AIR CONDITIONING (A/C)

DESCRIPTION

General

The air conditioning (A/C) can only be operated with the engine running. The A/C is selected using the Air Temperature Control (ATC) panel on the fascia. The A/C system controls the temperature, distribution and volume of air supplied to the vehicle interior. The system is electronically controlled with automatic and manual modes of operation. The system also features separate temperature control of the LH and RH air outlets.

Rear A/C is an optional fitment and provides additional cooling by recirculating air through a second evaporator.

The cooling fan is used by the ATC ECU for A/C condensor cooling and also by the ECM for engine cooling. Refer to cooling fan Description and Operation in this manual for ECM operation.

Operation of the A/C system is dependant on various conditions being correct, i.e. engine coolant temperature, engine speed, vehicle speed, A/C dual cut-off switch etc. For further details of A/C operating parameters refer to the Workshop Manual Air Conditioning Description and Operation.

OPERATION

Air Conditioning Supply

Circuit supply

A feed from the battery positive terminal is connected on an R wire to the engine compartment fusebox. The feed passes through fusible links 1, 3, 4 and 8 and fuses 5, 6 and 13. Fusible links 1 and 4 are connected in series. Fuses 5 and 6 are also connected in series with fusible link 1.

The feed from the battery is also connected directly to the contacts of the main relay in the engine compartment fusebox.

From fusible link 3 is connected on an NR wire to the passenger compartment fusebox where it passes through fuse 20.

The feed from fusible link 4 is connected on an NK wire to the passenger compartment fusebox where it passes through fuses 6 and 7.

The feed from fusible link 8 is connected on an NW wire to the passenger compartment fusebox and from the fusebox to the ignition switch on an N wire.

Ignition switch supply

When the ignition switch is in position II, the feed from fusible link 8 flows through the ignition switch to the passenger compartment fusebox on a W wire and passes through fuse 31. From fuse 31 the feed passes on a GK wire to splice joint A9/A144. From the splice joint the feed is divided into three separate feeds as follows:

- A GK wire supplies power to the Air Temperature Control (ATC) ECU.
- A GR wire supplies power to the in-car temperature sensor.
- A GR wire to connector interface C0765-1/C0778-1 changes to a LGW wire to splice joint A1. From splice joint A1 the feed is connected on a LGW wire to the fresh/ recirculated air mode motor. A tapping from splice joint A1 passes on a LGW wire, via splice joint B1, to the coil of the blower relay. From splice joint B1 a second LGW wire is connected to the coil of the power relay.

Front Air Conditioning Operation

Air temperature control ECU supply

A feed from fusible link 3 in the engine compartment fusebox is connected on an NR wire to the passenger compartment fusebox. The feed passes through fuse 20 and is connected, via header C0725, to the Air Temperature Control ECU on a P wire.

Main relay/inertia switch supply

A feed from fuse 13 in the engine compartment fusebox is connected to the inertia switch by a NB wire. When the inertia switch is closed (not tripped), the feed continues on a WG wire to the coil of the main relay in the engine compartment fusebox. The main relay coil is then connected from the relay to the Engine Control Module (ECM)) on a UR wire. When conditions are correct, the ECM provides the earth path which in turn energises the main relay, closing the contacts.

Cooling fan relay supply
A feed from fuse 5 in the engine compartment fusebox, is connected to the contacts of the cooling fan relay.
Cooling fan motor operation
When the main relay is energised, a feed passes from the relay contacts to the coil of the cooling fan relay. The cooling fan relay coil is earthed on a BP wire (Td5 engines) or a GW wire (V8 engines) to the ECM.
When conditions are correct, the ECM provides the earth path which energises the cooling fan relay coil closing the contacts. The feed from fuse 5 in the engine compartment fusebox passes through the cooling fan relay contacts and from the fusebox to the cooling fan motor on a BN wire. The feed operates the cooling fan motor which is connected to earth header C0018 on a B wire.

Air conditioning compressor clutch relay supply
A feed from fuse 6 in the engine compartment fusebox, is connected to the contacts of the air conditioning compressor clutch relay.
Air conditioning compressor clutch operation
When the main relay is energised, a feed passes from the relay contacts to the coil of the air conditioning compressor clutch relay. The compressor clutch relay coil is earthed on a BS wire to the ECM.
When conditions are correct, the ECM provides the earth path which in turn energises the compressor clutch relay coil closing the contacts. The feed from fuse 6 in the engine compartment fusebox passes through the relay contacts and from the fusebox is connected on a BG wire to the air conditioning compressor clutch. The feed operates the air conditioning compressor clutch which is connected to earth header C0018 (Td5 engines) or earth eyelet connector C0807-1 (V8 engines).
Fresh/recirculated air mode motor
The feed from fuse 31 in the passenger compartment fusebox passes on a GK wire to splice joint A9/A144. From the splice joint the feed passes on a GR wire to connector interface C0765-1/C0778-1. From the connector interface the feed passes, via splice joint A1, to the fresh/recirculated air mode motor on a LGW wire.
The fresh/recirculated air mode motor is connected to the Air Temperature Control (ATC) ECU on an RG wire to ECU pin C0793-8 and on a UB wire to ECU pin C0793-16.
Blower relay
The feed from fuse 31 in the passenger compartment fusebox passes on a GK wire to splice joint A9/A144. From the splice joint the feed passes on a GR wire to connector interface C0765-1/C0778-1. From the connector interface the feed passes, via splice joint A1, to the coil of the blower relay. The coil is connected on an N wire to pin C0793-2 of the ATC ECU. When blower relay (R176) operation is required, the ATC ECU completes an earth path for the relay coil, energising the relay and closing the contacts. A feed from fuse 7 in the passenger compartment fusebox is connected on an NR wire to contacts of the blower relay. The feed passes through the relay contacts and is connected on a WR wire to the front blower motor. The front blower motor is connected on a B wire to the power relay and the power transistor via splice joint A10.
The contact of the blower relay is also connected on a B wire, via splice joint B9, to earth eyelet connector C0910-1. When the relay is connected to the earth, the front blower motor power feed will be removed preventing motor operation.

Power relay
The coil of the power relay receives a feed from fuse 31 in the passenger compartment fusebox. The feed passes on a GK wire to splice joint A9/A144. From the splice joint the feed passes on a GR wire to connector interface C0765-1/C0778-1. From the connector interface the feed passes, via splice joint A1, to the coil of the power relay. The coil is connected to pin C0793-10 on the ATC ECU.
The power relay operates speed 31 of the blower motor. This fastest motor speed is operated by the ATC ECU granting the earth path for the power relay coil. The energised coil closes the relay contacts and allows the earth for the front blower motor to pass, via splice joint A10, through the contacts. The earth path is completed on a B wire, via splice

joints A9 and B9, to earth eyelet connector C0910-1.

Power transistor

The power transistor controls speeds 1 to 30 of the front blower motor. The power transistor is controlled by the ATC ECU on a PG wire to ECU pin C0792-8 and on a G wire to ECU pin C0793-1.

Speeds 1 to 30 are controlled by the power transistor varying the resistance to the earth flow from the front blower motor. The earth path from the front blower motor is connected on a B wire, via splice joint A10, to the power transistor. The power transistor is connected on a B wire, via splice joints A9 and B9, to earth eyelet connector C0910-1.

Air Temperature Control (ATC) ECU

The ATC ECU is connected from ECU pin C0792-2 to the SLABS ECU pin C0504-3 on a KG wire via header C0290. The SLABS ECU provides a speed signal to the ATC ECU for blower speed control.

On V8 engine vehicles, the ECM is connected on a PW wire to ATC ECU pin C0793-12.

On Td5 engine vehicles, the ECM is connected on a GO wire to ATC ECU pin C0793-9.

On all vehicles, the ATC ECU is connected from pin C0791-4 on a B wire, via header C0725, to earth header C0017 LHD/C0018 RHD.

Air conditioning (A/C) dual cut-off switch

The A/C dual cut-off switch is a high/low pressure switch fitted into the A/C system. When the switch is operated, the ECM signals the ATC ECU to request the air conditioning compressor clutch relay to be de-energised.

The ATC ECU is connected from ECU pin C0793-11 on a YB wire to the A/C dual cut-off switch. The A/C dual cut-off switch is connected on a YS wire, via header C0290 (LHD only), to the ECM.

DESCRIPTION AND OPERATION

DISCOVERY SERIES II **4.81**

In-car temperature sensor

The in-car temperature sensor receives a feed from fuse 31 in the passenger compartment fusebox. The feed passes on a GK wire to splice joint A9/A144. From the splice joint the feed passes on a GR wire to the in-car temperature sensor and is connected to a motor which draws air over the sensor. The motor is connected on a B wire from the in-car temperature sensor, via header C0760, to earth header C0017 LHD/C0018 RHD.

A reference voltage from the ATC ECU pin C0791-8 is connected on a BW wire, via splice joint A145/A146 to the in-car temperature sensor. An input from the sensor is connected on a WB wire to the ATC ECU pin C0792-7.

Ambient Air Temperature (AAT) Sensor

A reference voltage from the ATC ECU pin C0791-8 is connected on a BW wire, via splice joint A145/A146 to the AAT sensor. An input from the sensor is connected on a YG wire to the ATC ECU pin C0792-6.

Heater Coolant Temperature (HCT) Sensor

A reference voltage from the ATC ECU pin C0791-8 is connected on a BW wire, via splice joints A145/A146, A26, B26, C26 and D26 to the HCT sensor. An input from the sensor is connected on an RB wire to the ATC ECU pin C0792-5.

Evaporator sensor

A reference voltage from the ATC ECU pin C0791-8 is connected on a BW wire, via splice joints A145/A146, A26, B26, C26 and D26 to the evaporator sensor. An input from the sensor is connected on a PB wire to the ATC ECU pin C0792-18.

Sunlight sensor

A reference voltage from the ATC ECU pin C0791-3 is connected on a GW wire, via splice joint A278, to the sunlight sensor. Two inputs from the sunlight sensor are connected on WU and WR wires to ATC ECU pins C0792-16 and C0792-17 respectively.

Air Temperature mode motor – LH

A reference voltage from the ATC ECU pin C0791-8 is connected on a BW wire, via splice joints A146/A146, A26 and B26 to the LH air temperature mode motor.

A reference voltage from the ATC ECU pin C0791-3 is connected on a GW wire to splice joint A278. From the splice joint the reference voltage continues on a GR wire, through splice joint A22 to the LH air temperature mode motor.

An input from the LH air temperature mode motor is passed to pin C0792-14 on the ATC ECU on an SU wire.

Two outputs from ATC ECU pins C0793-14 and C0793-6 are connected to the LH air temperature mode servo motor on GU and UO wires respectively. Each output drives the

servo motor to blend hot or cold air.

Air temperature mode motor – RH

A reference voltage from the ATC ECU pin C0791-8 is connected on a BW wire, via splice joints A145/A145, A26, B26 and C26 to the RH air temperature mode motor.
A reference voltage from the ATC ECU pin C0791-3 is connected on a GW wire to splice joint A278. From the splice joint the reference voltage continues on a GR wire, through splice joint A22 and B22 to the RH air temperature mode motor.
An input from the RH air temperature mode motor is passed to pin C0792-15 on the ATC ECU on a YG wire.
Two outputs from ATC ECU pins C0793-13 and C0793-5 are connected to the RH air temperature mode servo motor on Y and PY wires respectively. Each output drives the servo motor to blend hot or cold air.

Air distribution mode motor

A reference voltage from the ATC ECU pin C0791-8 is connected on a BW wire, via splice joints A145/A146, and A26 to the air distribution mode motor.
A reference voltage from the ATC ECU pin C0791-3 is connected on a GW wire to splice joint A278. From the splice joint the reference voltage continues on a GR wire, through splice joint A22 and B22 to the air distribution mode motor.
An input from the air distribution mode motor is passed to pin C0792-4 on a UY wire.
Two outputs from ATC ECU pins C0793-15 and C0793-7 are connected to the air distribution servo motor on US and UW wires respectively. Each output drives the servo motor to the windscreen demist or footwells position.

Rear Air Conditioning Operation

Rear Blower relay

A feed from fusible link 4 in the engine compartment fusebox is connected by an NK wire to the passenger compartment fusebox. The feed passes through fuse 6 in the the passenger compartment fusebox and is connected by a YG wire to the contacts of the rear blower relay.
A feed from fuse 31 in the passenger compartment fusebox is connected on a GK wire, via header C0289 (RHD only), to connector interface C0692-4/C0856-4. From the connector interface the feed continues on a WG wire to diode (G126). From the diode the feed is connected on a U wire, through splice joint A48, to the coil of the rear blower relay.
The coil of the rear blower relay is connected on a PG wire to the rear air conditioning switch.
The contacts of the rear blower relay are connected on a B wire to earth header C0707, via splice joint A52 when the relay coil is de-energised.

When the rear air conditioning switch is operated, the rear blower relay coil is energised, closing the relay contacts. This allows the feed from fusible link 4 in the engine compartment fusebox to pass through the relay to operate the rear blower motor on an NR wire.

Rear air conditioning switch

When the rear A/C switch is operated, an earth path is completed from the switch on a BR wire to the rear blower switch. The completion of the earth path energises the coil of the rear blower relay and illuminates the switch ON illumination.
The completion of the earth path is also used by the ATC ECU to sense when rear A/C has been selected on. A PG wire is connected from the rear A/C switch, via splice joint A58, to ATC ECU pin C0792-13.
From splice joint A48, the feed from fuse 31 is also connected on a U wire to connector interface C0856-3/C0692-3. From the connector interface the feed is connected to the on/ off illumination of the rear air conditioning switch on a WG wire.

Rear blower motor

The rear blower motor is connected on a G wire to splice joint A44. From splice joint A44 the motor is connected on G wires to the rear blower switch and the resistor pack.

Rear blower switch

The rear blower switch is a four position switch which controls the speed of the rear blower motor through a resistor pack.
With the switch in position 1, the earth path for the rear blower motor cannot pass through the rear blower switch. The earth path is through a fusible link and three resistors in the resistor pack to earth header C0707 on a B wire. This causes the rear blower motor to

operate at the slowest speed.
With the switch in position 2, the earth path for the rear blower motor is through the fusible link and two resistors in the resistor pack to the switch on an N wire. The switch is connected to earth header C0707 on a TB wire. This causes the rear blower motor to operate at the second slowest speed.
With the switch in position 3, the earth path for the rear blower motor is through the fusible link and one resistor in the resistor pack to the switch on a Y wire. The switch is connected to earth header C0707 on a B wire. This causes the rear blower motor to operate at the second fastest speed.
With the switch in position 4, the earth path for the rear blower motor is direct to the rear blower switch on a G wire, by-passing the resistor pack. This allows full power to flow through the motor which operates at its fastest speed.

HEATER BLOWER - FRESH/RECIRCULATED AIR MOTOR (NON A/C VEHICLES)

DESCRIPTION

General

The heater blower is operated from a four position linear switch located in the centre of the fascia on the heater control panel. The blower motor only operates with the ignition switch in position II. The blower motor control switch is illuminated when the side lights are turned on.
The blower motor is located in the air inlet duct. A resistor pack is located on the air inlet duct and controls the voltage through the blower motor for fan speeds one, two and three. Fan speed four drives the blower motor at full speed with a 12 V direct supply through the motor. Position zero is the off position.

Fresh/Recirculated Air Description

The heater blower circuit also incorporates a fresh/recirculated air switch and motor. The latching fresh/recirculated air switch is located in the centre of the fascia and has an indicator light to show when the switch is in the recirculation position. The switch is illuminated when the side lights are turned on. The fresh/recirculated air motor only operates with the ignition switch in position II.
The switch is connected to the fresh/recirculated air mode motor which, when selected, moves a flap in the heater air distribution unit to prevent the intake of air from outside the vehicle. A warning lamp on the switch illuminates to show that recirculated air has been selected.

OPERATION

Heater Blower - Fresh/Recirculated Air Supply

Circuit supply

A feed from the battery positive terminal is connected by an R wire to the engine compartment fusebox, where it passes through fusible links 1, 4 and 8. Fusible links 1 and 4 are connected in series.
The feed from fusible links 1 and 4 is connected from the engine compartment fusebox to the passenger compartment fusebox on an NK wire, where it passes through fuse 7. The feed is connected from the passenger compartment fusebox to the contacts of the blower relay on an NR wire.
A feed from fusible link 8 in the engine compartment fusebox is connected on an NW wire to the passenger compartment fusebox and from the fusebox to the ignition switch on an N wire.

Ignition switch supply

When the ignition switch is in position II, the feed from fusible link 8 flows through the ignition switch to the passenger compartment fusebox on a W wire where it passes through fuse 31. From fuse 31 the feed is connected on a GK wire to splice joint A240.
From the splice joint A240 the feed is connected on a GK wire to the fresh recirculated air switch.
From the splice joint A240, the feed is also connected on a GR to splice joint A5. From the splice joint A5 the feed is connected on GR wires to the coil of the blower relay and the fresh/ recirculated air mode motor.

Heater Blower Operation

The speed of the front blower motor is controlled by the blower motor switch position and three resistors located in the resistor pack. The blower motor will only operate with the ignition switch in position II.

With the ignition switch in position II and the blower motor switch in position 0 (off), the earth path for the blower relay coil is not complete and the relay coil cannot energise.

When the blower motor switch is moved to position 1, 2, 3 or 4 the blower relay coil is connected to earth on an N wire to the blower motor switch. The blower motor switch is connected on a B wire, via splice joint A7, to earth eyelet connector C0910-1. This causes the blower relay coil to energise closing the relay contacts.

With the relay contacts closed, the feed from fuse 7 in the passenger compartment fusebox passes through the relay contacts to the front blower motor.

With the blower motor switch in position 1, the earth path for the motor is via the resistor pack, through the 40 Amp in-line fuse and the three resistors (0.32/0.85/1.71 ohms) which limit the power flow to earth and operate the blower motor at slow speed. The resistor pack is connected on a B wire, via splice joint A7, to earth eyelet connector C0910-1.

With the blower motor in position 2, the earth path for the motor is via the resistor pack, through the in-line fuse and two resistors (0.32 and 0.85 ohms) which limit the power flow to earth and operate the blower motor at slow/medium speed. The resistor pack is connected on a PU wire to the blower motor switch. The blower motor switch is connected on a B wire, via splice joint A7, to earth eyelet connector C0910-1.

With the blower motor switch in position 3, the earth path for the blower motor is via the resistor pack, through the in-line fuse and through one resistor (0.32 ohm) which limits the power flow to earth and operates the blower motor at medium/fast speed. The resistor pack is connected on a G wire to the blower motor switch. The blower motor switch is connected on a B wire, via splice joint A7, to earth eyelet connector C0910-1.

With the blower motor switch in position 4, the earth path for the blower motor is direct to the blower motor switch on a BO wire via splice joint A1 and operates the blower motor at fast speed. The blower motor switch is connected on a B wire, via splice joint A7, to earth eyelet connector C0910-1.

Fresh/Recirculated Air Operation

The fresh/recirculated air mode motor can only operate when the ignition switch is in position II. The feed from fuse 31 in the passenger compartment fusebox is connected to the fresh/ recirculated air switch and the fresh/recirculated air mode motor.

Fresh air position

When the switch is in the fresh air position (latched out, indicator lamp off), the feed from fuse 31 on a GK wire cannot pass through the indicator bulb to earth due to the switch position.

The air mode motor is connected on an UB wire to the switch. When the motor reaches the end of its operation to move the fresh/recirculation air flap, an internal switch in the motor moves ready to accept a feed to move to the recirculate air position. While the motor is operating it is connected through the switch on a B wire, via headers C0725 and C0760 to earth header C0017 LHD/C0018 RHD.

Recirculated air position

When the switch is in the recirculate position (latched in, indicator lamp on) the feed from fuse 31 can pass through the indicator bulb which illuminates and flows through the switch contacts. The switch is connected on a B wire, via headers C0725 and C0760 to earth header C0017 LHD/C0018 RHD.

The air mode motor is connected on an RG wire to a diode and from the diode to the switch on an RU wire. When the motor reaches the end of its operation to move the fresh/ recirculation air flap, an internal switch in the motor moves ready to accept a feed to move to the fresh air position. While the motor is operating it is connected through the switch on a B wire, via headers C0725 and C0760 to earth header C0017 LHD/C0018 RHD.

FUEL BURNING HEATER (FBH) - Td5 ONLY

DESCRIPTION

General

The FBH system is an optional auxiliary heating system that compensates for relatively low coolant temperatures inherent in Diesel engines. At low ambient temperatures, the FBH system heats the coolant supply to the heater matrix and maintains it at a temperature for good in-car heating performance. FBH operation is fully automatic with no driver intervention required.
The system comprises an air temperature sensor, FBH pump and the FBH unit. The FBH unit has diagnostic capabilities and can be interrogated by TestBook/T4.

OPERATION

FBH Supply

Circuit supply

A feed from the battery positive terminal is connected by an R wire to the engine compartment fusebox where it passes through fusible link 8 and fuse 9.
The feed from fusible link 8 is connected to the passenger compartment fusebox on an NW wire and from the fusebox to the ignition switch on an N wire.

Ignition switch supply

When the ignition switch is in position II, the feed from fusible link 8 flows through the ignition switch to the passenger compartment fusebox on a Y wire and passes through fuse 27.

FBH Operation

From fuse 27, the feed passes through header C0760 to the instrument pack on an LG wire. The feed passes through the ignition/no charge warning lamp and is connected, via header C0294 LHD/C0287 RHD to the alternator by a NY wire. With the engine not running, the feed from the ignition switch passes to earth through the alternator windings and illuminates the ignition/no charge warning lamp.
When the engine is running, the voltage produced by the alternator, passes on the NY wire to header C0294 LHD/C0287 RHD extinguishing the ignition/no charge warning lamp. Simultaneously, the feed from the alternator passes on a third NY wire from the header C0294 LHD/C0287 RHD to the FBH air temperature sensor.
At temperatures below 5 degrees C (41 degrees F), the sensor contacts are closed and connect the feed from the alternator to FBH unit, on an N wire from the sensor to header C0294 and an NY wire from header C0294 to the FBH unit.

A feed from fuse 9 in the engine compartment fusebox is connected on a PN wire to the FBH unit. When the FBH unit senses the voltage from the air temperature sensor, internal circuitry in the FBH unit allows the feed from fuse 9 to activate the FBH. The FBH unit is connected on a B wire to earth header C0018 LHD/C0017 RHD.
The FBH unit supplies a feed on a WU wire to the FBH pump. The feed operates the FBH pump which is connected on a B wire to earth eyelet connector C0810-1.
The FBH unit is connected on a R wire to the diagnostic socket. This allows the FBH to be interrogated by TestBook/T4 to retrieve FBH diagnostic information.

COOLING FAN

DESCRIPTION

General

The cooling fan is located on brackets forward of the radiator. The fan motor is operated by a cooling fan relay controlled by the Engine Control Module (ECM). The main relay supplies a feed to the coil of the cooling fan relay. A permanent feed is supplied to the coils of the main and cooling fan relays located in the engine compartment fusebox. On V8 models a coolant temperature sensor is located in the inlet manifold, on Td5 models the sensor is located in the outlet housing.
The ECM controls the operation of the main and cooling fan relays. At a preset temperature the ECM receives an input from a coolant temperature sensor above the values stored in the ECM. The ECM logic enables the earth path for the coil of the cooling fan relay. The fan motor then gets a feed from the closed contacts of the cooling fan relay.
When the engine temperature falls, the sensor gives an input below the values stored in the ECM. When the input from the coolant temperature sensor is low, the ECM interrupts the earth path to the coil of the cooling fan relay. The contacts of the cooling fan relay open, this action breaks the feed to the cooling fan motor, and the motor stops. The cycle will start again when the engine coolant temperature rises and the sensor sends a high input to the

ECM.
The ECM has an engine off function, when the ignition is turned off the ECM logic goes into a watchdog routine and monitors the coolant temperature for approximately seven to ten seconds. If the coolant temperature is still high, over 100 degrees C (212 degrees F) V8, 110 degrees C (230 degrees F) Td5, the ECM logic can control the operation of the fan motor. On V8 engines the ECM will only enable the fan if the inlet air temperature is over 60 degrees C (140 degrees F). The ECM will allow the fan to run for a maximum of ten minutes, however the ECM continues to monitor the coolant temperature. The ECM logic will stop the fan if the coolant temperature is below the acceptable values stored in the ECM. To prevent a flat battery, the fan will be stopped (regardless of coolant temperature) if the battery voltage falls to 12 V.

DESCRIPTION AND OPERATION

4.90 DISCOVERY SERIES II

OPERATION

Cooling Fan Supply

Circuit supply

A permanent feed from the battery positive terminal is connected by an R wire to the engine compartment fusebox. A feed from this wire is connected to the contacts of the main relay and also to fuse 13. The feed passes through fuse 13 and to the inertia switch on a NB wire. The feed from the inertia switch flows on a WG wire to the engine compartment fusebox and is connected to the coils of the main relay. in this condition the coil and contacts of the main relay receive a permanent supply.
The permanent feed from the battery on a R wire to the engine compartment fusebox is also connected via fusible link 1 to fuse 5. From fuse 5 the permanent feed is connected to the contacts on the cooling fan relay. In this condition the contacts of the fan relay receives a permanent feed from the battery via fuse 5.

Main relay - ignition supply

When the ignition switch is a position II, the ECM switches on the earth path for coil of the main relay. Current flows through the coil of the main relay and flows on a UR wire to pin C0635-23 V8/C0658-21 Td5 on the ECM. With the coil of the main relay energised the main relay contacts close, power is now available to the coil of the cooling fan relay, via the closed contacts of the main relay.

Cooling Fan Operation

V8 engine

The engine coolant temperature sensor sends an input on a G wire to pin C0636-22 on the ECM. The engine coolant temperature sensor is earthed on a RB wire to pin C0636-21 on the ECM.
When the coolant temperature is high, the value of input from the coolant temperature sensor causes the ECM logic to switch on the earth path for the coil of the cooling relay, on a GW wire to pin C0636-31 on the ECM. With the coil of the cooling relay earthed the coil is now energised. The cooling relay contacts close and current flows on a BN wire to the cooling fan motor.

DESCRIPTION AND OPERATION

DISCOVERY SERIES II **4.91**

Td5 engine

The engine coolant temperature sensor sends an input on a KG wire to pin C0158-7 on the ECM. The engine coolant temperature sensor is earthed on a KB wire to pin C0158-18 on the ECM.
When the coolant temperature is high, the value of input from the coolant temperature sensor causes the ECM logic to switch on the earth path for the coil of the cooling relay, on a BP wire to pin C0658-4 on the ECM. With the coil of the cooling relay earthed the coil is now energised. The cooling relay contacts close and current flows on a BN wire to the cooling fan motor.

All models

The current flows through the cooling fan motor to earth header C0018 on a B wire. The cooling fan motor will operate as long as the ECM receives a high signal input from the coolant temperature sensor. When the coolant temperature is low, the ECM logic interrupts the earth path to the coil of the cooling relay. The contacts of the cooling fan relay open, the fan motor power supply is now broken and the motor stops. The cooling fan will cycle on and off as the coolant temperature rises and falls.

HEATED REAR WINDOW (HRW)

DESCRIPTION

General

The HRW is operated from a non-latching switch located to the left of the instrument pack. The switch has an indicator light to show when the HRW is operating. The HRW element comprises fourteen metallic strips bonded to the inside surface of the rear window. The HRW will only function when the engine is running due to the high current draw and subsequent load on the battery.

The HRW can also be operated by the air temperature control ECU on vehicles fitted with air conditioning.

When the HRW is selected on, heater elements in the door mirror glass also operate. Refer to Mirrors - Description and Operation in this manual for details.

OPERATION

Heated Rear Window Supply

Circuit supply

A feed from the battery positive terminal is connected by an R wire to the engine compartment fusebox, where it passes through fusible links 1, 6, 8 and fuse 13. Fusible links 1 and 6 are connected in series.

A feed from fusible links 1 and 6 is connected from the engine compartment fusebox to the passenger compartment fusebox on an S wire, where it passes through fuse 8 and is connected to the contacts of the heated rear screen relay.

A feed from fuse 13 in the engine compartment fusebox is connected on a PN wire to the Body Control Unit (BCU).

A second feed from fuse 13 is connected on a PN wire to the passenger compartment fusebox and is connected to the coil of the heated rear screen relay.

A feed from fusible link 8 in the engine compartment fusebox is connected on an NW wire to the passenger compartment fusebox and from the fusebox to the ignition switch on an N wire.

Ignition switch supply

When the ignition switch is in position II, the feed from fusible link 8 flows through the ignition switch to the passenger compartment fusebox on a Y wire. The feed continues through fuse 29 in the passenger compartment fusebox and is connected to the BCU on a GU wire.

Heated Rear Window Switch Operation

When the HRW switch is operated, an earth path is completed from the HRW switch to earth header C0017 LHD/C0018 RHD on a B wire, via header C0760.

The completion of the earth path from the HRW switch, completes an earth path from the BCU to the switch on an NB wire. The earth path completes a circuit within the BCU for an internal electronic switch which receives its feed from fuse 29 in the passenger compartment fusebox.

The internal switch closes, completing a circuit which allows the feed from fuse 13 to flow through the internal switch, then to the HRW switch on an NP wire. The feed illuminates the HRW switch indicator light and is earthed from the switch to earth header C0017 LHD/C0018 RHD on a B wire, via header C0760.

The feed from fuse 29 is connected to a second internal switch within the BCU. When the HRW switch is operated, the completed earth path closes the internal switch. This completes an earth path from the coil of the heated rear screen relay, through the Intelligent Driver's Module (IDM) and from the passenger compartment fusebox to the BCU on an SK wire, via header C0293 LHD/C0292 RHD. This connection is the serial data bus between the IDM and the BCU.

The BCU earth is connected from the BCU to earth header C0551 on a B wire. The IDM is also connected to earth header C0551 on a B wire from the passenger compartment fusebox.

The completed earth path energises the heated rear screen relay, closing the contacts and allowing the feed from fuse 8 in the passenger compartment fusebox to flow through the contacts.

The feed flows from the passenger compartment fusebox to the rear screen heater element

on an NP wire.
The rear screen heater element is connected to earth header C0706 on a B wire.< /PARA>
The momentary operation of the non-latching HRW switch, signals internal electronic switches within the BCU to close. Internal circuitry within the BCU holds the switches closed for a pre-determined period or until the HRW switch is pushed a second time.

Air Temperature Control (ATC) ECU Operation

On vehicles fitted with air conditioning, the HRW can be operated when 'DEF', 'feet/screen' or 'screen' is selected on the ATC control panel.
When one of the above selections is made, the ATC ECU provides a feed to the HRW switch into the NP wire from the BCU to the HRW switch. This illuminates the switch indicator light. Simultaneously, the ATC ECU also provides an earth path into the NB wire from the BCU to the HRW switch. This earth path allows the internal electronic switches within the BCU to close, powering the rear screen heater element as described previously.

HEATED FRONT SCREEN (HFS)

DESCRIPTION

General

The heated front screen (HFS) is operated from a non-latching switch located to the left of the instrument pack. The switch has an indicator light to show when the HFS is operating.
The HFS comprises two elements laminated in the screen, each element being controlled by a separate fuse. The HFS will only function with the engine running, due to the high current draw and subsequent load on the battery.
The HFS can also be operated by the air temperature control ECU on vehicles fitted with air conditioning.

OPERATION

Heated Front Screen Supply

Circuit supply

A feed from the battery positive terminal is connected by an R wire to the engine compartment fusebox, where it passes through fusible links 1, 7, 8 and fuse 13. Fusible links 1 and 7 are connected in series.
A feed from fusible link 1 is connected to the contacts of the heated front screen relay in the engine compartment fusebox.
A feed from fusible links 1 and 7 is connected to the contacts of the auxiliary circuits relay in the engine compartment fusebox.
A feed from fuse 13 is connected from the engine compartment fusebox to the Body Control Unit (BCU) on a PN wire.
A feed from fusible link 8 in the engine compartment fusebox is connected on an NW wire to the passenger compartment fusebox and from the fusebox to the ignition switch on an N wire.

Ignition switch supply

When the ignition switch is in position I or II, the feed from fusible link 8 flows through the ignition switch to the passenger compartment fusebox on an LGW wire. The feed continues through fuse 26 in the passenger compartment fusebox and is connected on an LG wire to the coil of the auxiliary circuits relay in the engine compartment fusebox.

In this condition, the auxiliary circuits relay coil is energised and the contacts close. The relay coil is earthed to earth header C0018 on a B wire from the engine compartment fusebox, via header C0286 LHD/C0288 RHD.
When the ignition switch is in position II, the feed from fusible link 8 flows through the ignition switch to the passenger compartment fusebox on a Y wire. The feed continues through fuse 29 in the passenger compartment fusebox and is connected to the BCU on a GU wire.

Heated Front Screen Operation

When the HFS switch is operated, an earth path is completed from the HFS switch to earth header C0017 LHD/C0018 RHD on a B wire, via header C0760.
The completion of the earth path from the HFS switch, completes an earth path from the

BCU to the switch on a KO wire. The earth path completes a circuit within the BCU for an internal electronic switch which receives its feed from fuse 29.
The internal switch closes, completing a circuit which allows the feed from fuse 13 to flow through the internal switch, then to the HFS switch on a PS wire. The feed illuminates the HFS switch indicator light and is earthed from the switch to earth header C0017 LHD/C0018 RHD on a B wire, via header C0760.
The feed from fuse 29 is connected to a second internal switch within the BCU. When the HFS switch is operated, the completed earth path closes the internal switch. This completes the connection from the heated screen relay coil to the BCU on a KN wire. The earth path from the BCU is on a B wire to earth header C0551.
The completed earth path energises the heated screen relay, closing the relay contacts, allowing the feed from fusible link 1 to flow through the relay contacts to fuses 7 and 8.
The feed from fuse 7 is connected to the LH front screen element on a PS wire. The LH front screen element is connected to earth header C0018 LHD/C0017 RHD on a B wire.
The feed from fuse 8 is connected to the RH front screen element on a PK wire. The RH front screen element is connected to earth header C0017 LHD/C0018 RHD on a B wire.
The momentary operation of the non-latching HFS switch, signals internal switches in the BCU to close. Electronics within the BCU holds the switches closed for a pre-determined period or until the HFS switch is pushed a second time.

DESCRIPTION AND OPERATION

Air Temperature Control (ATC) ECU operation

On vehicles fitted with air conditioning, the HFS can be operated when 'DEF', 'feet/screen' or 'screen' is selected on the ATC control panel.
When one of the above selections is made, the ATC ECU provides a feed to the HFS switch into the PS wire from the BCU to the switch. This illuminates the HFS switch indicator light.
Simultaneously, the ATC ECU also provides an earth path into the KO wire from the BCU to the HFS switch. This earth path allows the internal electronic switches within the BCU to close, powering the front screen elements as described previously.