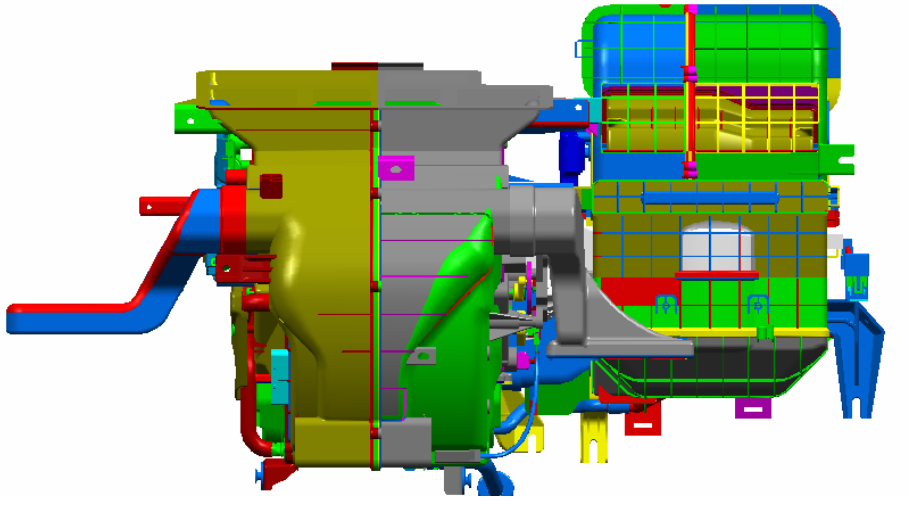
Air Conditioning System

Objectives	To understand the components of air conditioning system. To understand the control function and operation condition. To understand the troubleshooting method.

The A/C-Heater system combines heating, cooling, ventilation, dehumidifying. The heating system can be made simply as is utilized the heat generated by the engine. In the other hand the cooling system requires more complicated equipment to create cool air. When air is cooled, the moisture in the air condenses and forms water droplets that separate from the air. The airflow is controlled by manual type and automatic type.

Full Automatic Temperature Control (FATC) features completely automatic control of discharge air temperature. FATC also controls the circulation and humidity of the air inside the vehicle.

With FATC, the driver selects the temperature and the FATC functions to maintain that temperature, regardless of outside temperature changes. A FATC control module controls air conditioning, ventilating, heating, and defrosting systems. These electronic control systems automatically adjust doors, blower speeds, and compressor cycling.

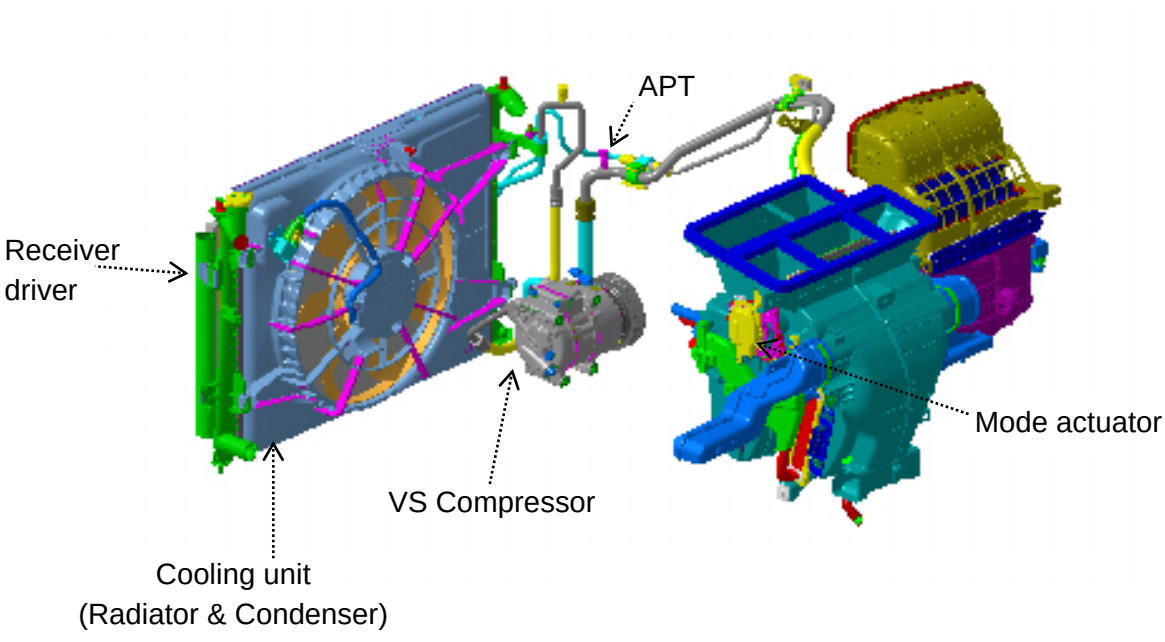


1. General Information

1.1 Specification

Items		Type
Compressor		VS (Variable Swash plate) type
Condenser		Sub –cool type (Condenser, Receiver Drier)
Refrigerant quantity		500g
Pressure detecting		APT(Automotive Pressure Transducer)
HVAC		Semi- center mounting type (Blower unit HVAC)
Cooling fan		1 Fan
Sensor & Actuator Type	Ambient & AQS	Separated type
	In-car & Humidity	Integrated type (Humidity sensor, In-car sensor)
	Photo sensor	Integrated type (Auto light and A/C)
	Fin thermo sensor	Air Type
	Coolant temp. sensor	Applied
	Temperature actuator	Position sensor built in actuator(with potentio meter)
	Mode door actuators	Vent actuator, Floor actuator, Def actuator Position sensor built in actuator (with potentio meter)
	Intake actuator	Position sensor built in actuator (with potentio meter)
Diagnosis		Controller, Hi-scan

1.2 Air condition structure

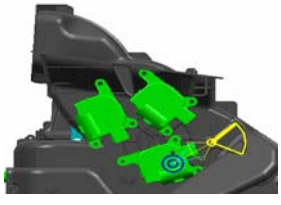


1.3 HVAC components

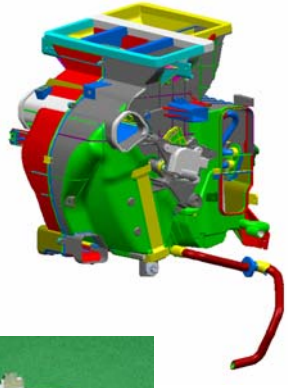

Evaporator

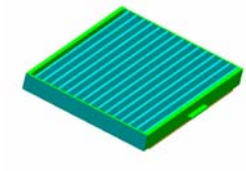

Water coolant sensor


MOS FET

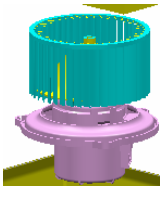

Actuator


Heater core

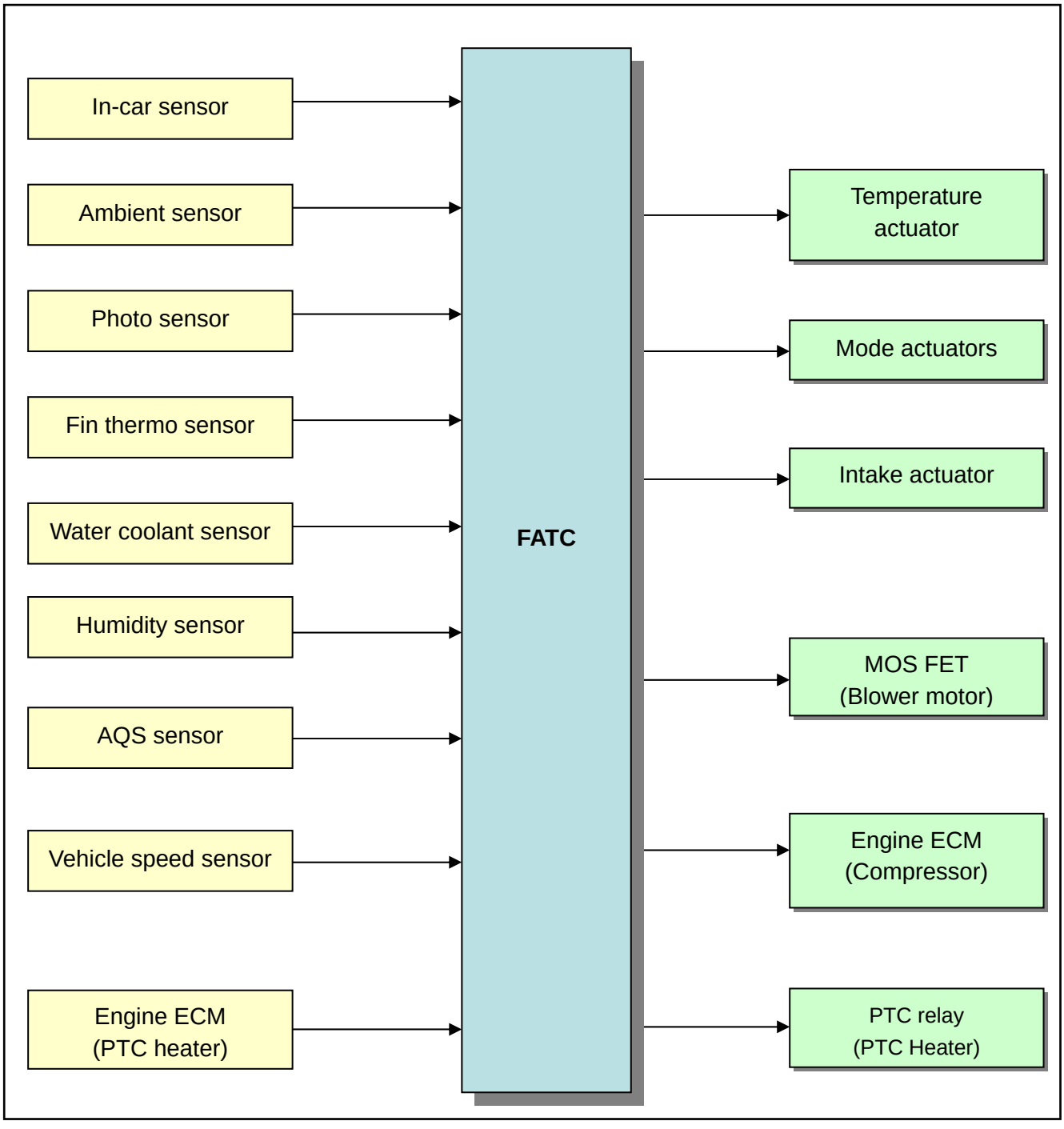



Air filter


Fin thermo sensor

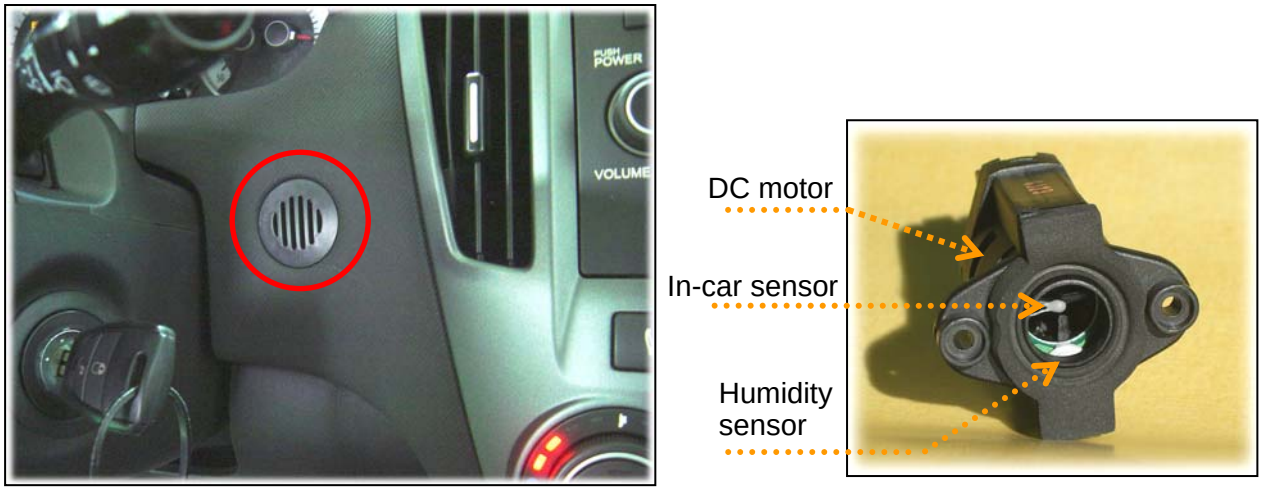

Blower motor

2. Input and output



3. Main sensors and actuators

3.1 In-car sensor and humidity sensor



(1) in-car sensor

The in-car sensor is located on the center facia panel as shown in the picture. It contains a NTC type thermister, which measures the temperature of the air inside the passenger compartment.

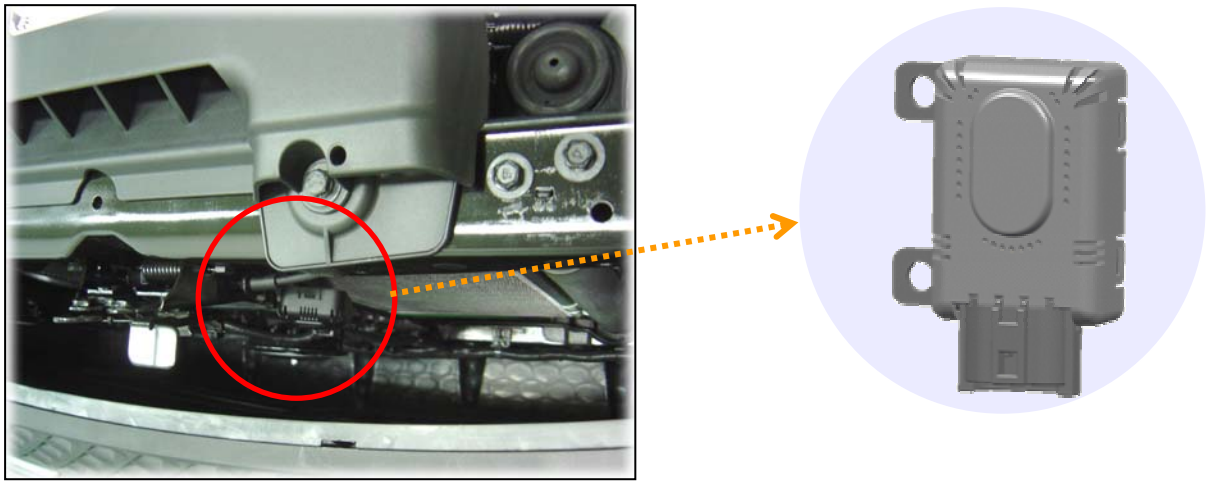
(2) Humidity sensor

Humidity sensor detects the relative humidity of the car's cabin.

3.2 Ambient sensor

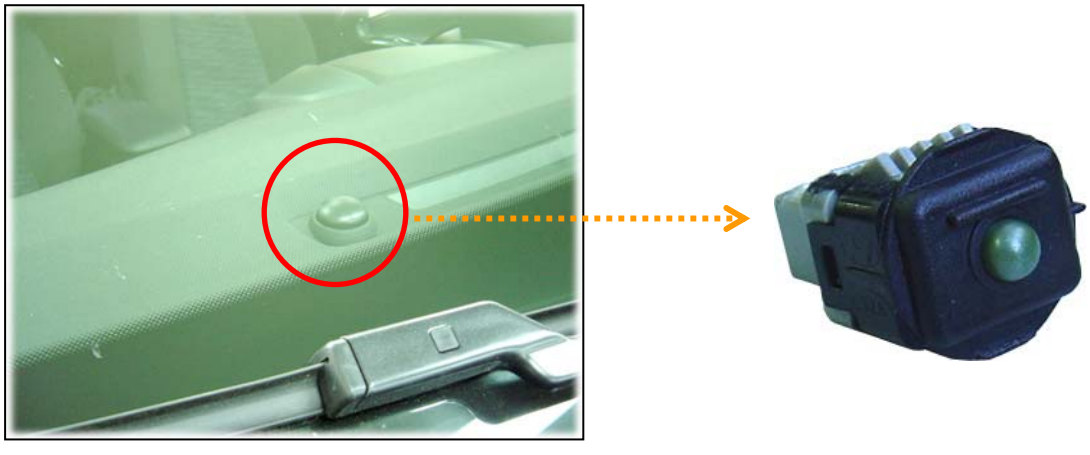
The ambient temperature sensor is located at the front of the condenser fan. This sensor detects the temperature of outside air and sends voltage signals to the controller.

3.3 AQS sensor



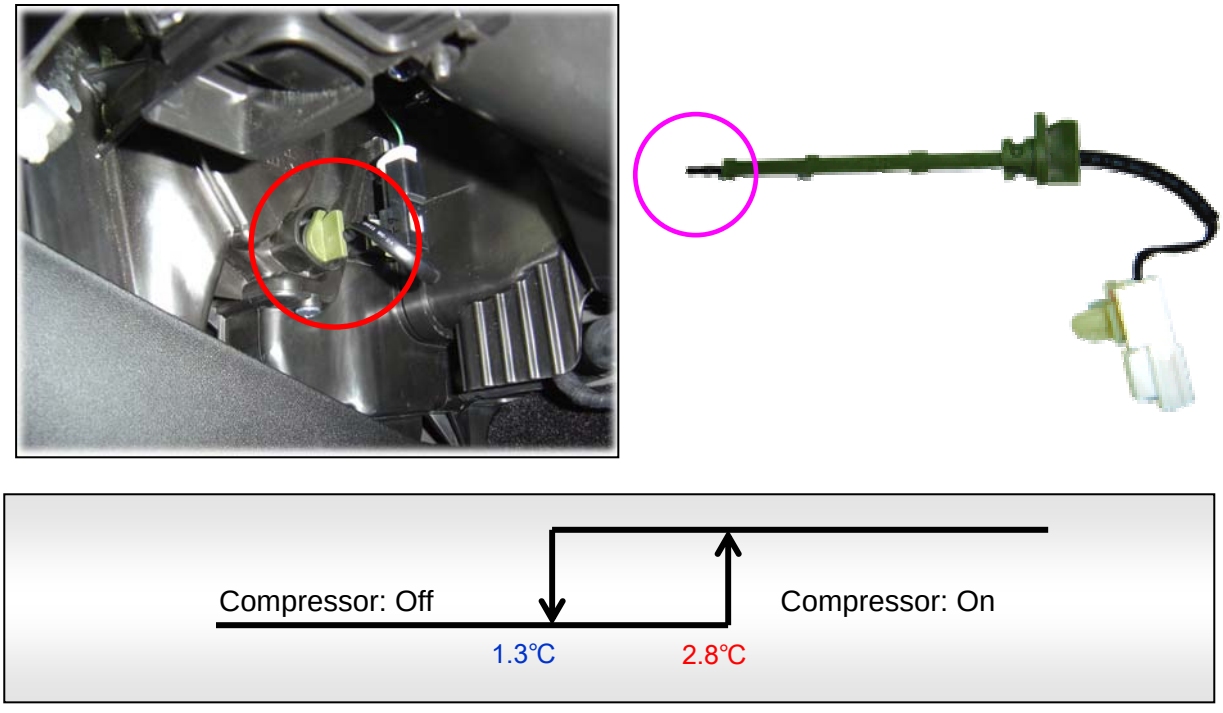
The Air Quality System detects exhaust gas of neighboring vehicles and intercepts automatically. AQS controls the inlet of car automatically and can be easily installed to the existing vehicle.

3.4 Photo sensor



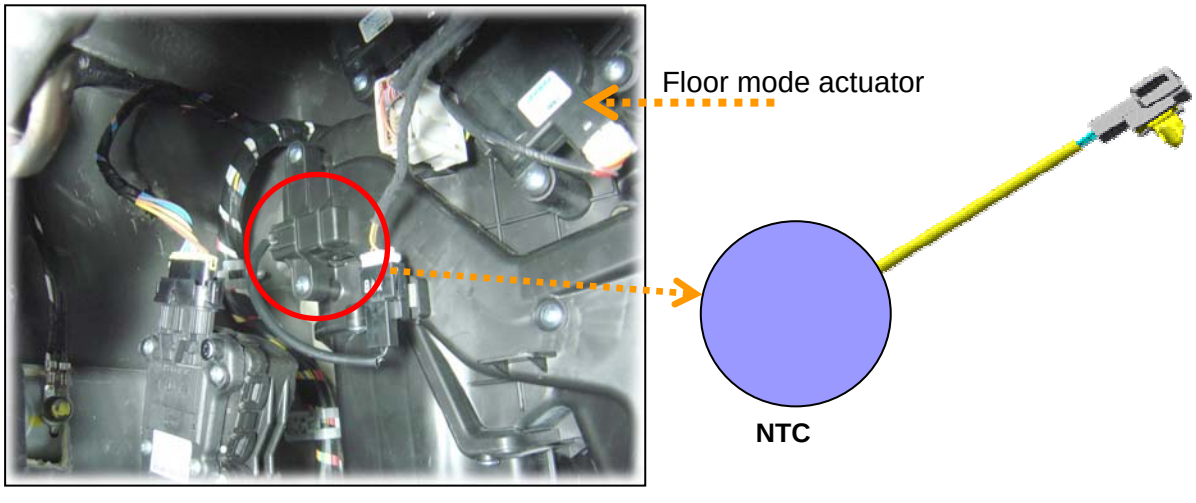
In response to photo intensity level in vehicle, the sensor will send signal to control module to control the blower level and discharge temperature.

3.5 Fin thermo sensor



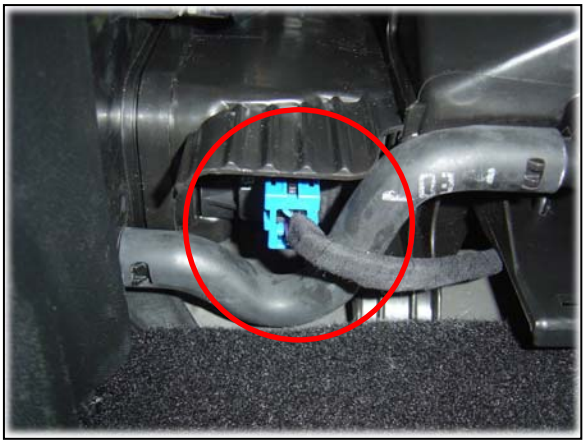
Fin sensor is installed in front of the evaporator in order to detect the temperature of evaporator. It prevents evaporator from freezing.

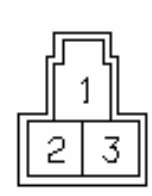
3.6 Water coolant temperature sensor



Water temperature sensor attached to the heater core inlet tube detects the coolant temperature in the heater core and sends the signal to the controller. The signal becomes data for the controller to carry out CELO function.

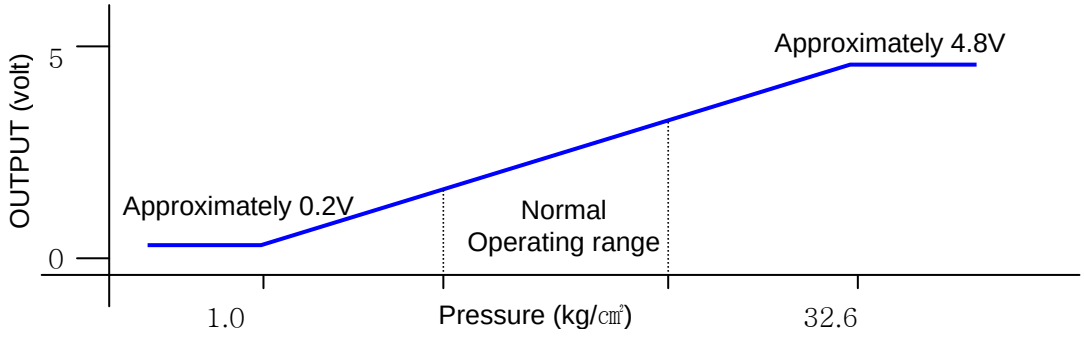
3.7 FET (Field Effect Transistor)





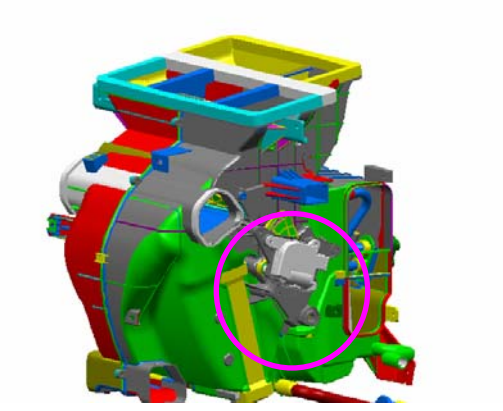
Pin No.	Functioin
1	Drain (motor feedback)
2	Source (ground)
3	Gate

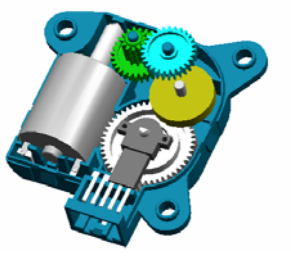
3.8 APT (Automotive Pressure Transducer)



APT sensor convert the pressure value of high pressure line into voltage value after measure it. By converted voltage value, engine ECM controls cooling fan by operating it high speed or low speed. ENG ECM stops the operation of compressor when the pressure (voltage of APT signal) of refrigerant line is too high or too low irregularly to optimize air conditioning system.

3.9 Temperature door actuator





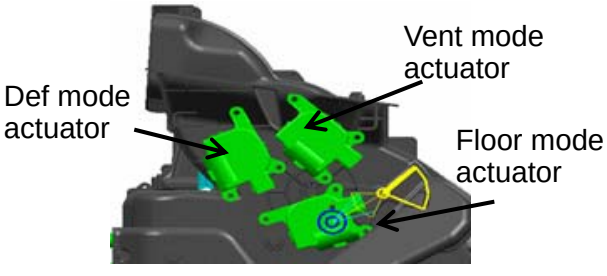
The actuator controls the position of the temperature blend door based on the voltage signal from the FATC module. Potentiometer, inside of actuator, sends a feedback signal to the controller and controller cuts off the voltage signal coming from the controller when the required door position is achieved.

3.10 Mode actuator

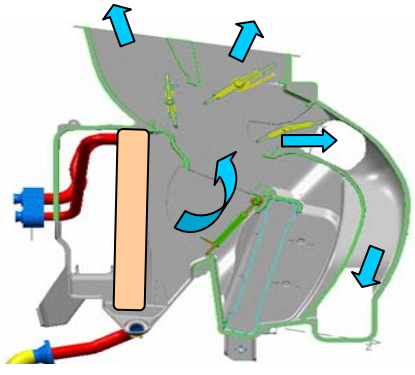
The 3 mode actuators (Vent, floor, defrost) allow an occupant to choose the air flow mode to desired position.

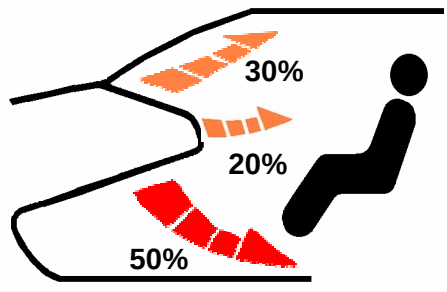
Button	Mode	Function
A	Vent	Manual mode
A+B	Vent + Floor	
A+C	Vent + Defrost	
B+C	Floor + Defrost	
A+B+C	Vent + Floor + Defrost	
D	Vent + Floor + Defrost	Auto mode

Mode actuators

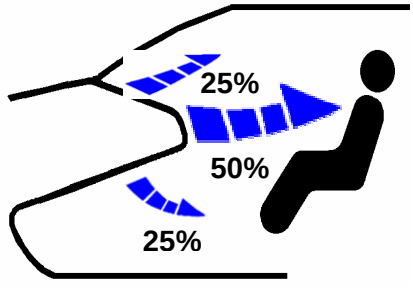


Air flow



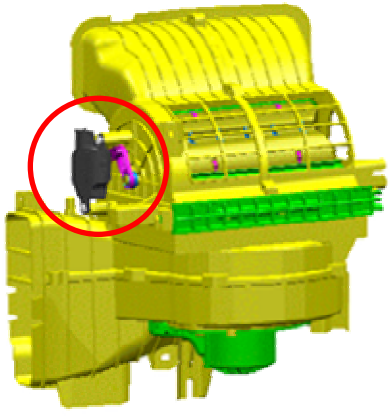


Heater



Air conditioner

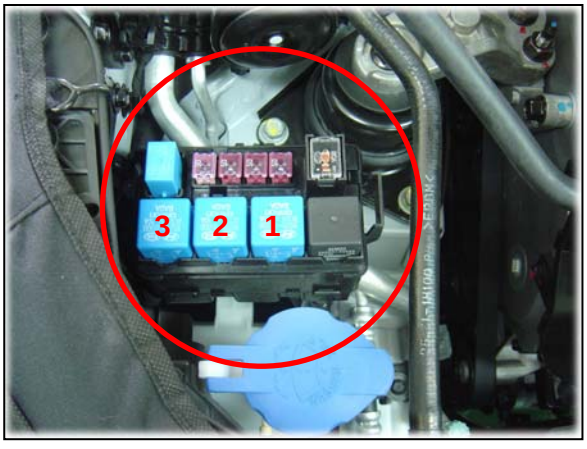
3.11 Air intake actuator



The intake door actuator (fresh/recirculation actuator) allows an occupant to choose between fresh (outside) air or recirculated inside air by moving the intake (fresh/recirculation) door to the desired position.

3.12 PTC (Positive Temperature Coefficient) heater

PTC heater

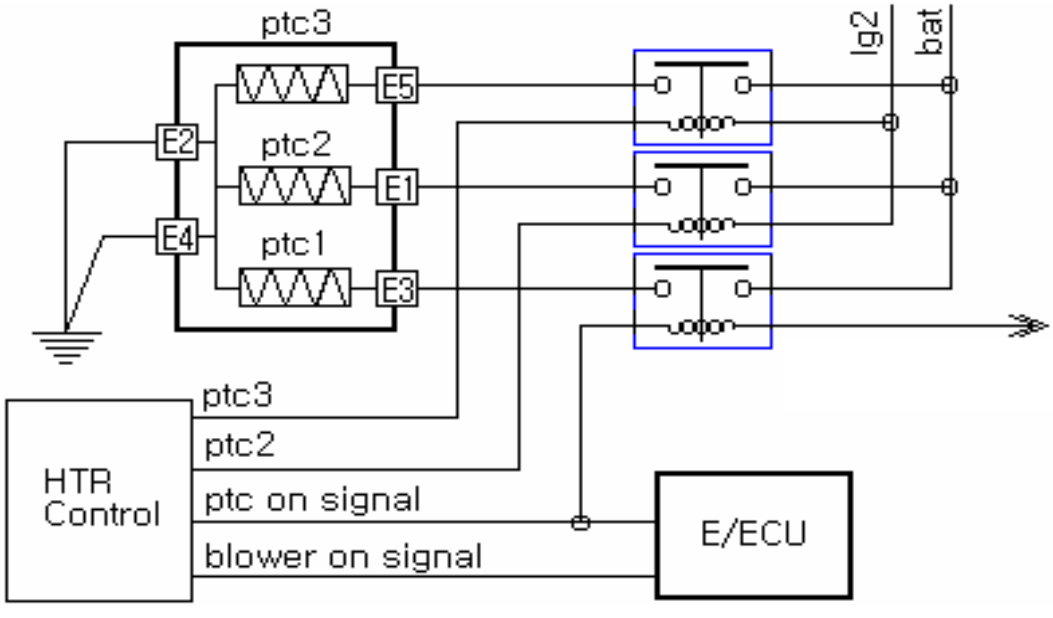


PTC heater relay

3.13.1 PTC heater operating condition

Engine RPM	Above 700 RPM	Engine coolant temp	Below 70
Intake air temp(MAF)	Below 5	Blower motor	On
Battery voltage	Below 8.9 V: Off Above 12.5V: On	Operating time	Max. 60 minutes

If PTC Heater operation conditions are satisfied, Engine ECM operates PTC heater relay 1, heater/air conditioner controller receives PTC heater relay 1 operation signal, heater /air conditioner controller will apply a ground to the control side of relay 2 and 3, allowing the relay contacts to close.



4. Logic cancel and selection (Manual A/C)

A. Select DEF mode

B. Push Intake button 5 times within 3 seconds

C. See LED display of intake button flashes 3 times.

D. Logic cancel & selection

5. Temperature unit change

User may choose the temperature indication between °C and °F.

Press the auto button for 3 seconds during pressing off button.

* Setting unit: °C (Battery disconnection)

Press for 3 seconds or more

Keep pressing

6. Diagnosis (using controller button)

The FATC module self diagnosis test feature will detect electrical malfunction and provide error codes for system components with suspected failures.

7. DTC list & failsafe

DTC	Description	Failsafe
00	Normal	
11	In-car temperature sensor open circuit	25℃ Fixed
12	In-car temperature sensor short circuit	
13	Ambient temperature sensor open circuit	20℃ Fixed
14	Ambient temperature sensor short circuit	
15	Water temp. sensor open circuit	- 2℃ Fixed
16	Water temp. sensor short circuit	
17	Evaporator sensor open circuit	- 2℃ Fixed
18	Evaporator sensor short circuit	
19	Temp actuator feedback line short or open	Setting temp.:15 ~ 22.5℃ Max cool
20	Temp actuator failure	Setting temp.:23 ~ 30℃ Max hot
21	Vent mode actuator feedback line short or open	If indicator is off : Close
22	Vent mode actuator failure	If indicator is on : Open
25	Intake actuator feedback line short or open	At FRE mode : Fresh mode fixed
26	Intake actuator failure	At REC mode : REC mode fixed
27	AQS sensor open	
28	AQS sensor short	
31	AQS sensor failure	
34	Floor actuator feedback line short or open	If indicator is off : Close
35	Floor actuator failure	If indicator is on : Open
36	DEF actuator feedback line short or open	If indicator is off : Close
37	DEF actuator failure	If indicator is on : Open