SECTION 1—GENERAL DESCRIPTION

1–1. TRANSMISSION

The 1000 and 2000 Product Families Electronic Controls system features closed-loop clutch control to provide superior shift quality over a wide range of operating conditions. The 1000 and 2000 Product Families configurations can be programmed to provide five forward speeds, neutral, and reverse. The fifth range has an overdrive gear ratio. The 1000 and 2000 Product Families incorporate a variety of standard and optional design features.

Figure 1–1 is a block diagram of the basic system inputs and outputs.

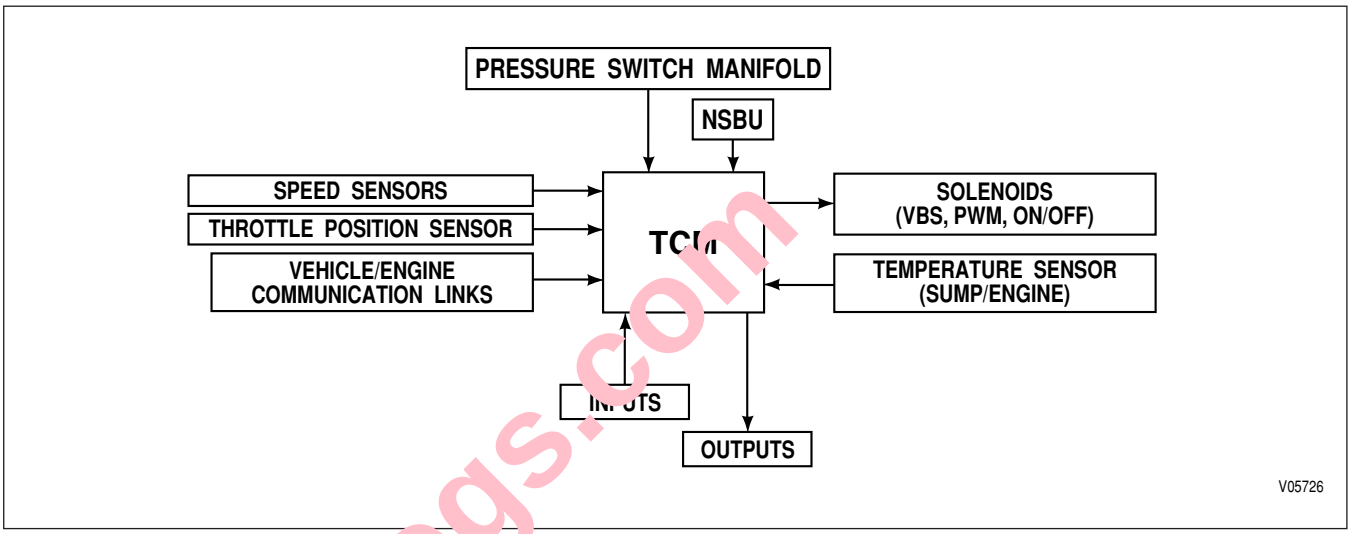

Figure 1–1. Transmission Control Module Block Diagram

Figure 1–2 shows the electronic control components.

Electronic Controls consist of the following elements:

- Remote 12V or 24V Sealed Transmission Control Module (TCM)
- Throttle Position Sensor (TPS), electronic engine throttle data, or PWM signal
- Speed Sensors — Input (Engine), Turbine, and Output
- Control Valve Assembly (Electro-Hydraulic Valve Body)
- NSBU Switch
- Pressure Switch Manifold (PSM)
- Wiring Harnesses

NOTE: All external harnesses are OEM-supplied.

GENERAL DESCRIPTION

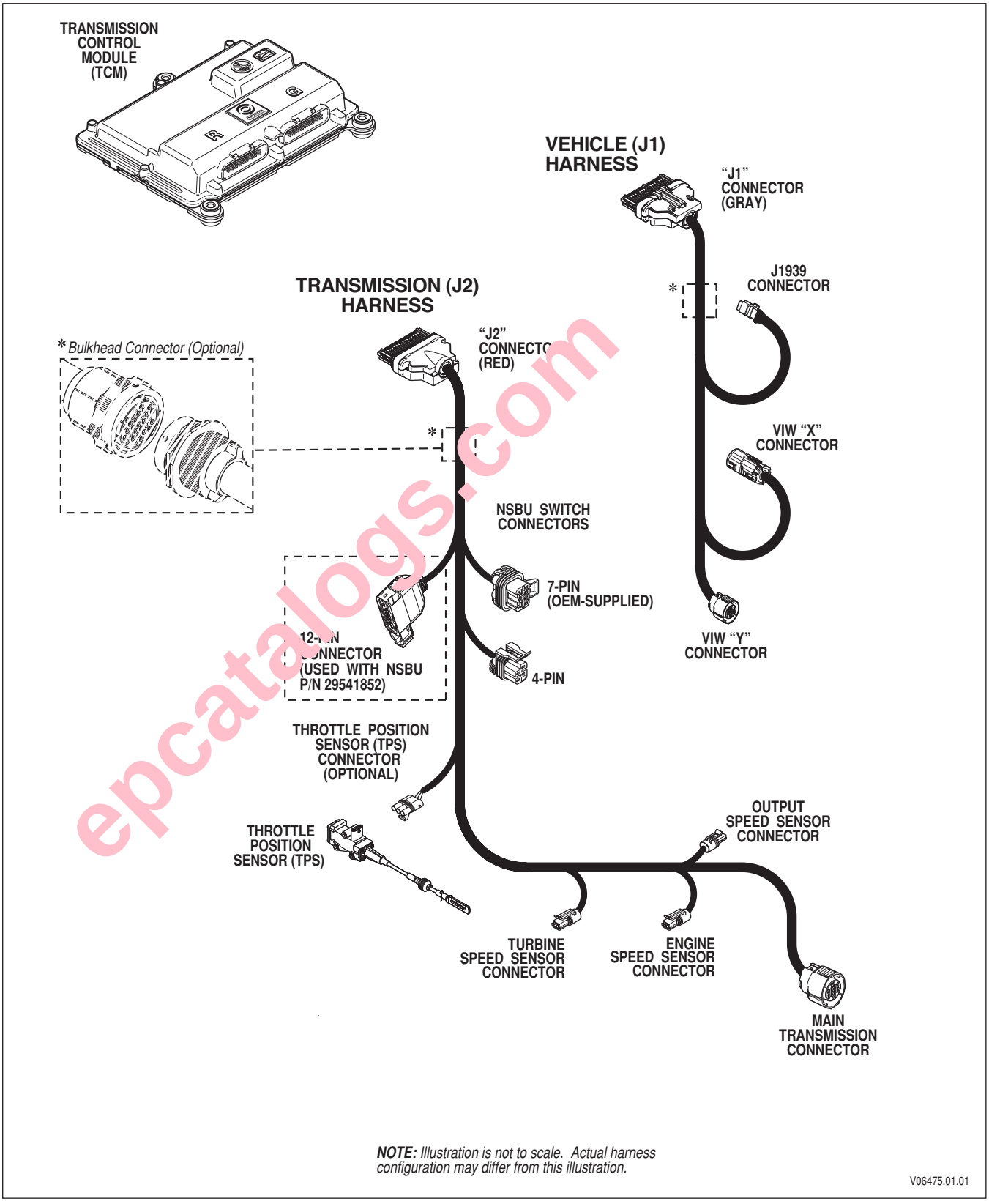

Figure 1–2. Electronic Control Components

GENERAL DESCRIPTION

1–2. TRANSMISSION CONTROL MODULE (TCM)

The electronic control of the transmission is performed by a microcomputer. The microcomputer is an independent controller and is referred to as a Transmission Control Module (TCM). TCMs are available in both 12V and 24V configurations to match the configuration of the vehicle electrical system.

The TCM (Figure 1–3) receives and processes signals from various switches and sensors. The TCM determines shift sequences, shift timing, and clutch apply and release pressures. The TCM uses the information to control transmission solenoids and valves, supply system status, and provide diagnostic information.

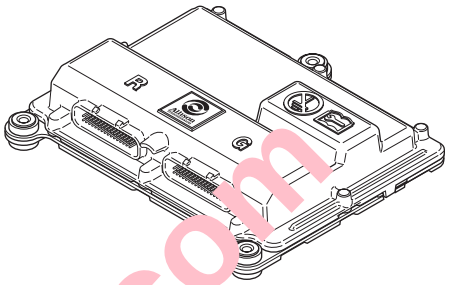

Figure 1–3. Transmission Control Module (TCM)

1–3. SHIFT SELECTOR

The vehicle is equipped with a lever-type shift selector (Figure 1–4). In addition to the lever assembly provided for the operator, other components associated with the shift selector are the manual selector valve in the main control valve body and an NSBU switch mounted on the selector shaft. Shift selector components (with the exception of the transmission selector shaft) are customer-supplied.

A. Shift Selector Range Positions

The operator chooses the transmission range by moving the selector lever to the appropriate gate position (Figure 1–4). When properly adjusted, the shifter gates prevent inadvertent shifting between ranges and correspond to the internal transmission detent positions. A positive detent is provided in the transmission to maintain the selector shaft in the selected position.

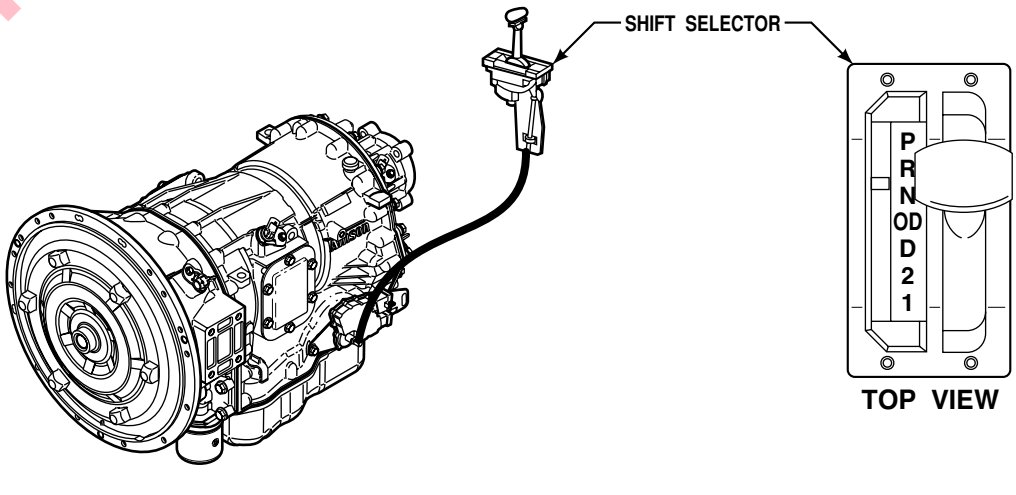

Figure 1–4. Typical Lever-Type Shift Selector

GENERAL DESCRIPTION

The TCM shift calibration determines the available forward ranges for each selector position. Although specific installations vary, typical selector positions for the 1000 and 2000 Product Families are:

P — Park. Parking pawl or parking brake is engaged, if available. This position is not available on all shift selectors.

R — Reverse.

N — Neutral. May be used when starting the engine and for stationary operations. The NSBU Switch disables the starter switch if a range other than **N** (Neutral) or **P** (Park) is selected before starting the vehicle.

OD — Overdrive. The highest forward range used for normal driving. The transmission shifts to first range for starting, then automatically upshifts through the ranges (as operating conditions permit) until the highest range is attained.

D, **2**, **1** — Forward Range. The transmission shifts to first range for starting. The range selected on the shift selector is the highest range which will be attained during automatic shifting.

B. Manual Selector Valve

The manual shift selector shaft is attached to the manual selector valve within the transmission main control valve body. The selector valve has three positions: Reverse, Neutral, and Forward.

NOTE: For transmissions equipped with a Park position, the selector valve remains in the Neutral position when the selector is moved to Park.

The Neutral and Reverse selector valve positions (refer to Appendix H—Hydraulic Schematics) exhaust the C1 and C2 holding clutches. By exhausting C1 and C2 clutches, forward range is inhibited. This provides the capability for the operator to override the electronically commanded ranges if **N** (Neutral) is required.

C. NSBU Switch

The installation of a transmission-mounted neutral start/reverse signal switch is required. This switch, commonly called an “NSBU Switch” (Figure 1–5), 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 typically used as confirmation that the transmission is in **N** (Neutral) before the engine starter is engaged. The NSBU switch is interfaced to the starter circuit with weatherproof electrical connectors. The reverse signal provision may be used to activate vehicle back-up lights and/or reverse warning devices.

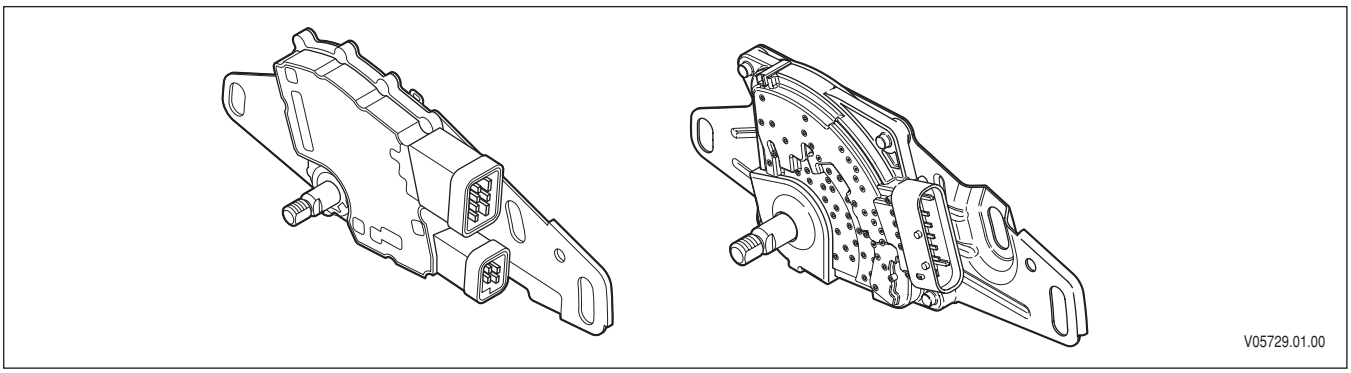

Figure 1–5. NSBU Switch

GENERAL DESCRIPTION

1–4. THROTTLE POSITION SENSOR

The Throttle Position Sensor (TPS) can be mounted to the engine, chassis, or transmission. The TPS (Figure 1–6) contains a pull actuation cable and a potentiometer. One end of the cable is attached to the engine fuel lever and the other, inside a protective housing, to the TPS potentiometer. Output voltage from the TPS is directed to the TCM through the external harness. The voltage signal indicates the throttle position and, in combination with other input data, determines shift timing.

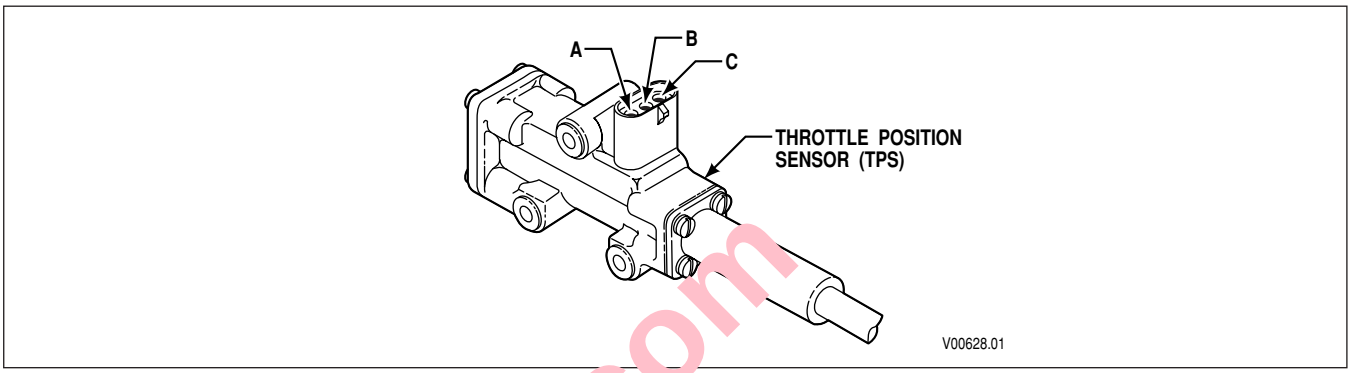

Figure 1–6. Throttle Position Sensor

1–5. SPEED SENSORS

There are three speed sensors available for use with 1000 and 2000 Product Families transmissions: the input (engine) speed sensor, the turbine speed sensor, and the output speed sensor (Figure 1–7). 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.

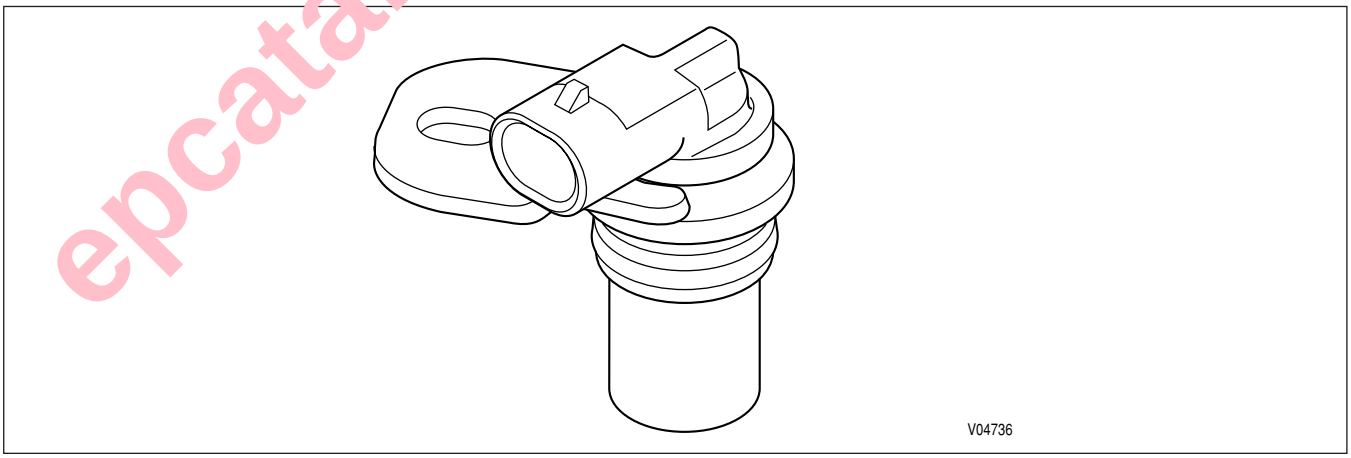

Figure 1–7. Typical Speed Sensor

The speed sensors are variable reluctance devices which 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 which is mounted adjacent to a rotating ferrous member (such as a gear tooth). Two signal wires extend from one end of the housing and an exposed end of the pole piece is at the opposite end of the housing. The permanent magnet produces lines of flux around the pole piece. As a ferrous object (such as a gear tooth) approaches and passes through the gap at the end of the pole piece, an AC voltage pulse is induced in the wire coil. The TCM calculates the frequency of these AC pulses and converts it to a speed value. The AC voltage generated varies from 150mV at low speed to 15V at high speed. The signal wires from the sensor are formed as twisted pairs to cancel magnetically induced fields. The cable is also shielded to protect from voltage-related fields. Noise from other sources is eliminated by using two-wire differential inputs at the TCM.