PCM [SKYACTIV-D 2.2]

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Purpose/Function

- High-level driveability and lower fuel consumption have been realized by controlling the appropriate engine conditions (fuel injection/ignition timing) according to operation conditions.
- Controls each output part based on the signal from each input part.
- The control descriptions are as shown below.

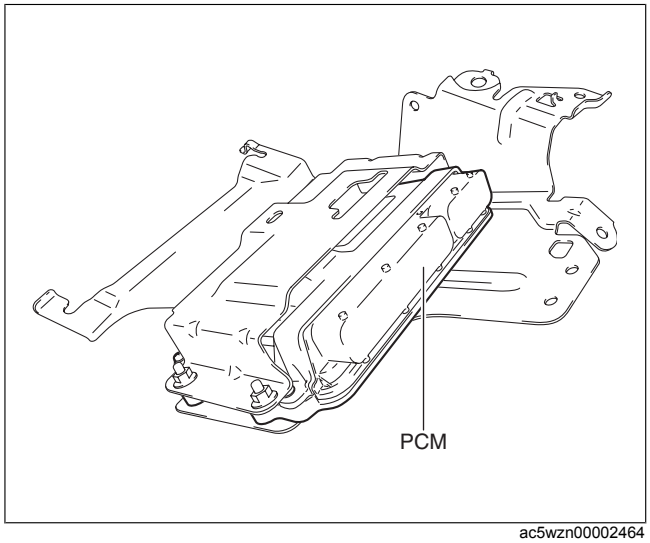
Function	Description
Main relay control	• Supplies power to each part by switching the main relay on/off at the optimal timing according to the vehicle conditions.
Idle speed control	• The PCM controls the fuel injection amount so that the target idle speed according to the engine operation conditions is obtained.
Two-stage turbo control	• By switching the air charging between the large-type turbocharger and small-type turbocharger, driveability under a wide range of conditions and emission performance have been improved. • The following 3 solenoid valves are driven according to the engine operation conditions to switch the air charging between the large-type turbocharger and small-type turbocharger. — Compressor bypass solenoid valve • The compressor bypass valve opens/closes according to the on/off signal from the PCM. — Regulating solenoid valve • The regulating valve opens/closes according to the duty signal from the PCM. — Wastegate solenoid valve • The wastegate valve opens/closes according to the duty signal from the PCM.
Intake stroke EGR using double exhaust valve actuation system (IDEVA) control	• The exhaust valve is opened during the intake stroke according to the engine operation conditions. • The PCM controls the exhaust valve open/close during the intake stroke by operating the OCV and switching the engine oil passages based on the engine operation conditions. • By opening the exhaust valve during the intake process, high temperature exhaust gas flows back (inside EGR) and the temperature of the air in the cylinder is raised to realize combustion stability during cold temperatures. • During DPF regeneration control (auto DPF regeneration control), supply of high temperature exhaust gas to the DPF is required, external EGR is inhibited by the EGR valve and EGR cooler bypass valve operation, and NOx is reduced by introducing internal EGR.
Fuel injection amount control	• The fuel injection amount is controlled by the opening of the nozzle in the fuel injector based on the signal from the PCM. • The PCM learns and corrects the variation in the fuel injection amount of each cylinder.
Multiple fuel injection control	• Multiple fuel injection control has been adopted in which the number of fuel injections is divided over several times for the purpose of noise and NOx reduction. — For single injection, a greater amount of fuel is consumed to inject the necessary amount of fuel at one time. For this reason, the fuel is combusted rapidly at a high temperature and high pressure, resulting in increased noise and NOx. — In multiple injection, combustion is performed more slowly to divide the necessary fuel amount over several times, thus controlling noise and the occurrence of NOx. • The PCM injects fuel several times prior to the main injection according to the vehicle operation conditions. (Pilot injection) • During fast idle increase and DPF generation control, fuel is injected after the main injection to increase the temperature. (Follow-up injection, post injection)
Fuel injection timing control	• The PCM determines and controls the optimum fuel injection timing according to engine operation conditions based on the signals from each input sensor.
Fuel pressure control	• The PCM performs feedback control of the fuel pressure in the common rail to gain optimum fuel injection pressure according to engine operation conditions. • Because the fuel pressure can be controlled regardless of the engine operation conditions, high pressure fuel injection even at low engine speeds is possible. As a result, generation of NOx and PM can be reduced.
Intake shutter valve control	• The PCM controls the intake shutter valve when the following controls are performed. — EGR control: It is difficult to recirculate exhaust gas because of the influence of the two-stage air charging pressure, therefore, the intake shutter valve is closed during EGR control to make recirculated exhaust gas induction easier. — DPF regeneration control: Intake air is reduced during DPF regeneration control to cause the exhaust gas temperature to increase more easily. — During deceleration: Intake air is reduced so that the catalyst temperature is not lowered by the incoming outside air.

Function	Description
Glow control	• Heating of the glow plug is controlled by the PCM through the glow control module to improve engine startability and DPF regeneration performance. • Energization time to the glow plug is determined according to the engine coolant temperature and engine starting conditions.
EGR control	• To recirculate an optimum amount of exhaust gas to the combustion chamber according to engine operation conditions, the PCM performs duty control of the EGR valve (DC motor) to open and close the valve. • The intake air temperature increases or decreases rapidly according to the exhaust gas temperature, and it affects the combustion temperature. To optimize the temperature of the recirculated exhaust gas, opening and closing of the EGR valve and EGR cooler bypass valve are controlled according to the engine coolant temperature. • During fast idle increase and DPF regeneration control, the EGR valve is controlled so as not to operate to prevent the post-injected fuel from circulating to the intake side. (The EGR control is stopped)
A/F sensor heater control	• By activating the A/F sensor using the A/F sensor heater, stable detection of the oxygen concentration is possible even when the exhaust gas temperature is low. • When the exhaust gas temperature is high, enerzation to the A/F sensor heater is stopped to protect the A/F sensor from a rise in temperature.
Diesel particulate filter regeneration control	• When the amount of accumulated particulate matter (PM) in the DPF exceeds a certain value, the PCM controls to combust and eliminate PM. • Two methods are available to combust and eliminate PM, one is automatic DPF regeneration control which is performed by the PCM automatically, and the other is compulsory DPF regeneration control which can be forcibly performed externally.
A/C cut-off control	• Controls the A/C operation by switching the A/C relay on/off at the optimal timing according to engine operation conditions. By controlling the A/C operation, acceleration performance and engine reliability have been improved.
Electrical fan control	• Through cooling of the radiator and condenser by operation of the cooling fan according to vehicle conditions, engine reliability and cooling performance have been improved. • The PCM determines the engine operation conditions based on the signal from each sensor and performs duty-control of the fan control module to control the rotation speed of the cooling fan motor.
Starter cut-off control	• The PCM controls energization to the starter relay according to an immobilizer system request to improve security. • While the shift lever is not in P or N position, starter relay energization using the push button start is inhibited. (ATX) • When the clutch pedal is not depressed, starter relay energization using the push button start is inhibited. (MTX)
Generator control	• Idling stability has been improved by optimum control of the generator voltage according to the engine operation and electrical load conditions. • The PCM determines the engine operation and electrical load conditions based on the input signals from each control part to control the energization time of the generator field coils.
Run dry prevention (RDP) control	• To prevent air from flowing into the fuel line when fuel in the fuel tank decreases, the output is intentionally controlled to warn the user to supply fuel.
Blow-by heater control	• Operates the blow-by heater at an extremely low temperature to prevent freezing of the moisture in the blow-by gas in the ventilation pipe and blocking the passage. • The PCM operates the blow-by heater by switching the blow-by heater relay on/off.
i-stop control	• When the vehicle is stopped such as at a stop light, the i-stop control stops/starts the engine automatically to improve fuel economy and reduce exhaust gas and idling noise. • The PCM determines whether to permit/inhibit i-stop control based on the signal from each input part and CAN communication. • The i-stop control includes the engine stop control, engine restart control, electric AT oil pump driver control, and hill launch assist functions.
DC-DC converter control	• Stability of the power supply to the cabin has been realized by preventing decreases in the power supply due to battery voltage decreases while the engine is restarted by the i-stop control. • When the engine is restarted by the i-stop control, the PCM sends a battery voltage (DC-DC converter downstream voltage) boost request signal to the DC-DC converter.
Engine oil control	• The PCM reduces the oil pump load applied to the engine by controlling the appropriate engine hydraulic pressure according to the engine operation conditions. • The engine hydraulic pressure in two steps. When hydraulic pressure is not needed, the oil pump discharge amount is reduced by the operation of the engine oil solenoid valve.

Function	Description
Immobilizer system	• The immobilizer system is a vehicle theft prevention device that only allows remote transmitters that have been previously programmed to the vehicle to start the engine. • The start stop unit performs immobilizer system fail-safe.

Construction

- The PCM is installed in the engine room.



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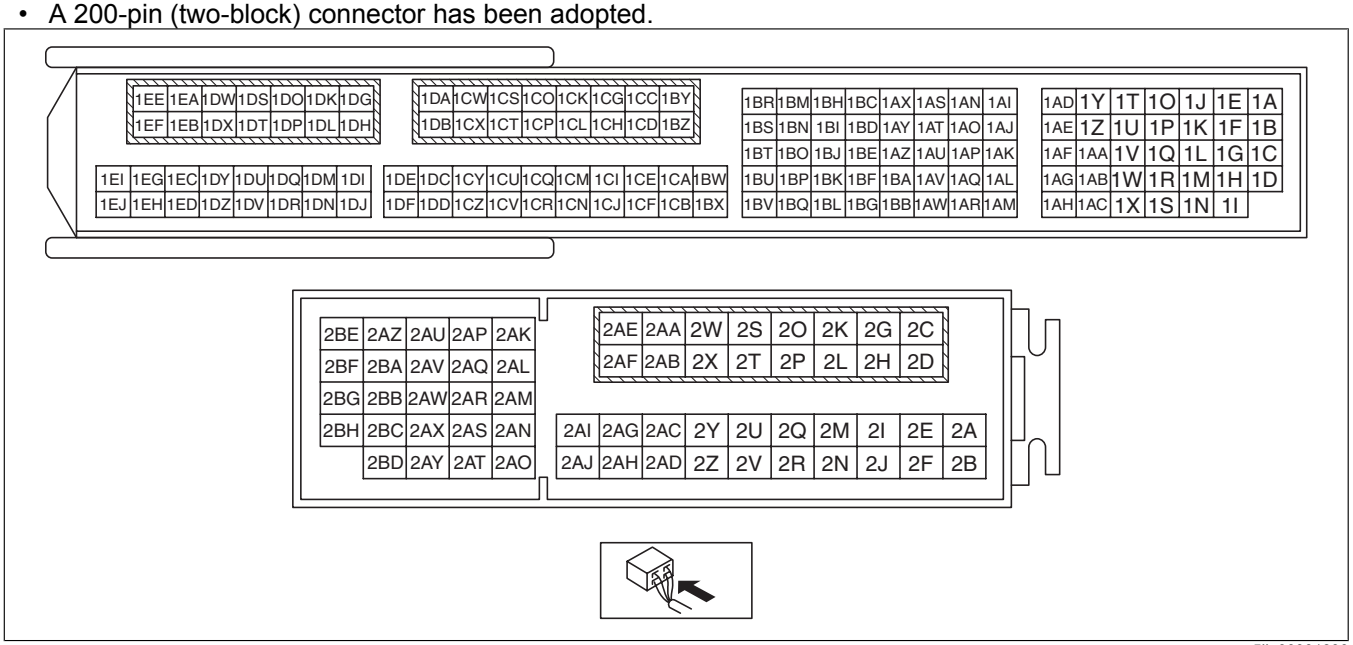
- A 200-pin (two-block) connector has been adopted.



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- BARO sensor is integrated.

Operation

- For operation content, refer to the following references:

Function	Page
Main relay control	(See MAIN RELAY CONTROL [SKYACTIV-D 2.2].)
Idle speed control	(See IDLE SPEED CONTROL [SKYACTIV-D 2.2].)
Two-stage turbo control	(See TWO-STAGE TURBO CONTROL [SKYACTIV-D 2.2].)
Intake stroke EGR using double exhaust valve actuation system (IDEVA) control	(See INTAKE STROKE EGR USING DOUBLE EXHAUST VALVE ACTUATION SYSTEM (IDEVA) CONTROL [SKYACTIV-D 2.2].)
Fuel injection amount control	(See FUEL INJECTION AMOUNT CONTROL [SKYACTIV-D 2.2].)
Multiple fuel injection control	(See MULTIPLE FUEL INJECTION CONTROL [SKYACTIV-D 2.2].)

Function	Page
Fuel injection timing control	(See FUEL INJECTION TIMING CONTROL [SKYACTIV-D 2.2].)
Fuel pressure control	(See FUEL PRESSURE CONTROL [SKYACTIV-D 2.2].)
Intake shutter valve control	(See INTAKE SHUTTER VALVE CONTROL [SKYACTIV-D 2.2].)
Glow control	(See GLOW CONTROL [SKYACTIV-D 2.2].)
EGR control	(See EGR CONTROL [SKYACTIV-D 2.2].)
A/F sensor heater control	(See AIR FUEL RATIO (A/F) SENSOR HEATER CONTROL [SKYACTIV-D 2.2].)
Diesel particulate filter regeneration control	(See DIESEL PARTICULATE FILTER REGENERATION CONTROL [SKYACTIV-D 2.2].)
A/C cut-off control	(See A/C CUT-OFF CONTROL [SKYACTIV-D 2.2].)
Electrical fan control	(See ELECTRICAL FAN CONTROL [SKYACTIV-D 2.2].)
Starter cut-off control	(See STARTER CUT-OFF CONTROL [SKYACTIV-D 2.2].)
Generator control	(See GENERATOR CONTROL [SKYACTIV-D 2.2].)
Run dry prevention (RDP) control	(See RUN DRY PREVENTION (RDP) CONTROL [SKYACTIV-D 2.2].)
Blow-by heater control	(See BLOW-BY HEATER CONTROL [SKYACTIV-D 2.2].)
i-stop control	(See i-stop CONTROL [SKYACTIV-D 2.2].)
DC-DC converter control	(See DC-DC CONVERTER CONTROL [SKYACTIV-D 2.2].)
Engine oil control	(See ENGINE OIL CONTROL [SKYACTIV-D 2.2].)
Immobilizer system	(See IMMOBILIZER SYSTEM.)

Fail-safe

DTC No.	Fail-safe function
P0601:00	• Inhibits engine-stop by operating the i-stop function.
P0606:00	• PCM restricts engine torque. • Inhibits the EGR control. • Inhibits the diesel particulate filter regeneration control. • Inhibits engine-stop by operating the i-stop function. • PCM restricts engine-transaxle integration control.