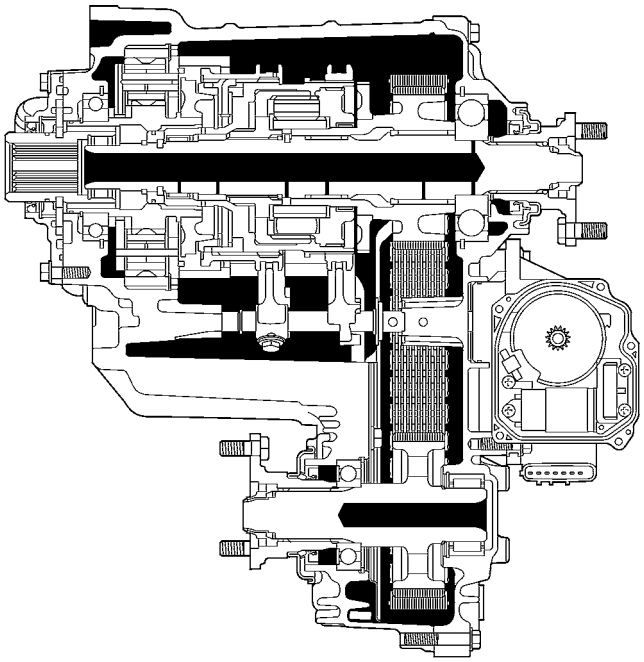
TRANSFER

■ DESCRIPTION

- The JF2A transfer has been newly developed. This transfer is a compact and lightweight full-time 2-speed transfer.
- The center differential uses a TORSEN* LSD (Limited Slip Differential).
- A planetary gear train is used in the reduction mechanism and a silent chain is used to reduce noise for the front drive. The 4WD control switch is used to change the transfer gear ratio, and the center differential lock switch is used to change the center differential between free and lock.

*: TORSEN is JTEKT CORPORATION's registered trademark.



JF2A Transfer 080CH30Y

▶ Specifications ◀

Transfer Type		JF2A
Drive Type		Full-time
Gear Ratio	H4	1.000
	L4	2.618
Reduction Gear Type		Single Pinion Planetary
Center Differential Gear Type		TORSEN LSD
Oil Capacity	Liters (US qts, Imp. qts)	1.45 (1.53, 1.28)
Oil Viscosity		SAE 75W-90
Oil Grade		API GL-5
Weight (Reference)*	kg (lb)	50.0 (110.2)

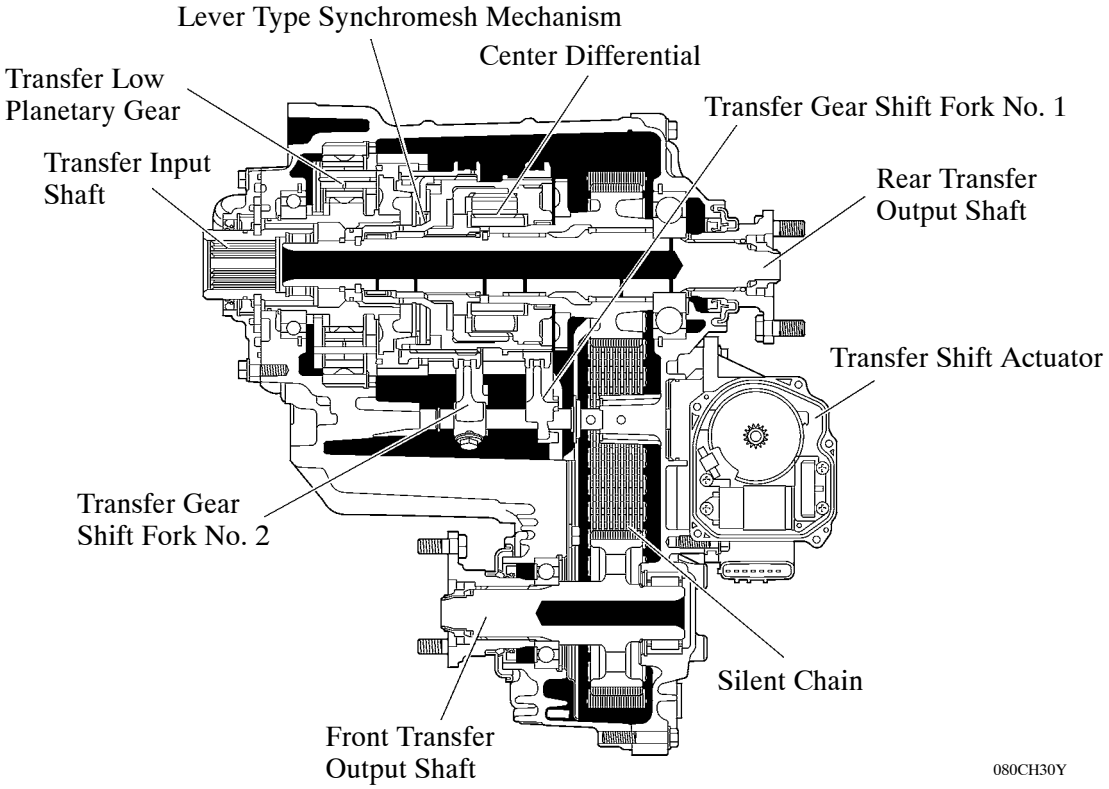
*: Weight shows the figure with the fluid fully filled.

■CONSTRUCTION

1. General

The construction of the JF2A transfer is shown below.

- A planetary gear unit is used in the reduction mechanism and a silent chain is used to reduce front drive noise.
- The center differential uses a TORSEN LSD (Limited Slip Differential). As a result, this LSD ensures the proper torque distribution during acceleration and high-speed driving.
- A lever type synchromesh mechanism is used for the H4-L4 switching section to eliminate gear clash when switching between H4 and L4.
- For the JF2A transfer, a transfer shift actuator that has 2 built-in shift motors is used. As a result, switching between H4 and L4 can be performed independently using the shift motors, achieving a simple shift actuation mechanism. This enhances efficiency of power transfer and durability of the shift mechanism.

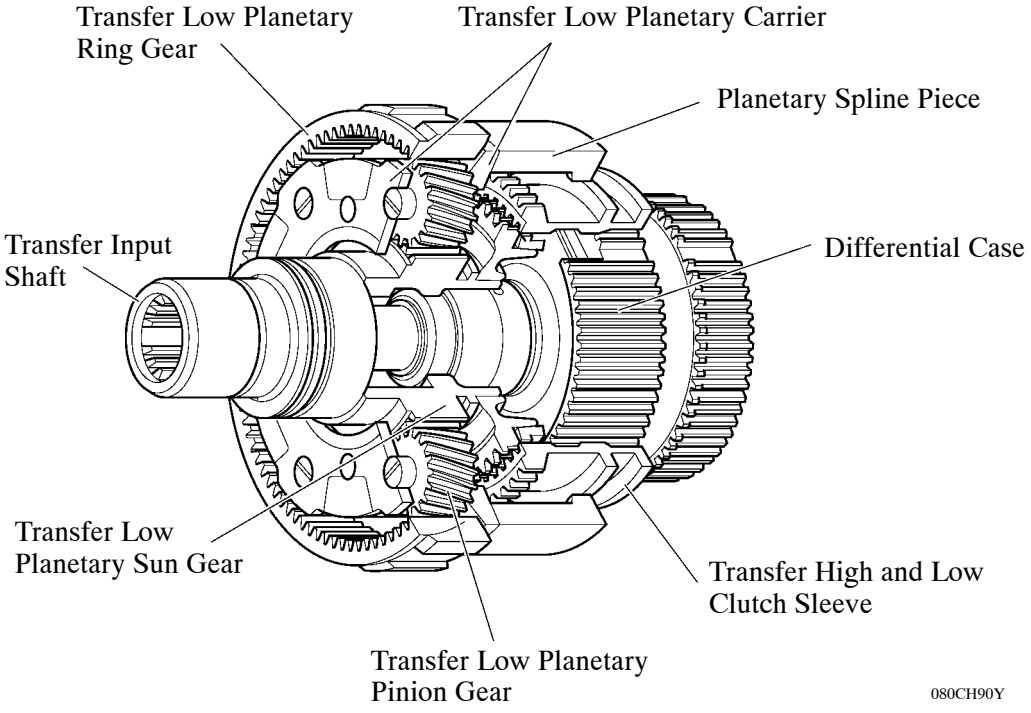


2. Planetary Gear Unit

General

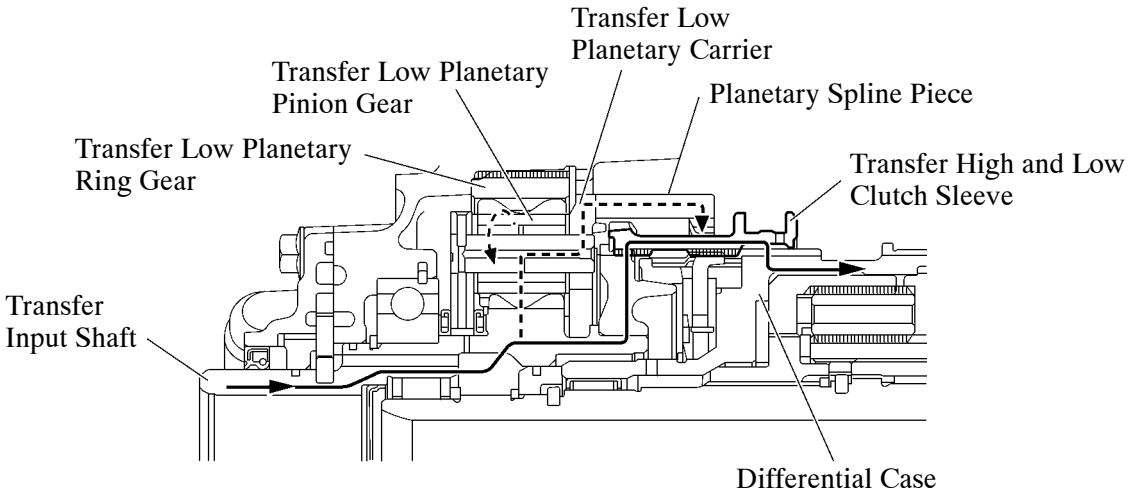
The transfer low planetary gear unit consists of a transfer low planetary sun gear, 6 transfer low planetary pinion gears, a transfer low planetary ring gear, and a transfer low planetary carrier.

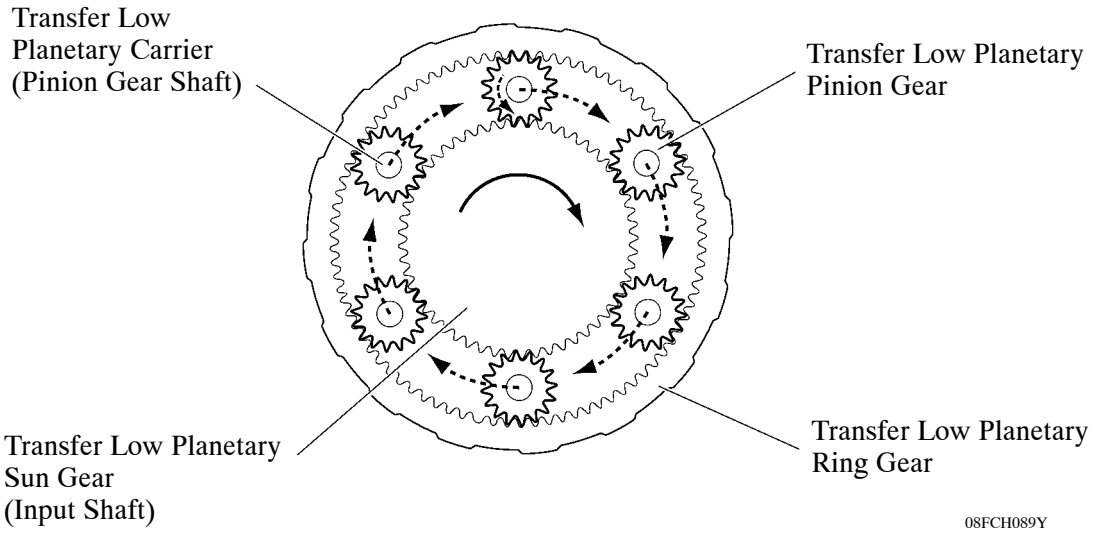
- The transfer low planetary sun gear is integrated with the transfer input shaft.
- The 6 transfer low planetary pinion gears are fitted to the transfer low planetary carrier. Each transfer low pinion gear shaft is fixed to the transfer low planetary carrier. A planetary spline piece is fitted to the rear of the transfer low planetary carrier.
- The transfer low planetary ring gear is fixed to the transfer case and its internal teeth mesh with the transfer low planetary pinion gears.
- In this planetary gear unit, the drive torque transmission route is switched in accordance with the movement of the transfer high and low clutch sleeve. The drive torque from the transfer input shaft is transmitted to the differential case via the transfer high and low clutch sleeve.



H4 Position

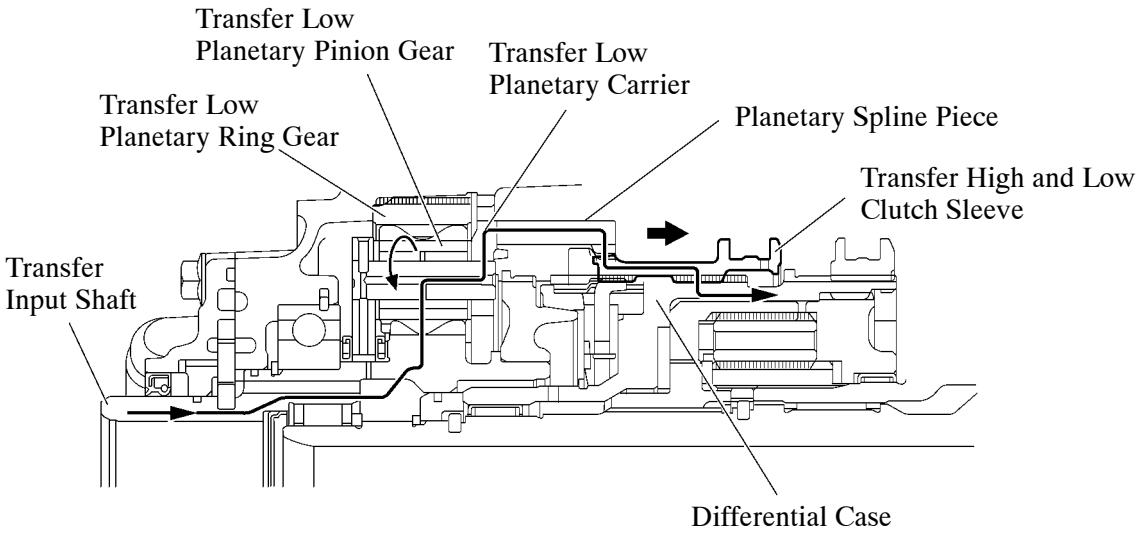
In the H (H4) position, the splines at the rear of the transfer input shaft mesh with the internal gear teeth of the transfer high and low clutch sleeve.
Also, the transfer high and low clutch sleeve is meshed to the differential case. Thus, the rotation of the input shaft is transmitted to the transfer high and low clutch sleeve, and then to the differential case.

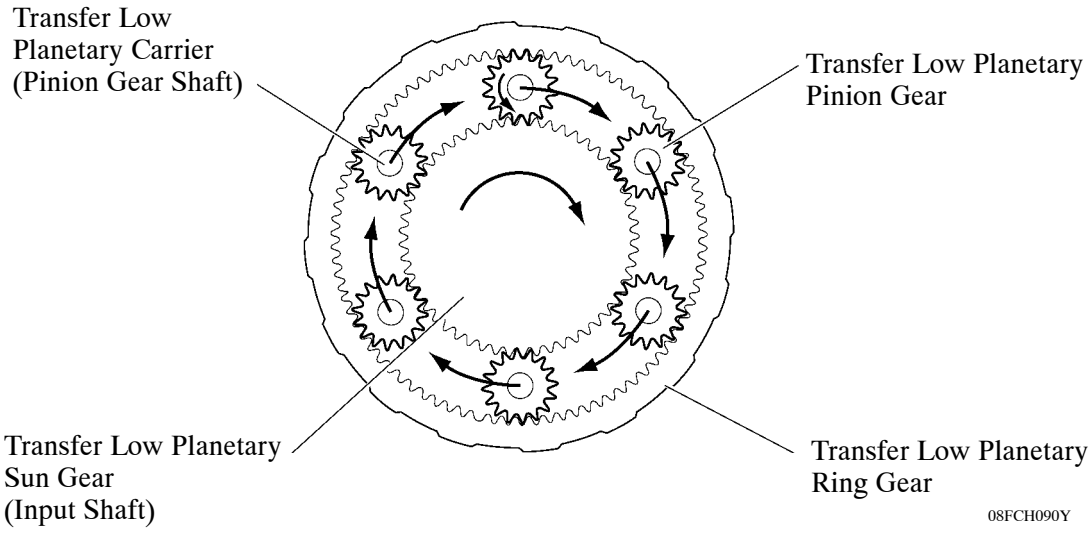




L4 Position

In the L (L4) position, the external teeth of the transfer high and low clutch sleeve are meshed with the planetary spline piece.
Thus, the rotation of the transfer input shaft is transmitted in a reduced form to the transfer low planetary sun gear, transfer low planetary pinion gears, transfer low planetary pinion gear shafts, transfer low planetary carrier, planetary spline piece, transfer high and low clutch sleeve, and differential case.

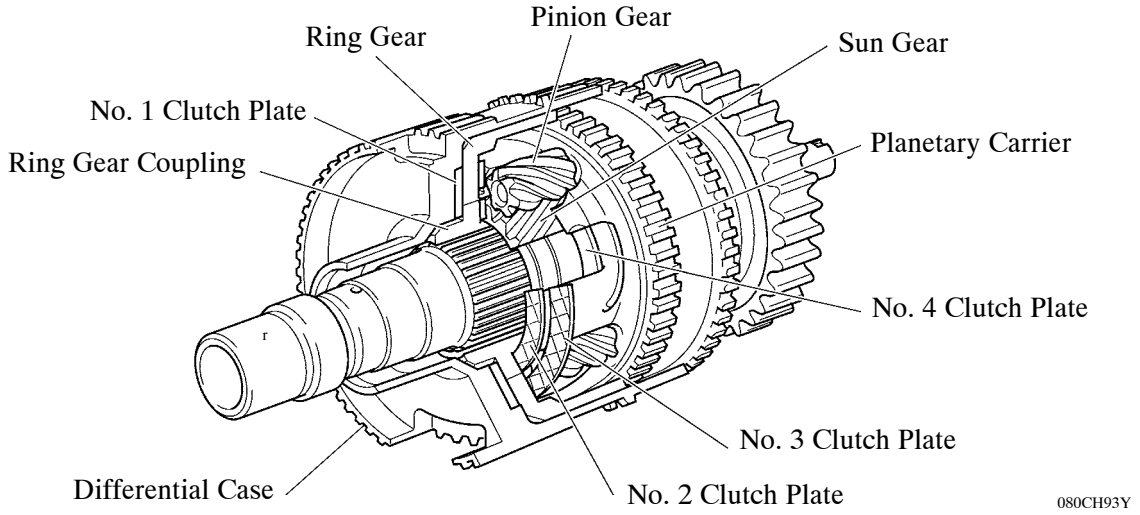


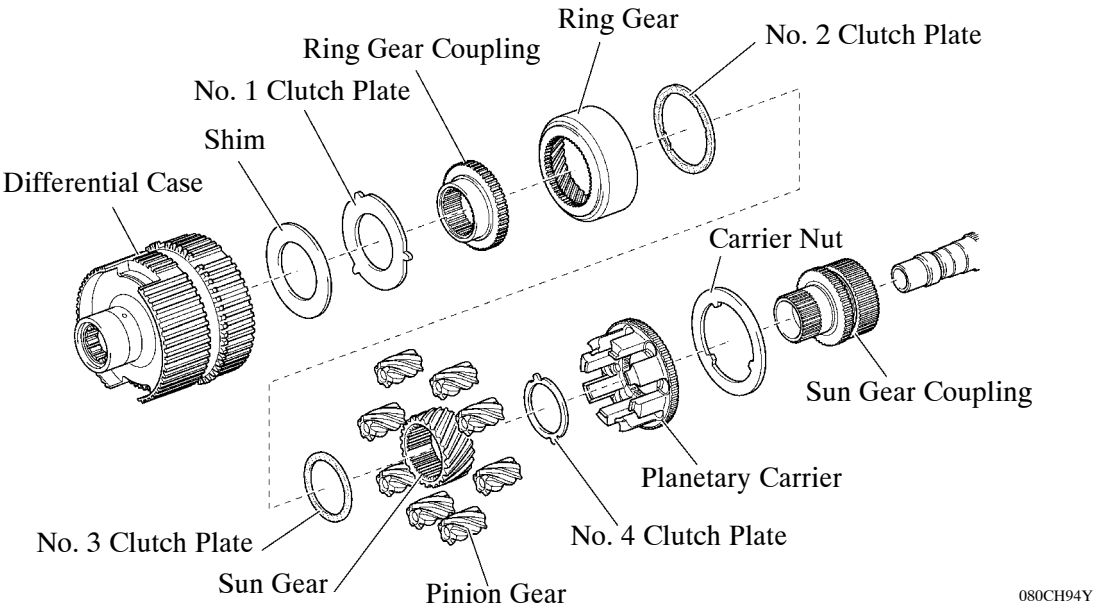


3. Center Differential (TORSEN LSD)

General

- The center differential uses a TORSEN LSD (Limited Slip Differential).
- The TORSEN LSD is torque-sensing LSD. It generates a limited-differential torque in proportion to the drive torque, and instantly changes the front and rear torque distribution.
- The torque distribution during straightline driving is 40/60 (front/rear), which is helpful for an appropriate steering response during the initial stage of a turn. During the acceleration stage of a turn, the torque distribution to the rear wheels increases.
- This center differential consists of a differential case, a ring gear coupling, a ring gear, 8 pinion gears, a sun gear, a planetary carrier, and clutch plates.



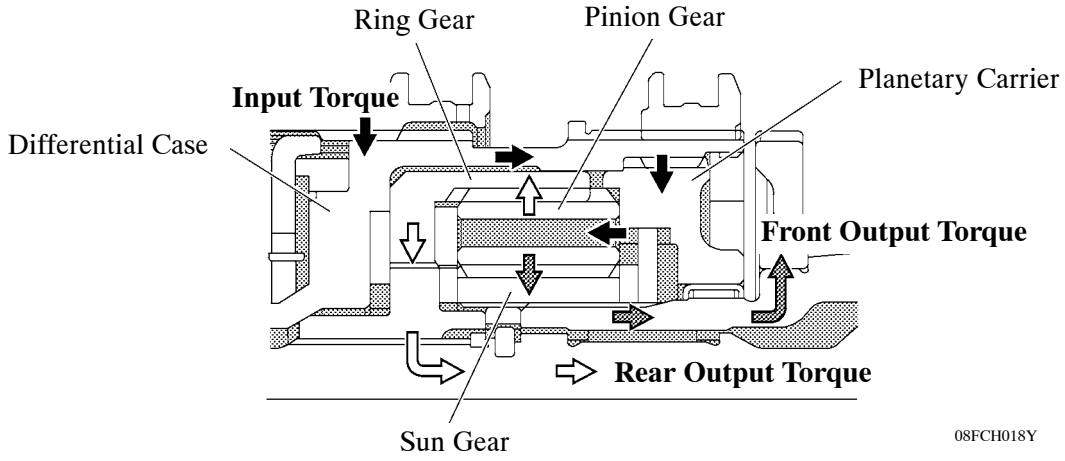


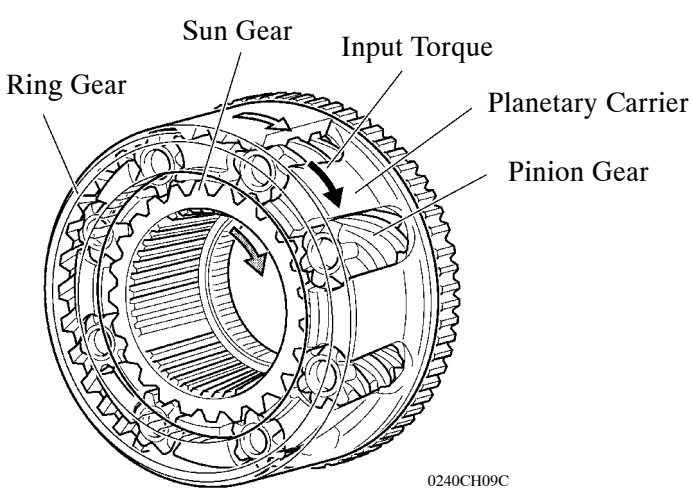
Service Tip

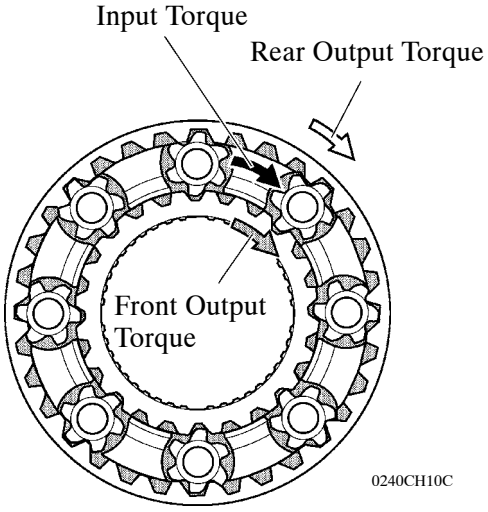
The TORSEN LSD cannot be disassembled, so it must be replaced as an assembly.
For details, see the 2008 LEXUS LX 570 Repair Manual (Pub. No. RM08F0U).

Normal Driving Operation

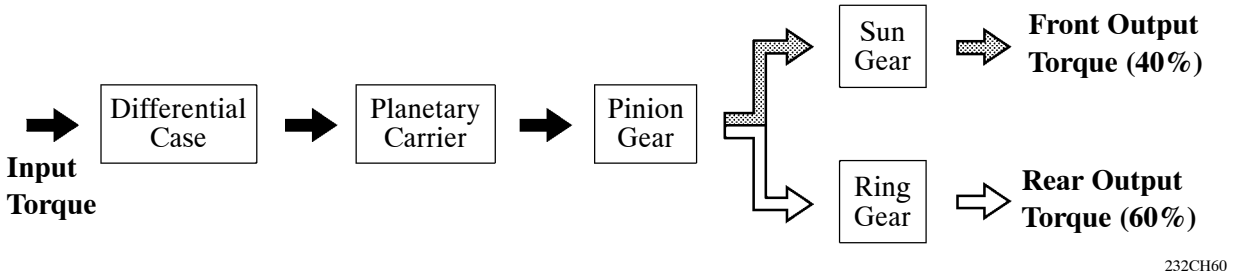
During normal driving (front wheel speed = rear wheel speed), the drive torque that is input by the differential case is transmitted (front: 40/rear: 60) as shown below, without involving the LSD function.







▶ Power Flow ◀

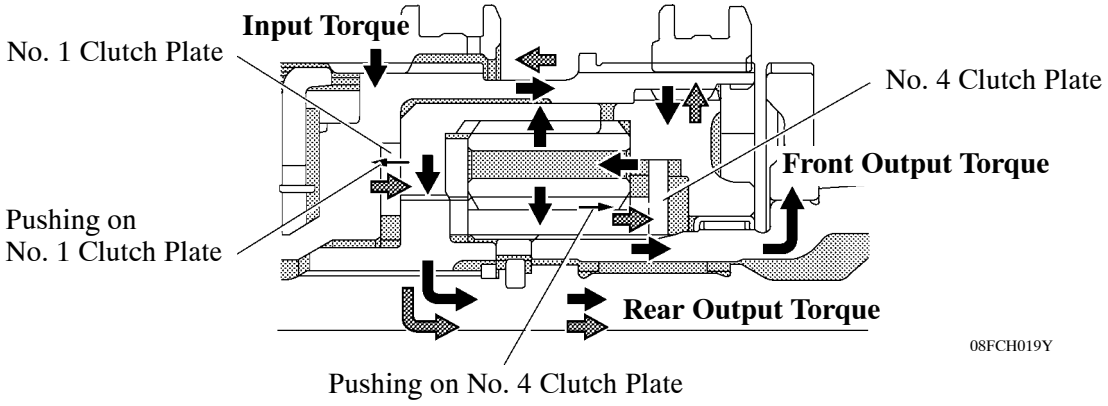


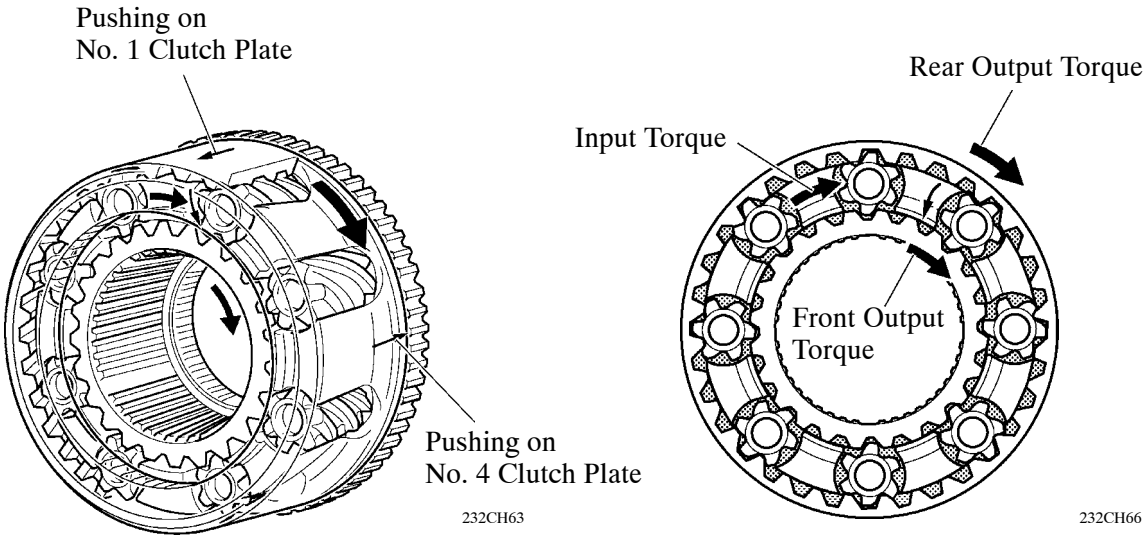
Front Wheel Skid Driving Operation

During front wheel skid driving (front wheel speed > rear wheel speed) when a rotational difference exists between the sun gear and the ring gear, the distribution of the drive torque that is input by the differential case changes instantly before the torque is transmitted, as follows:

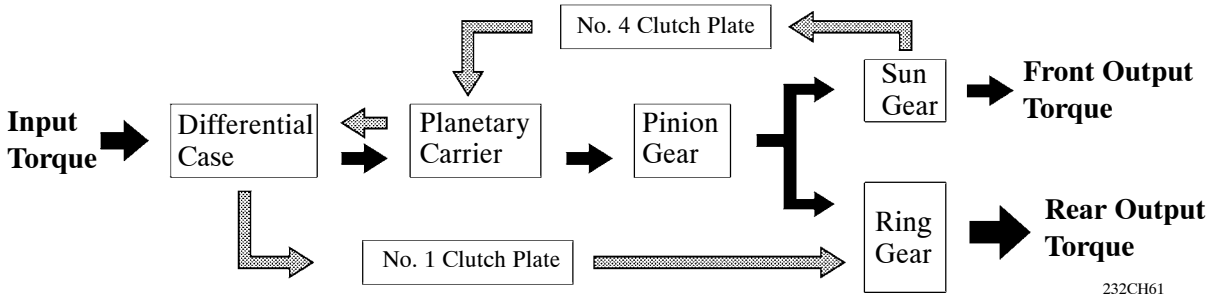
- The sun gear transmits torque to the planetary carrier while pushing on the No. 4 clutch plate. The planetary carrier transmits this torque to the ring gear from the differential case via the No. 1 clutch plate.
- The ring gear outputs torque while pushing on the No. 1 clutch plate.

These LSD functions change the torque distribution.





▶ Power Flow ◀

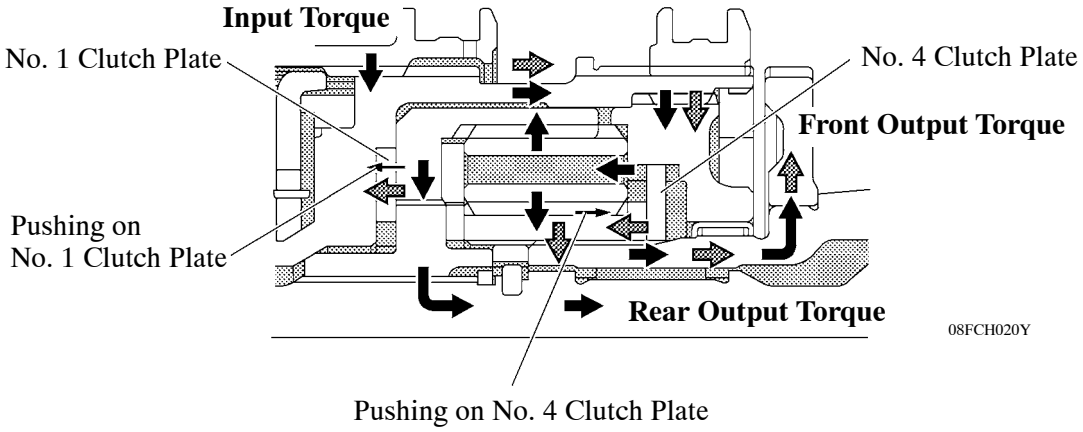


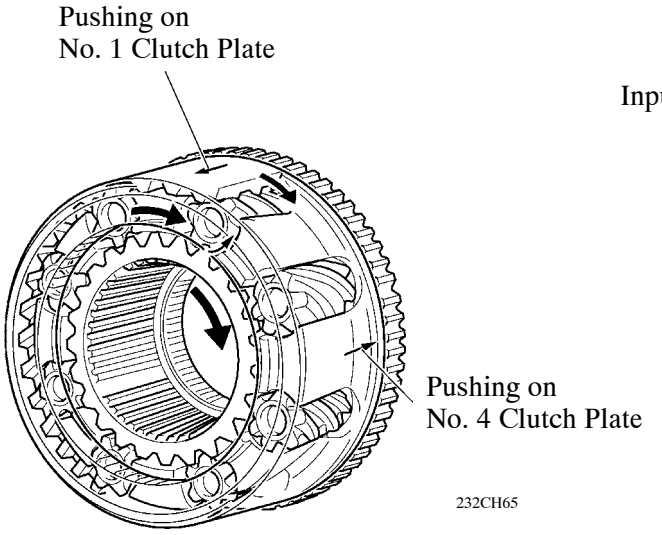
Rear Wheel Skid Driving Operation

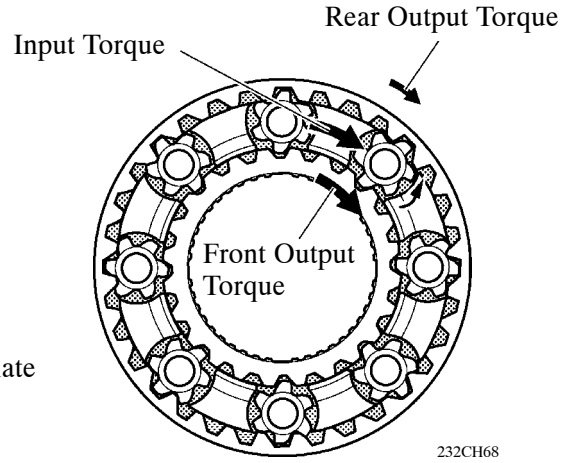
During rear wheel skid driving (front wheel speed < rear wheel speed), when a rotational difference exists between the sun gear and the ring gear, the distribution of the drive torque that is input by the differential case changes instantly before the torque is transmitted, as follows:

- The ring gear transmits torque to the differential case while pushing the No. 1 clutch plate. The differential case transmits this torque from the planetary carrier to the sun gear via the No. 4 clutch plate.
- The sun gear outputs torque while pushing on the No. 4 clutch plate.

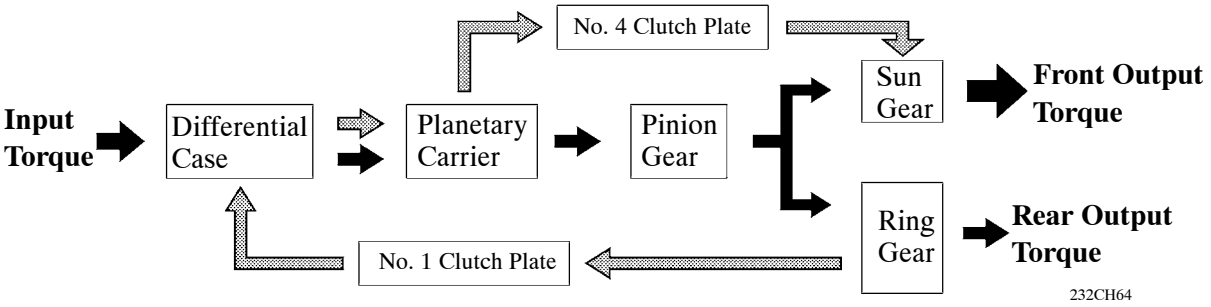
These LSD functions change the torque distribution.







▶ Power Flow ◀

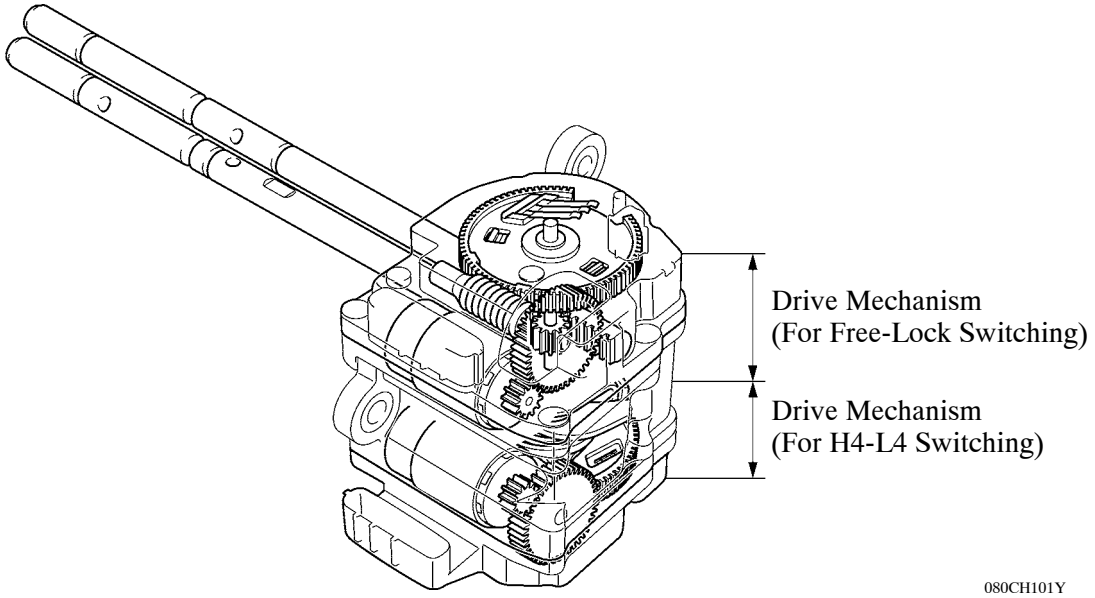


4. Transfer Shift Actuator

General

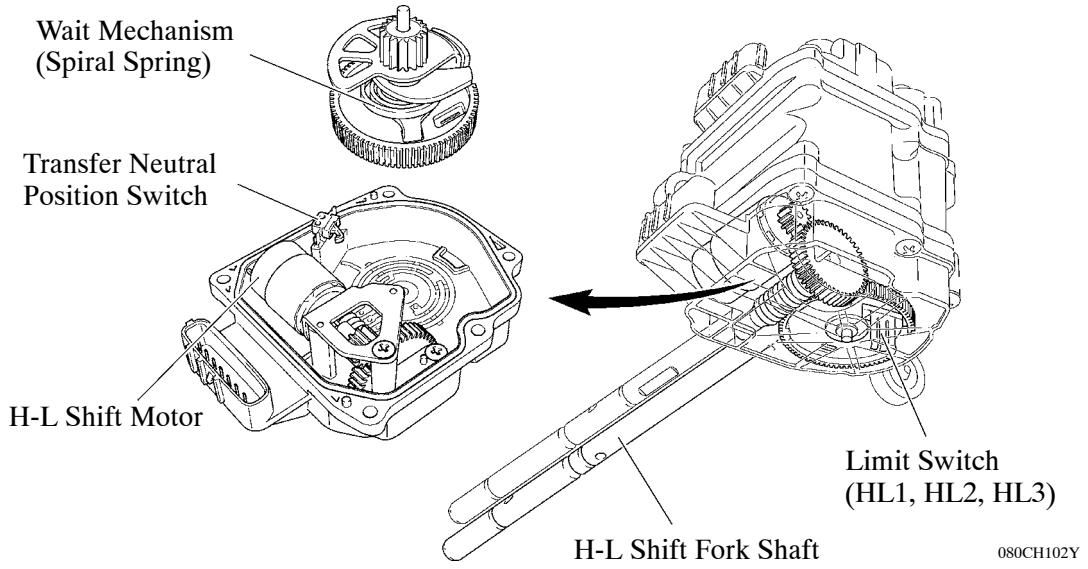
The transfer shift actuator consists of the following two mechanisms.

- H4-L4 switching (to switch the transfer gear ratio).
- Free-lock switching (to switch the center differential lock).

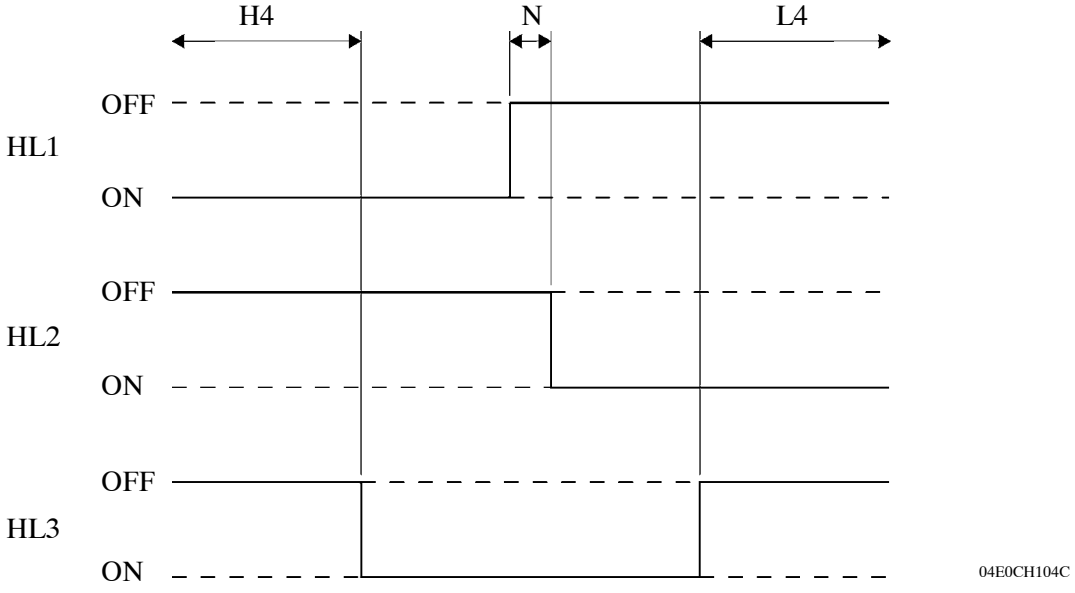


Drive Mechanism for H4-L4 Switching

- The drive mechanism for H4-L4 switching consists of an H-L shift motor, a limit switch, a transfer neutral position switch, a wait mechanism (spiral spring), and an H-L shift fork shaft. This drive mechanism cannot be disassembled.
- The limit switch has three contact points and detects the shift motor position.
- The wait mechanism (spiral spring) is used for H-L shift fork shaft operations. If the operating resistance of the H-L shift fork shaft is high, the rotation of the H-L shift motor is partially stored in the spiral spring. Afterward, when the operating resistance is reduced, the spring force causes the H-L shift fork shaft to slide.

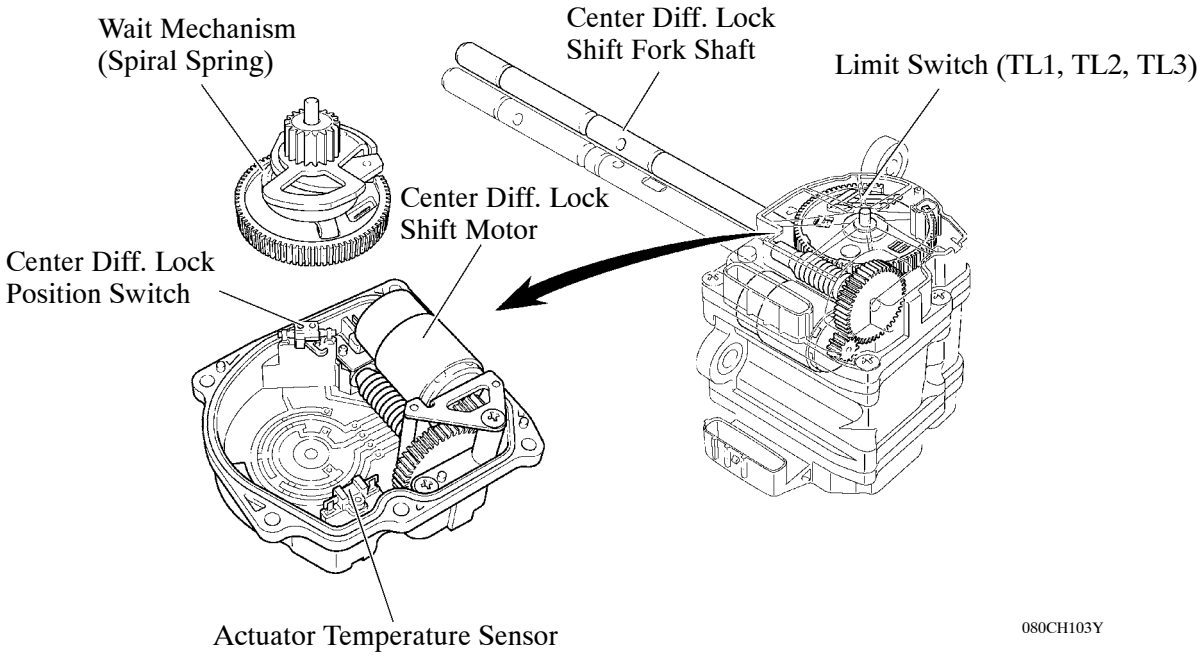


▶ Combination of 3 Contact Point Switches ◀

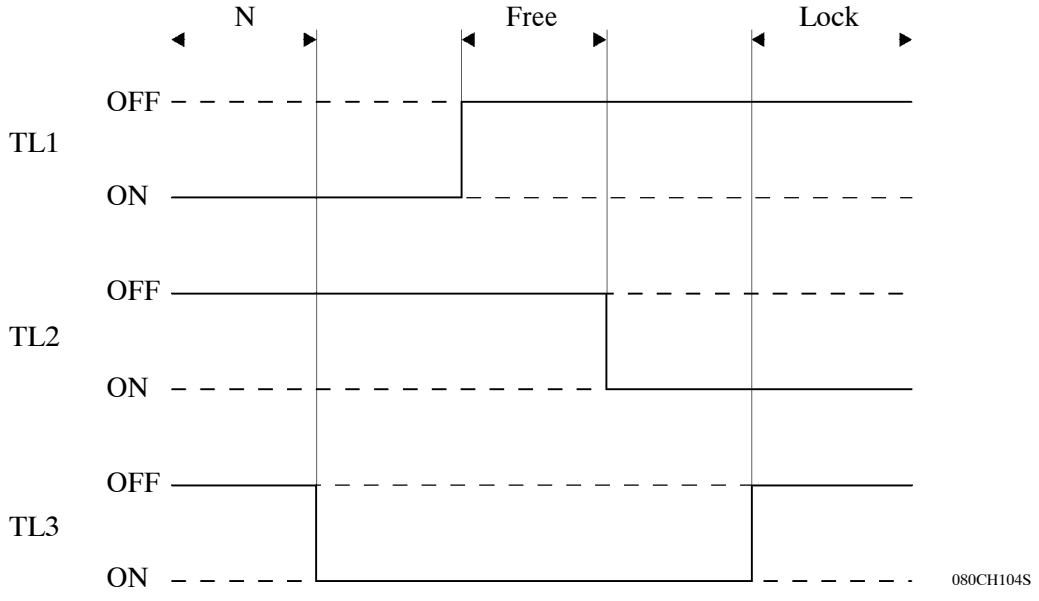


Drive Mechanism for Free-Lock Switching

- The drive mechanism for free-lock switching consists of a center differential lock shift motor, a limit switch, a center differential lock position switch, a wait mechanism (spiral spring), a center differential lock shift fork shaft, and an actuator temperature sensor. This drive mechanism cannot be disassembled.
- The limit switch has three contact points and detects the shift motor position.
- The wait mechanism (spiral spring) is used for center differential lock shift fork shaft operations. If the operating resistance of the center differential lock shift fork shaft is high, the rotation of the center differential lock shift motor is partially stored in the spiral spring. Afterward, when the operating resistance is reduced, the spring force causes the center differential lock shift fork shaft to slide.
- An actuator temperature sensor is provided on the shift actuator in order to allow an increase of the amount of current applied to the shift motors, and improves switching performance at low temperatures.



▶ Combination of 3 Contact Point Switches ◀

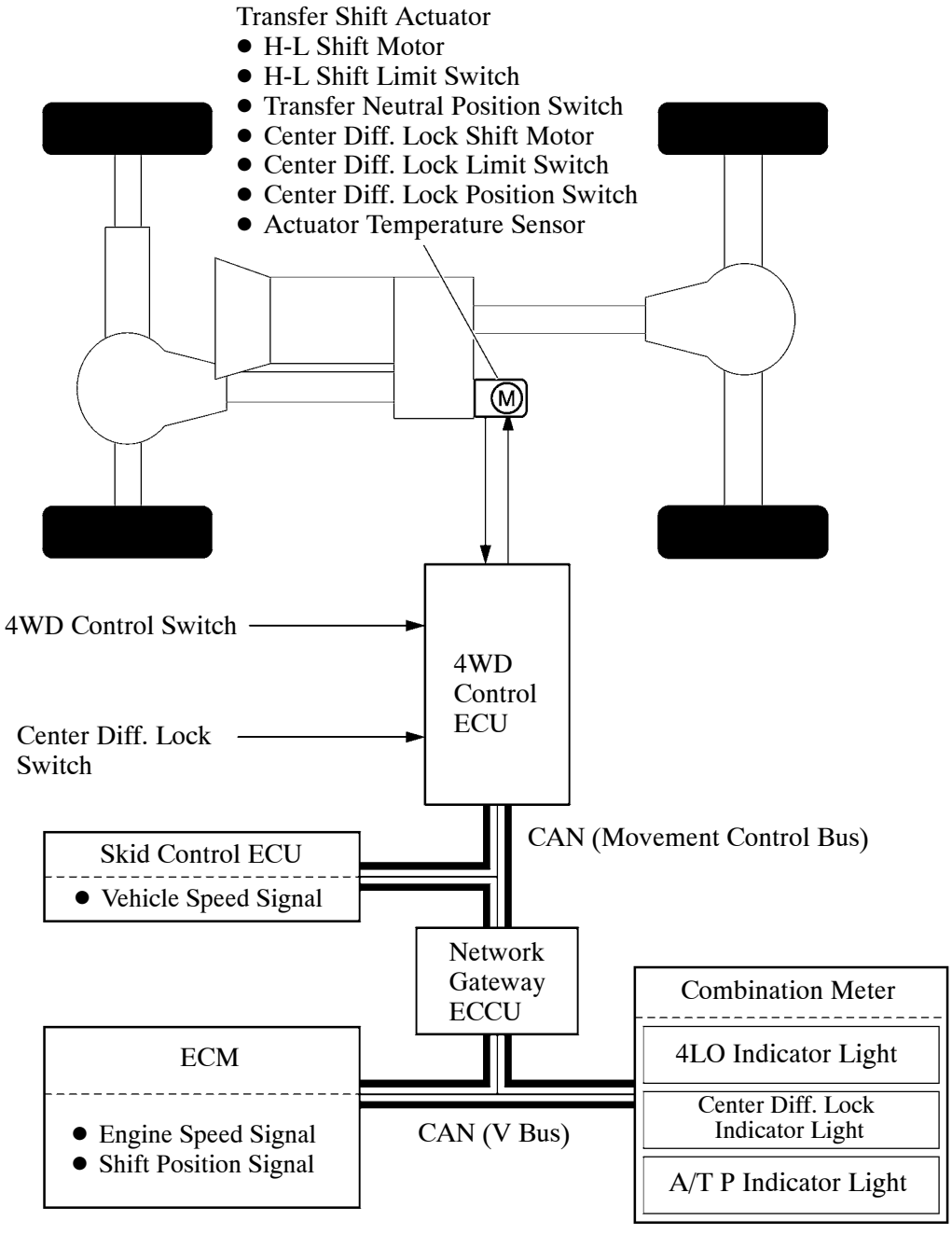


■4WD SYSTEM

1. General

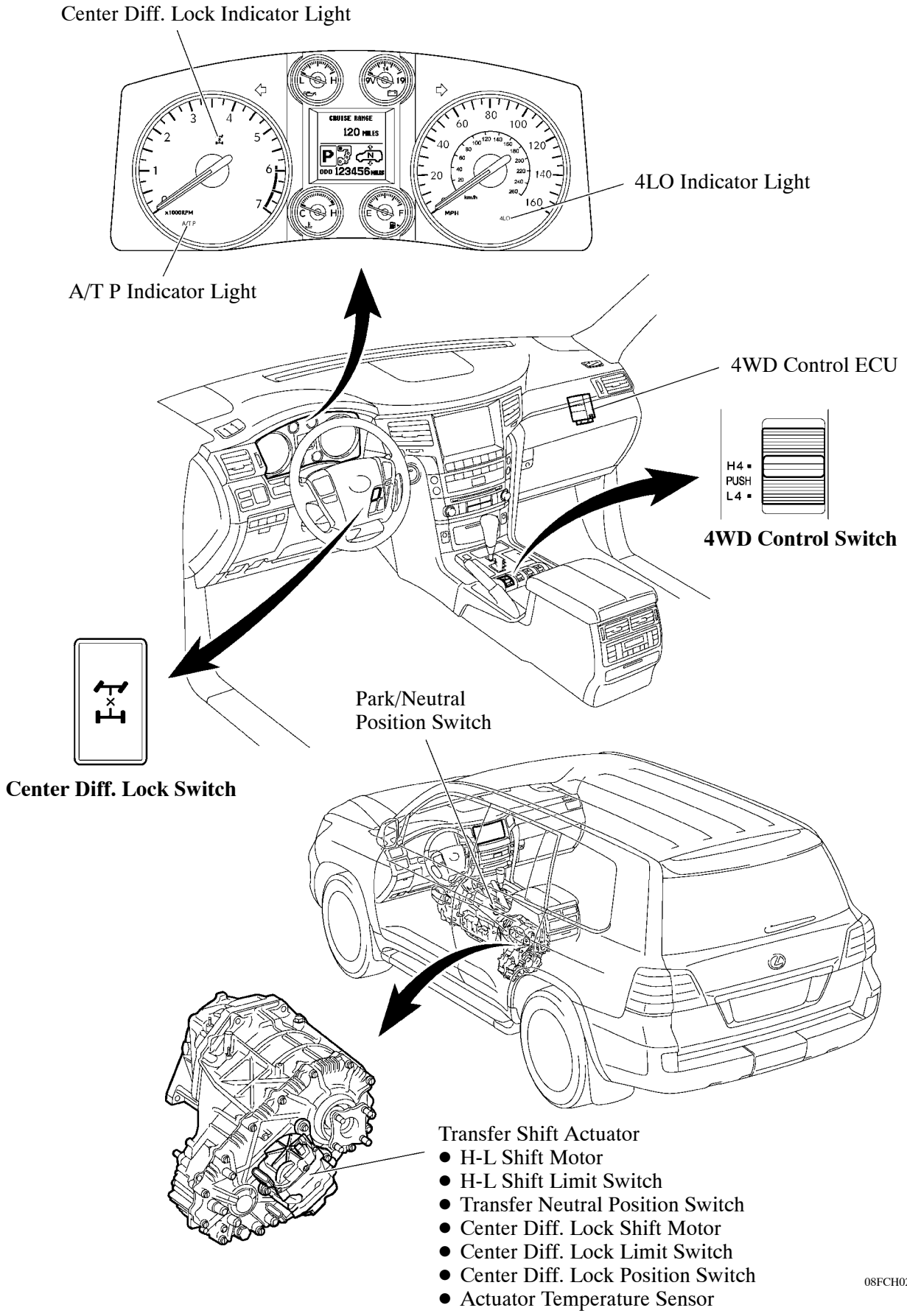
- The 4WD system used on the ’08 LX 570 allows the driver to select the appropriate mode from among the four drive modes by utilizing the 4WD control switch and center differential lock switch.
- Through these switch signals, the 4WD control ECU actuates the 2 shift motors in the transfer shift actuator.

▶ System Diagram ◀

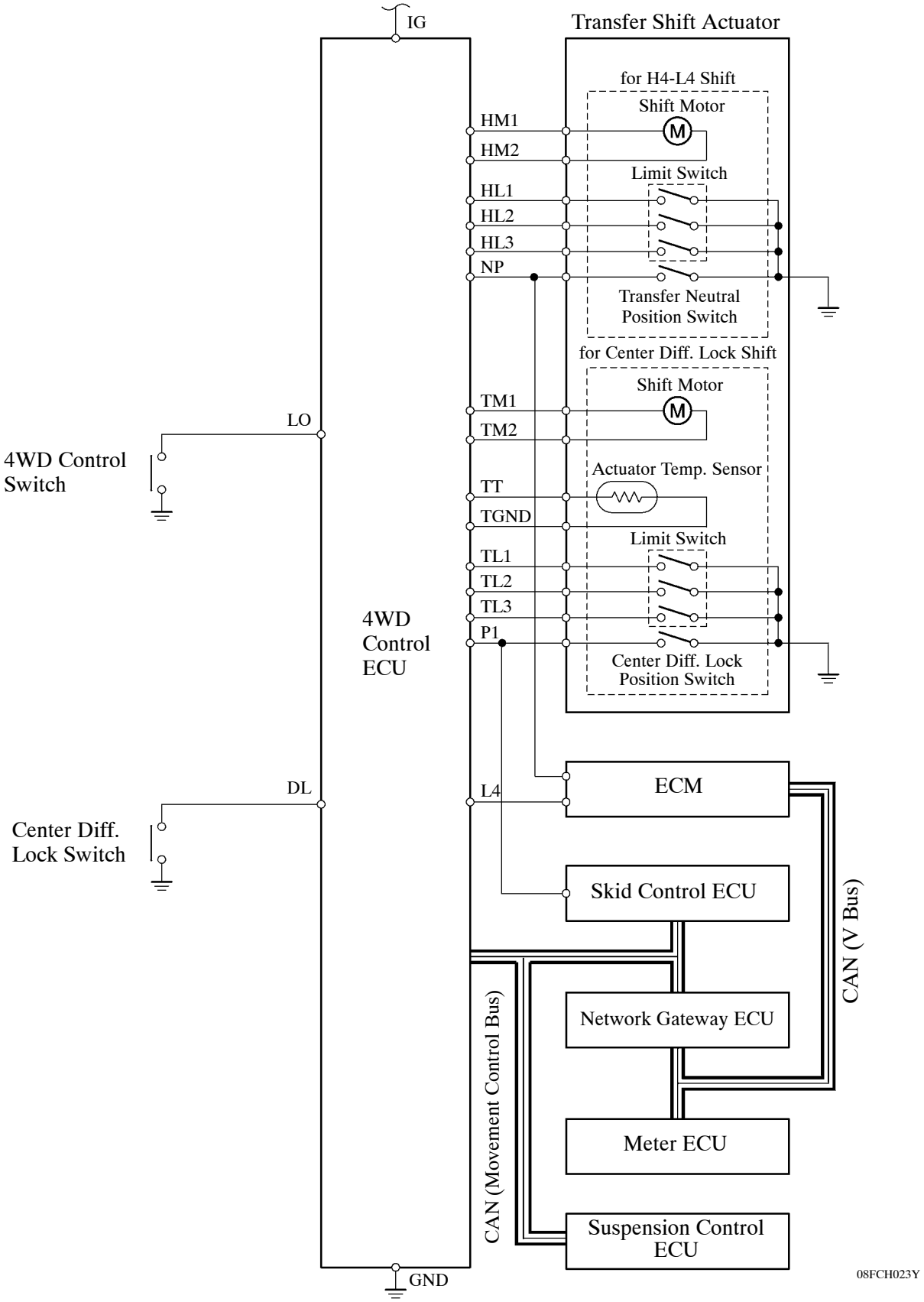


08FCH021Y

2. Layout of Main Components



3. Wiring Diagram

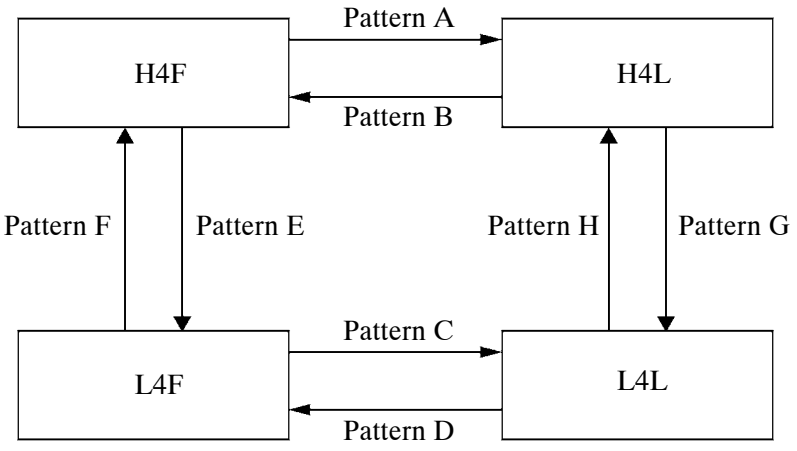


4. System Operation

General

- The 4WD mode switching pattern of this system is as shown in the illustration below. The system operation of each switching pattern is explained from the next page.
- When the vehicle speed is below approximately 100 km/h (62 mph), free-lock switching of the center differential lock (switching patterns A to D) is available while the vehicle is running.
- The H4-L4 switching of the transfer gear ratio (switching patterns E to H) is available only when the vehicle is stationary and the shift position is N.

▶ 4WD Mode Switching Pattern ◀



H4F: High Speed 4WD & Center Differential Free
H4L: High Speed 4WD & Center Differential Lock
L4F: Low Speed 4WD & Center Differential Free
L4L: Low Speed 4WD & Center Differential Lock

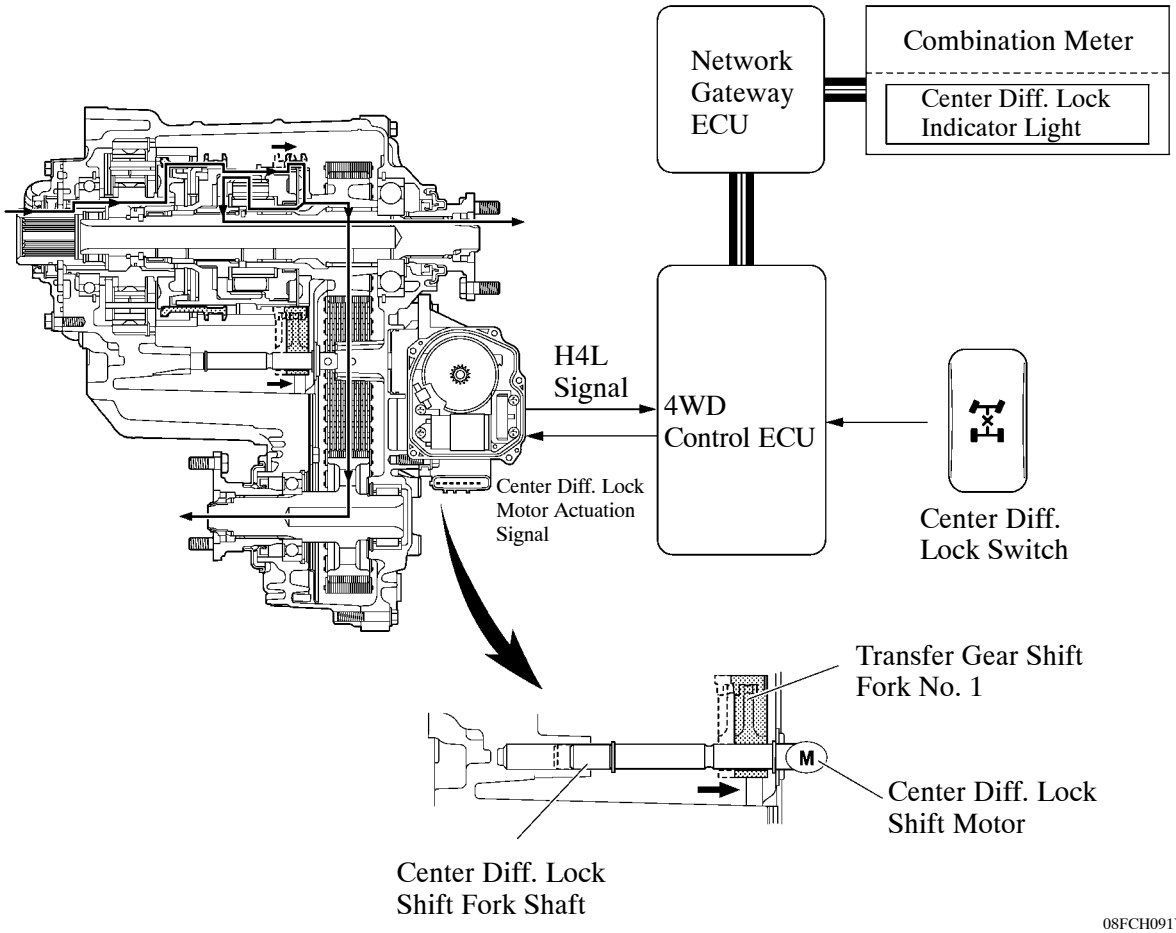
Service Tip

The neutral position is provided between H4 and L4. Switch to the neutral position or release the neutral position with the vehicle at standstill.

- The procedures to switch to the neutral position are as follows:
  1) Switch the transfer position to H4F.
  2) Move the shift lever to the P position.
  3) Depress the brake pedal three times, and then keep it depressed.
  4) Move the shift lever to the N position.
  5) Depress the brake pedal three times.
  6) Turn 4WD control switch from H4 to L4, then to H4.
  7) The 4LO indicator light blinks.
  8) Move the shift lever to the P position.
  9) The A/T P indicator light turns ON, and the neutral position is selected.
- The procedures to release the neutral position are as follows:
  1) Move the shift lever to the N position.
  2) Turn the 4WD control switch from H4 to L4, then to H4.
  3) The 4LO indicator light turns OFF.
  4) The transfer position is switched to H4F, and the neutral position is released.

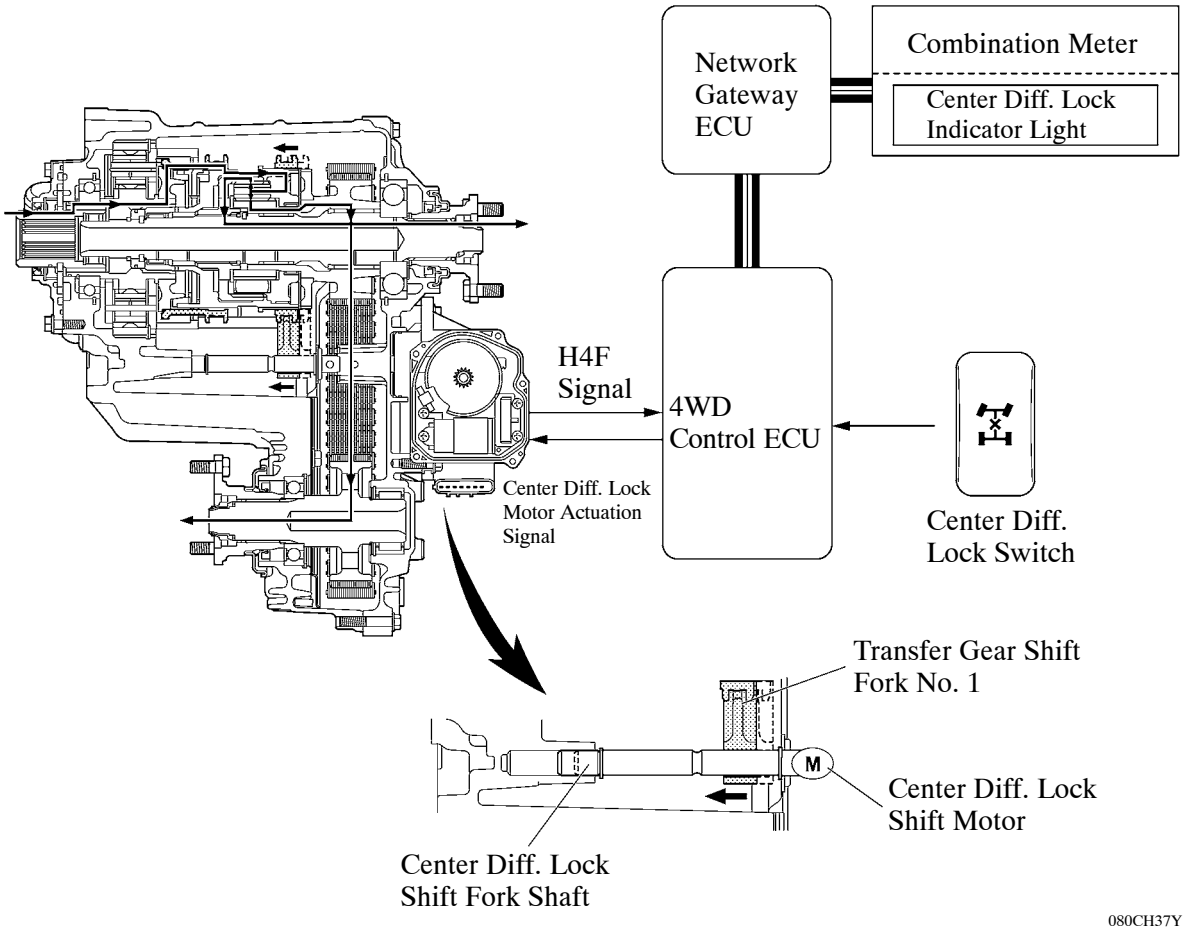
Switching Pattern A (H4F → H4L)

- In H4F mode, when the center differential lock switch is turned ON, the 4WD control ECU actuates the center differential lock shift motor to move the center differential lock shift fork shaft to the right. Simultaneously, the center differential lock shift fork shaft moves to the right together with the transfer gear shift fork No. 1. As a result, the center differential lock sleeve engages the differential case and the drive sprocket piece, and the mode changes to H4L.
- The 4WD control ECU detects the state of the center differential through the limit switch and center differential lock position switch. The 4WD control ECU causes the center differential lock indicator light to turn ON when the center differential is locked.



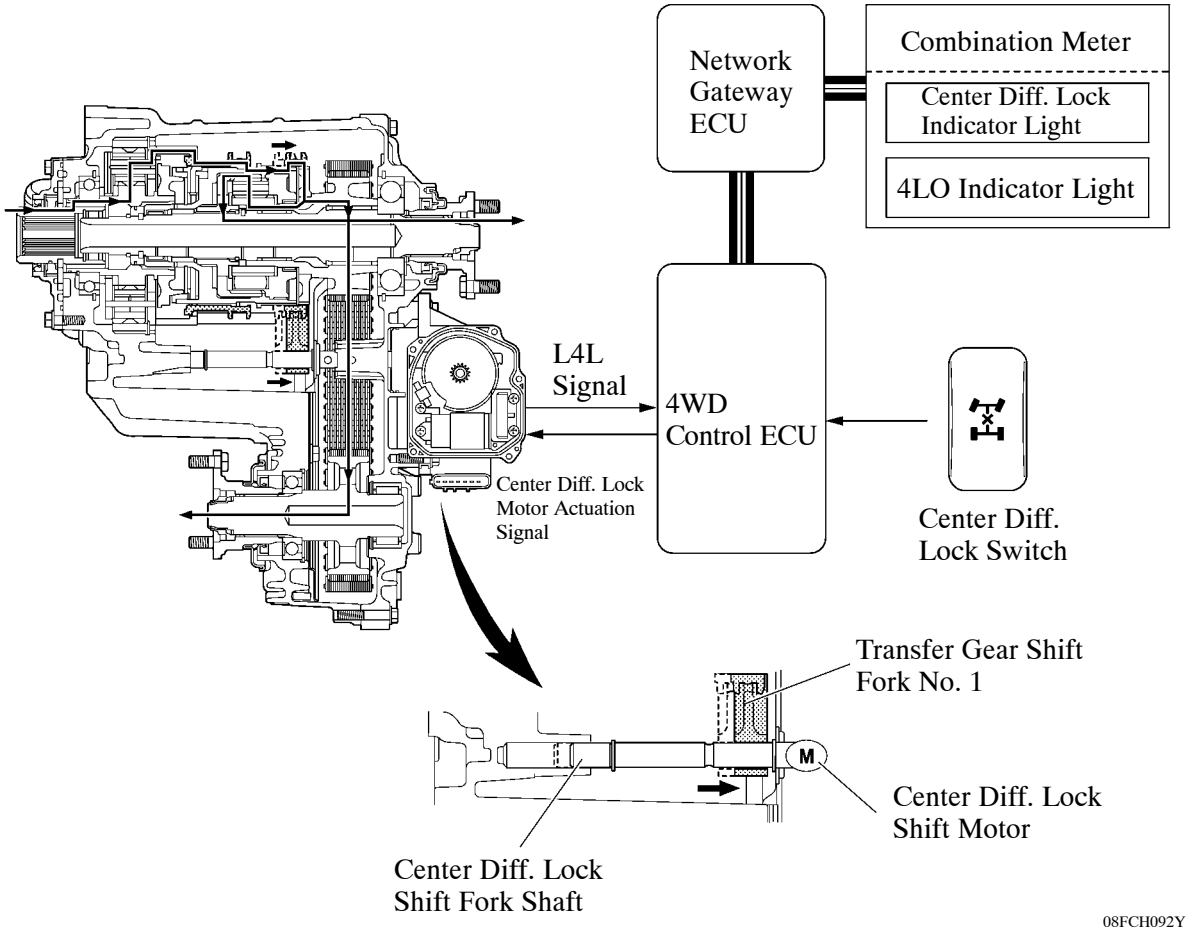
Switching Pattern B (H4L → H4F)

- In H4L mode, when the center differential lock switch is turned OFF, the 4WD control ECU actuates the center differential lock shift motor to move the center differential lock shift fork shaft to the left. Simultaneously, the center differential lock shift fork shaft moves to the left together with the transfer gear shift fork No. 1. As a result, the center differential lock sleeve disengages the differential case and the drive sprocket piece, and the mode changes to H4F.
- The 4WD control ECU detects the state of the center differential through the limit switch and center differential lock position switch. The 4WD control ECU causes the center differential lock indicator light to turn OFF when the center differential is unlocked.



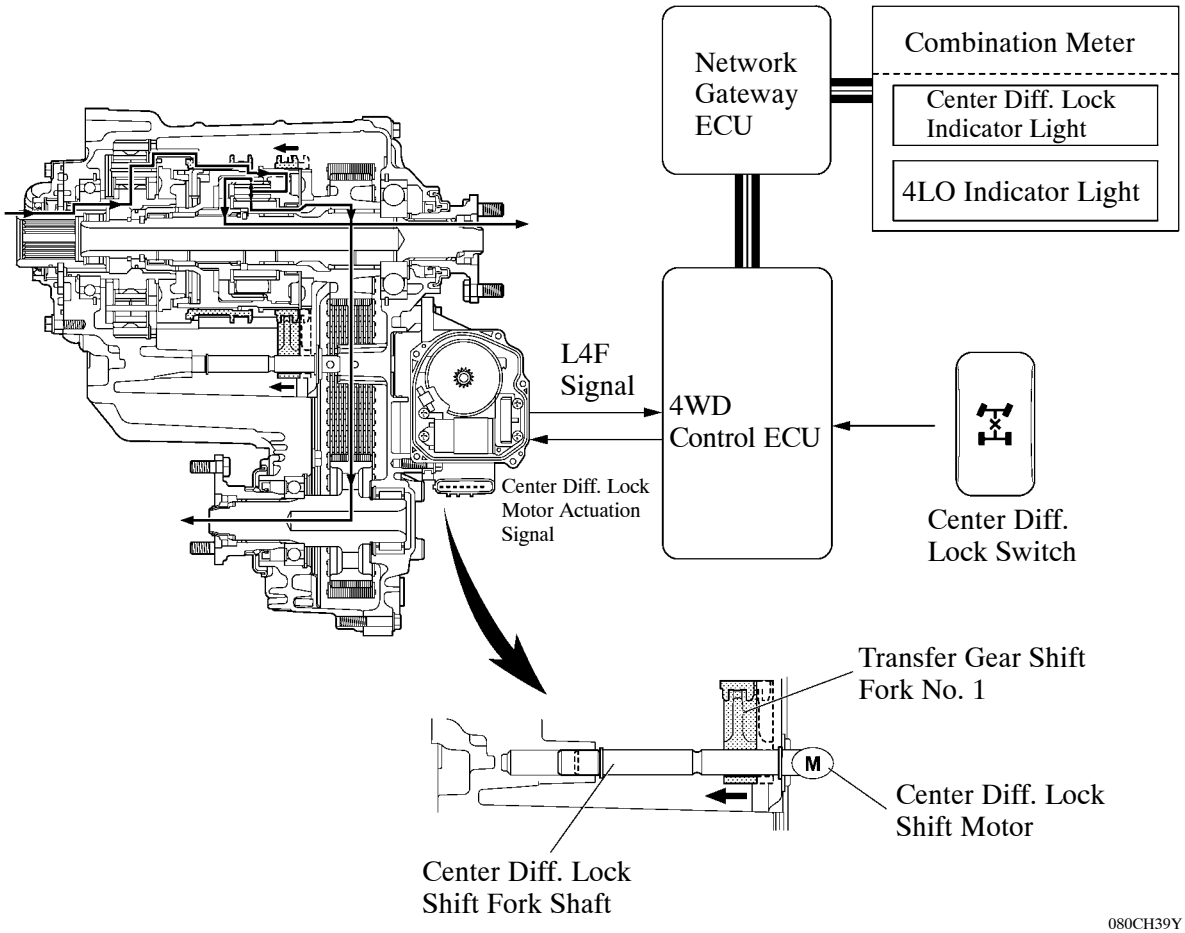
Switching Pattern C (L4F → L4L)

- In L4F mode, when the center differential lock switch is turned ON, the 4WD control ECU actuates the center differential lock shift motor to move the center differential lock shift fork shaft to the right. Simultaneously, the center differential lock shift fork shaft moves to the right together with the transfer gear shift fork No. 1. As a result, the center differential lock sleeve engages the differential case and the drive sprocket piece, and the mode changes to L4L.
- The 4WD control ECU detects the state of the center differential through the limit switch and center differential lock position switch. The 4WD control ECU causes the center differential lock indicator light to turn ON when the center differential is locked.



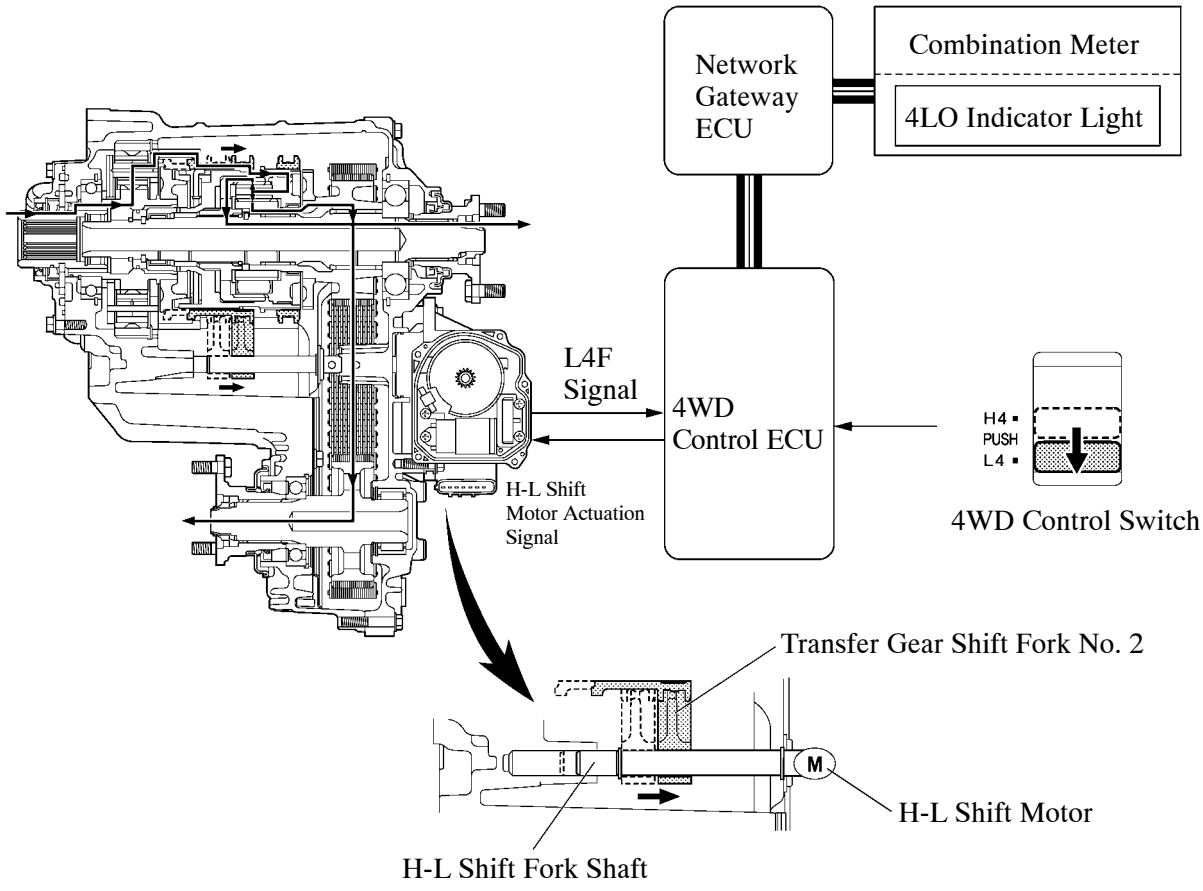
Switching Pattern D (L4L → L4F)

- In L4L mode, when the center differential lock switch is turned OFF, the 4WD control ECU actuates the center differential lock shift motor to move the center differential lock shift fork shaft to the left. Simultaneously, the center differential lock shift fork shaft moves to the left together with the transfer gear shift fork No. 1. As a result, the center differential lock sleeve disengages the differential case and the drive sprocket piece, and the mode changes to L4F.
- The 4WD control ECU detects the state of the center differential through the limit switch and center differential lock position switch. The 4WD control ECU causes the center differential lock indicator light to turn OFF when the center differential is unlocked.



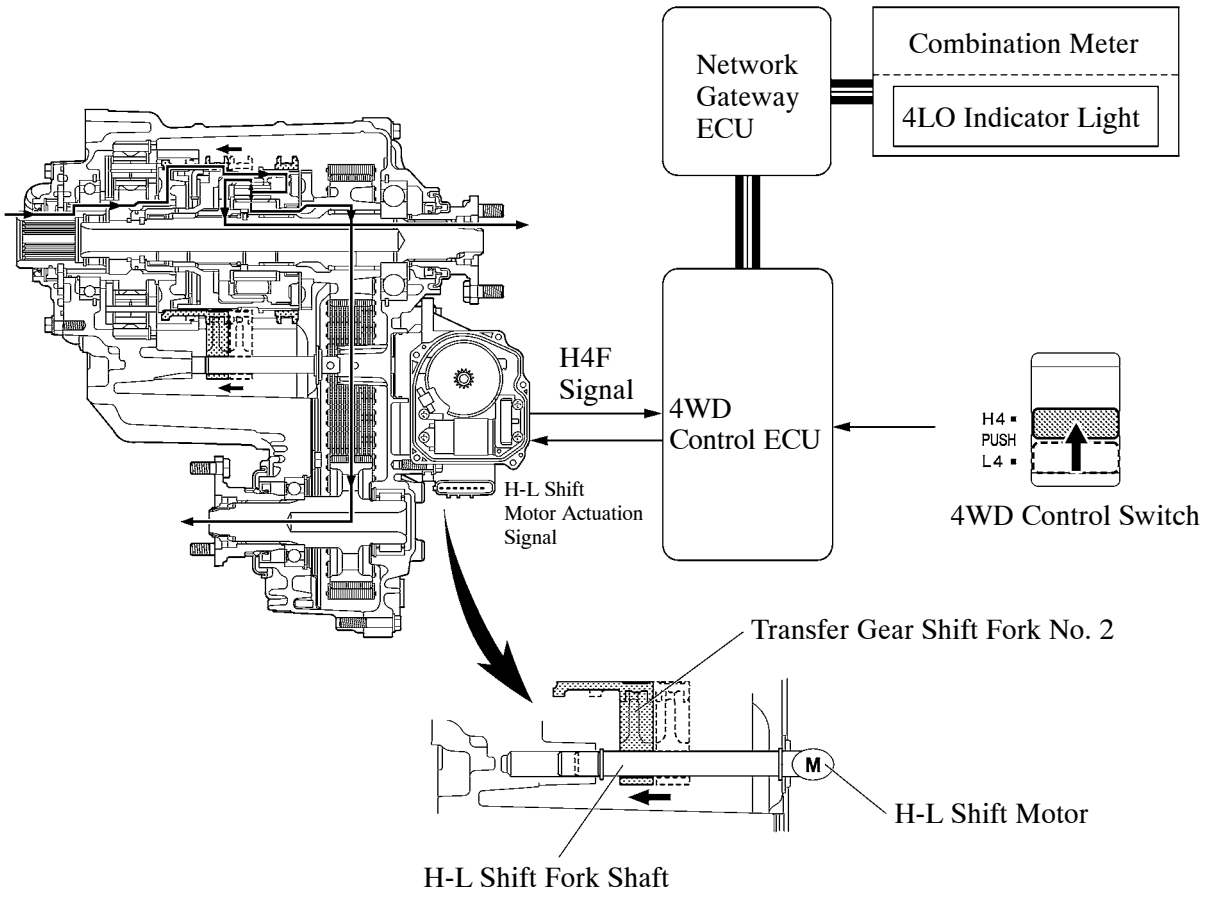
Switching Pattern E (H4F → L4F)

- In H4F mode, when the 4WD control switch is turned to the L4 position, the 4WD control ECU actuates the H-L shift motor to move the H-L shift fork shaft to the right. Simultaneously, the H-L shift fork shaft moves to the right together with the transfer gear shift fork No. 2. As a result, the high and low clutch sleeve of the planetary gear unit engages with the planetary carrier, and the mode changes to L4F.
- The 4WD control ECU detects the state of the H-L position through the limit switch and transfer neutral position switch. The 4WD control ECU causes the 4LO indicator light to turn ON when switching to the L4F mode has been completed.



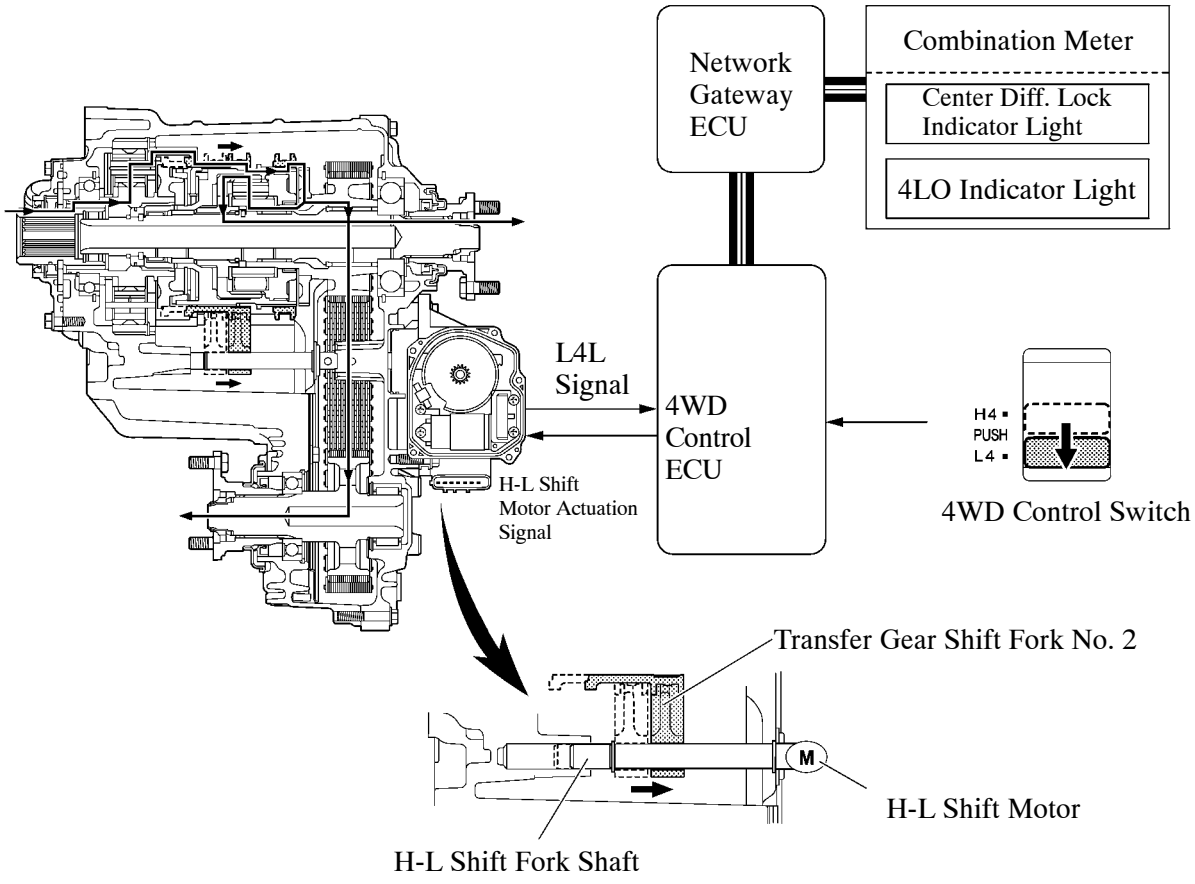
Switching Pattern F (L4F → H4F)

- In L4F mode, when the 4WD control switch is turned to the H4 position, the 4WD control ECU actuates the H-L shift motor to move the H-L shift fork shaft to the left. Simultaneously, the H-L shift fork shaft moves to the left together with the transfer gear shift fork No. 2. As a result, the high and low clutch sleeve of the planetary gear unit engages with the rear of the transfer input shaft, and the mode changes to H4F.
- The 4WD control ECU detects the state of the H-L position through the limit switch and transfer neutral position switch. The 4WD control ECU causes the 4LO indicator light to turn OFF when switching to the H4F mode has been completed.



Switching Pattern G (H4L → L4L)

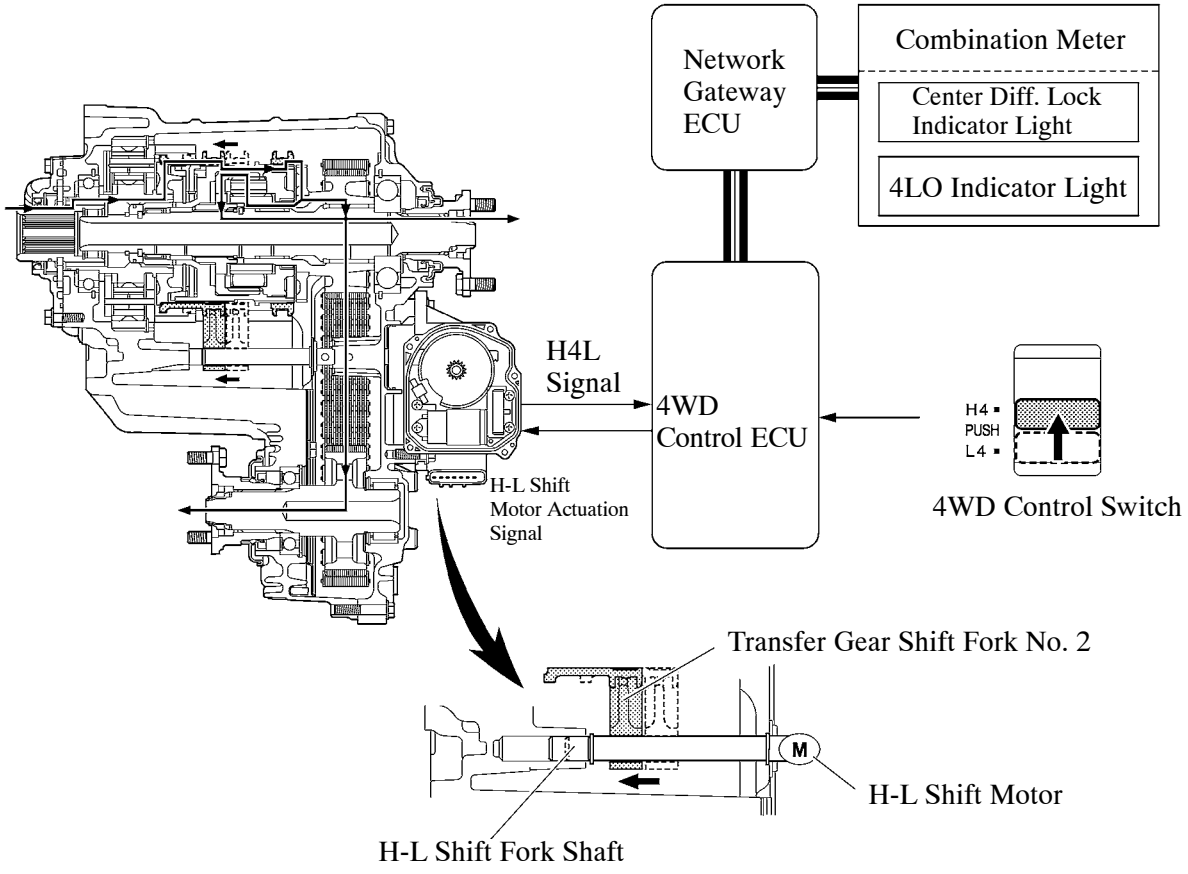
- In H4L mode, when the 4WD control switch is turned to the L4 position, the 4WD control ECU actuates the H-L shift motor to move the H-L shift fork shaft to the right. Simultaneously, the H-L shift fork shaft moves to the right together with the transfer gear shift fork No. 2. As a result, the high and low clutch sleeve of the planetary gear unit engages with the planetary carrier, and the mode changes to L4L.
- The 4WD control ECU detects the state of the H-L position through the limit switch and transfer neutral position switch. The 4WD control ECU causes the 4LO indicator light to turn ON when switching to the L4L mode has been completed.



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Switching Pattern H (L4L → H4L)

- In L4L mode, when the 4WD control switch is turned to the H4 position, the 4WD control ECU actuates the H-L shift motor to move the H-L shift fork shaft to the left. Simultaneously, the H-L shift fork shaft moves to the left together with the transfer gear shift fork No. 2. As a result, the high and low clutch sleeve of the planetary gear unit engages with the rear of transfer input shaft, and the mode changes to H4L.
- The 4WD control ECU detects the state of the H-L position through the limit switch and transfer neutral position switch. The 4WD control ECU causes the 4LO indicator light to turn OFF when switching to the H4L mode has been completed.



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