

Up To Standards

Aerostar All Wheel Drive Electronics

By Mike Weinberg
Contributing Editor

Since Ford introduced the all-wheel-drive Aerostar model, equipped with a Dana 28 transfer case, tech lines around the country have been very busy. Part of the problem is a lack of understanding and good information about how this system works. The other part of the problem is resolution of driveline and other problems with design and manufacture that all new

models go through.

I have written articles about the inner workings of the Dana 28 transfer case in previous issues of this magazine, and after a brief review here we will concentrate on understanding the electronics involved and quick diagnostic tips.

The Dana 28 transfer case is a full-time unit that provides all-wheel-drive capability to the Aerostar. In the unit are an

electromagnetic clutch assembly, typical chain-driven sprockets and a planetary set. Under normal driving conditions torque is split 33 $\frac{1}{3}$ to the front axle and 66 $\frac{2}{3}$ to the rear axle. Both output shafts of the transfer case are monitored by speed sensors inputting information to a control module under the driver's seat. When the computer senses a slip

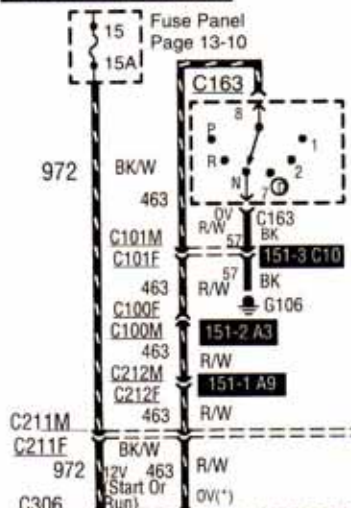
continues page 30

For diagnostic information, refer to Section 07-07 of the Service Manual.

1997 Aerostar All-Wheel-Drive

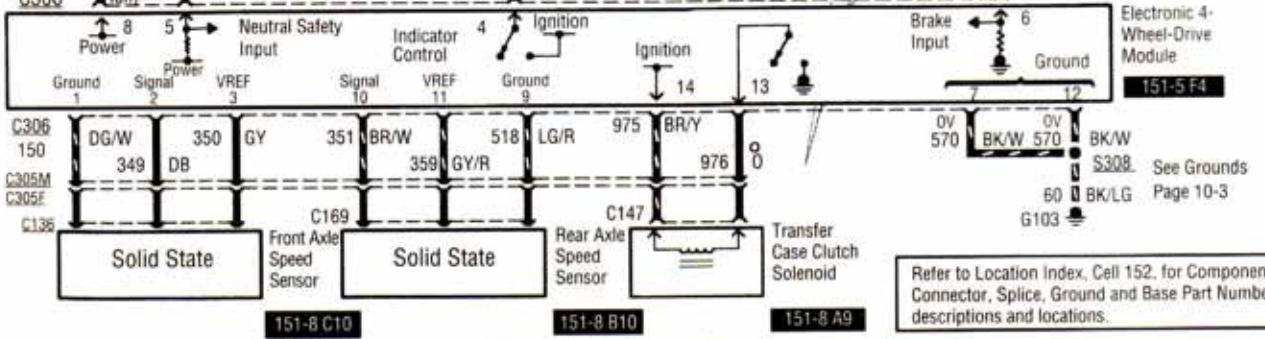
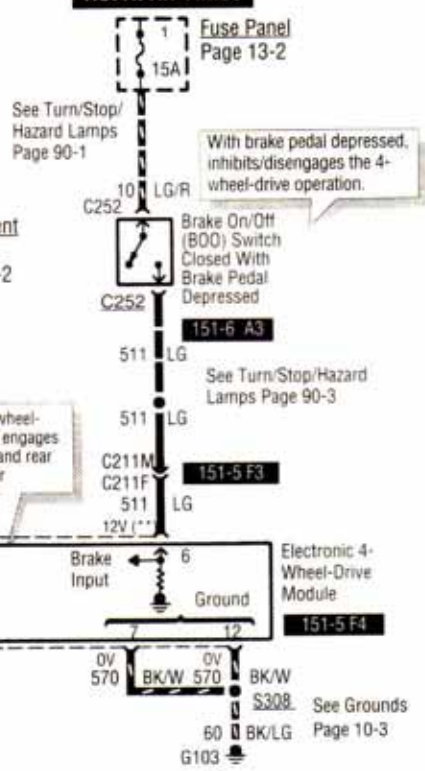
Figure 1

Hot In Start Or Run

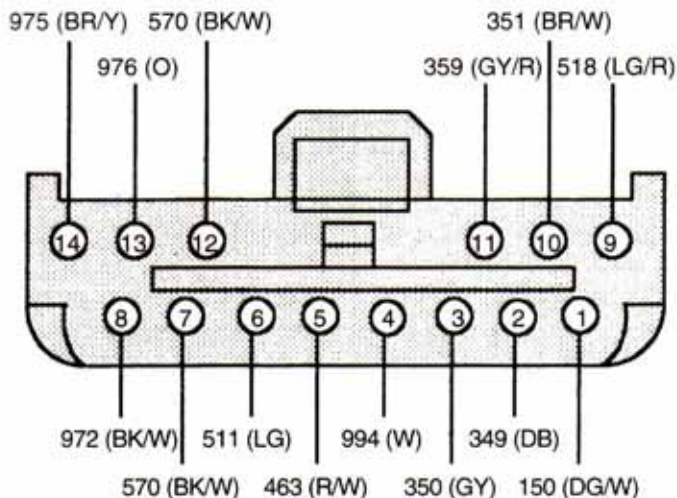


- * With Digital Transmission Range (DTR) Sensor In Neutral
- ** With Brake Pedal Depressed

Hot At All Times



Refer to Location Index, Cell 152, for Component, Connector, Splice, Ground and Base Part Number descriptions and locations.

Figure 2

Electronic 4-Wheel-Drive Module

Pin	Circuit	Function
1	150 (DG/W)	Front-Axle Speed-Sensor Ground
2	349 (DB)	Front-Axle Speed-Sensor Signal
3	350 (GY)	Front-Axle Speed-Sensor VREF
4	994 (W)	Indicator Control
5	463 (R/W)	Neutral Sensor From DTR
6	511 (LG)	Brake On/Off (BOO) Switch
7	570 (BK/W)	Ground
8	972 (BK/W)	Power (Hot in Run)
9	518 (LG/R)	Rear-Axle Speed-Sensor Ground
10	351 (BR/W)	Rear-Axle Speed-Sensor Signal
11	359 (GY/R)	Rear-Axle Speed-Sensor VREF
12	570 (BK/W)	Ground
13	976 (O)	Clutch-Solenoid Signal Low
14	975 (BR/Y)	Clutch-Solenoid Signal High

Note: Front-axle and rear-axle speed sensors generate a variable-frequency square-wave signal that the electronic 4-wheel-drive module uses to compute axle speed.

(different driveshaft speeds), it turns on the electromagnetic clutch for about 3 seconds. This locks the geartrain in the transfer case and provides a 50/50 torque split to the axles.

After 3 seconds the clutch will come off; if the slip is still there the clutch will continue to cycle on and off until axle speeds equalize.

The most-common complaint

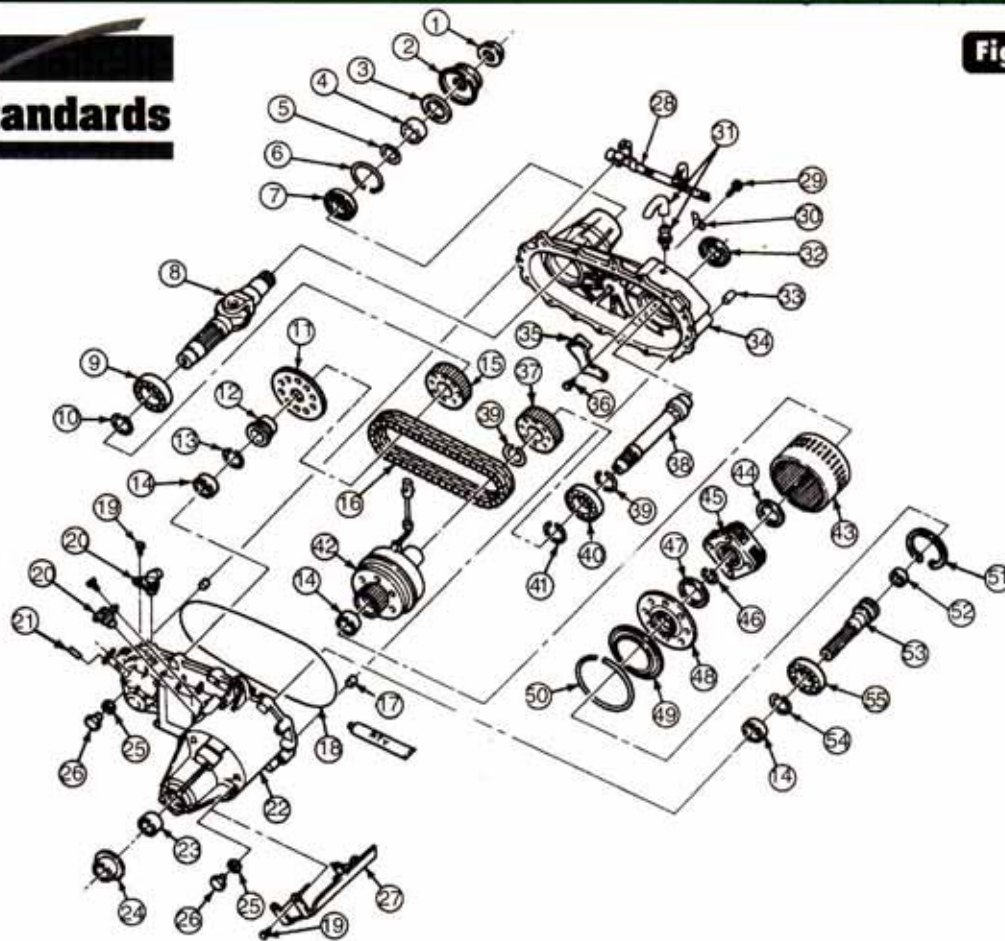
Up To Standards

on these units is wheel hop and vibration during cornering. Before doing anything else on these vehicles, check tire pressures (they all must be equal) and make sure all the tires are the same size and diameter. There has been a high failure rate on the speed sensors. The quickest test here is to go under the driver's seat and disconnect the control module and road-test the vehicle. If the wheel hop is gone, it is safe to assume that the problem is not internal to the transfer case, and the speed sensors should be tested on a scope and replaced as necessary.

There are many concerns with NVH (noise, vibration and harshness) on this unit. Ford has issued a comprehensive technical bulletin addressing these problems, and I would suggest that you obtain a copy of this for reference when one of these vehicles is in the shop. The article is #92-17-12.

The service manuals do not provide adequate electric schematics on these vehicles, so diagnosis is next to impossible. We have included here the factory diagrams, which are excellent aids in diagnosing electronic problems. You will notice that this is a simple system with inputs coming to the control module from the speed sensors on the transfer case, the manual-lever-position sensor, the brake on/off (BOO) switch and the magnetic clutch in the transfer case. With this information you should have no problem getting your customer back on the road.

continues page 32



Number	Description	Number	Description	Number	Description
1	Locknut	20	Sensor	39	Snap Ring
2	Deflector	22	Rear Case Half	40	Ball Bearing
3	Oil Seal	23	Steel Bushing	41	Snap Ring
4	Steel Bushing	24	Oil Seal	42	Electric-Clutch Assembly
5	O-Ring	25	Washer	43	Planetary Ring Gear
6	Snap Ring	26	Hex-Head Plug	44	Thrust Washer
7	Ball Bearing	27	Shield, Heat	45	Planetary Carrier Assembly
8	Front Output Shaft	28	Wiring Harness	46	Snap Ring
9	Ball Bearing	29	Round-Head Drive Screw	47	Thrust Washer
10	Snap Ring	30	Clip	48	Plate
11	Tone Wheel Ring	31	Vent	49	Cover
13	Snap Ring	32	Oil Seal	50	Snap Ring
14	Needle-Bearing Assembly	33	Dowel Pin	51	Snap Ring
15	Drive Sprocket	34	Front Case Half	52	Steel Bushing
16	Drive Chain	35	Oil Baffle	53	Rear Output Shaft
17	Dowel Pin	36	Hex Tapping Screw	54	Snap Ring
18	RTV Sealant	37	Drive Sprocket	55	Ball Bearing
19	Hex-Head Self-Tapping Screw	38	Input Shaft		

One other small but important item to put in your memory banks: The Dana 28 transfer case uses ATF for lube. There is a vent hose on top of the transfer case. This small, U-shaped preformed rubber hose must face the front of the vehicle and be exactly centered.

If the hose is not directly in line with dead center, air rushing by it will create a venturi effect and siphon oil out of the unit. **TD**

THE BOTTOM LINE:

Tell us your opinion of this article:

Circle the corresponding number on the free information card.

- 87 Useful information.
- 88 Not useful information.
- 89 We need more information.

Stay "Up To Standards" with LUBE-GARD® Limited Slip Supplement, which contains unique components designed for clutches in limited-slip differentials. Limited Slip Supplement advanced friction modifier eliminates chatter, rust and corrosion to protect bearing and gear surfaces. Heat-transfer components help pull heat away from the gearbox and clutches, resulting in lower unit operating temperatures.

800-333-LUBE
www.lubegard.com