

SWITCH ASSEMBLY NEUTRAL START BACKUP - CLOCKWISE

GM2802M

1 SCOPE. This document specifies the requirements for a family of transmission mounted neutral start and backup lamp switches (NSBU) as shown in Figure 1. Identified in Table 1 are different configurations with corresponding GM part numbers. The switch schematic, shown in Figure 2, contains the following circuits:

Neutral Start: The neutral start circuits carries the cranking motor solenoid load/cranking motor solenoid relay load in park or neutral only and thus functions as an interlock to prevent cranking in gear. In the condition of a misadjusted switch or during initial assembly, the circuit must be capable of making, carrying and breaking its load for a limited number of cycles.

Backup Lamps: The backup lamp circuit makes, carries, and breaks a lamp load when the transmission is shifted into and out of reverse position. The circuit is fed from an ignition switch terminal which is hot in run and crank only.

Park Accessory: The park accessory circuit primarily carries, and sometimes makes and breaks various loads in park position only. Typical loads are Brake-Transmission-Shift-Interlock (BTSI) solenoids, fuel door release, decklid or hatch release, door lock relays, and electronic modules. In some applications the circuit is not used.

Park Neutral: The park-neutral circuit is closed in park and neutral only. This circuit makes, carries, and breaks a low level Powertrain Control Module (PCM) input used in part to control the torque converter clutch, idle air control valve, and other engine management functions. In some applications this circuit makes, carries, and breaks the loads listed for the park accessory circuit (above).

Mode Indication: Circuitry for PRNDL, transmission mode, or Engine Control Module (ECM) park/neutral indication varies depending upon the requirements for the vehicle/transmission/control system used. See Table 1 for specific requirement by part number.

1.1 CALIBRATION. Switch torque to actuate, make and break points, and travel shall be within the calibration curves (torque and continuity vs. rotation) shown in Figure 4 regardless of ambient temperature, load current, system voltage, rate of actuation, and usage cycles within its ratings (Section 3).

2 REFERENCED STANDARDS.

GM9071P	GM9110P	GM9605P
GM9100P	GM9604P	GM9609P

3 OPERATING PARAMETERS. Switches shall be designed and tested by the supplier to show their ability to operate within the ranges of voltage, current, temperature, and velocity as shown in Tables 2, 3, and 4 of this specification. Switches shall meet all requirements of GM9604 "Standard Practice For Specifying Switches" found in sections 1.1 and 2 through 14 except as noted below or otherwise noted in this specification.

Paragraph 2.1 of GM9604P shall be: Temperature Rating. All devices are required to meet specification requirements from -40°C to 135°C as shown in Table 2.

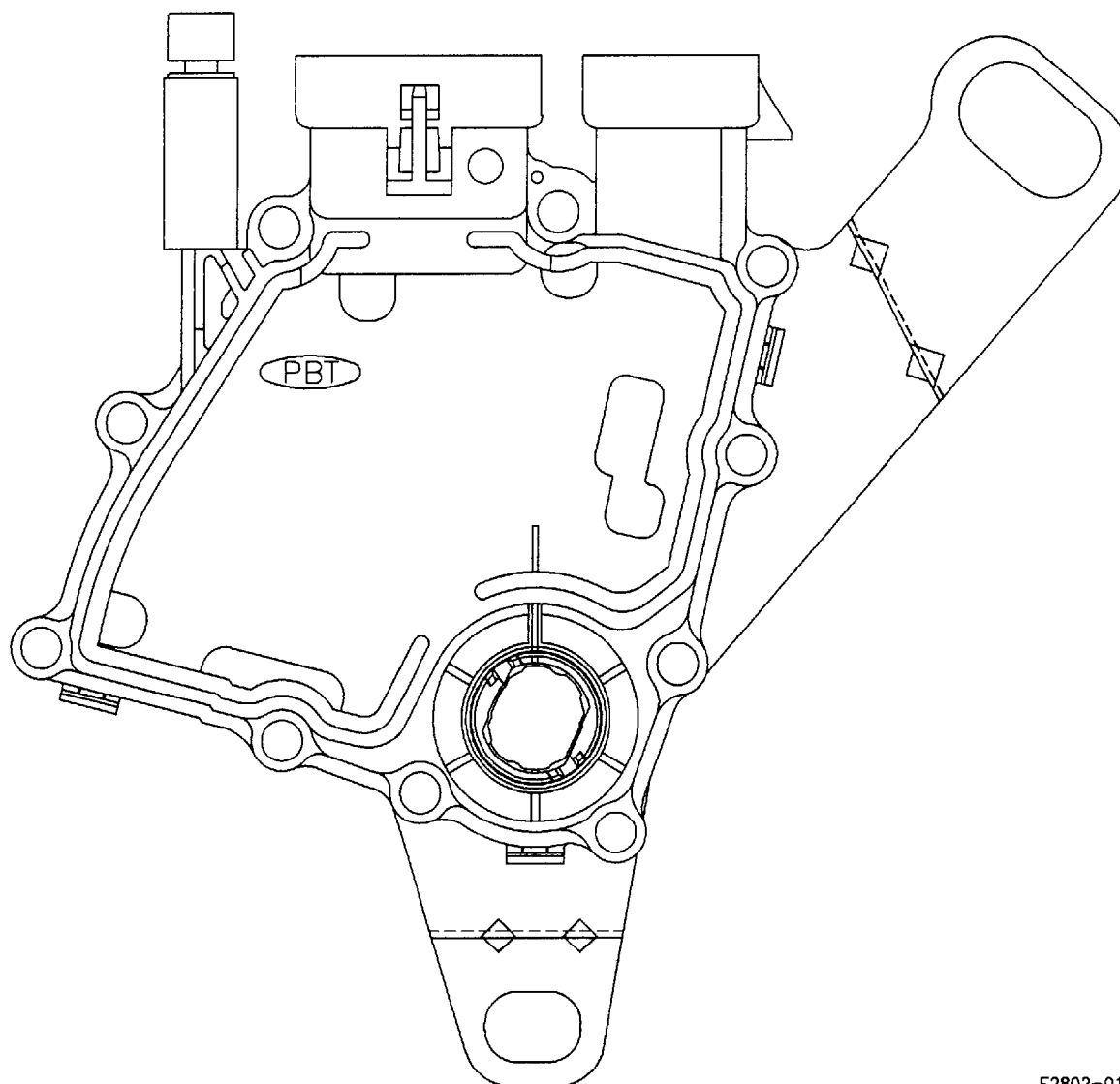
4 GENERAL INFORMATION. Definitions and conditions of tests identified in Tables 2 and 3 shall be in accordance with GM9604P and GM9110P.

4.1 PRECEDENCE. If conflicts exist, the order of precedence shall be:

1. part drawing
2. this specification
3. other referenced documents

4.2 ANNUAL REVALIDATION. Annual revalidation is required. Suppliers who furnish more than one OEM Part Number to General Motors may test one part number per year using a predetermined written rotational test plan. FWD and RWD designs shall be rotated evenly. Reference the part number tested when updating all release data packages and include rotation plan. New part numbers may not be included in the rotating plan until their second year of production. Design release and reliability demonstration of new part numbers do not count towards revalidation of existing part numbers unless approved by General Motors Engineering. Revalidation for a change in design, material, or process may be used for annual revalidation provided a complete validation test is performed.

Rev	Date	Description	Div
B	11/94	Revised Figure 5 Revised Tables 1, 2, 3, 4	EL
C	3/95	Revised Figures 2, 5 Revised Tables 1, 2, 3, 4	EL

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FIGURE 1 - BASE NSBU SWITCH

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TABLE 1 - NSBU SWITCH DESCRIPTIONS

Automatic Transmission		Switch Description	
Gear Positions	Type	Mode Output	Bracket Type
3 Speed (3T40)	FWD	Yes	LAD 3 spd
3 Speed (3T40)	FWD	No	LAD 3 spd
3 Speed (3T40)	FWD	No	MCD 3 spd
4 Speed (4T40E/60E)	FWD	Yes	LAD 4 spd
4 Speed (4T40E/60E)	FWD	Yes	MCD/CLCD 4 spd
4 Speed (4T40E)	FWD	Yes	LAD, 4 spd
4 Speed (4T80E)	FWD	Yes	Northstar

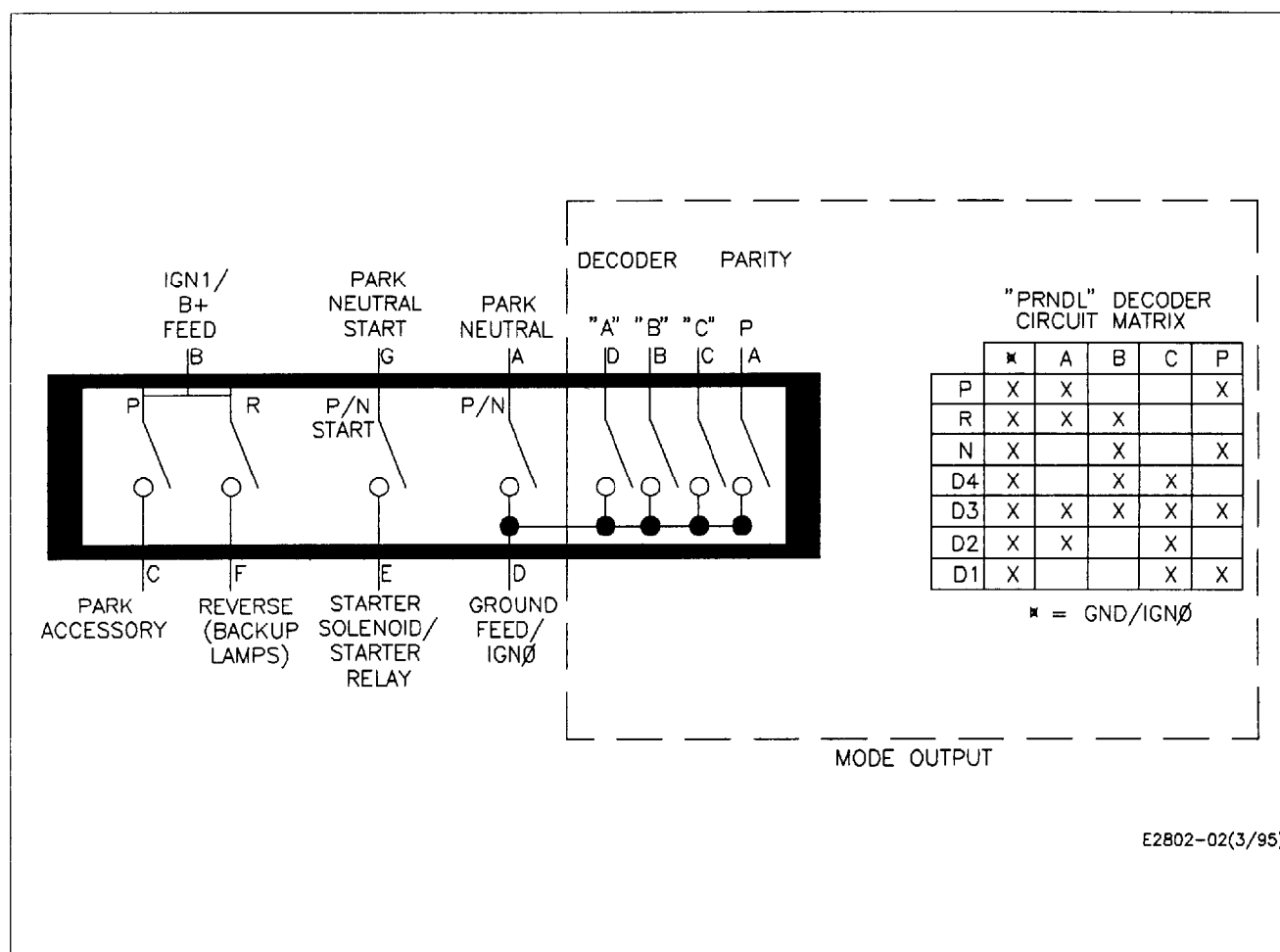


FIGURE 2 - NSBU CIRCUIT SCHEMATIC

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TABLE 2 - SPECIFICATION PARAMETERS RELATING TO PINOUT

2.1	Switch Temperature Rating		-40°C to 135°C				
	Circuit Identification		Park/Neutral	Decoder	Neutral Start	Back - Up	Park/Accry
			7A to 7D	A:4D to 7D, B:4B to 7D C:4C to 7D, P:4A to 7D	7G to 7E	7B to 7F	7B to 7C
2.2	Current Rating	Steady State/ Peak	.400A/ .750A	.015A/ .025A	A.18.8A/72A B..34A	8.4A/ 55A	10.0A/ 10.0A
		Duty Cycle/Load	A.CONT/RES	CONT/RES	INT/ INDUCTIVE	CONT/ LAMP	CONT/ INDUCTIVE
2.4	Rate of Actuation	min	10°/sec	10°/sec	10°/sec	10°/sec	10°/sec
		max	200°/sec	200°/sec	200°/sec	200°/sec	200°/sec
2.5	Wire Size mm ² (AWG)		0.5 (20 AWG)	0.5 (20 AWG)	A.5.0 (10 AWG) B.0.5 (20 AWG)	0.5 (20 AWG)	0.5 (20 AWG)
5.1	Voltage Drop/Contact Resistance (max)		A.100 m-ohm (Note 18)	100 m-ohm (Note 18)	A.250 mV B.200 m-ohm	250 mV	250 mV
5.2	Open Circuit Resistance (min)		20 M-Ohm	20 M-Ohm	20 M-Ohm	20 M-Ohm	20 M-Ohm
5.10	Contact Bounce	% O.C. Volts	100%	100%	NA	NA	NA
		Max. Duration	1.0 ms	1.0 ms	NA	NA	NA
		No. Bounces	0 max	0 max	NA	NA	NA
9.3	Durability Equipment	Rate	118°/sec	118°/sec	118°/sec	118°/sec	118°/sec
		Level	.8 N-M	.8 N-M	.8 N-M	.8 N-M	.8 N-M

Durability Instructions:

- Maintain power supply at 14.0 ± 0.2 V for effective battery operation.
- $.06 \leq$ wiring resistance (including trim resistor) ≤ 0.30 Ohms. Set wiring resistance to $.06 \Omega$ for neutral start circuit and 0.30Ω for all others.
- Battery cold crank amps $\geq$ max. load (including transients) for sum of all circuit branches.
- Power supply amps $\geq$ max. load amps (steady state) for sum of all circuit branches.
- Attach data acquisition/counter sense leads at a point 76.2mm from the connector interface. Data acquisition/counter shall indicate a complete cycle when open circuit voltage is above 90% of supply and closed circuit voltage is below 10% of supply. Failure to obtain these levels shall constitute a miscycle (failure).
- Use PED connectors and seals for all tests. BeCu Ag-plated female terminals are required for all applications and tests when temperatures exceed 125°C. (Terminals: 280 series - P/N 12176387 and 150 series - P/N 12160222).
- Ground all mounting bolts.
- Check contact resistance using voltmeter-ammeter method at rated load.
- Use cranking motor solenoid and electronic circuit to open pull-in coil .030-.100 s after closure. Maintain load temperature below 93°C.
- Energize Crank and Park Accessory circuits for 2.0 s using solid state or essentially bounce free relay. Do not make or break crank load with NSBU switch while under test.

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10. Actuate switch per 16 position programmed durability schedule as follows: N, R, P, D, P, R, D, P, D, P, R, D, L1, L2, L3, D, for 1.5X life. 1X life shall be defined as 12,500 major cycles (50,000 minor cycles). See Figure 7. Dwell in each position for 4.0 s. One programmed cycle requires 64 s not including transition time and contains four vehicle cycles. Use same schedule for 3 speed except omit L1 position. See Figure 4 for gear Positions.
11. Take voltage drop, contact resistance, and open circuit voltage 1.0 - 3.5 s after start of 4.0 s dwell.
12. Test 50% of samples using Load A and 50% using Load B.
13. Measure the Neutral/Start mV drop at 18.8 Amps steady state.
14. Samples shall not be removed from the durability test stand until 1X life is obtained. Performance (check) measurements shall be taken at the specified intervals at ambient temperature as provided through test stand data acquisition as well as independent measurement devices. At 1X life, remove switches from the test stand and conduct performance checks as indicated in Table 4, page 7. After completing performance checks, reinstall switches on the test stand and complete testing.
15. During durability testing, all circuits shall be monitored on a per cycle basis.
16. Application/Test Circuit: The following parts must be used: an R-C network - the load consists of a 39 Ω resistor in series with a 250 μ F capacitor, both in parallel with a 39 Ω resistor; Starter Relay-use door lock relay (12065107 with coils in parallel); PRNDL Module (22567725); four 1156 bulbs (94117866); 100 Amp/480UAC Wet Mercury Relay; 1.4 $\Omega \pm 5\%$ resistor for R6; and use Pull-In coil (10499039) and an L-R network to simulate the Hold-In coil - the load consists of a 460 μ H/26A inductor in series with a 638m-ohm/750W resistor.
17. Open circuit resistance after durability testing must be greater than 5 Megaohms at 110 volts. Isolation resistance after durability testing must be greater than 20 Megaohms at 500 volts.
18. Voltage drop measurements (on a per cycle basis) for all Decoder, Park/Neutral circuits greater than 50 millivolts and low level Neutral Start circuits greater than 70 millivolts shall be recorded in a separate file for future engineering review.
19. Measured switch carrier/transmission shaft hysteresis shall not exceed 0.5° for the life of the switch (as measured during displacement tests).
20. Qualification Statement: During the course of durability cycling, anomalies may occur which do not fully satisfy the GM2802M specification. Anomalies considered parametric and not detrimental to the overall unit function will be reviewed with the supplier and GM for authorization. (Reference: Note 10 and Note 18.)