GROUP 13B

MULTIPOINT FUEL INJECTION (MPI) <4G63-Turbo>

CONTENTS

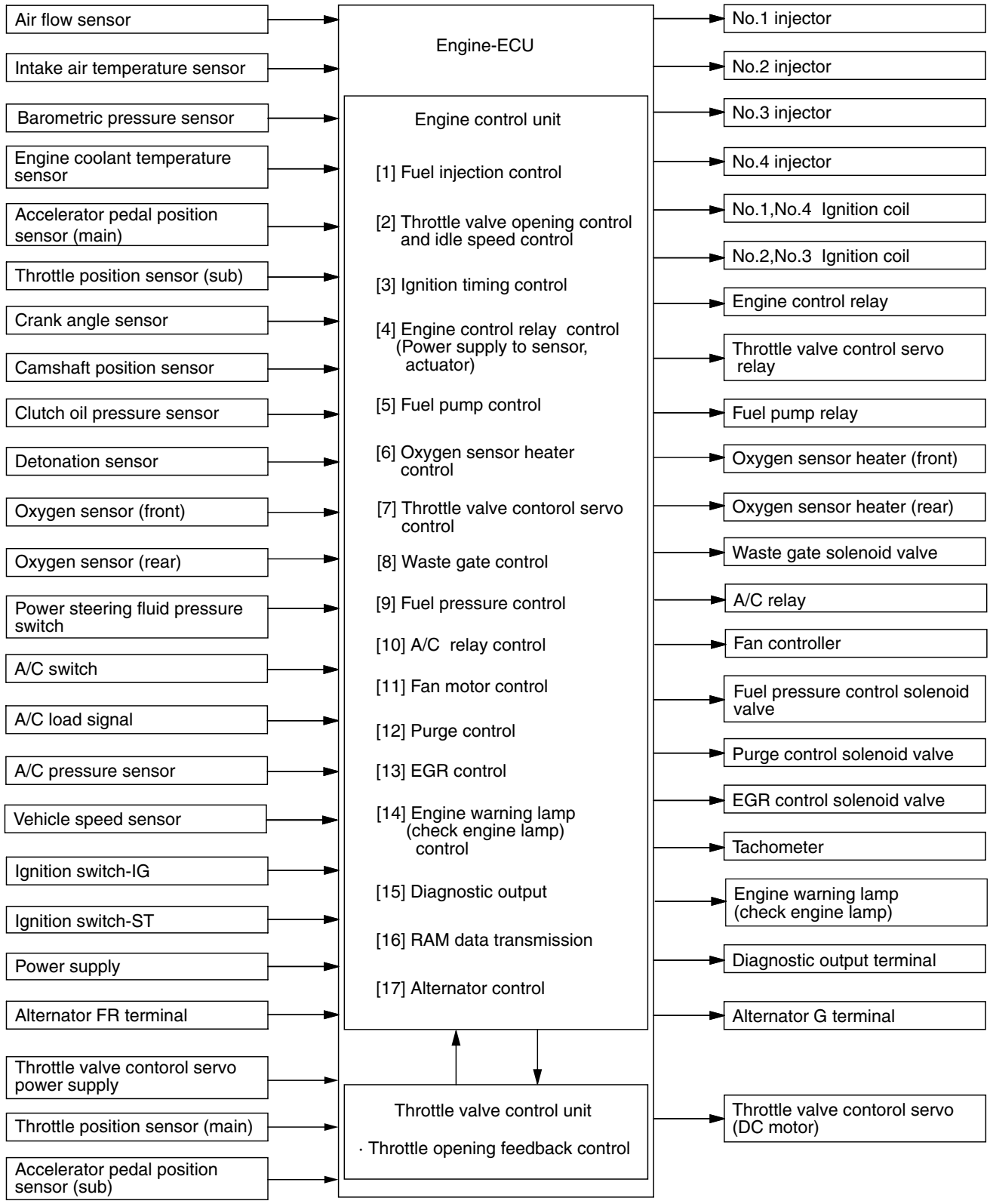
GENERAL INFORMATION

M2132000100473

The control system is basically the same as that of the 4G63-DOHC-INTERCOOLER TURBO engine used in the LANCER EVOLUTION. It incorporates the following enhancement.

Improvement	Remark
The electronic-controlled throttle valve system is used.	Improvement of feeling in operation.
The throttle position sensor (main and sub) is used.	Improved reliability.
The Accelerator pedal position sensor is used.	The sensor is basically the same as that of the 4G64-GDI engine used in the SPACE WAGON.
The clutch oil pressure sensor is used.	Reduces the amount of hydrocarbon (HC) discharge by making fuel injection volume corrections during shift changes.

SYSTEM BLOCK DIAGRAM



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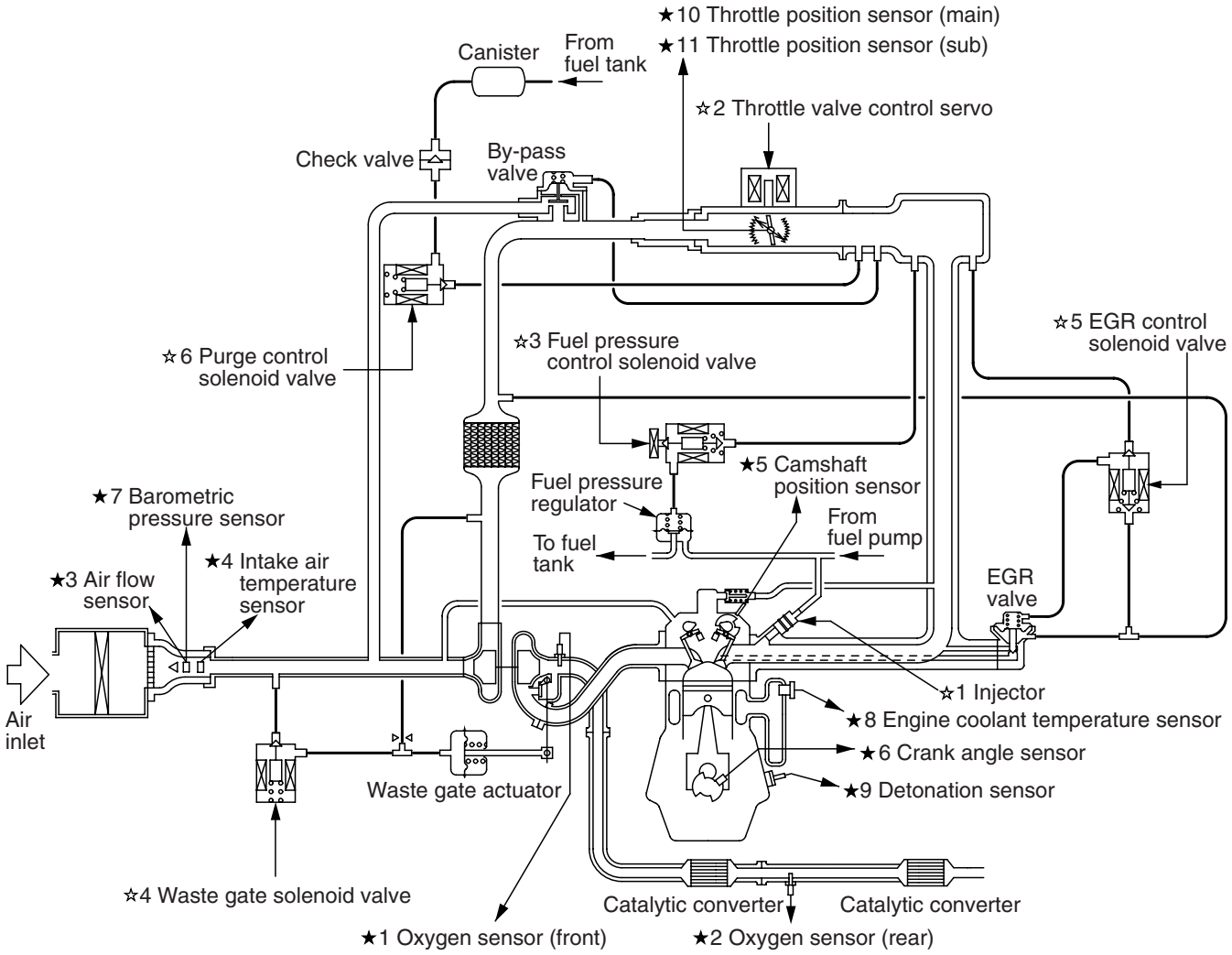
MULTI POINT FUEL INJECTION SYSTEM DIAGRAM

★1 Oxygen sensor (front) ★2 Oxygen sensor (rear) ★3 Air flow sensor ★4 Intake air temperature sensor ★5 Camshaft position sensor ★6 Crank angle sensor ★7 Barometric pressure sensor ★8 Engine coolant temperature sensor ★9 Detonation sensor ★10 Throttle position sensor(main) ★11 Throttle position sensor(sub)	● Power supply ● Ignition switch-IG ● Ignition switch-ST ● A/C switch ● A/C load signal ● Power steering fluid pressure switch ● Alternator FR terminal ● Accelerator pedal position switch ● Accelerator pedal ● position sensor (main) ● Accelerator pedal position sensor (sub) ● Vehicle speed sensor ● Clutch oil pressure sensor	⇨ Engine-ECU ⇨	☆1 Injector ☆2 Throttle valve control servo ☆3 Fuel pressure control solenoid valve ☆4 Waste gate solenoid valve ☆5 EGR control solenoid valve ☆6 Purge control solenoid valve	● Engine control relay ● Fuel pump relay ● A/C compressor relay ● Ignition coil ● Fan controller ● Engine warning lamp ● Diagnosis output ● Alternator G terminal ● Air flow sensor reset signal ● Oxygen sensor heater (front) ● Oxygen sensor heater (rear) ● Tachometer



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LIST OF COMPONENT FUNCTIONS

Name		Function
ECU	Engine-ECU	Uses the signals input from the various sensors to control operation of actuators in accordance with the driving conditions.
Sensors	Ignition switch-IG	Detects the ON/OFF position of the ignition switch. When this signal is input to the engine-ECU, power is supplied to components such as the injectors, air flow sensor, idle speed control servo and crank angle sensor.
	Ignition switch-ST	Detects whether the engine is cranking. The engine-ECU controls the fuel injection, throttle valve opening angle and ignition timing to the appropriate settings based on this signal.
	Air flow sensor (AFS)	Senses air intake volume using Karman flow meter. In accordance with this information and engine speed, engine-ECU controls injectors" basic activation duration.
	Barometric pressure sensor	Senses atmospheric pressure using semiconductor diffused pressure sensor. In accordance with data from this sensor, engine-ECU determines vehicles" altitude and adjusts fuel injection rate as a function of altitude to ensure appropriate air/fuel ratio.
	Oxygen sensor	Detects the concentration of oxygen in the exhaust gas by means of zirconia and platinum electrodes. The engine-ECU judges whether the air/fuel mixture ratio is at the stoichiometric air fuel ratio based on this concentration.
	Intake air temperature sensor	Detects the temperature of the intake air by means of a thermistor. The engine-ECU corrects the fuel injection amount to the correct amount corresponding to the intake air temperature based on the voltage output from this sensor.
	Engine coolant temperature sensor	Detects the temperature of the engine coolant by means of a thermistor. The engine-ECU detects how warm the engine is based on the signal from this sensor, and uses this to control the fuel injection amount, 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. Based on the voltage that is output by this sensor, the engine-ECU effects throttle valve feedback control.
	Accelerator pedal position sensor (APS) <main, sub>	This sensor detects the position of the accelerator and inputs it into the engine-ECU. Based on the voltage that is output by this sensor, which determines the accelerator position (and the intention of the driver), the engine-ECU effects appropriate fuel injection and throttle valve position controls.
	Vehicle speed sensor	Uses magnetic resistance element to sense vehicle speed.

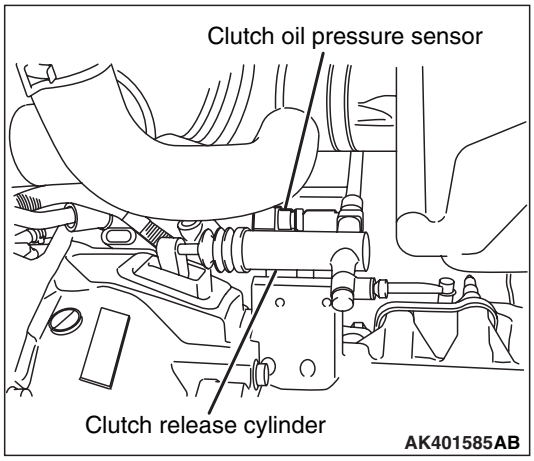
Name		Function
Sensor	Detonation sensor	Detects cylinder block vibration when knocking is generated by the piezoelectric element. The engine-ECU controls retardation of the ignition timing according to the knocking strength.
	Camshaft position sensor	Detects the No. 1 cylinder compression top dead centre position by means of a magnetic resistance element.
	Crank angle sensor	Detects the crank angle by means of a Hall element. The engine-ECU controls the injectors based on the signal from this sensor.
	Alternator FR terminal	Detects the energizing duty ratio of the alternator field coil.
	Power steering fluid pressure switch	Detects whether there is a power steering load present by means of a contact switch.
	Clutch oil pressure sensor	The variation of the hydraulic pressure in the clutch release cylinder is detected according to the clutch pedal depressed.
	A/C switch	Detects the ON/OFF condition of the A/C.
	A/C pressure sensor	A/C detects the refrigerant pressure and inputs the load of the A/C compressor to the engine-ECU.
	A/C load signal	A/C inputs the drive state of the compressor (low load/high load) to the engine-ECU. The engine-ECU controls the A/C idle-up engine speed using this signal.

Name		Function
Actuators	Engine control relay	This relay turns ON and OFF the engine-ECU 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.
	Injector	Drives the fuel injection by means of drive signals from the engine-ECU. Maltiple spray hole type is used.
	Ignition coil (with power transistor)	Interrupts the ignition coil primary current in accordance with the ignition signals from the engine-ECU, in order to generate a high voltage for ignition.
	EGR control solenoid valve	Controls the EGR flow volume through signals under the duty control from the engine-ECU.
	Fuel pump relay	Controls the power supplied to the fuel pump in accordance with the ignition signals received from the engine-ECU.
	Fan controller	Controls the radiator fan speed smoothly by means of signals from the engine-ECU.
	Throttle valve control servo	Controls the throttle valve position in accordance with the signals received from the engine-ECU.
	Purge control solenoid valve	Controls the amount of purge air introduced to the air intake plenum by means of signals from the engine-ECU.
	Alternator G terminal	Controls the amount of power generated by the alternator through signals under the duty control from the engine-ECU.
	A/C relay	Controls the operation of the A/C compressor in accordance with the signals received from the engine-ECU.
	Oxygen sensor heater	Turns ON and OFF the oxygen sensor heater circuit in accordance with the signals received from the engine-ECU.
	Waste gate solenoid valve	Controls the boost pressure that affects the waste gate actuator in response to the signals from the engine-ECU.
	Fuel pressure control solenoid valve	Controls the fuel pressure in response to the signals form the engine-ECU.
	Engine warning lamp	Illuminates to notify the driver of any abnormalities when a problem occurs with any of the sensors.

SENSOR

M2132001000297

CLUTCH OIL PRESSURE SENSOR



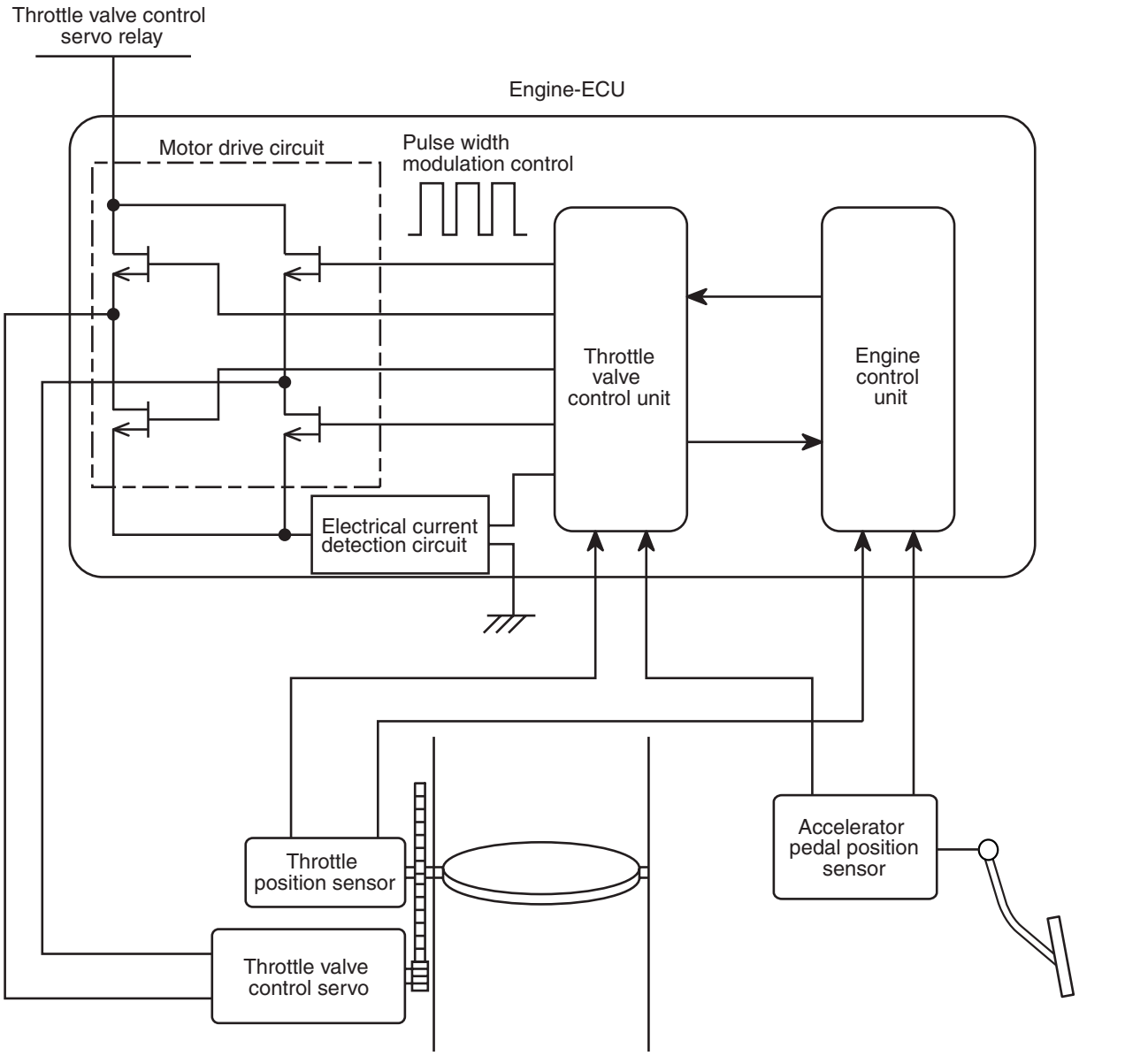
The clutch oil pressure sensor is a sensor detecting the variation of the hydraulic pressure in the clutch release cylinder according to the clutch pedal depressed.
When the driver depresses the clutch pedal while shifting gears, the clutch oil pressure sensor detects the variation in the oil pressure.Upon detecting this signal, the engine-ECU makes the fuel injection volume corrections during the shift change, thus reducing the discharge of hydrocarbon (HC) emissions associated with insufficient release of the acceleration pedal.

THROTTLE VALVE OPENING ANGLE CONTROL

M2132015000126

The control arrangement is basically the same as that 4G69-SOHC MIVEC engine using OUTLANDER.

SYSTEM CONFIGURATION DIAGRAM



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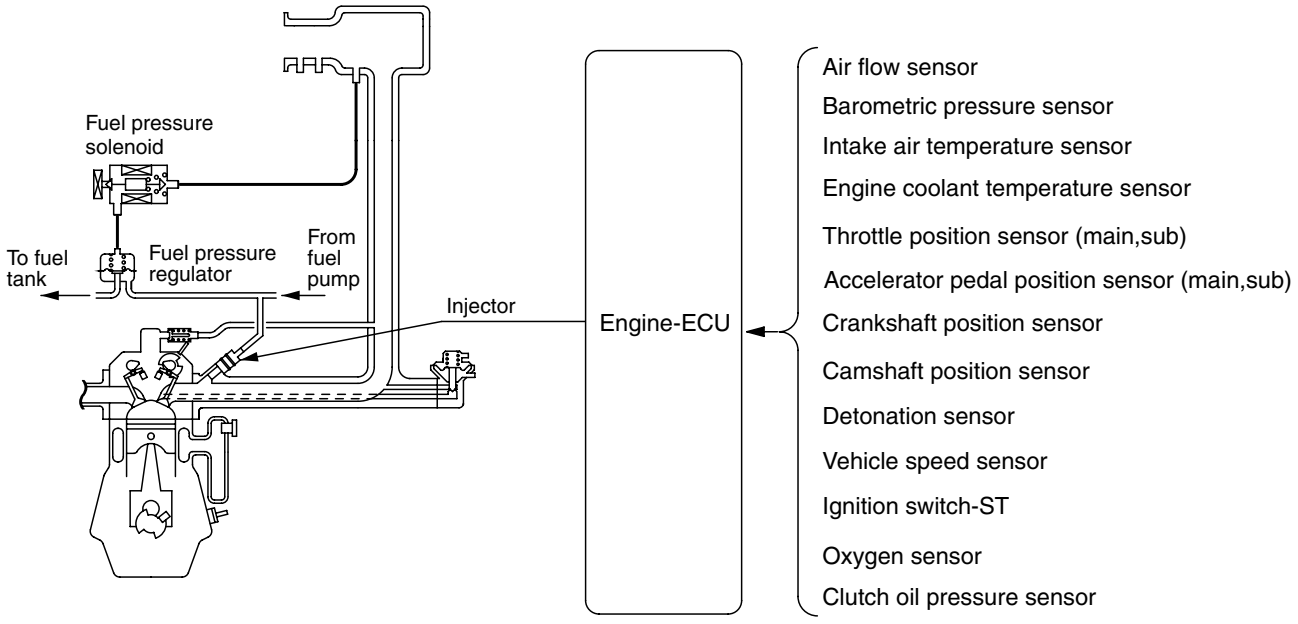
FUEL INJECTION CONTROL

M2132003000390

The fuel injection system is basically the same as the 4G69-SOHC MIVEC engine used in the OUTLANDER.The clutch oil pressure sensor has been newly added to provide the fuel correction control during the shift changes. When the driver depresses the clutch pedal while shifting gears, this control changes the fuel injection volume for the predetermined period after the verification time has elapsed.

System Configuration Diagram



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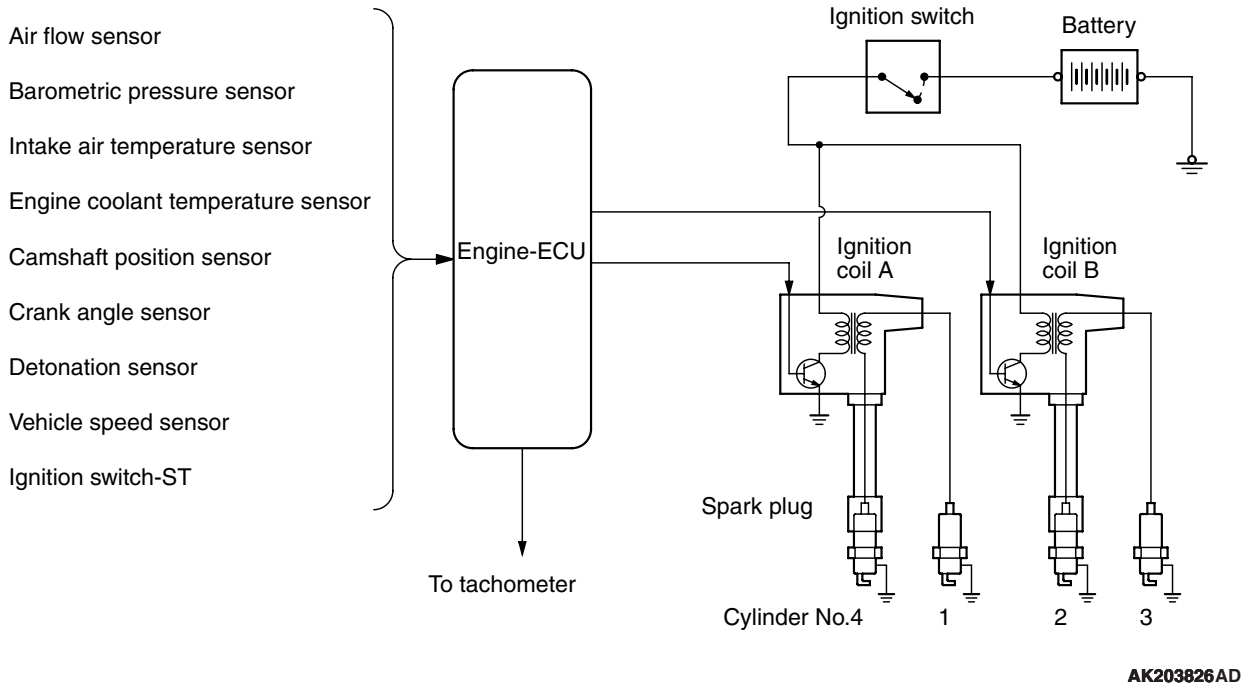
IGNITION TIMING AND DISTRIBUTION CONTROL

M2132005000363

The ignition timing and distribution control system is basically the same as the control system for the 4G63-DOHC-INTERCOOLER TURBO engine installed in the LANCER EVOLUTION.

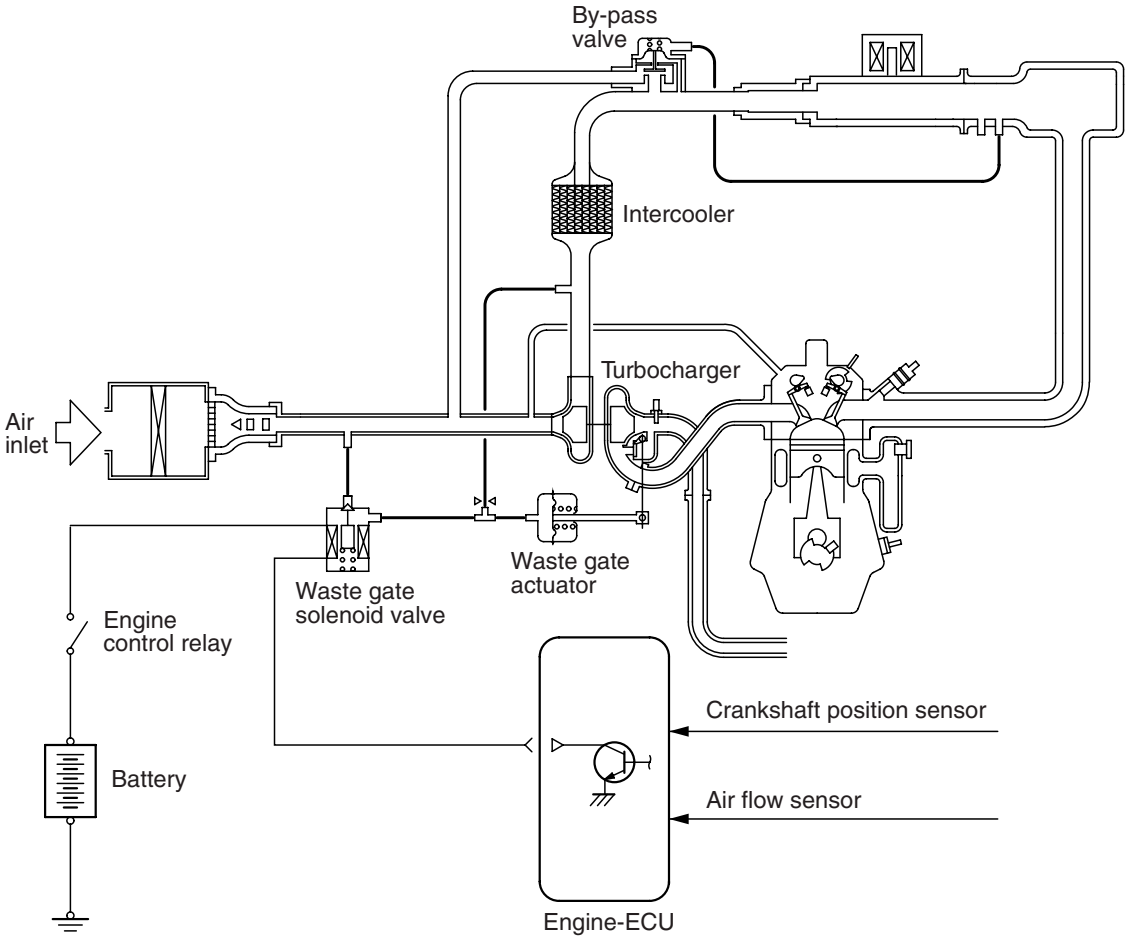
System Configuration Diagram



WASTE GATE CONTROL

M2132013000045

The waste gate control system is basically the same as the control system for the 4G63-DOHC-INTER-COOLER TURBO engine installed in the LANCER EVOLUTION.



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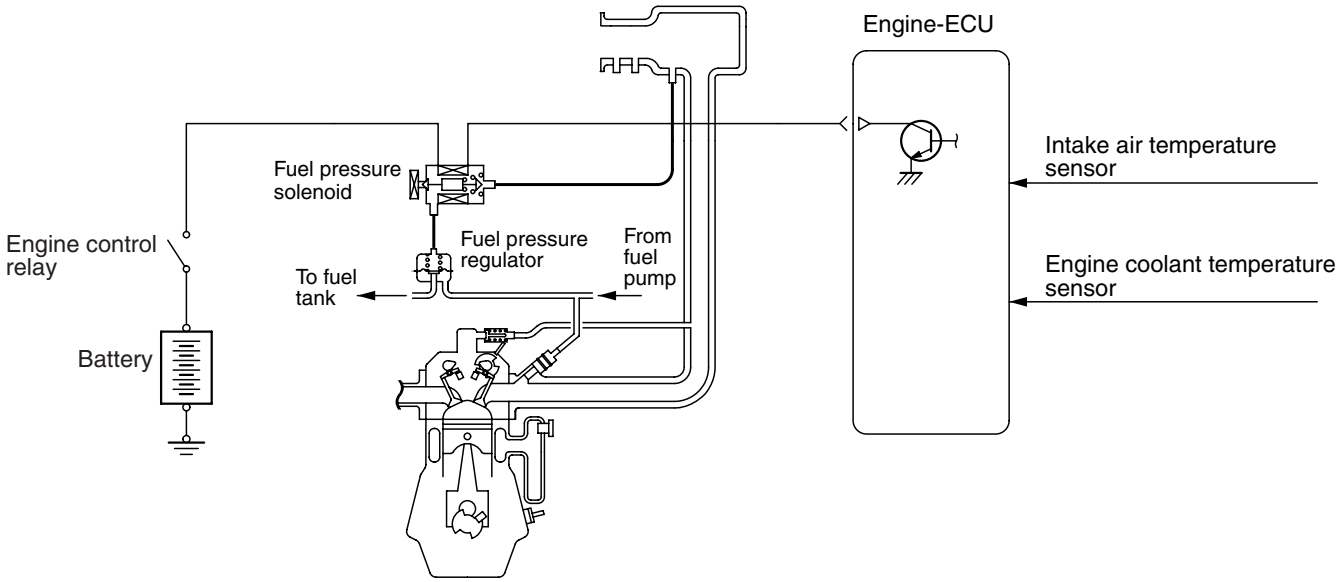
FUEL PRESSURE CONTROL

M2132020000047

The fuel pressure control system is basically the same as the 4G63-DOHC-INTERCOOLER TURBO engine installed in the LANCER EVOLUTION.



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EGR CONTROL, PURGE CONTROL

M2132011000157

Refer to EMISSION CONTROL SYSTEM.

OTHER CONTROL FUNCTIONS

M2132010000314

These control systems operate on essentially same principles as those in the 4G63-DOHC engine for OUTLANDER.

- ENGINE CONTROL RELAY CONTROL
- A/C RELAY CONTROL
- FUEL PUMP RELAY CONTROL
- OXYGEN SENSOR HEATER CONTROL
- AIR FLOW SENSOR FILTER RESET CONTROL
- FAN MOTOR CONTROL
- ALTERNATOR CONTROL

DIAGNOSIS SYSTEM

M2132009000406

Engine -ECU has been provided with the following functions for easier system inspection.

FREEZE-FRAME DATA

When the engine-ECU 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
P0090	Fuel pressure control valve system	Open circuit or short-circuit in solenoid valve-related circuits	ON
P0100	Air flow sensor system	Open circuit or short-circuit in sensor-related circuits	ON
P0105	Barometric 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

Code No.	Diagnosis item	Main diagnosis contents	Engine warning lamp
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 heater (front) 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 heater (rear) 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
P0243	Waste gate solenoid valve system	Open circuit or short-circuit in solenoid valve-related circuits	ON
P0300*	Random cylinder mis-fire detected system	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	ON
P0335	Crank angle sensor system	Abnormal sensor output	ON
P0340	Camshaft position sensor system	Abnormal sensor output	ON
P0443	Purge control solenoid valve system	Open circuit or short-circuit in solenoid valve-related circuits	ON
P0500	Vehicle speed sensor system	Open circuit or short-circuit in sensor-related circuits	ON
P0513	Immobilizer system	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

Code No.	Diagnosis item	Main diagnosis contents	Engine warning lamp
P0622	Alternator FR terminal system	Open circuit or short-circuit in sensor-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	ON
P0657*	Throttle valve control servo relay circuit malfunction	Open circuit or short-circuit in sensor-related circuits	ON
P0805	Clutch oil pressure sensor system	Open circuit or short-circuit in sensor-related circuits	ON
P1603*	Battery back-up line system	Open circuit or short-circuit in system-related circuits	ON
P2100*	Throttle valve control servo circuit (open)	Open circuit in system-related circuits	ON
P2101*	Throttle valve control servo magneto malfunction	Short-circuit in system-related circuits	ON
P2102*	Throttle valve control servo circuit (shorted low)	Short-circuit in system-related circuits	ON
P2103*	Throttle valve control servo circuit (shorted high)	Short-circuit in system-related circuits	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
–	Engine-ECU	Abnormality in engine-ECU	ON

NOTE: When the first time a malfunction is detected, the engine-ECU 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	Hz
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
24	Vehicle speed sensor	km/h
25	Barometric pressure sensor	kPa
28	A/C switch	ON/OFF
34	Air flow sensor reset signal	ON/OFF
37	Volumetric efficiency	%
41	Injectors	mS
44	Ignition advance	° BTDC
49	A/C relay	ON/OFF
59	Oxygen sensor (rear)	mV
77	Accelerator pedal position sensor (sub)	mV
78	Accelerator pedal position sensor (main)	mV
B4	Power steering fluid pressure switch	ON/OFF
13*	Intake air temperature sensor	°C
21*	Engine coolant temperature sensor	°C
22*	Crank angle sensor	r/min
24*	Vehicle speed sensor	km/h
81*	Long-term fuel compensation	%
82*	Short-term fuel compensation	%
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

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
09	Fuel pressure control solenoid valve	Solenoid valve turns from OFF to ON
10	Exhaust gas recirculation (EGR) control solenoid valve	Solenoid valve turns from OFF to ON
12	Waste gate solenoid valve	Solenoid valve turns from OFF to ON
17	Basic ignition timing	Set to ignition adjustment mode
21	Fan controller	Drive the radiator fan motor
34	Electronic-controlled throttle valve system	Stop the throttle valve control servo