

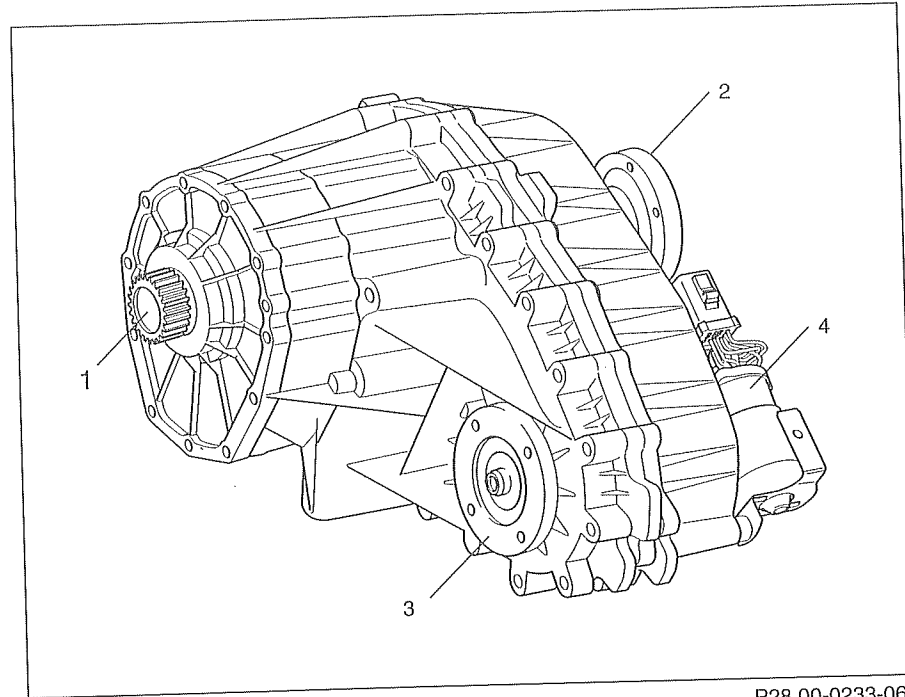
Transfer Case

System Description

The transfer case for the M-Class is a full-time four-wheel drive design with an open center differential utilizing a double planetary gear set.

The transfer case also incorporates another planetary gear set that is electrically shifted for either high or low range. A chain connects the front and rear output shafts.

- 1 Input shaft
- 2 Rear output flange
- 3 Front output flange
- 4 Hi-Lo motor

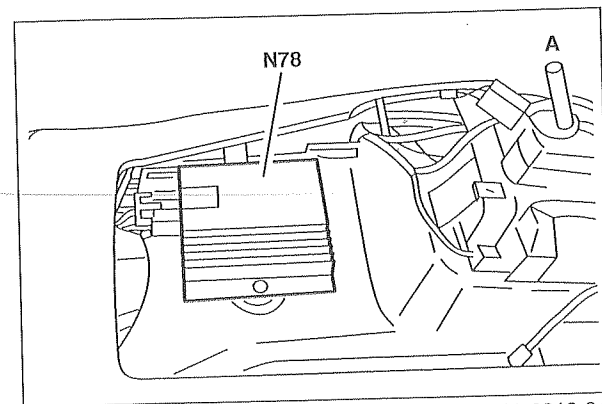


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Component Location

Transfer Case Control Unit

The transfer case control unit N78 is located on the tunnel below the console, aft of the shifter.



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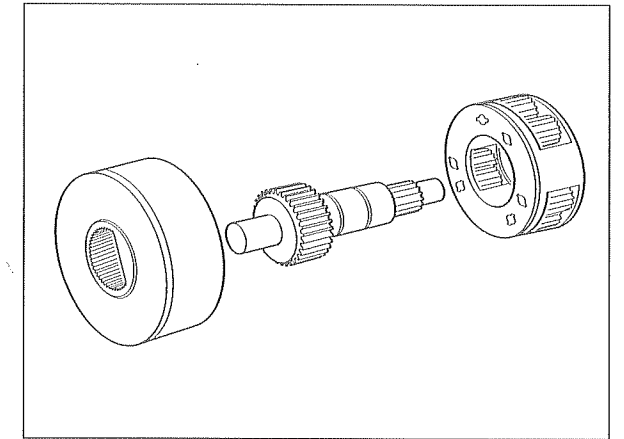
- A Shifter
- N78 Transfer case control module

Component Description

Transfer Case

The transfer case is contained in an aluminum housing that is flange-connected directly to the 5-speed automatic transmission.

The double planetary gear differential is on the output shaft driving the rear driveshaft. A gear meshed into the rear of the double planetary gear set drives the front driveshaft through a multi-link chain. A drum style ring gear connects the intermediate shaft to the output shaft through the planetary pinion gears.

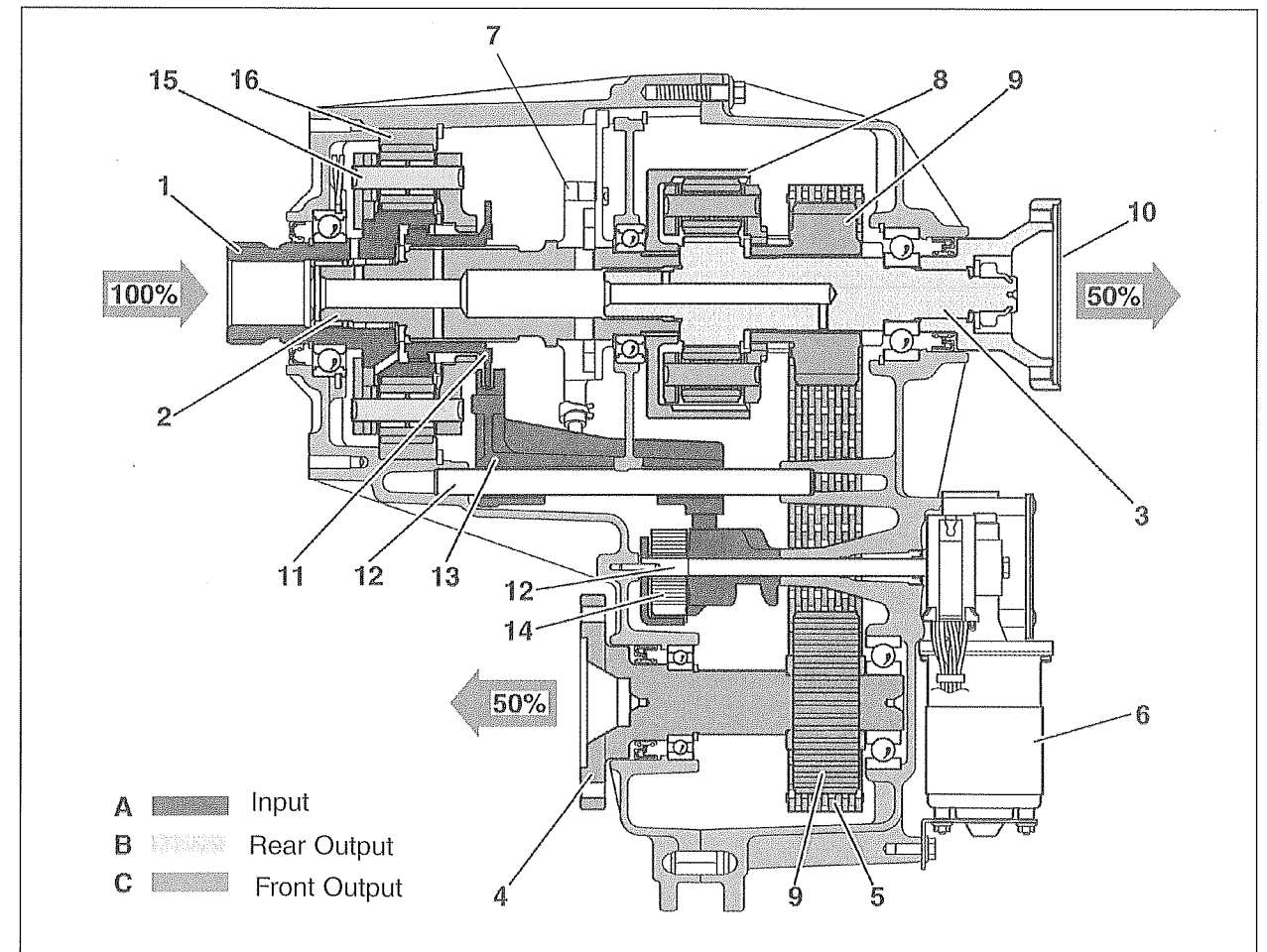


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The 2-speed front planetary gear set located on the input shaft as a part of the carrier assembly has a 1:1 ratio high range. The low range, off-road reduction is 2.64:1.

- 1 Input shaft
- 2 Intermediate shaft
- 3 Output shaft
- 4 Front output flange
- 5 Chain
- 6 Shift motor
- 7 Oil pump
- 8 Double planetary gear set
- 9 upper drive sprocket
- 10 Rear output flange
- 11 Reduction hub (high position)
- 12 Shift shaft and cam
- 13 Shift fork
- 14 Shift spring
- 15 Planetary pinion shaft
- 16 Planetary gear set (carrier assy.)

Transfer Case Cross Section



28100241

Low range gearing uses helical cut gears for quiet operation. The transfer case provides front-to-rear torque as follows:

Transfer Case	% Torque Split
Series 1	50-50
Series 2	48-52

Note:

M-Class built through early 1998 will have the Series 1 transfer case. Vehicles built after that date will have the Series 2 transfer case.

The input and two output shafts ride in ball bearings. The intermediate shaft is supported by a ball bearing in the center and by a pocket needle bearing in the front. All bearings are

System Operation

Under normal highway operating conditions, the power from the transmission is directly coupled to both front and rear drive shafts.

Power Flow from the Input Shaft to the Intermediate Shaft

High Gear Range

Power is transferred from the transmission through the input shaft which has the sun gear for the high/low simple planetary gear set machined onto it. The input shaft, being engaged with the intermediate shaft by splines on the inside diameter of the sun gear, provides a direct 1:1 connection to the output shafts. The 3 planetary (pinion) gears on the simple planetary carrier mesh with the sun gear, but the carrier rotates freely around the sun gear, within the ring gear which is attached to the transfer case housing. The carrier is "in neutral" and no gear reduction is taking place.

Low Gear Range

In low gear range, power is transferred from the transmission through the input shaft to the planetary carrier. A reduction hub is splined onto the intermediate shaft and has gear teeth on its

nondirectional except the input shaft bearing.

Transfer case lubrication is separate from the automatic transmission lubrication. The transfer case uses DEXRON II E or DEXRON III ATF. A Gerotor pump riding on the intermediate shaft provides the internal oil pressure in forward speeds.

Hi-Lo Motor

The Hi-Lo Motor is controlled by the transfer case control unit (N78). The bi-directional motor shifts the planetary gear set into Hi (1:1) or Low (2.64:1) gear.

front outer edge. In high gear, those teeth are in a neutral position within the carrier, engaging the planetary (pinion) gears. When low range is selected, a shift fork pulls the reduction hub back, engaging the gear teeth on a flange that is pinned to the planetary carrier body. This engagement allows power to flow from the input shaft, through the sun gear, through the planetaries (pinions) and out from the carrier to the intermediate shaft. The gear reduction is 2.64:1.

Power Flow from the Intermediate Shaft

A drum type ring gear is splined onto the rear of the intermediate shaft and provides power from the intermediate shaft to the outer planetaries (pinions) of the double planetary gear set. The outer planetaries (pinions) transfer power to a gear which runs on the output shaft and meshes with a gear attached to the outside of the carrier. The carrier, via the dual outside gear, drives the chain to the front output shaft.

The inner splines of the drum style ring gear drive the rear output shaft and small sun gear, which drives the inner planetary pinions.

Double Planetary as Differential

Because the small sun gear is fixed to the shaft and the large sun gear rotates freely on the rear output shaft, the double planetary gear set is able to compensate for differences in front or rear drive shaft speeds, which is what makes it a differential.

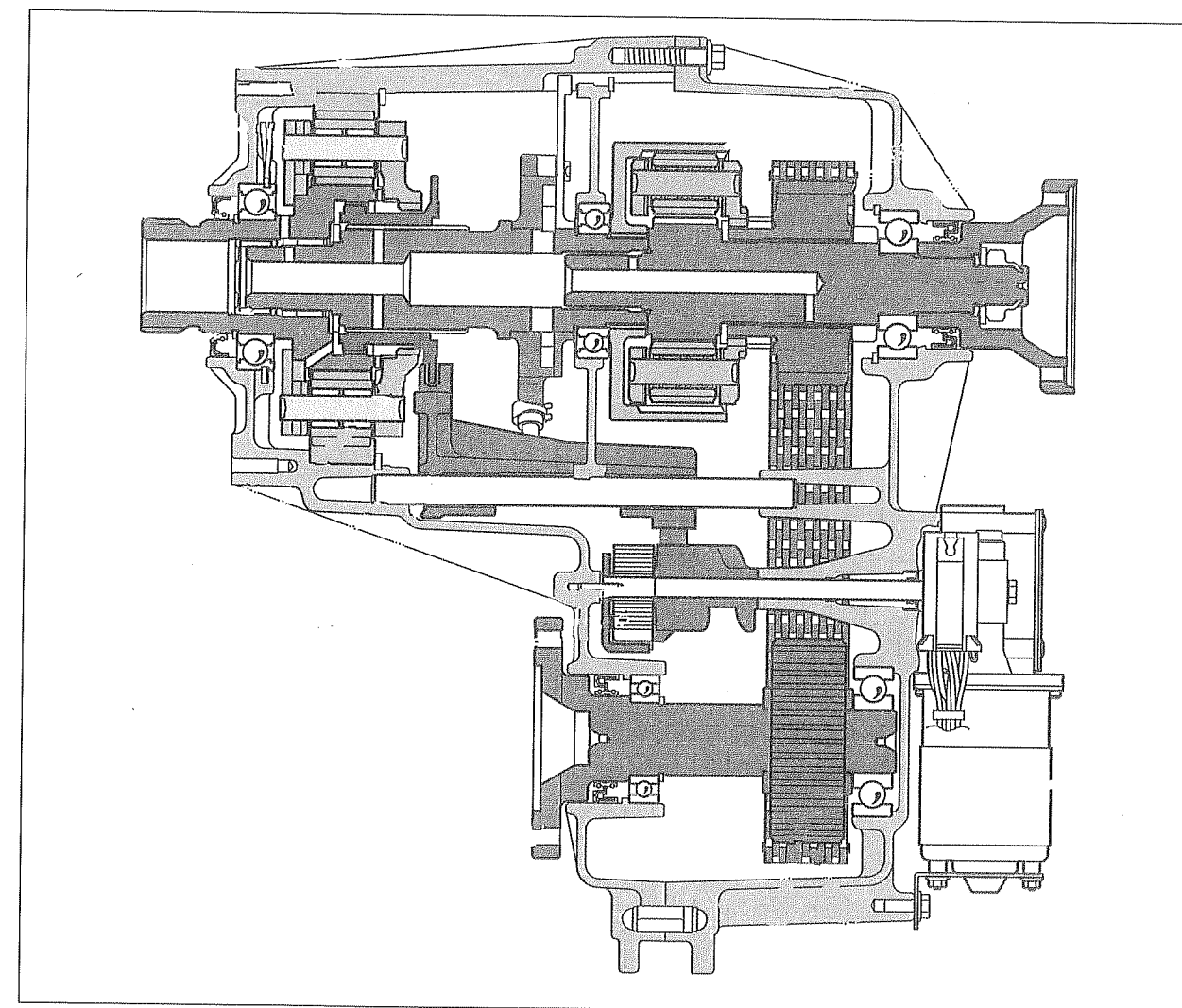
Shift Fork in High and Low Range

For typical driving conditions the transfer case is normally in high range. A flat spring on the shift

shaft that is also attached to the shift cam, holds the shift lever in the high range position.

When the driver selects low range the electric shift motor rotates the cam which moves the shift fork which pulls the reduction hub back, locking the planetary carrier to transfer power through the planetary pinions and provide gear reduction.

Transfer Case High Range



Transfer Case Electronic / Electric Control

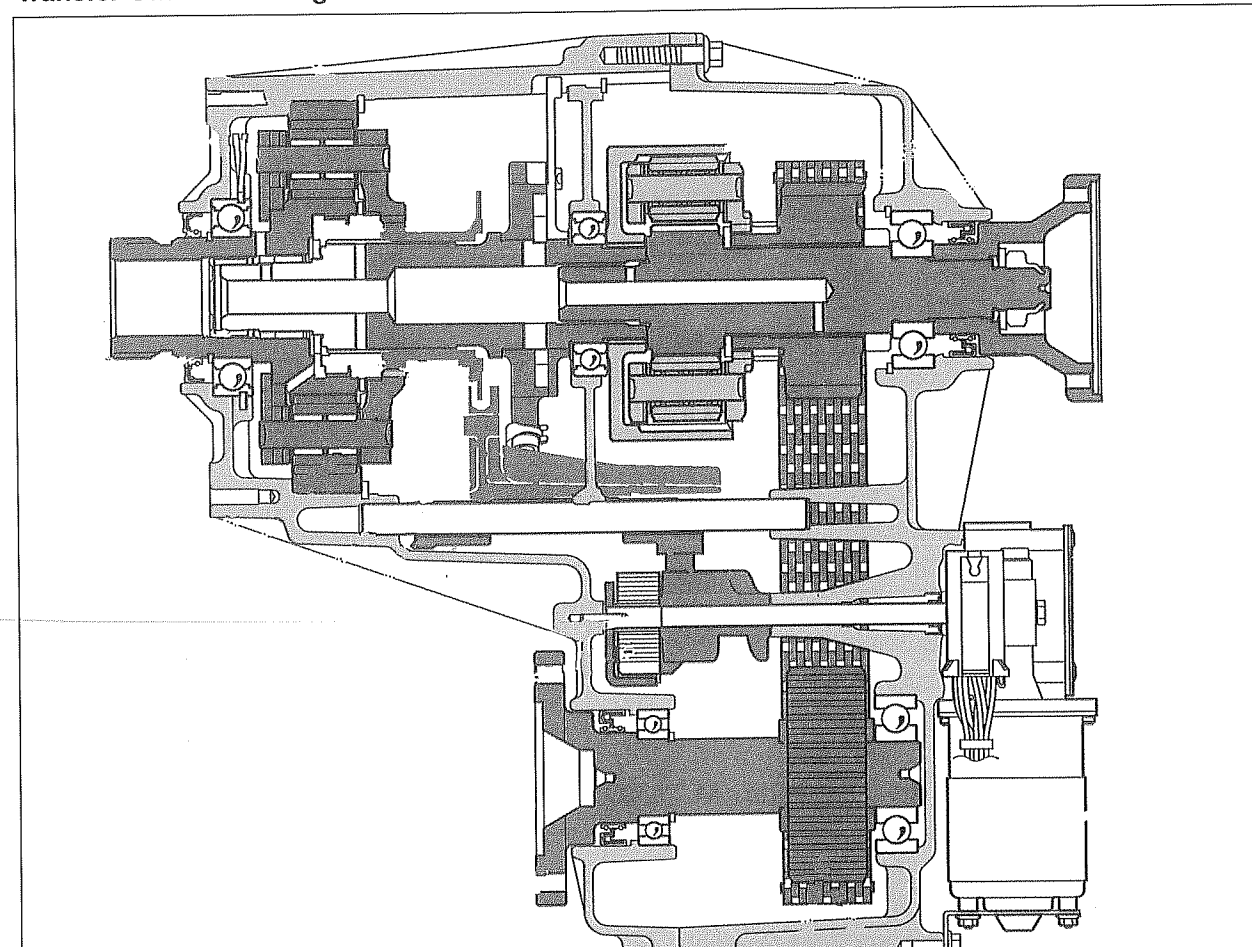
The electric shift motor is under the control of the Transfer Case ECU (N78). Shifting between high and low range is done by controlling a bi-directional DC motor that controls the transfer case shift shaft. The control module N78 utilizes the CAN bus to receive and transmit information required for operation of the shift motor. The control module N78 is operational when the ignition switch is in position 2. The CAN bus supplies the control module N78 with information on vehicle speed, transmission status and engine RPM. The control module N78 transmits information to the CAN on high or low range status, diagnostics to the All Activity Module N10, and notice of proper shift conditions being met (or not).

Shift Strategy

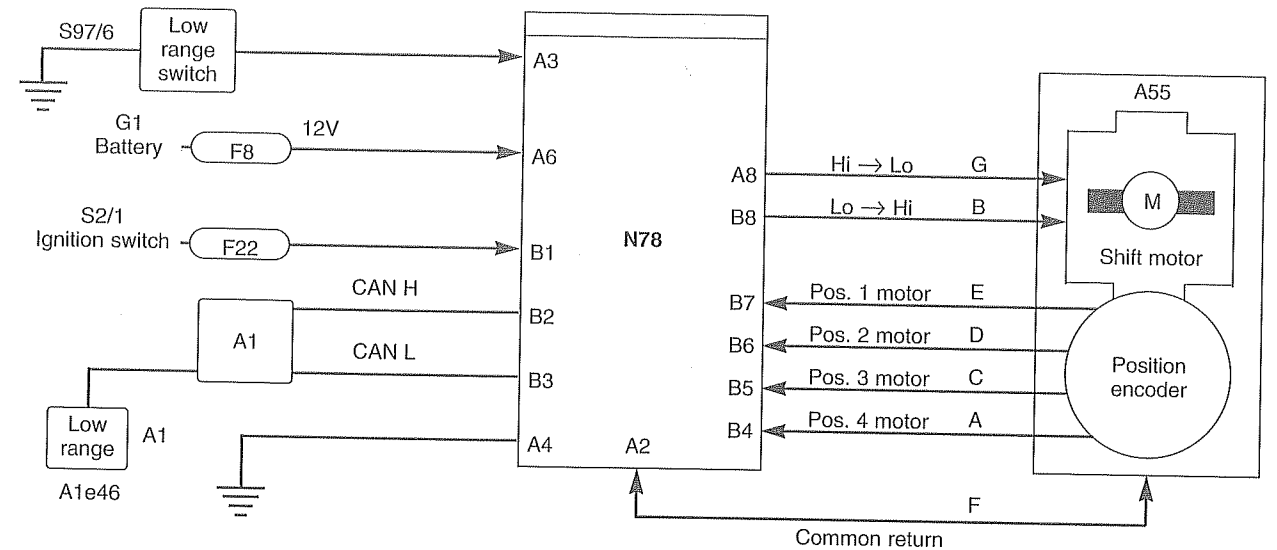
The Transfer Case ECU (N78) looks for the following conditions:

- **All four wheels at zero speed.**
CAN bus data from the 4-ETS/ABS module must show the speed of all four wheels at 0 km/h (signal from the wheel speed sensors).
- **A/T in Neutral.**
CAN bus data from the ETC (N15/3) must show the transmission gear selector lever in the "N" position.
- **Engine at idle speed.**
CAN bus data from the engine ECM must show engine speed between 400 and 1500 rpm.
- **Hi-Lo shift motor (A55) in position.**
The transfer case shift motor (A55) must be in a proper position to shift (e.g., high range) and providing a valid code to the shift motor position encoder in the Transfer Case ECM N78.

Transfer Case Low Range



Hi-Lo Motor Control Circuit



If all conditions are met, the low range lamp blinks three times during the switch-over. A steady light from the low range lamp indicates the low range shift has taken place.

The light flashes four times within two seconds if the switching conditions are not met or if the low range mode is defective.

Service Tips

- The low range mode is defective and a fault is detected if the low range lamp pulses for 5 seconds on and 5 seconds off.
- Lubrication is Dexron IIE or Dexron IIIATF.
- The ATF oil should not need replacement during the normal life of the vehicle.
- The transfer case has four (4) replaceable seals. (Refer to the exploded parts illustration).

Part #	Quantity	On-vehicle replacement
(24)	(2)	- Rear seal only
(44)	(1)	-
(22)	(1)	N/A

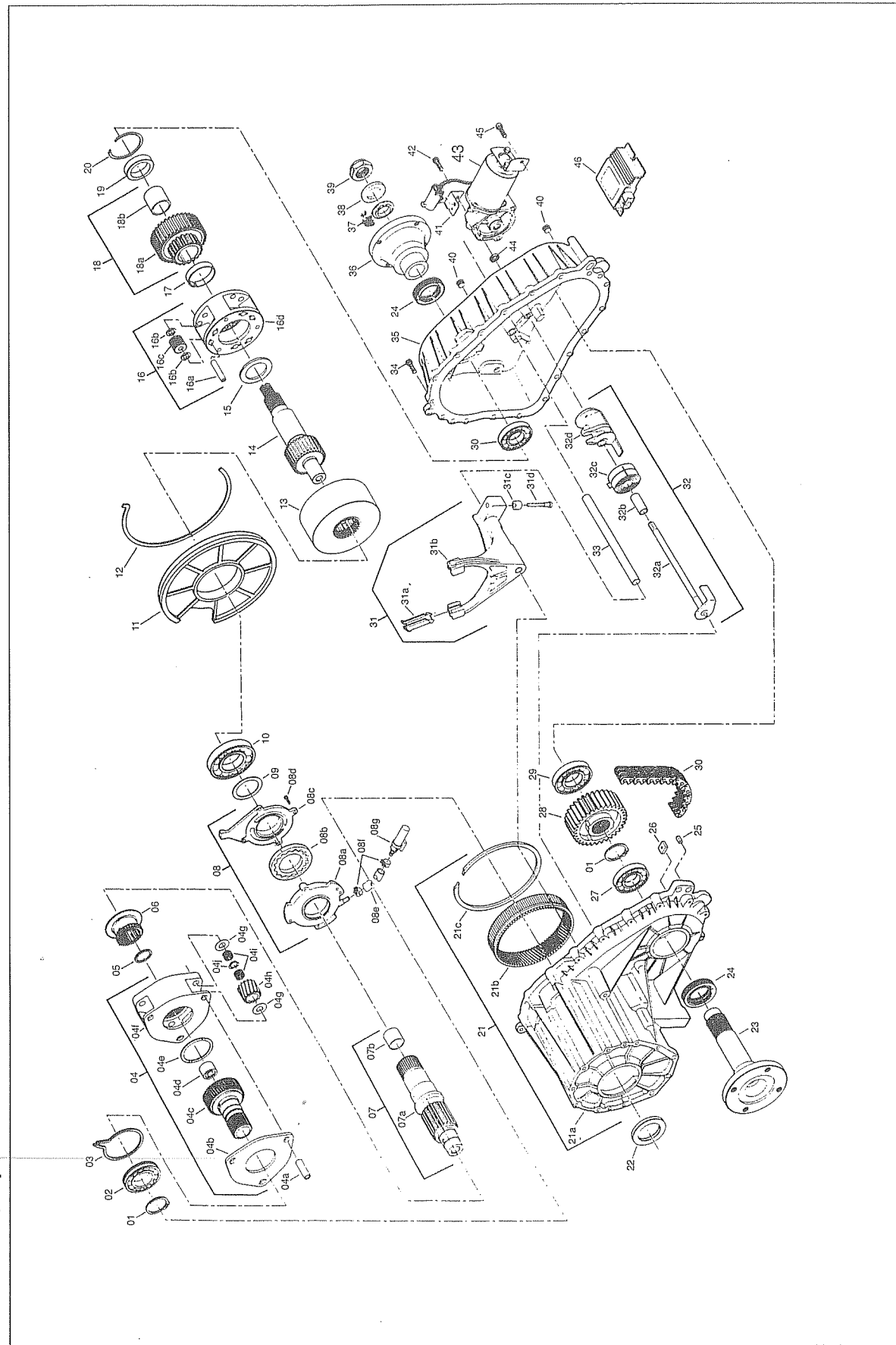
The rear oil seal (24) must be installed

To switch back to the high range the same conditions must be met. The low range lamp switches OFF to indicate a shift back to high range.

If all conditions are met, the control module N78 will apply the proper polarity to shift motor A55 until the position encoder returns the desired signal. At that time the voltage is removed from the shift motor A55 and the position is updated via the CAN to the instrument cluster A1.

- To disassemble the transaxle, note the following:
 - The transfer case must be in high range before disassembly.
 - The external snap ring (03) is partially hidden by the front carrier assembly (04).
- When reassembling the transaxle, note the following:
 - Align the flat on the intermediate shaft (07) with the flat in the pump drive (08) before reinstalling.
 - The installed pump should rest completely below the ball bearing support (11) area in the transfer case housing.
 - Verify the thrust washer (15) is installed inside the carrier assembly.

Transfer Case, exploded view



4780018

Item No.	Description	Qty
01	Ring, Snap	1
02	Bearing, Ball	1
03	Ring, Snap	1
04*	Asm. - Carrier Complete	1
04a	Shaft, Pinion	3
04b	Plate, Planet Carrier	1
04c	Shaft, Input	1
04d	Bearing, Needle	1
04e	Washer, Thrust	1
04f	Carrier, Planet	1
04g	Washer, Thrust	6
04h	Gear, Pinion	3
04i	Bearing, Needle	90
04j	Spacer, Pinion	3
05	Washer, Thrust	1
06	Hub, Reduction	1
07*	Asm. - Intermediate Shaft	1
07a	Shaft, Intermediate	1
07b	Bushing	1
08*	Asm. - Gerotor Pump	1
08a	Cover, Gerotor Pump	1
08b	Gear Sot. Gerotor	1
08c	Gerotor Pump Body	1
08d	Bolt	4
08e	Hose	1
08f	Clamp, Hose	2
08g	Lube Pickup & Filter	1
09	Washer, Thrust	1
10	Bearing, Ball	1
11	Support, Ball Bearing	1
12	Ring, Retaining	1
13	Gear, Differential Ring	1
14	Shaft, Rear Output	1
15	Washer, Thrust	1
16*	Asm. - Carrier Complete	1
16a	Shaft, Pinion	6
16b	Washer, Thrust	12
16c	Gear, Pinion	6
16d	Carrier, Planet	1
17	Spacer	1
18*	Asm. - Upper Sprocket	1
18a	Sprocket, Upper Drive	1
18b	Bushing	1

Item No.	Description	Qty
19	Spacer	1
20	Ring, Retaining	1
21*	Asm. - Case	1
21a	Case, Transfer	1
21b	Gear Ring-Reduction	1
21c	Ring, Retaining	1
22	Seal, Oil	1
23	Shaft, Lower Output	1
24	Seal, Oil	2
25	Dowel, Spring Pin	2
26	Magnet	1
27	Bearing, Ball	1
28	Sprocket, Lower Drive	1
29	Bearing, Ball	2
30*	Asm. - Chain, Drive	1
31*	Asm. - Reduction Shift Fork	1
31a	Facing, Shift Fork	2
31b	Fork, Shift Reduction	1
31c	Cam Follower	1
31d	Pin. Shift Fork	1
32*	Asm. - Shift Shaft	1
32a	Shaft, Shift	1
32b	Spacer	1
32c	Spring, Torsion	1
32d	Cam. Electric Shift	1
33	Rail, Shift	1
34	Bolt, Hex Flange Head	18
35	Cover, Transfer Case	1
36	Flange, Companion	1
37	Seal, Oil	1
38	Washer	1
39	Nut, Stake	1
40	Plug, Drain	2
41	Bracket, Motor	1
42	Bolt, Metric Hex Head	3
43	Shift Motor	1
44	Seal, Oil	1
45	Cap Screw, Hex Head	1
46	Electronic Control Unit	1
47	RTV (Neutral Cure)	AR

□ Indicates Sub-Assembly
* Serviced Only as Sub-Assembly