Caution
- **Vehicle specifications differ depending on the vehicle identification number (VIN).**
  - **— Type A VIN:**
    - **JM0 KE****** 100001−**
    - **JM6 KE****** 100001−**
    - **JM7 KE****** 100001−**
    - **JM8 KE****** 100001−**
    - **JMZ KE****** 100001−**
    - **KE10** 100001−**
  - **— Type B VIN:**
    - **JM0 KE****** 200001−**
    - **JM6 KE****** 200001−**
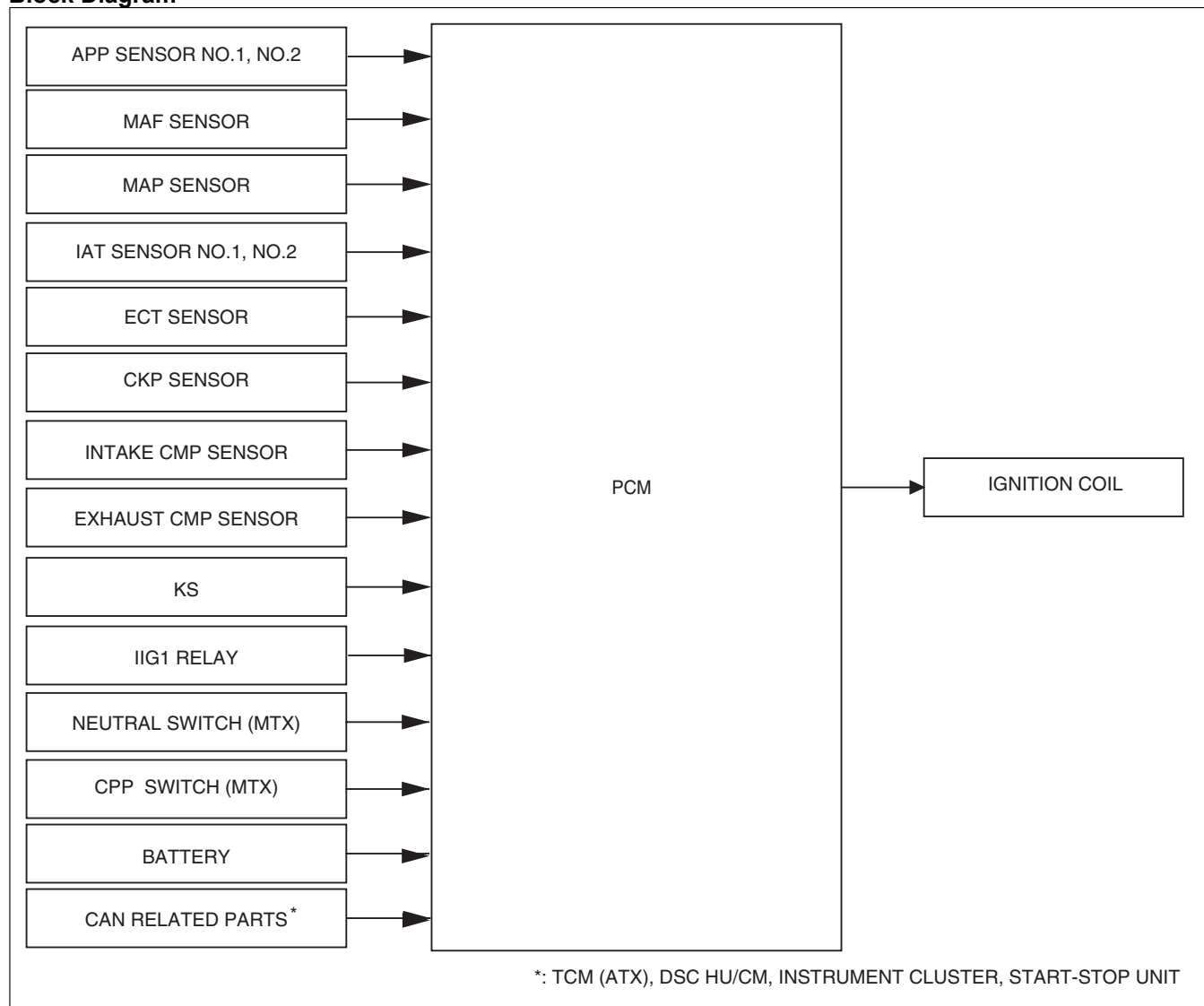   - **JM8 KE****** 200001−**
    - **JMZ KE****** 200001−**
    - **KE10** 200001−**

Outline
- Controls ignition to optimum timing according to engine operation conditions.
- Serviceability has been improved by eliminating the necessity of ignition timing adjustment.
- The PCM determines the engine operation conditions based on input signals from each sensor and blocks current to the ignition coils at the calculated ignition timing, causing the spark plugs to discharge (ignite) by the effect of electromagnetic mutual induction.
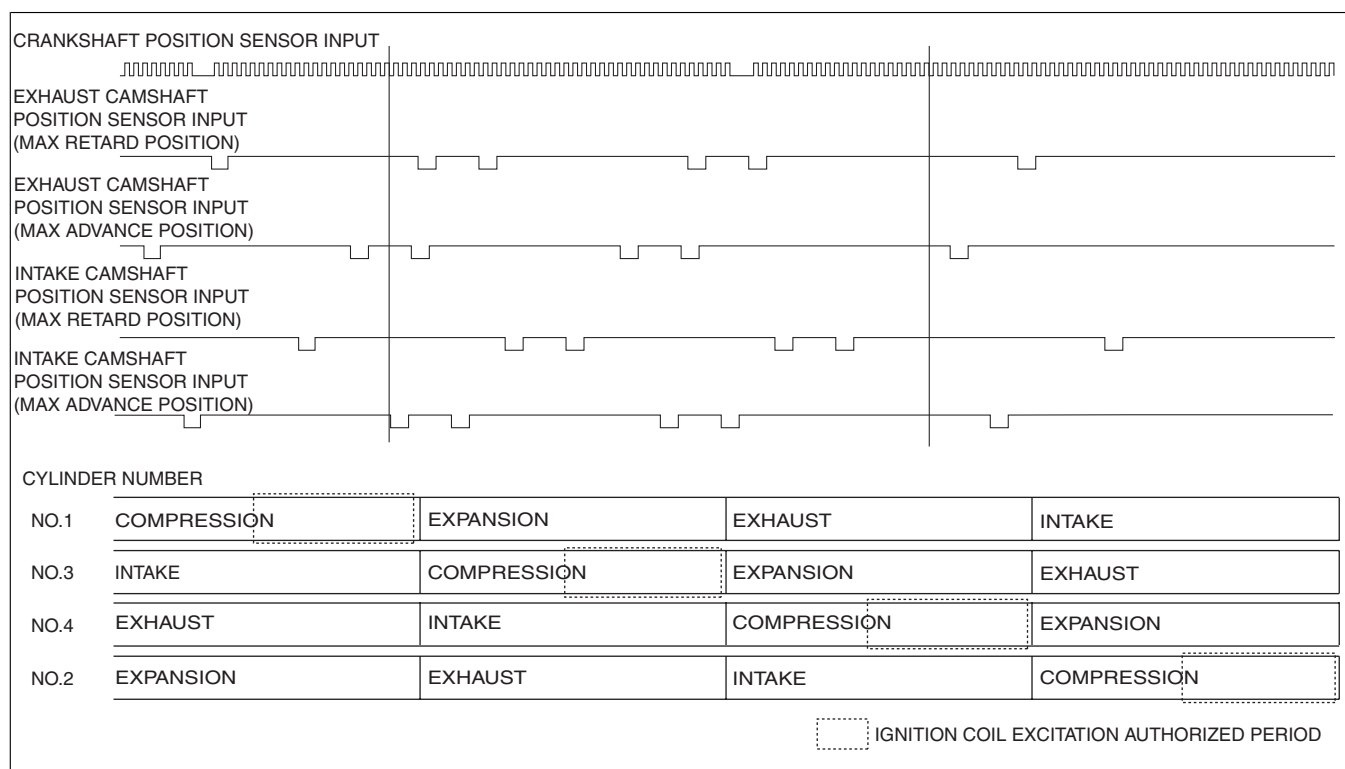
Block Diagram

APP SENSOR NO.1, NO.2	→		
MAF SENSOR	→		
MAP SENSOR	→		
IAT SENSOR NO.1, NO.2	→		
ECT SENSOR	→		
CKP SENSOR	→	PCM	→ IGNITION COIL
INTAKE CMP SENSOR	→		
EXHAUST CMP SENSOR	→		
KS	→		
IIG1 RELAY	→		
NEUTRAL SWITCH (MTX)	→		
CPP SWITCH (MTX)	→		
BATTERY	→		
CAN RELATED PARTS *	→		

*: TCM (ATX), DSC HU/CM, INSTRUMENT CLUSTER, START-STOP UNIT

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Operation
Ignition method
- The PCM energizes the ignition coils according to the ignition timing calculated from the engine operation conditions and the igniter energization time.
- The igniter energization time (ignition coil energization time) is determined according to battery voltage and engine speed.

Timing chart

CRANKSHAFT POSITION SENSOR INPUT

EXHAUST CAMSHAFT
POSITION SENSOR INPUT
(MAX RETARD POSITION)

EXHAUST CAMSHAFT
POSITION SENSOR INPUT
(MAX ADVANCE POSITION)

INTAKE CAMSHAFT
POSITION SENSOR INPUT
(MAX RETARD POSITION)

INTAKE CAMSHAFT
POSITION SENSOR INPUT
(MAX ADVANCE POSITION)

CYLINDER NUMBER

|				
NO.1	COMPRESSION	EXPANSION	EXHAUST	INTAKE
NO.3	INTAKE	COMPRESSION	EXPANSION	EXHAUST
NO.4	EXHAUST	INTAKE	COMPRESSION	EXPANSION
NO.2	EXPANSION	EXHAUST	INTAKE	COMPRESSION

⬚ IGNITION COIL EXCITATION AUTHORIZED PERIOD

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Determination of Ignition Timing (Type A VIN)
Division of control zones
- To perform optimum ignition control under all engine operation conditions, the PCM:
  — Divides the engine control operation into each control zone according to the engine speed and accelerator pedal opening angle.
  — Determines the ignition timing for each control zone.
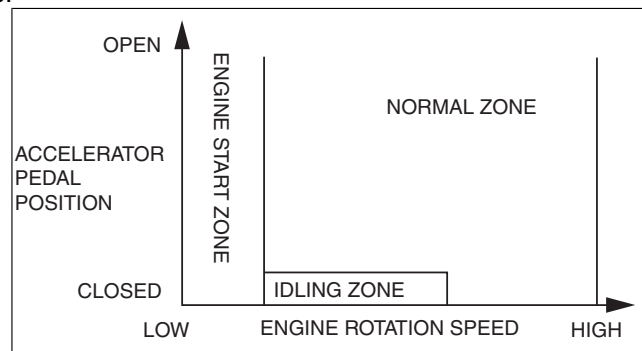
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Control zone	Control condition	Ignition method
Engine start	Engine speed is less than 500 rpm	Engine starting
Idle zone	Accelerator pedal not depressed	(Cycle estimated ignition) (Determines ignition timing adding each correction to idle spark advance)
Normal zone	Engine operation except start and idling zones	(Cycle estimated ignition) (Determines ignition timing adding each correction to basic spark advance)

Ignition timing calculation method table

A: Ignition timing base, B: Correction for ignition timing

Contents		Calculation method or determination method for ignition timing, spark advance, and correction	Control zone		
			ENGINE START ZONE	IDLING ZONE	NORMAL ZONE
Starting ignition		Determination based on engine coolant temperature	A		
Cycle estimated ignition	**Idle spark advance**	**Set value according to target speed and charging efficiency**[*]		A	
	Basic spark advance	**Set value according to engine speed and charging efficiency**[*]			A
Correction	Engine coolant temperature spark advance correction	Purpose: Ensures combustion stability when engine coolant temperature is low **According to engine coolant temperature** • High charging efficiency[*], low engine coolant temperature→large correction		B	B
	Intake air temperature correction	Purpose: Suppresses knocking when engine intake air temperature is high **According to engine intake air temperature and engine coolant temperature** • High engine intake air temperature, high engine intake air temperature→large correction			B
	Warm-up promotion spark retard correction	Purpose: Activates the catalytic converter earlier **Maximum 50 s after engine start** • According to engine coolant temperature→correction		B	
	Idle speed feedback correction	Purpose: Ensures idling stability **While idling (inhibited during test mode)** • Large difference between actual engine speed and target engine speed→large correction • Small difference between actual engine speed and target engine speed→small correction		B	
	Torque reduction correction	Purpose: Such as reduction of shift shock, traction control, or suppression of vehicle vibration **According to torque reduction request from PCM, TCM, or DSC** • Large torque reduction request→large correction			B
	Deceleration fuel cut recovery retard correction	Purpose: Reduces shock during recovery from deceleration fuel cut **Recovery from deceleration fuel cut** • Correction according to time since fuel cut recovery		B	B
	Knocking spark retard correction	Purpose: Knocking suppression **Acceleration when charging efficiency[*] volume increase (acceleration amount) is given value or more** • Large acceleration amount→large correction			B
	Valve timing correction	Purpose: Ensures combustion stability **When phase difference changes due to electric variable valve timing control and variable valve timing control** • Correction according to change in phase difference			B

[*] : Charging efficiency is the ratio of the actual amount of intake air to the maximum air charging amount (mass volume) of the cylinder. This value increases proportionately to the increase in engine load.

Determination of Ignition Timing (Type B VIN)
Division of control zones
• The PCM performs different ignition controls for engine starting and those other than engine starting to stabilize the engine starting.

Control zone	Control condition	Ignition method
Engine start zone	Engine speed is less than 500 rpm	Engine starting

Control zone	Control condition	Ignition method
Normal zone	Engine operation except engine start zone	(Cycle estimated ignition) (Determines ignition timing adding each correction to basic spark advance)

Ignition timing calculation method table

A: Ignition timing base, B: Correction for ignition timing

Contents		Calculation method or determination method for ignition timing, spark advance, and correction	ENGINE START ZONE	NORMAL ZONE
Starting ignition		Determination based on engine coolant temperature	A	
Cycle estimated ignition	**Basic spark advance**	**Set value according to engine speed and charging efficiency***		A
Correction	Engine coolant temperature spark advance correction	Purpose: Ensures combustion stability when engine coolant temperature is low **According to engine coolant temperature** • High charging efficiency*, low engine coolant temperature→large correction		B
	Intake air temperature correction	Purpose: Suppresses knocking when engine intake air temperature is high **According to engine intake air temperature and engine coolant temperature** • High engine intake air temperature, high engine intake air temperature→ large correction		B
	Warm-up promotion spark retard correction	Purpose: Activates the catalytic converter earlier **Maximum 50 s after engine start** • According to engine coolant temperature→correction		B
	Torque reduction correction	Purpose: Such as reduction of shift shock, traction control, or suppression of vehicle vibration **According to torque reduction request from TCM, or DSC** • Large torque reduction request→large correction		B
	Knocking spark retard correction	Purpose: Knocking suppression **Acceleration when charging efficiency* volume increase (acceleration amount) is given value or more** • Large acceleration amount→large correction		B
	Valve timing correction	Purpose: Ensures combustion stability **When phase difference changes due to electric variable valve timing control and variable valve timing control** • Correction according to change in phase difference		B

*: Charging efficiency is the ratio of the actual amount of intake air to the maximum air charging amount (mass volume) of the cylinder. This value increases proportionately to the increase in engine load.

- If immobilizer system related information (engine start prohibited) is received from the start stop unit, the PCM stops ignition.
- When a collision signal is received from the SAS control module, the PCM stops the ignition.