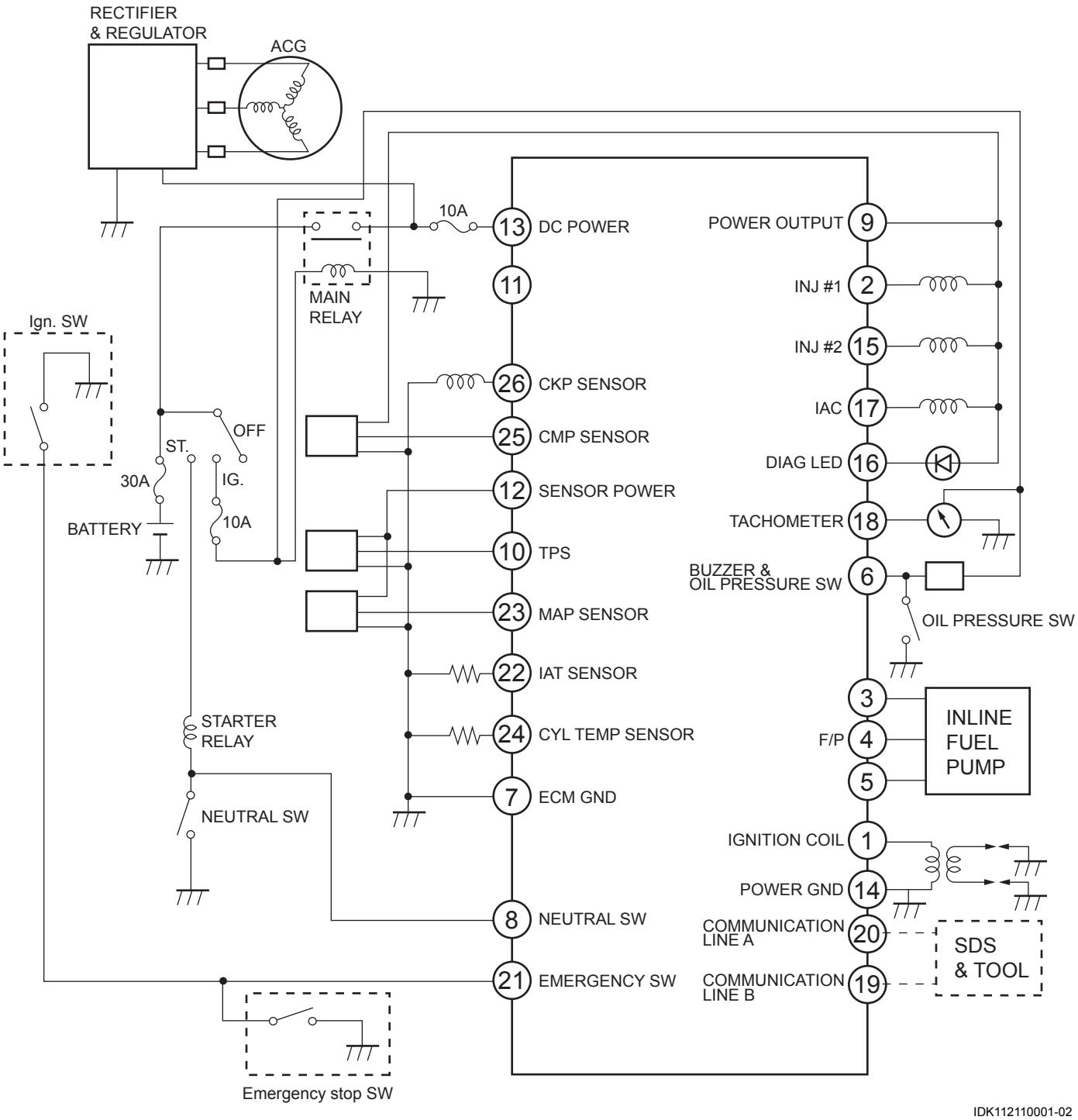
Engine Control

General Description

Engine Control Module (ECM) (Remote Control Model)

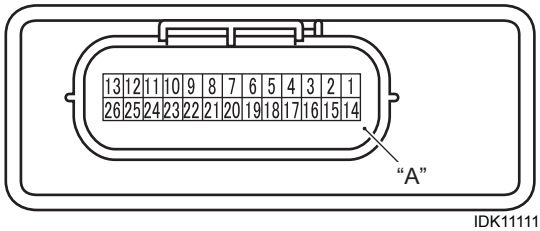
CENDK1121101007

ECM Input / Output Circuit Diagram
Remote control model



IDK112110001-02

ECM Connector / Terminals Layout



IDK111110007-01

"A": ECM

Remote control model

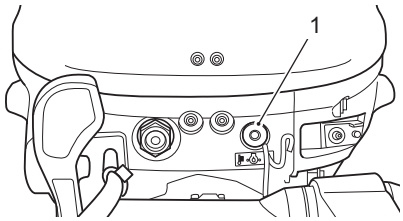
Terminal	Wire color	Circuit
1	O	Ignition coil
2	O/B	No.1 Fuel injector
3	B/Y	High pressure fuel pump (V)
4	B/R	High pressure fuel pump (W)
5	B/W	High pressure fuel pump (U)
6	Bl/Y	Oil pressure switch
7	B	Ground for ECM
8	Y/G	Neutral switch
9	Gr/R	Power output
10	Br/Y	Throttle position sensor
11	–	–
12	R	Power for sensor (5 V)
13	Gr	DC power for ECM
14	B	Ground for ECM power
15	B/Br	No.2 Fuel injector
16	P	Diag LED
17	W/B	IAC valve
18	Y/B	Tachometer
19	Y	Communication line (B)
20	O/Y	Communication line (A)
21	Bl/R	Emergency stop switch
22	Lg/B	IAT sensor
23	W	MAP sensor
24	Lg/W	Cylinder temp. sensor
25	Y/Bl	CMP sensor
26	R/B	CKP sensor

Caution System Description (Remote Control Model)

CENDK1121101008

The following three caution systems alert the operator when an abnormality occurs on the engine.

- OVER-REVOLUTION CAUTION
- LOW OIL PRESSURE CAUTION
- OVERHEAT CAUTION



IDK111110023-02

1. Caution lamp

Caution type	Caution lamp	*Caution buzzer	Engine RPM limited
Over-revolution	Yes	No	Yes
Low oil pressure	Yes	Yes	Yes
Overheat	Yes	Yes	Yes

*: Remote control model only

Lamp Check / Buzzer Check
(Remote control models)
When the ignition key is turned to the “ON” position:

- Caution lamps turns on for two seconds.
- Caution buzzer sounds.

NOTE

On remote control model:
The caution buzzer sounds when ignition switch is turned ON.
Then it stops sounding when engine starts and the oil pressure switch turns OFF by reaching engine oil pressure at 15 kPa (0.15 kg/cm^2, 2 psi.).

Over-Revolution Caution System
Condition:
The ECM controlled over revolution limiter will engage at the engine speeds shown below. Once engaged it will initiate an intermittent fuel injection signal to reduce engine speed.

Over revolution limiter
DF9.9B: 5 900 r/min
DF15A: 6 200 r/min
DF20A: 6 300 r/min

Action:

Engine speed	• Automatically reduced to approx.3 000 r/ min. by an intermittent fuel injection signal. • If the operator decreases the engine speed below the over revolution system maximum preset value, within 10 seconds, the over-revolution caution control will be cancelled.
Caution lamp	Caution lamp lights continuously.

Reset:
Close the throttle to reduce the engine speed below approx. 3 000 r/min. for one second.

NOTE

In neutral gear, the preset maximum engine speed value before the over-revolution caution system activates is 3 000 r/min.
In the operation of Neutral gear over-revolution caution system, the caution lamp does not light.
To cancel the Neutral gear over-revolution caution control, close throttle completely.

Low Oil Pressure Caution System

Condition:

Immediate activation of the system when the oil pressure switch is turned “ON” due to an engine oil pressure drop below 15 kPa (0.15 kg/cm^2, 2 psi.) while engine is running.

Action:

Engine speed	• Automatically reduced to approx. 2 000 r/min. maximum by an intermittent fuel injection signal. • The engine automatically stops 3 minutes after the caution system is activated.
Caution lamp	Caution lamp lights continuously.
Caution buzzer	Sound in a series of long (1.5 sec.) beeps.

NOTE

If the engine is automatically stopped due to the caution system, the engine can be started again. However, the caution system will repeatedly activate until the cause is eliminated.

Reset:

Stop the engine and check the engine oil level. Refill the engine oil to the correct level if it is below the low oil level mark.

If the engine oil level is correct, the following causes may be considered:

- Improper oil viscosity.
- Malfunctioning oil pressure switch.
- Clogged oil strainer or oil filter.
- Worn oil pump relief valve.
- Oil leakage from the oil passage.
- Excessive wear/damage of oil pump.

NOTE

The low oil pressure caution system will reset when the oil pressure is restored to over 15 kPa (0.15 kg/cm^2, 2 psi.) at approx. 2 000 r/min. or less engine speed operation.
The engine must be stopped and checked immediately once the system is activated.

Overheat Caution System

Immediate activation of the system when:

- Cylinder temperature reaches 90 °C (194 °F)
- The rate of cylinder wall temperature variation within a given time exceeds the preset rate.

Action:

Engine speed	• Automatically reduced to approx. 3 000 r/min. maximum by intermittent fuel injection and ignition signals. • The engine automatically stops 3 minutes after the caution system is activated.
Caution lamp	Caution lamp lights continuously.
Caution buzzer	Sound in a series of long (1.5 sec.) beeps.

NOTE

If the engine is automatically stopped due to the caution system, the engine can be started again. The caution system will repeatedly activate until the cause is eliminated.

Reset:

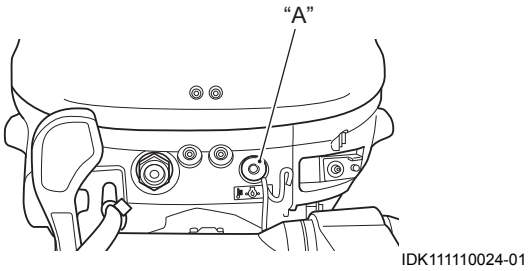
System reset will occur when the cylinder temperature drops below the limits shown below. However, the system may be activated again unless the cause for overheat (such as insufficient water) is removed.

Reset temperature	Approx. 70 °C (158 °F)

Self-Diagnostic System Description (Remote Control Model)

CENDK1121101009

The self-diagnostic system alerts the operator when an abnormality occurs in a signal from a sensor, or switch, etc. When the system is activated, the caution lamp flashes (lights intermittently) according to each code pattern along with buzzer sound.



IDK111110024-01

"A": Caution lamp

NOTE

- **The buzzer sound will be stopped approx. 30 seconds after activating the diagnostic system during engine operation.**
- **Diagnostic code indication appears by the caution lamp during ignition key turns ON. However, the buzzer keeps sounding by the pattern of oil pressure caution if engine stops.**

Priority / Code / Pattern for Self-Diagnostic System Operation

0: OFF, 1: ON

Priority	Failed item	Code	Lamp flashing pattern	Fail-Safe system active
1	MAP sensor 1	3 – 4	 MCODE00D34-0-01	Yes
2	Cylinder temp. sensor	1 – 4	 MCODE00D14-0-01	Yes
3	IAT sensor	2 – 3	 MCODE00D23-0-01	Yes
4	CKP sensor	4 – 2	 MCODE00D42-0-01	No
5	CMP sensor	2 – 4	 MCODE00D24-0-01	No
6	Air intake system	2 – 2	 MCODE00D22-0-01	Yes
7	MAP sensor 2	3 – 2	 MCODE00D32-0-01	No
8	Fuel injector	4 – 3	 MCODE00D43-0-01	No
9	Throttle position sensor	2 – 1	 MCODE00D21-0-01	Yes
10	Rectifier/Regulator (Over-charging)	1 – 1	 MCODE00D11-0-01	No
11	Oil pressure switch (R model)	5 – 3	 MCODE00D53-0-01	No

NOTE

- **If two or more items fail at once, the self-diagnostic indication appears according to the priority order. The indication repeats three times.**
- **If the failed item remains, the self-diagnostic indication appears again after starting the engine.**
- **After correcting the failed item, the self-diagnostic indication appears until the ECM receives the proper signal with the engine running.**
- **Cancellation of the self-diagnostic indication is automatically performed when the failure is corrected and a normal signal is received by the ECM for a period of 20 – 30 seconds.**

NOTE

To cancel the diagnostic display for oil pressure switch failure, perform the following procedure after it is corrected:

1. **Turn the ignition key to ON. The diagnostic code for oil pressure switch failure will continue to be displayed until a normal signal sequence is received by the ECM.**
2. **Turn the ignition key to OFF once and turn ON again.**
   At the second turning on, cancel of the oil pressure switch failure code is completed.

Oil Change Reminder System Description (Remote Control Model)

CENDK1121101010

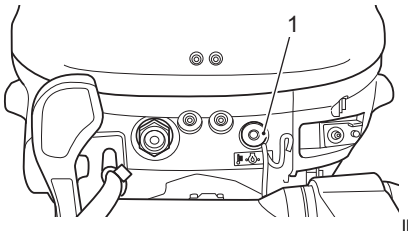
This system informs the operator that it is time to change the ENGINE OIL based on the recommended maintenance schedule.
When the total motor operating hours has reached the pre-programmed hours, the caution lamp will flash.
If the engine is running, the buzzer will begin a series of double beeps additionally.
The above mentioned indication will repeat until the activated system is manually canceled.

NOTE

The buzzer sound will be stopped approx. 30 seconds after activating system during engine operation.

NOTE

This system will activate up to 2 100 hour's operation.

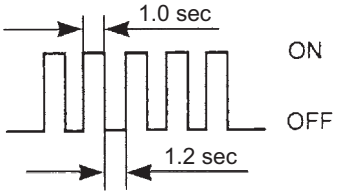


IDK111110025-01

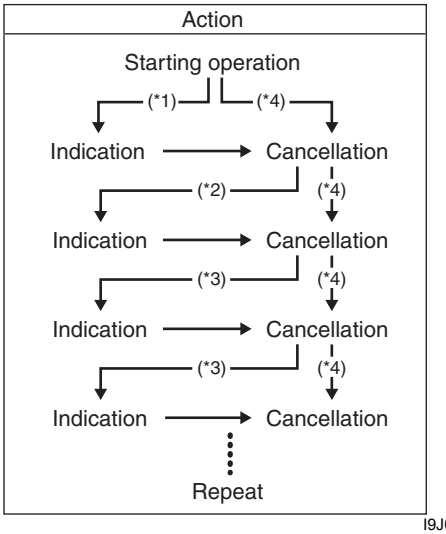
1. Caution lamp

Indication of System Activation

Caution lamp flashing pattern



IDK111110004-01

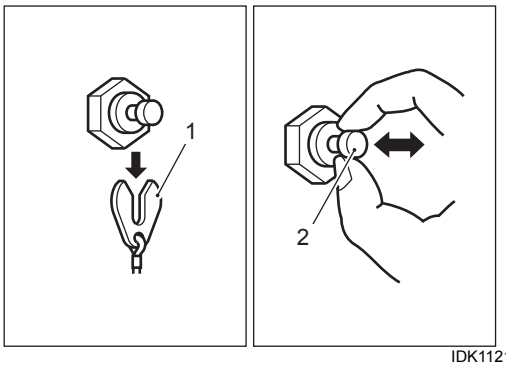


I9J011110010-03

*1:	Lapse of initial 20 hour's operation
*2:	Lapse of 80 hour's operation
*3:	Lapse of 100 hour's operation
*4:	When performing cancellation before system activation

Cancellation Procedure

1) Sift into “NEUTRAL”.
2) Turn the ignition key to the “ON” position.
3) Pull out the emergency stop switch plate (1).
4) Pull up the emergency stop switch knob (2) three times within 3 seconds. The caution lamp is no longer lit when the reminder cancellation is successful.



IDK112110002-01

5) Turn the ignition key to the “OFF” position.
6) Set the plate (1) in the original position.

NOTE

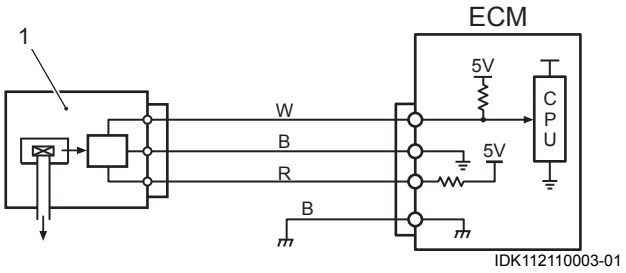
- **Cancellation of the system is possible whether or not the engine oil has been replaced.**
  Once the system has been activated, SUZUKI strongly recommends that the engine oil be replaced before canceling the system.
- **If the engine oil has been replaced with the system not activated, it is still necessary to perform the cancellation procedure to reset the Oil Change Reminder System.**

Diagnostic Information and Procedures

Self-Diagnostic Code “3 – 4” MAP Sensor (Remote Control Model)

CENDK1121104015

Wiring Diagram



1. MAP sensor

Troubleshooting

Step 1

1) With the ignition switch “OFF”, disconnect the MAP sensor connector.
2) With the ignition switch “ON”, check the voltage at the “R” wire terminal of the MAP sensor connector.

Is the voltage approx. 4 – 5 V?

Yes — Go to step 2.

No
- “R” wire open, “R” wire shorted to ground or a poor wire connection.
- If the wiring and connection is OK, substitute a known-good ECM and recheck.

Step 2

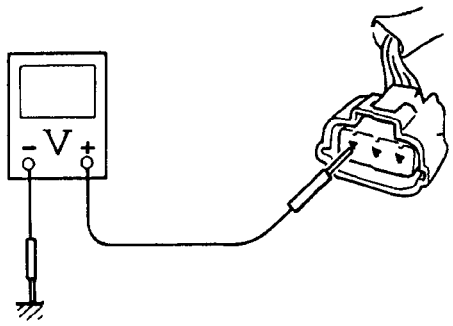
1) Check the MAP sensor output voltage change.
   Refer to “MAP Sensor Output Voltage Inspection” in related manual.

Is it in good condition?

Yes — Substitute a good ECM and recheck.

No
- Faulty MAP sensor.
- “R” wire shorted to “W” wire, “B” wire open, poor “B” wire connection, poor “W” wire connection, “W” wire open or poor MAP sensor connection.
- If the wiring and connection is OK, intermittent trouble or a faulty ECM may be the cause.

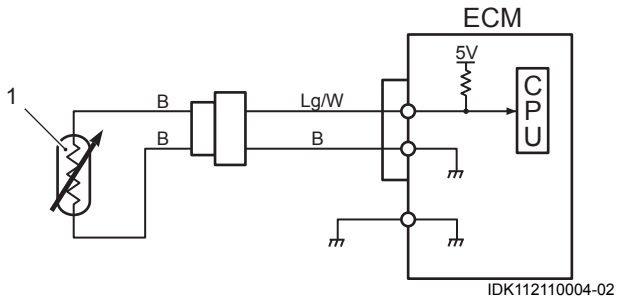
For step 1



Self-Diagnostic Code “1 – 4” Cylinder Temp. Sensor (Remote Control Model)

CENDK1121104016

Wiring Diagram



1. Cylinder temp sensor

Troubleshooting

Step 1

1) With the ignition switch “OFF”, disconnect the cylinder temp. sensor connector.
2) With the ignition switch “ON”, check the voltage at the “Lg/W” wire terminal of the cylinder temp. sensor connector.

Is the voltage 4 V or more?

Yes — Go to step 2.

No
- “Lg/W” wire shorted to the “B/W” wire or ground circuit.
- If the wiring is OK, substitute a known-good ECM and recheck.

Step 2

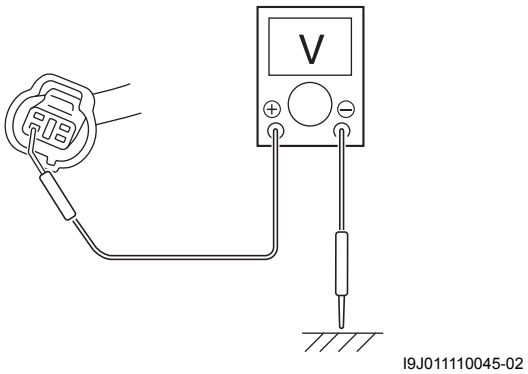
1) Check the Cylinder temp. sensor.
Refer to “Cylinder Temp. Sensor Inspection” in related manual.

Is it in good condition?

Yes — Poor Cylinder Temp. sensor connection, intermittent trouble or a faulty ECM may be the cause.

No — Faulty Cylinder Temp. sensor.

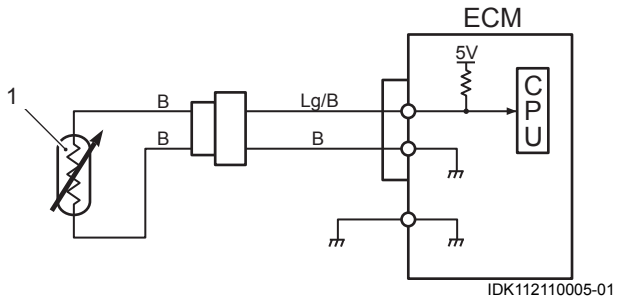
For step 1



Self-Diagnostic Code “2 – 3” IAT Sensor (Remote Control Model)

CENDK1121104017

Wiring Diagram



1. IAT sensor

Troubleshooting

Step 1

1) With the ignition switch “OFF”, disconnect IAT sensor connector.
2) With the ignition switch “ON”, check the voltage at the “Lg/B” wire terminal of the IAT sensor connector.

Is the voltage 4 V or more?

Yes — Go to step 2.

No
- “Lg/B” wire shorted to “B” wire or ground circuit.
- If the wiring is OK, substitute a known-good ECM and recheck.

Step 2

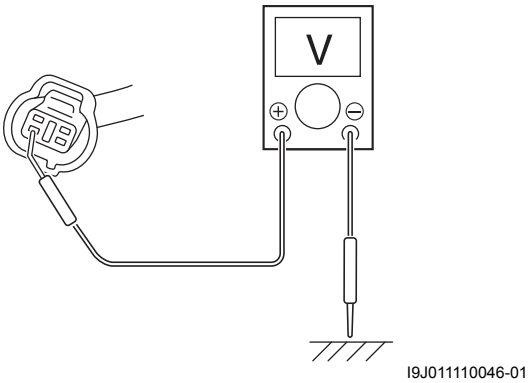
1) Check the IAT sensor.
   Refer to “IAT Sensor Inspection” in related manual.

Is it in good condition?

Yes — Poor IAT sensor connection, intermittent trouble or a faulty ECM may be cause.

No — Faulty IAT sensor.

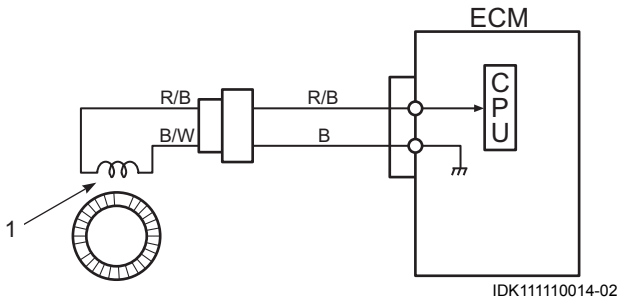
For step 1



Self-Diagnostic Code “4 – 2” CKP Sensor (Remote Control Model)

CENDK1121104018

Wiring Diagram



1. CKP sensor

Troubleshooting

Step 1

1) Check the CKP sensor air gap.
Refer to “CKP Sensor Removal and Installation” in related manual.

Is it in good condition?

Yes Go to step 2.

No Incorrectly adjusted air gap.

Step 2

1) Check the CKP sensor resistance.
Refer to “Resistance Check” in related manual.

Is it in good condition?

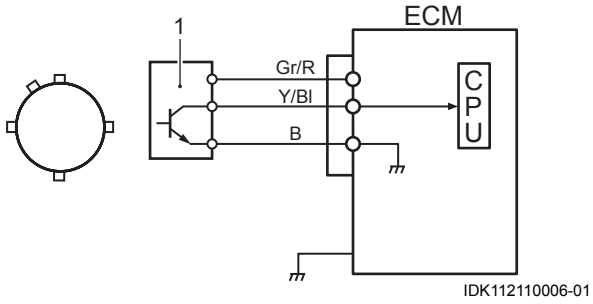
Yes Open wire between the CKP sensor and the ECM, poor lead wire connection or sensor lead wires are shorted to each other. If lead wire and connection are ok, intermittent trouble or a faulty ECM may be the cause.

No Faulty CKP sensor.

Self-Diagnostic Code “2 – 4” CMP Sensor (Remote Control Model)

CENDK1121104019

Wiring Diagram



IDK112110006-01

1. CMP sensor

Troubleshooting

Step 1

Is CMP sensor installed properly and the wire harness connected securely?

Yes Go to step 2.

No Correct.

Step 2

1) With the ignition switch “OFF”, disconnect the connector from the CMP sensor.
2) Check for proper connection to the CMP sensor at “Gr/R”, “Y/Bl” and “B” wire terminals.
3) If OK, turn the ignition switch “ON” and check the voltage at the “Gr/R”, “Y/Bl” and “B” wire terminals of the CMP sensor connector.

CMP sensor voltage
Terminal “Gr/R”: 10 – 14 V
Terminal “Y/Bl”: 4 – 5 V
Terminal “B”: 0 V

Is the voltage satisfactory?

Yes Go to step 5.

No Go to step 3.

Step 3

Was terminal “Y/Bl” voltage in step 2 within specification?

Yes Go to step 4.

No “Y/Bl” wire open or shorted to ground/ power supply circuit. If the wiring and connection is OK, substitute a known-good ECM and recheck.

Step 4

Was terminal “Gr/R” voltage in step 2 within specification?

Yes Go to step 5.

No “Gr/R” wire open circuit. If the wiring and connection is OK, substitute a known-good ECM and recheck.

Step 5

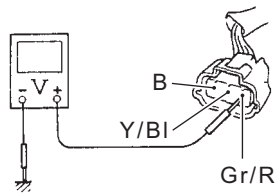
1) Check the CMP sensor and sensor trigger vane. Refer to “CMP Sensor Inspection” in related manual.

Is check result satisfactory?

Yes Substitute a known-good ECM and recheck.

No Replace CMP sensor.

For step 2

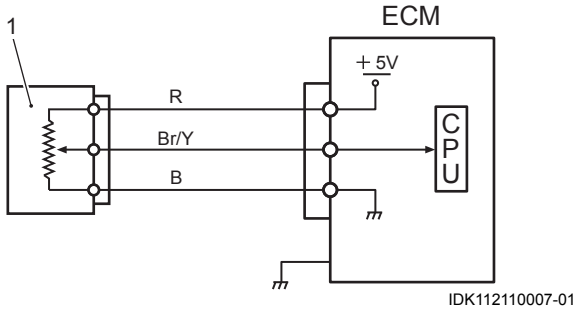


IDK111110008-01

Self-Diagnostic Code “2 – 2” Air Intake System (Remote Control Model)

CENDK1121104020

Wiring Diagram



1. TPS

Troubleshooting

Step 1

1) With the ignition switch “OFF”, disconnect the TPS connector.
2) With the ignition switch “ON”, check the voltage at the “R” wire terminal of TPS connector.

Is the voltage approx. 4 – 5 V?

Yes — Go to step 2.

No
- “R” wire open, “R” wire shorted to ground circuit or poor wire connection.
- If the wiring and connection is OK, substitute a known-good ECM and recheck.

Step 2

1) Check the TPS output voltage change. Refer to “TPS Inspection” in related manual.

Is it in good condition?

Yes — Go to step 3.

No
- Faulty TPS.
- “R” wire shorted to “Br/Y” wire, “B” wire open, poor “B” wire connection, poor “Br/Y” wire connection, “Br/Y” wire open or poor TPS connection.
- If the wiring and connection is OK, intermittent trouble or a faulty ECM may be the cause.

Step 3

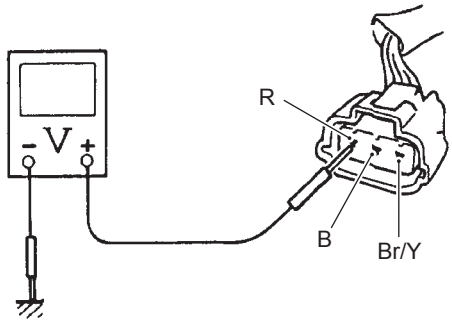
1) Check the MAP sensor, IAC system and intake manifold (system) for air leakage.

Is the result OK?

Yes — Intermittent trouble or faulty ECM. Substitute a known-good ECM and recheck.

No — Faulty air intake system.

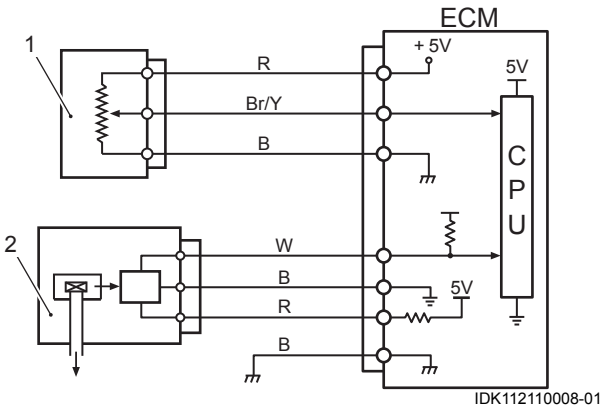
For step 1



Self-Diagnostic Code “3 – 2” MAP Sensor 2 (Remote Control Model)

CENDK1121104021

Wiring Diagram



1. TPS	2. MAP sensor

Troubleshooting

Step 1

1) With the ignition switch “OFF”, disconnect the MAP sensor connector.
2) With the ignition switch “ON”, check the voltage at the “R” wire terminal of the MAP sensor connector.

Is the voltage approx. 4 – 5 V?

Yes — Go to step 2.

No
- “R” wire open, “R” wire shorted to ground circuit or poor wire connection.
- If the wiring and connection is OK, substitute a known-good ECM and recheck.

Step 2

1) Check the MAP sensor output voltage change. Refer to “MAP Sensor Output Voltage Inspection” in related manual.

Is it in good condition?

Yes — Go to step 3.

No — Faulty MAP sensor.

Step 3

1) With the ignition switch “OFF”, disconnect the TPS connector.
2) With the ignition switch “ON”, check the voltage at the “R” wire terminal of the TPS connector.

Is the voltage approx. 4 – 5 V?

Yes — Go to step 4.

No
- “R” wire open, “R” wire shorted to ground circuit or poor wire connection.
- If the wiring and connection is OK, substitute a known- good ECM and recheck.

Step 4

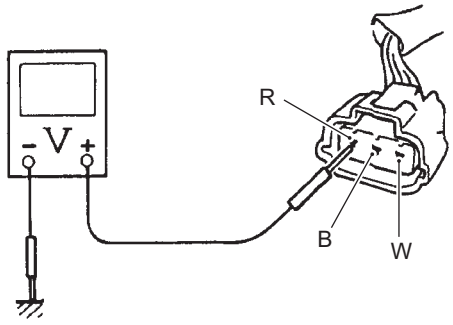
1) Check the TPS output voltage change. Refer to “TPS Inspection” in related manual.

Is it in good condition?

Yes — Intermittent trouble, substitute a known-good ECM and recheck.

No
- Faulty TPS.
- “R” wire shorted to “Br/Y” wire, “B” wire open, poor “B” wire connection, poor “Br/Y” wire connection, “Br/Y” wire open or poor TPS connection.
- If the wiring and connection is OK, intermittent trouble or a faulty ECM may be the cause.

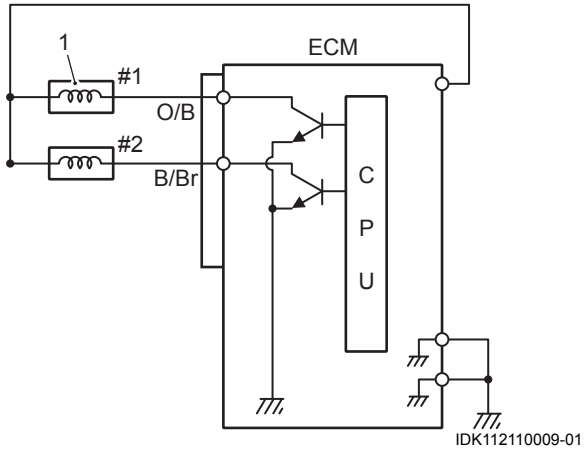
For step 1



Self-Diagnostic Code “4 – 3” Fuel Injector (Remote Control Model)

CENDK1121104022

Wiring Diagram



1. Fuel injector

Troubleshooting

Step 1

1) Turn the ignition switch ON.
Using a sound scope, check that each injector has an operating sound when the engine is cranking.

Do all injectors make an operating sound?

Yes — Fuel injector and its circuit are in good condition.

No — Go to step 2.

Step 2

1) Check the fuel injector, the wiring connection and the wire harness of the fuel injector not making the operating sound.

Are all of the above OK?

Yes — Substitute a known-good ECM and recheck.

No — Faulty injector or its circuit.

Step 3

1) With the ignition switch “OFF”, disconnect the connector from the fuel injector.
2) Check the voltage at “Gr/R” wire terminal with the ignition switch “ON”.

Is the voltage 12 V (battery voltage)?

Yes — Go to step 4.

No — Power circuit open.

Step 4

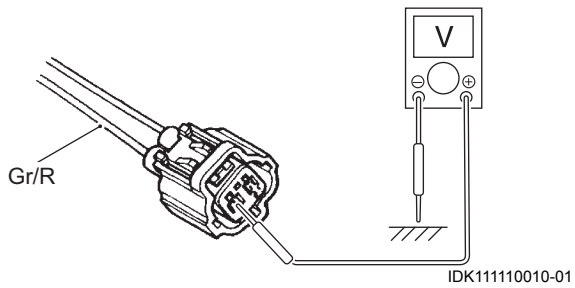
1) Disconnect the ECM connector with the ignition switch “OFF”, and check all of the injectors for resistance.
Refer to “Resistance Check” in related manual.

Is the resistance 10 – 14 Ω for each injector?

Yes — Substitute a known-good ECM and recheck.

No — Faulty injector or its circuit.

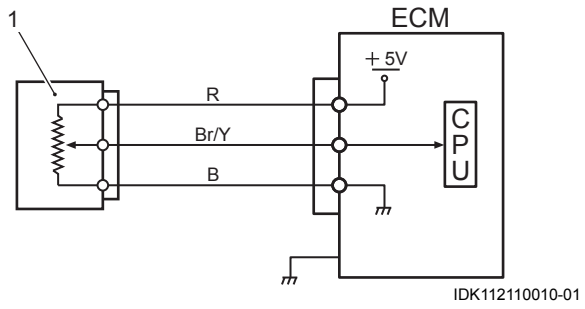
For step 3



Self-Diagnostic Code “2 – 1” TPS (Throttle Position Sensor) (Remote Control Model)

CENDK1121104023

Wiring Diagram



1. TPS

Troubleshooting

Step 1

1) With the ignition switch “OFF”, disconnect the TPS connector.
2) With the ignition switch “ON”, check the voltage at the “R” wire terminal of the TPS connector.

Is the voltage approx. 4 – 5 V?

Yes — Go to step 2.

No
- “R” wire open, “R” wire shorted to ground circuit or poor connection.
- If the wiring and connection is OK, substitute a known-good ECM and recheck.

Step 2

1) Check the TPS output voltage change.
Refer to “TPS Inspection” in related manual.

Is it in good condition?

Yes — Substitute a known-good ECM and recheck.

No
- Faulty TPS.
- “R” wire shorted to “Br/Y” wire, “B” wire open, poor “B” wire connection, poor “Br/Y” wire connection, “Br/Y” wire open or poor TPS connection.
- If the wiring and connection is OK, intermittent trouble or a faulty ECM may be the cause.

Self-Diagnostic Code “1 – 1” Rectifier / Regulator (Over Charging) (Remote Control Model)

CENDK1121104024

NOTE

It is difficult to thoroughly check the rectifier/regulator. Before replacing it with new one, check that the ground point has good electrical contact.

Troubleshooting

Step 1

1) Check the rectifier/regulator.
Refer to “Rectifier / Regulator Inspection” in related manual.

Is the result OK?

Yes — Go to step 2.

No — Faulty rectifier/regulator.

Step 2

1) With the engine running, check charging voltage at idle speed.

Is the result 16 V or higher?

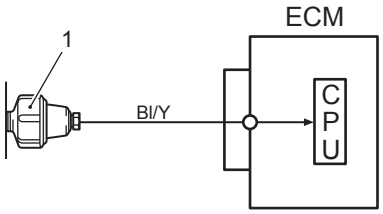
Yes — Faulty rectifier/regulator.

No — Faulty ECM or wire continuity/connection failure.

Self-Diagnostic Code “5 – 3” Oil Pressure Switch (Remote Control Model)

CENDK1121104025

Wiring Diagram



IDK112110011-01

1. Oil pressure switch

Troubleshooting

Step 1

1) With the ignition switch “OFF”, remove the oil pressure switch wire at switch.
2) With the ignition switch “ON”, check the voltage between the oil pressure switch wire terminal and body ground.

Is the voltage approx. 5 V?

Yes Go to step 2.

No
- Oil pressure switch wire open or poor connection.
- If wire and connection are OK, substitute a known-good ECM and recheck.

Step 2

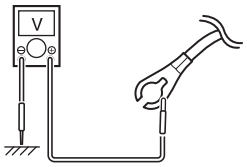
1) Check the oil pressure switch operation.
   Refer to “Oil Pressure Switch Inspection” in related manual.

Is it in good condition?

Yes Poor oil pressure switch wire connection, intermittent trouble or a faulty ECM may be the cause.

No Faulty oil pressure switch.

For step 1



I9J011110064-01

Service Instructions

Inspection of The ECM and Its Circuit (Remote Control Model)

CENDK1121106005

NOTICE

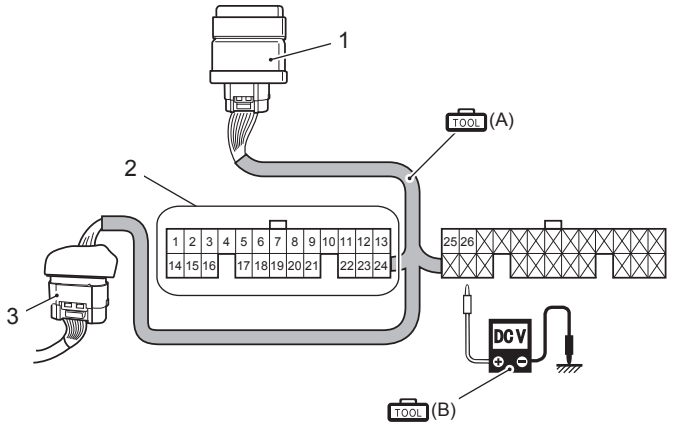
If you connect a voltmeter or ohmmeter directly to ECM terminals by removing ECM connector, you can damage the control module.

Never connect a voltmeter or an ohmmeter directly to any terminal of ECM by disconnecting control module connector.

Special tool
TOOL (A): 09930–88940 (26-pin test cord)
TOOL (B): 09930–99320 (Digital tester)

Tester knob indication
DCV

1) Turn the ignition switch “OFF”.
2) Connect the 26-pin test cord between the ECM and wire harness as shown in figure.

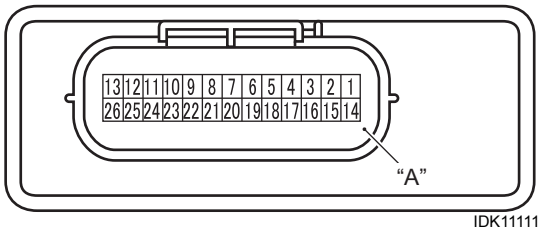


IDK112110012-02

1. ECM	2. White connector	3. Wire harness

3) Turn the ignition switch “ON”.
4) Connect the tester probe (“–”, Black) to body ground, and measure the voltage according to the “Circuit Voltage Table” (Page 1A-19).

Circuit Voltage Table
Remote control model



IDK111110007-01

"A": ECM terminal

Terminal	Wire color	Circuit	Standard voltage	Condition/Remarks
1	O	Ignition coil	—	—
2	O/B	No.1 Fuel injector	Approx. 12 V	• Ignition switch ON.
3	B/Y	High pressure fuel pump (V)	Approx. 0.6 V	• Ignition switch ON.
4	B/R	High pressure fuel pump (W)	Approx. 0.6 V	• Ignition switch ON.
5	B/W	High pressure fuel pump (U)	Approx. 0.6 V	• Ignition switch ON.
6	Bl/Y	Oil pressure switch	—	—
7	B	Ground for ECM	—	—
8	Y/G	Neutral switch	Approx. 0 V	• Ignition switch ON. • Shift into Neutral
			Approx. 4.7 V	• Ignition switch ON. • Shift into Forward or Reverse
9	Gr/R	Power output	Approx. 8 V	• Ignition switch ON. • While cranking engine with starter motor.
			Approx. 12 V	• Ignition switch ON.
10	Br/Y	Throttle position sensor	Approx. 0.7 V	• Ignition switch ON. • Throttle FCT
			Approx. 4 V	• Ignition switch ON. • Throttle WOT
11	—	—	—	—
12	R	Power for sensor (5V)	Approx. 5 V	• Ignition switch ON.
13	Gr	DC power for ECM	Approx. 12 V	• Ignition switch ON.
14	B	Ground for ECM power	—	—
15	B/Br	No.2 Fuel injector	Approx. 12 V	• Ignition switch ON.
16	P	Diag LED	—	—
17	W/B	IAC valve	Approx. 0 V	• Ignition switch ON.
18	Y/B	Tachometer	—	—
19	Y	Communication line (B)	—	—
20	O/Y	Communication line (A)	—	—
21	Bl/R	Emergency stop switch	Approx. 5 V	• Ignition switch ON. • Stop switch plate IN.
			Approx. 0 V	• Ignition switch ON. • Stop switch plate OUT.
22	Lg/B	IAT sensor	0.04 – 4.6 V	• Ignition switch ON.
23	W	MAP sensor	0.79 – 4.2 V	• Ignition switch ON.
24	Lg/W	Cylinder temp. sensor	0.14 – 4.75 V	• Ignition switch ON.
25	Y/Bl	CMP sensor	Approx. 0.3 V or 5 V	• Ignition switch ON.
26	R/B	CKP sensor	—	—