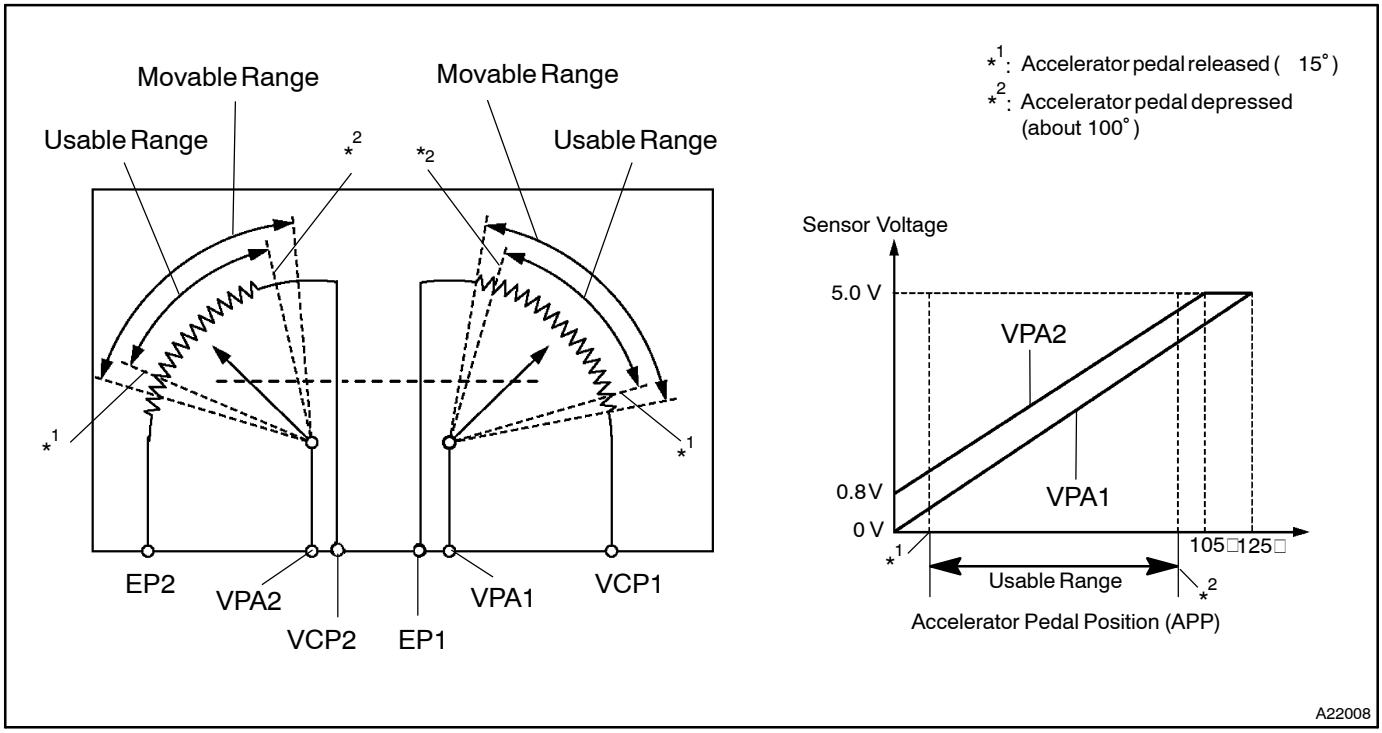
DTC	P2 138/19	Throttle/Pedal Position Sensor/Switch ”D”/”E” Voltage Correlation

HINT:
This is the repair procedure for the ”accelerator pedal position sensor”.

CIRCUIT DESCRIPTION

A vehicle that is equipped with an Electronic Throttle Control System (ETCS) does not have a throttle cable. The APP sensor is mounted on the accelerator pedal bracket. The APP sensor has 2 sensor elements/signal outputs: VPA 1 and VPA2. VPA 1 is used to detect the actual accelerator pedal angle (used for engine control) and VPA2 is used to detect malfunctions in VPA 1. Voltage applied to VPA 1 and VPA2 changes between 0.2 V and 5 V in proportion to the accelerator pedal angle.

The engine control ECU monitors the accelerator pedal angle from VPA 1 and VPA2 signal outputs, and controls the throttle actuator based on these signals.



DTC No.	DTC Detection Condition (Open or short in accelerator pedal position sensor circuit)	Main trouble Area
P2120/19	Condition (a) continues for 0.5 seconds or more: (1 trip detection logic) (a) VPA ≦ 0.2 V and VPA2 ≧ 0.97 deg, or VPA ≧ 4.8 V	• Accelerator pedal position sensor • Engine control ECU
P2122/19	Condition (a) and (b) continues for 0.5 seconds or more: (1 trip detection logic) (a) VPA ≦ 0.2 V (b) VPA2 ≧ 0.97 deg	• Accelerator pedal position sensor • VCPA circuit open • VPA circuit open or ground short • Engine control ECU
P2123/19	Condition (a) continues for 2.0 seconds or more: (1 trip detection logic) (a) VPA ≧ 4.8 V	• Accelerator pedal position sensor • EPA circuit open • Engine control ECU
P2125/19	Condition (a) continues for 0.5 seconds or more: (1 trip detection logic) (a) VPA2 ≦ 0.5 V and VPA ≧ 0.97 deg, or VPA2 ≧ 4.8 V and 0.2 V ≦ VPA ≦ 3.45 V	• Accelerator pedal position sensor • Engine control ECU
P2127/19	Condition (a) and (b) continues for 0.5 seconds or more: (1 trip detection logic) (a) VPA2 ≦ 0.5 V (b) VPA ≧ 0.97 deg	• Accelerator pedal position sensor • VCP2 circuit open • VPA2 circuit open or ground short • Engine control ECU

P2128/19	Condition (a) and (b) continues for 2.0 seconds or more: (1 trip detection logic) (a) VPA2 ≧ 4.8 V (a) 0.2 V ≦ VPA ≦ 3.45 V	• Accelerator pedal position sensor • EPA circuit open • Engine control ECU
P2138/19	Condition (a) or (b) continues for 2.0 seconds or more: (1 trip detection logic) (a) |VPA – VPA2| ≦ 0.02 V (b) VPA ≦ 0.2 V and VPA2 ≦ 0.5 V	• VPA and VPA2 circuit are short circuited • Accelerator pedal position sensor • Engine control ECU

HINT:
After confirming DTC P2 120, P2 122, P2 123, P2 125, P2 127, P2 128 and P2 138 use the hand –held tester to confirm the accelerator pedal opening percentage.

Trouble area	Accelerator pedal position expressed as voltage			
	Accelerator pedal completely released		Accelerator pedal fully depressed	
	ACCEL POS # 1	ACCEL POS #2	ACCEL POS # 1	ACCEL POS #2
VC 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
E2 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

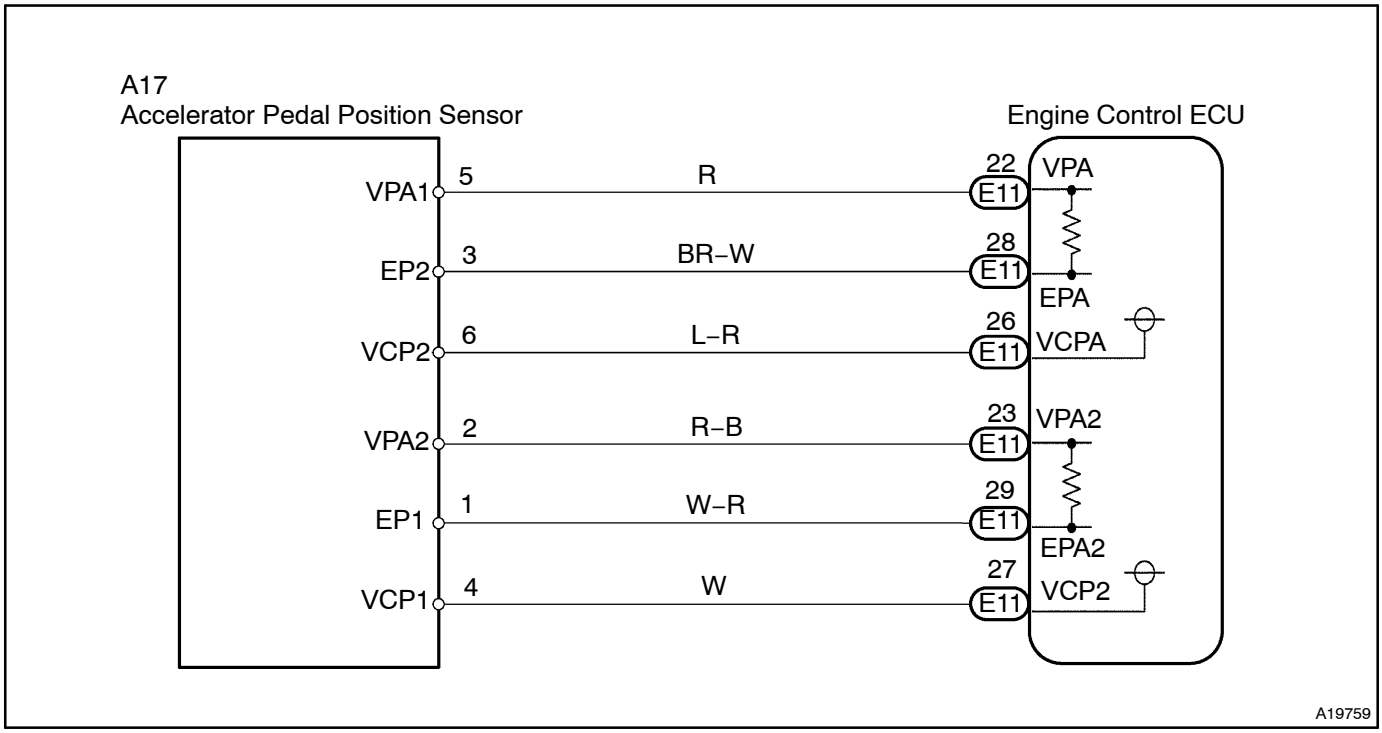
MONITOR DESCRIPTION

When VPA or VPA2, deviates from the standard, or the difference between the voltage outputs of the two sensors is less than threshold, the engine control ECU concludes that there is a defect in the accelerator pedal position sensor. The engine control ECU turns on the MIL and a DTC is set.
Example:
When the voltage output of the VPA below 0.2 V or exceeds 4.8 V.
The monitor runs for 2 seconds (the first 2 seconds for engine idle) after the engine is started.

FAIL SAFE

The accelerator pedal position sensor has two (main and sub) sensor circuits. If a malfunction occurs in either of the sensor circuits, the engine control ECU detects the abnormal signal voltage difference between the two sensor circuits and switches to limp mode. In limp mode, the remaining circuit is used to calculate the accelerator pedal opening to allow the vehicle to continue driving.
If both circuits malfunction, the engine control ECU regards the opening angle of the accelerator pedal to be fully closed.
In this case, the throttle valve will remain closed as if the engine is idling.
If a "pass" condition is detected and then the ignition switch is turned OFF, the fail –safe operation will stop and the system will return to normal condition.

WIRING DIAGRAM

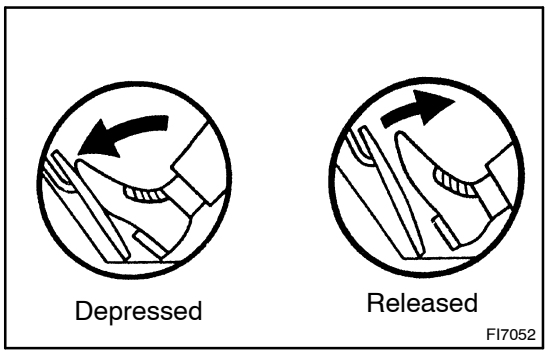


INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand –held tester. Freeze frame data records the engine conditions 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, as well as other data from the time when a malfunction occurred.

1	**Connect hand –held tester, and read the voltage for accelerator pedal position sensor data.**



PREPARATION:

(a) Connect the hand –held tester to the DLC3.

(b) Turn the ignition switch ON and push the hand –held tester main switch ON.

(c) Enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ETCS / ACCEL POS # 1 and ACCEL POS #2.

CHECK:

Read the voltage for the accelerator pedal position sensor data.

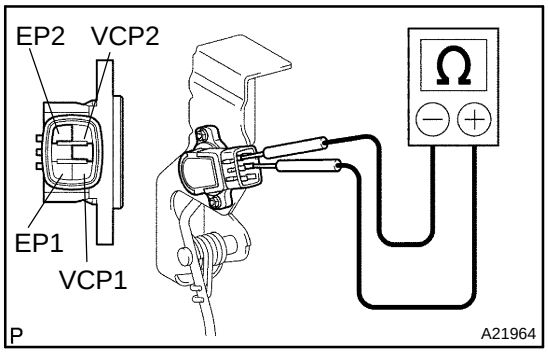
OK:

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 accelerator pedal position sensor.



(a) Disconnect the accelerator pedal position sensor connector.

CHECK:

(a) Measure the resistance between each terminal.

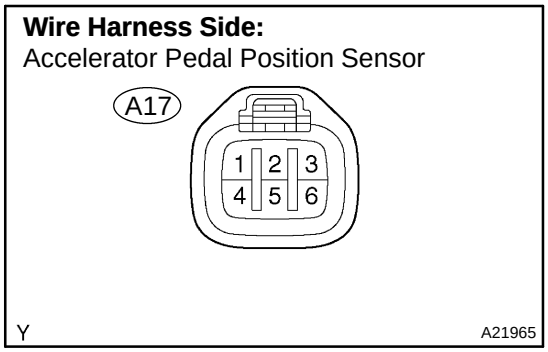
OK:

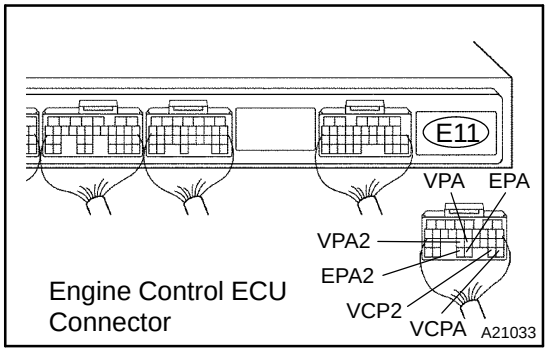
Tester Connection	Specified Condition
3 − 6	1.5 to 6.0 kΩ at 20_C (68_F)
1 − 4	1.5 to 6.0 kΩ at 20_C (68_F)

NG → **Replace accelerator pedal position sensor.**

OK

3	Check for open and short in harness and connector in VCPA, VCP2, VPA, VPA2 EPA and EPA2 circuit between engine control ECU and accelerator pedal position sensor.





PREPARATION:

(a) Disconnect the A17 accelerator pedal position sensor connector.

(b) Disconnect the E11 engine control ECU connector.

CHECK:

Measure the resistance between the wire harness side connectors.

OK:

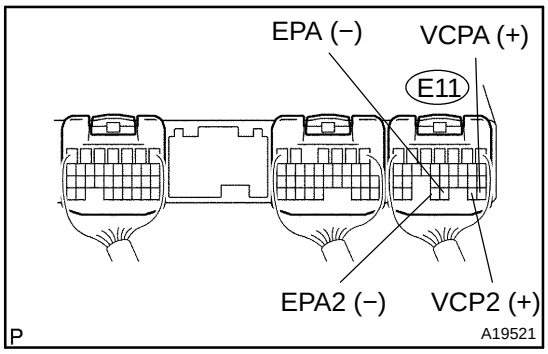
Tester Connection	Specified Condition
VPA1 (A17−5) − VPA (E11−22)	Below 1 Ω
EP1 (A17−3) − EPA (E11−28)	Below 1 Ω
VCP1 (A17−6) − VCPA (E11−26)	Below 1 Ω
VPA2 (A17−2) − VPA2 (E11−23)	Below 1 Ω
EP2 (A17−1) − EPA2 (E11−29)	Below 1 Ω
VCP2 (A17−4) − VCP2 (E11−27)	Below 1 Ω
VPA1 (A17−5) or VPA (E11−22) − Body ground	10 kΩ or higher
EP1 (A17−3) or EPA (E11−28) − Body ground	10 kΩ or higher
VCP1 (A17−6) or VCPA (E11−26) − Body ground	10 kΩ or higher
VPA2 (A17−2) or VPA2 (E11−23) − Body ground	10 kΩ or higher

EP2 (A17−1) or EPA2 (E11−29) − Body ground	10 kΩ or higher
VCP2 (A17−4) or VCP2 (E11−27) − Body ground	10 kΩ or higher

NG → **Repair or replace harness or connector.**

OK

4	**Check voltage between terminals VCPA and EPA, and VCP2 and EPA2 of engine control ECU terminals.**



PREPARATION:

(a) Turn the ignition switch ON.

(b) Disconnect the A17 accelerator pedal position sensor connector.

CHECK:

Measure the voltage between the specified terminals of the E11 engine control ECU connector.

OK:

Tester Connection	Specified Condition
VCPA (E11−26) − EPA (E11−28)	4.5 to 5.5 V
VCP2 (E11−27) − EPA2 (E11−29)	4.5 to 5.5 V

NG → **Replace engine control ECU (See Pub. No. RM630, page FI−74).**

OK

5	**Check if DTC output recur?**

PREPARATION:

(a) Connect the hand−held tester to the DLC3.
(b) Disconnect the battery terminals or remove the EFI or ECD No. 1 fuse and ETCS fuse (Clear DTCs).
(c) Start the engine.
(d) Drive the engine at idle for 15 seconds or more.

CHECK:

Read the DTC output.

OK:

No DTC output.

OK → **System is OK.**

NG

Replace engine control ECU (See Pub. No. RM630E, page FI−74).