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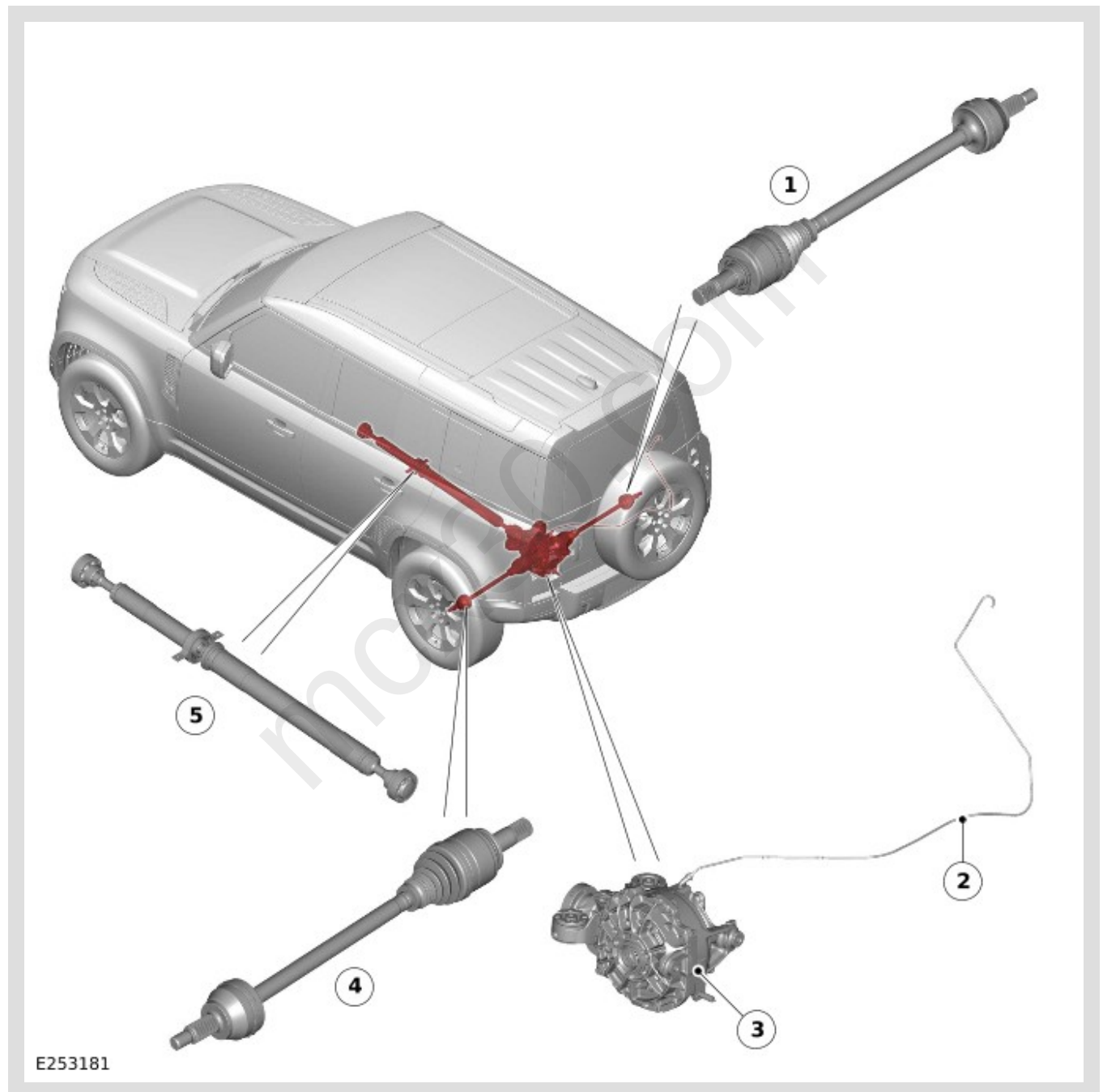
REAR DRIVE AXLE/DIFFERENTIAL

REAR DRIVE AXLE AND DIFFERENTIAL (G2341729)

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COMPONENT LOCATION

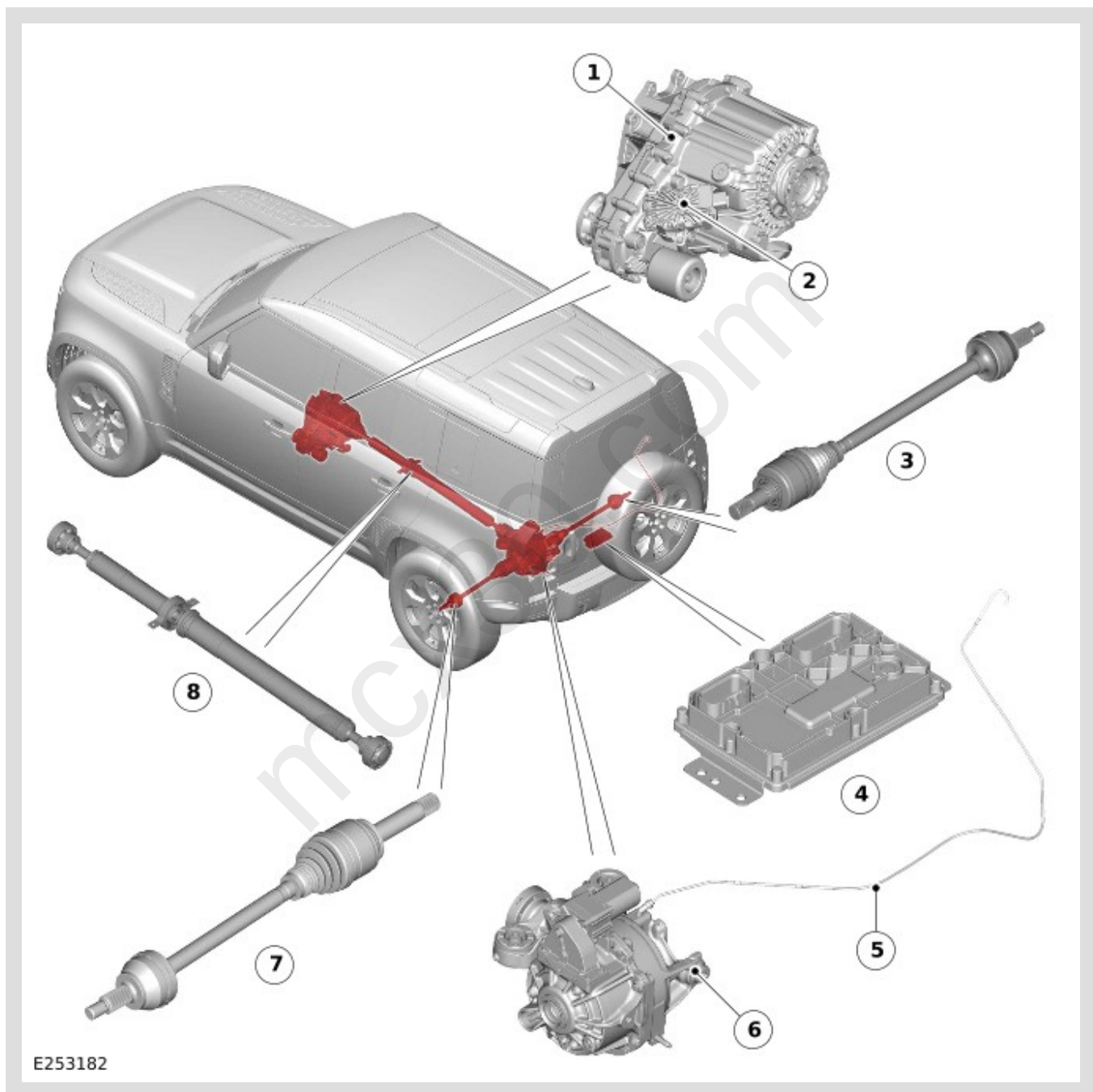
COMPONENT LOCATION - 1 OF 2 - REAR DIFFERENTIAL



ITEM	DESCRIPTION
1	Rear right halfshaft
2	Breather pipe

ITEM	DESCRIPTION
3	Rear differential
4	Rear left halfshaft
5	Rear driveshaft

COMPONENT LOCATION - 2 OF 2 - ELECTRONIC TORQUE MANAGER REAR DIFFERENTIAL - IF EQUIPPED



ITEM	DESCRIPTION
1	Transfer case
2	Transfer Case Control Module (TCCM)
3	Rear right halfshaft

ITEM	DESCRIPTION
4	Rear Differential Control Module (RDCM)
5	Breather pipe
6	Electronic Torque Manager (ETM) rear differential
7	Rear left halfshaft
8	Rear driveshaft

OVERVIEW

The rear differential has 2 functions:

- To convert the 'angle of drive' through 90° and distribute drive, through the rear drive halfshafts, to the rear wheels.
- To compensate for differences in the rotational speeds of the vehicle's rear wheels during cornering.

Depending on vehicle specification there are 2 types of differential installed:

- Rear differential.
- Electronic Torque Manager (ETM) rear differential.

Both types of differential are attached to the rear subframe at 4 mounting points. Each mounting point incorporates an insulator to reduce the Noise, Vibration and Harshness (NVH). The insulators in the forward mounting points are installed in the differential. The insulators in the rear mounting points are installed in the rear subframe. A damper weight attached to the rear of the differential is used to control linear vibrations.

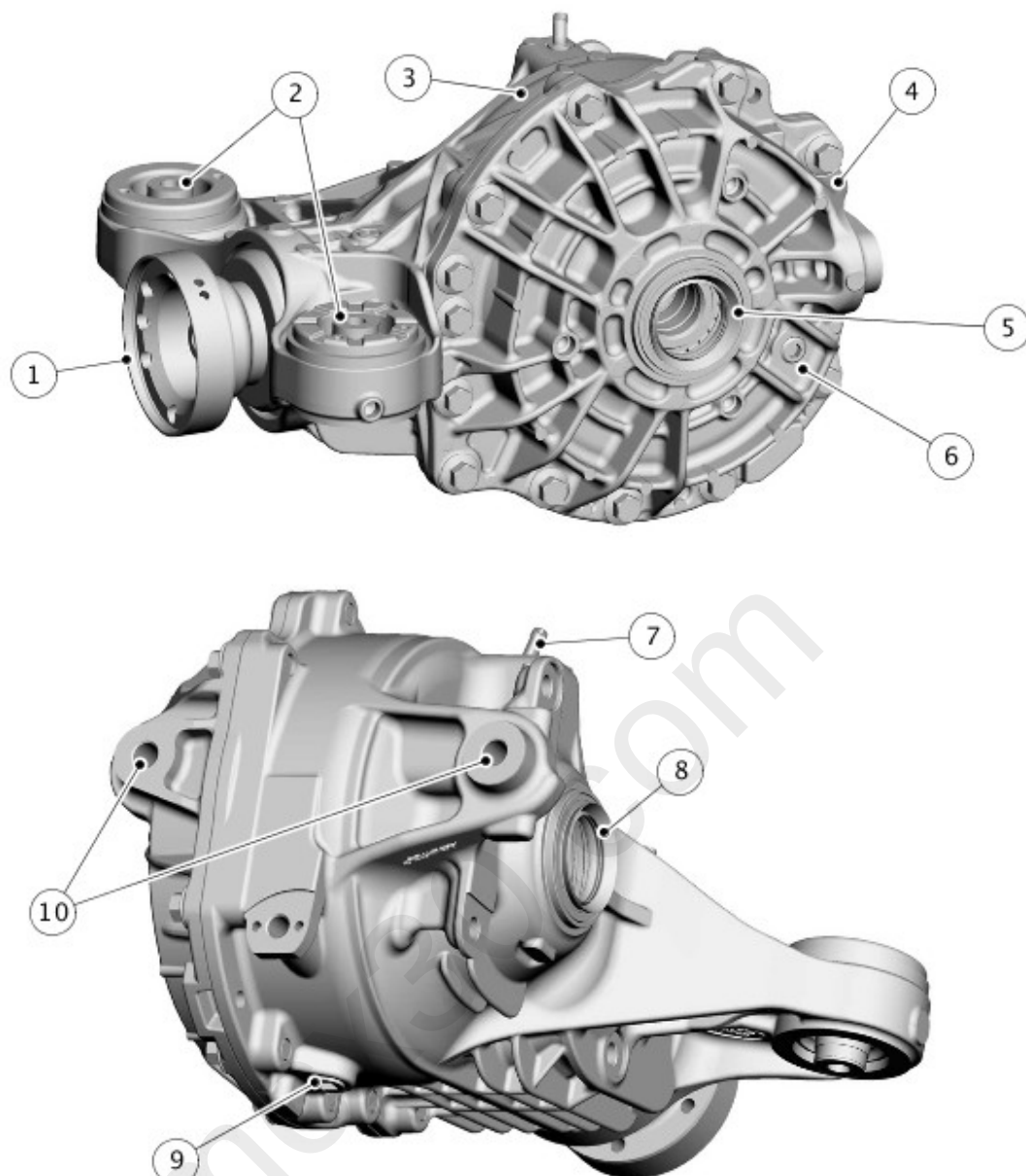
The rear axle gear ratio varies depending on the engine variant.

For additional information, refer to: [Specifications](#) (205-02 Rear Drive Axle/Differential, Specifications).

DESCRIPTION

REAR DIFFERENTIAL

External View - Rear Differential

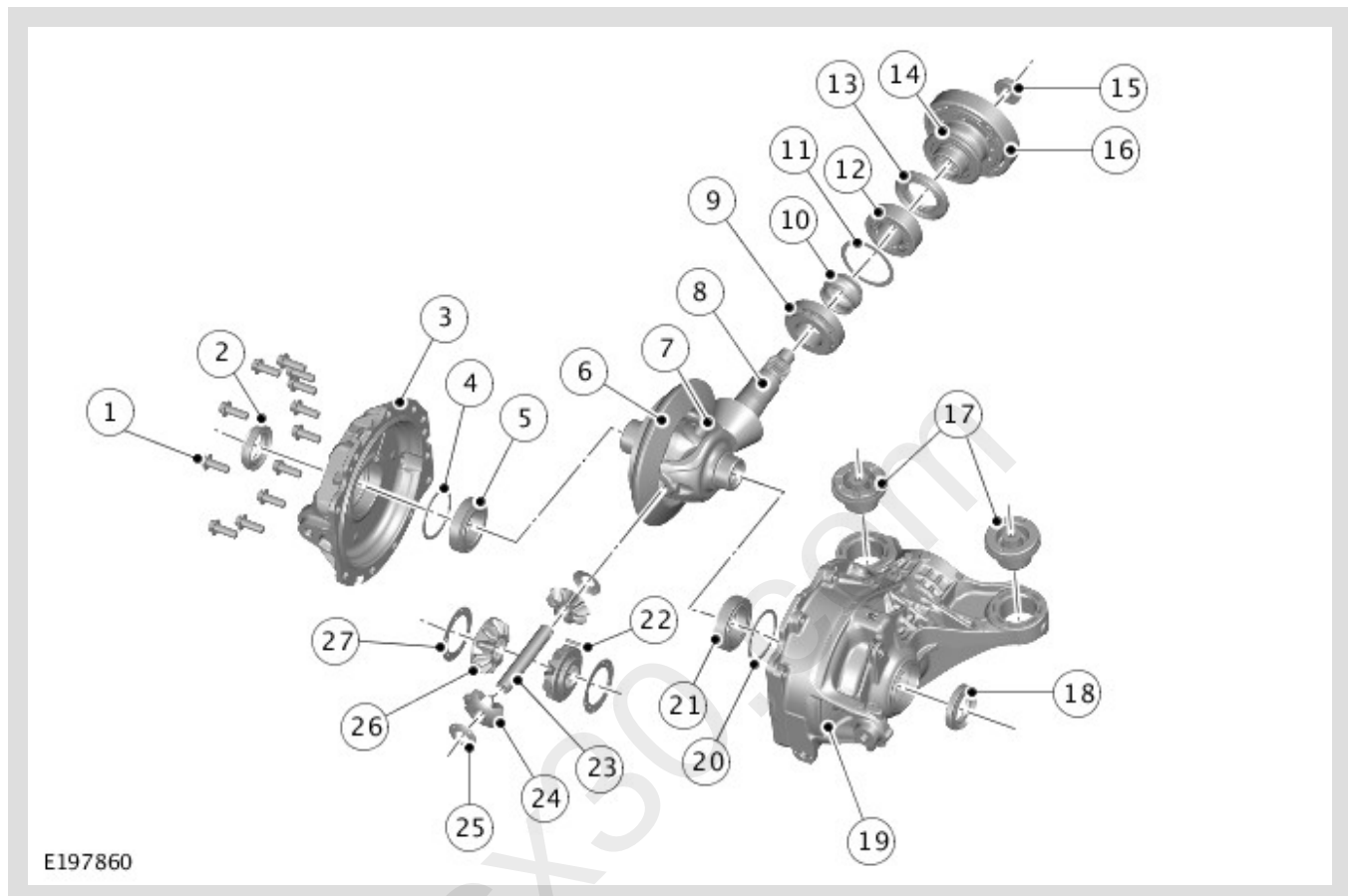


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ITEM	DESCRIPTION
1	Input flange
2	Front mounting points with insulators
3	Carrier
4	Cover
5	Rear left halfshaft oil seal
6	Filler/Level plug
7	Breather pipe connection
8	Rear right halfshaft oil seal

ITEM	DESCRIPTION
9	Magnetic drain plug
10	Rear mounting points

Exploded View - Rear Differential



ITEM	DESCRIPTION
1	Bolt (quantity 12)
2	Halfshaft oil seal
3	Cover
4	Shim
5	Differential bearing
6	Drive gear
7	Differential case
8	Pinion shaft
9	Pinion shaft bearing - Pinion head
10	Collapsible spacer

ITEM	DESCRIPTION
11	Shim - Pinion head
12	Pinion shaft bearing - Tail end
13	Pinion shaft oil seal
14	Dust slinger
15	Input flange nut
16	Input flange
17	Mounting insulator (quantity 2)
18	Halfshaft oil seal
19	Carrier
20	Shim
21	Differential bearing
22	Roll pin
23	Planet gear shaft
24	Planet gear (quantity 2)
25	Thrust washer - Planet gear (quantity 2)
26	Sun gear (quantity 2)
27	Spacer - Sun gear (quantity 2)

The rear differential is a conventional design using a hypoid gear layout.

The aluminum housing comprises 2 parts, the cover and the carrier. The carrier provides locations for all the internal components. The cover is sealed to the carrier with recommended sealant and secured with bolts. The cover and carrier have cast fins, which assist rigidity and cooling. A breather stub is attached to the top of the carrier, which allows for the connection of a remote breather pipe.

The rear differential contains a quantity of oil for splash lubrication of the internal components. A magnetic drain plug is installed in the bottom of the carrier and a filler/level plug is installed in the cover.

The pinion shaft has a hypoid gear at its inner end, which mates with the crown wheel drive gear. The crown wheel drive gear is located on the differential case and secured with 10 bolts. The differential case is mounted on taper roller bearings located in machined bores in the carrier and the cover. Shims are installed behind the bearing cups to apply the correct bearing preload and hypoid backlash.

The differential case has a through hole, which provides location for a cross shaft. The planet gears are installed on the cross shaft, with thrust washers between the planet gears and the differential case. A roll pin locks the cross shaft to the differential case.

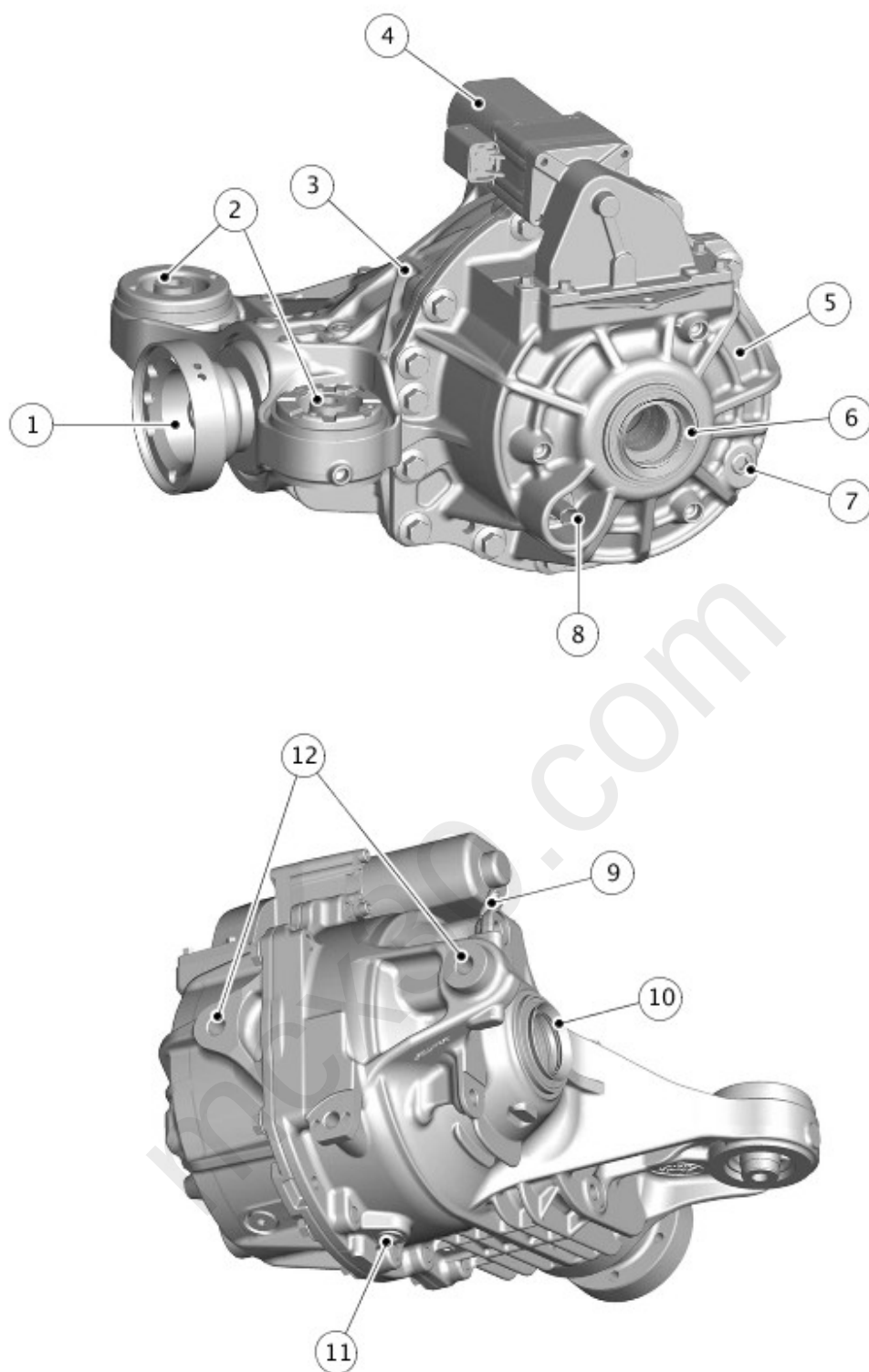
The sun gears are located in pockets in the differential case and mesh with the planet gears. Belville washers are installed between the sun gears and the differential case and set the correct mesh contact between the planet gears and the sun gears. Each sun gear has a machined bore with internal splines and a machined groove. The splines transfer drive to the rear drive halfshafts. The groove provides positive location for the circlip, installed to the inboard end of the rear drive halfshafts.

Oil seals are installed in the carrier and the cover to seal the rear drive halfshafts.

ELECTRONIC TORQUE MANAGER REAR DIFFERENTIAL – IF EQUIPPED

External View - Electronic Torque Manager Rear Differential

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ITEM	DESCRIPTION
1	Input flange
2	Front mounting points with insulators
3	Carrier

ITEM	DESCRIPTION
4	Differential locking motor
5	Cover
6	Rear left halfshaft oil seal
7	Filler/Level plug
8	Oil temperature sensor
9	Breather pipe connection
10	Rear right halfshaft oil seal
11	Magnetic drain plug
12	Rear mounting points

The Electronic Torque Manager (ETM) rear differential has the same functionality as the rear differential. The ETM rear differential also incorporates a locking and torque biasing function to give improved traction performance and vehicle dynamic stability. Operation of the ETM rear differential is controlled by the RDCM. The RDCM operates the differential locking motor under the control of the TCCM.

The basic construction of the ETM rear differential is similar to the rear differential.

The ETM rear differential has the following additional parts:

- A multiplate clutch and actuator assembly installed on the left sun gear.
- A differential locking motor and reduction gear housing attached to the cover.
- An oil temperature sensor installed in the cover.

The differential case has 2 through holes, which provides location for the 2 cross shafts. The planet gears are installed on the cross shafts, with thrust washers between the planet gears and the differential case. Circlips are secure the cross shafts to the differential case.

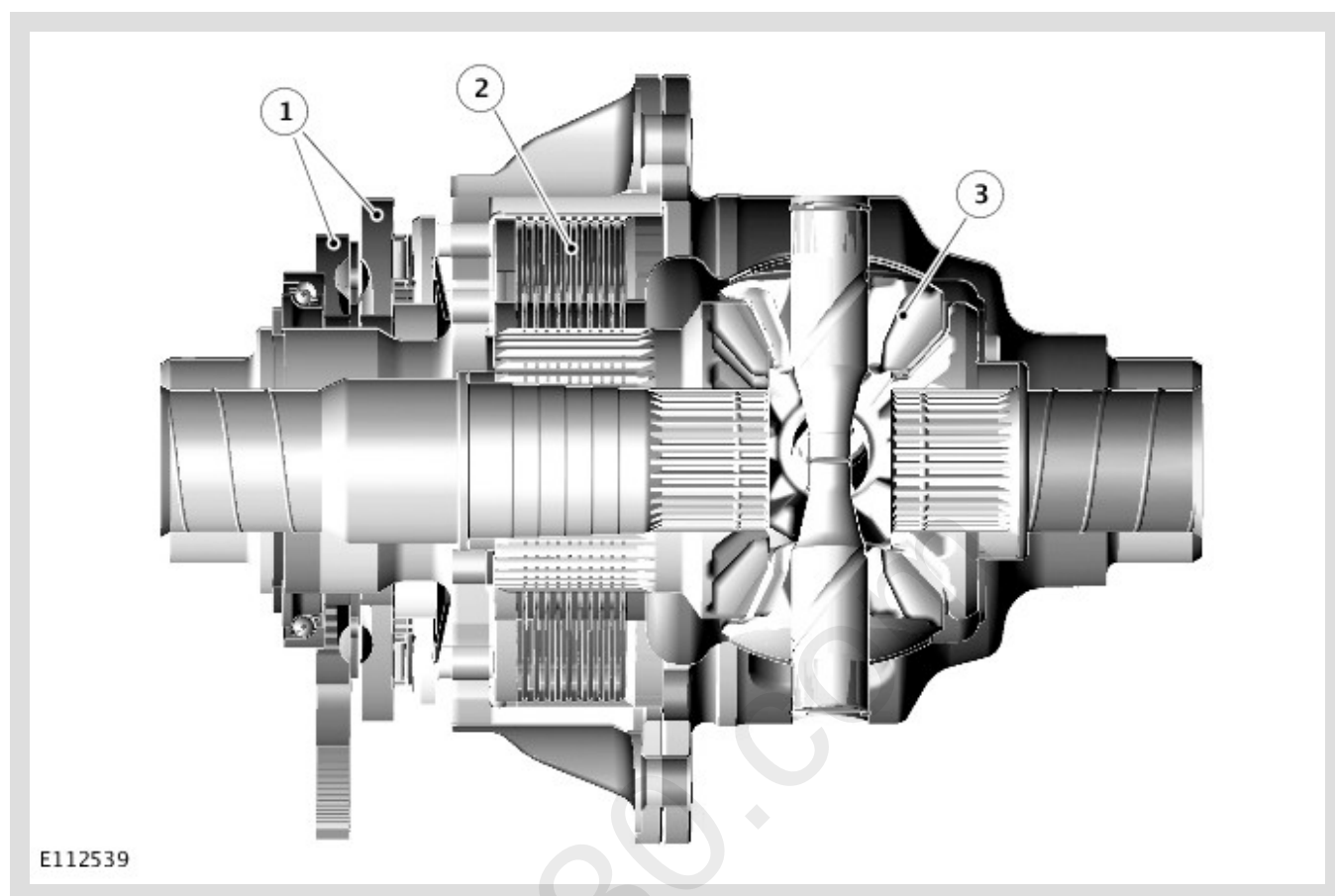
The multiplate clutch is contained in a clutch basket attached to the differential case with the crown wheel drive gear securing bolts. Alternate plates of the clutch pack are keyed to the clutch basket and the left sun gear. A pressure disc is installed on the outer end of the clutch pack and keyed to the clutch basket. A thrust race on the end of the clutch basket incorporates lugs which extend through the clutch basket onto the pressure disc.

The actuator assembly is mounted on bearings on the outboard end of the clutch basket, against the thrust race. The actuator assembly consists of input and output actuators separated by 5 ball bearings. A locking pin in the cover engages with a slot in the output actuator to prevent it turning but allow it to move axially. The input actuator engages with the reduction gear housing and is free to rotate relative to the cover.

Ball bearings locate in curved grooves in the mating faces of the input and output actuators. The bottom surface of each groove incorporates a ramp. Rotation of the input actuator forces the ball bearings up the ramps in the grooves

and induces an axial movement in the output actuator. The thrust race and pressure disc transfer the axial movement from the output actuator to the clutch pack.

Sectional View - Electronic Torque Manager Rear Differential



ITEM	DESCRIPTION
1	Actuator
2	Multiplate clutch
3	Differential

The differential locking motor is a 12V Direct Current (DC) motor. The differential locking motor adjusts the frictional loading of the sun gear multiplate clutch through the reduction gear housing and the actuator assembly. The RDCM controls the differential locking motor through hardwired connections. Adjusting the frictional loading of the multiplate clutch adjusts the locking torque between the crown wheel drive gear and the sun gear.

The differential locking motor is secured to the reduction gear housing with 4 bolts. The reduction gear housing is located in position on the cover with 2 dowels and secured with 4 bolts. An O-ring seals the joint between the motor and the reduction gear housing.

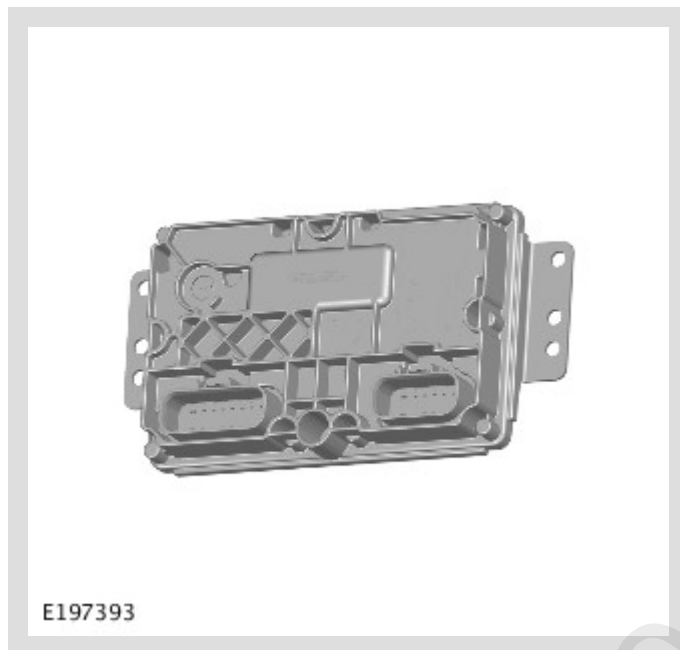
The motor is driven by a 12V DC power supply directly from the RDCM.

The differential locking motor also incorporates the following connections with the RDCM:

- A motor temperature sensor, to prevent excessive use from damaging the motor.
- There are 2 Hall effect motor position sensors, to enable closed loop control of the motor.

The oil temperature sensor provides a differential oil temperature signal to the RDCM, to prevent excessive use from damaging the multiplate clutch.

REAR DIFFERENTIAL CONTROL MODULE



The RDCM is located in the luggage compartment, adjacent to the Direct Current to Direct Current converter (DC/DC). The RDCM is secured to the loadspace floor panel with 4 nuts. The RDCM controls operation of the differential locking motor.

The RDCM receives power supply from the Rear Junction Box (RJB) and an ignition signal from the Body Control Module/Gateway Module (BCM/GWM). A connection with the High Speed (HS) Controller Area Network (CAN) Underbody (UN) systems bus allows the RDCM to communicate with other systems on the vehicle.

OPERATION

REAR DIFFERENTIAL

Rotational input from the driveshaft is passed through the input flange to the pinion shaft and pinion gear. The angles of the pinion gear to the crown wheel drive gear moves the rotational direction through 90°.

The transferred rotational motion is now passed to the crown wheel drive gear, which in turn rotates the differential case. The cross-shaft, which is secured to the differential case, also rotates at the same speed as the case. The planet gears, which are mounted on the shaft, also rotate with the case. In turn, the planet gears transfer their rotational motion to the left and right sun gears, then rotates the halfshafts.

When the vehicle is moving in the straight forward direction, the torque applied through the differential to each sun gear is equal. In this condition both halfshafts rotate at the same speed and the planet gears do not rotate.

If the vehicle is turning, the outer wheel will be forced to rotate faster than the inner wheel by having a greater distance to travel. The differential senses the torque difference between the sun gears. The planet gears rotate on their axes to allow the outer wheel to rotate faster than the inner wheel.

ELECTRONIC TORQUE MANAGER REAR DIFFERENTIAL

The multiplate clutch prevents excessive differential slip and therefore maximizes the traction performance of the vehicle. This is fundamentally different from 'braked' traction control systems, which can only counteract differential slip when it occurs. The multiplate clutch actively controls the torque flow through the differential and optimizes the torque distribution in the driveline. The clutch biases the torque from the differential to the wheel with the higher grip and prevents the wheel with the lower grip from spinning.

A certain amount of differential slip is required to allow the vehicle to turn corners and to remain stable under control of the TCCM. The TCCM monitors the driver's demands through primary vehicle controls. The TCCM sends signals to the RDCM to set the slip torque in the Electronic Torque Manager (ETM) rear differential. The TCCM sends the control signals to the Body Control Module/Gateway Module (BCM/GWM) through the FlexRay systems bus. Then the BCM /GWM transmits these signals to the RDCM through the HS CAN Underbody (UN) systems bus. The system is completely automatic and does not require any special driver input.

The differential strategy in the TCCM includes:

- A pre-loading function, which increase locking torque with increased driving torque.
- A slip controller to decrease locking torque for optimum comfort, for example when parking.

The FlexRay systems bus messages, used by the TCCM include the following inputs:

- Wheel speed
- Steering angle
- Automatic transmission speed
- Temperature information
- Car configuration
- Axle ratios
- Driving mode inputs.

The TCCM also sends messages through the FlexRay systems bus to inform other control modules on the network the status of the ETM rear differential.

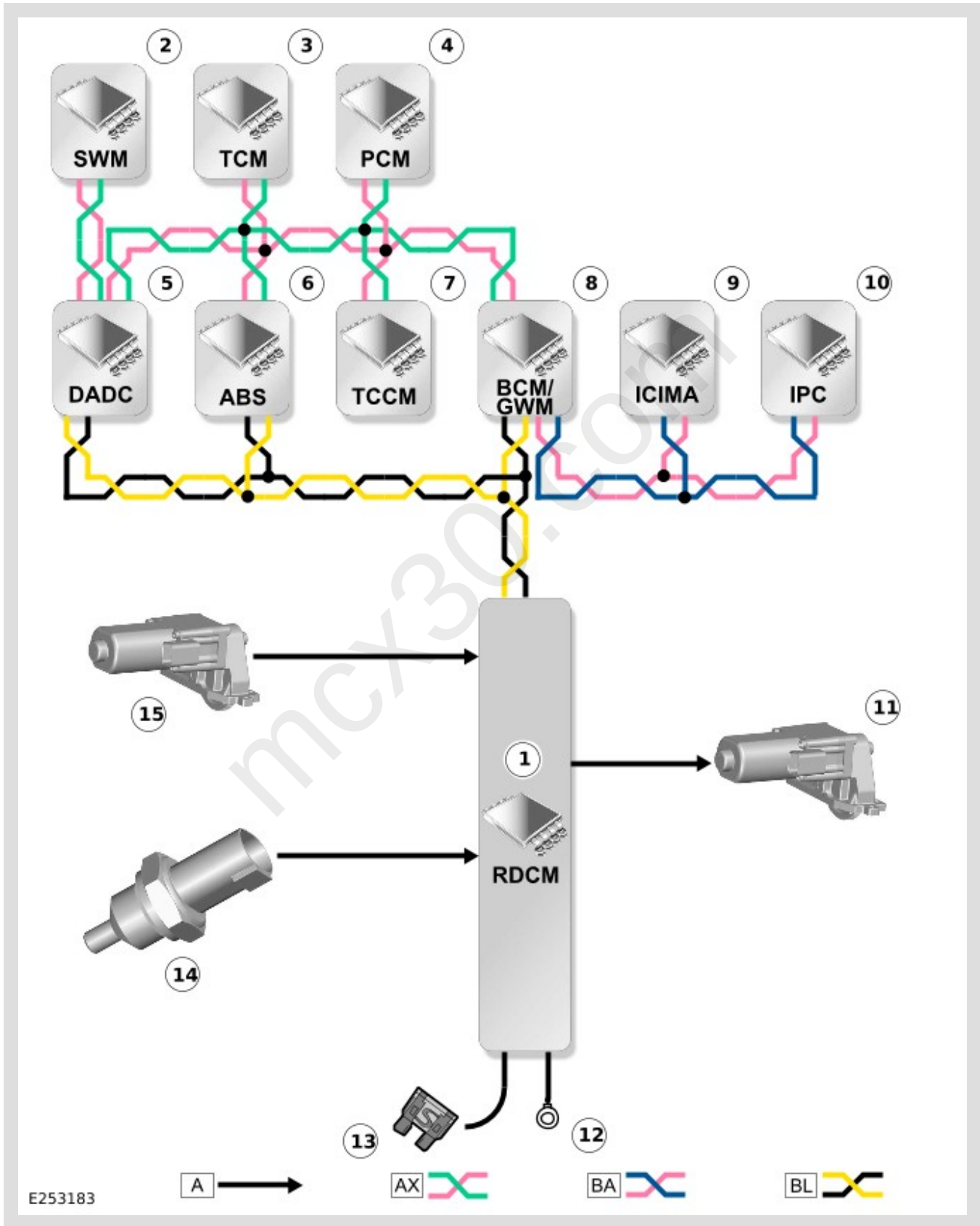
If the RDCM or the TCCM are replaced, the Jaguar Land Rover (JLR) approved diagnostic equipment must be connected to the vehicle and the differential self-calibration procedure must be completed. This procedure must also be completed if the differential locking motor or the ETM rear differential is replaced.

If a fault occurs with the ETM rear differential, the TCCM, the RDCM, or 1 of the required input signals, the RDCM records a Diagnostic Trouble Code (DTC). The TCCM requests a warning in the message center. The message center is in the center of the Instrument Panel Cluster (IPC).

The following message can be displayed:

MESSAGE	DESCRIPTION	CHIME
REDUCED TRACTION	Fault or overheat condition present with the Electronic Torque Manager (ETM) rear differential. System deactivated until temperature return within limits or the fault is rectified.	Single

CONTROL DIAGRAM - ELECTRONIC TORQUE MANAGER REAR DIFFERENTIAL



A = HARDWIRED: AX = FLEXRAY: BA = HS CAN HUMAN MACHINE INTERFACE (HMI) SYSTEMS BUS: BL = HS CAN UNDERBODY (UN) SYSTEMS BUS.

ITEM	DESCRIPTION
1	RDCM
2	Steering Wheel Module (SWM)
3	Transmission Control Module (TCM)
4	Powertrain Control Module (PCM)
5	Driver Assistance Domain Controller (DADC)
6	Anti-Lock Brake System Control Module (ABS)
7	TCCM
8	Body Control Module/Gateway Module (BCM/GWM)
9	Interactive Control Interface Module (ICIMA)
10	IPC
11	Differential locking motor
12	Ground
13	Power supply
14	Oil temperature sensor
15	Position sensor - Differential locking motor