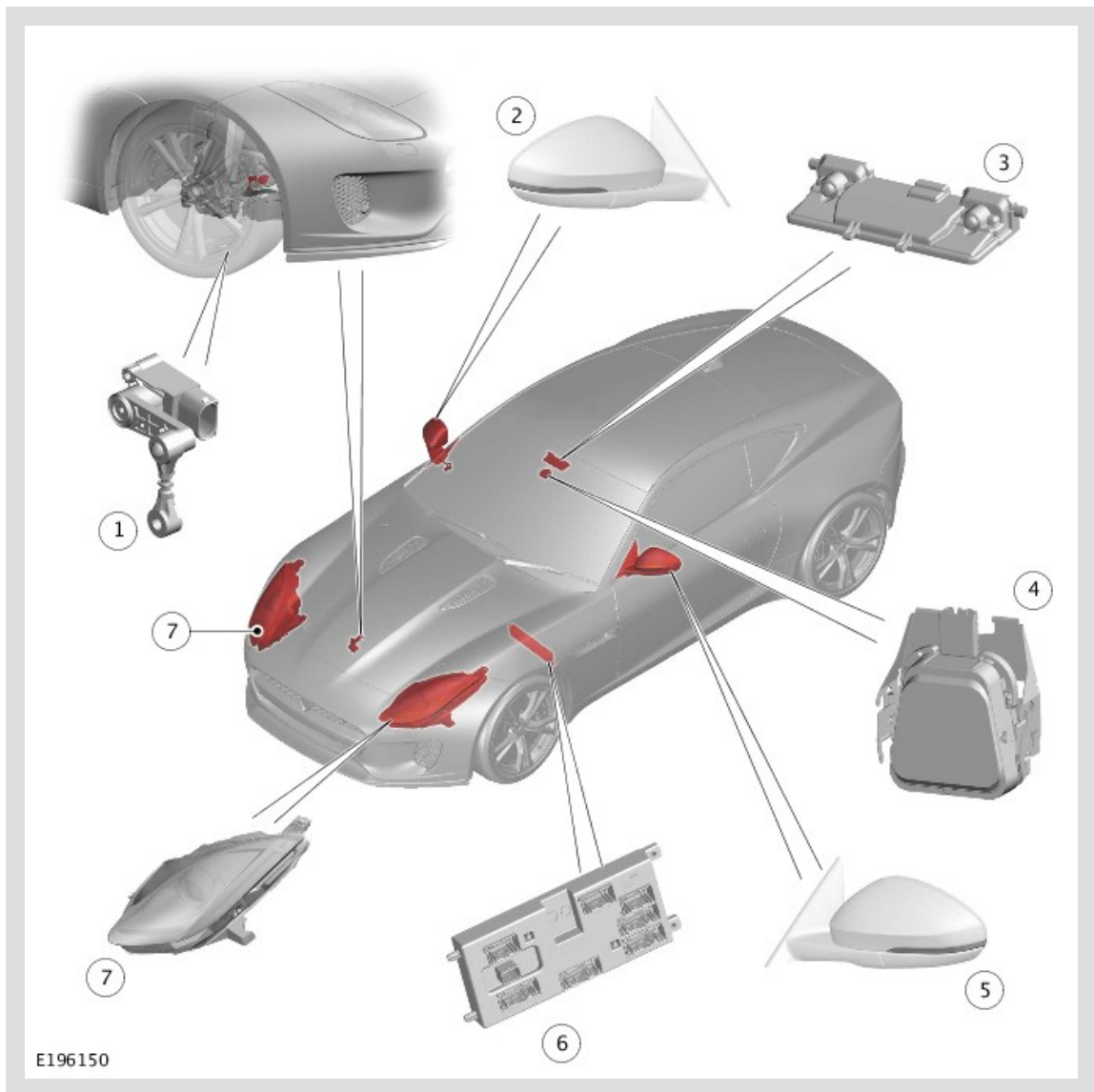


2018.0 F-TYPE (X152), 417-01
EXTERIOR LIGHTING

DESCRIPTION AND OPERATION

COMPONENT LOCATION

COMPONENT LOCATION - 1 OF 4

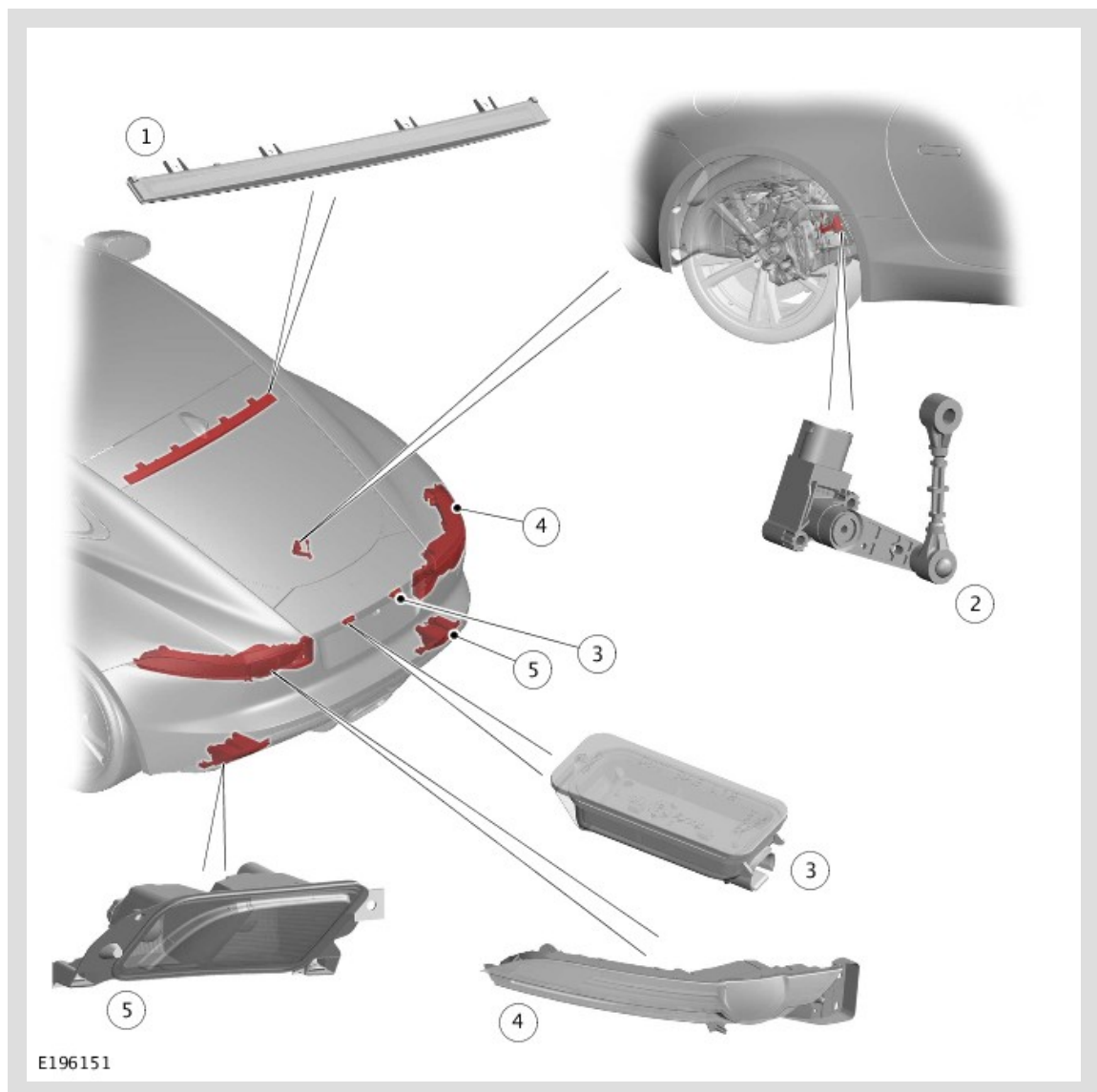


ITEM

DESCRIPTION

1	Front right height sensor
2	Right side repeater lamp
3	Image Processing Control Module (IPMA)
4	Rain/light sensor
5	Left side repeater lamp
6	Body Control Module/Gateway Module (BCM/GWM) assembly
7	Headlamp assembly - 2 off

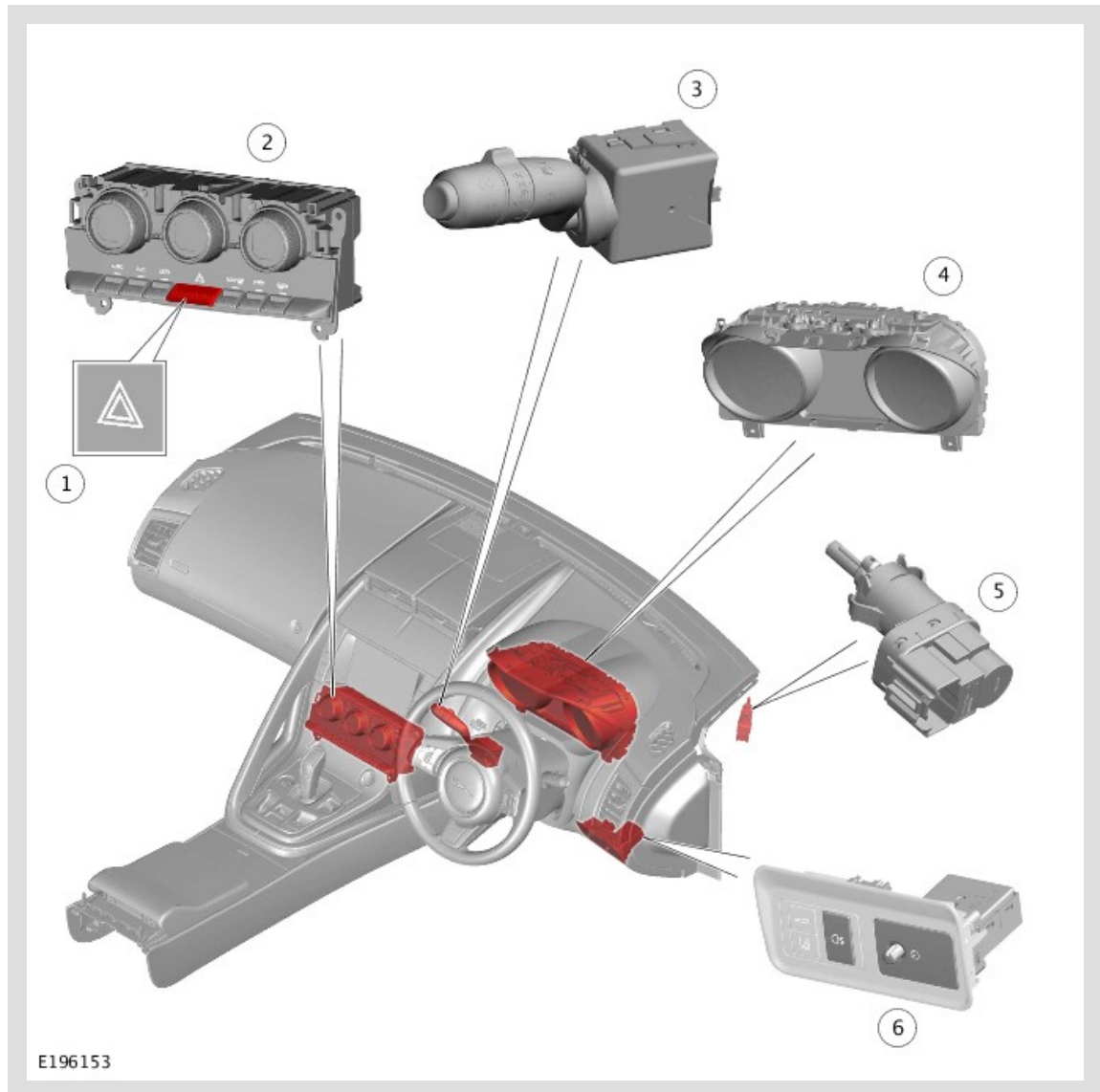
COMPONENT LOCATION - 2 OF 4



ITEM	DESCRIPTION
1	High Mounted Stop Lamp (HMSL)
2	Rear height sensor

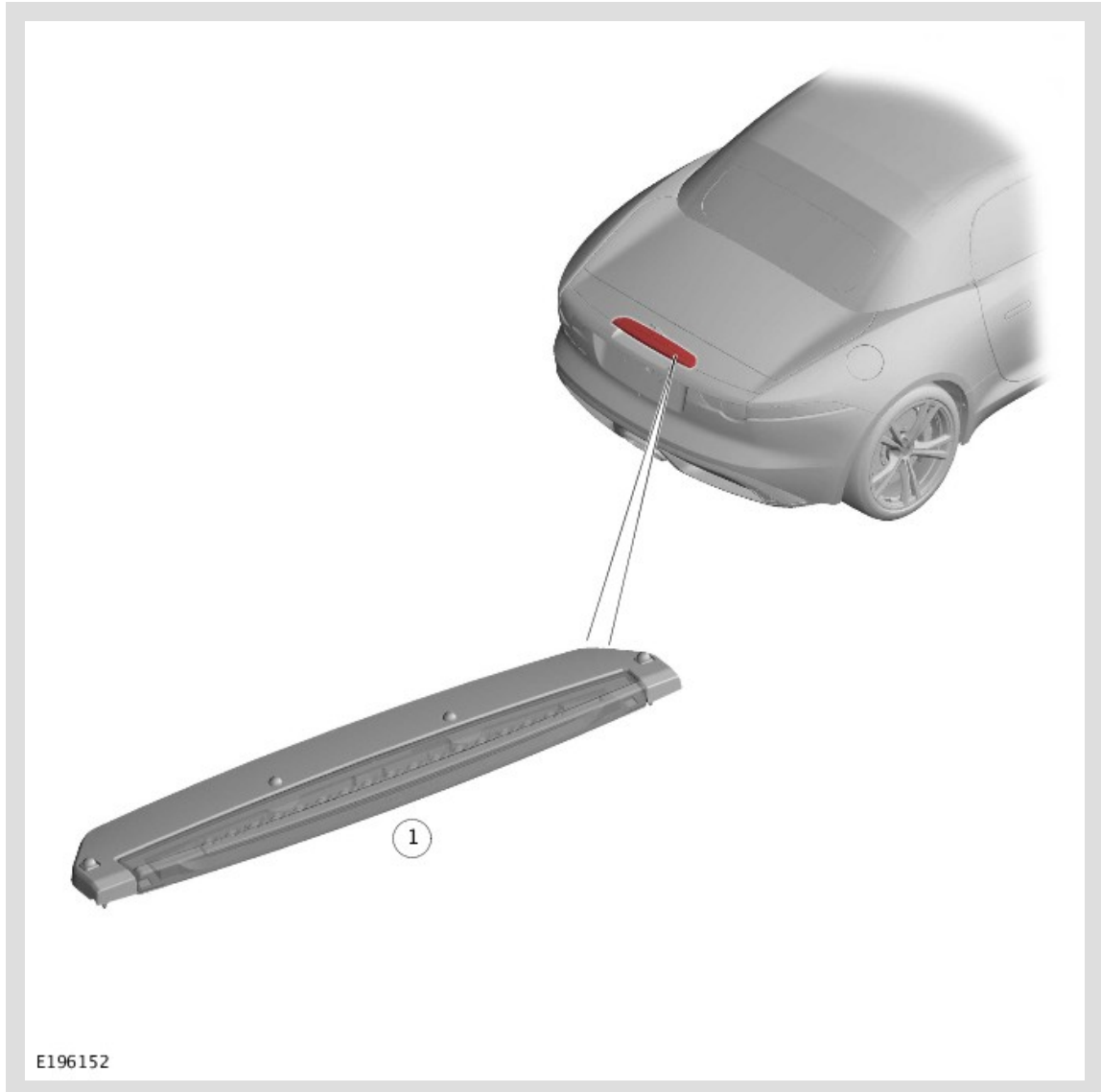
3	License plate lamp – 2 off
4	Tail lamp assembly – 2 off
5	Fog/reverse lamp – 2 off

COMPONENT LOCATION - 3 OF 4



ITEM	DESCRIPTION
1	Hazard warning lamp switch
2	Hazard warning lamp switch - Integrated Control Panel (ICP)
3	Light control switch and left steering column multifunction switch
4	Instrument Cluster (IC)
5	Brake pedal switch
6	Rear fog lamp switch

COMPONENT LOCATION - 4 OF 4 – CONVERTIBLE ONLY



ITEM	DESCRIPTION
1	High Mounted Stop Lamp (HMSL)

OVERVIEW

Exterior lighting consists of:

- Two headlamp assemblies, each containing a:
 - Headlamp
 - Turn signal indicator
 - Combined Daytime Running Lamp (DRL) and side lamp

- Side marker lamp and reflector (NAS only).
- Two tail lamp assemblies, each containing a:
 - Turn signal indicator
 - Tail lamp
 - Stop lamp
 - Rear side markers
- Two fog/reverse lamps
- A High Mounted Stop Lamp (HMSL)
- Two license plate lamps.
- Two side repeater lamps
- An Image Processing Module (IPMA) - If equipped
- Two height sensors
- A brake pedal switch
- A lighting control switch and steering column multifunction switch
- A rear fog lamp switch
- A hazard warning lamp switch
- A rain/light sensor
- Warning indicators.

The exterior lighting is controlled by the Body Control Module /Gateway Module (BCM/GWM) assembly.

The BCM/GWM assembly controls the following vehicle functions:

- Control and monitoring of exterior lamps including turn signal indicators and hazard warning lamp functionality.
- Monitoring and evaluation of check control inputs from other system control modules and output of applicable messages in the Instrument Cluster (IC) message center.

The BCM/GWM assembly is connected to the Medium Speed (MS) and High Speed (HS) Controller Area Network (CAN) buses. The BCM/GWM assembly contains a microprocessor which performs the control, monitoring and evaluation of functions.

Driver lighting selections are made using the lighting control switch and left steering column multifunction switch, the rear fog lamp switch and the hazard warning lamp switch. The BCM/GWM assembly operates the brake lamps using the inputs from the brake pedal switch.

Depending on model and market specification, the lighting system may have:

- An Auto High Beam (AHB) function, where the headlamps are automatically switched between low and high beam in response to signals from the Image Processing Module (IPMA).
- An autolamps function, where the exterior lights are automatically turned on or off in response to signals from the rain/light sensor used for automatic wiper operation.

For additional information, refer to: [Wipers and Washers](#) (501-16 Wipers and Washers, Description and Operation).

The headlamps and tail lamps assemblies that contain Light Emitting Diodes (LED)s are not serviceable parts. The Light Emitting Diode Driver Module (LEDDM) for the LED headlamps is a serviceable part.

DESCRIPTION

HEADLAMP ASSEMBLIES

Each headlamp assembly is secured to the front body structure with three bolts and washers. The rear of the headlamp assembly has a removable cap for access to the xenon headlamp bulb. The headlamp assembly has two adjustment screws on the rear which allow for the manual setting of the vertical and horizontal alignment.

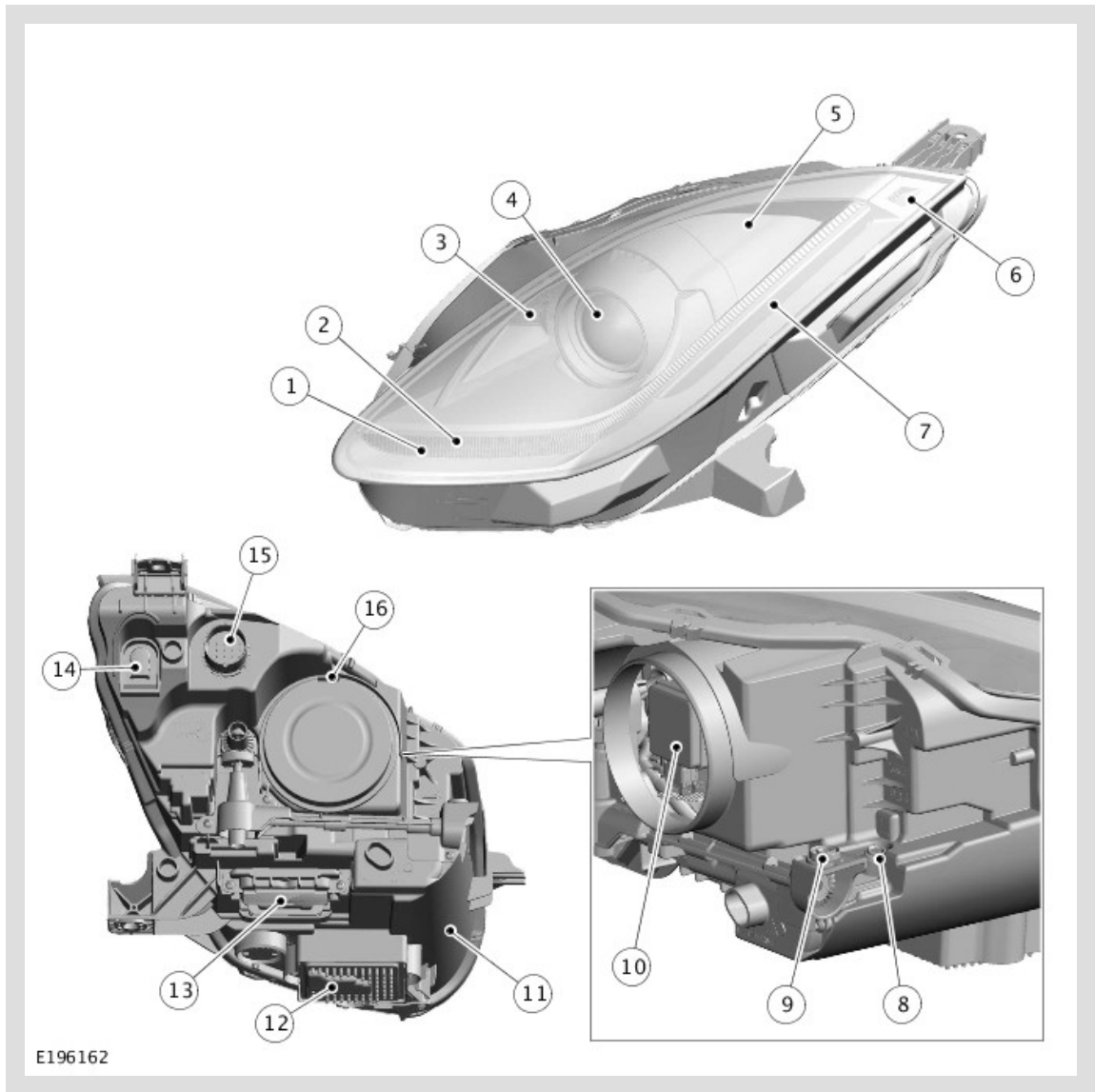
Three types of headlamp are available:

- Xenon headlamps - Base version
- Full Light Emitting Diode (LED) headlamps
- Full LED headlamps with Auto High Beam (AHB) and Adaptive Front lighting System (AFS)123 functions.

Each headlamp assembly has an integral connector which provides inputs and outputs for the various functions of the headlamp assembly. A xenon bulb control module and a Light Emitting Diode Driver Module (LEDDM) are installed on the underside of the headlamp housing, to control power to the xenon headlamps and the LED lamps respectively.

The headlamp beam pattern is suitable for driving on either side of the road. There is no need for any mechanical adjustment or external decals.

Xenon Headlamp Assembly



ITEM	DESCRIPTION
1	Turn signal indicator
2	Daytime running lamp/side lamp
3	Cornering lamp or static bending lamp - If equipped
4	Xenon headlamp
5	Lens
6	Side marker lamp - North American Specification (NAS) only
7	Reflector - North American Specification (NAS) only
8	Vertical adjuster
9	Horizontal adjuster
10	Xenon bulb and igniter

11	Housing
12	Light Emitting Diode Driver Module (LEDDM)
13	Xenon bulb control module
14	Vent
15	Electrical connector
16	Cap



WARNING:

The xenon system generates up to 28000 volts and contact with this voltage could lead to fatality. Make sure that the headlamps are switched off before working on the system.

The following safety precautions must be followed when working on a xenon headlamp system:

- DO NOT attempt any procedures on the xenon headlamps when the lights are switched on.
- Handling of the xenon bulb must be performed using suitable protective equipment, e.g. gloves and goggles. The glass part of the bulb must not be touched.
- Xenon bulbs must be disposed of as hazardous waste.
- Only operate the lamp in a mounted condition in the reflector.

The xenon headlamp operates as both a low and high beam unit. The unit comprises a reflector, an adaptor ring, the lens, a shutter controller and the xenon bulb, which together is an assembly known as the projector module. The projector module is installed in a carrier frame that allows the module to tilt for vertical movement of the headlamp beam. Vertical movement is controlled by an actuator, connected between the carrier frame and the projector module, operated by the Body Control Module/Gateway Module (BCM/GWM) assembly for automatic headlamp leveling.

The reflector is curved and provides the mounting for the xenon bulb. The bulb locates in a keyway to ensure correct alignment in the reflector and is secured by a plastic mounting ring. The bulb is an integral part of the xenon bulb igniter. The shutter controller is a solenoid which operates the shutter mechanism via a lever. The shutter is used to change the beam projection between low and high beam.

The xenon headlamps are controlled by the BCM/GWM assembly using a xenon bulb control module and a xenon bulb igniter for each headlamp. These provide the regulated power supply required to illuminate the xenon bulbs through their start-up phases of operation.

The xenon bulbs illuminate when an arc of electrical current is established between 2 electrodes within the bulb. The xenon gas sealed in the bulb reacts to the electrical excitation and the heat generated by the current flow produces the characteristic blue/white light.

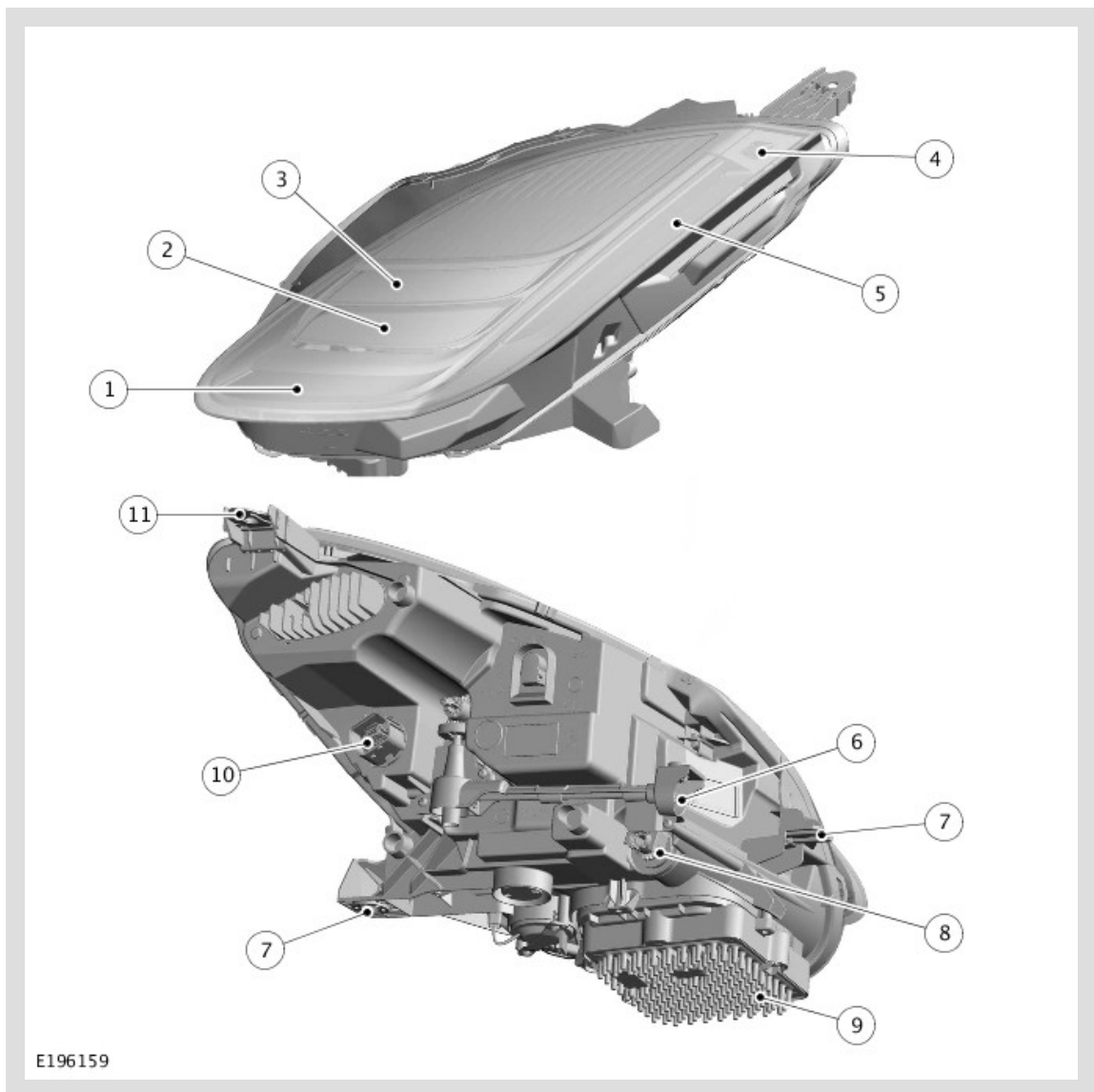
To operate at full efficiency, the xenon bulb goes through 3 stages of operation before the output for continuous operation is achieved. The 3 phases are; start-up phase, warm-up phase and continuous phase.

In the start-up phase, the bulb requires an initial high voltage starting pulse of up to 28000 volts in order to establish the arc. This high voltage starting pulse is produced by the igniter and, once the arc is established, the warm-up phase begins. During the warm-up phase, the xenon bulb control module regulates the supply to the bulb to 2.6A which gives a lamp output of 75W. While in this phase, the xenon gas begins to illuminate brightly and the environment within the bulb stabilizes, ensuring a continual current flow between the electrodes. When the warm-up phase is completed, the xenon bulb control module changes to continuous phase. The supply voltage to the bulb is reduced and the operating power required for continual operation is reduced to 35W. The process from start-up to continuous phase is completed in a very short time.

The xenon bulb control modules (one per headlamp) receive an operating voltage from the BCM/GWM assembly when the headlamps are switched on. The modules regulate the power supply required through the phases of start-up.

The xenon bulb igniters (one per headlamp) generate the initial high voltage required to establish the arc. The igniters have integral coils which generate the high voltage pulses required for start-up. Once the xenon bulbs are operating, the igniters provide a closed circuit for the regulated power supply from the xenon bulb control modules.

Light Emitting Diode Headlamp Assembly



ITEM	DESCRIPTION
1	Daytime Running Lamp (DRL) and turn signal indicator

2	Light Emitting Diode (LED) high beam module
3	Light Emitting Diode (LED) low beam module
4	Side marker lamp - North American Specification (NAS) only
5	Reflector - North American Specification (NAS) only
6	Horizontal adjuster
7	Lower mounting point - 2 off
8	Vertical adjuster
9	Light Emitting Diode Driver Module (LEDDM)
10	Electrical connector
11	Upper mounting point

The Light Emitting Diode (LED) headlamp has a low and a high beam module. This LED modules are powered and controlled by the Light Emitting Diode Driver Module (LEDDM). Each headlamp contains a LEDDM named LEDDM A - for the left headlamp and LEDDM B-for the right headlamp. The LEDDM A is always the master controller and the LEDDM B is referred as being the slave. The master is communicating with the slave by a local Controller Area Network (CAN) connection thought the vehicle harness.

Vertical movement is controlled by an actuator, operated by the LEDDM) for automatic headlamp leveling.

The other LEDs are a self-contained unit located within the headlamp assembly.

The cooling of the LED control unit allows the warm air to be used for de-icing and demisting the lens of the headlight unit. The cooling of the control unit ensures long life of the LED headlight unit.

The greatest advantage offered by white LEDs lies in the color of their light, which is also known as the color temperature. Reaching

approximately 6,000° Kelvin the intensity of their light is just about the same as the quality of daylight. When referring to light, Kelvin is a unit of color temperature.

ADAPTIVE FRONT LIGHTING SYSTEM 123

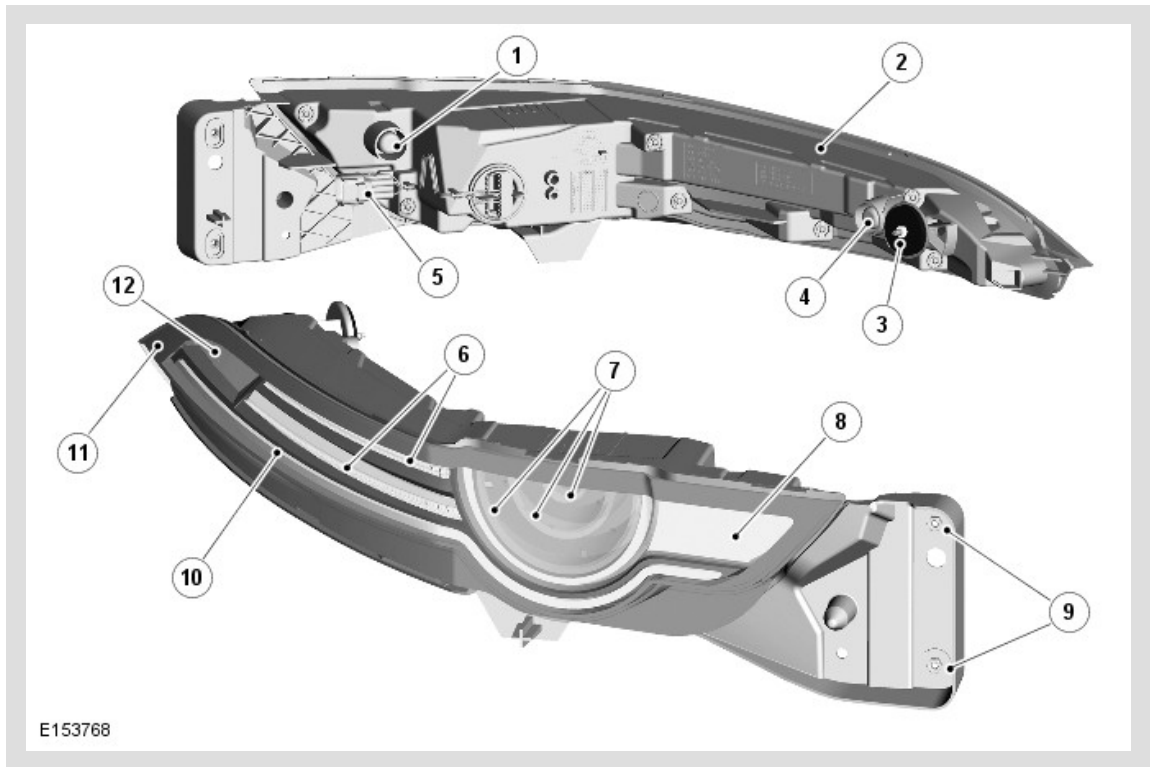
The Adaptive Front lighting System (AFS)123 is using only the low beam module, to switch the different classes. The Light Emitting Diodes (LED)s are controlled by the Light Emitting Diode Driver Module (LEDDM).

There are different input signals that are received form the Body Control Module/Gateway Module (BCM/GWM) assembly in order to change the AFS123 classes. These signals are transmitted through the High Speed (HS) Controller Area Network (CAN) chassis systems bus from the BCM/GWM assembly to the LEDDMs contained in the headlamp assemblies.

The AFS123 sub-system components in the headlamp are:

- Low beam module
- Light Emitting Diode Driver Module (LEDDM)
- Leveling motor

TAIL LAMP ASSEMBLIES



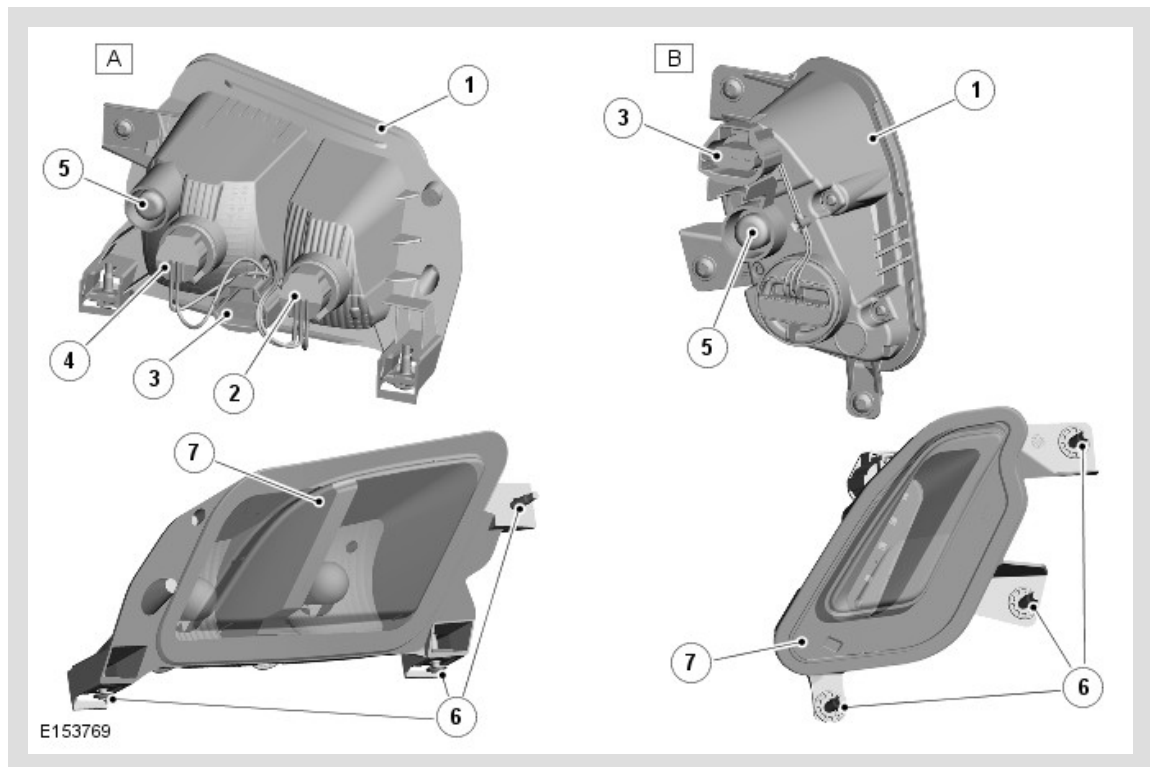
ITEM	DESCRIPTION
1	Vent
2	Housing
3	Securing nut and washer
4	Vent
5	Electrical connector

6	Turn signal indicator
7	Stop lamp
8	Reflector
9	Securing nut and washer
10	Tail lamp
11	Lens
12	Reflector

Each tail lamp assembly is attached to the rear quarter and the back panel of the luggage compartment with three nuts and washers.

In the tail lamp assemblies all lamps are illuminated by Light Emitting Diodes (LED). The Body Control Module/Gateway Module (BCM/GWM) assembly controls all functions of the tail lamp assemblies.

FOG/REVERSE LAMPS



ITEM	DESCRIPTION
A	Fog/reverse lamp with bulbs
B	Fog/reverse lamp with Light Emitting Diodes (LED)s

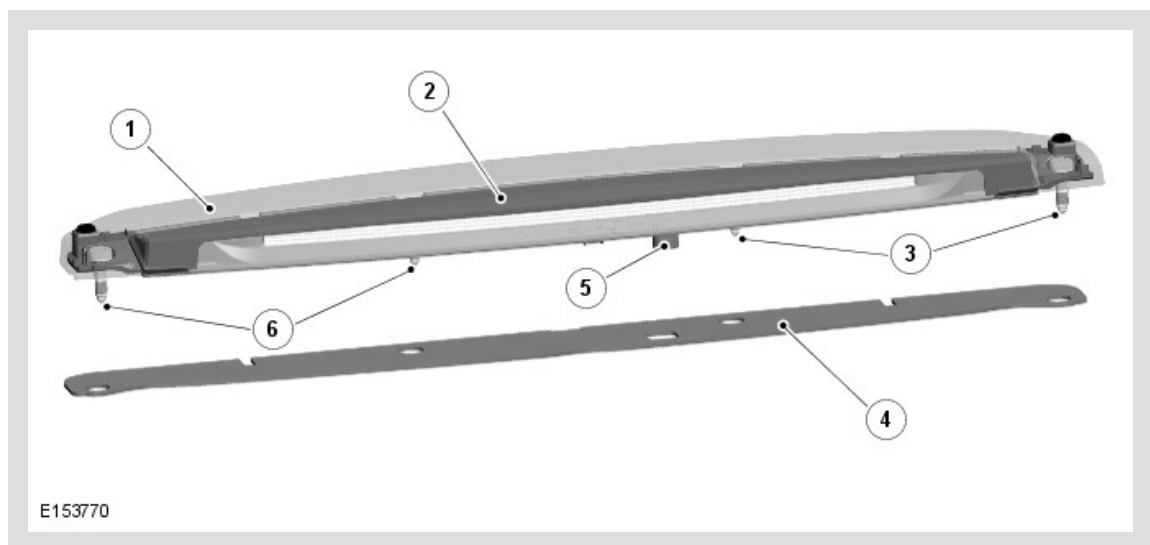
1	Housing
2	Fog lamp bulb holder
3	Electrical connector
4	Reverse lamp bulb holder
5	Vent
6	Securing screw
7	Lens

Each fog/reverse lamp is attached to the rear valance with three screws and contains either bulbs or Light Emitting Diodes (LED)s, depending on model and market specification.

The fog/reverse lamps that contain bulbs have separate clear bulbs for the fog and reverse lamps. The bulbs are installed in bulb holders located in separate compartments in the housing, and the lens is split into red and clear areas as appropriate for the two lamps.

The fog/reverse lamps that contain LEDs have different colored LEDs for the fog and reverse lamps located in a single compartment, and a clear lens.

HIGH MOUNTED STOP LAMP



ITEM	DESCRIPTION
1	Bezel/Cover

2	Lamp assembly
3	Bolt and washer
4	Gasket
5	Electrical connector
6	Bolt and washer

On the convertible vehicles the High Mounted Stop Lamp (HMSL) is located under the trailing edge of the deployable spoiler on the luggage compartment lid. The HMSL is secured to the luggage compartment lid with four bolts and washers concealed under a bezel, which clips onto the lamp. A gasket seals the interface between the HMSL and the luggage compartment lid.

On the coupe vehicles the HMSL is located on the upper part of the tailgate, under the upper moulding. The HMSL is secured to the tailgate with four bolts and five plastic clips. A gasket seals the interface between the HMSL and the tailgate.

The HMSL is illuminated by Light Emitting Diodes (LED)s. The HMSL is activated, along with the tail lamp stop lamps, when the ignition is in power mode 6 or above and the stop lamp switch is active (by pressing the brake pedal).

LICENSE PLATE LAMPS



On the convertible vehicles two license plate lamps are located in the underside of an exterior finisher on the luggage compartment lid.

On the coupe vehicles two license plate lamps are located in the underside of the lower exterior finisher on the tailgate.

Each lamp is secured to the finisher with spring clip located at the right end of the lamp. The license plate lamps are illuminated by Light Emitting Diodes (LED)s.

The license plate lamps are illuminated at all times when the side lamps are active.

SIDE REPEATER LAMPS

NOTE:

Left side is shown right side is similar.



ITEM	DESCRIPTION
1	Side repeater lamp

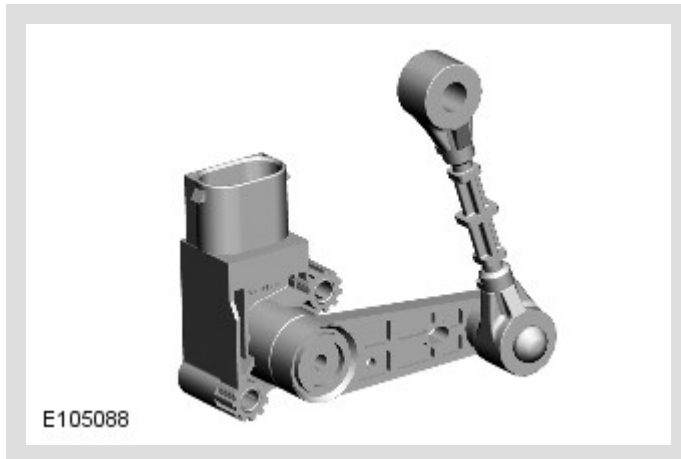
A side repeater lamp for the turn signal indicators is located in each exterior mirror, and can be accessed by removing the mirror cap.

The Body Control Module/Gateway Module (BCM/GWM) assembly controls the side repeater lamps through the related door module.

HEIGHT SENSORS

△ NOTE:

Rear height sensor shown; front height sensor similar.



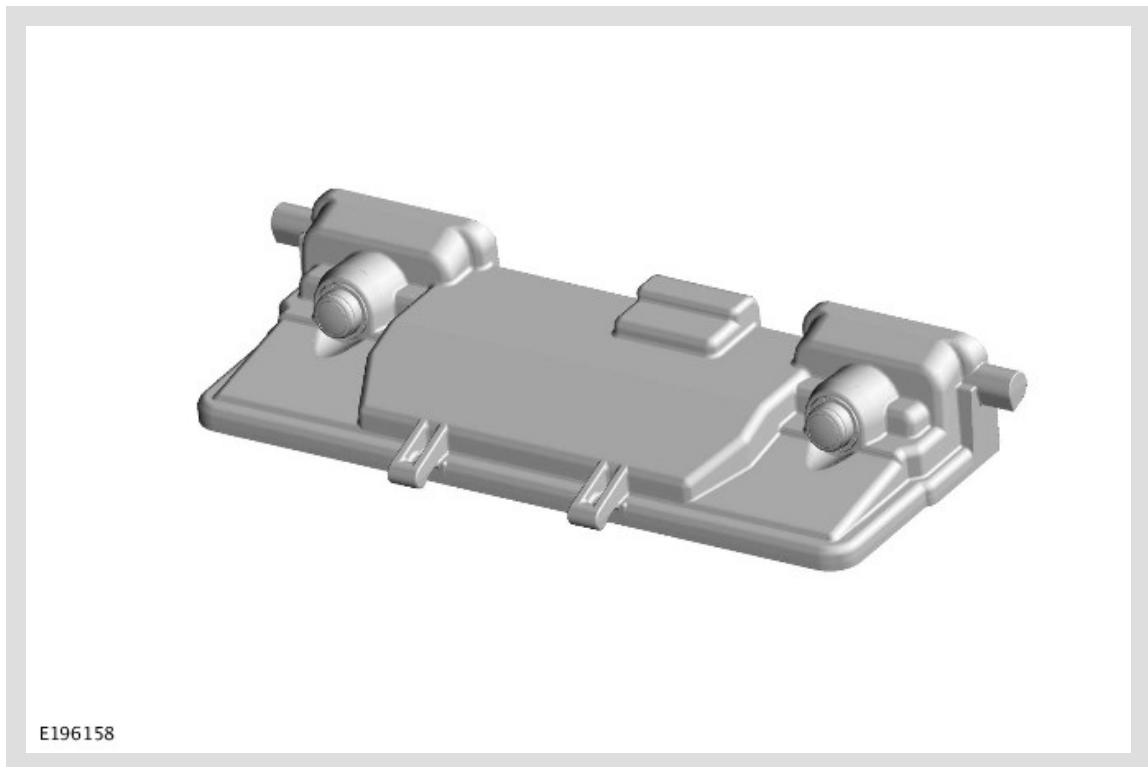
The height sensors used by headlamp leveling are both located on the right side of the vehicle.

The body of the front height sensor is attached to a bracket on the front subframe. The sensor link rod is connected to a pin screwed into the lower suspension arm.

The body of the rear height sensor is attached to the rear subframe. The sensor link rod is connected to a clip attached to the upper suspension arm.

Each sensor has three connections with the Integrated Chassis Control Module (CHCM) power, ground and signal. The CHCM outputs the suspension height data to both of the Light Emitting Diode Driver Module (LEDDM) on the High Speed (HS) Controller Area Network (CAN) chassis systems bus.

IMAGE PROCESSING MODULE



Vehicles equipped with the Auto High Beam (AHB) feature have an Image Processing Module (IPMA). The IPMA contains two cameras installed with the lenses directed through the windshield. The IPMA is located behind the interior rear view mirror.

The camera is a low resolution image sensor that detects headlamps and tail lamps of the vehicles ahead. The IPMA evaluates the image data, checking for light intensity and location. Depending on the image data, the IPMA sends a low or high beam request message to the Body Control Module/Gateway Module (BCM/GWM) assembly via the High Speed (HS) Controller Area Network (CAN) chassis systems bus. The BCM/GWM assembly then controls the high and low beam functions.

BRAKE PEDAL SWITCH

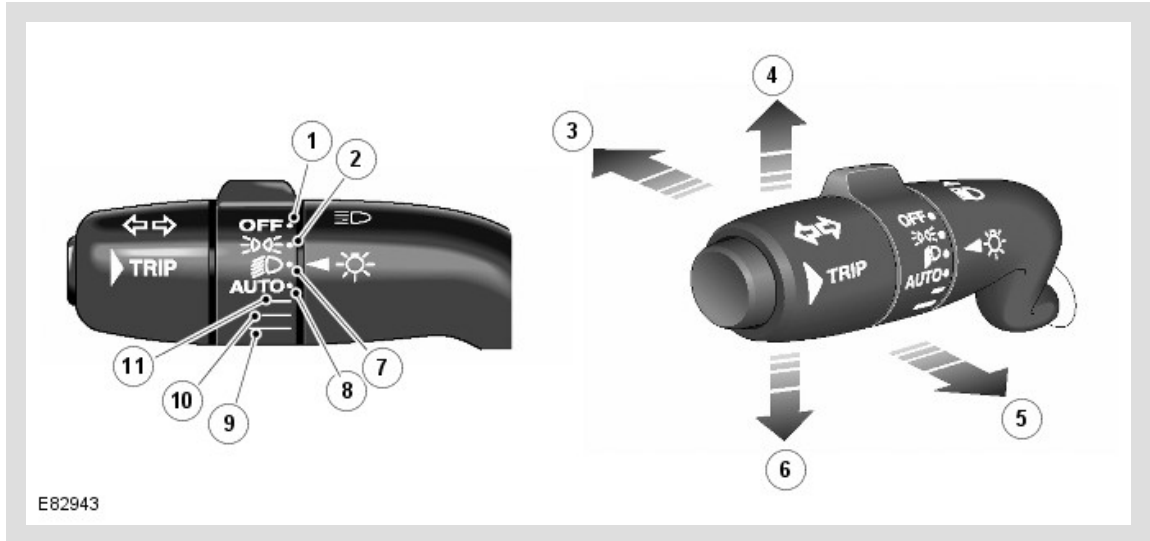


The brake pedal switch is a two pole switch mounted in the brake pedal bracket and operated by the brake pedal. The output connections of the two poles are hardwired to the Body Control Module/Gateway Module (BCM/GWM) assembly. The input connection of one pole is a hardwired signal feed from the BCM/GWM assembly. The input connection of the second pole is hardwired to ground. The BCM/GWM assembly compares the signals from the two poles to confirm the status of the brake pedal switch. The BCM/GWM assembly uses the signals to operate the stop lamps.

△ NOTE:

The output connections are also connected to the Powertrain Control Module (PCM).

LIGHTING CONTROL SWITCH AND LEFT STEERING COLUMN MULTIFUNCTION SWITCH



ITEM	DESCRIPTION
1	Off position
2	Side lamp position
3	High beam position
4	Right turn signal indicator position
5	Headlamp flash/high beam off position
6	Left turn signal indicator position
7	Headlamp position
8	Autolamps position
9	Headlamp timer 120 second delay position
10	Headlamp timer 60 second position
11	Headlamp timer 30 second position

The lighting control switch is located on the left steering column multifunction switch.

The lighting control switch is a rotary control with positions for the following lighting functions:

- Off
- Side and tail lamps
- Headlamps
- Autolamps
- Headlamp delay timer (3 time period selections).

The left steering column multifunction switch also provides for the following functions:

- High beam headlamps
- Headlamp flash
- Turn signal indicators
- Trip computer function.

For additional information, refer to: [Information and Message Center](#) (413-08 Information and Message Center, Description and Operation).

For both the lighting control switch and steering column multifunction switch, analogue inputs are used by the Body Control Module /Gateway Module (BCM/GWM) assembly. When a switching event occurs, the change of input voltage, referenced against the reference ground, is assessed in order to determine which switching mechanism was activated.

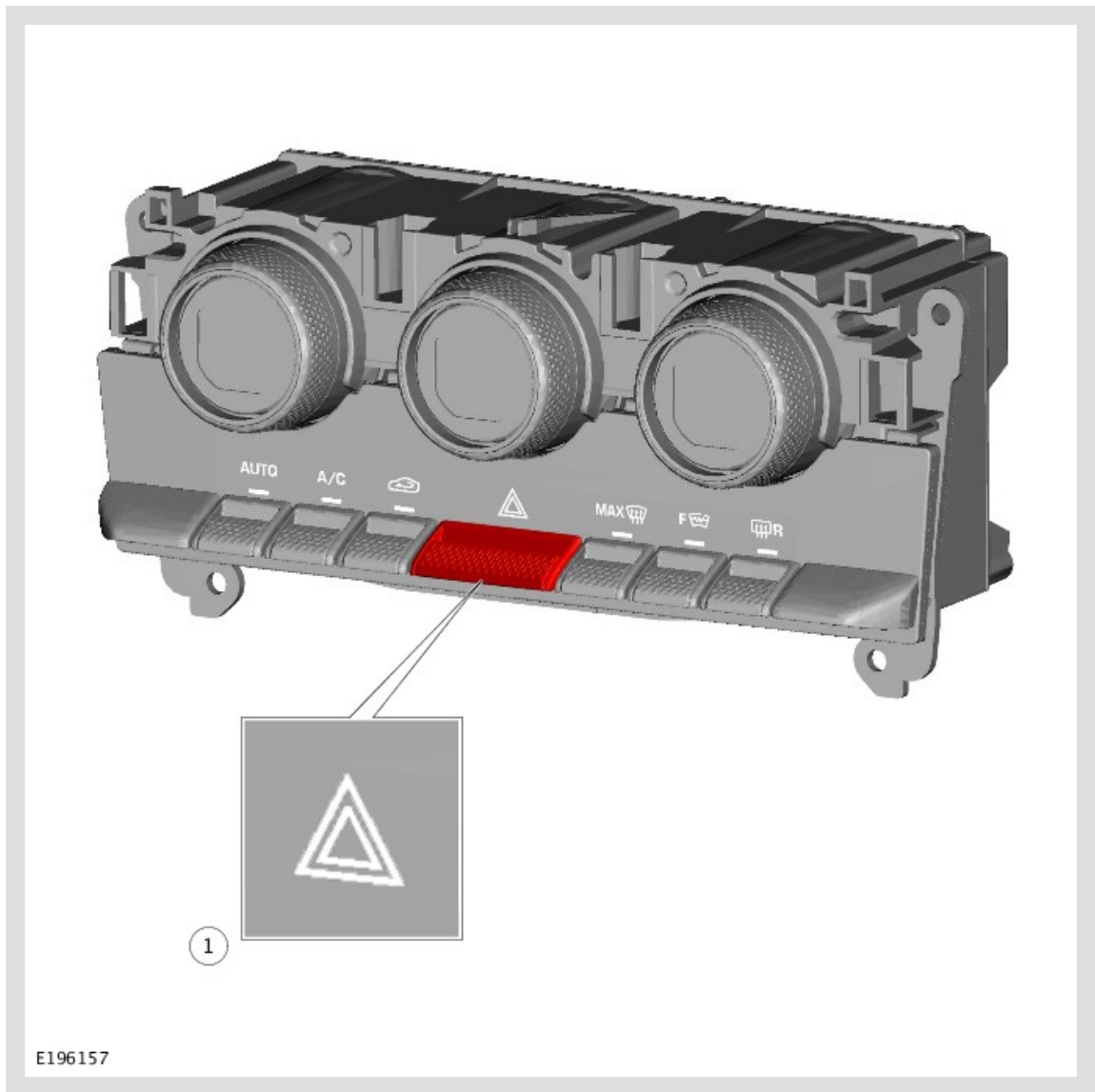
REAR FOG LAMP SWITCH



ITEM	DESCRIPTION
1	Rear fog lamp switch

The rear fog lamp switch is a non-latching momentary switch installed on the auxiliary lighting switch in the instrument panel, adjacent to the steering column. The Body Control Module/Gateway Module (BCM/GWM) assembly receives signals from the rear fog lamp switch via hardwired connection.

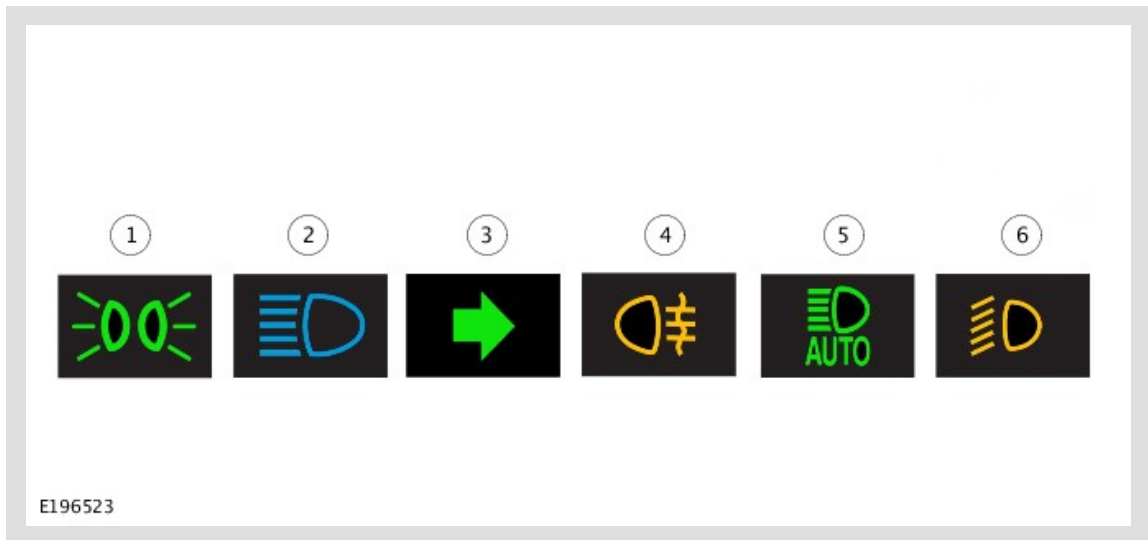
HAZARD WARNING LAMP SWITCH



ITEM	DESCRIPTION
1	Hazard warning lamp switch

The hazard warning lamp switch is located on the Integrated Control Panel (ICP), and hardwired to the Body Control Module/Gateway Module (BCM/GWM) assembly and ground.

WARNING INDICATORS



ITEM	DESCRIPTION
1	Side lamps
2	Headlamp high beam
3	Turn signal indicators
4	Rear fog lamps
5	Auto High Beam (AHB)
6	Dipped beam fault warning

The warning indicators are in the Instrument Cluster (IC). The warning indicators are activated by the Body Control Module/Gateway Module (BCM/GWM) assembly using Medium Speed (MS) Controller Area Network (CAN) comfort systems bus messages.

OPERATION

BODY CONTROL MODULE/GATEWAY MODULE ASSEMBLY

The lighting circuits are protected by Metal Oxide Semiconductor Field Effect Transistors (MOSFET). The control circuitry within the Body Control Module/Gateway Module (BCM/GWM) assembly for each individual circuit can detect and isolate a problem circuit. The side repeater lamps receive power from the related door module in response to Medium Speed (MS) Controller Area Network (CAN) body systems bus signals from the BCM/GWM assembly. The rest of the exterior lamps receive power from the Light Emitting Diode Driver Module (LEDDM) or from the BCM/GWM assembly directly.

Input Signals For Lamp Control

The BCM/GWM assembly receives inputs from the following switches:

- Lighting control switch and left steering column multifunction switch for turn signal indicators, side lamps, headlamps, low/high beam /headlamp flash and autolamps.
- Rear fog lamp switch
- Hazard warning lamp switch
- Brake pedal switch
- Rain/light sensor.

On vehicles with automatic transmission, the BCM/GWM assembly receives the reverse gear signal from the Transmission Control Switch (TCS) on hardwired connection.

On vehicles with manual transmission, the BCM/GWM assembly receives the reverse gear signal from the reverse lamp switch, which is located on the transmission.

If the BCM/GWM assembly receives a reverse gear signal, activates the reverse lamps.

The BCM/GWM assembly activates the hazard warning indicators if an alarm is activated and to signify vehicle locking and unlocking to the driver.

The BCM/GWM assembly also receives requests to activate the hazard warning indicators from:

- The Restraints Control Module (RCM), via a hardwired connection in the event of a crash.
- The Anti-lock Brake System (ABS) control module, via the High Speed (HS) CAN chassis systems bus, if vehicle deceleration exceeds a stored value during emergency braking.

On vehicles with Auto High Beam (AHB), the BCM/GWM assembly receives signals from the Image Processing Module (IPMA) on the HS CAN chassis systems bus. The BCM/GWM assembly controls the high beam headlamps.

If the Electronic Park Brake (EPB) is applied while the vehicle is moving above 3 km/h (2 mph), the Electric Park Brake Control Module (EPBCM) sends signal to the BCM/GWM assembly. The BCM/GWM assembly receives the signals on HS CAN powertrain systems bus and activates the stop lamps.

Circuit Protection

Operation of the lamps is performed using MOSFETs. The MOSFETs can detect overload, load interruption with the lamps switched on and short circuit to positive with the lamps switched off.

The MOSFETs replace the traditional requirement for fusing by acting as a sort of resettable fuse, with associated Diagnostic Trouble Codes (DTC)s. However, fuses are still used when relays are implemented instead of MOSFETs.

Lamp Monitoring

The bulb and Light Emitting Diode (LED) failure monitoring is performed by the BCM/GWM assembly. The lamps are monitored by the MOSFETs in order to detect failure.

The BCM/GWM assembly provides outputs to each MOSFET. The output switches the MOSFET to supply the required output to power the applicable lighting circuit. The processor evaluates the circuits by detecting the returned signals from the controlling MOSFET.

If a turn signal indicator fails, the green turn signal warning indicator in the Instrument Cluster (IC) will flash at twice the normal rate. The audible ticking from the IC sounder will also be at twice the normal rate.

Different types MOSFET device are used to control the lighting functions. Depending on what type of MOSFET is used, load interruption failure detection may or may not be possible.

In some instances, the MOSFETs can reach high temperatures without a short to ground detection occurring. In these cases, the MOSFETs will react to the heat increase and cut the supply to the affected circuit. Once the fault has been rectified or the MOSFET has cooled, the MOSFET will automatically reset and operate the circuit normally.

DAYTIME RUNNING LAMPS

The Daytime Running Lamps (DRL) are initially activated when the following parameters are met:

- The lighting control switch is in the off or autolamps position (when autolamps are not requested on).
- 'P' (Park) is not selected.
- The Body Control Module/Gateway Module (BCM/GWM) assembly receives an engine running signal.
- The ignition state is Power mode 7.

The DRL shall remain off if:

- 'P' (Park) is still selected.

or

- 'N' (Neutral) is selected and while the Electronic Park Brake (EPB) is applied.

or

- The vehicle is not set in motion for the first time after a manually activated ignition cycle (not an auto Stop/Start sequence).

If the lighting control switch is moved to the side lamp or headlamp positions, DRL are deactivated and normal side lamp and headlamp functionality is operational. Certain markets use DRL in different ways and may not be disabled when selecting side lights.

When the DRL are active, the headlamp flash function using the left hand steering column multifunction switch will operate normally.

In North American Specification (NAS) market, when the EPB is applied or the Transmission Control Switch (TCS) is in the P position, the DRL are turned off. This is to reduce battery discharge during long periods of engine idling in cold climate conditions. When the EPB is released or the TCS is moved from the P position, normal DRL functionality is restored.

The DRL must be switched off during the entire operation cycle of the direction indicators, on the same side of the vehicle as the active direction indicator lamp or hazard warning signal.

HEADLAMPS

The low beam headlamps are switched on when the ignition is on and one of the following occurs:

- The lighting control switch is the headlamp position.
- The lighting control switch is in the autolamps position and a lights on signal is received by the Body Control Module/Gateway Module (BCM/GWM) assembly from the rain/light sensor.
- The headlamps can be switched on by pressing the headlamp switch on the smart key. The smart key signals are relayed to the BCM/GWM assembly by the Remote Function Actuator (RFA) on the

Medium Speed (MS) Controller Area Network (CAN) body systems bus.

The low beam headlamps can also be operated by the headlamp delay feature.

The high beam headlamps are switched on when the ignition is on and one of the following occurs:

- The lighting control switch is in the headlamp position or the headlamps are activated by the autolamps feature and the left steering column multifunction switch is pushed forward, away from the driver.
- The Auto High Beam (AHB) system is active.

The headlamp flash function operates with the ignition on or off, when the left steering column multifunction switch is pulled towards the driver.

Headlamp Delay

The BCM/GWM assembly controls a headlamp delay function which illuminates the headlamps after the ignition is turned off. The headlamp delay will operate on low beam headlamps only regardless of the position of the left steering column multifunction switch.

To initiate this feature, the lighting control switch must be in one of the three headlamp timer positions when the ignition mode is changed from on to off. The low beam headlamps will then remain on for the selected time period (30, 60 or 120 seconds) after the ignition is turned off.

The headlamp delay feature can also be switched off by pressing the headlamp switch on the smart key. The smart key signals are relayed to the BCM/GWM assembly by the Remote Function Actuator (RFA) on the Medium Speed (MS) Controller Area Network (CAN) body systems bus.

Headlamp Leveling

The Chassis Control Module (CHCM) receives information relating to vehicle attitude from the front right and rear right height sensors and transmits to the BCM/GWM assembly. The BCM/GWM assembly processes these signals and provides an output to the leveling motors to adjust the headlamp vertical aim according to vehicle speed and vehicle loading.

AUTOLAMPS

The Body Control Module/Gateway Module (BCM/GWM) assembly uses the rain/light sensor to control the autolamps functionality. The wiper system also uses the rain/light sensor for automatic wiper operation.

For additional information, refer to: [Wipers and Washers](#) (501-16 Wipers and Washers, Description and Operation).

The driver can override the system operation by selection of side lamps or headlamps on if the ambient light conditions require front and rear lighting to be active.

The rain/light sensor measures the ambient light around the vehicle in a vertical direction and also the angular light level from the front of the vehicle.

The rain/light sensor can detect if the vehicle has entered a tunnel or similar environment and will activate the headlamps. When the tunnel is exited, the rain/light sensor detects the sudden increase in light levels and requests the lights to be switched off.

Certain light and weather conditions are not detected accurately by the rain/light sensor. The driver should override the autolamps function if in any doubt about weather conditions and the requirement for exterior lights to be active.

The autolamps operation uses ambient light levels which are monitored by a photo-diode incorporated in the rain/light sensor. The rain/light sensor sends a lights on/off request to the BCM/GWM

assembly via the Local Interconnect Network (LIN) bus. The BCM /GWM assembly responds by switching the low beam headlamps, front side lamps and rear tail lamps on/off.

Operation of the autolamps requires the ignition to be in on, the lighting control switch to be in the AUTO position and a lights on request signal from the rain/light sensor.

If the autolamps function has been selected and the ambient light falls below a pre-defined level then the rear fog lamps can be manually activated. If the ambient light rises above that level then the fog lamps will be deactivated along with the rest of the lamps. If the ambient light then falls below this level again the lamps will be activated, but the fog lamps which were previously selected will not.

Windshield Wiper Detection

The BCM/GWM assembly switches on the side lamps and headlamps when the following parameters are met:

- The lighting control switch is in the AUTO position
- The windscreen wipers are switched on for more than 20 seconds.

When the windscreen wipers are switched off, the BCM/GWM assembly switches the side lamps and headlamps off two minutes later. The side lamps and headlamps will also be activated if the number of wipe cycles within the previous minute is greater than 12. Following this activation, there is a two minute delay and then the lights will be turned off after the number of wipe cycles per minute drops below three.

AUTO HIGH BEAM



WARNING:

The Auto High Beam (AHB) system is designed as a driving aid only. Should the road conditions require, it is the driver's responsibility to consider other road users and operate the high

beam headlamps in a safe manner. In certain circumstances the driver will be required to intervene.

The Auto High Beam (AHB) operates as part of the autolamps system. When driving at night with the lighting control switch in the automatic position and the left steering column multifunction switch in the central position, with sufficient darkness (approximately 1 lux or less) and a suitable road speed, AHB will automatically operate the high beam headlamps when necessary. An AHB warning indicator in the Instrument Cluster (IC) confirms to the driver when the AHB system is selected and enabled.

 **NOTE:**

The exterior lighting on threshold for the autolamps system is approximately 100 lux which is measured by the rain/light sensor. At light levels below this value the low beam headlamps and exterior lights will be switched on. The AHB will not function until the light level has reached approximately 1 lux. At light levels above 1 lux high beam is not required and therefore is not activated.

Auto High Beam Activation

The AHB will only activate and illuminate the warning indicator, to show the system is activated for high beam control, when the following conditions are met:

- AHB is enabled in the IC **Vehicle setup** menu
- Lighting control switch is in the autolamps position
- Left steering column multifunction switch is in the central position
- The ambient light level is below 100 lux
- The system has not been overridden or cancelled
- The camera (image) sensor view is not blocked.

High Beam Control

When the AHB activated, the Body Control Module/Gateway Module (BCM/GWM) assembly will switch the headlamps to high beam when all the following conditions occur:

- No relevant oncoming traffic
- No relevant preceding traffic
- In non-urban environment, i.e. with no street lighting
- Ambient light level is below 1 lux
- Road speed is suitable.

Low Beam Control

The BCM/GWM assembly will switch the headlamps to low beam when any of the following conditions occur:

- Relevant oncoming traffic is present
- Relevant preceding traffic is present
- In urban environment, i.e. with street lighting
- Ambient light level is above 1 lux
- Road speed is not suitable
- Unrecognizable reflective inputs from road signs or markings.

Road Speed

The BCM/GWM assembly receives the road speed signal from the Anti-lock Brake System (ABS) control module. The BCM/GWM assembly and the ABS control module communicate on the High Speed (HS) Controller Area Network (CAN) chassis systems bus. When the other activation conditions are correct, the BCM/GWM assembly will switch the headlamps to high beam when the road speed has increased above 40 km/h (25 mph).

When the road speed falls to below 24 km/h (15 mph), the BCM /GWM assembly will switch the headlamps to low beam. The 15 km/h (10 mph) difference between the on and off road speed thresholds prevents the system continually switching between high and low beam at low speeds.

Override

The driver can manually override the AHB function at any time. When the AHB system is activated, pulling the left steering column multifunction switch to the high beam 'flash' position or pushing it forward to the high beam position will de-activate the system and the AHB warning indicator in the IC will extinguish.

When the multifunction switch is returned to the central position, from a forward high beam position, the system is re-activated and the AHB warning indicator will illuminate again.

Correct Performance

In addition, the AHB function will only exhibit best performance if all of the following conditions are met:

- No false inputs are received by the Image Processing Module (IPMA) camera, such as reflected light from certain static signs
- Headlamps are correctly aligned
- AHB function has been set for correct hand of drive in the **Vehicle set-up** menu of the Instrument Cluster (IC)
- The Image Processing Module (IPMA) camera has been through a self-learning 'auto aim' calibration procedure if any components have been replaced
- There are no large reflective items, white papers, etc., sitting on top of the instrument panel in near view of the IPMA camera, or stickers placed directly in front of the camera.

Enabling or disabling AHB will not affect the hand of drive settings once set.

Auto High Beam Limitations

The AHB function can occasionally have difficulty distinguishing between light from other vehicles or reflected light from static highly reflective road signs.

These situations may cause the AHB function to undesirably operate the high beam headlamps or take no action at all. Examples of these situations are as follows:

- Hollows or crests in the road
- Highly reflective static road signs
- Tight bends
- Poorly illuminated vehicles e.g. cyclists or small mopeds
- Highway central barriers
- Extreme weather conditions e.g. fog, heavy snow
- Exterior domestic or industrial lighting.

There are situations when a driver is able to judge if a high beam deactivation is desirable before the AHB system actually operates, for example over a crest of a hill. Headlamps from an oncoming vehicle can sometimes be seen on the horizon prior to the detection sensor receiving an input. It is the driver's preference to determine if early intervention is desired in this and similar situations.

Auto High Beam Calibration

To achieve effective operation of the AHB, a calibration routine is performed on vehicle build and system tolerances are set to an accuracy of +/- 0.2 degrees. This initial calibration is a 'one time only' procedure. Should the AHB components or the windshield require replacement, an automatic calibration routine will be performed. The calibration procedure is a continual process that takes place during a normal drive cycle at night.

The calibration procedure could take between 10 - 30 minutes depending on the following driving conditions:

- If sufficient road markings (lane markings) are visible to the image sensor - approximately 10 minutes
- If insufficient road markings are visible, the system uses the tail lights of preceding vehicles - approximately 30 minutes.

 **NOTE:**

Until this calibration is complete the system may not react correctly during operation. This should be made clear to the customer before vehicle handover.

Due to mechanical calibration tolerance the correct mirror assembly must be used for the vehicle model types in question and it is not exchangeable with other vehicle model types.

After any rectification work and before any calibration drives, the headlamps should be checked for correct alignment.

Auto High Beam Diagnosis

 **NOTE:**

Windshield stickers, stone chips, dirt and general road film will affect the successful operation of the IPMA camera if sufficient blocking is present. Avoid placing reflective objects on the instrument panel, for example white paper, which can affect the image sensor.

The AHB has a self-diagnosis capability. The BCM/GWM assembly can compare data from the rain/light sensor to light levels detected by the IPMA camera. If a deviation is detected it is assumed that the ambient light available to the IPMA camera is being restricted by dirt or other blockage and the system will be deactivated.

The Diagnostic Trouble Codes (DTC)s are stored in the BCM/GWM assembly. The DTCs can be accessed using Jaguar approved diagnostic equipment. Within the diagnostic system is a procedure to test the basic operation of the camera function.

In the event of a fault, the warning strategy to the driver is as follows:

- The IPMA internal fault - AHB warning indicator will extinguish with no additional message to driver.
- The BCM/GWM assembly has lost all communication with the IPMA - AHB warning indicator will extinguish with no additional message to driver.
- The IPMA is blocked - AHB warning indicator will extinguish with an additional "Camera Blocked" message within the message center.

ADAPTIVE FRONT LIGHTING SYSTEM 123

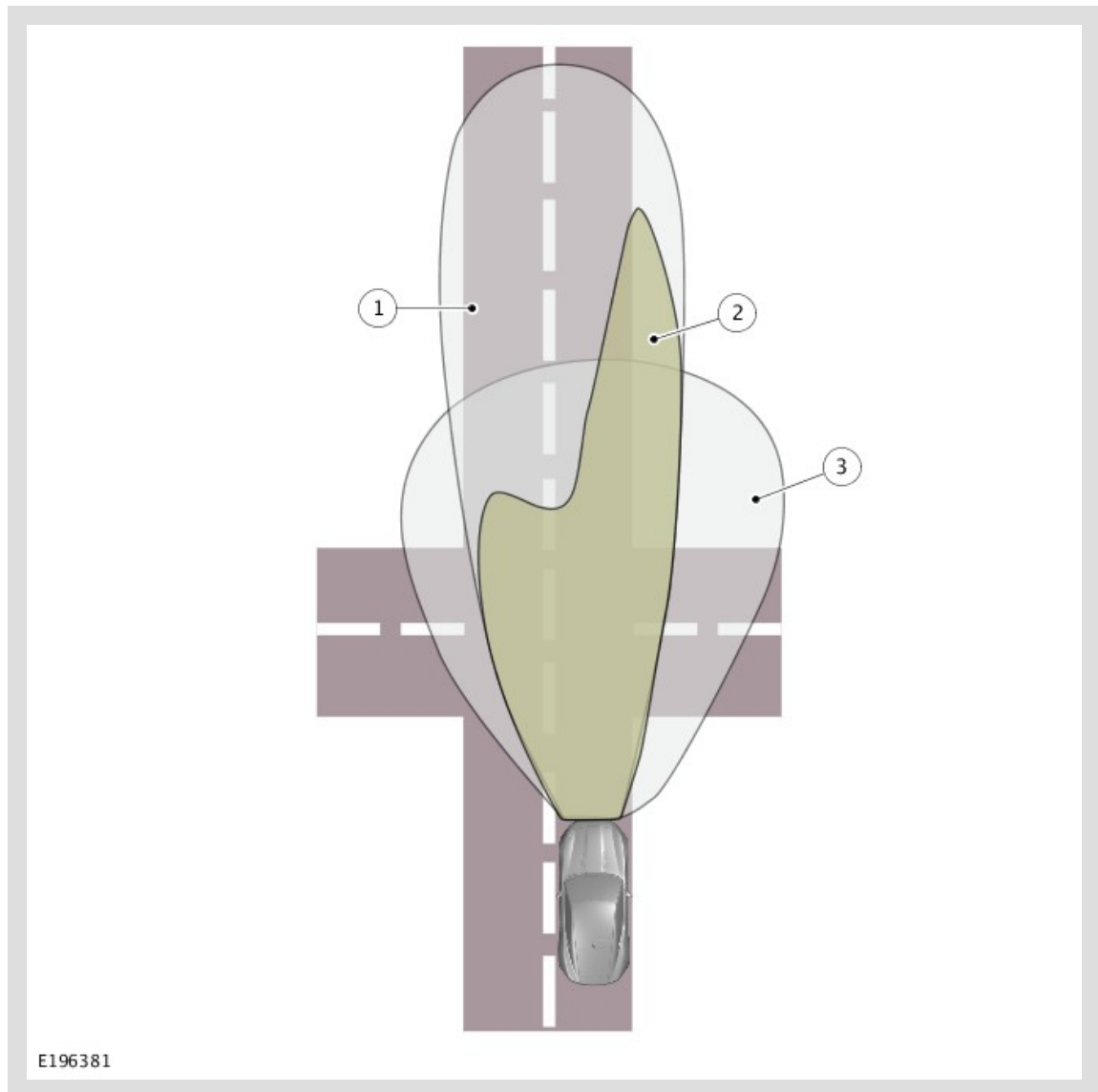
The Adaptive Front lighting System (AFS) 123 function is enabled when the low beam headlamps are switched on automatically by the rain light sensor when the lighting control switch is in the AUTO position. If the lighting control switch is moved to any other position then AFS123 operation will cease and the lighting system will default to the appropriate condition for the new lighting control switch setting.

The AFS123 will only operate when the Body Control Module/Gateway Module (BCM/GWM) assembly receives an engine running signal. The engine running signal comes from the Powertrain Control Module (PCM) on the High Speed (HS) Controller Area Network (CAN) powertrain systems bus.

The AFS123 consists of the following classes of operation in which the components of the AFS123 adapt automatically to according to the conditions described below:

- City class - operates below 48 km/h (30 mph).
- Country class - operates between 49 km/h (30.5 mph) and 110 km/h (68 mph).

- Adverse Weather class - operates below 64 km/h (40 mph).
- Motorway class - operates above 110 km/h (68 mph).



ITEM	DESCRIPTION
1	Motorway class
2	Country class and Adverse Weather class
3	City class

City Class

The City class is activated to allow greater visibility around the vehicle during city traffic conditions and to identify other road users such as:

- Pedestrians
- Cyclists
- Oncoming vehicles.

Above 48 km/h (30 mph) City class will transition to Country class. In order to prevent repeated switching between classes the transition from Country class to City class will occur at 40 km/h (25 mph) as the vehicle speed decreases. If the conditions for Adverse Weather class are met whilst City class is active then Adverse Weather class will take priority.

Country Class

The Country class is the standard low beam as normally defined for non-AFS vehicles. The Country class has a greater forward range of illumination as it includes the kink beam. The Country class will be used whilst setting the initial aim of the low beam.

Whenever the vehicle is put into Park the class will be changed to Country class. When Park is no longer selected then the mode resumes with the same conditions at the point Park was selected.

Above 110 km/h (68 mph) Country class will transition to Motorway class. In order to prevent repeated switching between classes the transition from Motorway class to Country class will occur at 90 km/h (56 mph) as the vehicle speed decreases. If the conditions for Adverse Weather class are met whilst Country class is active then Adverse Weather class will take priority.

Adverse Weather Class

The Adverse Weather class is a specially designed variant of Country class. The optical design is not able to achieve the requirements of wet road class but gets as close as possible to this whilst remaining compliant optically to a Country class beam. The Adverse Weather class reduces the amount glare caused by light reflecting up off a wet road surface.

The Adverse Weather class will be active when the following conditions are met:

- The vehicle speed is between 0 km/h and 64 km/h (40 mph)
- The front wipers must have been in continual operation for 120 seconds, either manually or automatically.

Above 64 km/h (40 mph) Adverse Weather class will transition to Country class. In order to prevent repeated switching between classes the transition from Country class to Adverse Weather class will occur at 55 km/h (34 mph) as the vehicle speed decreases

Motorway Class

The Motorway class is activated to allow greater focus on distance during motorway driving or driving at higher speeds. The Motorway class enables the driver to be more focused on far vision and reduce distractions caused by excessive light at the sides of the vehicle.

The Motorway class shall be active when the vehicle speed is above 110 km/h (68 mph). In order to prevent repeated switching between classes the transition from Motorway class to Country class shall occur at 90 km/h (56 mph) as the vehicle speed decreases

Initialization Procedure

When the BCM/GWM assembly receives an ignition on signal, it performs the initialization procedure which ensures that the headlamps are correctly aligned.

The leveling initialization starts less than 1 second after the headlamp leveling initialization is activated to ensure that the headlamps are at or below the 0 degree position in the vertical axis, thus preventing glare to oncoming vehicles. The AFS swivel initialization is completed in less than 2.5 seconds. The left and right AFS actuator motors are powered from the 0 degree position to a small movement to the inboard position, then another small movement to the outboard position and then back to the 0 degree position.

Failure Mode

In the event of a failure of the AFS123, a warning indicator in the Instrument Cluster (IC) is illuminated to warn the driver. The AFS123 warning is contained in the message notification on the message center, and will continuously appear until the fault is rectified. The AFS123 warning indicator will also be illuminated if a failure of the steering angle sensor or the vehicle speed signal is detected.

Illumination of the AFS123 warning indicator does not necessarily mean that there is a fault with the AFS123. The fault may be caused by a failure of another system preventing the AFS123 operating correctly.

The BCM/GWM assembly performs a diagnostic routine every time AFS123 is requested. If any fault is found, the BCM/GWM assembly will suspend the operation of the AFS123 function.

In case of the xenon projector, if the leveling has failed in a position other than the correct straight ahead position, the BCM/GWM assembly will attempt the following:

- To drive the projector module to a position a small amount lower than the standard position. If the swivel function has failed, the BCM/GWM assembly will attempt the following.
- To lower the projector module using the leveling actuator motors to a position much lower than standard to prevent excess glare to oncoming vehicles.

The BCM/GWM assembly software can detect an internal failure of the control module control circuits. The control module will power the projector modules to the zero position and prevent further operation.

Faults can be investigated by interrogating the BCM/GWM assembly using the Jaguar approved diagnostic equipment to check for Diagnostic Trouble Codes (DTC)s.

REAR FOG LAMPS

The rear fog lamps can only be activated if the ignition is on and the headlamps or autolamps are on.

If one of the following condition occurs, the rear fog lamps will be extinguished:

- The lighting control switch is moved to the side lamp or off position
- The "Autolamp" feature turns off the headlamps
- The rear fog lamp switch is pressed when the fog lamps are operating
- The ignition is switched off.

If the headlamps are subsequently turned on the rear fog lamp operation will not be active and the rear fog lamp switch must be pressed to activate the lamps.

TURN SIGNAL INDICATORS

The Body Control Module/Gateway Module (BCM/GWM) assembly has a turn signal indicator lane change function. If light control switch is gently pushed to either turn signal indicator position and then released, the applicable turn signal indicators will flash 3 times and then will be automatically cancelled.

If a turn signal indicator Light Emitting Diode (LED) fails:

- The green turn signal warning indicator in the Instrument Cluster (IC) will flash at twice the normal rate
- The audible ticking from the IC sounder will also be at twice the normal rate.

If a LED fail occurs, the lamp unit must be replaced.

NOTE:

If a side repeater lamp fails, the flash rate is unchanged.

HAZARD WARNING LAMPS

The hazard warning lamps operate at all times when selected and are not depending on an ignition mode.

The hazard warning lamp switch is a momentary switch that connects a ground signal to the Body Control Module/Gateway Module (BCM /GWM) assembly. The connection of this ground signal is then used to determine whether to activate or deactivate the hazards warning lamps, based upon the current operating mode of the feature. When the hazard warning lamps are active, they override any request for turn signal indicator operation.

CENTRAL DOOR LOCKING AND ALARM INDICATIONS

The hazard warning lamps are also operated by:

- The Central Door Locking (CDL) system when the vehicle is locked or unlocked.
- The active anti-theft system if an alarm is triggered.

For additional information, refer to: [Handles, Locks, Latches and Entry Systems](#) (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

If the hazard warning lamps are active when a lock or unlock request is made, the hazard warning cycle is interrupted to allow the visual indication of the requested lock cycle. When visual indication is completed, the hazard warning operation will continue.

CRASH SIGNAL ACTIVATION

The hazard warning lamps are also activated if the vehicle is involved in an accident where an airbag is deployed. When the Restraints Control Module (RCM) deploys an airbag, it also sends hardwired crash signals to the Body Control Module/Gateway Module (BCM /GWM) assembly. The BCM/GWM assembly activates the hazard warning lamps. The hazard warning lamps continue to operate until

the ignition is in the off or accessory mode and then returned to the ignition on mode. Once this condition has occurred, the RCM will cease transmission of the crash signal.

EMERGENCY BRAKING ACTIVATION

During emergency braking, if vehicle deceleration exceeds a stored value the Anti-lock Brake System (ABS) control module sends signals to the Body Control Module/Gateway Module (BCM/GWM) assembly. The BCM/GWM assembly and the ABS control module communicate on the High Speed (HS) Controller Area Network (CAN) chassis systems bus. The BCM/GWM assembly automatically activates the hazard warning lamps at a faster rate than normal (approximately 4 Hz). If the vehicle speed reduces below 5 km/h (3 mph), the hazard warning lamps remain active but switch to the normal rate of operation.

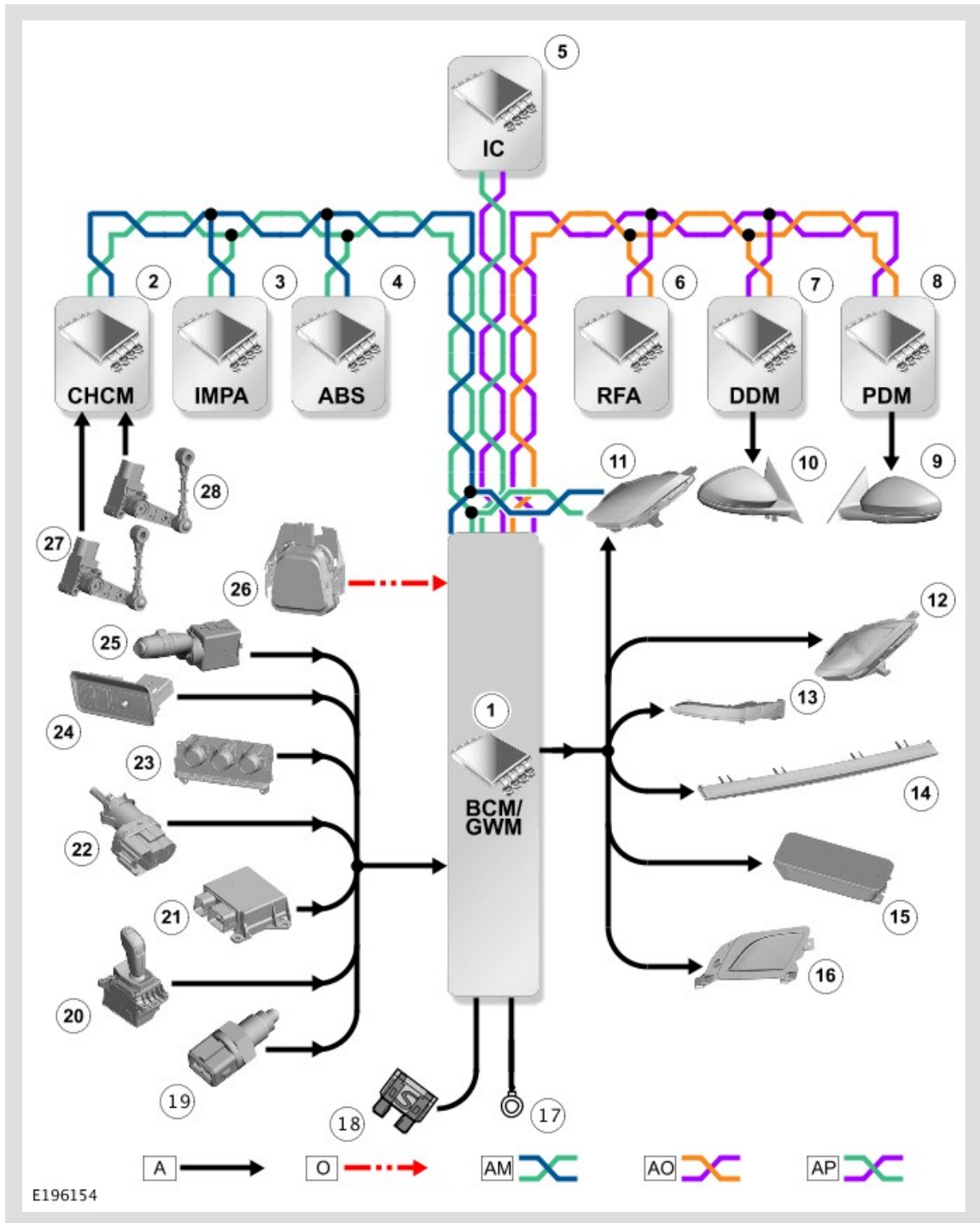
The emergency braking activation of the hazard warning lamps is cancelled when one of the following occurs:

- The vehicle deceleration falls below a second (lower) stored value.
- The Dynamic Stability Control (DSC) OFF or TracDSC mode is selected.
- The left or right turn signal indicators are selected.

LIGHT EMITTING DIODE FAILURE

If one Light Emitting Diode (LED) in the lamp group fails, then all other LEDs in that group are extinguished by the lamp. The affected lamp unit must be replaced

CONTROL DIAGRAM



A = HARDWIRED; O = LOCAL INTERCONNECT NETWORK (LIN) BUS; AM = HIGH SPEED (HS) CONTROLLER AREA NETWORK (CAN) CHASSIS SYSTEMS BUS; AO = MEDIUM SPEED (MS) CONTROLLER AREA NETWORK (CAN) BODY SYSTEMS BUS; AP = MEDIUM SPEED (MS) CONTROLLER AREA NETWORK (CAN) COMFORT SYSTEMS BUS.

ITEM	DESCRIPTION
1	Body Control Module/Gateway Module (BCM/GWM) assembly

2	Chassis Control Module (CHCM)
3	Image Processing Module (IPMA)
4	Anti-lock Brake System (ABS) control module
5	Instrument Cluster (IC)
6	Remote Function Actuator (RFA)
7	Driver Door Module (DDM)
8	Passenger Door Module (PDM)
9	Left side repeater lamp
10	Right side repeater lamp
11	Light Emitting Diode Driver Module (LEDDM) - 2 off (If equipped)
12	Xenon headlamp - 2 off (If equipped)
13	Tail lamp assembly - 2 off
14	High Mounted Stop Lamp (HMSL)
15	License plate lamp - 2 off
16	Rear fog/reverse lamp - 2 off
17	Ground
18	Power supply
19	Reverse lamp switch - Vehicles with manual transmission
20	Transmission Control Switch (TCS) - Vehicles with automatic transmission
21	Restraints Control Module (RCM)
22	Brake pedal switch
23	Hazard warning lamp switch - Integrated Control Panel (ICP)
24	Rear fog lamp switch - Auxiliary lighting switch
25	Light control switch and left steering column multifunction switch
26	Rain/light sensor
27	Front height sensor
28	Rear height sensor

