

ESA (Electronic Spark Advance)

- This system selects the optimal ignition timing in accordance with the signals received from the sensors and sends the (IGt) ignition signal to the igniter. The ignition timing can be expressed by the formula given below. The default ignition timing is set to 5° BTDC.

Calculation of ignition timing

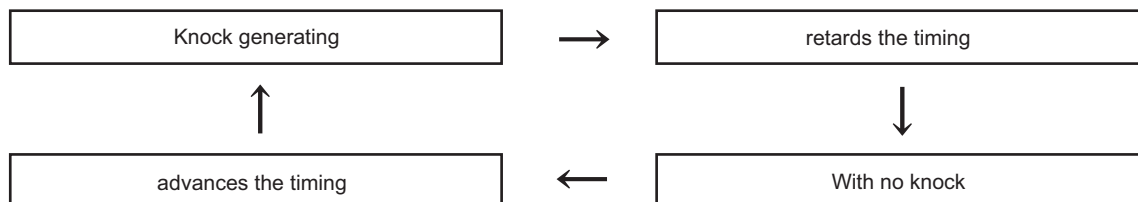
❖REFERENCE❖

Ignition Timing = A. Default Ignition Timing or B. Basic Timing Advance + C. Correction Timing Advance

A.Fixed Timing Advance Characteristic	During the starting of the engine, the timing is fixed to 5° BTDC. If the throttle valve is turned OFF and shorting the service terminals, the timing becomes fixed to 10° BTDC.
B.Basic Timing Advance Characteristic	The optimal ignition timing is selected from the map based on the signals received from the sensors.
C.Correction Timing Advance Characteristic	Appropriately advances or retards the timing in accordance with the conditions of the engine based on the signals received from the sensors.
C-1 Warm-Up Timing Advance Characteristic	Advances the ignition timing in accordance with the driving conditions when the engine coolant temperature is low, in order to improve drivability.
C-2 Idle Stabilization Timing Advance Characteristic	Advances the ignition timing when the idle speed decreases, in order to stabilize the idle speed. Conversely, retards the timing if the idle speed increases.
C-3 Transient Correction Timing Retard	Retards the ignition timing during sudden acceleration when the water temperature is higher than 60°C, in order to prevent the engine from knocking.
C-4 Acceleration Timing Retard	Temporarily retards the ignition timing during acceleration in order to improve drivability.
C-5 Knock Correction Timing Retard	Corrects the ignition timing in accordance with the signals received from the knock sensor when knocking occurs. Depending on the extent of the knocking that is detected, this function retards the timing by a prescribed angle at a time until there is no more knocking. After no more knocking occurs, this function advances the timing by a prescribed angle at a time. If knocking occurs again while advancing the timing, it retards the timing again.

Knock Control System

- When the engine ECU detects the engine knocking, it retards the timing, depending on the extent of knocking, by one predetermined angle at a time until the engine stops knocking.
- When the engine stops knocking, the engine ECU advances the timing by one predetermined angle at a time. If the engine starts knocking again, the engine ECU retards the timing again.



Knocking Feedback Control

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Maximum and Minimum Timing Advance Characteristics

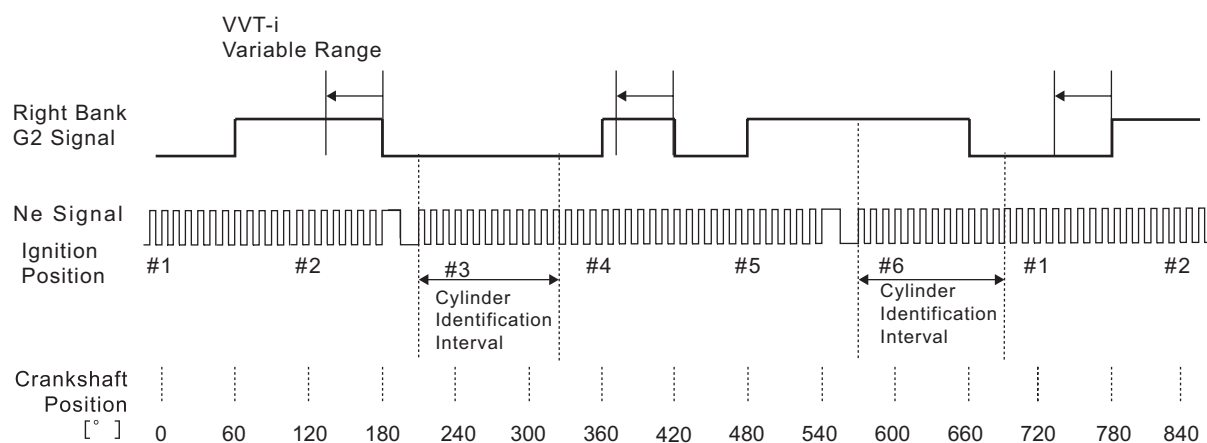
- The maximum and minimum timing advance angles are fixed because the engine can be adversely affected if the ignition timing advances or retards abnormally.

Maximum and Minimum Timing Advance Angles

Maximum Timing Advance Angle (BTDC)	49°
Minimum Timing Advance Angle (ATDC)	-20°

Calculation of ignition timing

- Based on the Ne and G2 signals, airflow meter signal, accelerator position signal, and water temperature signal, the engine ECU calculates the optimal ignition timing to suit the driving conditions. Then, the engine ECU sends an ignition signal to the ignition coil with a built-in igniter.



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