AUTO TRANS DIAGNOSIS - R4AW3 & V4AW3

1998 Mitsubishi Montero

1997-98 AUTOMATIC TRANSMISSIONS
Mitsubishi R4AW3 & V4AW3 Electronic Controls

Montero, Montero Sport

APPLICATION

TRANSMISSION APPLICATION

Vehicle	Transmission Model
Montero Sport 2WD	R4AW3
Montero & Montero Sport 4WD	V4AW3

CAUTION: Vehicle is equipped with Supplemental Restraint System (SRS). When servicing vehicle, use care to avoid accidental air bag deployment. SRS-related components are located in steering column, center console, instrument panel and lower panel on instrument panel. DO NOT use electrical test equipment on these circuits. If necessary, deactivate SRS before servicing components. See AIR BAG SERVICING article in APPLICATIONS & IDENTIFICATION.

DESCRIPTION

Automatic transmission is a 4-speed electronically controlled transmission. Solenoids that control shift changes are located in valve body. Solenoids are controlled by a Transmission Control Module (TCM). TCM receives information from various input devices and uses this information to control shift solenoids for transmission shifting and lock-up solenoid for torque converter lock-up.

An Overdrive (OD) switch is mounted on the shift lever. When OD switch is depressed to ON position, transmission will shift into 4th gear when shift lever is in "D" position, and OD OFF light on instrument panel will go off. When OD switch is released to OFF position, transmission will shift into 3rd gear, and OD OFF light on instrument panel will illuminate.

A pattern select switch is located near shift lever on center console. Pattern select switch contains a NORMAL and a HOLD operating position. When pattern select switch is depressed (HOLD position) with shift lever in Drive position, transmission starts in 2nd gear. Upshifts and downshifts will occur at a higher vehicle speed than with switch in NORMAL position. See MITSUBISHI R4AW3 & V4AW3 OVERHAUL article. Indicator light on instrument panel indicates pattern select switch is in HOLD position.

Transmission is equipped with a shift lock and key interlock system. Shift lock system prevents shift lever from being moved from Park unless brake pedal is depressed. Key interlock system prevents ignition key from being moved from ACC to LOCK position on ignition switch unless shift lever is in Park. See MITSUBISHI SHIFT LOCK SYSTEMS article.

OPERATION

TCM

TCM receives information from various input devices and uses

this information to control solenoids on transmission valve body. TCM controls transmission shifting and torque converter lock-up.

TCM contains a self-diagnostic system, which will store Diagnostic Trouble Codes (DTC) if failure or problem exists in electronic control system. DTC can be retrieved to determine problem area. See SELF-DIAGNOSTIC SYSTEM. TCM is located under left side of instrument panel, left of steering column. See Fig. 1.

TCM INPUT DEVICES

Brakelight Switch Signal

Brakelight switch delivers input signal to TCM, indicating vehicle braking. Brakelight switch is located on brake pedal support.

Cruise Control Electronic Control Unit (ECU)

Cruise control ECU delivers an input signal to control overdrive operation in accordance with vehicle speed when cruise control is operating. When in overdrive with cruise control on, if vehicle speed drops 2 MPH less than the set speed, overdrive is released to prevent reduction in vehicle speed. Once vehicle speed is more than the set speed, overdrive function is resumed. If coolant temperature is low, transmission will not shift into overdrive. Cruise control ECU is located below center A/C vent, behind temperature control panel on Montero. On Montero Sport, cruise control ECU is located behind driver’s kick panel.

Engine Coolant Temperature Sensor (ECT) Signal

Engine coolant temperature sensor delivers input signal to TCM, indicating engine coolant temperature. Coolant temperature sensor is located on engine.

Input & Output Shaft Speed Sensors

Sensors are magnetic pick-ups that monitor input and output shaft speeds. AC waveforms are input to TCM by sensors. Sensors are located on front and rear side of transmission case.

OD Switch Signal

The OD switch provides an input signal to TCM to indicate when overdrive is selected by operator. When OD switch is depressed to ON position, transmission will shift into 4th gear when shift lever is in "D" position, and OD OFF light on instrument panel will go off. When OD switch is released to OFF position, transmission will shift into 3rd gear, and OD OFF light on instrument panel will come on. The OD switch is mounted on shift lever.

Oil Temperature Sensor Signal

Oil temperature sensor provides TCM with ATF temperature values. TCM uses this information to control shift points for maximum performance. If transmission oil temperature exceeds standard values, instrument panel ATF - TEMP light will come on. Sensor is mounted to cooler line at transmission.

Park/Neutral Position (PNP) Switch Signal

PNP switch delivers an input signal to TCM indicating shift lever position. Switch is located on side of transmission.

Throttle Position (TP) Sensor Signal

TP sensor delivers closed throttle and variable throttle position input signals to TCM. TP sensor is located on side of throttle body.

4WD Low Range Detection Switch

4WD low range detection switch provides information to TCM

when transfer case is in 4WD low-lock range.

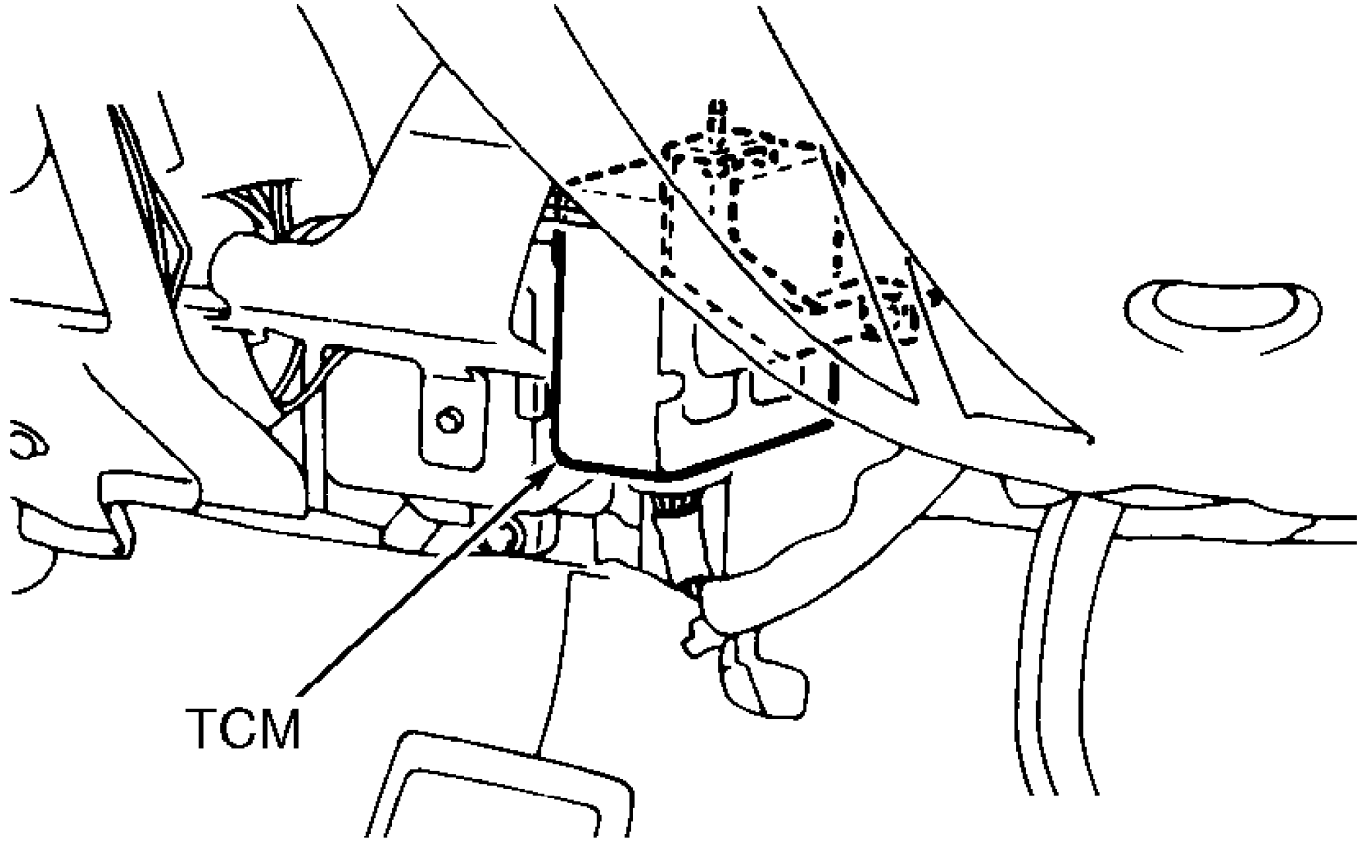

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Fig. 1: Locating Transmission Control Module (Montero)
Courtesy of Mitsubishi Motor Sales of America.

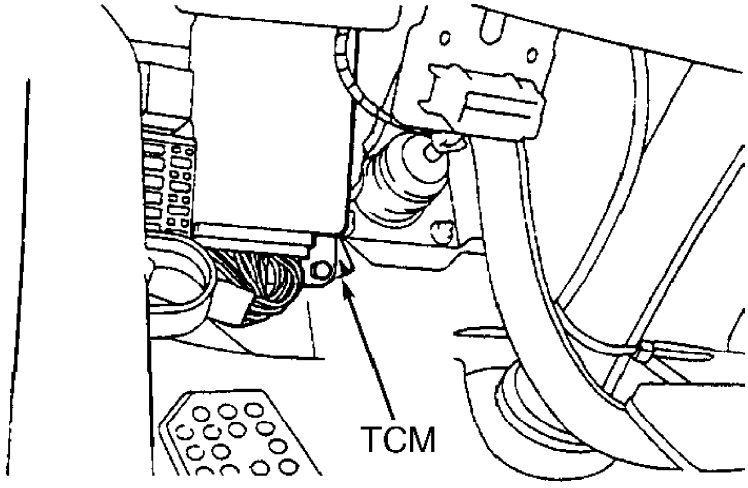

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Fig. 2: Locating Transmission Control Module (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America.

TCM OUTPUT DEVICES

Shift Solenoids No. 1 & No. 2

TCM controls transmission shifting by delivering an output signal to operate proper solenoid. Solenoids are located on transmission valve body. See Fig. 3. Solenoids are operated in accordance with shift lever range. If a solenoid malfunctions, TCM may select a preselected gear. See Fig. 4.

NOTE: TCM provides a fail-safe system which will place transmission in preselected gear depending on solenoid failure. In other gears, fail-safe system will not be activated and transmission will be placed in a specified gear. See Fig. 4.

Lock-Up Solenoid

TCM controls torque converter lock-up by delivering an output signal to lock-up solenoid. Lock-up solenoid is activated when shift lever is in "D" position and vehicle is at specified speed. Solenoid is located on transmission valve body. See Fig. 3.

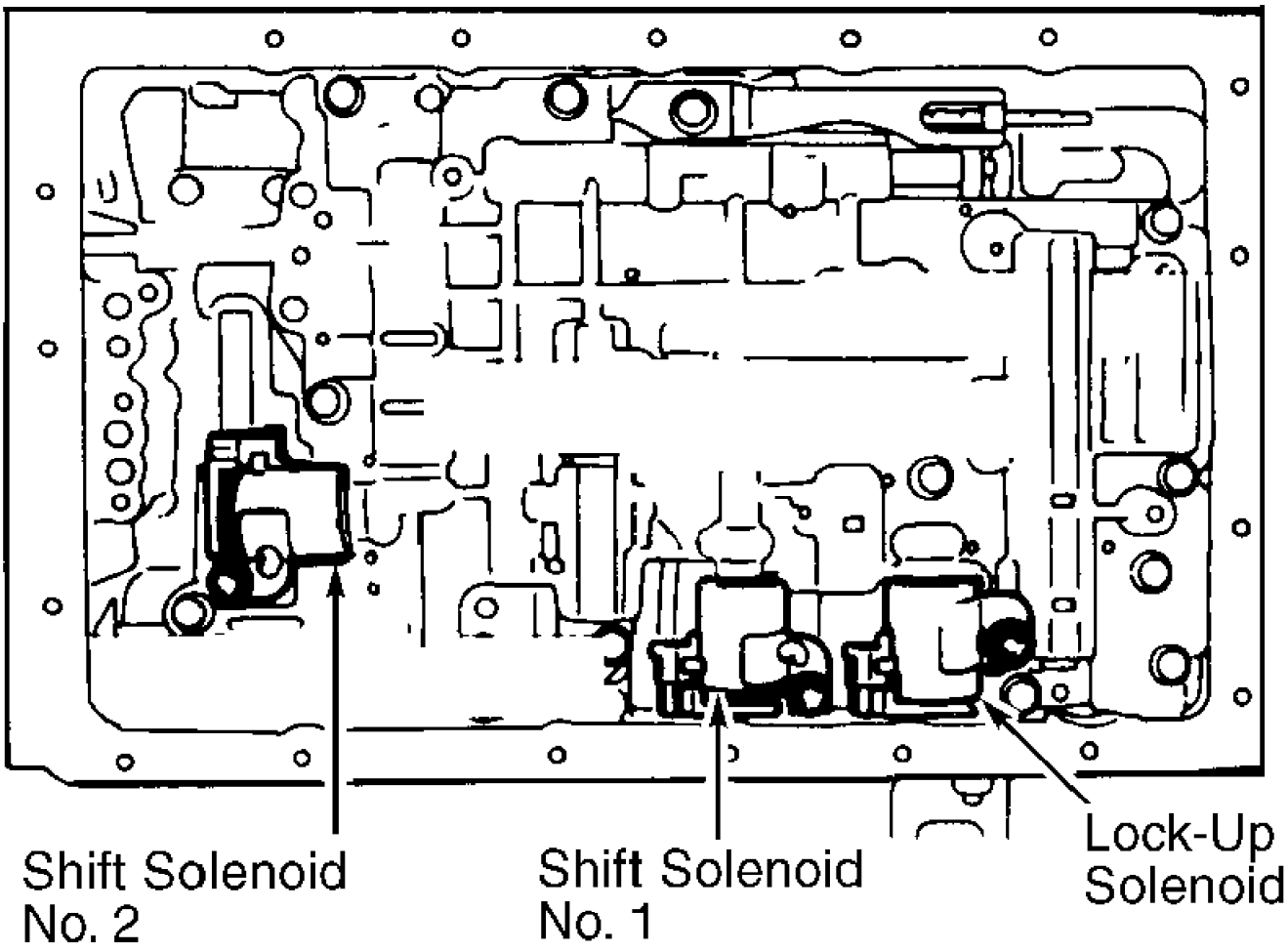

Fig. 3: Locating Lock-Up & Shift Solenoids
Courtesy of Mitsubishi Motor Sales of America.

Range	NORMAL			NO. 1 SOLENOID MALFUNCTIONING			NO. 2 SOLENOID MALFUNCTIONING			BOTH SOLENOIDS MALFUNCTIONING		
	Solenoid Valve		Gear Position	Solenoid Valve		Gear Position	Solenoid Valve		Gear Position	Solenoid Valve		Gear Position
	No. 1	No. 2		No. 1	No. 2		No. 1	No. 2		No. 1	No. 2	
D range	ON	OFF	1st	X	ON (OFF)	3rd (O/D)	ON	X	1st	X	X	O/D
	ON	ON	2nd	X	ON	3rd	OFF (ON)	X	O/D (1st)	X	X	O/D
	OFF	ON	3rd	X	ON	3rd	OFF	X	O/D	X	X	O/D
	OFF	OFF	O/D	X	OFF	O/D	OFF	X	O/D	X	X	O/D
2 range	ON	OFF	1st	X	ON (OFF)	3rd (O/D)	ON	X	1st	X	X	3rd
	ON	ON	2nd	X	ON	3rd	OFF (ON)	X	3rd (1st)	X	X	3rd
	OFF	ON	3rd	X	ON	3rd	OFF	x	3rd	X	X	3rd
L range	ON	OFF	1st	X	OFF	1st	ON	X	1st	X	X	1st
	ON	ON	2nd	X	ON	2nd	ON	X	1st	X	X	1st

( ): No fail-safe function X: Malfunctions

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Fig. 4: Checking Operation Of Shift Solenoids No. 1 & No. 2
Courtesy of Mitsubishi Motor Sales of America.

SELF-DIAGNOSTIC SYSTEM

SYSTEM DIAGNOSIS

NOTE: Before testing transmission, ensure fluid level is correct and throttle and shift cables are properly adjusted. Ensure engine starts with shift lever in Park and Neutral to ensure proper adjustment of park/neutral position switch. Transmission must first be tested by checking for stored codes. See RETRIEVING DIAGNOSTIC TROUBLE CODES (DTC).

TCM monitors transmission operation and contains a self-diagnostic system which stores a DTC if an electronic control system failure or problem exists. If a problem exists in any of the solenoids or speed sensors and a DTC is set, TCM delivers a signal to blink the ATF TEMP light on instrument panel to warn the driver. DTC may be set if a failure exists and can be retrieved for transmission diagnosis.

RETRIEVING DIAGNOSTIC TROUBLE CODES (DTC)

NOTE: Before retrieving DTC, ensure proper battery voltage exists for proper self-diagnosis system operation. DO NOT disconnect battery or ECM connectors before retrieving DTC.

Retrieving Codes Using Scan Tool

Ensure ignition switch is in OFF position. Connect scan tool to Data Link Connector (DLC). See Fig. 5. Turn ignition switch to ON position. Check for stored DTC and record code(s). See DIAGNOSTIC TROUBLE CODE IDENTIFICATION table.

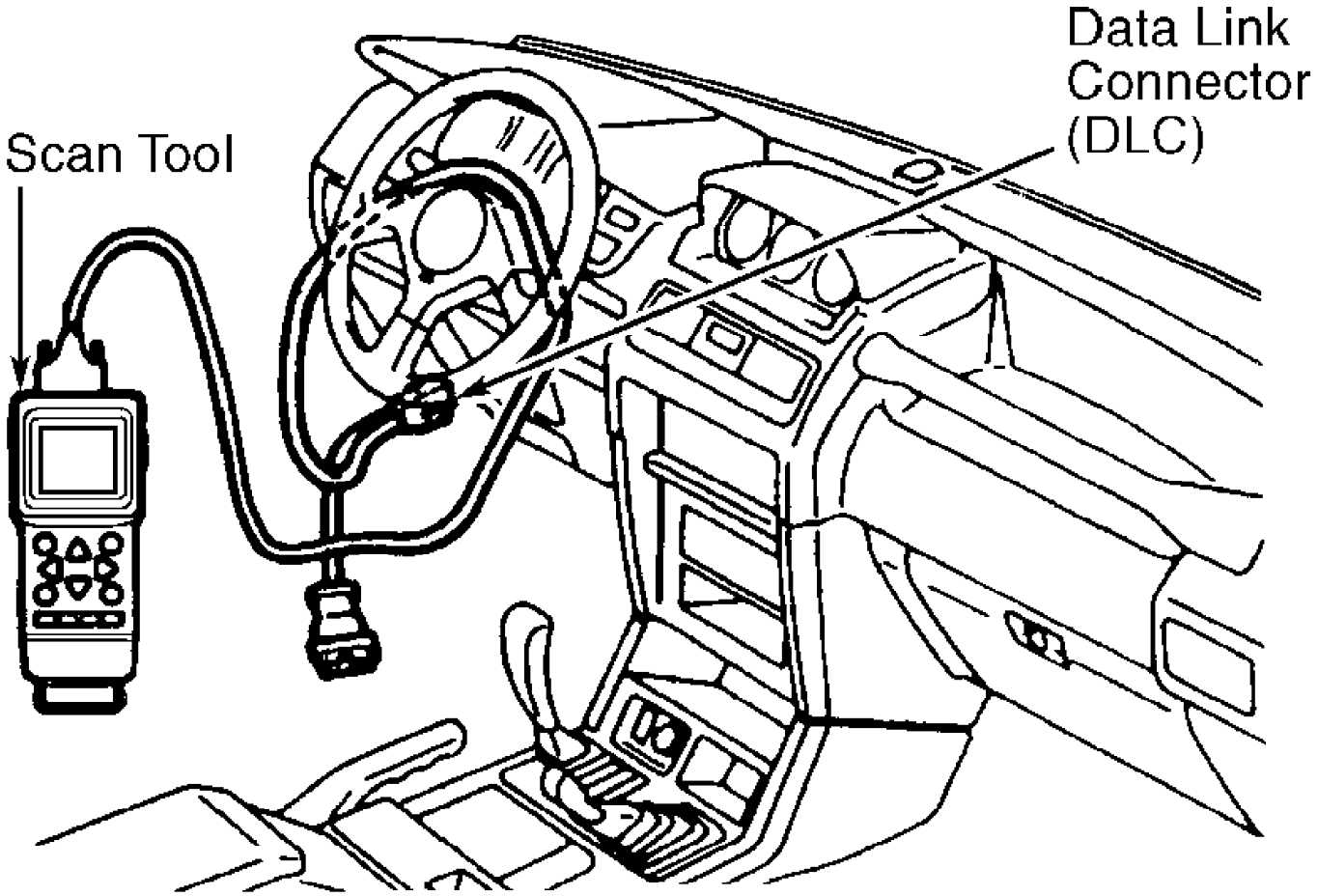

Fig. 5: Retrieving Codes Using Scan Tool
Courtesy of Mitsubishi Motor Sales of America.

Retrieving Codes Using Oil Temperature Warning Light

1) Using jumper wire, ground DLC terminal No. 1. See Fig. 6. Note number of flashes from oil temperature warning light on instrument panel. See Fig. 7. If normal system operation exists, oil temperature warning light will blink 2 times per second. See Fig. 8.

2) If system is operating correctly and no DTC exists, turn ignition off and remove jumper wire. If DTC exists, oil temperature warning light will flash once every 2 seconds. The number of flashes will equal first digit of DTC. After a pause of 2 seconds, second digit will be displayed. Oil temperature warning light will flash once every half second for second digit. See Fig. 8.

3) If more than one DTC exists, next DTC will be displayed after pause of 3 seconds. Smallest DTC number will be first. DTCs will be repeated.

4) Once DTC is obtained, determine probable cause and symptom. See DIAGNOSTIC TROUBLE CODE IDENTIFICATION table. To trouble shoot DTC, see DIAGNOSTIC TESTS. Turn ignition off and remove jumper wire.

NOTE: Once repairs have been performed, DTCs must be cleared from TCM memory. See CLEARING DIAGNOSTIC TROUBLE CODES (DTC).

DIAGNOSTIC TROUBLE CODE IDENTIFICATION

DIAGNOSTIC TROUBLE CODE IDENTIFICATION

DTC	(1) Probable Cause
11	Defective TP Sensor Or TP Sensor Circuit
15	Open Oil Temperature Sensor Circuit
16	Short Oil Temperature Sensor Circuit
21	Short Ignition Signal Circuit
22	Open Ignition Signal Circuit
23	Open Signal Line (ECT) From ECM To TCM
24	Short Signal Line (ECT) From ECM To TCM
29	Short Neutral Safety Switch Circuit
30	Open Neutral Safety Switch Circuit
31	Open No. 2 Speed Sensor Circuit
32	Open No. 1 Speed Sensor Circuit
41	Open Solenoid No. 1 Circuit
42	Short Solenoid No. 1 Circuit
43	Open Solenoid No. 2 Circuit
44	Short Solenoid No. 2 Circuit
47	Open Lock-Up Solenoid Circuit
48	Short Lock-up Solenoid Circuit
49	(2) Torque Converter Clutch Engagement Malfunction
50	(2) Torque Converter Clutch Disengagement Malfunction
51	1st Gear Ratio Signal Incorrect
52	2nd Gear Ratio Signal Incorrect
53	3rd Gear Ratio Signal Incorrect
54	4th Gear Ratio Signal Incorrect

(1) - Check listed fault code and component for probable cause. See appropriate fault code listing under DIAGNOSTIC TESTS. Check wiring and connections of specified component.
(2) - Scan tool is required for testing malfunctioning circuit.

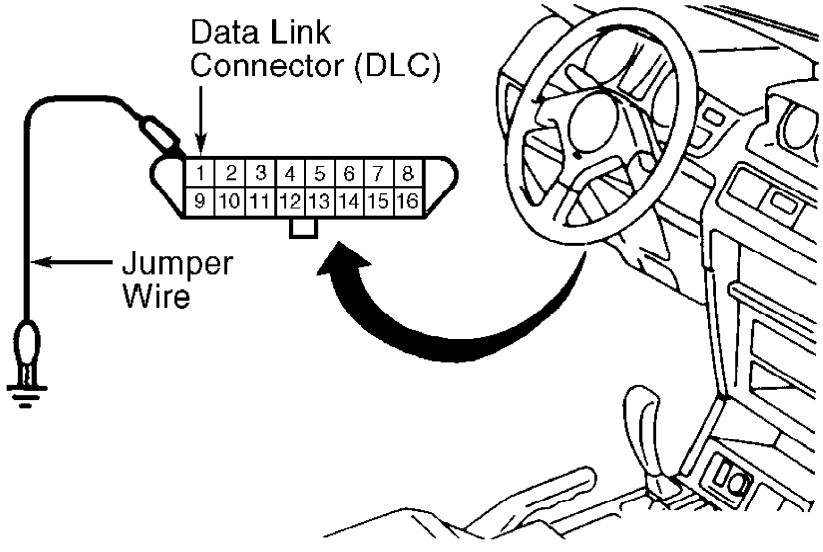

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Fig. 6: Identifying Data Link Connector (DLC) Terminals
Courtesy of Mitsubishi Motor Sales of America.

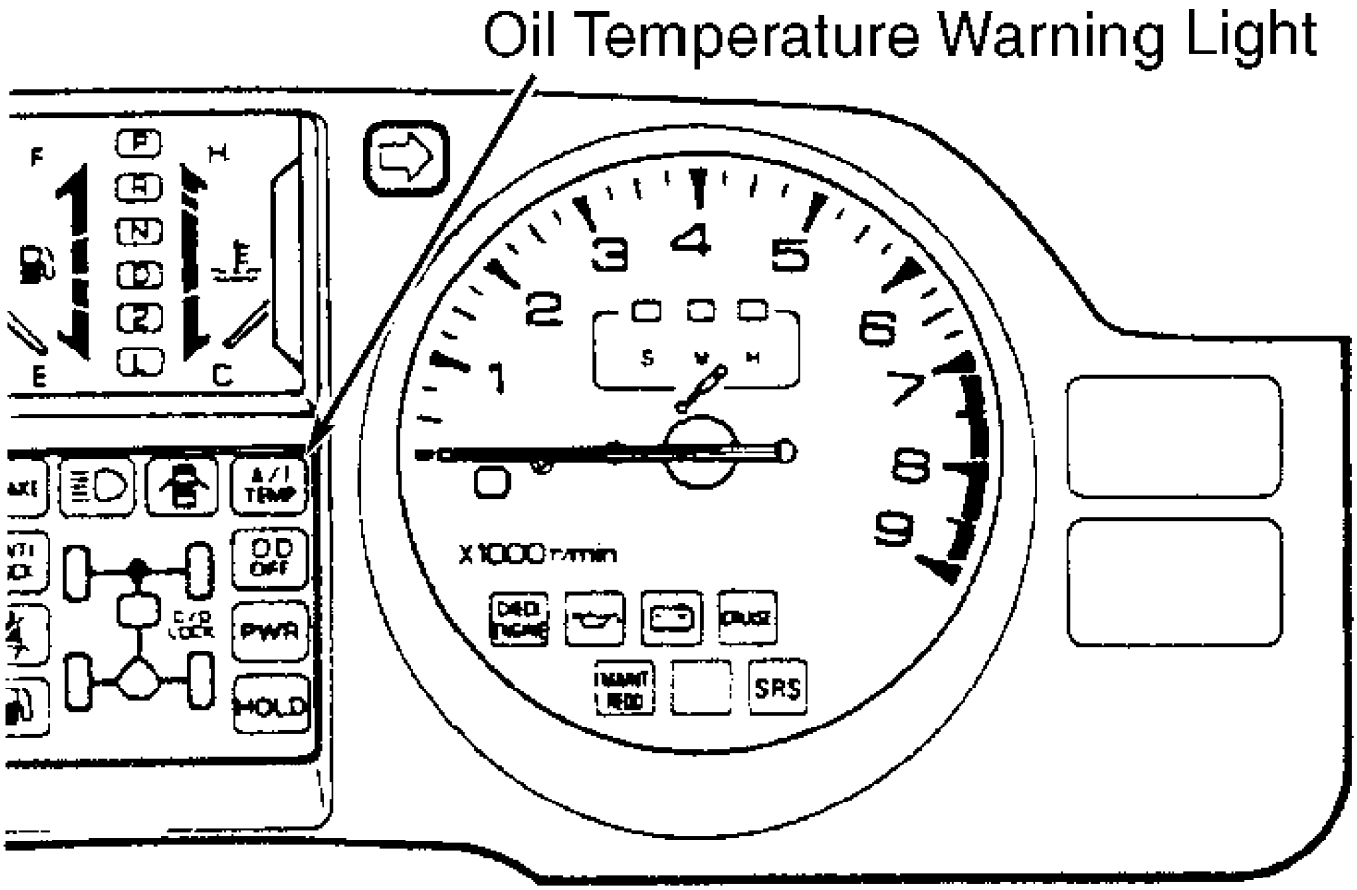

Fig. 7: Locating A/T Temperature Warning Light
Courtesy of Mitsubishi Motor Sales of America.

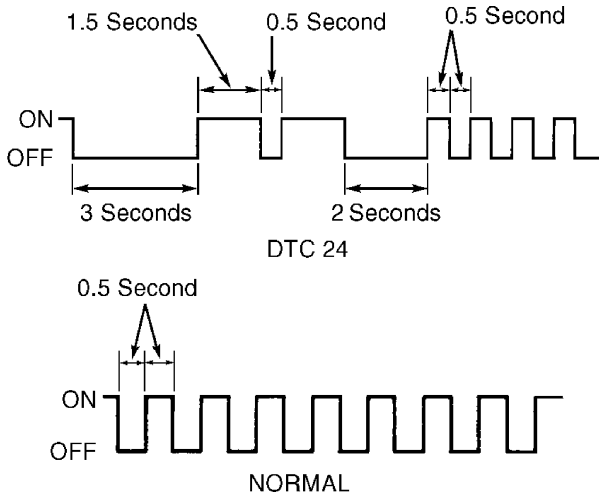

Fig. 8: Identifying DTC Displays
Courtesy of Mitsubishi Motor Sales of America.

CLEARING DIAGNOSTIC TROUBLE CODES (DTC)

Once repairs have been performed, DTCs must be cleared from TCM memory. DTCs may be cleared by disconnecting negative battery cable for 10 seconds or more. Reconnect cable and ensure DTCs have been cleared. Start engine and warm to normal operating temperature. Run engine at idle for 10 minutes. DTCs may also be cleared using scan tool. Refer to manufacturer's instruction manual.

DIAGNOSTIC TESTS

NOTE: For terminal and wire color identification, see WIRING DIAGRAMS.

DTC 11: THROTTLE POSITION (TP) SENSOR

For diagnosis and testing information, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE section. If TP sensor is okay, check wiring harness and connectors between TP sensor and TCM. Repair if necessary. If wiring harness and connectors are okay, replace TCM.

DTC 15 & 16: OPEN OR SHORT IN OIL TEMPERATURE SENSOR CIRCUIT

1) Test oil temperature for proper operation. See OIL TEMPERATURE SENSOR under COMPONENT TESTING. If oil temperature sensor is okay, check wire harness, connectors and ground circuit for poor connections or damage. Go to next step.
2) If wire harness and connectors are okay, check DTCs again and verify code No. 15 or No. 16 still exists. If either code still exists, replace TCM.

DTC 21 & 22: SHORT OR OPEN IN IGNITION SIGNAL CIRCUIT

1) Using an external tachometer, verify vehicles' tachometer is operating accurately. If tachometer is incorrect, check ignition coil and ignition power transistor and circuits for malfunction. See appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE section.
2) If tachometer is okay, check TCM wire harness connector for poor connection. If wire harness is okay, recheck DTCs. If codes reappear check wire harness between ignition power transistor and TCM. If wire harness is okay, replace TCM.

DTC 23 & 24: OPEN OR SHORT IN SIGNAL LINE (ECT) FROM ECM TO TCM

Check wire harness, connectors and ground circuit for poor connections or damage. Go to next step. If wire harness and connectors are okay, check DTCs again and verify code No. 23 or No. 24 still exists. If either code still exists, replace TCM.

DTC 29 & 30: SHORT OR OPEN IN PARK/NEUTRAL POSITION (PNP) SWITCH CIRCUIT

1) Check PNP switch for correct operation. See. If PNP switch is okay, disconnect switch connector and measure voltage between harness connector terminal No. 1 and ground.
2) If battery voltage does not exist, check wire harness and connectors. See WIRING DIAGRAMS. If battery voltage exists, check wire harness and connectors between PNP switch and TCM. If wire harness is okay, replace TCM.

DTC 31: INPUT SPEED SENSOR

1) Check input speed sensor. See INPUT SPEED SENSOR under COMPONENT TESTING. If resistance is as specified, reconnect speed sensor connector and go to next step. If resistance is not as specified replace input speed sensor and recheck DTCs.

2) Connect voltmeter between solenoid and sensor connector terminals No. 9 and No. 10. See Fig. 9. Lift and support vehicle to allow drive wheels to spin freely. With transmission in "D" position, engine at 1000 RPM and wheel speed at 19 MPH (30 km/h). Measured voltage should be .3-2.5 volts.

3) If voltage is as specified, go to next step. If voltage is not as specified, replace input speed sensor. If DTC still exists, check speed sensor rotor. See MITSUBISHI R4AW3 & V4AW3 OVERHAUL article. If DTC still exists after speed sensor rotor is replaced, check for noise interference and repair.

4) Check and repair wiring harness and connectors between input speed sensor and TCM. If wiring is okay, recheck DTC. If DTC still exists, replace TCM.

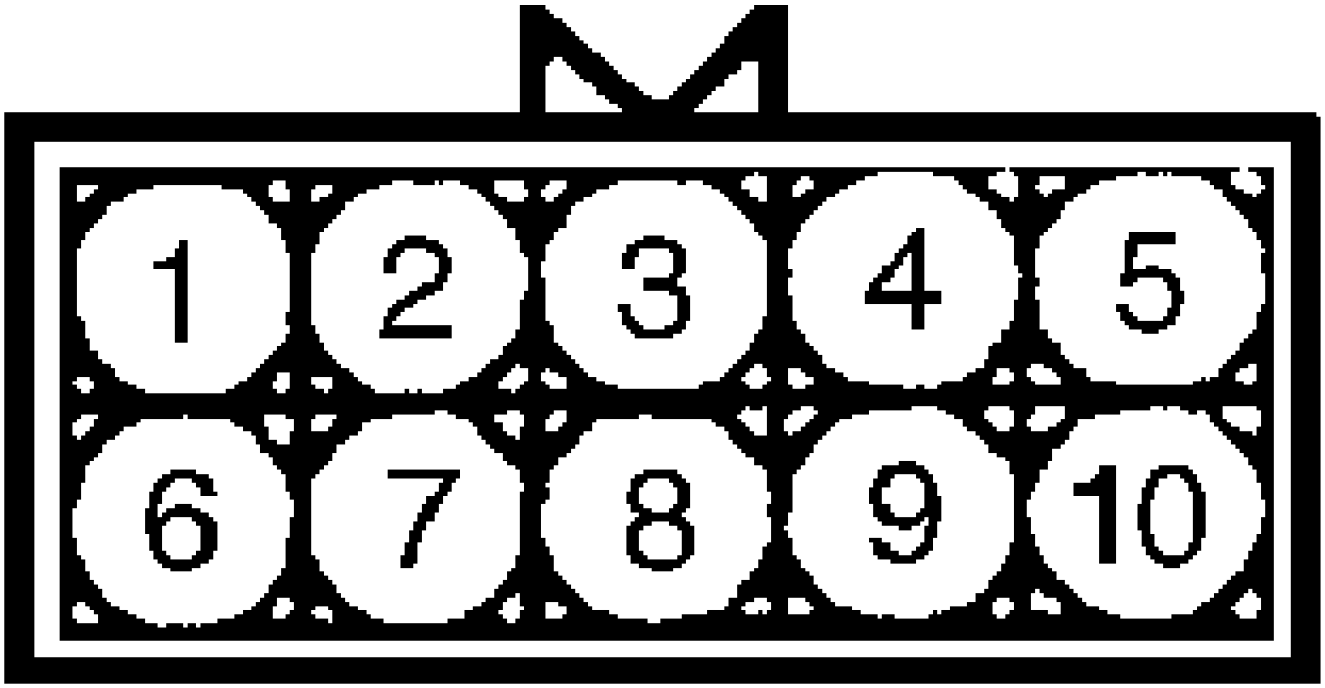

Fig. 9: Identifying Sensor & Solenoid Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

DTC 32: OUTPUT SPEED SENSOR

1) Check output speed sensor. See OUTPUT SPEED SENSOR under COMPONENT TESTING. If resistance is as specified, reconnect speed sensor connector and go to next step. If resistance is not as specified replace output speed sensor and recheck DTCs.

2) Connect voltmeter between solenoid and sensor connector terminals No. 3 and No. 4. See Fig. 9. Lift and support vehicle to allow drive wheels to spin freely. With transmission in "D" position, engine at 1000 RPM and wheel speed at 19 MPH (30 km/h). Measured

voltage should be .3-2.5 volts.

3) If voltage is as specified, go to next step. If voltage is not as specified, replace the output speed sensor. If DTC still exists, check speed sensor rotor. See MITSUBISHI R4AW3 & V4AW3 OVERHAUL article. If DTC exists after speed sensor rotor is replaced, check for noise interference and repair.

4) Check and repair wiring harness and connectors between output speed sensor and TCM. If wiring is okay, recheck DTCs. If DTCs still exists, replace TCM.

DTC 41 & 42: OPEN OR SHORT IN SOLENOID NO. 1 CIRCUIT

NOTE: A stuck solenoid will not set a DTC. DTCs are only set for circuit malfunctions, not mechanical failures.

1) Disconnect solenoid and sensor connector. Using ohmmeter, check resistance between solenoid connector terminal No. 6 and ground. See Fig. 9. Resistance should be 11-15 ohms at 77°F (25°C). If resistance is as specified, go to next step. If resistance is not as specified, replace solenoid No. 1 and recheck DTC.

2) Check wiring harness and connectors between solenoid No. 1 and TCM. If wiring and solenoid No. 1 is okay, replace TCM.

DTC 43 & 44: OPEN OR SHORT IN SOLENOID NO. 2 CIRCUIT

NOTE: A stuck solenoid will not set a DTC. DTCs are only set for circuit malfunctions, not mechanical failures.

1) Disconnect solenoid and sensor connector. Using ohmmeter, check resistance between solenoid connector terminal No. 7 and ground. See Fig. 9. Resistance should be 11-15 ohms at 77°F (25°C). If resistance is as specified, go to next step. If resistance is not as specified, replace solenoid No. 2 and recheck DTC.

2) Check wiring harness and connectors between solenoid No. 2 and TCM. If wiring and solenoid No. 2 is okay, replace TCM.

DTC 47 & 48: OPEN OR SHORT IN LOCK-UP SOLENOID CIRCUIT

NOTE: A stuck solenoid will not set a DTC. DTCs are only set for circuit malfunctions, not mechanical failures.

1) Disconnect solenoid and sensor connector. Using ohmmeter, check resistance between solenoid connector terminal No. 8 and ground. See Fig. 9. Resistance should be 11-15 ohms at 77°F (25°C). If resistance is as specified, go to next step. If resistance is not as specified, replace lock-up solenoid and recheck DTC.

2) Check wiring harness and connectors between lock-up solenoid and TCM. If wiring and lock-up solenoid is okay, replace TCM.

DTC 49: TORQUE CONVERTER CLUTCH (TCC) ENGAGEMENT MALFUNCTION

1) Using scan tool, verify vehicle tachometer and scan tool vehicle RPM values are identical. If tachometer values are identical, go to next step. If tachometer values are different, test ignition signal circuit. See DTC 21 & 22: SHORT OR OPEN IN IGNITION SIGNAL CIRCUIT.

2) Lift and support vehicle to allow drive wheels to spin freely. With transmission in "D" position, run engine to 1300-1900 RPM. Verify scan tool and speedometer read 31 MPH (50 km/h). If values are identical, go to next step. If values are different, test input speed sensor. See DTC 31: INPUT SPEED SENSOR.

3) Check lock-up solenoid for proper operation. See SOLENOIDS

under COMPONENT TESTING. If lock-up solenoid is okay, go to next step. If lock-up solenoid is bad, replace and retest system.

4) Check wiring harness and connectors between lock-up solenoid and TCM. If wiring harness and connectors are okay, check TCC engagement hydraulic pressure, valve body malfunction or TCC slipping.

DTC 50: TCC DISENGAGEMENT MALFUNCTION

1) Using scan tool, verify vehicle tachometer and scan tool vehicle RPM values are identical. If tachometer values are identical, go to next step. If tachometer values are different, test ignition signal circuit. See DTC 21 & 22: SHORT OR OPEN IN IGNITION SIGNAL CIRCUIT.

2) Lift and support vehicle to allow drive wheels to spin freely. With transmission in "D" position, run engine to 1300-1900 RPM. Verify scan tool and speedometer read 31 MPH (50 km/h). If values are identical, go to next step. If values are different, test input speed sensor. See DTC 31: INPUT SPEED SENSOR.

3) Check lock-up solenoid for proper operation. See SOLENOIDS under COMPONENT TESTING. If lock-up solenoid is okay, go to next step. If lock-up solenoid is bad, replace and retest system.

4) Check wiring harness and connectors between lock-up solenoid and TCM. If wiring harness and connectors are okay, check valve body malfunction or TCC sticking.

DTC 51: 1ST GEAR RATIO SIGNAL INCORRECT

1) If DTC 31 is set, go to DTC 31: INPUT SPEED SENSOR. If DTC 31 is not set and DTC 32 is set, go to DTC 32: OUTPUT SPEED SENSOR. If neither DTC 31 nor DTC 32 is set, go to next step.

2) Test input speed sensor. See INPUT SPEED SENSOR under COMPONENT TESTING. If resistance is as specified, go to next step. If resistance is not as specified, replace input speed sensor and recheck DTC. If DTC still exists, go to step 5).

3) Test output speed sensor. See OUTPUT SPEED SENSOR under COMPONENT TESTING. If resistance is as specified, go to next step. If resistance is not as specified, replace output speed sensor and recheck DTC. If DTC still exists, go to step 5).

4) If referenced here from another DTC, go back to referenced DTC. Check No. 2 one-way clutch system. See NO. 2 ONE-WAY CLUTCH in MITSUBISHI R4AW3 & V4AW3 OVERHAUL article.

5) Check output speed sensor and No. 2 speed sensor shielding wire. Repair as necessary. If shielding wire is okay, recheck DTC. If DTC still exists, replace sensor rotor. If DTC still exists after sensor rotor is replaced, check for interference noise and repair.

DTC 52: 2ND GEAR RATIO SIGNAL INCORRECT

If DTC 51 is set also, go to DTC 51: 1ST GEAR RATIO SIGNAL INCORRECT test. If DTC 51 is not set, check 2nd brake and No. 1 one-way clutch systems for a mechanical failure. See 2ND BRAKE and NO. 1 ONE-WAY CLUTCH in MITSUBISHI R4AW3 & V4AW3 OVERHAUL article.

DTC 53: 3RD GEAR RATIO SIGNAL INCORRECT

If DTC 51 is set also, go to DTC 51: 1ST GEAR RATIO SIGNAL INCORRECT test. If DTC 51 is not set, check direct clutch system for a mechanical failure. See DIRECT CLUTCH in MITSUBISHI R4AW3 & V4AW3 OVERHAUL article.

DTC 54: 4TH GEAR RATIO SIGNAL INCORRECT

If DTC 51 is set also, go to DTC 51: 1ST GEAR RATIO SIGNAL INCORRECT test. If DTC 51 is not set, check overdrive brake for a mechanical failure. See OVERDRIVE BRAKE in MITSUBISHI R4AW3 & V4AW3 OVERHAUL article.

SYMPTOM TROUBLE SHOOTING

NOTE: Check system using appropriate scan tool. See WIRING DIAGRAMS for electrical schematics and COMPONENT TESTING.

COMMUNICATION WITH SCAN TOOL NOT POSSIBLE

If scan tool cannot communicate with TCM, check proper connection with DLC. Check TCM power circuits, TCM ground circuits and malfunctioning TCM.

SHIFT POINTS INCORRECT

If shift points are incorrect, check for DTCs. If no DTC is present, check oil temperature sensor, pattern select switch, 4WD low range detection switch and TCM for proper operation.

UPSHIFTS OCCUR SPONTANEOUSLY

If upshifting occurs spontaneously, check park/neutral position switch, overdrive switch and TCM for proper operation.

TCC LOCK-UP MALFUNCTIONING

If TCC lock-up system is not operating properly, check torque converter, valve body, lock-up switch and oil temperature switch.

COMPONENT TESTING

A/T FLUID TEMPERATURE SWITCH

1) Remove fluid temperature switch, located to rear of neutral safety switch. Immerse switch in container of ATF up to top threaded portion of switch. Using a DVOM, check continuity between switch terminals. Continuity should not exist when fluid temperature is 257°F (125°C) or less.

2) When fluid is heated to 289-304°F (143-151°C), continuity should exist. Replace switch if necessary. Apply thread sealant to fluid temperature switch threads and install in transmission.

BRAKELIGHT SWITCH

1) Disconnect electrical connector from brakelight switch, located near brake pedal. Using ohmmeter, ensure continuity exists between terminal No. 2 (White/Red wire) and terminal No. 3 (Green wire) with brake pedal released. Replace brakelight switch if continuity does not exist. Continuity should not exist between terminals No. 2 and No. 3 with brake pedal depressed.

2) If continuity does not exist, ensure brake pedal is properly adjusted so brakelight switch has proper travel for switch operation. If proper brakelight switch travel exists, replace brakelight switch.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Disconnect electrical connector from coolant temperature sensor. Using ohmmeter, check resistance between terminals of coolant temperature sensor. Resistance should be as specified in accordance with the TEMPERATURE-TO-RESISTANCE VALUES table. Replace coolant temperature if resistance is not within specification.

TEMPERATURE-TO-RESISTANCE VALUES

Temperature °F (°C)	Ohms
32 (0)	5.8
68 (20)	2.4
104 (40)	1.1
176 (80)	0.3

INPUT SPEED SENSOR

Disconnect solenoid and sensor connector. Using ohmmeter, measure resistance between terminals No. 9 and No. 10. See Fig. 9. Resistance should be 560-680 ohms at 68°F (20°C). If resistance is not as specified, replace No. 2 speed sensor.

OIL TEMPERATURE SENSOR

Disconnect solenoid and sensor connector. Using ohmmeter, check resistance between sensor connector terminals No. 1 and No. 2. See Fig. 9. Resistance should be 10 k/ohms when oil temperature is 77°F (25°C). With oil temperature at 248°F (120°C), resistance should be 615 ohms. If resistance is not as specified, replace oil temperature sensor.

OUTPUT SPEED SENSOR

Disconnect solenoid and sensor connector. Using ohmmeter, measure resistance between terminals No. 3 and No. 4. See Fig. 9. Resistance should be 560-680 ohms at 68°F (20°C). If resistance is not as specified, replace output speed sensor.

OVERDRIVE SWITCH

Using a screwdriver, remove overdrive switch from selector lever, located below selector lever button. Using a DVOM, check continuity between overdrive switch terminals No. 3 and 5 with switch in ON position. Continuity should exist. With switch in OFF position, check continuity between terminals No. 3 and 4. Continuity should exist. If continuity is not as specified, replace switch. See Fig. 10.

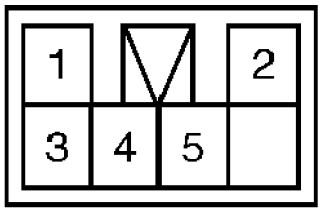

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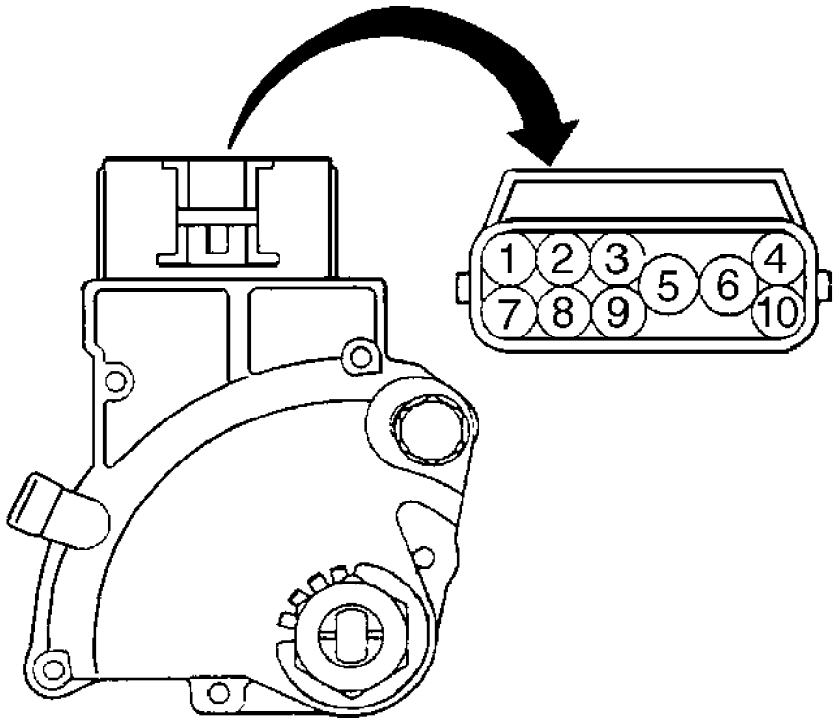
Fig. 10: Identifying Overdrive Switch Terminals
Courtesy of Mitsubishi Motor Sales of America.

PARK/NEUTRAL POSITION (PNP) SWITCH

Disconnect PNP switch harness connector. Using ohmmeter, check continuity between specified terminals. See Fig. 11. Replace as needed.



Item	Terminal No.								
	1	2	3	5	6	7	8	9	10
P	○			○	○				○
R	○							○	
N	○			○	○	○			
D	○						○		
2	○		○						
L	○	○							

99C04805

Fig. 11: Testing Park/Neutral Position (PNP) Switch
Courtesy of Mitsubishi Motor Sales of America.

PATTERN SELECT SWITCH

Using a screwdriver, remove pattern select switch from console. Switch is located at rear of selector lever, to right of emergency brake handle. Using a DVOM, check continuity between pattern select switch terminals No. 1 and 2, with switch in HOLD position. Continuity should exist. With switch in POWER position, check continuity between terminals No. 1 and 6. Continuity should exist. If continuity is not as specified, replace switch. See Fig. 12.

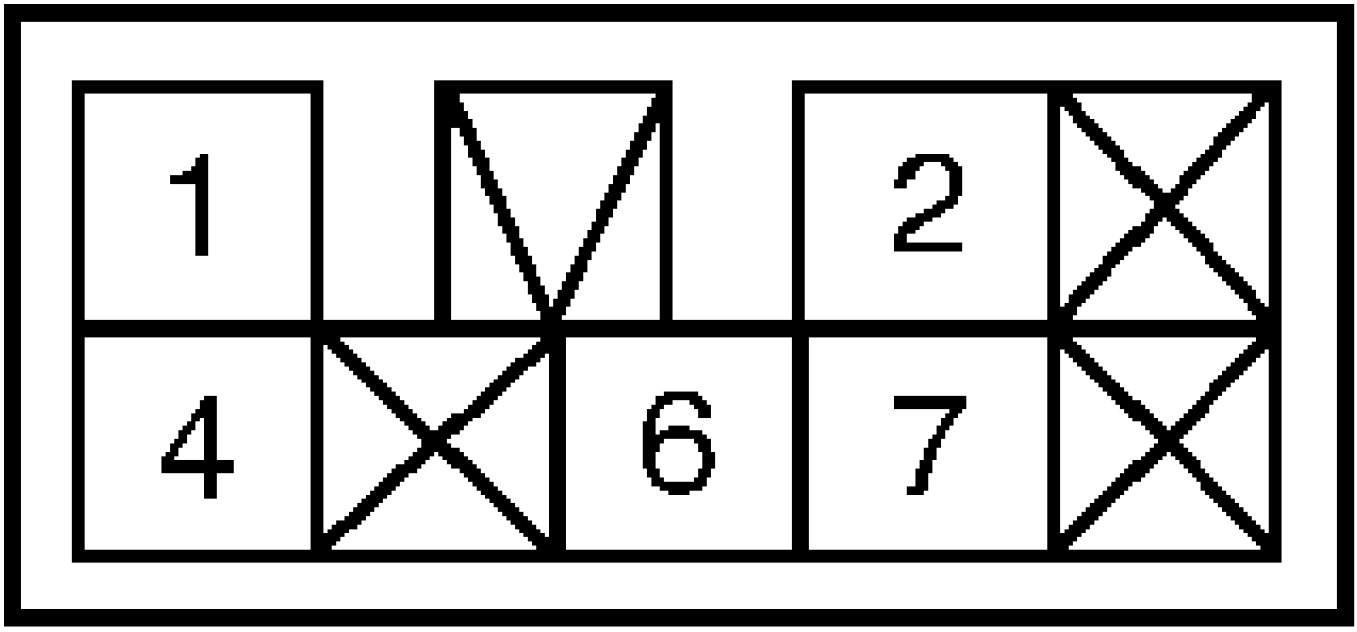


Fig. 12: Identifying Pattern Select Switch Terminals
Courtesy of Mitsubishi Motor Sales of America.

SOLENOIDS

For solenoid testing, refer to the appropriate DTC under DIAGNOSTIC TESTS. To check solenoid operation, apply battery voltage to appropriate terminal of TCM connector and ground. Ensure operating sound can be heard when battery voltage is connected. Replace solenoid if operating sound cannot be heard.

THROTTLE POSITION (TP) SENSOR

For diagnostic and testing information, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE section.

4WD LOW RANGE DETECTION SWITCH

For location and testing information on 4WD low range detection switch, see appropriate article in AXLE SHAFTS & TRANSFER CASES.

TCM PIN VOLTAGE CHARTS

Access TCM. See Fig. 1 or 2. Turn ignition on. Using DVOM,

backprobe TCM connector. See Fig. 13. Check voltage between designated terminals on TCM connector and ground. See TCM TERMINAL VOLTAGE SPECIFICATIONS table. Voltage should be as specified.

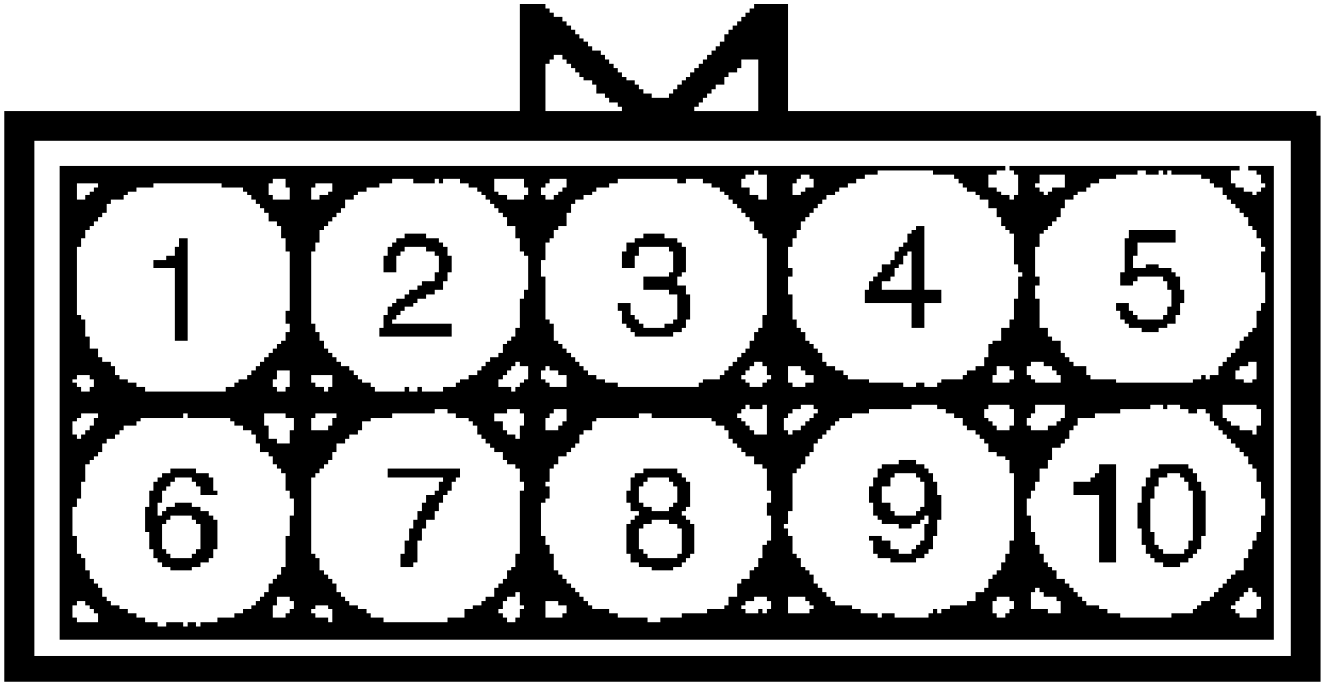


Fig. 13: Identifying TCM Terminals
Courtesy of Mitsubishi Motor Sales of America.

TCM TERMINAL VOLTAGE SPECIFICATIONS

Terminal No.	Circuit	Condition	Voltage
1	Lock-Up Solenoid	Lock-Up Clutch Engaged	Battery
1	Lock-Up Solenoid	Lock-Up Clutch Disengaged	0 Volts
2	Back-Up Power Supply	At All Times	Battery
5	Brakelight Switch	Brake Pedal Depressed	0 Volts
5	Brakelight Switch	Brake Pedal Released	Battery
8	TP Sensor	Throttle Closed (Idle)	.3-1.0
8	TP Sensor	Throttle Wide Open	4.4-5.0
11	Neutral Safety Switch	In "P" Position	Battery
11	Neutral Safety Switch	Except In "P"	0 Volts
12	Ground	Engine Idling	0 Volts

14	No. 1 Shift Solenoid	In 1st Or 2nd	Battery
14	No. 1 Shift Solenoid	In 3rd Or 4th Gear	0 Volts
15	Power Supply	Ignition ON	Battery
15	Power Supply	Ignition OFF	0 Volts
16	No. 2 Shift Solenoid	In 2nd Or 3rd Gear	Battery
16	No. 2 Shift Solenoid	In 1st Or 4th Gear	0 Volts
17	Diagnostic Test Mode	Not Specified	Not Specified
18	Diagnostic Output	Scan Tool Not Connected	Battery
21	Oil Temp Warning Lamp	Normal Temp. Range	0 Volts
21	Oil Temp Warning Lamp	For 5 Seconds After Ign. Is On	Battery
22	Oil Temp Sensor	Temp @ 248°F (120°C)	About 1.9
22	Oil Temp Sensor	Temp @ 302°F (150°C)	About 1.1
23	4WD Low Range Switch	4WD Lever In 4H-Lock	Battery
23	4WD Low Range Switch	4WD Lever In 4L-Lock	0 Volts
24	Neutral Safety Switch	In "R" Position	Battery
24	Neutral Safety Switch	Except In "R"	0 Volts
25	Ground	Engine Idling	0 Volts
26	Ground	Engine Idling	0 Volts
31	Neutral Safety Switch	In "L" Position	Battery
31	Neutral Safety Switch	Except In "L"	0 Volts
32	Neutral Safety Switch	In "N" Position	Battery
32	Neutral Safety Switch	Except In "N"	0 Volts
34	Power Mode	Power Mode Selected	Battery
34 Montero	4WD Detection Switch	2WD	4 Volts Or Greater
34 Montero	4WD Detection Switch	4WD	0-1 Volts
34 Montero Sport	Free Wheel Engage Switch	2WD	4 Volts Or Greater
34 Montero Sport	Free Wheel Engage Switch	4WD	0 Volts

35	Output Speed Sensor Gnd	Ignition Off	0 Volts
35	Output Speed Sensor Gnd	Ignition On	2.5 Volts
36	Input Speed Sensor Gnd	Ignition Off	0 Volts
36	Input Speed Sensor Gnd	Ignition On	2.5 Volts
37	Overdrive OFF Signal	(1) Steady Driving @ 31 MPH (50 km/h)	Battery
37	Overdrive OFF Signal	(1) Climbing Hill @ 31 MPH (50 km/h)	0 - 1
38	Engine Ign. Signal	Engine @ 3000 RPM	.3 - 3.0
39	Neutral Safety Switch	In "D" Position	Battery
39	Neutral Safety Switch	Except In "D"	0 Volts
40	Neutral Safety Switch	In "2" Position	Battery
40	Neutral Safety Switch	Except In "2"	0 Volts
41	HOLD Mode	HOLD Mode Selected	Battery
41	HOLD Mode	HOLD Mode Not Selected	0 Volts
42	Overdrive Switch	Overdrive ON	0 Volts
42	Overdrive Switch	Overdrive OFF	Battery
43	Output Speed Sensor	Vehicle Stopped	About 2.5
43	Output Speed Sensor	Vehicle Moving	Other Than 2.5
44	Input Speed Sensor	Vehicle Stopped	About 2.5
44	Input Speed Sensor	Vehicle Moving	Other Than 2.5
45	Coolant Temp Sensor	Temp @ 86°F (30°C)	2.5
45	Coolant Temp Sensor	Temp @ 158°F (70°C)	0 Volts
46	MIL Signal	Ignition ON	.5 4.5 Volts
(1) - Test circuit with shift lever in "D" position, mode selector normal and cruise control on.			

REMOVAL & INSTALLATION

BRAKELIGHT SWITCH

Removal & Installation

1) Disconnect electrical connector. Remove lock nut, and unscrew brakelight switch. To install, screw brakelight switch inward

until brakelight plunger contacts brake pedal.

2) Loosen brakelight switch 1/2 to one turn. Install and tighten lock nut on brakelight switch. Install electrical connector. Ensure brakelights and cruise control operate properly.

INPUT SPEED SENSOR

Removal & Installation

Disconnect electrical connector. Remove bolt securing sensor to transmission. Remove input speed sensor from transmission. See Fig. 14. To install, reverse removal procedure.

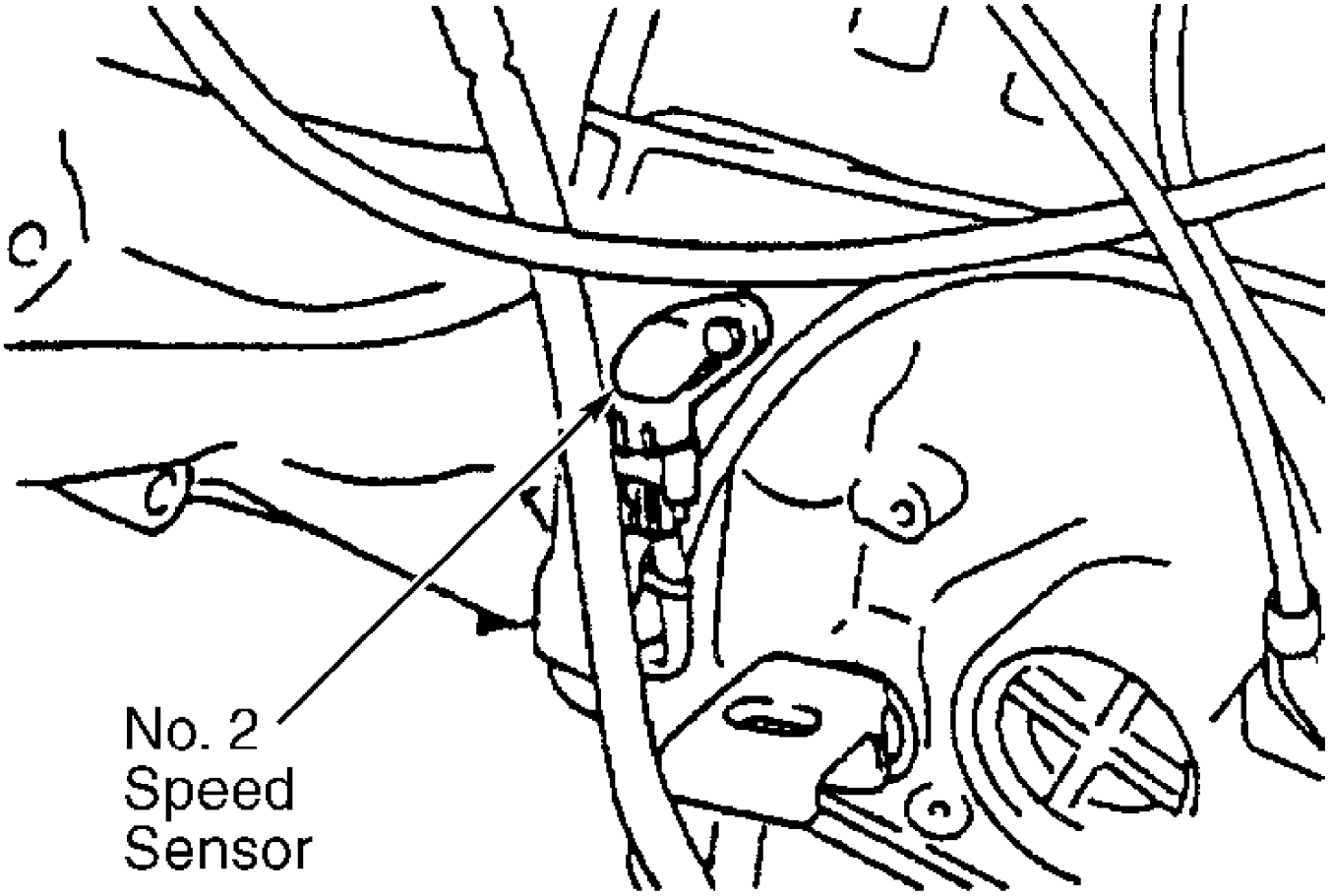


Fig. 14: Locating Input Speed Sensor
Courtesy of Mitsubishi Motor Sales of America.

OIL TEMPERATURE SENSOR

Removal & Installation

Sensor is located on transmission connected to cooler line, near PNP switch. Disconnect electrical connector. Remove oil temperature sensor from transmission. To install, reverse removal procedure using NEW gasket.

OUTPUT SPEED SENSOR

Removal & Installation

Disconnect electrical connector from output speed sensor. See Fig. 15. Remove bolt and output speed sensor. To install, reverse removal procedure.

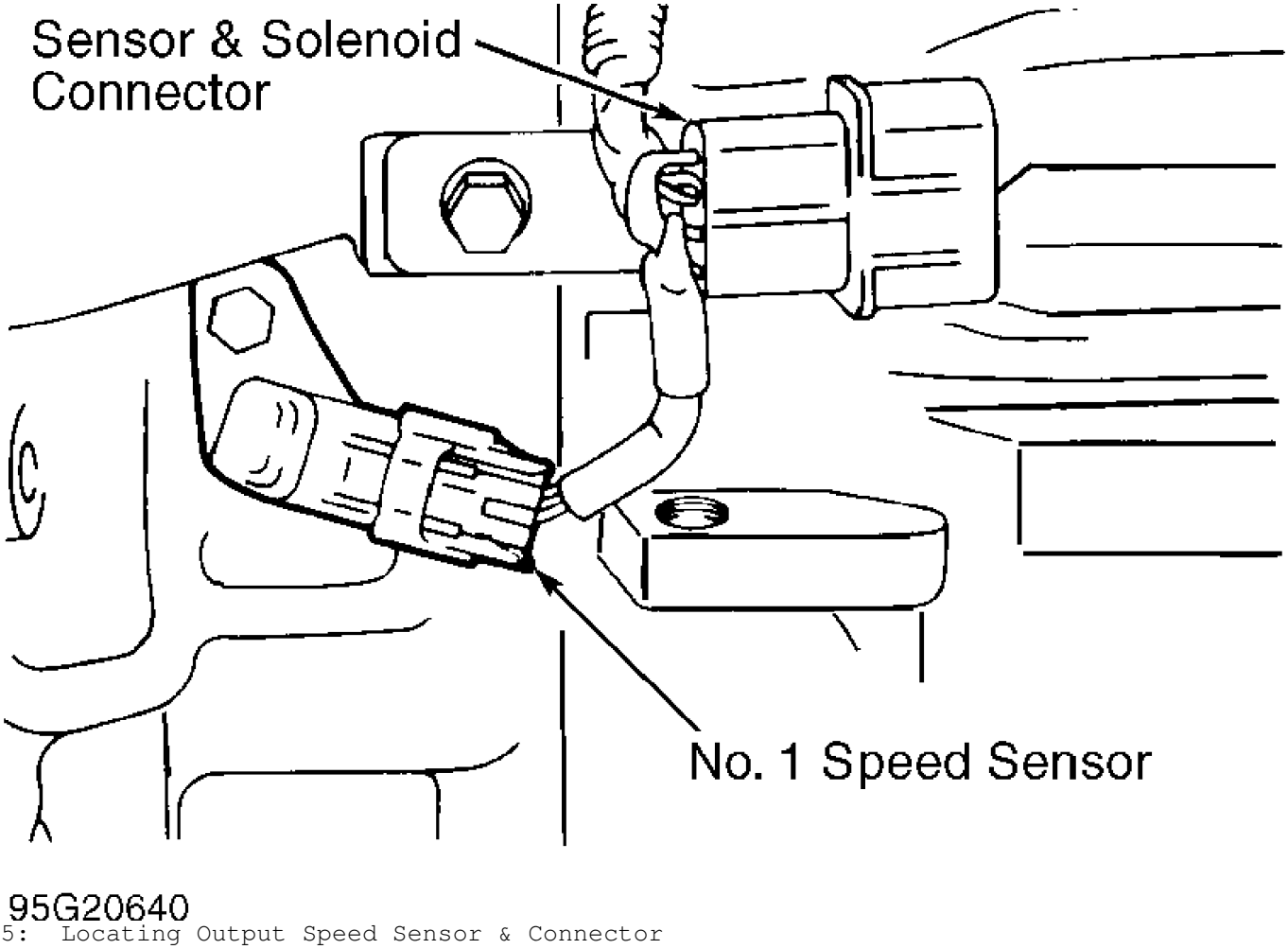


Fig. 15: Locating Output Speed Sensor & Connector
Courtesy of Mitsubishi Motor Sales of America.

PARK/NEUTRAL POSITION (PNP) SWITCH

Removal

Switch is located on side of transmission. Remove manual lever from control shaft on transmission. Bend up tabs on lock washer. Remove lock nut, lock washer and seal from control shaft. Remove retaining bolt and neutral safety switch.

Installation

1) Install switch on control shaft. Loosely install switch retaining bolt. Install seal and lock washer. Install lock nut and tighten to specification. See TORQUE SPECIFICATIONS.

2) Switch must be adjusted. Ensure parking brake is applied. Temporarily install manual lever on control shaft. Place shift lever in Neutral. Remove manual lever. Rotate switch and align reference mark on switch with groove.

3) Hold switch in this position. Tighten retaining bolt to specification. Bend tabs on lock washer over against lock nut. To install remaining components, reverse removal procedure.

SOLENOIDS

Removal & Installation

Solenoids are located on transmission valve body. See Fig. 3. Remove bolt, solenoid and gasket from valve body. To install, reverse removal procedure.

THROTTLE POSITION SENSOR

NOTE: For removal and installation information, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE section.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	INCH Lbs. (N.m)
Park/Neutral Switch Bolt	48 (5.4)
Park/Neutral Switch Lock Nut	35 (4.0)

WIRING DIAGRAMS

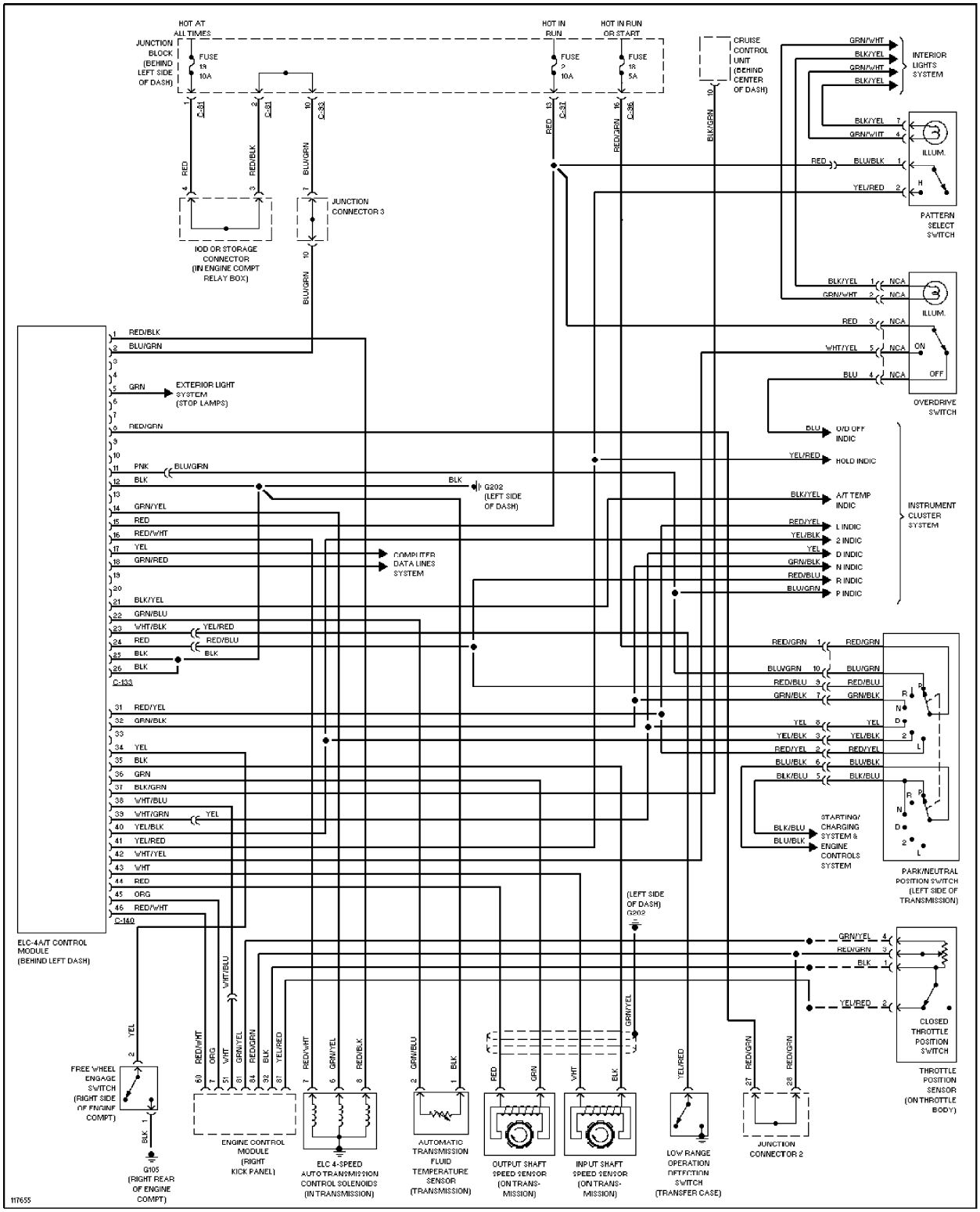


Fig. 16: Transmission Wiring Diagram (1997 Montero)

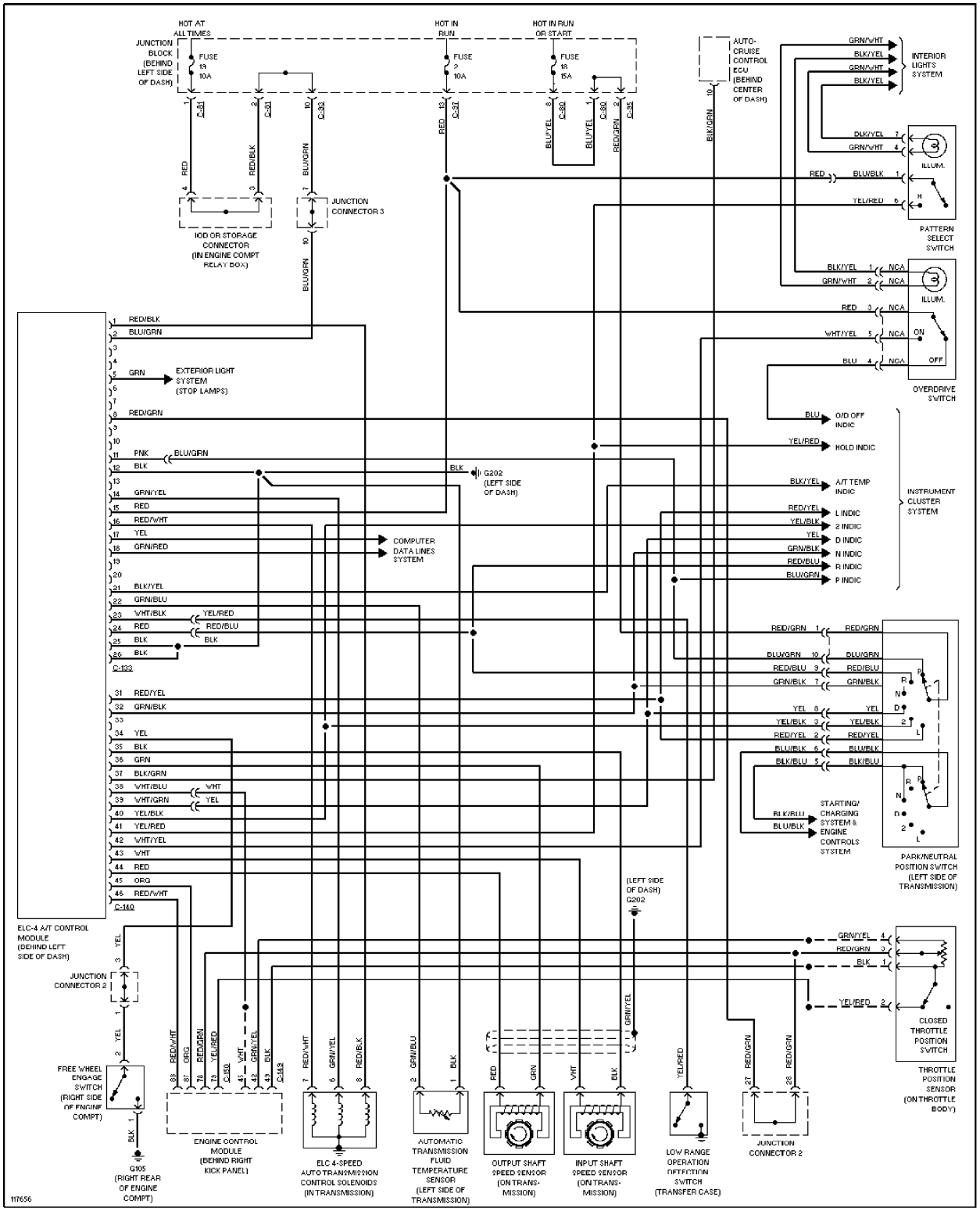


Fig. 17: Transmission Wiring Diagram (1998 Montero)

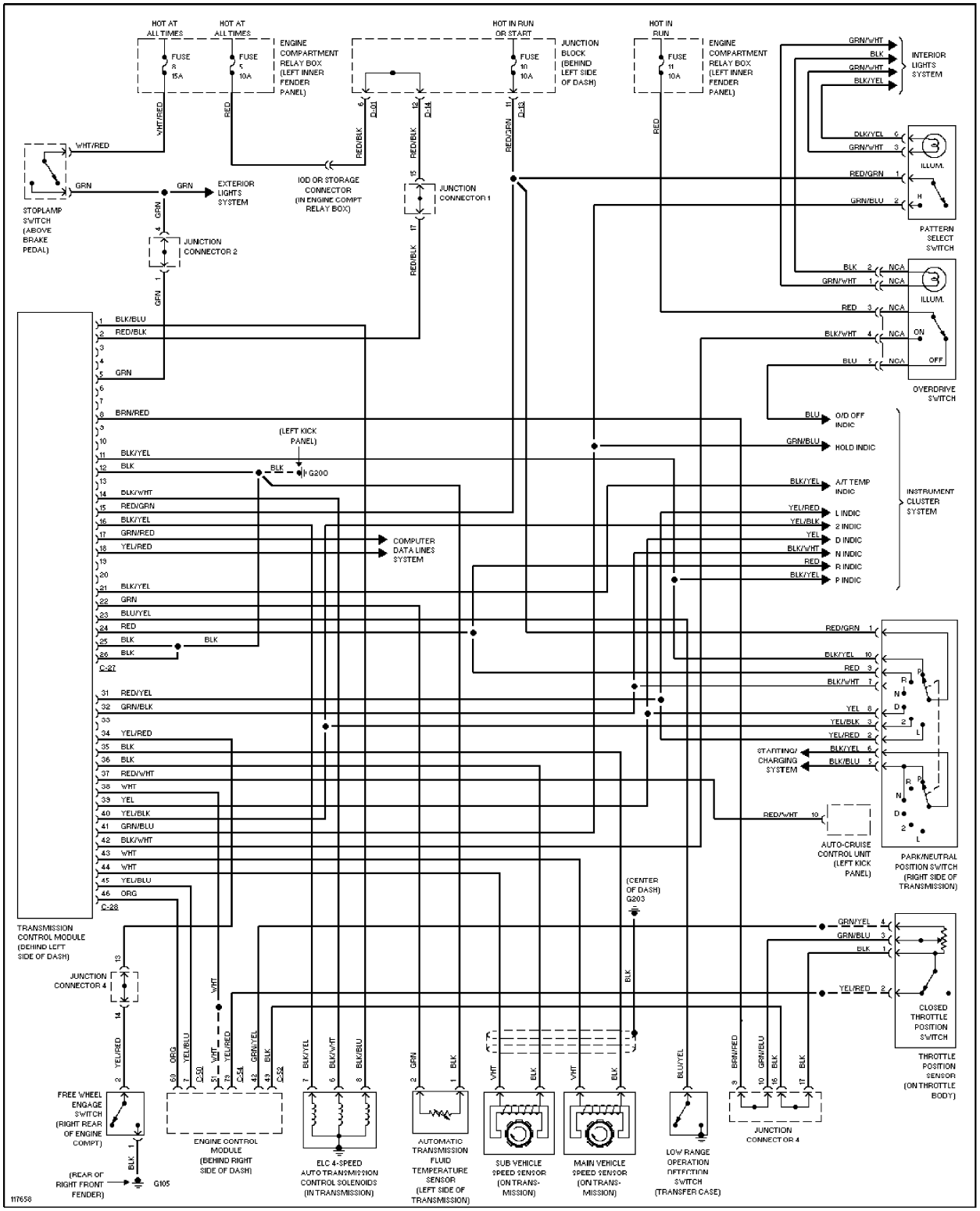


Fig. 18: Transmission Wiring Diagram (1997-98 Montero Sport)