

TEST D: DIGITAL TRANSMISSION RANGE SENSOR

NOTE: After each service or repair procedure has been completed, reconnect all components. Clear DTCs and repeat QUICK TEST. See **RETRIEVING DIAGNOSTIC TROUBLE CODES (QUICK TEST)** under **SELF-DIAGNOSTIC SYSTEM**. Ensure all EEC-IV systems are working properly and DTCs are no longer present.

1. Turn ignition switch to OFF position. Place gearshift lever in "P" position. Ensure Transmission Range (TR) sensor connector is fully seated, terminals are fully engaged in connector and in good condition. Repair as necessary. Apply parking brake. Place gearshift lever in "N" position. Disconnect shift cable/linkage from manual lever. Verify digital TR sensor alignment tool fits in appropriate slots. If TR sensor is correctly adjusted, go to next step. If sensor requires adjustment, adjust as necessary. See appropriate AUTOMATIC article in TRANSMISSION SERVICING. After adjustment, clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** under SELF-DIAGNOSTIC SYSTEM. Repeat **RETRIEVING DIAGNOSTIC TROUBLE CODES (QUICK TEST)** under SELF-DIAGNOSTIC SYSTEM.
2. Place transmission manual lever in "D" position. Reconnect shift cable/linkage from manual lever. Adjust shift cable/linkage as necessary and go to next step.
3. Place gearshift lever in "P" position. Disconnect TR sensor harness connector. Inspect both ends of connector for damage or pushed out terminals, corrosion, loose wires and missing or damaged seals. If connector is okay and you are directed here to diagnose a DTC, go to next step. If diagnosing a starting problem, back-up lights condition or engagement condition, go to step 9. If connector needs repair, repair as necessary and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** under SELF-DIAGNOSTIC SYSTEM. Repeat **RETRIEVING DIAGNOSTIC TROUBLE CODES (QUICK TEST)** under SELF-DIAGNOSTIC SYSTEM.
4. Turn ignition switch to OFF position. Connect NGS tester to DLC. Reconnect TR sensor connector. Turn ignition switch to ON position. Select TR PIDs TR and TR_D on NGS tester. While moving gearshift lever to each position, wiggle TR sensor wiring harness connector and tap on TR sensor lightly, while observing NGS tester display. See **Fig. 18**. If PID values do not match during wiggle or tap tests, go to next step. If PID values match during wiggle or tap tests, TR sensor is okay. Diagnose problem by symptom. See appropriate SYMPTOM DIAGNOSIS under **TROUBLE SHOOTING**.

Digital Transmission Range (TR) Sensor Diagnosis Chart

Selector Position	PID: TR	PID: TR_D(C)				PID: TR_V (volts)(A)(D)
		TR4	TR3A	TR2	TR1	TR3A (PCM pin 64 to sigrtn)
PARK (E)	P/N	0	0	0	0	0.0 Volts
In Between(B)	REV	0	1	0	0	1.3 - 1.8 Volts
REVERSE	REV	1	1	0	0	1.3 - 1.8 Volts
In Between(B)	REV	0	1	0	0	1.3 - 1.8 Volts
NEUTRAL	NTRL	0	1	1	0	1.3 - 1.8 Volts
In Between(B)	O/D ¹	1	1	1	0	1.3 - 1.8 Volts
OVERDRIVE(F)	O/D ¹	1	1	1	1	1.3 - 1.8 Volts
In Between(B)	Man 2	1	0	1	1	0.0Volts
Manual 2	Man 2	1	0	0	1	0.0Volts
In Between(B)	Man 2	1	0	1	1	0.0Volts
Manual 1	Man 1	0	0	1	1	0.0Volts

¹ Will read "Drive" if O/D is canceled

TR Sensor Diagnosis Chart:

- A. TR_V is the voltage at PCM terminal No. 64 (TR3A circuit) to signal return.
- B. "In Between" reading could be caused by a shift cable or digital TR sensor mis-aligned or a digital TR sensor failure of TR1, TR2, TR3A or TR4.
- C. TR_D: 1= Open digital TR sensor, 0= Closed digital TR sensor.
- D. Breakout Box readings taken from PCM signal terminals for TR1, TR2, TR3A and TR4 to signal return:
 - **Voltages For TR1, TR2 & TR4:**
 - 0 = 0.0 Volts (circuit shorted to ground).
 - 1 = 9.0-14.0 Volts (open circuit).
 - **Voltages For TR3A:**
 - 0 = 0.0 Volts (circuit shorted to ground).
 - 1 = 1.3-1.8 Volts (open circuit).
 - 1.8-5.0 Volts = Invalid reading (open in wires or bad resistor in digital TR sensor).

Wiggle Test Information For Open Or Shorts:

- E. TR1, TR2, TR3A and TR4 are all closed in "P" position (shorted to signal return), so "P" position is a good place to check for intermittent open circuits (with scan tool monitoring TR_D).
- F. TR1, TR2, TR3A and TR4 are all open in OVERDRIVE position, so OVERDRIVE is a good position to check for shorts to ground. To determine shorted components while observing TR_D, unplug TR sensor and check if short goes away. If short is still present, unplug transmission harness and check if short goes away. If short is still present, short is in PCM or vehicle wiring harness. Remove suspect circuit wire terminal from PCM connector. If short is still present, then PCM has an internal failure; otherwise failure is in vehicle wiring harness.

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Fig. 18: Digital TR Sensor PID Output Specifications
 Courtesy of FORD MOTOR CO.

5. Disconnect TR sensor harness connector. Connect TR "E" cable and transmission tester to TR sensor. See **Fig. 19**. Install TR Sensor overlay onto the tester. Perform TR sensor test as instructed on overlay. If TR "E" cable status lights match each selected gear position, TR sensor is okay. Go to next step. If TR "E" cable status lights do not match each selected gear position, replace and adjust TR sensor. See appropriate AUTOMATIC article in TRANSMISSION SERVICING for adjustments. Clear DTCs. Repeat **RETRIEVING DIAGNOSTIC TROUBLE CODES (QUICK TEST)** under SELF-DIAGNOSTIC SYSTEM.
6. Turn ignition switch to OFF position. Ensure TR sensor is disconnected. Disconnect PCM 104-pin harness connector, and inspect it for damaged terminals, corrosion and loose wires. Repair as necessary. Install breakout box, leaving PCM disconnected. Measure and record resistance between breakout box terminal No. 91 and TR sensor harness connector terminal No. 2. Measure and record resistance between breakout box terminal No. 17 or 34 (TR1) and TR sensor harness connector terminal No. 4. Measure and record resistance between breakout box terminal No. 49 and TR sensor harness connector terminal No. 5.

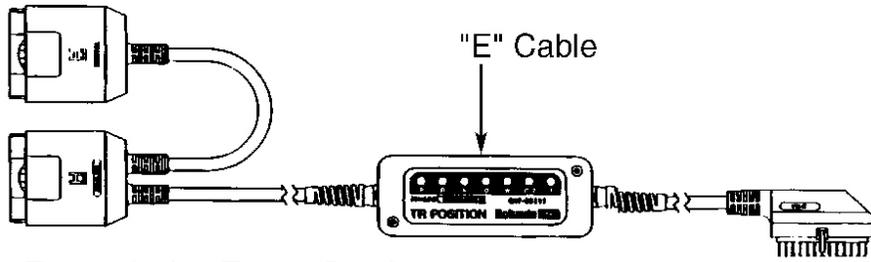
Measure and record resistance between breakout box terminal No. 50 and TR sensor harness connector terminal No. 6. Measure and record resistance between breakout box terminal No. 64 and TR sensor harness connector terminal No. 3. See **Fig. 22**. If each resistance reading is less than 5 ohms, go to next step. If any resistance reading is 5 ohms or more, repair open circuit. Remove breakout box and connect all components. Erase all DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** under SELF-DIAGNOSTIC SYSTEM. Repeat **RETRIEVING DIAGNOSTIC TROUBLE CODES (QUICK TEST)** under SELF-DIAGNOSTIC SYSTEM.

7. Ensure TR sensor harness connector is disconnected. Measure resistance between specified breakout box terminal. See **TR SENSOR/PCM CIRCUIT CHECK** table. If each measurement is more than 10 k/ohms, go to next step. If any measurement is 10 k/ohms or less, repair short circuit(s). Remove breakout box and connect all components. Erase all DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** under SELF-DIAGNOSTIC SYSTEM. Repeat **RETRIEVING DIAGNOSTIC TROUBLE CODES (QUICK TEST)** under SELF-DIAGNOSTIC SYSTEM.

TR SENSOR/PCM CIRCUIT CHECK

Application	Measure Between BOB Terminals No.
Short To Power	71, 97 & 17 (Or 34), 49, 50, 64, 91
Short To Ground	17 (Or 34), 49, 50, 64 & 51, 76, 77, 91, 103

8. Measure and record resistance between breakout box terminal No. 17 (or 34) and breakout box terminals No. 49, 50 and 64. Measure and record resistance between breakout box terminal No. 49 and breakout box terminals No. 17 (or 34), 50, and 64. Measure and record resistance between breakout box terminals No. 50 and breakout box terminals No. 17 (or 34), 49, and 64. Measure and record resistance between breakout box terminal No. 64 and breakout box terminals No. 17 (or 34), 49, and 50. If each resistance reading is more than 10 k/ohms, replace PCM. Reconnect all connectors and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** under SELF-DIAGNOSTIC SYSTEM. Repeat **RETRIEVING DIAGNOSTIC TROUBLE CODES (QUICK TEST)** under SELF-DIAGNOSTIC SYSTEM. If any resistance reading is 10 k/ohms or less, repair short circuit(s). Reconnect all connectors, clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES** under SELF-DIAGNOSTIC SYSTEM. Repeat **RETRIEVING DIAGNOSTIC TROUBLE CODES (QUICK TEST)** under SELF-DIAGNOSTIC SYSTEM.
9. Connect TR "E" cable marked DIGITAL and transmission tester to TR sensor. See **Fig. 19**. Install DIGITAL TR Sensor Overlay onto transmission tester. Perform switch test as instructed on DIGITAL TR sensor overlay. If transmission tester status light does not turn Red, replace and adjust TR sensor. If transmission tester status light turns Red, TR sensor is okay. For back-up lights concerns, see BACK-UP LIGHTS article in ACCESSORIES & EQUIPMENT. For 4WD Low condition, see **TEST TG: 4WD LOW (4X4L) RANGE**. For neutral-sense and starting concerns, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.



Transmission Tester Overlay

TRANSMISSION TESTER

DIGITAL TR SENSORS

PARK/NEUTRAL

LED RED IN
PARK OR
NEUTRAL
ONLY

● STATUS

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HOLD TO TEST

BACK-UP LAMPS

LED RED IN
REVERSE
ONLY

● STATUS

[]

HOLD TO TEST

ADDITIONAL

LED RED IN:

● STATUS

[]

MODEL
DEPENDENT
REFER TO
SHOP MANUAL

HOLD TO TEST

SWITCH TEST

FOR EACH SWITCH TEST:

- 1 PRESS AND HOLD EACH SWITCH BUTTON WHILE SHIFTING GEAR SELECTOR TO ALL GEAR POSITIONS:

- LED FOR THE ACTIVE TEST SHOULD LIGHT RED ONLY FOR THE INDICATED GEAR POSITION.
- IF LED FAILS TO LIGHT FOR THAT GEAR POSITION OR IF IT LIGHTS FOR A DIFFERENT GEAR POSITION:
 - VERIFY DIGITAL TR ALIGNMENT PER SHOP MANUAL, AND
 - RETEST

✗ NOT USED

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BEFORE ATTACHING
OVERLAY SET SWITCH
IN DOWN POSITION.

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SENSOR TEST

- 1 USE TR-E CABLE FOR TEST.
- 2 MAKE SURE ANALOG/DIGITAL SWITCH ON CABLE BOX IS SET TO DIGITAL.
- 3 USE CONNECTOR WITH BLACK BOOT TO CONNECT TO SENSOR.
- 4 MAKE SURE GEAR SELECTOR IS IN PARK. "P" LED ON CABLE BOX SHOULD BE LIT.

**DIGITAL TR
SENSOR TEST**

✗ NOT USED

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✗ NOT USED

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LED SEQUENCE

P	PARK
R	REVERSE
N	NEUTRAL
D	OVERDRIVE
*	TBD
D/3/2	SEE NOTE
1	FIRST

- 5 SHIFT GEAR SELECTOR INTO EACH GEAR, ONE AT A TIME MAKING SURE THE PROPER GEAR LED LIGHTS IN ORDER. REFER TO CHART FOR LED SEQUENCE.
- 6 IF LED'S LIGHT IN ORDER, SENSOR IS OK. IF LED'S DO NOT LIGHT IN ORDER, REPLACE SENSOR.

NOTE: REFER TO TRANSMISSION RANGE SELECTOR FOR PROPER IDENTIFICATION OF D, 3, OR 2.

PART No. 3122-708

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Fig. 19: Identifying TR Sensor "E" Cable & Transmission Tester Digital TR Sensor Overlay
 Courtesy of FORD MOTOR CO.