Section 1

Power Head

CONTENTS

NOTE

For the items with asterisk (*) in the "CONTENTS" below, refer to the same section of the service manual mentioned in the "FOREWORD" of this manual.

Engine Control

General Description

Engine Control Module (ECM) (2014/07)

CENFJ6111101011

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later,
05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

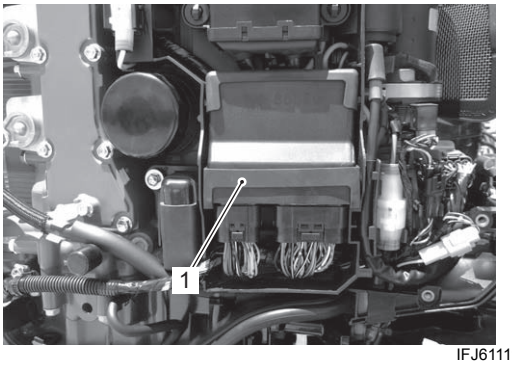
NOTE

For details other than the following information of Engine Control Module (ECM), refer to "Engine Control Module (ECM)" in related manual.

The case shape and connector configuration of the ECM have been changed.

- The connector has been changed from two 36-pin to one each of 18-pin and 34-pin.
- The ECM programming function has been changed for total operating hours indication on the multi-function tiller handle models.
- IAC fixed mode function has been added to ECM.

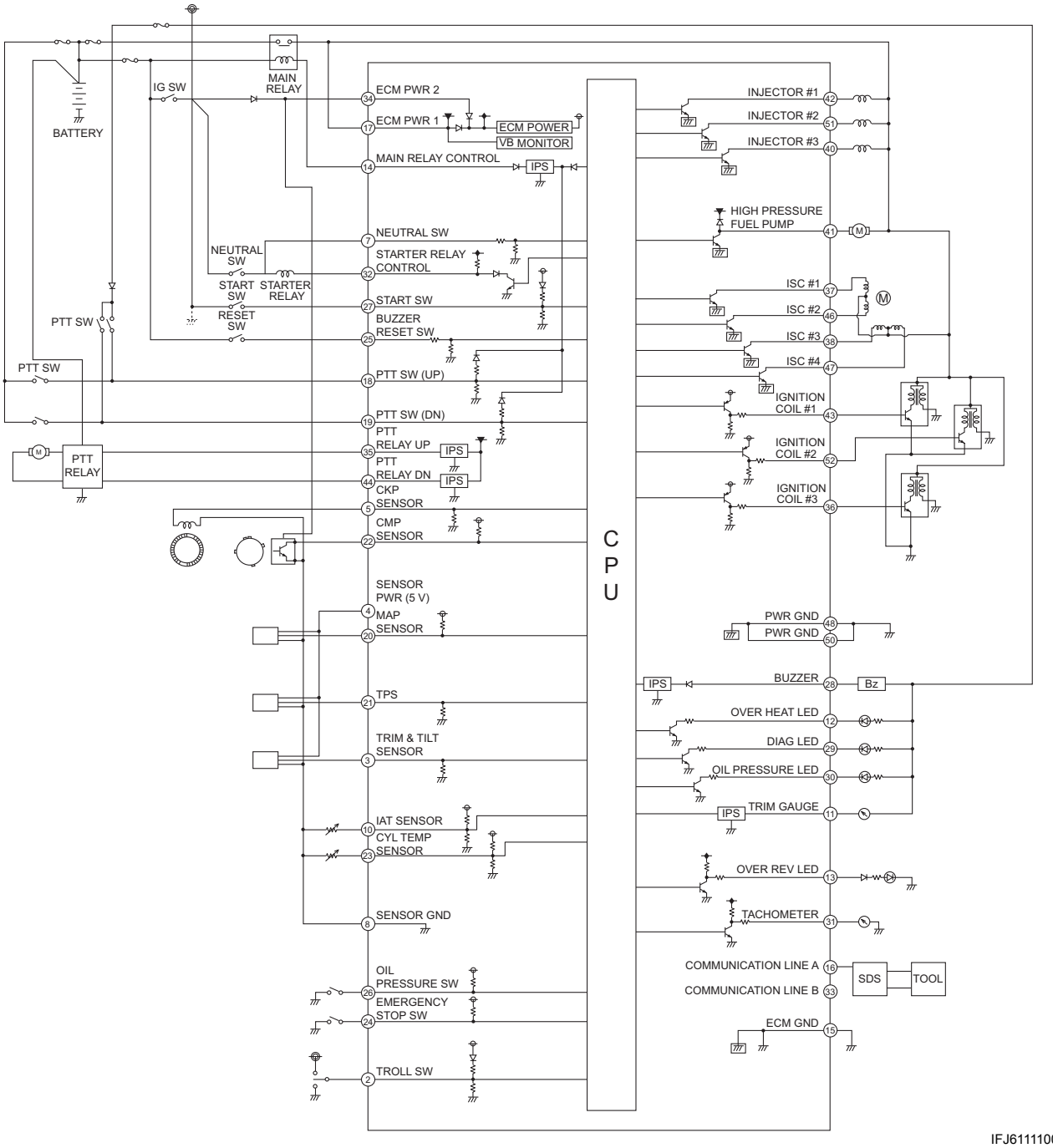
However, basic programming of the engine control, input data from sensor/switch to ECM, the output data to actuators are the same.



IFJ611110007-01

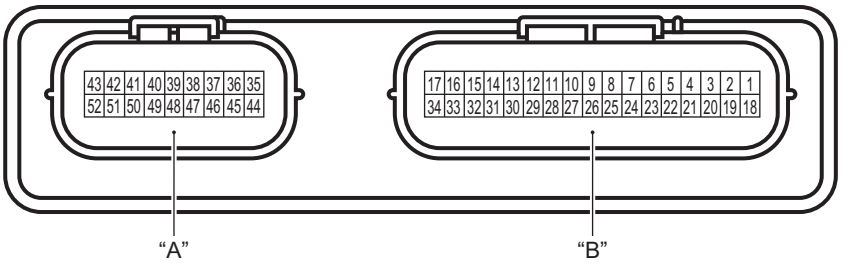
1. ECM

ECM Input / Output Circuit Diagram



IFJ611110001-01

ECM Connector / Terminals Layout



IFJ011110003-01

"A": 18-pin connector	"B": 34-pin connector

Terminal	Wire color	Circuit	Terminal	Wire color	Circuit
1	—	—	27	Br	Start switch
2	V	Troll mode switch	28	Bl/W	Buzzer
3	W/Y	Trim/Tilt sensor	29	G/W	CHECK ENGINE lamp
4	R	Power source for sensor	30	Bl/B	Oil lamp
5	R/B	CKP sensor	31	Y/B	Tachometer
6	B/G	Ignition switch key	32	G	Starter relay control
7	Y/G	Neutral switch	33	Y	PC communication line (B)
8	B/W	Ground for sensors	34	B/Bl	Power source No.2 for ECM
9	—	—	35	Lbl/W	PTT relay "UP"
10	Lg/B	IAT sensor	36	Gr/Y	No.3 ignition coil
11	Y	Trim gauge	37	W/B	IAC valve #1
12	G/Y	TEMP lamp	38	R/G	IAC valve #3
13	P/W	REV–LIMIT lamp	39	—	—
14	P/B	Ground for ECM main relay	40	R/W	No.3 fuel injector (–)
15	B	Ground for ECM	41	B/R	High pressure fuel pump (–)
16	O/Y	PC communication line (A)	42	O/B	No.1 fuel injector (–)
17	Gr	Power source No.1 for ECM	43	O	No.1 ignition coil
18	Lbl	PTT switch "UP"	44	P/W	PTT relay "DOWN"
19	P	PTT switch "DOWN"	45	—	—
20	W	MAP sensor	46	R/Y	IAC valve #2
21	Br/Y	Throttle position sensor	47	W/Bl	IAC valve #4
22	Y/Bl	CMP sensor	48	B	Ground for power
23	Lg/W	Cylinder temp. sensor	49	—	—
24	Bl/R	Emergency stop switch	50	B	Ground for power
25	O	Buzzer cancel	51	B/Br	No.2 fuel injector (–)
26	Bl	Oil pressure switch	52	Bl	No.2 ignition coil

Operating Hour Indication System Description (DF40ATH/QH/50ATH/50AVTH/60ATH/QH/60AVTH 2014/07)

CENFJ6111101012

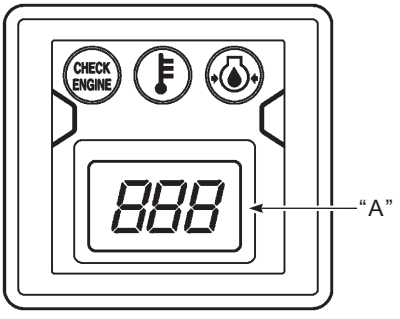
Applicable Model and Effective Serial Number:
DF40ATH/QH (04003F)-510001 and later.
DF50ATH (05003F)-510001 and later.
DF50AVTH (05004F)-510001 and later.
DF60ATH/QH (06002F)-510001 and later.
DF60AVTH (06003F)-510001 and later.

The operating hours indication in the tachometer-indicator equipped into the tiller handle has been improved.
When the ignition switch is initially turned “ON”, the total operating hours is shown at the 2 steps in the tachometer-indicator.
The detail of 2 steps indication, combination of total operating hours and tachometer indications are described below.

NOTE

The total operating hours displayed are those of the actual engine operation, not the ignition switch “ON” time.

Tachometer-Indicator



IFJ011110002-01

“A”: Tachometer indication

Tachometer Indication Procedure

Lapse of Time	Tachometer Indication
First 2 seconds after turning the ignition switch on	“0”
Next 2.5 seconds (1st step)	Indication of number of time in which the operating hours attain to 500 hours in the 3rd digit.
Next 1 second	“0”
Next 3 seconds (2nd step)	The hours subtracted the hours indicated in the first step indication from the total operating hours. (Indicated in unit of 10 hours)

Chart of Total Operating Hours Indication

Total Operating Hours	Tachometer Indication	
	1st Step	2nd Step
0 h – 50 h	0	0
51 h – 59 h		50
↓		↓
300 h – 309 h		300
↓		↓
540 h – 549 h		540
550 h – 559 h	100 (1 time)	50
↓		↓
800 h – 809 h		300
↓		↓
1 040 h – 1 049 h		540
1 050 h – 1 059 h	200 (2 times)	50
↓		↓
1 300 h – 1 309 h		300
↓		↓
1 540 h – 1 549 h		540
1 550 h – 1 559 h	300 (3 times)	50
↓		↓
1 800 h – 1 809 h		300
↓		↓
2 040 h and over		remaining at 540

NOTE

"0" of the first step indication signifies 0 time, "100" means 1 time (500 hours), "200" means 2 times (1 000 hours = 500 x 2), and "300" means 3 times (1 500 hours = 500 x 3).
The total operating hours are the sum of hours indicated in the first step, and the indicated hours in the second step (indicated in unit of 10 hours).

NOTE

When the analog monitor-tachometer is connected to tiller handle model, the monitor-tachometer indicates the total operating hours in 2 steps according to the above pattern of tachometer indication.

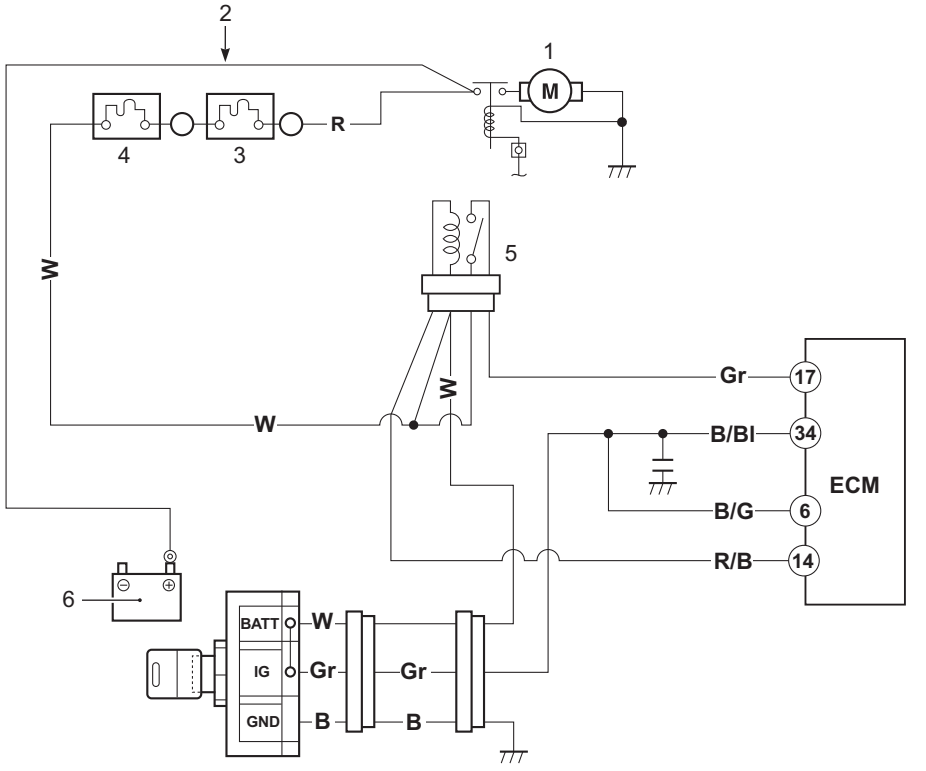
Diagnostic Information and Procedures

ECM Power and Ground Circuit Check (2014/07)

CENFJ6111104017

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later, 05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

Wiring Diagram



IFJ011110007-01

1. Starter motor	3. 30 amp. fuse	5. ECM main relay
2. Battery cable	4. 30 amp. fuse	6. Battery

Circuit Description

When the ignition switch is turned “ON”, the main relay turns “ON” (the contact point closes) and the main power is supplied to the ECM.

Troubleshooting

Step 1

Is operation of the main relay heard when the ignition switch is turned “ON”?

Yes Go to step 4.

No Go to step 2.

Step 2

Are the main fuses (30 amp.), and (for Ignition and ECM) in good condition?

Yes Go to step 3.

No Replace.

Step 3

1) Disconnect the ECM connector at the ECM with the ignition switch “OFF”.
2) Measure the voltage between the No. 14 terminal of the ECM connector and body ground.

Is the voltage 12 V (Battery Voltage)?

Yes Go to step 4.

No
- Check the ECM main relay.

  Refer to “ECM Main Relay Inspection” in related manual.
- Poor ECM main relay connection.
- R/B wire open, shorted or poor connection.

Step 4

1) Turn the ignition switch “OFF”.
2) Connect the 18 pin & 34 pin test cord set between the ECM and the main wire harness.
3) Turn the ignition switch “ON”.
4) Measure the voltage between the No. 34 terminal and body ground, and the No. 6 terminal and body ground.

Is the voltage 12 V (Battery Voltage)?

Yes Go to step 5.

No
- Check the ignition switch.

  Refer to “Ignition Switch Inspection” in Section 1I in related manual.
- Gr, B/Bl, B/G wire open circuit or poor connection.

Step 5

1) Turn the ignition switch “OFF”.
2) Connect the 18 pin & 34 pin test cord set between the ECM and the main wire harness.
3) Turn the ignition switch “ON”.
4) Measure the voltage between the No. 14 terminal and body ground.

Is the voltage approx. 0.5 V?

Yes Go to step 6.

No
- R/B wire open, shorted or poor connection.
- If the wiring and connection is OK, intermittent trouble or a faulty ECM may be the cause.

Step 6

1) Turn the ignition switch “ON”.
2) Measure the voltage between the No. 17 terminal and body ground.

Is the voltage 12 V (Battery Voltage)?

Yes ECM power and ground circuit are in good condition.

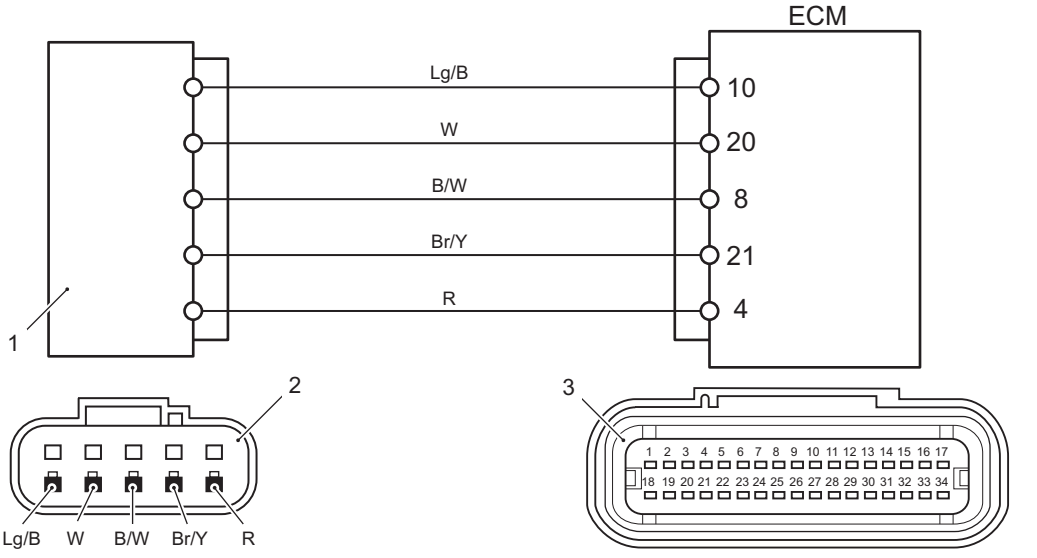
No
- Gr wire open, shorted or poor connection.
- Faulty ECM main relay.

Self-Diagnostic Code “3 – 4” MAP Sensor (2014/07)

CENFJ6111104018

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later, 05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

Wiring Diagram



IFJ611110002-04

1. MAP sensor / TPS / IAT sensor	2. Sensor connector (harness side)	3. ECM connector (harness side)

Troubleshooting

Step 1

1) Turn the ignition switch “OFF”.
2) Check the MAP sensor connector for loose or poor contacts.
   If OK, then check the MAP sensor lead wire continuity.
3) Disconnect the MAP sensor connector at sensor.
4) Check the continuity between “R” wire terminal and “B/W” wire terminal.

Is it no continuity?

Yes — Go to step 2.

No — “R” wire shorted to “B/W” wire.

Step 2

1) With the ignition switch “ON”, check the voltage at the “R” wire terminal of MAP sensor and ground.

Is the voltage approx. 4 – 5 V?

Yes — Go to step 3.

No — “R” wire open, “R” wire shorted to ground circuit or poor connection.

Step 3

1) With the ignition switch “OFF”, disconnect ECM connectors from ECM.
2) Check the continuity between “R” terminal of MAP sensor connector and No. 4 terminal of ECM connector.
   Also check “W” terminal of MAP sensor connector and No. 20 terminal of ECM connector.

Is it continuity?

Yes — Go to step 4.

No
- “R” wire open.
- “W” wire open.

Step 4

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

Is it in good condition?

Yes — Substitute a known-good ECM and recheck.

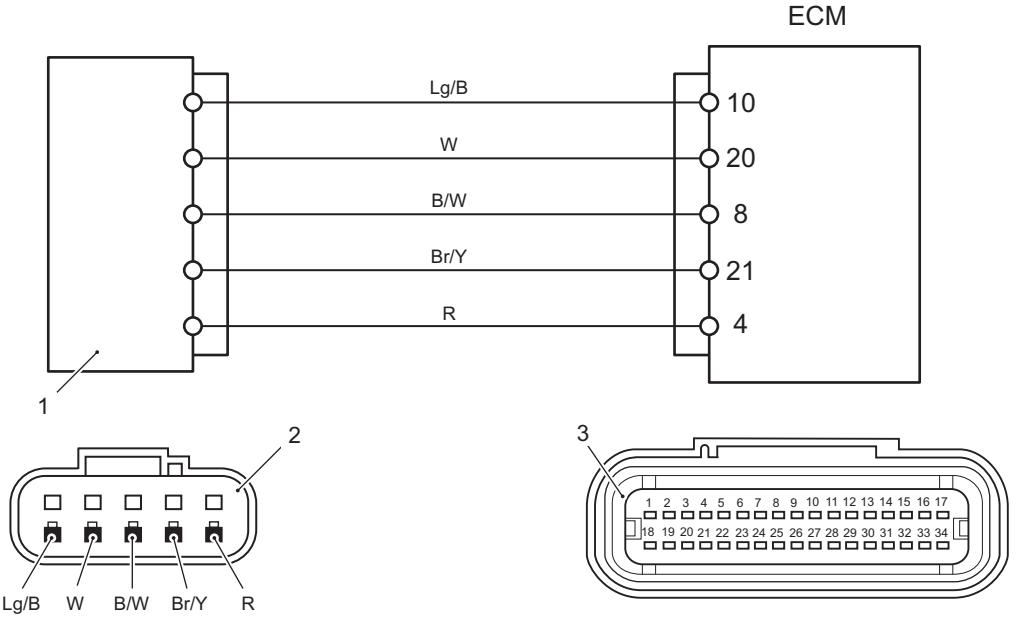
No
- Faulty MAP sensor.
- “R” wire shorted to “W” wire, “B/W” wire open, poor “B/W” wire connection, poor “W” wire connection, “W” wire open or poor MAP sensor connection.
- If the wiring and connection is OK, intermittent trouble or a faulty ECM may be the cause.

Self-Diagnostic Code “2 – 3” IAT Sensor (2014/07)

CENFJ6111104019

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later, 05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

Wiring Diagram



IFJ611110003-01

1. MAP sensor / TPS / IAT sensor	2. Sensor connector (harness side)	3. ECM connector (harness side)

Troubleshooting

Step 1

1) Turn the ignition switch “OFF”.
2) Check the IAT sensor connector for loose or poor contacts. If OK, then check the IAT sensor lead wire continuity.
3) Disconnect the IAT sensor connector at sensor.
4) Check the continuity between “Lg/B” wire terminal and “B/W” wire terminal.

Is it no continuity?

Yes — Go to step 2.

No — “Lg/B” wire shorted to “B/W” wire.

Step 2

1) With the ignition switch “OFF”, disconnect the 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 3.

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

Step 3

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

Is it in good condition?

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

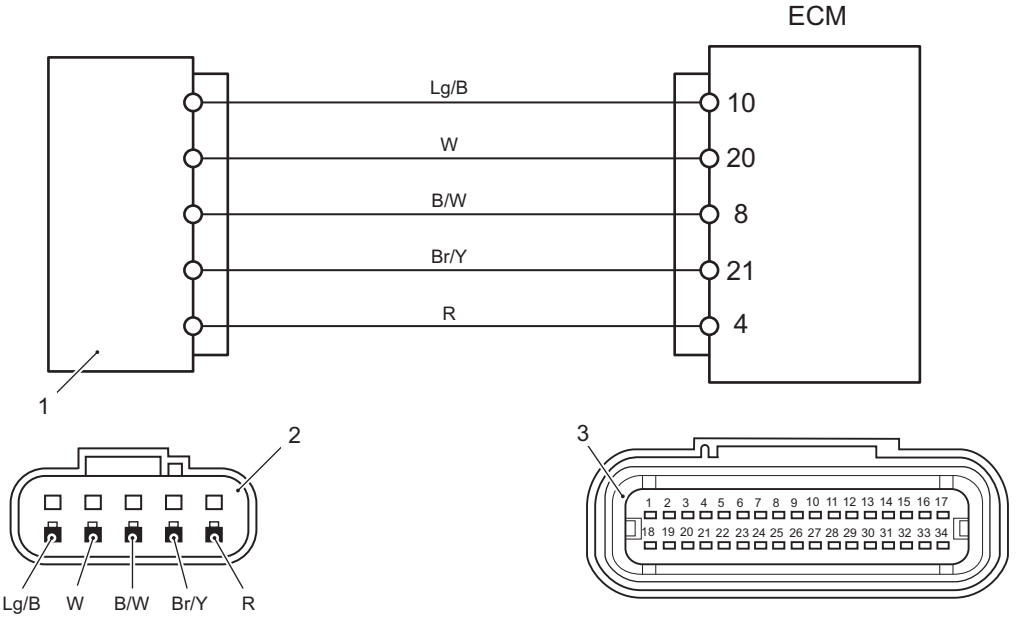
No — Faulty IAT sensor.

Self-Diagnostic Code “2 – 2” Air Intake System (2014/07)

CENFJ6111104020

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later, 05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

Wiring Diagram



IFJ611110004-01

1. MAP sensor / TPS / IAT sensor	2. Sensor connector (harness side)	3. ECM connector (harness side)

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 Section 1C in related manual.

Is it in good condition?

Yes — Go to step 3.

No
- Faulty TPS.
- “R” wire shorted to “Br/Y” wire, “B/W” wire open, poor “B/W” 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.

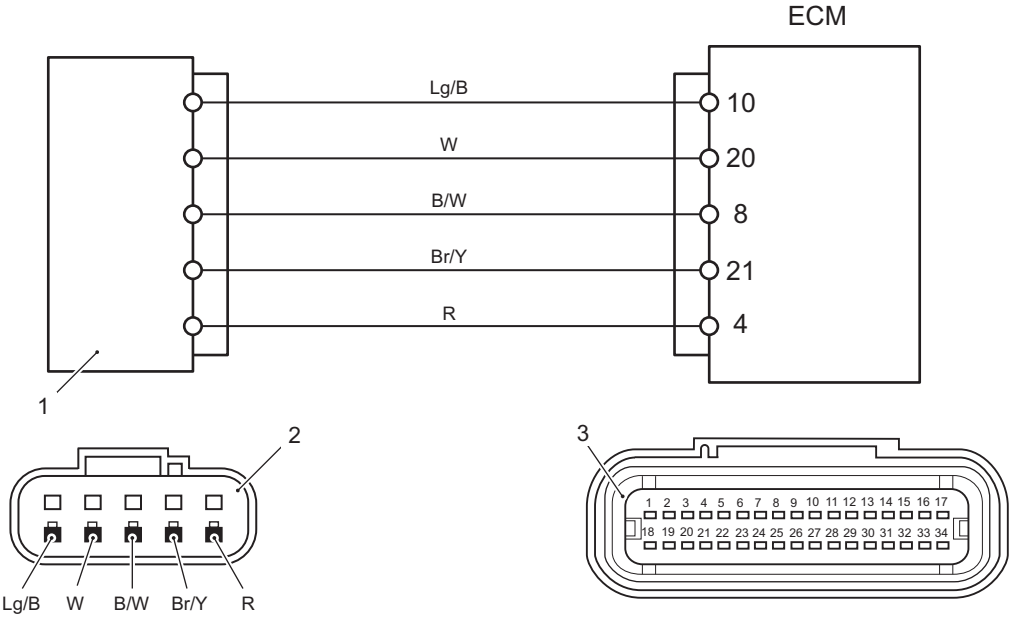
No — Faulty air intake system.

Self-Diagnostic Code “3 – 2” MAP Sensor 2 (2014/07)

CENFJ6111104021

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later, 05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

Wiring Diagram



IFJ611110005-01

1. MAP sensor / TPS / IAT sensor	2. Sensor connector (harness side)	3. ECM connector (harness side)

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 Section 1C in related manual.

Is it in good condition?

Yes — Go to step 3.

No — Faulty MAP sensor.

Step 3

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

Is it in good condition?

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

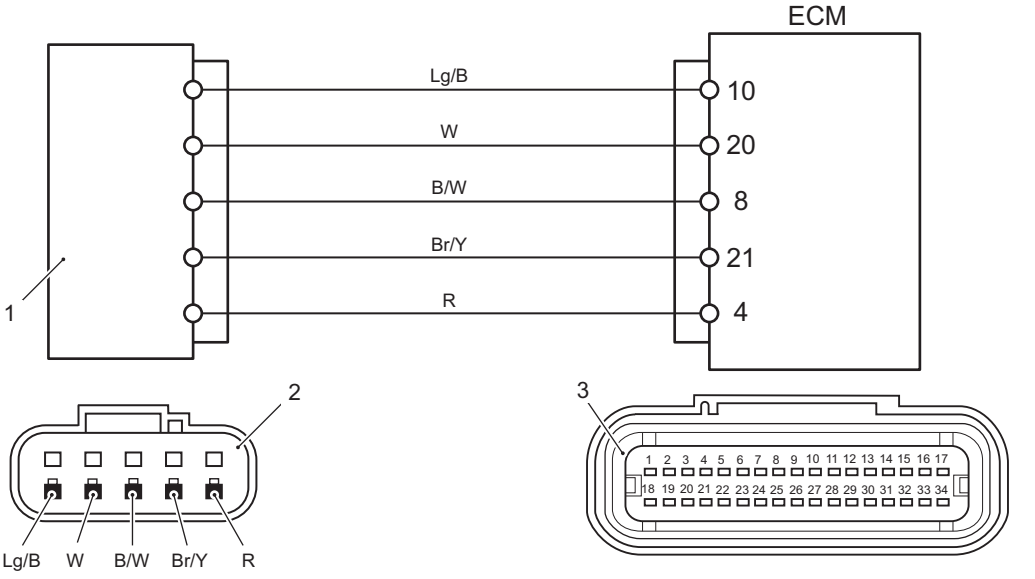
No
- Faulty TPS.
- “R” wire shorted to “Br/Y” wire, “B/W” wire open, poor “B/W” wire connection, poor “Br/Y” wire connection, “Br/Y” wire open or poor TPS connection.
- If the wiring and connection is OK, intermittent trouble or a faulty ECM may be the cause.

Self-Diagnostic Code “2 – 1” TPS (Throttle Position Sensor) (2014/07)

CENFJ6111104022

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later, 05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

Wiring Diagram



IFJ611110006-02

1. MAP sensor / TPS / IAT sensor	2. Sensor connector (harness side)	3. ECM connector (harness side)

Troubleshooting

Step 1

1) Turn the ignition switch “OFF”.
2) Check the TPS connector for loose or poor contacts.
   If OK, then check the TPS lead wire continuity.
3) Disconnect the TPS connector at sensor.
4) Check the continuity between “Br/Y” wire terminal and “R” wire terminal.

Is it no continuity?

Yes — Go to step 2.

No — “R” wire shorted to “Br/Y” wire.

Step 2

1) With the ignition switch “ON”, check the voltage at the “R” wire terminal of TPS and ground.

Is the voltage approx. 4 – 5 V?

Yes — Go to step 3.

No — “R” wire open, “R” wire shorted to ground circuit or poor connection.

Step 3

1) With the ignition switch “OFF”, disconnect ECM connectors from ECM.
2) Check the continuity between “Br/Y” terminal of TPS connector and No. 21 terminal of ECM connector.
   Also check “B/W” terminal of TPS connector and No. 8 terminal of ECM connector.

Is it continuity?

Yes — Go to step 4.

No
- “B/W” wire open.
- “Br/Y” wire open.

Step 4

1) Check the TPS output voltage change.
   Refer to “TPS Inspection” in Section 1C 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/W” wire open, poor “B/W” 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.

Service Instructions

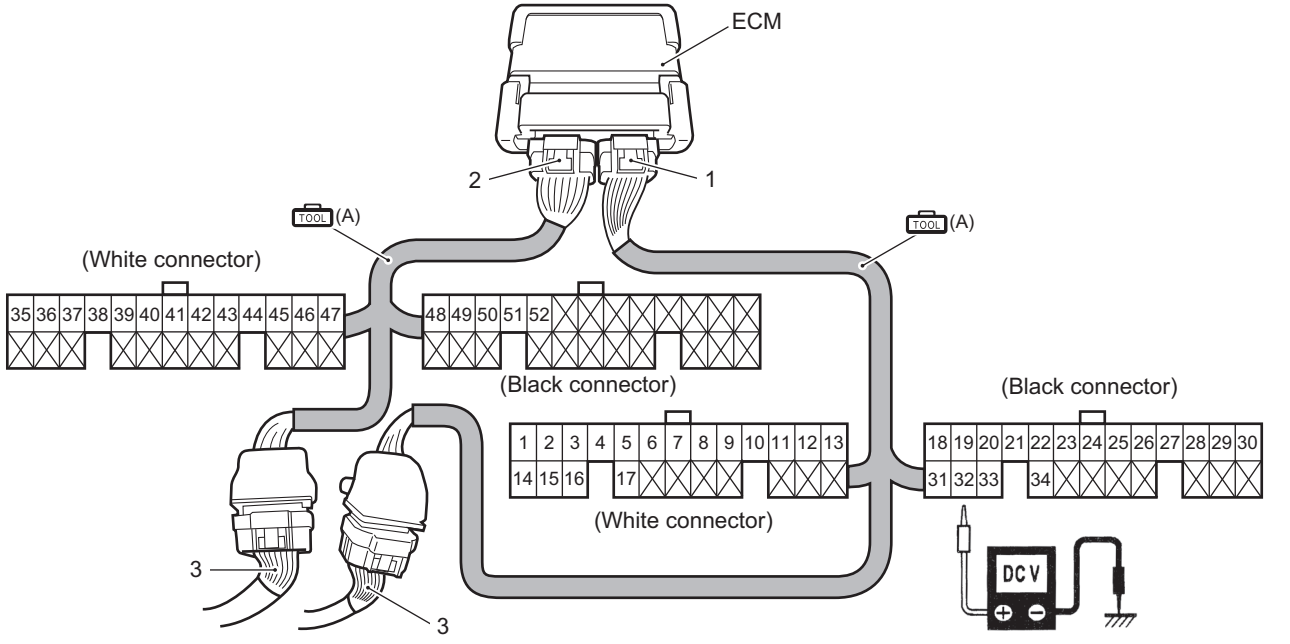
How to Use the 18-pin and 34-pin Test Cord Set (2014/07)

CENFJ6111106004

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later,
05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

This test cord is used when checking a circuit for voltage, etc. and is connected between the ECM and the wiring harness.
To take a measurement, connect the tester probe to the relevant terminal of the test cord.

Special tool
TOOL (A): 09930–89290 (18 pin & 34 pin test cord)



IFJ011110004-01

1. 34-pin test cord side	2. 18-pin test cord side	3. Wire harness

Inspection of the ECM and Its Circuit (2014/07)

CENFJ6111106005

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later, 05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

NOTICE

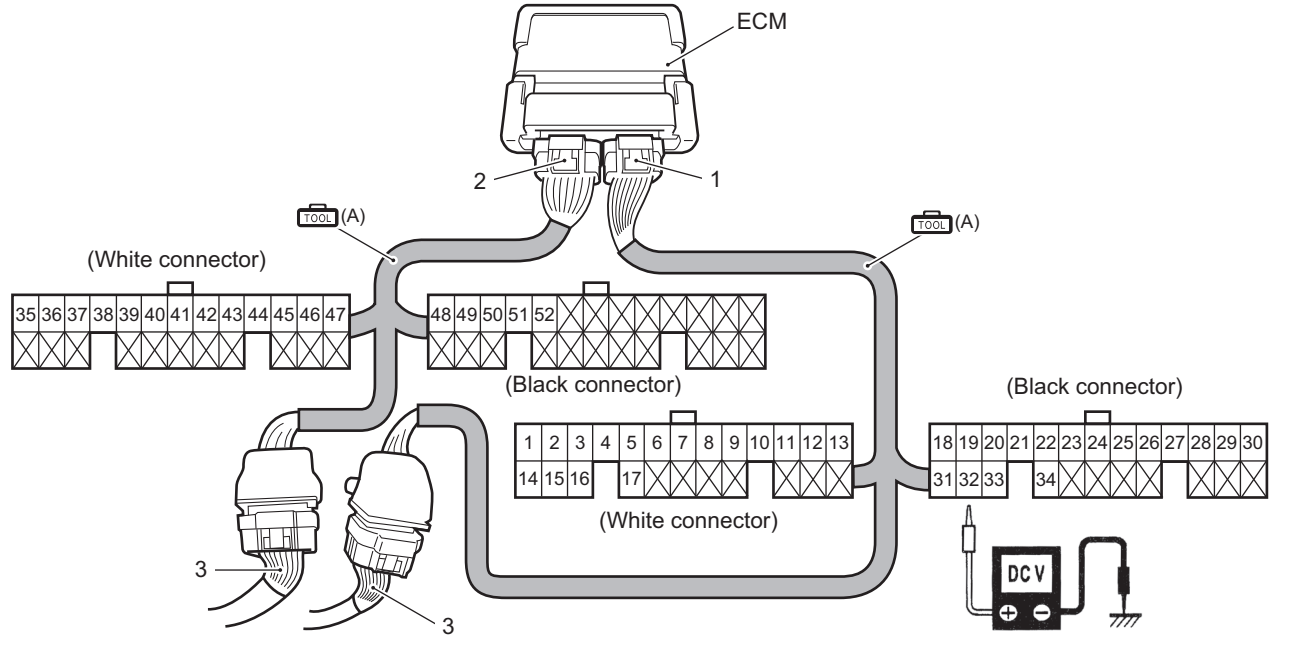
If you connect a voltmeter or ohmmeter directly to ECM terminals by removing ECM connector, you can damage the control module.

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

Special tool
(A): 09930–89290 (18 pin & 34 pin test cord)
: 09930–99320 (Digital tester)

Tester knob indication
Voltage (⎓)

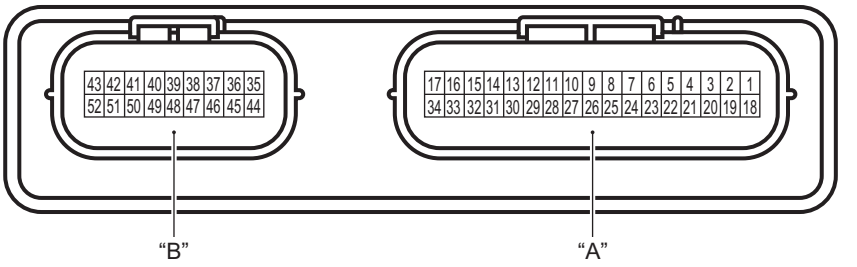
1) Turn the ignition switch “OFF”.
2) Connect the 18-pin and 34-pin test cord set between the ECM and wire harness as shown in figure.
3) Turn the ignition switch “ON”.
4) Connect the tester probe (“–”, Black) to body ground, and measure the voltage according to the “Circuit Voltage Table” (Page 1A-15).



IFJ011110005-01

1. 34-pin test cord side	2. 18-pin test cord side	3. Wire harness

Circuit Voltage Table



IFJ011110006-01

"A": 34-pin connector	"B": 18-pin connector

Terminal	Wire color	Circuit	Standard voltage	Condition/Remarks
1	—	—	—	—
2	V	Troll mode switch	Approx. 12 V	Ignition switch ON, troll mode switch UP side push.
			Approx. 2.6 V	Ignition switch ON, troll mode switch free.
			Approx. 0 V	Ignition switch ON, troll mode switch DOWN side push.
3	W/Y	Trim and Tilt sensor	Approx. 0.9 – 4.0 V	Ignition switch ON.
4	R	Power source for sensor	Approx. 5 V	Ignition switch ON.
5	R/B	CKP sensor	—	—
6	B/G	Ignition switch key	Approx. 12 V	Ignition switch ON.
7	Y/G	Neutral switch	Approx. 12 V	Ignition switch ON, shift into NEUTRAL.
			Approx. 0 V	Ignition switch ON, shift into FOREARD or REVERSE.
8	B/W	Ground for sensors	—	—
9	—	—	—	—
10	Lg/B	IAT sensor	0.04 – 4.46 V	Ignition switch ON.
11	Y	Trim gauge	—	—
12	G/Y	TEMP lamp	—	—
13	P/W	REV–LIMIT lamp	—	—
14	P/B	Ground for ECM main relay	Approx. 12 V	Ignition switch OFF.
			Approx. 0.5 V	Ignition switch ON. Engine cranking (running).
15	B	Ground for ECM	—	—
16	O/Y	PC communication line (A)	—	—
17	Gr	Power source No.1 for ECM	Approx. 12 V	Ignition switch ON.
18	Lbl	PTT switch "UP"	Approx. 12 V	Ignition switch ON. PTT UP switch ON.
			Approx. 0 V	Ignition switch ON. PTT UP switch OFF.
19	P	PTT switch "DOWN"	Approx. 12 V	Ignition switch ON. PTT DN switch ON.
			Approx. 0 V	Ignition switch ON. PTT DN switch OFF.
20	W	MAP sensor	0.79 – 4.2 V	Ignition switch ON.
21	Br/Y	Throttle position sensor	Approx. 3.8 V	Ignition switch ON. Throttle WOT.
			Approx. 0.7 V	Ignition switch ON. Throttle FCT.
22	Y/Bl	CMP sensor	Approx. 0.3 V or 5 V	Ignition switch ON.
23	Lg/W	Cylinder temp. sensor	0.14 – 4.75 V	Ignition switch ON.
24	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.
25	O	Buzzer cancel	Approx. 12 V	Ignition switch ON. Key pushed in.
			Approx. 0 V	Ignition switch ON. Key not pushed in.
26	Bl	Oil pressure switch	Approx. 5 V	While engine running.
			Approx. 0 V	Engine stopped (Ignition switch ON).
27	Br	Start switch	Approx. 2.5 V	Ignition switch ON.
			Approx. 12 V	Ignition switch START position.
28	Bl/W	Buzzer	—	—
29	G/W	CHECK ENGINE lamp	—	—

Terminal	Wire color	Circuit	Standard voltage	Condition/Remarks
30	Bl/B	Oil lamp	—	—
31	Y/B	Tachometer	—	—
32	G	Starter relay control	Approx. 0.5 V	Ignition switch ON, Cranking.
			Approx. 12 V	Ignition switch ON, Normal.
33	Y	PC communication line (B)	—	—
34	B/Bl	Power source No.2 for ECM	Approx. 12 V	Ignition switch ON.
35	Lbl/W	PTT relay “UP”	Approx. 0 V	PTT switch UP free.
			Approx. 12 V	PTT switch UP push.
36	Gr/Y	No.3 ignition coil	Approx. 0 V	Ignition switch ON.
37	W/B	IAC valve #1	Approx. 12 V or 0 V	Ignition switch ON.
38	R/G	IAC valve #3	Approx. 12 V or 0 V	Ignition switch ON.
39	—	—	—	—
40	R/W	No.3 fuel injector (–)	Approx. 12 V	Ignition switch ON.
41	B/R	High pressure fuel pump (–)	Approx. 0 V	• Stop switch plate IN, shift into NEUTRAL. For 3 sec. after ignition switch ON. • While engine running.
			Approx. 12 V	Engine stopped. Ignition switch ON. Stop switch plate IN, shift into NEUTRAL.
42	O/B	No.1 fuel injector (–)	Approx. 12 V	Ignition switch ON.
43	O	No.1 ignition coil	Approx. 0 V	Ignition switch ON.
44	P/W	PTT relay “DOWN”	Approx. 0 V	PTT switch DN free.
			Approx. 12 V	PTT switch DN push.
45	—	—	—	—
46	R/Y	IAC valve #2	Approx. 12 V or 0 V	Ignition switch ON.
47	W/Bl	IAC valve #4	Approx. 12 V or 0 V	Ignition switch ON.
48	B	Ground for power	—	—
49	—	—	—	—
50	B	Ground for power	—	—
51	B/Br	No.2 fuel injector (–)	Approx. 12 V	Ignition switch ON.
52	Bl	No.2 ignition coil	Approx. 0 V	Ignition switch ON.

Engine Electrical Devices

General Description

ECM Power Source Line (2014/07)

CENFJ6111301003

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later, 05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

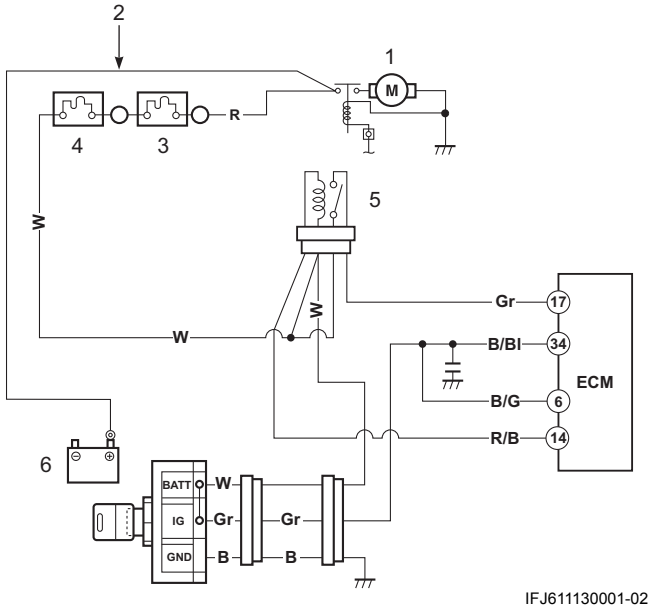
The ECM is battery dependent and must be provided with its own dedicated 12 V power supply. The electrical circuits which provide this supply are:

1. When the ignition switch is turned “ON”, battery power passes from the white lead wire, through the ignition switch contacts to the gray output lead wire to the No. 6 and 34 terminals of the ECM.

   NOTE

   Ensure that the battery cable connections are clean and secure.
   A failure at the battery connection will cause incorrect operation of the ECM and starter motor cranking system.

2. When the ECM main relay is energized, by turning the ignition switch “ON”, battery voltage is supplied to the No. 17 terminal of the ECM.



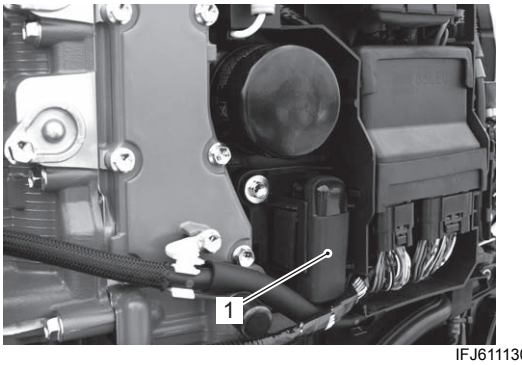
IFJ611130001-02

1. Starter motor	4. 30 amp. fuse
2. Battery cable	5. ECM main relay
3. 30 amp. fuse	6. Battery

Main Harness Capacitor

This capacitor stabilizes the voltage in the engine control system circuit.

- If a “short” occurs in this circuit, the ECM (30 amp.) fuse will blow causing the engine control system to be inoperative.
- If an “open” occurs in this circuit, the cranking system will not function.



IFJ611130002-01

1. Main harness capacitor

Service Instructions

Resistance Check (2014/07)

CENFJ6111306017

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later, 05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

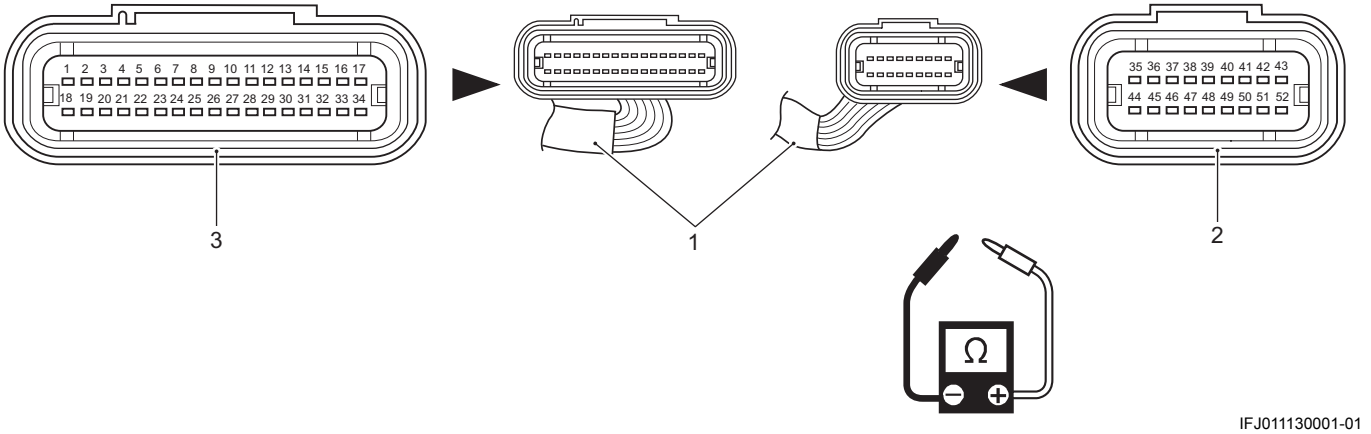
Special tool
TOOL : **09930–99320 (Digital tester)**

Tester knob indication
Resistance (Ω)

NOTE

Make sure ignition switch is always OFF when measuring resistance.

1) Turn ignition switch OFF.
2) Disconnect battery cables from battery.
3) Disconnect wire harness connector from ECM.
4) Connect the tester probes to terminal (wire harness side) and measure resistance according to the “Resistance Table” (Page 1C-2).



IFJ011130001-01

1. Engine main wire harness	2. 18-pin connector	3. 34-pin connector

Resistance Table

Circuit	Terminal for tester probe connection	Standard resistance (at 20 °C)
CKP sensor	5 (R/B) to 8 (B/W)	168 – 252 Ω
Fuel injector No.1	42 (O/B) to 17 (Gr)	10 – 14 Ω
Fuel injector No.2	51 (B/Br) to 17 (Gr)	
Fuel injector No.3	40 (R/W) to 17 (Gr)	
IAC valve #1	37 (W/B) to 17 (Gr)	25 – 34 Ω (Including IAC fuse 10 amp resistance)
IAC valve #2	46 (R/Y) to 17 (Gr)	
IAC valve #3	38 (R/G) to 17 (Gr)	
IAC valve #4	47 (W/Bl) to 17 (Gr)	
IAT sensor	10 (Lg/B) to 8 (B/W)	0 °C (32 °F): 5.3 – 6.6 kΩ 25 °C (77 °F): 1.8 – 2.3 kΩ 50 °C (122 °F): 0.73 – 0.96 kΩ 75 °C (135 °F): 0.33 – 0.45 kΩ (Thermistor characteristic)
Cylinder temperature sensor	23 (Lg/W) to 8 (B/W)	

IAT Sensor Inspection (2014/07)

CENFJ6111306018

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later, 05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

NOTE

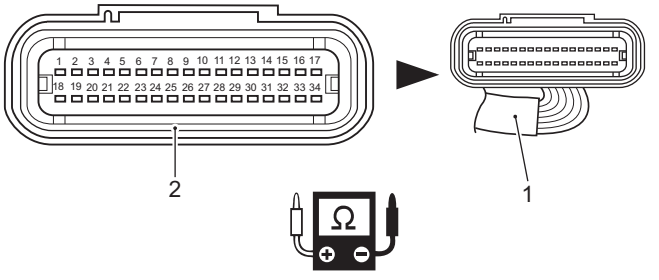
The IAT sensor is a thermistor type sensor, which is very sensitive to temperature change. Resistance will drop as temperature goes up.

1) Disconnect wire harness connector at ECM.
2) Connect tester probes to No. 10 terminal and No. 8 terminal (wire harness side) and measure resistance.

Special tool
TOOL : 09930–99320 (Digital tester)

Tester knob indication
Resistance (Ω)

IAT sensor resistance (Temperature)
1.8 – 2.3 kΩ (25°C (77°F))



IFJ611130003-01

1. Engine main wire harness	2. 34-pin connector

3) If out of specification, check wire harnesses for open and short.
If wire harnesses are in good condition, replace throttle body assembly and recheck.

NOTE

MAP sensor / TPS / IAT sensor are combined into one unit that is installed on top of the throttle body. Never loosen the screws securing TPS. TPS position has been adjusted the factory and must not be changed.

CMP sensor Inspection (2014/07)

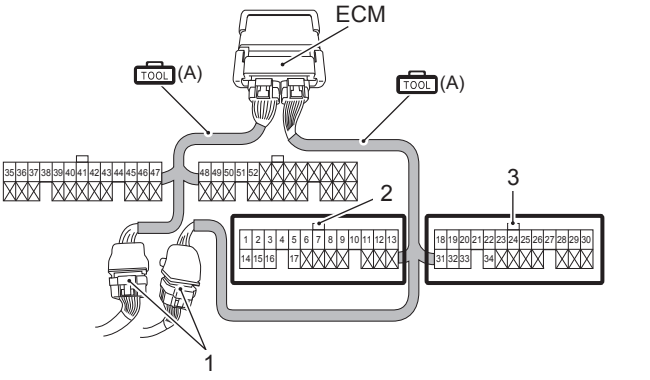
CENFJ6111306019

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later, 05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

1) Turn ignition switch OFF.
2) Remove the two bolts and fuel hose guard.
3) Remove the bolt and CMP sensor.

4) Connect the 18-pin and 34-pin test cord set between ECM and wire harness as shown in figure.

Special tool
TOOL (A): 09930–89290 (18 pin & 34 pin test cord)



IDG211130066-01

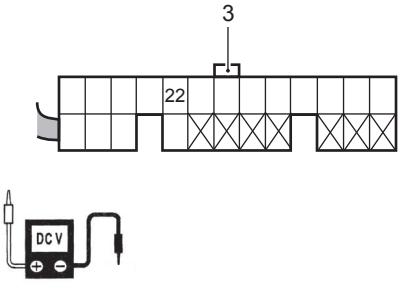
1. Wire harness	3. Black connector
2. White connector	

5) Connect the tester probe (“+”, Red) to No. 22 terminal.
6) Connect the tester probe (“–”, Black) to No. 8 terminal (or to body ground).

Special tool
TOOL : 09930–99320 (Digital tester)

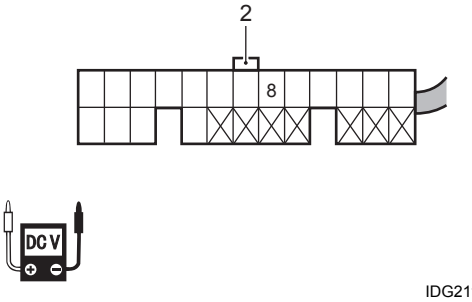
Tester knob indication
DC Voltage (⎓)

34-pin test cord (Black connector)



IDG211130025-01

34-pin test cord (White connector)

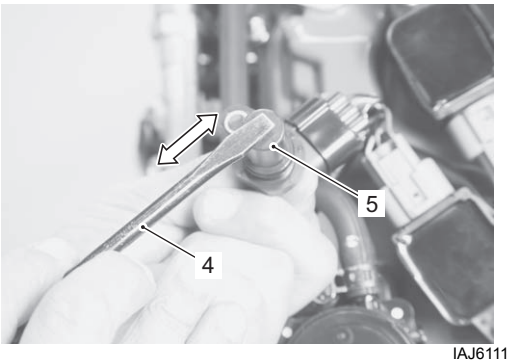


IDG211130026-01

7) Turn Ignition switch ON.
8) Measure the voltage when the tip of a steel screwdriver is brought near and then pulled away from the sensor tip.

When screwdriver is brought near
Approx. 5.0 V

When screwdriver is pulled away
Approx. 0.3 V



IAJ611130024-01

4. Screw driver	5. CMP sensor

9) If the voltage does not change in the above test, check wire harnesses for open and short.
If wire harnesses are in good condition, replace CMP sensor and recheck.
10) Reinstall CMP sensor.

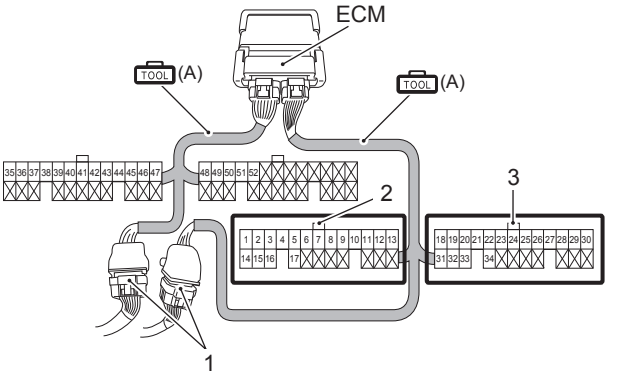
MAP Sensor Output Voltage Inspection (2014/07)

CENFJ6111306020

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later, 05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

1) Remove STBD lower side cover.
Refer to “Lower Side Cover Removal and Installation” in Section 2A in related manual.
2) Connect the 18-pin and 34 -pin test cord set between ECM and wire harness as shown in figure.

Special tool
TOOL (A): 09930–89290 (18 pin & 34 pin test cord)



IDG211130029-01

1. Wire harness	3. Black connector
2. White connector	

3) Install STBD lower side cover.
Refer to “Lower Side Cover Removal and Installation” in Section 2A in related manual.

NOTE

Keep the ECM connector and test cord dry to protect them from water spray during the inspection.

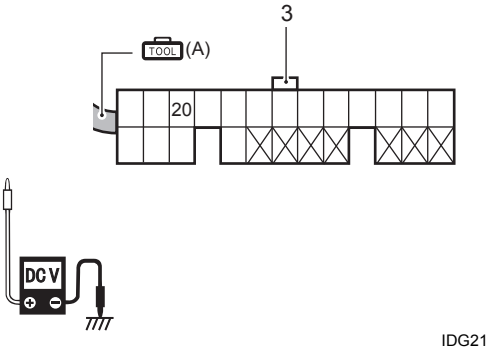
4) Start the engine, then shift into forward.
Gradually increase engine speed to 3 000 rpm, then measure the voltage change at “20” terminal (sensor output).

Special tool
TOOL : 09930–99320 (Digital tester)

Tester knob indication
DC Voltage (⎓)

MAP sensor output voltage change
Fully closed throttle: Approx. 1.4 V (258 mmHg)
1 000 rpm: Approx. 1.5 V (290 mmHg)
2 000 rpm: Approx. 2 V (407 mmHg)
3 000 rpm: Approx. 3 V (604 mmHg)

34-pin test cord (Black connector)



IDG211130031-02

5) If sensor voltage change is out of the specified value or no linear variation, check wire harnesses for open or short. If wire harnesses are in good condition, replace throttle body assembly and recheck them.
6) Remove the 18-pin and 34-pin test cord, then connect the connector to ECM.

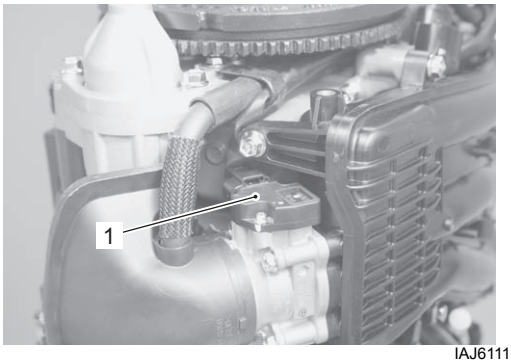
TPS Inspection (2014/07)

CENFJ6111306021

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later, 05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

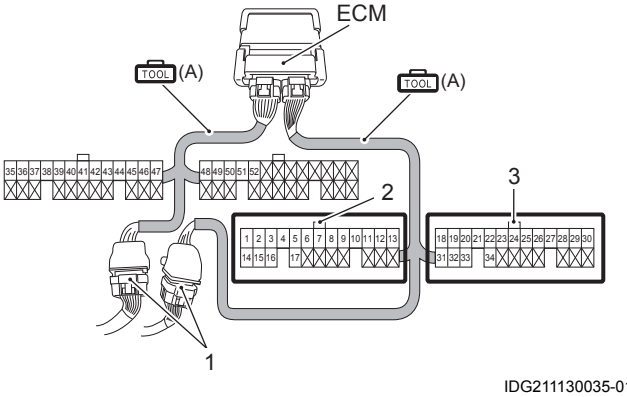
1) Turn ignition switch OFF.
2) Connect the 18-pin and 34-pin test cord set between ECM and wire harness as shown in figure.

Special tool
TOOL (A): 09930–89290 (18 pin & 34 pin test cord)



IAJ611130010-01

1. TPS	

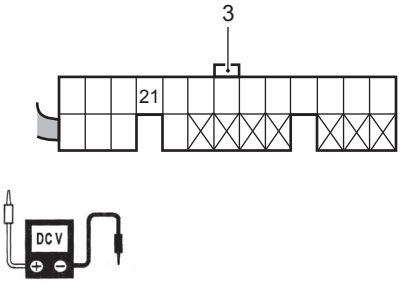


IDG211130035-01

1. Wire harness	3. Black connector
2. White connector	

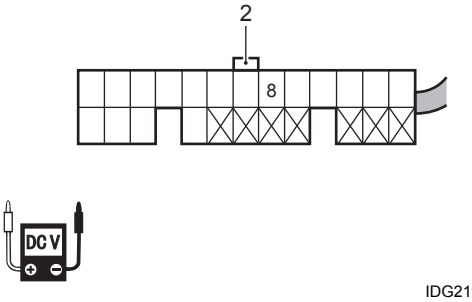
3) Connect tester probe (“+”, Red) to No. 21 terminal.
4) Connect tester probe (“–”, Black) to No. 8 terminal (or to body ground).

34-pin test cord (Black connector)



IDG211130036-01

34-pin test cord (White connector)



IDG211130037-01

5) Turn the ignition switch ON.
6) Check for sensor output voltage.
Slowly move the throttle lever to open, and check if voltage changes linearly within specification, according to throttle valve opening angle.

Sensor output voltage
FCT position: Approx. 0.7 V
WOT position: Approx. 3.8 V

Special tool
TOOL : 09930–99320 (Digital tester)

Tester knob indication
DC Voltage (⎓)

NOTE

MAP sensor / TPS / IAT sensor are combined into one unit that is installed on top of the throttle body.
Never loosen the screws securing TPS.
TPS position has been adjusted the factory and must not be changed.

7) If out of specification, check wire harnesses for open and short. If wire harnesses are in good condition, replace the throttle body and recheck.

Fuel System

General Description

Air Intake Components Description (2014/07)

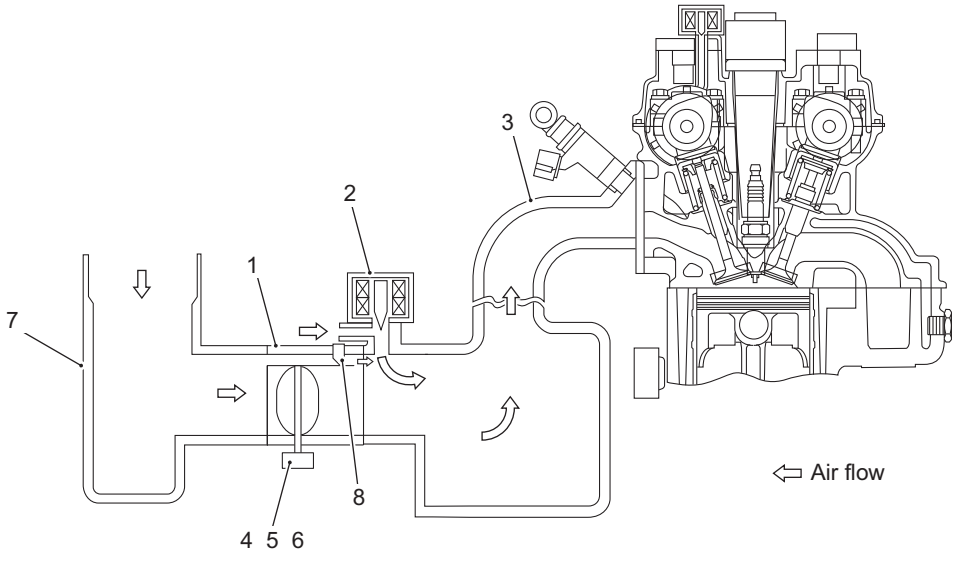
CENFJ6111701006

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later, 05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

NOTE

For details other than the following information of Air Intake Components Description, refer to "Air Intake Components Description" in related manual.

The by-pass air screw (BAS) has newly been added in the throttle body.
In accordance with this change, the by-pass air adjustment can be performed by BAS at throttle fully-closed position.



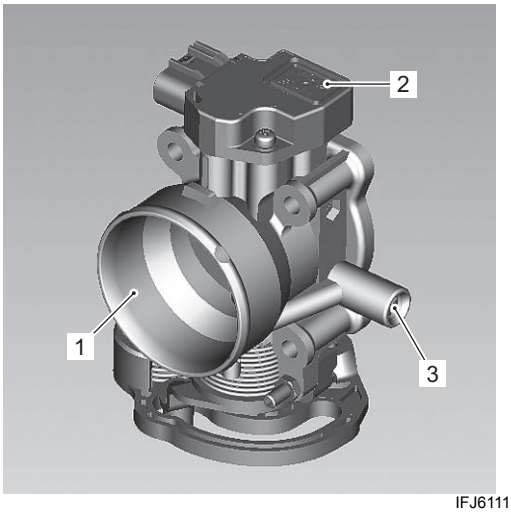
IFJ611170001-01

1. Throttle body	3. Intake manifold	5. MAP sensor	7. Air intake silencer
2. IAC valve	4. Throttle position sensor	6. IAT sensor	8. By-pass air screw

Throttle Body

NOTE

Do not try to adjust or remove any of the throttle body component parts (Sensor, throttle valve, throttle stop screw, etc.).
These components have been adjusted in factory to precise specifications.



IFJ611170002-01

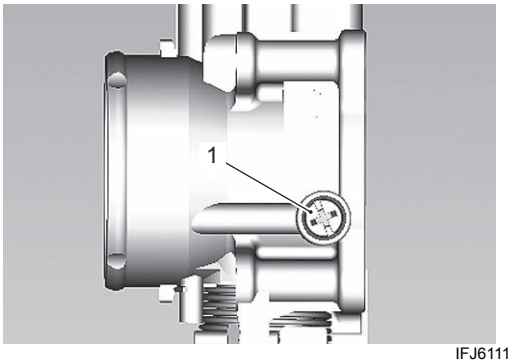
1. Throttle body assembly	3. By-pass air screw
2. MAP sensor / TPS / IAT sensor	

By-pass air screw / passage

Since the throttle valve is almost fully closed when idling / trolling, the main flow of air necessary to maintain idling / trolling speed passes through the by-pass air passage.
The by-pass air adjustment screw controls the flow of air through the passage and provides a means of partially adjusting the total amount of air necessary for idling / trolling.

NOTE

For the by-pass air screw adjustment procedure, refer to "Idle Speed and Idle Air Control (IAC) Duty Inspection (2014/07)" in Section 0B (Page 0B-1) in this manual.



IFJ611170003-01

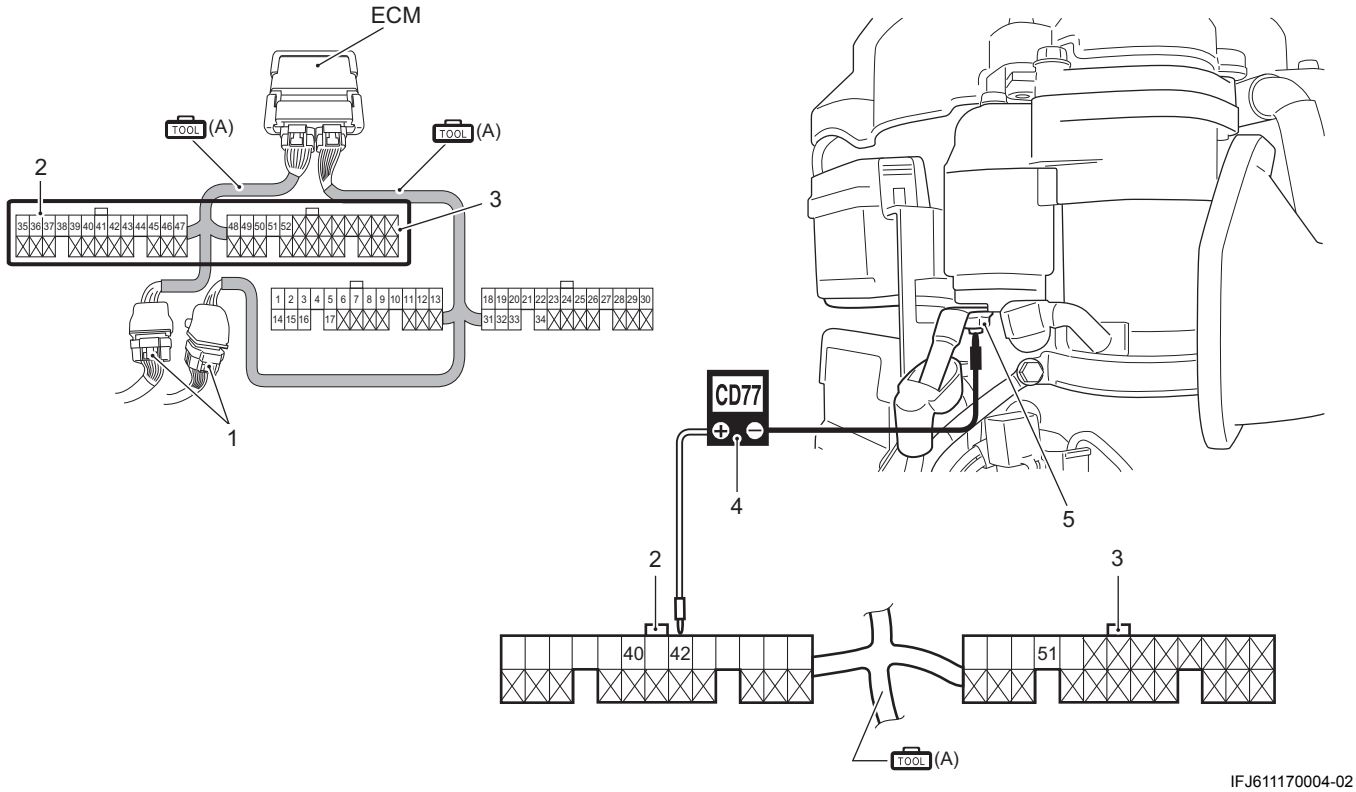
1. By-pass air screw

Service Instructions

Fuel Injector Operating Signal Inspection (2014/07)

CENFJ6111706018

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later,
05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.



IFJ611170004-02

1. Wire harness	3. Black connector (18-pin)	5. Starter motor magnetic switch “B” terminal
2. White connector (18-pin)	4. Peak voltmeter stevens CD-77	

Special tool
TOOL (A): 09930–89290 (18 pin & 34 pin test cord)
CD-77 : Stevens peak reading voltmeter CD-77

Tester knob indication
NEG 50

1) Disconnect all ignition coil connectors from the ignition coils.
2) Connect the test cord between the ECM and wire harness as shown in figure, then turn ignition switch “ON”.
3) Connect the tester probe (“–”, Black) to the starter motor magnetic switch terminal “B” (connected to battery positive (+) terminal) as shown in figure.
4) Connect the tester probe (“+”, Red) to each terminal.

Injector	Terminal	Wire color (Engine harness)
No.1	42	O/B
No.2	51	B/Br
No.3	40	R/W

5) Crank the engine and measure the voltage.
If out of specification, inspect the related parts as described in “Fuel System Diagnostic Information/Fuel Injection System Troubleshooting”.
Refer to “Fuel System Diagnosis” in related manual and “Fuel Injection System Troubleshooting” in related manual.

Fuel injector operating signal
Standard: Approx. 4 – 10 V or over

Ignition System

Service Instructions

Ignition Coil Operating Signal Inspection (2014/07)

CENFJ6111806010

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later, 05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

Special tool
TOOL (A): 09930–89290 (18 pin & 34 pin test cord)
CD-77 : Stevens peak reading voltmeter CD-77

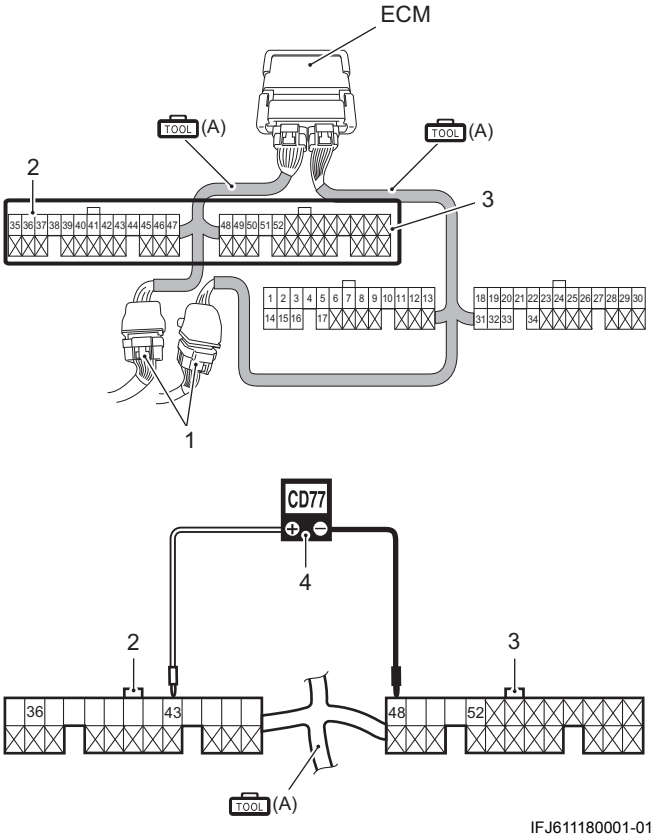
Tester knob indication
SEN 50

1) Disconnect all injector connectors from the fuel injectors.
2) Connect the test cord between the ECM and the wire harness as shown in figure then turn ignition switch ON.
3) Connect the tester probe Red (+) to each terminal, one at a time to test each circuit.

	Terminal	Wire color (Engine harness)
No.1 ignition coil	43	O
No.2 ignition coil	52	Bl
No.3 ignition coil	36	Gr/Y

4) Connect the tester probe Black (–) to No. 48 terminal (or to body ground).
5) Crank the engine and measure the voltage.
If out of specification, inspect the related parts. Refer to “Ignition System Symptom Diagnosis” in related manual and “Ignition System Troubleshooting” in related manual.

Ignition coil operating signal
Standard: Approx. 3 V or over



IFJ611180001-01

1. Wire harness	3. Black connector (18-pin)
2. White connector (18-pin)	4. Peak voltmeter stevens CD-77

Starting System

Diagnostic Information and Procedures

Starter System Troubleshooting (2014/07)

CENFJ6111904003

Applicable Model and Effective Serial Number:
04003F-510001 and later, 04004F-510001 and later, 05003F-510001 and later, 05004F-510001 and later, 06002F-510001 and later, 06003F-510001 and later.

⚠ CAUTION

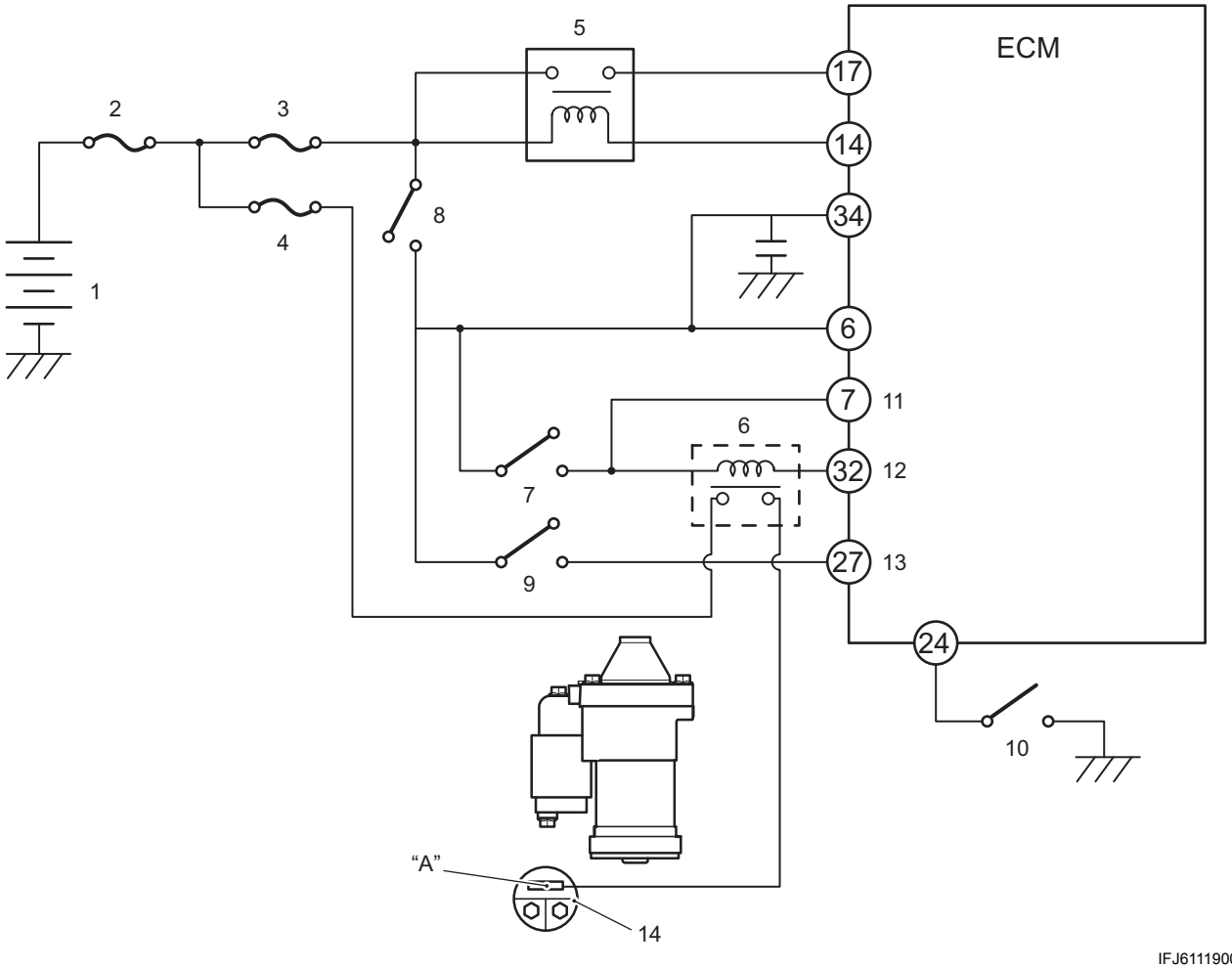
If any abnormality is found, immediately disconnect the battery cables from the battery.

NOTE

Before troubleshooting the electric starter system, make sure of the following:

- **Battery is fully charged.**
- **All cables/wires are securely connected.**
- **Shift is in "Neutral" position.**
- **Emergency stop switch lock plate is set in place.**
- **Fuse is not blown.**

Circuit Check Schematic



IFJ611190001-01

1. Battery	5. Main relay	9. Ign. switch "START"	13. START s/w signal
2. Main fuse	6. Starter relay	10. Emergency switch	14. Magnetic switch
3. Fuse (ECM)	7. Neutral switch	11. Neutral switch signal	
4. Fuse (Starter)	8. IG. s/w ON	12. Starter relay control signal	

Starter Motor will not Run

Step 1

1) Check main fuse and connection.
2) Check circuit fuse (for starter motor relay) and connection.

Are main fuse and circuit fuse good condition?

Yes — Go to step 2.

No — Repair or replace.

Step 2

1) Disconnect lead wire connector “A” from magnetic switch “S” terminal.
2) Measure voltage between lead wire connector “A” and body ground when turning ignition switch to “START”.

Is voltage 12 V (battery voltage)?

Yes
- Faulty starter motor.
- Poor wire connection.
- Substitute known-good starter motor and recheck.

No — Go to step 3.

Step 3

1) Check starter relay “Click” sound when turning ignition switch to “START”.

Is there “Click” sound?

Yes
- Burnt contact point or poor contacting action of starter relay.
- Open circuit between relay and magnetic switch.

No — Go to step 4.

Step 4

1) Turn ignition switch “OFF”.
2) Remove the starter motor relay.
3) Check for proper connection to starter motor relay.
4) If OK, then check starter motor relay.
   Refer to “Starter Motor Relay Inspection” in related manual.

Is it in good condition?

Yes — Go to step 5.

No — Replace starter motor relay.

Step 5

1) Check the neutral switch.
   Refer to “Neutral Switch Inspection” in related manual.

Is it in good condition?

Yes — Go to step 6.

No — Replace neutral switch.

Step 6

1) Check the ignition switch.
   Refer to “Ignition Switch Inspection” in related manual.

Is it in good condition?

Yes — Go to step 7.

No — Replace ignition switch.

Step 7

1) Check the emergency stop switch.
   Refer to “Emergency Stop Switch Inspection” in Section 1C in related manual.

Is it in good condition?

Yes — Go to step 8.

No — Replace emergency stop switch.

Step 8

1) Turn the ignition switch “OFF”.
2) Install the starter motor relay.
3) Disconnect the ECM connector at ECM.
4) Check for proper connection to ECM at each terminal.
5) Connect the 18 pin and 34 pin test cord set between ECM and the main harness.
6) Check the ECM power source circuit.
   Refer to “ECM Power and Ground Circuit Check (2014/07)” in Section 1A (Page 1A-6) in this manual.

Is it in good condition?

Yes — Go to step 9.

No — Power source line open, shorted or poor connection.

Step 9

1) Measure voltage between No. 32 terminal of ECM and body ground when turning ignition switch to “START”.

Is the voltage approx. 0.5 V?

Yes — Go to step 10.

No — Starter motor relay control circuit open, shorted or poor connection.

Step 10

1) Measure voltage between No. 7 terminal of ECM and body ground with ignition switch “ON”.

Is the voltage approx. 12 V?

Yes — Go to step 11.

No — Neutral switch circuit open, shorted or poor connection.

Step 11

1) Measure voltage between No. 27 terminal of ECM and body ground when turning ignition switch to “START”.

Is the voltage approx. 8 – 12 V?

Yes — Go to step 12.

No — Starter switch circuit open, shorted or poor connection.

Step 12

1) Measure voltage between No. 24 terminal of ECM and body ground with ignition switch “ON”.

Is the voltage approx. 5 V?

Yes — If check result is satisfactory, substitute a known-good ECM and recheck.

No — Emergency stop switch circuit open, shorted or poor connection.