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2005 JEEP Wrangler OEM Service and Repair Workshop Manual

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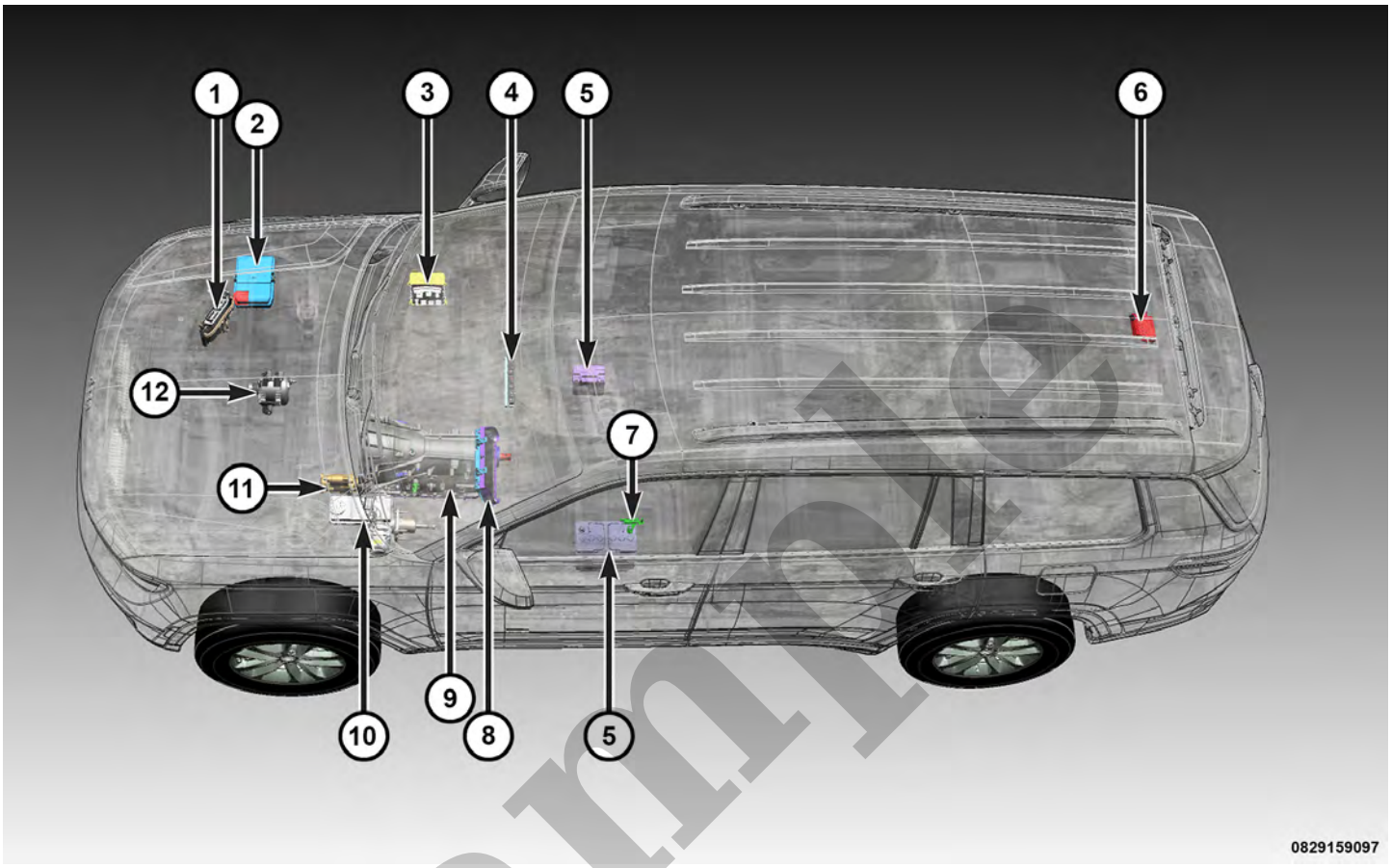
STARTING SYSTEM ON ADAS EQUIPPED VEHICLES



1 - Powertrain Control Module (PCM)	7 - Intelligent Battery Sensor 1 (IBS1) - ADAS equipped vehicles have an IBS2 on the auxiliary battery
2 - Starter Motor Relay - Located within the main Power Distribution Center (PDC)	8 - Instrument Panel Cluster (IPC)
3 - Body Control Module (BCM)	9 - Transmission Control Module (TCM)
4 - STOP/START Off Switch - Integral to the Integrated Center Stack (ICS)	10 - Anti-lock Brake System (ABS) Module
5 - Main and Auxiliary Battery	11 - Starter Motor
6 - Radio Frequency Hub	Not shown - Dual Battery System Module (equipped with ADAS only)

FUNCTIONAL DESCRIPTION - KEYLESS IGNITION NODE

When the operator presses the KIN button, the wireless FOBIK is validated by the RF Hub. If the key fob is recognized as belonging to the vehicle and is inside the vehicle, the system allows the ignition state of the vehicle to be changed by the operator between the ACC, RUN, and START ignition states. The KIN is also used to broadcast the start button status.

Light Emitting Diode (LED) Indicator Operation: The LEDs in the KIN button provide visual indication of the ignition system and button use to aid the driver. The Logic for LED control is implemented in the RF Hub. The KIN button contains four LEDs:

- OFF Indication
- ACC Indication (Accessory)
- ON Indication (ON or RUN)
- KIN switch indicator (button backlight)

The RF Hub will log a Diagnostic Trouble Code (DTC) indicating an incorrect ignition status value is present; in this state, the ignition status is unknown. This will continue until the correct signal is received by the RF Hub.

FUNCTIONAL DESCRIPTION - LOW FREQUENCY ANTENNA

There are several LF antennas located on this vehicle. These antennas are interrogated by the RFH to authenticate the key fob is in the vehicle when the KIN push button is pressed.

FUNCTIONAL DESCRIPTION - POWERTRAIN CONTROL MODULE (PCM)

The Powertrain Control Module (PCM) is the main module controlling operation of the starting system relays. When the PCM receives a CRANK command message it sends a signal to the Body Control Module (BCM) to energize the BCM controlled relay while simultaneously energizing the PCM controlled relay through in internal High Side Driver (HSD). The PCM also disables the double start over ride once the engine is started.

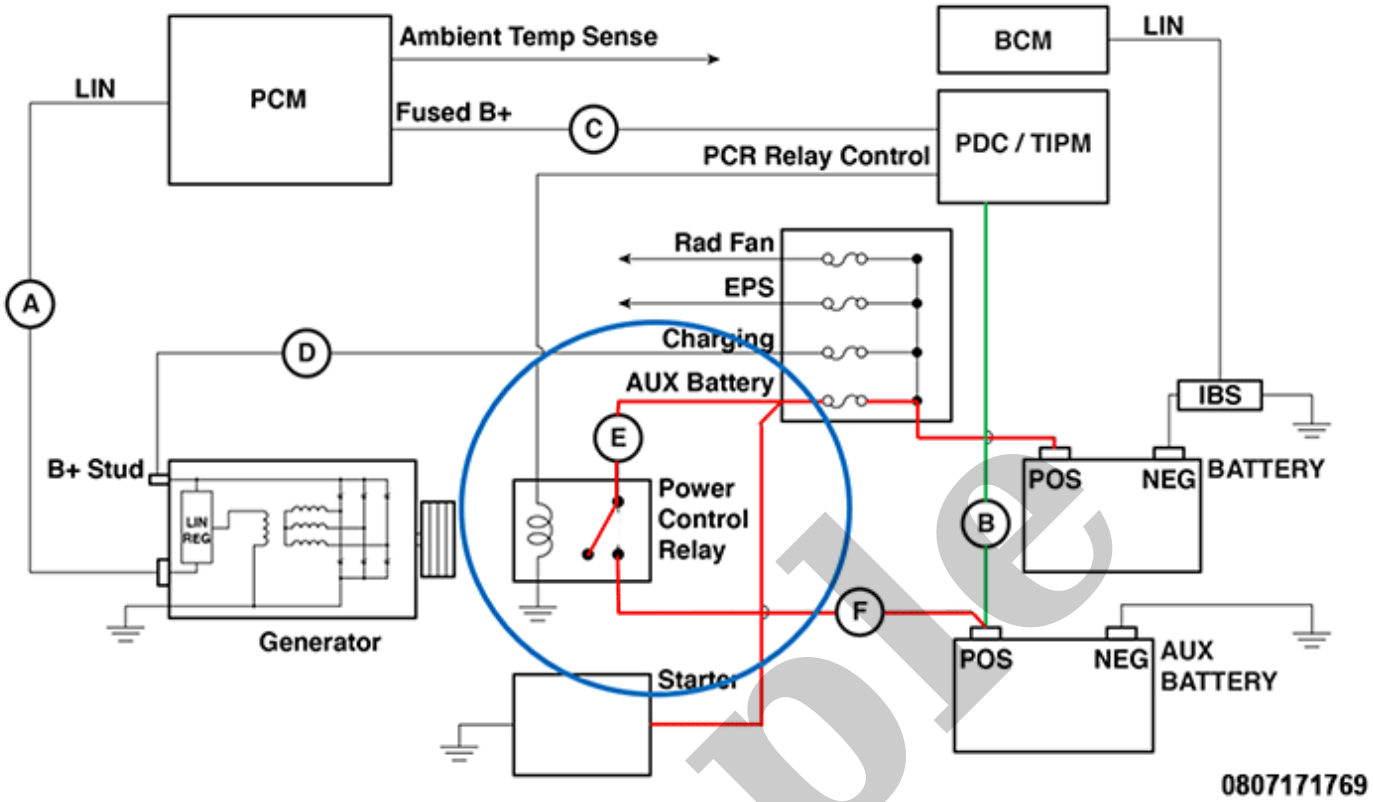
FUNCTIONAL DESCRIPTION - RADIO FREQUENCY HUB (RF HUB)

The Radio Frequency Hub (RFH):

- receives the input request to start from the KIN.
- energizes the key fob transponder in order to read it.
- sends a random code to the transponder and in return, receives a crypt code from the transponder.
- validates the key fob using LF antennas.
- validates that the brake is engaged.
- sends a request to the BCM to change the ignition state.

FUNCTIONAL DESCRIPTION - STARTER MOTOR

The standard starter motor incorporates the starter solenoid. It consists of a Direct Current (DC) motor powered by the battery and an electromagnet exciter. The starter is engaged when the Body Control Module



The power control relay or Dual Battery System Module (DBSM) is momentarily energized by the PCM during all ESS crank events. This allows the auxiliary battery to maintain full battery voltage to the PDC, vehicle modules and accessories during the initial starter in-rush so that there is no noticeable difference in vehicle features to the driver.

On ATX equipped vehicles the PCM sends a signal to TCM to indicate it is ready for an ESS event. The TCM responds it is ready for ESS and enters a hydraulic neutral state while in an auto-stop event and stays in hydraulic neutral during the auto-start event to avoid vehicle movement during engine cranking.

LISTED BELOW ARE THE OTHER SYSTEMS AND COMPONENTS THAT CONTRIBUTE TO ESS STARTING SYSTEM FUNCTIONALITY

FUNCTIONAL DESCRIPTION - ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

The ABS module incorporates the Electronic Stability Control (ESC) system. On vehicles equipped with Hill Start Assist (HSA), the ABS module also incorporates the HSA strategy.

On vehicles that are not equipped with HSA, there is a brake hold feature designed for the ESS system that should prevent the vehicle from lurching forward during an ESS auto-start on downhill grades. The ESC will attempt to hold the brake system pressure when the ESS system has determined that the vehicle is stopped on a grade and the ABS module has received a bus message indicating the ESS auto-stop engine shutdown is in an active state. The system holds brake system pressure until either a bus message is received indicating that the engine is running again or a message indicating that the accelerator pedal position is greater than 0%. No drive torque balancing is required. Brake system pressure is ramped out quickly as possible when either of those two signals meet the specified values.

On vehicles equipped with the HSA function for the ESS system, this functions only when the engine is running as well as the transmission shifter is in a specified gear location and downhill grade criteria is met. The ESS application is designed to shut off the engine as vehicle braking is applied by the driver. To avoid unintentional rollback, the HSA functionality is required while the engine is off and the vehicle is stopped on a shallower grade. The HSA will remain functional through the supply voltage dip experienced during warm engine cranking.

When the vehicle comes to a stand still and the ESS system state changes to indicate that an ESS auto-stop event is pending, the ABS Module activates the ESS HSA providing that the ESS HSA grade criteria is met and an adequate amount of brake master cylinder pressure is available. Note that the ESS HSA functionality will have a different HSA activation grade threshold to meet the vehicle application. When the ESS HSA function is active, the ESC will isolate the appropriate amount of brake system pressure needed. If the grade is greater than the ESS HSA grade threshold but less than the standard HSA grade threshold, the ESS HSA functions depending on the vehicle application and specified by the ESC system. The ESC system will:

- Deactivate when the ESS engine state changes to engine running.
- Remain active until the HSA timeout or engine drive off torque balancing values are met.

The ESC broadcasts the HSA state and the calculated HSA holding pressure over the Controller Area Network-Chassis (CAN-C) network bus. This signal identifies the following states of the HSA system:

- HSA is not active/pending. This indicates that the HSA activation requirements are yet to be determined or the vehicle is not at a stand still.
- Vehicle stand still has been detected and the HSA is not holding braking system pressure.

demand, and time in service. This information is reported through the LIN Bus circuit to the Body Control Module (BCM). The BCM broadcasts the information to the Powertrain Control Module (PCM) over the CAN Bus.

The IBS SOC data is also used by the BCM and other modules to determine when to begin disabling certain vehicle features that draw excessive electrical loads due to a low battery SOC. The SOC threshold for starting to disable features can vary based on vehicle and engine but is typically in the 50% to 60% range. The following items can contribute to, and should be considered when diagnosing a low SOC condition before replacing an IBS or battery:

- If the vehicle is jump started at the battery posts bypassing the IBS.
- If the battery is blind charged at the battery posts bypassing the IBS.
- Repeated short trip driving events not allowing enough charge time.
- The IBS accuracy is off and needs to relearn the battery SOC.

Depending on the vehicle, there could be a non-MIL DTC (P057F) set, or an EVIC message indicating a low battery state of charge limiting some features, such as ESS. In some cases, properly charging the batteries through the IBS can raise the IBS SOC enough to regain functionality and repair the issue. However, it can sometimes take two or three, 4-hour BUS off sleep cycles for an IBS to learn and update the Battery SOC. The IBS can be initiated into a learning curve by completely disconnecting the IBS from the battery, and disconnecting harness connector for 20 seconds. The IBS battery feed, LIN Bus and ground circuits should be checked before reconnecting the IBS. The IBS should default to approximately 80% SOC when reconnected. However, the IBS accuracy is determined to be low until the IBS can relearn battery SOC. This occurs after an engine run cycle and a subsequent ignition off sleep cycle of between one to four hours. Some features will be disabled until the IBS SOC is updated.

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The normal operating duty cycle range for each signal is between 10% and 90%. If the PCM detects that the duty cycle for either signal is above or below the normal duty cycle range a circuit fault will set. The PCM also monitors the rationality of the shifter position by comparing the actual gear shift position feedback to the calculated gear shift position. The gear shift position calculation is based on the transmission being in a forward gear with the clutch pedal not pressed, vehicle speed, engine speed, and calculated engine torque.

- **Neutral Position Sensor** - Some manual transmission equipped vehicles have a neutral position sensor instead of a gearshift position sensor. On these vehicles the PCM is only monitoring for the transmission to be in the neutral position or in any gear position. This is done for the purpose of determining when the ESS system can safely restart the vehicle without the clutch pedal being depressed. The neutral position sensor outputs a PWM signal. The sensor signal will typically be around 50% duty cycle when the shifter is in the neutral position. A duty cycle other than approximately 50% indicates that the shifter is is shifted to a gear range position.

The PCM will send messages over the CAN-C network bus indicating the status and requests of the ESS system. The signals are used in order to inform the overall network nodes the ESS status.

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- validates that the brake is engaged.
- sends a request to the BCM to change the ignition state.

FUNCTIONAL DESCRIPTION - START/STOP DISABLE SWITCH

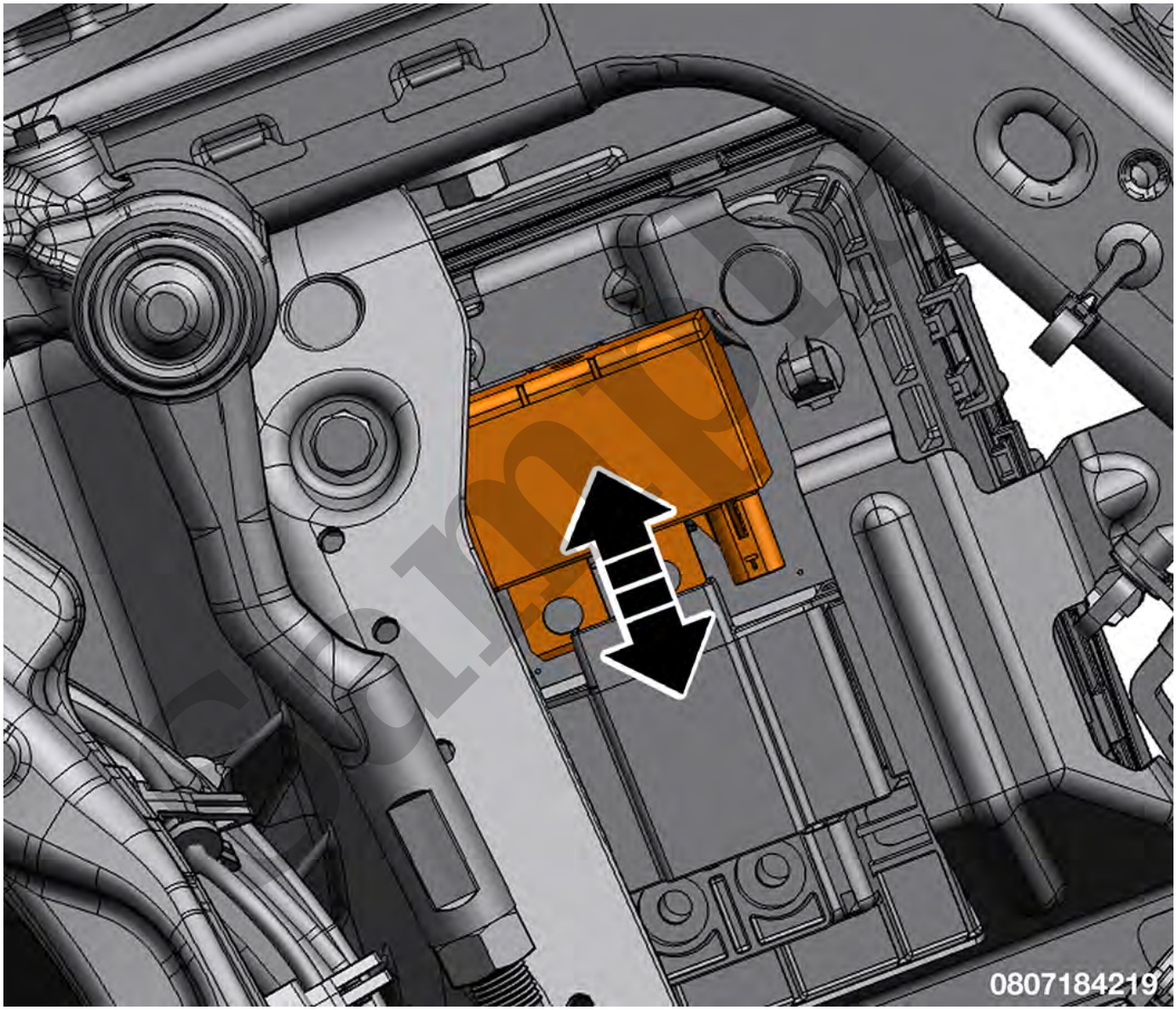
The Engine Stop/Start (ESS) switch is a driver select feature that permits the driver to inhibit the Engine Stop/Start feature. The ESS switch is typically located in a switch bank on or around the instrument cluster or center stack. The ESS switch is a smart device that sends two redundant input states to the Body Control Module (BCM) through a LIN bus circuit. The switch is a momentary press input, with the two states of the switch being pressed and not pressed. If the switch detects a circuit fault on either of the internal switches, a fault message is sent to the BCM for the faulty switch signal. The BCM passes the switch information to the Powertrain Control Module (PCM) over the CAN bus. The PCM uses this information for determining ESS system operation. The PCM also monitors for a stuck switch. If the input state received from the ESS switch is pressed for more than a calibrated period, the stuck switch diagnostic will fail.

The switch has a Light Emitting Diode (LED) to indicate to the driver the status of the ESS system. When the ESS system is active, the LED on the switch is off. When the ESS system is off or inhibited, the LED on the switch is constantly illuminated.

- Clutch pedal position faults
- Hill Start Assist (HSA) within range to hold the vehicle faults
- Brake booster pressure faults
- Fuel level faults during engine restart
- Torque security faults
- Loss of bus communication during engine restart
- Accelerometer sensor diagnostics
- Starter control. Anything that disables first crank would disable ESS
- Starter relay fault
- Starter relay circuit faults
- Air bag deployment
- Driver Presence Detection Module (DPDM) faults
- PCR Stuck Open Fault
- PCR Stuck Closed Fault
- Auxiliary Battery depleted
- Auxiliary Battery disconnected
- Battery SOC below calibrated threshold
- Vehicle altitude is above a calibrated threshold

1 - PCR Wire Harness Connector
2 - PCR Bolts

2. Disconnect the PCR Wire harness connector.
3. Remove the bolts that secure the Dual Battery Switch Module (DBSM) to the Power Distribution Center (PDC).



4. Slide the Module out of the PDC.

INSTALLATION

Follow the removal procedure in reverse for general reassembly of the components on the vehicle.

TORQUE SPECIFICATIONS - BATTERY SYSTEM - ADAS

–	Battery Positive B(+) at Bulkhead Isolator Nut	**6 N·m (53 In. Lbs.)**	–
–	Dual Battery Switch Module (DBSM) to Power Distribution Center (PDC)	**9 N·m (80 In. Lbs.)**	–
–	Battery Clamp To Pass Through Stud	**15 N·m (11 Ft. Lbs.)**	–