

ENGINE CONTROL

SECTION EC

CONTENTS

PRECAUTIONS	EC-3	Ignition Timing Adjustment:	
On Board Diagnostic (OBD) System of		Change the adjustment value from 5 dec	
Engine	EC-3	to 0 dec, and then adjust ignition timing.	EC-49
Precaution	EC-3	Fuel Pressure Clear:	
PREPARATION	EC-6	Perform (Cancel) fuel pressure clear.	EC-50
Special Service Tools	EC-6	Power Balance:	
DESCRIPTION	EC-7	Stop No. 3 cylinder in power balance.	EC-51
Description	EC-7	Self-diagnosis Clear:	
Component Parts Location	EC-12	Perform (Cancel) self-diagnosis.	EC-52
ECM Component	EC-13	BASIC INSPECTION	EC-53
Circuit Diagram	EC-16	Inspection of Idle Speed and	
TROUBLE DIAGNOSIS	EC-17	Ignition Timing	EC-53
ECM Terminal/Input/Output Signal		Throttle Valve Closed Position Learning	
Specification	EC-17	and Idle Air Volume Learning	EC-54
How to Proceed with Trouble Diagnosis	EC-24	Accelerator Pedal Released	
Diagnosis Chart by Symptom	EC-25	Position Learning	EC-55
Description	EC-32	Fuel Pressure Inspection	EC-55
Fail-Safe Function	EC-32	Accelerator Pedal Released	
TABLE OF DIAGNOSIS TROUBLE		Position Learning	EC-56
CODE (DTC)	EC-33	COMPONENT PARTS INSPECTION	EC-57
Service Tool	EC-41	Crankshaft Position Sensor (POS)	EC-57
Self-Diagnosis Function		Camshaft Position Sensor (PHASE)	EC-57
(Without Service tool)	EC-43	Mass Air Flow Sensor	EC-57
ECM Input/Output Monitor		Engine Coolant Temperature Sensor	EC-57
Reference Data	EC-44	Throttle Position Sensor 1, 2	
ECM Active Test	EC-45	(Electric throttle control actuator assembly) .	EC-58
Idle Air Volume Learning:		COMPONENT PARTS INSPECTION	EC-58
Perform (Cancel) Idle Air Volume Learning		Accelerator Pedal Position Sensors 1, 2	
(Normal).	EC-46	(Accelerator work unit)	EC-58
Air-fuel Ratio Adjustment:		Intake Air Temperature Sensor	
Change the adjustment value from 85 dec		(Joined with mass air flow sensor)	EC-59
to 100 dec, and then adjust air-fuel ratio.	EC-47	Stop Light Switch	EC-59
Learned Air-fuel Ratio Value:		Spark Plug	EC-59
Clear (Cancel) learned air-fuel ratio value. ...	EC-48	Ignition Coil	EC-60
		Gasoline Injector	EC-60
		Fuel Pump	EC-61

CONTENTS (Cont'd)

Electric Throttle Control Motor (Electric throttle control actuator assembly) .	EC-61
Heated Oxygen Sensor	EC-61
LPG Injector	EC-62
LPG Assistance Injector	EC-62
PTC Heater (Integrated with vaporizer)	EC-62
A/C System	EC-62
PCV GAS RECIRCULATION DEVICE	EC-63
System Diagram	EC-63
Component Parts Inspection	EC-63
ECM COMPONENTS	EC-64
Removal and Installation	EC-64

NOTE: This section contains information and specifications for both carbureted general overseas market models, as well as, electronic control models (manufactured in USA.) Therefore, ensure the specifications or procedures you are looking at are for the proper fuel delivery system; electronic controlled or carbureted.

PRECAUTIONS

On Board Diagnostic (OBD) System of Engine

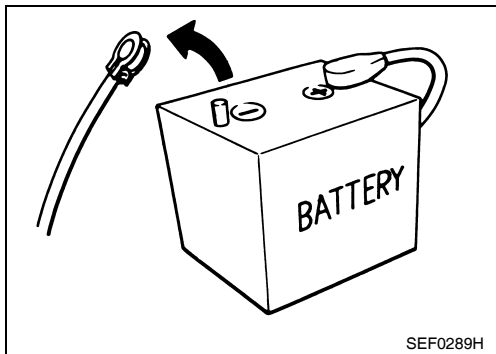
The ECM has an on board diagnostic system. It will light up the malfunction indicator light (MIL) to warn the driver of a malfunction causing emission deterioration.



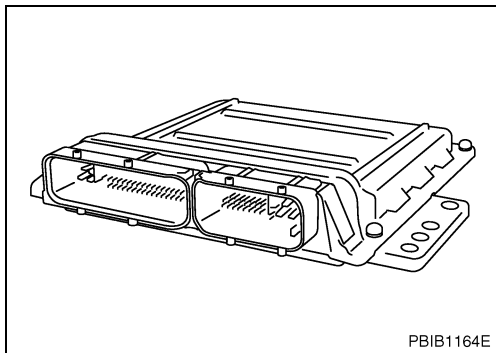
CAUTION:

- Be sure to turn the ignition switch OFF and disconnect the negative battery cable before any repair or inspection work. The open/short circuit of related switches, sensors, solenoid valves, etc. will cause the MIL to light up.
- Be sure to connect and lock the connectors securely after work. A loose (unlocked) connector will cause the MIL to light up due to the open circuit. (Be sure the connector is free from water, grease, dirt, bent terminals, etc.)
- Certain systems and components, especially those related to OBD, may use a new style slide-locking type harness connector.
- Be sure to route and secure the harnesses properly after work. The interference of the harness with a bracket, etc. may cause the MIL to light up due to the short circuit.
- Be sure to connect rubber tubes properly after work. A misconnected or disconnected rubber tube may cause the MIL to light up due to the malfunction of fuel injection system, etc.
- Be sure to erase the unnecessary malfunction information (repairs completed) from the ECM before returning the vehicle to the customer.

Precaution



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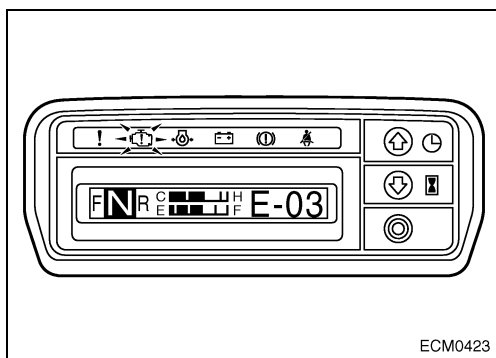
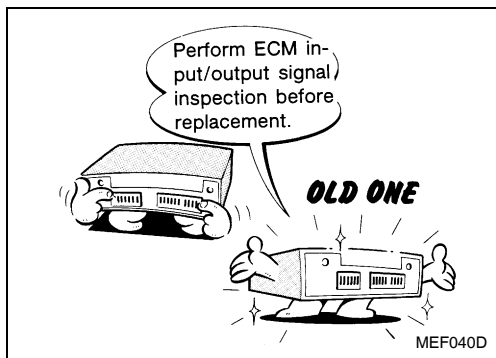
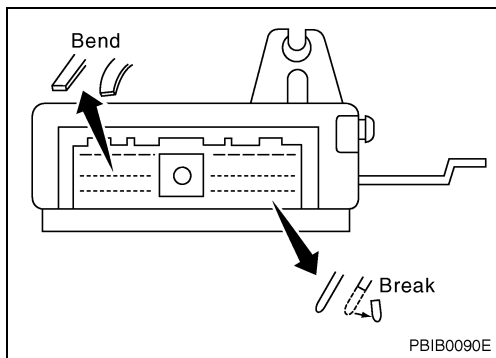
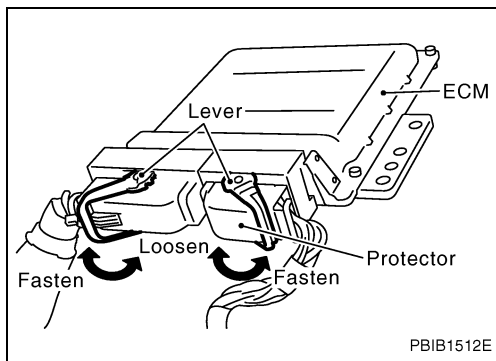


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- Always use a 12 volt battery as power source.
- Do not attempt to disconnect battery cables while engine is running.
- Before connecting or disconnecting the ECM harness connector, turn ignition switch OFF and disconnect battery ground cable. Failure to do so may damage the ECM because battery voltage is applied to ECM even if ignition switch is turned OFF.
- Before removing parts, turn ignition switch OFF and then disconnect battery ground cable.
- Do not disassemble ECM.
- If a battery cable is disconnected, the memory will return to the ECM value. The ECM will now start to self-control at its initial value. Engine operation can vary slightly when the terminal is disconnected. However, this is not an indication of a malfunction. Do not replace parts because of a slight variation.
- If the battery is disconnected, the following emission-related diagnostic information will be lost within 24 hours.
 - Diagnostic trouble codes
 - 1st trip diagnostic trouble codes

PRECAUTIONS

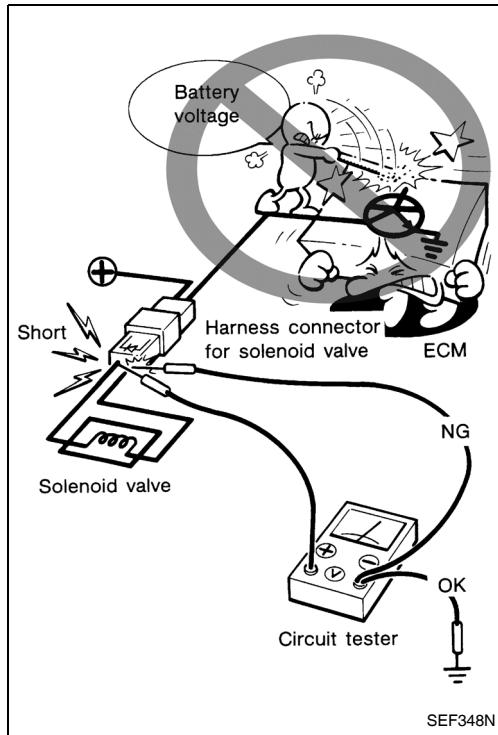
Precaution (Cont'd)



- When connecting ECM harness connector, fasten it securely with levers as far as they will go as shown in the figure.
- When connecting or disconnecting pin connectors into or from ECM, take care not to damage pin terminals (bend or break).
Make sure that there are not any bends or breaks on ECM pin terminal, when connecting pin connectors.
- Securely connect ECM harness connectors. A poor connection can cause an extremely high (surge) voltage to develop in coil and condenser, thus resulting in damage to ICs.
- Keep engine control system harness at least 10 cm (4 in) away from adjacent harness, to prevent engine control system malfunctions due to receiving external noise, degraded operation of ICs, etc.
- Keep engine control system parts and harness dry.
- Before replacing ECM, perform ECM Terminals and Reference Value inspection and make sure ECM functions properly.
- Handle mass air flow sensor carefully to avoid damage.
- Do not disassemble mass air flow sensor.
- Do not clean mass air flow sensor with any type of detergent.
- Do not disassemble electric throttle control actuator.
- Even a slight leak in the air intake system can cause serious incidents.
- Do not shock or jar the camshaft position sensor (PHASE), crankshaft position sensor (POS).
- After performing each TROUBLE DIAGNOSIS, perform DTC Confirmation Procedure or Overall Function Check.
The DTC should not be displayed in the DTC Confirmation Procedure if the repair is completed. The Overall Function Check should be a good result if the repair is completed.

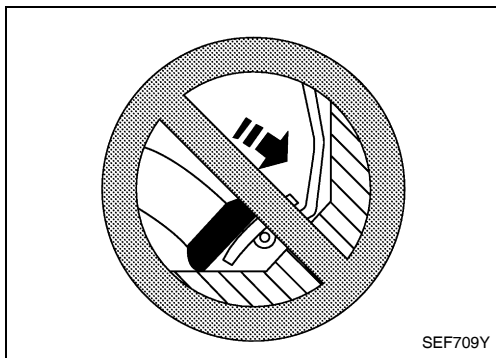
PRECAUTIONS

Precaution (Cont'd)



- When measuring ECM signals with a circuit tester, never allow the two tester probes to contact. Accidental contact of probes will cause a short circuit and damage the ECM power transistor.
- Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM's transistor. Use a ground other than ECM terminals, such as the ground.

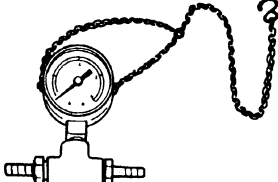
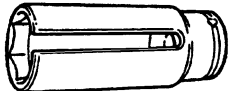
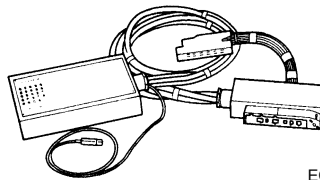
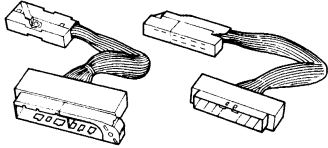
- Do not operate fuel pump when there is no fuel in lines.
- Tighten fuel hose clamps to the specified torque.



- Do not depress accelerator pedal when starting.
- Immediately after starting, do not rev up engine unnecessarily.
- Do not rev up engine just prior to shutdown.

PREPARATION

Special Service Tools

Description		Application
 ECM0013	EGI fuel pressure indicator ST19590000	For measuring fuel pressure gauge
 ECM0014	Heated oxygen sensor wrench KV10113700	Removing and installing heated oxygen sensor
 ECM0016	Check adapter V EG1755000 (for SMJ 150-pin connector)	For control unit input/output signal inspection
 ECM0017	Harness adapter EG17550200 (150-pin to 121-pin conversion adapter)	

DESCRIPTION

Description

- Adopts Electronic Concentrated engine Control System (ECCS). Fuel injection control, ignition timing control, idle speed control, and electronically controlled governor control etc. are all performed by a single control unit.
- Adopts electric throttle control actuator system to control electronically controlled governor.
- Adopts Hall IC type crankshaft position sensor (POS) and camshaft position sensor (PHASE).

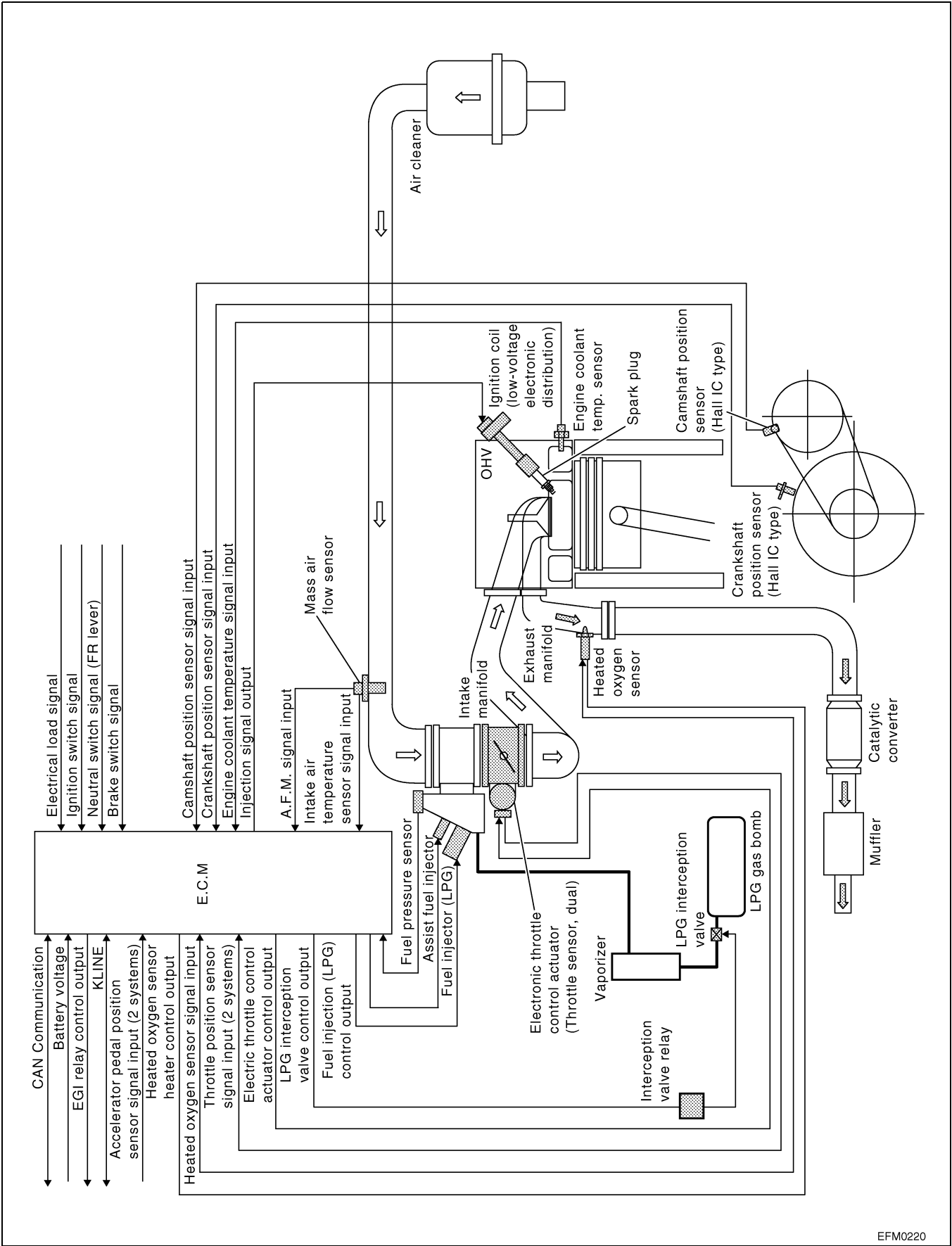
Items	Description
Electric throttle control actuator	• Adopts electronic throttle control actuator with integrated throttle control motor to adjust throttle valve opening optimally according to driving conditions or to improve safety and operability by electronically controlled governor.
Fuel injection control	• With fuel injection control, air-fuel ratio is optimized to improve exhaust performance and response. • Using feedback control through learning of air-fuel ratio compensation, the system corrects the ratio during transitional conditions, such as sudden sharp changes in the ratio, in order to improve drivability.
Ignition timing control	• Uses Hall IC crankshaft position sensor (POS) and camshaft position sensor (PHASE) to perform controls so that optimum ignition timing is obtained for every operating condition. Optimum ignition timing setup according to each fuel is also enabled at the time of a combined use formula. • Adopts electronic distribution system (NDIS) in which each cylinder is equipped with an ignition coil incorporating a power transistor for better ignition performance.
Idle speed control	• Adopts electronic throttle control actuator that continuously regulates intake air amount required for idling.
Governor speed control	• Performs maximum regulation of engine speed for oil pressure pump protection by engine speed signal.
Maximum speed regulation control	• Performs maximum speed regulation by vehicle speed sensor signal. Also, performs variable control of maximum speed by changeover switch.
Idling area torque up control	• Performs torque up control in idling area by engine speed signal in order to also enable cargo work at idling.
Overheat prevention control	• Reduces engine heat generation by reducing maximum engine speed and regulating maximum throttle opening when engine coolant temperature reaches approximately 110°C (230°F). • Prevents resulting in engine breakage by overheat by performing fuel cut at 1,000 rpm or more when engine coolant temperature reaches approximately 135°C (275°F). • Transmission overheat control; Reduce engine revolution when the transmission overheat switch (122 °C is detected. Transmission overheat switch via VCM. ECM reduce engine rpm to 1600.
Power/ECO mode control	• Changes throttle opening characteristic of throttle position by power/ECO mode control switch, and then minute operation of engine speed is enabled. (Option setting)
Fuel pump control (gasoline)	• Turns fuel pump relay ON/OFF depending on engine speed signal.
LPG interception valve control	• Turns interception valve relay ON/OFF depending on engine speed signal and fuel pressure sensor signal.
Fail-safe function	• Ensures vehicle's safe operation and enables vehicle to be driven in an emergency when any of the major system components (mass air flow sensor, engine coolant temperature sensor, etc.) have malfunctioned.
Diagnostic system	• Adopts self-diagnosis system for easier trouble diagnosis.
Oil pressure control	• Reduce engine revolution when the oil pressure low (approx. 0.2 bar) is detected for more than 5 seconds; ECM reduce rpm; Oil pressure switch via Meter panel; ECM reduce engine rpm to 1600.

K-ENGINE ELECTRONIC CONTROLLED SYSTEM DIAGRAM (GASOLINE)



DESCRIPTION

Description (Cont'd)
K-ENGINE ELECTRONIC CONTROLLED SYSTEM DIAGRAM (LPG)

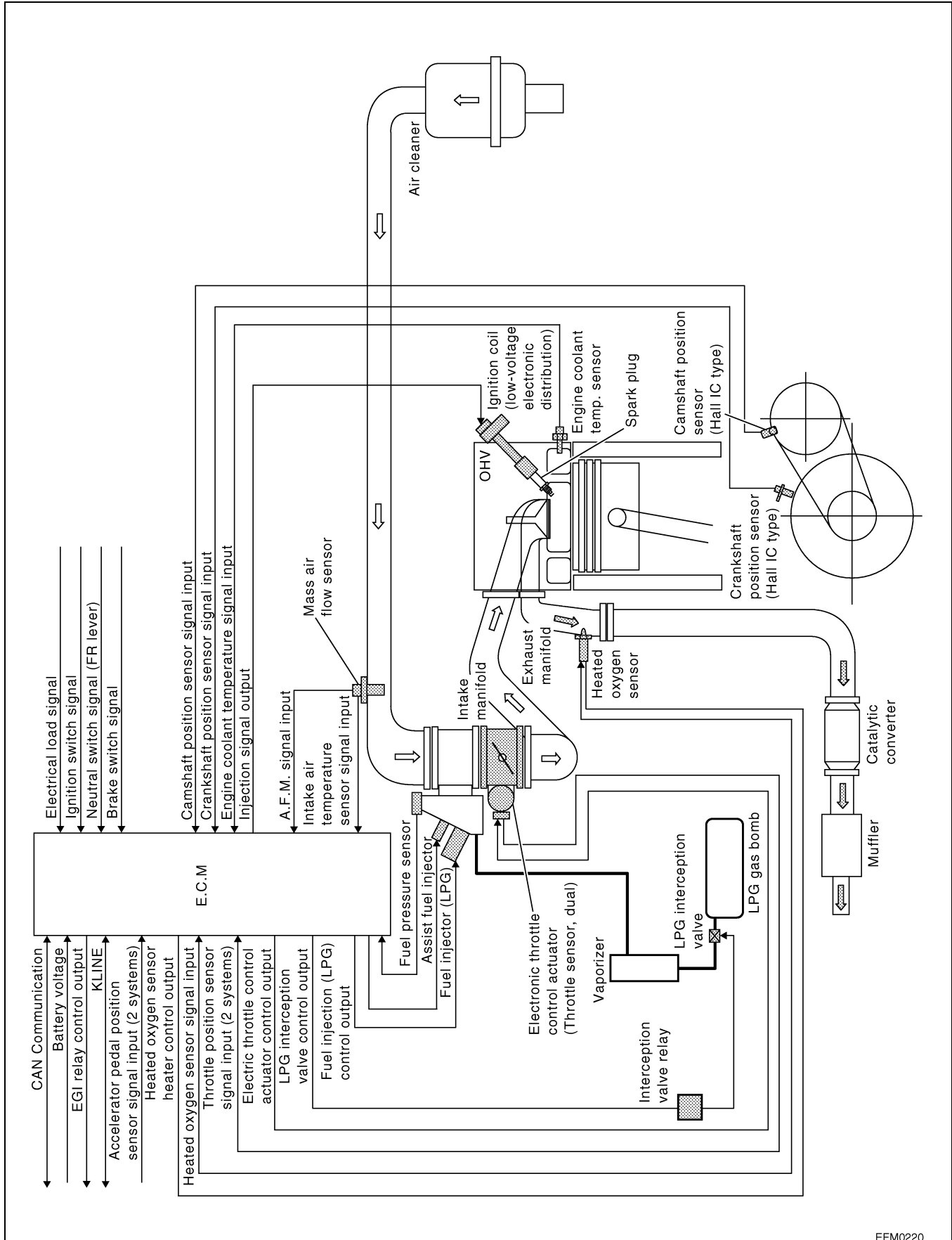


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DESCRIPTION

Description (Cont'd)

K-ENGINE ELECTRONIC CONTROLLED SYSTEM DIAGRAM (COMBINED USE)



EFM0220