

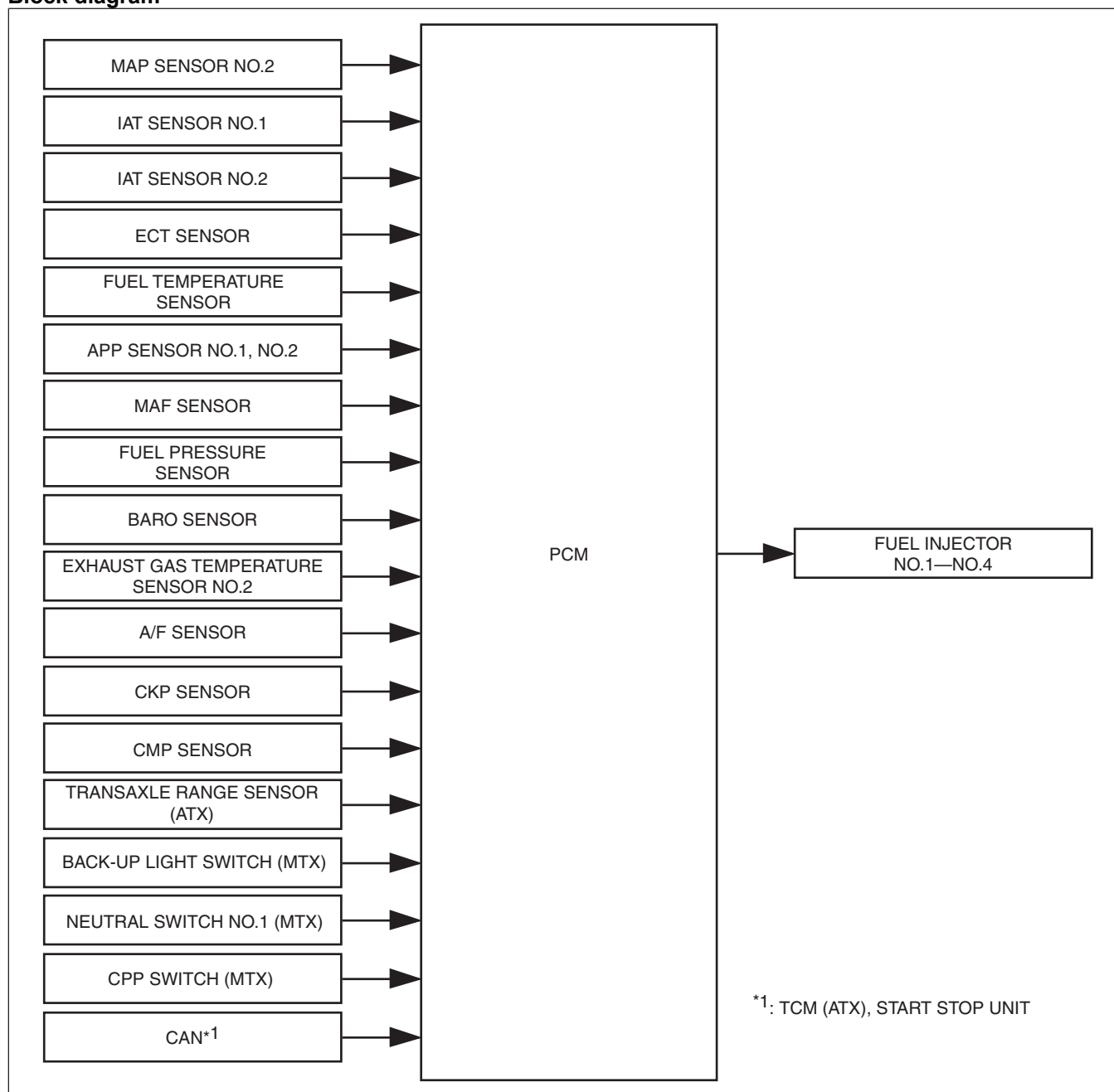
FUEL INJECTION AMOUNT CONTROL [SKYACTIV-D 2.2]

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Outline

- 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.

Block diagram



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Operation

- The PCM calculates the fuel injection amount according to engine operation conditions.
- The fuel injection amount is determined by comparing the basic injection amount with the maximum injection amount, and the lesser of the two amounts is used as the final fuel injection amount.

Basic injection amount

- Calculated according to the accelerator pedal opening angle and engine speed.

Maximum injection amount

- Calculated by adding each type of correction to the basic fuel injection amount according to the engine operation conditions.

Fuel cut

- If any of the following conditions are met, the PCM performs fuel-cut.
 - Engine stall
 - Immobilizer system-related signal (engine starting refusal) received from start stop unit
 - Crankshaft position sensor malfunction
 - Dual-mass flywheel resonance avoidance (MTX)

Fuel injection amount learning

- The PCM verifies the variation in fuel injection amount by calculating fluctuations in engine speed.
- The fuel injection amount of each cylinder is increased/decreased by correcting the fuel injection amount to each cylinder according to the changes in engine speed so that the fluctuation in engine speed is reduced.
- The correction amount is recorded in the PCM as a learned value, and remains recorded until it is updated.

Auto-learning

- The PCM periodically implements auto learning of the fuel injection. The idling sound may fluctuate due to the fuel injectors performing high/low fuel injection pressure during learning.
- If all of the following conditions are met, the PCM implements the fuel injection amount learning.
 - Shift lever position: Neutral (MTX)
 - Selector lever position: Either D position, N position, or P position (ATX)
 - Vehicle speed: **0 km/h {0 mph}**
 - Engine coolant temperature: **70—95 °C {158—203 °F}**
 - A/C non-operation
 - Accelerator opening angle: **0%**
 - DPF regeneration control not implemented
- If any of the implementation conditions is not met during the fuel injection amount learning, the fuel injection amount learning is canceled, but it will resume when the implementation conditions are met again.

Manual learning

- The fuel injection amount learning can be implemented using the Mazda Modular Diagnostic System (M-MDS) or a check connector.
- It is necessary to perform the fuel injection amount learning periodically (once/year) to maintain performance.

Brake override system

Brake override system operation conditions

- It gives priority to the brake operation if a malfunction occurs with the accelerator pedal such as if the accelerator pedal is depressed and does not return. The fuel injection amount is reduced if the brake pedal is depressed while the accelerator pedal is in a depressed condition until the vehicle is safely decelerated and comes to a complete stop.

Operation start conditions	<ul style="list-style-type: none">• If either one of the following conditions is met with the brake pedal depressed for the specified time^{*1} or more while the accelerator pedal is depressed, the PCM adjusts the fuel injection amount so that the engine speed is 1,000 rpm. While driving vehicle<ul style="list-style-type: none">— Accelerator pedal opening angle: 5% or more from fully closed— Vehicle speed: 10 km/h {6.2 mph} or more— Engine speed: 875 rpm or moreWhile vehicle is stopped<ul style="list-style-type: none">— Accelerator pedal opening angle: 5% or more from fully closed— Shift lever position: neutral (MTX)— Selector lever position: N position (ATX)— Engine speed: 875 rpm or more
Operation complete conditions	<ul style="list-style-type: none">• If the following conditions are met while the brake override system is operating, the PCM stops the operation of the brake override system and controls the fuel injection amount according to the throttle valve opening angle.<ul style="list-style-type: none">— Accelerator pedal not depressed— Brake pedal not depressed <p>Note</p> <ul style="list-style-type: none">• The brake override system operation stops by switching the ignition off.

^{*1} : Specified time is 0.6 to 10 s according to braking force calculated in PCM.

Prevention of unnecessary brake override system operation

- If the servicing procedure requiring the brake pedal and the accelerator pedal to be depressed simultaneously is performed, unnecessary operation of the brake override system can be prevented, if necessary.

Cancel conditions	<ul style="list-style-type: none"> If the releasing procedure is implemented with the following conditions met within 30 s after switching the ignition ON (KOEO), the brake override system does not operate until the recovery condition is met. <ul style="list-style-type: none"> Shift lever position: neutral (MTX) Selector lever position: N position (ATX) Vehicle speed: 0 km/h {0 mph} <p>Releasing procedure</p> <ol style="list-style-type: none"> Depress the brake pedal for 10 s with the accelerator pedal released. Repeatedly depress and release the accelerator pedal fully three times with the brake pedal depressed. Release the brake pedal
Recovery condition	<ul style="list-style-type: none"> The cancel conditions are reset when the ignition is switched off while the brake override system is canceled. As a result, the brake override system can operate.

Master warning light illumination request

- If any one of the following conditions is met, the PCM sends the master warning light illumination request signal to the instrument cluster. The master warning light illuminates to alert the driver that there is a malfunction in the brake system.
 - Brake switch (No.1 signal) has a malfunction
 - Brake switch (No.2 signal) has a malfunction

Master warning light flash request

- If the cancel condition for preventing unnecessary operation of the brake override system is implemented, the PCM sends a master warning light flash request signal to the instrument cluster. The driver is notified that the brake override system has been cancelled by the flashing of the master warning light.

AT Miss-acceleration Suppression Control (ATX)

- If the following conditions are met, the engine output is suppressed by closing the throttle valve.
 - Selector lever position: D/M position
 - Vehicle speed approx. 10 km/h {6.2 mph} or less
 - Obstruction ahead is a stationary object
 - Despite there being an obstruction such as a vehicle ahead or a wall, the accelerator pedal opening angle is the specified value or more (specified value of accelerator pedal opening angle differs depending on the distance to the obstruction ahead).
 - The DSC system and laser sensor are normal
 - TCS is not turned off using the TCS OFF switch
 - Smart City Brake Support (SCBS) has not been turned off using the instrument cluster personalization feature.

Fail-safe

- To prevent engine damage, the engine speed is restricted to 3,000 rpm or less when the engine coolant temperature is -10 °C {14 °F} while the ignition is switched ON. (Maximum 190 s period)