DTC	P2A00	A/F Sensor Circuit Slow Response (Bank 1 Sensor 1)

DTC	P2A03	A/F Sensor Circuit Slow Response (Bank 2 Sensor 1)

HINT:
- DTC P2A00 indicates malfunctions related to the bank 1 A/F sensor.
- DTC P2A03 indicates malfunctions related to the bank 2 A/F sensor.
- Bank 1 refers to the bank that includes cylinder No. 1.
- Bank 2 refers to the bank that includes cylinder No. 2.
- Sensor 1 refers to the sensor mounted in front of the Three-Way Catalytic Converter (TWC) and located near the engine assembly.

DESCRIPTION

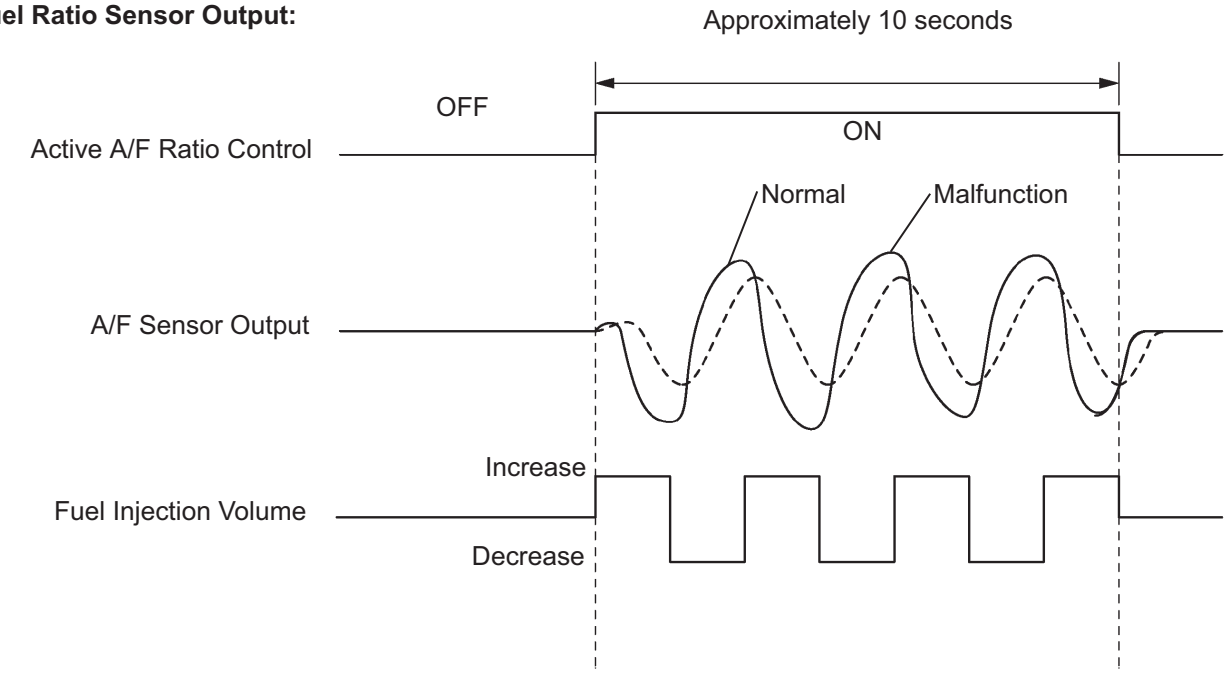
Refer to DTC P2195 (See page ES-355).

DTC No.	DTC Detection Condition	Trouble Area
P2A00 P2A03	Calculated value for air-fuel ratio (A/F) sensor response rate deterioration level is less than threshold	• Open or short in A/F sensor circuit • A/F sensor • ECM

MONITOR DESCRIPTION

After the engine is warmed up, the ECM performs air-fuel ratio feedback control to maintain the air-fuel ratio at the stoichiometric level. In addition, active A/F ratio control is performed for approximately 10 seconds after preconditions are met in order to measure the A/F sensor response rate. During active A/F ratio control, the ECM forcibly increases and decreases the injection volume to a certain amount, based on the stoichiometric air-fuel ratio learned during normal air-fuel ratio control, and measures the A/F sensor response rate. The ECM receives a signal from the A/F sensor while performing active A/F ratio control and uses it to calculate the A/F sensor response rate deterioration level.
If the value for A/F sensor response rate deterioration level is less than the threshold, the ECM interprets this as a malfunction and sets the DTC.

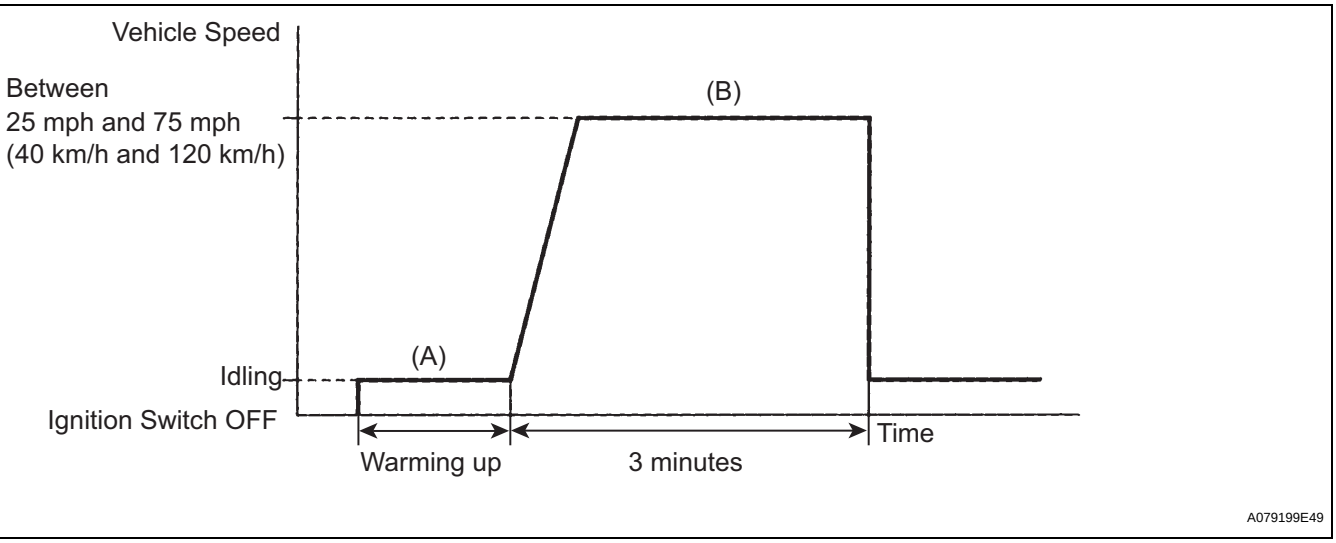
Air-fuel Ratio Sensor Output:



ES

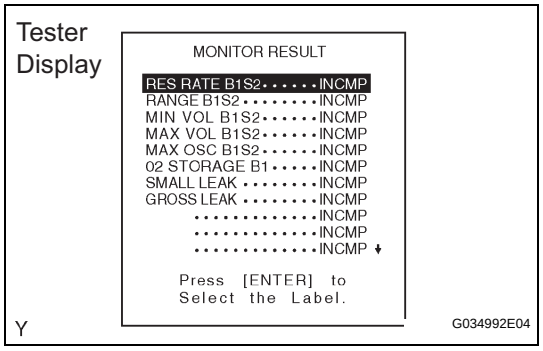
CONFIRMATION DRIVING PATTERN

HINT:
Performing this confirmation driving pattern will activate the A/F sensor response monitor.



1. Connect the intelligent tester to the DLC3.
2. Turn the ignition switch to the ON position.
3. Turn the tester on.
4. Clear the DTCs (where set).
5. Select the following menu items: DIAGNOSIS / ENHANCED OBD II / MONITOR INFO / MONITOR RESULT.

6. Check that RES RATE B1S1 and RES RATE B2S1 is INCOMPL.



7. Start the engine and warm it up (Procedure "A").
8. Drive the vehicle at between 25 mph and 75 mph (40 km/h and 120 km/h) for 3 minutes. However, the vehicle should be driven at a constant speed (Procedure "B").
9. Check the monitor result values on the intelligent tester by selecting the following menu items: DIAGNOSIS / ENHANCED OBD II / MONITOR INFO / MONITOR RESULT /RES RATE B1S1 and RES RATE B2S1 / Enter.
10. If the values indicated on the tester do not change, perform READINESS MONITOR DRIVE PATTERN for the A/F sensor and the heated oxygen sensor (See page ES-22).
    HINT:
    Completion of all A/F sensor monitors is required to change the value in test result.
11. Note the value of the Monitor Result.
12. Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DTC INFO / PENDING CODES.
13. Check if any DTCs (any pending DTCs) are set.

ES

MONITOR STRATEGY

Related DTCs	P2A00: A/F sensor (Bank 1) slow response P2A03: A/F sensor (Bank 2) slow response
Required Sensors / Components (Main)	A/F sensor
Required Sensors / Components (Related)	Vehicle speed sensor, Crankshaft position sensor
Frequency of Operation	Once per driving cycle
Duration	10 to 15 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	P0031, P0032, P0051, P0052 (A/F Sensor heater Sensor 1), P0100, P0101, P0102, P0103 (MAF Sensor), P0110, P0112, P0113 (IAT Sensor), P0115, P0116, P0117, P0118 (ECT Sensor), P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (TP Sensor), P0125 (Insufficient ECT for Closed Loop), P0171, P0172 (Fuel System), P0300, P0301, P0302, P0303, P0304, P0305, P0306 (Misfire), P0335 (CKP Sensor), P0340 (CMP Sensor), P0450, P0451, P0452, P0453 (EVAP System), P0500 (VSS), P2196, P2198 (A/F Sensor (Rationality))
Active A/F control	Performing
Active A/F control is performed when the following conditions are met	-
Battery voltage	11 V or more
Engine coolant temperature	75°C (167°F) or more
Idle	OFF
Engine RPM	Less than 4000 rpm
A/F sensor status	Activated
Fuel-cut	OFF
Engine load	10 to 70%

Shift position	2 or more
Catalyst monitor	Not yet
MAF	2.5 to 15 g/s

TYPICAL MALFUNCTION THRESHOLDS

Response rate deterioration level	Less than 0.18 V

MONITOR RESULT

Refer to CHECKING MONITOR STATUS (See page ES-19).

ES

WIRING DIAGRAM

Refer to DTC P2195 (See page ES-359).

INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be identified by performing the A/F CONTROL function provided in the ACTIVE TEST. The A/F CONTROL function can help to determine whether the Air-Fuel Ratio (A/F) sensor, Heated Oxygen (HO2) sensor and other potential trouble areas are malfunctioning.

The following instructions describe how to conduct the A/F CONTROL operation using an intelligent tester.

(a) Connect the intelligent tester to the DLC3.

(b) Start the engine and turn the tester on.

(c) Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.

(d) Select the following menu items on the tester: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL.

(e) 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).

(f) Monitor the voltage outputs of the A/F and HO2 sensors (AFS B1S1 and O2S B1S2 or AFS B2S1 and O2S B2S2) 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 voltage

Tester Display (Sensor)	Injection Volumes	Status	Voltages
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 or O2S B2S2 (HO2)	+25%	Rich	More than 0.55
O2S B1S2 or O2S B2S2 (HO2)	-12.5%	Lean	Less than 0.4

NOTICE:

The Air-Fuel Ratio (A/F) sensor has an output delay of a few seconds and the Heated Oxygen (HO2) sensor has a maximum output delay of approximately 20 seconds.

Case	A/F Sensor (Sensor 1) Output Voltage	HO2 Sensor (Sensor 2) Output Voltage	Main Suspected Trouble Area
1	**Injection Volume:** +25 % / -12.5 % **Output Voltage:** More than 3.35 V / Less than 3.0 V — OK	**Injection Volume:** +25 % / -12.5 % **Output Voltage:** More than 0.55 V / Less than 0.4 V — OK	-
2	**Injection Volume:** +25 % / -12.5 % **Output Voltage:** Almost no reaction — NG	**Injection Volume:** +25 % / -12.5 % **Output Voltage:** More than 0.55 V / Less than 0.4 V — OK	• A/F sensor • A/F sensor heater • A/F sensor circuit
3	**Injection Volume:** +25 % / -12.5 % **Output Voltage:** More than 3.35 V / Less than 3.0 V — OK	**Injection Volume:** +25 % / -12.5 % **Output Voltage:** Almost no reaction — NG	• HO2 sensor • HO2 sensor heater • HO2 sensor circuit
4	**Injection Volume:** +25 % / -12.5 % **Output Voltage:** Almost no reaction — NG	**Injection Volume:** +25 % / -12.5 % **Output Voltage:** Almost no reaction — NG	• Fuel pressure • Gas leakage from exhaust system (Air-fuel ratio extremely lean or rich)

– Following the A/F CONTROL procedure enables technicians to check and graph the voltage outputs of both the A/F and HO2 sensors.
– To display the graph, select the following menu items on the tester: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL / USER DATA / AFS B1S1 and O2S B1S2 or AFS B2S1 and O2S B2S2. Press the YES button and then the ENTER button. Then press the F4 button.
HINT:
• DTC P2A00 or P2A03 may be also set when the air-fuel ratio is stuck rich or lean.

ES

- 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 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 ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P2A00 AND/OR P2A03)

ES

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) Turn the tester on.
(d) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(e) Read the DTCs.

Result

Display (DTC Output)	Proceed to
P2A00 and/or P2A03	A
P2A00 and/or P2A03 and other DTCs	B

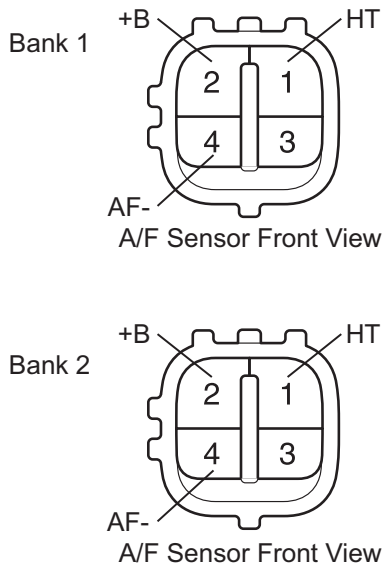
HINT:
If any DTCs other than P2A00 or P2A03 are output, troubleshoot those DTCs first.

B → **GO TO DTC CHART (See page ES-56)**

A

2	INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)

Component Side:



(a) Disconnect the A5 or A6 A/F sensor connector.

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

Standard resistance:

Bank 1

Tester Connection	Specified Condition
HT (1) - +B (2)	1.8 to 3.4 Ω at 20°C (68°F)
HT (1) - AF- (4)	10 kΩ or higher

Bank 2

Tester Connection	Specified Condition
HT (1) - +B (2)	1.8 to 3.4 Ω at 20°C (68°F)
HT (1) - AF- (4)	10 kΩ or higher

(c) Reconnect the A/F sensor connector.

Result

Result	Proceed to
OK	A
NG (for 2WD model)	B
NG (for 4WD model)	C

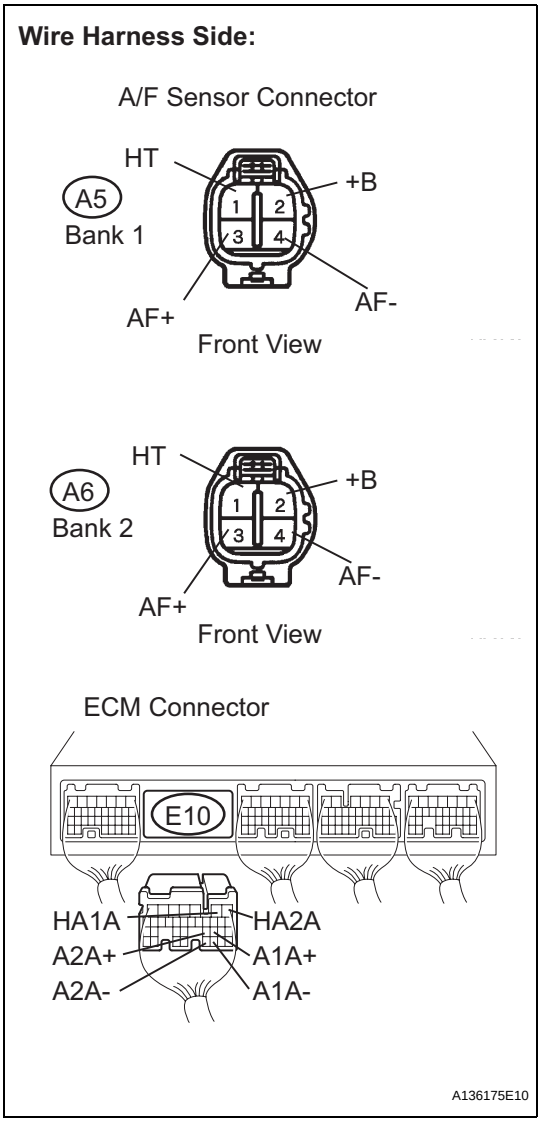
B → **REPLACE AIR FUEL RATIO SENSOR (See page EC-19)**

C → **REPLACE AIR FUEL RATIO SENSOR (See page EC-26)**

A

ES

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



(a) Disconnect the A5 or A6 A/F 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
+B (A5-2) - Body ground	9 to 14 V
+B (A6-2) - Body ground	9 to 14 V

(d) Turn the ignition switch off.
(e) Disconnect the E10 ECM connector.
(f) Measure the resistance according to the value(s) in the table below.

Standard resistance:

Check for open

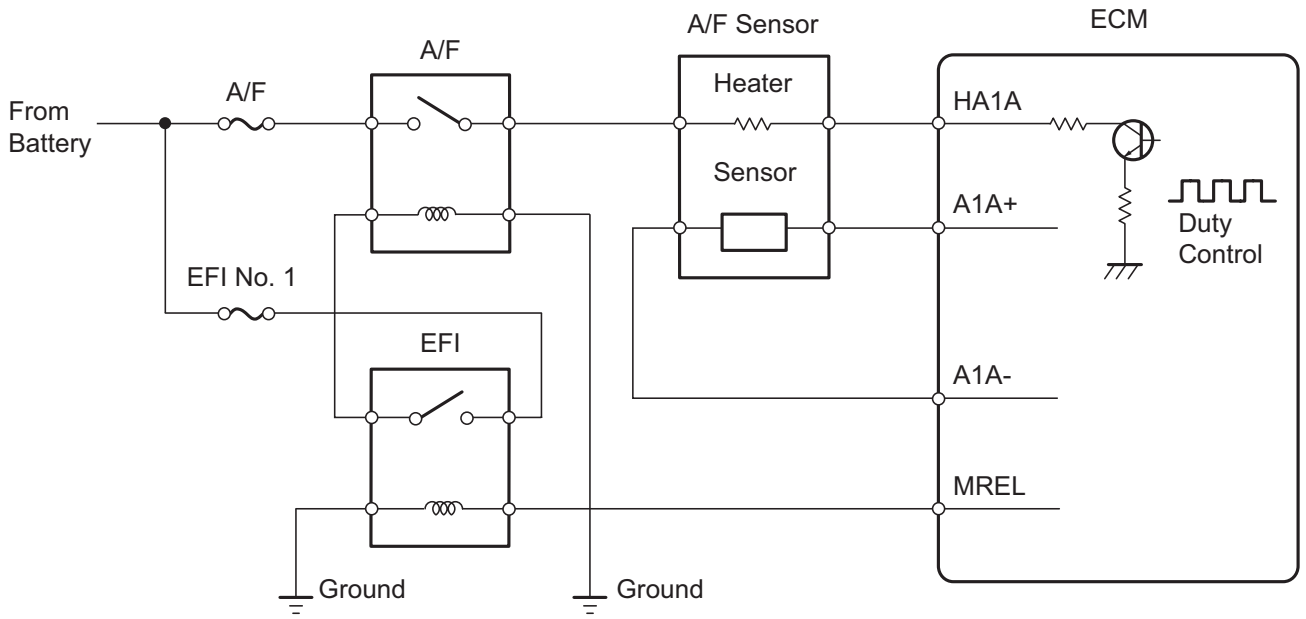
Tester Connection	Specified Condition
HT (A5-1) - HA1A (E10-2)	Below 1 Ω
AF+ (A5-3) - A1A+ (E10-22)	Below 1 Ω
AF- (A5-4) - A1A- (E10-30)	Below 1 Ω
HT (A6-1) - HA2A (E10-1)	Below 1 Ω
AF+ (A6-3) - A2A+ (E10-23)	Below 1 Ω
AF- (A6-4) - A2A- (E10-31)	Below 1 Ω

Check for short

Tester Connection	Specified Condition
HT (A5-1) or HA1A (E10-2) - Body ground	10 kΩ or higher
AF+ (A5-3) or A1A+ (E10-22) - Body ground	10 kΩ or higher
AF- (A5-4) or A1A- (E10-30) - Body ground	10 kΩ or higher
HT (A6-1) or HA2A (E10-1) - Body ground	10 kΩ or higher
AF+ (A6-3) or A2A+ (E10-23) - Body ground	10 kΩ or higher
AF- (A6-4) or A2A- (E10-31) - Body ground	10 kΩ or higher

(g) Reconnect the ECM connector.
(h) Reconnect the A/F sensor connector.

Reference (System Diagram of Bank 1 Sensor 1):



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (A/F SENSOR - ECM)**

OK

4	PERFORM CONFIRMATION DRIVING PATTERN

NEXT

5	CHECK WHETHER DTC OUTPUT RECURS (DTC P2A00 AND/OR P2A03)

(a) Read the DTCs using the intelligent tester.
(b) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DTC INFO / PENDING CODES.

Result

Display (DTC Output)	Proceed to
P2A00 and/or P2A03	A
No output	B

B → **CHECK FOR INTERMITTENT PROBLEMS**

A

6	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor (for 2WD model (See page EC-19) or 4WD model (See page EC-26)).

NEXT

7	PERFORM CONFIRMATION DRIVING PATTERN

NEXT

8	CHECK WHETHER DTC OUTPUT RECURS (DTC P2A00 AND/OR P2A03)

(a) Read the DTCs using the intelligent tester.
(b) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DTC INFO / PENDING CODES.

ES

Result

Display (DTC Output)	Proceed to
No output	A
P2A00 and/or P2A03	B

B → REPLACE ECM

A

END