ENGINE CONTROL SYSTEM

1491-01 / 1882-09 / 2313-15 / 1432-01 / 1432-07 / 1882-23 / 1882-01 / 2231-01 / 1432-08 / 1432-04 / 1432-17 / 1793-01 / 1719-16 / 1432-14 / 1719-02 / 1914-01 / 1432-03 / 1127-35 / 2010-01 / 1533-30 / 1882-21 / 1432-05

GENERAL INFORMATION

OVERVIEW AND OPERATING PROCESS

CONFIGURATION AND FUNCTION

REMOVAL AND INSTALLATION

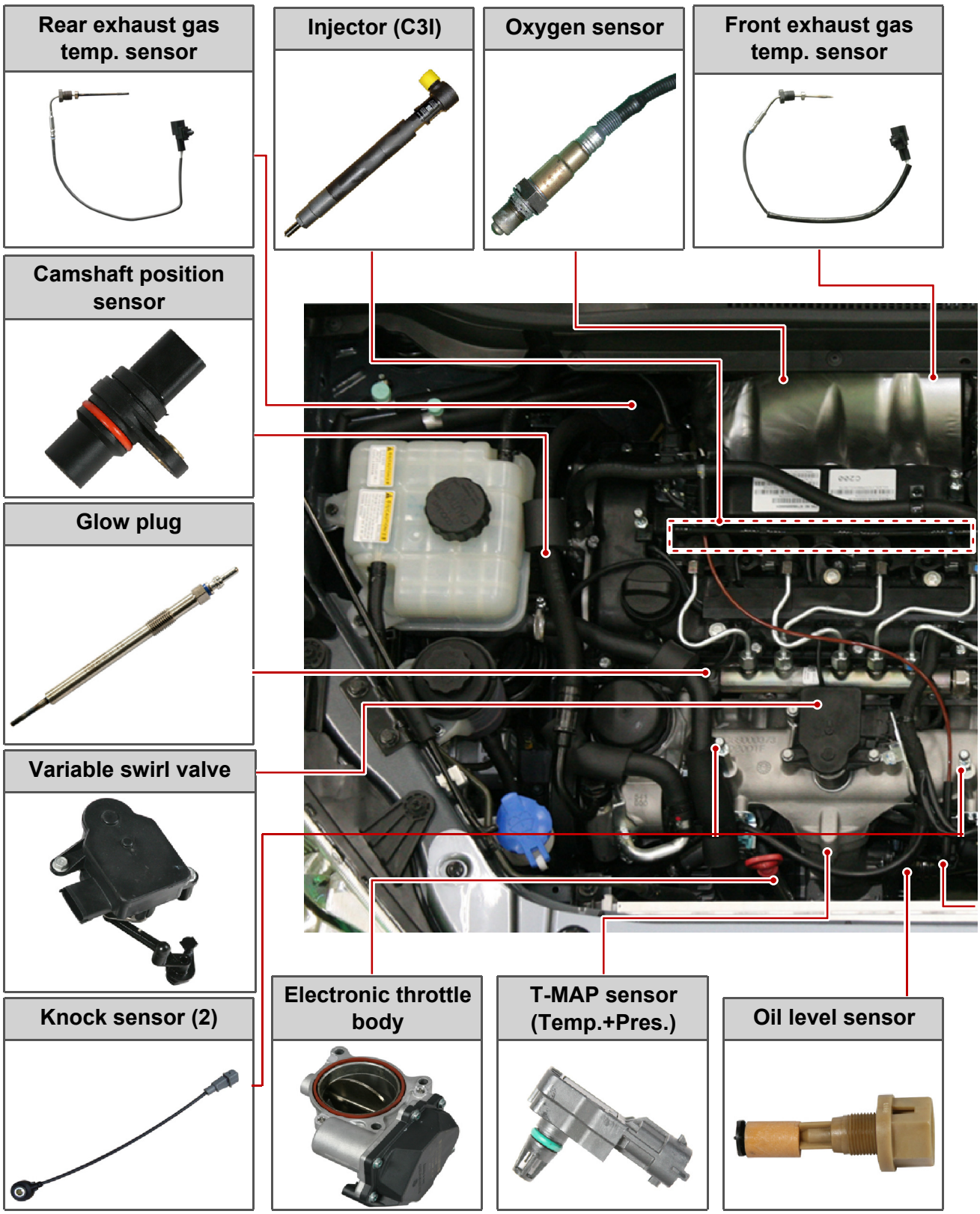
GENERAL INFORMATION

1. ENGINE DATA LIST

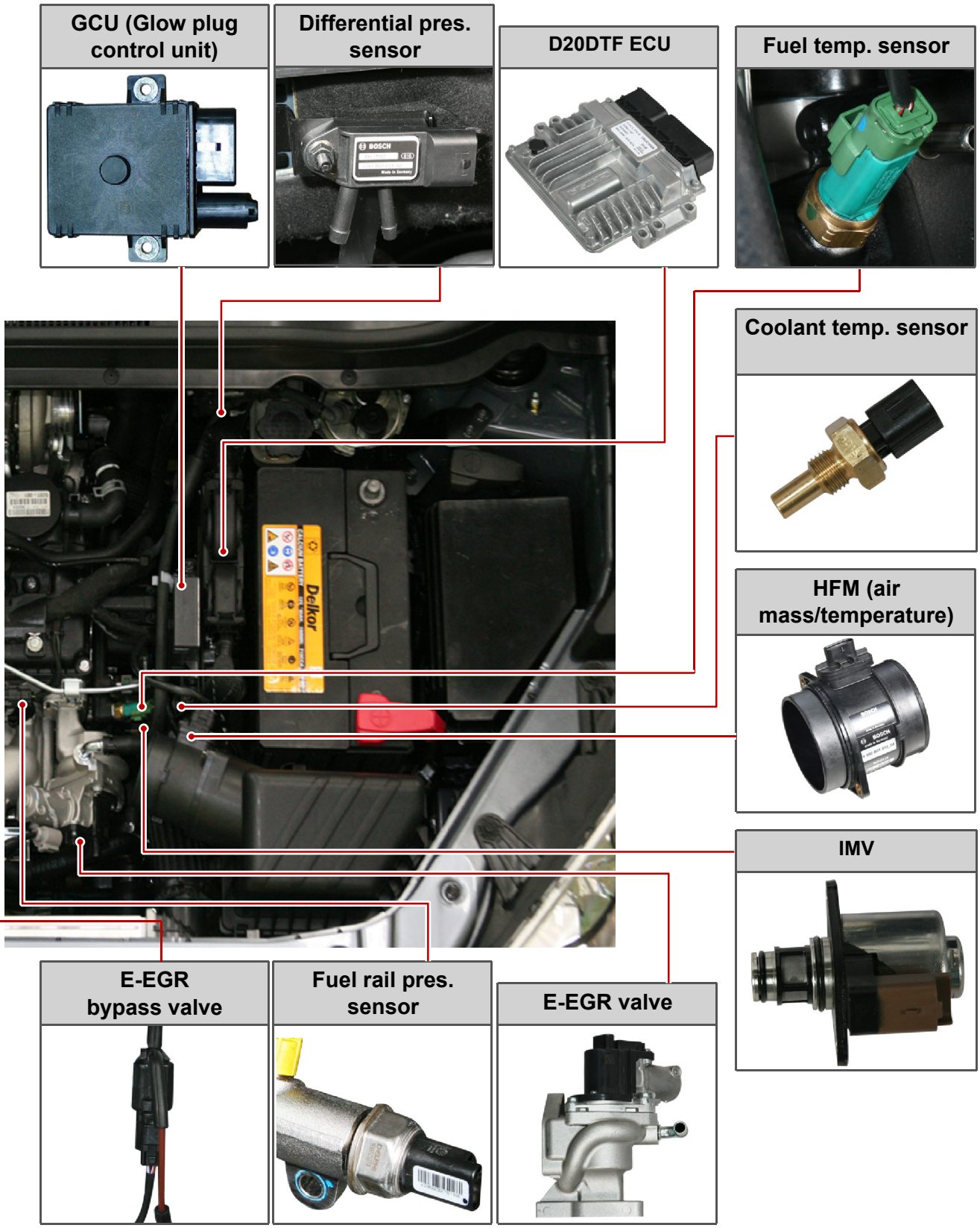
Data	Unit		Value
Coolant temperature	℃		0.436 V (130℃) to 4.896 V (-40℃)
Intake air temperature	℃		-40 to 130℃ (varies by ambient air temperature or engine mode)
Idle speed	rpm	A/T	780 ± 20
		M/T	750 ± 20
Engine load	%		18~25%
Mass air flow	kg/h		16 to 25 kg/h
Throttle position angle	°TA		0° (Full Open) to 78° (Close)
Engine torque	Nm		varies by engine conditions
Injection time	ms		3 to 5ms
Battery voltage	V		13.5 V to 14.1 V
Accelerator pedal position 1	V		04. to 4.8V
Accelerator pedal position 2	V		0.2 to 2.4 V
Throttle position 1	V		0.3 to 4.6 V
Throttle position 2	V		0.3 to 4.6 V
Oxygen sensor	mV		0 to 5 V
A/C compressor switch	1=ON / 0=OFF		-
Full load	1=ON / 0=OFF		-
Gear selection (A/T)	1=ON / 0=OFF		-
Knocking control	1=ON / 0=OFF		-
Brake switch	1=ON / 0=OFF		-
Cruise control	1=ON / 0=OFF		-

OVERVIEW AND OPERATING PROCESS

1. MAJOR COMPONENT



Modification basis	
Application basis	
Affected VIN	



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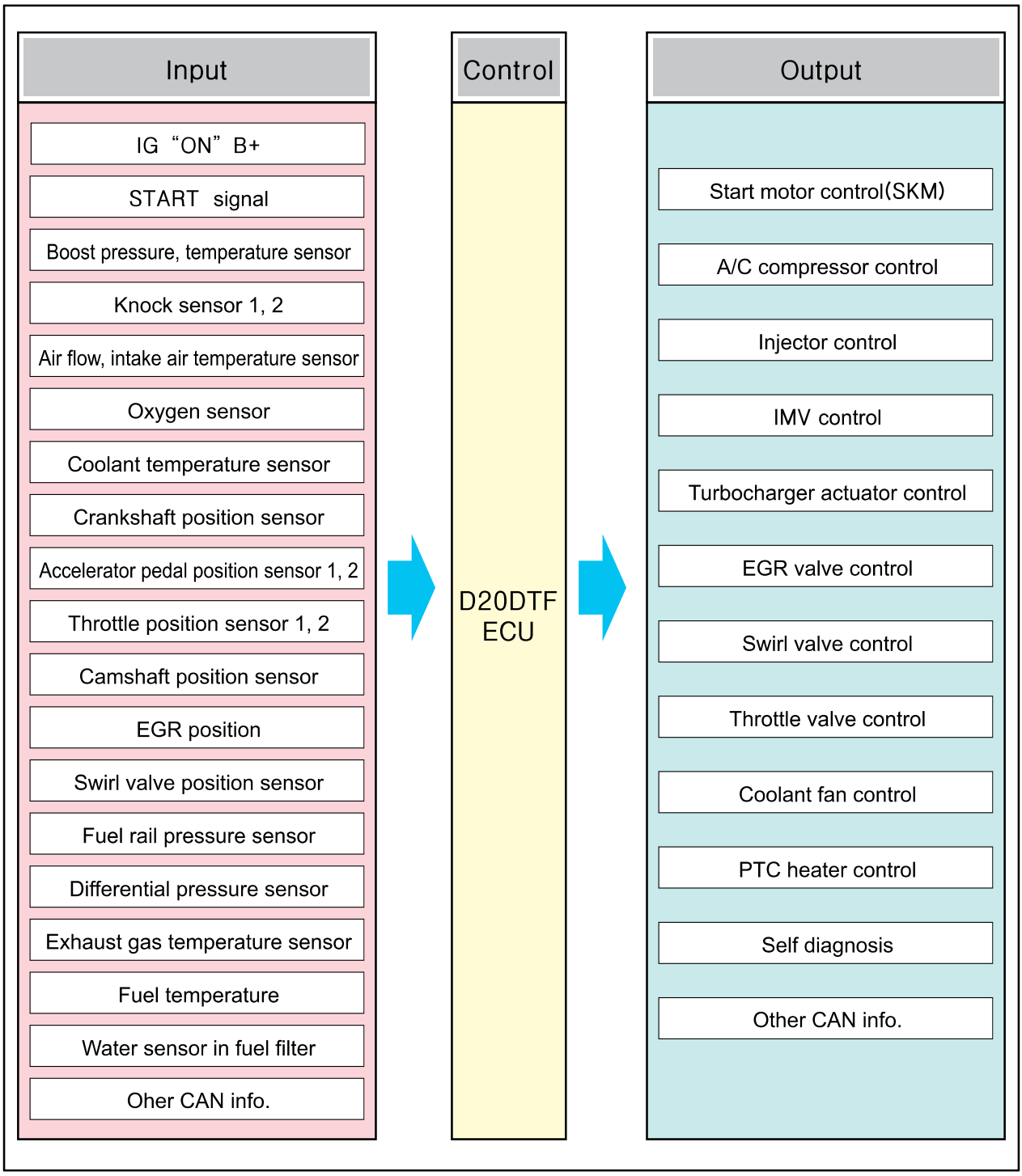
Application basis	
Affected VIN	

2. SYSTEM OPERATION

1) Input/Output of ECU

(1) ECU Block diagram



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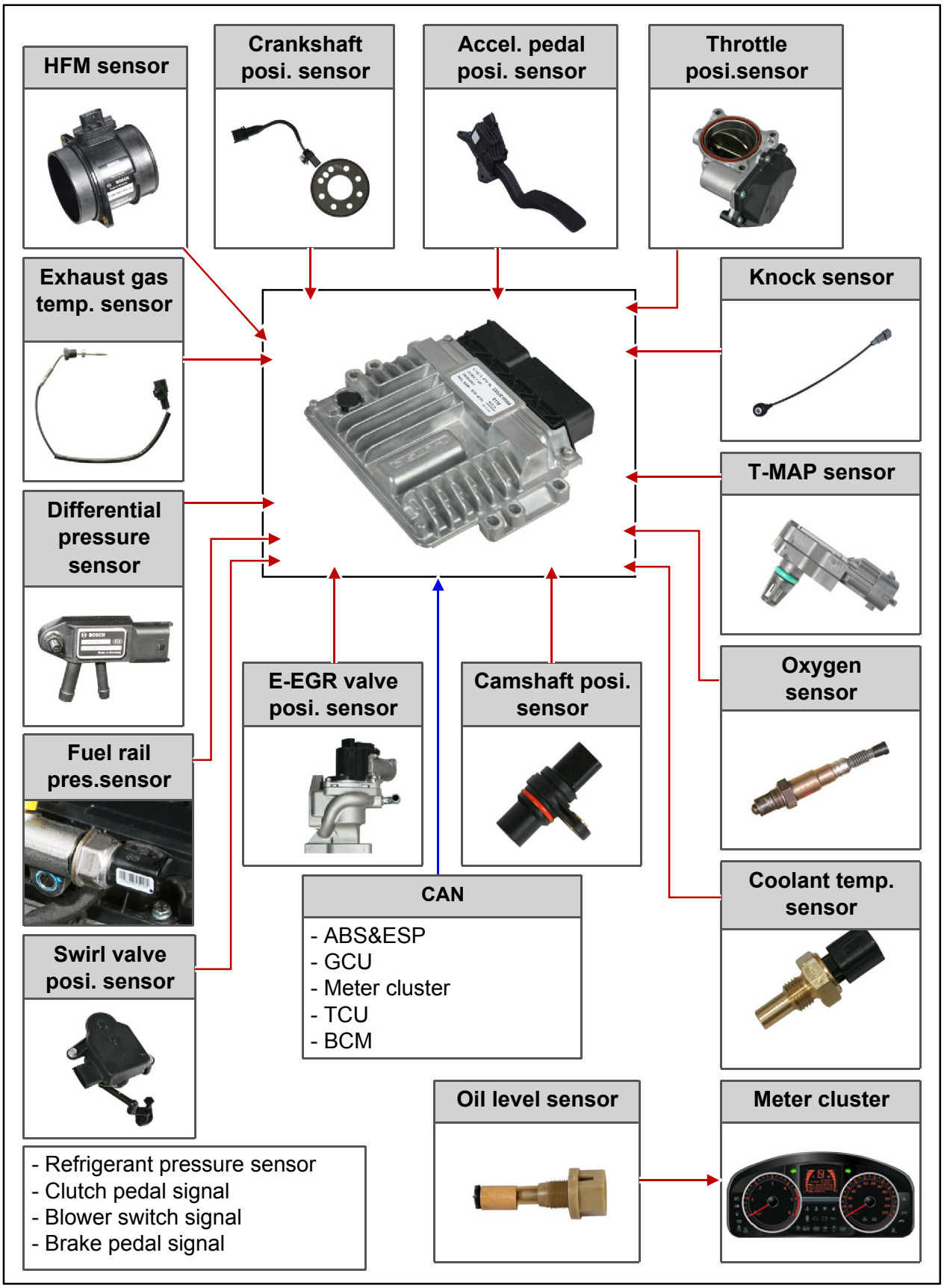
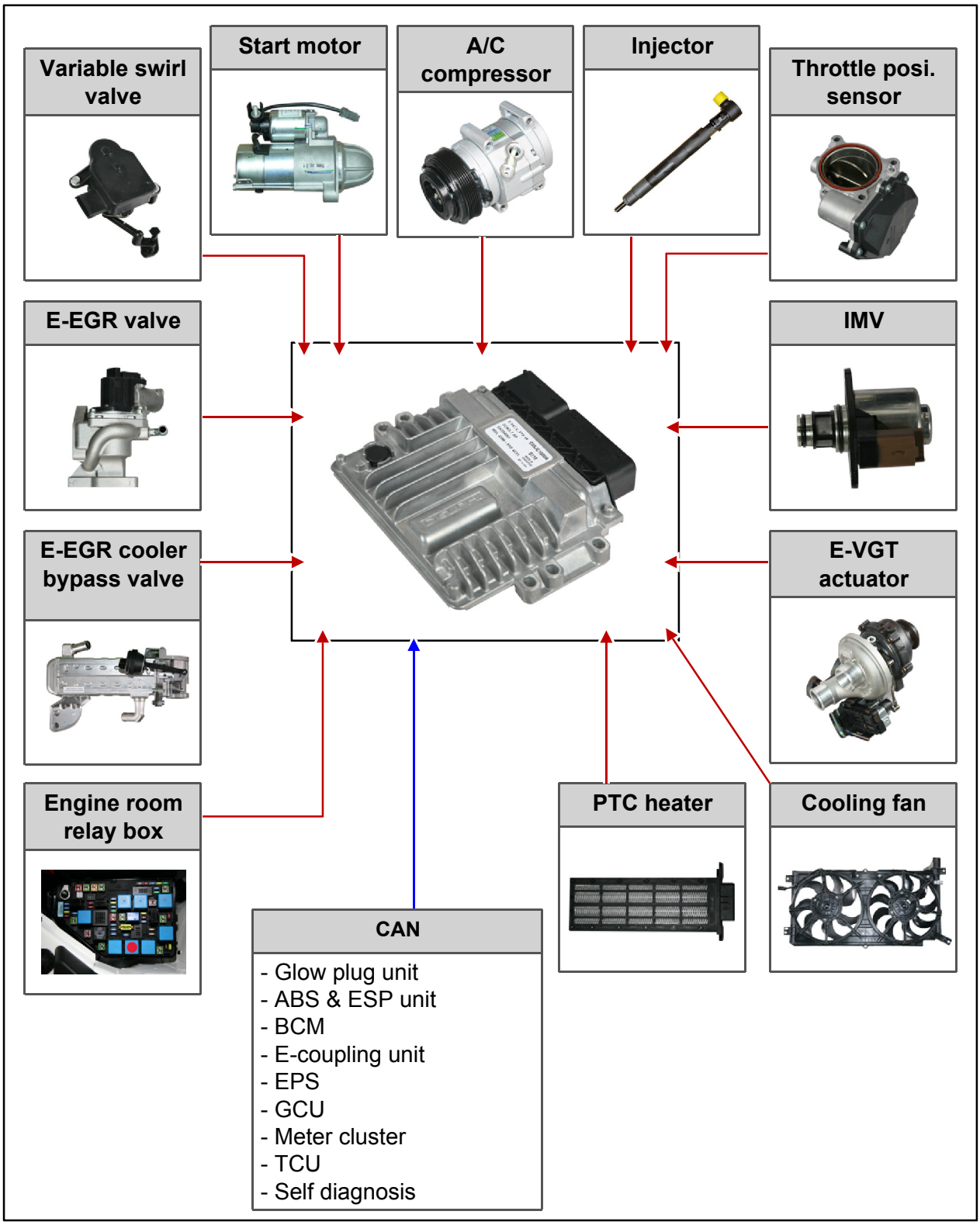
(2) Components for ECU Input



(3) Components for ECU Input



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2) ECU Control

(1) Function

a. ECU Function

ECU receives and analyzes signals from various sensors and then modifies those signals into permissible voltage levels and analyzes to control respective actuators.
ECU microprocessor calculates injection period and injection timing proper for engine piston speed and crankshaft angle based on input data and stored specific map to control the engine power and emission gas.
Output signal of the ECU microprocessor drives pressure control valve to control the rail pressure and activates injector solenoid valve to control the fuel injection period and injection timing; so controls various actuators in response to engine changes. Auxiliary function of ECU has adopted to reduce emission gas, improve fuel economy and enhance safety, comforts and conveniences. For example, there are EGR, booster pressure control, autocruise (export only) and immobilizer and adopted CAN communication to exchange data among electrical systems (automatic T/M and brake system) in the vehicle fluently. And Scanner can be used to diagnose vehicle status and defectives.
Operating temperature range of ECU is normally −40 to +85°C and protected from factors like oil, water and electromagnetism and there should be no mechanical shocks.
To control the fuel volume precisely under repeated injections, high current should be applied instantly so there is injector drive circuit in the ECU to generate necessary current during injector drive stages.
Current control circuit divides current applying time (injection time) into full-in-current-phase and hold-current-phase and then the injectors should work very correctly under every working condition.

b. Control Function

- Controls by operating stages
  To make optimum combustion under every operating stage, ECU should calculate proper injection volume in each stage by considering various factors.
- Starting injection volume control
  During initial starting, injecting fuel volume will be calculated by function of temperature and engine cranking speed. Starting injection continues from when the ignition switch is turned to ignition position to till the engine reaches to allowable minimum speed.
- Driving mode control
  If the vehicle runs normally, fuel injection volume will be calculated by accelerator pedal travel and engine rpm and the drive map will be used to match the drivers inputs with optimum engine power.

(2) Fuel Control

a. Fuel Pressure Control Elements

Pressure control consists of 2 principles.

- Determines rail pressure according to engine operating conditions.
- Controls IMV to make the rail pressure to reach to the required value.

Pressure in the fuel rail is determined according to engine speed and load on the engine.

- When engine speed and load are high
  The degree of turbulence is very great and the fuel can be injected at very high pressure in order to optimize combustion.
- When engine speed and load are low
  The degree of turbulence is low. If injection pressure is too high, the nozzle's penetration will be excessive and part of the fuel will be sprayed directly onto the sides of the cylinder, causing incomplete combustion. So there occurs smoke and damages engine durability.

Fuel pressure is corrected according to air temperature, coolant temperature and atmospheric pressure and to take account of the added ignition time caused by cold running or by high altitude driving. A special pressure demand is necessary in order to obtain the additional flow required during starts. This demand is determined according to injected fuel and coolant temperature.

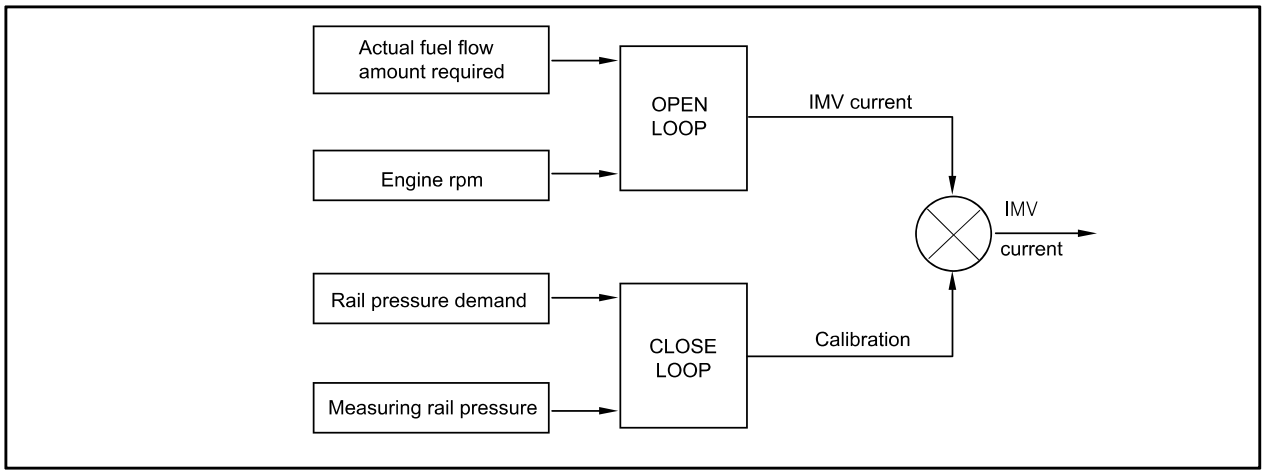
b. Fuel Pressure Control

Rail pressure is controlled by closed loop regulation of IMV.

▶ Open loop determines the current which needs to be sent to the actuator in order to obtain the flow demanded by the ECU.

▶ Closed loop will correct the current value depending on the difference between the pressure demand and the pressure measured.

- If the pressure is lower than the demand, current is reduced so that the fuel sent to the high pressure pump is increased.
- If the pressure is higher than the demand, current is increased so that the fuel sent to the high pressure pump is reduced.



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