Engine Control

General Description

Engine Control Module (ECM) (2015/07)

CENGG2111101010

Applicable Model and Effective Serial Number:
10003F-610001 and later, 11503F-610001 and later, 11504F-610001 and later,
11503Z-610001 and later, 14003F-610001 and later, 14003Z-610001 and later.

NOTE

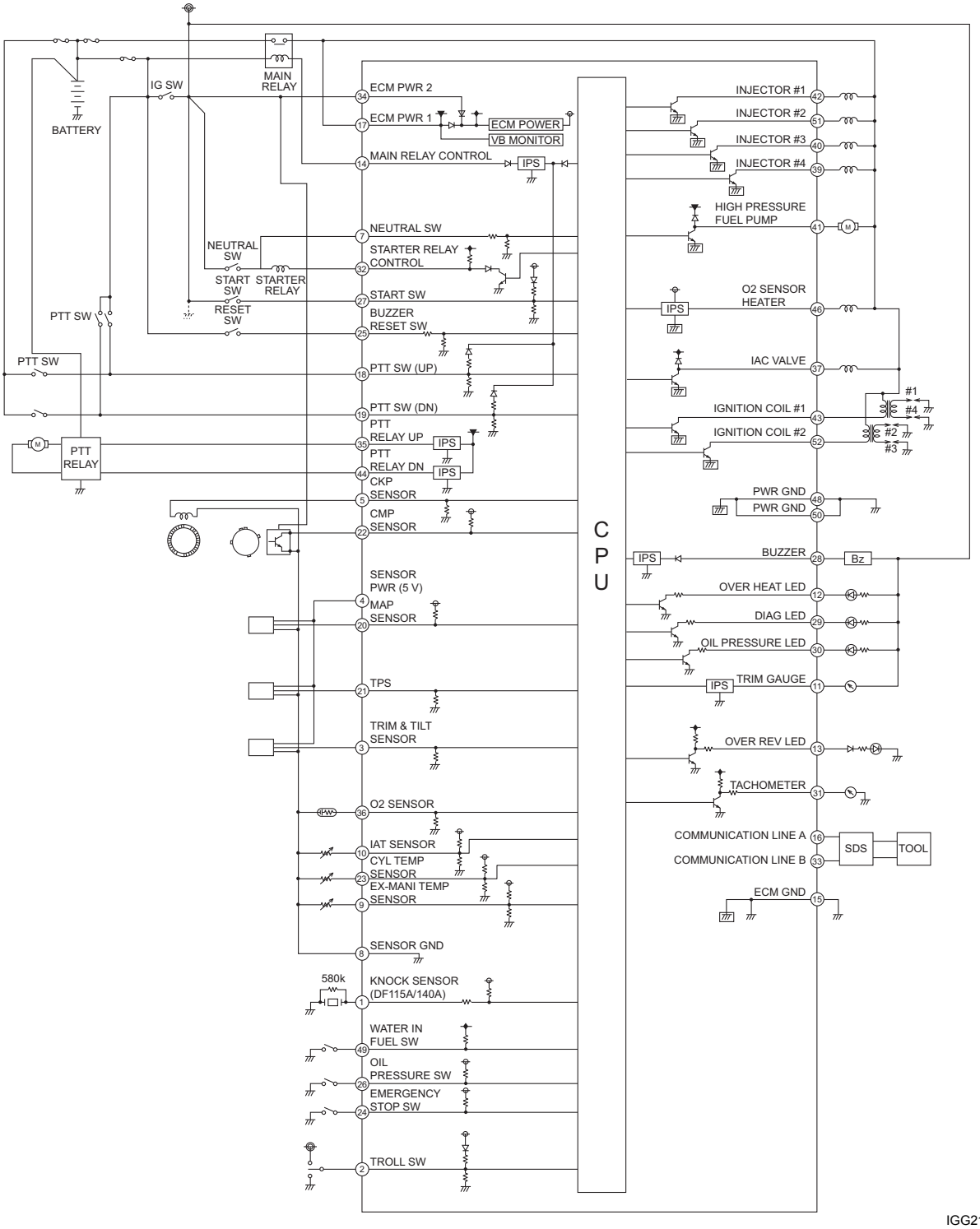
For details other than the following information of Engine Control Module (ECM), refer to "Engine Control Module (ECM)" in related manual.

A program (internal circuit) of the ECM has been changed.
This change has been performed by following reasons:

- Addition of the keyless start system.
- Control mode of the IAC system has been changed as follows.
  The IAC valve is always closed (0% duty) when engine is stopped while ignition switch is "ON".
  It was fully open (100% duty) under the same condition before.
  Other control modes are the same as the early model.

ECM Input / Output Circuit Diagram

Normal key start model



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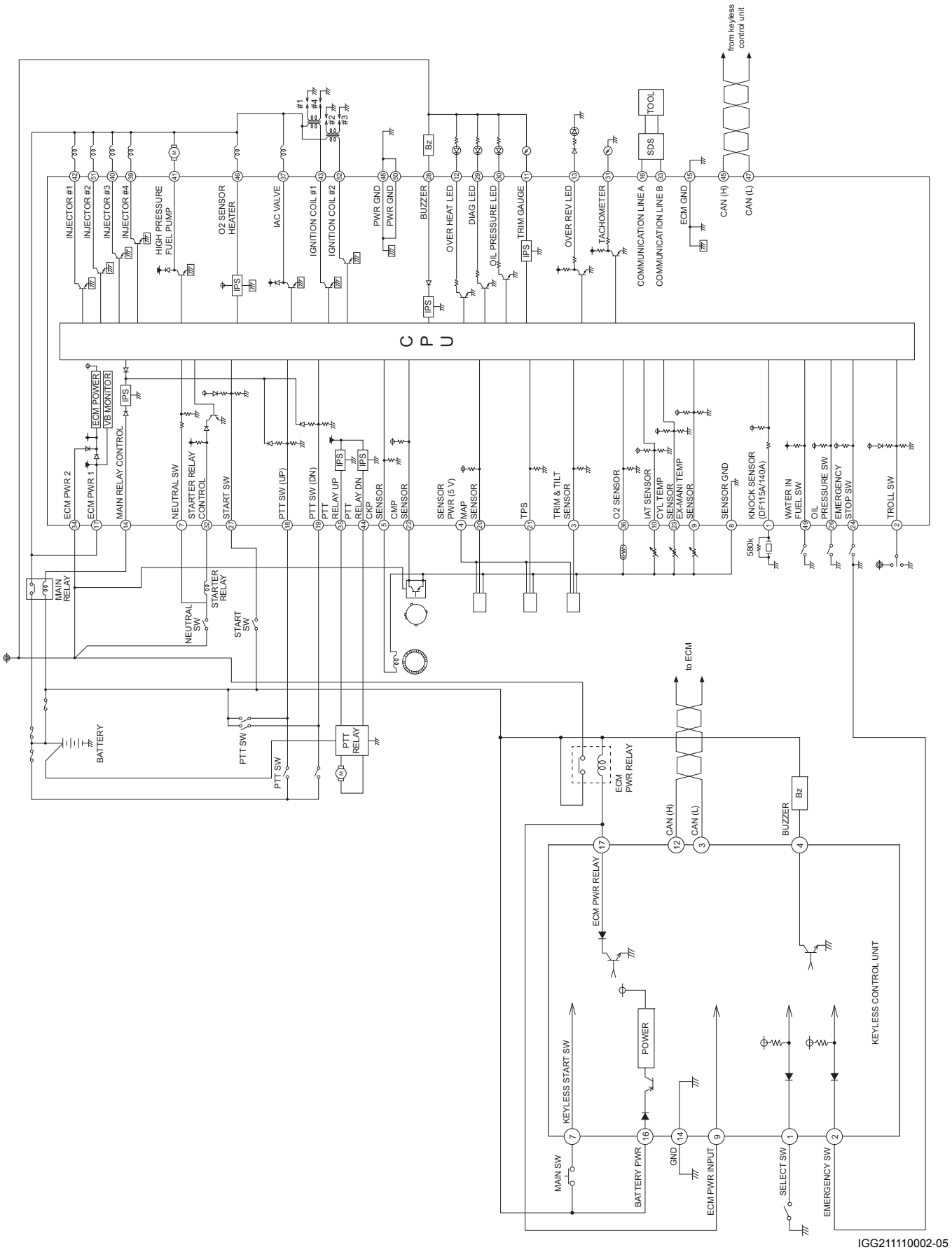
Keyless start model



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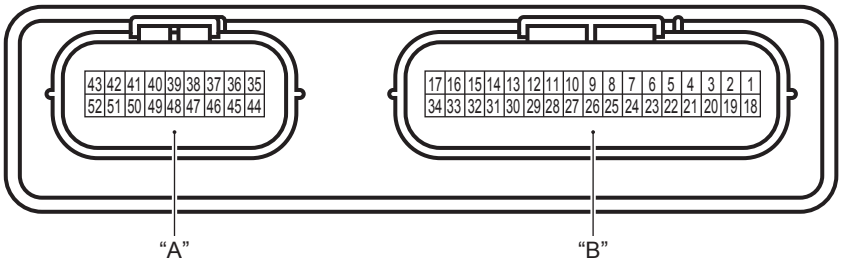
ECM Connector / Terminals Layout



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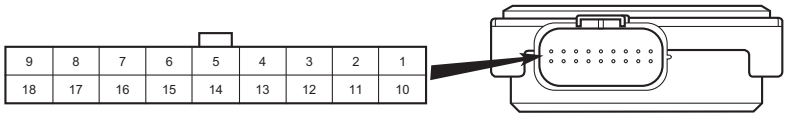
"A": 18-pin connector	"B": 34-pin connector

Terminal	Wire color	Circuit	Terminal	Wire color	Circuit
1	P/Bl	Knock sensor (DF115A/140A)	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/W	CKP sensor	31	Y/B	Tachometer
6	—	—	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	V/W	Ex. manifold temp. sensor	35	Lg	PTT relay "UP"
10	Lg/B	IAT sensor	36	Gr/R	O2 sensor
11	W/Y	Trim gauge	37	R/G	IAC valve
12	G/Y	TEMP lamp	38	—	—
13	P/W	REV–LIMIT lamp	39	Lg/W	No.4 fuel injector (–)
14	R/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	PTT relay "DOWN"
19	P	PTT switch "DOWN"	45	W/G	CAN (H)
20	W	MAP sensor	46	Lg/B	O2 sensor heater
21	Br/Y	Throttle position sensor	47	B/Lg	CAN (L)
22	Y/Bl	CMP sensor	48	B	Ground for power
23	Lg/W	Cylinder temp. sensor	49	R/Bl	Water detection switch
24	Bl/R	Emergency stop switch	50	B	Ground for power
25	O/W	Buzzer cancel	51	B/Br	No.2 fuel injector (–)
26	Bl	Oil pressure switch	52	Bl	No.2 ignition coil

- Terminal No.25 is not used for keyless start model.
- Terminal No.45 and 47 are applicable to the keyless start model only.

Keyless Control Unit Connector / Terminal Layout



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Terminal	Wire color	Circuit	Terminal	Wire color	Circuit
1	Y	Select switch	10	—	—
2	G	Mode switch (Emergency stop switch)	11	—	—
3	B/Lg	CAN (L)	12	W/G	CAN (H)
4	Bl	Buzzer	13	—	—
5	—	—	14	B	GND
6	—	—	15	—	—
7	Gr	Main switch	16	W	Battery power
8	—	—	17	P/B	ECM power relay
9	P/B	ECM power input	18	—	—

Caution System Description (2015/07)

CENGG2111101011

Applicable Model and Effective Serial Number:
10003F-610001 and later, 11503F-610001 and later, 11504F-610001 and later,
11503Z-610001 and later, 14003F-610001 and later, 14003Z-610001 and later.

NOTE

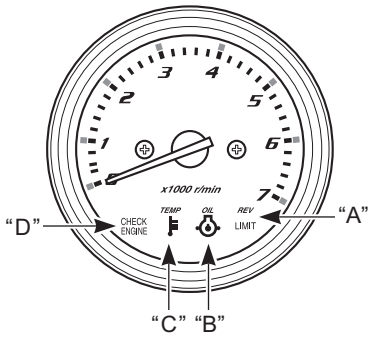
For details other the following information of Caution System Description, refer to "Caution System Description" in related manual.

For keyless start model, "Key-fob caution", "Key-fob low battery voltage caution" and "Keyless control unit low battery voltage caution" have been added to the caution system.

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

- OVER-REVOLUTION CAUTION
- LOW OIL PRESSURE CAUTION
- OVERHEAT CAUTION
- LOW BATTERY VOLTAGE CAUTION
- KEY FOB CAUTION *1
- KEY FOB LOW BATTERY VOLTAGE CAUTION *1
- KEYLESS CONTROL UNIT LOW BATTERY VOLTAGE CAUTION *1
  (*1: Keyless start model only)

Monitor-Tachometer



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"A": "REV LIMIT" lamp	"C": "TEMP" lamp
"B": "OIL" lamp	"D": "CHECK ENGINE" lamp

Caution type	Caution lamp	Caution buzzer	Engine RPM limited
Over-revolution	Yes "A"	No	Yes
Low oil pressure	Yes "B" ("A")	Yes	Yes
Overheat	Yes "C" ("A")	Yes	Yes
Low battery voltage	Yes "D"	Yes	No
Key-fob *1	Yes "D"	No	No
Key-fob low battery voltage *1	Yes "D"	No	No
Keyless control unit low battery voltage *1	Yes "D"	No	No

(*1: Keyless start model only)

Lamp Check / Buzzer Check
Normal key start model:
When the ignition key is turned to the “ON” position:

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

Keyless start model:
When the keyless start system is turned “ON”.

- Four Caution lamps turn on and caution buzzer sounds for first two seconds.
- After indicating the total motor operating hours for the next three seconds, four caution lamps turn on again until the engine is started.
- Four cation lamps continue turning on while the engine is stopped with the keyless start system ON.
- Four caution lamps become OFF after engine starting.

NOTE

If the caution system is activated, only the corresponding lamp will light.

Key-fob Caution System

NOTE

This caution system is applicable only to keyless start models.

Condition:
This system operates when an identification error of key fob occurs.

Action:
When this system activates, “CHECK ENGINE” lamp will flash according to the self-diagnostic code “9-2”.

Reset:
Inspect the key-fob and keyless control unit, and repair or replace the component that has caused the failure.

NOTE

If this system activates, check following:

- **The key-fob is within the communication range of the keyless control unit.**
- **The key-fob is in communication mode.**
- **There is not any object that interferes with the radio wave between the key-fob and the keyless control unit.**
- **The key-fob battery has sufficient capacity.**
- **The key-fob is the one that has been authenticated by the keyless start system of the engine.**

Key-fob Low Battery Voltage Caution System

NOTE

This caution system is applicable only to keyless start models.

Condition:
This system operates when the battery voltage of the key-fob drops to a point which could impair key-fob performance.

Action:
When this system activates, “CHECK ENGINE” lamp will flash according to the self-diagnostic code “9-1”.

Reset:
Inspect the key-fob battery and replace it.

NOTE

If this system activates, replace the battery of key-fob.

Keyless Control Unit Low Battery Voltage Caution System

NOTE

This caution system is applicable only to keyless start models.

Condition:
This system operates when the battery voltage of the keyless control unit drops to a point which could impair keyless control unit performance.

Action:
When this system activates, “CHECK ENGINE” lamp will flash according to the self-diagnostic code “9-3”.

Reset:
Inspect the power source of system, and replace or recharge the battery.

NOTE

If this system activates, check following:

- **The battery is in sound condition.**
- **Contact failure of the battery terminal.**

Self-Diagnostic System Description (2015/07)

CENGG2111101012

Applicable Model and Effective Serial Number:
10003F-610001 and later, 11503F-610001 and later, 11504F-610001 and later,
11503Z-610001 and later, 14003F-610001 and later, 14003Z-610001 and later.

For keyless start model, “Keyless system authentication error”, “Keyless system communication error” and “Keyless system failure” have been added to the self-diagnostic item.

Normal key start model:
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 “CHECK ENGINE” lamp flashes (lights intermittently) according to each code pattern, along with a buzzer sound.
When the engine is running, the buzzer sounds a series of short (0.2 sec.) beeps. When the engine is not running, the buzzer sounds according to each code pattern, but not simultaneously with the flashing lamp.
The buzzer sound can be temporally canceled by pushing the ignition key in.

Keyless start model:
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 “CHECK ENGINE” lamp flashes (lights intermittently) according to each code pattern, along with a buzzer sound.

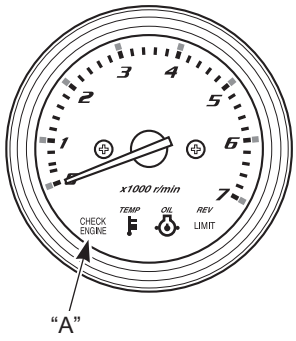
NOTE

The buzzer sound will be stopped 60 seconds after activating the diagnostic system.

NOTE

When diagnosis code of “9-1”, “9-2”, “9-3”, “9-4”, “9-5” or “9-6” appears, buzzer will not sound. In this case, only flash “CHECK ENGINE” lamp according to each code pattern.

Monitor-Tachometer



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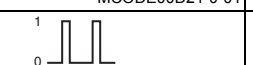
“A”: “CHECK ENGINE” lamp

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	Exhaust manifold temp. sensor	1 – 5	 MCODE00D15-0-01	Yes
9	Fuel injector	4 – 3	 MCODE00D43-0-01	No
10	Throttle position sensor	2 – 1	 MCODE00D21-0-01	Yes
11	Rectifier/Regulator (Over-charging)	1 – 1	 MCODE00D11-0-01	No
12	Oil pressure switch	5 – 3	 MCODE00D53-0-01	No
13	Trim sensor	3 – 7	 MCODE00D37-0-01	No
14	Knock sensor (DF115A/140A)	5 – 4	 MCODE00D54-0-01	Yes
15	O2 sensor	3 – 6	 MCODE00D36-0-04	Yes
16	O2 sensor heater	6 – 3	 MCODE00D63-0-01	Yes
17	Key-fob battery low *1	9 – 1	 MCODE00D91-0-01	No
18	Key-fob authentication error *1	9 – 2	 MCODE00D92-0-01	No
19	Keyless control unit battery low *1	9 – 3	 MCODE00D93-0-01	No
20	Keyless system authentication error *1	9 – 4	 MCODE00D94-0-01	No

Priority	Failed item	Code	Lamp flashing pattern	Fail-Safe system active
21	Keyless system communication error *1	9 – 5	 MCODE00D95-0-01	No
22	Keyless system failure *1	9 – 6	 MCODE00D96-0-01	No

*1: Keyless start model only

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 turning the ignition switch "ON".**
- **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.**
- **The Rectifier/Regulator self-diagnostic indication may not be displayed when the ignition switch is turned "ON" because the ECM cannot detect rectifier/regulator charging output if the engine is not running.**
  Under this condition, the buzzer will not sound a 1 – 1 code.
  However, if the rectifier/regulator has failed, the self diagnostic indication will appear again after starting the engine.

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.

Condition for Self-Diagnostic System Operation

Failed item	Condition
MAP sensor 1	• No signal (With engine running). • Receiving an out of range “4.9 – 114.6 kPa (0.2 – 4.5 V)” signal (With the engine running.).
Cylinder temp. sensor	• No signal. • Receiving an out of range “– 46 to + 170 °C (– 50.8 – +338 °F) (0.10 – 4.6 V)” signal.
IAT sensor	• No signal. • Receiving an out of range “– 46 to + 169 °C (– 50.8 – +336.2 °F) (0.10 – 4.6 V)” signal.
CKP sensor	• During the rotation of the predetermined crankshaft angle, the normal CKP sensor signal pattern is not received by the ECM. • During cranking, CMP sensor signal is received by the ECM, but not CKP sensor signal.
CMP sensor	• During four crankshaft rotations, the normal CMP sensor signal pattern is not received by the ECM.
Air intake system	• The engine operates at an abnormally high speed when the ECM is receiving a completely closed signal from the throttle position sensor. (Criterion: 2 100 r/min minimum)
MAP sensor 2	• From TPS sensor, the full close signal is inputted, but from the MAP sensor, the signal voltage exceeds 2.0 V.
Exhaust manifold temp. sensor	• No signal. • Receiving an out of range “– 46 to + 170 °C (– 50.8 – +338 °F) (0.10 – 4.6 V)” signal.
Fuel injector	• No operation signal from the ECM.
Throttle position sensor	• No signal. • Receiving an out of range “0.2 – 4.8 V” signal.
Rectifier/Regulator (Over-charging)	• Receiving 16 V or higher signal.
Oil pressure switch	• While the engine is stopped and the ignition switch is on, the ECM receives an “OFF” signal from the oil pressure switch.
Trim sensor	• Receiving an out of range “0.2 – 4.8 V” signal.
Knock sensor (DF115A/140A)	• No signal • Receiving an out of range “0.55 – 4.39 V” signal.
O2 sensor	• The compensation value of fuel injection amount is more than the predetermined value while the O2 feedback is executed. • The compensation value of fuel injection amount is below the predetermined value while the O2 feedback is executed.
O2 sensor heater	• No operation signal comes from the ECM. (Open or short in O2 sensor heater circuit)
Key-fob battery low *1	• Key-fob battery voltage decreased. • For detail, refer to “Key-fob Low Battery Voltage Caution System” (Page 1A-7).
Key-fob authentication error *1	• Authentication error between key-fob and keyless unit occurred. • Communication error between key-fob and keyless unit occurred. • For detail, refer to “Key-fob Caution System” (Page 1A-7).
Keyless control unit battery low *1	• Keyless control unit power source voltage decreased. • For detail, refer to “Keyless Control Unit Low Battery Voltage Caution System” (Page 1A-7).
Keyless system authentication error *1	• ECM detected that its ID code does not correspond with the ID code registered in the keyless control unit.
Keyless system communication error *1	• The ECM cannot receive CAN communication information from keyless control unit. (Faulty wire harness of keyless start system.)
Keyless system failure *1	• There is an irregularity on the internal circuit of the keyless control unit.

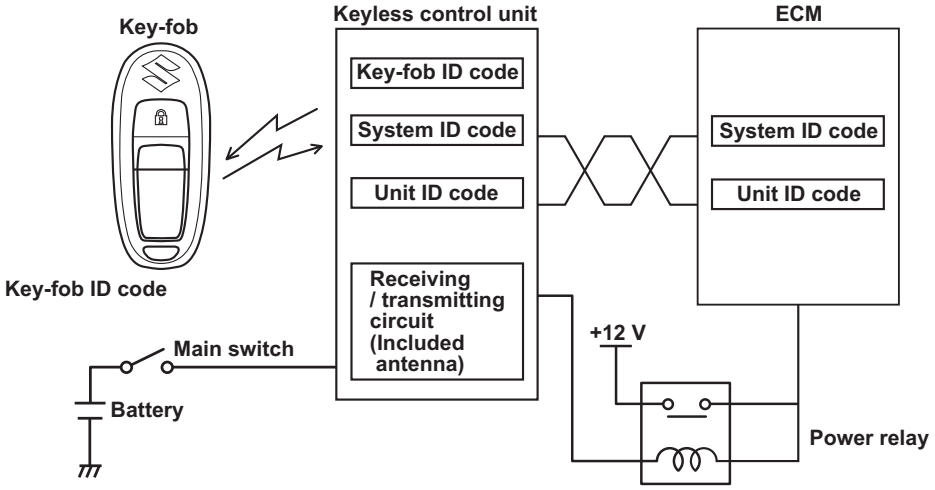
*1: Keyless start model only

Keyless Start System Description (2015/07)

CENGG2111101013

Applicable Model and Effective Serial Number:
Keyless start model:
10003F-610001 and later, 11503F-610001 and later, 11504F-610001 and later,
11503Z-610001 and later, 14003F-610001 and later, 14003Z-610001 and later.

The keyless start system uses a coded key fob to transmit an access code to the engine's starting system.
The engine can be started without operating a mechanical key when the key fob is located within a 1 m (39.3 in) radius of the keyless control unit.
The keyless start system consists of a key fob, keyless control unit, ECM, power relay, main switch, and related wiring.
Radio communication is performed between the key fob and the keyless control unit.
The keyless control unit and ECM are connected by a CAN communication bus to exchange information through CAN communication.
The system operates by means of radio communication by cross-checking the ID code of the key fob, keyless control unit and ECM.
When the ID codes between the key fob, keyless control unit and ECM match, the power relay turns ON to supply voltage to the engine control system, enabling the engine to be started.



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Function of component parts

Main key	The main knob key is used for pairing the key-fobs and powering the system.
Emergency key	The emergency key is used to create a pass code and to enter the pass code to start the engine(s) when all key-fobs have been lost or misplaced.
Key fob	Transmits ID code signal to keyless control unit.
Keyless control unit	Transmits its ID code to ECM.
ECM	• Check keyless control unit ID code. • Transmit its ID code to keyless control unit.

Shifting to keyless start system ON
With the key fob within the 1 m (39.3 in) radius, turn and release the main switch knob from “PUSH START/ STOP” to ON/OFF position:

1) First: The ID code of the key fob and the ID code registered in the keyless control unit are cross-checked.
   When both ID codes match, communication for cross-checking the key fob comparison is terminated.
2) Second: The system ID codes are cross-checked for comparison between the keyless control unit and ECM.
   The functions of ECM are enabled by matching the system ID codes.
3) Third: Registered unit ID codes are cross-checked between the keyless control unit and the ECM.
   When both unit ID codes match, the power relay turns ON and the ECM enters engine start standby mode.
   When the cross-check is complete, the engine is enabled to start (cranking, ignition, and injection). If not, the system power is turned OFF.

Shifting from keyless start system ON to OFF
When the key fob and the keyless control unit are within the communication range, the keyless start system turns OFF after 30 seconds if the main switch knob is turned from “PUSH START/STOP” to ON/OFF and release knob.
It takes about one minutes for the ECM internal circuit to turn OFF.
When the key fob is outside the communication range of the keyless control unit, the keyless start system is locked.

Emergency start
As a backup in case the key fob is not available, the system can be put into engine start standby mode by entering a passcode using the emergency mechanical key.

Immobilizer system
The engine can be started only when the key fob ID code corresponds with the registered code in keyless control unit.

Diagnostic Information and Procedures

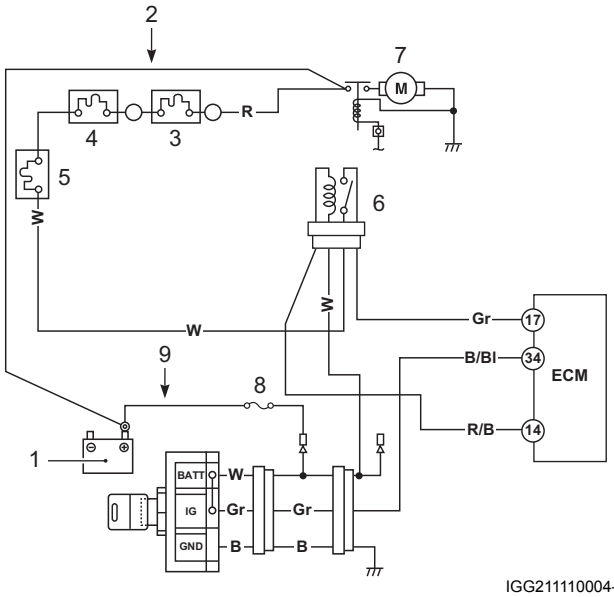
ECM Power and Ground Circuit Check (2015/07)

CENGG2111104021

Applicable Model and Effective Serial Number:
10003F-610001 and later, 11503F-610001 and later, 11504F-610001 and later, 11503Z-610001 and later, 14003F-610001 and later, 14003Z-610001 and later.

Wiring Diagram

Normal key start model



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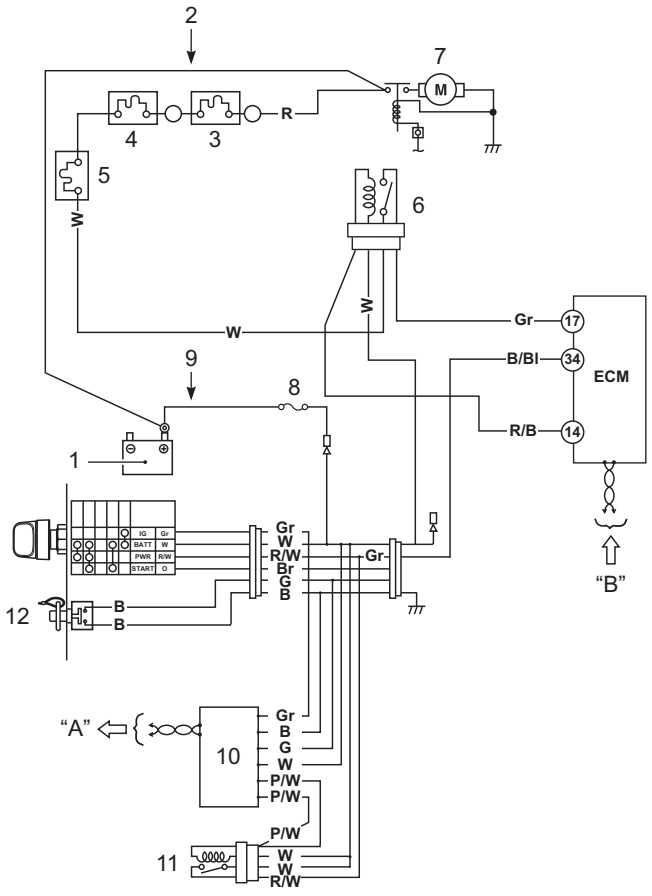
1. Battery	4. 60 A fuse	7. Starter motor
2. Battery cable	5. 30 A fuse	8. 15 A fuse
3. 60 A fuse	6. ECM main relay	9. Sub-battery cable

Keyless start model



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1. Battery	5. 30 A fuse	9. Sub-battery cable	"A": To ECM
2. Battery cable	6. ECM main relay	10. Keyless control unit	"B": From keyless control unit
3. 60 A fuse	7. Starter motor	11. ECM power relay	
4. 60 A fuse	8. 15 A fuse	12. Emergency stop switch	

Circuit Description

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)

a) **Normal key start model:**
The sub battery cable to the white lead wire in the remote control extension harness to the ignition switch.
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.34 terminal of ECM.

b) **Keyless start model:**
The sub-battery cable to the white lead wire in the remote control extension harness to the main switch.
When the main switch is turned ON, battery power passes from the white lead wire, through the main switch contacts to the gray output lead wire to the keyless control unit.
When this power signal is received by keyless control unit, it turns the ECM power relay on, then battery voltage is supplied through R/W lead line to No.34 terminal of ECM.

NOTE

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

2) The engine wiring harness to the main relay. When the ECM main relay is energized by turning the ignition switch ON, a circuit is formed which supplies battery voltage to the No.17 terminal of 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 (60 A and 60 A, for ignition and ECM) and sub battery cable fuse (15 A) 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 and 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.

Is the voltage 12 V (Battery Voltage)?

Yes Go to step 5.

No
- Check the ignition switch.

  [Keyless start model]

  Refer to "Main Switch Inspection (2015/07)" in Section 1I (Page 1I-11).
- Gr, (R/W), B/Bl wire open circuit or poor connection.
- Faulty ECM power relay. (Keyless start model)

Step 5

1) Turn the ignition switch "OFF".
2) Connect the 18 pin and 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 “9 – 4” Keyless System Authentication Error

CENGG2111104022

Applicable Model and Effective Serial Number:
Keyless start model:
10003F-610001 and later, 11503F-610001 and later, 11504F-610001 and later,
11503Z-610001 and later, 14003F-610001 and later, 14003Z-610001 and later.

This condition:
ECM detected that its ID code does not correspond with the ID code registered in the keyless control unit.

Correction:
Change the ECM to correspond with their ID codes.

Self-Diagnostic Code “9 – 5” Keyless System Communication Error

CENGG2111104023

Applicable Model and Effective Serial Number:
Keyless start model:
10003F-610001 and later, 11503F-610001 and later, 11504F-610001 and later,
11503Z-610001 and later, 14003F-610001 and later, 14003Z-610001 and later.

This condition:
The ECM cannot receive CAN communication information from keyless control unit.

Correction:

- Check communication such as open circuit on communication wire, poor or loose connections.
- Check the CAN communication line output voltage.
  Refer to “Inspection of the Keyless Control Unit and Its Circuit” (Page 1A-21).

Self-Diagnostic Code “9 – 6” Keyless System Failure

CENGG2111104024

Applicable Model and Effective Serial Number:
Keyless start model:
10003F-610001 and later, 11503F-610001 and later, 11504F-610001 and later,
11503Z-610001 and later, 14003F-610001 and later, 14003Z-610001 and later.

This condition:
There is an irregularity on the internal circuit of the keyless control unit.

Correction:
Replace the keyless control unit and ECM.

Service Instructions

Inspection of The ECM and Its Circuit (2015/07)

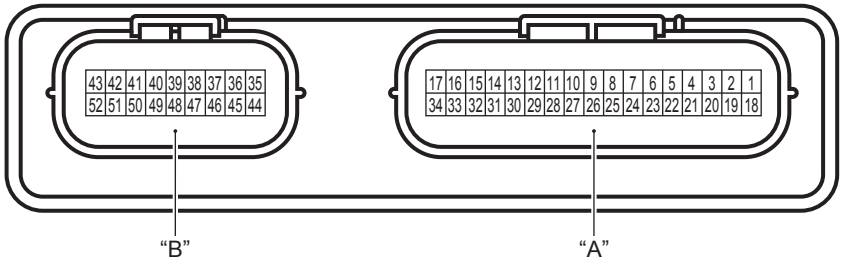
CENGG2111106005

Applicable Model and Effective Serial Number:
Normal key start model:
10003F-610001 and later, 11503F-610001 and later, 11504F-610001 and later,
11503Z-610001 and later, 14003F-610001 and later, 14003Z-610001 and later.

NOTE

For details other than the following information of Inspection of The ECM and Its Circuit, refer to "Inspection of The ECM and Its Circuit" in related manual.

Circuit Voltage Table



IDG211110018-03

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

Terminal	Wire color	Circuit	Standard voltage	Condition/Remarks
1	P/Bl	Knock sensor	Approx. 2.5 V	Ignition switch ON.
			Approx. 2.5 V	Engine running at idle speed.
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. 2 – 4.2 V	Ignition switch ON.
4	R	Power source for sensors	Approx. 5 V	Ignition switch ON.
5	R/W	CKP sensor	—	—
6	—	—	—	—
7	Y/G	Neutral switch	Approx. 12 V	Ignition switch ON, shift into NEUTRAL.
			Approx. 0 V	Ignition switch ON, shift into FORWARD or REVERSE.
8	B/W	Ground for sensors	—	—
9	V/W	Ex. manifold temp. sensor	0.14 – 4.75 V	Ignition switch ON.
10	Lg/B	IAT sensor	0.04 – 4.46 V	Ignition switch ON.
11	W/Y	Trim gauge	—	—
12	G/Y	TEMP lamp	—	—
13	P/W	REV-LIMIT lamp	—	—
14	R/B	Ground for ECM main relay	Approx. 12 V	Ignition switch OFF.
			Approx. 0.8 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.

Terminal	Wire color	Circuit	Standard voltage	Condition/Remarks
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/W	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	—	—
30	Bl/B	OIL lamp	—	—
31	Y/B	Tachometer	—	—
32	G	Starter relay control	Approx. 0.8 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	Lg	PTT relay “UP”	Approx. 0 V	PTT switch UP free.
			Approx. 12 V	PTT switch UP push.
36	Gr/R	O2 sensor	0.7 V or more	While engine idling after warming up.
			0.2 V or less	Engine stopped (Ignition switch ON).
37	R/G	IAC valve	Approx. 12 V	Ignition switch ON.
38	—	—	—	—
39	Lg/W	No.4 fuel injector (–)	Approx. 12 V	Ignition switch ON.
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. 12 V	Ignition switch ON.
44	P	PTT relay “DOWN”	Approx. 0 V	PTT switch DN free.
			Approx. 12 V	PTT switch DN push.
45	—	—	—	—
46	Lg/B	O2 sensor heater	Approx. 12 V	Ignition switch ON, Engine stopped.
			Approx. 0 V	While engine running, after engine warmed up.
47	—	—	—	—
48	B	Ground for power	—	—
49	R/Bl	Water detection switch	Approx. 12 V	Ignition switch ON. Water detection switch OFF.
			Approx. 0 V	Ignition switch ON. Water detection switch ON.
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. 12 V	Ignition switch ON.

Applicable Model and Effective Serial Number:
Keyless start model:
10003F-610001 and later, 11503F-610001 and later, 11504F-610001 and later,
11503Z-610001 and later, 14003F-610001 and later, 14003Z-610001 and later.

NOTE

For details other than the following information of Inspection of The ECM and Its Circuit, refer to "Inspection of The ECM and Its Circuit" in related manual.

Circuit Voltage Table

Terminal	Wire color	Circuit	Standard voltage	Condition/Remarks
1	P/Bl	Knock sensor	Approx. 2.5 V	Keyless start system ON.
			Approx. 2.5 V	Engine running at idle speed.
2	V	Troll mode switch	Approx.12 V	Keyless start system ON, troll mode switch UP side push.
			Approx. 2.6 V	Keyless start system ON, troll mode switch free.
			Approx. 0 V	Keyless start system ON, troll mode switch DOWN side push.
3	W/Y	Trim and Tilt sensor	Approx. 2 – 4.2 V	Keyless start system ON.
4	R	Power source for sensors	Approx. 5 V	Keyless start system ON.
5	R/W	CKP sensor	—	—
6	—	—	—	—
7	Y/G	Neutral switch	Approx. 12 V	Keyless start system ON, shift into NEUTRAL.
			Approx. 0 V	Keyless start system ON, shift into FORWARD or REVERSE.
8	B/W	Ground for sensors	—	—
9	V/W	Ex. manifold temp. sensor	0.14 – 4.75 V	Keyless start system ON.
10	Lg/B	IAT sensor	0.04 – 4.46 V	Keyless start system ON.
11	W/Y	Trim gauge	—	—
12	G/Y	TEMP lamp	—	—
13	P/W	REV-LIMIT lamp	—	—
14	R/B	Ground for ECM main relay	Approx. 12 V	Keyless start system OFF.
			Approx. 0.8 V	Keyless start system 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	Keyless start system ON.
18	Lbl	PTT switch "UP"	Approx. 12 V	Keyless start system ON. PTT UP switch ON.
			Approx. 0 V	Keyless start system ON. PTT UP switch OFF.
19	P	PTT switch "DOWN"	Approx. 12 V	Keyless start system ON. PTT DN switch ON.
			Approx. 0 V	Keyless start system ON. PTT DN switch OFF.
20	W	MAP sensor	0.79 – 4.2 V	Keyless start system ON.
21	Br/Y	Throttle position sensor	Approx. 3.8 V	Keyless start system ON. Throttle WOT.
			Approx. 0.7 V	Keyless start system ON. Throttle FCT.
22	Y/Bl	CMP sensor	Approx. 0.3 V or 5 V	Keyless start system ON.
23	Lg/W	Cylinder temp. sensor	0.14 – 4.75 V	Keyless start system ON.
24	Bl/R	Emergency stop switch	Approx. 5 V	Keyless start system ON. Stop switch plate IN.
			Approx. 0 V	Keyless start system ON. Stop switch plate OUT.
25	—	—	—	—
26	Bl	Oil pressure switch	Approx. 5 V	While engine running.
			Approx. 0 V	Engine stopped (Keyless start system ON).
27	Br	Start switch	Approx. 2.5 V	Keyless start system ON. Main switch knob not push in.
			Approx. 12 V	Keyless start system ON. Main switch knob push in.
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. 0.8 V	Keyless start system ON, Cranking.
			Approx. 12 V	Keyless start system ON, Normal.
33	Y	PC communication line (B)	—	—
34	B/Bl	Power source No.2 for ECM	Approx. 12 V	Keyless start system ON.
35	Lg	PTT relay “UP”	Approx. 0 V	PTT switch UP free.
			Approx. 12 V	PTT switch UP push.
36	Gr/R	O2 sensor	0.7 V or more	While engine idling after warming up.
			0.2 V or less	Engine stopped (Keyless start system ON).
37	R/G	IAC valve	Approx. 12 V	Keyless start system ON.
38	—	—	—	—
39	Lg/W	No.4 fuel injector (–)	Approx. 12 V	Keyless start system ON.
40	R/W	No.3 fuel injector (–)	Approx. 12 V	Keyless start system ON.
41	B/R	High pressure fuel pump (–)	Approx. 0 V	• Stop switch plate IN, shift into NEUTRAL. For 3 sec. after keyless start system ON. • While engine running.
			Approx. 12 V	Engine stopped. Keyless start system ON. Stop switch plate IN, shift into NEUTRAL.
42	O/B	No.1 fuel injector (–)	Approx. 12 V	Keyless start system ON.
43	O	No.1 ignition coil	Approx. 12 V	Keyless start system ON.
44	P	PTT relay “DOWN”	Approx. 0 V	PTT switch DN free.
			Approx. 12 V	PTT switch DN push.
45	W/G	CAN (H)	Approx. 2.5 V or 3.6 V	Keyless start system ON.
46	Lg/B	O2 sensor heater	Approx. 12 V	Keyless start system ON, Engine stopped.
			Approx. 0 V	While engine running, after engine warmed up.
47	B/Lg	CAN (L)	Approx. 2.5 V or 1.4 V	Keyless start system ON.
48	B	Ground for power	—	—
49	R/Bl	Water detection switch	Approx. 12 V	Keyless start system ON. Water detection switch OFF.
			Approx. 0 V	Keyless start system ON. Water detection switch ON.
50	B	Ground for power	—	—
51	B/Br	No.2 fuel injector (–)	Approx. 12 V	Keyless start system ON.
52	Bl	No.2 ignition coil	Approx. 12 V	Keyless start system ON.

Inspection of the Keyless Control Unit and Its Circuit

CENGG2111106006

Applicable Model and Effective Serial Number:
Keyless start model:
10003F-610001 and later, 11503F-610001 and later, 11504F-610001 and later,
11503Z-610001 and later, 14003F-610001 and later, 14003Z-610001 and later.

NOTICE

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

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

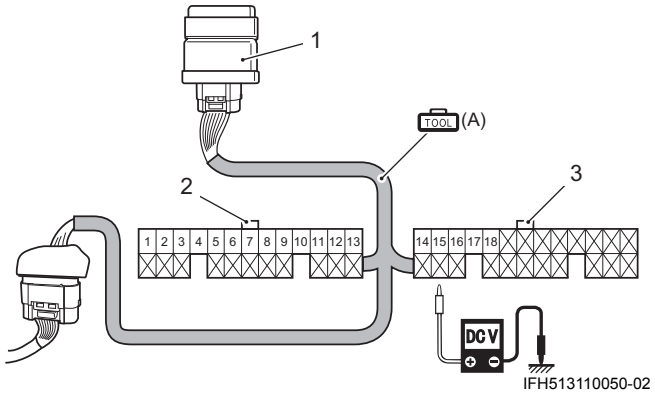
Special tool
TOOL (A): 09930–89290 (18 pin & 34 pin test cord)
TOOL : 09900–25008 (Multi circuit tester set)

Tester knob indication
DC voltage (⎓)

NOTE

In this inspection, the 34 pin test cord in the test cord set is not required.

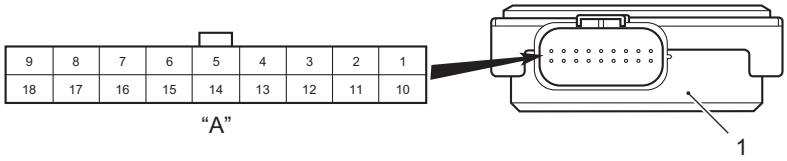
1) Turn the keyless start system “OFF”.
2) Connect the 18-pin test cord between the keyless control unit and wire harness as shown in figure.
3) Turn the keyless start system on.
4) Connect the tester probe (“–”, Black) to No.14 terminal (or to body ground), and measure the voltage according to the “Keyless Control Unit Circuit Voltage Table” (Page 1A-22).



1. Keyless control unit	2. White connector	3. Black connector

Keyless Control Unit Circuit Voltage Table

CENGG2111106007



IFH513110031-06

1. Keyless control unit	"A": 18-pin connector

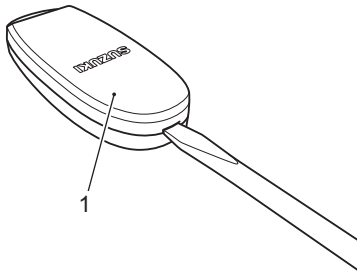
Terminal	Wire color	Circuit	Standard voltage	Condition/Remarks
1	Y	Select switch	Approx. 0 V	Keyless start system "OFF".
			Approx. 4.7 V	Keyless start system "ON".
2	G	Mode switch (Emergency stop switch)	Approx. 4.5 V	Keyless start system "ON", emergency stop switch plate in.
			Approx. 0 V	Keyless start system "ON", emergency stop switch plate out.
3	B/Lg	CAN (L)	Approx. 2.5 V or 1.4 V	Keyless start system "ON".
4	Bl	Buzzer	Approx. 12 V	Keyless start system "ON" or "OFF".
5	—	—	—	—
6	—	—	—	—
7	Gr	Main switch	Approx. 12 V	When main switch knob is "ON/OFF" position.
8	—	—	—	—
9	P/B	ECM power input	Approx. 11.3 V	Keyless start system "OFF".
			Approx. 0.8 V	Keyless start system "ON".
10	—	—	—	—
11	—	—	—	—
12	W/G	CAN (H)	Approx. 2.5 V or 3.6 V	Keyless start system "ON".
13	—	—	—	—
14	B	Ground	—	—
15	—	—	—	—
16	W	Battery power	Approx. 12 V	Keyless start system "ON" or "OFF".
17	P/B	ECM power relay	Approx. 11.3 V	Keyless start system "OFF".
			Approx. 0.8 V	Keyless start system "ON".
18	—	—	—	—

Key fob Battery Replacement

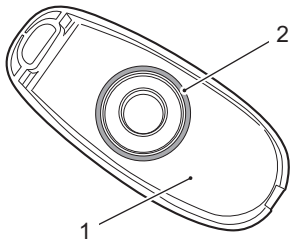
CENGG2111106008

Applicable Model and Effective Serial Number:
Keyless start model:
10003F-610001 and later, 11503F-610001 and later, 11504F-610001 and later, 11503Z-610001 and later, 14003F-610001 and later, 14003Z-610001 and later.

1) Insert a flat-blade screwdriver in the slot of the key fob, and then pry off the lower case (1).
Note the position of O-ring (2).

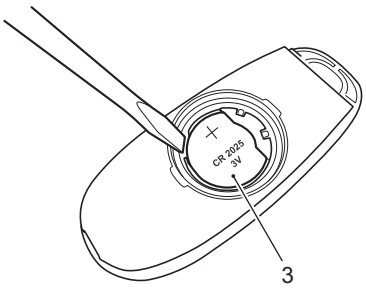


IFH513110051-01



IFH513110052-02

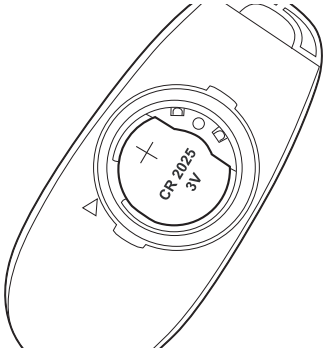
2) Remove the battery (3) using a flat-blade screwdriver as shown figure.



IFH513110053-01

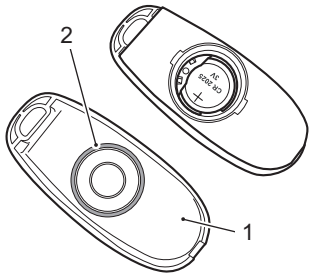
3) Replace the battery (3) so its (+) terminal faces the lower case side as shown in the illustration.

Lithium disc battery type:
CR2025 or equivalent.



IFH513110054-01

4) Confirm that the O-ring (2) is into place on the lower case.
Reinstall the lower case (1), and then fit lower case securely.



IFH513110055-01

NOTE

Dispose of the used battery properly according to applicable rules or regulations. Do not dispose of lithium batteries with ordinary household trash.

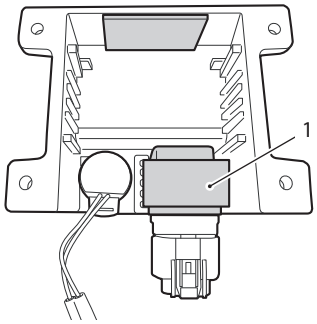
ECM Power Relay Inspection

CENGG2111106009

Applicable Model and Effective Serial Number:
Keyless start model:
10003F-610001 and later, 11503F-610001 and later, 11504F-610001 and later, 11503Z-610001 and later, 14003F-610001 and later, 14003Z-610001 and later.

Inspect the ECM power relay using the following procedures:

1) Turn the keyless start system “OFF”.
2) Disconnect the ECM power relay (1) from the keyless wiring.



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3) Check continuity between terminal (2) and (3) each time 12 V power supply is applied to terminal (4) and (5).
Connect the positive (+) lead to terminal (5), and negative (–) lead to terminal (4).

NOTICE

If the 12 V power supply wire is connected to wrong terminal or touched to each other, the power supply wire, tester may be damaged.

Be careful not to touch 12 V power supply wires to each other or with other terminals.

NOTICE

Diodes are used inside the power relay. Failure to correctly supply the battery voltage will result in power relay damage.

Be careful not to short-circuit the positive (+) and negative (–) cable, and connect them only to the correct terminal.

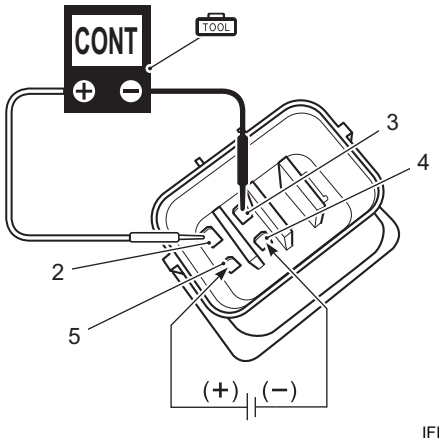
Special tool
TOOL : 09900–25008 (Multi circuit tester set)

Tester knob indication
Continuity (•))))

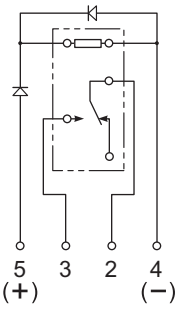
ECM power relay function

	Continuity
12 V power applied	Yes
12 V power not applied	No

If out of specification, replace ECM power relay.



IFH513110057-04



IFH513110058-02

Registering The First and Second Key-Fob ID Code

CENGG2111106010

Applicable Model and Effective Serial Number:
Keyless start model:
10003F-610001 and later, 11503F-610001 and later, 11504F-610001 and later, 11503Z-610001 and later, 14003F-610001 and later, 14003Z-610001 and later.

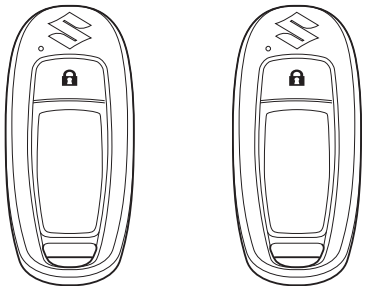
ID codes of individual key-fobs must be registered to enable the keyless start system:
To register the ID code of the first and second key-fob, do the following:

1) Complete the system wiring.
2) Connect the battery cable and sub battery cable to the battery.

NOTE

When system wiring is completed using keyless control unit with the following part number, two key-fob ID codes must be registered.
Otherwise the system cannot be operated until two ID codes are registered.

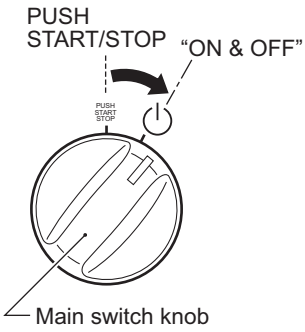
Part number: 37171-96L01 or 37171-96L11



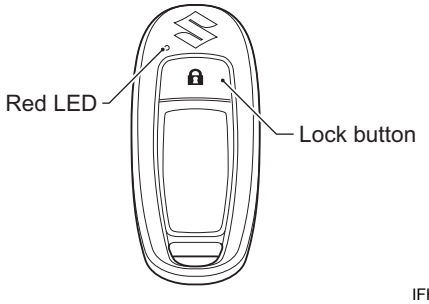
First key fob Second key fob

IGH511110008-01

3) **How to register the first key-fob ID code:**
Make sure the first key-fob is placed less than 0.3 m (12 in) from the keyless control unit.
The second key-fob must be separated more than 1m (3.2 feet) from the keyless control unit, or lock the second key-fob function by operating its lock button.
4) Turn the main switch knob from “PUSH START/STOP” to “ON & OFF” position, then release the knob.
The red LED on the key fob lights up; within 10 seconds, briefly press the key fob button.



IGG211110007-03



IFH513110060-02

NOTE

If the buzzer emits five (5) short sounds when the main switch knob is turned from “PUSH START/STOP” to “ON & OFF” position, the key fob function may be locked.
Press the lock button on the key-fob for more than one second to unlock the key fob function. Then perform step 4 again.

5) When the initial registration is successful, the buzzer emits one (1) short sound, followed by one (1) long sound, and the key fob’s red LED turns off.

NOTE

- **If the ID code registration is not successfully completed, the buzzer emits five (5) short sounds.**
- **If the registration is not successful, wait for about one minute, then perform step 4 again.**

6) **How to register the second key-fob ID code:**
   Make sure the second key-fob is placed less than 0.3 m (12 in) from the keyless control unit.
   The first key-fob must be separated more than 1 m (3.2 feet) from the keyless control unit, or lock the first key-fob function by operating its lock button.
7) As same way as the procedure of the first key-fob ID code registration, register the second key-fob ID code by operating the main switch knob and the second key-fob.
8) To confirm the key-fob registration was successful:
   a) Turn the main switch knob from “PUSH START/STOP” to “ON & OFF” position and release it.
   b) The buzzer emits two (2) short beeps and the four caution lamps light continuously in the monitor-tachometer.

   At this time, the keyless control unit and the ECM become a pair.

NOTE

Once an ECM has been connected and paired to a keyless start control unit, the ECM/outboard cannot be started with a normal key switch.
To unpair an ECM from an keyless control unit, see page “Unpairing an ECM from the Keyless Start System” (Page 1A-26).

NOTE

For multiple engine applications, the instance setting must be completed before this first key-on action.

Unpairing an ECM from the Keyless Start System

CENGG2111106011

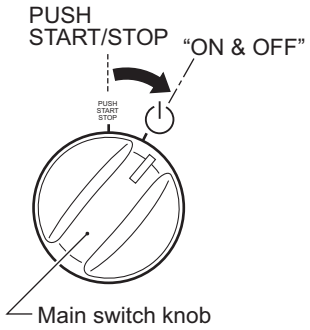
Applicable Model and Effective Serial Number:
Keyless start model:
10003F-610001 and later, 11503F-610001 and later, 11504F-610001 and later, 11503Z-610001 and later, 14003F-610001 and later, 14003Z-610001 and later.

When the outboard motor is resold, removed and started in a test tank, or if it is necessary to use the ECM on another engine, the ECM must be unpaired with the keyless control unit by erasing the ID code in the ECM. Do the following to erase the ID code:

NOTE

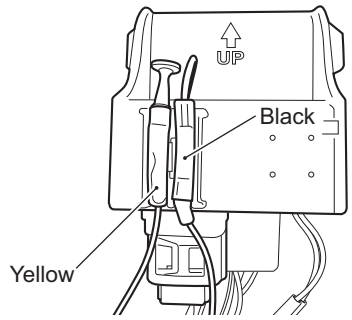
The key-fob ID code registered in the keyless control unit cannot be erased from the keyless control unit.

1) Make sure the key-fob and the keyless control unit are within communication range.
2) Turn the main switch knob from “PUSH START/STOP” to “ON & OFF” position, then release the knob.
   Confirm that the keyless start system has been turned ON.

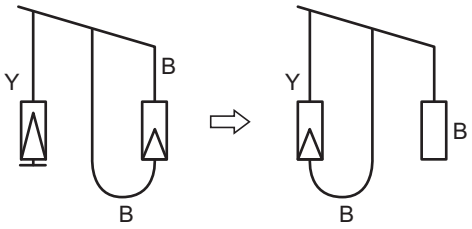


IGG211110007-03

3) Connect the black lead wire and the yellow lead wire in the keyless control harness.



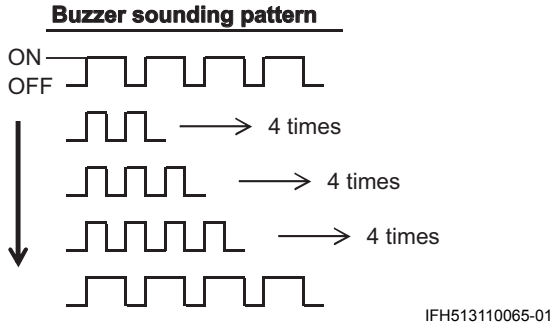
IGG211110010-01



Y: Yellow, B: Black

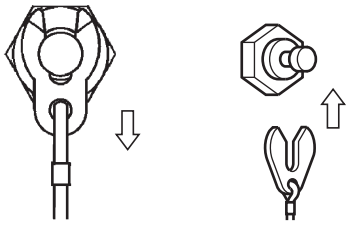
IFH513110064-01

4) The buzzer starts sounding in the following patterns: Four (4) long sounds, followed by:
   - Two (2) short sounds emitted four (4) times
   - Three (3) short sounds emitted four (4) times
   - Four (4) short sounds emitted four (4) times



IFH513110065-01

Immediately remove the lock plate from the emergency stop switch, then reinstall it.
If the unpairing is unsuccessful, the buzzer will continuously emit short beeps until the black lead wires are reconnected.



IFH513110066-01

5) Disconnect the black wire lead from the yellow wire lead, and then reconnect the two (2) black wire leads.
6) The buzzer sounds when unpairing is completed successfully.
   Four caution lamps in the monitor-tachometer become OFF.
7) Remove the battery cable from the battery.

NOTE

After unpairing an ECM from the keyless start system, do not turn the main switch knob to "ON & OFF" position.
If the switch is turned, the ID code cross-check will be performed again between the keyless control unit and ECM.