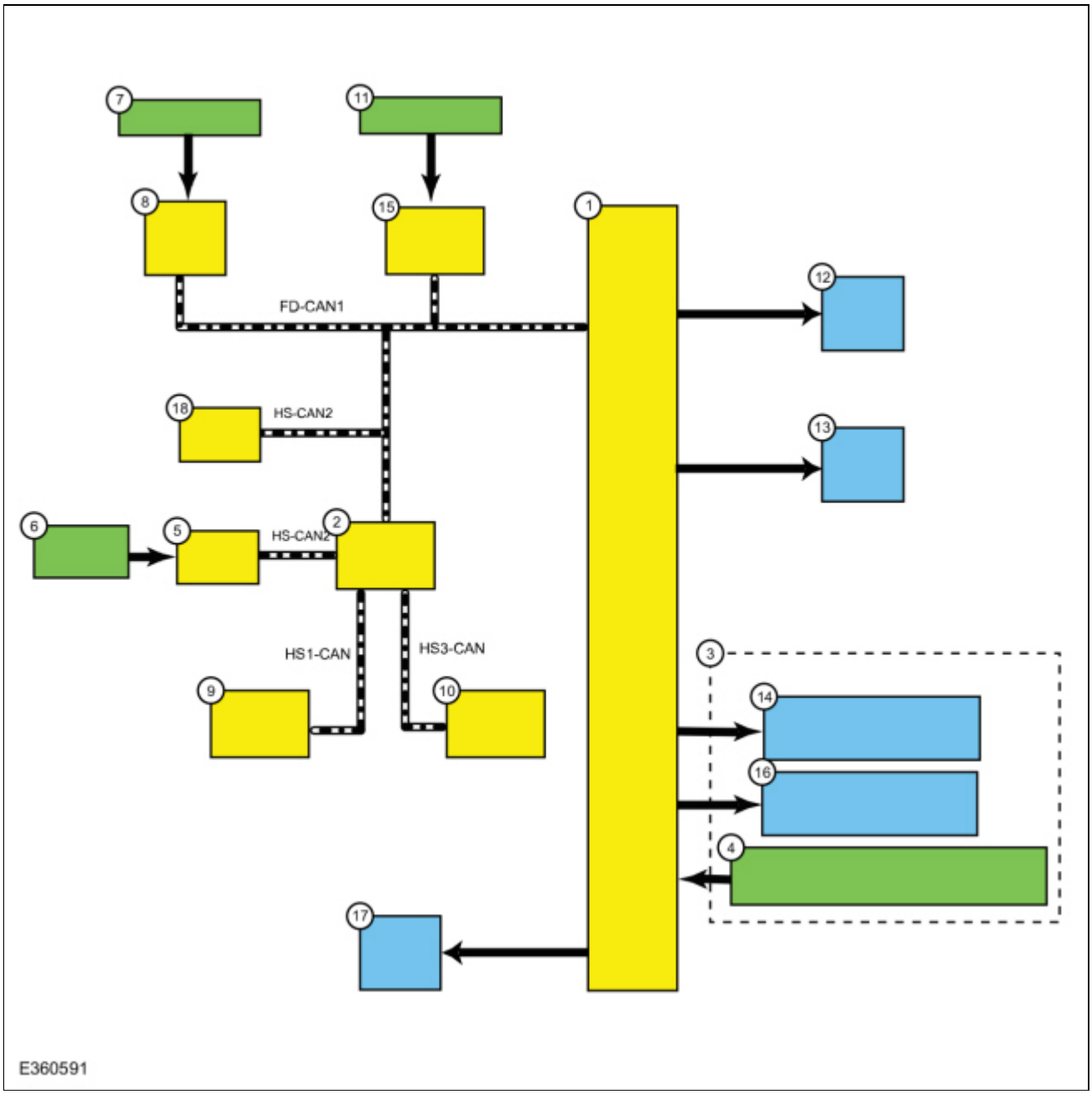
Four-Wheel Drive Systems - Vehicles With: Electronic Shift Transfer Case - System Operation and Component Description

System Diagram

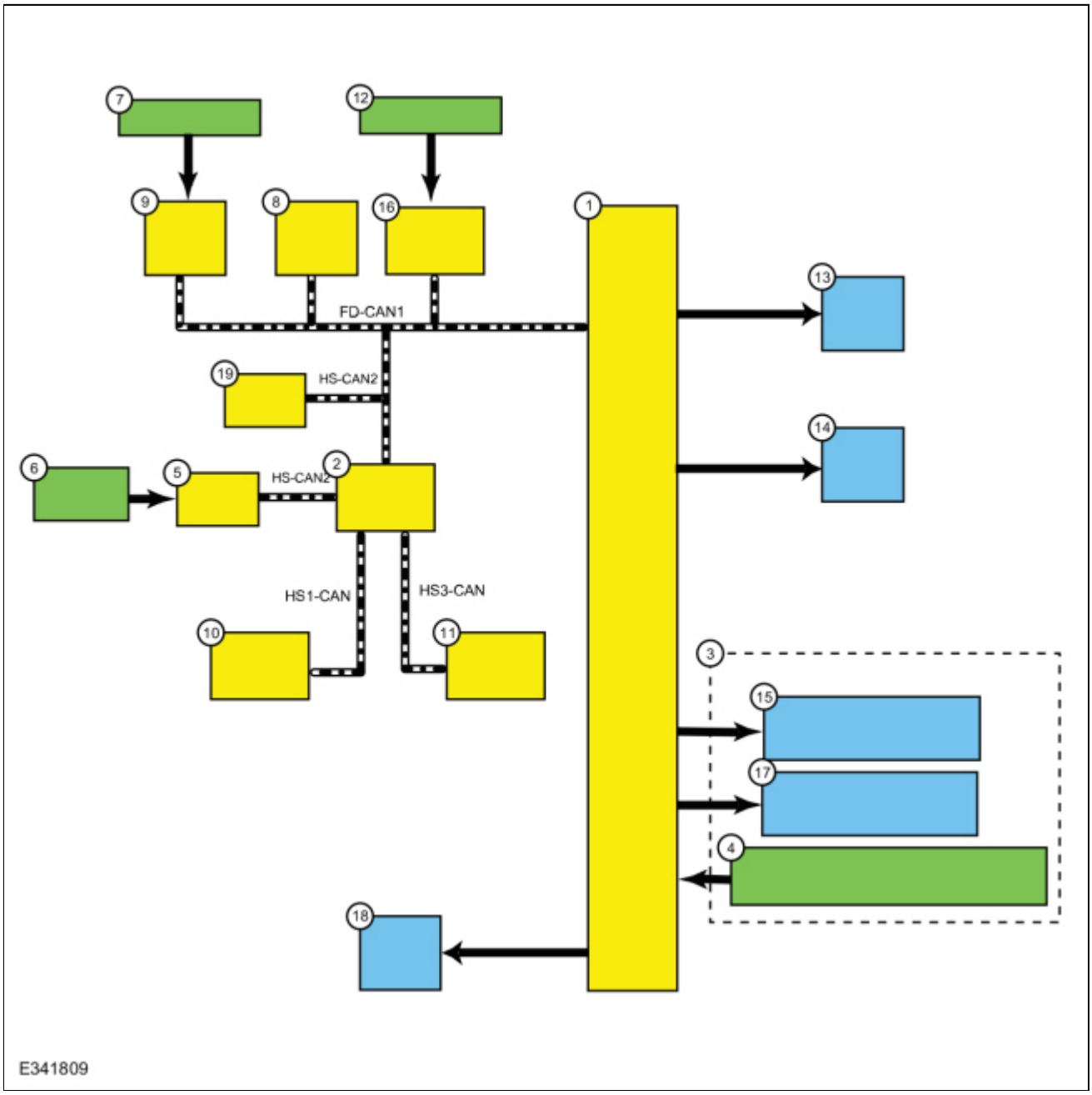
Vehicle Equipped with Gasoline Engines



Item	Description
1	TCCM
2	GWM
3	Transfer Case Assembly
4	Shift Motor Plate Position Sensor
5	ATCM

6	Drive Mode
7	Wheel Speed Data
8	EBB
9	BCM
10	IPC
11	APP
12	IWE LH
13	IWE RH
14	Clutch Solenoid
15	PCM
16	Shift Motor
17	ELD
18	RCM

Vehicle Equipped with Diesel Engine



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System Operation

IWE System

The IWE system consists of the following:

1	IWE s (spring-loaded Electric hubs)

The IWE system uses electronically actuated hubs to engage or disengage the front wheel hubs from the front half shafts.

When the 4WD system is in 2WD (2H) mode, the TCCM energizes the IWE s thus disengaging the front hubs from the front half shafts.

When operating in any 4WD mode, the TCCM deenergizes the IWE . An internal spring keeps the IWE clutch ring engaging the front hub and the front half shaft.

The TCCM has one startup strategy that affects IWE operation after initial key cycle:

- When ambient temperature is below 32 F (0 C), IWE s engage after initial key cycle and a driven gear is selected. The hubs stay engaged regardless of a 4x4 mode change for approximately 2 miles (3km). Once the set distance has been achieved, IWE s disengage (if the vehicle is in 2WD (2H)). Distance traveled resets only if the temperature is below calibrated threshold and another key cycle occurs or if customer shifts to Park (P) and back to a driven gear within the same key cycle. The TCCM uses this strategy to warm up the front axle in cold temperatures to improve driveline synchronization.

Electronic Locking Differential (ELD) System

The ELD system consists of the following components:

- ELD field coil, located at the rear differential
- Rear differential with dog clutch
- ATCM
- TCCM

Neutral Flat Tow

NOTE: *2WD vehicles cannot be towed with any wheels on the ground as vehicle or transmission damage may occur.*

NOTE: *Failing to put the transfer case into the NEUTRAL position damages vehicle components.*

Vehicles equipped with a 4WD system have neutral flat tow software in the TCCM . Following the neutral flat tow activation procedure commands the transfer case shift motor into a neutral position. Locking the transfer case in neutral prevents damage to the transmission while towing a 4WD vehicle on all 4 wheels (such as when being towed behind a motorhome).

Four Wheel Drive System Operation – Electronic Shift on the Fly (ESOF)

(2H) OPERATION

When the ATCM is in 2WD (2H), power is delivered to the rear wheels only. This mode is appropriate for normal on-road driving on dry pavement and provides the best fuel economy. Torque is passed through the transfer case to the rear drive shaft at a 1:1 ratio. In 2WD (2H):

- The ATCM sends a 2WD (2H) mode status to the TCCM via a GWM .
- The IWE are disengaged.
- The TCCM outputs a 0% duty cycle to the synchronization clutch field coil (4WD_CLTCH_OUT # = 0.00%).
- The shift motor is in the full CCW position. Refer to TRANSFER CASE SHIFT MOTOR STATUS in this section for further information.
- (2H) will momentarily be displayed in the message center at key up and after a 4WD (4H) to 2WD (2H) shift.

NOTE: *When shifting to (2H) mode in order for the IWE to completely disengage the vehicle steering wheel must be less than 90 deg and 5 seconds have elapsed since the shift to (2H) has been initiated.*

(4H) OPERATION

When 4WD (4H) is selected on the ATCM , the 4WD system provides mechanically locked four-wheel drive with power delivered to all four wheels, for increased traction. 4WD (4H) is for use in off-road or winter conditions such as deep snow, sand or mud. This mode is not for use on dry pavement.

Shifts from 2WD (2H) to 4WD (4H) can be made at any speed. When performing this shift, release the accelerator pedal prior to the shift and wait until the Shift in Progress message disappears in the IPC before accelerating. This improves the shift performance as the transfer case and IWE s engage. In 4WD (4H):

- The ATCM sends a 4WD (4H) mode status to the TCCM via GWM .
- The TCCM outputs a 0% to 97% duty cycle to the synchronization clutch field coil (4WD_CLTCH_OUT # = x.xx%).
- The shift motor rotates CW to the 4WD (4H) position. Refer to TRANSFER CASE SHIFT MOTOR STATUS in this section for further information.
- The TCCM outputs a 0% duty cycle to the synchronization clutch field coil (4WD_CLTCH_OUT # = 0.00%).
- The IWE are engaged.
- 4WD (4H) is displayed in the message center.

(4L) OPERATION

(4L) 4WD provides mechanically locked four-wheel drive power to both the front and rear wheels for use on low traction surfaces, but does so with an additional 2.64 gear reduction for increased torque multiplication. Intended only for off-road applications such as deep sand, steep grades or pulling heavy objects. 4WD (4L) does not engage when your vehicle is moving above 3 mph (5 km/h); this is normal and should be no reason for concern.

Shifts to and from 4WD (4L) can only be made below 3 mph with the transmission in Neutral. When performing this shift, wait until the 4x4 Shift in Progress message disappears in the IPC before moving the selector lever back to Drive. If the vehicle speed or transmission range is not within parameters, the message center will indicate the necessary action needed to complete the shift.

In (4L):

- The ATCM sends a 4WD (4L) mode status to the TCCM via GWM .
- The IWE are engaged.
- The TCCM outputs a 0% duty cycle to the synchronization clutch field coil (4WD_CLTCH_OUT # = 0.00%).
- The shift motor rotates to the full CW position. Refer to TRANSFER CASE SHIFT MOTOR STATUS in this section for further information.
- 4WD (4L) is displayed in the message center.

ESOF Transfer Case Shift Motor

Vehicles equipped with the Electronic Shift on the Fly (ESOF) system use a shift motor to enter and exit 2WD (2H), 4WD (4H), and 4WD (4L) modes.

The electric shift motor is mounted externally to the transfer case. It drives a rotary cam which moves the mode and range forks within the transfer case. The shift motor moves during shifts between 2WD (2H), 4WD (4H), and 4WD (4L). The TCCM directly controls the electric shift motor and can reverse motor polarity to reverse rotary cam/shift fork direction. The message center may display “Shift in Progress” while the shift motor is operating. The shift motor sense plate, an integral part of the shift motor assembly, informs the TCCM of the transfer case position. The sense plates are a set of 4 contacts that are opened and closed to represent each valid transfer case shift motor position. The mode and range forks are spring loaded so the motor can move to position regardless of the time it takes it takes for the transfer case internal shaft and hub splines to align and engage.

ESOF Transfer Case Shift Motor Status

Position	PLATE_A	PLATE_B	PLATE_C	PLATE_D
(2H)	Closed	Open	Closed	Closed
(4H)	Open	Closed	Closed	Open
(4L)	Open	Closed	Open	Closed
Neutral	Closed	Closed	Open	Open

Synchronization Clutch

The transfer case is equipped with an electronically controlled clutch which is located inside the case. This clutch is used to synchronize the speed of the front driveline with the rear driveline during 2WD (2H) to 4WD (4H) shifts. The clutch consists of a transfer case field coil, a field coil housing splined to the rear output shaft, and one steel clutch plate splined to the lock-up hub. When the ATCM is switched from 2WD (2H) to 4WD (4H) modes, the TCCM energizes the synchronization clutch. The magnetic field from the field coil pulls the lock-up hub clutch plate against the field coil housing. When the transfer case front and rear output shafts are synchronized, the spring-loaded lockup collar mechanically engages the 4WD drive sprocket to the field coil housing. After the shift to 4WD is completed, the synchronization clutch is deactivated.