

Controlling the AISIN TL80SN/AA80E

by Marty @ SSI performance
FAO D3 Performance & ProEFI



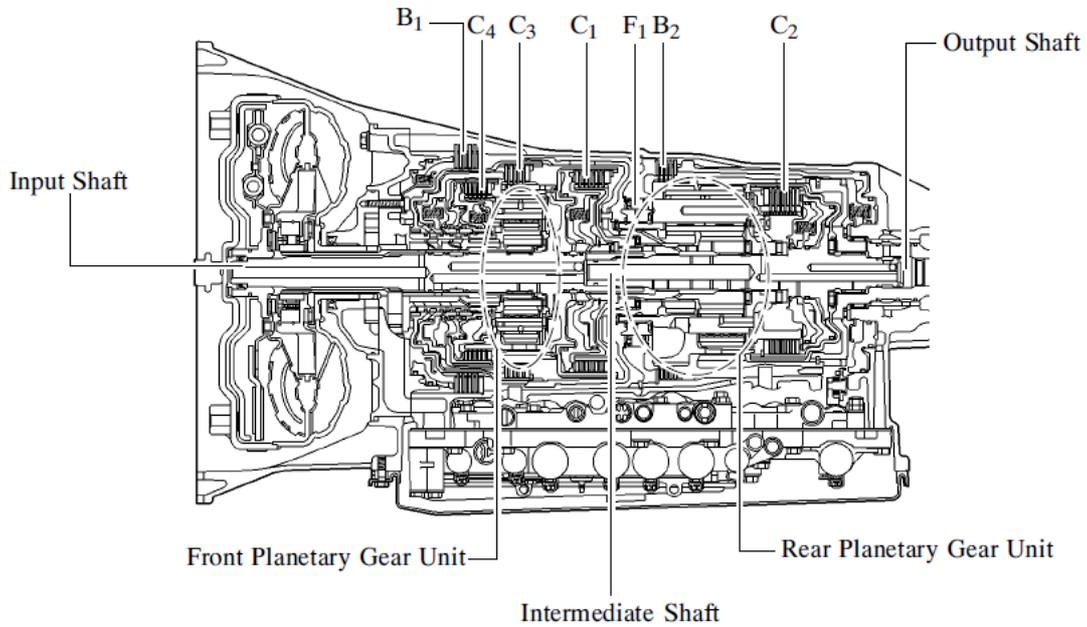
The AA80E is Aisins High Torque Automatic 8 Speed transmission, and is currently used by several manufacturers today. This Document deals with the version fitted to the Lexus IS-F models.

General Specs, Gear ratios and Rear end

Engine Type		2UR-GSE
Transmission Type		AA80E
Gear Ratio	1st	4.596
	2nd	2.724
	3rd	1.863
	4th	1.464
	5th	1.231
	6th	1.000
	7th	0.824
	8th	0.685
	Reverse	2.176
Fluid Type		Toyota Genuine ATF WS
Fluid Capacity	Liters (US qts, Imp. qts)	10.5 (11.1, 9.2)
Weight (Reference)*	kg (lb)	95.8 (211.2)

Differential FD21A type to FD21AT (TORSEN* LSD) type
Ratio **2.937:1**

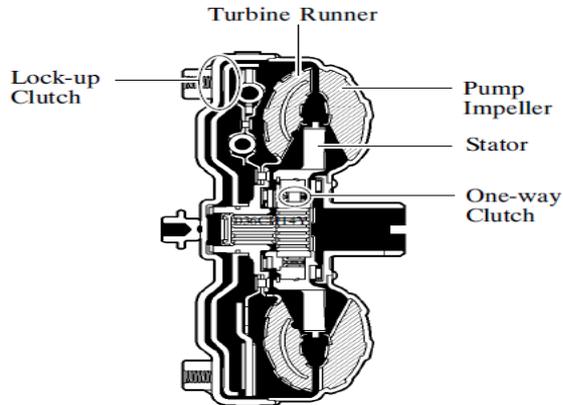
Clutch and gear Specifications



Engine Type			2UR-GSE
Transmission Type			AA80E
C ₁	No.1 Clutch	No. of Discs	6
C ₂	No.2 Clutch		6
C ₃	No.3 Clutch		4
C ₄	No.4 Clutch		5
B ₁	No.1 Brake		5
B ₂	No.2 Brake		4
F ₁	No.1 One-way Clutch		No. of Sprags
Front Planetary Gear Unit	No. of Front Sun Gear Teeth		38
	No. of Inner Pinion Gear Teeth		16
	No. of Outer Pinion Gear Teeth		19
	No. of Ring Gear Teeth		82
Rear Planetary Gear Unit	No. of Middle Sun Gear Teeth		34
	No. of Rear Sun Gear Teeth		30
	No. of Long Pinion Gear Teeth		20
	No. of Short Pinion Gear Teeth		17
	No. of Ring Gear Teeth		74

Torque Converter Specifications

A compact, lightweight and high-capacity torque converter clutch assembly is used. The torque converter clutch assembly supports flex lock-up clutch control, thus improving fuel economy.



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► Specifications ◀

Torque Converter Type	3-Element, 1-Step, 2-Phase
Stall Torque Ratio	1.83

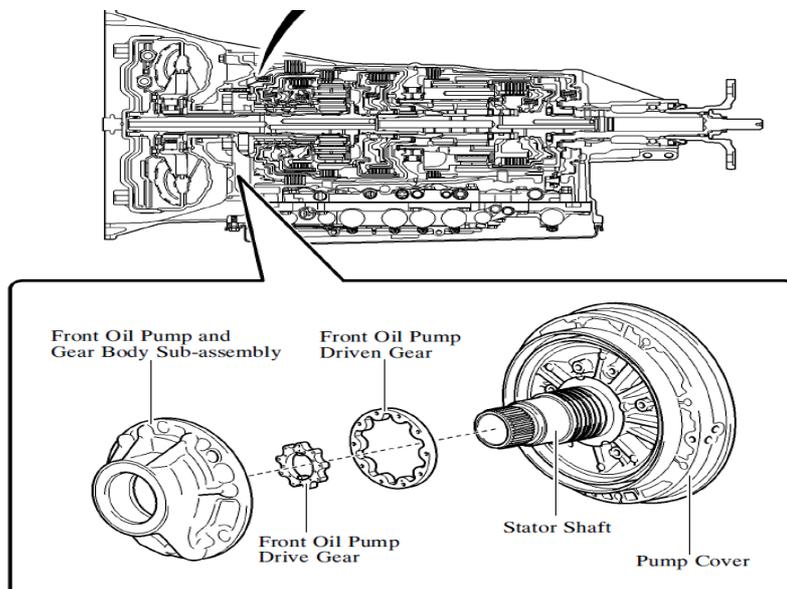
Stock Stall Speed is 2250 +/- 250

Oil Pump Assembly

The oil pump assembly is driven by the torque converter clutch assembly. It lubricates the planetary gear units and supplies operating fluid pressure for hydraulic control.

The pump cover is made of aluminum to reduce weight.

A pump cover with an integrated piston cylinder for the B1 brake is used.

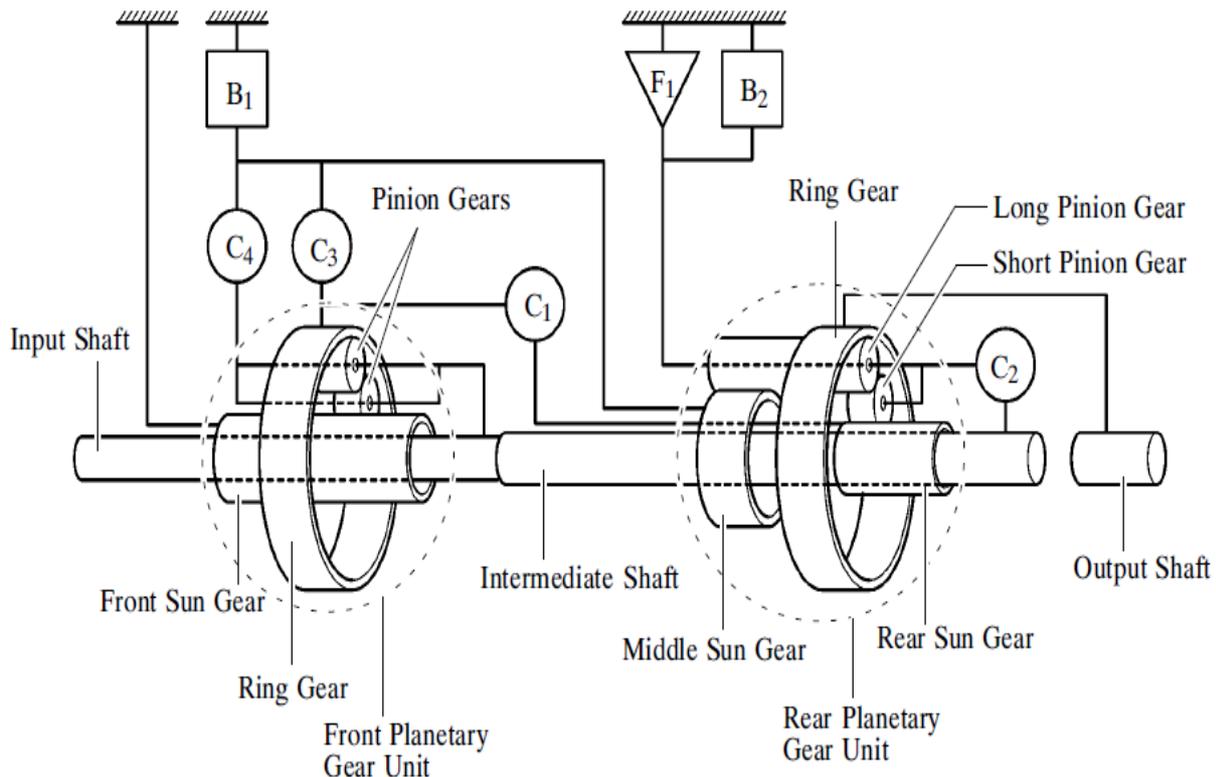


PLANETARY GEAR UNIT

The 8-speed configuration has been achieved by using 2 planetary gear units, creating an 8-speed automatic transmission.

A Ravigneaux type gear unit is used as the rear planetary gear unit. The gear unit consists of pairs of sun gears (middle and rear) and planetary pinion gears (long and short) with different diameters within a single planetary gear.

A centrifugal fluid pressure canceling mechanism is used in the C1, C2, C3, and C4 clutches that are applied when shifting from 2nd > 3rd, 3rd > 4th, 4th > 5th, 5th > 6th, 6th > 7th and from 7th > 8th



Function of Components

C1 No.1 Clutch Connects the front planetary ring gear and rear sun gear.

C2 No.2 Clutch Connects the intermediate shaft and rear planetary carrier.

C3 No.3 Clutch Connects the front planetary ring gear and middle sun gear.

C4 No.4 Clutch Connects the front planetary carrier and middle sun gear.

B1 No.1 Brake Prevents the middle sun gear from turning either clockwise or counterclockwise.

B2 No.2 Brake Prevents the rear planetary carrier from turning either clockwise or counterclockwise.

F1 No.1 One-way Clutch Prevents the rear planetary carrier from turning counterclockwise.

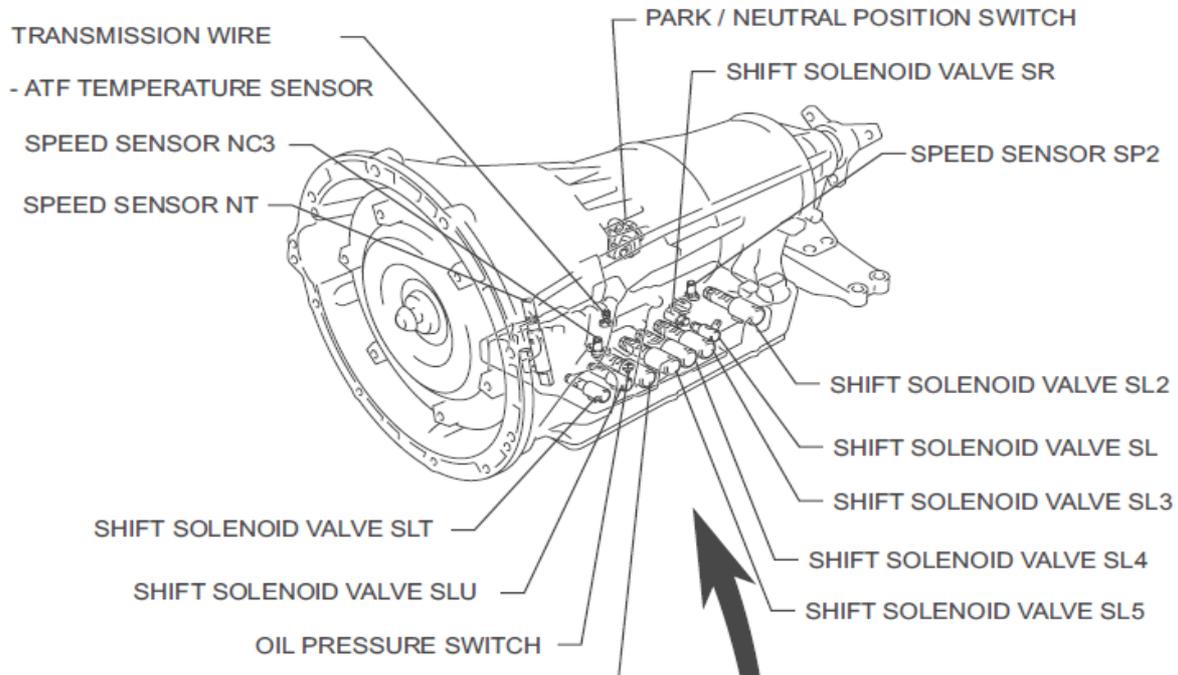
Planetary Gears

These gears change the route through which driving force is transmitted, in accordance with the operation of each clutch and brake, in order to increase or reduce the input and output speeds.

Valve body and General inputs/outputs

VALVE BODY ASSEMBLY :

SHIFT SOLENOID VALVE (SL1, SL2, SL3, SL4, SL5, SR, SL, SLU, SLT)



Speed Sensors

We have 3 Speed sensors available they are :- NT, NC3, SP2

These speed sensors are the Hall type.

The speed sensor NT detects the input speed of the transmission. The input shaft is used as the timing rotor for this sensor.

The speed sensor NC3 detects the speed of intermediate shaft. The C3 clutch drum is used as the timing rotor for this sensor.

The speed sensor SP2 detects the speed of the output shaft. The rear planetary ring gear is used as the timing rotor for this sensor.

Hall type speed sensors consists of a magnet and a Hall IC. The Hall IC converts the changes in the magnetic flux density that occur through the rotation of the timing rotor into an electric signal, and outputs the signal to the TCM.

ATF fluid Temp

We have 1 Temperature sensor for the ATF fluid

Oil pressure Switch

We have a Pressure controlled on/off switch used for pressure warning. **THIS NEEDS TO BE REPLACED WITH A PRESSURE TRANSDUCER** so we can monitor ATF fluid pressure during testing of line pressure control etc etc

Park / Neutral Switch used in conjunction with starter circuit as safety pre caution AND Outputs a switched 12v voltage depending on gear selector position at transmission. The individual outputs represent selector in the **P R N D** positions.

Shift Solenoid Valves

These are the 9 Solenoid valves that we need to control in order to operate the transmission electronically from our own TCM module. Each will be discussed in more detail later. The Solenoid valves are named :- **SL1, SL2, SL3, SL4, SL5, SR, SL, SLU, SLT**

Solenoid valve descriptions

SL1, SL2, SL3, SL4, SL5 are used for clutch hydraulic pressure control (gear selection)

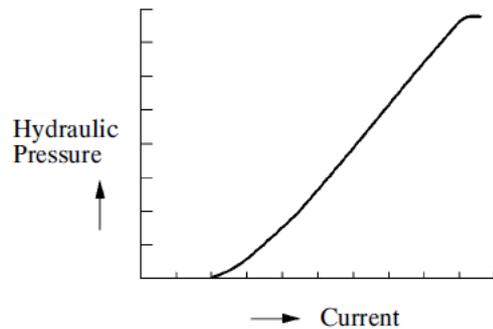
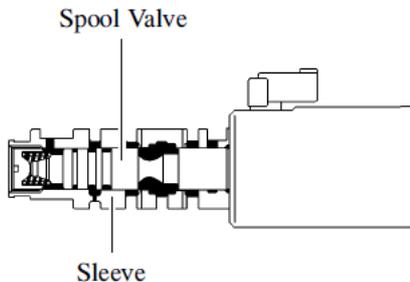
SR is used for shift timing control

SLU, SL are used for lock up clutch control

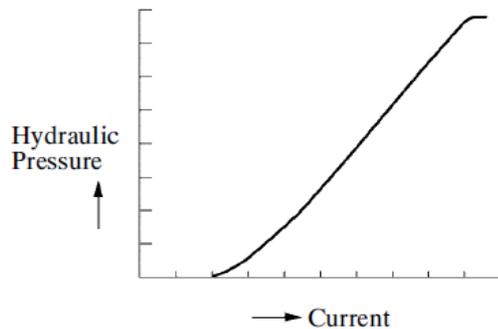
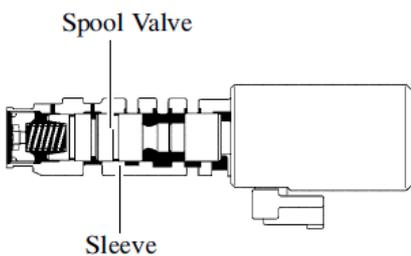
SLT is line pressure control

Shift solenoid valves SL1, SL2, SL3, SL4 and SL5 are high flow linear solenoid valves that can supply more pressure than conventional ones. These shift solenoid valves control engagement elements by directly regulating the line pressure without using a pressure regulation valve or a pressure reduction valve. Thus, the number of valves and the length of the valve body fluid passage have been reduced, the shifting response has been increased and the shift shock has been minimized.

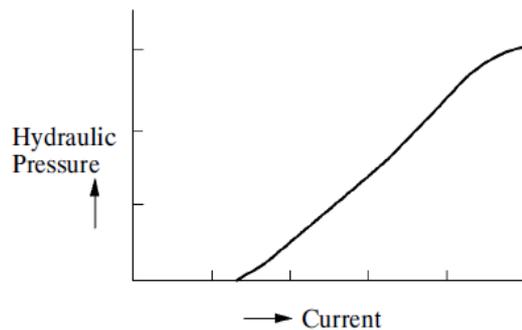
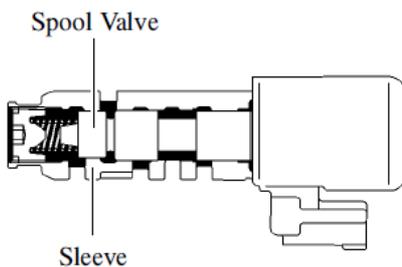
Shift Solenoids SL1,SL3,SL4,SL5



Shift Solenoid SL2, SLU

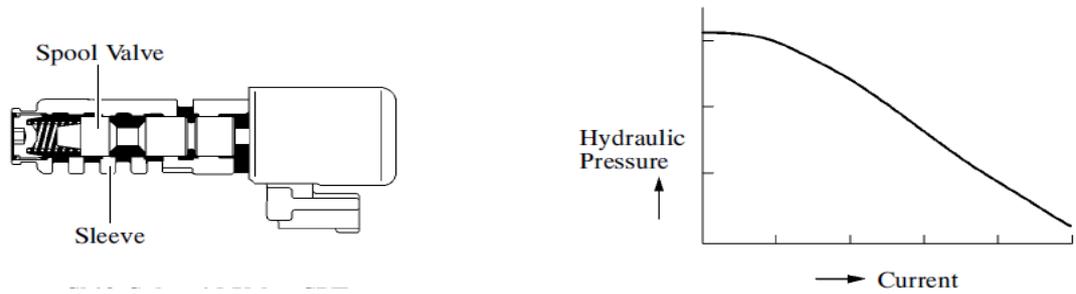


Shift Solenoid Valve SL2



Shift Solenoid Valve SLU

Shift Solenoid SLT



Pressure Function of Solenoid Valves

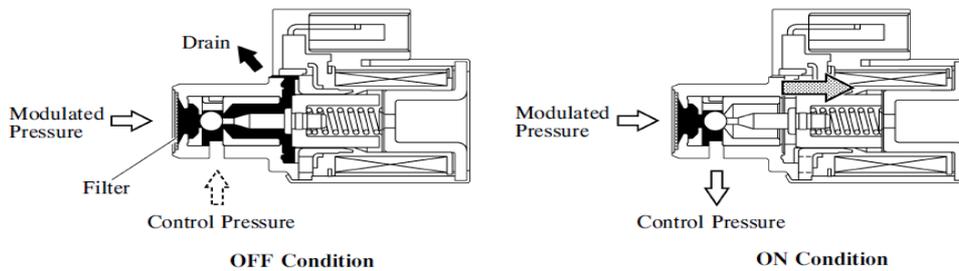
Shift Solenoid Valve	Function
SL1	C ₁ clutch pressure control
SL2	C ₂ clutch pressure control
SL3	C ₃ clutch pressure control
SL4	C ₄ clutch pressure control
SL5	B ₁ brake pressure control
SLU	<ul style="list-style-type: none"> • Lock-up clutch pressure control • B₂ brake pressure control
SLT	Line pressure control

Shift Solenoid Valve SL and SR

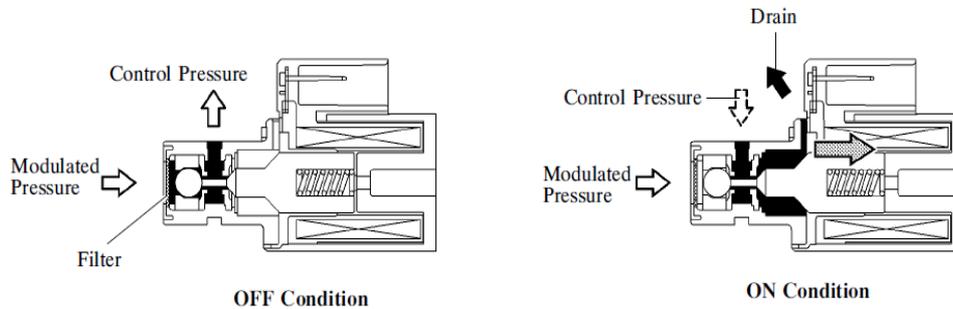
Shift Solenoid valve SL and SR are 3-way solenoid valves.

A filter is provided at the tip of the solenoid valve to further improve operational reliability.

SL Solenoid



SR Solenoid



Shift Solenoid Valve	Type	Function
SL	3-way	<ul style="list-style-type: none"> • Switches the lock-up relay valve. • Switches the reverse control valve.
SR	3-way	<ul style="list-style-type: none"> • Switches the clutch apply control valve. • Switches the sequence control valve.

SOLENOID CONTROL / POWER OUTPUT TABLES (IS-F)

The following show the relation between the shift solenoids and power output/flow in the aa80e as employed on the lexus ISF

Shift Lever Position	Shift Solenoid Valve								Clutch				Brake		One-way Clutch	
	SL1	SL2	SL3	SL4	SL5	SR	SL	SLU	C ₁	C ₂	C ₃	C ₄	B ₁	B ₂	F ₁	
P	○					○										
R				○		○	○					○		○		
N	○					○										
D	1st	○				○			○						○	
	2nd	○				○	○		○				○			
	3rd	○		○		○			○		○					
	4th	○			○	○	○	Δ	○			○				
	5th	○	○			○	○	Δ	○	○						
	6th		○		○	○	○	Δ		○		○				
	7th		○	○		○	○	Δ		○	○					
	8th		○			○	○	○	Δ		○			○		
D*	D8	1st	○				○			○						○
		2nd	○				○	○		○				○		
		3rd	○		○		○			○		○				
		4th	○			○	○	○	Δ	○			○			
		5th	○	○			○	○	Δ	○	○					
		6th		○		○	○	○	Δ		○		○			
		7th		○	○		○	○	Δ		○	○				
		8th		○			○	○	○	Δ		○			○	
	D7	1st	○				○			○						○
		2nd	○				○	○		○				○		
		3rd	○		○		○			○		○				
		4th	○			○	○	○	Δ	○			○			
		5th	○	○			○	○	Δ	○	○					
		6th		○		○	○	○	Δ		○		○			
		7th		○	○		○	○	Δ		○	○				
	D6	1st	○				○			○						○
		2nd	○				○	○		○				○		
		3rd	○		○		○			○		○				
		4th	○			○	○	○	Δ	○			○			
		5th	○	○			○	○	Δ	○	○					
		6th		○		○	○	○	Δ		○		○			
	D5	1st	○				○			○						○
		2nd	○				○	○		○				○		
		3rd	○		○		○			○		○				
4th		○			○	○	○	Δ	○			○				
5th		○	○			○	○	Δ	○	○						

○: ON Δ: In accordance with flex lock-up or lock-up

(Continued)

*: When in D position (fixed range mode)

Shift Lever Position		Shift Solenoid Valve								Clutch				Brake		One-way Clutch	
		SL1	SL2	SL3	SL4	SL5	SR	SL	SLU	C ₁	C ₂	C ₃	C ₄	B ₁	B ₂	F ₁	
D*	D4	1st	○					○			○						○
		2nd	○				○	○			○			○			
		3rd	○		○			○			○		○				
		4th	○			○		○	○	Δ	○			○			
	D3	1st	○					○			○						○
		2nd	○				○	○			○			○			
		3rd	○		○			○			○		○				
	D2	1st	○					○			○						○
		2nd	○				○	○			○			○			
	D1	1st	○						○	○						○	○
M	M1	1st	○						○	○					○	○	
	M2	2nd	○				○	○	○	Δ	○			○			
	M3	3rd	○		○			○	○	Δ	○		○				
	M4	4th	○			○		○	○	Δ	○			○			
	M5	5th	○	○				○	○	Δ	○	○					
	M6	6th		○		○		○	○	Δ		○		○			
	M7	7th		○	○			○	○	Δ		○	○				
	M8	8th		○			○	○	○	Δ		○			○		

○: ON Δ: In accordance with flex lock-up or lock-up

*: When in D position (fixed range mode)

For purposes of Control we will look at to basic modes of operation. D mode (automatic) and M mode (full manual). It should be noted from the above that FULL LOCKUP is permitted in manual mode from 2nd through 8th gears . In D mode, lock up is permitted in 4th through 8th gears

The Following table shows the SL1 to SL5 solenoid conditions in relation to forward gear selection

Gear Position	1st	2nd	3rd	4th	5th	6th	7th	8th
Shift Solenoid Valve SL1	ON	ON	ON	ON	ON	OFF	OFF	OFF
Shift Solenoid Valve SL2	OFF	OFF	OFF	OFF	ON	ON	ON	ON
Shift Solenoid Valve SL3	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF
Shift Solenoid Valve SL4	OFF	OFF	OFF	ON	OFF	ON	OFF	OFF
Shift Solenoid Valve SL5	OFF	ON	OFF	OFF	OFF	OFF	OFF	ON