Gesture Tailgate

The F-PACE is available with a Gesture Tailgate system. The system allows the user to open and/or close the power tailgate without physically touching the vehicle while their hands are full or when the vehicle is dirty. This operation means that the user does not need to press the Smart Key button or make physical contact with the vehicle.

The vehicle must be fitted with a power tailgate and have a full keyless entry system in order for the function to operate. The functionality uses capacitive sensors positioned in the left and right rear quarter of the bumper. The sensors recognize the action of a dedicated foot/leg movement ('kick gesture' below the bumper level) and in turn allow the automatic opening/closing of the power tailgate. Unlike many competitor systems, which use a single center-mounted sensor to detect the kick gesture, F-PACE benefits from two sensors mounted on either side of the rear bumper. This allows curbside operation – meaning that the user does not have to be standing directly behind the vehicle on the road. A major advantage of the twin sensor system is that the sensor locations are compatible with vehicles that are fitted with a towbar arm.

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Gesture Tailgate Operation

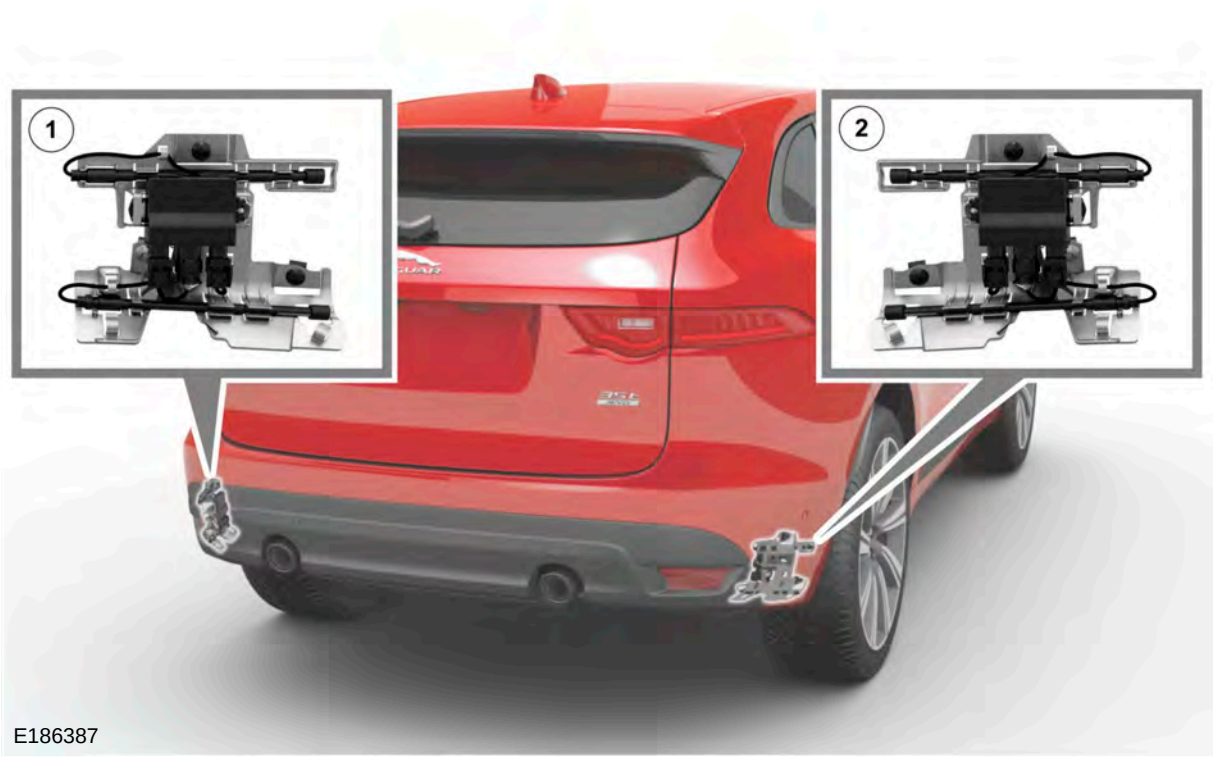
With the ignition off, the vehicle user approaches the rear of the vehicle and performs a smooth upward 'kick' gesture beneath one of the rear sensor areas. When a valid 'kick activation' has been sensed by the Gesture Tailgate system, the keyless entry system scans the rear of the vehicle for a valid Smart Key. Once a valid key has been detected, the keyless entry system communicates with the Remote Function Actuator (RFA) to request a visual confirmation (direction indicators flash), and tailgate activation.

Depending on the position of the tailgate, the Tailgate Control Module (TGCM) will send the appropriate command to either open the tailgate if closed or close the tailgate if already open. Tailgate operation begins within 500 ms following the recognition of a valid 'kick activation' and Smart Key. In the situation where the tailgate is moving, a stop command is sent.

If there is no valid Smart Key present, a warning feedback of two short sounder chirps will sound when a kick gesture is performed.

Hands-Free Tailgate Module Assemblies

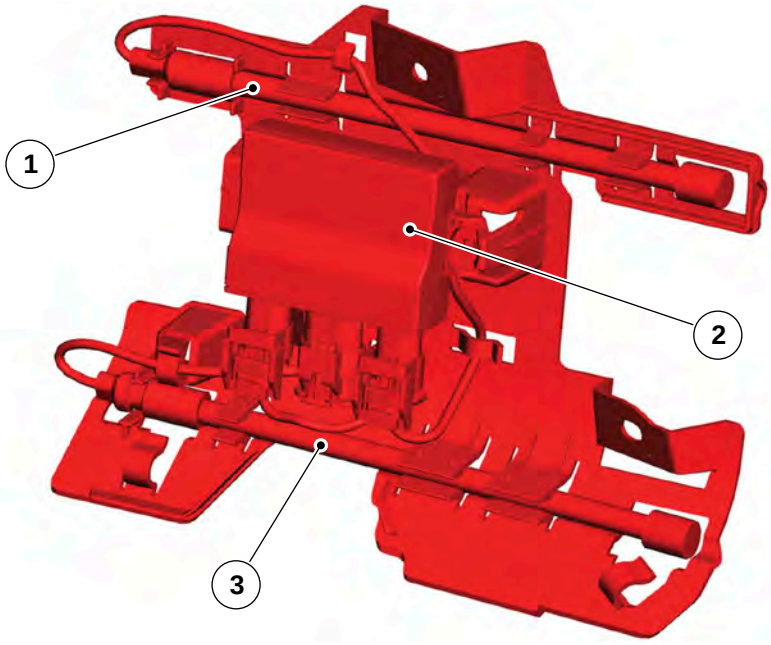
The gesture tailgate capacitive sensors are part of the Hands-Free Tailgate Module Assemblies installed at the rear of the vehicle.



Item	Description	Item	Description
1	Left hands-free tailgate module and sensors	2	Right hands-free tailgate module and sensors

The tailgate module assemblies consists of a control module connected to upper and lower capacitive sensing strips. The components are attached to a carrier plate, packaged at the rear of the vehicle in the rear bumper assembly. The capacitive sensor must be fitted in the correct orientation as incorrect fitment may cause the operation to function incorrectly. The sensor connectors have different locating tabs so that they cannot be incorrectly fitted to the control module.

Capacitive Sensor and Control Module Assembly



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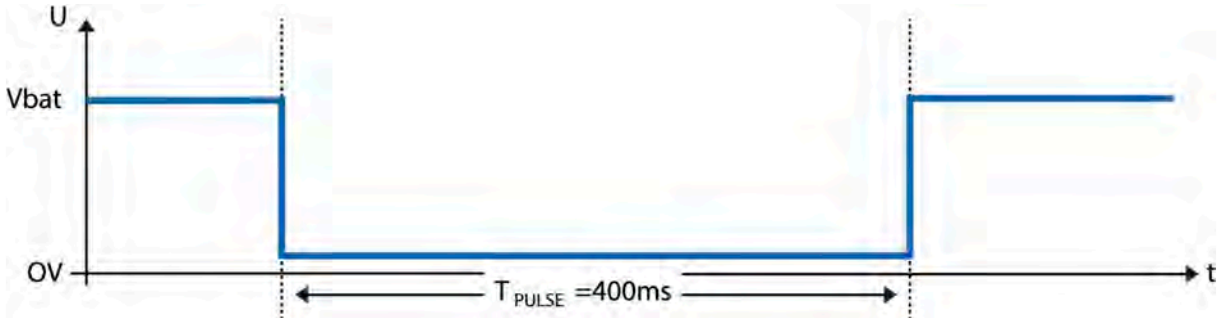
Item	Description	Item	Description
1	Upper sensor	3	Lower sensor
2	Control module		

Each of the upper and lower sensor strips form the 'kick activation' area, where the user executes a kick gesture to request tailgate activation. The left and right sensor assemblies function independently, however the two control module digital output signals share the same connection to the Remote Function Actuator (RFA).

The signal produced for JLR products is configured as a digital low side output which in our application is connected to a spare RFA input.

NOTE: The signal produced is not a LIN signal. For future GENERATION 2 hands-free tailgate modules, full LIN communications will be implemented.

Input Signal



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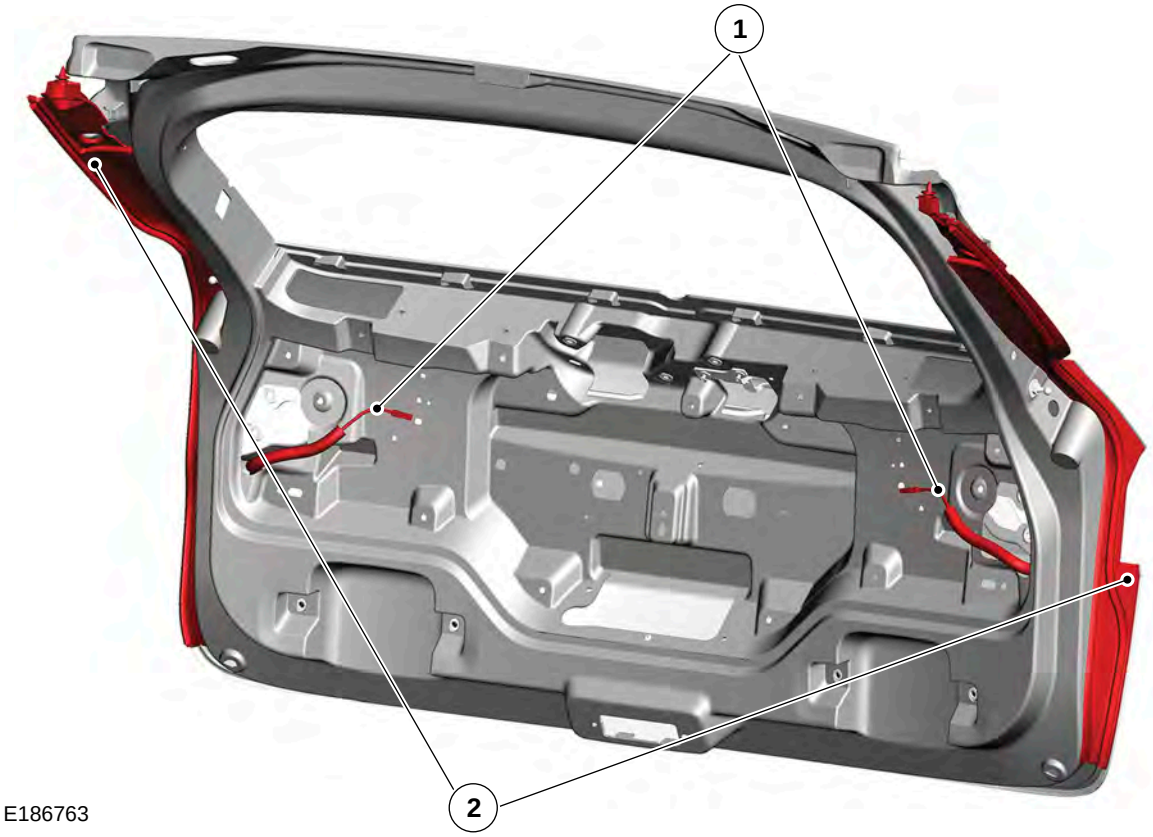
An active low input signal is used to indicate that a kick gesture has been sensed by the RFA. The RFA input signal is held at battery voltage when no kick has been sensed. A falling voltage edge indicates a valid kick has been recognized. The duration of the active low state is around 400ms after the falling edge. Once the signal has been stable for a predetermined time the RFA begins the Smart Key scan.

Anti-Trap Sensors

Anti-trap sensors are fitted to both sides of the tailgate assembly, built into the tailgate seal. Each sensor has a 3 kOhm resistance which can be measured across the connector plug. This resistance drops to below 100 ohms when the sensor is pressed. This drop in resistance is seen at the Tailgate Control Module. The purpose of the sensor is to stop an automatic lowering function when there is an obstruction between the tailgate and the body. This component can also be tested for voltage, however the tailgate lower function must be selected before the voltage can be seen. Expected values are approximately 9 volts when the anti-trap sensor is not pressed, which should then drop to approximately under 1 volt when pressed.

Both sensors can be tested directly at the sensor by removing the sensor connector and testing for resistance across the pins. When the sensor is pressed there should be a resistance reading across the pins under 100 ohms; with the sensor not pressed approximately 3 kOhms



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Item	Description	Item	Description
1	Anti-trap sensor connectors	2	Anti-trap sensors built into the seals

System Operation

Correct system operation is dependent on two variables:

- Distance from bumper: 2 – 10 cm (0.8 – 4 in.)
- Speed of the kick

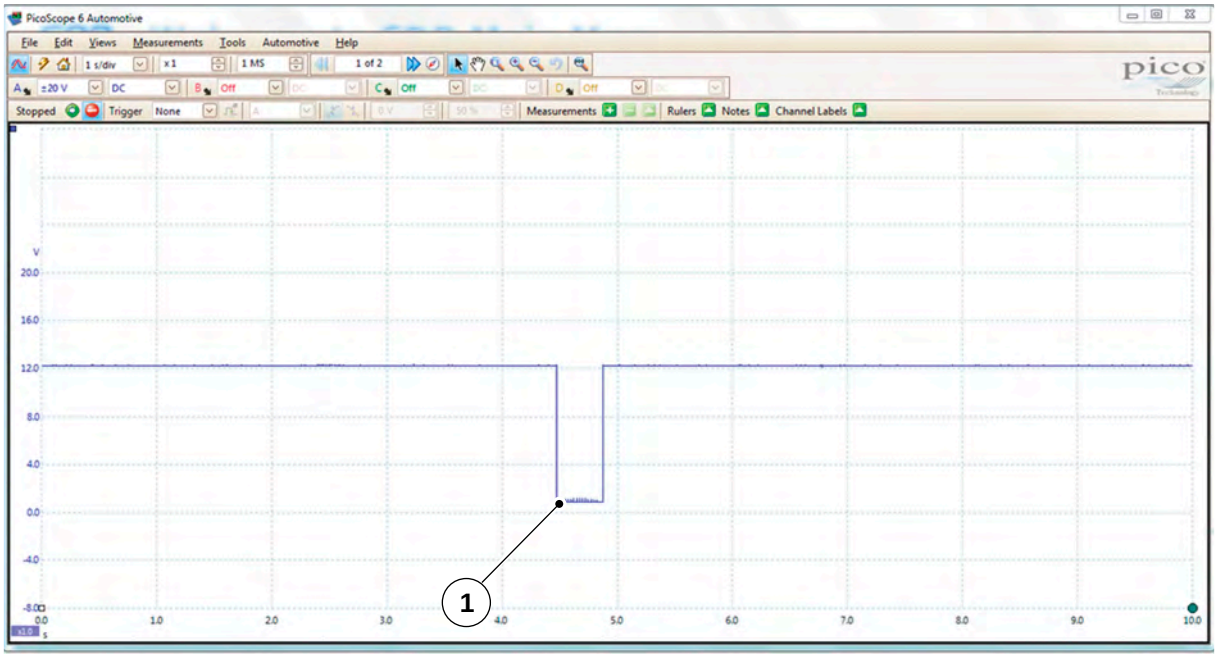
NOTE: There is no specific duration for the correct speed of the kick gesture. The leg movement speed should be such that the correct distance from the leg to the sensors can be achieved.

Gesture Tailgate Control

The following description provides a basic sequence of Gesture Tailgate operation:

1. The Remote Function Actuator (RFA) monitors the digital output line from the hands-free tailgate modules for an activation period of at least 200 ms
2. Once a valid 'kick activation' has been detected, the RFA scans the rear of the vehicle via the rear bumper antenna for a valid Smart Key. If a valid Smart Key is detected within range of the rear of the vehicle, the RFA sends a 'Gesture Tailgate/Open/Close Request' to the Body Control Module/Gateway Module (BCM/GWM).
3. On receipt of the 'Gesture Tailgate/Open/Close Request', the BCM/GWM activates the turn signal indicators, indicating to the vehicle user that a valid 'kick activation' has been detected
4. The BCM/GWM deactivates the turn signal indicators, and sends a signal to drive the tailgate latch motor to an unlatched state
5. The BCM/GWM sends a 'Power Open/Close Request' to the Tailgate Control Module (TGCM), indicating the source of the request is from a hands-free tailgate sensor module. The 'Open/Close' request has the same timing and requirements as similar 'Tailgate/Power Open/Close Requests'
6. The TGCM executes a 'Power Open/Close' activation, depending on the current/previous state/position of the tailgate.

Kick Gesture Waveform



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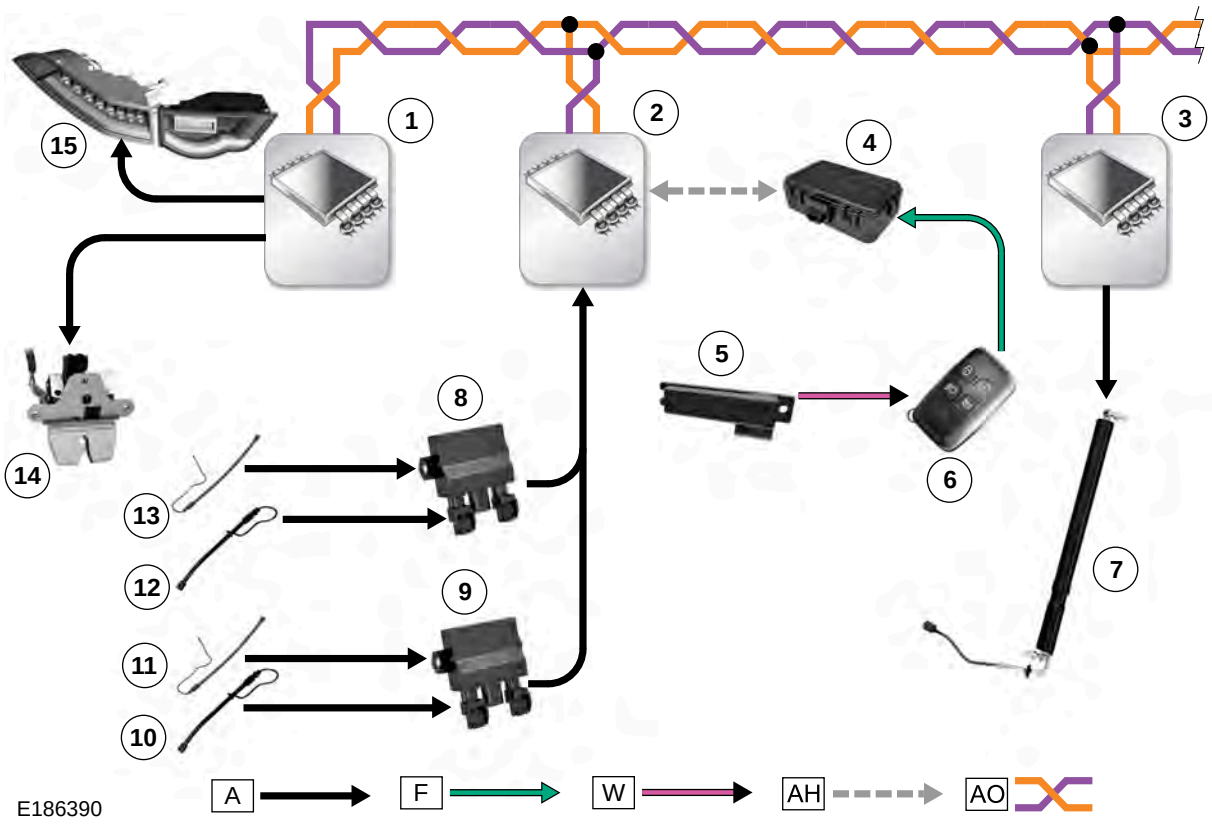
Item	Description
1	Signal drop when kick gesture performed

Gesture Tailgate Control Diagram



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Item	Description	Item	Description
A	Hardwired	6	Smart Key
AH	Serial Communication Line	7	Tailgate actuator
AO	MS CAN Body	8	Hands-free tailgate module (left)
F	RF Transmission	9	Hands-free tailgate module (right)
W	LF Transmission	10	Hands-free tailgate sensor (left upper)
1	Body Control Module/Gateway Module (BCM/GWM)	11	Hands-free tailgate sensor (left lower)
2	Remote Function Actuator (RFA)	12	Hands-free tailgate sensor (right upper)
3	Tailgate Control Module (TGCM)	13	Hands-free tailgate sensor (right lower)
4	Radio Frequency (RF) receiver	14	Tailgate latch
5	Low Frequency (LF) antenna	15	Direction indicators