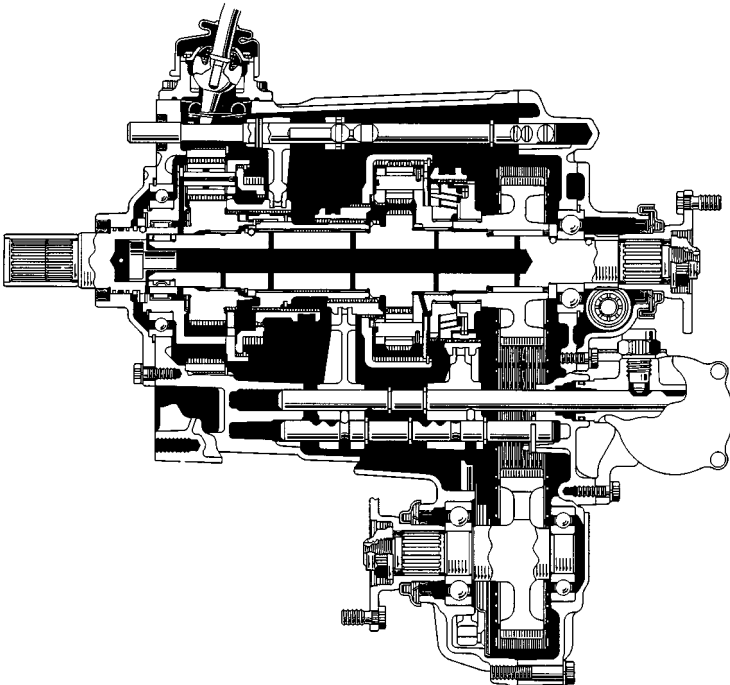


■ TRANSFER

1. Description

On the limited grade 4WD model, a VF3AM transfer, which is based on the VF2A transfer and contains a center differential mechanism, has been adopted. This VF3AM transfer is a multi-mode 4WD transfer that offers the advantages of a part-time 4WD that switches between 4WD and 2WD mode as necessary, and of a full-time 4WD that excels in driving performance.



VF3AM transfer

160RN11

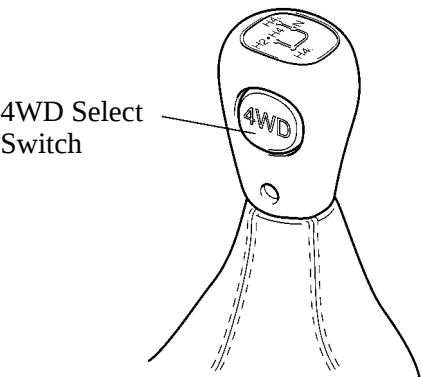
► Specifications ◀

Transfer Type		VF3AM*	VF2A
Item			
Drive System		Multi-Mode 4WD (Part-Time and Full-Time)	Part-Time 4WD
Gear Ratio	H2 and H4	1.000	←
	L4	2.566	←
Center Differential Gear Type		Double Pinion Planetary Gear	—
Oil Capacity liters (US qts, Imp. qts)		1.2 (1.3, 1.1)	1.0 (1.1, 0.9)
Oil Viscosity		SAE 75W-90	←
Oil Grade		API GL-4 or GL-5	←

*: Only for limited grade model

2. Shift Pattern

The shift pattern of the transfer is shown below.
The switching between H2 and H4 is effected by operating the 4WD select switch on the side of the shift lever.



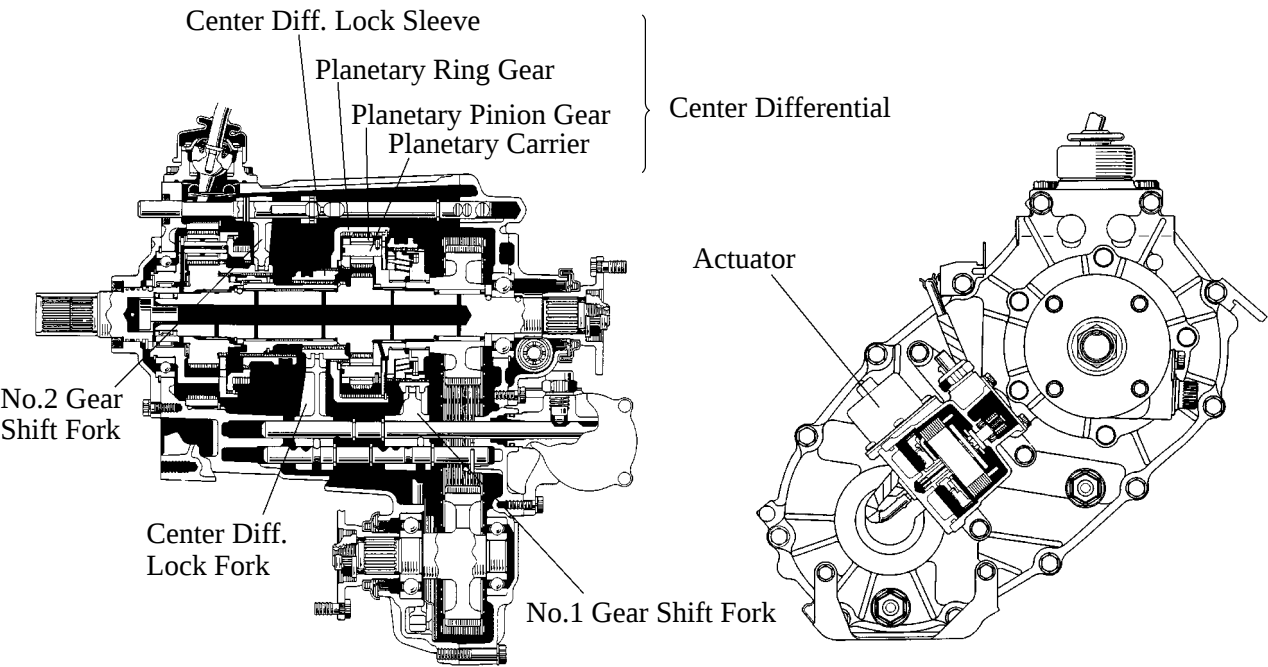
160RN12

Lever Position	Shift Range
H2	High Speed 2WD*
H4	High Speed 4WD
H4L	High Speed 4WD, Center Differential Lock
N	Neutral
L4L	Low Speed 4WD, Center Differential Lock

*: The center differential is in the locked state.

3. Construction

The construction of the transfer is shown below.



160RN11

160RN40

4. Center Differential

Construction

The double pinion planetary gear type center differential consists of a planetary ring gear, a planetary sun gear, a planetary carrier and 6 planetary pinion gears.

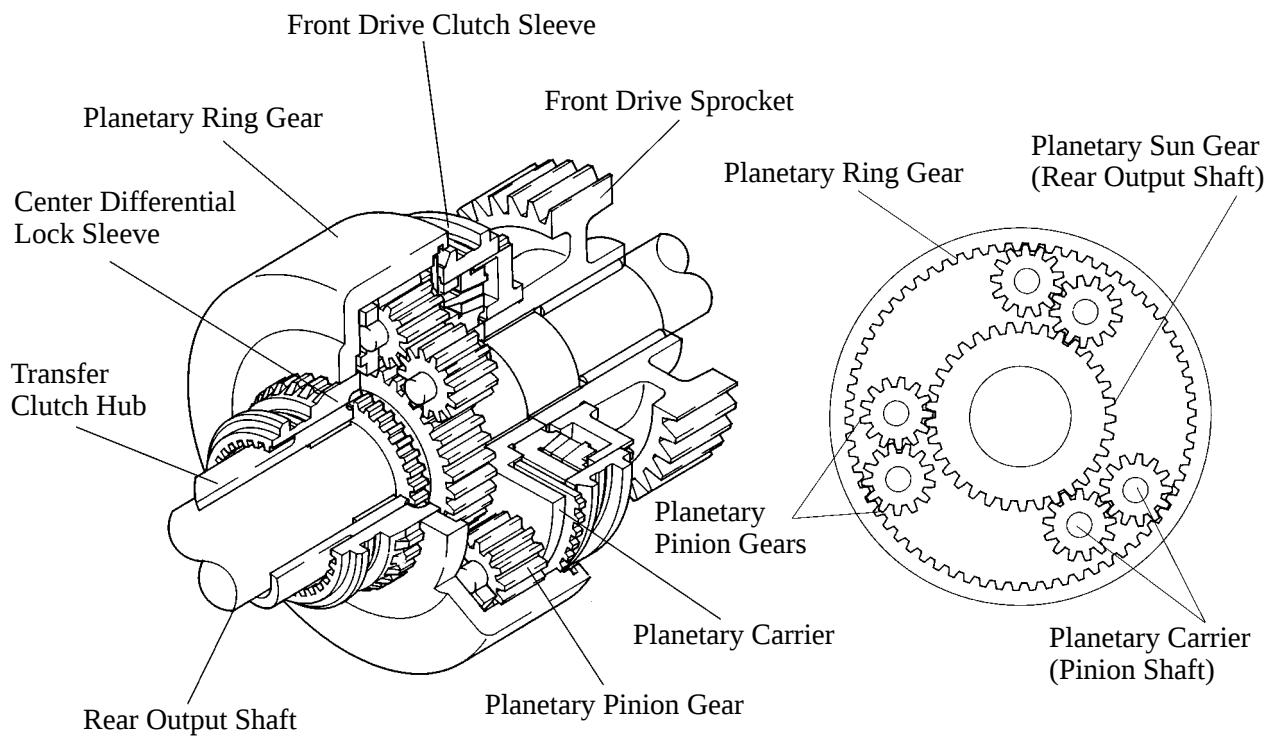
Three sets of planetary pinion gears, which are meshed in pairs, are enclosed in the planetary carrier.

One of the paired planetary pinion gears (the outer gear) is meshed with the planetary ring gear and the other side (the inner gear) is meshed with the planetary sun gear of the rear output shaft.

The drive force from the transfer clutch hub is transmitted to the planetary ring gear via the center differential lock sleeve.

The planetary carrier transmits the drive force to the front wheels and the planetary sun gear transmits the drive force to the rear wheels.

In addition, a center differential lock mechanism is provided in the front of the center differential.

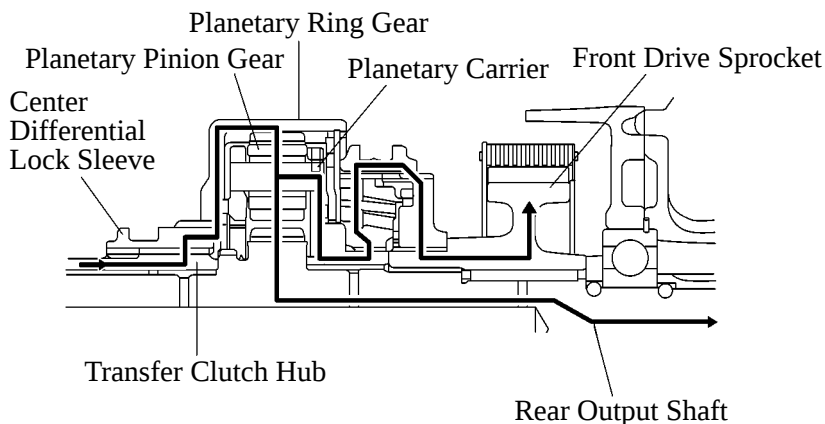


Operation

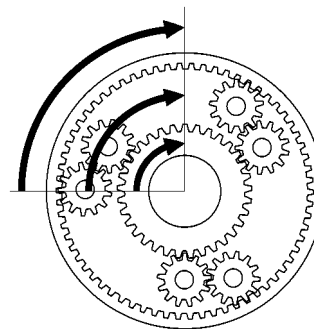
1) Free Mode

a. When the Vehicle is Travelling Straight

There is practically no speed difference between the front and rear wheels the vehicle is running straight at a constant speed. In this condition, the transfer clutch hub, drive sprocket and rear output shaft rotate at the same speed. That is, they rotate together with the center differential unit. In this case, the driving force from the transfer clutch hub is distributed uniformly and transmitted to the front and rear wheels from the planetary pinion carrier.



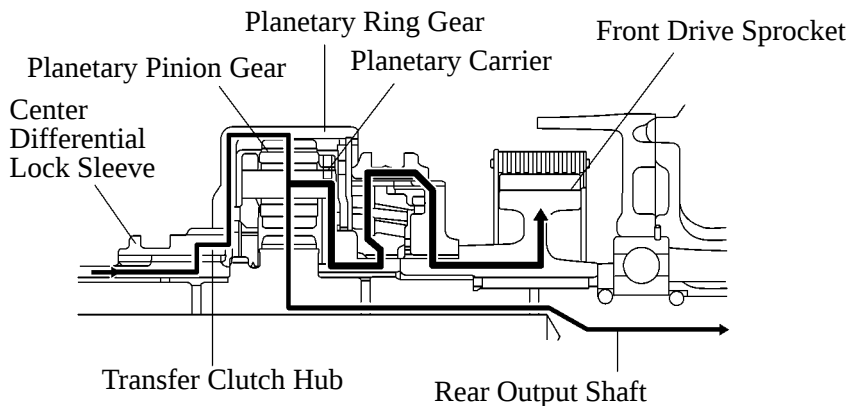
160RN15



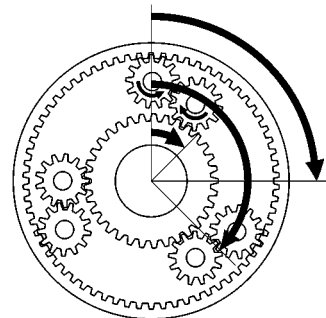
160RN16

b. When the Vehicle is Cornering

If a speed difference is generated between the front and rear wheels due to a turn, etc., the planetary pinion of the center differential unit rotates and absorbs the speed difference. For example, if the speed of the front wheels becomes greater than the speed of the rear wheels, the front drive sprocket rotates faster than the transfer clutch hub. As a result, the planetary carrier rotates faster, but in the same direction as the planetary ring gear. This causes the pinion gear (outer), which is meshed with the planetary ring gear, to rotate in the opposite direction while orbiting (revolving) the ring gear in the same direction. As a result, the other pinion gear (inner) rotates in the same direction as the ring gear and the rotation of the rear output shaft becomes slower than that of the drive sprocket by the amount of the rotating of the pinion gear.



160RN17

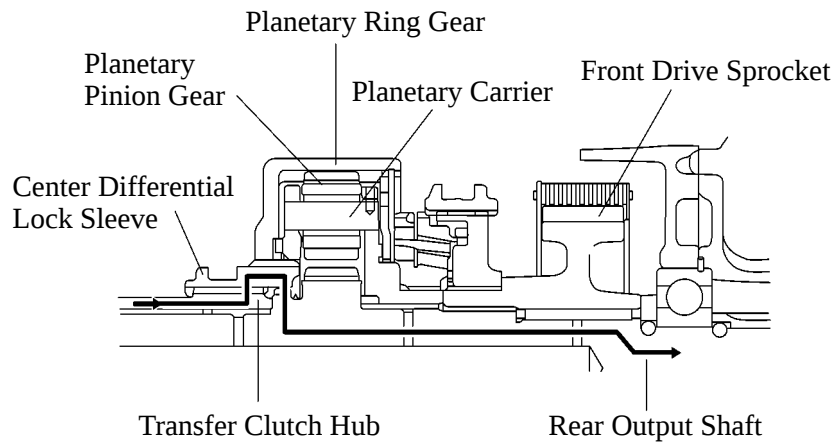


160RN18

2) Lock Mode

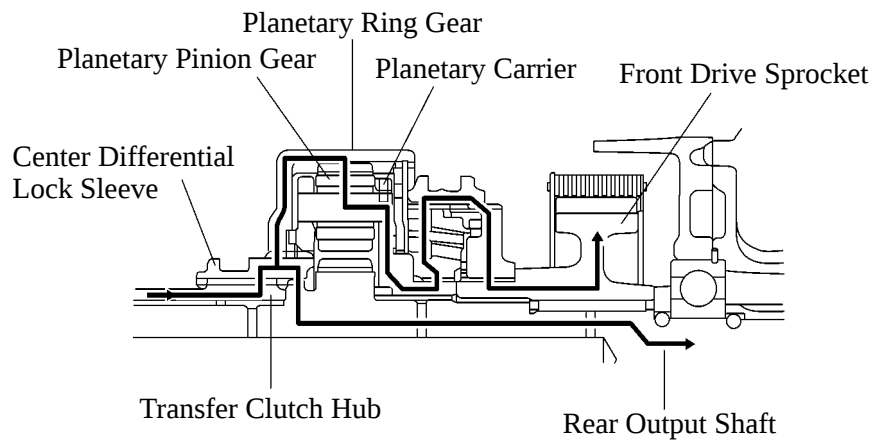
The center differential lock sleeve moves to the right, enabling the inner teeth of the center differential lock sleeve to mesh with the rear output shaft.

As a result, the center differential stops operating and assumes a locked state.



160RN30

H2 Condition



160RN19

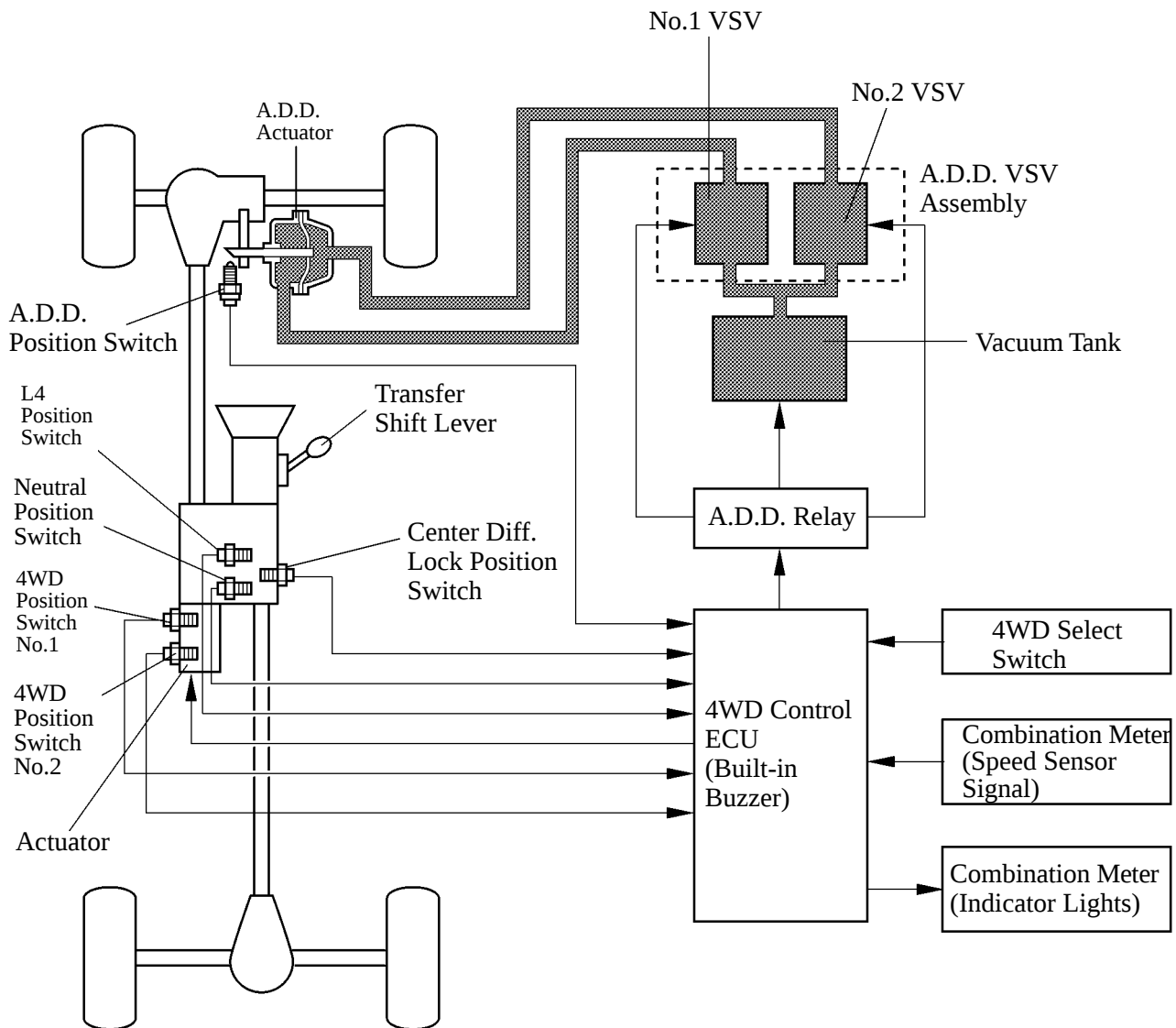
H4L Condition

5. Multi-Mode 4WD System

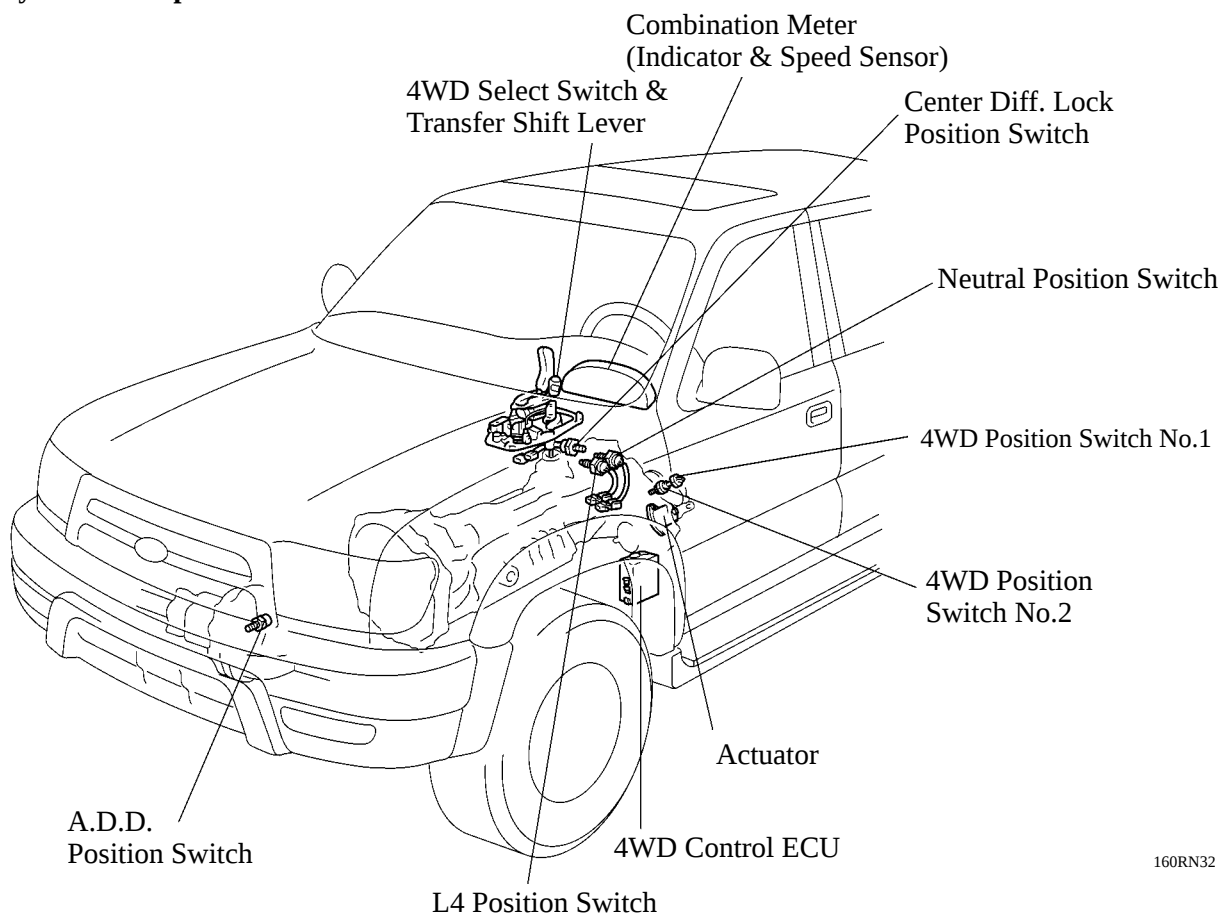
General

Through the combination of the VF3AM transfer and A.D.D., the multi-mode 4WD system maximizes the dynamic performance and achieves an efficient run by enabling an optimal driving mode to be selected from the 4 types of driving modes (in the H2, H4, H4L, and L4L ranges) in accordance with the road conditions, by operating the transfer shift lever and the 4WD select switch. The basic construction and operation of the A.D.D. are the same as that of '98 model.

System Diagram



Layout of Components



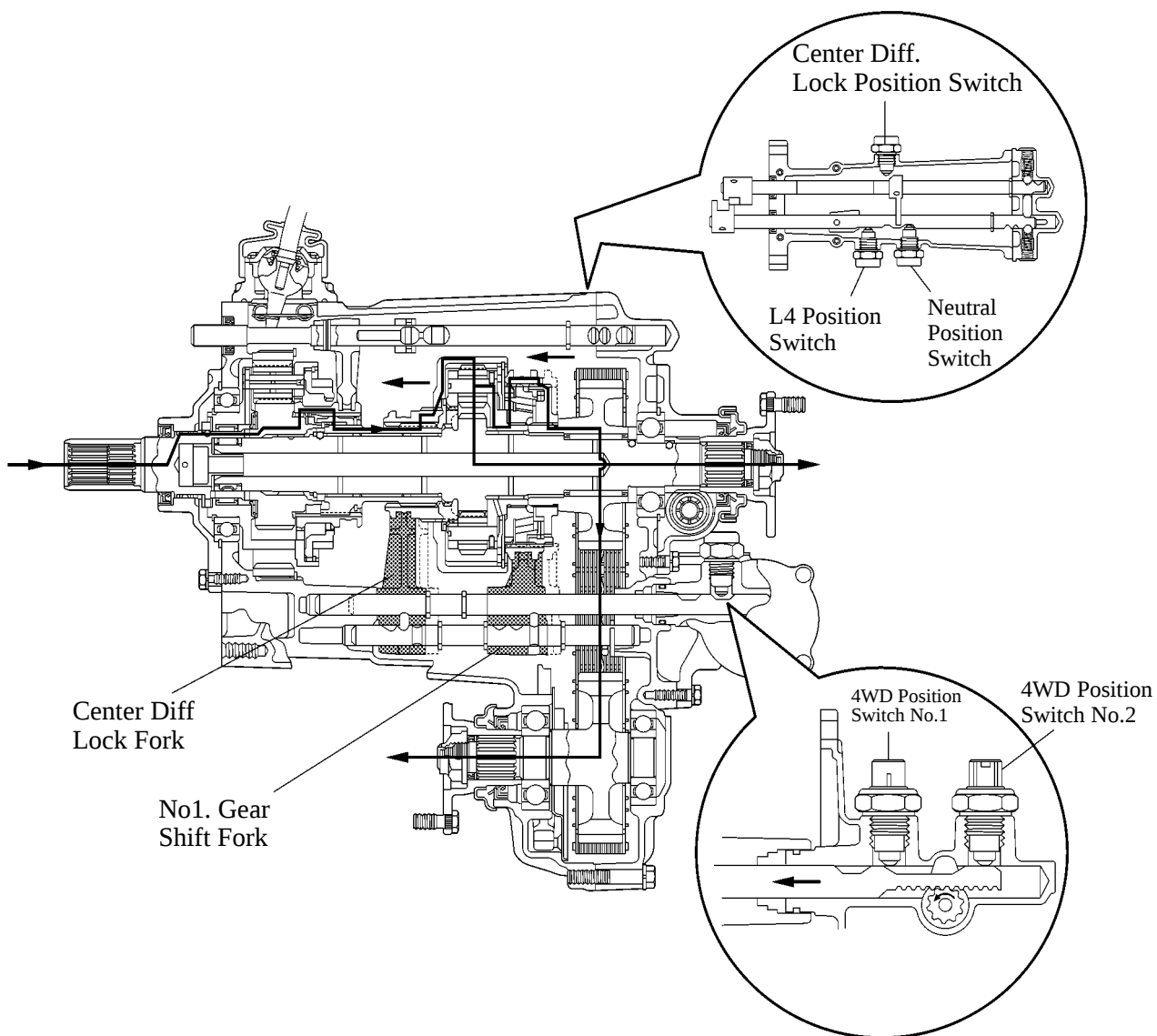
Function of Components

Components	Function
4WD Indicator Light	Indicates to the driver that both the transfer and A.D.D. are in the 4WD mode.
Center Diff. Lock Indicator Light	Indicates that the transfer is in the 4WD mode and the center differential is in the locked state.
A.T.P. Indicator Light	Indicates that the transfer is in the neutral state and that parking will not engage even if the A/T shift lever is moved to the P position.
Vehicle Speed Sensor	Detects the vehicle speed.
4WD Select Switch	Changes the driving mode (2WD or 4WD) of transfer and A.D.D.
L4 Position Switch	Detects that the transfer is in the L4 mode.
Neutral Position Switch	Detects that the transfer is in the neutral mode.
Center Diff. Lock Position Switch	To detect that the transfer shift lever is at the position of the center differential lock.
Transfer Shift Actuator	Drive the motor and changes the transfer driving mode (2WD or 4WD) in accordance with signals from the 4WD control ECU.
4WD Position Switch No.1	Detects that the transfer is in the H4L mode.
4WD Position Switch No.2	Detects that the transfer is in the 4WD mode.
A.D.D. Position Switch	Detects the A.D.D. driving mode.
4WD Control ECU	Changes the transfer and A.D.D. driving mode according to the condition of the 4WD select switch and other switches and sensors.

System Operation

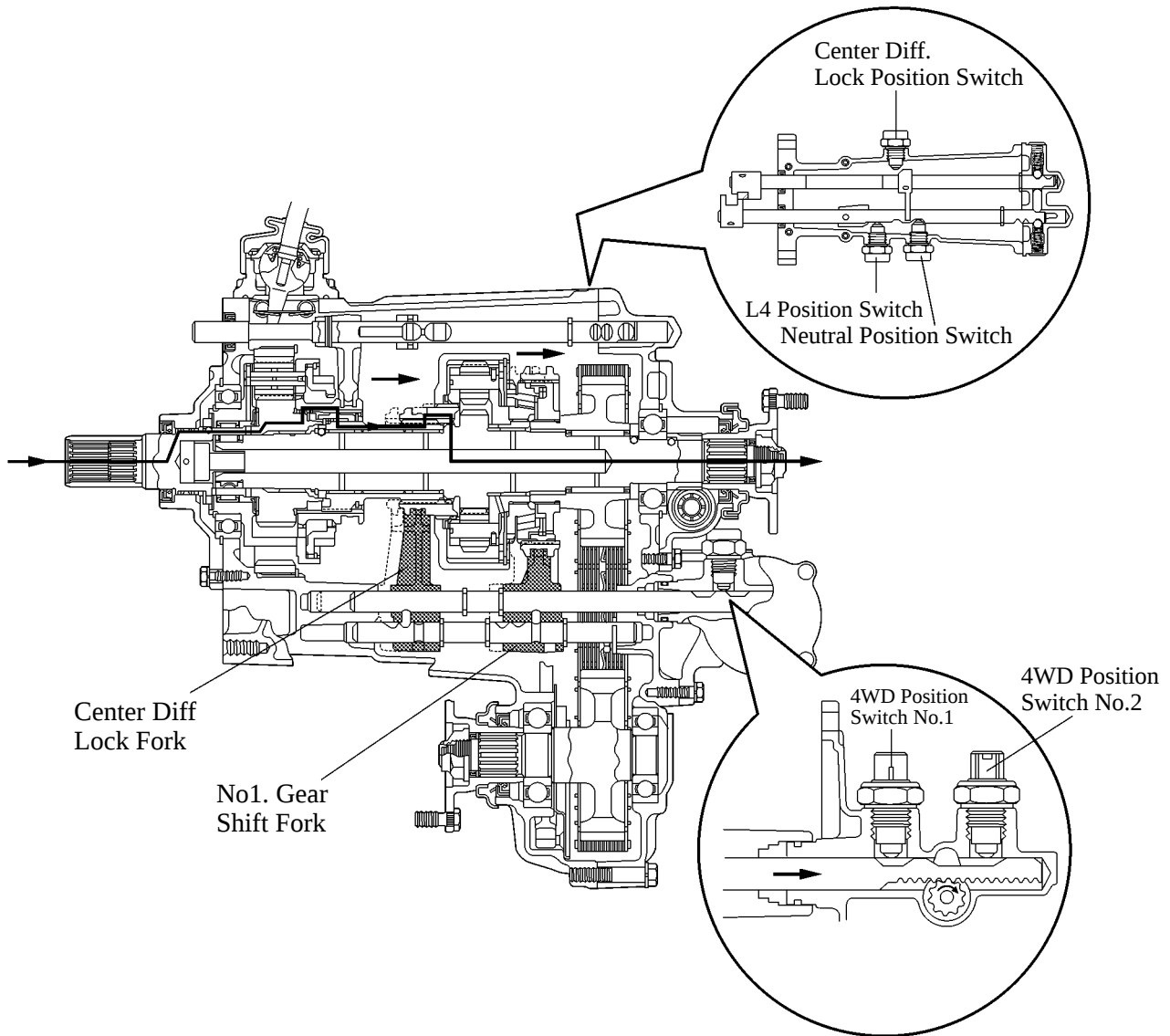
1) Shifting from H2 into H4 Range

When the 4WD select switch is turned from OFF to ON (H2 to H4), this signal is input into the 4WD control ECU. Then, the 4WD control ECU actuates the transfer shift actuator. The transfer shift actuator moves the gear shift fork No.1 to the left, causing the transfer to be momentarily in the H4L mode (this is because the center differential is locked in the 2WD mode, and also because it is before A.D.D. activates). At this time, the 4WD position switch No.1 turns ON. Then, because the 4WD select switch is ON and the center differential lock position switch is OFF, the 4WD control ECU activates A.D.D. to render it in the locked (4WD) state, and actuates the transfer shift actuator again to move the center differential lock fork to the left. As a result, the center differential is freed and the transfer assumes the H4 mode.



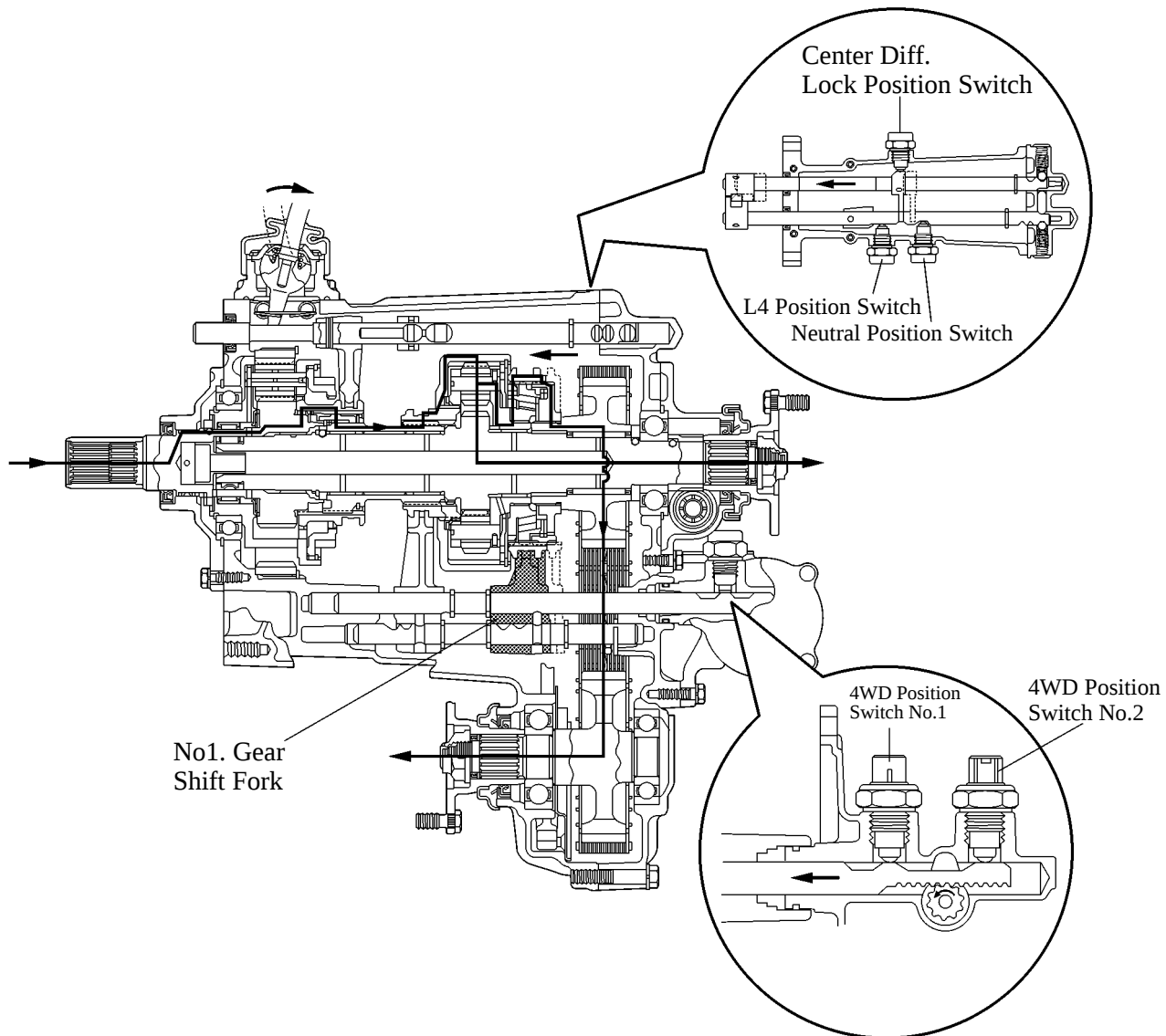
2) Shifting from H4 into H2 Range

When the 4WD select switch is turned from ON to OFF (H4 to H2), this signal is input into the 4WD control ECU. Then, the 4WD control ECU actuates the transfer shift actuator. The transfer shift actuator moves the center differential lock fork to the right, causing the vehicle to be momentarily in the H4L mode. At this time, the 4WD position switch No.1 turns ON. Then, because the 4WD select switch is OFF and the center differential lock position switch is OFF, the 4WD control ECU activates A.D.D. to render it in the free (2WD) state, and actuates the transfer shift actuator again to move the gear shift fork No.1 to the right. As a result, the transfer assumes the H2 mode.



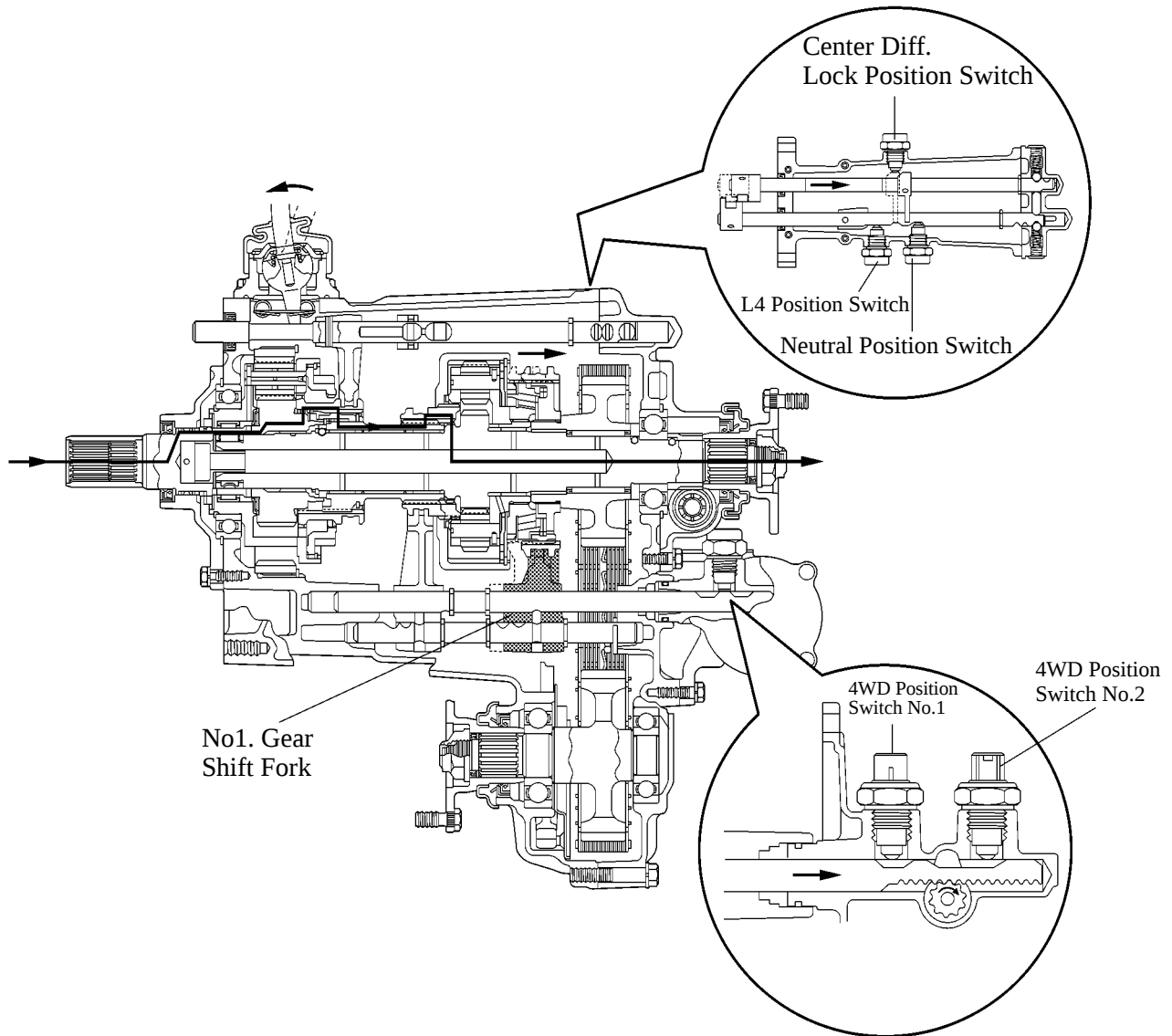
3) Shifting from H2 into H4L Range

When the transfer shift lever is shifted from H2 to H4L, the center differential lock position switch turns ON. This signal is input into the 4WD control ECU, and the ECU actuates the transfer shift actuator. Accordingly, the transfer shift actuator moves the gear shift fork No.1 to the left, locks the center differential, and causes the transfer to assume the H4L mode. At this time, the 4WD position switch No.1 is turned ON. Then, because the center differential lock position switch is ON, the 4WD control ECU operates A.D.D. to assume the locked (4WD) state.



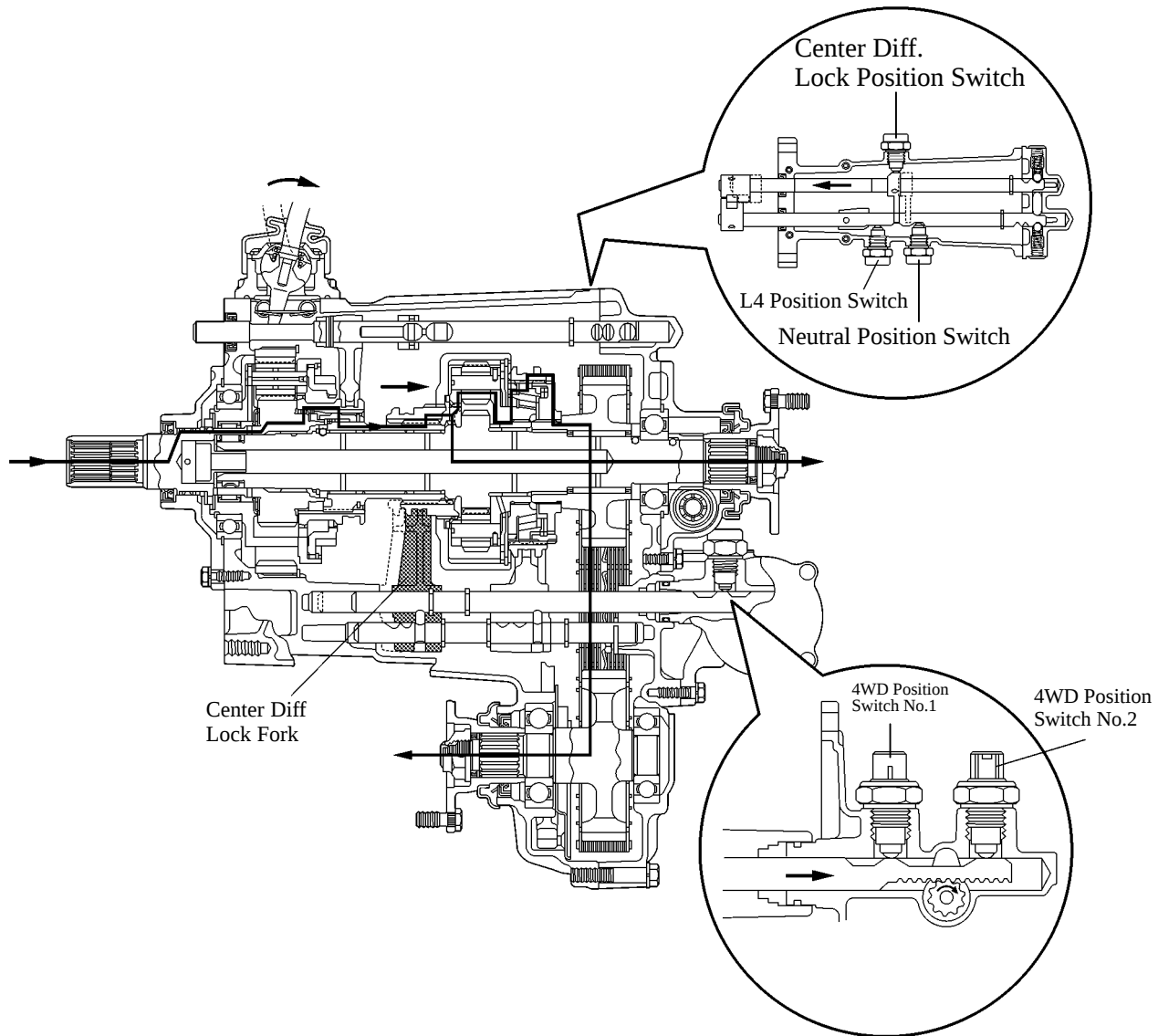
4) Shifting from H4L into H2 Range

When the transfer shift lever is shifted from H4L to H2, the center differential lock position switch is turned OFF. This signal is input into the 4WD control ECU, causing the ECU to actuate the transfer shift actuator. Accordingly, the transfer shift actuator moves the gear shift fork No.1 to the right, enabling the transfer to assume the H2 mode. At this time, the 4WD position switch No.1 turns OFF. Then, because the 4WD select switch is OFF and the center differential lock position is OFF, the 4WD control ECU operates A.D.D. to assume the free (2WD) state.



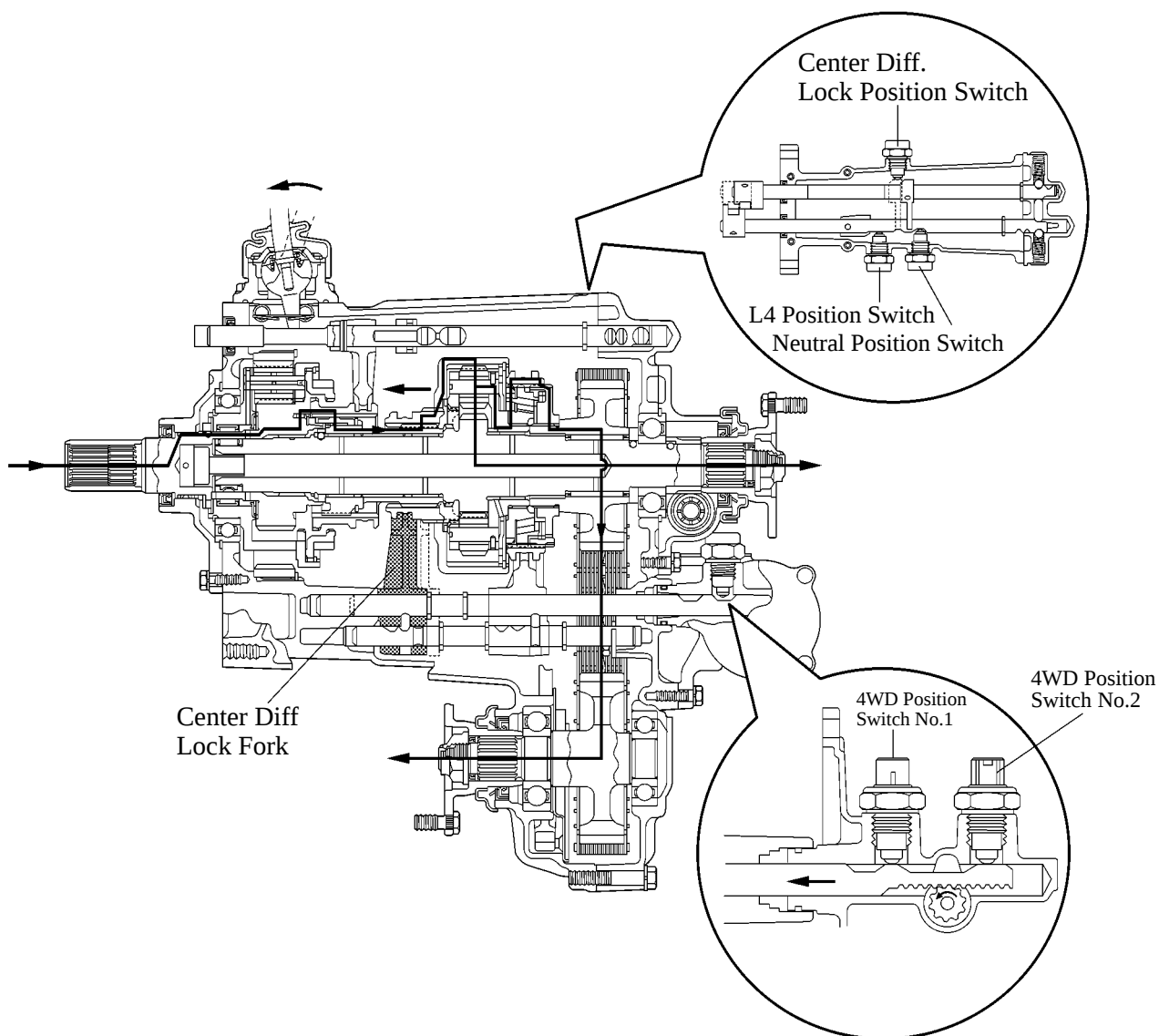
5) Shifting from H4 into H4L Range

When the transfer lever is shifted from H4 to H4L, the center differential lock position switch turns ON. This signal is input into the 4WD control ECU, and the ECU actuates the transfer shift actuator. Accordingly, the transfer shift actuator moves the center differential lock fork to the right, locks the center differential, and assumes the H4L mode.



6) Shifting from H4L into H4 Range

When the transfer shift lever is shifted from H4L to H4, the center differential lock position switch turns OFF. This signal is input into the 4WD control ECU, and the ECU actuates the transfer shift actuator. Accordingly, the transfer shift actuator moves the center differential lock fork to the left, frees the center differential, and assumes the H4 mode.



7) Shifting from H4L into L4L Range

When the transfer shift lever is shifted from H4L to L4L, the gear shift fork No.2 moves to the right, and the planetary carrier and the high & low clutch sleeve mesh and assume the L4L mode.

8) Shifting from L4L into H4L Range

When the transfer shift lever is shifted from L4L to H4L, the gear shift fork No.2 moves to the left, and the input shaft and the high & low clutch sleeve mesh and assume the H4L mode.

9) Shifting from H2 into H4 or H4L range when the vehicle speed is higher than 100 km/h (62 mph)

When driving in the 2WD mode, when the 4WD control ECU determines that the vehicle speed is higher than 100 km/h (62 mph) according to the vehicle speed signal from the combination meter, even if the H4 or H4L mode is selected, the 4WD control ECU restricts the operation of the transfer shift actuator. At this time, the 4WD control ECU flashes the 4WD indicator light and the center differential lock indicator light and intermittently sounds the buzzer that is enclosed in the 4WD control ECU. Thus, the driver is informed that it cannot be shifted to the H4 or H4L range. This control is canceled if the transfer shift lever is returned to the H2 mode or if the vehicle speed is reduced to be lower than 100 km/h (62 mph).

10) Shift halfway control

If the transfer shift actuator does not switch even if approximately 3 seconds have elapsed after the shift operation, the 4WD indicator light and the center differential lock indicator light flash to inform the driver that the shifting is halfway. After the switching of the transfer shift actuator is completed, the flashing of the indicator lights will stop.