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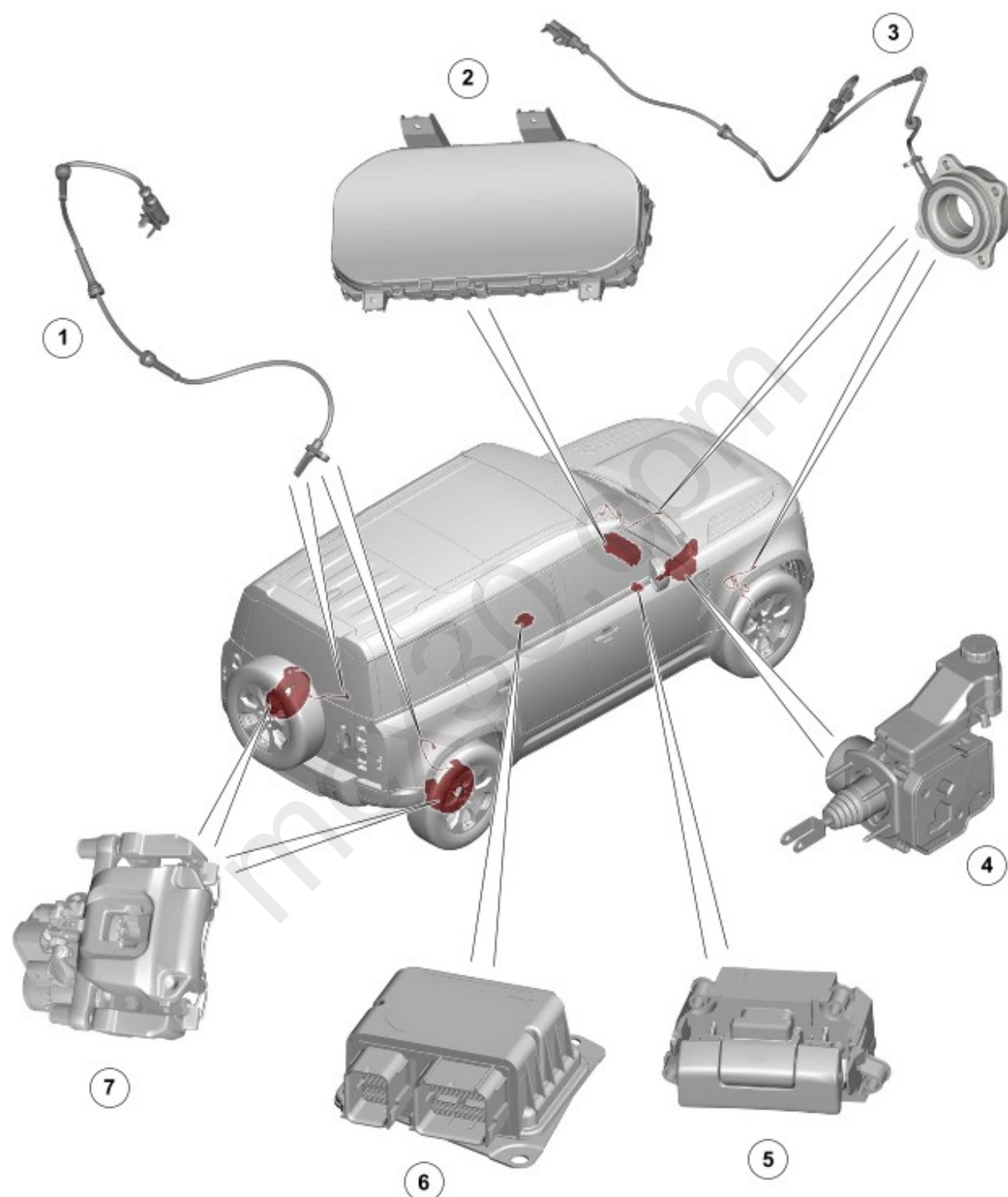
PARKING BRAKE AND ACTUATION

ELECTRIC PARK BRAKE (G2341731)

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COMPONENT LOCATION



ITEM	DESCRIPTION
1	Rear wheel speed sensor (quantity 2)
2	Instrument Panel Cluster (IPC)
3	Front wheel speed sensor (quantity 2)
4	Integrated Power Brake
5	Electric Park Brake (EPB) switch
6	Restraints Control Module (RCM)
7	EPB actuator (quantity 2)

OVERVIEW

The EPB is an electrically actuated system that operates the calipers on the rear brakes. The system consists of:

- An EPB switch
- EPB actuators (quantity 2)
- An Integrated Power Brake
- Warning indicators (quantity 2).

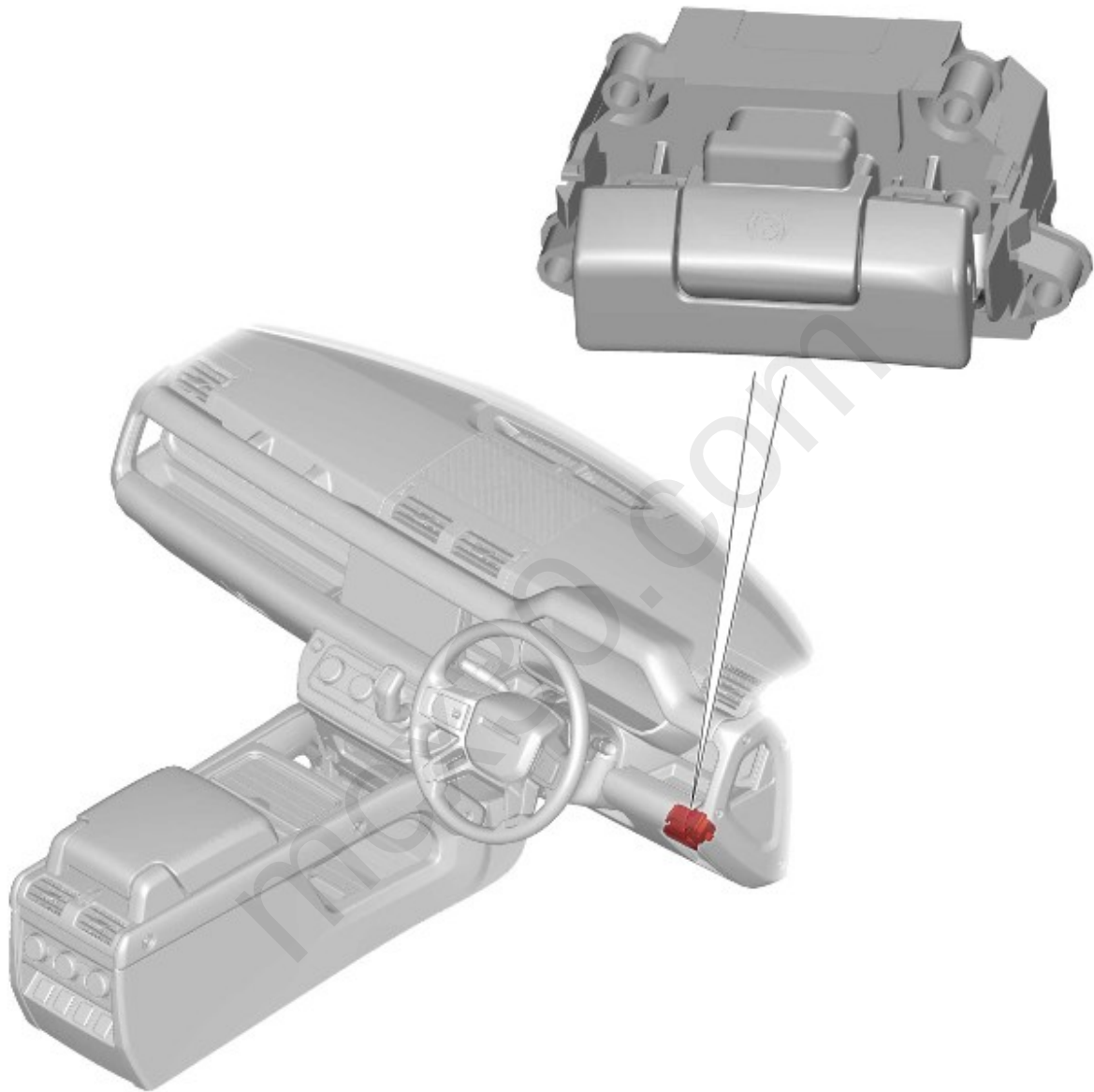
The EPB is controlled by the Integrated Power Brake control module, which uses the EPB actuators to apply and release the rear disc brakes.

Signals from other vehicle systems for operation of the EPB are transmitted to the Integrated Power Brake control module:

- On the High Speed (HS) Controller Area Network (CAN) underbody systems bus
- The FlexRay.

DESCRIPTION

ELECTRIC PARK BRAKE SWITCH



E252877

The EPB is manually applied and released using the EPB switch, which is located in the instrument panel lower section. Pushing the EPB switch lever applies the park brake. Pulling the EPB switch lever releases the park brake.

The EPB switch contains a pair of microswitches and has 4 hardwired connections with the Integrated Power Brake control module, consisting of 2 apply circuits and 2 release circuits. This enables the Integrated Power Brake control module to perform a plausibility check on each switch selection.

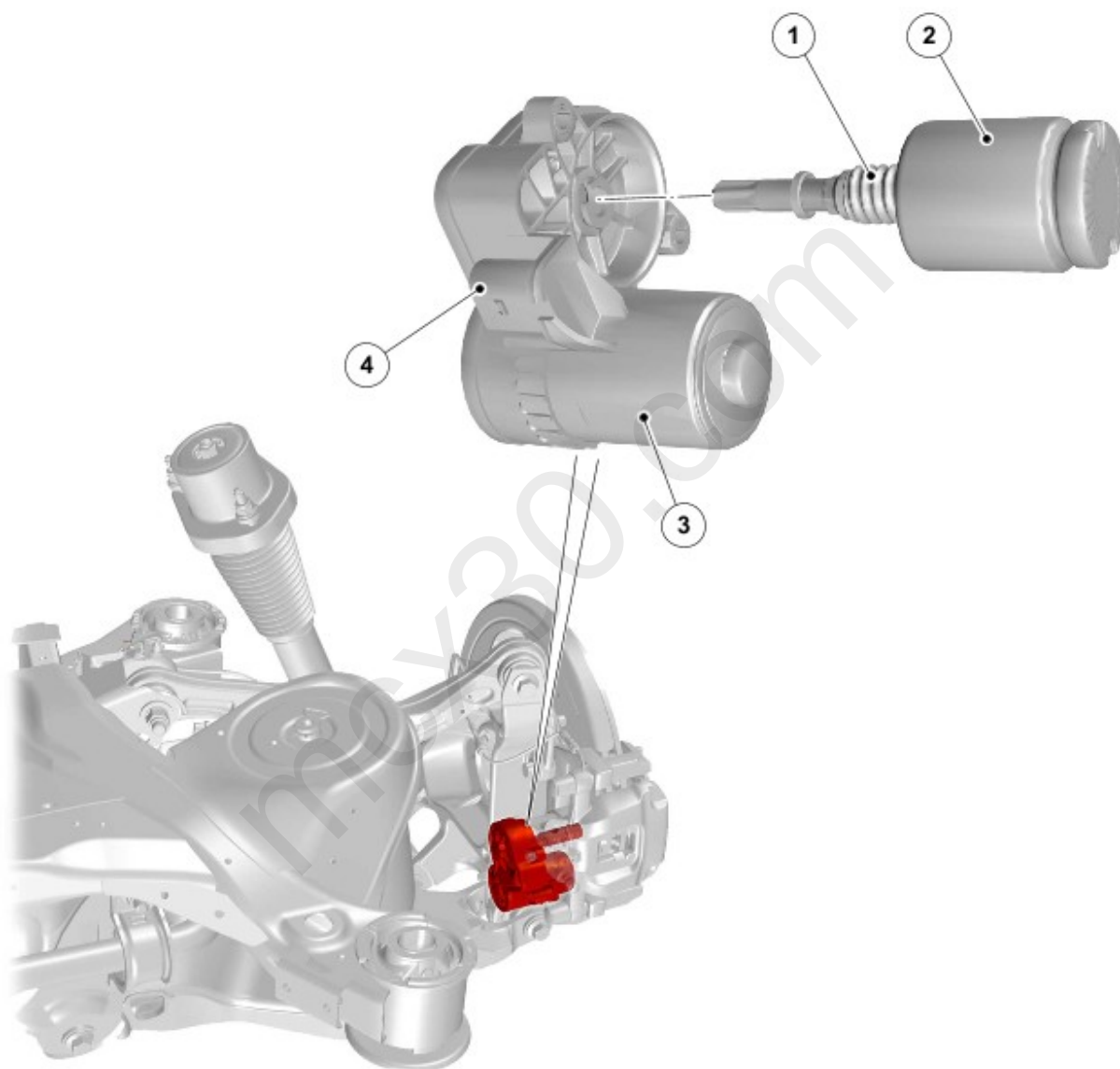
When the EPB switch is operated, the Integrated Power Brake control module activates the EPB actuators to apply the brakes. The Integrated Power Brake control module signals the IPC to turn on the EPB indicator lamp.

Interior lighting switch illumination is provided by a hardwired connection with the Body Control Module (BCM)/ Gateway Control Module (GWM).

ELECTRIC PARK BRAKE ACTUATORS

NOTE:

Rear right electric park brake actuator shown, rear left electric park brake actuator is similar.



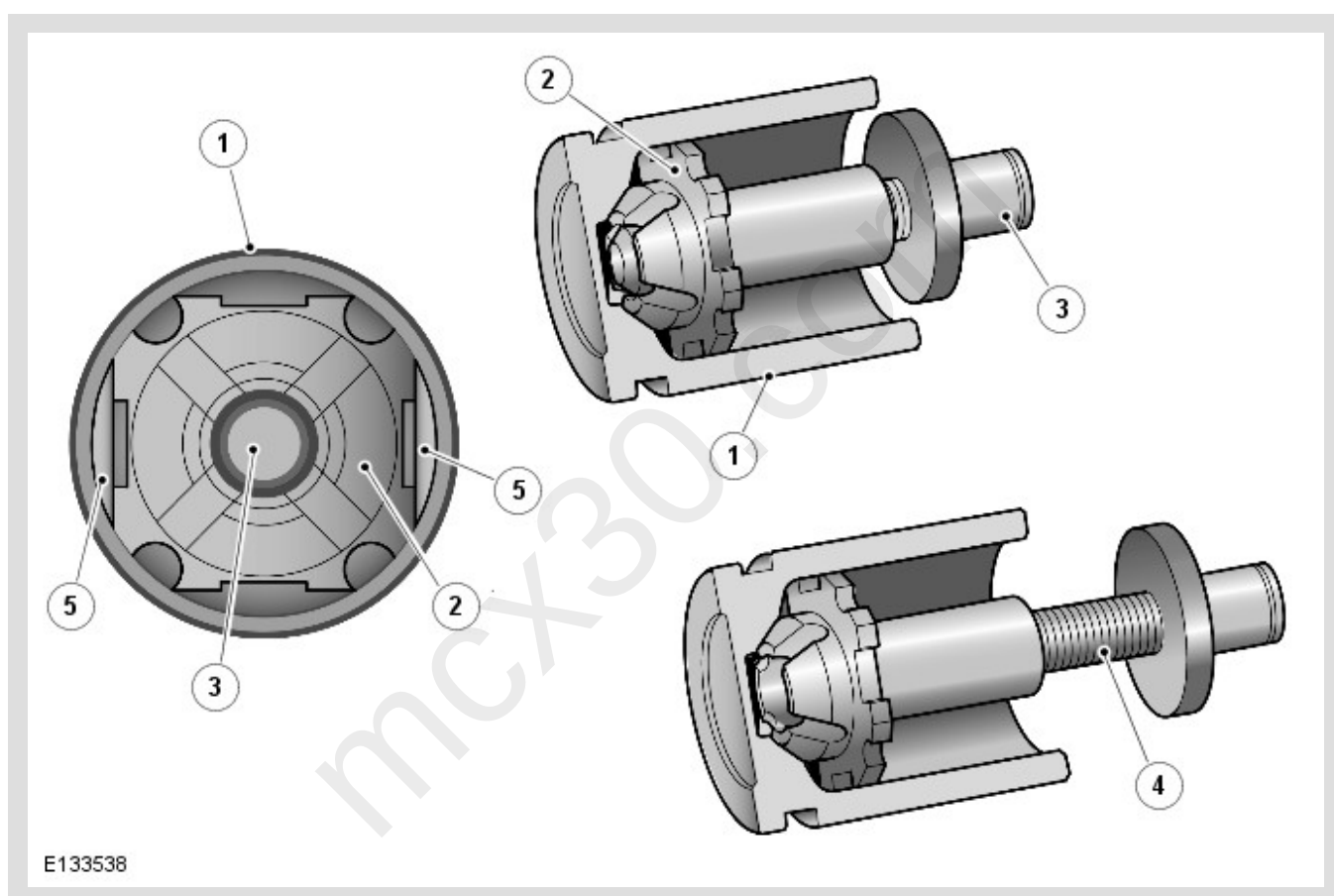
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ITEM	DESCRIPTION
1	Output shaft
2	Caliper piston

ITEM	DESCRIPTION
3	Motor
4	Electrical connector

The EPB actuators are electro-mechanical positioning units attached to the calipers of the rear brakes. Each actuator incorporates a reversible electric motor, driving an output shaft through a drive belt and planetary gear cluster.

The output shaft of the EPB actuator is engaged in the splined end of a spindle, which is inside the caliper piston and screwed into a thrust nut. Operation of the electric motor turns the spindle and produces linear movement of the thrust nut, to apply a target clamp load to the brake pads.



ITEM	DESCRIPTION
1	Caliper piston
2	Thrust nut
3	Spindle
4	Spindle thread
5	Flat surface

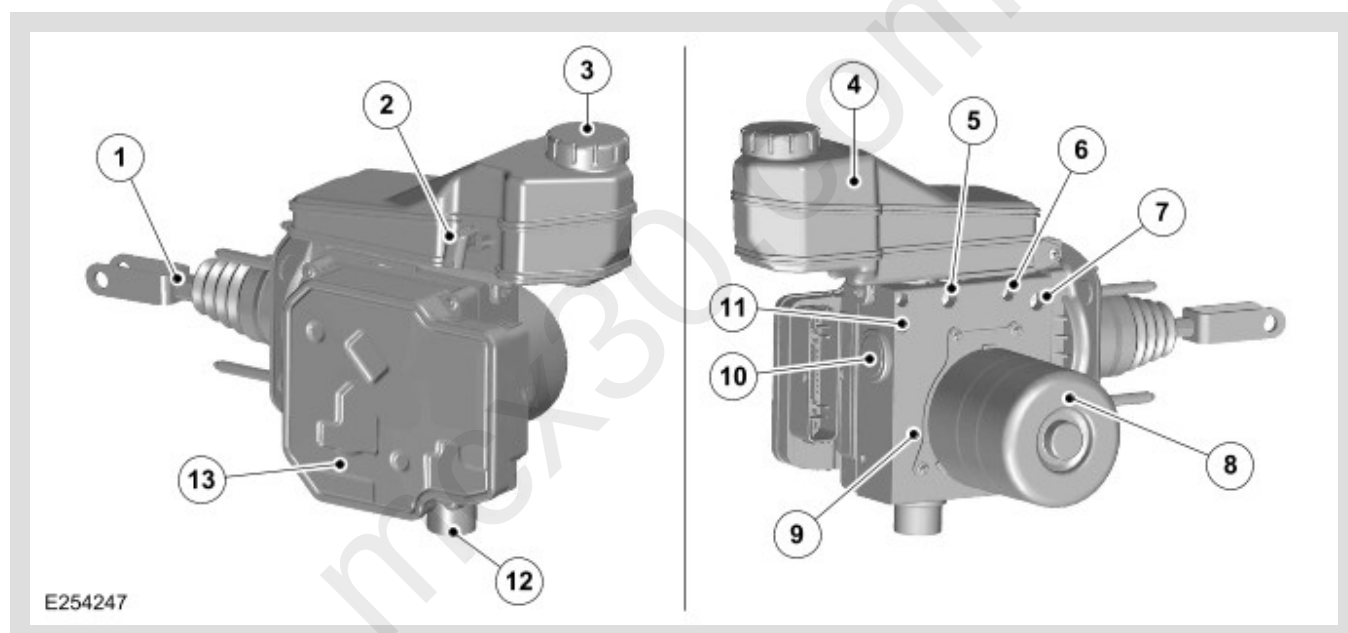
There are 2 flat surfaces on the inside of the caliper piston prevent the thrust nut from turning with the spindle. Scallops around the circumference of the thrust nut allow the free flow of hydraulic fluid. The fluid flows around the nut during mechanical operation by the EPB system and hydraulic operation by the brake pedal or the Integrated Power Brake.

Operation of each EPB actuator is controlled by the Integrated Power Brake control module through 2 hardwired connections with the electric motor. The Integrated Power Brake control module changes the polarity of the connections to change the direction of drive of the motor.

When the EPB is applied the electric motor turns the spindle to press the thrust nut against the caliper piston and apply the brake. The Integrated Power Brake control module measures the current draw of the electric motor and calculates the required brake pressure being applied by the thrust nut.

When the EPB is released, the electric motor turns the spindle for approximately 800 milliseconds to retract the thrust nut and release the pressure on the caliper piston.

INTEGRATED POWER BRAKE



ITEM	DESCRIPTION
1	Input rod and pedal interface
2	Brake fluid level sensor electrical connector
3	Brake fluid reservoir cap
4	Brake fluid reservoir
5	Front left brake outlet port
6	Front right brake outlet port
7	Rear left brake outlet port
8	Electric motor

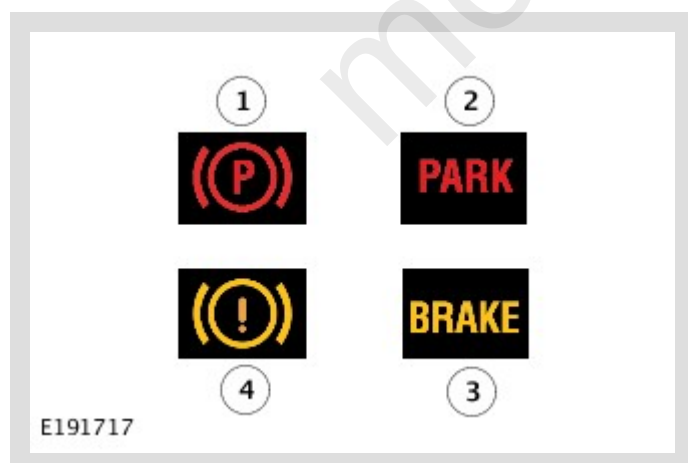
ITEM	DESCRIPTION
9	Hydraulic Control Unit (HCU)
10	Internal brake master cylinder
11	Rear right brake outlet port
12	Pedal feel simulator
13	Integrated Power Brake control module

The Integrated Power Brake has a control module which has a hardwired connection to each EPB actuator. Operation of the EPB is initiated by the EPB switch and software within the Integrated Power Brake control module.

The EPB has the following operating modes:

- Static apply/release
- Drive away release
- Automatic transmission apply/release
- Ignition OFF apply
- High temperature reclamp
- Roller test bench detection
- Driver exit apply
- Dynamic apply.

INSTRUMENT PANEL CLUSTER WARNING INDICATORS



ITEM	DESCRIPTION
1	EPB warning indicator - Rest of World (ROW)
2	EPB warning indicator - North American Specification (NAS)
3	Brake warning indicator - NAS

ITEM	DESCRIPTION
4	Brake warning indicator - ROW

The Integrated Power Brake requests the display of the warning indicators and messages in the IPC. Requests send through the BCM/ GWM on FlexRay. The BCM/ GWM then inform the IPC through HS CAN Human Machine Interface (HMI) systems bus.

When the EPB is applied in the static mode, the red EPB warning indicator is permanently illuminated:

- In Power Mode 6 (ignition ON)
- For 30 seconds in Power Mode 0 (Vehicle locked and armed)
- For 30 seconds in Power Mode 4 (Accessory (vehicle unlocked and Smart Key present))

If a fault is detected and the EPB is unable to apply, the red EPB warning indicator flashes. If any other EPB fault is detected, the amber brake warning indicator is illuminated. All fault indications are accompanied by a warning chime.

A message is also be displayed in the information and message center of the IPC.

For additional information, refer to: Instrument Cluster (413-01, Description and Operation).

OPERATION

When the EPB is applied, the Integrated Power Brake control module uses the wheel speed inputs to determine when to use the static and dynamic modes of operation. It uses the static mode at vehicle speeds up to 3 km/h (2 mph) and the dynamic mode at vehicle speeds greater than 3 km/h (2 mph).

STATIC APPLY/RELEASE

Static apply mode operates in all power modes. When the EPB switch is operated, the Integrated Power Brake control module activates the 2 EPB actuators to apply the brakes. Then signals the IPC to turn on the EPB indicator lamp through the BCM/ GWM.

For the static release mode to operate, Power Mode 6 (Ignition is ON) or higher must be selected with either the brake or accelerator pedal pressed. When the EPB switch is operated, the Integrated Power Brake control module activates the 2 EPB actuators to release the brakes. The Integrated Power Brake control module signals the IPC to turn off the EPB indicator lamp.

DRIVE AWAY RELEASE

With the vehicle stationary and the EPB applied, the drive away release mode releases the EPB when the accelerator pedal is pressed to help with a smooth drive away. This is done without the EPB switch being set to the release position.

The drive away release is only active if either the driver door is closed, or if the driver safety belt is buckled and the ignition is in Power Mode 7 (Engine running).

The following factors determine the point at which the Integrated Power Brake control module releases the brakes:

- Tilt angle - from the longitudinal motion sensor in the Restraints Control Module (RCM).
- Engine torque - from the Powertrain Control Module (PCM).
- Accelerator pedal applied - from the Accelerator Pedal Position (APP) sensor.
- Drive (D) or Reverse (R) selected - from the Transmission Control Switch (TCS).

Drive away release operation can be delayed by holding the EPB switch in the applied position, then releasing it back to its neutral position at the required time.

AUTOMATIC TRANSMISSION RELEASE

The EPB is automatically released when the TCS is taken out of Park (P). As long as the brake pedal is applied and the vehicle is in Power Mode 7 (Engine Running).

To prevent this automatic operation, operate and hold the EPB switch in the apply position when the TCS is taken out of Park (P).

AUTOMATIC TRANSMISSION APPLY

The EPB is automatically applied when the TCS is moved to the Park (P) position (Shift into Park (P) apply).

To prevent this automatic operation, operate and hold the EPB switch in the release position when the TCS is put into Park (P).

IGNITION OFF APPLY

The EPB is automatically applied when the Power Mode selected from 6 (Ignition ON) or greater to below 6 (Ignition ON).

To prevent this automatic operation, operate and hold the EPB switch in the release position no more than 5 seconds before set the ignition OFF.

HIGH TEMPERATURE RECLAMP

After heavy use of the brakes, the disc temperatures can be extremely high. If the vehicle is stationary and the EPB is applied, the Integrated Power Brake control module automatically reapplies the EPB as the brake discs cool down.

High temperature reclamp occurs at brake disc temperatures of 250°C (482°F) and above, or at any temperature when the vehicle is parked on a 20% or steeper slope. Depending on the temperature and inclination, up to 3 reclaims can occur, at varying time intervals, in the 10 minutes following the initial application of the EPB. To limit the number of reclaims, the ignition status as well as the current inclination of the vehicle is considered.

DRIVER EXIT APPLY

The EPB applies if all the following conditions occur:

- The vehicle is in Power Mode 7 (Engine Running).
- The vehicle is stationary.

- The driver door is open.
- The EPB is **not** applied.
- The transmission is **not** in Park (P).
- The brake pedal is not pressed.

ROLL AWAY DETECTION

If the initial brake torque proves insufficient to hold the vehicle stationary:

- When the EPB is applied.
- While the system remains awake.

The EPB mechanism attempts to reapply up to the full clamp force.

DYNAMIC APPLY

While the vehicle is moving, the dynamic apply mode gives emergency braking. At a vehicle speed greater than 3 km/h (2 mph), pulling up and holding the EPB switch produces a gradual deceleration of the vehicle. The red EPB warning indicator illuminates, together with a warning in the message center and a warning chime.

The vehicle stop lamps also light on, activated by a message from the Integrated Power Brake control module to the BCM/ GWM.

The dynamic apply operation is canceled if:

- The EPB switch is either released to its neutral position or operated to the release position.
- The accelerator pedal is pressed.

ACTUATOR DYNAMIC BRAKE FUNCTION

The Actuator Dynamic Brake Function (ADBF) mode is used if the Integrated Power Brake cannot operate the brakes hydraulically, but still has wheel speed signals available.

The wheel speed inputs allow the Integrated Power Brake control module to adjust the clamp load on the rear brakes as necessary to produce maximum deceleration without locking the wheels.

When the vehicle speed decreases to 3 km/h (2 mph), the Integrated Power Brake control module fully applies the EPB.

ADBF uses the EPB actuators to apply the rear brakes only, there is no hydraulic brake application and the front brakes are not applied.

ROLLER TEST BENCH MODE

This mode will be enabled whenever specific entry conditions are met that indicate that the vehicle is undergoing parking brake efficiency testing on a single axle roller bench.

It is not possible to enable this mode under normal driving conditions.

Entry/Enable Conditions

The mode will be enabled automatically when all of the following conditions are true:

- The EPB is fault free.
- The wheel speeds on the rear axle are equal and are between 1.8 km/h (1.11 mph) and 9 km/h (11.8 mph) for more than 3 seconds.
- The wheel speeds on the front axle are both equal to zero.
- The transmission is in Neutral (N).
- The vehicle is in Power Mode 6 (Ignition ON), with the engine is not running.
- Brake pedal is not pressed.
- The EPB is not operating, nor applying nor releasing.
- The EPB switch is in the neutral position.

When the EPB system has detected that the system is in Roller Test Bench mode:

- The system indicates that the Roller Test Bench mode is enabled, by illuminating the amber parking brake warning lamp.

Park brake switch response while the Roller Test Bench function is enabled

When the EPB switch is pulled, the park brake mechanism applies to a partial apply force, x% of the full clamp force. If the switch moves back to the neutral position, the park brake remains at the current clamp force.

- 1 The tester can momentarily apply the EPB switch several times to reach y% of the full clamp force which locks the rear road wheels.
- 2 The tester can apply and hold applied the EPB switch and the force is to be constant for 3 seconds and then increase by x% of the full clamp force. The clamp force increment behavior repeats until the park brake mechanism reaches y% of the full clamp force which locks the rear road wheels.

Function Exit

The system automatically exit from the Roller Test Bench mode if any of the following are true:

- When the park brake mechanism has achieved full clamp force.
- When all wheel speeds become equal.
- Both wheel speeds on the rear axle clamped by the EPB, exceed 10km/h (6.2 mph) for at least 1s.
- The transmission gear selector position is not Neutral (N).
- The EPB fault (or any fault that would prevent full EPB functionality).
- Power Mode moves lower than 6 (Ignition ON).

- Any of the enable conditions cannot be confirmed due to a fault.

When the Roller Test Bench mode has deactivated the amber brake warning lamp extinguishes.

BRAKE PAD REPLACEMENT

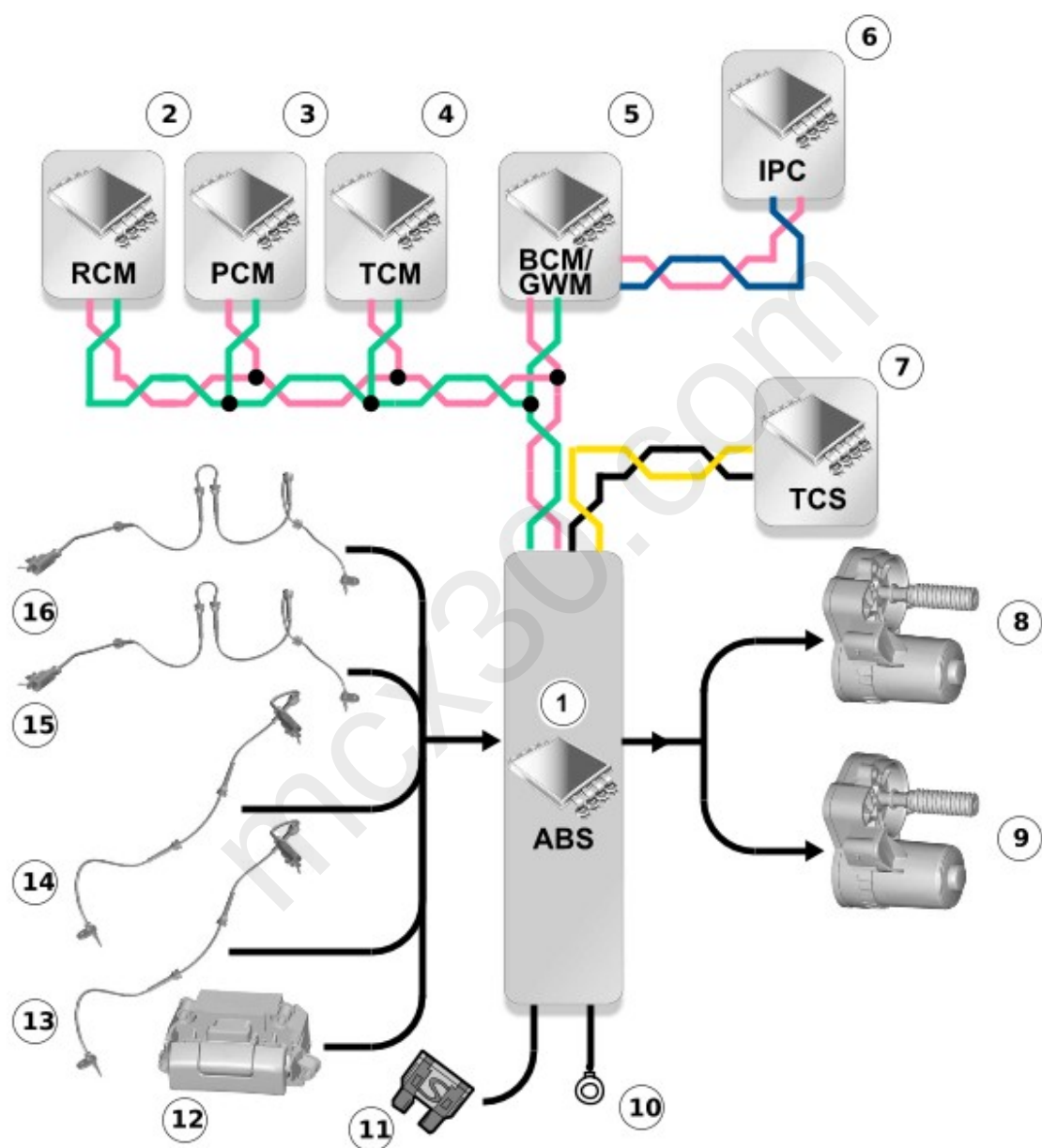
To replace the rear brake pads or discs it is necessary to fully retract the thrust nuts to allow retraction of the caliper pistons.

For additional information, refer to: [Electric Park Brake Release When the Vehicle Has No Electrical Power](#) (206-05 Parking Brake and Actuation, General Procedures).

For additional information, refer to: [Electric Park Brake Service Mode Activation and Deactivation](#) (206-05 Parking Brake and Actuation, General Procedures).

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CONTROL DIAGRAM



E252875

A = HARDWIRED: AX = FLEXRAY: BA = HS CAN HMI SYSTEMS BUS: BL = HS CAN UNDERBODY SYSTEM BUS.

ITEM	DESCRIPTION
1	Integrated Power Brake control module
2	RCM
3	PCM
4	Transmission Control Module (TCM)
5	BCM/ GWM
6	IPC
7	TCS
8	EPB actuator - Left
9	EPB actuator - Right
10	Ground
11	Power supply
12	EPB switch
13	Rear left wheel speed sensor
14	Rear right wheel speed sensor
15	Front right wheel speed sensor
16	Front left wheel speed sensor