
GROUP 13A

MULTIPOINT FUEL INJECTION (MPI)

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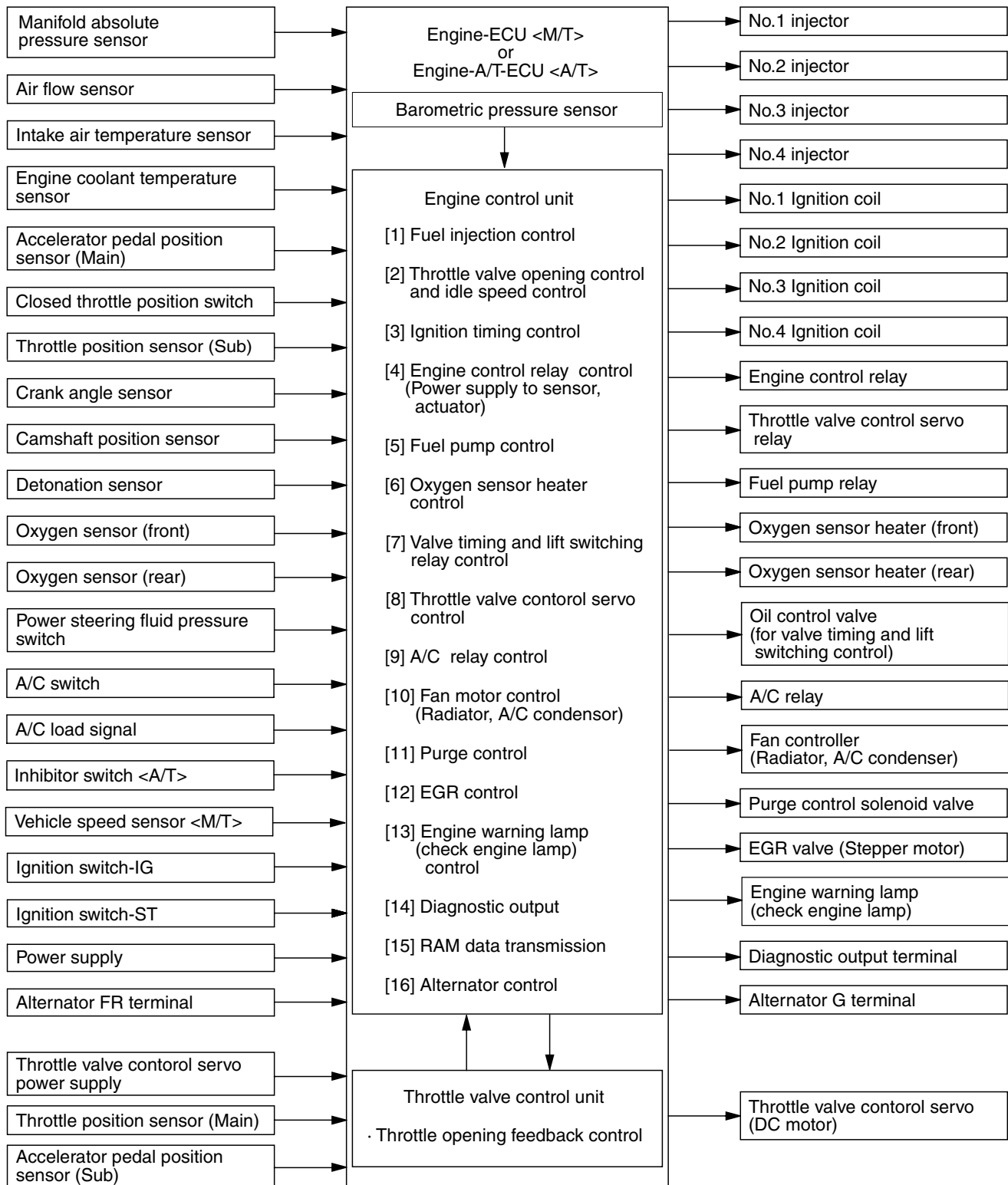
GENERAL INFORMATION

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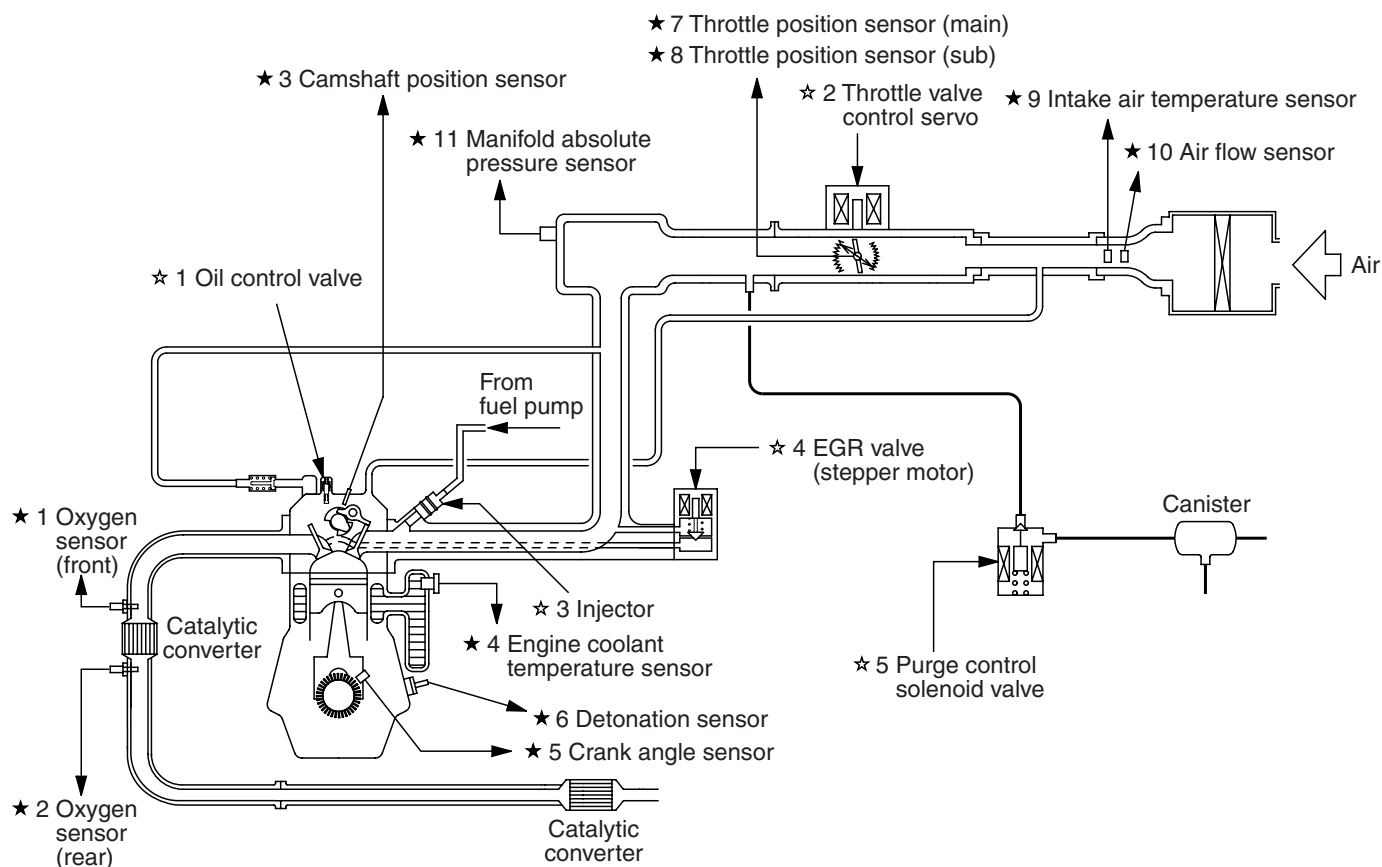
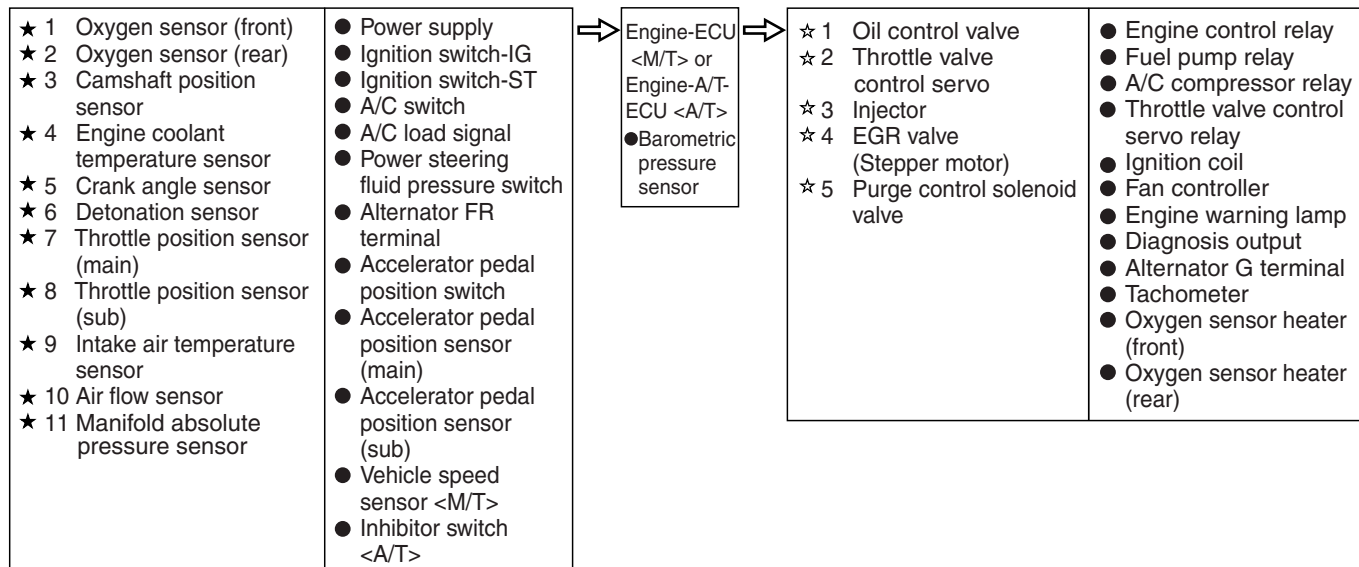
4G69-MIVEC is newly added. The following changes are added to the conventional controls based on OUTLANDER 4G69-MIVEC engine.

Improvements	Remarks
Dual oxygen sensors has been adopted.	The improvement of the exhaust gas purge performance.

SYSTEM BLOCK DIAGRAM



CONTROL SYSTEM DIAGRAM



LIST OF COMPONENT FUNCTIONS

Name		Function
ECU	Engine-ECU <M/T> or engine-A/T-ECU <A/T>	The signals that are input by the sensors enable the actuators to be controlled in accordance with the driving conditions.
Sensors	Ignition switch-IG	This signal indicates the ON/OFF condition of the ignition switch. When this signal is input, the engine-ECU <M/T> or engine-A/T-ECU <A/T> supplies power to the crank angle sensor, camshaft position sensor, etc.
	Ignition switch-ST	This signal indicates that the engine is cranking. Based on this signal, the engine-ECU <M/T> or engine-A/T-ECU <A/T> controls the fuel injection, throttle valve position, and the injection timing that are suited for starting the engine.
	Air flow sensor (AFS)	This signal, which indicates the intake air flow rate (mass), is input into the engine-ECU <M/T> or engine-A/T-ECU <A/T>. Based on the signals from this sensor, the engine-ECU <M/T> or engine-A/T-ECU <A/T> effects fuel injection control.
	Barometric pressure sensor	This sensor detects the altitude of the vehicle. It enables the engine-ECU <M/T> or engine-A/T-ECU <A/T> to make fuel injection volume corrections in order to achieve an appropriate air-fuel ratio.
	Manifold absolute pressure sensor	The intake pipe pressure is detected and input the engine-ECU <M/T> or engine-A/T-ECU <A/T>. The engine-ECU <M/T> or engine-A/T-ECU <A/T> controls the fuel injection based on this signal. Detects the internal pressure changes of intake manifold in accordance with the exhaust gas recirculation valve opening or closing. Performs the self-diagnostics of exhaust gas recirculation systems.
	Oxygen sensor	This sensor, which contains zirconia and platinum electrodes, detects the level of oxygen concentration in the exhaust gases. The engine-ECU <M/T> or engine-A/T-ECU <A/T> determines whether the air-fuel ratio is at the optimal stoichiometric ratio in accordance with this oxygen concentration level.
	Intake air temperature sensor	This sensor, which contains a thermistor, detects the temperature of the intake air. The engine-ECU <M/T> or engine-A/T-ECU <A/T> makes fuel injection volume corrections that suit the intake air temperature, in accordance with the voltage that is output by this sensor.
	Engine coolant temperature sensor	This sensor, which contains a thermistor, detects the temperature of the engine coolant. The engine-ECU <M/T> or engine-A/T-ECU <A/T> determines the warm-up condition of the engine in accordance with the voltage that is output by this sensor, in order to control the fuel injection volume, idle speed, and ignition timing.
	Throttle position sensor (TPS) <main, sub>	This sensor detects the position of the throttle valve and inputs it into the engine-ECU <M/T> or engine-A/T-ECU <A/T>. Based on the voltage that is output by this sensor, the engine-ECU <M/T> or engine-A/T-ECU <A/T> effects throttle valve feedback control.

Name		Function
Sensors	Accelerator pedal position sensor (APS) <main, sub>	This sensor detects the position of the accelerator and inputs it into the engine-ECU <M/T> or engine-A/T-ECU <A/T>. Based on the voltage that is output by this sensor, which determines the accelerator position (and the intention of the driver), the engine-ECU <M/T> or engine-A/T-ECU <A/T> effects appropriate fuel injection and throttle valve position controls.
	Camshaft position sensor	This sensor detects the top-dead-center (TDC) of the compression stroke of each cylinder.
	Crank angle sensor	This sensor detects the crank angle and inputs it into the engine-ECU <M/T> or engine-A/T-ECU <A/T>. The engine-ECU <M/T> or engine-A/T-ECU <A/T> effects injector control and other controls in accordance with the signals received from this sensor.
	Detonation sensor	This sensor, which contains a piezoelectric element, detects the vibration of the cylinder block that results from knocking. The engine-ECU <M/T> or engine-A/T-ECU <A/T> detects only the knocking of the engine from these vibrations, in order to retard the ignition timing in accordance with the strength of the knocks.
	Power steering fluid pressure switch	This is a contact point type switch that detects the load on the power steering.
	Vehicle speed sensor <M/T>	Uses magnetic resistance element to sense vehicle speed. It output 4 pulses per its rotation.
	A/C switch	Detects the ON/OFF condition of the A/C.
	A/C load signal	A/C inputs the drive state of the compressor (low load/high load) to the engine-ECU <M/T> or engine-A/T-ECU <A/T>. The engine-ECU <M/T> or engine-A/T-ECU <A/T> controls the A/C idle-up engine speed using this signal.
	Alternator FR terminal	This terminal is used for detecting the duty cycle ratio that energizes the alternator field coil.
	Inhibitor switch <A/T>	This is a contact point type switch that inputs a signal into the engine-A/T-ECU to determine whether the shift lever is in the neutral position.

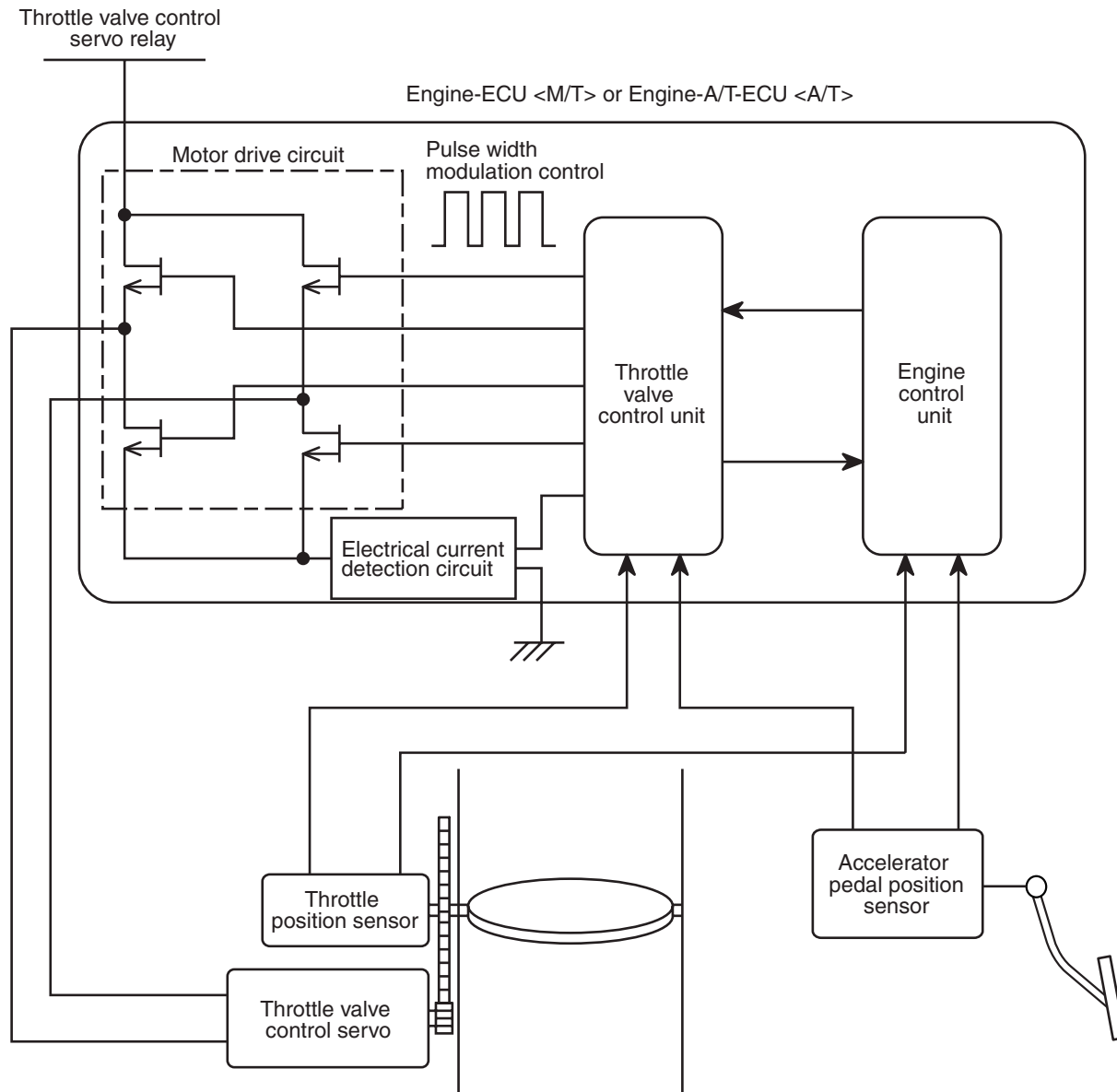
Name		Function
Actuators	Engine control relay	This relay turns ON and OFF the engine-ECU <M/T> or engine-A/T-ECU <A/T> power circuit.
	Throttle valve control servo relay	This relay turns ON and OFF the actuation power circuit for the throttle valve control servo in the engine-ECU <M/T> or engine-A/T-ECU <A/T>.
	Injector	The injectors inject fuel in accordance with the injection signals received from the engine-ECU <M/T> or engine-A/T-ECU <A/T>.
	Ignition coil (with power transistor)	Applies ignition coil primary current intermittently in accordance with the ignition signals received from the engine-ECU <M/T> or engine-A/T-ECU <A/T>, in order to generate high voltage for ignition.
	Fuel pump relay	Controls the power supplied to the fuel pump in accordance with the signals received from the engine-ECU <M/T> or engine-A/T-ECU <A/T>.
	A/C relay	Controls the operation of the A/C compressor in accordance with the signals received from the engine-ECU <M/T> or engine-A/T-ECU <A/T>.
	Purge control solenoid valve	Controls the flow rate of the purge air introduced into the surge tank in accordance with the signals received from the engine-ECU <M/T> or engine-A/T-ECU <A/T>.
	EGR valve (stepper motor)	Controls the EGR flow rate in accordance with the signals received from the engine-ECU <M/T> or engine-A/T-ECU <A/T>.
	Alternator G terminal	Controls the amount of current generated by the alternator in accordance with the signals received from the engine-ECU <M/T> or engine-A/T-ECU <A/T>.
	Fan controller	Controls the speed of the radiator fan and the condenser fan steplessly in accordance with the signals received from the engine-ECU <M/T> or engine-A/T-ECU <A/T>.
	Throttle valve control servo	Controls the throttle valve position in accordance with the signals received from the engine-ECU <M/T> or engine-A/T-ECU <A/T>.
	Oil control valve (OCV)	The oil control valve, which is actuated by the signals received from the engine-ECU <M/T> or engine-A/T-ECU <A/T>, changes the valve timing.
	Engine warning lamp (check warning lamp)	Illuminates to notify the driver of any abnormalities when a problem occurs with any of the sensors.
	Oxygen sensor heater	Turns ON and OFF the oxygen sensor heater circuit in accordance with the signals received from the engine-ECU <M/T> or engine-A/T-ECU <A/T>.

THROTTLE VALVE OPENING ANGLE CONTROL

M2132015000278

This uses basically the same control method as 4G69-MIVEC engine on OUTLANDER.

SYSTEM CONFIGURATION DIAGRAM



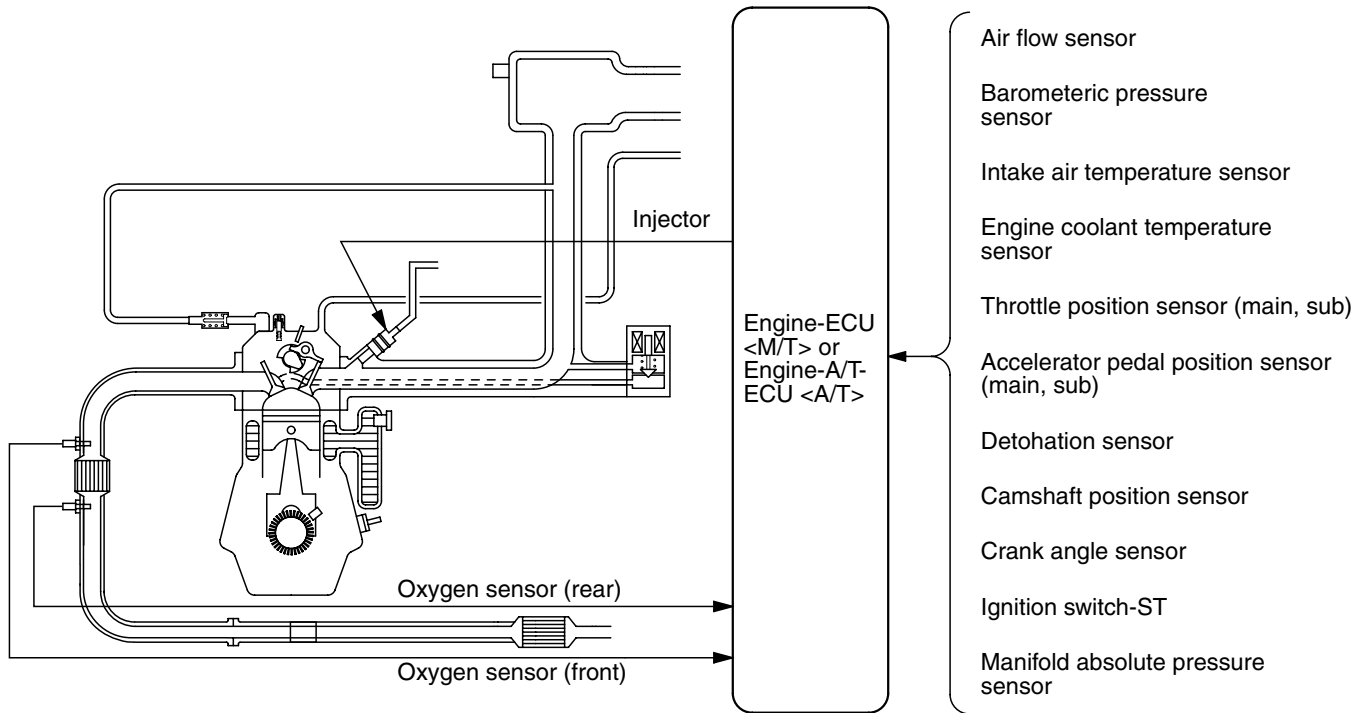
AK303329AE

FUEL INJECTION CONTROL

M2132003000709

This uses basically the same control method as 4G69-MIVEC engine on OUTLANDER.

SYSTEM CONFIGURATION DIAGRAM



AK501853 AB

OXYGEN SENSOR

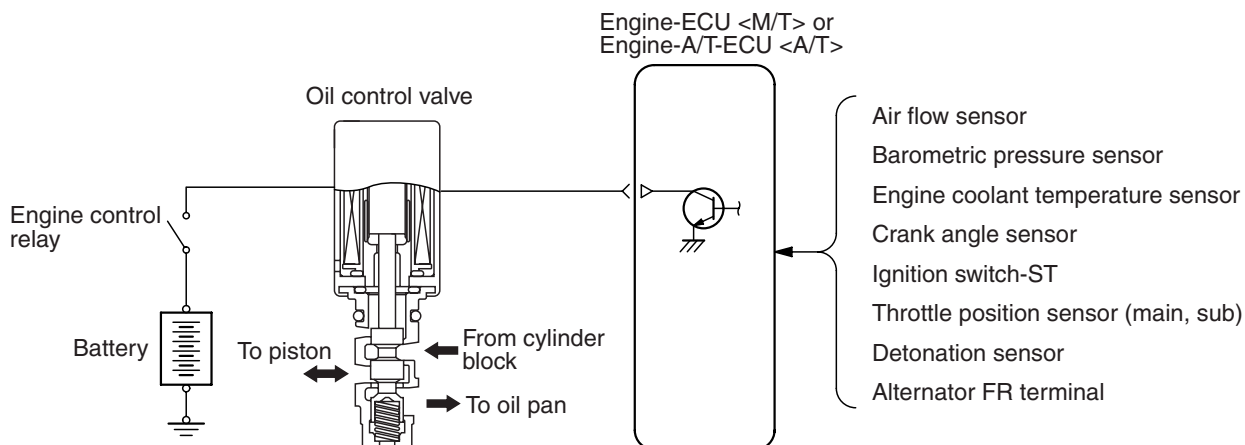
The oxygen sensors detect the level of oxygen concentration in the exhaust gases. Front and rear oxygen sensors are installed in front and back of the manifold catalytic converter (MCC), respectively. The engine-ECU <M/T> or engine-A/T-ECU <A/T> uses the output signal of the front oxygen sensor to effect

closed-loop control, and uses the output signal of the rear oxygen sensor in order to make corrections to the output signal of the front oxygen sensor. By resolving the output signal deviations associated with the deterioration of the front oxygen sensor, this system is able to effect a level of exhaust gas control that is higher than in the past.

VARIABLE INDUCTION CONTROL

M2132017000092

This uses basically the same control method as 4G69-MIVEC engine on OUTLANDER.



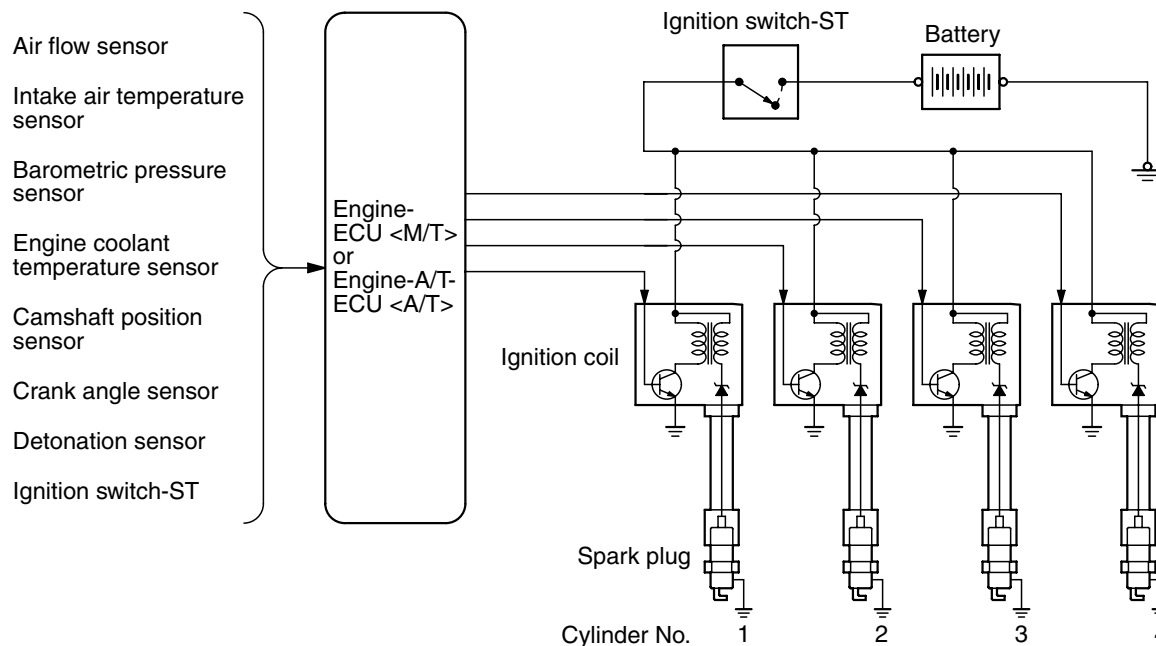
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IGNITION TIMING AND DISTRIBUTION CONTROL

M2132005000631

This uses basically the same control method as 4G69-MIVEC engine on OUTLANDER.

SYSTEM CONFIGURATION DIAGRAM



AK101328AH

EGR CONTROL, PURGE CONTROL

M2132011000179

Refer to [P.17-8](#) GROUP 17 –Emission Control –General Information

OTHER CONTROL FUNCTIONS

M2132010000541

The following controls are basically the same as 4G69-MIVEC engine on OUTLANDER

- Fan motor control
- Power supply
- Fuel pump relay control
- Oxygen sensor heater control
- Alternator control

DIAGNOSIS SYSTEM

M2132009000741

Engine -ECU <M/T> or engine-A/T-ECU <A/T> has been provided with the following functions for easier system inspection.

FREEZE-FRAME DATA

When the engine-ECU <M/T> or engine-A/T-ECU<A/T> detects a problem and stores the resulting diagnosis code, the engine condition at that time is also memorized. The M.U.T.-II/ III can then be used to analyze this data in order to increase the effectiveness of troubleshooting. The freeze-frame data display items are given below.

Item No.	Data		Unit
12	Air flow sensor		gm/s
13	Intake air temperature sensor		°C
21	Engine coolant temperature sensor		°C
22	Crank angle sensor		r/min
24	Vehicle speed		km/h
44	Ignition advance		deg
81	Long-term fuel compensation		%
82	Short-term fuel compensation		%
88	Fuel control condition	Open loop	OL
		Closed loop	CL
		Open loop owing to drive condition	OL-DRV.
		Open loop owing to system malfunction	OL-SYS.
		Closed loop based on one oxygen sensor	CL- HO2S
87	Calculation load value		%
8A	Throttle position sensor (main)		%
–	Diagnosis code during data recording		–

DIAGNOSIS CODE

The diagnosis and engine warning lamp items are given in the table below.

Code No.	Diagnosis item	Main diagnosis contents	Engine warning lamp
P0100	Air flow sensor system	Open circuit or short-circuit in sensor-related circuits	ON
P0105	Manifold absolute pressure sensor system	Open circuit or short-circuit in sensor-related circuits	ON
P0110	Intake air temperature sensor system	Open circuit or short-circuit in sensor-related circuits	ON
P0115	Engine coolant temperature sensor system	Open circuit or short-circuit in sensor-related circuits	ON
P0122*	Throttle position sensor (main) circuit low input	Open circuit or short-circuit in sensor-related circuits	ON
P0123*	Throttle position sensor (main) circuit high input	Open circuit in sensor-related circuits	ON
P0125*	Feedback system monitor	Oxygen sensor not operating	ON
P0130	Oxygen sensor (front) system	Open circuit or short-circuit in sensor-related circuits	ON
P0135	Oxygen sensor (front) heater system	Open circuit or short-circuit in heater-related circuits	ON
P0136	Oxygen sensor (rear) system	Open circuit or short-circuit in sensor-related circuits	ON
P0141	Oxygen sensor (rear) heater system	Open circuit or short-circuit in heater-related circuits	ON
P0170	Abnormal fuel system	Leanness or richness problem	ON
P0201	No. 1 injector system	Open circuit or short-circuit in injector-related circuits	ON
P0202	No. 2 injector system	Open circuit or short-circuit in injector-related circuits	ON
P0203	No. 3 injector system	Open circuit or short-circuit in injector-related circuits	ON
P0204	No. 4 injector system	Open circuit or short-circuit in injector-related circuits	ON
P0222*	Throttle position sensor (sub) circuit low input	Open circuit or short-circuit in sensor-related circuits	ON
P0223*	Throttle position sensor (sub) circuit high input	Open circuit in sensor-related circuits	ON
P0300*	Random / multiple cylinder mis-fire detected	Abnormal ignition signal (Mis-firing)	ON
P0301*	No. 1 cylinder mis-fire detected	Mis-firing	ON
P0302*	No. 2 cylinder mis-fire detected		
P0303*	No. 3 cylinder mis-fire detected		
P0304*	No. 4 cylinder mis-fire detected		
P0325	Detonation sensor system	Abnormal sensor output	—

Code No.	Diagnosis item	Main diagnosis contents	Engine warning lamp
P0335	Crank angle sensor system	Abnormal sensor output	ON
P0340	Camshaft position sensor system	Abnormal sensor output	ON
P0403	Exhaust gas recirculation (EGR) control system	Open circuit or short-circuit in valve-related circuits	ON
P0421	Warm up catalyst malfunction	Abnormal exhaust gas purification performance of catalyst	ON
P0443	Purge control solenoid valve system	Open circuit or short-circuit in solenoid valve-related circuits	ON
P0500	Vehicle speed sensor system <M/T>	Abnormal sensor output	ON
P0513	Immobilizer malfunction	Open circuit or short-circuit in system-related circuits	—
P0551*	Power steering fluid pressure switch system	Open circuit or short-circuit in system-related circuits	ON
P0603	EEP ROM system	Abnormality in engine-ECU <M/T> or engine-A/T-ECU <A/T>	ON
P0606*	Powertrain control module main processor malfunction	Abnormality in engine-ECU<M/T> or engine-A/T-ECU<A/T>	ON
P0622	Alternator FR terminal system	Open circuit or short-circuit in system-related circuits	—
P0638*	Throttle valve control servo circuit range/performance problem	Abnormal throttle valve control servo	ON
P0642*	Throttle position sensor power supply	Abnormality in engine-ECU<M/T> or engine-A/T-ECU<A/T>	ON
P0657*	Throttle valve control servo relay circuit malfunction	Open circuit or short-circuit in sensor-related circuits	ON
P0705	Inhibitor switch system	abnormality in A/T system	ON
P0710	A/T fluid temperature sensor system	abnormality in A/T system	ON
P0715*	Input shaft speed sensor system	abnormality in A/T system	ON
P0720*	Output shaft speed sensor system	abnormality in A/T system	ON
P0740*	Torque converter clutch solenoid valve system	abnormality in A/T system	ON
P0750*	Low-reverse solenoid valve system	abnormality in A/T system	ON
P0755*	Underdrive solenoid valve system	abnormality in A/T system	ON
P0760*	Second solenoid valve system	abnormality in A/T system	ON
P0765*	Overdrive solenoid valve system	abnormality in A/T system	ON
P1021	Oil control valve system	Open circuit or short-circuit in solenoid valve-related circuits	ON
P1602*	Communication Malfunction (between engine-ECU<M/T> or engine-A/T-ECU<A/T> main processor and system LSI)	Abnormality in engine-ECU<M/T> or engine-A/T-ECU<A/T>	ON

Code No.	Diagnosis item	Main diagnosis contents	Engine warning lamp
P1603*	Battery back-up circuit malfunction	Open circuit or short-circuit in system-related circuits	ON
P1751*	A/T control relay malfunction	Abnormality in A/T system	ON
P2100*	Throttle valve control servo circuit (open)	Open circuit in system-related circuits	ON
P2102*	Throttle valve control servo circuit (shorted low)	Short-circuit in system-related circuits	ON
P2121*	Accelerator pedal position sensor (main) circuit range/performance problem	Abnormal sensor output	ON
P2122*	Accelerator pedal position sensor (main) circuit low input	Open circuit or short-circuit in sensor-related circuits	ON
P2123*	Accelerator pedal position sensor (main) circuit high input	Open circuit in sensor-related circuits	ON
P2126*	Accelerator pedal position sensor (sub) circuit range/performance problem	Abnormal sensor output	ON
P2127*	Accelerator pedal position sensor (sub) circuit low input	Open circuit or short-circuit in sensor-related circuits	ON
P2128*	Accelerator pedal position sensor (sub) circuit high input	Open circuit in sensor-related circuits	ON
P2135*	Throttle position sensor (main and sub) circuit range/performance problem	Abnormal sensor output	ON
P2138*	Accelerator pedal position sensor (main and sub) circuit range/performance problem	Abnormal sensor output	ON
P2173*	Abnormal intake air amount	Abnormal sensor output	ON
P2226*	Barometric pressure sensor system	Open circuit or short-circuit in sensor-related circuits	ON
–	Engine-ECU<M/T> or engine-A/T-ECU<A/T>	Abnormality in engine-ECU<M/T> or engine-A/T-ECU<A/T>	ON

NOTE: When the first time a malfunction is detected, the engine-ECU<M/T> or engine-A/T-ECU<A/T> does not store a fault code. However, if the same malfunction is again detected the next time the engine is operated, a fault code is stored. For systems or components marked with "*" to be diagnosed, when the first time a malfunction is detected, a fault code is stored and the engine warning lamp is illuminated.

DATA LIST FUNCTION

The data list items are given in the table below

Item No.	Inspection item	Unit
11	Oxygen sensor (front)	mV
12	Air flow sensor	gm/s
13	Intake air temperature sensor	°C
14	Throttle position sensor (sub)	mV
16	Power supply voltage	V
18	Cranking signal (ignition switch-ST)	ON/OFF
21	Engine coolant temperature sensor	°C
22	Crank angle sensor	r/min
25	Barometric pressure sensor	kPa
26	Accelerator pedal position switch	ON/OFF
27	Power steering fluid pressure switch	ON/OFF
28	A/C switch	ON/OFF
37	Volumetric efficiency	%
41	Injectors	ms
44	Ignition advance	° BTDC
49	A/C relay	ON/OFF
59	Oxygen sensor (rear)	mV
68	EGR valve	STEP
77	Accelerator pedal position sensor (sub)	mV
78	Accelerator pedal position sensor (main)	mV
79	Throttle position sensor (main)	mV
95	Manifold absolute pressure sensor	kPa
9A	Throttle position sensor (main) mid opening learning valve	mV
12*	Air flow sensor	gm/s
13*	Intake air temperature sensor	°C
21*	Engine coolant temperature sensor	°C
22*	Crank angle sensor	r/min
24*	Vehicle speed sensor	km/h
44*	Ignition advance	deg
81*	Long-term fuel compensation on	%
82*	Short-term fuel compensation on	%
87*	Calculated load valve	%
88*	Fuel control condition on	Closed loop/Open loop –drive condition
8A*	Throttle position sensor (main)	%
A1*	Oxygen sensor (front)	V
A2*	Oxygen sensor (rear)	V
A9*	Engine warning lamp distance	–

NOTE: Items marked "*" will not appear if a data list is selected in the check mode.

ACTUATOR TEST FUNCTION

The actuator test items are given in the table below

Item No.	Inspection item	Drive contents
01	Injectors	Cut fuel to No. 1 injector
02		Cut fuel to No. 2 injector
03		Cut fuel to No. 3 injector
04		Cut fuel to No. 4 injector
07	Fuel pump	Fuel pump operates and fuel is recirculated
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON
17	Basic ignition timing	Set to ignition adjustment mode
21	Fan controller	Drive the fan motor
22	Oil control valve	Solenoid valve turns from OFF to ON
34	Throttle valve control servo	Stop the throttle valve control servo