

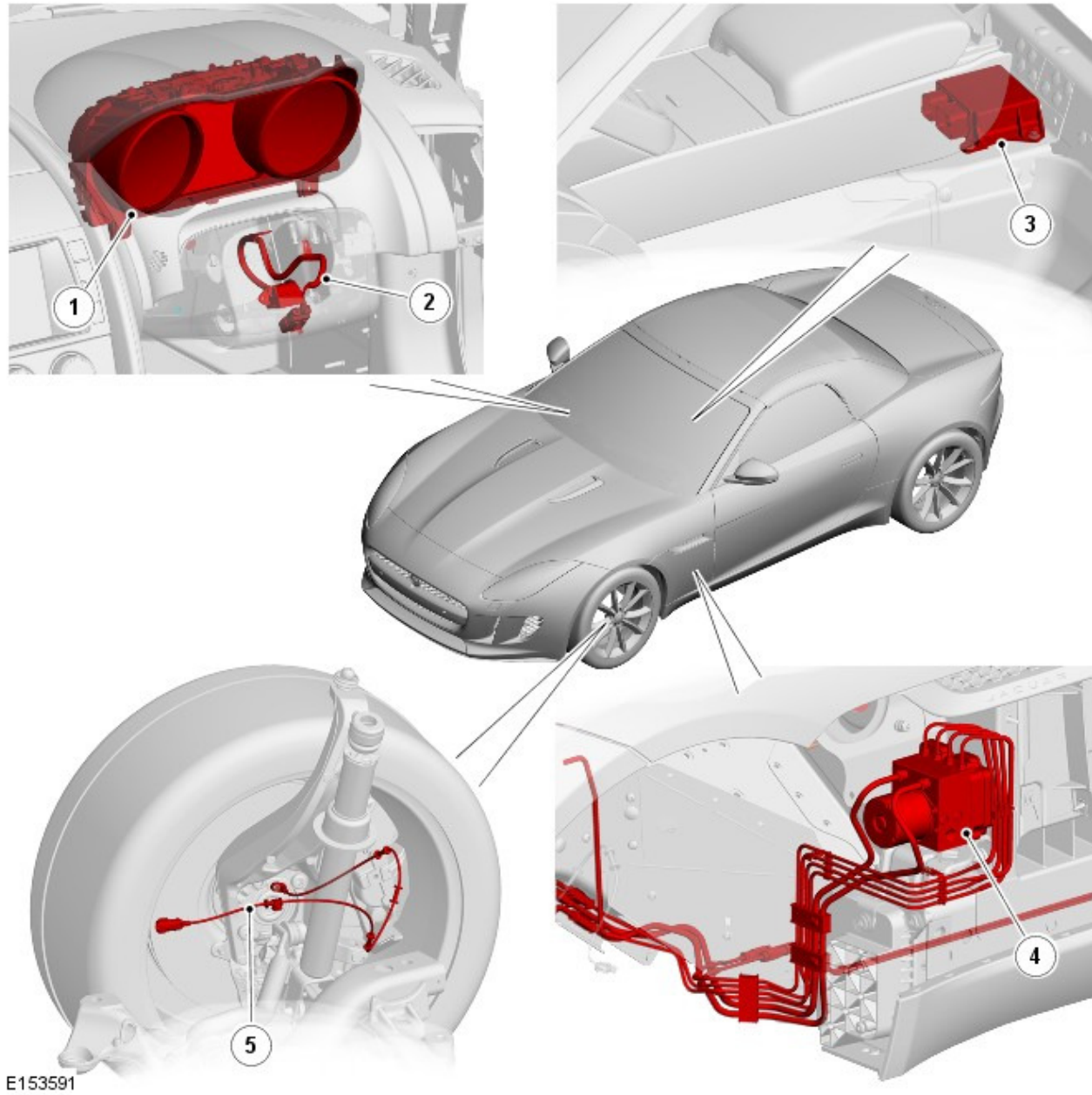
Published: 02-Apr-2014

Anti-Lock Control - Stability Assist - Anti-Lock Control - Stability Assist

Description and Operation

COMPONENT LOCATION

 NOTE: Convertible vehicle shown, coupe is similar.



E153591

Item	Description
1	Instrument Cluster (IC)
2	Steering angle sensor
3	Restraints Control Module (RCM)
4	Anti-lock Brake System (ABS) control module
5	Wheel speed sensor (4 off)

DESCRIPTION

The ABS (Anti-lock Brake System) and DSC (Dynamic Stability Control) system features a Bosch modulator, which is an integrated four-channel HCU (Hydraulic Control Unit) and Anti-lock Brake System (ABS) control module. The unit is installed in the brake hydraulic circuit between the brake master cylinder and the four brake calipers.

The ABS module is connected to the HS (High Speed) CAN (Controller Area Network) bus, and actively interacts with other vehicle system control modules and associated sensors to receive and transmit current vehicle operating information.

When required, the ABS module will actively intervene and operate the HCU during braking or vehicle maneuvers to correct the vehicle attitude, stability, traction or speed. During incidents of vehicle correction, the ABS module may also request the ECM (Engine Control Module) to control engine power in order to further stabilize and correct the vehicle.

To provide full system functionality, the ABS and DSC system comprise the following components:

- DSC switch.
- Four wheel speed sensors.
- Steering angle sensor.
- Yaw rate and lateral acceleration sensor, located in the RCM (Restraints Control Module).
- Brake Pedal switch.
- Instrument Cluster indicator lamps.
- Integrated ABS control module and HCU.

The ABS provides the following brake functions that are designed to assist the vehicle or aid the driver:

- ABS.
- DSC (Dynamic Stability Control), including TracDSC.
- CBC (Corner Brake Control).
- EBD (Electronic Brake Force Distribution).
- ETC (Electronic Traction Control).
- EBA (Emergency Brake Assist).
- EDC (Engine Drag-torque Control).
- Understeer control.
- Electronic Emergency Brake Prefill.
- Brake disc wiping. (Vehicles without Carbon Ceramic Brakes)
- Electronic Brake Prefill. (Carbon Ceramic Brakes equipped vehicles only)
- Brake fluid temperature warning. (Carbon Ceramic Brakes equipped vehicles only)
- Brake Disc Wear Prediction. (Carbon Ceramic Brakes equipped vehicles only)
- TVB (Torque Vectoring by Braking). (Coupe vehicles with 5.0L V8 S/C engine only)

All the brake functions listed are automatically active when the ignition is in power mode and the engine is running. The DSC system can be selected to off using the DSC switch.



WARNING: Although the vehicle is fitted with DSC, it remains the driver's responsibility to drive safely according to the prevailing conditions.

DYNAMIC STABILITY CONTROL SWITCH



E153592

The DSC switch is mounted in the floor console adjacent to the TCS (Transmission Control Switch).

DSC becomes active whenever the engine is running. A momentary press of the switch allows the driver to toggle between the standard DSC settings and the TracDSC settings. The message TRAC DSC or DSC ON will temporarily be displayed in the IC (Instrument Cluster) message center. The amber DSC off warning indicator in the IC remains illuminated while TracDSC is selected.

DSC can be switched off by pressing and holding the switch for more than 3 seconds. The message DSC OFF will be displayed in the IC message center to confirm DSC has been switched off. The amber DSC OFF warning indicator in the IC will remain illuminated. The system can be switched back on again by simply pressing and releasing the switch. The message DSC ON will then temporarily appear in the IC message center to confirm the system is on.

DSC returns to ON at the beginning of each ignition cycle, regardless of the previous setting.

If a fault is detected with the DSC switch, the ABS module defaults to the DSC on setting and any switch requests are ignored.



WARNING: It is recommended that when using show chains, DSC is switched on and JaguarDrive control winter mode is selected.

WHEEL SPEED SENSORS



E153593

An active wheel speed sensor is installed in each wheel hub to provide the ABS module with a rotational speed signal from each road wheel. The head of each front wheel speed sensor is positioned close to a magnetic encoder ring incorporated into the inboard seal of the wheel bearing. The head of each rear wheel speed sensor is positioned close to a magnetic encoder ring incorporated into the rear wheel bearing assembly. A fly lead connects each sensor to the vehicle harness.

The wheel speed sensors each have a signal and a return connection with the ABS module. When the ignition is ON the ABS module supplies a signal feed to the wheel speed sensors and monitors the return signals. Any rotation of the road wheels induces current fluctuations in the return signals, which are converted into individual wheel speeds and overall vehicle speed by the ABS module.

The ABS module broadcasts the individual wheel speeds and the vehicle speed on the HS CAN bus for use by other systems.

If a wheel speed sensor fault is detected by the ABS module, 'ABS FAULT' will be displayed in the IC message center and an amber warning indicator will illuminate.

STEERING ANGLE SENSOR



E153594

The steering angle sensor measures the steering wheel angle and the rate of change of the steering wheel angle. These measurements are received by the ABS module and broadcast on the HS CAN bus for use by other systems.

The steering angle sensor is mounted on the steering column upper shroud mounting bracket, immediately behind the multifunction switches, and is secured by two screws. A fly lead connects the sensor to the passenger compartment wiring harness via a four pin multiplug.

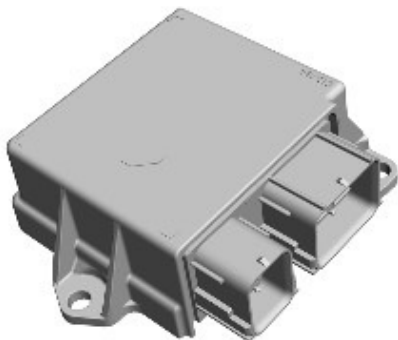
The sensor is housed in a 'U' shaped plastic casing and contains two offset LED (Light Emitting Diode) facing two detectors.

An encoder ring is mounted on the inner steering column shaft and intersects the LED's and detectors. The encoder ring contains 60 slots which break and restore the light beams between the LED's and the detectors as the steering wheel is rotated. The ABS module is able to determine the direction of rotation of the steering wheel by monitoring when the light beams change state. The LED's and detectors are mounted in such a way that only one beam will change state, either to broken or restored, at any one time.

The center (straight ahead) position of the steering wheel has to be learned by the ABS module every time the ignition is switched ON. This process begins when the vehicle starts to move. The steering angle sensor is unable to determine the center position so yaw rate and lateral acceleration inputs from the RCM and wheel speed signals are also used by the ABS module to help it perform this process. If extreme conditions are present, for example ice causing extreme wheel spin or understeer/oversteer, the ABS module may not be able to determine the center position of the steering wheel. In this situation 'DSC NOT AVAILABLE' will be displayed in the IC message center and the amber warning indicator will illuminate. The ABS control module will continue to try to learn the straight ahead position and will extinguish the warning once it has done so.

'DSC NOT AVAILABLE' will also be displayed if the ABS module detects a steering angle sensor fault. The amber warning indicator will illuminate until the fault is rectified.

YAW RATE AND LATERAL ACCELERATION SENSOR

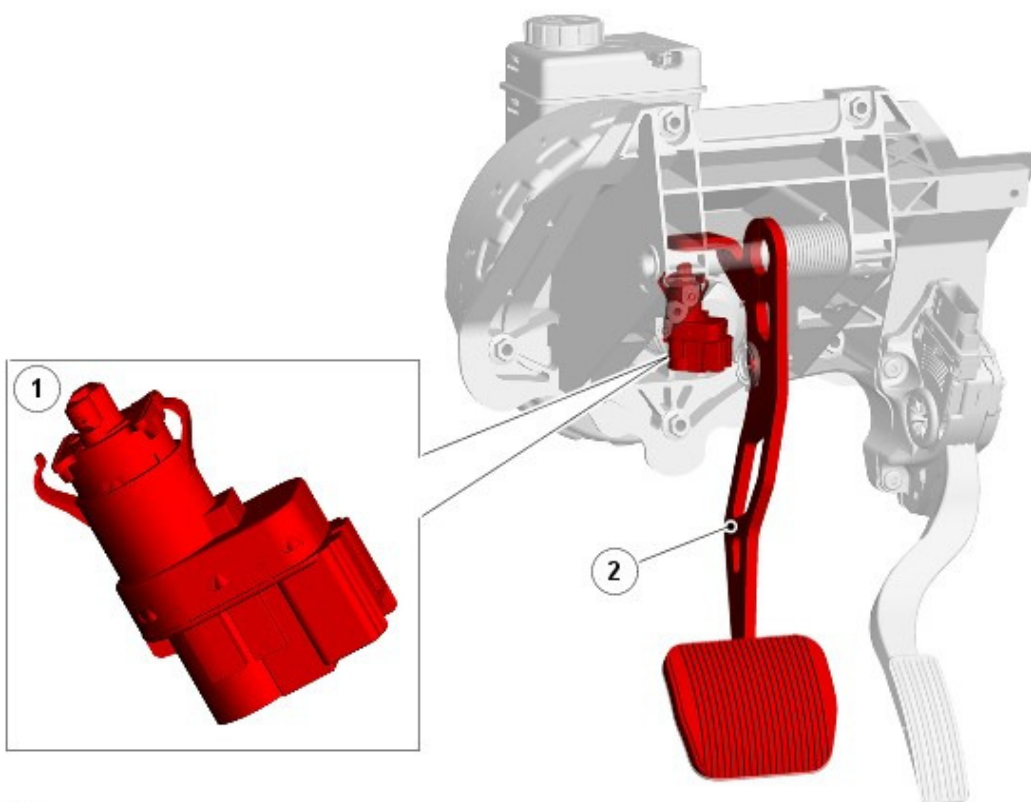


E153595

The yaw rate and lateral acceleration sensor is contained within the RCM. When the ignition is ON, the sensor receives a power feed from the CJB (Central Junction Box). The ground path for the sensor is located on the instrument panel cross-car beam. The sensor measures the yaw rate and lateral acceleration of the vehicle, providing values to the ABS control module via a dedicated, private high speed CAN bus connection. The ABS module broadcasts these values on the HS CAN bus for use by other systems.

If a sensor fault is detected by the ABS control module, 'DSC NOT AVAILABLE' will be displayed in the IC message center and the amber warning indicator will illuminate.

BRAKE PEDAL SWITCH



E153482

Item	Description
1	Brake pedal switch
2	Brake pedal

The Brake Pedal switch is mounted on the brake pedal box and is connected to the vehicle harness via a four pin multiplug.

When the brake pedal is pressed, the switch contacts close. This allows a hardwired signal feed to be sent to the ECM. A Brake Pedal switch status message is then sent from the ECM to the ABS control module on the HS CAN bus. The ABS control module is then able to control braking force accordingly in conjunction with the HCU.



NOTE: The brake pedal switch also forms part of the speed control system.

BRAKE WARNING INDICATORS



E153596

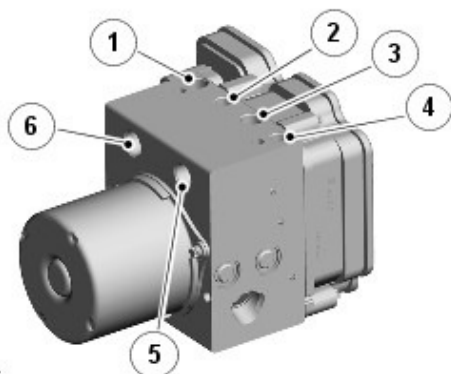
Item	Description
1	ABS warning indicator (all except USA, Canada and Mexico) - also shared with EPB (electronic parking brake) warning
2	DSC activity warning indicator
3	DSC OFF warning indicator
4	Brake warning indicator (all except USA)
5	Brake warning indicator (USA only)

The IC and message center contains warning indicators and warning messages to display the operating status of the anti-lock control - stability assist functions. The warning indicators and messages provide a visual notification of either a system warning or information indication to the driver. There are four warning indicators on the IC, which vary dependent on market, and several types of message relating to the anti-lock control - stability assist functions. The DSC OFF message is accompanied by an audible warning.

The following anti-lock control - stability assist warning indicators are installed in the IC:

- An amber ABS warning indicator.
- A red brake warning indicator.
- An amber DSC activity warning indicator.
- An amber DSC OFF warning indicator.

ABS CONTROL MODULE



E153484

Item	Description
1	Left front brake outlet port
2	Right rear brake outlet port
3	Left rear brake outlet port
4	Right front brake outlet port
5	Primary circuit inlet port
6	Secondary circuit inlet port

The ABS module is secured to a mounting bracket located in the left front wheel arch. The module is mounted on the rear face of the HCU, which it uses to control all braking and stability functions by modulating hydraulic pressure to the individual wheel brakes.

If an ABS modulator fault is detected, 'ABS FAULT' will be displayed in the IC message center and the amber warning indicator will illuminate.



CAUTION: The ABS module and the HCU comprise a single unit and must not be separated.

HYDRAULIC CONTROL UNIT

The HCU is a four channel unit, secured to a mounting bracket located in the left front wheel arch. The HCU modulates the supply of hydraulic pressure to the brakes under the control of the ABS module.

OPERATION

Anti-Lock Brake System

The ABS controls the speed of all road wheels to ensure optimum wheel slip when braking at the adhesion limit. The wheels are prevented from locking to retain effective steering control of the vehicle.

The brake pressures are modulated separately for each wheel. Rear brake pressures are controlled to maintain rear stability on split friction surfaces.

Dynamic Stability Control

DSC uses brakes and powertrain torque control to assist in maintaining the yaw stability of the vehicle. While the ignition is energized the DSC function is permanently enabled, unless selected off using the DSC switch.

DSC enhances driving safety in abrupt maneuvers and in under-steer or over-steer situations that may occur in a bend. The ABS module monitors the yaw rate and lateral acceleration of the vehicle, steering input and individual wheel speeds, then selectively applies individual brakes and signals for powertrain torque adjustments to reduce under-steer or over-steer conditions.

In general:

- In an under-steer situation the inner wheels are braked to counteract the yaw movement towards the outer edge of the bend.
- In an over-steer situation the outer wheels are braked to prevent the rear end of the vehicle from pushing towards the outer edge of the bend.

The ABS module monitors the tracking stability of the vehicle using inputs from the wheel speed sensors, the steering angle sensor, and the yaw rate and lateral acceleration sensor. The tracking stability is compared with stored target data. Whenever the tracking stability deviates from the target data, the ABS module intervenes by applying the appropriate control strategy.

The following interactions occur in an intervention situation:

- HS CAN signal to the ECM, to reduce engine torque.
- Application of braking to the appropriate corner of the vehicle.

TracDSC

TracDSC is an alternative setting of DSC with reduced system interventions. With TracDSC engaged, traction may be somewhat increased, although stability may be reduced compared to normal DSC. TracDSC is intended for use only on dry tarmac by suitably experienced drivers and should not be selected for other surfaces or by drivers with insufficient skill and training to operate the vehicle safely with the TracDSC function engaged. The less restrictive TracDSC setting may be preferred, for example, by expert drivers engaged in high performance driving on dry tarmac surfaces such as tracks and circuits.



WARNING: Vehicle safety may be reduced by inappropriate use of TracDSC. TracDSC should only be used in suitable conditions.

Briefly pressing and releasing the DSC switch will switch the vehicle between normal DSC settings and TracDSC settings. To confirm which setting has been selected, either DSC ON or TracDSC will be temporarily displayed in the IC message center.

When TracDSC is selected, the amber DSC off warning indicator located in the IC will illuminate. The DSC activity indicator will flash if DSC becomes active.



NOTE: If speed control is engaged it will automatically disengage if DSC or TracDSC becomes active.

Corner Brake Control

CBC (Corner Brake Control) influences the brake pressures, below and within DSC and ABS thresholds, to counteract the yawing moment produced when braking in a corner. CBC produces a correction torque by limiting the brake pressure on one side of the vehicle.

Electronic Brake Force Distribution

EBD uses the ABS braking hardware to automatically optimize the pressure to the rear brakes, below the point where ABS is normally invoked.



NOTE: Only the rear brakes are controlled by the EBD function.

Electronic Traction Control

ETC (Electronic Traction Control) attempts to optimize forward traction by reducing engine torque, or by applying the brake of a spinning wheel until traction is regained.

ETC is activated if an individual wheel speed is above that of the vehicle reference speed (positive slip) and the brake pedal is not pressed. The brake is applied to the spinning wheel, allowing the excess torque to be transmitted to the non-spinning wheel through the drive line. If necessary, the ABS control module also sends a HS CAN bus message to the ECM to request a reduction in engine torque.

When the DSC function is selected off using the DSC switch, the braking and engine torque reduction features are both disabled.

Emergency Brake Assist

EBA assists the driver in emergency braking situations by automatically increasing the applied braking effort. The ABS control module invokes EBA when:

- The brake pedal is rapidly pressed.
- The brake pedal is pressed hard enough to bring the front brakes into ABS operation.

When EBA is active, the ABS module increases the hydraulic pressure to all of the brakes until the threshold for ABS operation is reached. This action applies the maximum braking effort for the available traction. The ABS control module monitors for the sudden application of the brakes, using inputs from the brake pedal switch and from the pressure sensor within the HCU. With the brake pedal pressed, if the rate of increase of hydraulic pressure exceeds the predetermined limit, the ABS control module invokes emergency braking.

When the brake pedal is pressed hard enough to bring the front brakes into ABS operation, the ABS module increases the hydraulic pressure to the rear brakes up to the ABS threshold.

EBA operation continues until the driver releases the brake pedal, sufficiently for the hydraulic pressure in the HCU to drop below a threshold value stored in the ABS control module.

During an emergency braking situation the ABS control module will activate the hazard warning lamps. For additional information, refer to: [Exterior Lighting](#) (417-01 Exterior Lighting, Description and Operation).

Engine Drag-Torque Control

EDC (Engine Drag-torque Control) prevents wheel slip caused by any of the following:

- A sudden decrease in engine torque when the accelerator is suddenly released.
- A downshift using the Jaguar sequential shift function.

When the ABS control module detects the onset of wheel slip without the brakes being applied, the ABS control module signals the ECM via the HS CAN bus to request a momentary increase in engine torque.

Electronic Emergency Brake Prefill

Electronic brake prefill senses any rapid throttle lift off, activating a small brake hydraulic pressure build-up of approximately 3 to 5 bar (43.5 to 72.5 lbf/in²) in anticipation of the brakes being applied.

This application produces a quicker brake pedal response and consequently slightly shorter stopping distances.

Electronic Brake Prefill



NOTE: Carbon Ceramic Brakes equipped vehicles only.

Electronic brake prefill senses all throttle lift off actions, activating a small brake hydraulic pressure build-up of approximately 3 to 5 bar (43.5 to 72.5 lbf/in²) in anticipation of the brakes being applied.

This application produces a quicker brake pedal response and consequently slightly shorter stopping distances.

Brake fluid temperature warning



NOTE: Carbon Ceramic Brakes equipped vehicles only.

If the vehicle is equipped with Carbon Ceramic Brakes, there is a Brake fluid temperature warning function available in the ABS control module which informs the driver when the brake fluid has overheated and there is a risk that the fluid will vaporize. The ABS control module calculates the brake system thermal loading. When the calculated temperature reaches the stored threshold temperature (240 °C / 464 °F) the ABS control module sends a message to the IC via the HS CAN bus and also stores a DTC. The IC illuminates a red warning light, and displays the BRAKES OVERHEATING message in the message center. The warning light and the message is visible until the calculated brake temperature falls below 180°C (356°F).



WARNING: The calculated brake fluid temperature can increase when the vehicle is stationary or the ignition is switched off.

Brake Disc Wear Prediction



NOTE: Carbon Ceramic Brakes equipped vehicles only.

There is a brake disc wear prediction algorithm available in the ABS control module to monitor brake disc duty levels due to driver brake applications. The data is used to calculate the brake disc life reduction caused by each braking event. The calculated current wear value for each disc can be read using a Jaguar approved diagnostic system. The wear value can also be reset if new discs are fitted.

For additional information, refer to: [Anti-Lock Control - Stability Assist](#) (206-09 Anti-Lock Control - Stability Assist, Diagnosis and Testing).

When the calculated wear of any brake disc exceeds a predetermined level (3%), the ABS control module generates a DTC, and sends a message to the IC via the HS CAN bus. The IC then displays the message 'CERAMIC DISC WORN'. The approved Jaguar diagnostic system must be used to identify which discs require replacement.

For additional information, refer to: [Diagnostic Trouble Code \(DTC\) Index - DTC: Anti-Lock Brake System Control Module \(ABS\)](#) (100-00 General Information, Description and Operation).



CAUTION: Important:

Brake discs wear estimate cannot be determined or reset without access to a Jaguar approved diagnostic system.

In the event of a brake disc being replaced by a new one, it is imperative that the wear value for that disc is reset to zero.

Do not move brake discs from one wheel location to another or from one vehicle to another.

In the event of the ABS control module being replaced, unless new brake discs are also fitted it is imperative that the current wear value of all brake discs is read from the old module and written to the new module.

If the current wear value of a brake disc cannot be verified from information stored in the ABS control module, the disc wear level may be calculated by weighing the discs.

For additional information, refer to: [Carbon Ceramic Brake Disc Cleaning And Inspection](#) (206-00 Brake System - General Information, General Procedures) / [Anti-Lock Control - Stability Assist](#) (206-09 Anti-Lock Control - Stability Assist, Diagnosis and Testing).

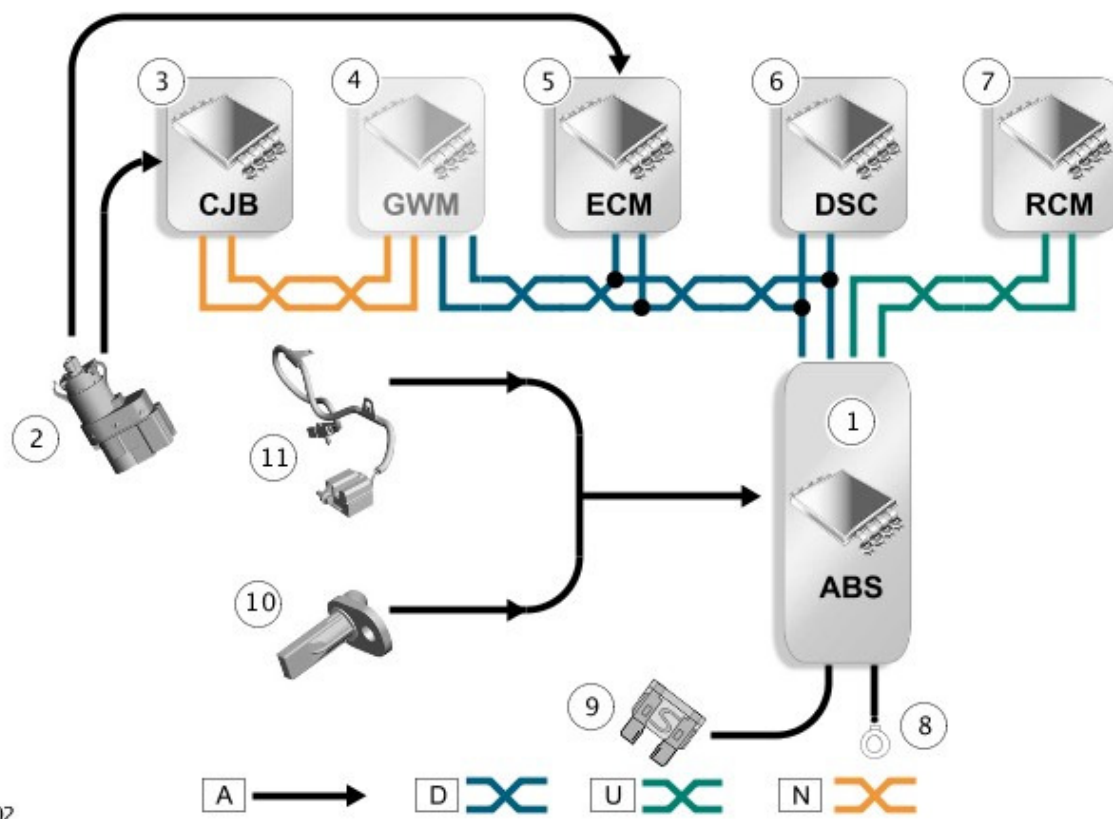
Torque Vectoring by Braking



NOTE: Coupe vehicles with 5.0L V8 S/C engine only.

TVB reduces near-limit understeer of the vehicle, during cornering by braking the inside wheels, increasing the yaw moment acting on the vehicle. The engine output torque is increased by the ECM, to compensate for the braking effect, maintaining vehicle progress. This extends the linear range of the vehicle and increases the maximum cornering capacity. The system monitors the level of understeer by comparing the measured vehicle yaw rate, to a calculated yaw rate target determined from driver steering input and vehicle speed.

INPUT/OUTPUT DIAGRAM



A = Hardwired; D = HS (High Speed) CAN (Controller Area Network); N = MS (Medium Speed) CAN bus; U = Private CAN bus.

Item	Description
1	Anti-lock Brake System (ABS) control module Ground
2	Brake pedal switch
3	Central Junction Box (CJB)
4	Gateway module (GWM)
5	Engine Control Module (ECM)
6	DSC Switch
7	Restraints Control Module (RCM)
8	Ground
9	Power supply from Engine Junction Box (EJB)
10	Wheel speed sensor (4 off)
11	Steering angle sensor