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CLIMATE CONTROL

CONTROL COMPONENTS (G2342524)

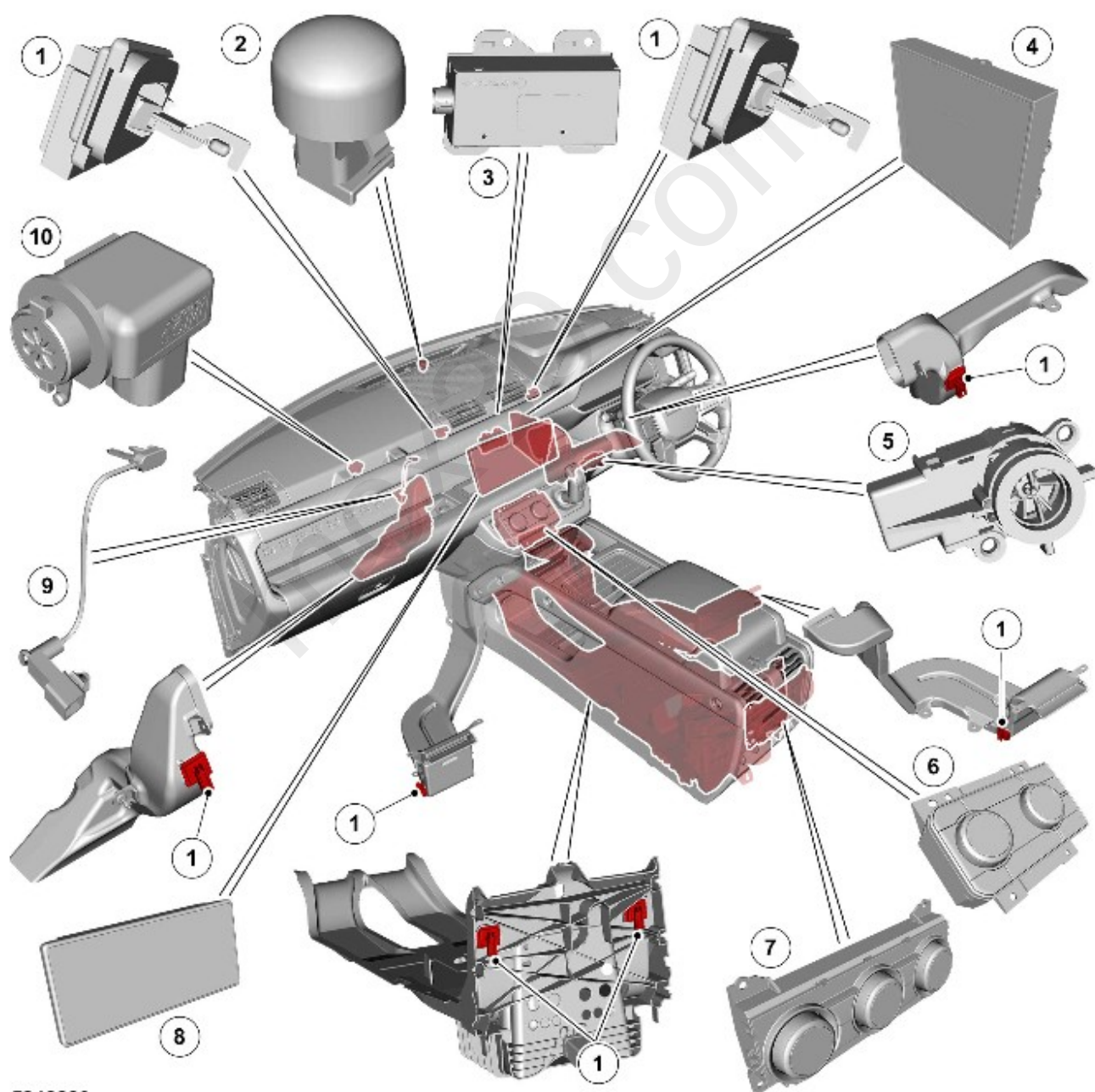
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COMPONENT LOCATION

COMPONENT LOCATION - 1 OF 2

 NOTE:

Right Hand Drive (RHD) vehicle is shown, Left Hand Drive (LHD) vehicle is similar.



E248880

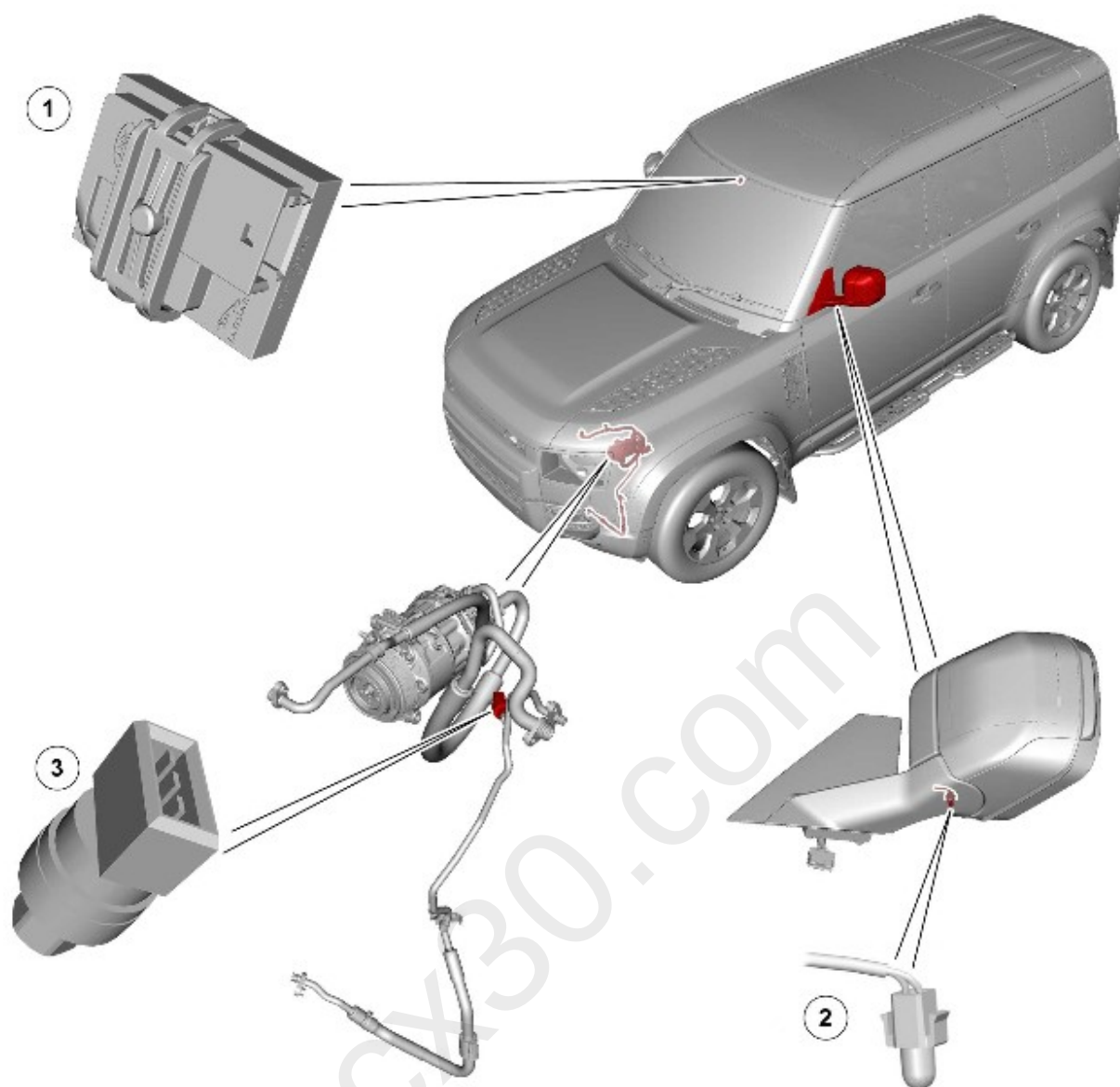
ITEM	DESCRIPTION
1	Duct air temperature sensor (quantity 8)
2	Sunload sensor
3	Air ionizer
4	Heating, ventilation, and air conditioning (HVAC) control module
5	In-vehicle temperature sensor
6	Integrated Control Panel (FCIM)
7	Rear Integrated Control Panel (FCIMB)
8	Touch Screen (FCDIM)
9	Evaporator temperature sensor
10	Pollution sensor

COMPONENT LOCATION - 2 OF 2



NOTE:

Vehicle with 5 doors is shown, vehicle with 3 doors is similar.



E248881

ITEM	DESCRIPTION
1	Humidity sensor
2	Ambient Air Temperature (AAT) sensor
3	Refrigerant pressure sensor

OVERVIEW

The climate control system consists of the Air Conditioning (A/C) system and the heating and ventilation system. The climate control system controls the temperature, volume and distribution of air from the climate control assembly. Operation can be fully automatic, but manual overrides are provided for the intake air source, blower speed and air distribution.

The climate control system is a 2 or 3 zone system that maintains the individual temperature levels selected for the following:

- Driver area
- Front passenger area
- Second row seat passenger area.

The auxiliary climate control is available as an option with 3 zone climate system.

For additional information, refer to: [Auxiliary Climate Control](#) (412-02 Auxiliary Climate Control, Description and Operation).

The climate control system consists of the following components:

- FCIM
- FCIMB
- HVAC control module
- AAT sensor
- Refrigerant pressure sensor
- Evaporator temperature sensor
- In-vehicle temperature sensor
- Humidity sensor
- Sunload sensor
- Pollution sensor (if equipped)
- Duct air temperature sensors (quantity 8).

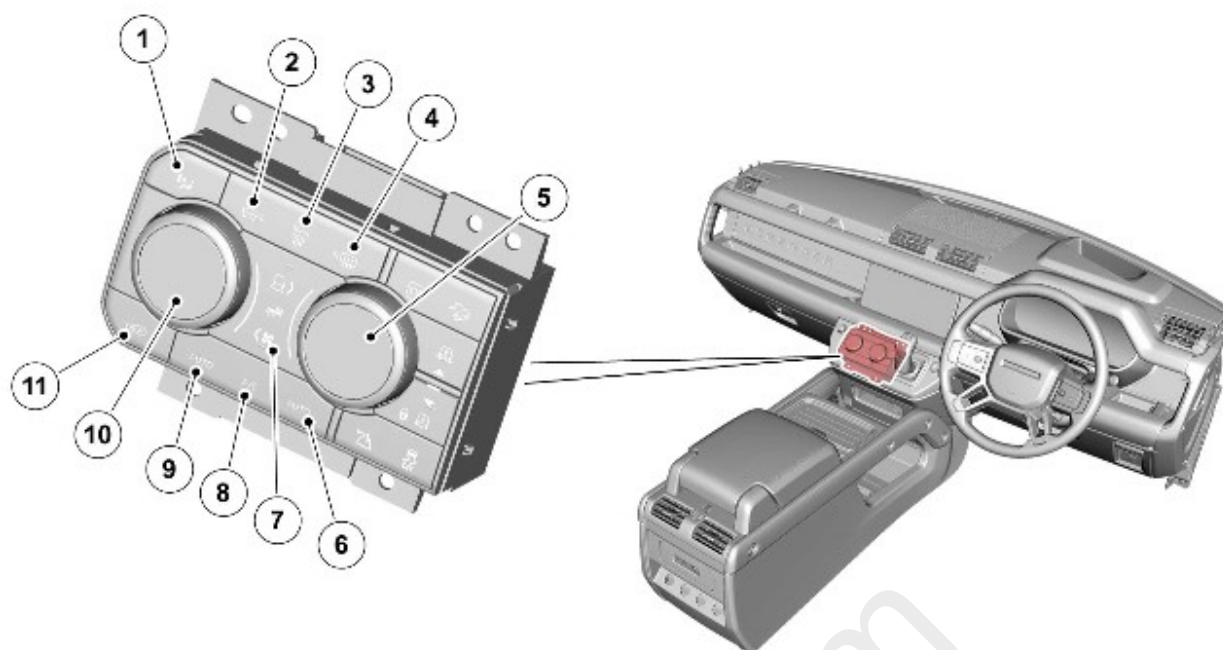
DESCRIPTION

FCIM



NOTE:

RHD vehicle is shown, LHD vehicle is similar.



E248882

ITEM	DESCRIPTION
1	Climate control switch
2	Heated windshield
3	Maximum windshield defrost
4	Heated rear window
5	Temperature setting - Right
6	Auto switch
7	Blower speed switch
8	A/C switch
9	Auto switch
10	Temperature setting - Left
11	Recirculation switch

The FCIM is installed in the center of the instrument panel. The FCIM contains rotary and push switches for controlling the temperature, volume and distribution of air to the front row seat passengers. Each push switch contains an amber

status Light Emitting Diode (LED). Display screens are integrated into the rotary switches to display the selected temperature and blower speed as applicable. The FCIM communicates with the HVAC control module through the private Controller Area Network (CAN) bus.

The FCIM enables the control of the following:

- Outside air or recirculation
- Air flow rate
- A/C
- Zone temperatures
- Automatic operation
- Heated windshield
- Heated rear window
- Maximum A/C
- Maximum windshield defrost.

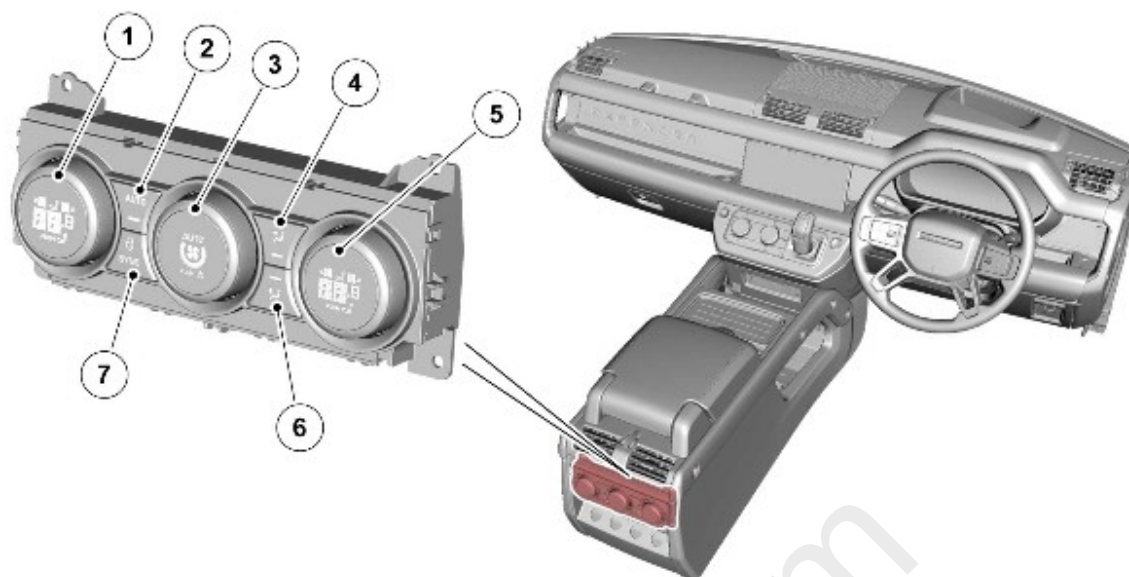
The FCDIM can display controls for the climate control functions.

FCIMB



NOTE:

RHD vehicle is shown, LHD vehicle is similar.



E248883

ITEM	DESCRIPTION
1	Temperature setting - Left
2	Automatic mode switch
3	Blower speed control
4	Air distribution - Face
5	Temperature setting - Right
6	Air distribution - Feet
7	Synchronize switch

The FCIMB is installed in the rear of the floor console. The FCIMB contains rotary and push switches for controlling the temperature, volume and distribution of air to the second row seat passengers. Each push switch contains an amber status LED. Display screens are integrated into the center of the rotary switches to display the selected temperature and blower speed as applicable.

The second row seat heating (if equipped) is controlled by the rotary switch on each side of the FCIMB. The display screens also show the heated second row seat indicator to indicate when the heater is ON and the amount heating.

For additional information, refer to: [Seats - \[+\] 5 Seat Configuration](#) (501-10 Seating, Description and Operation).

For additional information, refer to: [Seats - \[+\] 6 Seat Configuration](#) (501-10 Seating, Description and Operation).

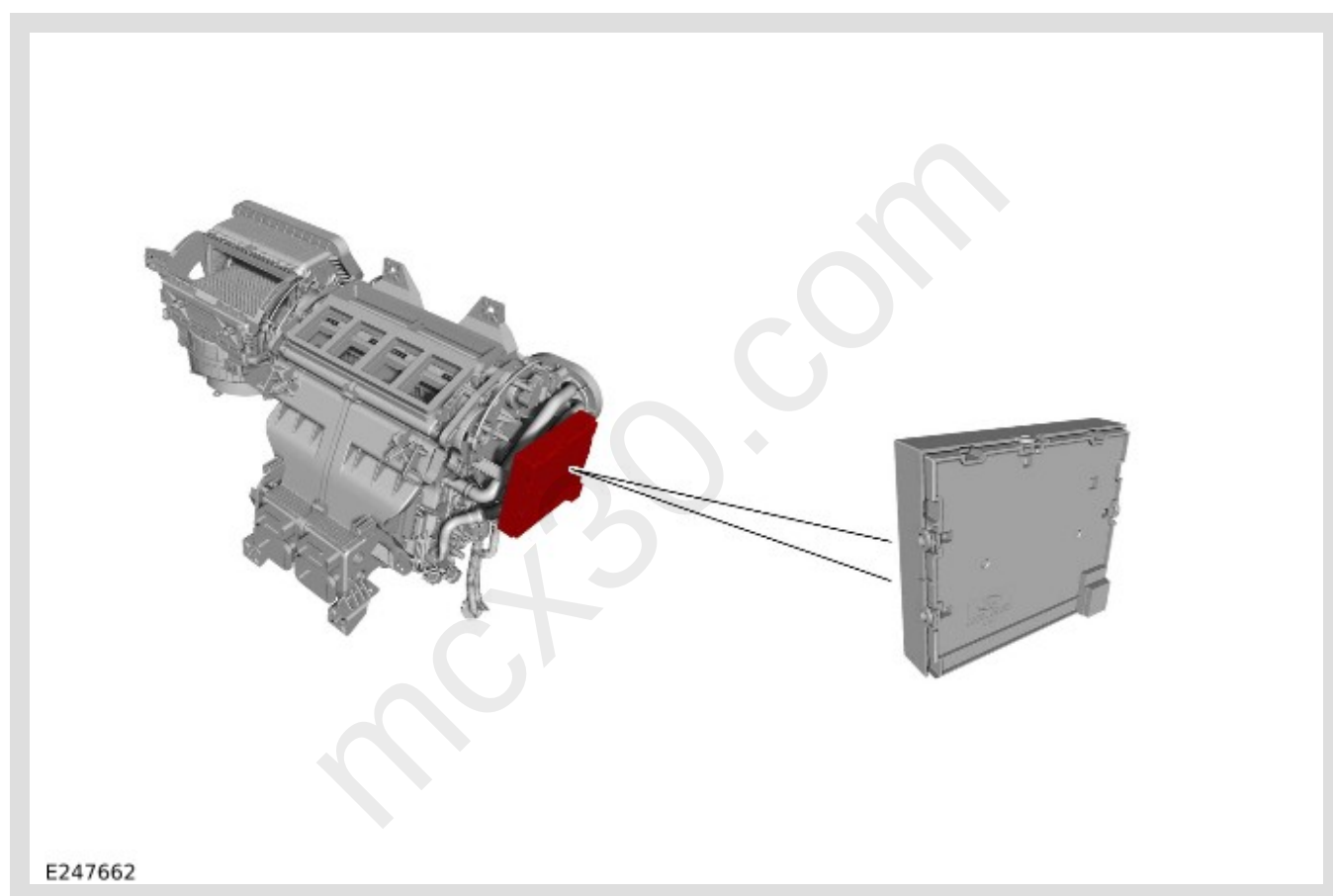
For additional information, refer to: [Seats - \[+\] 7 Seat Configuration](#) (501-10 Seating, Description and Operation).

The FCIMB has a fused power supply from the Rear Junction Box (BCMB). The FCIMB is connected to the High Speed (HS) CAN Human Machine Interface (HMI) systems bus. The FCIMB converts selections on the climate control switches into HS CAN HMI messages and transmits them to the HVAC control module. The HVAC control module sends the climate status back to the FCIMB to be displayed.

HVAC CONTROL MODULE

NOTE:

RHD vehicle is shown, LHD vehicle is similar.



The HVAC control module is located behind the driver side of the instrument panel. The HVAC control module controls the air distribution and temperature.

The HVAC control module processes inputs from the following:

- The climate control system sensors.
- The FCDIM.
- The FCIM.
- The FCIMB and other systems.

The HVAC control module then outputs the appropriate control signals to the A/C system and the heating and ventilation system.

The HVAC control module also controls the following:

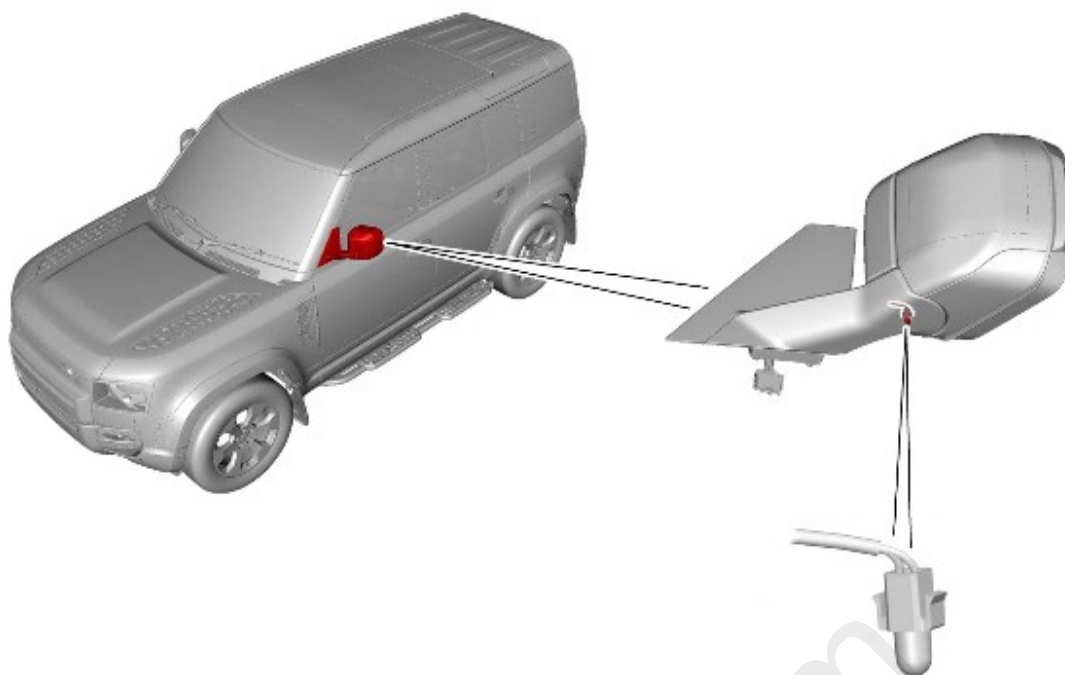
- The temperature control for the front seats and rear seats (if equipped).
 - For additional information, refer to: [Seats - \[+\] 5 Seat Configuration](#) (501-10 Seating, Description and Operation).
 - For additional information, refer to: [Seats - \[+\] 6 Seat Configuration](#) (501-10 Seating, Description and Operation).
 - For additional information, refer to: [Seats - \[+\] 7 Seat Configuration](#) (501-10 Seating, Description and Operation).
- Fuel Fired Booster Heater (FFBH) (if equipped).
 - For additional information, refer to: [Fuel Fired Booster Heater](#) (412-02 Auxiliary Climate Control, Description and Operation).
- Electric booster heater (if equipped).
 - For additional information, refer to: [Electric Booster Heater](#) (412-02 Auxiliary Climate Control, Description and Operation).

AAT SENSOR



NOTE:

Vehicle with 5 doors is shown, vehicle with 3 doors is similar.



E248884

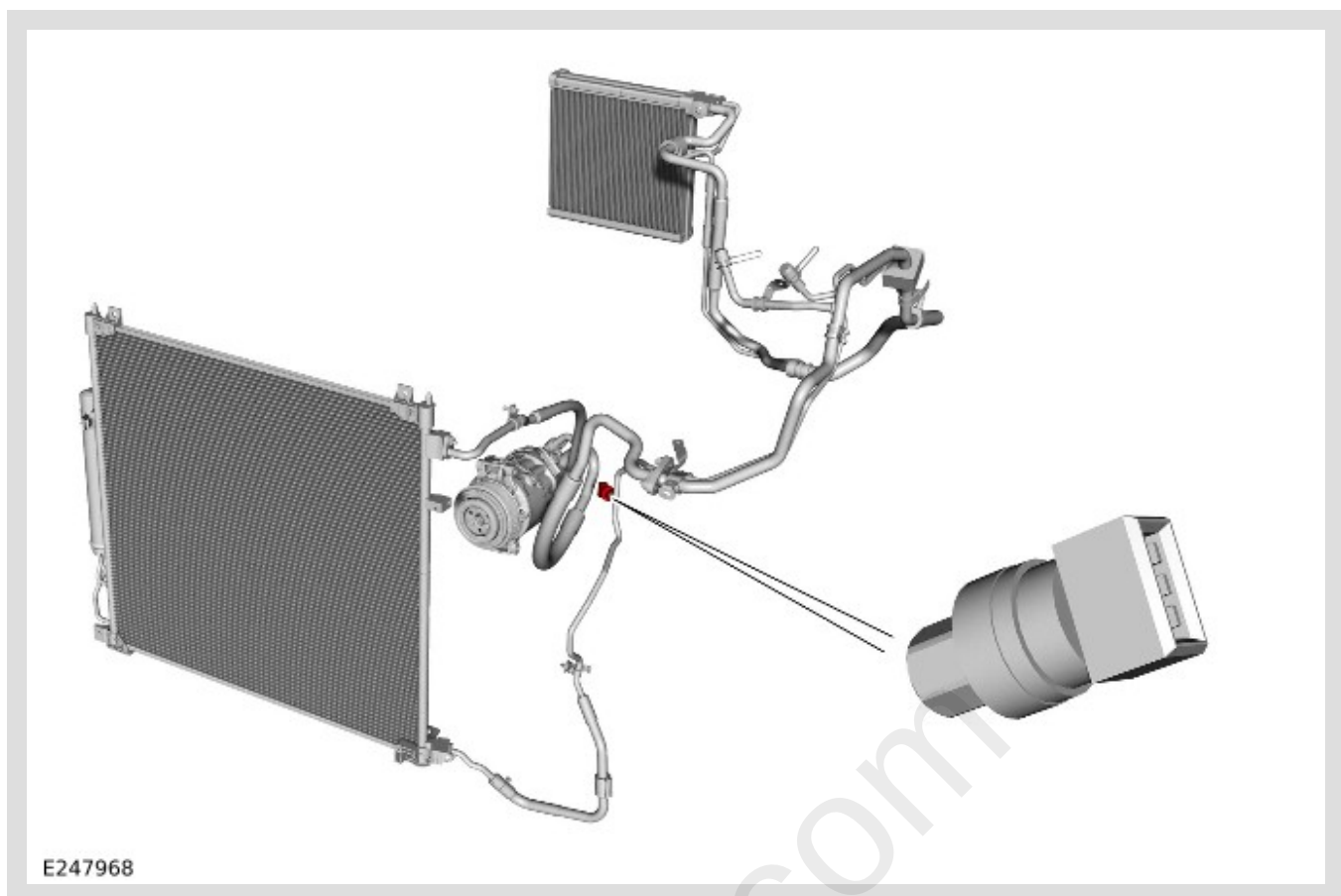
The AAT sensor is a Negative Temperature Coefficient (NTC) thermistor installed in the left door mirror. The bulb of the sensor is positioned over a hole in the bottom of the mirror casing.

The Powertrain Control Module (PCM) supplies the AAT sensor with a 5V reference voltage. The PCM then translates the return signal voltage into a temperature value. The PCM transmits the temperature value on the FlexRay circuit for use by other systems. The HVAC control module receives the temperature value from the Body Control Module (BCM) / Gateway Control Module (GWM). The HVAC control module communicates with the BCM/ GWM through the HS CAN HMI systems bus.

REFRIGERANT PRESSURE SENSOR

NOTE:

Vehicle without auxiliary climate control is shown, vehicle with auxiliary climate control is similar.



The refrigerant pressure sensor is located in the High Pressure (HP) pipe between the A/C condenser and the Thermostatic Expansion Valve (TXV).

The HVAC control module supplies a 5V reference voltage to the refrigerant pressure sensor. The HVAC control module receives a return signal voltage, between 0V and 5V, related to system pressure.

The HVAC control module uses the signal from the refrigerant pressure sensor to protect the refrigerant system from extremes of pressure. The signal is also used to calculate the A/C compressor load on the engine. The HVAC control module transmits the A/C compressor load value for use in controlling the speed of the engine cooling fan.

The PCM receives this value through:

- The HS CAN HMI systems bus
- The BCM/ GWM
- The FlexRay.

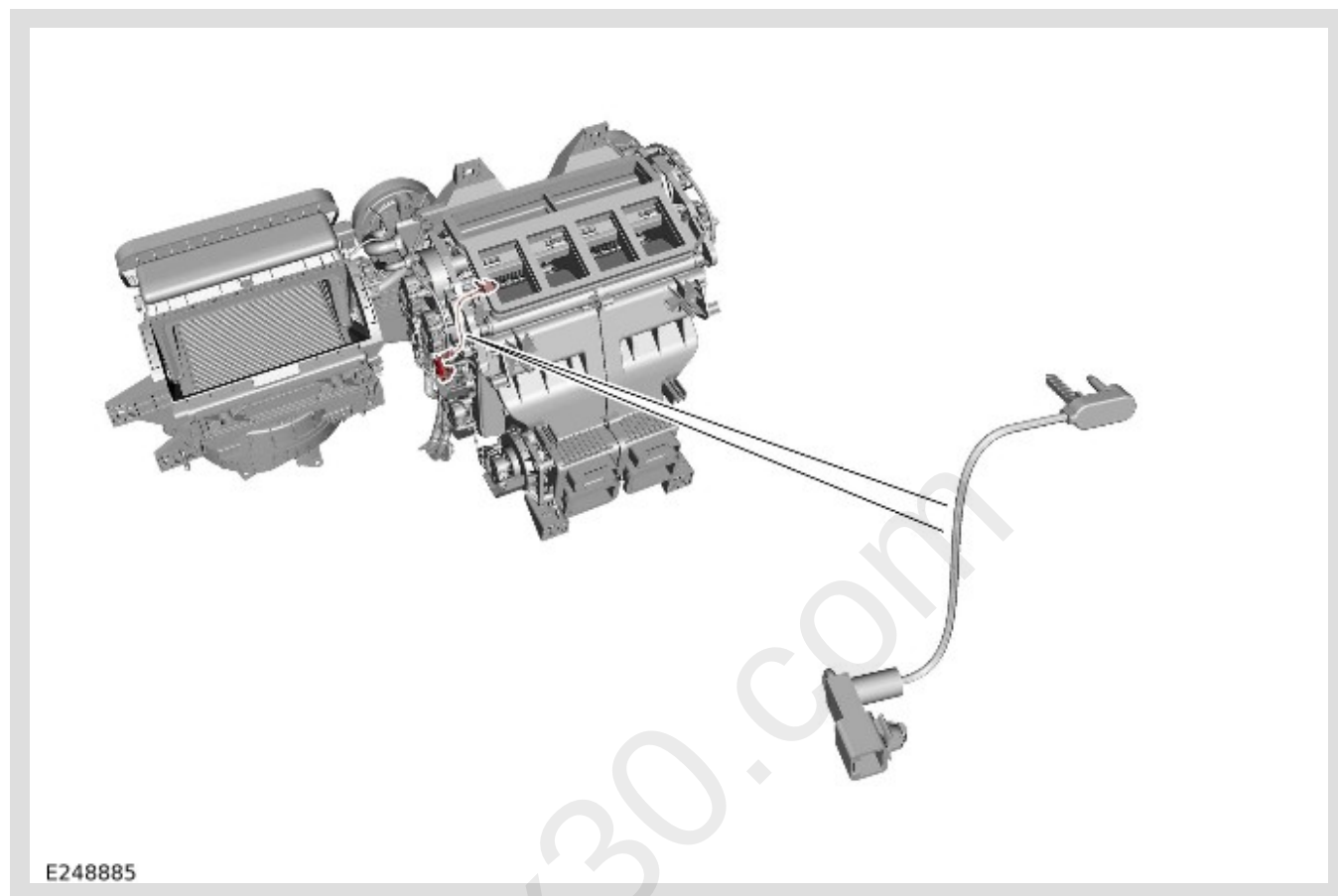
To protect the system from extremes of pressure, the HVAC control module disengages the clutch to switch OFF the A/C compressor when the pressure:

- Decreases to 2.1 ± 0.2 bar (31.5 ± 3 psi). The HVAC control module loads the A/C compressor again when the pressure increases to 2.3 ± 0.2 bar (33.4 ± 3 psi).
- Increases to 31 ± 1 bar (450 ± 14.5 psi). The HVAC control module loads the A/C compressor again when the pressure decreases to 26 ± 1 bar (377 ± 14.5 psi).

EVAPORATOR TEMPERATURE SENSOR

NOTE:

RHD vehicle is shown, LHD vehicle is similar.



The evaporator temperature sensor is a NTC thermistor. The sensor provides the HVAC control module with a temperature signal from the air outlet of the evaporator. The sensor extends into the air flow on the downstream of the evaporator.

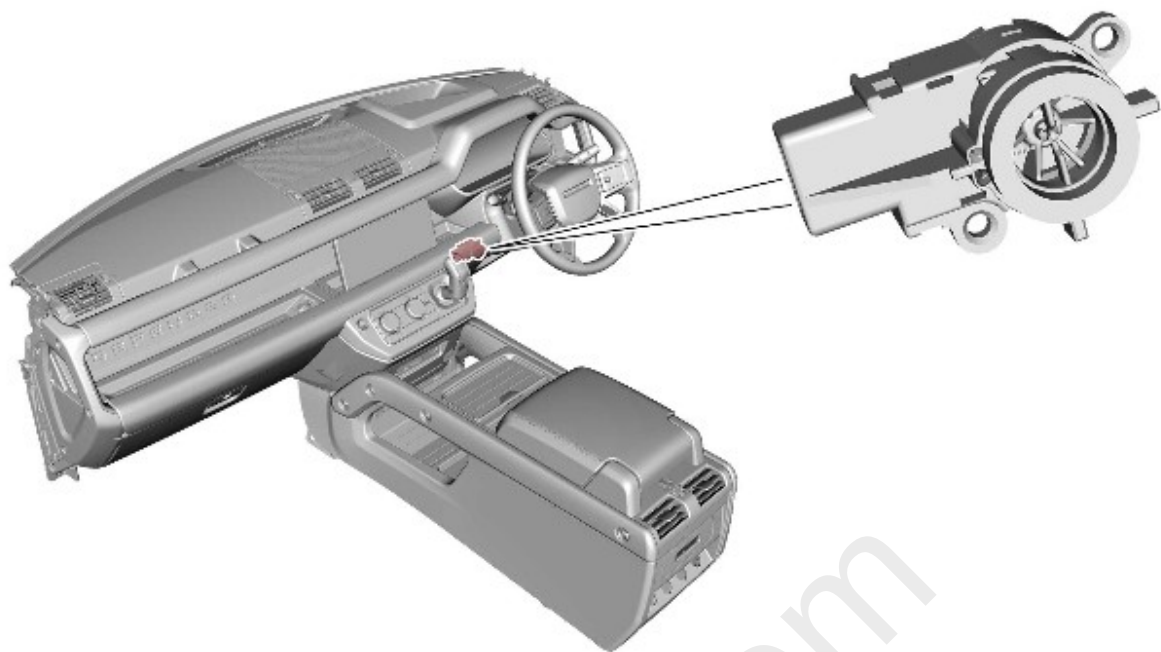
The HVAC control module uses the signal from the evaporator temperature sensor to control the load of the A/C compressor. The purpose is to allow the HVAC control module to control the operating temperature of the evaporator.

The HVAC control module supplies the evaporator temperature sensor with a 5V reference voltage and translates the return signal voltage into a temperature. When the sensor develops a fault, the HVAC control module adopts a default temperature of 0 °C (32 °F).

IN-VEHICLE TEMPERATURE SENSOR

NOTE:

RHD vehicle is shown, LHD vehicle is similar.



E248886

The in-vehicle temperature sensor is a NTC thermistor. The sensor is installed behind a grill in the instrument panel, on the inboard of the steering column. A motor driven fan in the sensor draws air through the grill and over the thermistor.

The HVAC control module supplies the in-vehicle temperature sensor with a 5V reference voltage and translates the return signal voltage into a temperature. When the in-vehicle temperature sensor develops a fault, the HVAC control module adopts a default temperature of 20 °C (68 °F).

The HVAC control module uses the signal from the in-vehicle temperature sensor to control:

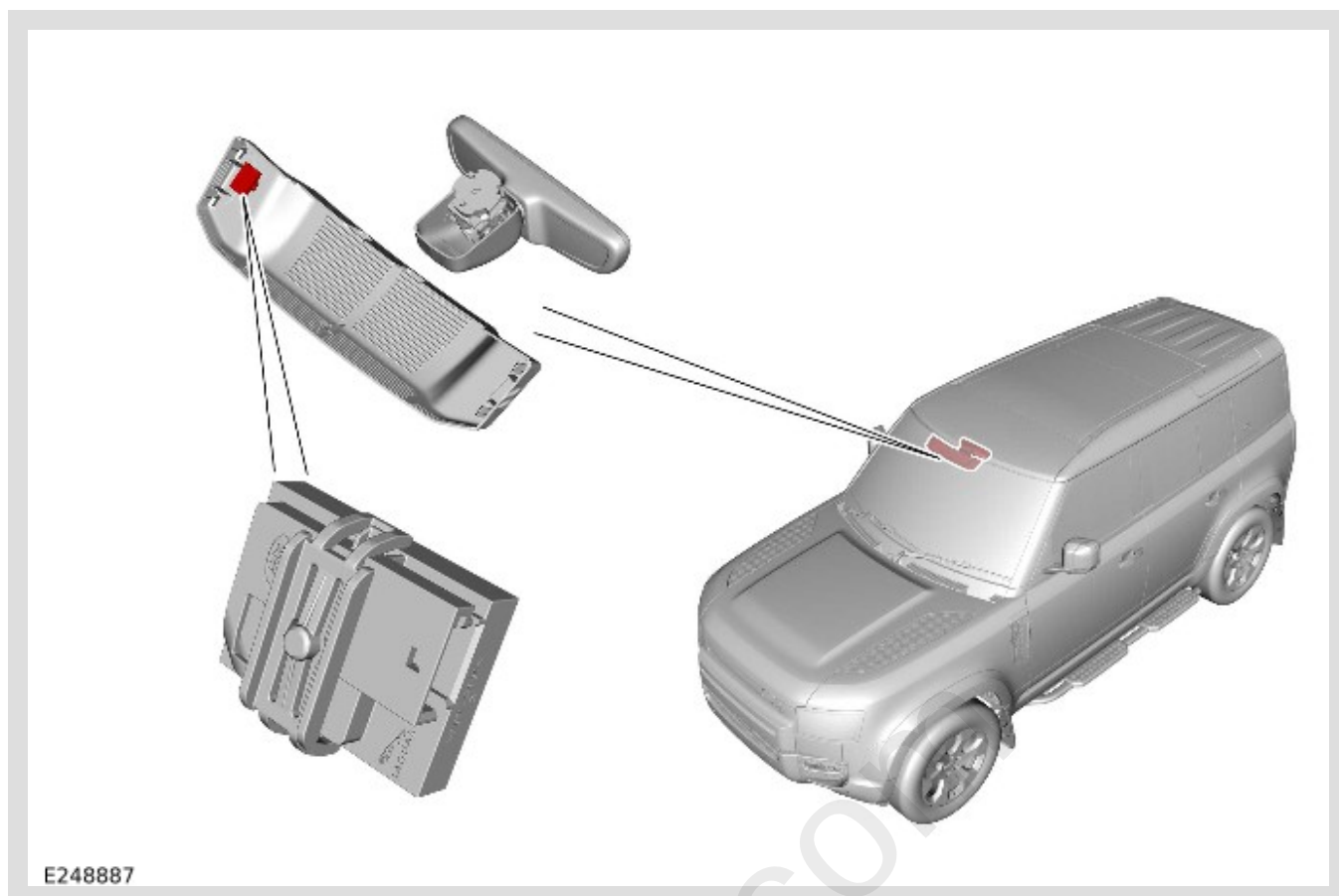
- The climate control assembly output temperatures
- The climate control assembly blower speed
- The climate control assembly air distribution.

HUMIDITY SENSOR



NOTE:

Vehicle with 5 doors is shown, vehicle with 3 doors is similar.



The humidity sensor is installed in a bracket attached to the inside of the windshield, close to the Rear View Mirror (RVM). The sensor is concealed under a cover, which clips onto the bracket. The sensor comprises 3 individual elements:

- A capacitive humidity sensor
- A NTC thermistor air temperature sensor
- An infrared windshield glass temperature sensor.

The humidity sensor has a power supply connection from the BCM/ GWM. The data from the 3 individual elements of the humidity sensor are transmitted on the Local Interconnect Network (LIN) to the HVAC control module.

The HVAC control module uses these signals to control the following:

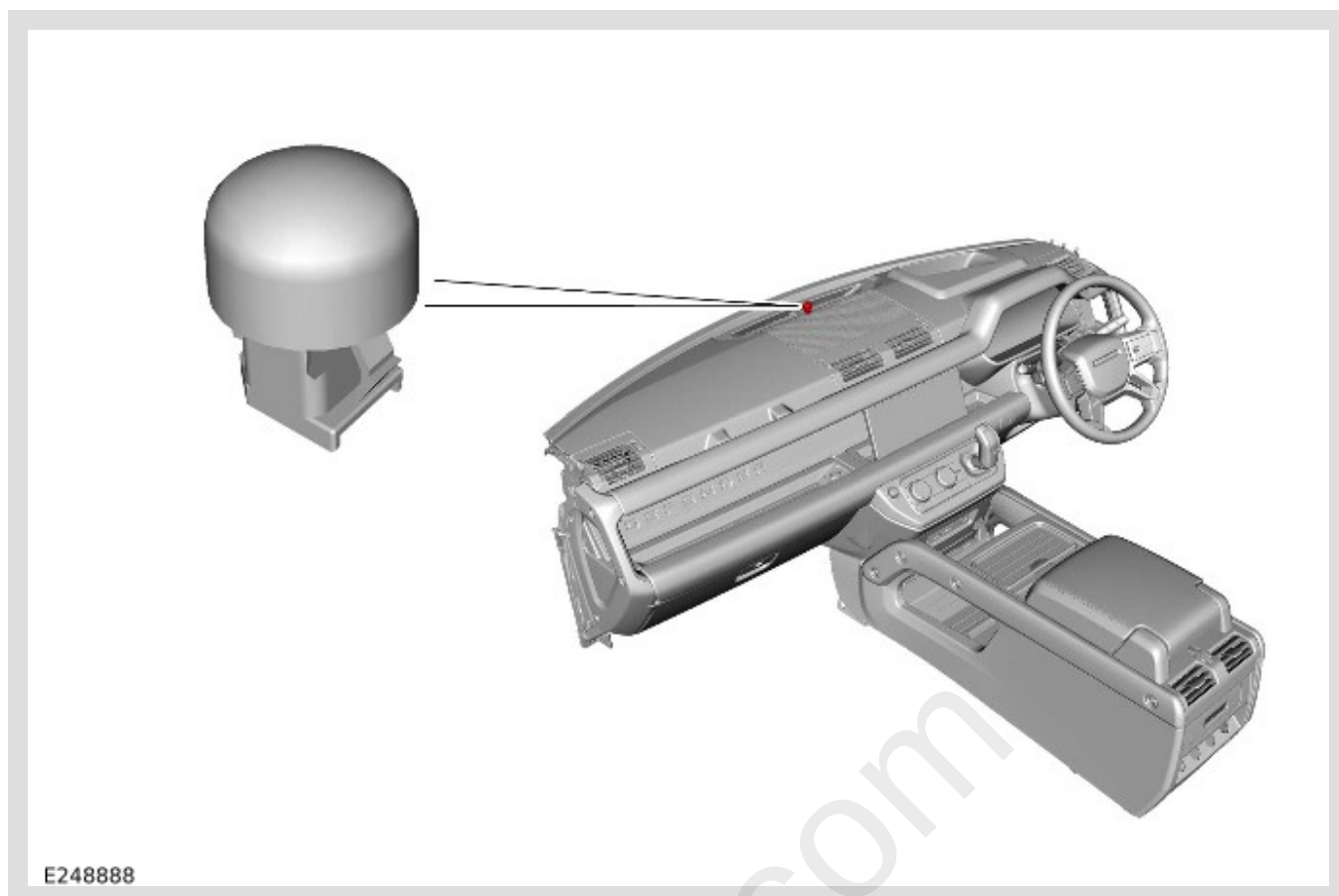
- Adjusts the humidity of the air in the vehicle as necessary, to provide the optimum comfort level for occupants.
- Calculates the dew point temperature of the air at the inside of the windshield.

SUNLOAD SENSOR



NOTE:

RHD vehicle is shown, LHD vehicle is similar.



The sunload sensor is installed in the center of the instrument panel upper surface. The sunload sensor contains a photoelectric cell. The photoelectric cell provides the HVAC control module with an input of light intensity equating to the sunload heating effect on the passenger compartment.

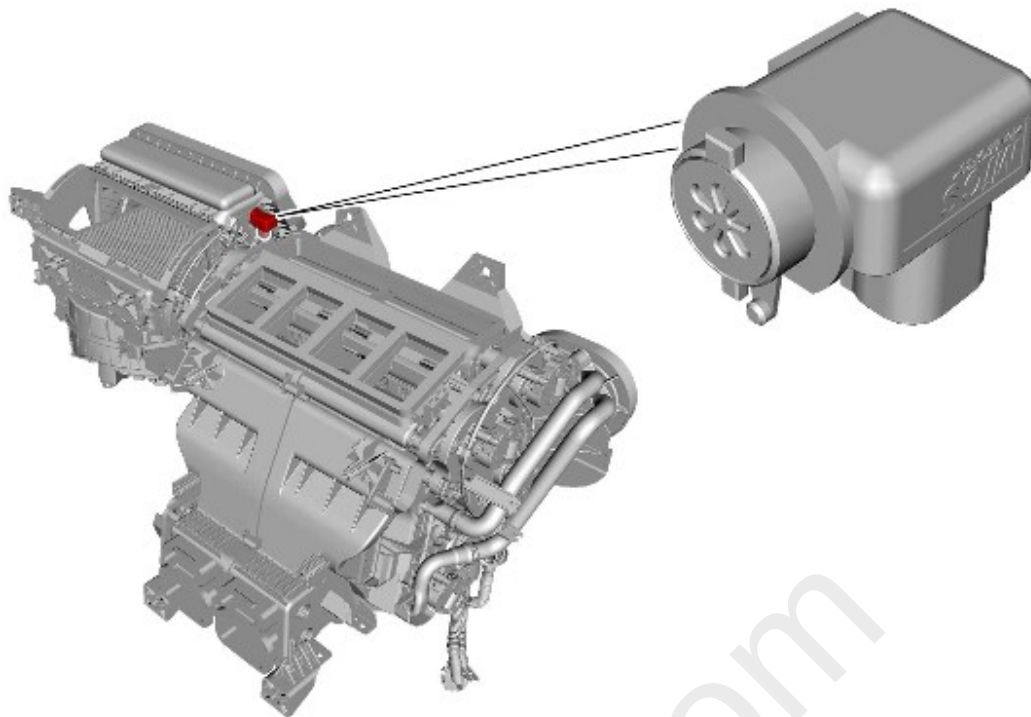
The HVAC control module supplies the sunload sensor with a 5V reference voltage. To compensate the sunload heating effect and maintain the required passenger compartment temperature, the HVAC control module adjusts:

- The blower speed
- The output air temperature
- The air distribution.

POLLUTION SENSOR

NOTE:

RHD vehicle is shown, LHD vehicle is similar.



E248889

The pollution sensor is installed on the inboard of the air inlet duct, in the fresh air inlet.

The pollution sensor has power supply, ground and signal connections with the HVAC control module. Semiconductor material in the sensor undergoes a change of conductance when exposed to specific gases. The sensor uses this property to monitor for gases such as Carbon Monoxide (CO) and Nitrogen Oxides (NOx). The change of conductance is used to determine the quality of the fresh air entering the vehicle. The sensor transmits the air quality to the HVAC control module, in a Pulse Width Modulation (PWM) signal, as 1 of the following 4 conditions:

- Static or reduced pollution levels
- Small increase in pollution levels
- Medium increase in pollution levels
- Rapid or large increase in pollution levels.

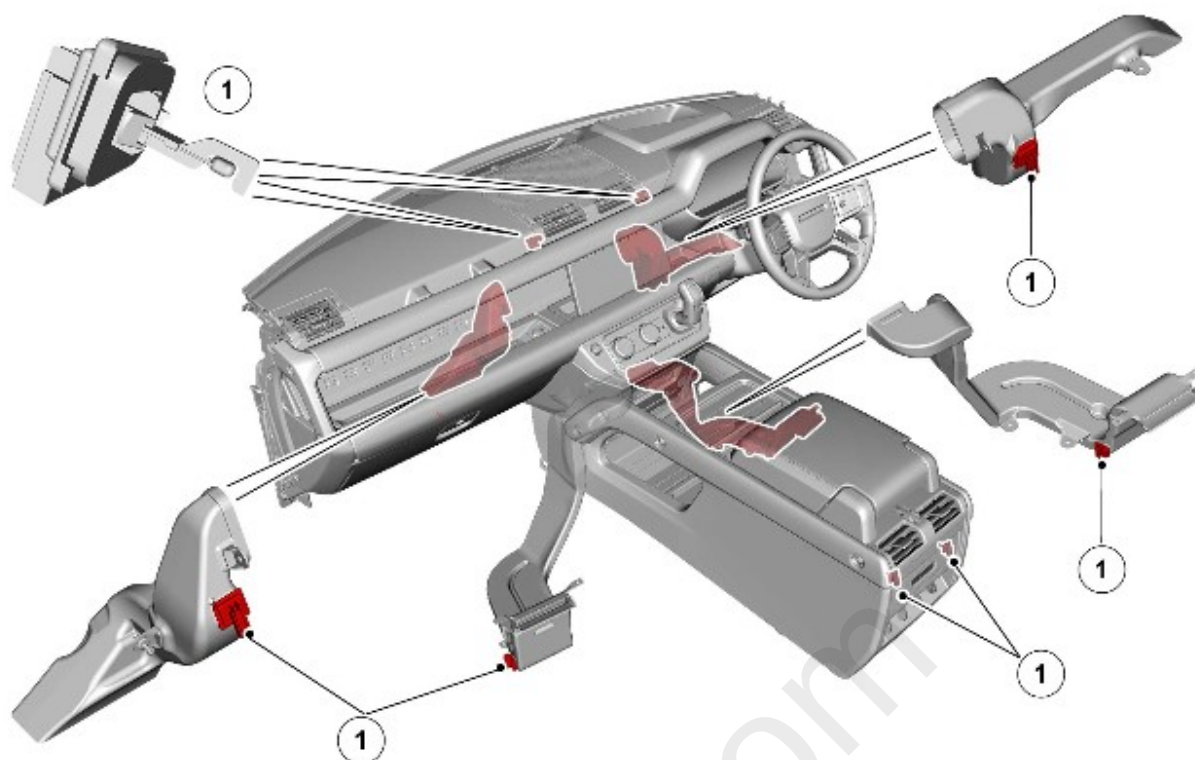
Using the signal from the pollution sensor, the HVAC control module controls the intake air source to reduce the amount of contaminants entering the interior. It is possible to put the system into recirculation through the switch but it is not possible to select fresh air. The pollution sensor may be turned OFF through the climate settings on the FCDIM.

DUCT AIR TEMPERATURE SENSORS



NOTE:

RHD vehicle is shown, LHD vehicle is similar.



E248890

The duct air temperature sensors are NTC thermistors. The sensors are installed in the following distribution ducts:

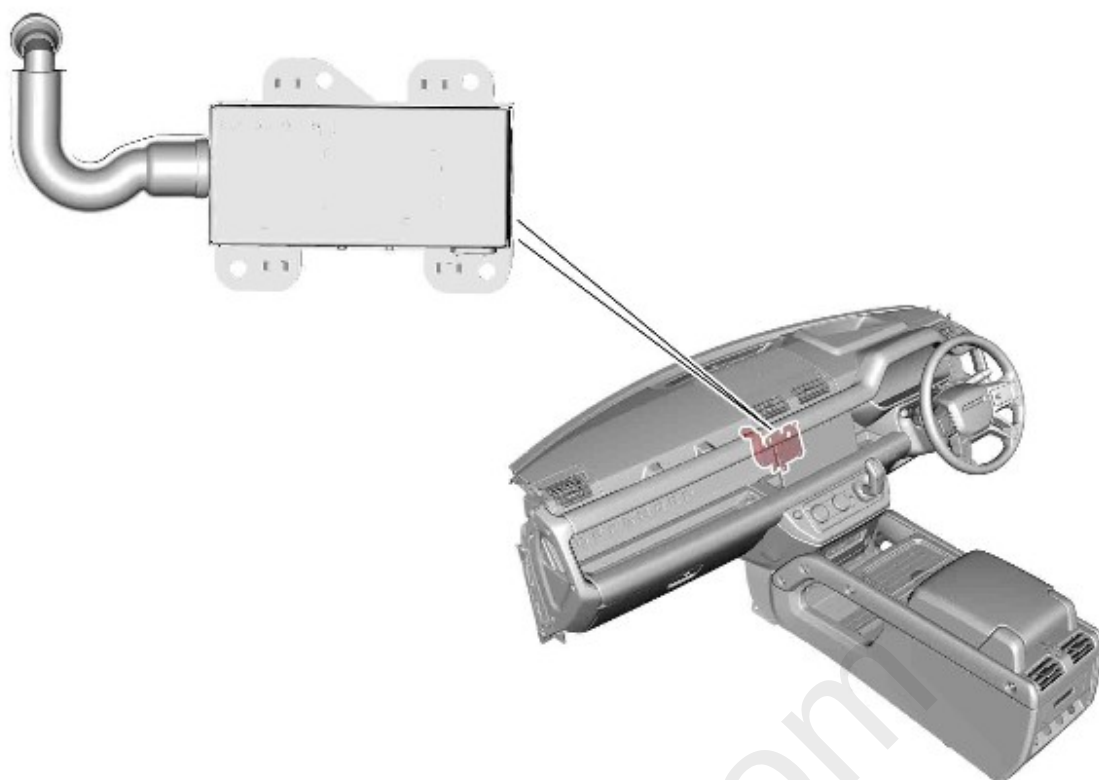
- Left and right center front face ducts.
- Left and right front foot ducts.
- Left and right second row foot ducts.
- Left and right second row face ducts.

The HVAC control module provides a 5V reference signal and ground connections to the duct air temperature sensors. The HVAC control module uses the sensor inputs in the calculations used to set the temperatures of the air leaving the climate control assembly.

AIR IONIZER

NOTE:

RHD vehicle is shown, LHD vehicle is similar.



E248183

The air ionizer technology helps the well being of both driver and passengers. The air ionizer improves the air quality within the passenger compartment and can help reduce allergens, viruses, bacteria and odours. The air ionizer uses nano-sized charged water particles which decompose harmful substances to cleanse the air. The air ionizer can be switched ON or OFF through the climate settings on the FCDIM.

The air ionizer is only connected to the left center face vent in the instrument panel.

The air ionizer is connected to a power supply and a ground connection. The air ionizer operates when an electrical signal is received from the HVAC control module.

OPERATION

2 ZONE CLIMATE CONTROL

The 2 zone climate control system separates the zones into the driver and front passenger compartment.

In Power Mode 7 (engine running), the climate control system can be activated using the 'AUTO' switches on the FCIM. The climate control may also be activated using the power soft key on the 'CLIMATE - Front' menu of the FCDIM.

3 ZONE CLIMATE CONTROL

The 3 zone climate control system separates the zones into the driver, front passenger and the second row seat passenger compartment.

In Power Mode 7 (engine running), the climate control system can be activated using the 'AUTO' switches on the FCIM . The climate control may also be activated using the power soft key on the 'CLIMATE - Front' menu of the FCDIM. When the FCIMB is unlocked on the FCDIM, pressing the 'AUTO' switch on the FCIMB also activates the system.

On vehicle with auxiliary climate control, the auxiliary climate control can also be controlled from the FCDIM.

For additional information, refer to: [Auxiliary Climate Control](#) (412-02 Auxiliary Climate Control, Description and Operation).

INTAKE AIR CONTROL

The HVAC control module automatically controls the source of inlet air. Unless the source is overridden by pressing the recirculation switch on the FCIM to give timed or latched recirculation.

Timed recirculation

A brief press of the recirculation switch illuminates the switch indicator and activates timed recirculation. There is a pop up on the FCDIM informing the user when the system has entered timed recirculation. Timed recirculation is automatically canceled after a set time, which varies with AAT.

Latched recirculation

Pressing and holding the recirculation switch for more than 2 seconds causes the switch indicator to flash 5 times and then illuminate constantly. A second press of the recirculation switch cancels recirculation and the HVAC control module returns the recirculation door to the fresh air position.

During automatic control, the HVAC control module determines the required position of the recirculation door from comfort algorithms and the pollution sensor. The HVAC control module is looking for spikes in pollution and attempts to stop the spikes entering the vehicle.

The sensitivity of the pollution sensor can be adjusted on the FCDIM, using the setting soft key of the 'CLIMATE - Front' menu. The pollution sensing function can also be switched OFF by adjusting the sensitivity to the minimum setting. When there is a fault with the pollution sensor, the HVAC control module disables automatic operation of the recirculation door. The HVAC control module continues automatic operation of the recirculation door due to the comfort algorithms.

AIR TEMPERATURE CONTROL

The HVAC control module calculates the temperature blend motor positions required to achieve the selected temperature and compares it against the current position. When there is any difference, the HVAC control module signals the motors to adopt the new position.

Air temperature is controlled automatically unless maximum heating (HI) or maximum cooling (LO) is selected. When maximum heating or cooling is selected, a comfort algorithm in the HVAC control module adopts an appropriate strategy for:

- Air distribution
- Blower speed

- Air source.

Temperature control in 1 zone can be compromised by another zone being set to a high level of heating or cooling. True maximum heating or cooling can only be selected for the driver zone. The temperature is displayed as 'HI' or 'LO' on the FCDIM and/or the FCIM switches. When 'HI' or 'LO' is selected for the driver zone, the temperature for the other zones is automatically set to match the driver zone. When the zone is set at a value different from the 'HI' or 'LO' setting, the other zone returns to the previous value set.

When the A/C is selected OFF in the automatic mode, no cooling of the inlet air occurs. The minimum output air temperature from the system is AAT plus any heat pick up in the air inlet path.

When the 'SYNC' switch on the FCDIM is pressed, the HVAC control module synchronizes the temperature of the other zones with the driver zone temperature.

BLOWER CONTROL

When the system is in the automatic mode, the HVAC control module determines the blower speed required from a comfort algorithm. When the system is in the manual mode, the HVAC control module operates the blower at the speed selected on the FCIM. The HVAC control module also adjusts blower speed to compensate for the ram effect on inlet air produced by forward movement of the vehicle. As vehicle speed and ram effect increases, blower motor speed is reduced. The blower motor speed is increased as the speed and ram effect decreases.

AIR DISTRIBUTION CONTROL

Distribution doors are used to direct air into the passenger compartment. The doors are operated by electric motors, which are controlled by the HVAC control module using the LIN messages.

For additional information, refer to: [Heating and Ventilation](#) (412-01 Climate Control, Description and Operation).

When the A/C system is in automatic mode, the HVAC control module automatically controls air distribution into the passenger compartment in line with its comfort algorithm. Automatic control is overridden by distribution selections on the FCDIM, the FCIM or the FCIMB. Air distribution remains as selected until 1 of the 'AUTO' switches is selected or a different manual selection is made.

A/C COMPRESSOR CONTROL

When A/C is selected, the HVAC control module maintains the evaporator at an operating temperature that varies with the passenger compartment cooling requirements. When the requirement for cooled air decreases, the HVAC control module raises the evaporator operating temperature by reducing the flow of refrigerant. The flow of refrigerant is provided by the A/C compressor. The HVAC control module closely controls the rate of temperature increase to avoid introducing moisture into the passenger compartment.

When the requirement for cooled air increases, the HVAC control module lowers the evaporator operating temperature by increasing the flow of refrigerant. The flow of refrigerant is provided by the A/C compressor.

When A/C is OFF, the A/C compressor current signal supplied by the HVAC control module reduces the compressor solenoid valve to the minimum flow position. The A/C compressor clutch is then released and the compressor stops.

The HVAC control module incorporates limits for the operating pressure of the refrigerant system. When the system approaches the HP limit, the compressor current signal is progressively reduced until the system pressure decreases. When the pressure continues to rise, the A/C compressor clutch is released until the pressure falls below a lower threshold. When the system falls below the Low Pressure (LP) limit, the A/C compressor clutch is released. When the system pressure is below the lower limit prior to initial engagement, the A/C compressor clutch is prevented from engaging.

AIR CONDITIONING COMPRESSOR TORQUE

The HVAC control module transmits refrigerant pressure and A/C compressor current values. The values are transmitted on the HS CAN power mode zero systems bus. The values are transmitted through the BCM/ GWM onto the FlexRay circuit to the PCM.

The PCM uses these values to calculate the torque being used to drive the A/C compressor. The PCM compares the calculated value with its allowable value and forces the HVAC control module to inhibit the A/C compressor. The PCM transmits the 'ACCompressorTorqMax' CAN message set to 0. This forces the HVAC control module to disengage the clutch to switch OFF the A/C compressor. The purpose is to remove the load on the engine required to drive the A/C compressor.

By reducing the A/C compressor torque, the PCM is able to reduce the load on the engine when it needs to maintain:

- Vehicle performance
- Cooling system integrity.

COOLING FAN CONTROL

The PCM control module determines the amount of condenser cooling required from the refrigerant pressure sensor. There is a direct relationship between the temperature and pressure of the refrigerant. The cooling requirement is transmitted on the HS CAN power mode zero systems bus. Then this message is transmitted through the BCM/ GWM onto the FlexRay circuit to the PCM. The PCM then controls the temperature of the condenser using the cooling fan (s).

MAXIMUM DEMIST

When the 'MAX' demist switch on the FCIM is pressed, the HVAC control module configures the climate control system as follows:

- Automatic mode OFF
- A/C ON
- Selected temperature unchanged
- Air inlet set to fresh air
- Air distribution set to windshield
- Blower speed set to high speed.

The HVAC control module also sends a message through the BCM/ GWM to activate the windshield and rear window heaters. The message is transmitted on the HS CAN power mode zero systems bus.

The programmed demist function can be canceled by 1 of the following:

- A second press of the 'MAX' demist switch.
- Selecting any air distribution soft key on the FCDIM.
- Pressing the driver or passenger side 'AUTO' switch on the FCIM.
- Selecting Power Mode 4 (accessory (vehicle unlocked and Smart Key present)) or lower.

The blower speed can be adjusted without terminating the programmed demist function. When the blower speed has been adjusted and the 'MAX' demist switch is pressed again, the system goes back to the maximum demist default settings. The windshield and rear window heaters remain ON until they time out or either can be canceled by pressing its dedicated FCIM button.

AIR IONIZATION

The air ionizer is operated by touching the air ionization icon on the FCDIM. The FCDIM sends a signal to the HVAC control module through the HS CAN HMI systems bus. The HVAC control module only operates the air ionizer when the air flow is directed to the face vents in the instrument panel.

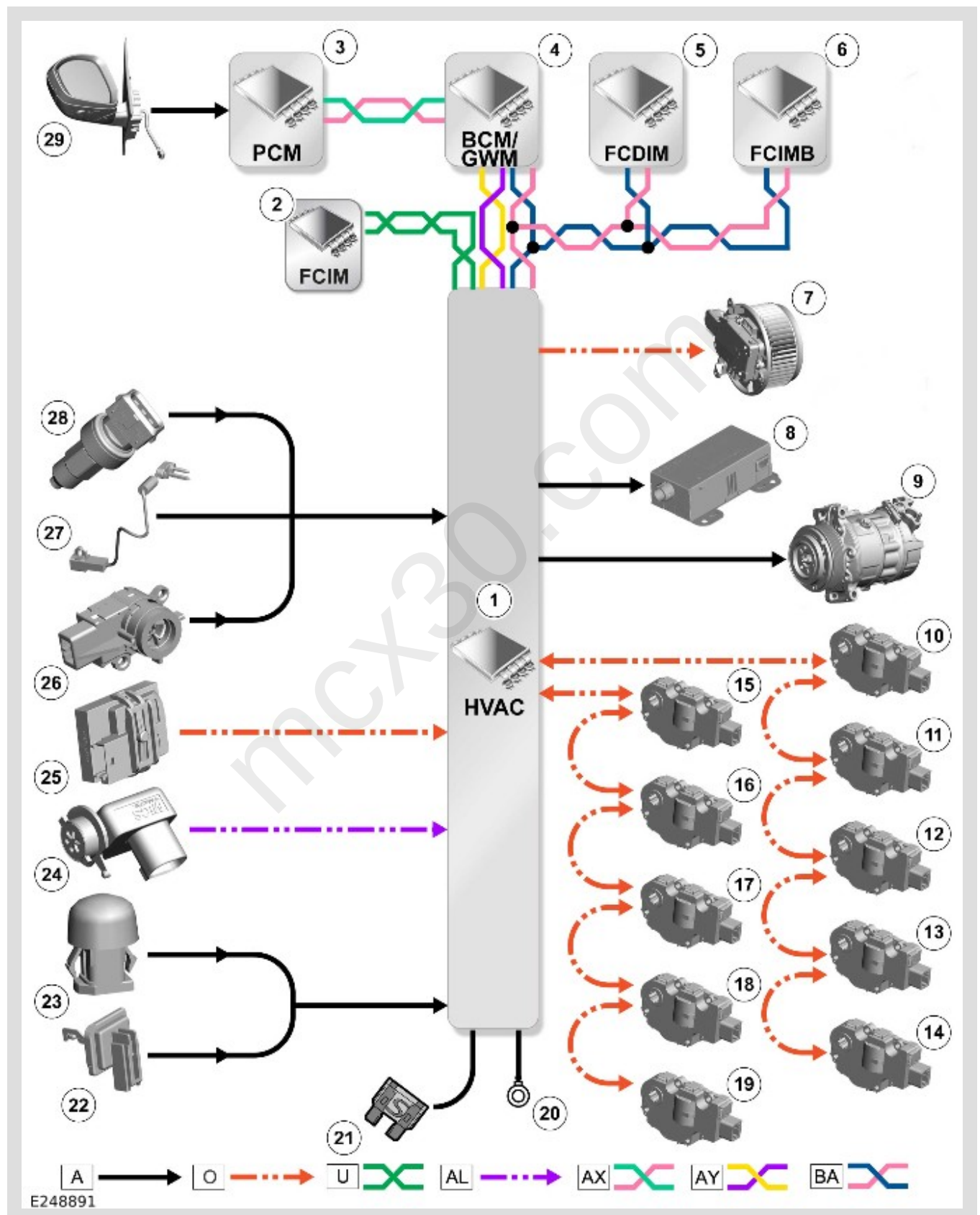
DIAGNOSTICS

The HVAC control module records any Diagnostic Trouble Code(s) (DTC) and related data. Read the DTC and related data with the Jaguar Land Rover (JLR) approved diagnostic equipment.

The JLR approved diagnostic equipment can read live data and activate certain components.

CONTROL DIAGRAM

CONTROL DIAGRAM - 1 OF 1



A = HARDWIRED: O = LIN: U = PRIVATE CAN BUS: AL = PWM: AX = FLEXRAY: AY = HS CAN POWER MODE ZERO
SYSTEMS BUS: BA = HS CAN HMI SYSTEMS BUS.

ITEM	DESCRIPTION
1	HVAC control module
2	FCIM
3	PCM
4	BCM/ GWM
5	FCDIM
6	FCIMB
7	Blower motor
8	Air ionizer
9	A/C compressor clutch
10	Demist distribution motor
11	Rear face/foot distribution motor
12	Rear left temperature blend motor
13	Front left temperature blend motor
14	Front left face/foot distribution motor
15	Recirculation motor
16	Cool air bypass motor
17	Front right face/foot distribution motor
18	Front right temperature blend motor
19	Rear right temperature blend motor
20	Ground
21	Power supply
22	Duct air temperature sensors (quantity 8)
23	Sunload sensor
24	Pollution sensor
25	Humidity sensor
26	In-vehicle temperature sensor
27	Evaporator temperature sensor
28	Refrigerant pressure sensor

ITEM	DESCRIPTION
29	AAT sensor

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