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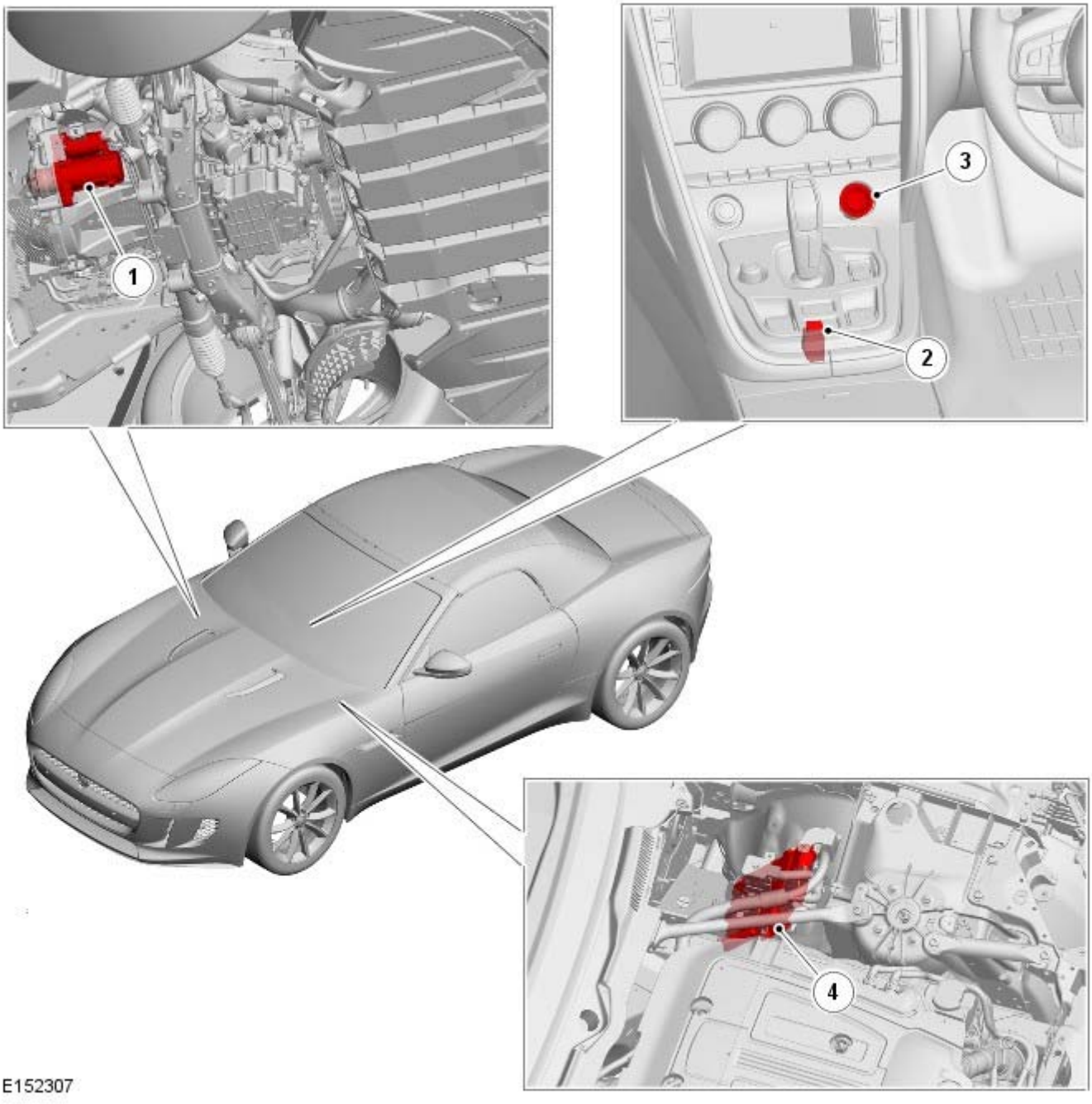
Starting System - V6 S/C 3.0L Petrol - Starting System

Description and Operation

COMPONENT LOCATION

NOTE: AT (Automatic Transmission) variant shown, MT (Manual Transmission) variant is similar.



Item	Description
1	Starter motor
2	Auto stop/start / Deployable spoiler switchpack
3	Stop/start switch
4	Engine Control Module (ECM)

OVERVIEW

The starter motor is manufactured by Denso and is rated at 2.0 kW. The motor is geared directly to the pinion. The motor is a series wound motor with an overrunning clutch. The interior of the motor is ventilated through a breather tube attached to the underside of the motor housing.

The V6 3.0L S/C Petrol engine features Auto stop/start technology in some markets. The auto stop/start system automatically stops and re-starts the engine when appropriate conditions are met. This reduces the amount of time the engine is running at idle speed which improves economy and reduces engine emissions. This provides advantages for vehicles which spend time in congested environments, for example waiting at traffic lights or frequent stopping and starting in traffic queues.

The advantages of the Auto stop/start system are:

- Carbon Dioxide (CO2) emissions significantly reduced
- Fuel consumption improved.

NOTE: Fuel economy and emissions reduction will vary depending on driving style and traffic conditions.

The Auto stop/start system is automatically activated each time an ignition cycle occurs and is operational in 'DRIVE' and 'SPORT' transmission positions. The driver can disable the system by pressing the Auto stop/start switch in the floor console.

The Auto stop/start system stops the engine when it is not needed, this is known as auto stop. The engine will restart automatically when vehicle parameters are met and the driver removes their foot from the brake pedal, this is known as auto start. The engine will be at full operating speed before the driver's foot reaches the accelerator pedal.

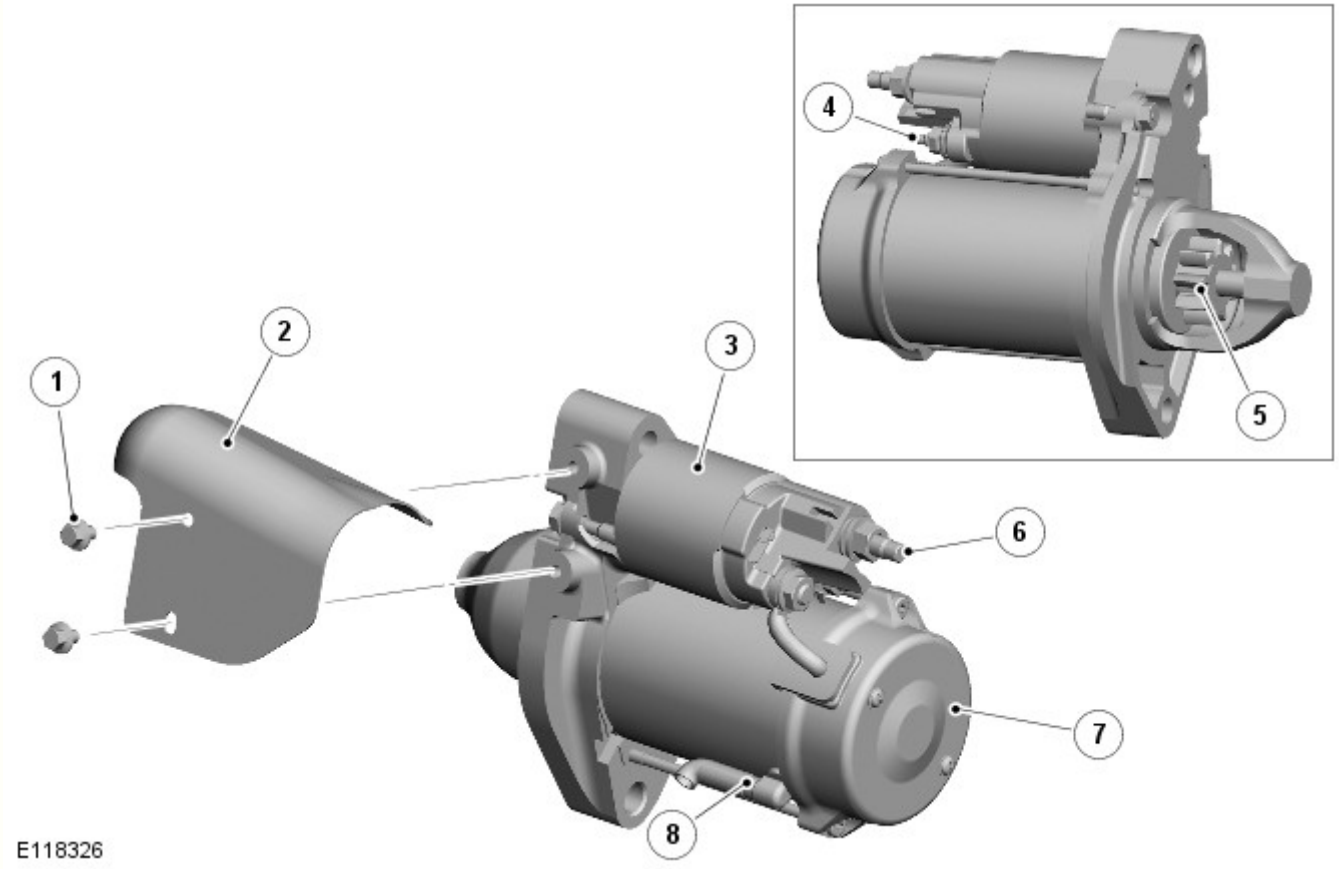
The Auto stop/start system is fully integrated into the vehicle electrical systems and other system modules communicate to determine if an auto stop or start is viable.

The Auto stop/start system uses a VQM (Voltage Quality Module), to ensure sufficient battery power is available for repeated engine starts without affecting the operation of the vehicle systems.
For additional information, refer to: Battery and Cables (414-01 Battery, Mounting and Cables, Description and Operation).

DESCRIPTION

STARTER MOTOR

NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

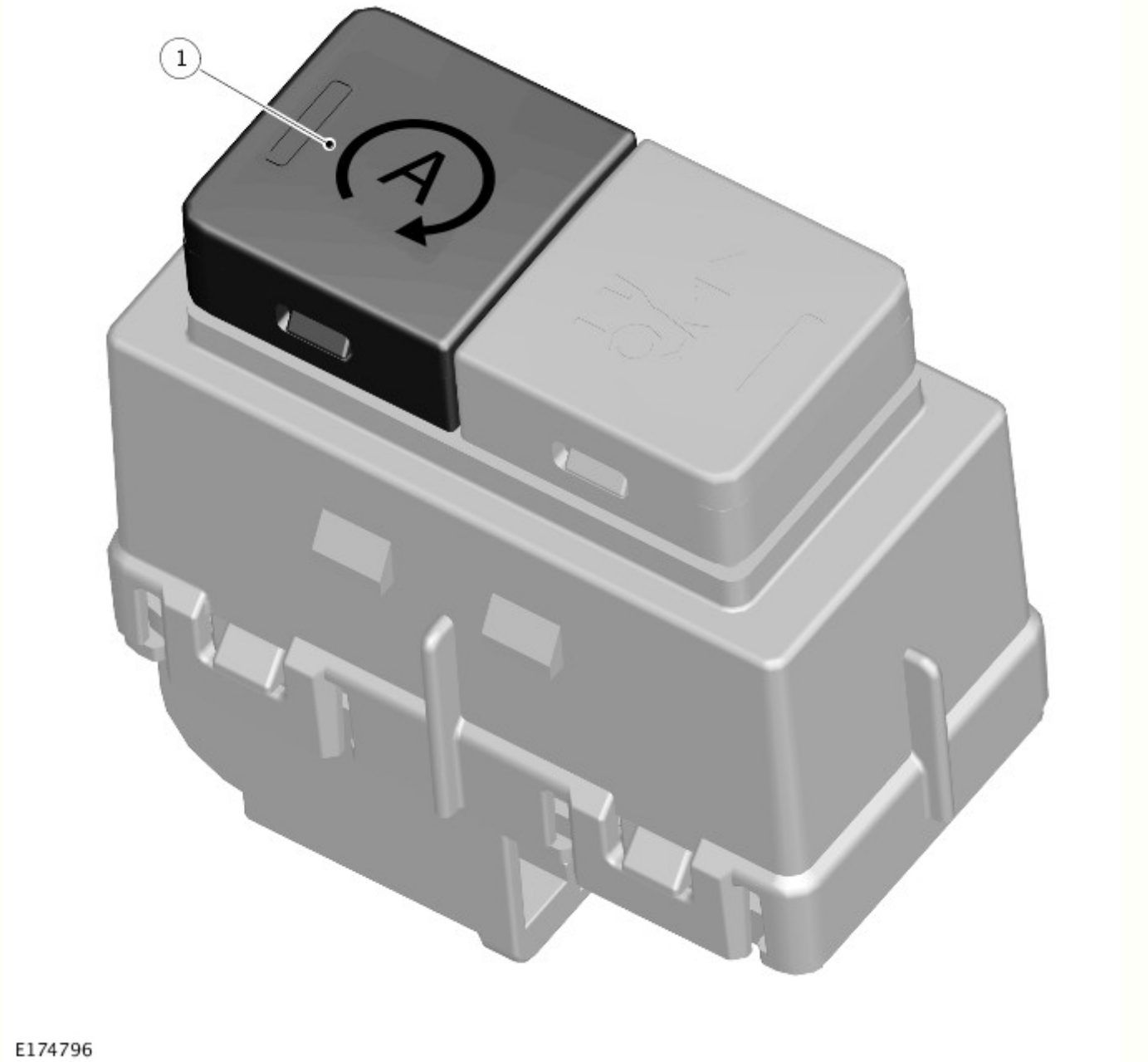


Item	Description
1	Bolt (2 of)
2	Heatshield
3	Starter motor solenoid
4	Starter solenoid electrical connection

6	Battery electrical connection
7	Starter motor
8	Breather tube

The starter motor is located on the rear right side of the cylinder block and protrudes through an aperture to drive the drive plate via a ring gear. The motor is secured to the cylinder block by 2 bolts. Power to operate the motor is supplied from BJB (Battery Junction Box). Power to operate the solenoid is supplied from the starter motor relay in the left EJB (Engine Junction Box).

AUTO STOP/START SWITCH



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Item	Description
1	Auto stop/start switch

On vehicles with Auto stop/start system, the Auto stop/start switch is located in the floor console. An amber LED (Light Emitting Diode) in the Auto stop/start switch remains illuminated while the auto stop/start system is active. Selection of the Auto stop/start switch is transmitted from the JDS (JaguarDrive Switchpack) to the GWM (Gateway Module) via the HS (High Speed) CAN (Controller Area Network) chassis systems bus. The GWM then transmits this message to the ECM on the HS CAN powertrain systems bus.

AUTO STOP/START WARNING INDICATOR

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On vehicles with Auto stop/start system, an Auto Stop/start warning indicator is located in the IC (Instrument Cluster). The warning indicator illuminates green when the engine stops during a stop/start cycle, then goes off when the engine restarts. The warning indicator illuminates amber when the Auto stop/start system is disabled. The warning indicator is controlled by a HS CAN powertrain systems bus message from the ECM.

OPERATION

OPERATION - VEHICLES WITHOUT STOP/START SYSTEM

When the Auto stop/start switch is pressed, if the KVM (Keyless Vehicle Module) detects a valid smart key in the vehicle the CJB (Central Junction Box) transmits a hardwired crank request to the ECM.
For additional information, refer to: Anti-Theft - Passive (419-01B Anti-Theft - Passive, Description and Operation).

The ECM energizes the starter motor relay, when:

- it receives a crank request from the CJB
- the brake pedal is pressed
- the TCS (Transmission Control Switch) is in 'P' (Park) or 'N' (Neutral) - on vehicles with AT (Automatic Transmission)
- it receives a 'N' (Neutral) signal from the gear selector position sensor - on vehicles with MT (Manual Transmission).

The energized starter relay supplies battery power to the starter solenoid, which energizes and causes the pinion gear to engage with the ring gear. When the starter solenoid is energized it also closes high-current contacts, which connects battery power from the BJB to the motor to turn the engine.

OPERATION - VEHICLES WITH STOP/START SYSTEM

At the beginning of a drive cycle, when the Stop/start switch is operated, the Auto stop/start system operates in the same way as on vehicles without stop/start.

The Auto stop/start system is controlled by the ECM and the GWM (Gateway Module) via HS CAN powertrain systems bus messages and signals from other system components and modules to determine the correct conditions for system operation. The Auto stop/start system detects when it is appropriate to stop and start the engine.

Before the engine is stopped the following parameters must be detected:

- The vehicle must be stopped from a speed greater than 4 km/h (2.5 mph)
- Sufficient brake pressure must be applied to the brake pedal to ensure the vehicle is stationary
  - OR
- The vehicle must be stationary and 'P' or 'N' selected on the TCS (AT equipped vehicles)
- The vehicle must be stationary and 'N' selected on the MT.

Before the engine is restarted, the following parameters must be detected:

- The accelerator pedal is pressed (ECM detects a signal from the APP (Accelerator Pedal Position) sensor)
- The vehicle speed exceeds approximately 1 km/h (0.5 mph)
- Climate control system demand increases (signal from the ATCM (Automatic Temperature Control Module))
- Brake vacuum has been reduced from repeated use of brake pedal with engine not running (detected by ECM from the brake vacuum sensor)
- Battery charge becomes low
- Auto stop/start is deactivated using the Auto stop/start switch in the floor console.
- A steering wheel paddle switch is operated to select a gear
- 'D' (Drive) or 'S' (Sport) selected on the TCS and the brake pedal is released

The following conditions will prevent an Auto stop:

- The external ambient temperature is less than 0°C (32°F) (detected by the ECM via the AAT (Ambient Air Temperature) sensor)
- The external ambient temperature is more than 40°C (104°F) (detected by the ECM via the AAT sensor)
- The engine has not reached its optimum operating temperature (detected by the ECM via the ECT (Engine Coolant Temperature) sensor)
- The driver door is opened (detected by the CJB from the door ajar switch)
- The driver safety belt is not fastened (detected by the RCM (Restraints Control Module) from the driver seatbelt buckle switch)
- The climate control system requires the engine to be running, for example; windshield demist selected
- The battery charge is low (signal from the GWM)
- The hood is open (detected by the CJB from the hood ajar switch)
- Auto stop/start is deactivated using the Auto stop/start switch in the floor console.
- A steering wheel paddle switch has been used to select a gear (vehicles with AT)

STOP/START STRATEGY

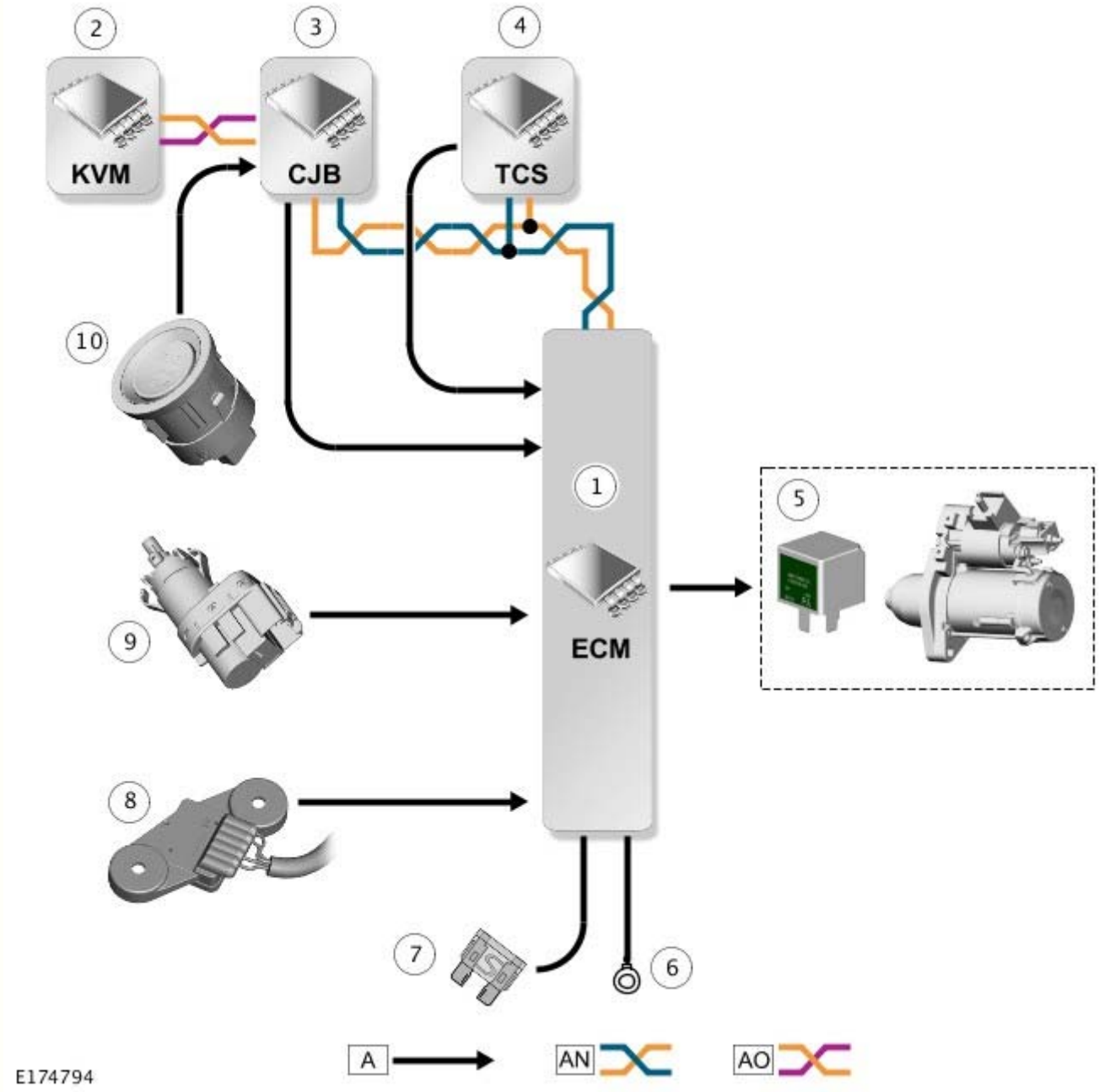
Engine Speed above 330 RPM:

When the engine speed is above 330 RPM, and an ECO stop is initiated, the restarting of the engine is controlled by the ECM. The ECM activates the fuelling and engine systems only.

Engine Speed below 330 RPM:

When the engine speed is below 330 RPM, and an ECO stop is initiated, the restarting of the engine is controlled via the starter motor. The starter motor has the capability of engaging with the transmission ring gear whilst still rotating. When the starter motor rotates the engine speed up to 330 RPM, the ECM then activates the fuelling and engine systems to restart the engine.

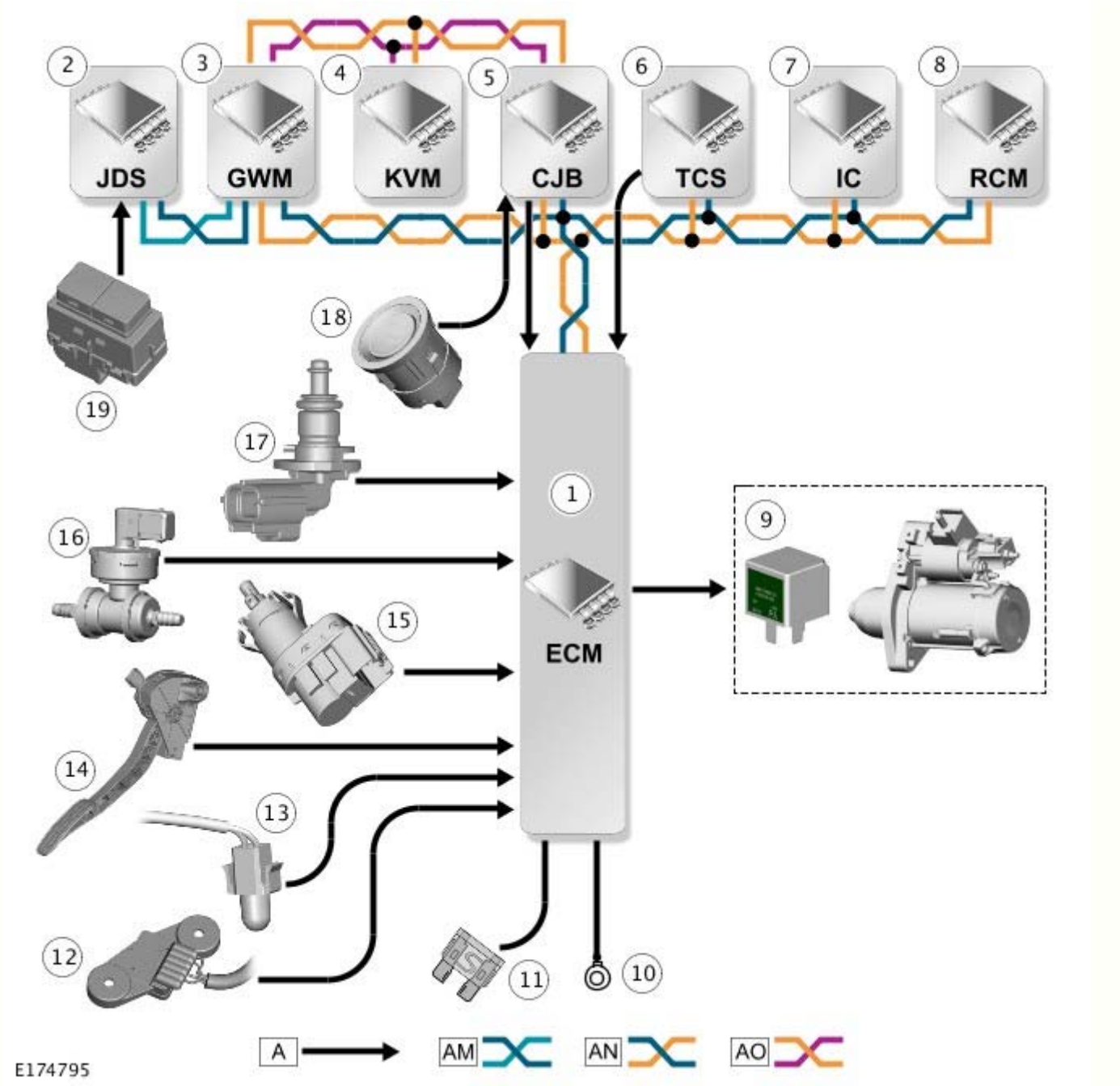
INPUT/OUTPUT DIAGRAM - SHEET 1 OF 2 - VEHICLES WITHOUT STOP/START



A = Hardwired; AN = HS (High Speed) CAN (Controller Area Network) powertrain systems bus; AO = MS (Medium Speed) CAN body systems bus.

Item	Description
1	Engine Control Module (ECM)
2	Keyless Vehicle Module (KVM)
3	Central Junction Box (CJB)
4	Park/Neutral signal - Transmission Control Switch (TCS) - vehicles with Automatic Transmission (AT)
5	Starter motor
6	Ground
7	Power supply - left Engine Junction Box (EJB)
8	Neutral signal - Gear selector position sensor - vehicles with Manual Transmission (MT)
9	Brake pedal switch
10	Stop/start switch

INPUT/OUTPUT DIAGRAM - SHEET 2 OF 2 - VEHICLES WITH STOP/START



A = Hardwired; AM = HS (High Speed) CAN (Controller Area Network) chassis systems bus; AN = HS CAN powertrain systems bus; AO = MS (Medium Speed) CAN body systems bus.

Item	Description
1	Engine Control Module (ECM)
2	JaguarDrive Switchpack (JDS)
3	Gateway Module (GWM)
4	Keyless Vehicle Module (KVM)
5	Central Junction Box (CJB)
6	Park/Neutral signal - Transmission Control Switch (TCS) - vehicles with Automatic Transmission (AT)
7	Instrument Cluster (IC)
8	Restraints Control Module (RCM)
9	Starter motor
10	Ground
11	Power supply - left Engine Junction Box (EJB)
12	Neutral signal - Gear selector position sensor - vehicles with Manual Transmission (MT)
13	Ambient Air Temperature (AAT) sensor
14	Accelerator pedal position sensor
15	Throttle body
16	Evaporative emission (EVAP) canister purge valve
17	Electronic Variable Camshaft Timing (EVCT) solenoid
18	Ignition switch
19	Immobilizer control unit

15	Brake pedal switch
16	Brake vacuum sensor
17	Engine Coolant Temperature (ECT) sensor
18	Stop/start switch
19	Auto stop/start / Deployable spoiler switchpack