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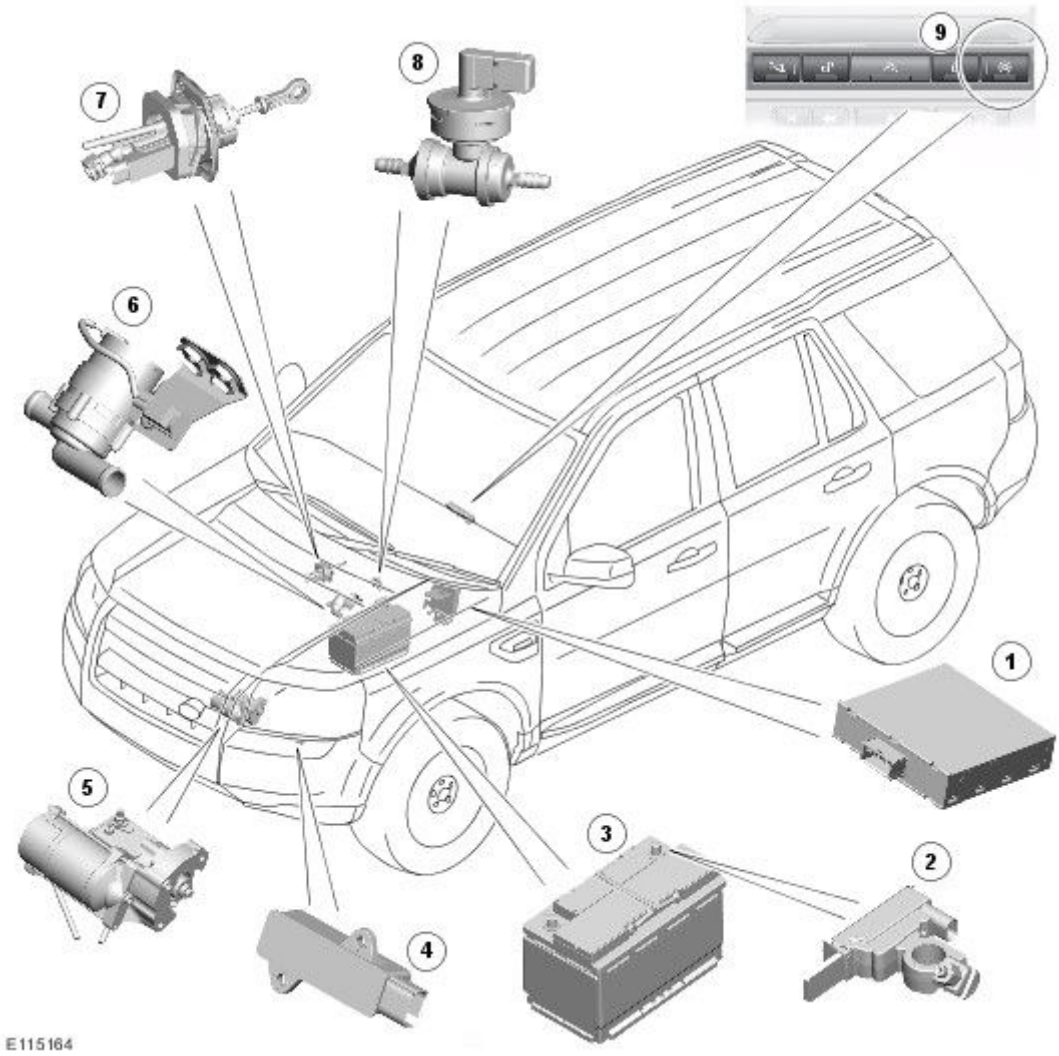
Starting System

STOP/START SYSTEM

COMPONENT LOCATION



Item	Part Number	Description
1		Voltage quality module
2		Battery monitoring system module
3		Absorption glass mat battery
4		Gear neutral sensor
5		Starter motor
6		Auxiliary coolant pump
7		Linear clutch sensor
8		Brake vacuum sensor
9		Stop/Start switch

OVERVIEW

The TD4_e introduces the first intelligent ‘Stop/Start’ system into a Land Rover vehicle. The system automatically shuts down and restarts the vehicle’s engine when the appropriate conditions are satisfied. This reduces the amount

of time the engine spends idling, thereby improving fuel economy and reducing emissions. This is advantageous for vehicles which spend significant amounts of time in congested traffic, for example:

- waiting at traffic lights,
- frequently coming to a halt in traffic jams.

Gains from this technology in comparison to a previous TD4 vehicle without Stop/Start, and based on a legally defined ‘European Drive Cycle’ are typically in the range of:

- CO emissions, reduced by almost 8 percent over the standard EU4 drive cycle, this equates to a reduction of 15g/km.
- Fuel consumption, improved by 3.8 miles per gallon; or 0.6 liters for every 62 miles / 100 kilometers.

NOTE:

Fuel economy and emission reduction will vary on driving style and traffic congestion.

Introduced as standard in the diesel vehicle with manual transmission, the Stop/Start system is automatically activated each time an ignition cycle occurs. However, the driver can deactivate the system by pressing the ‘Eco’ switch in the fascia.

Eco Stop/Start Switch

NOTE:

In addition to the Stop/Start system the ‘Eco’ switch also operates the Gear Shift Indicator system.

For additional information, refer to Instrument Cluster (413-01 Instrument Cluster)

The LED tell-tale light in the Eco switch is illuminated to inform the driver that the Stop/Start system is functioning correctly. The tell-tale light will extinguish if:

- The driver switches off the Stop/Start system.
- Either HDC (hill decent control) or TR (terrain response) is active.
- There is a system fault; for additional information, refer to the System Fault section below.

New software added to the controls the operation of the Stop/Start system where in addition to its own dedicated components the Stop/Start system encompasses many other vehicle systems. Complex technology interconnects these systems and ensures all the necessary conditions are satisfied by monitoring, among others:

- position of the clutch pedal,
- gear selector position
- road speed
- state of vital vehicle systems
- environmental conditions.

If all necessary conditions are satisfied the Stop/Start system will automatically stop the engine if:

- the vehicle is stationary,
- the transmission is in neutral,
- the clutch pedal is fully released.

The driver will be notified that the engine is shutdown by the ‘Eco’ icon being illuminated in the instrument cluster. Other warnings normally associated with an engine shutdown, for example the ignition and low oil pressure indicators are suppressed so will not illuminate during an engine shutdown in a Stop/Start cycle.

Eco Stop/Start Indicator

The engine will automatically restart when the driver depresses the clutch, ready for a gear to be selected. The ‘Eco’ icon in the instrument cluster will extinguish at this point.

If system conditions are not approved by the ECM the Stop/Start system will not behave as expected, examples of this are:

- System inhibit: the engine will continue running even though the vehicle is stationary with the transmission in neutral and the clutch pedal fully released.
- System override: the engine has been stopped by the Stop/Start system but conditions have since changed, this will activate an early automatic engine restart.

These interventions are to ensure the Stop/Start system does not impact on:

- vehicle and occupant safety,
- driver requirements,
- occupant comfort,
- vehicle ‘on-road’ and ‘off-road’ capabilities.

Although the main control logic for Stop/Start operation resides in the ECM; the has also been upgraded with new software to communicate engine shutdown inhibits to the ECM. In some instances, depending on the reason for the system intervention the driver will be notified via the message Center the reason for the intervention. For additional information, refer to message Center table below.

System conditions that influence the operation of the Stop/Start system are discussed further in the ‘Stop Inhibitors, Start Initiators and Start Inhibitors’ section, below.

WARNING: To avoid injury when performing repair work on the vehicle always disable the Stop/Start system by pressing the ‘ECO’ button, ensure that ‘ECO STOP/START OFF’ is displayed in the message Center and the ECO tell-tale light in the switch is extinguished.

MESSAGE CENTER

A number of driver information messages have been introduced to inform the driver of the Stop/Start system’s status of operation.

The instrument cluster receives message Center data from the ECM via the CJB over the medium speed bus. The CJB generates this data based on medium and high speed CAN bus inputs and hardwired inputs received from various system control modules. Software contained within the instrument cluster converts the data from the CJB into display messages for the driver.

Stop/Start Messages

Message	Other Warnings	Reason	Action
ECO STOP/START ON	Tell-tale light in the Eco switch illuminated.	The system has been switched off and then later switched on within the same ignition cycle.	If required, press the Eco switch to deactivate the Stop/Start system.
ECO STOP/START OFF	Tell-tale light in the Eco switch extinguished.	The Eco switch has been pressed.	If required, press the Eco switch to reactivate the Stop/Start system.
ECO STOP/START UNAVAILABLE	Tell-tale light in the Eco switch extinguished.	Either, HDC (hill decent control) or TR (terrain response) is active.	Deselect HDC or TR if terrain conditions permit.
SELECT NEUTRAL TO RESTART	None	The engine has been shutdown in a Stop/Start cycle and the driver has engaged a gear without depressing the clutch.	Depress clutch and select neutral.
RESTART REQUIRED PRESS CLUTCH	None	When an engine restart is required in a Stop/Start cycle but the driver's location is unknown. Either the driver's door or safety belt is unlatched.	Depress clutch.
ECO STOP/START FAULT	Tell-tale light in the Eco switch extinguished.	Stop/Start not available due to system or sub-system failure.	Connect Land Rover approved diagnostic equipment to diagnose fault.

NOTE:

'SELECT NEUTRAL TO RESTART' can appear if the driver is resting their hand on the gear lever with enough pressure to move the transmission out of the neutral window without engaging a gear.

NOTE:

If after an unsuccessful automatic restart the driver is requested to restart the engine for example, by depressing the clutch. This action has to be completed within 50 seconds, otherwise the Stop/Start system will deactivate and a conventional start will be required.

REFINEMENT AND DURABILITY

Engine operating refinement has been maintained and in some cases refined to ensure the vehicle's occupants witness an almost seamless operation with regard to engine shutdown and restart within a Stop/Start cycle.

To reduce engine shake when the engine is shutting-down a revised throttle closing strategy is introduced, which ramps down the fuel injection in a more smooth and controlled manner. At the same time the generator is turned-off to reduce load on the engine.

ECM software changes and revised engine calibration further aid a smoother engine shutdown. Furthermore the optimized engine mounting strategy and tuning assists in reducing engine shake on engine start-up.

Components directly involved with engine start-up and shut-down have been either upgraded or replaced to withstand the increased frequency of Stop/Start cycles over the lifetime of the vehicle. These enhanced and more robust components are discussed in this section.

 **CAUTION: To maintain the correct operation of the Stop/Start system care must be taken when replacing components, that only approved parts are fitted as some components from earlier vehicles will fit the TD4_e.**

Starter Motor

To improve durability due to the increased start-demands on the starter motor a number of improvements have been made:

- Grease seals have been upgraded.
- A hard wearing copper-tungsten contact material has been introduced to improve wear resistance within the starter solenoid.
- The pinion gear is manufactured from a harder grade of steel.

Flywheel Ring Gear

Due to the increased start-demands, the flywheel ring gear is manufactured from a harder grade of steel with 25% more carbon content which increases its durability.

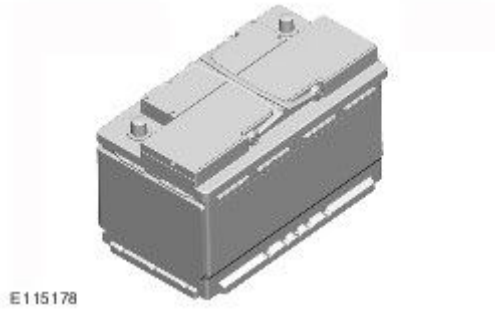
Dual Mass Flywheel

As with previous diesel powered vehicles a dual-mass flywheel is fitted to ensure refinement when the engine is being either started, stopped or running at low speeds.

To provide an even greater level of refinement due to the increased start and stop demands, a new friction disc has been developed for the TD4_e dual-mass flywheel. The new friction disc which is able to withstand seven-times the pressure of a standard disc is manufactured from polyetheretherketone also known as PEEK.

PEEK is a semi-crystalline thermoplastic, which is resistant to both organic and aqueous environments. It has a high-melting point making it resistant to thermal degradation. It is also one of the few plastics compatible with ultra-high vacuum applications and is typically used in bearings, piston parts and pumps.

Absorption Glass Mat Battery



Conventional batteries lose their capacity to hold charge overtime as their internal lead plates steadily deteriorate with the continual vibration and erosion that occurs with normal use. The rate of deterioration depends on a number of factors, including charge and discharge cycling rates. Therefore the extreme power consumption of a Stop/Start system would have a detrimental effect on the life-span of this type of battery.

To counteract the deeper discharge and recharge cycles of a Stop/Start system, a high-performance battery based on Absorption Glass Mat technology has been developed to reduce battery deterioration caused by excessive usage. The battery owes its success to the ‘absorbent glass mat’ which is a fine fibreglass mat compressed between the lead plates. The ‘absorbent glass mat’ also absorbs the battery acid, enabling a more efficient use of the cell’s volume.

While the ‘absorbent glass mat’ permits the electrolyte to function normally, it also provides mechanical support for the lead plates, therefore reducing vibration and subsequent degradation. This technology substantially increases the effective charge and discharge life of the battery. The battery also has an extremely low internal resistance, resulting

in a quicker reaction between acid and plate material.

Absorption glass mat battery technology offers several advantages:

- The battery remains completely spill and leak proof due to the absorption of the fibreglass mat.
- In freezing conditions, expanding fluid is unable to cause any damage as the plates are packed in fibreglass mats; consequently there is virtually no plate movement.
- Vibration or shock does not damage the battery.
- As electrolyte is contained through the acid in the mat, there is no need for battery maintenance.

The battery's capacity is 80Ah, meaning the battery is theoretically capable of supplying an 80 amp current for one hour. A typical engine restart will draw a very high current for a fraction of a second, so will have very little impact on the battery's total state of charge. An engine restart may typically consume about 0.001% of a new battery's full-charge capacity.

If a new battery is fitted to the vehicle, the BMS (battery monitoring system) module will require recalibrating to register the greater charge holding capacity of the battery, this is performed using Land Rover approved diagnostic equipment. If diagnostic equipment is not available the BMS module will recalibrate automatically however, this could take 48 hours to complete depending on vehicle usage. The Stop/Start system will not function correctly until the BMS module is recalibrated.

If the BMS module is replaced the module will recalibrate automatically; for additional information refer to the Battery Monitoring System section, below.

CONTROL DIAGRAM

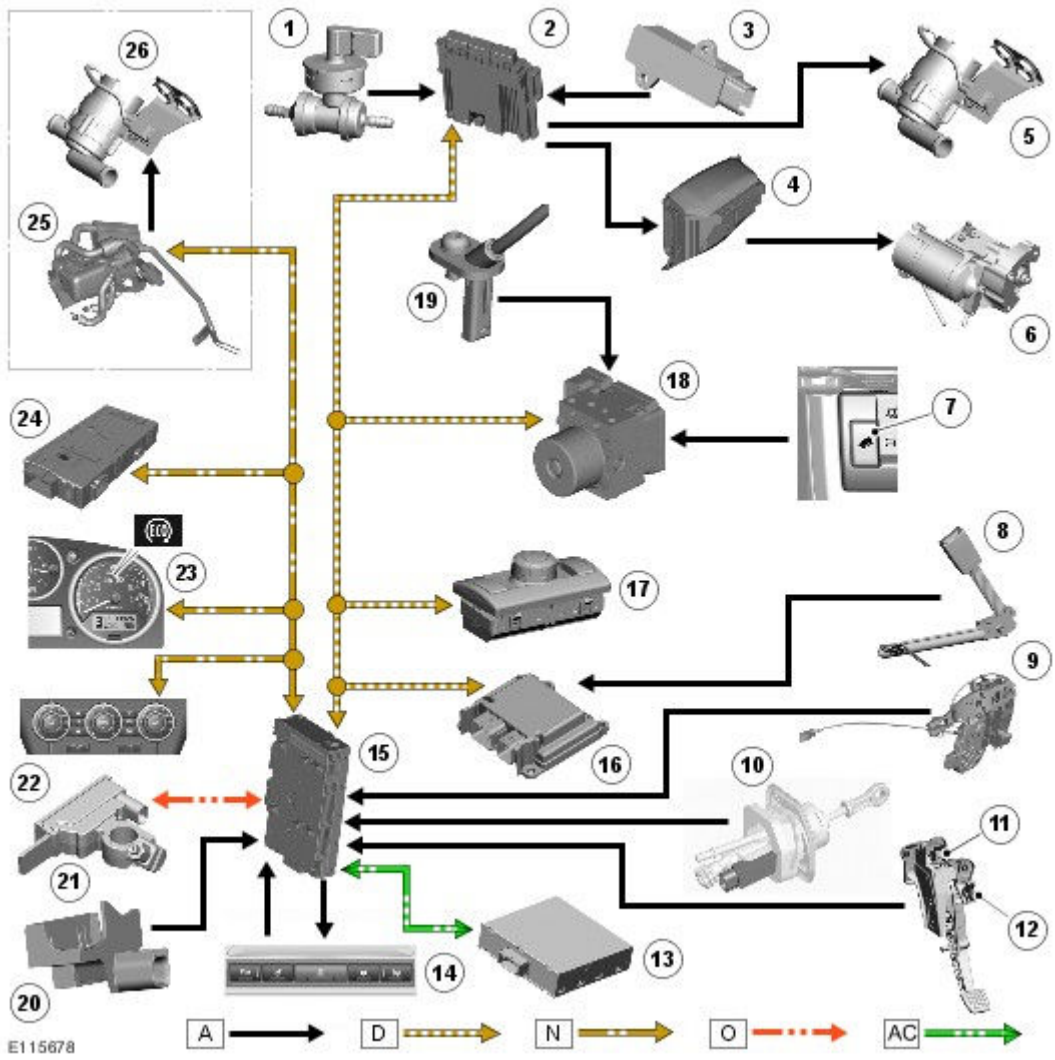
New software added to the controls the operation of the Stop/Start system where in addition to its own dedicated components the Stop/Start system encompasses many other vehicle systems. Complex technology interconnects these systems and many of the inputs associated with the Stop/Start system are relayed to the ECM and transmitted via the , which has also been upgraded with new software. The control logic for inhibiting an engine shutdown during a Start/Stop cycle resides in the CJB. The CJB also acts as a gateway relaying this information to the ECM over the medium and high-speed CAN bus networks.

Eight vehicle harnesses have been modified to accommodate the Stop/Start system.

Stop/Start Control Diagram

NOTE:

A = Hardwired; **D** = High Speed CAN bus; **N** = Medium Speed CAN bus; **O** = LIN bus; **AC** = Diagnostic Link.



Item	Part Number	Description
1		Brake vacuum sensor
2		Engine control module
3		Gear neutral sensor
4		Battery junction box
5		Auxiliary coolant pump*
6		Starter motor
7		Hill decent control switch
8		Driver’s safety-belt buckle-switch
9		Driver’s door ajar-switch
10		Linear clutch switch
11		Clutch pedal top-of-travel switch
12		Clutch pedal bottom-of-travel switch
13		Voltage quality module
14		Stop/Start switch and status LED
15		Central junction box
16		Restraints control module
17		Terrain response control module
18		ABS (anti-lock brake system) module
19		Wheel speed sensor
20		Hood latch ajar switch

21		Battery monitoring system module
22		Automatic temperature control module
23		Instrument cluster
24		Trailer module
25		Fuel fired heater (if fitted)
26		Auxiliary coolant pump **

* Vehicles without fuel fired heater.

** Vehicles with fuel fired heater.

INTELLIGENT TECHNOLOGY

New and revised components as discussed in this section have been developed to ensure that all vehicle systems operate virtually uninterrupted in a Stop/Start cycle.

Voltage Quality Module

During an engine Stop/Start cycle the VQM (voltage quality module) maintains the vehicle’s electrical systems by supplying a support voltage around the vehicle's electronic components during an engine restart. This allows crucial vehicle systems to continue uninterrupted when there is a sudden draw of amps from the battery.

The vehicle’s starter motor consumes 2kW of electrical power and can draw several hundred amps of current from the battery during cranking. This sudden draw of current causes a momentary voltage drop around all the vehicle circuits. Many of the vehicle's electronic systems are designed to operate at a nominal 12 volts, so this sudden drop in battery voltage without the VQM installed would temporarily interrupt services such as:

- audio system
- cellular phone
- navigation system
- message Center.

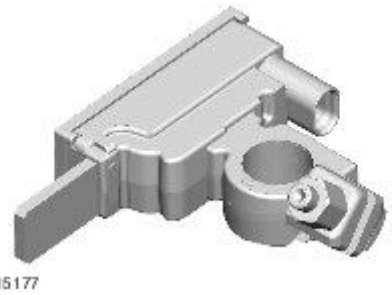
Once the engine is running a signal from the ECM triggers a relay within the VQM to bypass the converter stage and voltage control is given back to the vehicle's normal charging system. The VQM is specified to boost voltage for one second, although in many situations it can supply a voltage boost for up to 5 seconds.

The VQM is effectively a converter, which converts a variable DC input voltage from as low as 6V up to a stable 12V DC output ± 0.5V.

Rated at a nominal 180W, it can supply up to 15 amps of load at 12 volts. The VQM can tolerate instantaneous spikes up to 300 Watts, enough to maintain uninterrupted power to vehicle systems during engine cranking.

VQM faults are transmitted via a diagnostic link to the CJB where they are held; the fault codes can be diagnosed using Land Rover approved diagnostic equipment.

Battery Monitoring System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Mounted on the battery negative terminal the BMS (battery monitoring system) module is integral with the battery negative cable.

Battery health status is a fundamental factor in the correct operation of the Stop/Start system. Computation of the battery status is performed by the BMS module and will initiate a 'Stop Inhibitor' or 'Start Initiator' in a Stop/Start cycle if the battery cannot meet the required demand. For additional information refer to the 'Stop Inhibitors, Start Initiators and Start Inhibitors' section, below.

The battery status information is transmitted from the BMS module over the bus to the CJB which has a two-way communication with the BMS module. The control logic for inhibiting engine shutdown and initiating an early engine restart during a Start/Stop cycle resides in the CJB. The CJB also acts as the gateway relaying this information to the ECM over the high-speed CAN bus.

Battery status information is also transmitted from the CJB over the medium-speed CAN bus to the instrument cluster. The instrument cluster displays battery charge warning messages to indicate generator or battery monitoring system faults to the driver.

The BMS module constantly computes the status of the electrical system on the basis of the following data:

- battery deterioration
- battery state of charge
- battery current demand.

If any of these factors show a low measurement, the ECM suspends the Stop/Start feature until more battery power is available. The factors are discussed below:

Battery deterioration

Although fitted with a high-performance battery based on AGM (absorption glass mat) technology, the charge holding capacity of the battery will still deteriorate, however at a much slower rate than a conventional battery. This degradation will reflect on the amount of charge the battery can hold until it reduces to a condition where the battery will need replacing.

The battery monitoring system calculates the condition of the battery by observing a range of inputs including:

- ambient temperature
- charge and discharge activity
- voltage and
- internal resistance.

The latest condition value of the battery is stored in the dedicated memory of the BMS to ensure the most accurate forecast of the batteries condition.

State of charge

The BMS analyses how much charge has been drawn or replenished to determine the battery's present state of charge.

Current demand

During a Stop/Start cycle when vehicle system use is in high demand, for example the following are operating:

- head lights

- climate control
- audio system.

The battery will discharge more rapidly due to the high current demand.

In this event the BMS calculates various factors to determine how long the battery can supply a current at the present level of demand. This calculation is used by the CJB to determine if to authorize whichever is needed in the Stop/Start cycle, either to:

- prevent an engine stop, or
- initiate an engine restart.

To provide this information to the CJB the BMS module calculates a range of battery variables, including:

- state of charge
- battery surface temperature to calculate the internal temperature
- internal resistance
- voltage
- current flow into and from the battery.

The battery monitoring system calculates these variables against programmed detailed battery life models to determine how long the given current can be supported.

Battery monitoring system modes

The battery monitoring system has three distinct modes:

- Active mode: during normal vehicle operation, battery data is uploaded and calculated every second.
- Sleep mode: during ignition off, battery data is uploaded every second and calculated every hour to reduce inactive current drain.
- Transport mode: battery monitoring intervals are minimized.

Battery replacement

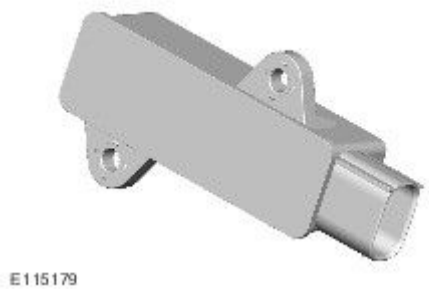
If a new battery is fitted to the vehicle, the BMS (battery monitoring system) module will require recalibrating to register the greater charge holding capacity of the battery, this is performed using Land Rover approved diagnostic equipment. If a diagnostic system is not available the BMS module will recalibrate automatically however, this could take 48 hours to complete depending on vehicle usage. The Stop/Start system will not function correctly until the BMS module is recalibrated.

If the BMS module is replaced the module will re-calibrate automatically.

CAUTION: To avoid damage/malfunctioning of the BMS module, always use a suitable body ground point rather than the battery negative terminal when connecting a slave power supply.

For additional information, refer to Battery (414-01 Battery, Mounting and Cables)

Gear Neutral Sensor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A PLCD (permanent magnet linear contactless displacement) sensor is located on the exterior of the transmission

casing and hardwired to the ECM. The sensor's function is to detect that neutral gear has been selected within a calibrated window.

No calibration is necessary for the Gear Neutral Sensor upon replacement, it is however monitored and a DTC will be logged should a fault occur. Fault codes can be diagnosed using Land Rover approved diagnostic equipment.

Linear Clutch Sensor

To ensure an engine restart during a Stop/Start cycle does not delay the getaway demands of city driving, the engine is restarted in approximately 800 milliseconds. This is achieved through the linear clutch sensor triggering an engine restart when the clutch pedal is at the start of its downward travel. So while the driver continues to depress the clutch through the rest of its travel the engine restart is already in progress.

The linear clutch sensor is a PLCD (permanent magnet linear contactless displacement) type and is located on the clutch master cylinder and hardwired to the CJB. The sensor provides the CJB with a continuous input of the clutch pedal's position; this information is relayed to the ECM on the high-speed CAN bus. The 'top of travel' signal is used to authorize an automatic engine restart if all other system conditions are approved.

The linear clutch sensor also provides a 'bottom of travel' signal near the end of the clutch pedal's travel. This signal is used if the engine stalls and is a requirement to authorize a stall recovery. This is unique function that allows the engine to restart automatically if all other system conditions are approved. For additional information refer to the Stall Recovery section, below.

A magnet inside the clutch master cylinder provides the position indicator for the linear clutch sensor. For this reason, if the master cylinder is replaced the correct replacement master cylinder must be identified and fitted.

The two existing clutch position-switches, located on the clutch pedal housing and used as inputs for various vehicle systems, are also utilized by the Stop/Start system for plausibility checks.

If a fault develops with the linear clutch sensor a DTC will be logged in the CJB.

NOTE:

The Stop/Start system will not function correctly if the driver rests their foot on the clutch pedal while driving the vehicle.

Brake Vacuum Sensor

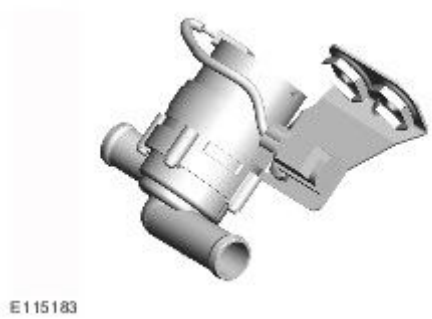
To ensure the vehicle's braking system is never compromised, a brake vacuum sensor is introduced on Stop/Start vehicles to monitor vacuum reserves in the brake servo. The vacuum sensor is mounted in the vacuum pipe and hardwired to the ECM. In the event of brake vacuum decreasing below a set threshold during a Stop/Start cycle the ECM will send a signal to either:

- Restart the engine and consequently replenish vacuum reserves.
- Inhibit the engine shutting down if vacuum reserves are not sufficient.

An example of vacuum reserves depleting, is by the driver repeatedly pressing the brake pedal when the engine is shutdown during a Start/Stop cycle. This action will initiate an engine restart when vacuum reserves decrease below the set threshold.

If a fault develops with the brake vacuum sensor a DTC will be logged in the CJB.

Auxiliary Coolant Pump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During a Stop/Start cycle when the engine is shutdown and consequently the engine-driven coolant pump is stationary, the desired set cabin temperature cannot be maintained for a prolonged period, especially in cold ambient temperatures. To counteract this, an auxiliary electric coolant-pump has been integrated into the cooling system to maintain the coolant flow through the cabin's heater core. This supporting circulation therefore prolongs the set temperature setting in the cabin and accordingly prevents an early engine restart.

Depending on vehicle classification the auxiliary coolant pump is either:

- Hardwired directly to the ECM.
- Or if the vehicle is fitted with a FFBH (fuel fired booster heater), the FFBH coolant pump is utilized and activated via the FFBH.

The functionality of both types of auxiliary coolant pump is the same with regards the Stop/Start system.

To disguise the activation sound of the auxiliary pump, the pump is activated at the same time as the engine shuts down.

Remote Handset

To allow the driver ease of use, a revised remote handset release has been introduced. This allows the driver to instantly release the remote handset from the start control module when the engine is shutdown in a Stop/Start cycle.

The vehicle reverts to the conventional remote handset release when not in a Stop/Start cycle, that is by pressing the ignition Start/Stop button before releasing the remote handset.

Stall Recovery

In the event of an engine stall, the Stop/Start system enters a unique 'stall recovery' mode. This feature automatically attempts to restart the engine as soon as the driver fully depresses the clutch pedal; the natural reaction of the driver when experiencing a stalled engine situation.

Once the clutch sensor detects the 'bottom of travel' threshold, refer to 'Linear Clutch Sensor', the starter motor is activated to restart the engine. The warning indicators normally associated with an engine stall, for example the ignition and low oil pressure indicators in the instrument cluster will be suppressed so will not illuminate. The Eco indicator does however remain illuminated.

A 'stall recovery' event is the only state when the Stop/Start system will permit the engine to be started when the transmission is in gear; hence the requirement for the clutch pedal to be fully depressed. If the stall recovery fails and the engine does not restart, the driver will be requested via the Message Center to 'select neutral' to attempt another restart.

If the engine does not restart after this request the 'stall recovery' mode will time-out and deactivate. At this point the

'Eco' icon in the instrument panel will extinguish and the lights usually associated with an engine stall will illuminate. As a result the driver will be required to perform a conventional engine restart.

Although stall recovery is a feature of the Stop/Start system it is possible for it to activate independently from the Stop/Start parameters. For example:

- If the Stop/Start system has been deactivated by the driver stall recovery will still function.
- Stall recovery will activate at ambient temperatures as low as (minus) - 2°C, whereas the Stop/System operating temperature threshold is above 4°C.
- Different to the operation of the Stop/Start system, stall recovery will still function when the vehicle is towing; refer to the 'Trailer Towing' section.

NOTE:

As the necessary criteria will not have been satisfied when the vehicle is at the beginning of a journey stall recovery will not function. For example, if the vehicle stalls when leaving the garage or driveway a conventional engine restart will be required.

Trailer Towing

The Stop/Start system will automatically disable when trailer lights are detected by the CJB via signals from the trailer module, this information is then transmitted to the ECM. It is not possible for the system to detect when a trailer power plug is inserted in the vehicle's towing socket so it uses operation of the trailer lights as its indicator.

The trailer towing system inhibits Stop/Start as it is possible that trailer power requirements could interfere with the operation of the battery monitoring system. In particular, a trailer battery could reverse the feed current to the vehicle during an engine cranking event, this could possibly:

- Confuse the battery monitoring system into detecting an unrealistically small current at engine cranking.
- Rupture the fuse associated with the trailer module.

Climate Control System

NOTE:

The 'ECON' button has been renamed 'A/C' to prevent confusion with the Stop/Start system 'Eco' switch.

A number of changes have been made to the logic and operation of climate control system, within a Stop/Start cycle to:

- maintain occupant comfort
- prevent windshield misting
- conserve battery power.

This has been achieved by the module monitoring and varying, as necessary various climate control functions within a Stop/Start cycle.

In some circumstances the ATC has the capability to inhibit an engine shutdown or initiate an engine restart within a Stop/Start cycle. This is achieved by the ATC module communicating with the CJB on the medium speed CAN. The various override functions the ATC has in a Stop/Start cycle are discussed below:

Coolant temperature

The ATC module will inhibit an engine shutdown or initiate an engine restart within a Stop/Start cycle if the coolant temperature falls below the calculated threshold to support the cabin temperature set by the vehicle occupants.

Windshield demisting

The variant of climate control fitted to the vehicle influences the software changes that have been made. For example, the base climate-control system does not have a humidity sensor, as used on a highline system to initiate a windshield demist. Therefore, a calculation for demisting the windshield is made using the signals from the rain sensor and ambient temperature sensor. Using the probability that windshield misting will occur if it is raining and the ambient temperature is cool, the ATC will presume a windshield demist is required and start the engine when in a Stop/Start cycle.

Evaporator temperature the main cause of windshield misting is also monitored and the high-line climate control system will periodically cool the evaporator as necessary to reduce misting during a Stop/Start cycle. The system operates the windshield demist shutter and if the evaporator is wet the shutter will remain closed for a few seconds after an engine restart until the vapor is dissipated.

If the driver selects either ‘programmed defrost’ or the ‘windshield heater’ it is assumed that a quick demist of the windshield is required. Therefore, the ATC via the CJB will either: inhibit an engine shutdown or initiate an engine restart.

Heater fan speed

During an engine shutdown the ATC monitors cabin temperature and maintains the fan speed at a level that will conserve, for as long as possible the heat in the core of the cabin heater. If the driver selects a higher fan speed and the heat cannot be maintained in the heater core, the engine will restart.

Heated rear window and heated seats

If the heated rear window or heated seats are active or activated during an engine shutdown event the power output of the relevant system will be interrupted until the engine is restarted. The tell-tale light in the relevant switch will illuminate to indicate the system is active even though the system is receiving no power. This feature is used to conserve battery power.

Fuel fired heater

The FFBH (fuel fired booster heater) and Stop/Start system will not operate simultaneously, due to low ambient temperatures being a factor in the function of both systems.

Hood Latch Ajar-Switch

 **WARNING: To avoid injury when performing repair work on the vehicle always disable the Stop/Start system by pressing the ‘ECO’ button, ensure that ‘ECO STOP/START OFF’ is displayed in the message Center and the ECO tell-tale light in the switch is extinguished.**

The hood latch ajar-switch hardwired to the CJB, has two functions:

- Acts as a stop inhibitor, allowing the engine to remain running if the hood latch is released.
- Deactivates the Stop/Start system if an engine stop is taking place, this results in an engine stalled condition. The engine can be restarted using the ignition button. Stall recovery will not function in this condition; refer to the Stall Recovery section.

After the hood is closed reactivation of the Stop/Start system is achieved by manually starting the engine.

System Fault

The Stop/Start system is automatically activated each time an ignition cycle occurs; the driver will be informed the system is operating by the tell-tale light in the Eco switch illuminating. If the tell-tale light does not illuminate this will indicate that there is either a system fault or the system is not available. Only when the driver attempts to activate the system by pressing the ‘Eco’ button will they be informed of a fault by ‘ECO STOP/START FAULT’ being displayed in the message Center.

Owing to the Stop/Start system’s complexity due to many other vehicle modules and communication networks involved in its function. It is recommended that all other system faults be initially diagnosed and eliminated when investigating Stop/Start faults as these could affect the operation of the Stop/Start system.

System can be diagnosed using Land Rover approved diagnostic equipment.

STOP INHIBITORS, START INITIATORS AND START INHIBITORS

A number of selectable features or vehicle situations can influence the operation of the Stop/Start system’s operation. These can, depending on the particular circumstances:

- prevent the engine shutting down (stop inhibitor),

- initiate an autonomous restart (start initiator),
- prevent an engine restart (start inhibitor).

Stop Inhibitors

Under normal circumstances the Stop/Start system will automatically shutdown the engine if:

- the vehicle is stationary,
- the transmission is in neutral,
- the clutch pedal is fully released.

The following conditions will inhibit the engine from shutting down:

Driver effected stop inhibitor

The following driver effected conditions will inhibit the engine from shutting down:

- Driver switches off the Stop/Start system
- Transmission not in neutral(note that the driver resting their hand on the gear lever can move the transmission out of the neutral window without engaging a gear)
- Clutch pedal not fully released
- Accelerator pedal depressed
- Hood is open
- Driver's door is open
- Driver's safety belt is disengaged
- HDC (hill decent control) is active
- TR (terrain response) mode is active
- Climate control system used above calibrated threshold
- Windshield demist is operating
- Trailer electrical connection detected

Vehicle system effected stop inhibitor

The following vehicle system conditions will inhibit the engine from shutting down:

- Driver switches off the Stop/Start system
- Brake servo vacuum below threshold
- Battery cold cranking capability below threshold
- Battery state of charge is low
- Catalytic converter outside either pre or post calibration range
- is regenerating
- Engine coolant temperature below threshold
- Engine oil temperature below threshold

Environmental effected stop inhibitor

The following environmental conditions will inhibit the engine from shutting down:

- External temperature above 35°C
- External temperature below 4°C

Start Initiators

When the engine has shutdown within a Stop/Start cycle the following conditions will initiate an early restart within the same Stop/Start cycle:

Driver effected start initiator

The following driver effected conditions will initiate an early engine restart:

- Driver switches off the Stop/Start system
- Vehicle speed above calibrated threshold 3 Km/hour (2 mile/hour) A restart will only occur if the transmission is in neutral and the driver's presence is detected for example, the driver's safety belt remains secured and

the driver's door remains latched
    - A restart will only occur if the transmission is in neutral and the driver's presence is detected for example, the driver's safety belt remains secured and the driver's door remains latched
- Brake servo vacuum below threshold (driver operating brake pedal)
- HDC (hill decent control) is activated
- TR (terrain response) mode is activated
- A higher heater fan speed is selected
- Windshield demist is activated

Vehicle system effected start initiator

The following vehicle system conditions will initiate an early engine restart:

- Battery cranking capability is near its lower threshold
- Battery state of charge is near its lower threshold
- Windshield demist activates
- The interior cabin temperature decreases below or increases above the occupant's set thresholds

Environmental effected start initiator

The following environmental conditions will initiate an early engine restart:

- External temperature rises above 35°C
- External temperature reduces below 4°C

Start Inhibitors

When the engine has shutdown within a Stop/Start cycle the following conditions will prevent an automatic restart:

Driver effected start inhibitor

The following driver effected conditions will inhibit an automatic engine restart:

- Hood has been opened
- The accelerator pedal is depressed
- Gear selector moved out of neutral; message Center will display: 'Select Neutral To Restart'
- Driver's safety belt is disengaged; this is an automatic start inhibitor therefore the engine can be restarted by depressing the clutch pedal
- Driver's door is unlatched; this is an automatic start inhibitor therefore the engine can be restarted by depressing the clutch pedal

Vehicle system effected start inhibitor

The following vehicle system conditions will inhibit an automatic engine restart:

- Engine has shutdown for longer than 5 minutes: a conventional restart will be required
- There is a system fault