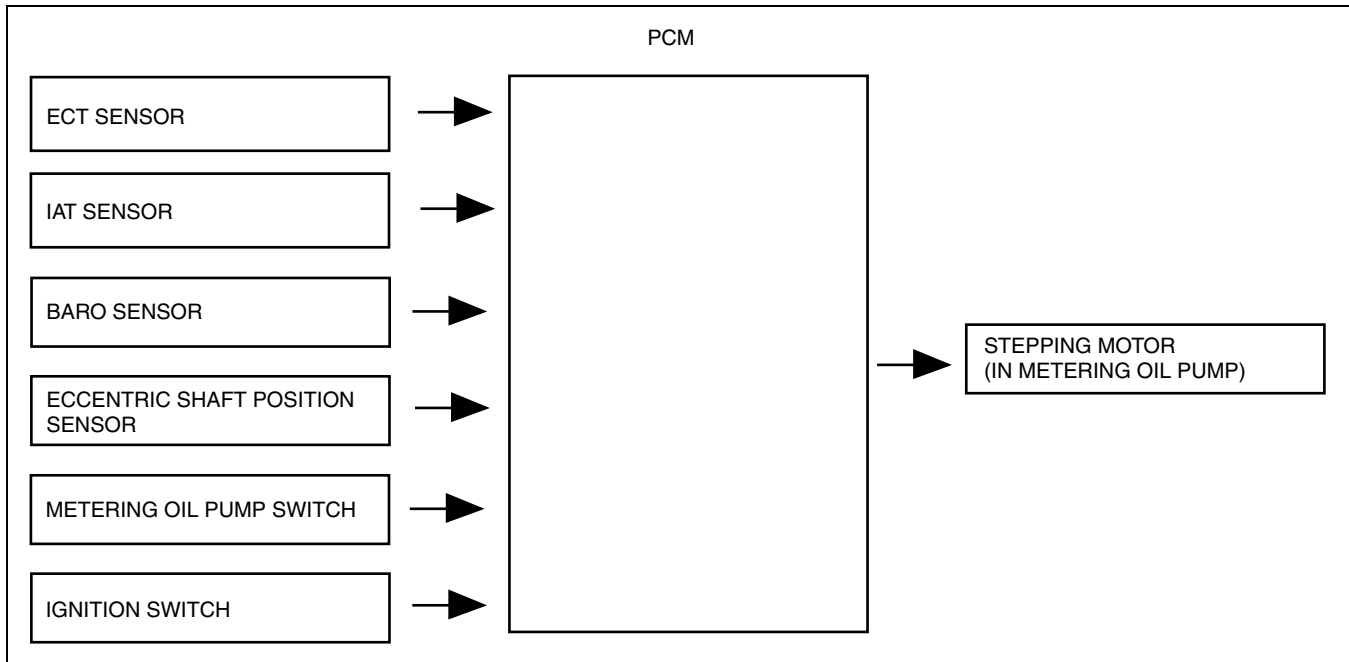


CONTROL SYSTEM

METERING OIL PUMP CONTROL BLOCK DIAGRAM

CHU014000140S37

- The PCM calculates the optimum amount of oil delivery (stepping motor step number) by determining the engine operation conditions based on each input signal, and sends an operation signal to the stepping motor (inside the metering oil pump).



CHU0140S027

METERING OIL PUMP CONTROL OPERATION

CHU014000140S38

Outline

- The PCM changes the amount of stroke of the plunger by controlling the amount of stepping motor rotation (step number), adjusting the amount of oil delivery.
- The stepping motor operates by the combination of coils No.1—No.4, according to the stepping motor step number.

Example of energization condition for each coil and step number

On: Energization, Off: Non-energization

Step number	0	1	2	3	4	5	6	7	8	9	10	30	52
Coil No.1 (PCM terminal 2W)	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On
Coil No.2 (PCM terminal 2AB)	Off	On	On	Off	Off	On	On	Off	Off	On	On	On	Off
Coil No.3 (PCM terminal 2V)	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off
Coil No.4 (PCM terminal 2Y)	On	Off	Off	On	On	Off	Off	On	On	Off	Off	Off	On

- The energization condition of stepping motor coils No.1—No.4 can be verified by verifying the step number based on the WDS data monitor function PID (MOP POS).

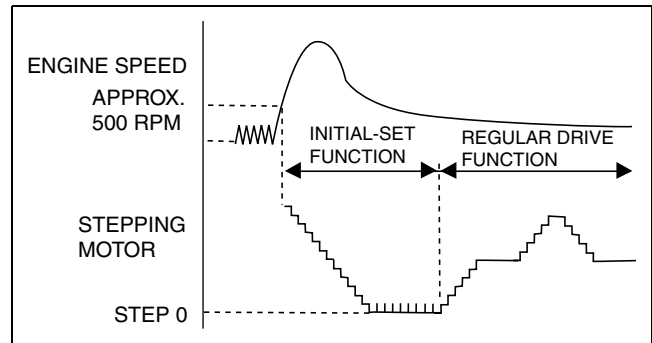
Energization Off Function

- When the ignition switch is turned to the ON position and the engine is stopped, current flow to stepping motor coils No.1—No.4 is stopped, saving on battery consumption.

CONTROL SYSTEM

Initial-set Function

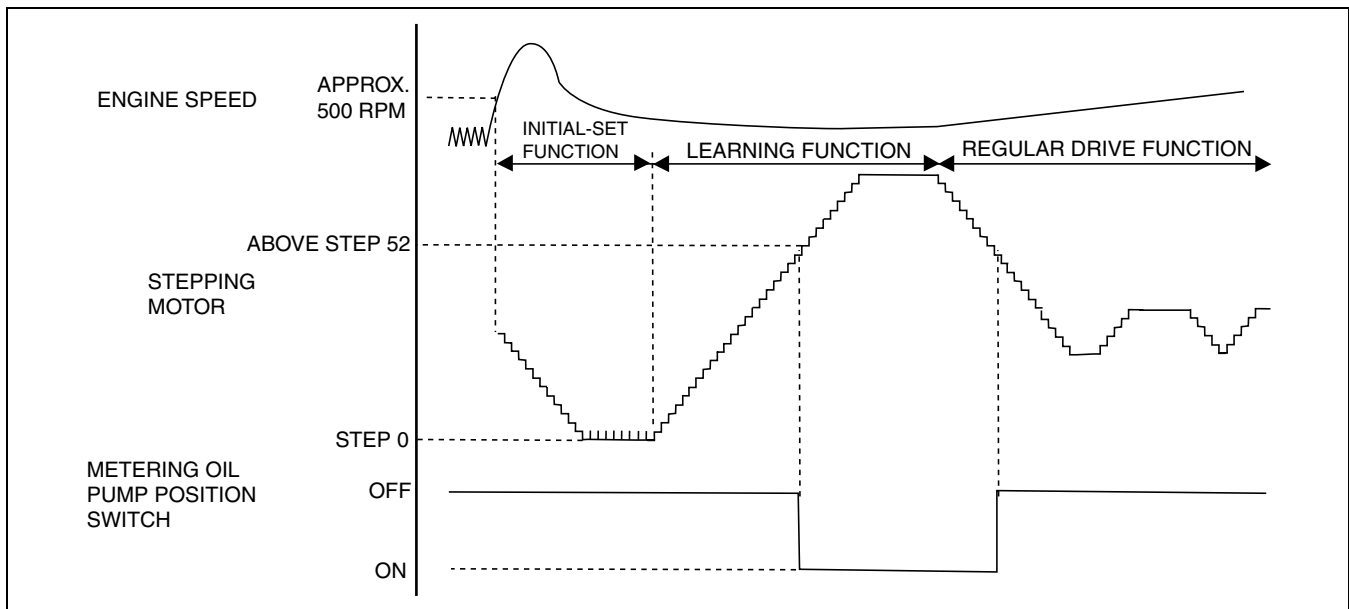
- Reverses the stepping motor 60 steps at engine start, and detects the 0-step position.
- The 0-step position becomes the reference for the regular drive function.



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Monitor Function

- When the following conditions are met and after the initial-set function is completed, the monitor function activates.
 - Ignition switch at ON for 12th time.
 - When the battery terminals are connected.
- The PCM monitors the stepping motor position when the position switch is on. The monitor method is as follows:
 - The stepping motor is rotated 60 steps clockwise from the 0-step position after the initial-set function, the step number is counted until the position switch turns on.
- The position switch is on above step 52. However, if the on position for the position switch is not detected above step 52, a malfunction of the stepping motor is determined and the fail-safe function is activated.



Fail-safe Function

- When the stepping motor is determined to be malfunctioning by the monitor function, the fail-safe function is activated.
- The fail-safe function controls fuel injection time, ignition timing, the target step for the stepping motor as indicated in the table below, and controls engine output to protect the engine. Due to this, burning of engine seals is prevented.
- Ineffective injection time is determined according to battery voltage and lengthens as battery voltage becomes lower.

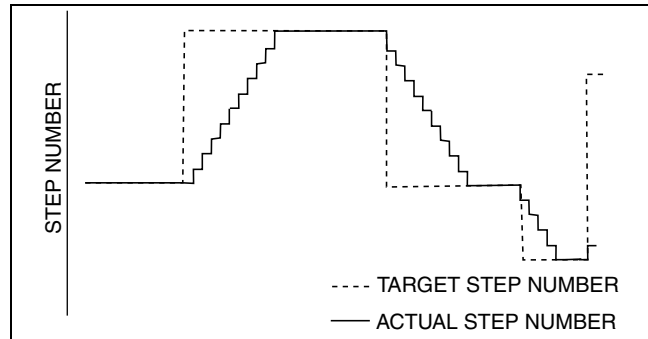
CONTROL SYSTEM

Fail-safe for each control

Control	Fail-safe	
Fuel injection control (pulse width at last injection)	At engine start	Regular control
	When the throttle opening angle exceeds 13%.	4.50 ms + ineffective injection time
	Other	2.65 ms + ineffective injection time
Ignition timing control (ignition timing)	Leading side	Fixed at 4.88°CA
	Trailing side	
Metering oil pump control (Step number)	Stepping motor fixed at step 7	

Regular Drive Function

- The PCM always calculates the optimum target step number according to the engine operation conditions, and controls the stepping motor step number so that it is close to the actual step number in reference to the target.
- If the actual step number is less than the target step number, the amount of stroke of the plunger is increased by increasing the stepping motor step number, which increases the amount of oil delivered. If the actual step number is larger than the target step number, the stepping motor step number is lowered, the amount of stroke of the plunger is reduced, and the amount of oil delivery is reduced. (See 01-11-5 METERING OIL PUMP CONSTRUCTION/OPERATION.)



CHU0140S030

Ignition Switch Off Function

- After the ignition switch is turned off, the PCM sets the target step to step 0 and when the actual step reaches 0, control of the metering oil pump ends.
- After the ignition switch is turned off, a main relay ON request is output and the ignition switch off function operates. (See 01-40-10 MAIN RELAY CONTROL OPERATION.)