SECTION : 419-10 Body Electronics Module (BEM)

VEHICLE APPLICATION : 2008.0 Falcon

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DESCRIPTION AND OPERATION

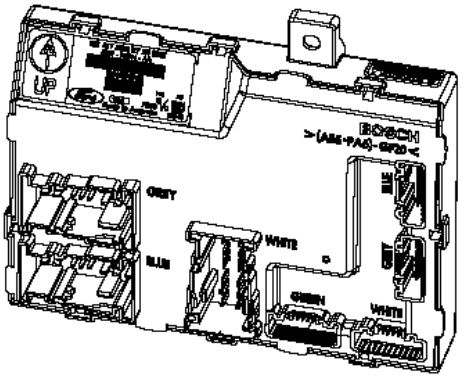
Body Electronics Module

General Description

The Body Electronics Module, hereafter referred to as BEM, combines a transponder Challenge /Response immobilisation system with the Body electronics functions.

- The BEM incorporates the following functions
- The transponder system uses challenge / response immobilisation (PATS).
- The RF receiver is now within the BEM.
- The Remote Central locking features selectable one or two stage unlocking with hazard acknowledgement. Hazard messages are sent via the CAN BUS.
- Illuminated entry and exit, when using the remote central locking control and ignition key removal.
- Door Unlocked warning is via the horn and hazard lamps.
- Ignition key in the lock, horn and hazard warning.
- Automatic Door Relock Timer for remote entry.
- Manual control of the dome lamp, illuminated entry and exit delay.
- Manual Central Locking.
- Manual boot release.
- Personalisation/Priority key setting.
- Door and Boot ajar signalling.
- Battery saver for Dome, Boot, glovebox lamps and keyless Radio/audio play feature.
- Automatic time out for backlight heater.
- Front intermittent wiper timer (variable wiper dwell with speed dependency or fixed dwell).
- Front wipe after wash including drip wipe.
- Power window supply control.
- Ignition position status (via CAN).
- 125kb/s CAN
- Diagnostics via CAN
- Automatic Headlamp control
- Sunload sensor status (via CAN)
- Seat memory Interface.
- Rear Seat Belt status (where fitted).
- Alarm Siren Interface (via LIN).
- Trailer sense status (via CAN).

All current, resistance, frequency figures are ± 10% unless specified otherwise. All voltage readings will be as specified.



Accessories Line Status

The BEM reports the status of the Accessories line via the CAN BUS. The Accessories line is high when the ignition switch is in the Accessories and Ignition positions and open in the Start position.

Heated Backlight Timer

The heated backlight relay may be activated with the ignition switch in either the ignition or accessories position and pressing the heated backlight switch. The relay will deactivate when 15 minutes has elapsed or the ignition is switched off. When the ignition key is held in the start position the relay is deactivated and resumes when the key returns to the ignition position. (Timer still runs in Start) The backlight can be turned off at anytime by pressing the rear demister switch.

The input from the Backlight switch is indicated via the CAN line to the BEM.

Activation of the relay can occur when the battery voltage is greater than 10.7 volts and not when the battery voltage falls below 10.3 volts.

Front Wash Wipe Systems.

Wiper speed selection:

The wiper motor and wash functions are relay controlled within the BEM. The inputs from the wiper switch are active low with internal pull-ups in the BEM.

Low, High and Intermittent is available on the front wiper stalk by pulling each line low to select the wipe function required. An internal relay provides dynamic braking during the park operation when high, low or intermittent is selected.

Front Intermittent Wiper Timer with variable dwell, speed dependency and wipe after take off.

The intermittent feature has 5 detent positions; at zero vehicle speed times of 4.0 seconds, 6.5 seconds, 9.0 seconds, 11 seconds and 14 seconds are available. For each 8 Km/h of vehicle speed the time is shortened in 10 steps up to 80Km/h; where the time becomes constant at 1 second, 2 seconds, 3.5 seconds, 5.5 seconds and 7.5 seconds respectively.

A wipe after take off will occur approximately 3.2 seconds after the vehicle reaches 8Km/H this time may be shorted if a wipe has occurred before take off. This function only operates if intermittent is selected. If the potentiometer is open circuit the intermittent function will default to 7.0 seconds.

Front Washer Control, Wipe after wash.

The front washer motor is activated by operating the front washer switch momentarily; the BEM holds the washer internal relay on for 1.25 seconds then releases, if a longer time is required the driver holds the switch for the time required. After the washer motor has run for 0.5 seconds the wiper is activated for as long as the washer motor is activated.

Drip Wipe Function.

3 seconds after the wash function has stopped, the wiper will activate for one wipe. This is known as Drip wipe. This function is selected or deselected by the Ford diagnostic configuration.

If for any reason the park switch feedback is not detected the wiper will complete approximately 3 wipes after a wash function.

Park on Ignition off.

If wipers are active and ignition is turned off, the wipers will auto-park. If wiper park signal is missing, auto-park will not function, and wipers will stop after 5 seconds.

Power Window Control

With the ignition switch in the accessories or ignition position the power window relay is active and deactivated when in the start position returning to active state when the switch is in the run position.

Turning the ignition switch off and the doors closed the relay will be active for 1 hour. Opening any door will reduce this time to 40 Seconds. If a remote unlock is activated the relay will be active for 40 seconds then deactivated; if the drivers door is opened a further 40 seconds will be activated.

If the relay is activated and a remote lock signal is received then the relay will be deactivated.

Sunload / Twilight Sensor Module (High Series)

The sunload sensor battery supply is via the Battery Saver circuit (see Battery Saver for operation description). With the battery saver circuit active, the BEM transmits the sunload sensor status via CAN to the Climate control system; this data contains sunload information for both passenger and driver. The Twilight sensor for Auto Headlamps is part of the assembly.

Should a fault condition occur, the headlamp relays will default to on, provided the headlamp switch is in the Auto position. The twilight sensor is sent to the Instrument Cluster via CAN for day/night status.

Courtesy Lamp and Battery Saver Control Operation.

When the ignition switch is in the accessories, Ignition or start position and any door is ajar or open and door ajar status is indicated then the courtesy lamp including the boot lamp, a short fade in of 1 second to full brightness will occur. When all doors are closed a 1 second fade out to lamp off will occur.

When the ignition switch is off and any door is opened the courtesy lamp will remain active until battery saver time out occurs; this is 15 minutes. When all doors are closed an exit delay of 20 seconds when it will fade for 6 seconds and go out. This will be overridden if a door is opened, turning the ignition on, pressing the interior dome lamp switch or activation of a remote key.

If the ignition key is removed from the lock and no door is opened an exit delay of the dome lamp of 20 seconds followed by a 6 second fade will occur.

If the ignition is off and if the Panic button on the remote key is pressed the dome lamp will be activated.

With The Ignition off and all doors closed, activation of a remote key door lock will deactivate the dome lamp with a short fade out.

If no remote keys have been taught (Predelivery) then the dome lamp will deactivate in a shorter time than normal to conserve the battery; regardless of the ignition switch position.

The interior lamp switch in the vehicle communicates via CAN to turn on and of the dome lamp function. It operates independent of any aforementioned conditions.

The above conditions can be modified via the ICC personalisation Lighting Menu. Refer to ICC section for details.

Battery Saver Supply

When the battery saver is active, it provides battery supply to the Courtesy lamps, Glove box lamp, TILA Ring lamp, Boot lamp, Active Antenna and sunload/ twilight sensor.

Battery Saver is activated when the ignition switch is in Accessories, Ignition or start positions. It is also activated when opening or closing a door, boot or by pressing any remote key button.

Battery saver is deactivated if the ignition is off and the last event was opening and closing a door/boot or pressing any remote key button.

If no remote keys are taught to the BEM. (Predelivery) Then battery saver will deactivate in a shorter time period

If the battery saver is deactivated and the audio keyless play is activated and the vehicle in not in predelivery mode, then the battery saver will be re-enabled by a CAN message from the audio module.

With the Ignition on, the battery saver can be deactivated by CAN signal from Audio unit to test the antenna module.

State	Summary of State
Normal Mode	Battery Saver On, Courtesy Off
Saver Mode	Battery Saver Off, Courtesy Off
Courtesy Mode	Battery Saver on, Courtesy On
Exit Mode	Battery Saver On, Exit Delay & Fade Out
Audio Keyless Mode	Battery Saver On, Courtesy On or Off
Audio/Antenna Test Mode	Battery Saver Off

Child Night Light

Training Mode:

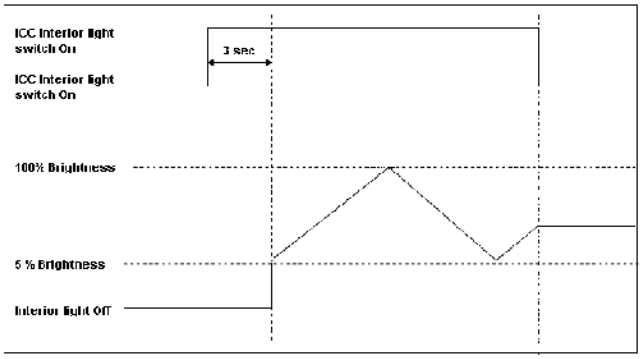
To enter training mode press and hold the interior lamp switch for 3 seconds.

If training mode is entered with dome lamp off, the lamp will ramp up from 0% to 100%, and then ramp down from 100% to 5%. If training mode is entered with dome lamp on, the lamp will ramp down to 5% and continue to cycle.

If at any time the interior lamp switch is released, the setting will be maintained. This value will be retained in permanent memory only when exiting the training mode, which is done with a short press (at least 1.5 second press) or dome lamp timeout.

If the interior lamp switch is pressed and held again, the ramping will continue as per previous ramp direction.

Note, child night light settings can not be saved if a remote key is not trained to the BEM.



Central locking and Door Status

The BEM reports to the cluster door ajar status for all for doors. It also reports boot and hood ajar if alarm fitted.

Manual and Remote Boot Release (Secure boot is disabled)

Boot release button located on boot is enabled during the following conditions:

* When the vehicle is unlocked
* The remote boot release button is pressed (enabled for 40 seconds).

Boot release button located on boot is disabled during the following conditions:

* When the vehicle is locked (except when a remote boot release button is pressed)
* When the vehicle speed is greater than 12Km/h.
* When battery over voltage is detected.

The above conditions can be modified via the ICC personalisation security boot locking menu.

Boot release under (Secure Boot Enabled)

When Secure Boot is enabled and vehicle exited and locked after the ignition has been turned off, the following will occur:

* Boot release is disabled if driver door remain locked.
* Boot release is enabled if ignition is on, vehicle is not immobilised, and the vehicle speed is below 12kph.
* Boot release is enabled for 40 seconds if remote key boot button is pressed.
* In plant mode, secure boot is disabled.

Vehicle ID	Description	Comment
00	**Unknown**	If a Door is ajar and the remote lock is requested, all doors will unlock and horn alert will sound.
01	**Sedan**	If a Door is ajar and the remote lock is requested, all doors will unlock and horn alert will sound.
03	**Utility**	If this is not configured, vehicle will behave as a sedan and give rear door ajar warning and prevent the vehicle from locking.

Central Locking

Manual Central Door Locking Functions.

Manual door locking function may be initiated by pressing the central door locking button (lock and unlock) (ICC) via CAN, manually operating the drivers door with a mechanical key (ignition Key) or interior door handle or by opening a door.

In the event of a crash, identified by an airbag deployment a trigger (VIA CAN) unlocks all doors. Once a crash unlock has occurred, all subsequent door inputs are ignored including the central door switch until the next Ignition on/off cycle.

When a door slam is detected, that is the drivers door is closed when in a locked state, the drivers door will unlock.

When a driver's door is ajar and the central locking switch is pressed or the driver's door is opened all doors will unlock even if they are already unlocked.

After power up or a reset door lock status will not change to avoid lockout conditions or doors unlocking on power up.

The BEM has lock feedback from driver's door only, the BEM does not have locking feedback from passenger doors.

Mechanical Door Lock Strategy

During single door unlock mode, based on the last remote key pressed.

- Open driver's door from the inside with the interior handle will unlock all doors.
- Mechanically unlocking the driver's door will unlock all doors.

During two stage unlock mode. Based on the last remote key pressed.

- Opening the driver's door with a mechanical key will have no effect on passenger doors.

Central Locking via ICC button will lock or unlock all dors irrespective of the BEM being in one or two stage mode.

Action	Activation Methods	Output	Pulse Time
Driver's Door Unlocks	• Mechanically unlock driver's door, with all doors previously locked, during stage 2 unlock. • Open driver's door, during stage 2 unlock when all doors are locked. • Lock attempted with driver's door open	Driver's door unlock line Lock status published on CAN.	0.1sec
All Doors Unlock	• Press central door unlocking switch with driver's door open and passenger door locked. • Mechanically unlock the driver's door, with all doors previously locked, during stage 1 unlock. • Press central door unlock switch. • Open a passenger door with driver's door locked. • Lock attempted with a passenger door open. • Passenger door is closed with the driver's door locked. • Crash indicated CAN notification. • Driver's door slammed when locked.	Door unlock line Lock status published on CAN.	0.1sec
Driver's door ajar and all doors unlocked	• Open driver's door, during stage 1 unlock, with a mechanical key. • Lock attempt with driver's door open	Door unlock line. Driver's door unlock line Lock status published on CAN.	0.1sec
All Doors Lock	• Press central locking switch with drivers door unlocked and closed. • Mechanically lock driver's door.	Door Lock Line. Lock status published on CAN.	0.1sec

Remote Central Locking functions

Remote entry and Panic Alarm functions operate when the ignition key is in the off position, although the receiver is active all the time.

Two stage unlocking may be activated or deactivated for each remote key.

If one stage unlocking is active, then a single press of the unlock button will unlock all doors.

If two stage locking is active then only the driver's door will unlock on the first remote key press of the unlock button. The remaining doors will be unlocked on the second press of the remote key unlock button or if the button is held down once the first press in completed.

To toggle between one stage and two stage unlocking, press both the lock and unlock buttons simultaneously for 3 seconds or set in personalisation in ICC menu.

The 2 stage unlocking of each remote key (Maximum 3) is stored in the BEM, the default state is one stage unlocking.

Action	Activation	Output	Time on	Time off
Remote Driver's door unlock	• Press the remote door unlock button when the driver's door is locked with 2 stage unlocking active	Driver's door unlock line	0.1sec	-
		Hazards Via CAN* Horn Chirp*	0.2 sec	-
Remote all Doors unlock	• Press remote door unlock button with one stage unlocking active.	Driver's door unlock line	0.1 sec	-
		Other Doors Unlock Line	0.1 sec	-
		Hazards Via CAN* Horn Chirp*	0.2 sec	-
Remote Passenger Doors Unlock	• Press the remote door unlock button with driver's door unlocked with one stage unlocking active. • Continue to hold the remote door unlock button after the driver's door has unlocked for 2 seconds in 2 stage unlock mode.	Other Doors Unlock Line	0.1 sec	-
		Hazards Via CAN*	0.2 sec	-
Remote Door lock	• Press the remote door lock button when the drivers door is unlocked	Door lock line	0.1 sec	-
		Hazards Via CAN* Horn Chirp*	0.2 sec	0.2 sec
Confirmation of remote door lock	• Press remote door lock button after all doors lock. Horn sounds within 3 seconds of second push.	Door lock line	0.1 sec	-
		Hazards Via CAN*	0.2 sec	0.2 sec
		Horn Relay*	0.02 sec	-
Enable boot release switch	• Press remote Boot Button.	Boot release switch enabled	40 seconds time out	-
		Hazards Via CAN*	1.0 sec	
Panic alarm activation	• Press the remote panic button	Hazards Via CAN*	0.2 sec	0.2 sec
		Horn relay	0.2 sec	0.2 sec
Panic alarm deactivation	• Press remote panic button	Hazards Via CAN*	-	-
	• Turn ignition key on • Panic alarm time expires	Horn relay	-	-
Toggle between one stage and 2 stage unlocking	• Press both the lock and unlock buttons Simultaneously for 3 seconds	Hazards Via CAN*	0.4 sec	0.2 & 0.3sec

* Disabled / Enabled via personalisation setting.

Panic Alarm (If available)

Pressing the Panic button activates the panic alarm until it times out in 30 seconds; or the panic button is pressed a second time or the ignition is turned on. During Panic Function the Hazard lamps will flash being enabled via the CAN BUS.

Remote Lock Horn and Hazard Warning.

If the remote key is used to lock the vehicle a number of checks are made to ensure it is secure.

A horn warning and indicator flash will occur if the BEM detects a door, boot, or the ignition key is in the lock.

If the ignition key is left in the lock, or a door is ajar an error is reported to the instrument cluster via CAN message.

Activation Method	Output	Time on	Time off
Remote door lock where a door ajar is detected, a door fails to lock or a transponder is detected near the ignition lock	Door lock Line	-	0.1 sec
	Door unlock line, door ajar or fails to Lock	-	0.1 sec
	Door unlock line , transponder detected		0.1 sec
	Hazard lamps via CAN, 2 Pulses repeated	0.2 , 0.3	0.2 ,0.3
	Horn relay, Rapid pulses	0.02	0.09
	CAN message sent to Instrument Cluster.	On	
	Courtesy lamp Output	On	Exit delay

Automatic Door Relock

If the remote key is used to lock the vehicle, then unlocked with the remote key and no door is opened. The BEM will automatically relock after 40 seconds.

Drive Away Locking.

When the ignition is turned on and the engine started, all doors will lock when the vehicle gets to a speed of 12Kmh, if the driver's or passenger doors are unlocked. This function can be enabled / disabled in ICC personalisation settings.

Taxi Mode

Press of the Central locking switch will lock all doors. Press of the Central unlock switch will unlock the passenger doors but the driver's door remains locked. The boot switches also enable. This function can be enabled using the PDS.

RF Remote Key control functions

The RF remote keys will only be detected by the BEM when the ignition is off, or when the ignition is in the accessories position during key teach procedures.

Remote Key Teaching

Make sure you have all the keys that need to be taught to the vehicle available, when you enter teach mode the stored information in the BEM related to remote keys will be erased.

Turn the ignition key from OFF to Accessories and within 5 seconds press the demister switch 3 times. When teach mode has been entered successfully the door locks will cycle from lock to unlock to lock again or from unlock to lock to unlock. Press each remote key in turn (any Button) as each key is taught the door locks will cycle as described above. Teach each key in turn to a maximum of 8 keys. When finished, turn the ignition switch to the off position, as you exit the door locks will cycle again.

Resynchronisation of Remote Keys

If for any reason the RF remote key fails to be recognised by the BEM it may not be synchronised.

Press the remote key three times or press a recognised remote key followed by a transmission of an unsynchronised key within 30 seconds.

Seat Memory Information

When the driver's door is unlocked using the remote key and the ignition is not turned to the on position within 8 seconds, the BEM will identify the key used and send the key data to the Seat module where the seat settings are stored. The seat module matches the key used to the setting data within the seat module.

Mirror position data is also stored (in the seat module) and matched to the last remote key used.

Seat Memory Information

When the driver's door is unlocked using the remote key and the ignition is not turned to the on position within 8 seconds, the BEM will identify the key used and send the key data to the Seat module where the seat settings are stored. The seat module matches the key used to the setting data within the seat module.

Mirror position data is also stored (in the seat module) and matched to the last remote key used.

Automatic Headlamps.

When the ignition is turned on to Accessories or Run positions, setting the lamp switch to Auto will enable auto headlamp control. Various factors like twilight sensor status. Ignition on/off, Driver's door status will determine if the headlamps are on or off in the headlamps Auto Position.

In the event of sensor or circuit failure, the auto headlamps activation will follow the ignition and accessories status.

The Table below, summaries the conditions controlling the BEM headlamp Output.

Case	Twilight Sensor Status	Ignition or Accessory	Driver's door ajar	BEM Headlamp relay output
1	Light	On	N/A	Off
2	Light to Dark*	On	N/A	Delayed Off to On 2.0 secs
3	Dark to Light*	On	N/A	Delayed On to Off 15 Secs
4	Light	On to Off	N/A	Off
5	Dark	On to Off	Not Triggered	Delayed On to Off 120 Secs**
6	Dark	On to Off	Triggered	Delayed On to Off 120 Secs**
7	Light	Off	N/A	Off
8	Light to Dark	Off	N/A	Off
9	Dark	Off (Less than 120 Secs)	Closed to Open	If On delayed, 60 secs
10	Dark	Off	N/A	Off
11	Dark to Light	Off	N/A	Off
12	Light	Off to On	N/A	Off

***Sensitivity can be adjusted using personalisation settings in ICC**
**** Delay can be adjusted using personalisation settings in ICC (Follow me home function)**

Note: Items 5,6 & 9 delay will be zero if low side driver (internal to BEM) fails.

- When the Ignition is on the driver's door status has no effect on the BEM Auto Headlamp output.
- The BEM Headlamp output control will run regardless of whether Auto is selected or not.
- The BEM headlamp output control will run the headlamps when Auto is selected.
- The Twilight sensor will supply Accurate PWM signals varying in frequency for different light intensity conditions.
- The twilight sensor will supply PWM signals in less than 0.5 seconds after power up.

Failsafe Feature.

The BEM has a failsafe feature that provides Headlamps to be ON during Ignition On and Headlamps OFF during Ignition OFF. The BEM will drive headlamps into Failsafe when the BEM detects a fault in the Headlamp driver system. Once Normal operation is detected again the BEM will get out of failsafe Mode. If the BEM is reset by removing and replacing the fuse or disconnecting and reconnecting the battery, the Headlamp function will not resume normal mode until the twilight sensor reloads light level information to the BEM.

Headlamp Failure Warning (Displayed on Instrument Cluster)

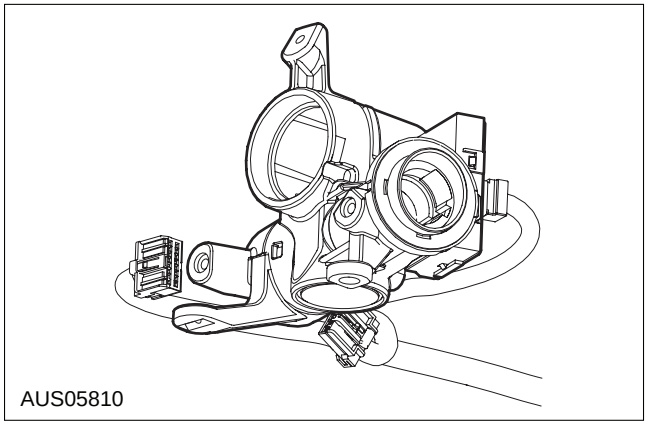
When a BEM Headlamp output failure is detected a CAN message is published, causing an error message be displayed by the in the instrument cluster.

Electronic Immobilisation System.

The Electronic immobilisation system has multiple elements of which the Body electronics module is a part. The associated components are as follows:

* **Ignition key with Digital Signature Transponder (DST)**. The ignition key serves as the authority to start and drive the vehicle. The mechanical key interfaces with the lock to turn to the Accessory, Ignition or Start position selected by the driver. The DST contains stored information which has been taught to it by the BEM; the DST will respond with the identification information when the BEM issues a challenge via the Transceiver Lock Assembly (TILA).
* **Transceiver Integrated Lock Assembly (TILA)** in addition to the steering lock and Ignition and start functions, serves as an interface between the Ignition key (DST) and the BEM through the use of a transceiver circuit. The transceiver consists of a transmit and receive antenna coupled to electronic circuitry in a housing attached to the side of the steering lock. Under BEM control, the transceiver uses an RF field to transmit and receive data from the DST in the ignition key.
* **Body Electronics Module** The BEM is responsible for verifying if the DST ignition key is known to the BEM and has responded to the challenge with a known response that is matched. Once the BEM is satisfied that a match has occurred the BEM will mobilise. The BEM will then accept a challenge from the PCM and send a response over the CAN line to the PCM.
* **Powertrain Control Module The PCM** is responsible for allowing the vehicle to start. A challenge is sent from the PCM to the BEM. Once it has received a correct response the car will be no longer immobilised. If the challenge fails the vehicle will be immobilised.
  The PCM will allow about 2 seconds to receive a correct response before immobilising the engine.
* **Instrument Cluster** A challenge occurs between the Instrument Cluster and the PCM, the failure of which will not allow the vehicle to start.

Transceiver Lock assembly (TILA)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The TILA comprises a Transceiver with an ignition key light ring, steering lock and ignition starter switch that will perform the following functions:

The Transceiver provides an electrical/RF interface between the BEM and the transponder housed in the ignition key head. The transceiver generates a low frequency field that is radiated by the integrated antenna, and used to transmit and receive signals from the transponder. The transceiver may be removed by loosening the retaining screw and sliding the assembly off the lock housing. When replacing the transceiver it is important that the tightening torque for the retaining screw is observed.

This is 19.5 Nm Max for the original screw.

The **Ignition Key light Ring** illuminates as part of the courtesy lamp function with illuminated entry and exit delays.

The **Ignition Starter Switch** provides electrical contact of the battery supply to the accessories, ignition and starter circuits. In the start position, a lamp proofing circuit is provided with a ground. The start position is spring loaded to return to the ignition position. The switch mechanism cannot be removed and is not serviceable.

RF receiver

The RF receiver antenna is mounted inside the BEM. The receiver detects the encoded signals from the RF remote keys into data that is validated by the BEM. Once validated the command sent to the receiver is acted upon by the BEM. Ie lock or unlock etc.

The range of the remote keys may be reduced by the use of aftermarket window tinting, heavy rain, snow, hail, close proximity to trees. Strong RF signals on or near the frequency of the receiver may cause de-sensitisation.

Design requirement for range performance is minimum 10 meters from centre of vehicle.

BEM Replacement in Service.

To install a replacement BEM into a vehicle the DST ignition key teaching and parameter reset operations need to be performed. Replacement BEM's are programmed in an armed state at the factory and cannot mobilise a car without DST keys taught correctly and PCM and Instrument Cluster parameter reset. A BEM from one vehicle cannot be transplanted into another vehicle without a parameter reset, and DST keys retrained. A parameter reset on the PCM and Instrument Cluster is required for the system to re-initialise.

Ignition Key Teach Mode (DST)

This mode allows Dealers to Train DST keys to the BEM, erase keys and reteach keys.

As a security measure whenever teach mode is entered all DST key information stored in the BEM memory will be erased.

Once the DST keys are taught the PCM needs to perform a Parameter reset so the vehicle can be started. It is recommended that the operator sit in the driver's seat with the doors closed.

The ignition must be off to enter dealer key teach mode.

Using the PDS tool select Ignition Key teach, when teach mode is entered a mode acknowledgement will occur.

Place the first key in the ignition and turn to the on position, one acknowledgement will occur when the 1st key is taught and its code is stored in the BEM memory.

Immediately turn the key to the off position and remove the taught key; place the 2nd key in the ignition and turn on. Two acknowledgements will occur for the second key and so on. Repeat this procedure up to 8 keys.

When finished turn the ignition off. An acknowledgement will be received on exit of teach mode.

If a key cannot be recognised no acknowledgement will occur.

Monitoring the error status via the diagnostic link can also identify a programming failure.

Teach Mode will be exited if:

- The BEM power is interrupted.
- The ignition key is off for more than 10 seconds.
- Turning the ignition on, with a trained key.
- Once 8 keys have been taught to the BEM

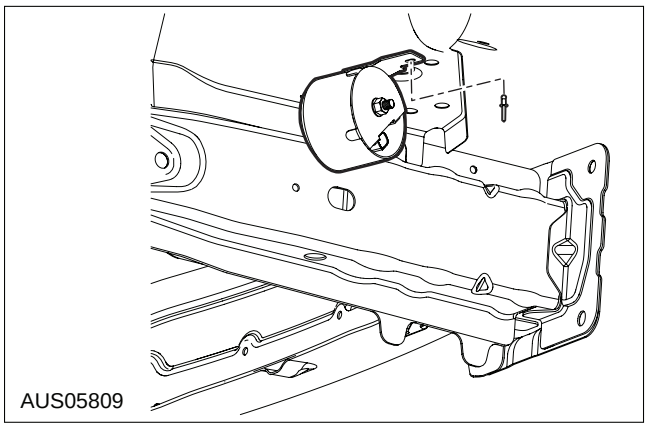
Customer Spare DST Key Teach Mode

The customer key teach mode allows the owner limited teach and delete key function. To enter customer key teach mode, the owner must have two valid keys that are already taught to the BEM. Insert one of the trained keys into the ignition lock and turn to the accessories position, turn to off and remove the key. Within 5 seconds insert the second key and turn to the ignition on position. At this point the door locks should cycle to indicate the teach mode has been entered. To teach additional keys to the BEM, insert the new key and turn to the ignition position, if successful the door lock cycling will indicate the number of keys taught. Once acknowledgment has occurred turn the key to off and insert the next key to be taught. Up to additional 6 keys may be taught in this way.

For key deletion only the keys that are not taught to the BEM will be deleted. The two known keys used to enter teach mode plus any additional keys taught will be valid, all other keys will be erased. To exit teach mode leave the ignition on for longer than 10 seconds. An acknowledgment will be received when the BEM exits teach mode.

BBS (Battery Backed Siren) module

Check DTC relevant to BBS (B2665) and also replacement strategy after 5 years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DIAGNOSIS AND TESTING

Body Electronics Module

Inspection and Verification

On Demand Self Test

Using the PDS Tester it is possible to conduct an on demand self test.

The pre-conditions for this test are as follows:

* Ignition key in the ignition switch and turned to the ignition on position
* Headlamp switch in Auto position
* Boot shut
* Glovebox open
* Do not sit in the Drivers seat

During this test, it is important to make visual observations.

The total time for the test is 5.5 seconds the following table gives the order and function being tested.

NOTE: We can categorise the tests as visible and invisible to the operator. The following is a table of tests/operations to be performed. It will do different tasks.

Time (second)	Visible Tests	Invisible Tests	Precondition	Comments
0 (start)	Door Lock Battery Saver	Driver Door Lock feedback	 Leave open “glove box” or turn on “map lamp” to observe	Relay energised for 200ms Battery saver will be on for rest of the test
0.2	Memory Seat Ignition switch position	Seat Module Data line • Test for open circuit* • Test for short to battery Accessory line status Ignition line status	!!!Do not sit on the seat Ignition key in position II.	
0.5	Driver Door Unlock Horn Relay	Driver Door Lock feedback Horn Relay line • Test for short to battery		Relay energised for 200ms 100ms On
1.5	Front wash motor		Key in ignition position	
2.0	Front wiper motor High speed wipe	Wiper Feedback	Key in ignition position	Wipe until wiper parks
2.6	Front wiper motor Low speed wipe	Wiper Feedback	Key in ignition position	
3.7	Heated Backlight Power Windows Dome lamp Headlamp On	Heated Backlight Relay • Open circuit* • Short to battery Power Window Relay • Open circuit* • Short to battery Transceiver TX Data Line • Open circuit* • Short to battery TILA Challenge • TILA - Key ID unknown • TILA - Faulty transponder • TILA disconnected • TILA – Faulty or fixed code transponder	Ignition key in position II. Hold button to observe window operation Headlamp switch in “auto” position Battery Saver active. Battery Saver active	Look at dash board to observe indicator Headlamp turns on

continued on the following page

Time (second)	Visible Tests	Invisible Tests	Precondition	Comments
		Sunload Sensor* • Circuit Open • Circuit short to battery • Circuit short to ground	Key in ignition position	
		Twilight Sensor* • Circuit Open* • Circuit short to battery • Circuit short to ground	Battery Saver active	
5.5 (end)				Tester will display the test results. Front wiper will be parked.

BEM Diagnostic Trouble Code (DTC) index

DTC	Description	Precondition	Action
B1213	Anti-Theft Number of Programmed Keys Is Below Minimum	Number of programmed keys is less than 2.	Program more Keys
B1259	Solar Radiation Sensor Circuit Open	Circuit open or short to battery, Input greater then 4.78V, External Fault	Check Driver's Sunload Sensor and Wiring.
B1261	Solar Radiation Sensor Circuit Short To Ground	Input held at less than 0.17V, External Fault	Check Driver's Sunload Sensor and Wiring.
B1300	Power Door Lock Circuit Failure	Door Lock Motor Error / Driver's door lock feedback did not change after lock action, External Fault	Pinpoint tests G and N.
B1348	Heated Backlite Relay Circuit Open	O/C or S/C to Ground, External Fault	Check Heated Backlite and wiring
B1349	Heated Backlite Relay Short To Battery	S/C to Battery, External Fault	Check Heated Backlite and wiring
B1473	Wiper Low speed circuit motor failure	Front wiper park sense does not change state while front wiper is operating. Front wiper park circuit failure or front wiper low speed motor failure or total disconnection of the wiper. External Fault.	Check wiper motor low output BEM pinAb. Check wiring and wiper park signal change at BEM pin De. Check wiper motor
B1476	Wiper High Speed Circuit motor failure	Front wiper park sense does not change state while front wiper is operating. Front wiper park circuit failure or front wiper high speed motor failure. External Fault.	Check wiper motor low output BEM pin Ad. Check wiring and wiper park signal change at BEM pin De.Check wiper motor.
B1548	Power Window Master Circuit Open	Power Window Relay driver O/C or S/C to Ground, External Fault	Check Power window relay and wiring
B1549	Power Window Master Circuit Short To Battery	Power Window Relay driver S/C to Battery, External Fault	Check Power window relay and wiring
B1600	PATS Ignition Key Transponder Signal Is Not Received	TILA RF receiver error	Check power available on Cl & earth . Check continuity from BEM pin Ew to TILA J6/1 (Rx) and BEM pin Eu to TILA J6/9 (Tx). Check TILA
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	Key ID unknown or Incorrect challenge	Check programmed key is used. Reprogram keys if required.
B1602	PATS Received Invalid Format Of Key-Code From Ignition Key Transponder	Faulty or fixed code transponder	Program correct transponder Key
B1693	Auto lamp On Circuit Failure	Auto headlamps Driver Circuit Failure, External Fault.	Twilight sensor Headlamp switch must be in Auto position. Check Wiring and headlamp switch and headlamp relay.
B1790	Auto lamp Sensor Input Circuit Failure	Twilight sensor input circuit failure	Check operation of battery saver. Check Twilight sensor and wiring
B1982	Driver's Door Unlock Relay Circuit Failure	Driver's door unlock is not successful / Driver's door lock feedback did not change after unlock action	Pinpoint tests G and N.

continued on the following page

DTC	Description	Precondition	Action
B2072	Seat Memory Module Data Line Short to Battery	S/C to Battery, External Fault	Check Seat memory module and wiring BEM pin Ds
B2073	Seat Memory Module Data Line Open or Short to Ground	O/C or S/C to Ground, External Fault	Check Seat memory module and wiring BEM pin Ds
B2074	Seat Memory Module Enable Line Short to Battery	S/C to Battery, External Fault	Check Seat memory module and wiring BEM pin Ds
B2075	B Seat Memory Module Enable Line Open or Short to Ground	O/C or S/C to Ground, External Fault	Check Seat memory module and wiring BEM pin Ds
B2103	Antenna Not Connected	TILA antenna not connected, External Fault	Check power available on Cl & earth . Check continuity from BEM pin Ew to TILA J6/1 (Rx) and BEM pin Eu to TILA J6/9 (Tx). Check TILA.
B2141	NVM Configuration Failure	No PCM ID Stored	Conduct a parameter reset
B2431	Transponder Programming Failed	Key programming failed	Program new key. If this fails try new transponder. If this still fails try a new TILA.
B2511	Horn Output Relay Circuit Short to Battery	S/C to Battery, External Fault	Test wiring BEM pin Dq and horn relay
B2555	Dome lamp output circuit short to battery	S/C to Battery, External Fault	Check wiring and BEM pin Ci
B2665	Battery backed Sounder circuit failure	Siren battery faulty	Replace Siren
B2682	PCM (PCM) Communication Fault	Immobilisation Message Invalid	Conduct a parameter reset. If this fails check the PCM.
B2891	Front Wiper Switch Potentiometer Circuit Failure	Potentiometer is missing, External Fault (O/C or S/C)	Check wiper dwell pot and wiring BEM pins Fk to Fh
B2929	Transmit Data Line Short to Battery	S/C to Battery, External Fault	Check continuity from BEM Eu to TILA J6/9. Check wiring and TILA.
B2930	Transmit Data Line Open Circuit or Short to Ground	O/C or S/C to Ground, External Fault	Check continuity from BEM Eu to TILA J6/9. Check wiring and TILA.
B2970	Tailgate Release Switch Circuit Failure	Boot/Tailgate Release switch stuck failure. Detected based on valid CAN bit received. Switch detected pressed for 2 minutes.	Check Boot/Tailgate release switch input at BEM pin Gp
C1943	Airbag Deployment Indication Input Fault	Airbag Deployed received. Status read during self tests.	Airbag deployed - No action
P2531	Ignition Switch Run Position Circuit Low	Ignition is not detected during Self Test	Check for supply at BEM pin Bg
P2537	Ignition Switch Accessory Position Circuit Low	Accessory is not detected during Self Test	Check for supply at BEM pin Dc Check 15A Acc fuse
U0100	Lost Communication With ECM/PCM	Missing CAN Message for 5 seconds	Check CAN network and ECM/ PCM DTC's

continued on the following page

DTC	Description	Precondition	Action
U0155	Lost Communication With Instrument Cluster (IC) Control Module	Missing CAN Messages for 5 seconds	Check CAN network and IC DTC's
U0156	Lost Communication With Information Centre (MC)	Missing CAN Messages for 5 seconds	Check CAN network and MC DTC's
U2197	Invalid 'Vehicle Speed' data	CAN bytes for vehicle speed is read as $FFFF from PCM	Check CAN network and ECM/ PCM DTC's

Symptom Chart

Condition	Possible Sources	Action
No TILA light Ring Illumination	* BEM related - Courtesy lamp driver * Battery BEM fuse blown * Cluster fault * Wiring fault * TILA fault - O/C globe	* Check 12v at Cl and TILA pin 1 * Check BEM battery fuse * Test continuity TILA pin 1 to TILA pin 6 * Go to pinpoint test A * Check other possible causes on symptom chart
No Demist Function	* BEM related - Relay driver failure - DTC's logged * Backlight fuse 40A blown * BEM accessories fuse Blown * Mirror fuse (7.5A) blown * External Relay failure * Demist Element fault * Demist switch failure (ICC) - Audio fault * Wiring fault - No accessories feed to BEM - CAN line failure	* Check relevant fuses * Check DTC B1348/49. If present go to Pinpoint Test B. If not present check ICC, wiring, Element, external relay.
BEM does not mobilise	* BEM related - PCM/BEM comms not working - BEM/TILA comms not working * More than one key in the TILA antenna field. * Transponder does not validate. * Wrong type of transponder key eg Ford Transit. * Magnetic badge on key ring. * Vehicle parked close to magnetic scanner. * PCM fault * Wiring fault (CAN) * TILA fault * Transponder key fault	* Connect PDS * Turn Ignition On and Run On Demand Self Test. * Record any DTC's logged. * Refer DTC chart for relevant pinpoint tests - Note TILA Status * Record any DTC's logged. * Low frequency security scanners may interfere with TILA read process. * Check other possible causes on symptom chart.
Customer Cannot Teach Transponder Keys	* BEM related - Customer Key teach mode not enabled. BEM programmed to disable customer key teach. * Ignition not turned to accessories position. * Low Battery Voltage. * More than one key in antenna * Wiring fault field * TILA fault * Transponder key fault	* Check programmed keys mobilise car. * Pinpoint test C * If pinpoint test C OK check other probable causes on symptom chart.

continued on the following page

Condition	Possible Sources	Action
BEM/PCM Training Failure	* BEM Related - BEM has not learnt Ignition Key. - BEM does not learn PCM key or loses Key (System Noise) - BEM validation failure (dealer used Dealer Teach Mode causing code erasure) * Low battery prevents Training. * Power interrupted during training. * Wiring fault. * Water in PCM connector (No codes Logged) * PCM fault * Wiring fault	* Use PDS to check vehicle anti theft status PID THEFTS * Use PDS to check if ignition keys have been trained (>1) * PID N_KEYCODE If training fails retry parameter reset. * If pinpoint test C OK check other probable causes on symptom chart.
Auto Headlamps do not turn on at low light level	* BEM related - Setting values Incorrect. * Open circuit wiring sunload sensor to BEM. * Twilight sensor fault * Wiring fault * Headlamp switch fault	* Check setting values PID ON_THOLD and DTC's B1693, B1790, B1791 with PDS. * Control headlamp drivers using PDS PID AUTOOUTST#. * Check other possible causes on symptom chart.
No Automatic Delay of Headlamps	* BEM related - Faulty Headlamp Drivers - Low Series BEM Fitted. - No Park input to Cluster or BEM * Pin Dc or Bg remains high at Ignition Off. * Headlamp switch fault * Wiring fault	* Check setting values PID ON_THOLD and DTC's B1693, B1790, B1791 with PDS. * Control headlamp drivers using PDS PID AUTOOUTST#. * Go to Pinpoint Test D * Check other possible causes.
Wipers do not Park in Off position	* BEM Related - Feedback circuit faulty De. * Wiring fault * Wiper motor fault * Wiper switch fault	* Operate wipers and monitor wiper park switch status using PDS and monitor pin De. If De does not follow status of PID WFLUID Byte 1 Bit 0 then change BEM else. * Check other possible causes on symptom chart.
Wipers do not Operate in Intermittent Mode.	* BEM Related - No accessories input to BEM - BEM wiper relay faulty * Wiring fault * Wiper motor fault * Wiper switch fault	* Do all tests in Wiper does not park, if ok proceed. * Using PDS read wiper switch status PID WP_STAT by selecting each position with intermittent selected. Pin Fk should vary between 0 - 2.5V as intermittent position is changed. If voltage varies and PID WP_STAT does not reflect change then replace BEM. * Else check other possible causes.

continued on the following page

Condition	Possible Sources	Action
No Variable Speed Dependant Wipers	* BEM Related - No accessories input to BEM - BEM wiper relay faulty * No Speed data or invalid data from PCM * Wiring faulty (CAN)	* Functional test for missing CAN messages * Check for existence of DTC U2917 (invalid speed data) using PDS. If present check PCM else * Check other possible causes.
Intermittent Dwell Time cannot be changed	* BEM Related - BEM potentiometer input faulty. - BEM wiper motor driver faulty (relay or relay drive circuit) * Wiper dwell pot switch faulty * Wiper stalk switch faulty * Wiring faulty	* Use PDS to Monitor Wiper dwell positions 1 to 5 (PID WP_STAT) while changing position of dwell pot. - If not OK then test dwell pot. * If PDS check OK then check Check other possible causes
No Wash Function or timed wash or wipe after wash	* BEM Related - BEM output driver faulty - BEM wash input faulty * Washer bottle empty * No accessories supply to BEM * Faulty wash motor * Faulty wiring * Faulty washer switch	* Using PDS activate and deactivate washer motor output (PID WASH_SW). Check activation of pin Ae during PID tests If no operation of washer motor, check wiring and motor. If wiring and motor OK then change BEM. * Check other possible causes.
Power Windows not Working	* BEM related - Faulty BEM power window supply output * Wiring faulty * Power window switch ass. faulty * Power window motor faulty	* Go to Pinpoint test E * Check other possible causes.
Power windows do not time out 45 seconds after door opened	* BEM related - BEM power window supply output faulty - BEM door ajar inputs faulty * Faulty door ajar switch. * Wiring fault	* Go to Pinpoint Test E * Go to pinpoint test M * Check other possible causes
Doors will not lock, Horn beeps	* BEM related - Door Ajar input faulty * Door open * Ignition key in ignition lock. * Transponder in vicinity of ignition * Faulty Door actuator * Wiring fault * Water ingress into connectors of door circuits.	* Check if key in ignition * Check if transponder in vicinity of ignition * Check cluster door ajar indicator if not accurate then * Go to pinpoint test M * Go to doors will not lock/unlock * Check other possible causes

continued on the following page

Condition	Possible Sources	Action
Doors will not Lock/unlock	* BEM related - BEM door lock driver circuit faulty - BEM door ajar inputs faulty - BEM door lock status input faulty * PCM mistakenly reports a crash (lock only) * Remote key not trained * Remote key battery Flat * Poor range due to aftermarket window tint * High local RF field. * Faulty door feedback circuit * Ignition turned on * Blown Door Fuse * Remote receiver fault * Wiring fault * Door lock motor fault * ICC switch fault	* Check all doors are closed * Using PDS ensure BEM is not in taxi mode. PID TAXI_MODE should = off. If not then change status of the mode. * Check for DTC B1300. Action DTC's * Go to Pinpoint Test C * Following test should be called up from DTC chart: * Check door lock output status with PDS (PID D_LCKO#) * Monitor status of door lock feedback (PID DLOCK_ST) while activating locks manually. * Go to pinpoint test M * Go to Pinpoint Test F * Check other possible causes
Door Locks Change State randomly	* BEM related - Door lock feedback circuit faulty - Door lock output faulty * Wiring fault (Ground shift). Turning on high current loads such as headlamps can cause the feedback reference at pin Gi to move upwards. * ICC faulty	* Using PDS check for DTC B1300. Action DTC * Check earth connections for door actuators, main battery to body earth * Refer to earth path, Door actuator * Check other possible causes
No Response from Remote Keys all Buttons	* BEM related: - Comms line with Receiver not working - Ignition and/or Accessories not low at key off * Remote key not trained. * Two remotes operating at the same time * Remote key lost sychronisation. * Remote key battery Flat. * Poor range due to aftermarket window tint. * High local RF field * Remote Receiver not operating.	* Resynchronise keys. * Replace remote key battery if required. * Retrain all keys. * Go to Pinpoint Test F * Go to Pinpoint Test D * Relocate vehicle and test remote keys.

continued on the following page

Condition	Possible Sources	Action
Boot will not open using Boot release switch	* BEM Related: - Input to BEM faulty - BEM output faulty * Vehicle Locked and Battery Saver Timed out * Wiring faults * Switch fault. * Solenoid fault	* Press decklid switch, Ignition On. Monitor decklid switch status, PID DECKLIDOS# * If PID does not change state then check Gp goes low when boot release pressed * Press decklid switch, Ignition On. Monitor decklid output status, PID DECKLIDOS# * If PID does not change state Activate PID DECKLIDOS# * Listen for activation of solenoid. If not OK then test Cn with a test light to ground press boot release switch a short pulse should be observed. * Test solenoid and wiring to boot solenoid. * Check other possible causes
Battery Saver Circuit Not Functioning Remote key will not turn on dome lamp. **NOTE**: The following functions will not operate: Dome lamps, Glove box lamps, Boot lamp, Sunload/Twilight sensor, Power Antenna, Antenna amplifier, TILA Light Ring.	* BEM related: - Incorrect Personalised settings. - Battery saver timed out. - Faulty Battery Saver Output * Fault in wiring	* Cycle ignition switch. Does battery saver turn on? If not proceed as follows. * Use PID BATSAVRLY# to turn on battery saver * Go To Pinpoint Test H. * Check other possible causes
Dome lamp not functioning	* BEM Related: - Personalized settings incorrect - No 12 V Input at J3/6 - Low Side Driver Failure pin Ci - Door ajar input faulty * Remote Receiver did not receive unlock signal * Ignition On * Blown Globe	* Go to Pinpoint Test I * Got to Pinpoint test H * Go to Pinpoint test M and monitor dome lamp operation * Check other possible causes
Dome lamp will not go out	* BEM Related: - Shorted Low Side Driver * Faulty Wiring * Can message not being received from ICC * Short circuit on TILA	* Press dome lamp button on ICC, if dome lamps do not turn off then * Test for shorts on Ci to ground and to dome lamps, check wiring from BEM to Light ring for shorts to ground. * Select PID ILLENTRLY#, and monitor status while pressing dome lamp switch. If not changing state then check ICC and CAN wiring. If PID is changing state then check wiring. If wiring OK then control PID ILLENTRLY#. IF wiring OK, CAN comms OK and PID will still not turn off dome lamp then change BEM. * Check other possible causes

continued on the following page

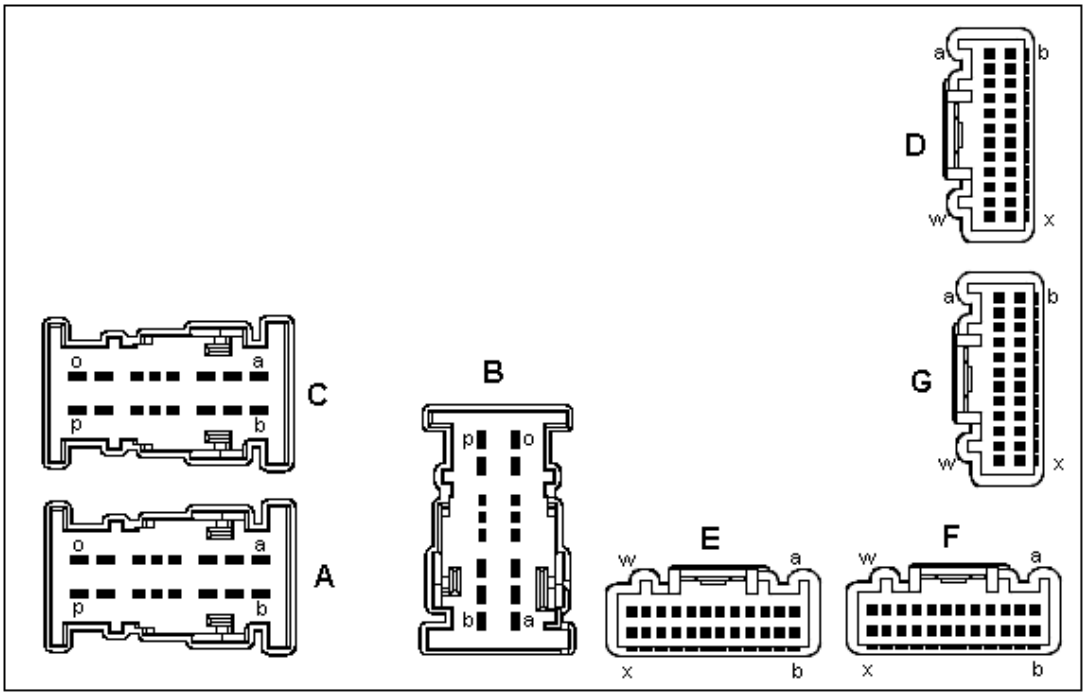
Condition	Possible Sources	Action
No Hazard Acknowledgment of Remote Key	* BEM Related: - BEM/receiver comms not operating - BEM not sending CAN message - BEM CAN global wake up line faulty * Wiring fault (CAN line wake up faulty) * Faulty cluster * Faulty receiver	* Confirm other remote functions are operating correctly * With ignition on check the CAN communication between BEM and cluster by opening and closing a door to check if door ajar status is correctly shown on cluster. If status is not correctly shown then check CAN wiring. If status is correctly shown then proceed * Check other possible causes
BEM does not have Accessories input. (CCT297)	* If 12V is not available at the BEM the following functions will be affected: - No wash function - No intermittent wipe - No power windows -No rear demist - No ICC operation * Fuse blown * Wiring fault * BEM input faulty	* Check the 15A fuse is not blown * Check wiring * If fuse OK and wiring OK then change BEM
BEM Accessories line remains high at key off resulting in No remote entry No battery saver function No boot release time out Rear demist time out not cancelled	* BEM related - Internal short on BEM * External wiring problem * This fault is often due to the fitment of other accessories holding the accessories line high. Audio amplifiers or mobile phones can have high supply line capacitance that keeps the voltage high after key off	* Remove all non standard accessories and see if problem persists * If problem persists without the accessories then check wiring. If wiring OK then change the BEM
No Ignition input to BEM in ignition or start position resulting in No Headlamp failure chime *	* BEM related - Ignition input on BEM faulty * Wiring fault * Blown fuse * No global can make up	* Tila fault * Check fuse * Check wiring * Check TILA * Using PDS check PID IGN_SW correctly reflects ignition switch position. If it does not and wiring and fuse and TILA are OK then change BEM.
Cannot Teach Transponder Keys	* BEM related - Customer Key teach mode not enabled - BEM/TILA communication circuit faulty * Faulty TILA * Faulty wiring * Faulty transponder * Low Battery Voltage	* Confirm correct procedure has been used to enter transponder key teach mode * Using already trained key check that key out/dome on function works. If this does not work there is a problem with TILA/ BEM system and all possible causes should be checked. If TILA, wiring, and transponder are OK then change BEM

continued on the following page

Condition	Possible Sources	Action
Headlamps do not go on when light level is low (dark conditions) with Ignition on and Auto Selected	* BEM related - Low series BEM in a High series car. - Twilight level settings incorrect * No connection between J1/6, J2/1 and the headlamp switch * Faulty Headlamp switch * Low series Headlamp switch fitted in high series car * Faulty twilight sensor * Faulty wiring	* Check other possible causes * Using PDS control using PID AUTOOUTST# to turn headlamps on and off (with headlamp switch in auto position). If this does not work then change BEM. If this works then * Check twilight level settings using PDS and interrogating PID ON_THOLD & OFF_THOLD. Adjust these thresholds using block write $0F if required
No Wipe on take off	* BEM related - Speed signal not received on CAN from PCM * Faulty PCM * Faulty CAN line	* Using PDS Check for U0100 or B2682 DTC's. This, in conjunction with PID PCM_MSG will indicate if there have been issues with CAN comms to PCM * Check other possible causes * Use PDS to determine if park switch is in parked position. PID WPRPRKSTS * Test continuity between De and Ab, wiper off. Tests internal relay contacts. * Test continuity between De and of wiper park switch * Inspect wiper park switch * Check Adjustment
Wipers do not operate in intermittent mode	* BEM related - Faulty wiper interface circuitry - Faulty wiper dwell pot input circuit - Wiper motor drivers not working * Faulty wiper motor * Faulty wiper dwell pot * Faulty wiring	* Do all tests in Wipers do not park in Off position, if ok proceed * Using PDS read wiper switch status PID WP_STAT by selecting each position with intermittent selected * Test wiring between Ek and wiper switch. Goes low when intermittent selected * Check Wiper switch grounding * Check other possible causes
No Timed Wash Function or Wipe after Wash	* BEM related - Wash input circuit faulty * Wiring fault * Wiper switch fault	* If washer motor runs but no timed feature, check wiring between Ae and washer motor (cct 941) * Check 12 V available at Dc and Bg with ignition on
No Headlamp Fail Chime	*BEM related - Ignition input circuit faulty - CAN communication to cluster not working - BEM thinks its in auto mode * No Ignition Input to BEM * Cluster faulty * Wiring faulty * Headlamp switch faulty	* Check headlamp switch is in auto position * Check BEM communications to cluster by opening and closing a door when ignition is on and confirming the cluster is correctly displaying door ajar status * Check other possible causes * Test 12V available at Bg when in ignition position, and 0V when ignition is off

Connector Circuit Reference

BEM



Colour coding for connectors:

A – Blue B – White C – Grey D – Blue E – Green F – White G – Grey

Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
A-a	55B (B-P) V.batt batt. Saver supply	De-energised: >11 Energised: >11 Level: V Bat
A-b	58B (W-L) Front wiper low relay o/p	De-energised: <2 Energised: > 11 Level: H & L
A-c	298A (L-Y) Acc front washer pump	De-energised: < 2 Energised: > 11 Level: H & L
A-d	56B (L-Y) Front wiper high relay o/p	De-energised: < 2 Energised: > 11 Level: H & L
A-e	941 (GR-B) Front washer motor	De-energised: < 2 Energised: > 11 Level: H & L
A-f	Not connected	
A-g	Not connected	
A-h	57EG (BLK) Front wiper return	De-energised: < 2 Energised: < 2 Level: Ground
A-i	Not connected	
A-j	Not connected	

continued on the following page

Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
A-k	Not connected	
A-l	38BA (Y-B) V.batt BEM	De-energised: >11 Energised: >11 Level: V Bat
A-m	Not connected	
A-n	Not connected	
A-o	134 (W) V.batt locking	De-energised: >11 Energised: >11 Level: V Bat
A-p	57N (BLK) Sig Ground 2	De-energised: 0 Energised: 0 Level: Ground
B-a	Not connected	
B-b	Not connected	
B-c	Not connected	
B-d	38 (L-Y) V.batt wiper front	De-energised: >11 Energised: >11 Level: V Bat
B-e	Not connected	
B-f	Not connected	
B-g	16HB (R-G) Igniton sw	De-energised: < 2 Energised: >11 Level: H & L
B-h	950 (W-B) Front washer switch	De-energised: > 11 Energised: < 2 Level: H & L
B-i	Not connected	
B-j	Not connected	
B-k	Not connected	
B-l	Not connected	
B-m	57EE (BLK) Sgnd	De-energised: 0 Energised: 0 Level: Ground
B-n	Not connected	
B-o	Not connected	
B-p	57CE (BLK) Gnd power	De-energised: 0 Energised: 0 Level: Ground
C-a	Not connected	
C-b	Not connected	
C-c	117A (Y-B) Door lock motors	De-energised: < 2 Energised: > 11 Level: H & L
C-d	54B (G-Y) Battery saver relay o/p	De-energised: < 2 Energised: > 11 Level: H & L
C-e	118A (R-Y) Door unlock motor	De-energised: < 2 Energised: > 11 Level: H & L
C-f	Not connected	

continued on the following page

Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
C-g	Not connected	
C-h	Not connected	
C-i	53G (B-L) Interior lamps	De-energised: < 2 Energised: > 11 Level: Variable
C-j	Not connected	
C-k	Not connected	
C-l	23 (R-Y) Tila supply	De-energised: < 2 Energised: > 11 Level: H & L
C-m	1329A (Y) Drivers door unlock motor	De-energised: < 2 Energised: > 11 Level: H & L
C-n	84 (V) Boot release output	De-energised: < 2 Energised: > 11 Level: H & L
C-o	Not connected	
C-p	Not connected	
D-a	Not connected	
D-b	Not connected	
D-c	297B (B-Y) Accessories switch	De-energised: < 2 Energised: > 11 Level: H & L
D-d	Not connected	
D-e	28 (B-O) Front wiper park switch	De-energised: > 3.5 Energised: < 1.5 Level: H & L
D-f	Not connected	
D-g	267 (BR) Memory seat enable	Energised: Data Level: H & L
D-h	Not connected	
D-i	219A (O-R) Auto headlamp relay 1	De-energised: > 11 Energised: < 2 Level: H & L
D-j	Not connected	
D-k	686 (V) Back light relay	De-energised: > 11 Energised: < 2 Level: H & L
D-l	Not connected	
D-m	513 (BR) Power window relay	De-energised: > 11 Energised: < 2 Level: H & L
D-n	Not connected	
D-o	Not connected	
D-p	Not connected	
D-q	1A (L) Horn relay	De-energised: > 11 Energised: < 2 Level: H & L
D-r	Not connected	

continued on the following page

Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
D-s	268 (B-O) Memory seat data	De-energised: < 1.5 Energised: data Level: H & L
D-t	Not connected	
D-u	Not connected	
D-v	Not connected	
D-w	1304 (P) Hood Ajar (alarm option)	De-energised: >11 Energised: < 1.5 Level: H & L
D-x	Not connected	
E-a	Not connected	
E-b	Not connected	
E-c	Not connected	
E-d	Not connected	
E-e	2147 (B-Y) Seat rear mid	Un-buckled: >11 Buckled: < 1.5 Level: H & L
E-f	Not connected	
E-g	Not connected	
E-h	Not connected	
E-i	Not connected	
E-j	Not connected	
E-k	590 (G-W) Front wiper int auto sw	De-energised: >11 Energised: < 1.5Level: H & L
E-l	Not connected	
E-m	1355 (BR) Trailer detect	De-energised: >11 Energised: < 1.5 Level: H & L
E-n	Not connected	
E-o	Not connected	
E-p	Not connected	
E-q	Not connected	
E-r	Not connected	
E-s	Not connected	
E-t	Not connected	
E-u	340 (B-LG) Transciever TX data	De-energised: Data Energised: Data Level: H & L
E-v	Not connected	
E-w	24 (L-O) Transciever RX data	De-energised: Data Energised: Data Level: H & L
E-x	Not connected	
F-a	Not connected	
F-b	Not connected	
F-c	Not connected	
F-d	Not connected	

continued on the following page

Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
F-e	58A (W-L) Front wiper low switch	De-energised: >11 Energised: < 1.5 Level: H & L
F-f	Not connected	
F-g	Not connected	
F-h	589A (O) Var wiper dwell pot return	De-energised: 0 Energised: 0 Level: ground
F-i	Not connected	
F-j	Not connected	
F-k	993 (BR-W) Var wiper dwell pot	Minimum: 0 Maximum: >11 Level: variable
F-l	Not connected	
F-m	Not connected	
F-n	Not connected	
F-o	Not connected	
F-p	56A (L-Y) Front wiper high switch	De-energised: >11 Energised: < 1.5 Level: H & L
F-q	Not connected	
F-r	Not connected	
F-s	2148 (L) Seat rear pass	De-energised: >11 Energised: < 1.5 Level: H & L
F-t	Not connected	
F-u	Not connected	
F-v	2181K (B-Y) MS-CAN low	De-energised: data Energised: data Level: H & L
F-w	Not connected	
F-x	2180K (W-B) MS-CAN high	De-energised: data Energised: data Level: H & L
G-a	Not connected	
G-b	Not connected	
G-c	Not connected	
G-d	219C (O-R) Auto head lamp relay 2	De-energised: > 11 Energised: < 2 Level: H & L
G-e	630 (B-R) Passenger rear door ajar	De-energised: >11 Energised: < 1.5 Level: H & L
G-f	Not connected	
G-g	627 (B-O) Driver rear door ajar	De-energised: >11 Energised: < 1.5 Level: H & L
G-h	Not connected	

continued on the following page

Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
G-i	122 (Y) Driver door lock feedback	De-energised: >11 Energised: < 1.5 Level: H & L
G-j	Not connected	
G-k	788 (R-W) Sun load sensor input	Analogue – 0 to 5V
G-l	Not connected	
G-m	26 (M) Boot ajar	De-energised: >11 Energised: < 1.5 Level: H & L
G-n	Not connected	
G-o	Not connected	
G-p	170 (R-Y) Boot release switch	De-energised: >11V Energised: < 1.5 Level: H & L
G-q	Not connected	
G-r	2146 (G-W) Seat rear driver side	Un-buckled: >11V Buckled: < 1.5 Level: H & L
G-s	628 (W) Driver front door ajar	De-energised: >11V Energised: < 1.5 Level: H & L
G-t	629 (W-R) Pass front door ajar	De-energised: >11V Energised: < 1.5 Level: H & L
G-u	2184 (O-L) Lin-1	De-energised: data Energised: data Level: H & L
G-v	234 (W-L) Twilight sensor input	Level: data
G-w	Not connected	
G-x	Not connected	

Pinpoint Tests

PINPOINT TEST A : COURTESY LAMP DRIVER TEST	
CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1 :	
	1.Using PDS operate courtesy lamp drivers and monitor pin Ci.
	Is pin low when drivers activated and high otherwise?
	Yes
	Return to symptom chart for next steps
	No
	GO to A2
A2 :	
	Check wiring to pin Ci. Is wiring OK?
	Yes
	Replace BEM
	No
	Fix wiring

PINPOINT TEST B : HEATED BACKLIGHT TEST	
CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1 :	
	1. Using PDS monitor (BACKL_SW) when pressing ICC backlight switch.
	Is input OK?
	Yes
	GO to B2
	No
	Check other probable causes on symptom chart.
B2 :	
	1. Turn on demist relay using PDS (HEAT_BCK)
	2. Check voltage at pin Dk is 0V.
	3. Turn demist relay off using PDS.
	4. Check voltage at pin Dk is 12V.
	Are results OK?
	Yes
	Check other probable causes on symptom chart.
	No
	GO to B3
B3 :	
	1. Check wiring to pin Dk
	Is wiring OK?
	Yes
	Replace BEM
	No
	Fix wiring

PINPOINT TEST C : IGNITION SWITCH VOLTAGE LEVELS	
CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1 :	
	Does Battery Accessory and Ignition and ground have appropriate voltage levels when key in relevant ignition position?
	Yes
	Return to symptom chart
	No
	Check TILA and wiring

PINPOINT TEST D : IGNITION AND ACCESSORY LOW AT KEY OFF	
CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1 :	
	Does ignition and Accessories go low at Ignition Off?
	Yes
	Return to symptom chart
	No
	Check TILA and wiring

PINPOINT TEST E : POWER WINDOW SUPPLY	
CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1 :	
	1. Activate and deactivate BEM power window supply (PID WIND_OS#)
	Is the measured output voltage Dm as expected?
	Yes
	Go to symptom chart.
	No
	GO to E2
E2 :	
	Is wiring to pin Dm OK?
	Yes
	Change BEM
	No
	Fix wiring

PINPOINT TEST F : REMOTE RECEIVER OPERATION	
CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1 :	
	1. Connect PDS.
	2. Monitor status of PID TNSMT_CMD while pressing different buttons on remote key.
	Does PID status reflect last button pressed?
	Yes
	Go to symptom chart
	No
	GO to F2
F2 :	
	1. Take known good remote key and try and train it to the car.
	Does BEM acknowledge receipt of key press as part of training procedure?
	Yes
	Original remote key was faulty. Replace original remote key.
	No
	GO to F3
F3 :	
	1. Change receiver and take known good remote key and try and train it to the car.
	Does BEM acknowledge receipt of key press as part of training procedure?
	Yes
	Original receiver was faulty.
	No
	Replace BEM and repeat step F2. If still unsuccessful then replace ICC (Internal ICC wiring fault).
PINPOINT TEST G : DOOR LOCK INPUT	
CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1 :	
	1. Monitor voltage at pin Gi while locking and unlocking the drivers door.
	Is voltage 0V when door unlocked and 12V when door locked?
	Yes
	Return to symptom chart
	No
	Check wiring and door lock feedback on motor.

PINPOINT TEST H : BATTERY SAVER CIRCUIT NOT FUNCTIONING	
CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1 :	
	1.Ensure glove box globe is present and operational
	2.Activate PID BATTSAVRLY# command with Glove Box Door open
	Does glove box lamp illuminate?
	Yes
	Battery saver circuit operating correctly. Return to symptom chart.
	No
	GO to H2
H2 :	
	1.Using PDS activate and deactivate battery saver and monitor pin Cd.
	Is voltage output as expected?
	Yes
	Return to symptom chart.
	No
	GO to H3
H3 :	
	Check wiring to pin Cd. Is wiring OK?
	Yes
	Replace BEM
	No
	Fix wiring

PINPOINT TEST I : DOME LAMP NOT FUNCTIONING	
CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1 :	
	1.Turn off ignition.
	2.Monitor Personalizes settings TAXI_MODE, PANIC_ALR, DTRIG_MOD, MDT_MOD, HAZ_WARN, HORN_WARN, BAT_SAV, COURTESY.
	3.Test 12V available on Cd. Operate Dome switch on ICC.
	Does Dome lamp operate?
	Yes
	Dome lamp operating correctly.
	No
	GO to I2
I2 :	
	1.Select PID LR_AJAR, RR_AJAR
	Did dome lamp turn on?
	Yes
	Return to symptom chart
	No
	Ground Ci . GO to I3
I3 :	
	Does dome lamp light?
	Yes
	BEM fault
	No
	Wiring fault

PINPOINT TEST J : NO DEMIST FUNCTION	
CONDITIONS	**DETAILS/RESULTS/ACTIONS**
J1 :	
	Are DTC’s B1348 and B1349 present?
	Yes
	Follow fault finding chart for these codes
	No
	GO to J2
J2 :	
	1.Check radio fuse 15A is not blown.
	2.Check backlight fuse 40A is not blown.
	3.Test heater element continuity.
	4.Test element earth point.
	5.Using PID BACKL_SW check status of heated backlight switch and status of output driver when switch operated with ignition on (PID HEAT_BCK#).
	Is the backlight status available?
	Yes
	Return to symptom chart.
	No
	Check CAN communications.

PINPOINT TEST K : NO WASH FUNCTION	
CONDITIONS	**DETAILS/RESULTS/ACTIONS**
K1 :	
	1.Supply 12 V to pin Ae.
	Does washer motor run?
	Yes
	Fault is in the wiring or wiper switch.
	No
	GO to K2
K2 :	
	Confirm ground is connected to washer motor?
	Yes
	GO to K3
	No
	Check wiper fuse. If wiper fuse blown or missing, then replace. If fuse OK then check wiring.
K3 :	
	1.Using PDS control BEM washer motor output activate. PID WASHPUMP#.
	Monitor pin Ae. Is pin 12V when output is activated and 0V otherwise?
	Yes
	Return to symptom chart.
	No
	Check wiring. If wiring OK then change BEM.
PINPOINT TEST L : POWER WINDOWS NOT WORKING	
CONDITIONS	**DETAILS/RESULTS/ACTIONS**
L1 :	
	1.Connect PDS.
	Is the status of the power window relay with the ignition turned on OK?
	Yes
	Return to symptom chart.
	No
	Test for 12 v output from the power window relay pin Dm, Check power window front and rear fuses.

PINPOINT TEST M : DOOR AJAR INPUT TEST	
CONDITIONS	**DETAILS/RESULTS/ACTIONS**
M1 :	
	1.Check Door ajar status with PDS (PID LR_AJAR, RR_AJAR, LF_AJAR, RF_AJAR) while opening and shutting doors.
	Does PID reflect door ajar status?
	Yes
	Return to symptom chart.
	No
	GO to M2
M2 :	
	1.Check voltage at following pins and compare to PIDs bits as follows:
	Does PID status reflect voltage levels?
	Yes
	Return to symptom chart.
	No
	GO to M3
M3 :	
	Is wiring to relevant pins OK?
	Yes
	Change BEM.
	No
	Fix wiring.
PINPOINT TEST N : DOOR LOCK OUTPUT TEST	
CONDITIONS	**DETAILS/RESULTS/ACTIONS**
N1 :	
	1.Ensure fuses and wiring are not faulty.
	2.Control door lock output status with PDS (PID D_LCKO#).
	Does this reflect soldier button requested position?
	Yes
	Return to symptom chart.
	No
	GO to N2
N2 :	
	1.Monitor voltage level at pins Ce, Cc and Cm while locking and unlocking doors with PDS.
	Are voltage levels as expected?
	Yes
	Return to symptom chart
	No
	If fuses and wiring and motors have been checked to be OK then replace the BEM.

GENERAL PROCEDURES

Remote Key Teaching

1. Have all remote keys to be taught to the system available for this session.
2. Turn the ignition switch to the accessories position, within 5 seconds, press the demist button 3 times, teach mode is acknowledged by the door locks changing state. i.e. lock to unlock or unlock to lock. When teach mode is entered all remote key codes stored in memory will be erased.
3. Once key teach mode has been entered, immediately press any button on the remote key. If the BEM learns the key, the doors locks will change state.
4. Select the next remote key to be taught, again press any button, and wait for the doors locks to change state. Repeat this procedure until all keys are taught (up to 8 keys may be taught).
5. To exit mode, turn key to off or ignition on. The door locks will cycle to indicate the mode has been terminated. If the ignition key is moved from the accessories position during key teach the session will be terminated.

Receiver Resynchronization

1. If a remote key is out of synchronization it may be resynchronized by transmitting with a valid key to the BEM then within 30 seconds transmit with the key to be resynchronized.

Dealer DST Ignition Key Teach Mode

NOTE: This mode is used by dealers to teach DST keys to new P & BEM or for general DST key erasing and teaching. Entering Dealer key teach mode will also erase the PCM ID in the BEM. On completion of the key teach the PCM will be prompted to perform a parameter reset. It is recommended that the dealer be seated in the vehicle with the doors closed.

1. Starting with the key in the ignition position, turn the ignition to the off position.
2. Within 2 minutes of turning the key to the off position enter dealer key teach mode using the PDS.
3. When the dealer key teach mode is entered the PCM ID is erased, an acknowledgment will be received. Place the first DST ignition key to be taught in the ignition switch and turn to ignition on, a door lock actuation acknowledgement ill be received if teach is successful.
4. Turn the key to off and remove the DST key.
5. Place the next key in the ignition and turn to on, when the second key is taught 2 acknowledgments will be received and so on. Up to 8 keys may be taught in this way.
6. To exit at any time turn the ignition off for longer than 10 seconds.
7. Next perform a coded access reset to reteach the PCM ID to the BEM.

Customer DST Ignition Key Teach

NOTE: PCM ID is not disturbed in this teach mode.

1. The customer must have 2 valid keys that are recognised by the BEM.
2. It is recommended that the customer sit in the vehicle with the doors closed.
3. Place the first key in the ignition and turn to accessories position turn to off and remove key.
4. Within 5 seconds place the second key into the ignition and turn to the ignition position. At this point the door locks will state to indicate learn mode is entered.
5. To teach a new key insert the new key within 5 seconds and turn to the ignition position, if successful an acknowledgment will be received.

Lost Keys

NOTE: It is recommended that the vehicle be taken to the dealer if keys are lost. The lost keys can be erased from the BEM and new keys taught.

Customer Key Erasure

NOTE: This procedure can only be used if more than 2 keys have been programmed to the BEM.

NOTE: The two keys used to enter teach mode will not be erased.

1. Enter Customer key teach mode and when acknowledgment is received.
2. Place the second key used to enter teach mode in the ignition lock and turn to the ignition on position, then off and remove, followed by the first key which must also be turned to the ignition on position then removed. The BEM will perform two acknowledgments.
3. All other keys are erased. Leaving the ignition off for longer than 10 seconds will exit the mode and an acknowledgment will be received.

PCM Coded Access Reset

NOTE: Coded Access reset is used whenever a BEM, PCM or Cluster is replaced or Dealer key teach is used. The PDS Diagnostic tool is used to perform this function.

Changing BEM

Whenever a BEM is to be replaced the following steps need to be done. Read and record the following values.

1. Body Type and VIN
2. Battery saver/ interior lamp operation (taxi/ normal/etc)

When the new BEM is installed using PDS and “Module Installation” the above setting along with stored remote pad values should be automatically entered into the new BEM.

If the data is unable to be recovered from the existing BEM then the data and values will need to be manually entered.

In a separate operation PDS will be required to teach a minimum of two ignition keys to the new BEM and a parameter reset before the vehicle can be started.

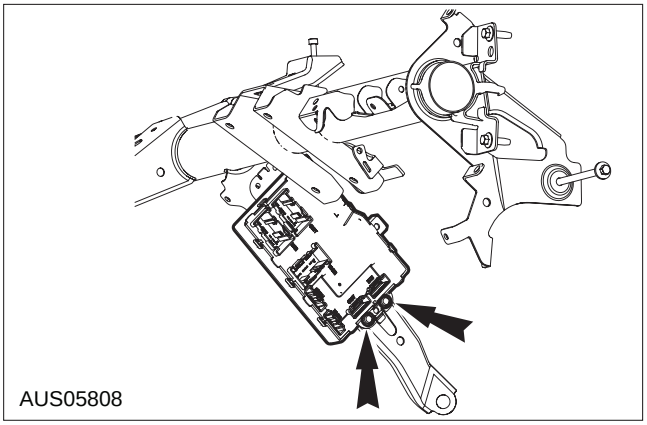
REMOVAL AND INSTALLATION

The BEM

Removal

NOTE: The BEM is mounted on the drivers side on the centre console above and left of the brake pedal.

1. Remove the BEM bracket to instrument panel reinforcement assembly retaining screws.



2. Position the ignition key in the off position.
3. Disconnect the electrical interface connectors.
   NOTE: Ensure that the ESD handling procedures are observed.
4. Remove the BEM from the BEM bracket.

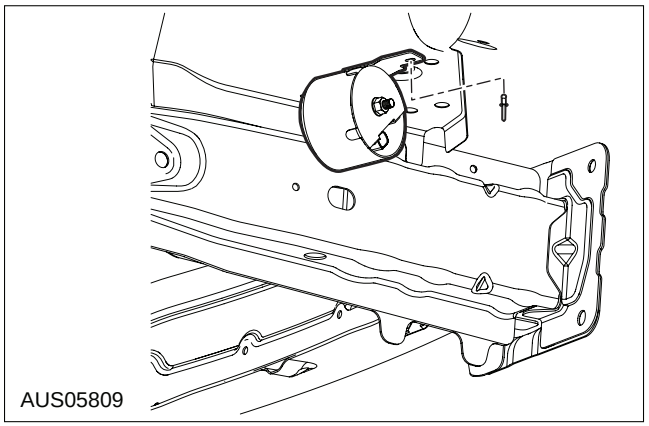
Installation

1. Installation is the reverse of the removal.

The BBS

Removal

1. Remove the front right wheel and tyre. Refer to section 204-04.
2. Remove the front right inner splash guard. Refer to section 501-02.
3. Disarm the vehicle alarm by unlocking via the remote key.
4. Drill out the rivet retaining the siren.
5. Disconnect the electrical connector.
6. Remove the siren from the vehicle.



Installation

1. Position siren to the vehicle
2. Rivet the siren using rivet V840140 (4.8 x 10.2)
3. Connect the electrical connector.
4. Install the front right inner splash guard. Refer to section 501-02.
5. Install the front right wheel and tyre. Refer to section 204-04.