Transfer Case: Testing and Inspection
Mechanical Shift on the Fly (MSOF)

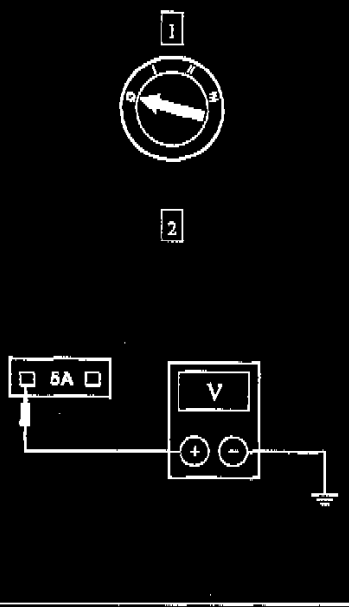
Inspection and Verification

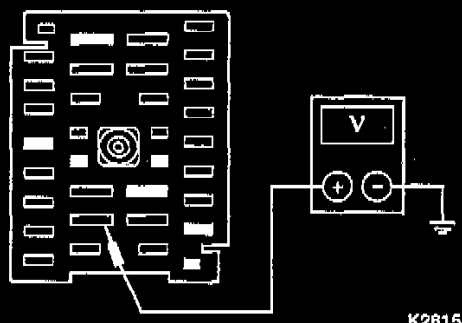
1. Verify the customer concern by operating the 2WD/4WD engagement.
2. Visually inspect the following for obvious signs of mechanical and electrical damage:
   - Switches
   - Fuse(s)
   - Damaged wiring harness
   - Loose or corroded connector(s)
   - Circuitry

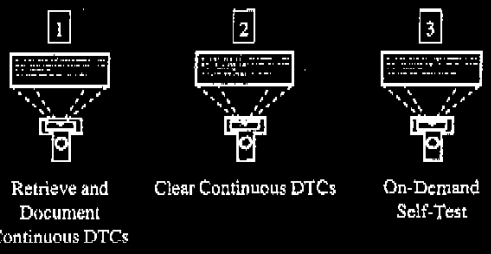
3. If the concern is not visually evident, determine the symptom and proceed to the following Symptom Chart.

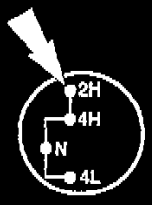
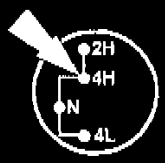
DTC	Circuit	Description	Test Mode
B1342	N/A	GEM Defective	On-Demand, Continuous
B1355	687 (GY/Y)	Ignition RUN Circuit Open or Short to Ground	On-Demand
B1359	297 (BK/LB)	Ignition RUN/ACC Circuit Open or Short to Ground	On-Demand, Continuous
B136	532 (R/LB)	Ignition START Circuit Short to Battery	On-Demand, Continuous
P1804	210 (LB)	4WD High Indicator Circuit Open or Short to Ground	On-Demand, Continuous
P1806	210 (LB)	4WD High Indicator Short to Battery	On-Demand, Continuous
P1824	779 (BR)	4WD Electric Clutch Relay Circuit Open or Short to Ground	On-Demand, Continuous
P1826	779 (BR)	4WD Electric Clutch Relay Short to Battery	Continuous
P1832	605 (R)	Transfer Case 4WD Solenoid Circuit Open or Short to Ground	Continuous
P1834	605 (R)	Transfer Case 4WD Solenoid Short to Battery	On-Demand, Continuous
P1876	145 (GY/BK)	Transfer Case 2WD Solenoid Circuit Open or Short to Ground	On-Demand, Continuous
P1877	145 (GY/BK)	Transfer Case 2WD Solenoid Short to Battery	On-Demand, Continuous

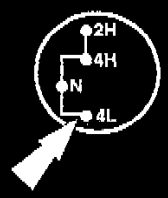
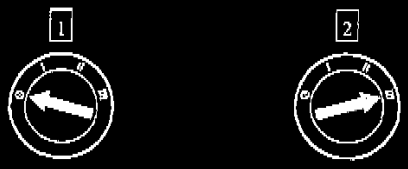
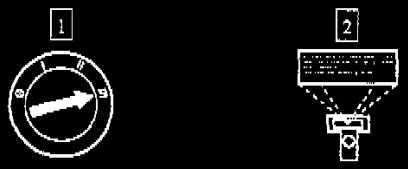
PID	Circuit	Circuit Description	Expected Values
4WDELCL	779 (BR)	4WD Electric Clutch Relay Coil Status	ON---, OFF---, ON-B-, OFF O-G
4WDHIGH	777 (Y)	4WD High Indicator Status	ON---, OFF---, ON-B-, OFF O-G
2WDSOL	145 (GY/BK)	2WD Solenoid Status	ON---, OFF---, ON-B-, OFF O-G
4WDSOL	605 (R)	4WD Solenoid Status	ON---, OFF---, ON-B-, OFF O-G
IGN_GEM	297 (BK/LG)	Ignition Switch Status	START, RUN, OFF, ACC

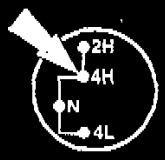
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F1 CHECK THE VOLTAGE OUTPUT FROM FUSE 15 (5A)	
	2 Measure the voltage between fuse 15 (5A) pin 1, and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **F4.** → **No** GO to **F2.**
F2 CHECK FUSES 15 (5A) and 22 (50A)	
	1 Check fuse 15 (5A) in the fuse junction panel and fuse 22 (50A) in the power distribution box. • Are the fuses OK? → **Yes** GO to **F3.** → **No** REPLACE the fuse(s). CLEAR the DTCs. TEST the system for normal operation. If the fuse(s) fails again, CHECK for a short to ground. REPAIR as necessary.

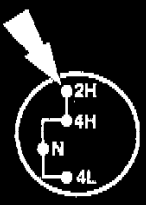
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F3 CHECK CIRCUIT 1052 (T/BK) FOR VOLTAGE	
1  Fuse Junction Panel C243 2  K26156-A	2 Measure the voltage between fuse junction panel C243-11, circuit 1052 (T/BK), and ground. • Is the voltage greater than 10 volts? → **Yes** REPLACE the fuse junction panel. CLEAR the DTCs. TEST the system for normal operation. → **No** REPAIR circuit 1052 (T/BK). CLEAR the DTCs. TEST the system for normal operation.
F4 CHECK THE IGNITION STATES	
1 2 3  New Generation STAR (NGS) Tester	3 **NOTE:** If the vehicle is equipped with a manual transmission, depress the clutch pedal while turning the ignition switch to the START. Monitor the PID IGN_GEM and rotate the ignition switch through the START, RUN, OFF, and ACC positions. • Do the PID values agree with the ignition switch positions? → **Yes** GO to **F5.** → **No** REPAIR the ignition circuit(s) (RUN/ACC: circuit 297 [BK/LG], RUN: circuit 1040 [R/LB], START: circuit 32 [R/LB] or circuit 481 [GY/Y]) in question. CLEAR the DTCs. TEST the system for normal operation.

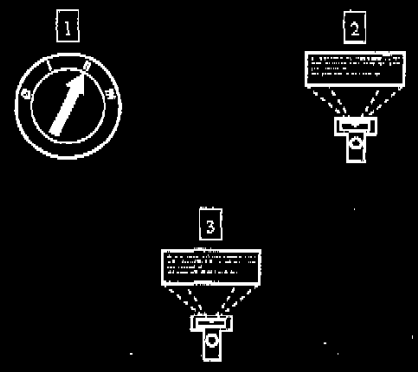
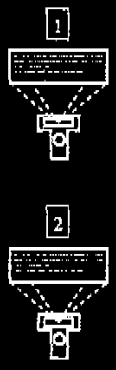
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F5 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCs)	
 Retrieve and Document Continuous DTCs Clear Continuous DTCs On-Demand Self-Test	• Are any DTCs recorded? → **Yes** If DTC B1342, REPLACE the GEM. CLEAR the DTCs. TEST the system for normal operation. If DTC P1824, GO to **F11**. If DTC P1826, GO to **F11**. If DTC P1804, GO to Pinpoint Test H. If DTC P1806, GO to Pinpoint Test H. If DTC P1832, GO to Pinpoint Test G. If DTC P1834, GO to Pinpoint Test G. If DTC P1876, GO to Pinpoint Test G. If DTC P1877, GO to Pinpoint Test G. → **No** GO to **F6**.

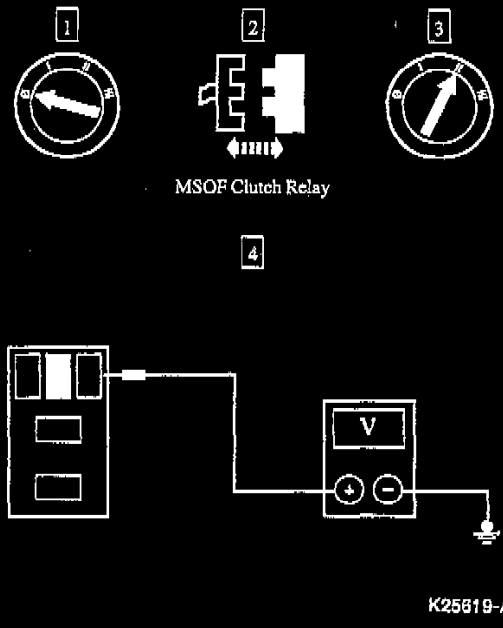
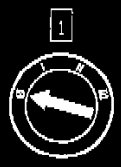
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F6 CHECK THE 4x4 INDICATORS	
1 	
2	2 Shift into 2H. Both indicators should be off.
 C11964-B	
3	3 Shift into 4H. The 4x4 indicator should illuminate.
 C11965-B	

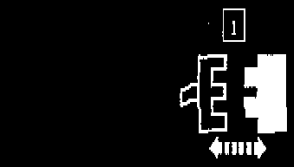
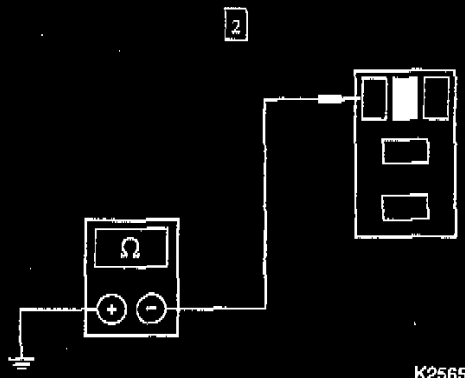
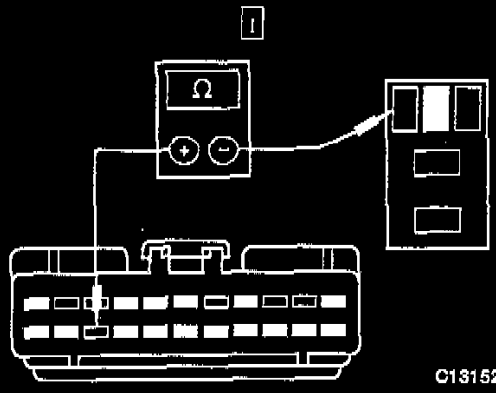
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F6 CHECK THE 4x4 INDICATORS	
4  C11966-B	4 Shift into 4L. The low range indicator should illuminate; the 4x4 indicator should remain illuminated. • Do the indicators operate correctly? → **Yes** GO to **F7**. → **No** If the 4H indicator does not operate, GO to **E7**. If the 4L indicator does not operate, GO to Pinpoint Test H.
F7 CHECK 4x4 LAMP PROVEOUT	
1 2 	• Does the 4x4 lamp proveout (illuminate) for two seconds after starting the vehicle? → **Yes** GO to **F25**. → **No** GO to Pinpoint Test H.
F8 CHECK THE FRONT AXLE ENGAGEMENT	
1 2  4  	2 Set the active commands AXLE ENGG to ON and AXLE DSCN to OFF and drive a short distance. 3 Raise and support the vehicle with the engine running.

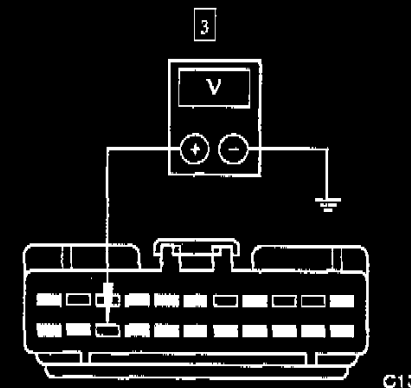
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F8 CHECK THE FRONT AXLE ENGAGEMENT	
	5 Spin one front tire. The other front tire should spin in the opposite direction. • Is the axle disconnect working properly? → **Yes** Exit active command mode and GO to **F9**. → **No** GO to Pinpoint Test G.
F9 CHECK THE FRONT DRIVESHAFT ENGAGEMENT	
1  C11985-B 2  	1 Shift into 4H. 3 The front and rear driveshaft should both spin. • Is the transfer case locking the front driveshaft to the rear driveshaft? → **Yes** GO to **F10**. → **No** Mechanical transfer case concern.

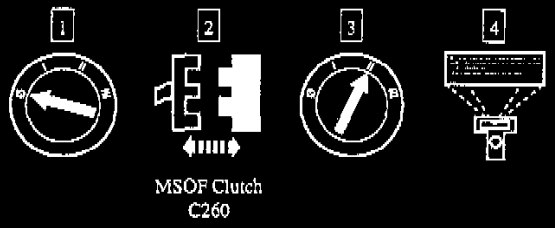
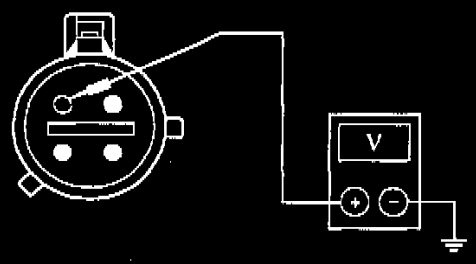
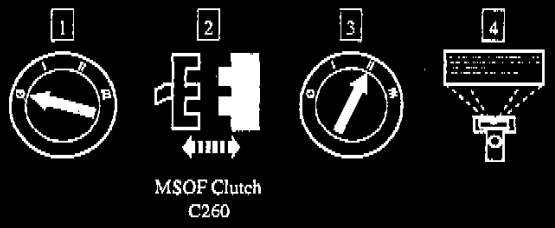
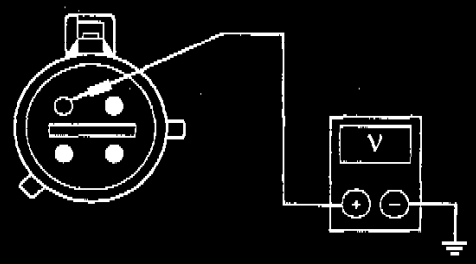
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F10 CHECK THE FRONT DRIVESHAFT DISENGAGEMENT	
1  C11964-B 2  	1 **NOTE:** When 2H is engaged, the front driveshaft may spin due to viscous drag in the transfer case, especially if cold. If this occurs, the front driveline can be easily stopped. Shift into 2H. Only the rear driveshaft should spin. ▪ Does only the rear driveshaft spin? → **Yes** GO to **F11**. → **No**
F11 CHECK THE FRONT AXLE DISENGAGEMENT	
1  2  	1 Set the active commands AXLE ENGG to OFF and AXLE DSCN to ON.

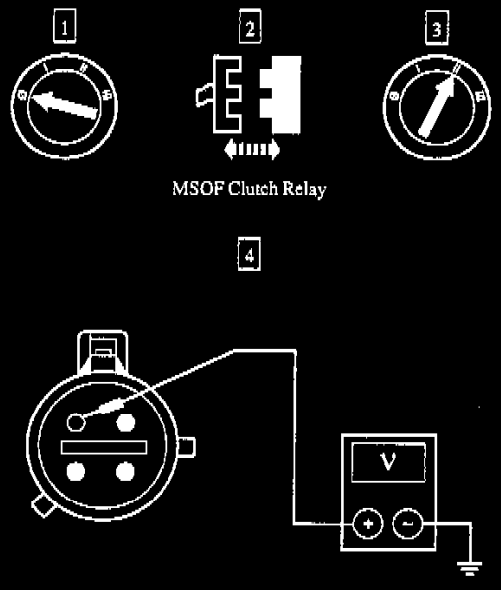
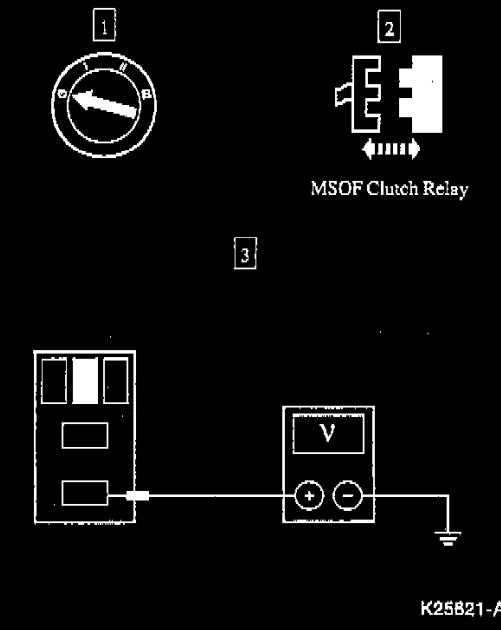
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F11 CHECK THE FRONT AXLE DISENGAGEMENT	
	3 Spin one front tire. The other front tire should not spin. • Is the axle disconnect working properly? → **Yes** GO to **F12**. → **No** GO to Pinpoint Test G.
F12 CHECK THE MECHANICAL SHIFT ON THE FLY (MSOF) CLUTCH RELAY COIL CIRCUIT ACTIVATION	
	2 Set the active command SHIFT CLUTCH to ENERGIZED. 3 Monitor the PID 4WDELCL. • Is the PID 4WDELCL indicating ON---? → **Yes** GO to **F13**. → **No** If the PID 4WDELCL displays ON-B-, GO to **F18**.
F13 CHECK THE MSOF CLUTCH RELAY COIL CIRCUIT DE-ACTIVATION	
	1 Set the active command SHIFT CLUTCH to DE-ENERGIZED. 2 Monitor the PID 4WDELCL. • Is the PID 4WDELCL indicating OFF---? → **Yes** GO to **F20**. → **No** If the PID 4WDELCL displays OFF 0-G, GO to **F14**.

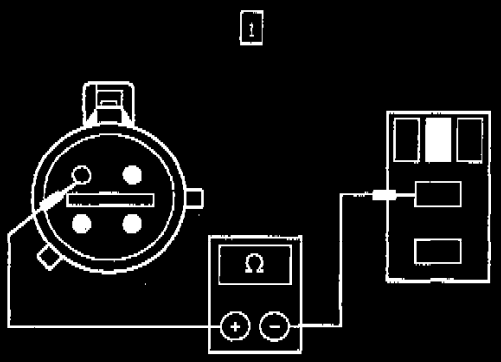
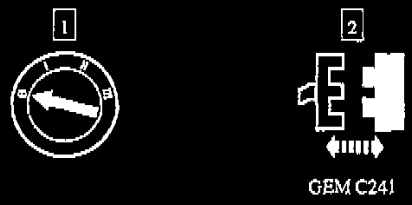
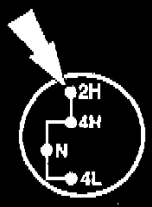
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F14 CHECK THE VOLTAGE TO THE MSOF CLUTCH RELAY COIL CIRCUIT	
	4 Measure the voltage between MSOF clutch relay connector pin 1, circuit 294 (W/LB), and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **F15**. → **No** REPAIR circuit 294 (W/LB). CLEAR the DTCs. TEST the system for normal operation.
F15 CHECK THE MSOF CLUTCH RELAY	
	2 Check the MSOF clutch relay; refer to the Relay Component Test • Is the MSOF clutch relay OK? → **Yes** GO to **F16**. → **No** REPLACE the MSOF clutch relay. CLEAR the DTCs. TEST the system for normal operation.

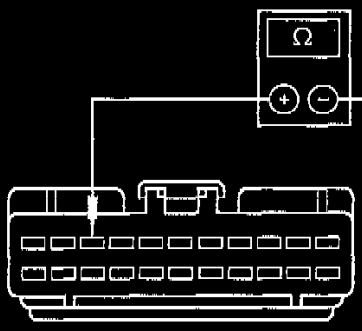
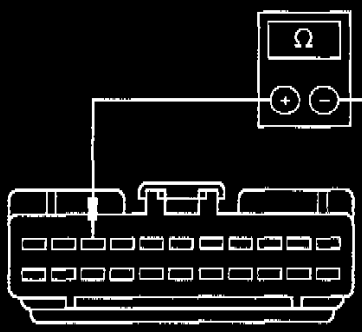
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F16 CHECK CIRCUIT 976 (O) FOR SHORT TO GROUND	
 GEM C241  K25651-A	2 Measure the resistance between MSOF clutch relay connector pin 2, circuit 976 (O), and ground. • Is the resistance greater than 10,000 ohms? → **Yes** GO to **F17**. → **No** REPAIR circuit 976 (O). CLEAR the DTCs. TEST the system for normal operation.
F17 CHECK CIRCUIT 976 (O) FOR OPEN	
 C13152-A	1 Measure the resistance between MSOF clutch relay connector pin 2, circuit 976 (O), and GEM C241-14, circuit 976 (O). • Is the resistance less than 5 ohms? → **Yes** REPLACE the GEM. CLEAR the DTCs. TEST the system for normal operation. → **No** REPAIR circuit 976 (O). CLEAR the DTCs. TEST the system for normal operation.

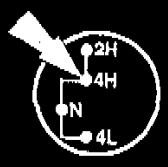
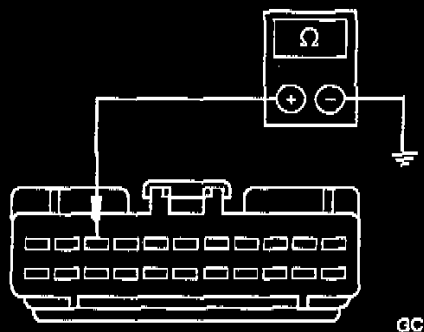
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F18 CHECK THE MSOF CLUTCH RELAY	
 MSOF Clutch Relay	3 Check the MSOF clutch relay; refer to the Relay Component Test • Is the MSOF clutch relay OK? → **Yes** GO to **F19**. → **No** REPLACE the MSOF clutch relay. CLEAR the DTCs. TEST the system for normal operation.
F19 CHECK CIRCUIT 976 (O) FOR SHORT TO POWER	
 GEM C241  C13153-A	3 Measure the voltage between GEM C241-14, circuit 976 (O), and ground. • Is any voltage indicated? → **Yes** REPAIR circuit 976 (O). CLEAR the DTCs. TEST the system for normal operation. → **No** REPLACE the GEM. CLEAR the DTCs. TEST the system for normal operation.

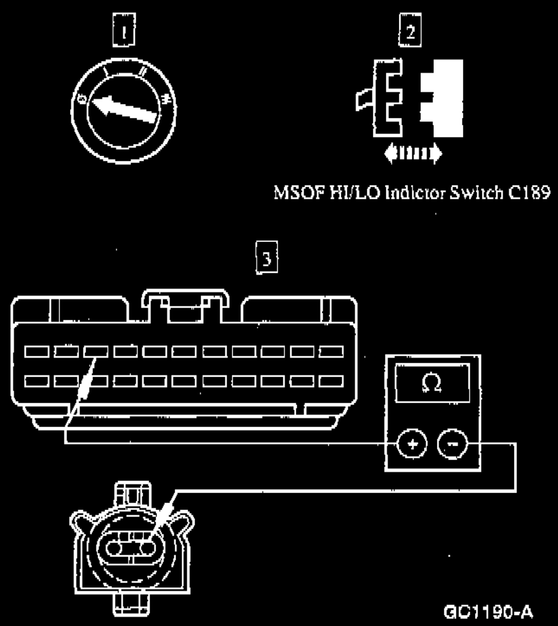
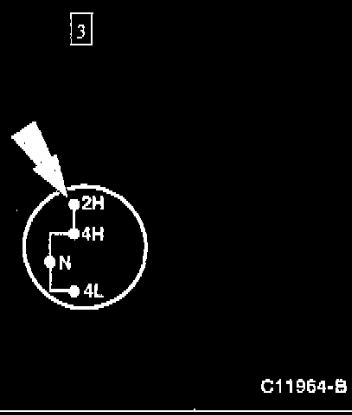
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F20 CHECK CIRCUIT 779 (BR) FOR VOLTAGE — SHIFT CLUTCH ENERGIZED	
 MSOF Clutch C260	4 Set the active command SHIFT CLUTCH to ENERGIZED.
5	5 Measure the voltage between MSOF clutch C260-1, circuit 779 (BR), and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **F21**. → **No** GO to **F23**.
 C11987-A	
F21 CHECK CIRCUIT 779 (BR) FOR VOLTAGE — SHIFT CLUTCH DE-ENERGIZED	
 MSOF Clutch C260	4 Set the active command SHIFT CLUTCH to DE-ENERGIZED.
5	5 Measure the voltage between MSOF clutch C260-1, circuit 779 (BR), and ground. • Is the voltage 0 volts? → **Yes** GO to **F29**. → **No** GO to **F22**.
 C11987-A	

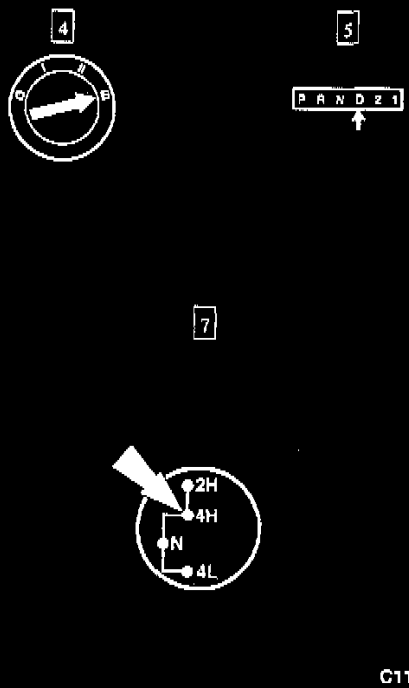
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F22 CHECK CIRCUIT 779 (BR) FOR SHORT TO POWER	
	4 Measure the voltage between MSOF clutch C260-1, circuit 779 (BR), and ground. • Is the voltage greater than 10 volts? → **Yes** REPAIR circuit 779 (BR). CLEAR the DTCs. TEST the system for normal operation. → **No** REPLACE the MSOF clutch relay. CLEAR the DTCs. TEST the system for normal operation.
F23 CHECK THE VOLTAGE TO THE MSOF CLUTCH RELAY SWITCH	
	3 Measure the voltage between MSOF clutch relay connector pin 3, circuit 704 (DG/LG) and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **F24**. → **No** CHECK fuse 17 (30A). REPLACE if necessary. If fuse 17 (30A) is OK, REPAIR circuit 704 (DG/LG). CLEAR the DTCs. TEST the system for normal operation.

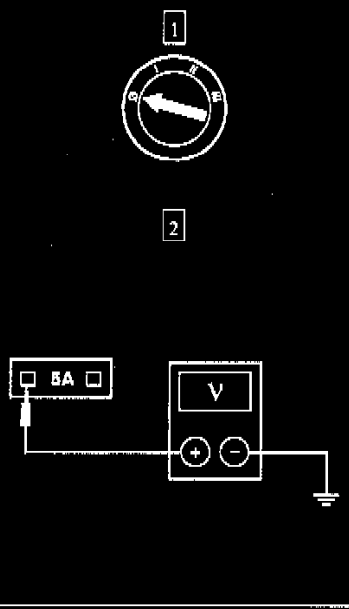
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F24 CHECK CIRCUIT 779 (BR) FOR OPEN	
 C13164-A	1 Measure the resistance between MSOF clutch relay connector pin 5, circuit 779 (BR), and MSOF clutch C260-1, circuit 779 (BR). • Is the resistance less than 5 ohms? → **Yes** REPLACE the MSOF clutch relay. CLEAR the DTCs. TEST the system for normal operation. → **No** REPAIR circuit 779 (BR). CLEAR the DTCs. TEST the system for normal operation.
F25 CHECK CIRCUIT 783 (GY) FOR SHORT TO GROUND	
 3  C11964-B	3 Shift in 2H.

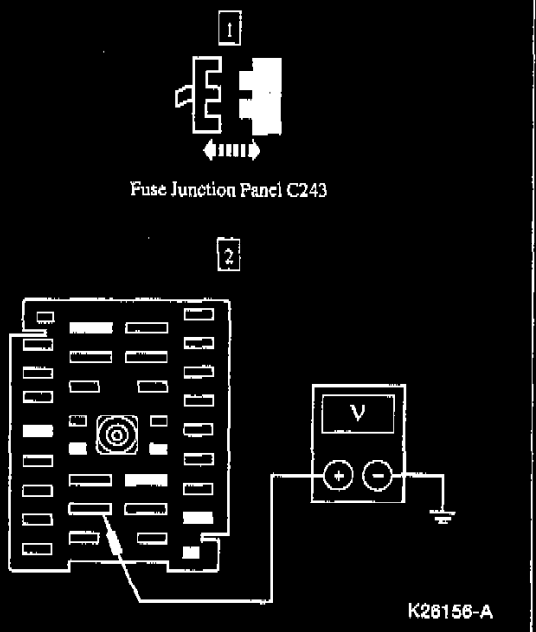
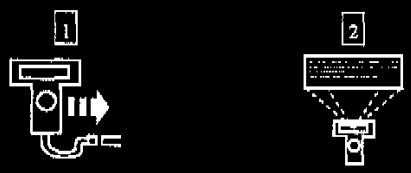
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F25 CHECK CIRCUIT 783 (GY) FOR SHORT TO GROUND	
4  GC1189-A	4 Measure the resistance between GEM C241-3, circuit 783 (GY), and ground. • Is the resistance greater than 10,000 ohms? → **Yes** GO to **F27**. → **No** GO to **F26**.
F26 CHECK MSOF HI/LO INDICATOR SWITCH FOR SHORT TO GROUND	
1  2  MSOF HI/LO Indictor Switch C189 3  GC1189-A	3 Measure the resistance between GEM C241-3, circuit 783 (GY), and ground. • Is the resistance greater than 10,000 ohms? → **Yes** REPLACE the MOSF HI/LO indicator switch. CLEAR the DTCs. TEST the system for normal operation. → **No** REPAIR circuit 783 (GY). CLEAR the DTCs. TEST the system for normal operation.

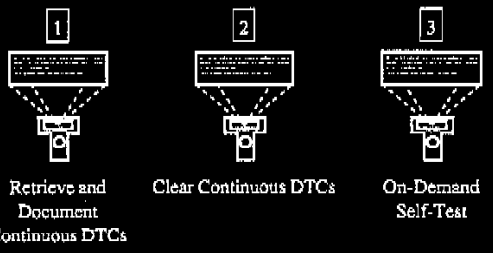
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F27 CHECK CIRCUIT 783 (GY) BETWEEN GEM C241-3 AND GROUND FOR OPEN	
1  C11965-B	1 Shift into 4H
2  GC1189-A	2 Measure the resistance between GEM C241-3, circuit 783 (GY), and ground. • Is the resistance less than 5 ohms? → **Yes** GEM operates properly. System OK. → **No** GO to F28.

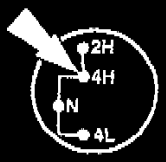
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F28 CHECK CIRCUIT 783 (GY) FOR OPEN	
 	3 Measure the resistance between GEM C241-3, circuit 783 (GY), and MSOF HI/LO indicator switch C189, circuit 783 (GY). • Is the resistance less than 5 ohms? → **Yes** REPLACE the MOSF HI/LO indicator switch. CLEAR the DTCs. TEST the system for normal operation. → **No** REPAIR circuit 783 (GY). CLEAR the DTCs. TEST the system for normal operation.
F29 CHECK THE SYNCHRONIZATION OF THE FRONT OUTPUT	
 	1 Raise and support the vehicle. 2 Remove the front driveshaft. 3 Shift into 2H.

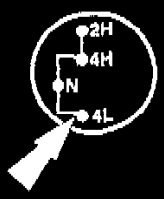
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
F29 CHECK THE SYNCHRONIZATION OF THE FRONT OUTPUT	
	6 Increase tire rotation between 20-25 mph (35-40 kph) and hold. 7 Shift into 4H. • Does the front output rotate? → **Yes** VERIFY the concern. RETURN to the Symptom Chart. → **No**

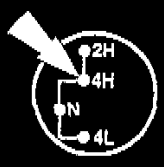
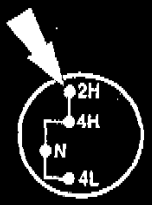
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
G1 CHECK THE POWER OUTPUT FROM FUSE 15 (5A)	
	2 Measure the voltage between fuse 15 (5A) pin 1, and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **G4.** → **No** GO to **G2.**
G2 CHECK FUSES 15 (5A) and 22 (50A)	
	1 Check fuse 15 (5A) in the fuse junction panel and fuse 22 (50A) in the power distribution box. • Are the fuses OK? → **Yes** GO to **G3.** → **No** REPLACE fuse(s). CLEAR the DTCs. TEST the system for normal operation. If the fuse(s) fail again, CHECK for a short to ground. REPAIR as necessary.

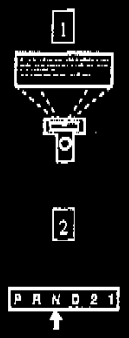
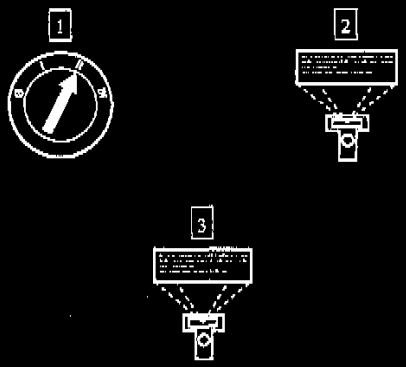
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
G3 CHECK CIRCUIT 1052 (T/BK) FOR VOLTAGE	
 Fuse Junction Panel C243	2 Measure the voltage between fuse junction panel C243-11, circuit 1052 (T/BK), and chassis ground. • Is the voltage greater than 10 volts? → **Yes** REPLACE the fuse junction panel. CLEAR the DTCs. TEST the system for normal operation. → **No** REPAIR circuit 1052 (T/BK). CLEAR the DTCs. TEST the system for normal operation.
G4 CHECK THE IGNITION STATES	
 New Generation STAR (NGS) Tester	2 **NOTE:** If the vehicle is equipped with a manual transmission, depress the clutch pedal while turning the ignition switch to the START. Monitor the PID IGN_GEM while cycling the ignition switch through the START, RUN, OFF, and ACC positions. • Do the PID values agree with the ignition switch positions? → **Yes** GO to G5. → **No** REPAIR the ignition circuit(s) (RUN/ACC: circuit 297 [BK/LG], RUN: circuit 1040 [R/LB], START: circuit 32 [R/LB] or circuit 481 [GY/Y]) in question. CLEAR the DTCs. TEST the system for normal operation.

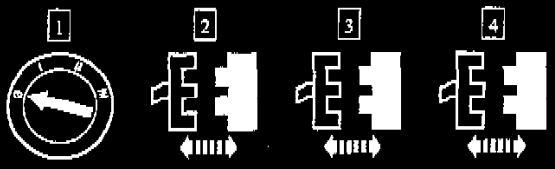
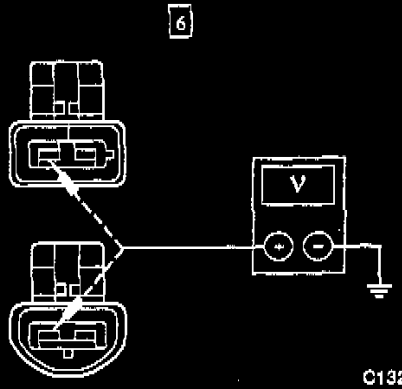
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
G5 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCs)	
	• Are any DTCs recorded? → **Yes** If DTC B1342, REPLACE the GEM. CLEAR the DTCs. TEST the system for normal operation. If DTC P1824, GO to Pinpoint Test F. If DTC P1826, GO to Pinpoint Test F. If DTC P1804, GO to Pinpoint Test H. If DTC P1806, GO to Pinpoint Test H. If DTC P1832, GO to **G11**. If DTC P1834, GO to **G11**. If DTC P1876, GO to **G11**. If DTC P1877, GO to **G11**. → **No** GO to **G6**.

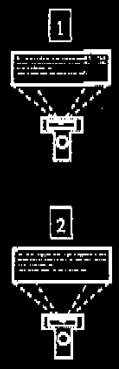
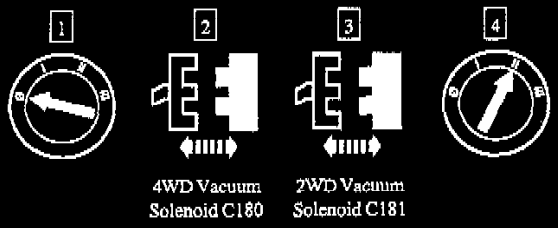
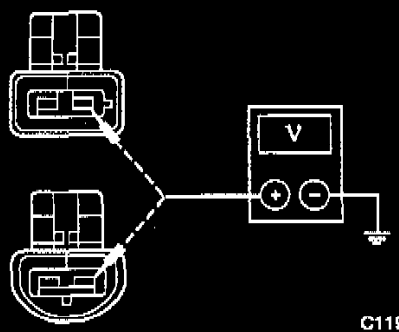
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
G6 CHECK THE 4x4 INDICATORS	
1  2  C11964-B 3  C11965-B	2 Shift into 2H. Both indicators should be off. 3 Shift into 4H. The 4x4 indicator should illuminate.

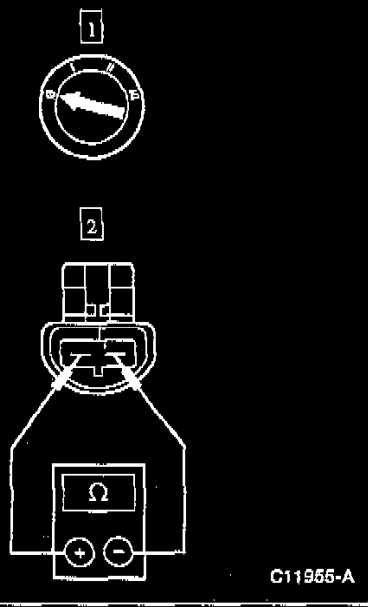
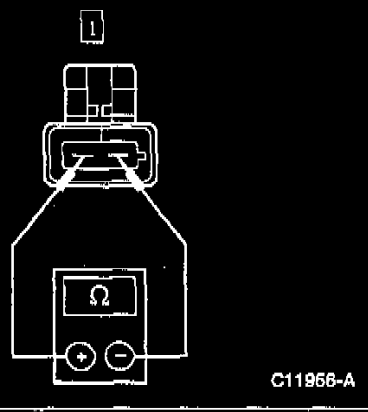
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
G6 CHECK THE 4x4 INDICATORS	
4  G11966-B	4 Shift into 4L. Low range indicator should illuminate; the 4x4 indicator should remain illuminated. • Do the indicators operate correctly? → **Yes** GO to **G7**. → **No** If the LOW RANGE indicator does not operate, GO to Pinpoint Test H. If the 4x4 indicator does not operate, VERIFY the 4x4 lamp does not proveout after starting the vehicle, GO to Pinpoint Test H. If 4x4 indicator does proveout, GO to **F25**.
G7 CHECK THE FRONT AXLE ENGAGEMENT	
1  2  4  	2 Set the active commands AXLE ENGG to ON and AXLE DSCN to OFF and drive a short distance. 3 Raise and support the vehicle with the engine running. 5 Spin one front tire. The other front tire should spin in the opposite direction. • Is the axle disconnect working properly? → **Yes** Exit the active command mode, GO to **G8**. → **No** GO to **G11**.

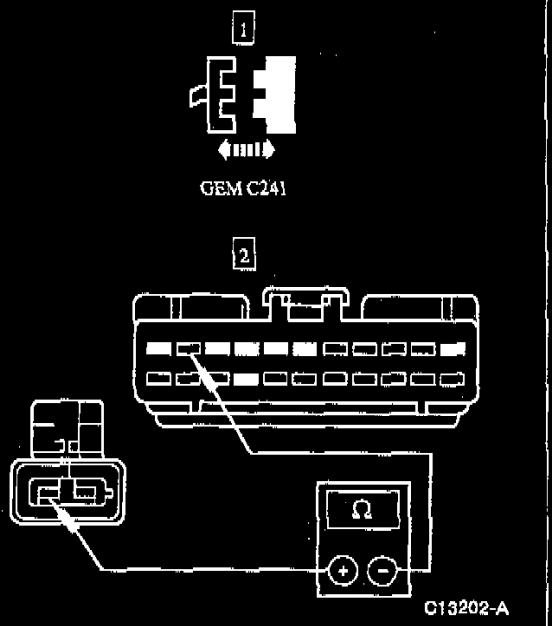
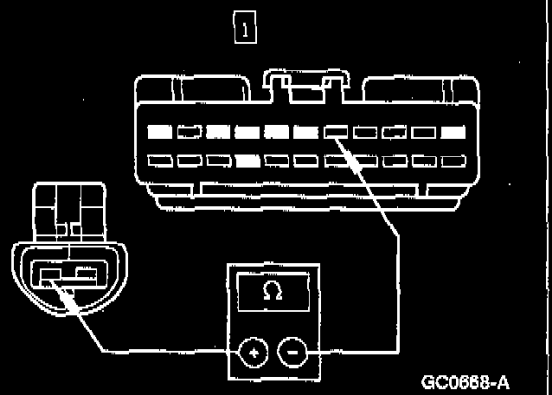
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
G8 CHECK THE FRONT DRIVESHAFT ENGAGEMENT	
1  C11985-B 2  	1 Shift into 4H. 3 The front and rear driveshaft should both spin. • Is the transfer case locking the front driveshaft to the rear driveshaft? → **Yes** GO to **G9**. → **No** Mechanical transfer case concern.
G9 CHECK THE FRONT DRIVESHAFT DISENGAGEMENT	
1  C11984-B	1 **NOTE:** When 4WD is disengaged, the front driveshaft may spin due to viscous drag in the transfer case, especially if cold. If this occurs, the front driveline can be easily stopped. Shift into 2H. Only the rear driveshaft should spin. • Does only the rear driveshaft spin? → **Yes** GO to **G10**. → **No** Mechanical transfer case concern.

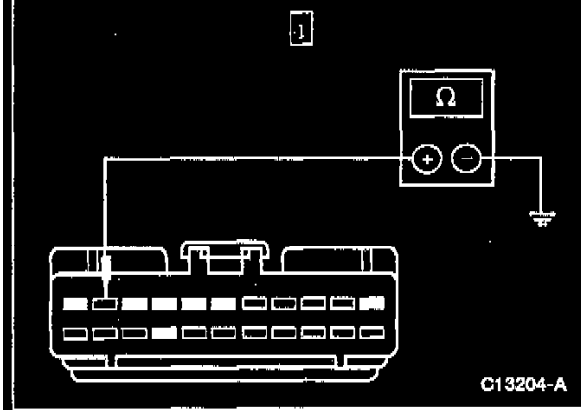
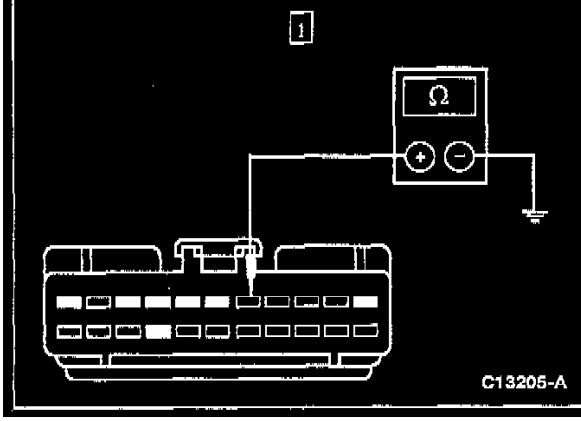
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
G10 CHECK THE FRONT AXLE AND THE FRONT DRIVESHAFT ENGAGEMENT	
	1 Set the active commands AXLE ENGG to OFF and AXLE DSCN to ON. 3 Spin one front tire. The other front tire should not spin. • Is the axle disconnect working properly? → **Yes** GO to Pinpoint Test A → **No** GO to **G11**.
G11 CHECK 4WD AND 2WD VACUUM SOLENOID CIRCUITS	
	2 Monitor the PIDs 4WDSOL and 2WDSOL. 3 Toggle the active commands AXLE ENGG to ON and AXLE DSCN to ON. • Does 4WDSOL indicate ON--- and 2WDSOL indicate ON---? → **Yes** GO to **G12**. → **No** If the PID displays ON-B-, GO to **G13**.

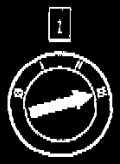
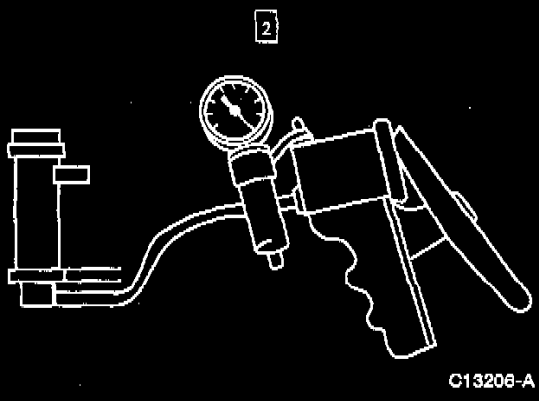
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
G12 CHECK 4WD AND 2WD VACUUM SOLENOIDS	
	1 Monitor the PIDs 4WDSOL and 2WDSOL.
	2 Toggle the active commands AXLE ENGG to OFF and AXLE DSCN to OFF. • Does 4WDSOL indicate OFF--- and 2WDSOL indicate OFF---? → **Yes** GO to **G22**. → **No** If PID displays OFF O-G, GO to **G15**.
G13 CHECK CIRCUITS 145 (GY/BK) AND 605 (R) FOR SHORT(S) TO POWER	
	
	
	6 Measure the voltage between 4WD vacuum solenoid C180, circuit 605 (R), 2WD vacuum solenoid C181, circuit 145 (GY/BK), and ground. • Is the voltage greater than 10 volts? → **Yes** REPAIR the circuit(s) (145 [GY/BK], 605 [R]) in question. CLEAR the DTCs. TEST the system for normal operation. → **No** RECONNECT GEM C241, 4WD vacuum solenoid and 2WD vacuum solenoid. GO to **G14**.

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
G14 CHECK THE 4WD AND 2WD VACUUM SOLENOIDS	
	1 Monitor the PIDS 4WDSOL and 2WDSOL. 2 Set the active commands AXLE ENGG and AXLE DSCN to ON. • Do the PIDS 4WDSOL and 2WDSOL indicate ON-B-? → **Yes** REPLACE the GEM. CLEAR the DTCs. TEST the system for normal operation. → **No** REPLACE the vacuum solenoid in question. CLEAR the DTCs. TEST the system for normal operation.
G15 CHECK VOLTAGE TO THE 4WD AND 2WD VACUUM SOLENOIDS	
 	5 Measure the voltage between 4WD vacuum solenoid C180, circuit 294 (W/LB), 2WD vacuum solenoid C181, circuit 294 (W/LB), and ground. • Are the voltages greater than 10 volts? → **Yes** GO to **G16**. → **No** REPAIR circuit(s) 294 (W/LB) or fuse 23 (10A). CLEAR the DTCs. TEST the system for normal operation.

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
G16 CHECK THE 4WD VACUUM SOLENOID	
	2 Measure the resistance between terminals 1 and 2 on the 4WD vacuum solenoid. • Is the resistance between 50 and 100 ohms? → **Yes** GO to **G17**. → **No** REPLACE the 4WD vacuum solenoid. CLEAR the DTCs. TEST the system for normal operation.
G17 CHECK THE 2WD VACUUM SOLENOID	
	1 Measure the resistance between terminals 1 and 2 on the 2WD vacuum solenoid. • Is the resistance between 50 and 100 ohms? → **Yes** GO to **G18**. → **No** REPLACE the 2WD vacuum solenoid. CLEAR the DTCs. TEST the system for normal operation.

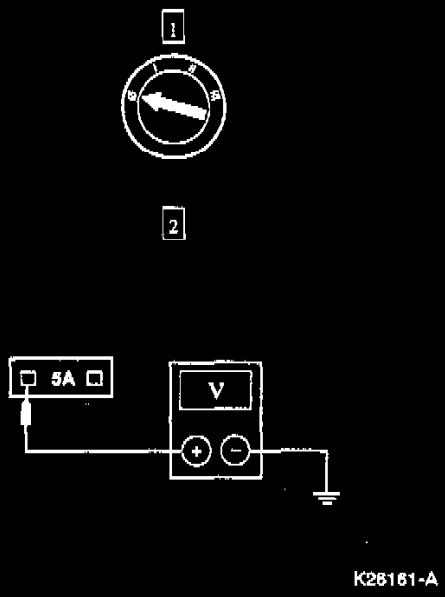
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
G18 CHECK CIRCUIT 145 (GY/BK) FOR OPEN	
	2 Measure the resistance between GEM C241-2, circuit 145 (GY/BK), and 2WD vacuum solenoid C181, circuit 145 (GY/BK). • Is the resistance less than 5 ohms? → **Yes** GO to **G19**. → **No** REPAIR circuit 145 (GY/BK). CLEAR the DTCs. TEST the system for normal operation.
G19 CHECK CIRCUIT 605 (R) FOR OPEN	
	1 Measure the resistance between GEM C241-7, circuit 605 (R), and 4WD vacuum solenoid C180, circuit 605 (R). • Is the resistance less than 5 ohms? → **Yes** GO to **G20**. → **No** REPAIR circuit 605 (R). CLEAR the DTCs. TEST the system for normal operation.

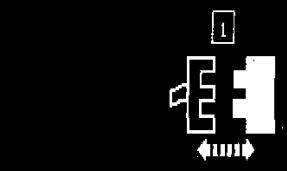
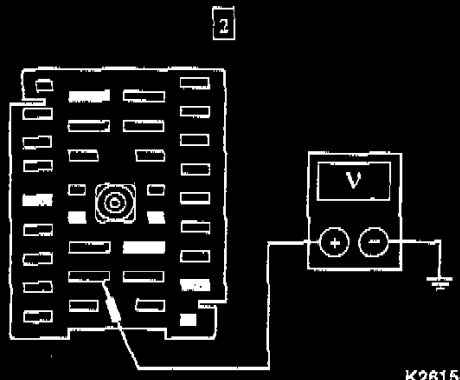
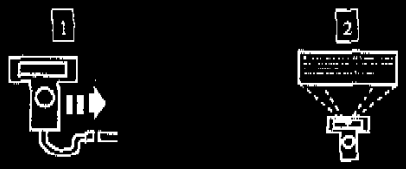
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
G20 CHECK CIRCUIT 145 (GY/BK) FOR SHORT TO GROUND	
	1 Measure the resistance between GEM C241-2, circuit 145 (GY/BK), and ground. • Is the resistance greater than 10,000 ohms? → **Yes** GO to **G21**. → **No** REPAIR circuit 145 (GY/BK). CLEAR the DTCs. TEST the system for normal operation.
G21 CHECK CIRCUIT 605 (R) FOR SHORT TO GROUND	
	1 Measure the resistance between GEM C241-7, circuit 605 (R), and ground. • Is the resistance greater than 10,000 ohms? → **Yes** REPLACE the GEM. CLEAR the DTCs. TEST the system for normal operation. → **No** REPAIR circuit 605 (R). CLEAR the DTCs. TEST the system for normal operation.

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
G22 CHECK THE VACUUM AT THE 4WD AND 2WD VACUUM SOLENOIDS	
	2 Verify the vacuum (with the engine running) at the feed lines on the 2WD and 4WD vacuum solenoids. • Is vacuum present? → **Yes** GO to **G23**. → **No** REPAIR the vacuum feed line in question. CLEAR the DTCs. TEST the system for normal operation.
G23 CHECK THE 4WD AND 2WD VACUUM SOLENOIDS BY APPLYING VACUUM	
  	2 Connect Vacuum Pump to the feed line of the vacuum solenoid being tested.

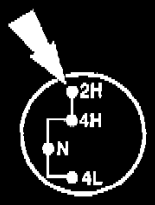
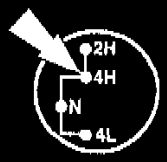
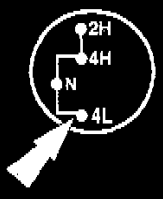
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
G23 CHECK THE 4WD AND 2WD VACUUM SOLENOIDS BY APPLYING VACUUM	
	4 Monitor the PIDs 2WDSOL and 4WDSOL. 5 Toggle the active command AXLE ENGG and AXLE DSCN to OFF. 6 Apply vacuum and verify the vacuum solenoids are closed. • Are the solenoids closed? → **Yes** RELEASE the applied vacuum. GO to **G24**. → **No** REPLACE the vacuum solenoid in question. CLEAR the DTCs. TEST the system for normal operation.
G24 CHECK THE 4WD AND 2WD VACUUM SOLENOIDS — ON	
	1 Toggle the active command AXLE ENGG and AXLE DSCN to ON. 2 Apply vacuum and verify the vacuum solenoids are open. • Are the solenoids OPEN? → **Yes** RELEASE the applied vacuum. GO to **G25**. → **No** REPLACE the vacuum solenoid in question. CLEAR the DTCs. TEST the system for normal operation.

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
G25 CHECK THE VACUUM FEED LINES TO THE VACUUM MOTOR	
	2 Verify the feed lines from the vacuum solenoids to the vacuum motor are OK. • Are the feed lines OK? → **Yes** RECONNECT the vacuum lines, GO to **G26**. → **No** REPAIR the feed line(s) in question. CLEAR the DTCs. TEST the system for normal operation.
G26 CHECK THE VACUUM MOTOR	
 	1 Remove the linkage from the vacuum motor. 3 Toggle the active commands AXLE ENGG to ON and AXLE DSCN to OFF. • Does the vacuum motor move to the engaged position? → **Yes** REPAIR the front axle assembly. CLEAR the DTCs. → **No** REPAIR the vacuum motor. CLEAR the DTCs. TEST the system for normal operation.

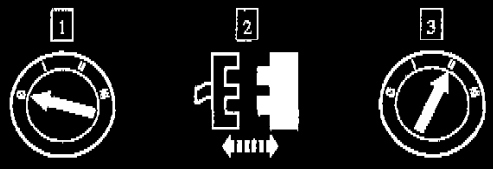
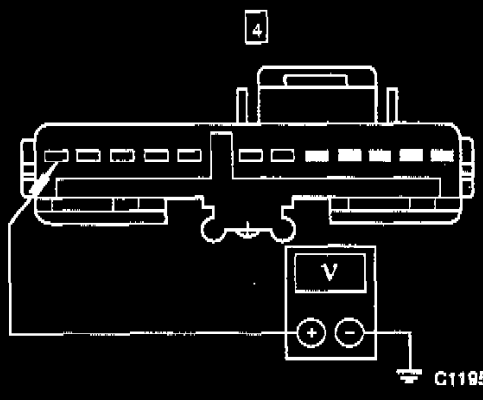
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
H1 CHECK THE VOLTAGE OUTPUT FROM FUSE 15 (5A)	
	2 Measure the voltage between fuse 15 (5A) pin 1, and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **H4.** → **No** GO to **H2.**
H2 CHECK FUSES 15 (5A) and 22 (50A)	
	1 Check fuse 15 (5A) in the fuse junction panel and fuse 22 (50A) in the power distribution box. • Are the fuses OK? → **Yes** GO to **H3.** → **No** REPLACE fuse(s). CLEAR the DTCs. TEST the system for normal operation. If the fuse(s) fail again, CHECK for a short to ground. REPAIR as necessary.

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
H3 CHECK CIRCUIT 1052 (T/BK) FOR VOLTAGE	
 Fuse Junction Panel C243 	2 Measure the voltage between fuse junction panel C243-11, circuit 1052 (T/BK), and ground. • Is the voltage greater than 10 volts? → **Yes** REPLACE the fuse junction panel. CLEAR the DTCs. TEST the system for normal operation. → **No** REPAIR circuit 1052 (T/BK). CLEAR the DTCs. TEST the system for normal operation.
H4 CHECK THE IGNITION STATES	
 New Generation STAR (NGS) Tester	2 **NOTE:** If the vehicle is equipped with a manual transmission, depress the clutch pedal while turning the ignition switch to the START. Monitor the PID IGN_GEM while turning the ignition switch through the START, RUN, OFF, and ACC positions. • Do the PID values agree with the ignition switch positions? → **Yes** GO to **H5**. → **No** REPAIR the ignition circuit(s) (RUN/ACC: circuit 297 [BK/LG], RUN: circuit 1040 [R/LB], START: circuit 32 [R/LB] or circuit 481 [GY/Y]) in question. CLEAR the DTCs. TEST the system for normal operation.

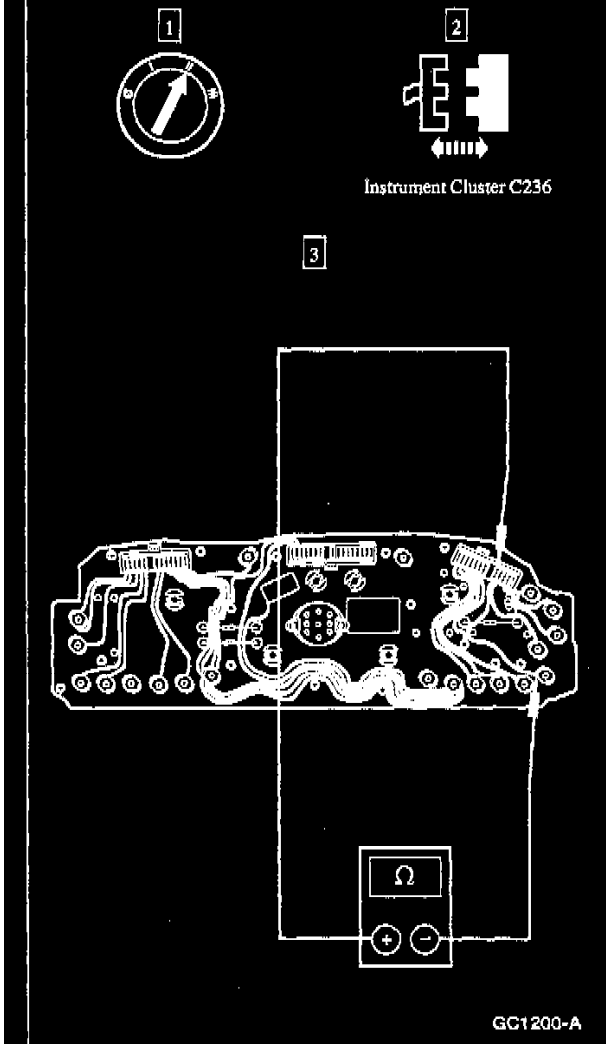
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
H5 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCs)	
 Retrieve and Document Continuous DTCs Clear Continuous DTCs On-Demand Self-Test	• Are any DTCs recorded? → **Yes** If DTC B1342, REPLACE the GEM. CLEAR the DTCs. TEST the system for normal operation. If DTC P1824, GO to Pinpoint Test E. If DTC P1826, GO to Pinpoint Test E. If DTC P1804, GO to **H6**. If DTC P1806, GO to **H6**. If DTC P1832, GO to Pinpoint Test G. If DTC P1834, GO to Pinpoint Test G. If DTC P1876, GO to Pinpoint Test G. If DTC P1877, GO to Pinpoint Test G. → **No** GO to **H6**.

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
H6 CHECK THE 4x4 INDICATORS	
1 	
2	2 Shift into 2H. Both indicators should be off.
 C11964-B	
3	3 Shift into 4H. The 4x4 indicator should illuminate.
 C11965-B	
4	4 Shift into 4L. Low range indicator should illuminate; the 4x4 indicator should remain illuminated. • Do the indicators operate correctly? → **Yes** Indicators operating correctly. → **No** If the high indicator is inoperative, GO to **H7**. If the low indicator is inoperative, GO to **H17**.
 C11966-B	

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
H7 CHECK THE GEM 4WD HIGH OUTPUT	
 	1 Monitor the PID 4WDHIGH. 2 Toggle the active command HIGH LAMP to ON and then OFF. The 4x4 indicator should illuminate then go off. • Does the PID 4WDHIGH display ON-B-? → **Yes** GO to **H15**. → **No** If the PID 4WDHIGH displays OFF O-G and the lamp stays on continuously, GO to **H13**. If the PID 4WDHIGH displays OFF O-G and the lamp does not illuminate, GO to **H8**.
H8 CHECK THE 4X4 HIGH INDICATOR BULB	
	2 Remove and check the 4x4 HIGH indicator bulb. • Is the bulb OK? → **Yes** GO to **H9**. → **No** REPLACE the bulb. CLEAR the DTCs. TEST the system for normal operation.

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
H9 CHECK FOR VOLTAGE AT THE 4x4 LAMP	
	2 Measure the voltage between 4x4 HIGH lamp socket and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **H11.** → **No** GO to **H10.**
H10 CHECK THE VOLTAGE TO THE INDICATORS	
 Instrument Cluster C238 	4 Measure the voltage between instrument cluster C238-12, circuit 640 (R/Y), and ground. • Is the voltage greater than 10 volts? → **Yes** REPLACE the instrument cluster. CLEAR the DTCs. TEST the system for normal operation. → **No** CHECK fuse 29 (5A). REPLACE if necessary. If OK, REPAIR circuit 640 (R/Y). CLEAR the DTCs. TEST the system for normal operation.

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
H11 CHECK THE INSTRUMENT CLUSTER FOR OPEN	

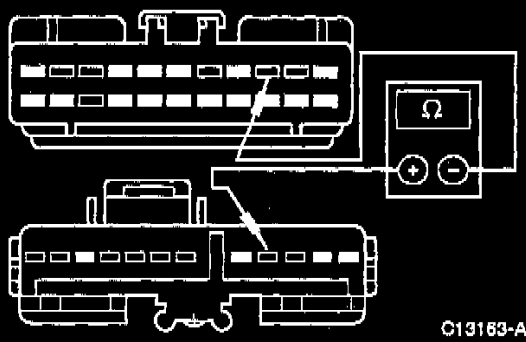
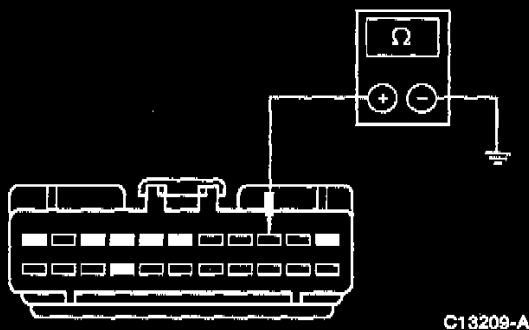


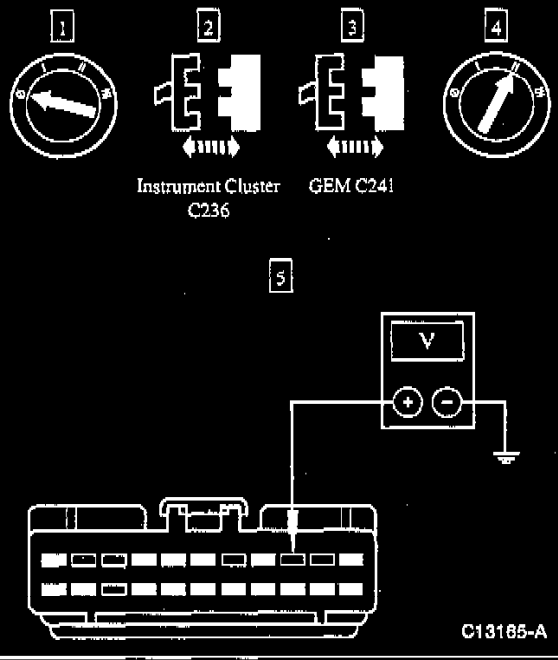
3 Measure the resistance between 4x4 HIGH socket and instrument cluster terminal 4.

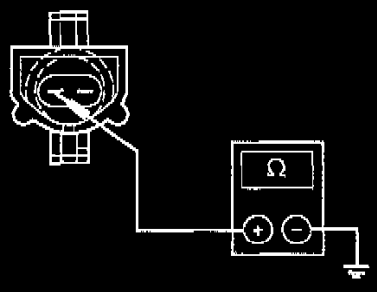
- Is the resistance less than 5 ohms?

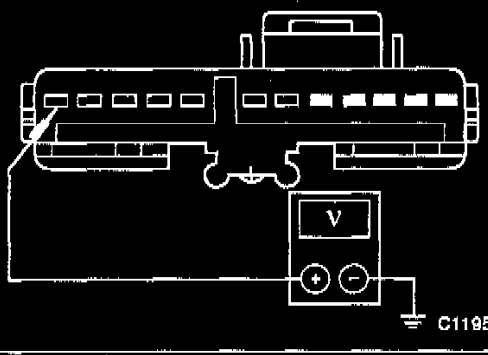
→ **Yes**
GO to **H12**.

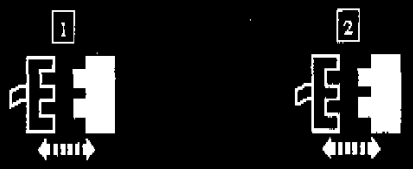
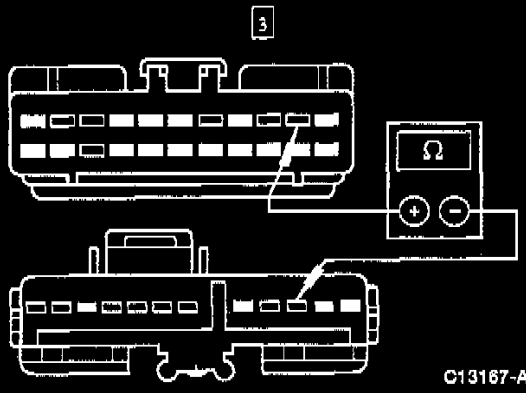
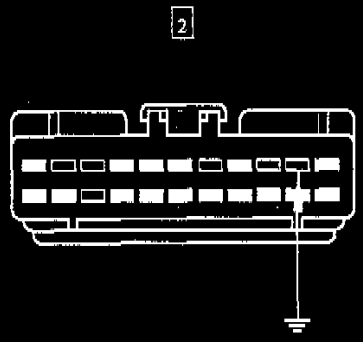
→ **No**
REPLACE the instrument cluster. CLEAR the DTCs. TEST the system for normal operation.

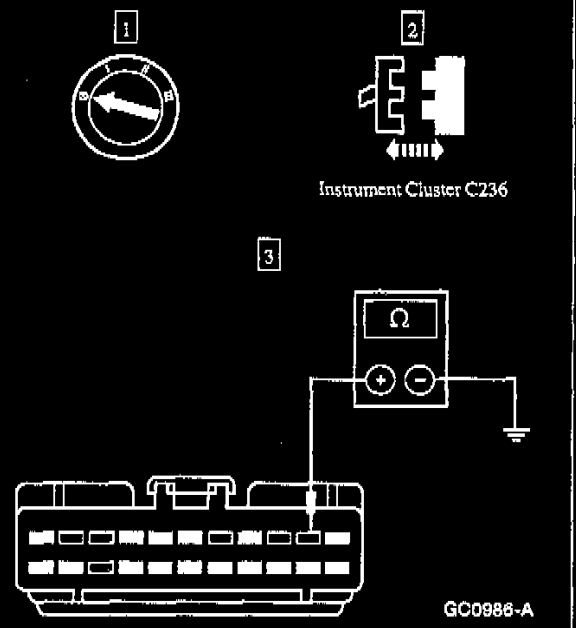
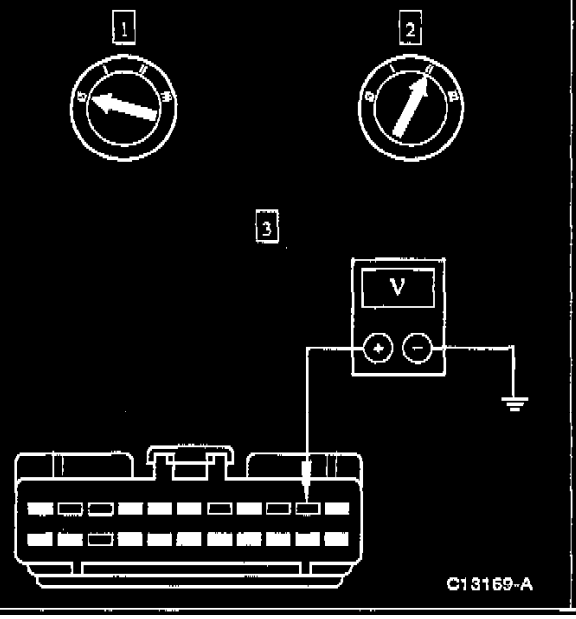
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
H12 CHECK CIRCUIT 210 (LB) FOR OPEN	
1  GEM C241 2  C13163-A	2 Measure the resistance between GEM C241-9, circuit 210 (LB), and instrument cluster C236-4, circuit 210 (LB). • Is the resistance less than 5 ohms? → **Yes** REPLACE the GEM. CLEAR the DTCs. TEST the system for normal operation. → **No** REPAIR circuit 210 (LB). CLEAR the DTCs. TEST the system for normal operation.
H13 CHECK CIRCUIT 210 (LB) FOR SHORT TO GROUND	
1  C13209-A	1 Measure the resistance between GEM C241-9, circuit 210 (LB), and ground. • Is the resistance greater than 10,000 ohms? → **Yes** RECONNECT instrument cluster C236. GO to **H14**. → **No** REPAIR circuit 210 (LB). CLEAR the DTCs. TEST the system for normal operation.

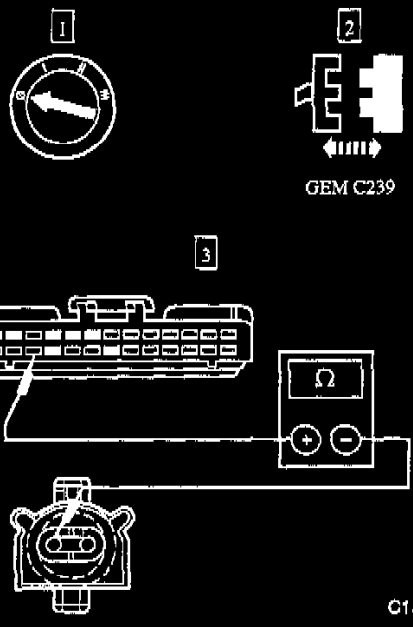
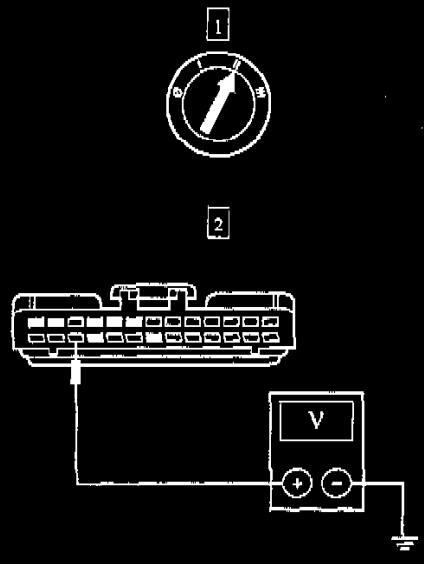
TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
H14 CHECK THE INSTRUMENT CLUSTER FOR SHORT TO GROUND	
	• Is the 4x4 HIGH indicator illuminated? → **Yes** REPLACE the instrument cluster. CLEAR the DTCs. TEST the system for normal operation. → **No** REPLACE the GEM. CLEAR the DTCs. TEST the system for normal operation.
H15 CHECK CIRCUIT 210 (LB) FOR SHORT TO POWER	
	5 Measure the voltage between GEM C241-9, circuit 210 (LB), and ground. • Is any voltage indicated? → **Yes** REPAIR circuit 210 (LB). CLEAR the DTCs. TEST the system for normal operation. → **No** GO to **H16**.
H16 CHECK THE INSTRUMENT CLUSTER FOR SHORT TO POWER	
	1 Set the active command mode HIGH LAMP to ON.

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
H16 CHECK THE INSTRUMENT CLUSTER FOR SHORT TO POWER	
	2 Monitor the PID 4WDHIGH. • Does the PID indicate ON-B-? → **Yes** REPLACE the GEM. CLEAR the DTCs. TEST the system for normal operation. → **No** REPLACE the instrument cluster. CLEAR the DTCs. TEST the system for normal operation.
H17 CHECK THE 4WD INDICATOR SWITCH	
  4WD Indicator Switch C189 3  C11970-A	3 Measure the resistance between circuit 784 (LB/BK) terminal of the 4WD indicator switch and ground with the 4WD indicator switch in all switch positions. • Is the resistance greater than 10,000 ohms with the 4WD indicator switch in the 2H and 4H positions and less than 5 ohms with the 4WD indicator switch in the 4L position? → **Yes** GO to **H18**. → **No** REPLACE the 4WD indicator switch. CLEAR the DTCs. TEST the system for normal operation.

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
H18 CHECK THE VOLTAGE TO THE INSTRUMENT CLUSTER	
1  Instrument Cluster C238 2  3  	3 Measure the voltage between instrument cluster C238-12, circuit 640 (R/Y), and ground. • Is the voltage greater than 10 volts? → **Yes** GO to **H19**. → **No** CHECK fuse 29 (5A). REPLACE if necessary. If OK, REPAIR circuit 640 (R/Y). CLEAR the DTCs. TEST the system for normal operation.
H19 CHECK THE 4X4 LOW INDICATOR	
1 	2 Remove and check the 4x4 low indicator bulb. • Is the bulb OK? → **Yes** REINSTALL the 4x4 low indicator bulb. GO to **H20**. → **No** REPLACE the bulb. CLEAR the DTCs. TEST the system for normal operation.

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
H20 CHECK CIRCUIT 975 (BR/Y) FOR OPEN	
 GEM C241 Instrument Cluster C236  C13167-A	3 Measure the resistance between GEM C241-10, circuit 975 (BR/Y), and instrument cluster C236-3, circuit 975 (BR/Y). • Is the resistance less than 5 ohms? → **Yes** RECONNECT instrument cluster C236. GO to **H21**. → **No** REPAIR circuit 975 (BR/Y). CLEAR the DTCs. TEST the system for normal operation.
H21 CHECK THE INSTRUMENT CLUSTER — 4x4 LOW	
  C13168-A	2 Connect a jumper wire between GEM C238-10, circuit 975 (BK/Y), and ground. • Does 4x4 low indicator illuminate? → **Yes** GO to **H22**. → **No** REPLACE the instrument cluster. CLEAR the DTCs. TEST the system for normal operation.

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
H22 CHECK CIRCUIT 975 (BR/Y) FOR SHORT TO GROUND	
	3 Measure the resistance between GEM C241-10, circuit 975 (BR/Y), and ground. • Is the resistance greater than 10,000 ohms? → **Yes** GO to **H23**. → **No** REPAIR circuit 975 (BR/Y). CLEAR the DTCs. TEST the system for normal operation.
H23 CHECK CIRCUIT 975 (BR/Y) FOR SHORT TO POWER	
	3 Measure the voltage between GEM C241-10, circuit 975 (BR/Y), and ground. • Is any voltage indicated? → **Yes** REPAIR circuit 975 (BR/Y). CLEAR the DTCs. TEST the system for normal operation. → **No** GO to **H24**.

TEST CONDITIONS	TEST DETAILS/RESULTS/ACTIONS
H24 CHECK CIRCUIT 784 (LB/BK) FOR OPEN	
	3 Measure the resistance between GEM C239-16, circuit 784 (LB/BK), and 4WD indicator switch C189, circuit 784 (LB/BK). • Is the resistance less than 5 ohms? → **Yes** GO to **H25**. → **No** REPAIR circuit 784 (LB/BK). CLEAR the DTCs. TEST the system for normal operation.
H25 CHECK CIRCUIT 784 (LB/BK) FOR SHORT TO POWER	
	2 Measure the voltage between GEM C239-16, circuit 784 (LB/BK), and ground. • Is any voltage indicated? → **Yes** REPAIR circuit 784 (LB/BK). CLEAR the DTCs. TEST the system for normal operation. → **No** REPLACE the GEM. CLEAR the DTCs. TEST the system for normal operation.

Condition	Possible Source	Action
• 4WD HIGH Does Not Engage at Speed Properly (Driveline Does Not Synchronize Properly), but Does Engage at Rest	• MSOF switch/circuit. • MSOF electric clutch relay/circuit. • MSOF transfer case electric clutch. • MSOF transfer case clutch armature.	• GO to Pinpoint Test F.
• Front Axle Not Engaging Properly; Transfer Case Engagement OK	• 4x4 solenoid/circuit. • 4x2 solenoid/circuit. • Vacuum circuit.	• GO to Pinpoint Test G.
• 4x4 or LOW Range Indicator Not Operating Properly	• Fuse(s). • Bulb/circuit. • MSOF switch/circuit. • Transmission range (TR) sensor.	• GO to Pinpoint Test H.