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Model Year: 2013		Model: FR-S	Doc ID: RM000000PDV0M3X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0016-P0019: Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A) (2013 FR-S)			
DTC	P0016	Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A)	
DTC	P0017	Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor B)	
DTC	P0018	Crankshaft Position - Camshaft Position Correlation (Bank 2 Sensor A)	
DTC	P0019	Crankshaft Position - Camshaft Position Correlation (Bank 2 Sensor B)	

DESCRIPTION

In the VVT (Variable Valve Timing) system, the appropriate intake and exhaust valve open and close timing is controlled by the ECM. The ECM performs intake and exhaust valve control by performing the following: 1) controlling the camshaft and camshaft timing oil control valve, and operating the camshaft timing gear; and 2) changing the relative positions of the camshaft and crankshaft.

DTC No.	DTC Detection Condition	Trouble Area
P0016	One of the following conditions is met (2 trip detection logic): <ul style="list-style-type: none">• Slip intake valve timing for 1 second (bank 1).• Intake camshaft position has slipped from the central lock position for 1 second (bank 1).	<ul style="list-style-type: none">• Valve timing• Camshaft timing oil control valve (for intake side of bank 1)• Oil control valve filter (bank 1)• Camshaft timing gear assembly (for intake side of bank 1)• ECM
P0017	One of the following conditions is met (2 trip detection logic): <ul style="list-style-type: none">• Slip exhaust valve timing for 5 seconds (bank 1).• Exhaust camshaft position has slipped from the central lock position for 5 seconds (bank 1).	<ul style="list-style-type: none">• Valve timing• Camshaft timing oil control valve (for exhaust of bank 1)• Oil control valve filter (bank 1)• Camshaft timing gear assembly (for exhaust side of bank 1)• ECM

DTC No.	DTC Detection Condition	Trouble Area
P0018	One of the following conditions is met (2 trip detection logic): <ul style="list-style-type: none">• Slip intake valve timing for 1 second (bank 2).• Intake camshaft position has slipped from the central lock position for 1 second (bank 2).	<ul style="list-style-type: none">• Valve timing• Camshaft timing oil control valve (for intake side of bank 2)• Oil control valve filter (bank 2)• Camshaft timing gear assembly (for intake side of bank 2)• ECM
P0019	One of the following conditions is met (2 trip detection logic): <ul style="list-style-type: none">• Slip exhaust valve timing for 5 seconds (bank 2).• Exhaust camshaft position has slipped from the central lock position for 5 seconds (bank 2).	<ul style="list-style-type: none">• Valve timing• Camshaft timing oil control valve (for exhaust side of bank 2)• Oil control valve filter (bank 2)• Camshaft timing gear assembly (for exhaust side of bank 2)• ECM

MONITOR DESCRIPTION

To monitor the correlation of the intake camshaft position and crankshaft position, the ECM checks the VVT learned value while the engine is idling. The VVT learned value is calibrated based on the camshaft position and crankshaft position. The intake valve timing is set to the most retarded angle while the engine is idling. If the VVT learned value is out of the specified range in consecutive driving cycles, the ECM illuminates the MIL and stores DTC P0016 (bank 1) or P0018 (bank 2).

To monitor the correlation of the exhaust camshaft position and crankshaft position, the ECM checks the VVT learned value while the engine is idling. The VVT learned value is calibrated based on the camshaft position and crankshaft position. The exhaust valve timing is set to the most advanced angle while the engine is idling. If the VVT learned value is out of the specified range in consecutive driving cycles, the ECM illuminates the MIL and stores DTC P0017 (bank 1) or P0019 (bank 2).

MONITOR STRATEGY

Related DTCs	<p>P0016: Crankshaft / Camshaft correlation (intake) functional check (Bank 1)</p> <p>P0017: Crankshaft / Camshaft correlation (exhaust) functional check (Bank 1)</p> <p>P0018: Crankshaft / Camshaft correlation (intake) functional check (Bank 2)</p>
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	P0019: Crankshaft / Camshaft correlation (exhaust) functional check (Bank 2)
Required Sensors/Components (Main)	Camshaft timing gear assembly Camshaft timing exhaust gear assembly
Required Sensors/Components (Related)	VVT sensor Crankshaft position sensor
Frequency of Operation	Continuous
Duration	1 second: P0016, P0018 5 second: P0017, P0019
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs not stored	None
Battery voltage	10.9 V or more
Elapsed time after engine start	60 seconds or more
Engine coolant temperature	50°C (122°F) or higher
VVT feedback control	Not active

VVT target position	Less than 0.01°CA
Learning experienced flag	Set
Duration of no power steering switch change	3 seconds or more
Duration of no neutral switch change	3 seconds or more

P0016, P0018

Engine speed	1400 to 3000 rpm
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P0017, P0019

Engine speed	500 to 1700 rpm
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TYPICAL MALFUNCTION THRESHOLDS**P0016, P0018 (One tooth misalignment)**

Actual angle of camshaft - Learning value of the base position	10°CA or more
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P0016, P0018 (Two teeth misalignment)

Actual angle of camshaft	Less than 28°CA or more than 87°CA
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P0017, P0019 (One tooth misalignment)

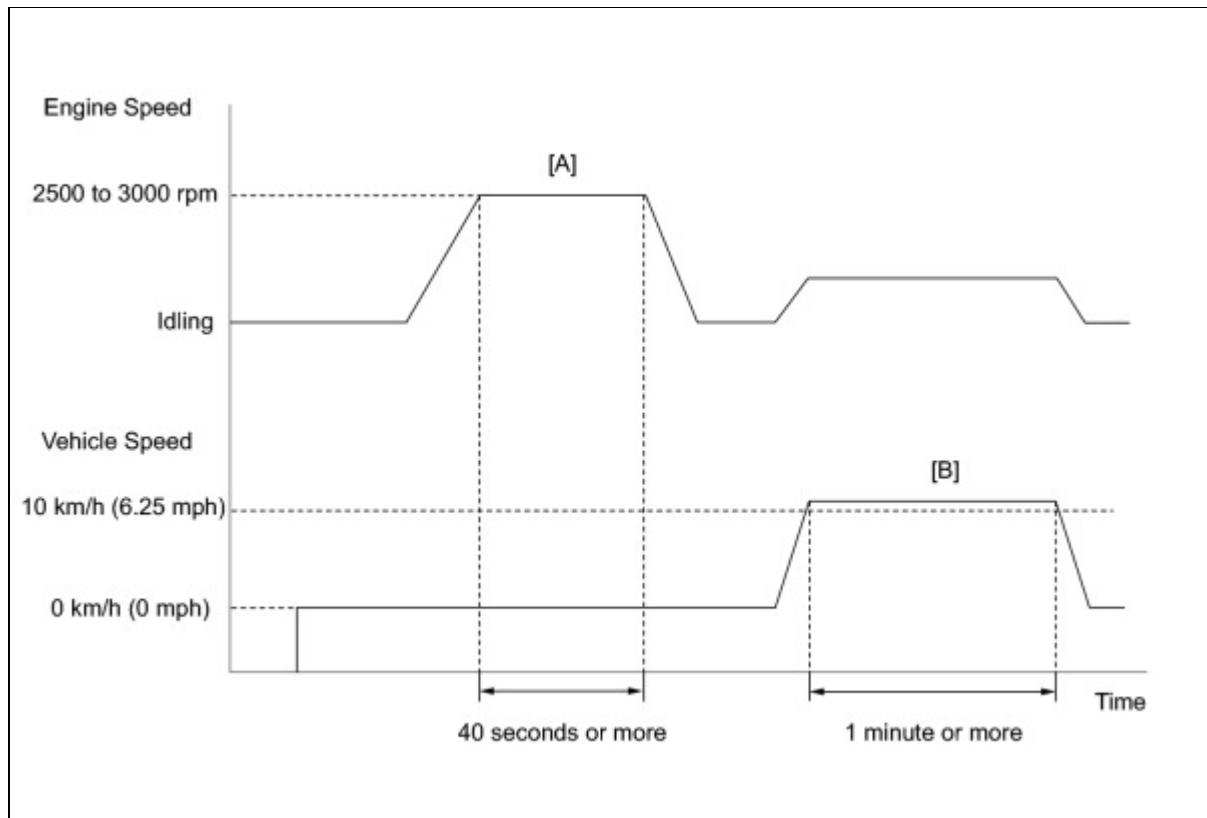
Actual angle of camshaft - Learning value of the base position	10°CA or more
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P0017, P0019 (Two teeth misalignment)

Actual angle of camshaft

Less than 58°C_A or more than 117°C_A

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO.
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.


HINT:

- If a pending DTC is output, the system is malfunctioning.

- If a pending DTC is not output, perform the following procedure.
- 11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
- 12. Input the DTC: P0016, P0017, P0018 or P0019.
- 13. Check the DTC judgment result.

Techstream Display	Description
NORMAL	<ul style="list-style-type: none">○ DTC judgment completed○ System normal
ABNORMAL	<ul style="list-style-type: none">○ DTC judgment completed○ System abnormal
INCOMPLETE	<ul style="list-style-type: none">○ DTC judgment not completed○ Perform driving pattern after confirming DTC enabling conditions
N/A	<ul style="list-style-type: none">○ Unable to perform DTC judgment○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit


HINT:

- If the judgment result shows NORMAL, the system is normal.
 - If the judgment result shows ABNORMAL, the system has a malfunction.
14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0010 for the camshaft timing oil control valve (for intake camshaft) circuit .

Refer to DTC P0013 for the camshaft timing oil control valve (for exhaust camshaft) circuit .

INSPECTION PROCEDURE

HINT:

- If DTC P0016 or P0017 is displayed, check the intake camshaft circuit for the right bank VVT system (bank 1).
- If DTC P0018 or P0019 is displayed, check the intake camshaft circuit for the left bank VVT system (bank 2).
- Bank 1 refers to the bank that includes the No. 1 cylinder*.

*: The No. 1 cylinder is the cylinder which is farthest from transmission.

- Bank 2 refers to the bank that does not include the No. 1 cylinder.
- Read freeze frame data using the Techstream. 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 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.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0016, P0017, P0018 OR P0019)
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- Connect the Techstream to the DLC3.
- Turn the ignition switch to ON.
- Turn the Techstream on.
- Enter the following menus: Powertrain / Engine / Trouble Codes.
- Read DTCs.

Result

Result	Proceed to
DTC P0016, P0017, P0018 or P0019 is output	A
DTC P0016, P0017, P0018 or P0019 and other DTCs are output	B

HINT:

If any DTCs other than P0016, P0017, P0018 or P0019 are output, troubleshoot those DTCs first.

B  [GO TO DTC CHART](#)

A


2.	PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE CAMSHAFT TIMING OIL CONTROL VALVE)
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HINT:

If the VVT system can be operated through the Active Test, it can be assumed that the VVT system is operating normally.

- (a) Connect the Techstream to the DLC3.
- (b) Start the engine.
- (c) Turn the A/C on.
- (d) Turn the Techstream on.
- (e) Warm up the engine.
- (f) Enter the following menus: Powertrain / Engine / Active Test / Control the VVT Linear (Bank 1) or Control the VVT Exhaust Linear (Bank 1) / VVT Change Angle #1, VVT Ex Chg Angle #1, VVT Change Angle #2, VVT Ex Chg Angle #2.
- (g) Perform the Active Test. Check that the displacement angle varies.


OK:

Displacement angle varies.

NG ► [INSPECT CAMSHAFT TIMING OIL CONTROL VALVE \(FOR INTAKE OR EXHAUST CAMSHAFT\)](#)

OK
▼

3.	CHECK VALVE TIMING
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- (a) Check the valve timing .


Result

Result	Proceed to
NG	A
OK	B

B ► [CHECK WHETHER DTC OUTPUT RECURS \(DTC P0016, P0017, P0018 OR P0019\)](#)

A ▶ [ADJUST VALVE TIMING](#)

4.	INSPECT CAMSHAFT TIMING OIL CONTROL VALVE (FOR INTAKE OR EXHAUST CAMSHAFT)
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(a) Inspect the camshaft timing oil control valve (for intake or exhaust camshaft)  .

NG ▶ [REPLACE CAMSHAFT TIMING OIL CONTROL VALVE \(FOR INTAKE OR EXHAUST CAMSHAFT\)](#)

OK

5.	INSPECT OIL CONTROL VALVE FILTER AND OIL PIPE
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(a) Check that the oil control valve filter and oil pipe are not clogged.


OK:

The oil control valve filter and oil pipe are not clogged.

NG ▶ CLEAN OR REPLACE OIL CONTROL VALVE FILTER AND OIL PIPE

OK

6.	INSPECT CAMSHAFT TIMING GEAR ASSEMBLY (FOR INTAKE OR EXHAUST CAMSHAFT)
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(a) Inspect the camshaft timing gear assembly (for intake camshaft or exhaust camshaft)  .


NG ▶ [REPLACE CAMSHAFT TIMING GEAR ASSEMBLY \(INTAKE OR EXHAUST CAMSHAFT\)](#)

OK

7.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0016, P0017, P0018 OR P0019)
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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

- (c) Turn the Techstream on.
- (d) Clear the DTCs .
- (e) Turn the ignition switch off and wait for at least 30 seconds.
- (f) Turn the ignition switch to ON.
- (g) Turn the Techstream on.
- (h) Start the engine and warm it up.
- (i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.
- (j) Enter the following menus: Powertrain / Engine / Trouble Codes / Pending.
- (k) Read pending DTCs.

Result

Result	Proceed to
DTC is not output	A
DTC P0016, P0017, P0018 or P0019 is output	B

B  [REPLACE ECM](#)

A  END

