THM AF23/33-5
PRELIMINARY INFORMATION

GENERAL DESCRIPTION

The AF23/33-5 transaxle is a fully automatic, five speed, electronically controlled, front wheel drive transmission, as shown in Figure 1. It consists primarily of a four element torque converter, three planetary gear sets, friction and mechanical clutches and a pressurization and control system.

The four element torque converter contains a pump, a turbine, a pressure plate assembly splined to the turbine, and a stator assembly. The torque converter acts as a fluid coupling to smoothly transmit power from the engine to the transmission. It also hydraulically provides additional torque multiplication when required. The pressure plate, when applied, provides a mechanical "direct drive" coupling of the engine to the transmission.

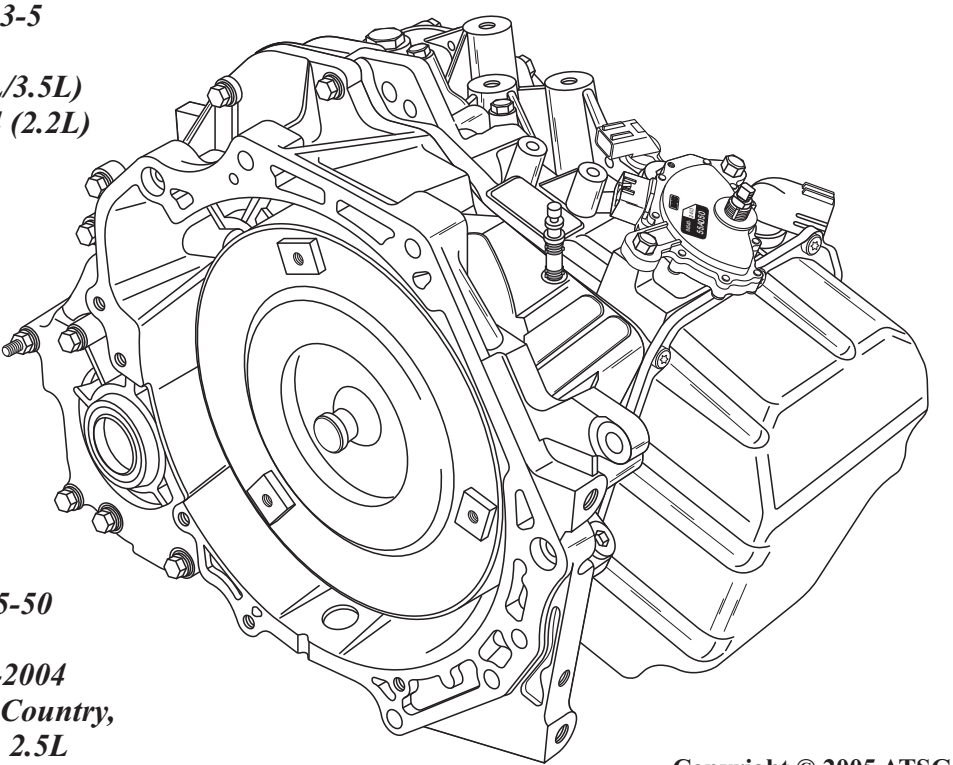
The three planetary gear sets provide the five forward gear ratios and reverse. Changing gear ratios is fully automatic and is accomplished through the use of a Transmission Control Module (TCM). The TCM recieves and monitors various electronic sensor inputs and uses this information to shift the transmission at the optimum time.

The TCM commands shift solenoids, within the transaxle, on and off to control shift timing. The TCM controls line pressure to maintain proper shift feel and clutch apply pressure. The TCM also controls the apply and release of the torque converter clutch which allows the engine to deliver the maximum fuel efficiency without sacrificing vehicle performance.

A Component Application chart and solenoid application chart have been provided for you in Figure 3.

Continued on next Page

G.M. Designation AF23/33-5
Found In:
Saturn Vue, 2002-2004 (3.0L/3.5L)
Saturn Ion Sedan, 2003-2004 (2.2L)



Volvo Designation AW 55-50
Found In:
Some Volvo Models 2000-2004
60, 70, 80 & 90 Series, Cross Country,
Equipped with 2.3L, 2.4L, 2.5L

Figure 1

GENERAL DESCRIPTION (Cont'd)

The hydraulic system primarily consists of a gear type pump, four control valve bodies, case cover, converter housing and case. The pump maintains the working pressures needed to stroke the servo and clutch pistons that apply or release the friction components. These friction components, when applied or released, support the automatic shifting qualities of the transaxle.

The friction components used in this transaxle consist of seven multiple disc clutches and one band. The multiple disc clutches combine with two mechanical sprag clutches, to deliver five forward gear ratios and reverse, through the gear sets. The gear sets then transfer torque through the front differential assembly and out to the drive axles.

GEAR RANGE DESCRIPTION

The transaxle can be operated in any one of the six different positions on the shift quadrant, that is shown in Figure 2.

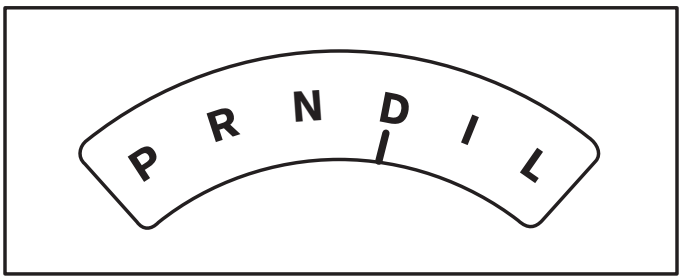


Figure 2

P - Park position enables the engine to be started while preventing the vehicle from rolling either forward or backward. For safety reasons the vehicle's parking brake should be used in addition to the "Park" position. Since the front differential assembly and drive axles are mechanically locked to the case through the parking pawl, Park position should not be selected until the vehicle has come to a complete stop.

R - Reverse position enables the vehicle to be operated in a rearward direction.

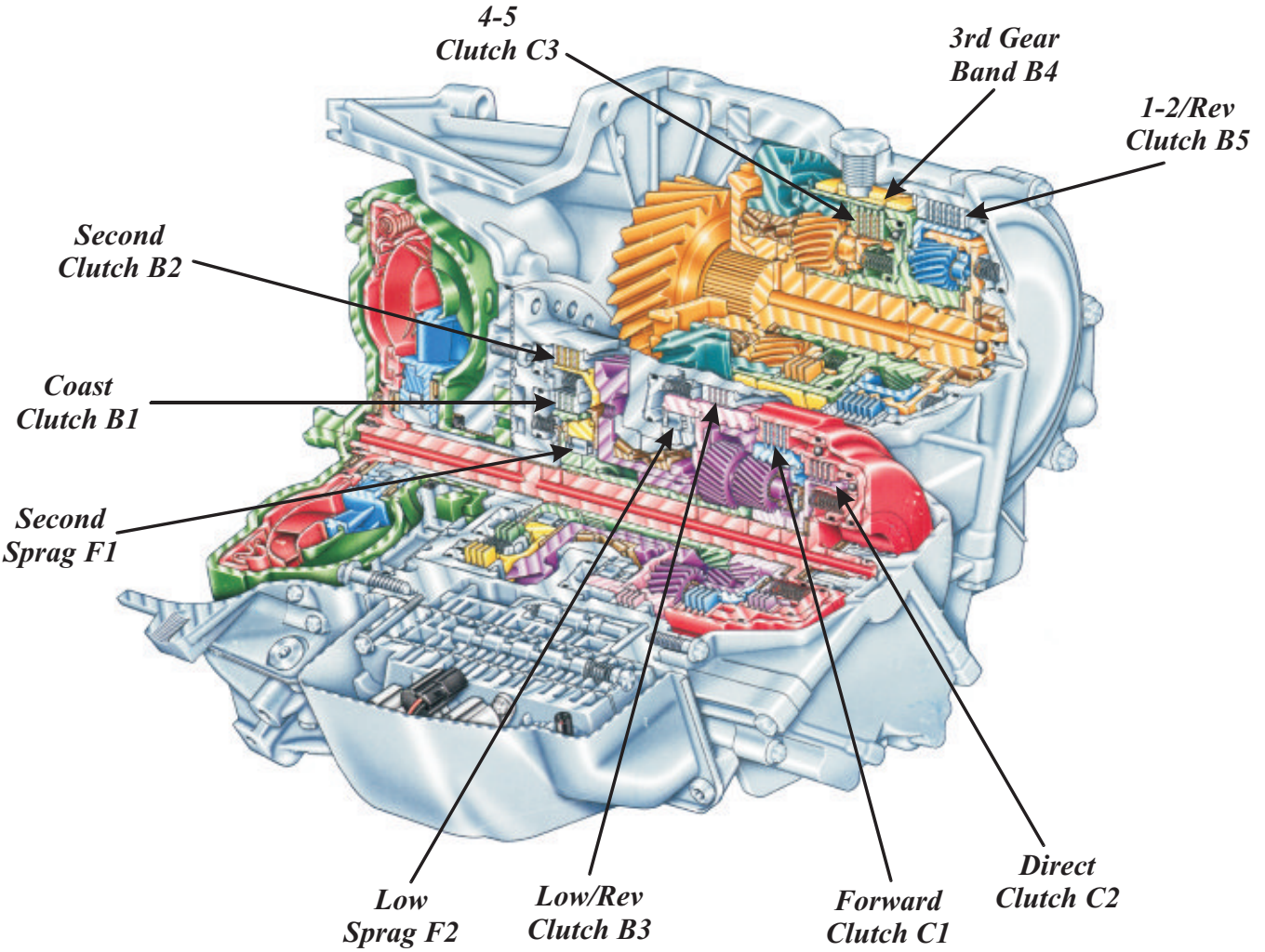
N - Neutral position enables the engine to start and operate without driving the vehicle. If necessary, this position should be selected to restart the engine while the vehicle is moving.

D - Drive position should be used for all normal driving conditions for maximum efficiency and fuel economy. Drive range allows the transmission to operate in each of the five forward gear ratios. Downshifts to a lower gear ratio are available for safe passing by depressing the accelerator or by manually selecting a lower gear range with the selector lever.

I - Intermediate range can be used for conditions where it may be desirable to use only three gear ratios. These conditions include towing a trailer and driving on hilly terrain. This range is also helpful for engine braking when descending slight grades. Upshifts and downshifts are the same as in Drive range for 1st, 2nd, and 3rd gears except that the transmission is prevented from shifting above third gear. Intermediate range can be selected at any vehicle speed but will downshift into third gear only if vehicle speed is low enough to prevent engine overspeed.

L - Low range adds more performance for congested traffic and hilly terrain. It has the same starting ratio as 1st gear in Drive or Intermediate ranges but prevents the transmission from shifting above 2nd gear. Thus, Low can be used to retain 2nd gear for acceleration and engine braking as desired. Low range can be selected at any vehicle speed but will downshift into second gear only if vehicle speed is low enough to prevent engine overspeed. Low range is particularly beneficial for maintaining maximum engine braking when descending steep grades.

COMPONENT APPLICATION AND SOLENOID CHART



RANGE	GEAR	RATIO	SOL S1	SOL S2	SOL S3	SOL S4	SOL S5	SECOND CLUTCH (B2)	COAST CLUTCH (B1)	SECOND SPRAG (F1)	LOW SPRAG (F2)	LO/REV CLUTCH (B3)	FWD CLUTCH (C1)	DIRECT CLUTCH (C2)	4-5 CLUTCH (C3)	3RD BAND (B4)	1-2/REV CLUTCH (B5)
PARK	P		OFF	OFF	OFF	OFF	OFF										APPLIED
REVERSE	R	3.18	Off*	OFF	On*	OFF	On*					APPLIED		APPLIED			APPLIED
NEUTRAL	N		OFF	OFF	OFF	OFF	OFF										APPLIED
DRIVE	1	4.68	ON	OFF	ON	OFF	OFF				HOLD		APPLIED				APPLIED
	2	2.94	OFF	ON	ON	OFF	OFF	APPLIED	APPLIED	HOLD			APPLIED				APPLIED
	3	1.92	OFF	ON	ON	ON	OFF	APPLIED	APPLIED	HOLD			APPLIED			APPLIED	
	4	1.30	OFF	ON	OFF	ON	OFF	APPLIED	APPLIED	HOLD			APPLIED		APPLIED		
	5	1.00	OFF	OFF	OFF	ON	OFF	APPLIED					APPLIED	APPLIED	APPLIED		
	LIMP	1.00	OFF	OFF	OFF	OFF	OFF	APPLIED					APPLIED	APPLIED	APPLIED		
INTERM	1	4.68	ON	OFF	ON	OFF	OFF				HOLD		APPLIED				APPLIED
	2	2.94	OFF	ON	ON	OFF	OFF	APPLIED	APPLIED	HOLD			APPLIED				APPLIED
	3	1.92	OFF	ON	ON	ON	OFF	APPLIED	APPLIED	HOLD			APPLIED			APPLIED	
LOW	1 E/B	4.68	ON	OFF	ON	OFF	ON				HOLD	APPLIED	APPLIED				APPLIED
	2	2.94	OFF	ON	ON	OFF	OFF	APPLIED	APPLIED	HOLD			APPLIED				APPLIED

* If vehicle speed is above 7km/h (4 mph), the TCM commands the shift solenoids to inhibit reverse

Figure 3

ELECTRICAL COMPONENTS

Park/Neutral Position Switch Assembly

The Park/Neutral Position Switch assembly is a sliding contact switch attached to the manual shift detent lever assembly on the outside of transaxle, as shown in Figure 4. The four inputs to the TCM from the P/N switch indicate which position has been selected by the manual selector lever. This information is used for engine controls as well as determining the transaxle shift patterns. The state of each input is available for display on the scan tool. The four inputs parameters shown in Figure 5 are Mode A, Mode B, Mode C and Mode PA.

The Park/Neutral Position Switch assembly is also responsible for allowing the engine to be started in Park or Neutral only, and no other selector position. This switch is also responsible for illuminating the Back-Up lamps when Reverse is selected, as shown in Figure 5.

If the TCM detects an improper signal from the Park/Neutral Position Switch assembly, a DTC will be activated.

The DTC strategy may be different between the models you are working on i.e. Saturn or Volvo. All references in this information is for Saturn.

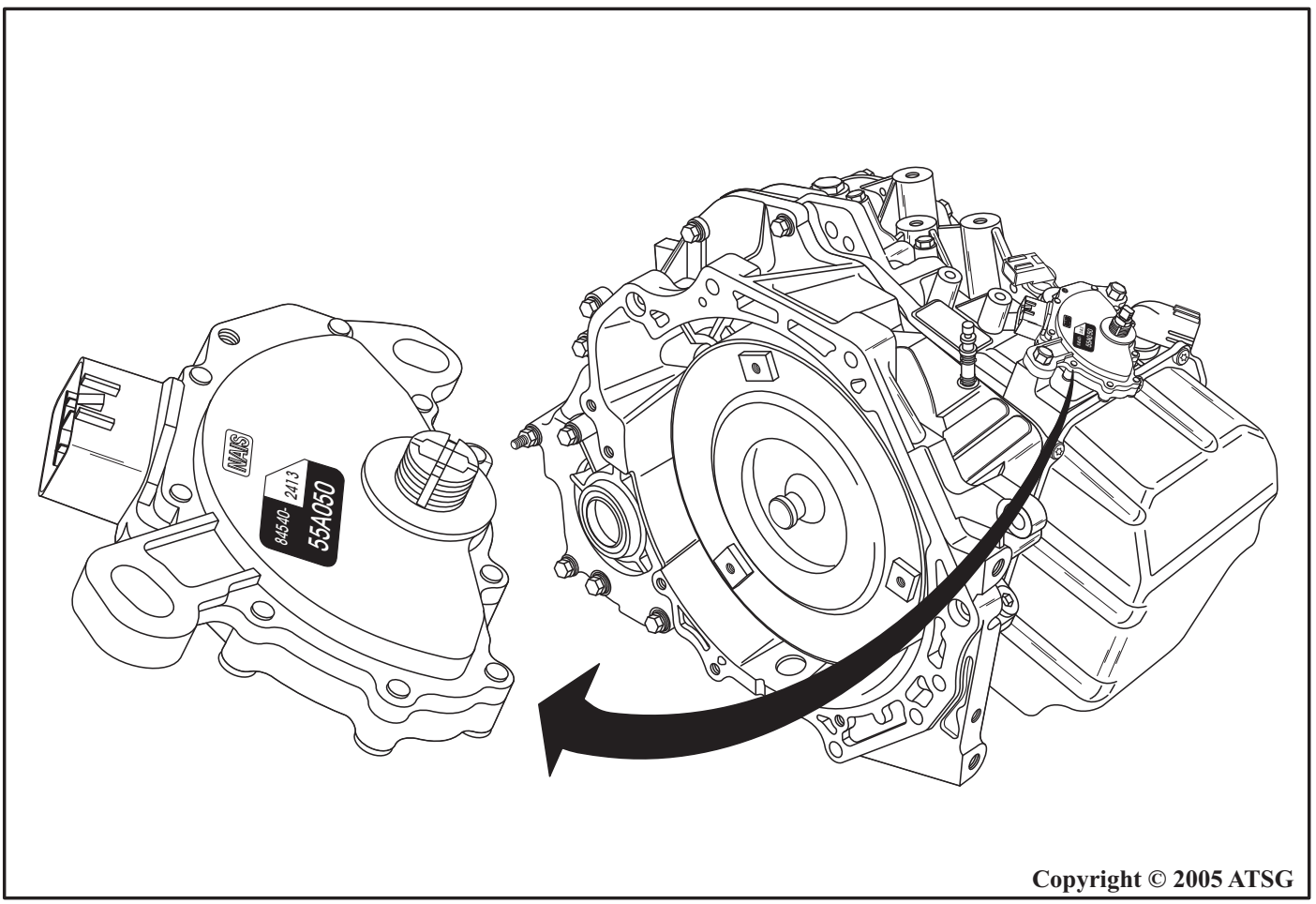
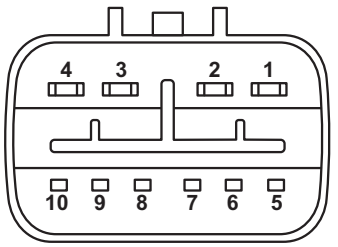


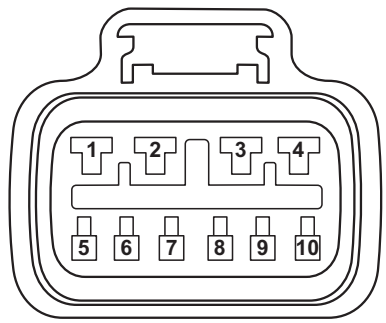
Figure 4

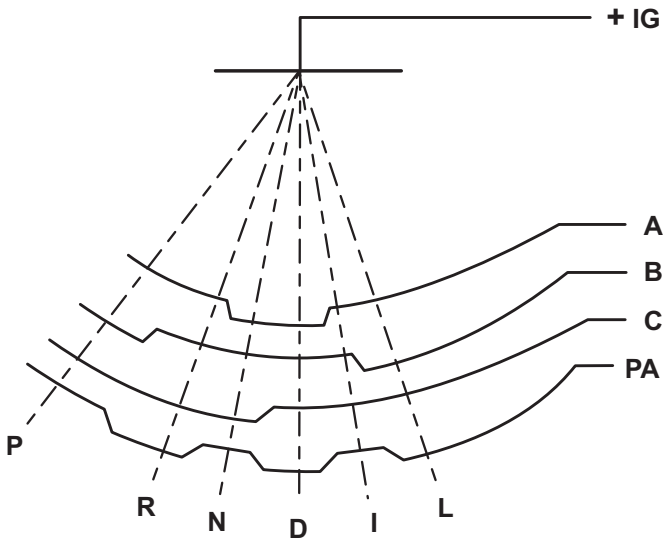
TRANSAXLE RANGE SWITCH 10-WAY CONNECTOR IDENTIFICATION			
Pin No.	*Wire Color*	*Circuit Number*	*Circuit Function*
1	*Pink*	*239*	*Back-Up Lamp Power Fuse (10A) From Underhood Fuse Block .*
2	*Lt. Green*	*24*	*Out To Back-Up Lamps.*
3	*Purple*	*6*	*Out To Starter Relay.*
4	*Yellow*	*5*	*Starter Relay Power Fuse (30A) From Underhood Fuse Block.*
5	*Gray*	*773*	*Transaxle Range "C" Signal To TCM.*
6	*Yellow*	*772*	*Transaxle Range "B" Signal To TCM.*
7	*Not Used*		
8	*White*	*776*	*Transaxle Range "P" Signal To TCM.*
9	*Pink*	*239*	*Range Switch Power Fuse (10A) From Underhood Fuse Block.*
10	*Tan/White*	*771*	*Transaxle Range "A" Signal To TCM.*

Transaxle Range Switch Connector, Face View



Transaxle Range Switch Vehicle Harness Connector, Face View





RANGE INDICATOR	CIRCUIT				
	+ IG	A	B	C	PA
Park	1	1	0	0	1
Reverse	1	1	1	0	0
Neutral	0	1	0	1	
Drive	1	0	1	1	0
Intermediate	1	1	1	1	1
Low	1	1	0	1	0

1 = Closed (Resistance < 10 ohms)
2 = Open (Resistance > 100k ohms)

Figure 5

ELECTRICAL COMPONENTS (Cont'd)

Shift Solenoids

The AF23/33-5 uses five electromagnetic shift solenoids to control upshifts and down shifts in all forward ranges and controlled by the TCM. They work together in a combination of ON and OFF sequences to control the various shift valves.

Reverse, 1st Shift Solenoid (SS1)

The reverse, 1st shift solenoid is a normally-open (N.O.), ON/OFF type solenoid controlled by the TCM. Line fluid feeds the S1 signal fluid circuit through orifice No. 3. When the reverse, 1st shift solenoid is energized (ON), S1 fluid is blocked from exhausting through the solenoid, creating S1 fluid pressure that acts on the U1 shift valve and the M1 shift valve. When the reverse, 1st shift solenoid is OFF, any existing S1 signal fluid pressure is exhausted through holes at the base of the solenoid, as shown in Figure 6.

2-3, 3-4 Shift Solenoid (SS2)

The 2-3, 3-4 shift solenoid is a normally-open (N.O.) ON/OFF type solenoid controlled by the TCM. Drive fluid feeds the S2 signal fluid through orifice No. 25. When the 2-3, 3-4 shift solenoid is energized (ON), S2 fluid is blocked from exhausting through the solenoid, creating S2 signal fluid pressure that acts on the M2 shift valve, against spring force, to move the valve into the applied position. When the 2-3, 3-4 shift solenoid is OFF, any existing S2 signal fluid pressure is exhausted through the end of the solenoid, as shown in Figure 6.

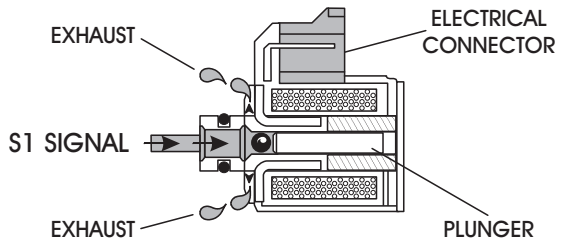
1-2, 2-3, Reverse Shift Solenoid (SS3)

The 1-2, 2-3, reverse shift solenoid is a normally-closed (N.C.) ON/OFF type solenoid controlled by the TCM. Drive fluid feeds the S3 signal fluid through orifice No. 24. When the 1-2, 2-3, reverse shift solenoid is energized (ON), S3 signal fluid is allowed to exhaust through the base of the solenoid, as shown in Figure 6. When the 1-2, 2-3, reverse shift solenoid is OFF, S3 signal fluid is blocked from exhausting through the base of the solenoid, creating S3 signal fluid pressure that acts on the U2 shift valve, against spring force, to move the valve into the applied position.

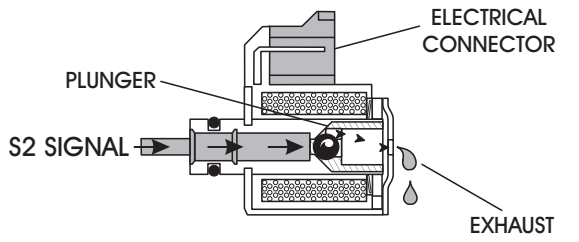
3-4, 4-5 Shift Solenoid (SS4)

The 3-4, 4-5 shift solenoid is a normally-open (N.O.) ON/OFF type solenoid controlled by the TCM. Line fluid feeds the S4 signal fluid through orifice No. 4. When the 3-4, 4-5 shift solenoid is energized (ON), S4 fluid is blocked from exhausting through the solenoid, creating S4 signal fluid pressure that acts on the U2 shift valve and the U1 shift valve. When the 3-4, 4-5 shift solenoid is OFF, any existing S4 signal fluid pressure is exhausted through the end of the solenoid, as shown in Figure 6.

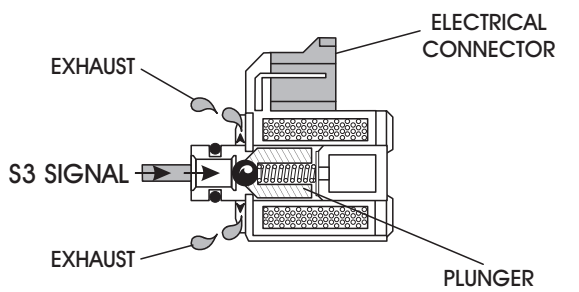
Reverse, 1st Shift Solenoid (SS1) "Normally Open"



2-3, 3-4 Shift Solenoid (SS2) "Normally Open"



1-2, 2-3, Reverse Shift Solenoid (SS3) "Normally Closed"



3-4, 4-5 Shift Solenoid (SS4) "Normally Open"

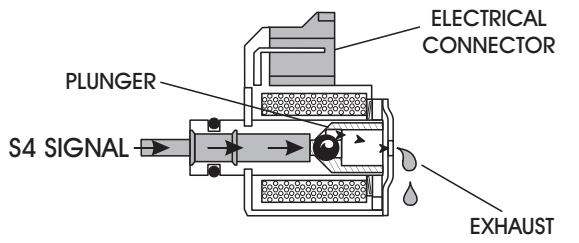


Figure 6

ELECTRICAL COMPONENTS (Cont'd)

Reverse Shift Solenoid (SS5)

The reverse shift solenoid is a normally-closed (N.C.) ON/OFF type solenoid controlled by the TCM. Line fluid feeds the S5 signal fluid through orifice No. 5. When the reverse shift solenoid is energized (ON), S5 signal fluid is allowed to exhaust through the base of the solenoid, as shown in Figure 7. When the reverse shift solenoid is OFF, S5 signal fluid is blocked from exhausting through the base of the solenoid, creating S5 signal fluid pressure that acts on the shift pressure relay valve, against spring force, to move the valve into the applied position.

Reverse Shift Solenoid (SS5) "Normally Closed"

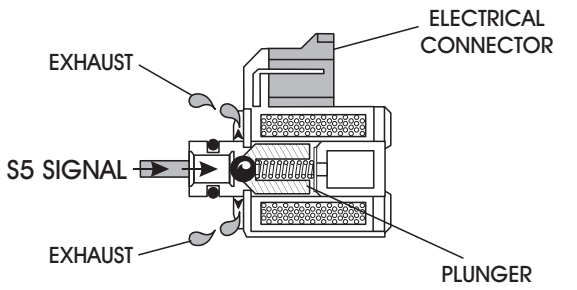


Figure 7

Line Pressure Control Solenoid (SLT)

The line pressure control solenoid is a normally-open 3-port solenoid and is a precision electronic pressure regulator that controls transaxle line pressure based on current flow through its coil windings. This solenoid is Pulse Width Modulated (PWM) and operates at a fixed frequency of 300 Hz (cycles per second) and from 0.0 to 1.1 amps. As current flow is increased, the pressure control to throttle signal is decreased. As current flow is decreased, the pressure control to throttle signal is increased (See Figure 8).

If a total electronic failure is encountered, this solenoid will put line pressure to maximum pressure, and will set DTC P0962 or P0963 in the TCM memory.

Line Pressure Control Solenoid (SLT) "Normally Open"

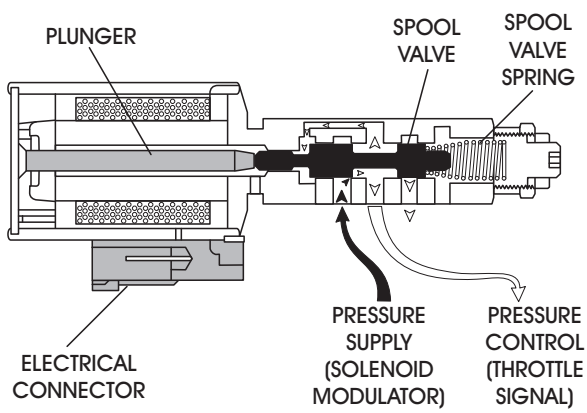


Figure 8

Transmission Adapt Function

Programming within the TCM allows for automatic adjustments in pressure that are based on the changing characteristics of the internal transaxle components. As the apply components within the transaxle wear, the time to apply a clutch increases. In order to compensate for this wear, the TCM adjusts trim pressure by controlling the line pressure control solenoid in order to maintain the originally calibrated shift timing. This process is reffered to as "Adaptive Learning" and is used to assure consistent shift feel and increase transaxle durability. The TCM monitors the ISS and OSS during commanded shifts to determine if a shift is occuring too fast (harsh) or too slow (soft) and adjusts the line pressure control solenoid signal to maintain a set shift feel.

ELECTRICAL COMPONENTS (Cont'd)

Shift Pressure Control Solenoid (SLS)

The shift pressure control solenoid is a normally-open 3-port solenoid and is a precision electronic pressure regulator that controls transaxle clutch apply pressure based on current flow through its coil windings. This solenoid is Pulse Width Modulated (PWM) and operates at a fixed frequency of 300 Hz (cycles per second) and from 0.0 to 1.1 amps. As current flow is increased, the pressure control to clutch apply is decreased. As current flow is decreased, the pressure control to clutch apply is increased (See Figure 9).

If a total electronic failure is encountered, this solenoid will put clutch apply pressure to maximum pressure, and will set DTC P0970 or P0971 in the TCM memory.

Shift Pressure Control Solenoid (SLS) "Normally Open"

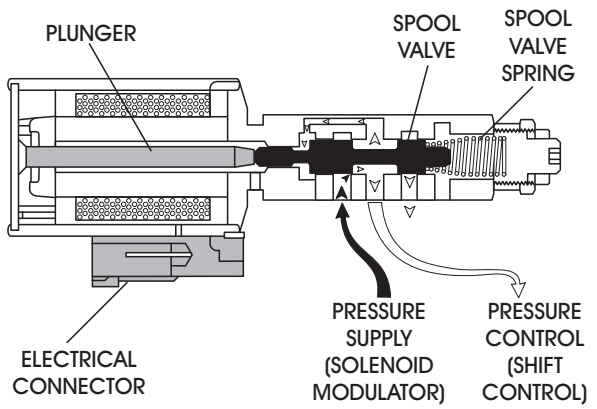


Figure 9

Transmission Adapt Function

Programming within the TCM allows for automatic adjustments in pressure that are based on the changing characteristics of the internal transaxle components. As the apply components within the transaxle wear, the time to apply a clutch increases. In order to compensate for this wear, the TCM adjusts trim pressure by controlling the shift pressure control solenoid in order to maintain the originally calibrated shift timing. This process is reffered to as "Adaptive Learning" and is used to assure consistent shift feel and increase transaxle durability. The TCM monitors the ISS and OSS during commanded shifts to determine if a shift is occuring too fast (harsh) or too slow (soft) and adjusts the shift pressure control solenoid signal to maintain a set shift feel.

TCC Lock-Up Pressure Control Solenoid (SLU)

The TCC lock-up pressure control solenoid (SLU) is a normally-closed 3-port solenoid and is a precision electronic pressure regulator that control the apply and release of the torque converter clutch, the second clutch (B2), and the Low/Reverse clutch (B3) during Low range, based on current flow through its coil windings. This solenoid is Pulse Width Modulated (PWM) and operates at a fixed frequency of 300 Hz (cycles per second) and from 0.0 to 1.1 amps. As the current flow is increased, the pressure control to TCC lock-up control pressure is increased. As current flow is decreased, the pressure control to TCC lock-up control pressure is decreased (See Figure 10).

If a total electronic failure is encountered, the torque converter clutch apply will be inhibited, and will set DTC P0966 or P0967 in the TCM memory.

TCC Pressure Control Solenoid (SLU) "Normally Closed"

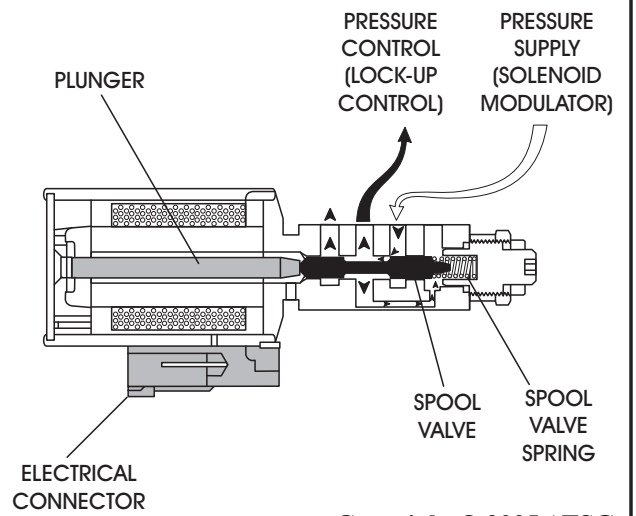


Figure 10

ELECTRICAL COMPONENTS (Cont'd)

Transmission Fluid Temp (TFT) Sensor

The TFT sensor is part of the transaxle internal wire harness assembly, as shown in Figure 12. The TFT sensor is a thermister, which changes value based on temperature, as shown in the chart in Figure 11.

The TCM supplies a 5 volt reference signal to the TFT sensor and measures the voltage drop in the circuit. When the transaxle fluid is cold, the TFT sensor resistance is high and the TCM detects high signal voltage. As the fluid temperature warms to a normal operating temperature, the resistance becomes less and the signal voltage decreases. The TCM uses this information to maintain shift quality and TCC apply quality over the entire operating temperature range.

If the TCM detects an improper signal from the TFT sensor, a DTC will be stored in TCM memory.

Temperature °C	*Ohms Resistance*
-40 °C	*77,480*
-30 °C	*44,000*
-20 °C	*25,880*
-10 °C	*15,730*
0 °C	*9,846*
10 °C	*6,445*
20 °C	*4,184*
30 °C	*2,829*
40 °C	*1,955*
50 °C	*1,379*
60 °C	*992*
70 °C	*726*
80 °C	*541*
90 °C	*409*
100 °C	*314*
110 °C	*247*
120 °C	*192*
130 °C	*153*
140 °C	*124*
150 °C	*101*

Figure 11

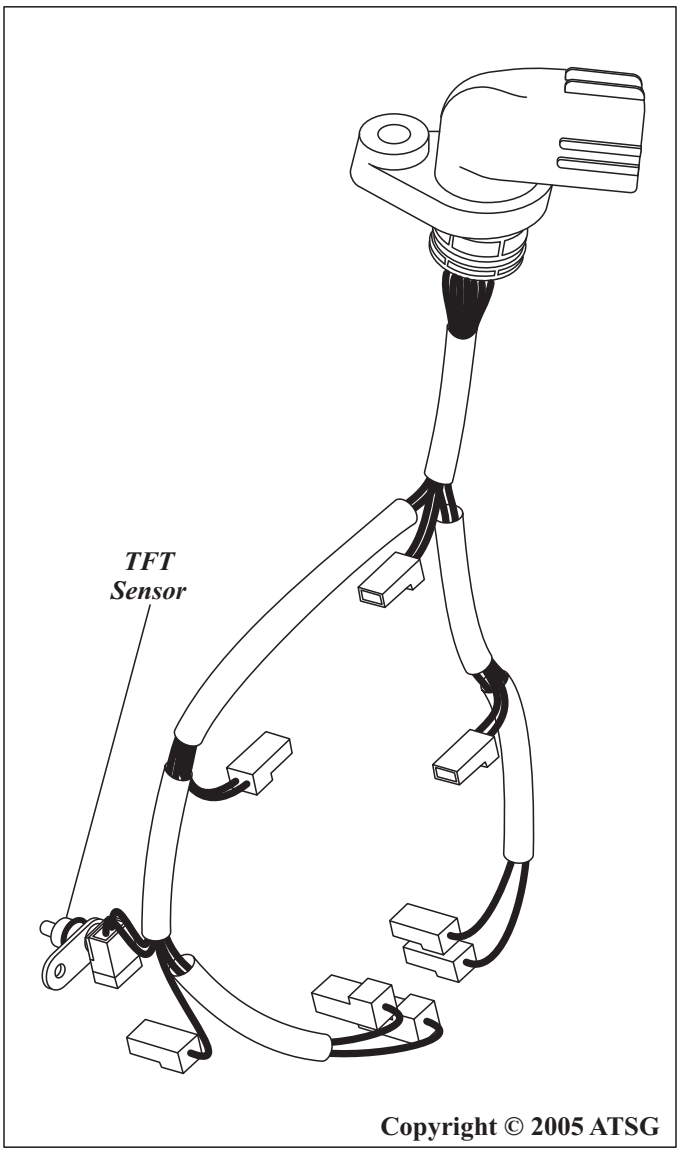


Figure 12

ELECTRICAL COMPONENTS (Cont'd)

Output Shaft Speed (OSS) Sensor

The Output Shaft Speed (OSS) sensor is an active, hall effect pickup located in the top of the transaxle case, as shown in Figure 13. This sensor is mounted in the case opposite the parking gear that is splined to the front differential transfer drive gear carrier assembly shaft. The sensor is supplied with a reference voltage of 0.6 volts. As the parking gear is rotated, a square wave voltage signal is generated by the teeth on the parking gear as they pass by the sensor, that is proportional to vehicle speed.

If the TCM detects an improper signal from the OSS, a DTC will be stored in the TCM memory.

Input Shaft Speed (ISS) Sensor

The Input Shaft Speed (ISS) sensor operates identically to the OSS sensor, except that it uses the teeth on the forward/direct clutch housing as the reluctor or rotor. The forward/direct clutch housing is driven at converter turbine speed. The TCM uses transaxle input and output speeds to help determine line pressure, transaxle shift patterns, TCC apply pressure, gear ratios, and TCC slippage for diagnostic purposes.

If the TCM detects an improper signal from the ISS, a DTC will be stored in the TCM memory.

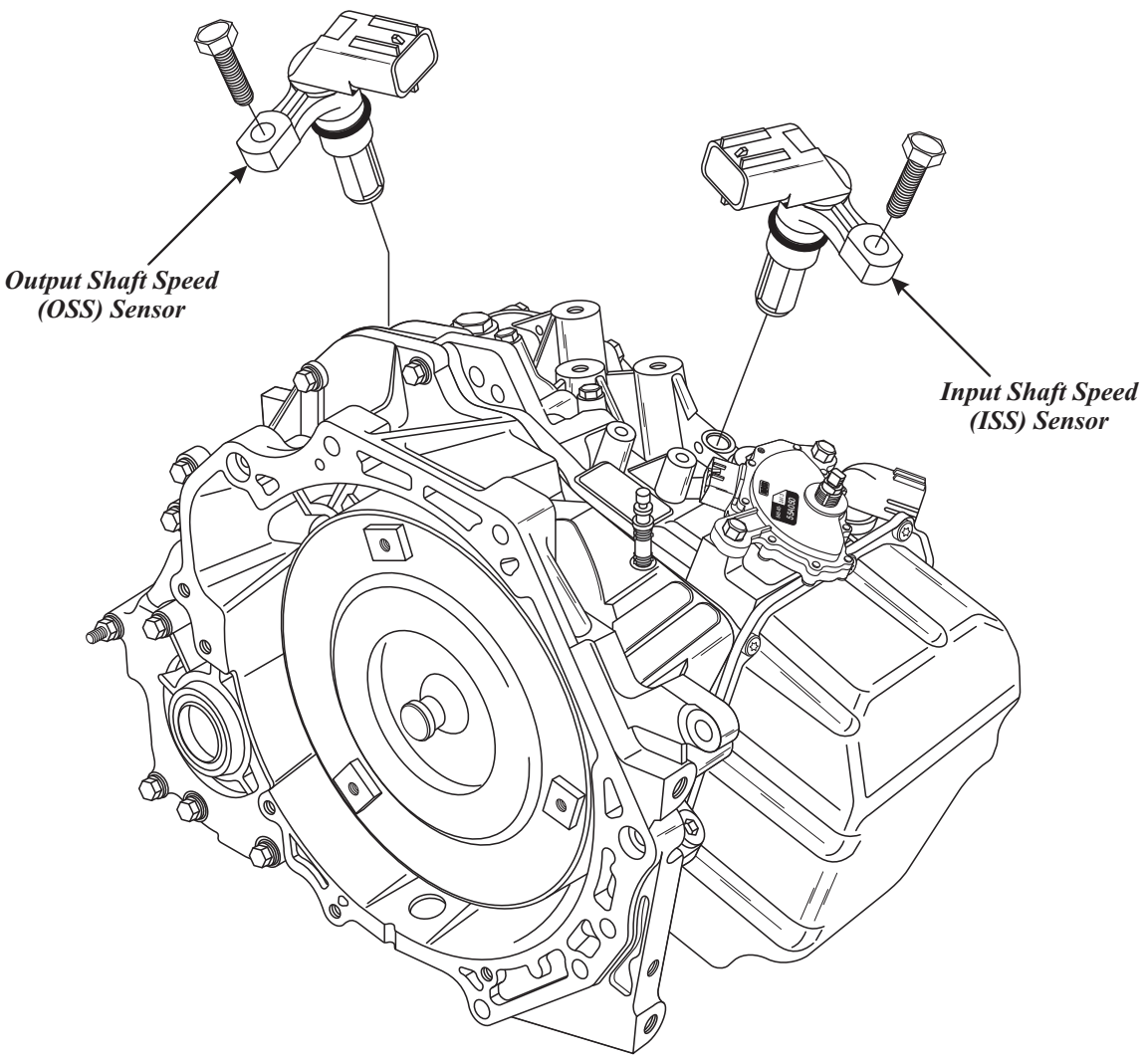


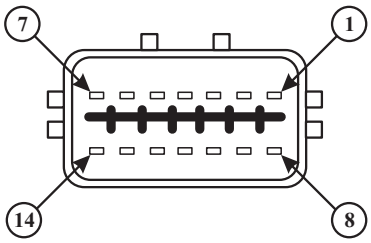
Figure 13

ELECTRICAL COMPONENTS (Cont'd)

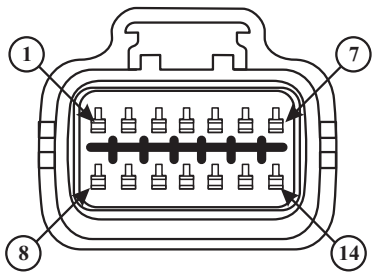
Transaxle CaseConnector Identification

The 14-way transaxle case connector is actually part of the internal wiring harness assembly, as shown in Figure 12. We have provided you with a chart in Figure 14 that identifies the individual terminals in the 14-way transaxle case connector and the vehicle external harness connector, color of the wires and circuit function. A complete transaxle wire schematic from transaxle to the TCM is provided in Figure 15, and a resistance chart for internal transaxle electrical components is dhown in Figure 16.

TRANSAXLE CASE 14-WAY CONNECTOR IDENTIFICATION			
Pin No.	***Wire Color***	***Circuit Number***	***Circuit Function***
1	***Orange/Black***	***586***	***Transaxle Fluid Temp (TFT) Lo signal to TCM.***
2	***Red/White***	***981***	***Shift Pressure Control Solenoid (SLS) ground signal from TCM.***
3	***Lt. Green***	***977***	***TCC Control Solenoid (SLU) ground signal from TCM.***
4	***Black/White***	***979***	***Line Pressure Control Solenoid (SLT) ground signal from TCM.***
5	***Not Used***		
6	***Lt. Blue***	***974***	***Shift Solenoid 4 (S4) voltage signal from TCM.***
7	***Brown***	***972***	***Shift Solenoid 2 (S2) voltage signal from TCM.***
8	***Tan/White***	***585***	***Transaxle Fluid Temp (TFT) Hi signal to TCM.***
9	***Pink/White***	***980***	***Shift Pressure Control Solenoid (SLS) voltage signal from TCM.***
10	***Dk. Blue***	***976***	***TCC Control Solenoid (SLU) voltage signal from TCM.***
11	***Orange/White***	***978***	***Line Pressure Control Solenoid (SLT) voltage signal from TCM.***
12	***Purple***	***975***	***Shift Solenoid 5 (S5) voltage signal from TCM.***
13	***Red***	***973***	***Shift Solenoid 3 (S3) voltage signal from TCM.***
14	***Purple/White***	***971***	***Shift Solenoid 1 (S1) voltage signal from TCM.***



Transaxle Case Connector (Face View)



Vehicle Harness Connector (Face View)

Figure 14

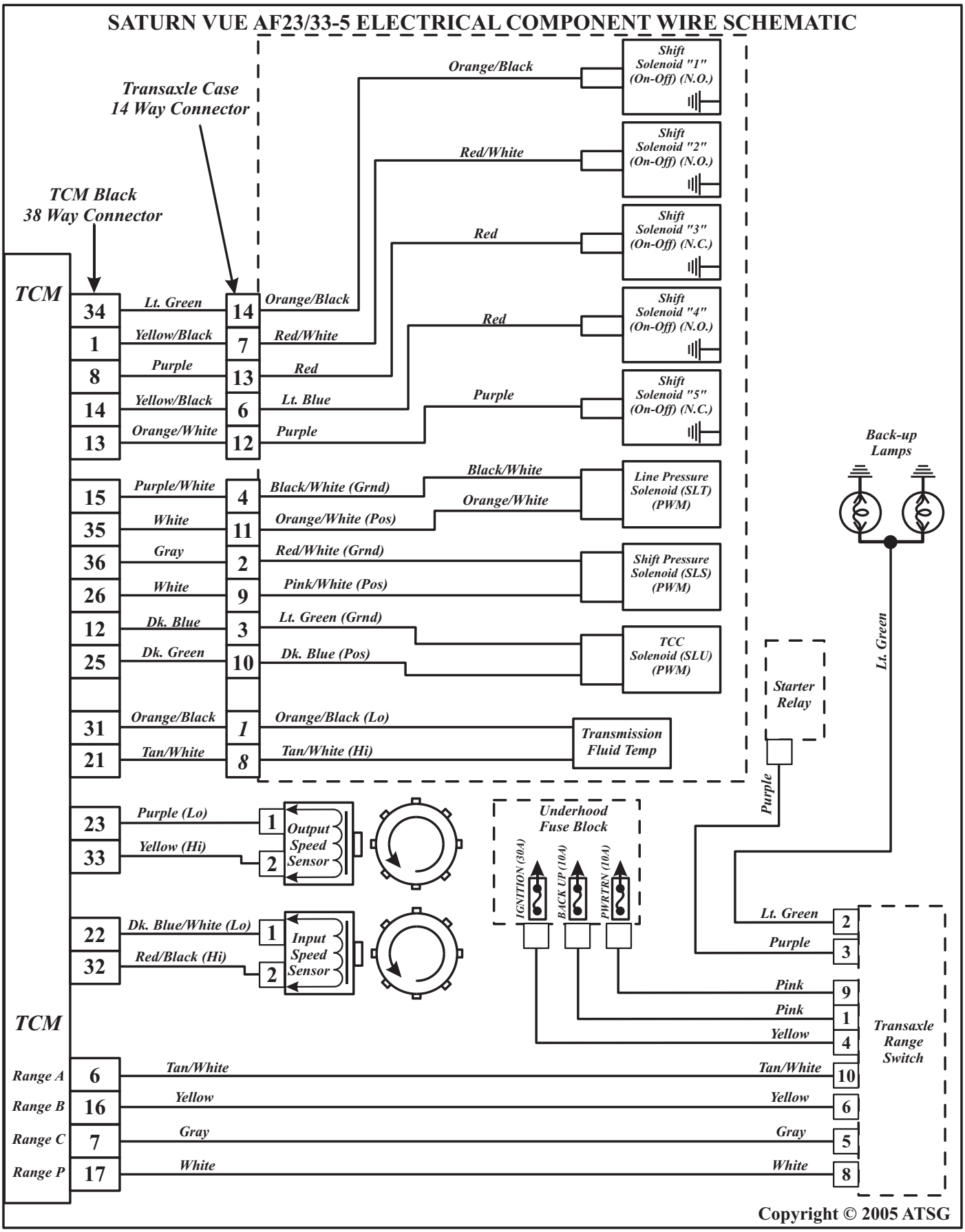

SATURN VUE AF23/33-5 ELECTRICAL COMPONENT WIRE SCHEMATIC
Transaxle Case
14 Way Connector
TCM Black
38 Way Connector
TCM
34 Lt. Green
1 Yellow/Black
8 Purple
14 Yellow/Black
13 Orange/White
14 Orange/Black
7 Red/White
13 Red
6 Lt. Blue
12 Purple
Shift Solenoid "1" (On-Off) (N.O.)
Shift Solenoid "2" (On-Off) (N.O.)
Shift Solenoid "3" (On-Off) (N.C.)
Shift Solenoid "4" (On-Off) (N.O.)
Shift Solenoid "5" (On-Off) (N.C.)
15 Purple/White
35 White
36 Gray
26 White
12 Dk. Blue
25 Dk. Green
4 Black/White (Grnd)
11 Orange/White (Pos)
2 Red/White (Grnd)
9 Pink/White (Pos)
3 Lt. Green (Grnd)
10 Dk. Blue (Pos)
Line Pressure Solenoid (SLT) (PWM)
Shift Pressure Solenoid (SLS) (PWM)
TCC Solenoid (SLU) (PWM)
31 Orange/Black
21 Tan/White
1 Orange/Black (Lo)
8 Tan/White (Hi)
Transmission Fluid Temp
Back-up Lamps
Lt. Green
Starter Relay
Purple
23 Purple (Lo)
33 Yellow (Hi)
1 Output Speed Sensor 2
22 Dk. Blue/White (Lo)
32 Red/Black (Hi)
1 Input Speed Sensor 2
Underhood Fuse Block
IGNITION (30A)
BACK UP (10A)
PWRTRN (10A)
Lt. Green 2
Purple 3
Pink 9
Pink 1
Yellow 4
Transaxle Range Switch
TCM
Range A 6
Range B 16
Range C 7
Range P 17
Tan/White 10
Yellow 6
Gray 5
White 8
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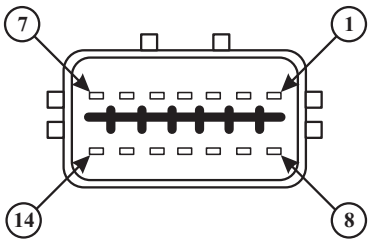
Figure 15

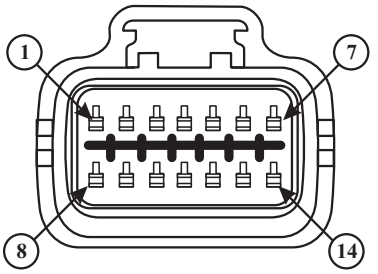
TRANSAXLE CASE 14-WAY CONNECTOR IDENTIFICATION		
Component	*Terminal Numbers*	*Ohms Resistance*
Shift Solenoid 1 (S1)	*14 and Grnd*	*11 - 16 Ohms @ 20° C (68° F)*
Shift Solenoid 2 (S2)	*7 and Grnd*	*11 - 16 Ohms @ 20° C (68° F)*
Shift Solenoid 3 (S3)	*13 and Grnd*	*11 - 16 Ohms @ 20° C (68° F)*
Shift Solenoid 4 (S4)	*6 and Grnd*	*11 - 16 Ohms @ 20° C (68° F)*
Shift Solenoid 5 (S5)	*12 and Grnd*	*11 - 16 Ohms @ 20° C (68° F)*
Line Pressure Control Solenoid (SLT)	*4 and 11*	*5.0 - 5.6 Ohms @ 20° C (68° F)*
Shift Pressure Control Solenoid (SLS)	*2 and 9*	*5.0 - 5.6 Ohms @ 20° C (68° F)*
TCC Control Solenoid (SLU)	*3 and 10*	*5.0 - 5.6 Ohms @ 20° C (68° F)*
Transaxle Fluid Temp (TFT)	*1 and 8*	*See Chart Below*
Input Shaft Speed (ISS) Sensor		*> 10 M Ohms @ 20° C (68° F)*
Output Shaft Speed (OSS) Sensor		*> 10 M Ohms @ 20° C (68° F)*

Transaxle Fluid Temp (TFT)

Temperature °C	*Ohms Resistance*
-40 °C	*77,480*
-30 °C	*44,000*
-20 °C	*25,880*
-10 °C	*15,730*
0 °C	*9,846*
10 °C	*6,445*
20 °C	*4,184*
30 °C	*2,829*
40 °C	*1,955*
50 °C	*1,379*
60 °C	*992*
70 °C	*726*
80 °C	*541*
90 °C	*409*
100 °C	*314*
110 °C	*247*
120 °C	*192*
130 °C	*153*
140 °C	*124*
150 °C	*101*



Transaxle Case Connector (Face View)



Vehicle Harness Connector (Face View)

Figure 16

EXTERNAL ELECTRONIC COMPONENTS

Throttle Position (TP) Sensor

The ECM monitors the variable voltage signal from the TP sensor to calculate throttle angle. These inputs are then sent over the CAN bus to the TCM, to determine the appropriate line pressure, shift pattern and TCC apply and release for the transaxle. In general with greater throttle angle, upshift speeds and line pressure will both increase.

Manifold Absolute Pressure (MAP) Sensor

The MAP sensor changes relative to intake manifold pressure which results from changes in engine load and speed. These changes are converted into a voltage signal which is monitored by the ECM and transmitted over the CAN bus to the TCM to assist in adjusting line pressure and shift timing.

Engine Coolant Temp (ECT) Sensor

The ECM monitors the variable resistance signal from this sensor to determine engine coolant temperature. When the engine is cold, resistance is high, and when engine is hot, resistance through sensor is low. The ECM then transmits this information over the CAN bus to the TCM where it is used to prevent TCC apply when the engine temp is below approximately 20°C (68°F).

Accelerator Pedal Position (APP) Sensor

The APP sensor is monitored by the ECM to determine accelerator pedal position and is transmitted over the CAN bus to the TCM, in order to help determine the appropriate line pressure, shift pattern and TCC apply and release speeds. In general with increased throttle position, upshift speeds and line pressure both increase.

TCC Brake Switch

This signal is transmitted over the CAN bus to the TCM and causes the TCM to command TCC release. When the brake pedal is depressed at low speeds, the TCM opens the ground path for the TCC electrical circuit which releases the converter clutch.

Controller Area Network (CAN) Bus

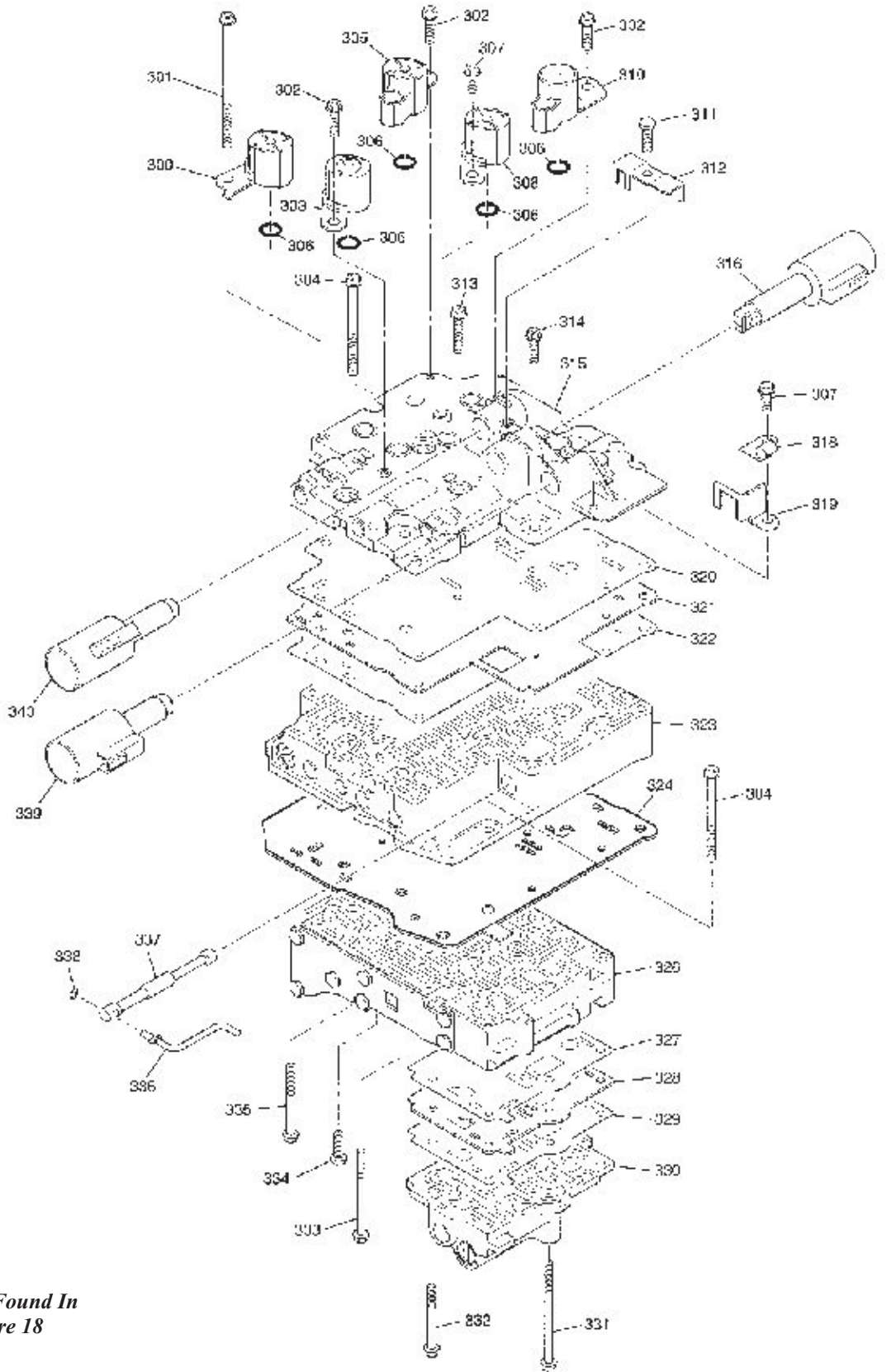
The CAN bus consists of two twisted wires that connect the various vehicle control modules together, allowing them to share information about vehicle conditions.

Note: The sensor/switch information listed above is not a complete listing of TCM inputs that may affect transaxle operation. The combination and usage of these inputs may vary depending on model and the application. Always refer to the appropriate service manual for specific electrical diagnosis information.

	SATURN VUE AF2333-5 DIAGNOSTIC TROUBLE CODES
CODE	***DESCRIPTION***
P0562	***System Voltage low (Battery)***
P0563	***System Voltage high (Battery)***
P0601	***TCM Read only memory failure (ROM)***
P0602	***TCM not programed (no vin number loaded in TCM)***
P0603	***TCM long term memory failure (check-sum failure)***
P0604	***TCM random access failure (RAM)***
P0703	***Brake switch fault via ECM thru CAN***
P0705	***Transmission range switch fault***
P0711	***Transmission fluid temp sensor performance***
P0713	***Transmission fluid temp sensor circuit low voltage***
P0715	***Transmission fluid temp sensor circuit high voltage***
P0717	***Input speed sensor low voltage***
P0722	***Output speed sensor low voltage***
	Continued on next Page

SATURN VUE AF2333-5 DIAGNOSTIC TROUBLE CODES	
CODE	***DESCRIPTION***
P0727	***Engine RPM sensor fault via ECM thru CAN***
P0730	***Incorrect 1st gear Low ratio***
P0731	***Incorrect 1st gear ratio***
P0732	***Incorrect 2nd gear ratio***
P0733	***Incorrect 3rd gear ratio***
P0734	***Incorrect 4th gear ratio***
P0735	***Incorrect 5th gear ratio***
P0736	***Incorrect Reverse ratio***
P0741	***TCC stuck off***
P0744	***TCC intermittent system fault (Mechanical)***
P0762	***SS3 stuck open (Mechanical)***
P0962	***Line Pressure Control Solenoid Low current***
P0963	***Line Pressure Control Solenoid High current***
P0966	***TCC Pressure Control Solenoid Low current***
P0967	***TCC Pressure Control Solenoid High current***
P0970	***Shift Pressure Control Solenoid Low current***
P0971	***Shift Pressure Control Solenoid High current***
P0973	***SS1 Control Circuit Low voltage***
P0974	***SS1 Control Circuit High voltage***
P0976	***SS2 Control Circuit Low voltage***
P0977	***SS2 Control Circuit High voltage***
P0979	***SS3 Control Circuit Low voltage***
P0980	***SS3 Control Circuit High voltage***
P0982	***SS4 Control Circuit Low voltage***
P0983	***SS4 Control Circuit High voltage***
P0985	***SS5 Control Circuit Low voltage***
P0986	***SS5 Control Circuit High voltage***
P1719	***Incorrect shifting detected (Mechanical)***
P1779	***Invalid Torque Delivered Signal from ECM via CAN***
P1780	***Invalid Torque Reduction request from ECM via CAN***
P1781	***Invalid Engine Torque Signal Circuit from ECM via CAN***
P1791	***Invalid Pedal Position Signal Circuit from ECM via CAN***
P1792	***Invalid Engine Coolant Signal Circuit from ECM via CAN***
P1868	***Transmission fluid over 212°F or Calculated Fluid life at 0%***

COMPLETE VALVE BODY ASSEMBLY EXPLODED VIEW



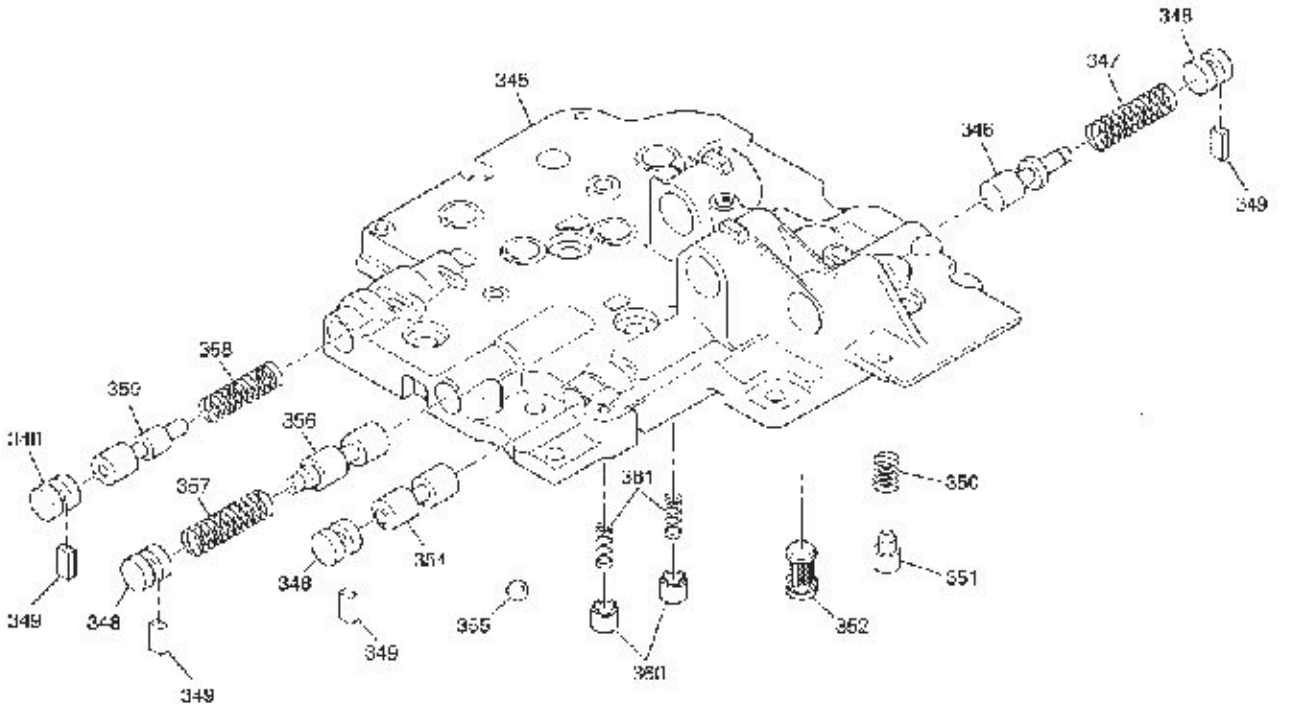
Legend Found In Figure 18

Figure 17

300 1-2, 2-3 REVERSE SHIFT SOLENOID (S3) - DARK GRAY
301 VALVE BODY BOLT, M5 X 0.8 X 62 (1)
302 VALVE BODY BOLT, M5 X 0.8 X 28 (3)
303 3-4, 4-5 SHIFT SOLENOID (S4) - BLUE
304 VALVE BODY BOLT, M5 X 0.8 X 50 (2)
305 REVERSE SHIFT SOLENOID (S5) - BROWN
306 SHIFT SOLENOID "O" RING SEAL (6)
307 VALVE BODY BOLT, M5 X 0.8 X 10 (2)
308 2-3, 3-4 SHIFT SOLENOID (S2) - BLACK
310 REVERSE, 1ST SHIFT SOLENOID (S1) - BLACK
311 VALVE BODY BOLT, M5 X 0.8 X 13 (1)
312 SOLENOID ASSEMBLY RETAINER
313 VALVE BODY BOLT, M5 X 0.8 X 20 (2)
314 VALVE BODY BOLT, M5 X 0.8 X 16 (2)
315 FRONT VALVE BODY ASSEMBLY
316 LINE PRESSURE CONTROL SOLENOID (SLT) - BLUE
318 WIRING HARNESS CLIP
319 TCC PRESSURE CONTROL SOLENOID (SLU) RETAINER
320 FRONT VALVE BODY TO FRONT SPACER PLATE GASKET
321 FRONT VALVE BODY SPACER PLATE
322 FRONT SPACER PLATE TO MIDDLE VALVE BODY GASKET
323 MIDDLE VALVE BODY ASSEMBLY
324 MIDDLE V.B. TO REAR V.B. SPACER PLATE/GASKET ASSEMBLY
326 REAR VALVE BODY ASSEMBLY
327 REAR V.B. TO SPACER PLATE GASKET
328 REAR V.B. TO REAR V.B. NO. 2 SPACER PLATE
329 REAR V.B. NO. 2 SPACER PLATE TO REAR V.B. NO. 2 GASKET
330 REAR VALVE BODY NO.2 ASSEMBLY
331 VALVE BODY BOLT, M5 X 0.8 X 76 (1)
332 VALVE BODY BOLT, M5 X 0.8 X 49.5 (4)
333 VALVE BODY BOLT, M5 X 0.8 X 40 (1)
334 VALVE BODY TEST HOLE PRESSURE TAP, M6 X 1.0 X 12 (1)
335 VALVE BODY BOLT, M5 X 0.8 X 35 (2)
336 MANUAL VALVE LINK
337 MANUAL VALVE
338 MANUAL VALVE LINK RETAINER
339 TCC PRESSURE CONTROL SOLENOID (SLU) - BLACK
340 SHIFT PRESSURE CONTROL SOLENOID (SLS) - GREEN

Figure 18

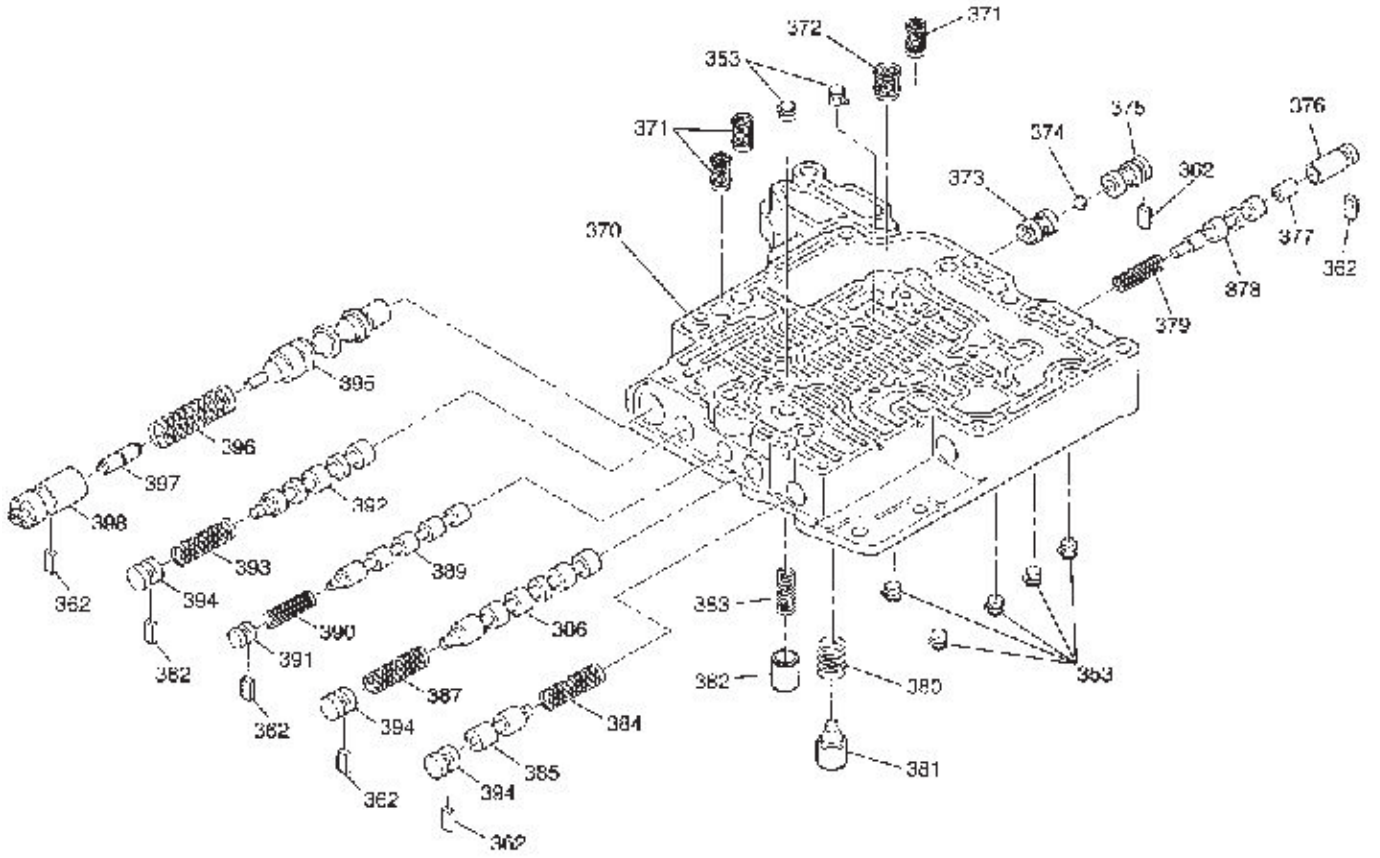
FRONT VALVE BODY EXPLODED VIEW



345 FRONT VALVE BODY CASTING
346 SOLENOID MODULATOR VALVE
347 SOLENOID MODULATOR VALVE SPRING (YELLOW)
348 SOLENOID MODULATOR VALVE BORE PLUG (4)
349 BORE PLUG RETAINER (3.2 X 5 X 10) (4)
350 PRESSURE RELIEF VALVE SPRING (NATURAL)
351 PRESSURE RELIEF VALVE
352 SCREEN
354 FORWARD CLUTCH (C1) CONTROL VALVE
355 CHECKBALL
356 NEUTRAL RELAY VALVE
357 NEUTRAL RELAY VALVE SPRING (LT. BLUE)
358 2ND COAST CLUTCH (B1) CONTROL VALVE SPRING (BLUE)
359 2ND COAST CLUTCH (B1) CONTROL VALVE
360 CHECK VALVE (2)
361 CHECK VALVE SPRING (2)

Figure 19

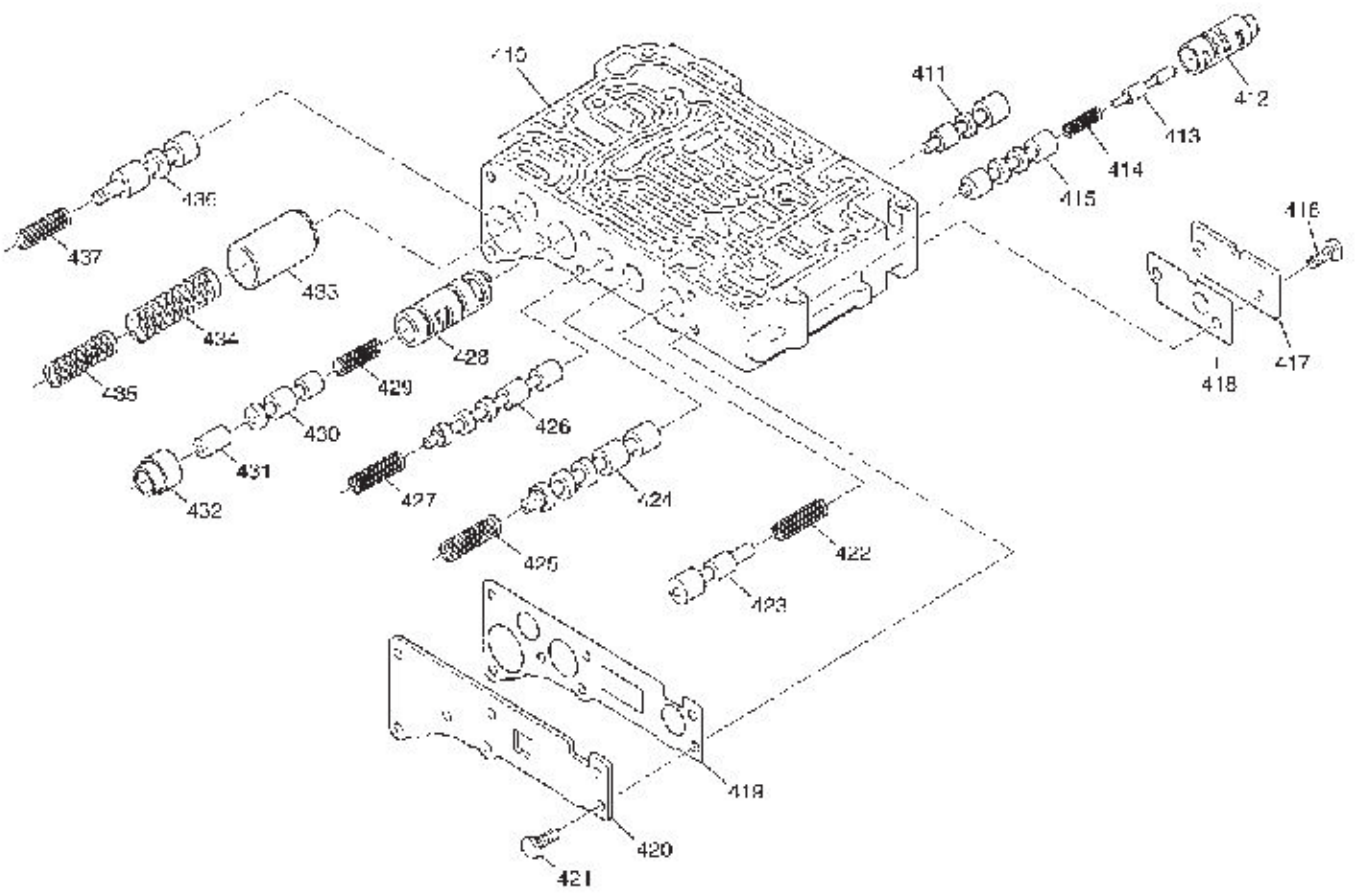
MIDDLE VALVE BODY EXPLODED VIEW



353 ACCUMULATOR CHECK VALVE ASSEMBLY (7)
362 BORE BLUG RETAINER (3.2 X 5 X 12.5) (7)
370 MIDDLE VALVE BODY CASTING
371 SCREEN (3)
372 SCREEN (1)
373 REVERSE SHIFT CHECKBALL "INNER" BUSHING
374 REVERSE SHIFT CHECKBALL
375 REVERSE SHIFT CHECKBALL "OUTER" BUSHING
376 SOLENOID RLAY VALVE BUSHING
377 SOLENOID RELAY VALVE PLUNGER
378 SOLENOID RELAY VALVE
379 SOLENOID RELAY VALVE SPRING (ORANGE)
380 COOLER BY-PASS VALVE SPRING (NATURAL)
381 COOLER BY-PASS VALVE
382 TCC CHECK VALVE
383 TCC CHECK VALVE SPRING (YELLOW)
384 3RD GEAR BAND (B4) RELEASE VALVE SPRING (BLUE)
385 3RD GEAR BAND (B4) RELEASE VALVE
386 U1 SHIFT VALVE
387 U1 SHIFT VALVE SPRING (LT. GREEN)
389 M1 SHIFT VALVE
390 M1 SHIFT VALVE SPRING (LT. BLUE)
391 M1 SHIFT VALVE BORE PLUG
392 U2 SHIFT VALVE
393 U2 SHIFT VALVE SPRING (LT. GREEN)
394 U2 SHIFT VALVE BORE PLUG (3)
395 PRIMARY PRESSURE REGULATOR VALVE
396 PRIMARY PRESSURE REGULATOR VALVE SPRING (PURPLE)
397 PRIMARY PRESSURE REGULATOR REVERSE BOOST VALVE
398 PRIMARY PRESSURE REGULATOR VALVE BUSHING

Figure 20

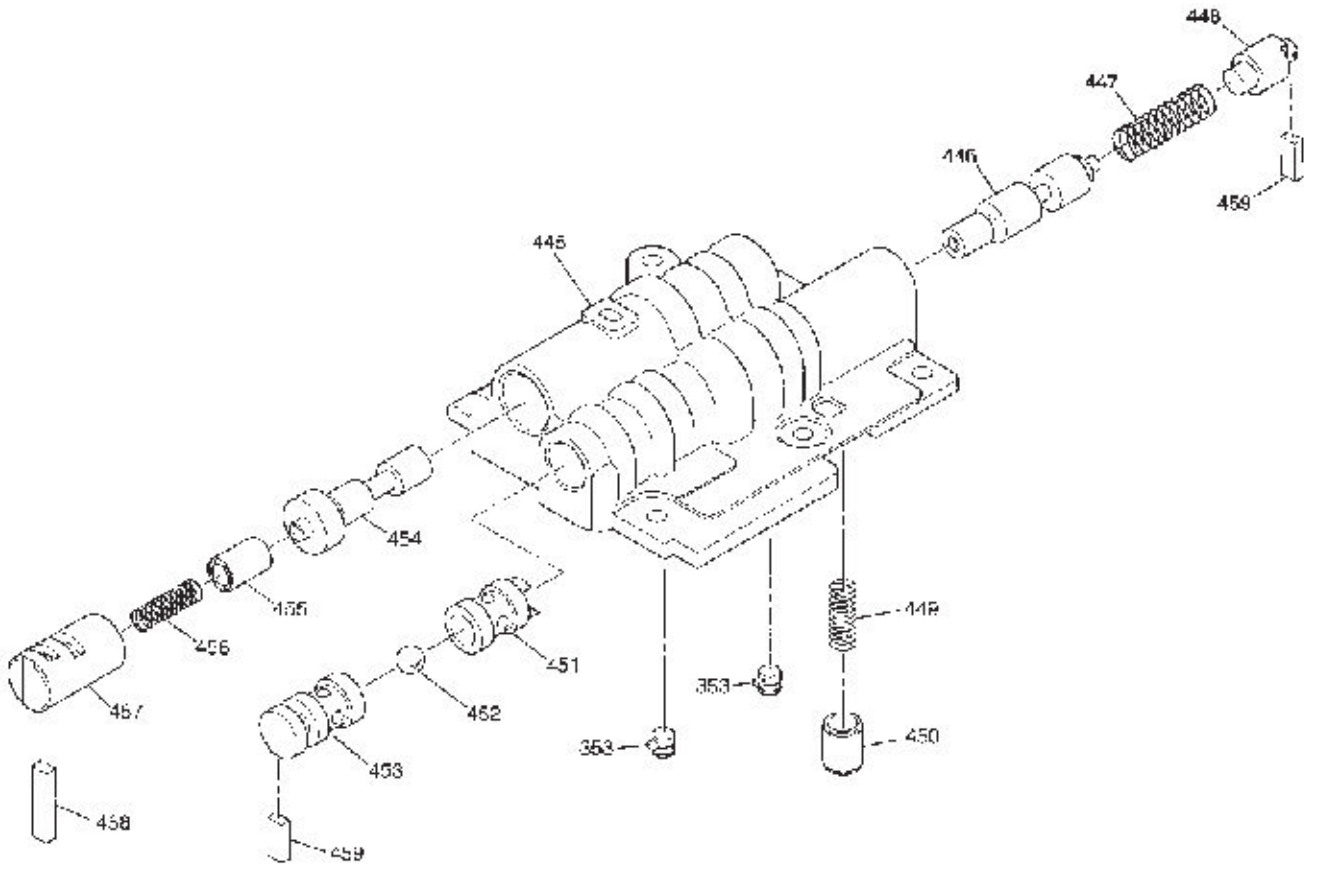
REAR VALVE BODY EXPLODED VIEW



410 REAR VALVE BODY CASTING
411 1-2, REVERSE CLUTCH (B5) CONTROL VALVE
412 LOCK-UP RELAY CONTROL VALVE BUSHING
413 LOCK-UP RELAY CONTROL VALVE PLUNGER
414 LOCK-UP RELAY CONTROL VALVE SPRING (RED)
415 LOCK-UP RELAY VALVE
416 SMALL COVER PLATE BOLT, M5 X 0.8 X 13 (2)
417 SMALL COVER PLATE
418 SMALL COVER PLATE GASKET
419 LARGE COVER PLATE GASKET
420 LARGE COVER PLATE
421 LARGE COVER PLATE BOLT, M5 X 0.8 X 13 (7)
422 3RD GEAR BAND (B4) CONTROL VALVE SPRING (ORANGE)
423 3RD GEAR BAND (B4) CONTROL VALVE
424 SHIFT PRESSURE RELAY VALVE
425 SHIFT PRESSURE RELAY VALVE SPRING (LT. GREEN)
426 M2 SHIFT VALVE
427 M2 SHIFT VALVE SPRING (LT. BLUE)
428 SHIFT PRESSURE CONTROL VALVE BUSHING
429 SHIFT PRESSURE CONTROL VALVE SPRING (WHITE)
430 SHIFT PRESSURE CONTROL VALVE
431 SHIFT PRESSURE CONTROL VALVE PLUNGER
432 SHIFT PRESSURE CONTROL VALVE PLUNGER SLEEVE
433 LINE PRESSURE CONTROL ACCUMULATOR PISTON
434 LINE PRESSURE ACCUMULATOR "OUTER" SPRING (ORANGE)
435 LINE PRESSURE ACCUMULATOR "INNER" SPRING (ORANGE)
436 SECONDARY REGULATOR VALVE
437 SECONDARY REGULATOR VALVE SPRING (NATURAL)

Figure 21

NUMBER 2 REAR VALVE BODY EXPLODED VIEW



353 ACCUMULATOR CHECK VALVE ASSEMBLY (2)
445 NUMBER 2 REAR VALVE BODY CASTING
446 2ND CLUTCH (B2) CONTROL VALVE
447 2ND CLUTCH (B2) CONTROL VALVE SPRING (NATURAL)
448 2ND CLUTCH (B2) CONTROL VALVE BORE PLUG
449 TCC CHECK VALVE SPRING (LT. BLUE)
450 TCC CHECK VALVE
451 REVERSE SHIFT INHIBIT CHECKBALL "INNER" BUSHING
452 REVERSE SHIFT INHIBIT CHECKBALL
453 REVERSE SHIFT INHIBIT CHECKBALL "OUTER" BUSHING
454 LOCK-UP CONTROL VALVE
455 LOCK-UP CONTROL VALVE PLUNGER
456 LOCK-UP CONTROL VALVE SPRING (YELLOW)
457 LOCK-UP CONTROL VALVE BUSHING
458 BORE PLUG RETAINER (3.2 X 5 X 21.2) (1)
459 BORE PLUG RETAINER (3.2 X 5 X 15) (2)

Figure 22