Technical Bulletin # 1308

Transmission: *ZF4HP16*
Subject: *Electronical Components Description*
Application: *2005 Suzuki Forenza L4 - 2.0L*
Issue Date: *February, 2010*

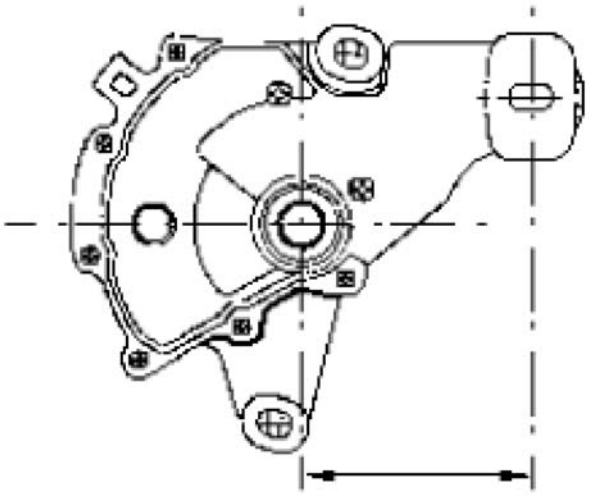
ZF4HP16
Electronical Components Description

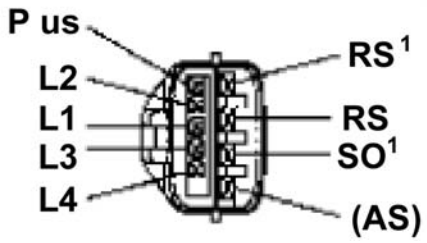
Selector Lever/Program Switch
The driver engages the travel position via the selector lever: P: Park Position R: Reverse N: Neutral D: Forward Speeds

Park/Neutral Position Switch
The Park/Neutral Position Switch is located on the selector shaft and informs the TCM of the current selector lever position P-R-N-D-3-2-1. The selector lever position is transmitted to the TCM in encoded form along 4 lines. The encoding is such that malfunctions in the connecting lead are identified. The Park/Neutral Position Switch is located on the selector shaft, which is connected to the selector lever via a pull cable. In addition, the Park/Neutral Position Switch controls the starter interlock, the reversing light and the selector lever position indicator on the instrument panel.

Signal Combination

	L1	L2	L3	L4
P	0	0	12	0
R	0	0	0	12
N	0	12	0	0
D	12	12	12	0
3	12	12	0	12
2	12	0	12	12
1	0	12	12	12





Signal Combination

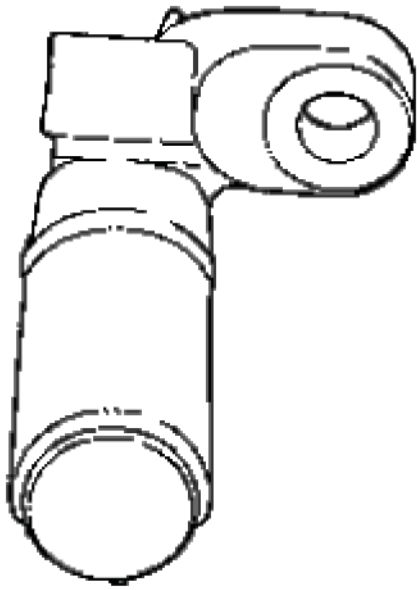
Automatic Transaxle Output Speed Sensor (A/T OSS)

The vehicle A/T OSS is a magnetic inductive pickup that relays information relative to vehicle speed to the TCM. Vehicle speed information is used by the tCM to control shift timing, line pressure and TCC (lock up clutch) apply and release.

The output speed sensor mounts in the case at the speed sensor rotor, which is pressed onto the spur gear. An air gap of **0.1 mm - 1.3 mm (0.004 - 0.05 inch)** is maintained between the sensor and the teeth on the spur gear teeth. The sensor consists of a permanent magnet surrounded by a coil of wire. As the differential rotates, an AC signal is generated by the output speed sensor **(OSS)**.

Automatic Transaxle Input Speed Sensor (A/T ISS)

The A/T ISS is a magnetic inductive pickup that relays information relative to transaxle input speed to the TCM. The TCM uses transaxle input speed information to control line pressure, TCC apply and release and transaxle shift patterns. This information is also uses to calculate the appropriate operating gear ratios and TCC slippage. The input speed sensor mounts onto piston B that is inside of the valve body. An air gap of **1.8 - 2.2 mm (0.07 - 0.086 inch)** is maintained between the sensor and the piston B. The sensor consits of a permanent magnet surrounded by a coil of wire. As the piston B is driven by the turbine shaft, an AC signale induced in the input speed sensor. Higher vehicle speeds induce a higher frequency and voltage measurement at the sensor. Sensor resistance should measure between **825 - 835 ohms at 20°C (68°F)**. Sensor can measure from **1,000 - 8,000 HZ**.



Shift Solenoid Valve: Solenoid 1, 2

The shift solenoids are two identical, normally open electronic exhaust work that control upshifts and downshifts in all forward gear ranges. These shift solenoids valves together in a combination of ON and OFF sequences to control the line pressure and shift mechanisms (clutches, brakes). Solenoid 1 controls the high or low of the line pressure (flow to each clutch valve) by the operation type (ON/OFF), i.e. solenoid is ON, line pressure will be below **(87 - 116 psi (6 - 8 bar))**, solenoid 1 is OFF, line pressure will be high **(232 - 261 psi (16 - 18 bar))**. Solenoid 2 controls the oil flow to clutch valve E or lockup clutch valve by the ON/OFF signal.

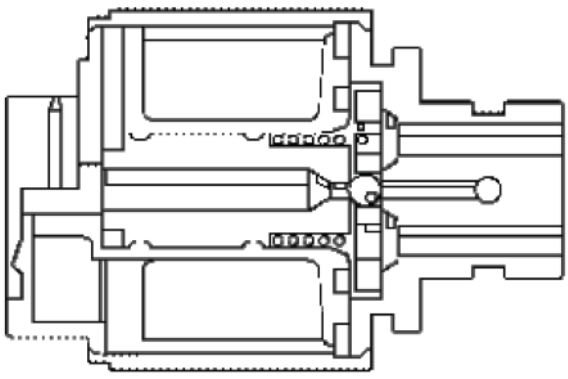
Gear	Solenoid 1	Solenoid 2
Park, Neutral	ON	ON
First	ON/OFF	ON
Second	ON/OFF	OFF
Third	ON/OFF	OFF
Fourth	ON/OFF	OFF
Reverse	ON/OFF	ON

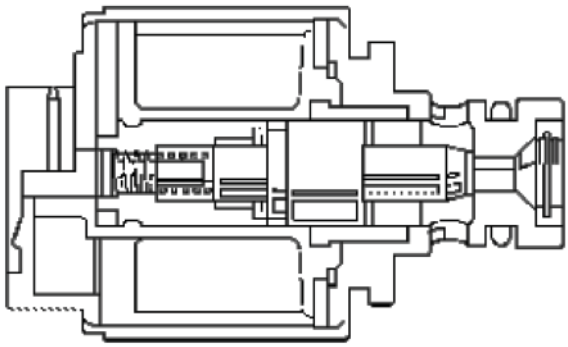
	Line Pressure	Resistance
Solenoid Valve 1 / Solenoid Valve 2	ON (low) 89.9~98.6 psi (6.2~6.8 bar) OFF (high) • 221.9~253.24 psi • (15.3~17.46 bar)	26.5 ± 0.5 ohm

The TCM monitors numerous inputs to determine the appropriate solenoid state combination and transaxle gear for the vehicle operating conditions.

Pressure Control Solenoid Valve (EDS VALVE 3, 4, 5, 6)

The pressure control valve (EDS valve 3, 4, 5, 6) is a precision electronic pressure regulator that controls the operation of the clutches, brakes and the lock-up clutch. The valve reduces the system pressure with which the downstream solenoid valves and electrical pressure regulating valves are supplied. It is possible to use smaller solenoid valves as a result. The EDS require a constant input pressure.





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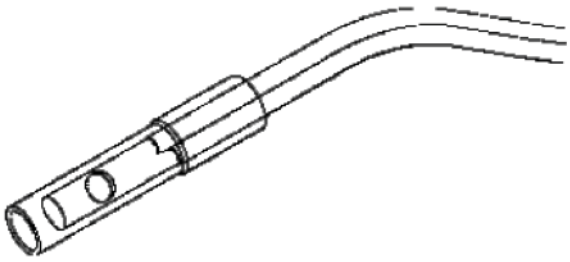
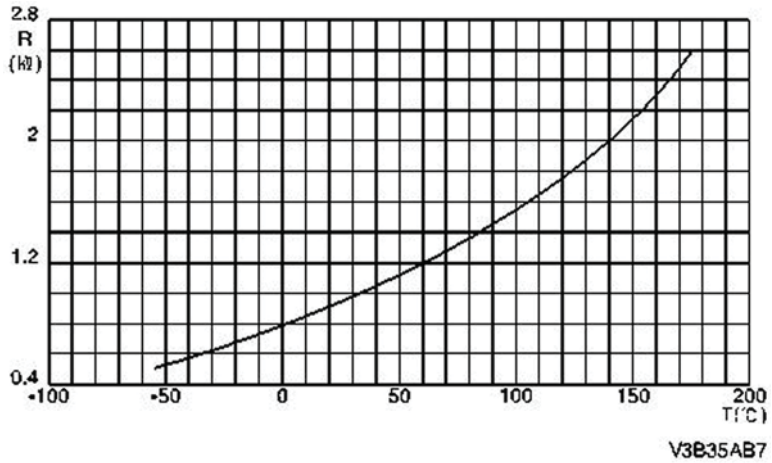
Transaxle Fluid Temperature (TFT) Sensor

The TFT sensor is a positive temperature coefficient thermistor (temperature sensitive resistor) that provides information to the TCM regarding transaxle fluid temperature. The temperature sensor is located in valve body. Calculated temperature is a factor used to determine the shift time and shift delay time. The internal electrical resistance of the sensor varies in relation to the operating temperature of the transaxle fluid (see chart).





The TCM sends a **5 volt** reference signal to the temperature sensor and measures the voltage rise in the electrical circuit. A higher fluid temperature creates a higher resistance in the temperature sensor, thereby measuring a lower voltage signal. The TCM measures this voltage as another input to help control line pressure, shift schedules and TCC apply.

When transaxle fluid temperature reaches **140°C (284°F)** the TCM enters "hot mode." Above this temperature the TCM modifies transaxle shift schedules and TCC apply in an attempt to reduce fluid temperature by reducing transaxle heat generation. During hot mode the TCM applies the TCC at all times in fourth gear.

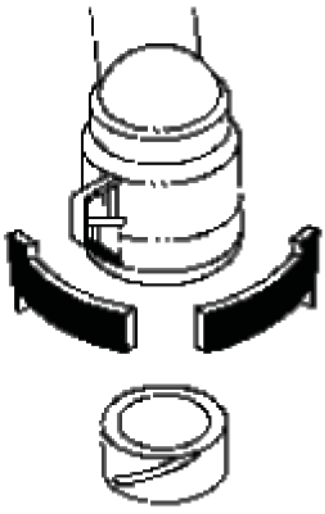
Transaxle Sensor - Temperature To Resistance To Voltage (approximate)					
°C (°F)	**R high (ohms)**	**R low (ohms)**	**°C (°F)**	**R high (ohms)**	**R low (ohms)**
-40 (-40)	586	556	50 (122)	1206	1173
-30 (-22)	641	611	60 (146)	1295	1256
-20 (-4)	699	670	70 (158)	1388	1341
-10 (14)	760	732	80 (176)	1485	1430
0 (32)	825	799	90 (194)	1585	1522
10 (50)	893	868	100 (212)	1690	1617
20 (68)	963	942	110 (230)	1798	1715
25 (77)	1000	980	120 (248)	1910	1816
30 (86)	1039	1017	130 (266)	2025	1920
			140 (284)	2145	2027

Also, the TCM commands the 2-3 and 3-4 shifts earlier to help reduce fluid heat generation. Hot mode may not be available on some applications.

Transaxle Electrical Connector
The transaxle electrical connector is a very important part of the transaxle operating system. Any interference with the electrical connection can cause the transaxle to set Diagnostic Trouble Codes **(DTCs)** and/or affect proper operation.

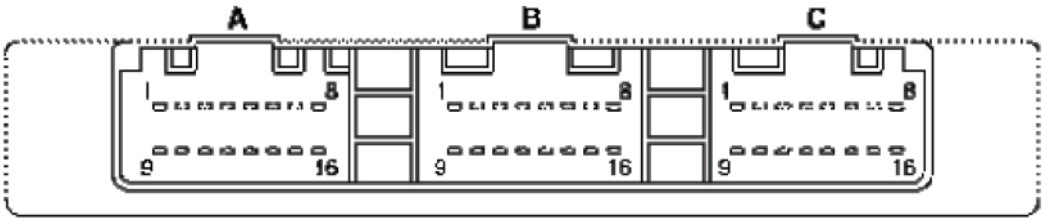
The following items can affect the electrical connections:
- Bent pins in the connector from rough handling during connection and disconnection.
- Wires backing away from the pins or coming unclamped (in either internal or external wiring harness).
- Dirt contamination entering the connector when disconnected.
- Pins in the internal wiring connector backing out of the connector or pushed out during reconnection.
- Excessive transaxle fluid leaking into the connector, wicking up into the external wiring harness, and degrading the wire insulation.
- Water/moisture intrusion in the connector.
- Low pin retention in the external connector from excessive connection and disconnection of the wiring connector assembly.
- Pin corrosion from contamination.
- Broken/cracked connector assembly.
- Points to remember when working with transaxle wiring connector assembly.
- To remove the connector, squeeze the two tabs towards each other and pull straight up.

Carefully limit twisting or wiggling the connector during removal. Bent pins can occur. DO NOT pry the connector off with a screwdriver or other tool. To reinstall the external wiring connector, first orient the pins by lining up arrows on each half of the connector. Push the connector straight down into the transaxle without twisting or angling the mating parts. The connector should click into place with a positive feel and/or noise.



Transaxle Control Module (TCM)
The transaxle control module **(TCM)** is an electronic device which monitors inputs to control various transaxle functions including shift quality and transaxle sensors, switches, and components to process for use within its' control program. Based on this input information, the TCM controls various transaxle output functions and devices.

Data Link Connector (DLC)
The data link connector **(DLC)** is a multiple cavity connector. The DLC provides the means to access serial data from the TCM to aid in powertrain diagnosis. The DLC allows the technician to use a scan tool to monitor various systems and display diagnostic trouble codes **(DTCs)**. The DLC connector is located within the driver's compartment, directly below the steering column.



	A Connector (Blue)	B Connector (Green)	C Connector (Gray)
1	Solenoid 2	Fluid Temperature Ground	Selector Lever Line L1
2	Not Used	Input Speed Sensor (+)	Not Used
3	Pressure Control Solenoid Valve (EDS 4)	BAT +	Not Used
4	TFT Sensor	Input Speed Sensor (-)	Hold Mode Switch
5	Stoplamp Switch	Output Speed Sensor (-)	Not Used
6	Hold Mode Indicator	Selector Lever Line L3	EDS Supply
7	DLC	Input Speed Sensor Ground	EDS Supply
8	CAN High	Speedometer	Solenoid Supply
9	Solenoid 1	Not Used	Not Used
10	Pressure Control Solenoid Valve (EDS 5)	Output Speed Sensor (+)	Not Used
11	Pressure Control Solenoid Valve (EDS 3)	Selector Lever Line L4	Not Used
12	Pressure Control Solenoid Valve (EDS 6)	Ground	Not Used
13	Not Used	Ground	Not Used
14	Not Used	Not Used	Not Used
15	Not Used	Selector Lever Line 2	IG ON
16	CAN Low	Not Used	IG ON

Data Link Connector (CAN TYPE) 2.0L DOHC (Delphi 32 bit)