419 : Electronic Feature Group

419-01A : Anti-theft - Active

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Antenna - bolt	5	-	44
Anti-theft alarm horn - nut	8	-	71
Battery backed sounder to bracket - nut	6	-	53
Battery backed sounder bracket to body - nut	8	-	71
Intrusion sensors - nut/screw	2	-	18
Keyless vehicle module - nut	5	-	44

Description and operation

Anti-Theft - Active

Authoring Template

COMPONENT LOCATION

Item	Part Number	Description
1		Keyless vehicle module
2		Left Hand (LH) and Right Hand (RH) door latch micro switches
3		Central Door Locking (CDL) RF receiver
4		Liftgate latch micro switch
5		Slave intrusion detection module
6		Intrusion detection module
7		Hood ajar switch
8		Passive anti-theft alarm horn (if fitted)
9		Battery backed sounder (if fitted) or battery backed sounder with tilt sensor (if fitted)
10		Vehicle horns

INTRODUCTION

The active anti-theft system monitors the hinged panels for unauthorized opening. In some markets the anti-theft system also incorporates monitoring of the vehicle interior and vehicle tilt sensing.

The active anti-theft alarm system is controlled by the following body system control modules:

- Central Junction Box (CJB)
- LH door module
- RH door module

- Auxiliary junction box
- Keyless vehicle module
- Instrument cluster.

The CJB is the main controller in the system. The CJB controls the following security functions, in addition to other vehicle functions:

- Locking, double locking and unlocking
- Monitoring of hinged panel microswitches and panel ajar states
- Microwave intrusion detection modules
- Anti-theft horns or battery backed sounder
- Passive arming and disarming
- Panic alarm function
- Transceiver coil and transponder reading
- Valet function (via Touch Screen Display (TSD))
- Interior lighting.

Two levels of vehicle locking are available; perimeter mode locks all opening panels and volumetric mode (if fitted) monitors the vehicle interior for intrusion and incorporates a tilt sensor to monitor if the vehicle is being moved.

Door Modules

The door modules provide the interface between the door latch motors, the door and latch microswitches and the CJB. The door modules provide door microswitch switch status information and enable the door motors on request from the CJB or the keyless vehicle module. Additionally, the door modules also control the exterior mirror functions. For additional information, refer to Rear View Mirrors (501-09)

Auxiliary Junction Box and Central Junction Box (CJB)

The auxiliary junction box controls, in conjunction with the CJB:

- the horns
- the liftgate latch motors and microswitches (including the liftgate external release switch)
- the liftgate ajar switch
- the turn signal indicators
- the fuel filler flap operation

The auxiliary junction box is also has a connection to the Restraints Control Module (RCM) for automatic operation of the interior lights and the turn signal indicators in the event of an accident.

The CJB and auxiliary junction box are both fitted with an anti-theft sense line. If the auxiliary junction box is disconnected when the alarm system is active, the full alarm will be activated by the CJB. If the CJB is disconnected when the alarm system is active, the auxiliary junction box takes control of the security system and sounds the full alarm. The alarm will also be activated if the instrument cluster is disconnected when the active anti-theft alarm system is active.

NOTE:

If the CJB is replaced, the new module will require configuring to the master car configuration using the Integrated Diagnostic System (IDS).

The CJB automatically arms and disarms the active anti-theft system when the vehicle is locked and unlocked after successful confirmation that a valid remote handset/smart key has been used.

Keyless Vehicle Module

The keyless vehicle module interfaces with the CDL RF receiver and collects RF signal information which is transmitted from the Smart Key. This information is translated into commands which are passed on the medium speed Controller Area Network (CAN) bus to the CJB, auxiliary junction box, the door modules and the instrument cluster.

The keyless vehicle module also monitors the liftgate external release switch, 2 interior antennae, 1 luggage compartment antenna and an additional rear bumper antenna and 2 door handle antennae if the passive entry system is fitted.

On vehicles with passive entry, the additional fast latch motors are controlled via the keyless vehicle module and the locking status is passed to the CJB on the medium speed CAN bus.

Instrument Cluster

The instrument cluster controls the alarm indicator which is incorporated into the sunload/light sensor mounted on the instrument panel.

The instrument cluster also controls, in conjunction with the Engine Control Module (ECM), the engine immobilization. The ECM controls the engine crank and fuel functions and the instrument cluster processes the valid transponder information.

Alarm Indicator

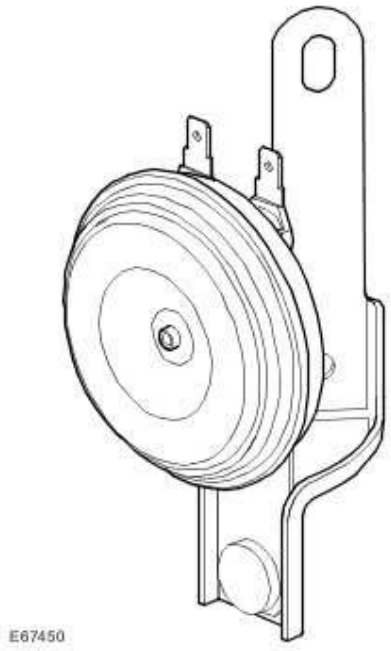
The alarm indicator is a Light Emitting Diode (LED) located in the body of the sunload/light sensor. When the ignition is off the indicator gives a visual indication of the active anti-theft system to show if the alarm system set or unset.

When the ignition is on, the indicator provides a visual indication of the status of the passive anti-theft (engine immobilization) system. If the immobilization system is operating correctly, the LED will be illuminated for 3 seconds at ignition on and then extinguish.

If a fault exists in the immobilization system, the LED will be either permanently illuminated or flashing for 60 seconds. This indicates that a fault exists and fault code has been recorded. After the 60 second period the LED will flash at different frequencies which indicate the nature of the fault. For additional information, refer to Anti-Theft - Active (419-01A)

Operation of the alarm indicator is controlled by the instrument cluster which varies the flash rate of the LED to indicate the system status of the alarm and the immobilization systems.

Passive Anti-Theft Horn (if fitted)



The passive anti-theft horn is located in the RH rear corner of the engine compartment and attached to the bulkhead. The anti-theft horn is connected directly to the CJB which activates the anti-theft horn when the alarm is triggered.

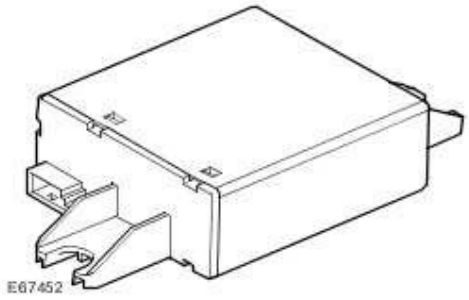
Battery Backed Sounder (if fitted)

The battery backed sounder is located in the RH rear corner of the engine compartment and attached to the bulkhead.

On vehicles with a battery backed sounder, a tilt sensor can be incorporated which monitors the vehicle attitude. The CJB monitors the tilt sensor and can detect if the vehicle is being moved, towed or raised and activate the alarm system. The type of battery backed sounder can be identified by a suffix change to the part number; sounders without a tilt sensor have the suffix AA and sounders incorporating a tilt sensor have the suffix BA.

Operation of the sounder is controlled by the CJB on a Local Interconnect Network (LIN) bus. The sounder is also connected with a permanent battery supply via the CJB. An integral, rechargeable battery powers the sounder if the battery power supply from the CJB is interrupted.

Intrusion Detection Modules



The intrusion detection modules are an optional fitment in some markets and are not available in other markets. Two intrusion detection modules are fitted. One module is located on the front of the floor console and monitors the front seat area, the second module is fitted at the rear of the floor console and monitors the rear seat area. The modules are wired together in parallel with the forward module being the master and the rearward module being the slave module.

Each intrusion detection module comprises two microwave sensors which allow the interior of the vehicle to be monitored. The intrusion detection modules also monitor the vehicle interior on soft top models when the soft top is down.

The intrusion detection modules are activated with the volumetric mode which in turn is enabled when the vehicle is double locked. The vehicle can be locked and alarmed with the module de-activated if a pet is to be left in the vehicle for example by single locking the active anti-theft system. The intrusion detection modules can also be de-activated by deselecting the 'Intrusion/Tilt' option in the 'Vehicle Settings' screen on the Touch Screen Display (TSD).

NOTE:

> The TSD method of de-activation of the intrusion detection modules is only for one arm cycle. They will revert to active once the vehicle is subsequently unlocked and then locked.

When the volumetric mode is active, if the vehicle battery voltage falls to below 9 volts, the CJB will ignore any inputs from the modules to prevent false alarm activation.

CONTROL DIAGRAM

NOTE:

> **A** = Hardwired; **D** = High speed CAN bus; **N** = Medium speed CAN bus; **O** = LIN Bus

Item	Part	Description

	Number	
1		Battery
2		Megafuse (175A)
3		Megafuse (175A)
4		Steering column lock
5		CJB
6		Power distribution box
7		Vehicle horns
8		Liftgate latch ajar switch
9		Intrusion detection module
10		Slave intrusion detection module
11		Keyless vehicle module
12		Hood ajar switch
13		CDL RF receiver
14		Instrument cluster
15		Light sensor (security LED)
16		RH door module
17		LH door module
18		LH door latch ajar switch
19		RH door latch ajar switch
20		Battery backed sounder (if fitted) or battery backed sounder with tilt sensor (if fitted)
21		Passive anti-theft alarm horn (if fitted)

22		Auxiliary junction box

PRINCIPLES OF OPERATION

The CJB automatically arms and disarms the active anti-theft system when it operates the Central Locking System (CLS).

On vehicles without intrusion detection modules, only the perimeter mode is available to monitor the hinged panels and the validity of the Smart key.

When perimeter mode is active, the CJB monitors panel ajar micro switches located in the latch mechanisms of the driver and passenger doors and the liftgate. A separate hood ajar micro switch, located in the engine compartment, monitors the hood status.

When volumetric mode is active, the CJB monitors the interior of the vehicle for movement using 2 microwave intrusion detection modules located within the center console.

Arming

On vehicles without intrusion detection modules and a tilt sensor, the active anti-theft system is armed in the perimeter mode when the vehicle is either locked or double locked.

On vehicles fitted with intrusion detection modules, the system has 2 modes of operation; perimeter mode and volumetric mode.

Perimeter Mode

- Perimeter mode only monitors the hinged panels and validity of the remote handset/smart key in the start control module. Perimeter mode is activated by a single press of the lock button on either the Smart key or the door handle lock button on vehicles with the Passive Entry system.

Volumetric Mode

- Volumetric mode monitors the vehicle interior for intrusion. If the vehicle is fitted with a battery backed sounder, which incorporates a tilt sensor, the vehicle attitude is also monitored when volumetric mode is active. Volumetric mode is activated by a second press of the lock button on either the Smart Key or the door handle lock button on vehicles with the Passive Entry system. The second press of either lock button must occur within 3 seconds of the first press. The second press of the lock button also activates the perimeter mode double locking feature.

The CJB arms the active anti-theft system when it locks or double locks the vehicle providing the following conditions are met:

- All doors, liftgate and hood are closed
- The Smart key is not sensed inside the vehicle

- With no valid Smart Key outside of the vehicle
- The CJB is not in transit mode.

When the vehicle has successfully completed its locking routine, confirmation will be given by a long single flash of the turn signal indicators to indicate the locked condition. If double locking is activated then confirmation will be given by a double flash of the turn signal indicators, one flash for locked and one long flash for double locked. In certain markets an audible warning is emitted to confirm arming or double locking.

Mislock

If any doors, liftgate or hood is open when a lock or double lock request is received, the anti-theft alarm system remains disarmed and the CJB generates a short mislock sound on the vehicle horns, battery backed sounder or passive anti-theft horn and the turn signal indicators will not flash. Each attempt to lock will be confirmed by two audible chimes being emitted.

When the CJB arms the active anti-theft alarm system, it first enables perimeter mode and monitors the status of the hinged panels. If the vehicle is double locked and the vehicle is fitted with a battery backed sounder, an arming signal is sent from the CJB to enable the sounder. If the vehicle is fitted with intrusion detection modules, the CJB then sends an arming signal to the modules and the tilt sensor when double locked. The CJB ignores the signals from the intrusion detection modules for the first 30 seconds to allow time for the vehicle interior to settle and prevent false alarm activation.

If the liftgate is opened via the Smart Key or external mechanical lock the intrusion detection modules and the tilt sensor are inhibited until the liftgate is closed.

Disarming

The CJB will disarm the active anti-theft system when it receives an unlock request from the Smart Key or, on vehicles with Passive Entry, when the Smart Key is sensed and the driver's or passenger door handles are pulled.

The CJB can selectively disarm parts of the active anti-theft system to prevent false alarm activation under certain conditions as follows:

- When the vehicle active anti-theft alarm system is armed in volumetric mode, if the vehicle battery voltage decreases to less than 9 V, the CJB will disable the volumetric mode and remain in the perimeter mode only. This prevents false alarm activation because the intrusion detection modules do not operate below 9 volts.
- On vehicles fitted with a battery backed sounder, if the vehicle battery voltage decreases from 9.5 to 9 V in more than a 30 minute period, the CJB de-activates the battery backed sounder and if required, will use the vehicle horns to sound an audible alarm trigger warning. This prevents false alarm activation. At voltages below 9 volts, the CJB will not generate the 'heartbeat' signal to the battery backed sounder. If the sounder fails to receive the 'heartbeat' signal, it interprets this as the CJB has been tampered with and self activates its sounder. If the battery voltage subsequently rises above 9.5 V, the CJB will re-arm the battery backed sounder.
- If the vehicle is unlocked using the unlock button on the smart key and within 45 seconds a hinged panel is not opened, the CJB automatically re-locks the vehicle and re-arms the active

anti-theft system (if 'auto re-lock' feature is enabled). This prevents leaving the vehicle unlocked and disarmed by accidental operation of the Smart Key unlock button.

Alarm

When the alarm is triggered, the CJB activates audible and visual warnings. The audible warnings are produced by the vehicles horns, the passive anti-theft horn or the battery backed sounder or a combination of the audible devices. Visible indications are produced using the turn signal indicator.

The CJB activates the vehicle horns, passive anti-theft horn or battery backed sounder for 30 seconds or a combination of the audible devices. The activation is stopped for 5 second and, if the alarm trigger is still present, the CJB will cycle again for 30 seconds. This will be repeated for up to a maximum of 10 cycles (3 cycles in some markets) of 30 seconds for any one arming period. The CJB will deactivate the alarm if the 10 cycles (3 cycles in some markets) have been completed and the alarm trigger is still present or until it receives a disarm signal.

NOTE:

If the battery backed sounder is triggered due tamper detection, the visual indication using the turn signal indicators is not activated.

The alarm can be triggered by any of the hinged panels being opened, an intrusion detection module detects a movement inside the vehicle, the tilt sensor detects vehicle movement, the CJB is disconnected or an ignition tamper is detected (invalid Smart Key).

Battery Backed Sounder

When the CJB arms the active anti-theft system, in either the perimeter mode or the volumetric mode, the CJB sends an arming signal to the sounder on the LIN bus. When the system is armed in the volumetric mode, the CJB also sends an arming signal to the tilt sensor (if fitted).

On receipt of the arming signals, the sounder and the tilt sensor respond with a status message. If the CJB does not receive the status signals within 12 seconds, the CJB assumes there is a fault and responds with a disarm signal to either the sounder and/or the tilt sensor and stores a related fault code. If the sounder is disarmed when the active anti-theft system is armed and the system is subsequently triggered, the CJB instructs the auxiliary junction box to energize the horn relay and use the vehicle horns to sound the audio warning in place of the sounder.

When the sounder is armed, the CJB sends a periodic (heartbeat) signal to the sounder which prompts the sounder to monitor the vehicle battery supply and the LIN bus link with the CJB. The sounder will operate if:

- it receives an alarm signal from the CJB or the tilt sensor
- the power supply or the LIN bus link from the CJB is disrupted.

The tilt sensor measures the longitudinal and lateral angle of the vehicle over a range of ±16° from the horizontal. When the active anti-theft system is armed in volumetric mode, the tilt sensor stores

the current vehicle angles in its memory and monitors the tilt sensor readings. If the vehicle angle changes in either direction by more than the alarm limit, the tilt sensor activates the sounder.

If the alarm system is active and the battery or battery backed sounder is disconnected, the battery backed sounder will operate without the visual indication of the turn signal indicators flashing.

Customer Programmable Security Features

A number of security features can be programmed to the customers requirements by use of the Touch Screen Display (TSD).

Global Open/Close

The global open/ close feature allows the driver to fully raise/lower the driver and passenger windows with a single press of a Smart Key button. The button must be pressed and held for more than 2 seconds. Either or both of the open/close functions can be disabled from the TSD.

NOTE:

Remote global close is not available in some markets, i.e. NAS market.

From the 'Home' screen, select the 'Vehicle' screen and select 'Veh. Settings'. The 'Security button will be highlighted as the default selection. Scroll the screen until the 'Global Open' and 'Global Close' selections are displayed. Global open and/or global close can be switched on or off by touching the applicable button on the TSD.

Valet Mode

Valet mode allows the liftgate to be inhibited when in valet mode. When in valet mode, if either the switch pack or exterior luggage compartment release button is pressed, an audible warning chime is emitted to warn that the liftgate is inhibited.

Enabling Valet Mode

Using the emergency key from the Smart Key, lock the glovebox. From the 'Home' screen, select the 'Valet' button'. The valet mode screen is displayed and requires a four digit Personal Identification Number (PIN) for access. Enter the PIN using the digits on the TSD and press 'OK'. When the PIN is accepted the screen displays 'Valet On'. The glovebox and the liftgate are now locked in valet mode. On leaving the vehicle, only give the attendant the Smart Key without the emergency key installed.

Disabling Valet Mode

After entering the vehicle, access the valet mode screen and enter the four digit PIN number and touch the 'OK' button. When the PIN is accepted, the screen displays 'Valet Off'. Unlock the glovebox using the emergency key and replace the emergency key in it stowage slot in the Smart Key.

Single Point Entry

The single point entry feature only unlocks one door, all other panels remain locked.

On vehicles with the remote Central Locking system (CLS), a single press of the unlock button on the

Smart key unlocks only the driver's door and the liftgate. A second press will unlock the passenger door.

On vehicles with the passive entry system, the first door handle which is pulled will only open that door to gain access to the vehicle. The remaining door and the liftgate will revert to central locking. The locked door can be unlocked by operating the interior door release lever and the liftgate can be released using the liftgate release button in the auxiliary lighting switch, the Smart Key liftgate release button or the exterior liftgate release button.

From the 'Home' screen, select the 'Vehicle' screen and select 'Veh. Settings'. The 'Security' button will highlighted by default. Select '2 stage unlock' and touch the on or off button to enable or diable the single point entry feature.

Changing from central locking to single point entry and back again can also be carried out by pressing the lock and unlock buttons on the Smart Key simultaneously. The turn signal indicators will flash for 4 seconds to confirm that the change has been performed.

Drive Away Locking

The drive away door locking feature locks the doors and the liftgate if they are unlocked when the transmission selector lever is not in 'P' and the vehicle speed is more than 7 km/h (5 mph).

From the 'Home' screen, select the 'Vehicle' screen and select 'Veh. Settings'. The 'Security' button will highlighted by default. Scroll the screen until the 'Drive away locking' section is displayed. Select the drive away locking feature on or off by touching the applicable button on the TSD.

Smart Key Additional Features

The Smart Key has convenience buttons in addition to the lock/unlock buttons.

Panic alarm

A panic alarm feature allows the driver to activate the vehicle alarm system using the Smart Key. The 'panic' button, identified by a triangle symbol, can be pressed 3 times or pressed and held for more than 3 seconds to activate the panic alarm.

Global Open/Close

A global open and close feature can be operated from the Smart Key. This feature allows the vehicle windows to be opened/closed by a single press of the lock or unlock button. The button must be pressed and held for more than 2 seconds to activate the global open/close feature.

NOTE:

Remote global close is not available in some markets, i.e. NAS market.

Liftgate Release

A liftgate release button can be pressed to open the liftgate. This will operate with car locked and alarmed or unlocked. If the vehicle is locked and alarmed, when the liftgate release button is pressed, the liftgate can be opened without triggering the alarm system. When the liftgate is subsequently closed, the alarm will be re-activated.

Headlamp Convenience

A headlamp convenience button can be pressed to operate the headlamp to assist departure or approach to the vehicle. A single press of the button will operate the headlamps for approximately 25 seconds after which they will automatically turn off. A second press of the button will turn off the headlamps if the 25 second period has not been reached. Pressing the Stop/Start button within the 25 second period will also turn off the headlamp convenience feature.

Convenience Mode

When a door is opened, for a vehicle with either remote RF central locking or passive entry, the vehicle's electrical system initiates the convenience mode. The following systems become active:

- Memory - seat adjustment and steering column
- Interior and exterior lighting
- TSD and Audio
- Instrument cluster message centre
- Horn
- Cigar lighter and power socket.

Anti-Theft - Active

The complexity of the electronics involved with the anti-theft system, and the multiplexed communication network which are connected to it, preclude the use of workshop general electrical test equipment. Therefore, reference should be made to the manufacturer approved diagnostic system for detailed instructions on testing the anti-theft system.

The manufacturer approved diagnostic system systematically tests and analyses all functions and the various systems affected by it.

Where a fault is indicated, some basic diagnostic methods may be necessary to confirm that connections are good and that wiring is not damaged before installing a new component.

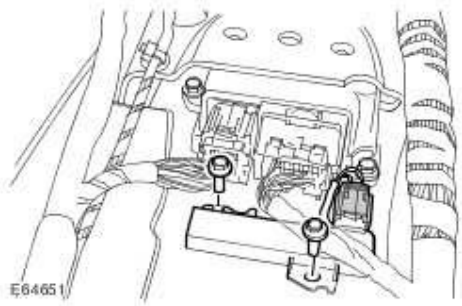
Antenna

Removal

1 . Remove the floor console.
For additional information, refer to Floor Console (76.25.01)

2 . Remove the keyless vehicle antenna.

- Remove the 2 Torx bolts.
- Disconnect the electrical connector.



Installation

1 . Install the keyless vehicle antenna.

- Connect the electrical connector.
- Tighten the Torx bolts to 3 Nm (2 lb.ft).

2 . Install the floor console.
For additional information, refer to Floor Console (76.25.01)

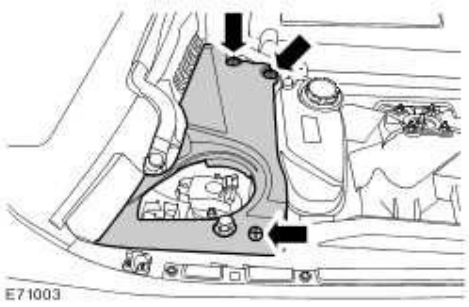
Anti-Theft Alarm Horn (86.52.03)

Removal

1 . Make the pedestrian protection system safe.
For additional information, refer to

2 . Remove the air intake cover.

- Remove the 3 clips.

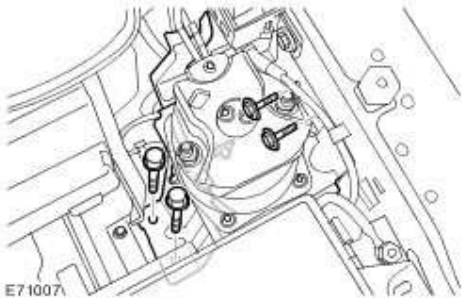


3 . Release the pedestrian protection actuator bracket.

- Release the 3 wiring harness clips.
- Remove the 4 bolts.

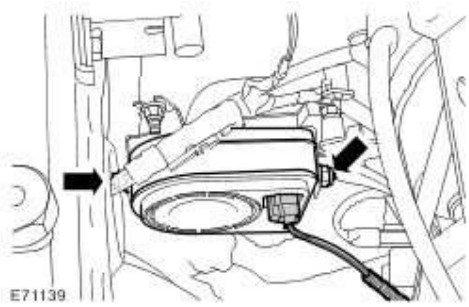
4 . Remove the pedestrian protection actuator and bracket.

- Disconnect the electrical connector.



5 . Remove the anti-theft alarm horn.

- Loosen but do not remove the 2 nuts.
- Disconnect the electrical connector.



Installation

1 . Install the anti-theft alarm horn.

- Connect the electrical connector.
- Tighten the nuts to 10 Nm (7 lb.ft).

2 . Install the pedestrian protection actuator and bracket.

- Connect the electrical connector.

3 . Secure the pedestrian protection actuator bracket.

- Attach the wiring harness clips.
- Tighten the bolts to 8 Nm (6 lb.ft).

4 . Install the air intake cover.

- Install the 3 clips.

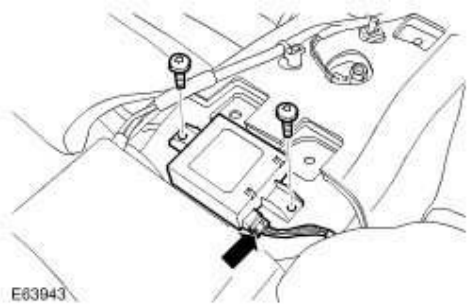
Rear Intrusion Sensor

Removal

1 . Remove the rear seat armrest.
For additional information, refer to Rear Seat Armrest (76.70.39)

2 . Remove the rear intrusion sensor.

- Disconnect the electrical connector.
- Remove the 2 Torx bolts.



Installation

1 . Install the rear intrusion sensor.

- Tighten the Torx bolts to 6 Nm (4 lb.ft).
- Connect the electrical connector.

2 . Install the rear seat armrest.
For additional information, refer to Rear Seat Armrest (76.70.39)

419-01B : Anti-Theft - Passive

General procedures

Anti-Theft Security Access

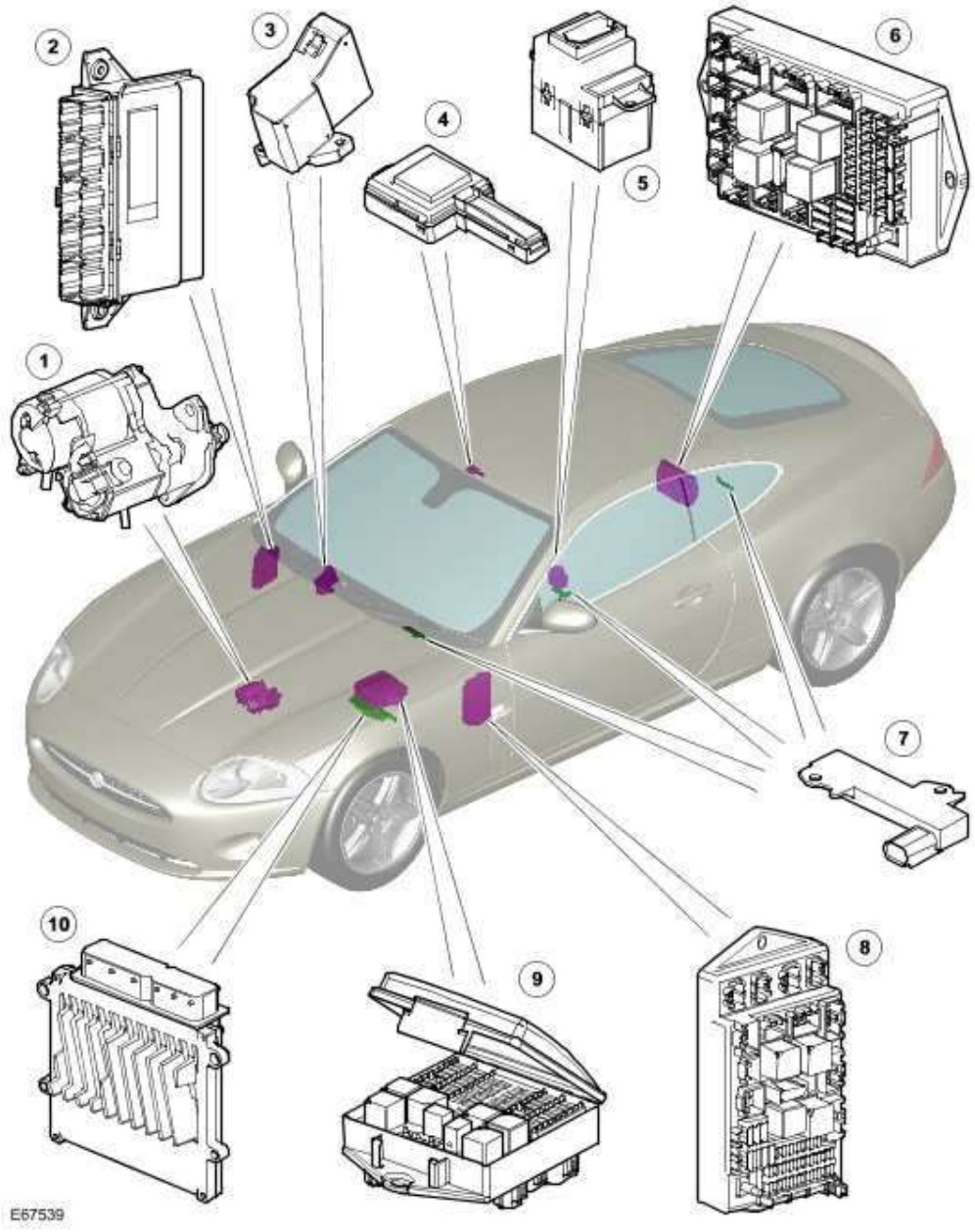
1. The complexity of the electronics involved with the passive anti-theft system of which the security access is a part, and the multiplexed communication network which are connected to it preclude the use of workshop general electrical test equipment. Therefore, reference should be made to the Jaguar approved diagnostic system for detailed instructions on security access . The Jaguar approved diagnostic system systematically tests and analyses all functions and the various systems affected by it.

Key Programming Using Diagnostic Equipment

1. The complexity of the electronics involved with the anti-theft, of which the key programming is a part, and the multiplexed communication network which are connected to it preclude the use of workshop general electrical test equipment. Therefore, reference should be made to the Jaguar Approved Diagnostic System for detailed instructions on key programming . The Jaguar approved diagnostic system systematically tests and analyses all functions and the various systems affected by it.
All new keys must be programmed using IDS. When using IDS to programme new key(s), the lost or obsolete key(s) will cease to function.

Anti-Theft - Passive

COMPONENT LOCATION



Item	Part Number	Description
1		Starter motor and solenoid

2		Keyless vehicle module
3		Electric steering column lock (Not NAS)
4		RF receiver
5		Start control module
6		Auxiliary junction box
7		Low Frequency (LF) antennae - Passive start system (3 off)
8		Central Junction Box (CJB)
9		Power distribution box
10		Engine Control Module (ECM)

INTRODUCTION

The Passive Anti-Theft System (PATS) prevents the vehicle from being driven away by unauthorized persons. This is achieved by having uniquely coded keys (both passive and transponder) and an encoded data exchange between multiple control modules. Unauthorized starting is prevented by inhibiting the fuel, engine (spark, injectors and crank) and ignition systems from operating.

The PATS is a function of the 'Passive Start' system. The system uses the following components:

- 'Smart Key'
- LF antennae - 3 off
- RF receiver
- Keyless vehicle module
- Start control module
- CJB
- ECM
- Instrument cluster.

The system is automatic and requires no input from the driver. The engine start system is initiated when the start/stop switch and the brake pedal are pressed simultaneously. Refer to Engine Controls for details of the ignition modes. For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - Vehicles Without: Supercharger)

The engine management system will only allow engine crank, spark and injector functions when the following conditions are met:

- A hardwired Park/Neutral signal is received from the Transmission Control Module (TCM)

- A hardwired ignition signal is received from the CJB
- A hardwired crank request signal is received from the CJB
- Encrypted data exchange between the instrument cluster and the ECM is verified.

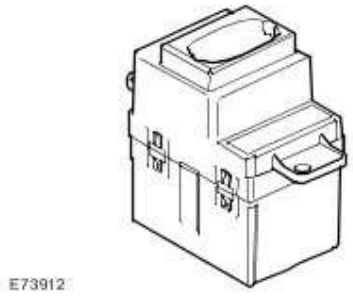
Before the CJB will send the hardwired ignition signal, it must satisfactorily complete the following:

- Exchange encrypted data with the keyless vehicle module to validate the smart key
- Exchange encrypted data with the instrument cluster to authorize the ignition status.

Additionally, before the CJB will send the hardwired crank request signal it must receive the following signals:

- Brake pressure signal from the ABS module which must be greater than a pre-determined threshold
- Hardwired transmission in 'Park' (P) signal from the selector lever.

START CONTROL MODULE



The start control module is located in the floor console, at the rear of the arm rest. The start control module is used if the keyless vehicle module is unable to authorise the Smart Key.

If the keyless vehicle module is unable to identify the Smart Key for any reason, for example if the Smart Key battery voltage is low or there is local RF interference, the transponder within the Smart Key can be read in the conventional manner. The driver will be alerted to this by a chime and a message in the instrument cluster message center 'SMART KEY NOT FOUND, PLEASE INSERT IN SLOT'. The Smart Key can be inserted into the start control module.

To insert the Smart Key, lift the arm rest on the floor console and slide back the spring loaded access cover on the start control module. Insert the Smart Key, with the key fob loop uppermost, into the slot. The start control module is motorized and will draw the Smart Key into the slot once inserted.

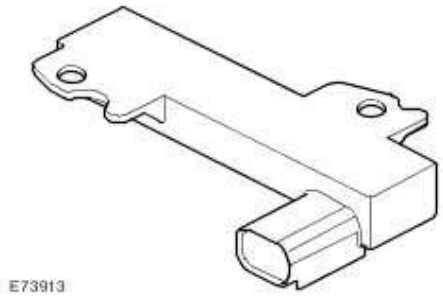
The start control module will then read the transponder within the Smart Key and, if the transponder identification is valid, pass authorization to the instrument cluster on the Local Interconnect Network (LIN) bus.

NOTE:

Inserting the Smart Key into the start control module will not charge the Smart Key battery. The battery is non-chargeable and must be replaced with a new CR2032 battery if defective.

A message 'REMOVE SMART KEY' will be displayed if the Smart Key is still in the start control module and the driver's door is opened. The Smart Key can be removed by pushing downwards on the key fob loop and releasing. The start control unit motor will then drive the Smart Key out from the slot.

LF ANTENNA



Three Low Frequency (LF) antennae for the passive start system are positioned in specific locations in the vehicle. The LF antennae are positioned in the following locations:

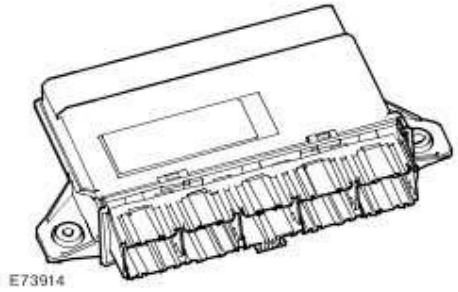
- Behind center console, below heater assembly and audio modules.
- In floor console between the driver and passenger seats, below start control module.
- On the battery tray.

NOTE:

On vehicles with the passive entry system, three additional antennae are used; one integrated into the rear bumper and one in each door handle assembly. These are only used by the passive entry system and have no function in the passive start system.

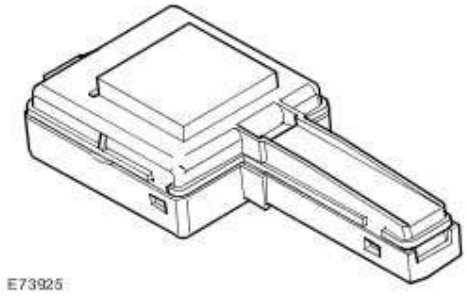
The keyless vehicle module transmits an LF signal via the antennae which is received by the Smart Key. The Smart Key then responds by transmitting a Radio Frequency (RF) signal which is received by the RF receiver and passed to the keyless vehicle module for authorization.

KEYLESS VEHICLE MODULE



The keyless vehicle module is located on the Right Hand (RH) 'A' pillar. The module controls signal transmissions to and from the Smart Key and provides authorization to allow the vehicle to be entered and started. The module has a medium speed Controller Area Network (CAN) connection to the Central Junction Box (CJB) for authorizing vehicle unlocking and starting.

RF RECEIVER

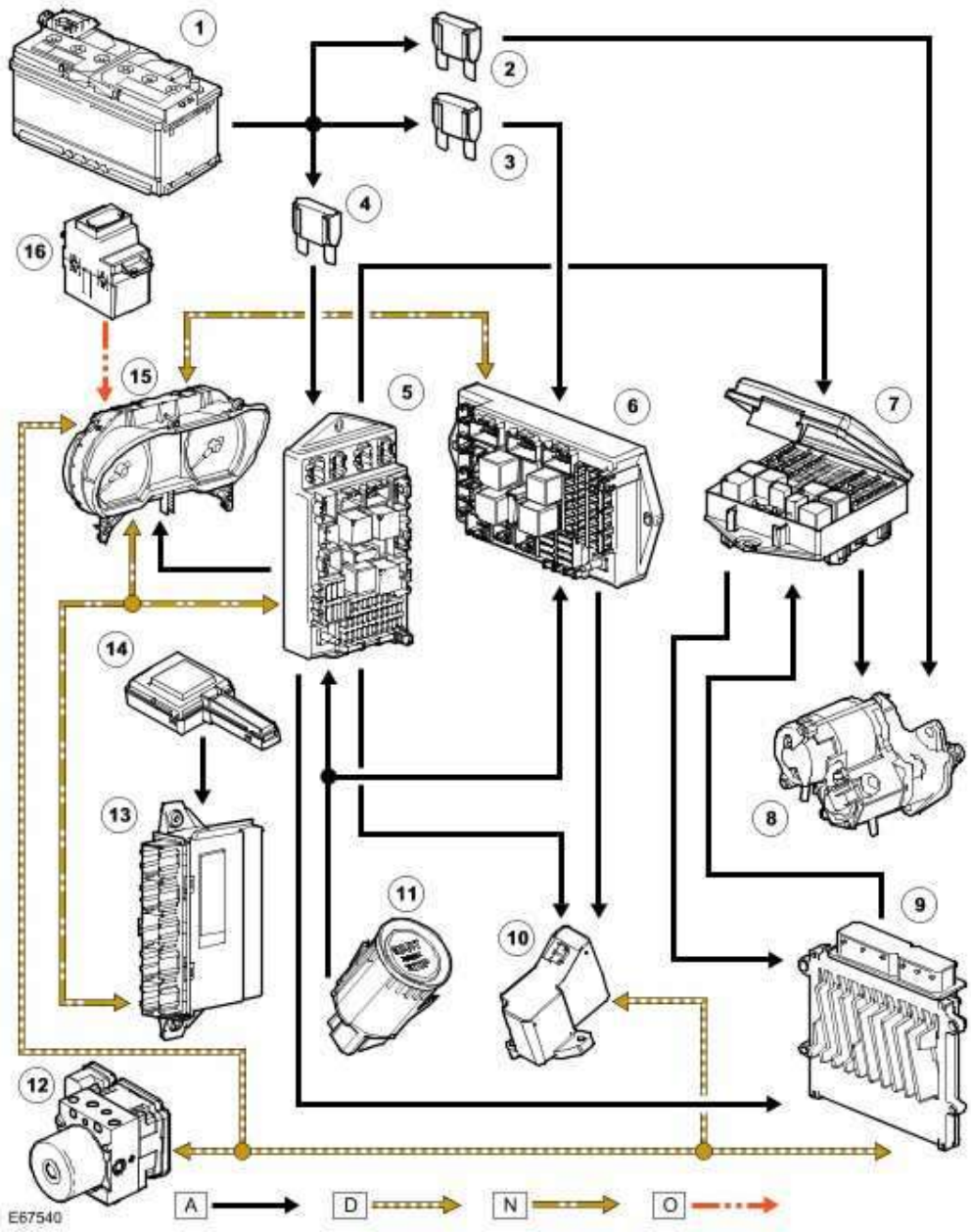


The RF receiver is located behind the overhead console. The receiver is available in two variants; 315 Mhz or 433 Mhz depending on market requirements. Transmissions are received from the Smart Key for key identification and remote lock/unlock requests or requests for operation of additional features.

CONTROL DIAGRAM

NOTE:

A = Hardwired; **D** = High speed CAN bus; **N** = Medium speed CAN bus; **O** = LIN bus



Item	Part Number	Description
1		Battery
2		Megafuse (400 A)
3		Megafuse (175 A)
4		Megafuse (175 A)

5		CJB
6		Auxiliary junction box
7		Power distribution box
8		Starter motor and solenoid
9		ECM
10		Electric steering column lock (Not NAS)
11		Start/Stop switch
12		ABS module
13		Keyless vehicle module
14		RF receiver
15		Instrument cluster
16		Start control module

PRINCIPLES OF OPERATION

At the request of the CJB, the keyless vehicle module prompts each of the LF antennae to output a LF signal. When the Smart Key is within range, it detects the LF signals and responds with an RF identification signal. The RF signal is detected by the RF receiver and passed to the keyless vehicle module.

NOTE:

> The LF antenna located in the rear bumper and in each door handle are only fitted if the vehicle has the Passive Entry option.

The keyless vehicle module authorizes the Smart Key and passes this information to the CJB via the medium speed CAN bus. Once the CJB receives the authorization and confirms response with internal calculation, it passes the result to the instrument cluster on the medium speed CAN bus. Once the CJB receives the authorization and confirms the response, it allows the ignition to be activated when the start/stop switch is pressed.

On receipt of the authorization message, the instrument cluster initiates the unlocking of the electric steering column lock (if fitted). Once the electric steering column lock is unlocked and power has

been removed, the instrument cluster will set its internal key status to valid. The instrument cluster will pass this key valid authorization to the auxiliary junction box. Once the auxiliary junction box receives the authorization and confirms the response with an internal calculation, it will enable the Fuel Pump Driver Module (FPDM).

The CJB also controls the engine crank request. If the transmission selector lever is in the park position and the driver presses the brake pedal and simultaneously presses the start/stop switch, the CJB interprets this as an engine crank request.

Before the engine crank request is allowed, the CJB compares a brake pressure signal received from the ABS module. The brake pressure signal is compared to an internally stored threshold value within the CJB. If the signal is greater than the stored threshold value, a crank request signal is sent to the ECM on the high speed CAN bus.

NOTE:

> If the Smart Key is not in the vehicle and an attempt is made to start the engine by pressing the start/stop switch, a message 'SMART KEY NOT FOUND, PLEASE INSERT IN SLOT' is displayed in the instrument cluster message center.

If the keyless vehicle module is unable to identify the Smart Key for any reason, the Smart Key can be inserted into the start control module. The start control unit will then read the transponder within the Smart Key and, if the transponder identification is valid, pass authorization to the instrument cluster on the Local Interconnect Network (LIN) bus.

If a replacement Smart Key is required, 2 Integrated Diagnostic System (IDS) diagnostic procedures are required to synchronize the passive start/entry and transponder functions of the Smart Key. If any module, which is involved in the Smart Key authorization process, require replacement, an IDS diagnostic procedure is also required to synchronize the replacement module into the system.

Anti-Theft - Passive

Principle of Operation

For a detailed description of the Anti-Theft - Passive system, refer to the relevant Description and Operation section in the workshop manual.
Anti-Theft - Passive

Inspection and Verification

Anti-theft - Passive

The best method to confirm the correct operation of the Passive Anti-Theft System (PATS) is to check the LED (located in the center of the instrument panel). The LED should illuminate solid for 3 seconds, when the ignition status is set to ON, and then extinguish. This validates all PATS functions (i.e. the key transponder matches a stored key code, the challenge/response sequence between the respective modules was successful resulting in the EMS being enabled).

Ignition fails to operate

Check that the smart key is located within the vehicle interior, and that it is the correct one for the vehicle. Insert the smart key into the start control unit (located in floor console cubby box), this is an alternative method to allow Ignition On/Engine Start.

Check that the start button circuit to the CJB is not open circuit or short circuit to power.

Check that the CAN network is not malfunctioning, i.e. open circuit or short circuit. This would mean that the remote keyless entry module, Central Junction Box (CJB) and instrument cluster would be unable to communicate.

Engine fails to crank

If a PATS fault is detected, the LED will flash for 60 seconds at 4Hz with a 50% duty cycle. At the end of this period, the LED will flash a 2 digit code; this code is repeated 10 times. The meaning of these fault codes along with the frequency of flashing is given in the accompanying table. As a general rule a fault code of 16 or less will cause the vehicle not to crank. Additionally, the manufacturer approved diagnostic system should be used to check the instrument cluster, CJB & ECM for Diagnostic Trouble Codes (DTCs).

One potential occurrence for failing to crank could be due to the 'Not In Park' switch (input to the CJB) or the P & N start switch (input to the ECM).

Check the Crank Request output from the CJB to ECM is not short circuit to ground or open circuit.

Check the Starter Relay circuit.

NOTE:

Due to Smart Start both sides of Relay Coil are switched directly from ECM (If conditions correct)

Check that the Steering Column Lock correctly operates and the steering wheel can turn freely.

Check that the CAN network is not malfunctioning, i.e. the CAN circuit is open or short circuit. This would mean that the instrument cluster and ECM would be unable to communicate resulting in no Challenge being performed to enable the ECM. This would be supported by LED Flash Code 24, see PATS Fault Code Table.

Also check the CAN network between the ABS module and the CJB. The CJB uses the CAN_BrakePressureTMC signal to determine if the brake pedal has been pressed in order to allow an engine crank. The CJB uses a value of 0x03, if the CJB sees a value less than this, it will not enable the Crank Request Output.

Engine cranks but will not start

If the Engine is cranking it means that the ECM has passed the authorisation required with the Instrument Cluster. If this authorisation failed, the ECM would not engage the starter relay. This could be confirmed by verifying the PATS LED prove out (illuminated solid for 3 seconds) or by reading DTCs from the instrument cluster and ECM.

In this case, the fuel pump circuit should be verified. The Fuel Pump Delivery Module (FPDM), which is supplied via the RJB (authentication required with the instrument cluster) and controlled by the ECM, supplies the fuel pump.

In all cases of suspected non-start issues, the most logical failure modes should be eliminated first. i.e.

- Check all relevant supplies and grounds to the relevant modules listed herein.
- Note any unusual behaviour from other systems/functionality.
- Note any functions that are not operating as expected.

PATS Fault Codes

For the various PATS modes/faults listed in the table , the instrument cluster will store a DTC and indicate this to the customer during the detection period defined in the 'when logged' column, by illuminating the indicator as described for 60 seconds and then flashing the LED 10 times as appropriate. The indication will stop immediately the ignition status is set to OFF any time during the fault indication sequence. Up to 4 DTCs could be stored per key read sequence (1-10 read attempts). No DTCs will be stored until all retry attempts are complete. Only the highest priority fault code will be flashed.

To determine the fault code from the LED: The LED will flash initially ten times with 1.5 seconds between. The LED will remain OFF for 2.5 seconds then flash a number of times with 0.5 seconds

between (the number of times the LED flashes represents the first digit of the code), the LED will remain OFF for 1.5 seconds then flash a number of times with 1.5 seconds between (the number of times the LED flashes represents the second digit of the code).

The PATS LED will be commanded on as shown under 'indication'. Normal PATS operations are complete within 400ms of the ignition switch transition from OFF to ON or START, worst case for ECM communication problems will be less than 2 seconds. If PATS is not complete during the 2 seconds the ECM will terminate PATS and await the next ignition ON or START event. PATS faults will be indicated via the LED as soon as possible and will terminate the LED prove out. At ignition OFF all previous flashing will cease and the perimeter anti-theft system will control the LED when the vehicle is locked and armed.

Mode of Operation/Fault	When Logged	Ignition Status	DTC	LED Fault Code	Indication
Prove out	N/A	Transition from OFF to ON	N/A	N/A	3 Seconds of steady illumination
Perimeter Anti-theft Control	N/A	OFF - Vehicle locked and armed	N/A	N/A	Off or 0.5Hz flashing at 5% duty cycle ± 20% until Off
Start Control Unit already programmed	Key Insert	Any	B1B0105	N/A	No Indication
Start Control Unit status = invalid response	Key Insert	Any	B1B0167	N/A	No Indication
Start Control Unit programming error	Key Insert	Any	B1B0151	N/A	No Indication
Start Control Unit challenge response error	Key Insert	OFF	B1B0162	N/A	No Indication
Key Programming timer expired or Key Auth Timer expired	Key Insert	Any	B1B0187	N/A	No Indication
Transponder challenge response error	Key Insert	Any	B1B0164	N/A	No Indication
Transponder keys stored below minimum number required	B&A/Dealer	Any	B1B0100	N/A	No Indication

Transponder not programmed	B&A/Dealer	Any	B1B0155	N/A	No Indication
If the instrument cluster sends a 'theft' key status to the ECM or the ECM returns a status message containing the data 'Disabled/Theft', the instrument cluster will set this DTC	EMS CAN communication	OFF to ON	B1B3364	16	60 seconds of 4Hz flashing at 50% duty cycle followed by fault code 16 flashing 10 times
During manufacturing a Target ID is transferred from the ECM when requested by the instrument cluster. The instrument cluster stores this unique vehicle number in EEPROM. If this ID fails to store in EEPROM correctly, the instrument cluster will set this DTC	B&A/Dealer	OFF to ON	B1B3305	22	60 seconds of steady indication followed by fault code 22 flashing 10 times
If the status message received from the ECM contains the data challenge response error, the instrument cluster will set this DTC	Challenge/Response	OFF to ON	B1B3362	23	60 seconds of steady indication followed by fault code 23 flashing 10 times
After the instrument cluster has transmitted its first PATS idle message, it will start a 2 second timer running. If the PATS sequence does not complete (Cluster received the Enable msg) within this time period the instrument cluster will set this DTC	Idle message missing	OFF to ON	B1B3387	24	60 seconds of steady indication followed by fault code 24 flashing 10 times

1 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

2 . If the cause is not visually evident, verify the symptom and refer to the manufacturer approved diagnostic system.