The learning process of comparing and adjusting shift parameters is referred to as adaptive control. The TCM constantly monitors operating conditions, such as battery voltage and transmission sump temperature, and adjusts shift parameters accordingly. After a shift is completed, the TCM compares the shift to a target shift profile in the TCM calibration and makes adjustments before the next shift of the same kind is made.

TRANSMISSION GEAR RATIOS

Transmission gear ratios are:

First gear	3.10:1
Second gear	1.81:1
Third gear	1.41:1
Fourth gear	1.00:1
Fifth gear	0.71:1
Reverse	4.49:1

TRANSMISSION IDENTIFICATION

An I.D. plate is attached to the passenger side of each Allison Transmission (Figure 5-1). The plate contains the model, date of manufacture, serial number, engineering feature configuration, transmission identification, and the engineering group (Figure 5-2).

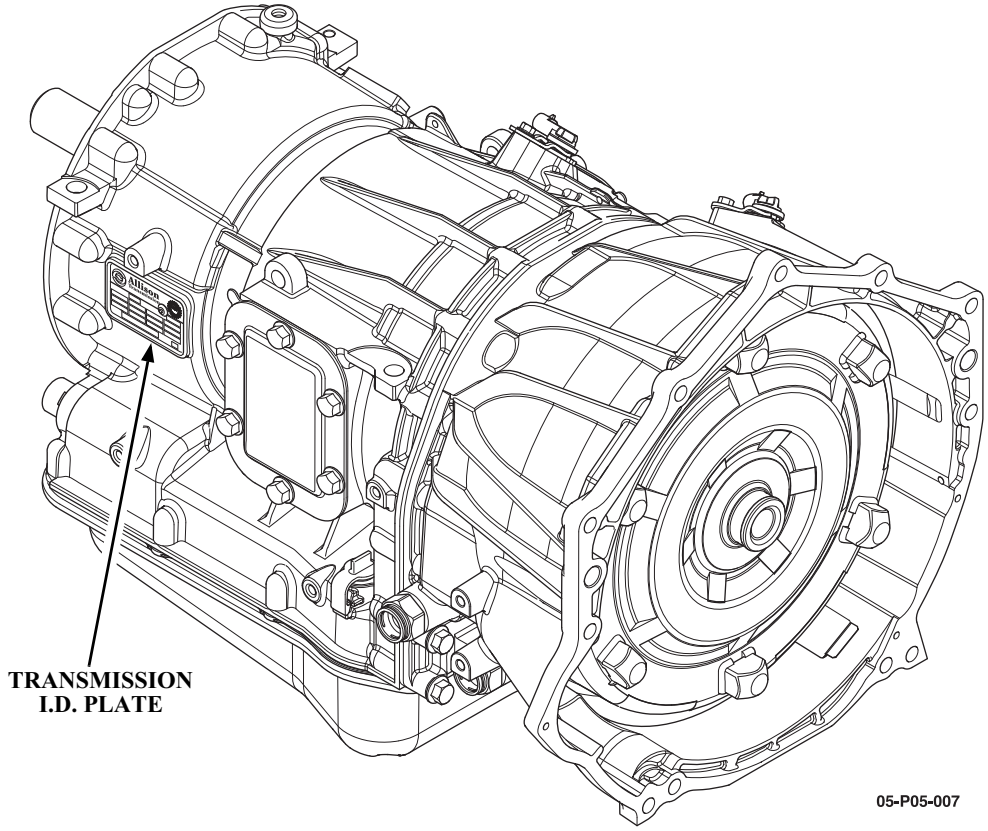

Figure 5-1: Transmission I.D. Plate location

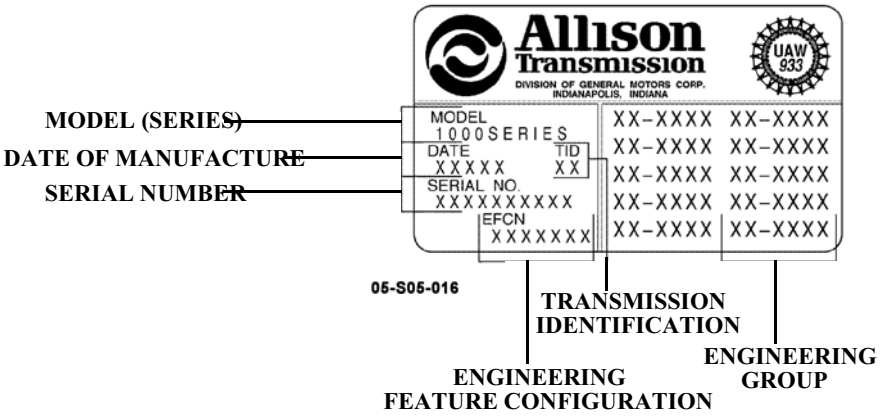

Figure 5-2: Transmission Identification (example plate)

TRANSMISSION CONTROL MODULE

A microcomputer controls the transmission by receiving and processing signals from various switches and sensors. The microcomputer determines shift sequences, shift timing, and clutch apply and release characteristics. The microcomputer is an independent controller and is referred to as a transmission control module (TCM). The TCM has a 12 volt configuration to match the configuration of the vehicle electrical system. The pressure switch manifold (PSM) and the park/neutral position (PNP) switch provide operator input to the TCM. Other data sent to the TCM include throttle position, engine, turbine, and output speeds, and sump temperature. An active special function, such as anti-lock brakes, is also an input to the TCM. The TCM processes this data to determine proper shift points, to monitor the current range, to perform ratio tests, and to compile diagnostic data. The TCM is programmed to protect the transmission and other vehicle driveline components by inhibiting actions, such as full-throttle NEUTRAL-to-range shifts and high speed direction changes. The TCM determines if a system malfunction exists and stores diagnostic codes related to the malfunction. The codes, accessed by the service technician, are used in diagnosing persistent or intermittent trouble in the system.

THROTTLE POSITION/TORQUE MANAGEMENT

The TCM receives input on throttle position/torque management, from a signal transmitted by the engine electronic controls. The engine electronic controls communicate directly to the transmission electronic controls over a serial communication interface (SCI) data link. The transmission TCM must be calibrated to receive these signals.

SPEED SENSORS

There are three speed sensors typically required for use with the 1000 Series transmissions (Figure 5-3). They include the input speed sensor (TIS), the turbine speed sensor, and the output speed sensor (TOS). The speed sensors provide RPM information to the TCM. The speed ratios between the various sensors allow the TCM to determine the transmission operating range. Speed sensor information is also used to control the timing of clutch apply pressures, resulting in the best possible shift quality. Hydraulic conditions are detected by comparing the speed sensor information, for the current range, to the range of the speed sensor information stored in TCM memory. The speed sensors are variable reluctance devices that convert mechanical motion to an AC voltage. Each sensor consists of a wire coil wrapped around a pole piece that is adjacent to a permanent magnet. These elements are contained in a housing that is mounted adjacent to a rotating ferrous member.

VEHICLE SPEED SENSOR (VSS)

The vehicle speed sensor is located on the transfer case (Figure 5-3). Vehicle speed sensor information is used to determine vehicle speed. The speed sensor is a variable reluctance device that converts mechanical motion to an AC voltage. The sensor consists of a wire coil wrapped around a pole piece that is adjacent to a permanent magnet. These elements are contained in a housing that is mounted adjacent to a rotating ferrous member. The signal is sent to the ECM then on to the speedo/tach module.

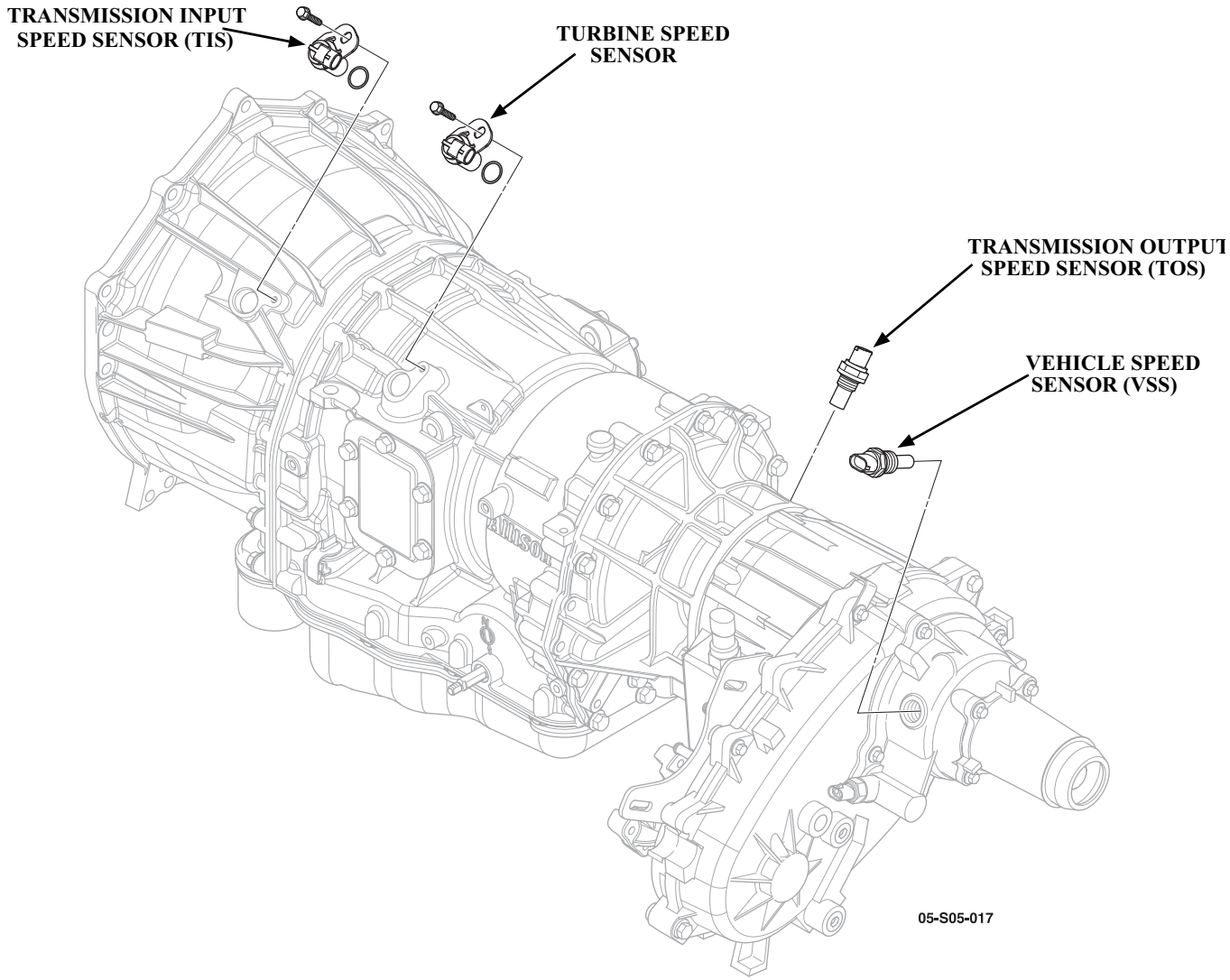

Figure 5-3: Speed Sensors

NEUTRAL START BACK UP (NSBU) SWITCH

The vehicle is equipped with a console style shift selector. In addition to the console shift selector provided for the operator, another component associated with the shift selector is the neutral start back up (NSBU) switch mounted on the selector shaft of the transmission. The NSBU switch transmits selector position information to the TCM. The NSBU switch mounts directly onto the transmission housing from the outside and detects the angular position of the shift selector shaft. this position is communicated to the TCM so that certain vehicle control functions can be coordinated with the position of the shift controls. The NSBU switch has redundant circuitry to alert the TCM in the event of a single wire or switch failure. The neutral signal output of the NSBU switch is used as confirmation that the transmission is in neutral before the engine starter is engaged. The NSBU switch is interfaced to the starter circuit. The reverse signal is used for back up lights, auto dimming mirror defeat and may be used for back up warning devices.

INTERNAL TRANSMISSION COMPONENTS

Several components of the 1000 Series electrical control system are located within the transmission, as part of the main control valve body. These components include three types of solenoids for controlling the hydraulic action of the valves, the pressure switch manifold and an internal wiring harness that links the internal components with the TCM.

SHIFT SOLENOIDS

The 1000 Series control valve body contains both normally closed (N/C) and normally open (N/O) solenoids. A N/C solenoid remains closed until a signal from the TCM energizes the solenoid. A N/O solenoid remains open until the TCM energizes the solenoid. When a solenoid valve is in the closed position, the valve blocks the flow. When a solenoid valve is in the open position, flow is permitted through the valve. The torque converter clutch pulse width modulated (TCC PWM) solenoid and the shift solenoids C, D, and E are N/C. Both solenoid types have an orifice, electrical windings, an iron core, and a steel check ball.

The solenoids used in the 1000 Series differ in their ability to control flow or fluid pressure. The solenoids may operate in the open or closed state with no modulation capability (C, D, and E solenoids), intermediate flow and resultant pressure based on duty cycle (F solenoid) or produce pressure proportional to current (A and B solenoids).

Shift solenoids C, D, and E provide the necessary logic to distribute fluid to the correct clutches. The shift solenoids provide either full control main pressure or exhaust to the head of each of the corresponding shift valves C, D, and E. Since the valve states, stroked or unstroked, are critical to providing the correct transmission range, each shift valve has a pressure switch, located in the pressure switch manifold, which provides feedback to the computer as to the position of the valve.

The modulated main pressure solenoid is a normally closed solenoid used to modulate the transmission main pressure. Under specific conditions, such as a low throttle setting, low engine torque, low engine speed, and low transmission output speeds, the transmission control module (TCM) commands the solenoid on. When the solenoid is applied, fluid is routed to the main pressure regulator valve; this in turn reduces the main pressure schedule and improves the volume of oil through the overage circuit. By modulating main pressure, the cooler flow at idle can be increased allowing improved cooling and reducing transmission pump noise.

Trim solenoids A and B are used to control on-coming, off-going and holding pressure to the five clutches. These solenoids are referred to as PPC solenoids, since the output hydraulic pressure supplied by these solenoids is proportional to the controlled current command.

Range	Pressure Switch C N/O	Pressure Switch C N/O	Pressure Switch D N/O	Pressure Switch D N/O	Pressure Switch E N/O	Pressure Switch E N/O	Pressure Switch R N/C	Pressure Switch R N/C
	Switch Status	Scan Tool Status	Switch Status	Scan Tool Status	Switch Status	Scan Tool Status	Switch Status	Scan Tool Status
R	Open	OFF*	Closed	ON	Closed	ON	Closed	ON
N	Closed	ON	Closed	ON	Closed	ON	Open	OFF
1	Open	OFF	Closed	ON	Open	OFF	Open	OFF
2	Open	OFF	Open	OFF	Open	OFF	Open	OFF
3	Closed	ON	Open	OFF	Open	OFF	Open	OFF
4	Closed	ON	Open	OFF	Closed	ON	Open	OFF
5	Open	OFF	Open	OFF	Closed	ON	Open	OFF

N/C = Normally Closed

N/O = Normally Open

* C pressure switch reverts to the Closed/ON state with throttle applied in Reverse.

The Allison 1000 series transmission consists of (5) clutches labeled C1 to C5. A combination of (2) clutches is required to be engaged to attain a torque path from the input to the output of the transmission. The following chart indicates the clutch combinations for each gear range.