INDEX

AUTOMATIC TRANSMISSION SERVICE GROUP
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INTRODUCTION

IMPORT COMPUTER CONTROL
"VOLUME II"

The continuing purpose of the Import Computer Controls Manual - Volume II, is to guide the technician to an understanding of the communication between the computer and the transmission or transaxle. Testing and diagnosing ***requires*** some working knowledge of this communication. In this manual, we attempt to simply identify and explain the inputs and outputs of the import computers. Attention is given to testing transmission solenoids, sensors and switches. Many import transmission controls can be checked using scanners and transmission testers. This manual identifies which transmissions can be diagnosed with the help of such devices. Included is a list of transmission trouble codes for most units.

The information and part numbers contained in this booklet have been carefully compiled from industry sources known for their reliability, but ATSG does not guarantee its accuracy.

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HONDA ACCORD 1990-1992
PRELUDE 1992

The electronic control system consists of the A/T Control Unit, input sensors, and 4 solenoid valves. The shifting and lock-up are electronically controlled according to engine and vehicle conditions for maximum efficiency. The A/T Control unit is located below the dash board on the Accord models and behind the right kick panel on the 1992 Prelude. The transmission control system for the 1990-1992 Accord and 1992 Prelude has built in diagnostics that will store trouble codes if certain malfunctions occur. Input from various sensors located throughout the car determines which shift control solenoid valve the A/T control unit will operate. The activation of the shift solenoids and the converter clutch solenoids causes valves in the valve body to operate and shift the transaxle through the gears and provide converter clutch.

When a problem occurs, it is important to first determine if there is a hydraulic/mechanical problem, or an electrical problem. This transaxle will start in 4th gear if there is no current supplied to the shift solenoids. 2nd gear will be available if the shifter is moved to the 1st gear position. If the problem is electrical, sensors, solenoids, and sometimes wiring will need to be checked. A basic overview of the location of the electrical components are shown in Figure 1. This will help when it is necessary to check a specific sensor or switch.

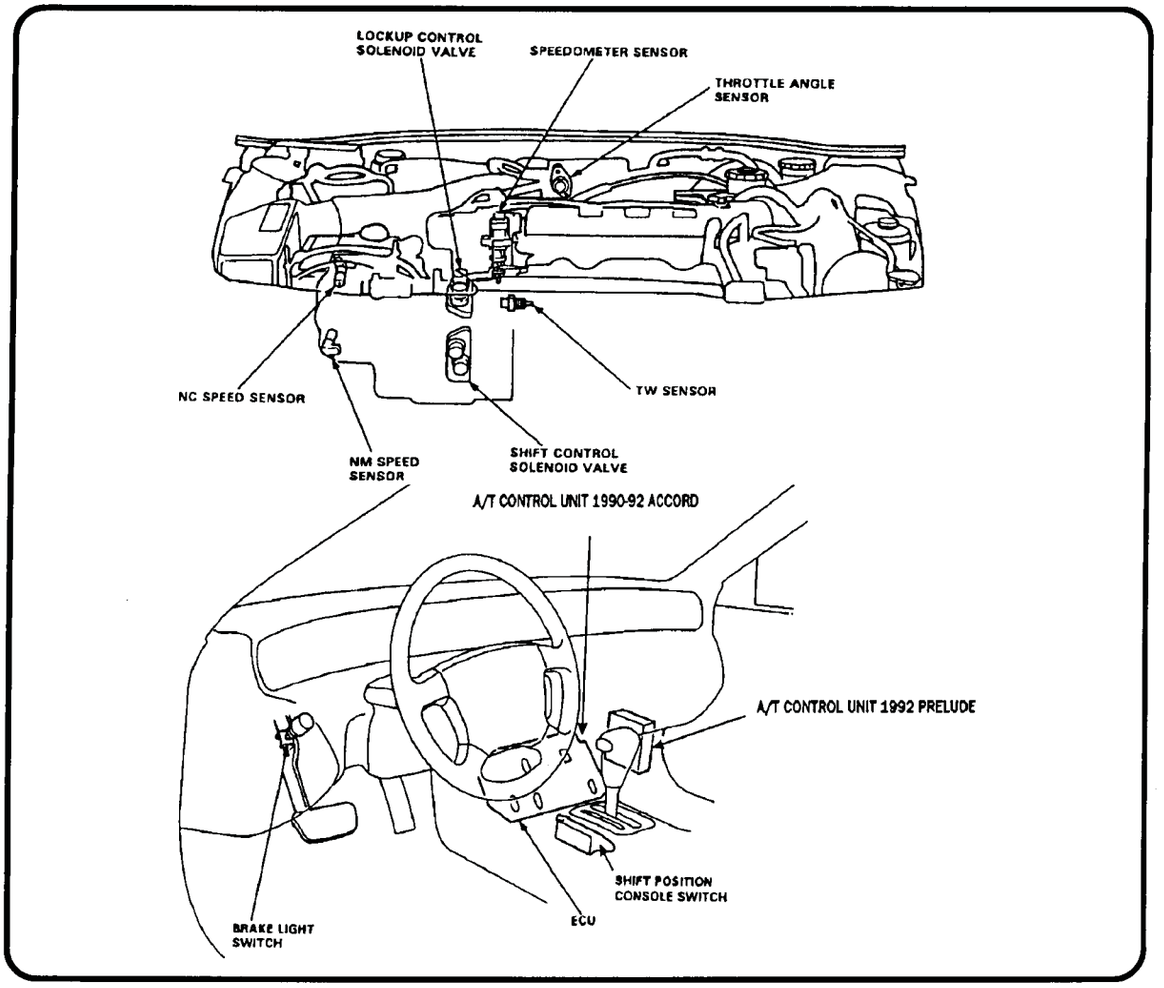
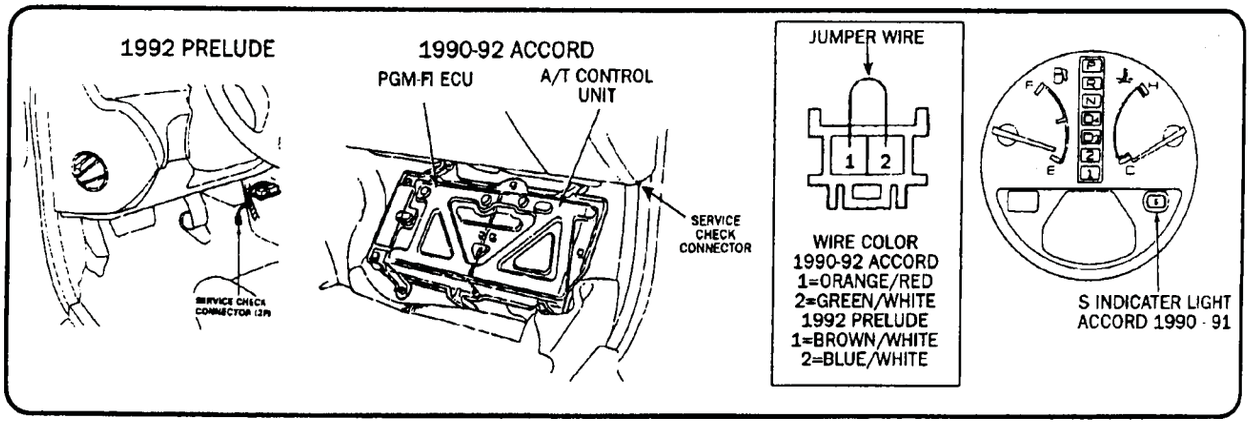


Figure 1.

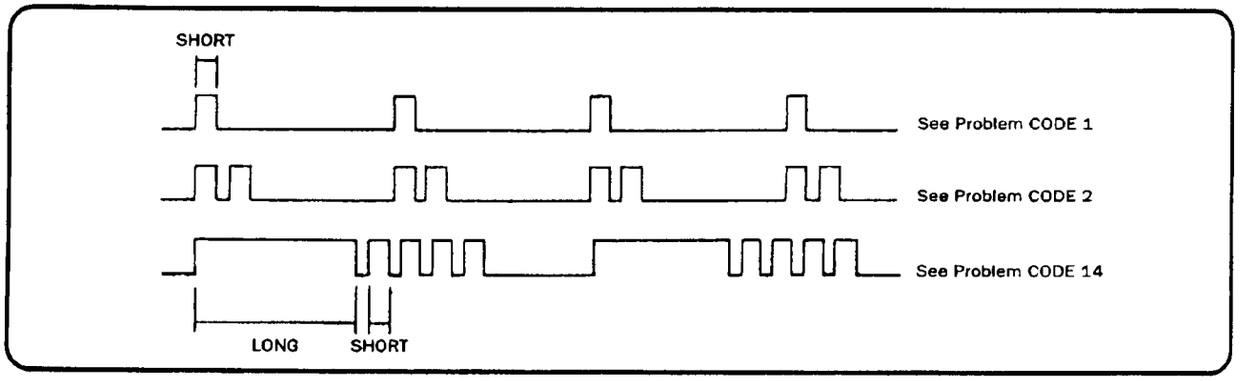
TROUBLE CODES

When the A/T control unit senses an abnormality in the input or output system, the S indicator light 1990-91, or D4 indicator light 1992, in the guage assembly will blink. However, when the Service Check Connector (located to the lower right of the glove compartment)is connected with a jumper wire, The S indicator light or D4 indicator light will blink the problem code when the ignition switch is turned on.

When the S or D4 light has been reported on, connect the two terminals of the service check connector together. Then turn on the ignition switch and observe the S indicator light, or the D4 indicator light.



Problem codes 1 through 9 are indicated by individual short blinks, problem codes 10 through 15 are indicated by a series of long and short blinks. One long blink equals 10 short blinks. Add the long and short blinks to determine the problem code. After determining the problem code, refer to the electrical system Symptom-to-component chart.



ACCORD

Some PGM-FI problems will also make the S or D4 indicator light come on. After repairing the PGM-FI system, disconnect the Back Up fuse (7.5 A) in the under hood relay box for more than 10 seconds to reset the A/T control unit memory

NOTE: Disconnecting the back up fuse also cancels the radio preset stations and the clock setting.

PRELUDE

Some PGM-FI problems will also make the D4 indicator light come on. After repairing the PGM-FI system, disconnect the clock radio fuse (10 A) in the under hood fuse/relay box for more than 10 seconds to reset the A/T control unit memory.

NOTE: Disconnecting the clock radio fuse also cancels the radio anti-theft code, preset stations and the clock settings. Get the customers anti-theft code to reset the radio.

TROUBLE CODES

Number of S/D4 indicator light blinks while Service Check Connector is jumped.	S or D4 Indicator light	Possible Cause	Symptom
1	Blinks	• Disconnected lock-up control solenoid valve A connector • Short or open in lock-up control solenoid valve A wire • Faulty lock-up control solenoid valve A	• Lock-up clutch does not engage. • Lock-up clutch does not disengage. • Unstable idle speed.
2	Blinks	• Disconnected lock-up control solenoid valve B connector • Short or open in lock-up control solenoid valve B wire • Faulty lock-up control solenoid valve B	• Lock-up clutch does not engage.
3	Blinks or OFF	• Disconnected throttle angle sensor connector • Short or open in throttle angle sensor wire • Faulty throttle angle sensor	• Lock-up clutch does not engage.
4	Blinks	• Disconnected sensor connector • Short or open in speed sensor wire • Faulty speed sensor	• Lock-up clutch does not engage.
5	Blinks	• Short in shift position console switch wire • Faulty shift position console switch	• Fails to shift other than 2nd ⟷ 4th gears. • Lock-up clutch does not engage.
6	OFF	• Disconnected shift position console switch connector • Open in shift position console switch wire • Faulty shift position console switch	• Fails to shift other than 2nd ⟷ 4th gears. • Lock-up clutch does not engage. • Lock-up clutch engages and disengages alternately.
7	Blinks	• Disconnected shift control solenoid valve A connector • Short or open in shift control solenoid valve A wire • Faulty shift control solenoid valve A	• Fails to shift (between 1st ⟷ 4th, 2nd ⟷ 4th or 2nd ⟷ 3rd gears only). • Fails to shift (stuck in 4th gear)
8	Blinks	• Disconnected shift control solenoid valve B connector • Short or open in shift control solenoid valve B wire • Faulty shift control solenoid valve B	• Fails to shift (stuck in 1st or 4th gears).

TROUBLE CODES

Number of S/D4 indicator light blinks while Service Check Connector is jumped.	S/D4 indicator light	Possible Cause	Symptom
9	Blinks	• Disconnected NC speed sensor connector • Short or open in the NC speed sensor wire • Faulty NC speed sensor	• Lock-up clutch does not engage.
10	Blinks	• Disconnected water temperature sensor connector • Short or open in the water temperature sensor wire • Faulty water temperature sensor	• Lock-up clutch does not engage.
11	OFF	• Disconnected ignition coil connector • Short or open in ignition coil wire • Faulty ignition coil	• Lock-up clutch does not engage.
14	OFF	• Short or open in FAS wire • Trouble in PGM-FI unit	• Transmission jerks hard when shifting.
15	OFF	• Disconnected NM speed sensor connector • Short or open in NM speed sensor wire • Faulty NM speed sensor	• Transmission jerks hard when shifting.

If the self-diagnosis S/D4 indicator light does not blink, perform an inspection according to the table listed below.

Sympton	Probable Cause
S/D4 indicator light is on steady, not blinking whenever the ignition is on.	———
S/D4 indicator light does not come on for 2 seconds after ignition is first turned on.	———
No 2-1 shift after releasing the brake at a stop in the D position, or shift lever cannot be moved from the P position with the brake pedal depressed.	Check brake light signal.
Lock-up clutch does not have duty operation (ON-OFF).	Check A/C signal with A/C on.
Lock-up clutch does not engage.	

- If a customer describes the symptoms for codes 3, 6, or 11, yet the S/D4 indicator light is not blinking, it will be necessary to recreate the symptom by test driving, and then checking the S/D4 indicator light with the ignition still ON.
- If the S/D4 indicator light displays codes other than those listed above or stays lit continuously, the control unit is faulty.
- Sometimes the S/D4 indicator light and the Check Engine light may come on simultaneously. If so, check the PGM-FI system according to the number of blinks on the PGM-FI ECU self-diagnosing indicator, then reset the memory by removing the Back-Up fuse in the under hood fuse/relay box for more than 10 seconds. Drive the vehicle for several minutes at speed over 30 mph (50 km/h), then recheck the lights.

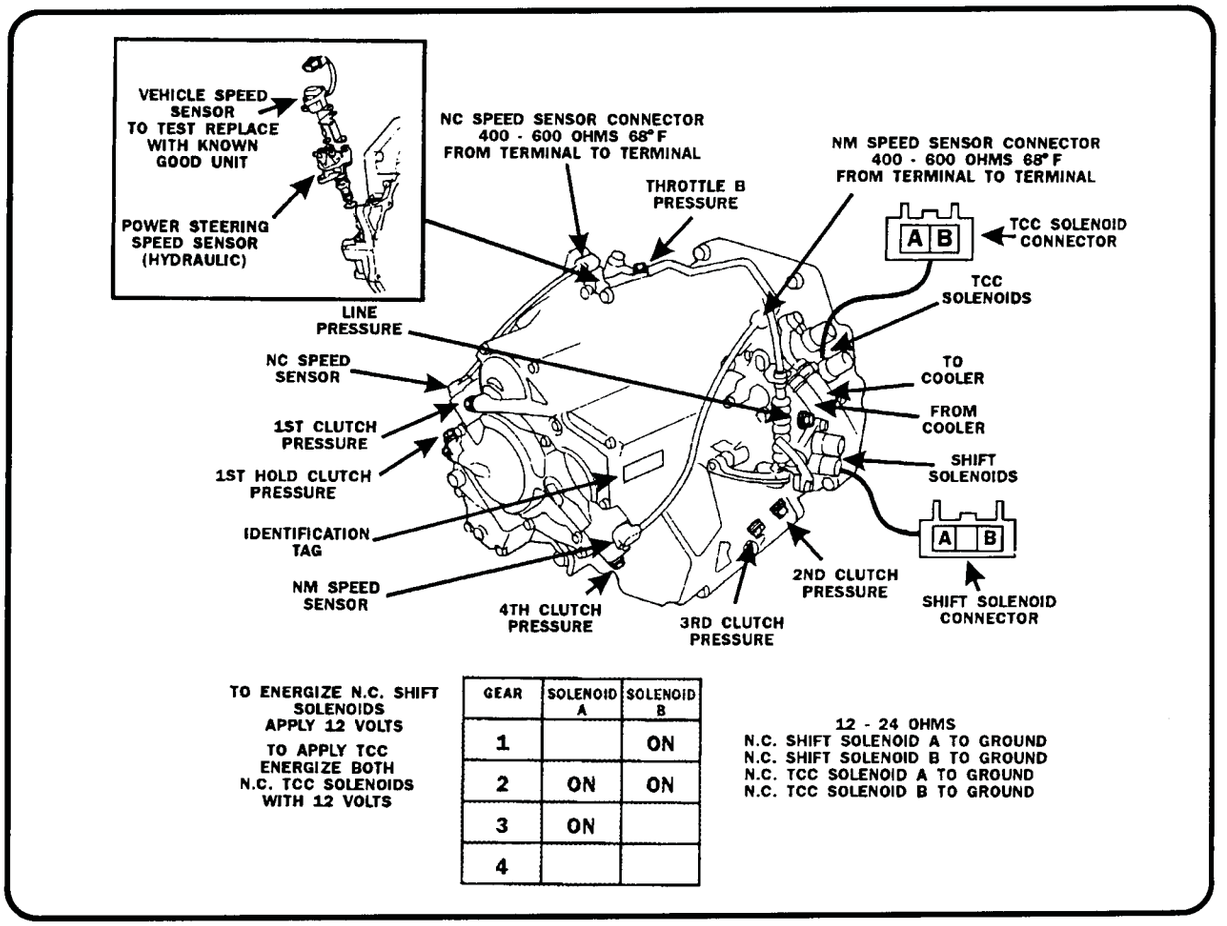
NOTE: Disconnecting the Back up fuse also cancels the radio preset stations and the clock setting. Make note of the radio presets before removing the fuse so you can reset them.

SOLENOIDS AND SENSORS

The **Shift Solenoids** are mounted to the outside of the transmission, near the bottom of the bell housing. Shift Solenoids A and B open when they are energized by the A/T control unit. The order in which they are energized determines the gear selected. The correct solenoid shift pattern is shown in Figure 6. The solenoids can be electrically checked with an ohmmeter. With the wire harness to the shift solenoids disconnected, there should be 12-24 ohms of resistance between each solenoid wire and ground.

The **TCC Solenoids** are mounted to the outside of the transmission, close to the top of the bell housing. See figure 6. They are normally closed and they open when they are energized. The A/T Control Unit first energizes TCC Solenoid A to partially apply the torque converter clutch, and then energizes TCC Solenoid B to complete the torque converter clutch application. For testing purposes, energize both solenoids at the same time. The solenoids can be electrically checked with an ohmmeter. With the wire harness to the TCC solenoids disconnected, there should be 12-24 ohms of resistance between each solenoid wire and ground.

The **Mainshaft and Countershaft Speed Sensors** are mounted on the transmission. See Figure 6. Ohms test values are shown below. The NM and NC Speed sensors are checked with the wire connectors disconnected



GEAR	SOLENOID A	SOLENOID B
1		ON
2	ON	ON
3	ON	
4		

Figure 2.

ELECTRICAL SCHEMATICS

The wiring schematics for the Accord are different than for the Prelude. The wiring for the 1990-1992 Accord models is shown in Figures 2 and 3. The wiring for the 1992 Prelude model is shown in Figures 4 and 5.

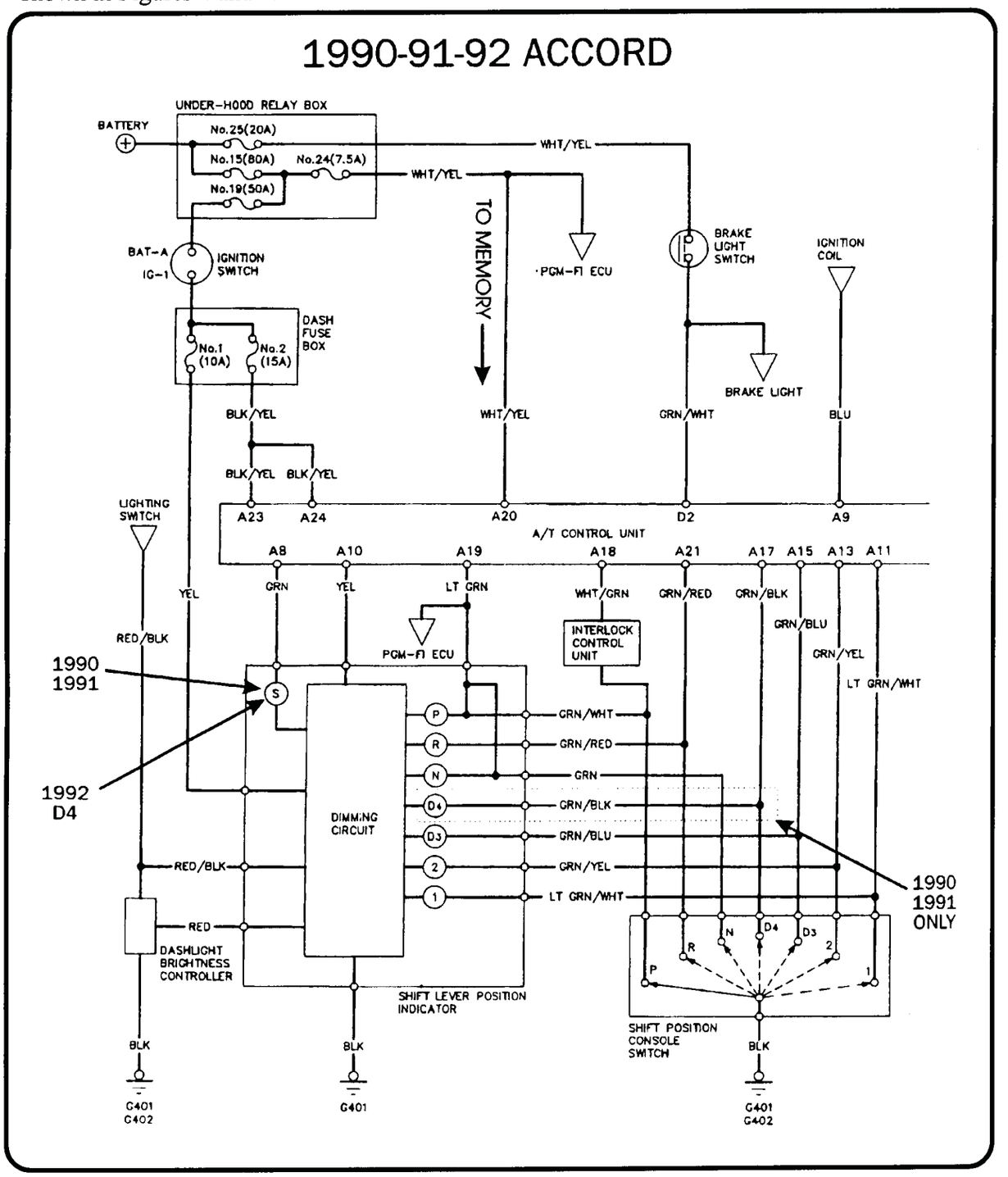


Figure 3.

ELECTRICAL SCHEMATICS

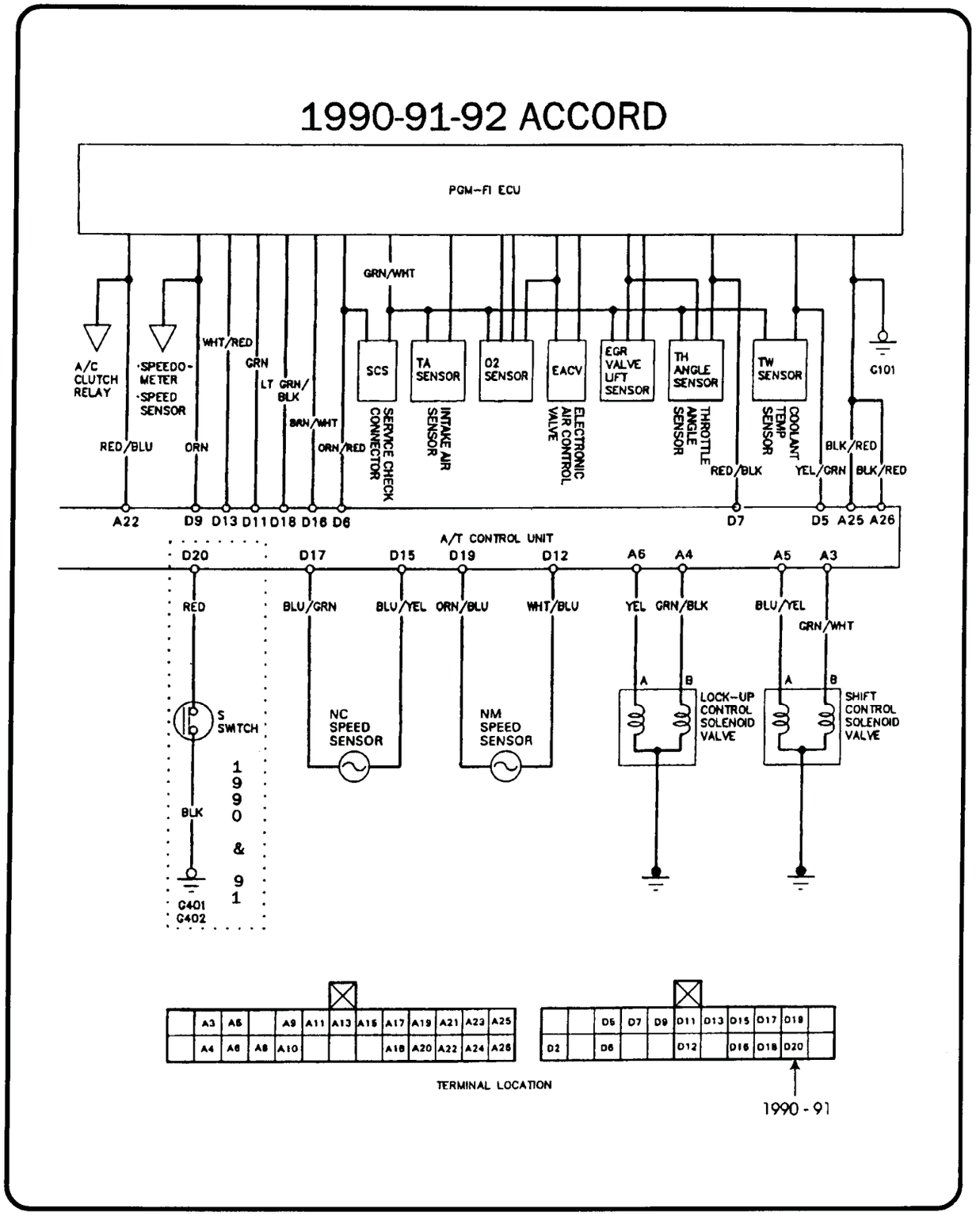


Figure 4.

ELECTRICAL SCHEMATICS

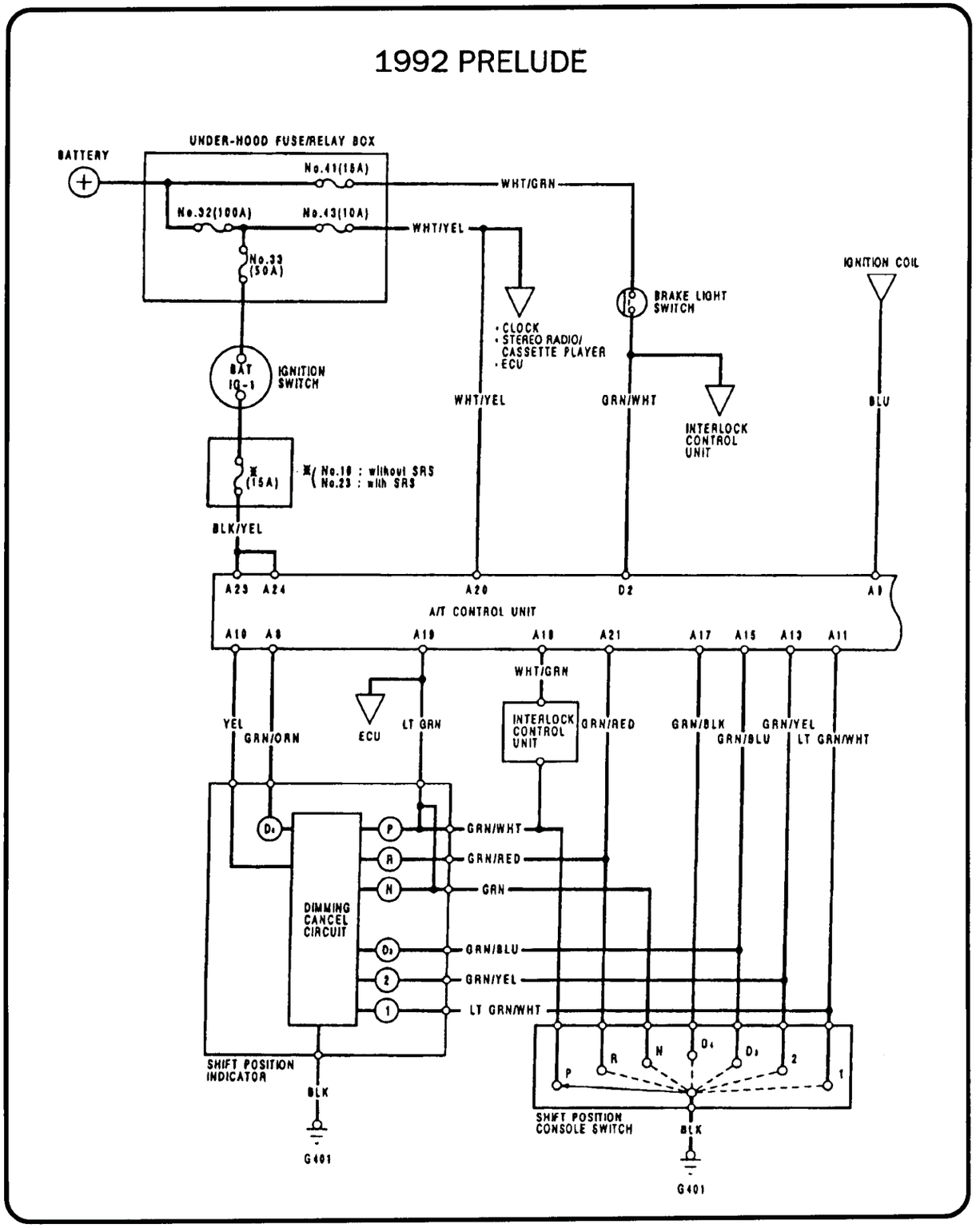


Figure 5.

ELECTRICAL SCHEMATICS

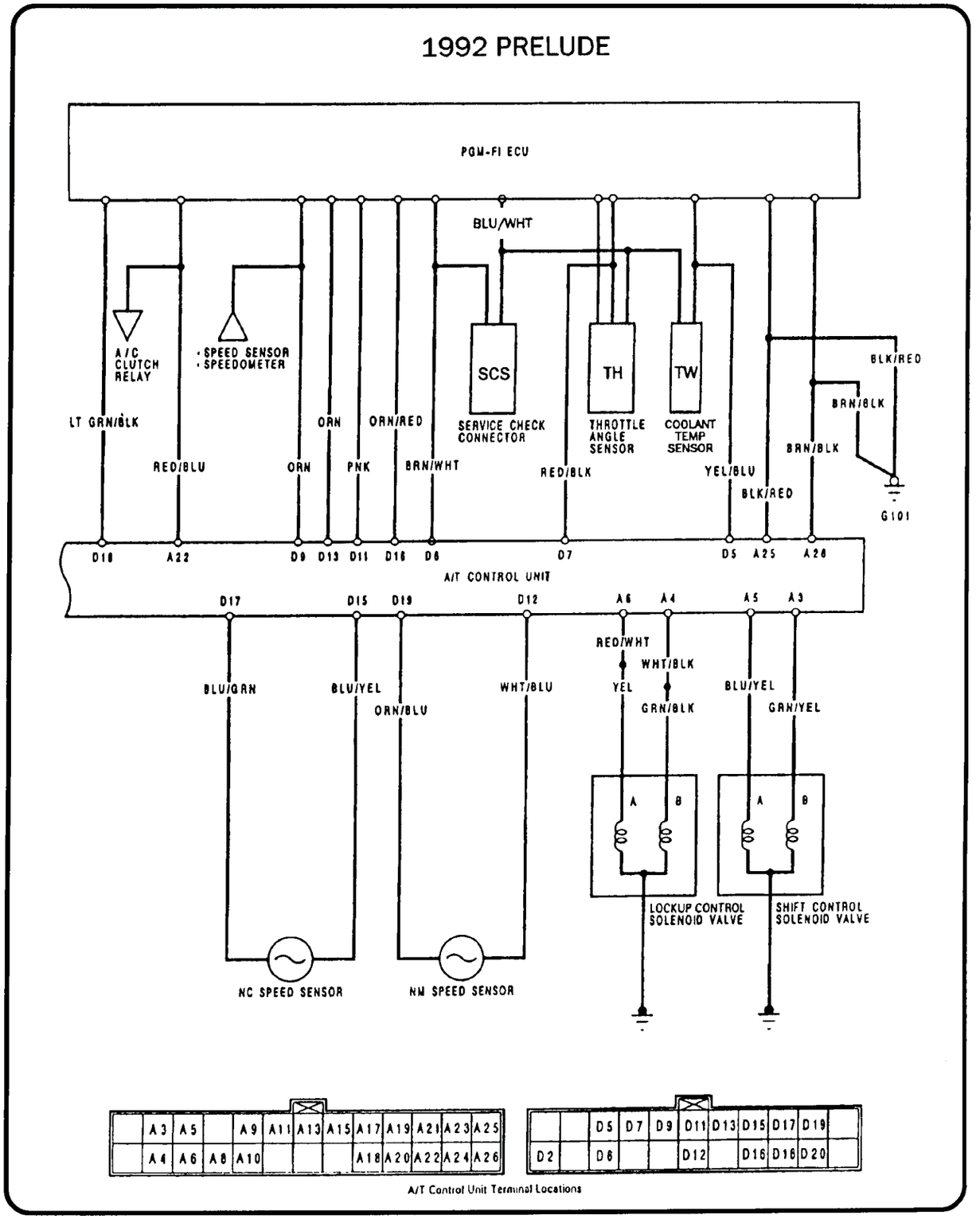


Figure 6.

ISUZU ELECTROMATIC

SELF DIAGNOSIS AND CODE RETRIEVAL

1988 VEHICLES: The instrument panel ECONOMY light functions as a pattern monitor lamp during self diagnosis (See Figure 1). Turn the ignition to the "ON" position (The Economy Switch can be in either the ECONOMY or NORMAL mode). The pattern monitor lamp will begin to blink rapidly indicating that an electrical problem does exist. If there were no problems detected, the light will simply come on for two seconds and go out (See Figure 2).

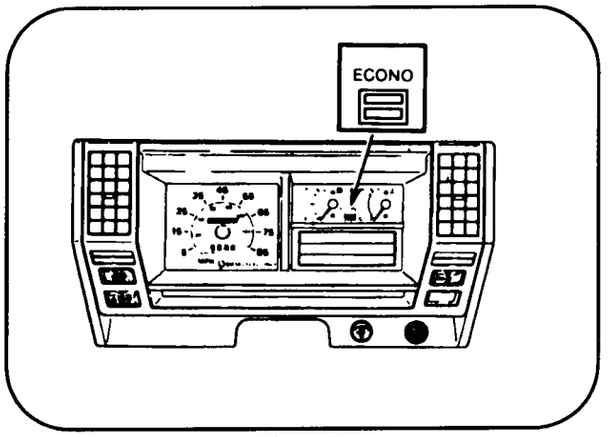


Figure 1

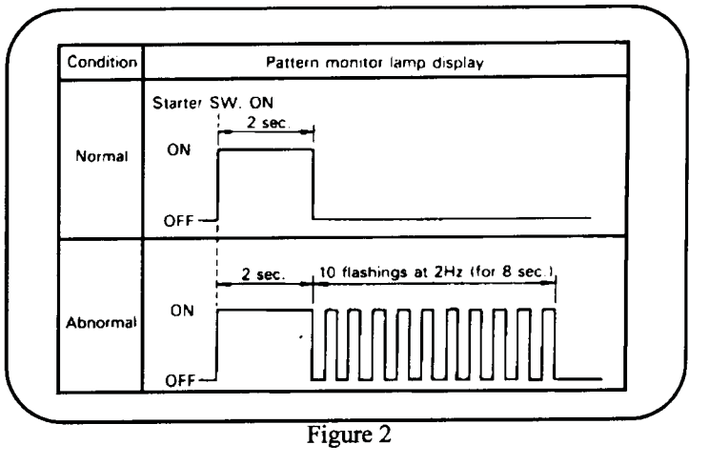


Figure 2

Retrieving Codes: If the pattern monitor lamp (economy indicator light), flashes to indicate that an electrical problem has been detected, follow the self diagnosis steps in Figure 3 to obtain the code or codes.

1. TURN THE IGNITION OFF.
2. PLACE THE SELECTOR LEVER INTO THE "D" POSITION.
3. PLACE THE ECONOMY DRIVE SWITCH TO THE "NORMAL" POSITION.
4. TURN THE IGNITION SWITCH TO THE "ON" POSITION.
5. PLACE THE SELECTOR INTO THE "2" RANGE.
6. PLACE THE ECONOMY DRIVE SWITCH TO THE "ECONOMY" POSITION.
7. PLACE THE SELECTOR LEVER INTO THE "1" RANGE.
8. PLACE THE ECONOMY DRIVE SWITCH TO THE "NORMAL" POSITION.
9. DEPRESS THE ACCELERATOR PEDAL TO THE FLOOR AND RELEASE.

Figure 3

CODE RETRIEVAL CONTINUED

After performing the "Self Diagnostic Input Steps", the indicator light will flash for 2 seconds as a bulb check. The light will then begin to blink indicating the status of each component by the time difference in the light blinking "ON" and "OFF" . In other words, the first blink after the 2 second flash is a check on the Vehicle Speed Sensor on the transmission. If there was a problem detected here, the light would stay lit for 6/10 of a second. If no problem was detected, the light would have stayed lit for only 1/10 of a second. The illustration shown in Figure 4 shows an example of "Shift Solenoid A" as being a problem. The 4th blinking light is a check the Shift Solenoid A circuit and since a problem was detected here, the 4th blinking light stayed lit longer than the rest.

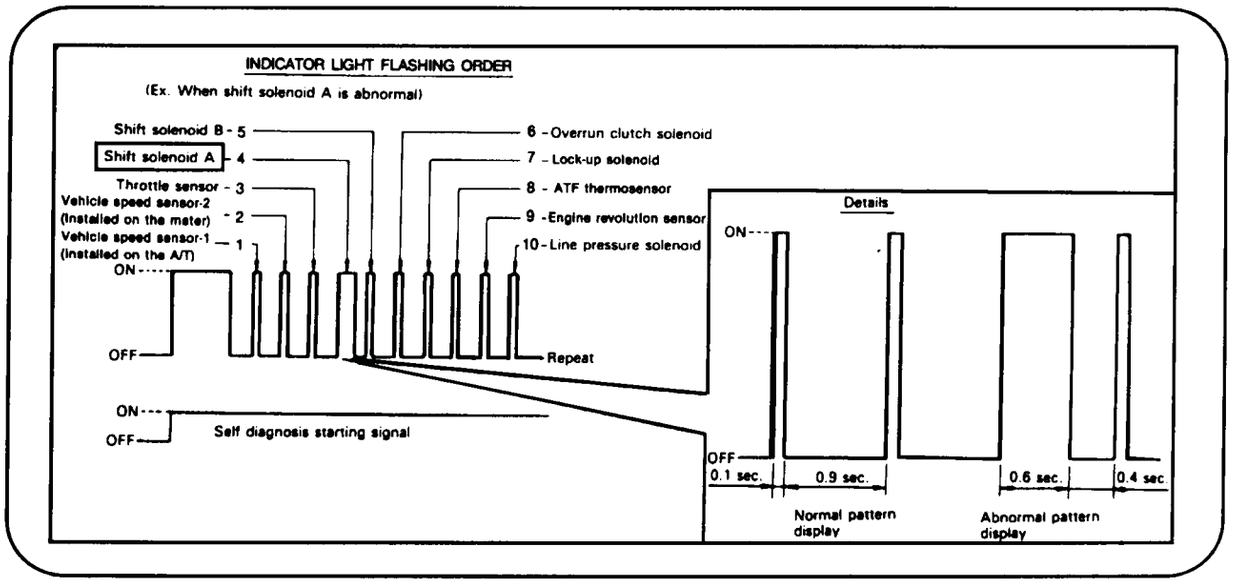


Figure 4

There are a total of 10 flashes with each flash representing a specific circuit. Refer to Figure 5 below for the flashing order and probable trouble.

No.	Component	Probable Trouble
1	Vehicle speed sensor-1	Sensor installed to the A/T open circuit
2	Vehicle speed sensor-2	Sensor installed to the meter open circuit
3	Throttle sensor	Open or short circuit
4	Shift solenoid A	Open or short circuit
5	Shift solenoid B	
6	Overrun clutch solenoid	
7	Lock-up solenoid	
8	ATF thermosensor	ATF thermosensor or battery power source open circuit
9	Engine-revolution sensor	Open circuit
10	Line pressure solenoid	Open or short circuit

Figure 5

CODE RETRIEVAL CONTINUED

1989 and 1990 vehicles: The 1989 vehicles inform and provide codes in the same manner as the 1988 vehicles. The only difference is in the operation of the Economy Drive Indicator Display. On 1988 vehicles if a code is present, when the key is turned to the "ON" position, the ECONOMY light will have a continuous flash irregardless of whether the button is in the ECONOMY MODE or NORMAL MODE. If no codes are present the light will come ON for two seconds and go out irregardless of what position the switch is in. On 1989 and 1990 vehicles, if NO codes are present and the switch is in the NORMAL MODE, the ECONOMY will come on for two seconds and go out. If the switch is placed in the ECONOMY MODE and NO codes is present, the ECONOMY light will come on and stay on. If codes ARE present, the ECONOMY light will have a continuous flash irregardless of what position the ECONOMY switch is in (Refer to Figure 6 Below). The Code retrieval method is the same as 1988 vehicles. Refer to figures 3, 4 and 5 to obtain and determine codes.

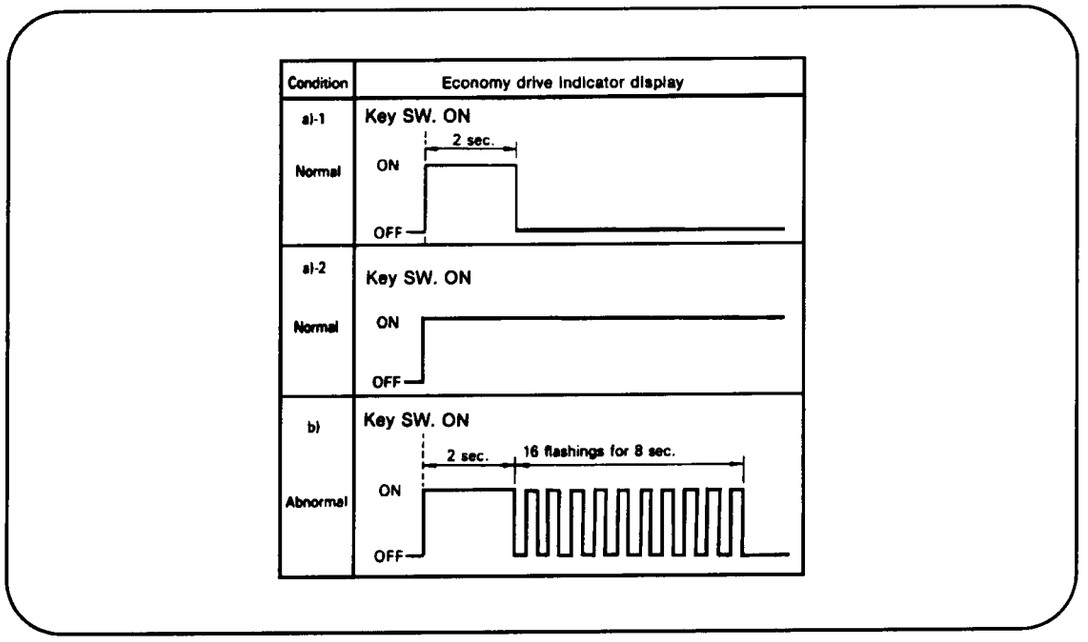


Figure 6

1991 to 1993 vehicles: The "Economy Drive Indicator Light" serves as a "Pattern Monitor Lamp" during self diagnosis as explained and shown in Figure 1. The "Economy Light" will blink a steady pattern when the ignition switch is turned to the "ON" position and an electrical problem has been detected as explained and shown in Figure 6.

Retrieving Codes: The trouble codes stored in the computers memory can be retrieved by jumping two leads in a diagnostic connector. 1991 vehicles have this diagnostic connector located behind the glove box as shown in Figure 7. 1992 and 1993 vehicles have this connector located under the brake and clutch fluid tank as shown in Figure 8. This connector is white in color and has a yellow wire with a black tracer and a solid black wire in the connector. When these two leads are connected together, the ECONOMY light will flash a TWO DIGIT code and repeat the code three times (See Figure 9). If there is more than 1 code stored in the computers memory, the lowest code number will be displayed first. Each code is displayed 3 times in a row before the next code comes up. Refer to Figure 10 for the list of TWO DIGIT codes for 1991 to 1993 vehicles.

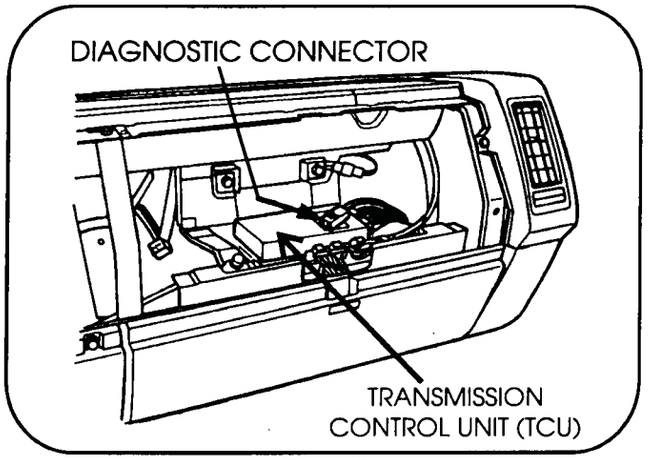


Figure 7
1991 Diagnostic connector location

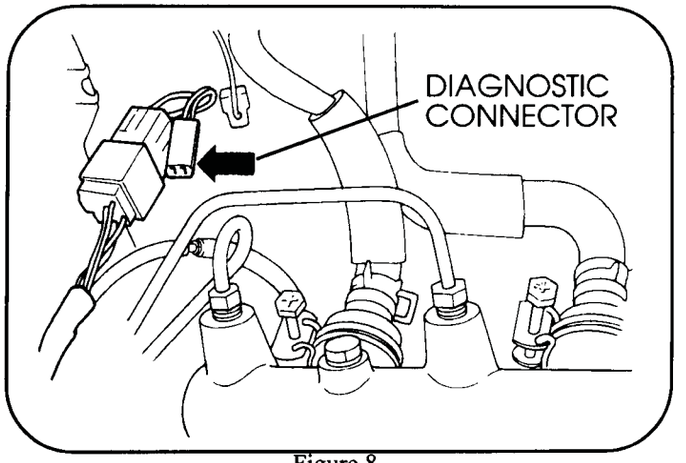


Figure 8
1992 and 1993 Diagnostic
connector location

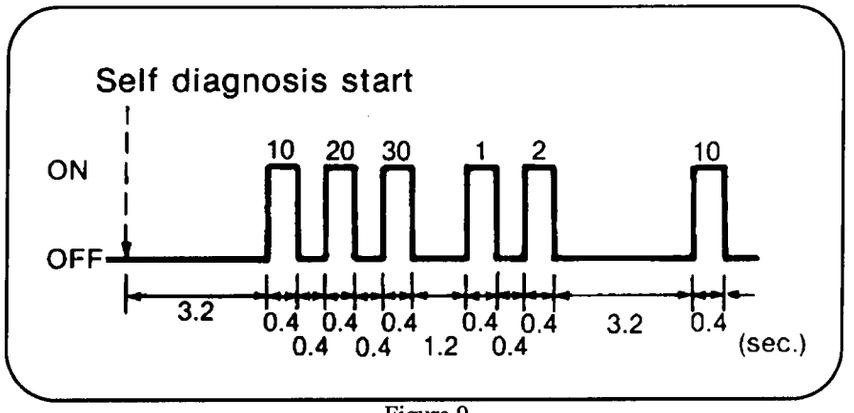


Figure 9
Trouble Code "32"

CODE No.	DIAGNOSIS ITEM	DIAGNOSED CONTENT
11	Vehicle speed sensor "1"	Vehicle speed sensor 1 circuit open or shorted
24	Vehicle speed sensor "2"	Vehicle speed sensor 2 circuit open or shorted
13	Engine revolution sensor	Engine revolution sensor circuit open or shorted
15	ATF thermosensor or battery back-up voltage	ATF thermosensor or battery back-up voltage circuit open or shorted
21	Throttle sensor	Throttle sensor circuit open or shorted
31	Shift solenoid A	Solenoid circuit open or shorted
32	Shift solenoid B	
33	Over-run clutch solenoid	
34	Lock-up duty solenoid	
35	Line pressure duty solenoid	

Figure 10
Trouble Code Chart for 1991-1993 Vehicles

ERASING CODES

To erase codes, simply remove the Number 11 fuse (See Figure 11) or disconnect the positive battery cable for approximately 10 seconds. The fuse box is located under the glove box.

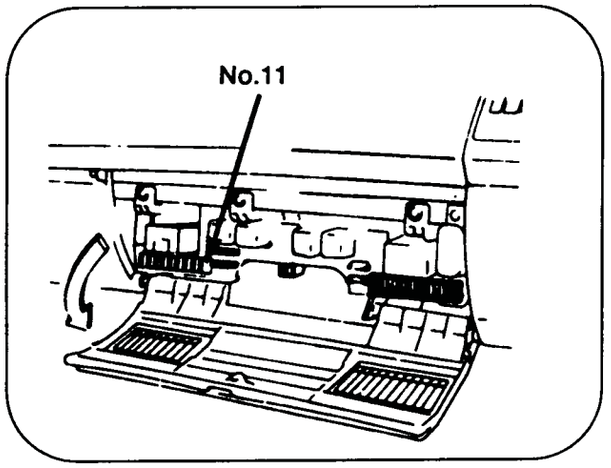


Figure 11

ELECTRICAL COMPONENT CHECK

IDLE SWITCH

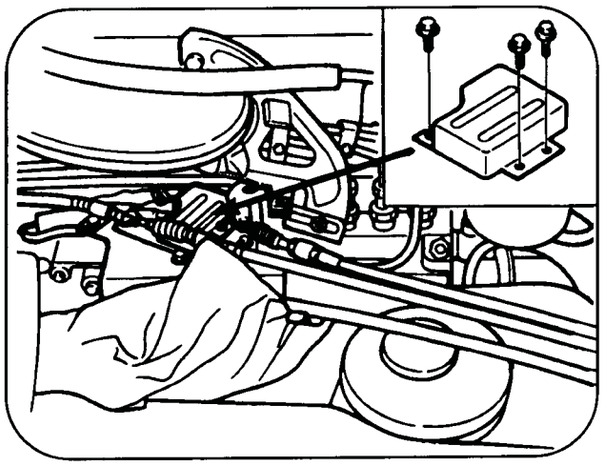


Figure 12

The IDLE SWITCH is attached to the injection pump and has a three bolt cover on it to protect it from dust (See Figure 12). Pin 14 at the computer sends battery voltage to both the THROTTLE SWITCH and the IDLE SWITCH. The IDLE SWITCH is a normally closed switch and when the switch is closed, it completes a ground circuit to pin 4 at the computer. To check the IDLE SWITCH for proper operation, remove the 3 bolt cover and unplug the two wire connector going to the switch and cross the connector on the switch side with an ohm meter.

When the Control Lever Cam is .004" from the Idle Set Bolt, the switch should show continuity. When the Control Lever Cam is .010" from the Idle Set Switch, the switch should read open (See Figure 13). Adjust or replace switch if necessary.

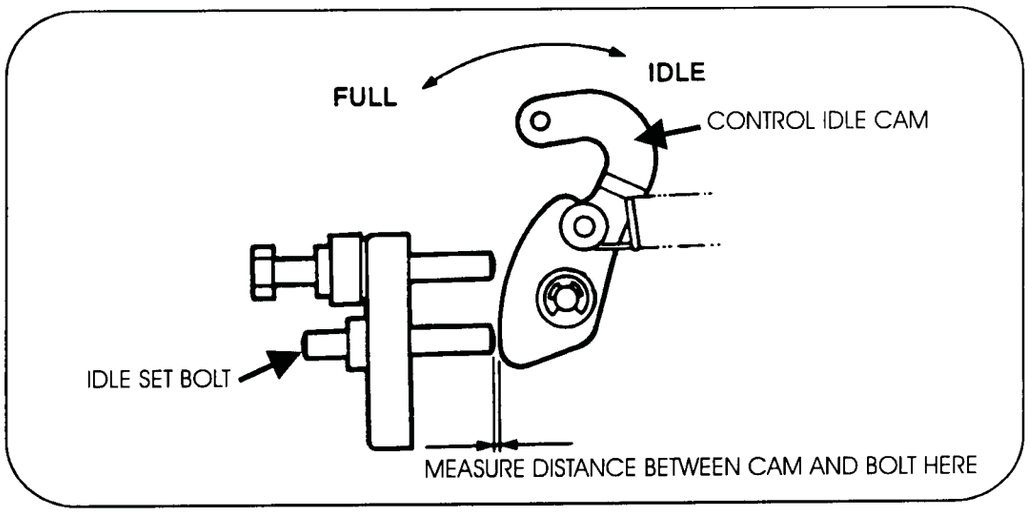


Figure 13

KICKDOWN SWITCH

The Kickdown Switch is a normally open switch and closes when the accelerator pedal is depressed approximately 1.38 ". A clicking sound can be heard if the switch is operating. The Kickdown switch can be checked with an ohm meter by placing the positive lead to the blade of the switch and the negative lead to a ground. With the accelerator pedal released, the switch should read open. With the accelerator pedal depressed approximately 1.38" of travel, the switch should read closed (See Figure 14).

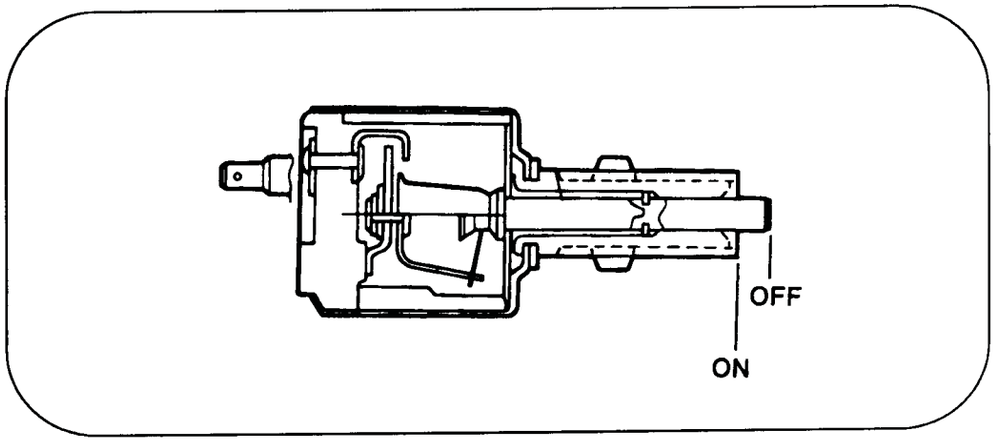


Figure 14

THROTTLE POSITION SWITCH AND SENSOR

The Throttle Position Sensor and Throttle Position Switch is located in one assembly (See Figure 15). The Throttle Position Switch is a normally open switch and closes when the accelerator pedal has reached a full throttle position. To check the switch, unplug the connector and cross the two pins on the switch side of the connector with an ohm meter. The switch should read open and close when the accelerator pedal has reached wide open throttle.
The throttle position sensor is fed with 5 volts from pin #10 at the computer. The sensor then sends voltage that is proportional to throttle opening back to the computer at pin #11. When the throttle is closed, approximately .5 volts is sent to the computer. As the throttle opens, the voltage increases in proportion to throttle opening. When wide open throttle has been reached, approximately 4.5 volts is sent to the computer.

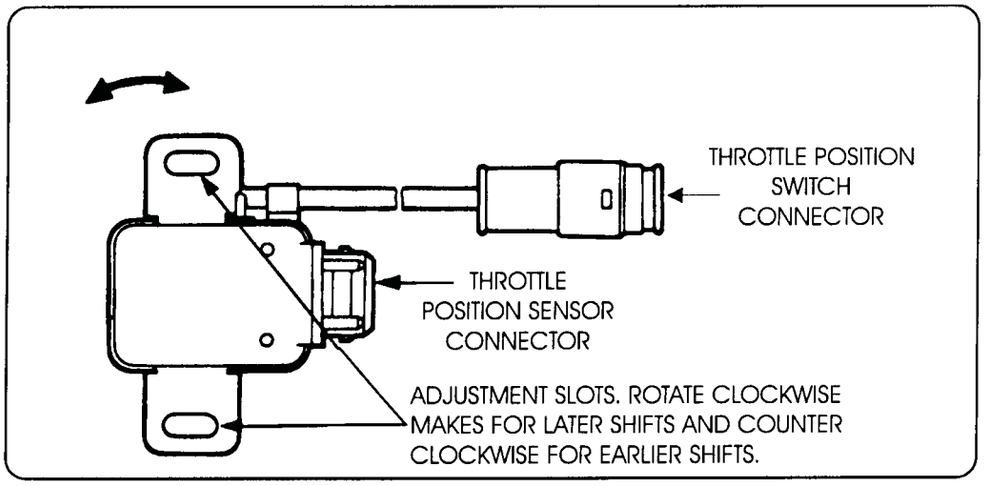


Figure 15

Figure 16 is a view of the pins in the TPS. The top pin is where the TPS receives the 5 volts sent by the computer. The bottom pin is a ground going to pin #15 at the computer. The middle pin is used by the sensor to send voltage proportional to throttle opening back to the computer. To check the TPS, keep the wires connected to the sensor. Turn the ignition ON and have the engine OFF. Carefully back probe the middle wire with the positive lead of a volt meter and place the negative lead to a ground. At closed throttle, the meter should read approximately .5 volts. As the throttle is opened, the voltage should rise smoothly to 4.5 volts when wide open throttle is reached.

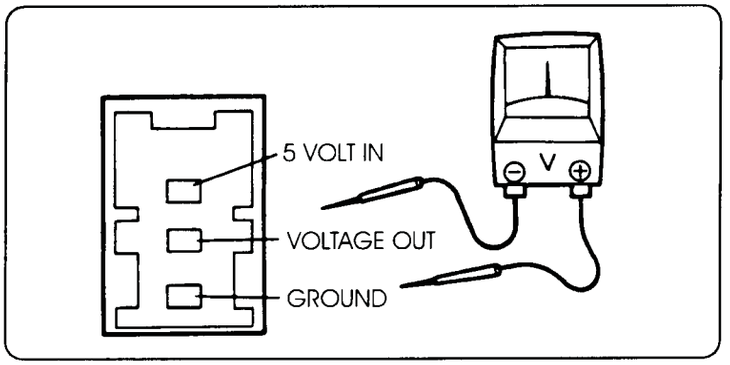


Figure 16

INHIBITOR SWITCH AND SOLENOIDS

Both the Inhibitor Switch and the Transmissions internal Solenoids can be checked for proper resistance through the external Harness connector as shown in Figure 17. The Inhibitor Switch Connectors are BLACK in color and the Solenoid Connector is BROWN in color.

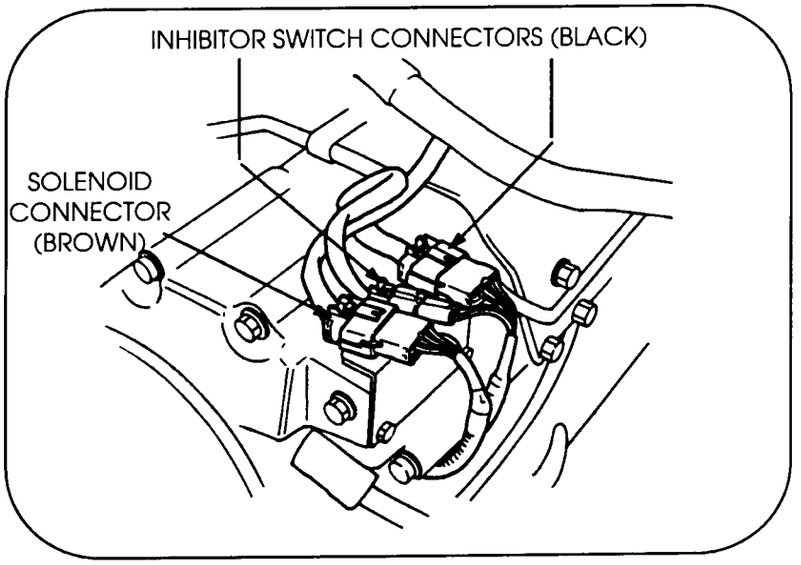


Figure 17

INHIBITOR SWITCH

To check the Inhibitor Switch, simply check for continuity through out the different shift lever positions as shown in Figure 18.

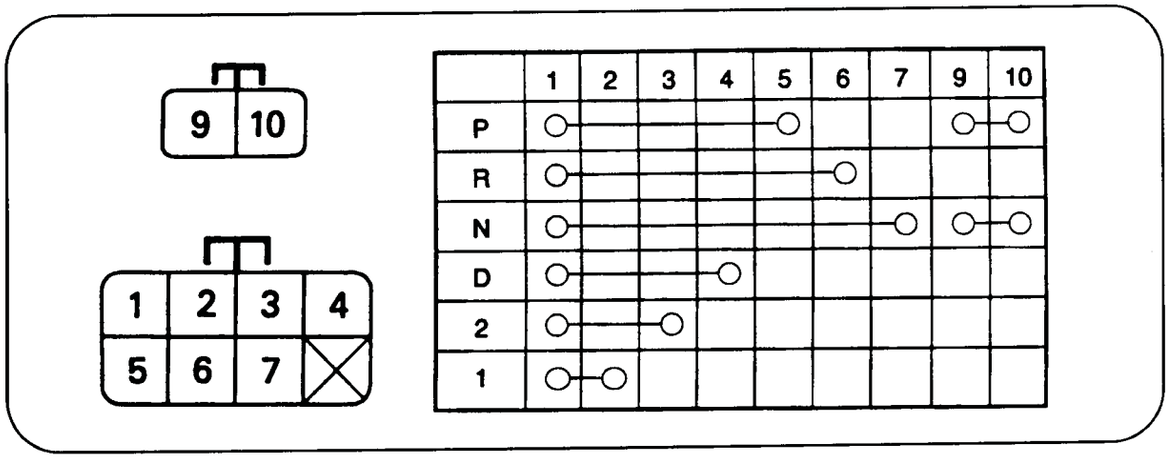


Figure 18

If the Inhibitor Switch Check reveals that the switch is out of range, adjust the switch by placing the selector lever in neutral. Align the switch by inserting a .15 inch diameter pin through the select lever and the inhibitor switch alignment hole as shown in Figure 19. Check the switch again using figure 18. If the switch fails the test after adjustment, replace the switch.

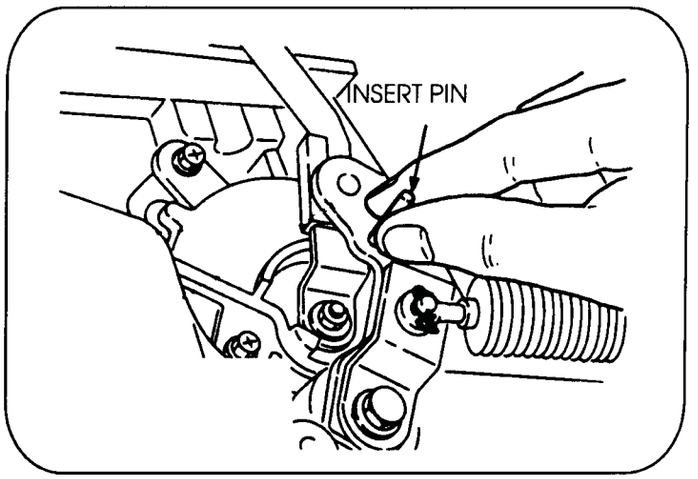


Figure 19

SOLENOID CHECK

Using an ohm meter, measure the resistance between the following connector terminals and ground as shown in Figure 20. Refer to Figure 21 for the proper values. Always keep in mind that you are only checking the solenoids for proper resistance, this test will not reveal solenoids that have a mechanical failure. If the unit had excessive metal damage or overheating, the solenoids should be replaced.

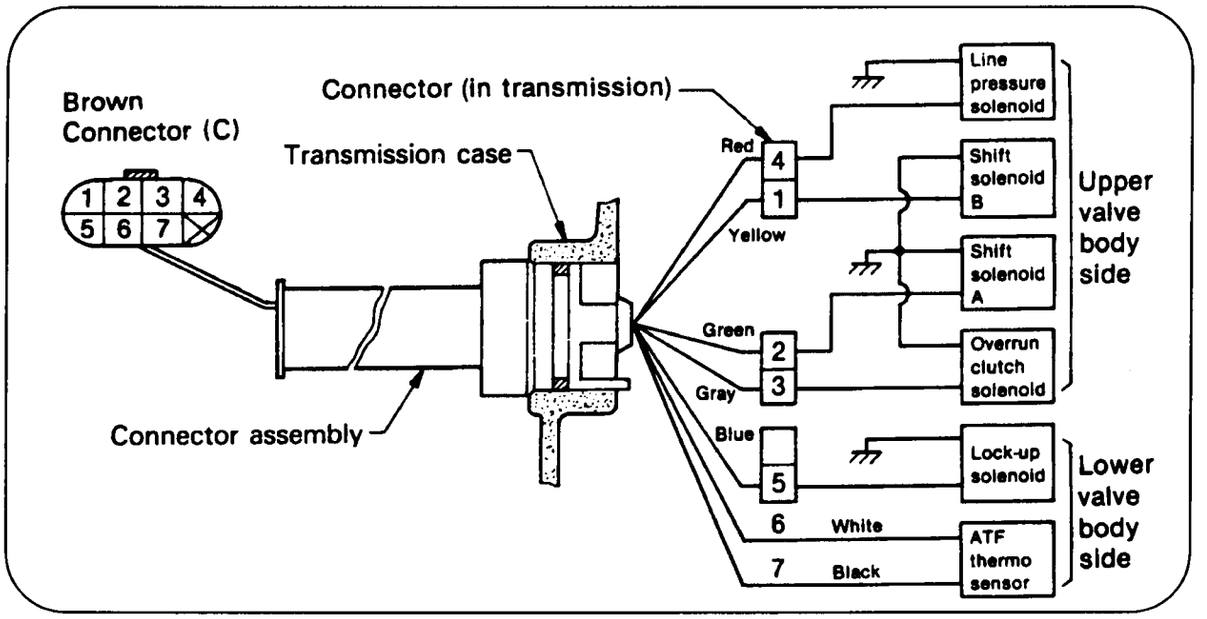
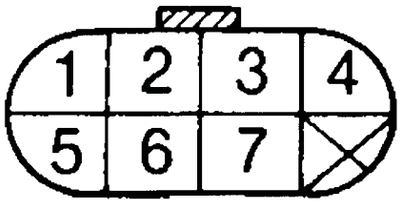


Figure 20

Solenoid	Terminal No.	Resistance (Ω)
Shift solenoid B	1	20 ~ 40
Shift solenoid A	2	
Overrun clutch solenoid	3	
Line pressure solenoid	4	2.5 ~ 5.0
Lockup solenoid	5	10 ~ 20
ATF thermosensor	6 ~ 7	2,500 approx. (at 20°C/68°F)
		300 approx. (at 80°C/176°F)



GEAR	SOLENOID A	SOLENOID B	LOCK-UP SOLENOID	OVERRUN SOLENOID	PRESSURE SOLENOID
1st	ON	ON	OFF	ACTIVATES UPON VARIOUS THRROTTLE OPENINGS	PULSE MODULATION CONTROLLED BY COMPUTER
2nd	OFF	ON	OFF		
3rd	OFF	OFF	OFF		
4th	ON	OFF	ON	OFF	

Figure 21

VEHICLE SPEED SENSORS

The illustration shown in Figure 22 is the Vehicle Speed Sensor #1. This sensor should measure 504 to 616 OHMS. Figure 23 shows the vehicle Speed Sensor #2 built into the speedometer head. This sensor can be checked by going to the Transmission Control Module (TCM) by placing the positive lead of an ohm meter to pin cavity 24 and the negative lead to a ground. Disconnect the speedo cable by the transmission and turn the cable by hand. If the ohm meter deflects repeatedly from open to close, the sensor is good.

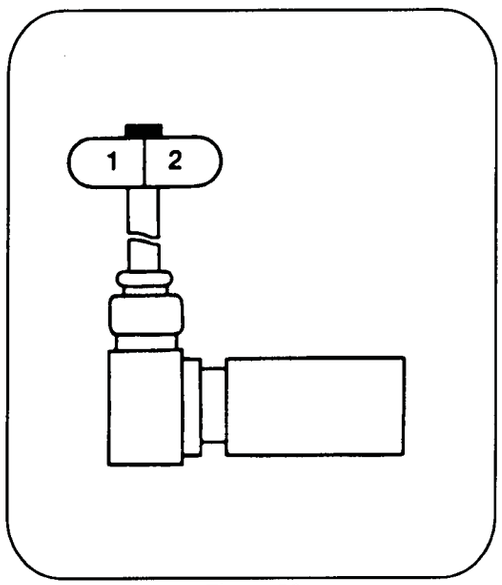


Figure 22
VEHICLE SPEED SENSOR #1

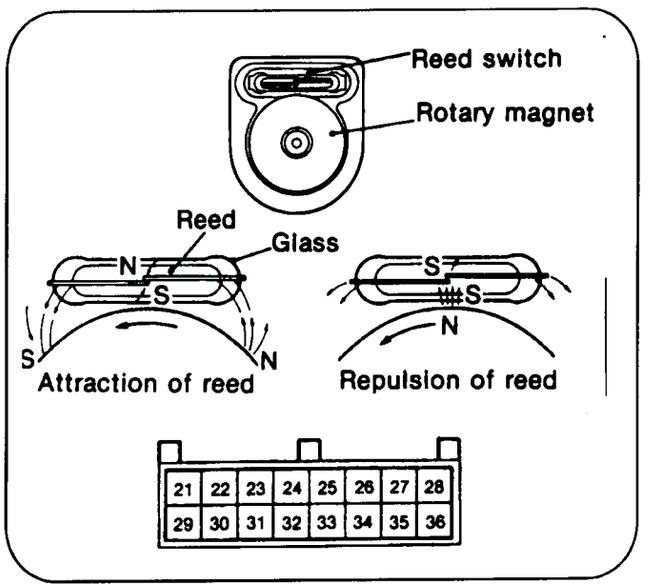


Figure 23
VEHICLE SPEED SENSOR #2

ENGINE REVOLUTION SENSOR

The Engine Revolution Sensor location is shown in Figure 24 below. This sensor should measure 2100 to 2500 ohms a approximately 77 F.

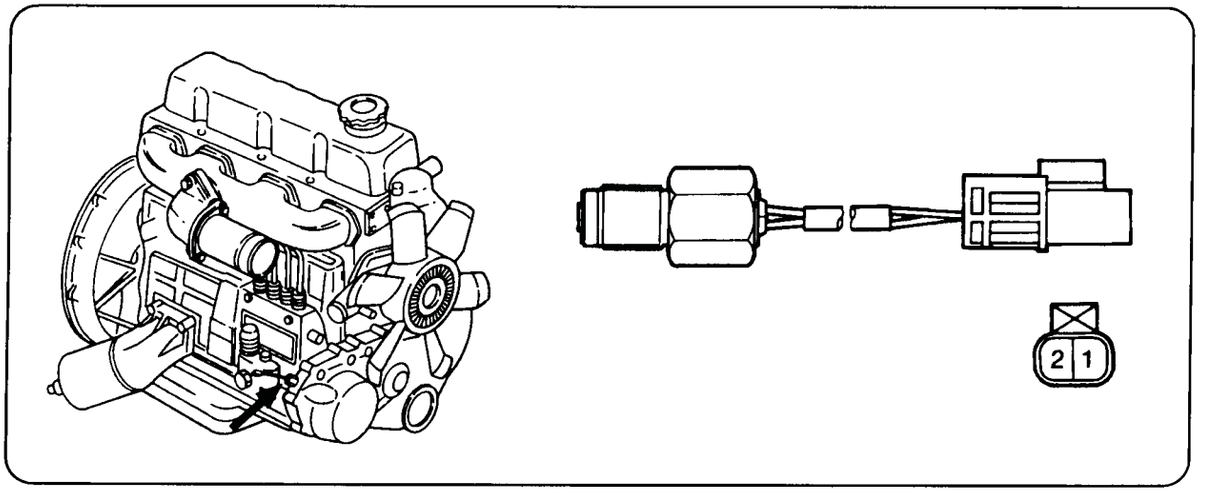


Figure 24

DROPPING RESISTOR

The dropping resistor is in a parallel circuit to the pressure control solenoid. Its purpose is to modify line pressure in relationship to engine temperature. This resistor can be checked with an OHM meter and should measure 11 to 15 ohms resistance. Refer to figure 25 for the location of the dropping resistor.

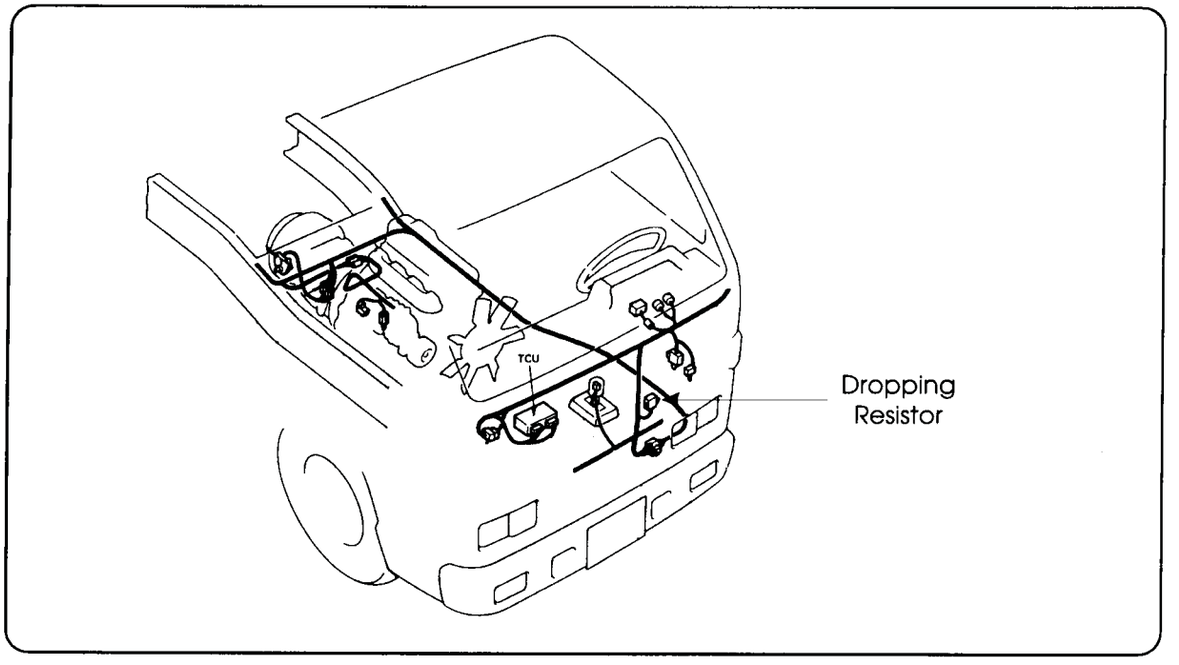
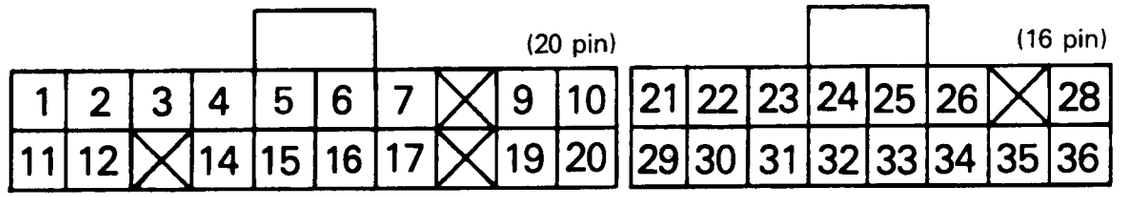


Figure 25

TRANSMISSION CONTROL UNIT PIN LAYOUT AND CHECKS



Pin No.	Function	Pin No.	Function
1.	2 range switch	19.	Nutral range switch
2.	1 range switch	20.	D range switch
3.	Exhaust brake signal	21.	Overrun clutch solenoid
4.	Idle switch	22.	Lock-up duty solenoid
5.	Diagnosis terminal	23.	Economy drive indicator
6.	Overdrive switch	24.	Vehicle speed sensor 2
7.	Kick-down switch	25.	Engine revolution sensor
8.	—	26.	Reverse range switch
9.	Economy drive switch	27.	—
10.	Throttle sensor voltage (5V out)	28.	Battery back-up voltage
11.	Throttle sensor	29.	Battery voltage
12.	ATF Thermosensor	30.	Battery voltage
13.	—	31.	Ground
14.	Idle switch voltage	32.	Ground
15.	Throttle sensor ground	33.	Duty solenoid (Dropping register)
16.	Vehicle speed sensor 1	34.	Duty solenoid (Line pressure)
17.	Full throttle switch	35.	Shift solenoid A
18.	—	36.	Shift solenoid B

Figure 26

Figure 26 is a view of the harness connector going into the Transmission Control Unit (TCU) from the wire side of the coonector Figure 27 shows the proper method in doing circuit checks at the TCU. Refer to the following pages for individual circuit checks and specifications.

Figure 27

CIRCUIT DIAGRAM

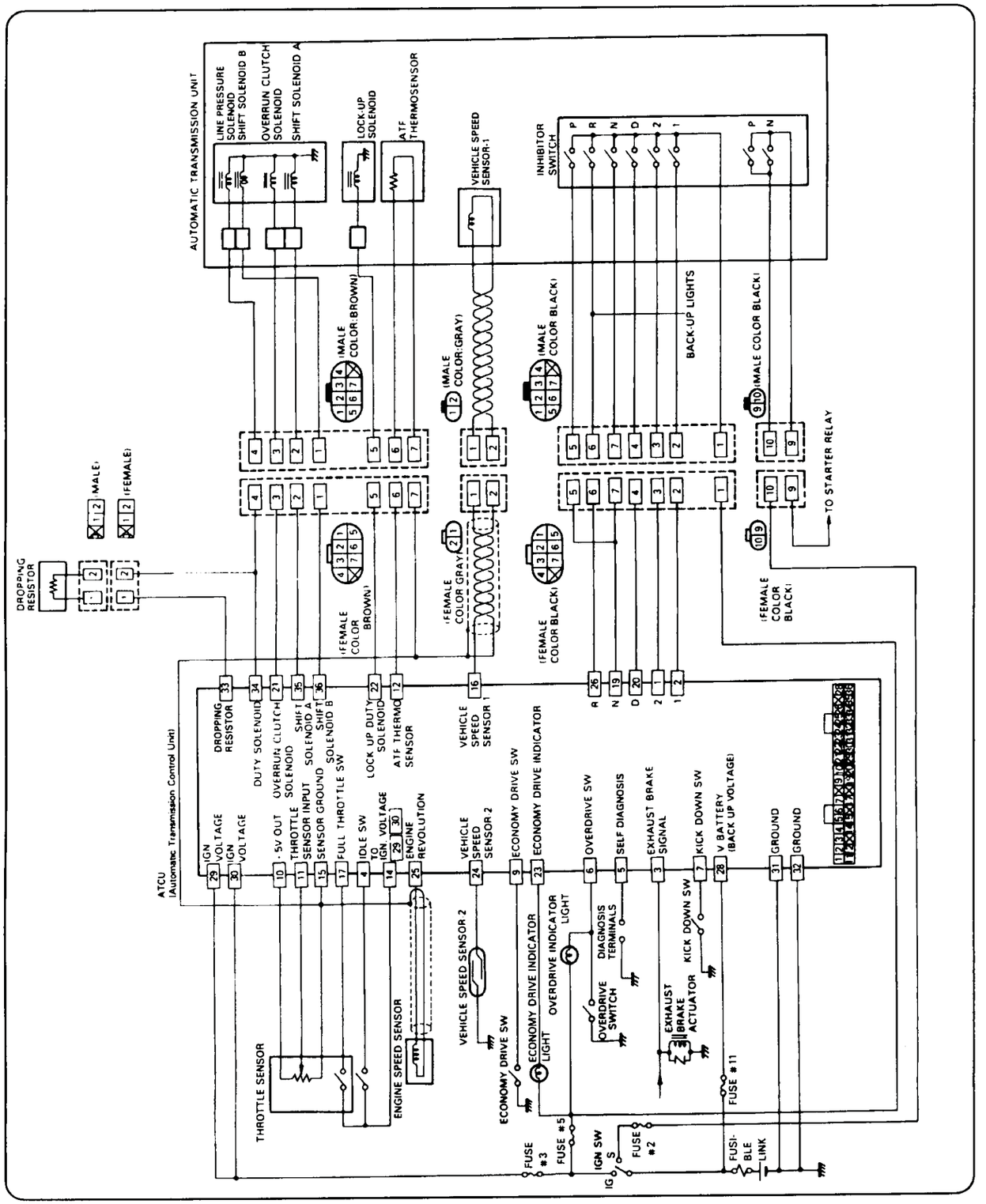


Figure 28

ISUZU TROOPER & RODEO 4L30-E

The V6 Isuzu Trooper and Rodeo use an electronically controlled overdrive transmission with five solenoids to control shifting, torque converter clutch, and oil pressure. This transmission has an overdrive section on the front with a separate oil pan. The rear section of the transmission is similar to the THM 180 except for the electronic controls on the valve body. The TCM (Transmission Control Module) is the computer that exclusively controls transmission functions. Engine electrical functions are controlled by a separate computer. If the power to the TCM or to the transmission is lost, the transmission will fail-safe to 4th gear when it is placed in the "D" position.

Fail-Safe Mode occurs as a result of system failure or faults detected by the TCM which could affect safety or damage the transmission. All grounds to the solenoids are canceled and the "Check Trans" light on the dash board flashes when this occurs. Without current to the solenoids, the transmission will start in 4th gear when the shift lever is placed in "D" or "3". In manual "2", 3rd gear is available, and in manual "1", 1st gear is available. Shifts will also be much firmer due to the lack of voltage to the force motor.

The shifting solenoids and the band apply solenoid are on the valve body in the main case. The "Force Motor" (pressure control solenoid) and the TCC solenoid is on the valve body in the overdrive section. The solenoid locations are shown in Figure 1. Electrical operation and check procedures will be explained further in this chapter.

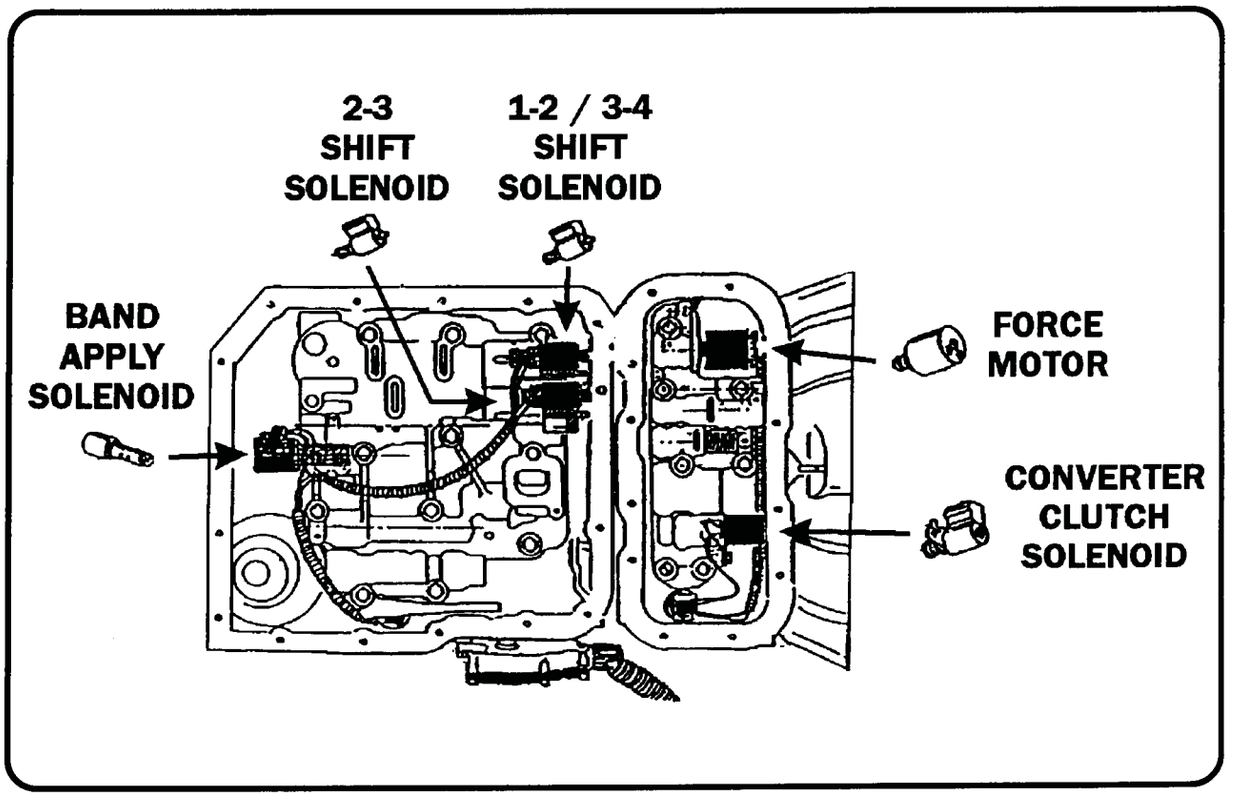


Figure 1.

TRANSMISSION CONTROLS

The **TCM (Transmission Control Module)** gathers input information from various sensors and switches in the vehicle and, then according to a programmed strategy, outputs voltage signals to the lamps and solenoids to control shifting and feel.The **input signals** that the TCM uses are briefly described in Figure 2, and the **output signals** that come out of the TCM are briefly described in Figure 3.

INPUT SIGNAL

Parts	Function
Speed sensor (fixed to T/M)	Senses rotation of output shaft and feeds the data to TCM
Throttle position sensor (fixed to engine)	Senses the extent of throttle valve opning and the speed of the throttle valve lever motion to open the valve and feeds the data to TCM (fed to ECM also)
Brake SW (fixed to brake pedal)	Senses whether the driver has pressed the brake pedal or not and feeds the information to TCM.
Kick-down SW (fixed to accelerator pedal)	Senses whether the driver has pushed the accelerator pedal fully or not and feeds the information to TCM.
Mode SW (fixed to T/M)	Senses the select lever position and the information to TCM.
Power drive SW (fixed to center consol)	Senses whether the driver has selected the power mode or economy mode and feeds the information to TCM.
Sump temp. senser	Senses the T/M oil temperature and feeds the data to TCM.
Coolant temp. SW	Senses the engine cooling water temperature and feeds the data to TCM (feeds the signal from ECM)
Engine speed signal	Feeds the signals monitoring engine speed to TCM from IGN module (fed to ECM also)
Air conditioner information	Senses whether the air conditioner has been switched on or not and feeds the information to TCM
Self diagnostic input	By monitoring the GND, the location of failure is shown on the T/M monitor lamp("CHECK TRANS") by flashing the code number
Barometer sensor (option)	Senses the altitude and feeds the data to TCM
Winter switch (fixed to center consol)	Senses whether the driver has selected the winter mode, and feeds the information to TCM

Figure 2.

OUTPUT SIGNAL

SOLENOID	Shift solenoid 1-2/3-4 2-3	Selects shift point and gear position suited to the vehicle running condition on the basis of TCM output
	Band apply solenoid	Controls oil flow suited to the vehicle running condition on the basis of TCM output
	TCC solenoid	Controls clutch engagement/disengagement suited to the vehicle running condition on the basis of TCM output
	Force motor (Pressure regulator valve)	Adjusts the oil pump delivery pressure to line pressure suited to the vehicle running condition on the basis TCM output
Power drive mode lamp		Informs the driver whether the vehicle is in the power mode or not
Winter drive mode lamp		Informs the driver whether the vehicle is in the winter mode or not
T/M monitor lamp ("CHECK TRANS")		Informs the driver of failure in the system. It also displays the self diagnosis code
Diagnostic 1 connector		When connected with TECH 1 or tester, can communicate the data for function check, etc.

Figure 3.

IMPORT COMPUTER CONTROLS

TROUBLE DIAGNOSIS

The TCM has a built in diagnostic system that will store trouble codes in the event of a malfunction. Trouble codes that have been stored or are now current can be retrieved by a Tech I scanner or by jumping the correct pins at the diagnostic connector. For **1990 and 1991** models, jump across the white **two wire connector** located under the dash on the left side using a jumper wire. See inset box in Figure 4. On **1992 and later** models jump the outer pins of the **three wire connector** behind the center console with a jumper wire. See Figure 4. Turn on the ignition. and watch the "Check Trans" light for flashes. Codes and flashing light interpretation is found on the next page.

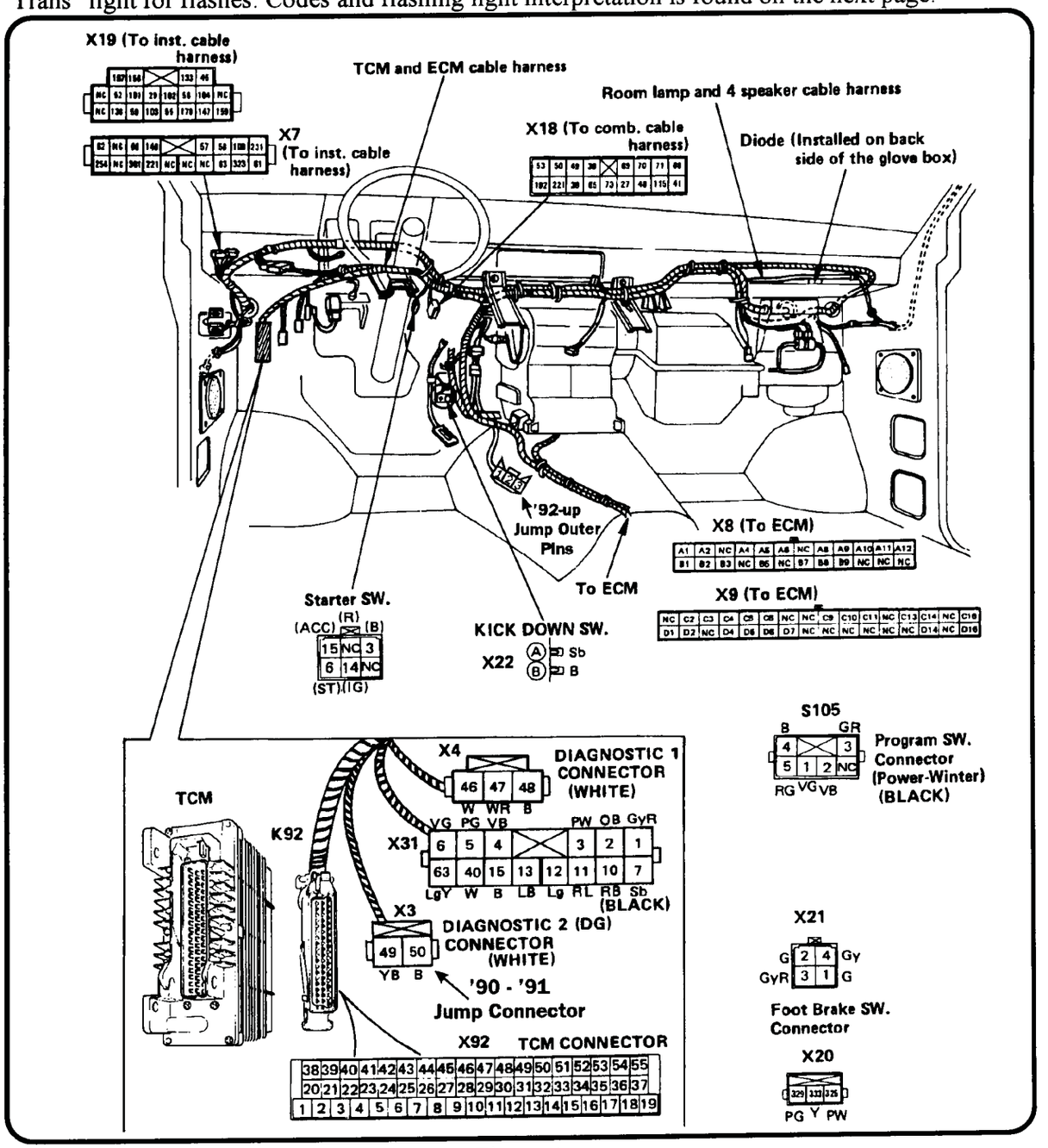


Figure 4.

TROUBLE CODES

Trouble codes are displayed at the "Check Trans" light in the same manner as in most General Motors vehicles. All codes are two digit codes. The first set of flashes is the first digit of the code. It is followed by a pause and then the second set of flashes which is the second digit of the code. Then there is a long pause and the code is repeated. All codes are flashed three times before the next code is flashed. After all stored codes are flashed, the sequence starts over again until the jumper leads are disconnected. A list of trouble codes for the transmission are shown in Figures 5 and 6.

Note: If the engine is not running when checking for trouble codes, a code 12 will flash first which means that the distributer isn't turning. This is normal.

Trouble Code	Information Sensor Cause of Fault	Trouble Code Storage when ...
17	SOLENOID 1 - 2/3 - 4 VOLTAGE LOW	• With ignition ON the fault is not recognised. • If the fault appears after starting the engine, this can at first be recognised on actuation of the solenoid valve. • The Emergency Program is activated on Fault Recognition.
21	THROTTLE POSIT. SENSOR VOLTAGE HIGH	• The control unit has a reading of > 4.9V. • With ignition ON the fault is not recognised. • The fault is immediately recognised after starting the engine. • The Emergency Program is activated on Fault Recognition.
22	THROTTLE POSIT. SENSOR VOLTAGE LOW	• The control unit has a reading of < 60 mV. • With ignition ON the fault is not recognised. • The fault is immediately recognised after starting the engine. • The Emergency Program is activated on Fault Recognition.
23	ENGINE COOLANT SWITCH	• Engine warm. • Engine speed > 500 rpm, after 20 min. the TCM reads high voltage. • TCC opration allowed.
25	SOLENOID 1 - 2/3 - 4 VOLTAGE HIGH	• With ignition ON and after starting the engine, the fault is immediately recognised. • The Emergency Program is activated on Fault Recognition.
26	SOLENOID 2 - 3 VOLTAGE LOW	• With ignition ON and after starting the engine, the fault is immediately recognised. • The Emergency Program is activated on Fault Recognition.

Trouble Code	Information Sensor Cause of Fault	Trouble Code Storage when ...
28	SOLENOID 2 - 3 VOLTAGE HIGH	• With ignition ON the fault is not recognised • If the fault appears after starting the engine, this can at first be recognised on actuation of the solenoid valve. • The Emergency Program is activated on Fault Recognition.
29	TCC SOLENOID VOLTAGE LOW	• With ignition ON the fault is not recognised. • If the fault appears after starting the engine, this is first recognised on actuation of the solenoid valve. • The Emergency Program is not activated, despite the blink of the "Check trans." warning light.
31	NO TRANSMISSION INPUT RPM SIGNAL	• With ignition ON the fault is not recognised. • If the fault appears after starting the engine, it is first recognised with a speed > 30 km/h: 18 mph and a throttle valve position > 12% • The Emergency Program is activated on Fault Recognition.
32	PRESS. REGULATOR SOLENOID VOLTAGE LOW	• With ignition ON the fault is immediately recognised. • The fault appears after starting the engine, it is first recognised. • The Emergency Program is activated on Fault Recognition.
33	PRESS. REGULATOR SOLENOID VOLTAGE HIGH	• With ignition ON the fault is immediately recognised. • If the fault appears after starting the engine, it will be recognised. • The Emergency Program is activated on Fault Recognition.

Figure 5.

TROUBLE CODES CONTINUED

Trouble Code	Information Sensor Cause of Fault	Trouble Code Storage when ...
34	BAND APPLY SOLENOID VOLTAGE HIGH	• With ignition ON and after starting the engine, the fault is immediately recognised. • The Emergency Program is activated on Fault Recognition.
35	BAND APPLY SOLENOID VOLTAGE LOW	• With ignition ON the fault is immediately recognised. • If the fault appears after starting the engine, this can at first be recognised on actuation of the solenoid valve. • The Emergency Program is activated on Fault Recognition.
36	TCC SOLENOID VOLTAGE HIGH	• With ignition ON the fault is immediately recognised. • If the fault appears after starting the engine, it will only be recognised if the converter clutch is not actuated. • The Emergency Program is not activated on Fault Recognition.
39	NO TRANSMISSION OUTPUT RPM SIGNAL	• The fault can be recognised at an engine speed > 3000 rpm in selector lever positions "1", "2", "3" and "D". • The Emergency Program is activated on Fault Recognition.
41	GEAR ERROR HYDRAULIC FAULT	• The fault is recognised when the relationship between engine speed and output speed is outside a certain tolerance range. • The Emergency Program is activated on Fault Recognition.
43	GROUND CONTROL RELAY CIRCUIT	• With ignition ON the fault is immediately recognised. • If the fault appears after starting the engine, it is not recognised. • The Emergency Program is activated on Fault Recognition.

Trouble Code	Information Sensor Cause of Fault	Trouble Code Storage when ...
46	DOWN SHIFT FAULT	• The fault is recognized if, when down-shifting, the engine speed rises above a certain value. • The Emergency Program is activated on Fault Recognition.
48	BATTERY VOLTAGE LOW	• With ignition ON and after starting the engine, the fault is immediately recognised, if the battery voltage falls below a value of 9.0 V. • The Emergency Program is activated on Fault Recognition.
49	BATTERY VOLTAGE HIGH	• With ignition ON and after starting the engine, the fault is immediately recognised, if the battery voltage rises above a value of 16.0 V.
55	REPLACE TCM	• With ignition ON and after starting the engine, the fault is recognised after 3 min. • The Emergency Program is activated on Fault Recognition.
56	SELECTOR SWITCH WRONG SIGNAL	• In selector lever position "R" a fault is recognised at a speed v > 100 km/h:62 mph or an output speed n > 3200 rpm. • In selector lever positions "N" and "P" a fault is recognised with a throttle valve aperture TV > 20 % and an engine speed n < 3000 rpm. • On Fault Recognition, the fault is stored and the Emergency Program is not activated.
65	AT OIL TEMPERAT. SENSOR VOLTAGE HIGH	• With ignition ON the fault is not recognised. • If the fault appears after starting the engine, it is recognised after a time-span of t > 20 sec. • The "Winter Program" can not be activated. • On Fault Recognition, the fault is stored and the Emergency Program is not activated.

Trouble Code	Information Sensor Cause of Fault	Trouble Code Storage when ...
66	AT OIL TEMPERAT. SENSOR VOLTAGE LOW	• With ignition ON the fault is not recognised. • If the fault appears after starting the engine, it is recognised after a time-span of t > 20 sec. • The band apply solenoid is turned OFF. • On Fault Recognition the fault is stored and the Emergency Program is not activated.
77	KICKDOWN SWITCH VOLTAGE LOW	• With ignition ON the fault is not recognised. • If the fault appears after starting the engine, it is recognised, if the kickdown function is actuated with a throttle valve aperture TV < 70 %. • The kickdown function can not be activated. • On Fault Recognition the fault is stored and the Emergency Program is not activated.

Figure 6.

TRANSMISSION INPUTS

The **Mode Switch (Inhibitor Switch)** is mounted to the left side of the main case at the shift lever shaft. It acts as a neutral safety switch and it also tells the TCM the shift lever position. Seven types of positions can be selected according to 5 signals from the Mode Switch. Battery voltage is directed through the Mode Switch (Inhibitor Switch) to the TCM or back-up lamp, and a ground is provided to close the neutral start relay. With the switch disconnected, check for continuity as shown below in Figure 9, and when connected, for voltage at terminal D.

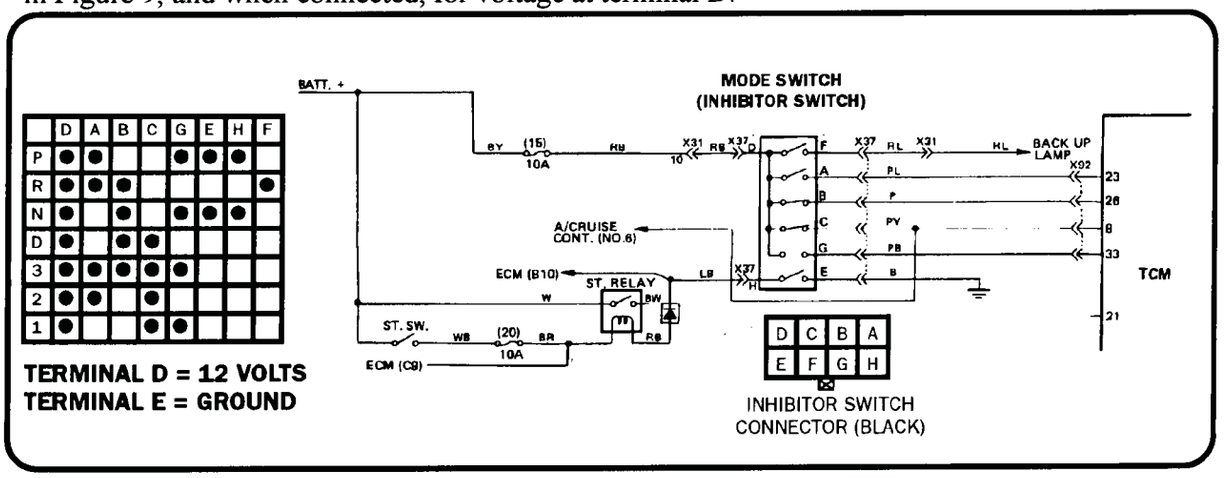


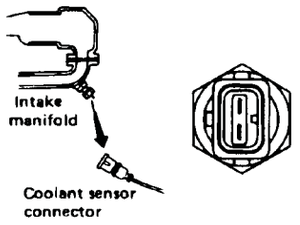
Figure 9.

The **Oil Temperature Sensor** is in the wire harness in the overdrive section of the transmission. It sends a signal to the TCM based on resistance. At 176° F., there is approximately 1.02 volts across terminal C and D with the ignition on and the wire connector connected. If the temperature exceeds 284° F., the resistance across the sensor signal the TCM to dis-able the "Winter Mode".

The **Winter Switch** on the dash board is normally closed. When it is pushed, it opens and signals the TCM to turn on the winter light on the dash and allow 3rd gear starts in "D" range only. This feature is for low traction conditions, and is cancelled automatically by the TCM if the vehicle exceeds 19 mph for more than one second, or the gear shift is moved to "3", "2", or "1".

The **PWR/ECO Switch** is on the dash and it changes the shift pattern from normal, in the economy mode, to higher speed shifts in the power mode. This switch does not operate when the Winter Switch is on.

The **Coolant Temperature Sensor** sends its signal to the TCM through the ECM first. The coolant temperature signal sent to the TCM is figured into the strategy for TCC and overdrive. The variable resistance signal can be checked at the coolant temperature sensor. See Figure 10.



Coolant temperature °C(°F)		Normal resistance KΩ
–10 (14)		7 – 12
10 (50)		3 – 5
20 (68)		2 – 3
50 (122)		0.7 – 1
80 (176)	(warmed)	0.2 – 0.4

Figure 10.

TRANSMISSION INPUTS

The **Throttle Position Sensor** is mounted to the throttle body on the motor. It receives a 5 volt referece signal from the ECM and sends a reurn voltage back to the ECm and TCM that is proportional to throttle openning. It can easliy be cheched with a voltmeter at throttle body. With the ignition on, the signal return voltage should be .5 to .9 volt. As the throttle is opened,the voltage should increase smoothly to about 4.5 volts at wide open throttle. See Figure 7 for throttle position sensor pin identification.

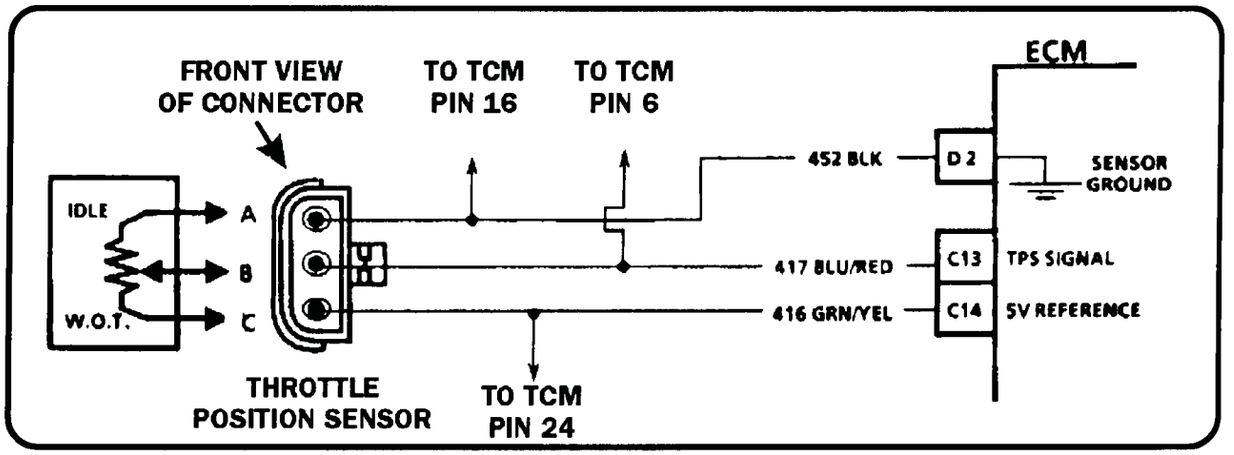


Figure 7.

The **Speed Sensor** is mounted to the transmission extension housing. It is an AC voltage generator that sends a signal to the TCM. The TCM converts the voltage frequency into a usable speed signal. It is best checked with an ohmmeter at the transmission. With the wire connector disconnected, check across the two pins on top of the speed sensor. See Figure 8. The correct reading should be about 3000 ohms at room temperature. Also check to make sure that there is no continuity at all between either pin of the speed sensor and ground.

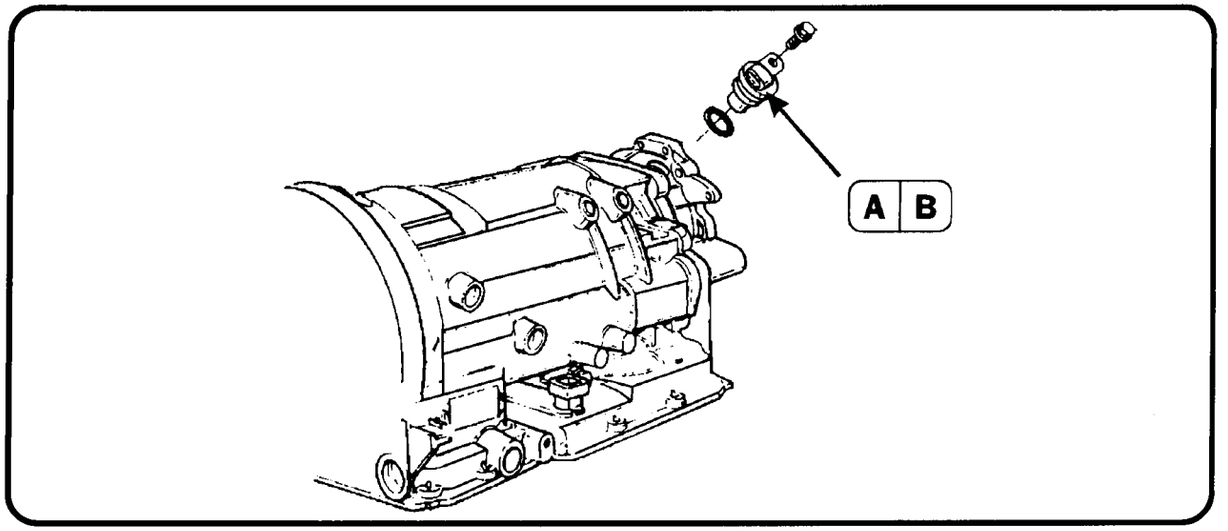


Figure 8.

The **Kickdown Switch** is connected to the accelerator pedal. It is normally open and it should close to ground when the accelerator pedal is fully deppressed. Check it with an ohmmeter.

TCU WIRE SCHEMATIC

The **Transmission Control Unit (TCU)** is seperate from the Engine Control Unit (ECU), but it shares some of the same vehicle information. When checking individual circuits, it is important to correctly identify exact pin location. The wire shematic shown in Figure 11 is for general circuit identification only. Specific pin locations for solenoids, and other sensors are shown in the sections of this chapter that explain those sensors. Pin numbers for the TCM connector can be identified in Figure 4 of this chapter.

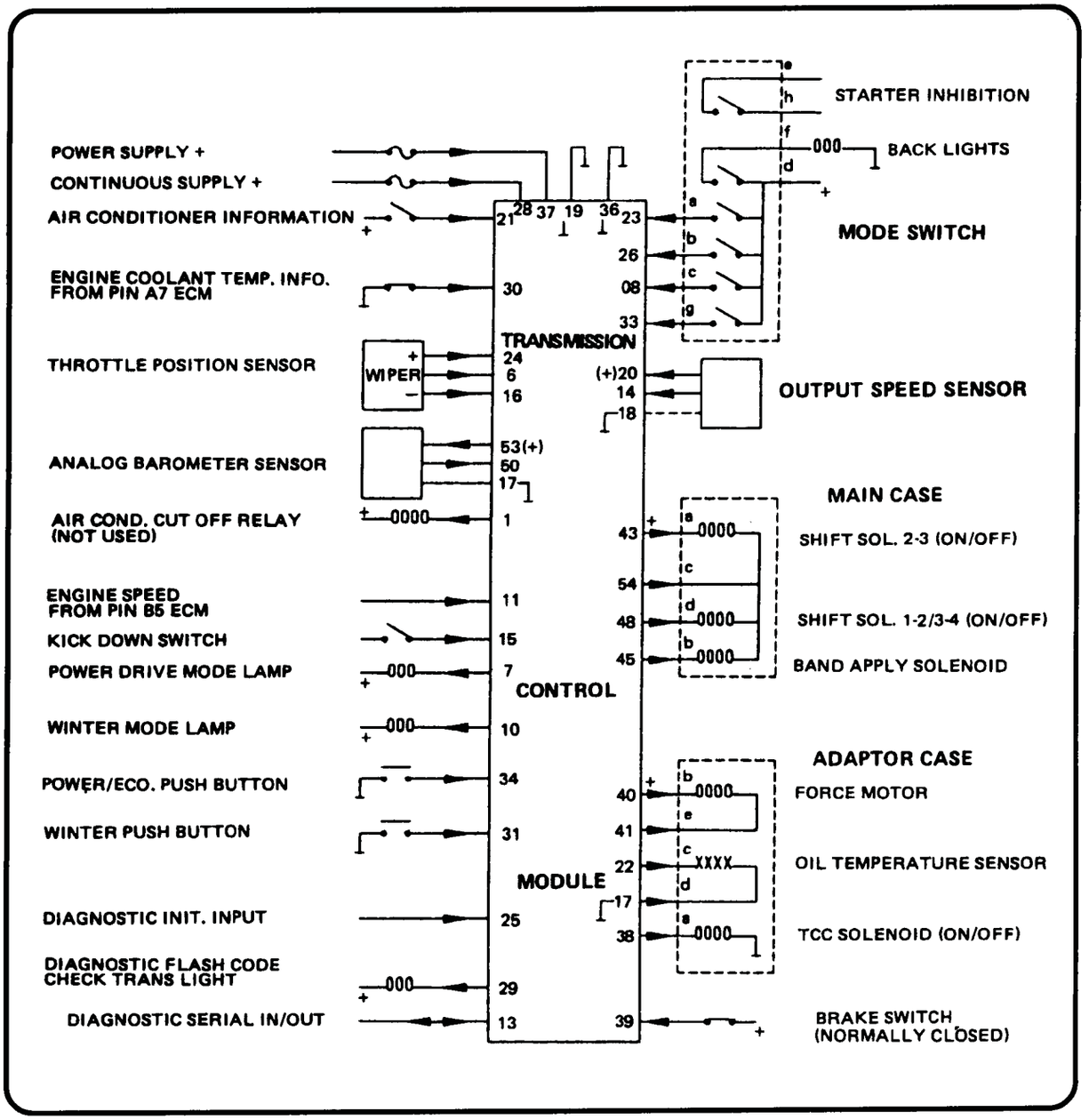
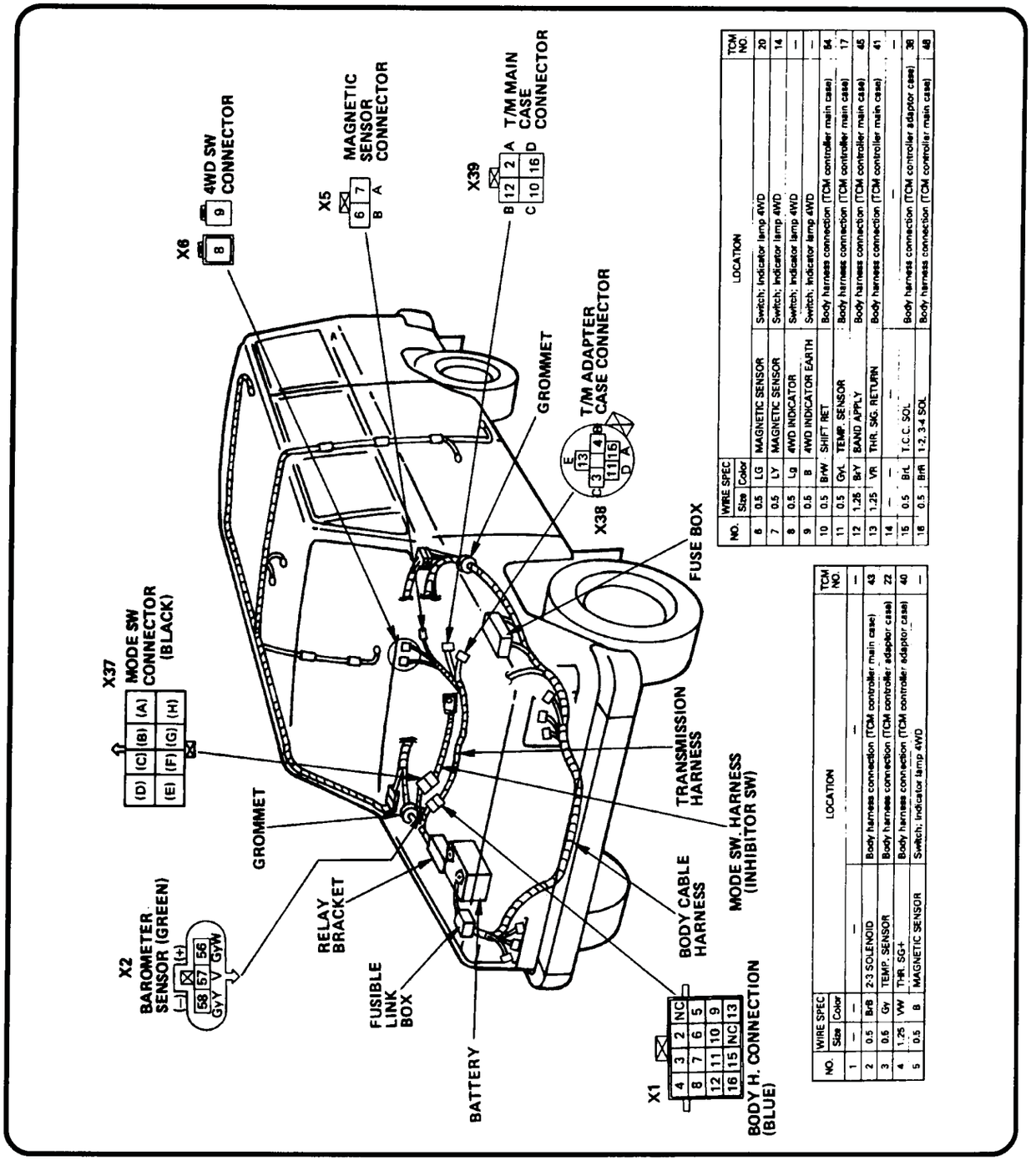


Figure 11.

WIRE CONNECTOR LAYOUT

The wiring harness for the Isuzu Trooper travels across the body from the drivers side where the TCU is located , to the passenger side where the transmission connectors are located. Connecter locations and pin identification for the transmission wiring harness is provided in Figure 12.



NO.	WIRE SPEC Size	WIRE SPEC Color	LOCATION	TCM NO.
6	0.5	LG	MAGNETIC SENSOR	Switch; Indicator lamp 4WD	20
7	0.5	LY	MAGNETIC SENSOR	Switch; Indicator lamp 4WD	14
8	0.5	Lg	4WD INDICATOR	Switch; Indicator lamp 4WD	—
9	0.5	B	4WD INDICATOR EARTH	Switch; Indicator lamp 4WD	—
10	0.5	Br/W	SHIFT RET	Body harness connection (TCM controller main case)	34
11	0.5	Gr/L	TEMP. SENSOR	Body harness connection (TCM controller main case)	17
12	1.25	Br/Y	BAND APPLY	Body harness connection (TCM controller main case)	45
13	1.25	V/R	THR. SIG. RETURN	Body harness connection (TCM controller main case)	41
14	—	—	—	—	—
15	0.5	Br/L	T.C.C. SOL	Body harness connection (TCM controller adaptor case)	36
16	0.5	Br/R	1-2, 3-4 SOL	Body harness connection (TCM controller main case)	48

NO.	WIRE SPEC Size	WIRE SPEC Color	LOCATION	TCM NO.
1	—	—	—	—
2	0.5	Br/B	2-3 SOLENOID	Body harness connection (TCM controller main case)	43
3	0.5	Gr	TEMP. SENSOR	Body harness connection (TCM controller adaptor case)	22
4	1.25	W/	THR. SG+	Body harness connection (TCM controller adaptor case)	40
5	0.5	B	MAGNETIC SENSOR	Switch; Indicator lamp 4WD	—

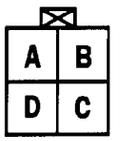
Figure 12.

SHIFT CONTROL

The **Shift Pattern** is controlled electronically with 2 shift solenoids that are located on the mian case valve body. They receive a 12 volt signal and ground from the TCM. The shifting speeds will vary as the TCM interprets numerous electronic signals from the various input sensors. the 2 shift solenoids are the 1-2/3-4 shift solenoid and the 2-3 shift solenoid. The correct operational chart for these solenoids is found in Figure 13.

GEAR / SOLENOID	1-2 / 3-4 SHIFT SOLENOID	2-3 SHIFT SOLENOID
1ST GEAR	OFF	ON
2ND GEAR	ON	ON
3RD GEAR	ON	OFF
4TH GEAR	OFF	OFF

VIEW LOOKING INTO CASE CONNECTOR



(C) 12 VOLTS FROM TCM

(A) GROUND TO 2-3 SOL. FROM TCM

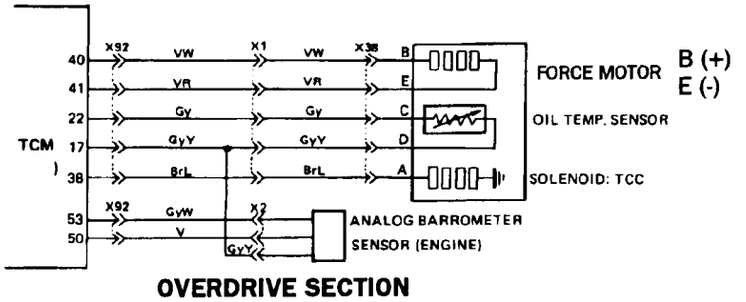
(D) GROUND TO 1-2/3-4 SOL. FROM TCM

Figure 13.

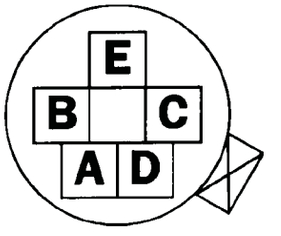
TRANSMISSION SOLENOIDS

The **Force Motor (Pressure Control Solenoid)** is located in the overdrive section of the transmission. It is the "large" solenoid on the passenger side, front of the overdrive section. It recieves a pulse width modulated signal from the TCM. Based primarily on the TPS and Speed Sensor, the TCM varies the signal to the Force Motor. This regulates throttle boost oil to the pressure regulator valve. It can be electically checked at the overdrive case connector. With the connector disconnected, there shoud be 3.7-4.7 ohms or resistance across "B" and "E". See Figure 14.

The **TCC Solenoid** is mounted to the valve body in the overdrive section of the transmission. It is internally grounded and gets a 12 volt signal from the TCM to control torque converter clutch apply. Converter clutch is normally available in 3rd and 4th gear according to vehicle conditions. On some models, if the transmission fluid exeeds 285°F., the TCM will command TCC in 2nd gear. Check the TCC Solenoid with an ohmmeter at the overdrive case connector. With the connector disconnected, there should be 17.5-18.5 ohms of resistance between pin A and ground. See Figure 15.



OVERDRIVE SECTION WIRE SCHEMATIC



VIEW LOOKING INTO CASE CONNECTOR

Figure 14.

TRANSMISSION SOLENOIDS CONTINUED

The **1-2 / 3-4 Shift Solenoid** is located on the outside front of the main valve body. It receives 12 volts from the TCM and also a ground signal from the TCM to complete the circuit. The 1-2 / 3-4 shift solenoid is grounded in 2nd and 3rd gear. This solenoid is normally closed. When it is energized (grounded) by the TCM, it opens and allows drive oil to shift the 1-2 / 3-4 shift valve. The 1-2 / 3-4 shift solenoid can be electrically checked at the main case connector. With the connector disconnected there should be 17.5 - 18.5 ohms of resistance across pins C and D of the case connector. See Figure 15.

The **2-3 Shift Solenoid** is located on the inside front of the main valve body. It receives 12 volts from the TCM and also a ground signal from the TCM to complete the circuit. The 2-3 shift solenoid is grounded in 1st and 2nd gear. This solenoid is normally open. When it is energized (grounded) by the TCM, it closes and prevents drive oil from actuating the 2-3 shift valve. The 2-3 shift solenoid can be electrically checked at the main case connector. With the connector disconnected, there should be 17.5 - 18.5 ohms of resistance across pins A and C of the case connector. See Figure 15.

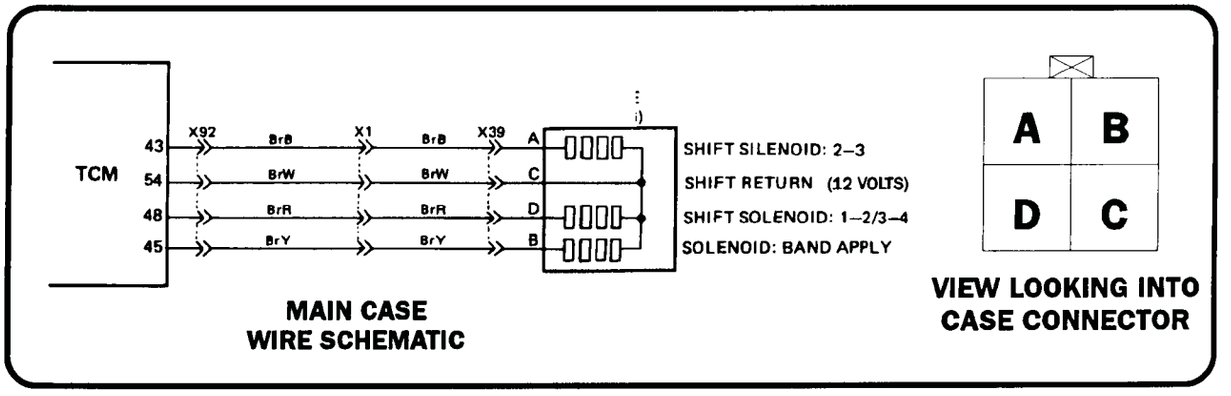


Figure 15.

The **Band Apply Solenoid** is located at the rear of the main valve body. It is a PWM (pulse width modulated) solenoid. It receives 12 volts from the PCM and a variable (pulse width) ground signal from the PCM to control band "feel" during a forced downshift. The stronger the signal from the PCM, the softer the "feel" of the band apply during 3-2 downshifts. The Band Apply Solenoid can be electrically checked at the main case connector. With the connector disconnected, there should be 9.5 - 10.5 ohms of resistance across pins B and C of the case connector. See Figure 15.

JEEP 30-40LE DIAGNOSIS

The Jeep 30-40LE automatic transmission, usually called the AW4, is very similar to the Toyota A340 transmission, but the computer control system is unique to the Jeep alone. It is a four speed automatic transmission with fourth gear being overdrive. It has a torque converter clutch that is electrically controlled by the computer. It can be engaged in 3rd or 4th gear in the drive or 3 range and is available in 2nd gear when the selector is placed in the 1-2 range. If electrical failure occurs in the transmission control system, this transmission will start in 4th gear in the drive range, with 3rd gear available in the 3 range and 1st gear available in the 1-2 range. The 1987-1990 Jeep computer has no ON-BOARD diagnostics. It uses OFF-BOARD diagnostics which means that an external computer in a scan tool can locate and diagnose malfunctions. Electronic diagnosis can only be accomplished with the use of a DRBII scan tool connected to the 6 pin and 15 pin diagnostic plug located under the hood near the firewall on the passenger side.

TRANSMISSION CONTROL UNIT (TCU)

The **TCU(Transmission Control Unit)** is located under the right side of the dash behind the glove compartment. There is an in-line push-in type fuse in the wire harness just before the TCU to provide electrical protection. See Figure 1. It must be checked first if the complaint or failure is "4th gear starts and manual shifts only. This fuse causes many problems and MUST be checked with a volt/ohmmeter because the failure is NOT always visible with the naked eye.

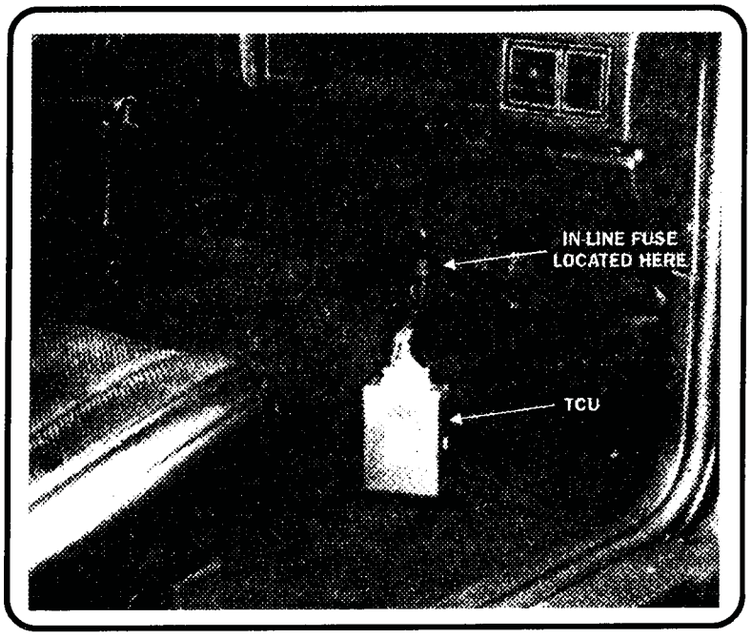
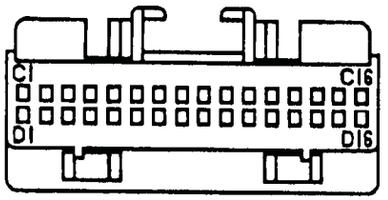


Figure 1.

The TCU connector that plugs into the computer has 32 cavities but not all of them have wires. The cavities that have wires for input information, outputs to the transmission, and diagnosic connector are identified in figure 2. The connector as seen here is viewed from the terminal end , which means that we are looking into the connector AFTER it has been disconnected from the computer(TCU). Each pin is identified as to its function in order to ease diagnosis when pinpoint tests must be made to solve hidden problems.

TRANSMISSION CONTROL UNIT (TCU)



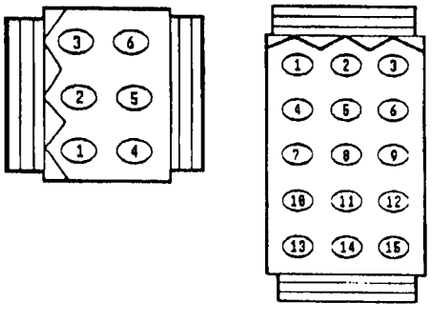
VIEW LOOKING INTO PINS AFTER CONNECTOR IS DISCONNECTED

This information is provided for those shops that have the DRBII tester as well as those shops that do not. The tester hook-up under the hood for the DRBII uses a 6 pin and a 15 pin connector. The pin numbers and their functions are described in Figure 3 below, but you MUST have a DRBII Tester to properly use these connectors to obtain data.

PIN	TERMINAL WIRE COLOR	CONTROL CIRCUIT
C1		
C2		
C3	T9 18TN	ROAD SPEED
C4	137 16YL	TRANS DIAGNOSTIC CONN.
C5	99 18BK	SHIFT LOGIC GROUND
C6		
C7		
C8	T12 18LG	1-2 GEAR INPUT
C9	T7 18VT	D GEAR INPUT
C10	T6 18BL	BRAKE FOR TCC
C11	177 18TN	POWER INPUT SIGNAL
C12		
C13		
C14	T8 18WT	CONVERTER LOCK-UP
C15	T7 18VT	S2 SOLENOID
C16	T6 18BL	S1 SOLENOID
D1	T3 18RD	TPS VOLTAGE SUPPLY
D2	T4 18GY	TPS INPUT
D3	T5 18TN/OR	TPS GROUND
D4		
D5		
D6		
D7		GROUND
D8		
D9		
D10		
D11		
D12		
D13		
D14	10 16RD	BATTERY
D15		
D16	11 18YL	IGNITION

Figure 2.

CAV	DIAGNOSTIC CONNECTOR #1	
1	30 18GN	TACHOMETER
1	30 18GN	TACHOMETER
2	11 14YL	I-1 IGNITION SWITCH
3	99 20BK	ECU GROUND
4	88 14GN	START SIGNAL (-)
5	10 14RD	BATTERY
6	F22 14OR	FUEL PUMP RELAY



CAV	DIAGNOSTIC CONNECTOR #2	
1	136 18PK	UPSHIFT LAMP - MANUAL
1	136 18PK	ECU SERIAL DATA - AUTO
2	F20 20BK	B+ LATCH - COIL GROUND
2	F20 20BK	B+ LATCH - COIL GROUND
3	34 18BK	PARK/NEUTRAL AUTO
3	34 18BK	ECU SERIAL DATA - MANUAL
4	F21 14PK	B+ LATCH-RELAY - COIL FEED
5	-	-
6	F34 20GY/BK	WIDE OPEN THROTTLE SWITCH
6	F34 20GY/BK	WIDE OPEN THROTTLE SWITCH
7	99 18BK	SYSTEM GROUND
8	F7 18TN	AIR TEMPERATURE SENSOR
8	F7 18TN	AIR TEMPERATURE SENSOR
9	F26 20OR	IGNITION TIMING
9	F26 20OR	IGNITION TIMING
10	F18 14BL	EGR PURGE SOLENOID
11	F4 18LG	ISA - EXTENDED
11	F4 18LG	ISA - EXTENDED
12	F24 18TN	COOLANT TEMPERATURE SENSOR
12	F24 18TN	COOLANT TEMPERATURE SENSOR
13	F12 18GY	ISA - CLOSED THROTTLE SWITCH
13	F12 18GY	ISA - CLOSED THROTTLE SWITCH
14	F3 18BR	ISA - RETRACT
14	F3 18BR	ISA - RETRACT
15	-	-

Figure 3

TRANSMISSION CONTROL UNIT (TCU)

As a system overview, a basic electrical diagram is shown in Figure 4. It shows the relationships of the TCU wiring to the vehicle and to the transmission solenoids. There are connectors between the different sensors, solenoids, switches, and the TCU, but they are not shown here.

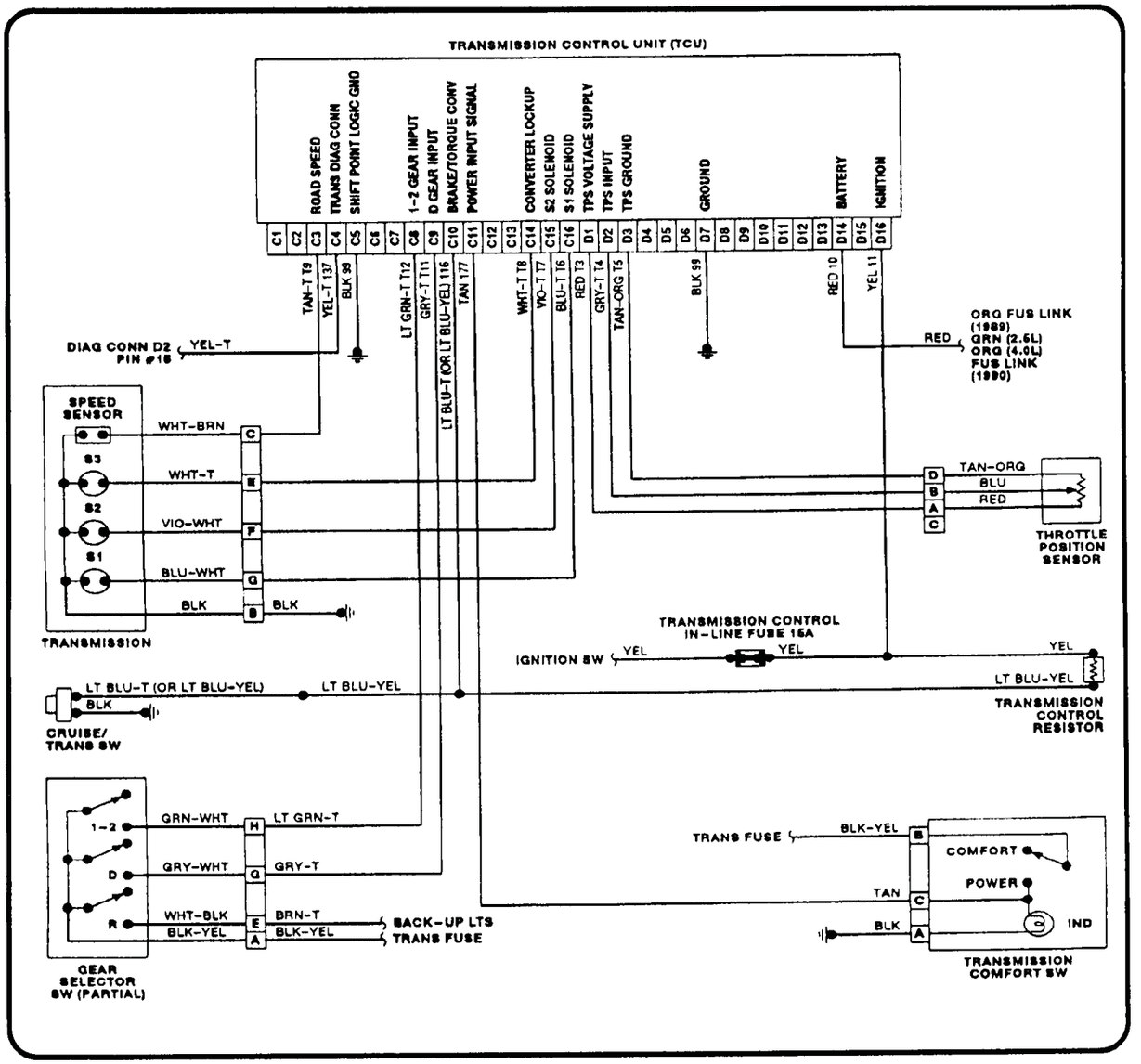


Figure 4.

TRANSMISSION INPUTS

The **Throttle Position Sensor** is located on the throttle body. See Figure 5. It senses throttle position, or engine load, and sends this information to the TCU in the form of a variable return voltage. There are two connectors at the throttle position sensor. One is for the ECU (Engine Control Unit) and one is for the TCU. It can be checked with either a voltmeter or an ohmmeter, but it seems that the voltmeter check is easiest. With the key on and the throttle position sensor connected, probe into the connector. There should be about 5 volts sent to the TPS. See Figure 6. The signal return wire should show slightly less voltage than that sent to the TPS. This voltage should drop smoothly as the throttle is opened. At full throttle there should be less than 1 volt at the signal return wire.

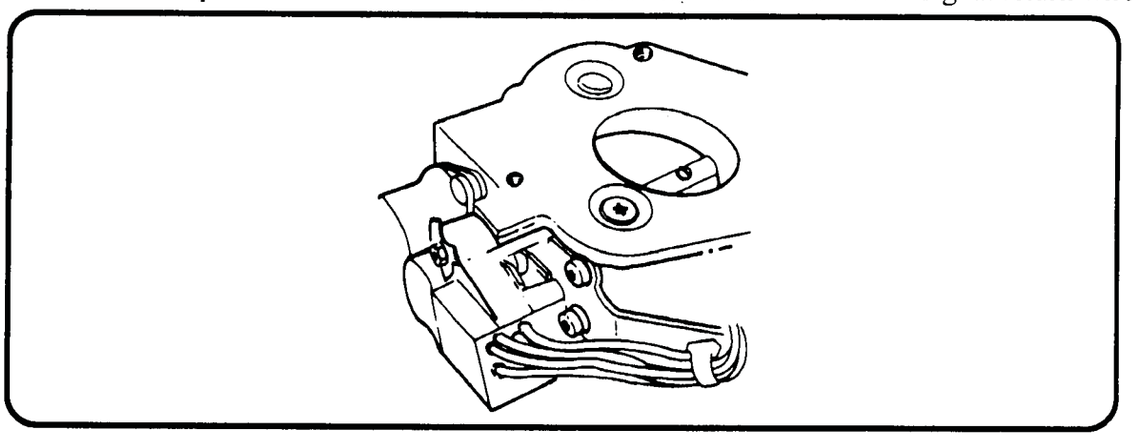


Figure 5.

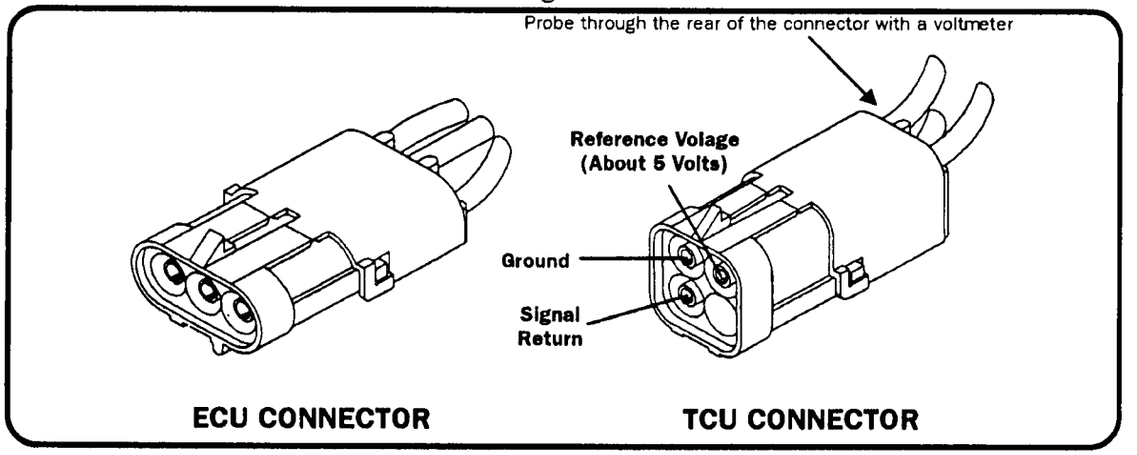
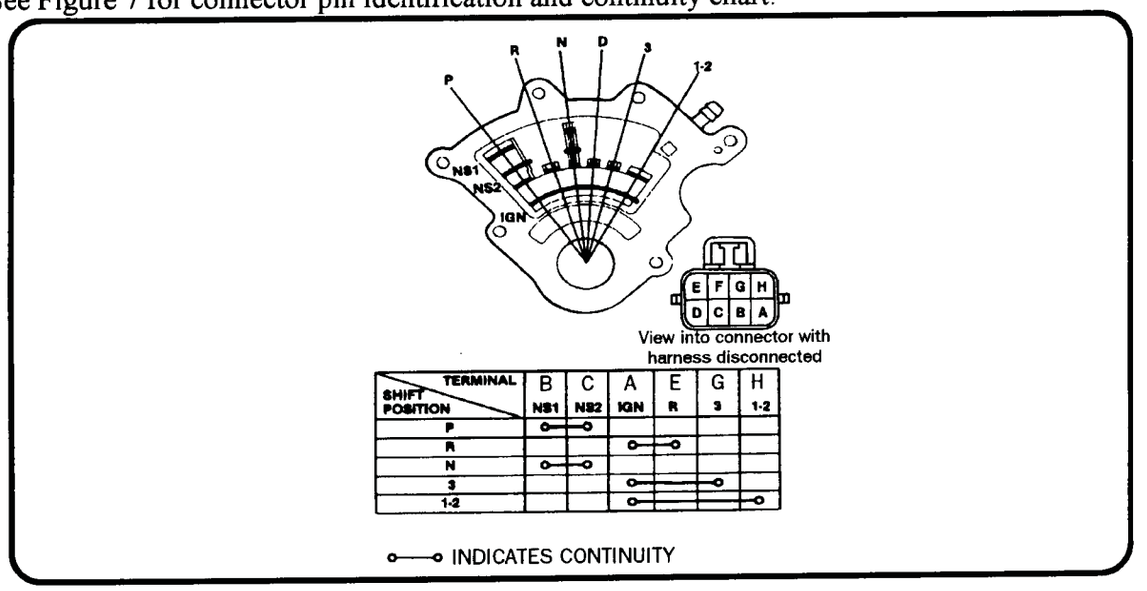


Figure 6.

The **Neutral Start Switch** is mounted to the right side of the transmission. Besides allowing the engine to start only in parkor neutral and operating the back-up lights, it provides electrical inputs to the TCU. Electrical contacts are provided within the switch for each gear selector range except D which is not used. The shift positions that are used as input to the TCUare 1-2 ND 3. If the drivers selects either of these positions,the contacts inside the switch signal the TCU to prevent upshifts beyond these ranges or to allow the transmission to downshift into 1st,2nd or 3rd gear. For example if the driver selects 3, the transmission will upshift 1-2-3 and downshift 3-2-1. A safety system within the TCU will not allow the transmission to obtain 1st gear until the vehicle speed drops below approximately 30mph even though the driver has selected the 1-2 range. This helps prevent engine damage.

TRANSMISSION INPUTS CONTINUED

This switch can be checked at the TCU or at the wire harness connector. It is most easily checked by disconnecting the 8 pin wire connector and checking each range for continuity with an ohmmeter. See Figure 7 for connector pin identification and continuity chart.



SHIFT POSITION \ TERMINAL	B NS1	C NS2	A IGN	E R	G 3	H 1-2
P	○—○					
R			○—○			
N	○—○					
3			○	———	○	
1-2			○			○

Figure 7.

The **Speed Sensor** is located on the left rear of the transmission. the sensor senses transmission output shaft speed and sends the information to the TCU. There is a rotor with a built in magnet attached to the output shaft and when the magnet passes the sensor as it rotates, it momentarily causes the reed switch in the speed sensor to close and then open again. The TCU "counts" the number of times that the reed switch closes and can accurately calculate vehicle speed. It can be checked with an ohmmeter and it should alternately show continuity and discontinuity as the output shaft is turned. See Figure 8.

Note; If the speed sensor fails, the transmission will NOT upshift.out of 1st gear.

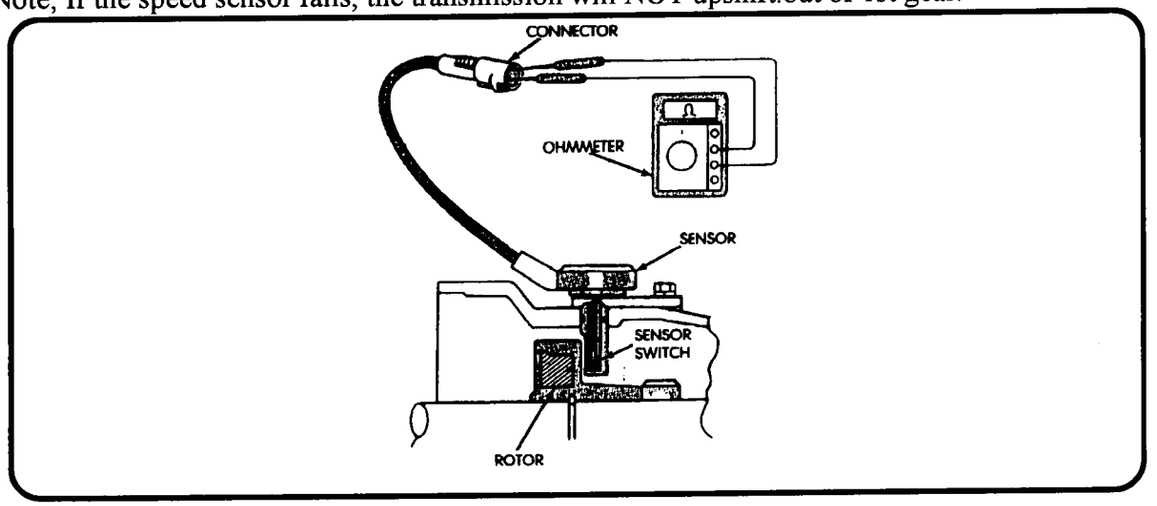
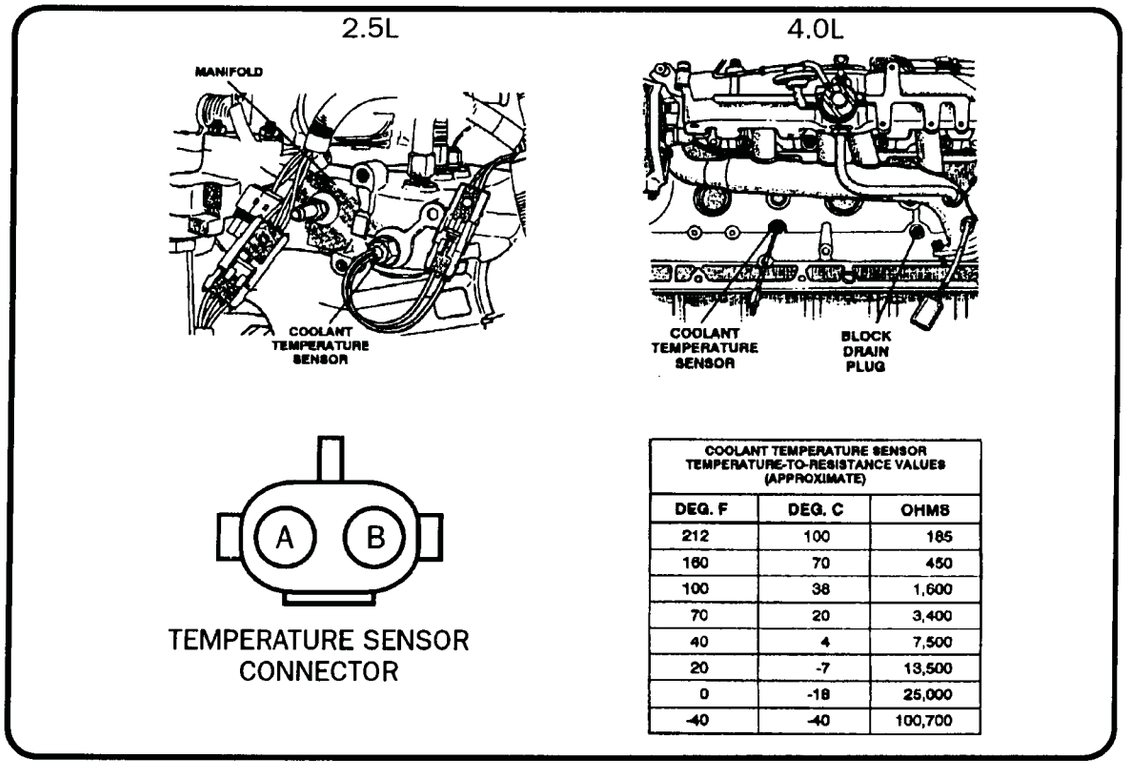


Figure 8.

TRANSMISSION INPUTS CONTINUED

The **Comfort/Power Switch** allows the driver to select from 2 possible shifting patterns or strategies. In the "COMFORT" mode, the transmission will upshift and downshift at its normal points, which results in the best fuel conservation. No voltage is applied to the TCU "pattern select" circuit in this position. In the "POWER" mode, the transmission will upshift at higher engine RPM(under hard acceleration) and will also downshift quickly. An indicator light illuminates when the switch is in the "POWER" position. In this position, the switch allows battery voltage to be applied to the TCU "pattern select" switch. The pattern select circuit is shown in the TCU schematic in Figure 4.

The **Temperature Sensor** is located on or under the manifold depending upon engine size. It has a 2-wire connector and it tells the Engine Control Unit how warm the engine is. This information is relayed to the diagnostis connector and it indirectly affects shifting through the shift logic ground terminal at the TCU. It can be checked with an ohmmeter. See Figure 9 for temperature sensor location and ohms readings according to temperature.



COOLANT TEMPERATURE SENSOR TEMPERATURE-TO-RESISTANCE VALUES (APPROXIMATE)

DEG. F	DEG. C	OHMS
212	100	185
160	70	450
100	38	1,600
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

Figure 9.

The **Brake Switch** sends a signal to the TCU so that torque converter clutch will be released whenever the brakes are applied. This will prevent engine stalling in the event that the wheels are locked during braking.

TCU OUTPUTS

The **Shift Solenoids** and the **TCC Solenoid** are mounted to the valve body and are activated by voltage sent from the TCU. Although the solenoids appear to be the same, they operate differently. Solenoids No.1.and 2. are normally closed and they open when electrically energized. Solenoid No.3. (TCC Solenoid)is normally open and it closes when it is electrically energized. See Figure 10. for each solenoid location.

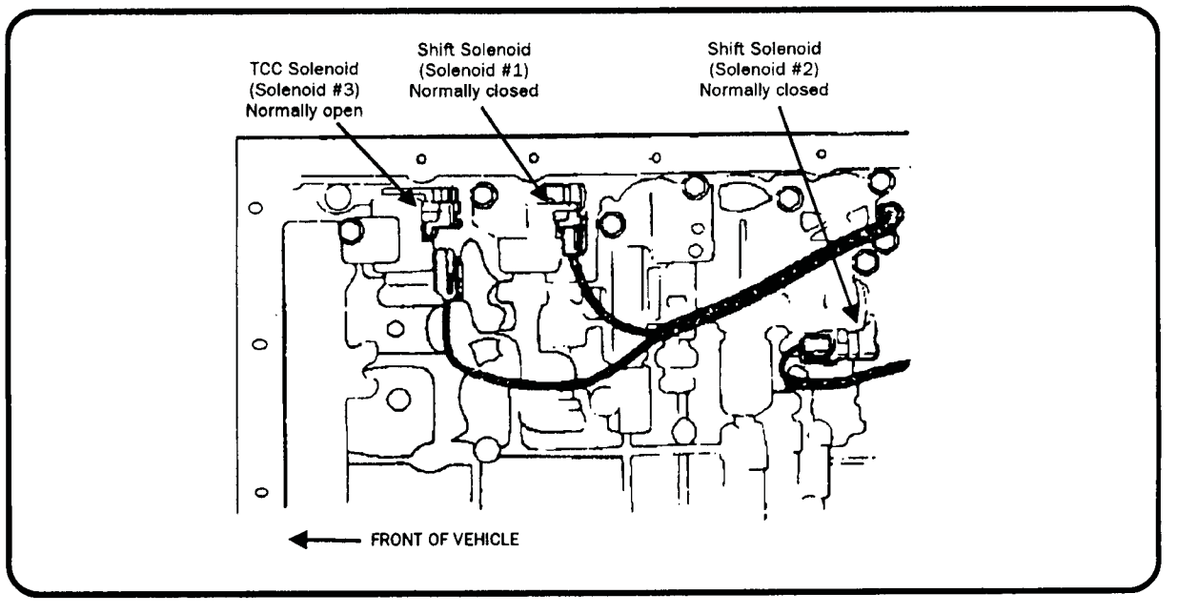
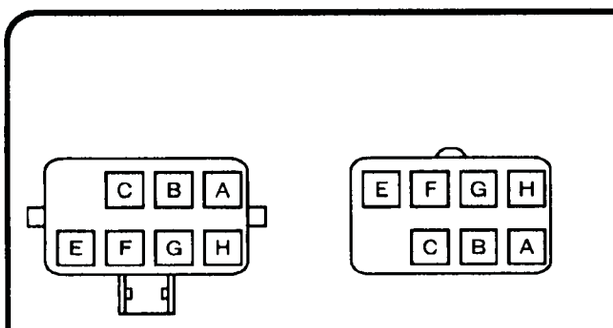


Figure 10.

If you are not sure if there is an electrical malfunction or not, the transmission solenoids may be energized independantly of the computer in order to check the transmission's shifting. To shift the transmission manually, energize the Solenoids with battery voltage according to the chart shown in figure 11.



	G	F	E
USUAL COLOR	WHITE	BLACK	YELLOW
GEAR	SOLENOID 1	SOLENOID 2	LOCKUP SOL
1st	ON	OFF	OFF
2nd	ON	ON	ON*
3rd	OFF	ON	ON*
4th	OFF	OFF	ON*
OHMS	11 - 15	11 - 15	11 - 15

* - AS DETERMINED BY COMPUTER

Figure 11

JEEP 30-40LE 1991-UP

The transmission control system on the 1991 and later Jeep with the 30-40LE (AW4) uses a TCU (Transmission Control Unit) that has a built in self-diagnostic system which can be accessed through a diagnostic connector. On Cherokee and Comanche, the diagnostic connector is located below the glove box on the passenger side. On Grand Cherokee models, the diagnostic connector and CCD bus-link is located near the steering column. See Figure 1 for diagnostic terminal identification.

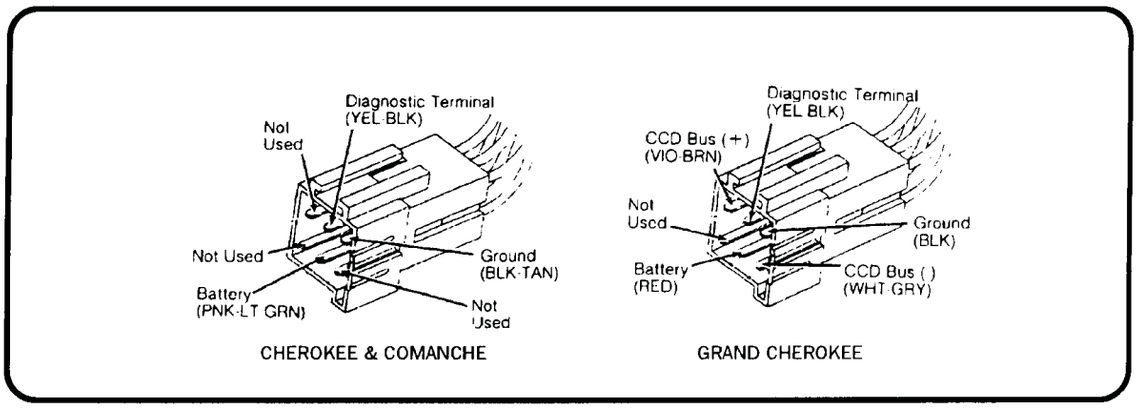


Figure 1.

This electronic system will store trouble codes if certain faults exist. These fault codes can be retrieved through the diagnostic connector with a hand held scanner with the proper cartridge and connector adapter. There are a total of 7 codes that can be set by the TCU. The chart below lists the possible trouble codes and their meaning.

FAULT CODE	PROBLEM AREA
700	Valve Body Solenoid
701	Power/Comfort Switch (91 only)
702	Speed Sensor
703	Gear Selector Switch
704	Throttle Position Sensor
705	Brake Switch
706	Wrong TCU

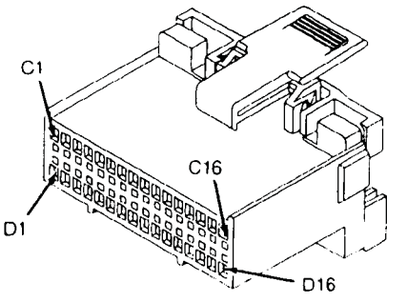
Note: Code 700 may refer to either Solenoid 1, 2, or 3.

Some hand held scanners and manuals use body code designations rather than model name when referring to specific diagnostic routines. The translation for model name to body codes:

Vehicle Model	Body Code
Cherokee	XJ
Comanche	MJ
Grand Cheroke	ZJ

TRANSMISSION CONTROL UNIT (TCU)

The Transmission Control Unit is completely different starting in 1991. Although the transmission is the same, some of the inputs have changed. There is also a difference in the TCU's from Grand Cherokee to Cherokee and Comanche. The TCU connector is the same for all models, but the pin usage has variations. For TCU connector pin identification, see Figure 2.



TCU CONNECTOR

CHEROKEE & COMANCHE

CAV	CIRCUIT	FUNCTION
C1-C2		Not Used
C3	505 TN/WT	Trans Speed Sensor
C4	137 YL/BK	Auto Trans Diagnostic
C5-C7		Not Used
C8	506 LG/BK	Low (1-2) Input
C9	507 GY/BK	Drive (3) Input
C10	K29 WT/PK	Brake Input
C11	177 TN	①
C12-C13		Not Used
C14	508 WT/BK	S3 Solenoid (Converter Lockup)
C15	509 VT/WT	S2 Solenoid
C16	510 DB/WT	S1 Solenoid
D1		Not Used
D2	K22 OR/DB	Throttle Position Sensor
D3	K4 BK/LB	TPS Signal Ground
D4-D6		Not Used
D7	Z12 BK/TN	Power Ground
D8-D13		Not Used
D14	A14 RD	Battery
D15		Not Used
D16	T17 YL	Ignition (Run/On)

GRAND CHEROKEE

CAV	CIRCUIT	FUNCTION
C1-C2		Not Used
C3	T14 LG/WT	Trans Speed Sensor
C4	D82 BK/YL	Auto Trans Diagnostic
C5-C7		Not Used
C8	T25 LG	Low (1-2) Input
C9	T50 DG	Drive (3) Input
C10	L53 BR	Brake Input
C11-C13		Not Used
C14	T20 LB/BR	S3 Solenoid (Converter Lockup)
C15	T59 PK	S2 Solenoid
C16	T60 BR/YL	S1 Solenoid
D1		Not Used
D2	K22 OR/DB	Throttle Position Sensor
D3	K4 BK/LB	TPS Signal Ground
D4-D6		Not Used
D7	Z1 BK	Power Ground
D8-D13		Not Used
D14	A5 RD	Battery
D15		Not Used
D16	F86 LB/RD	Ignition (Run/On)

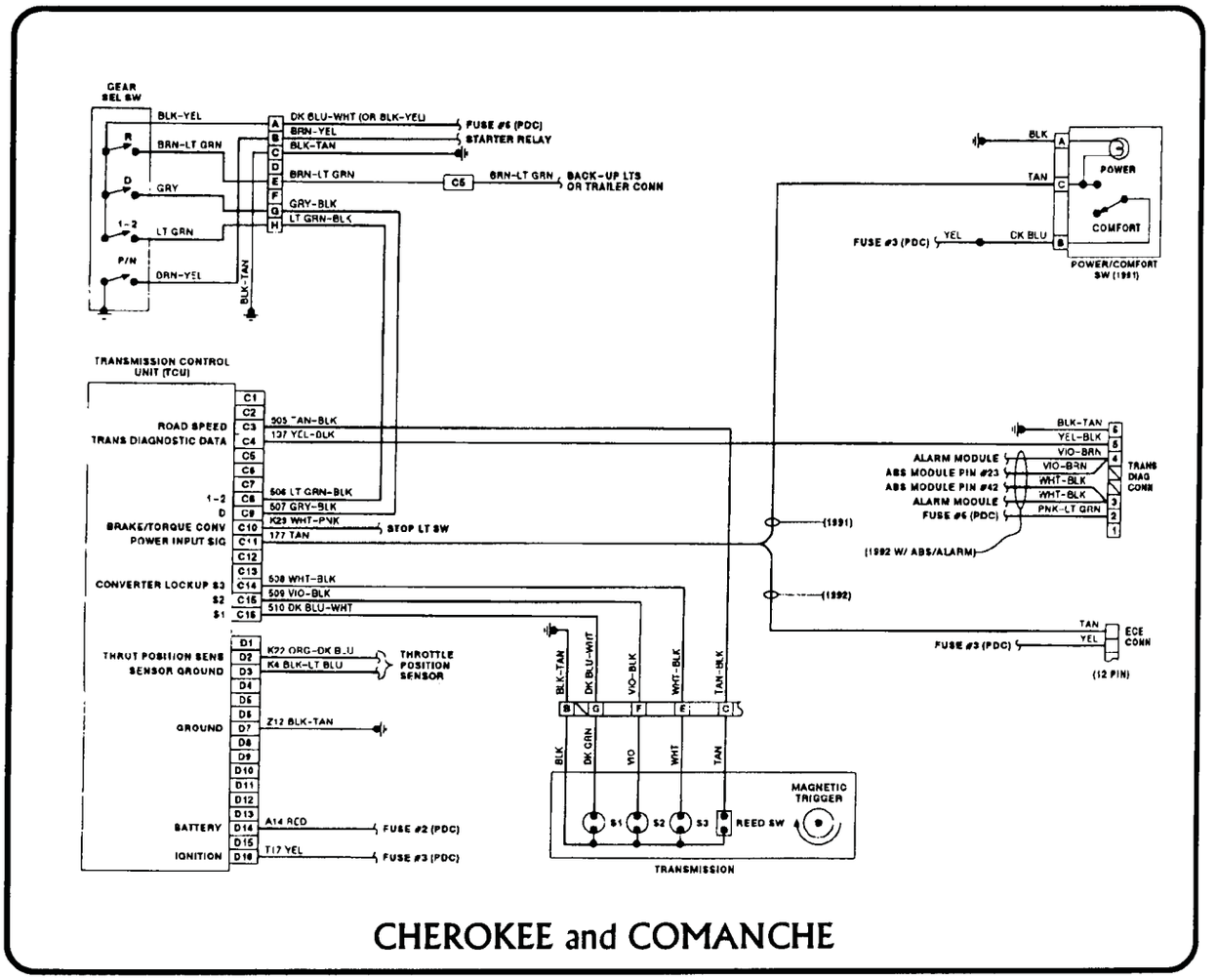
① **Goes to power/comfort switch on 1991 models only.**

Figure 2.

TCU CONTINUED

An overview of of the electrical system is provided for both the Cherokee/Comanche and the Grand Cherokee. The electrical schematics are simplified so that only Transmission related components are identified. Wire colors are for the 1991-1992 model years.

The TCU for the Cherokee and the Comanchee is located behind the right side of the instrument panel. The electrical schematic is shown in Figure 3.

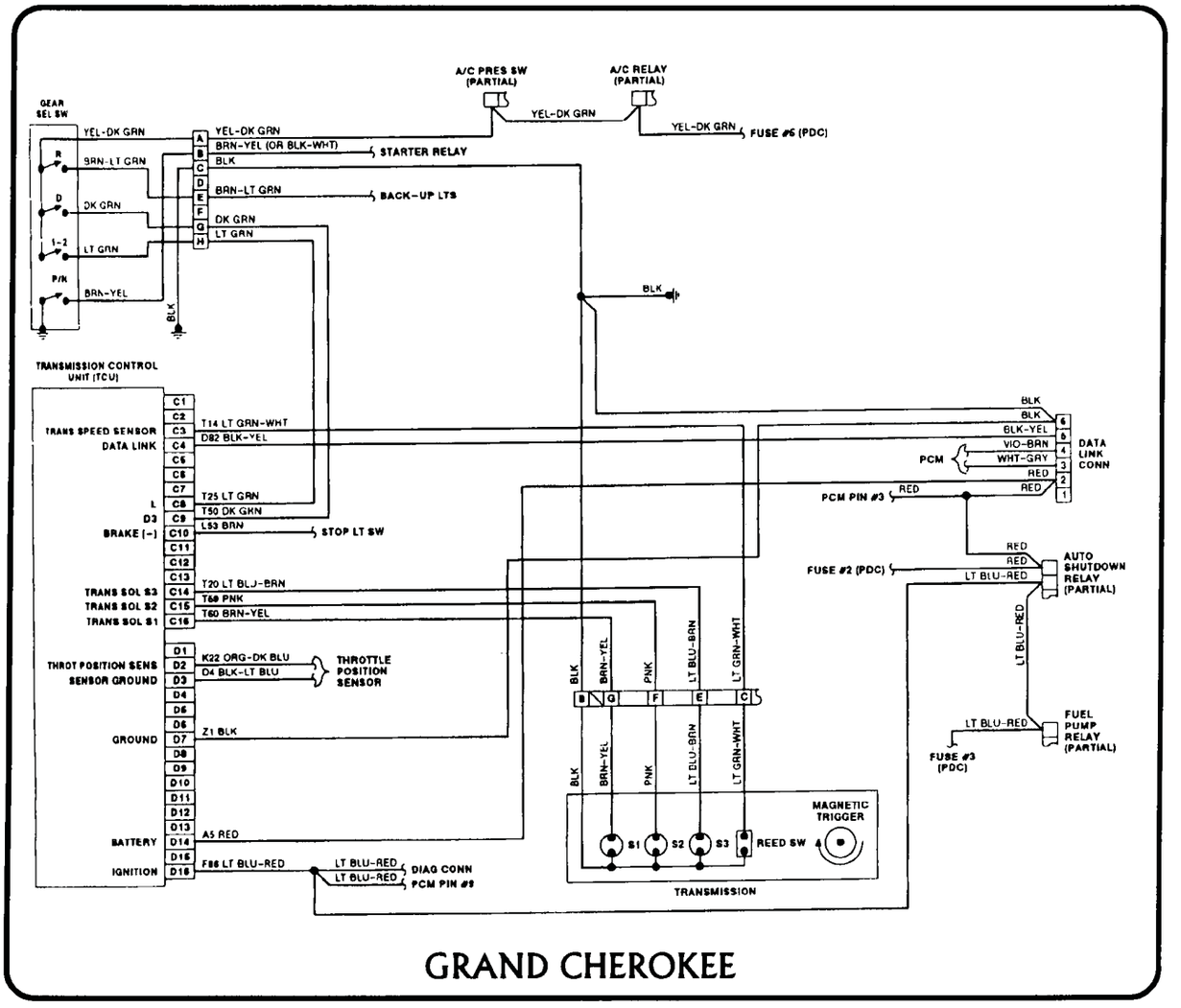


CHEROKEE and COMANCHE

Figure 3.

TCU CONTINUED

The TCU for the Grand Cherokee is located above the steering column or on top left side of the instrument panel, near the steering column. If removal is necessary, the hold down plate must be unbolted from the engine side of the firewall. The electrical schematic is shown in Figure 4.



GRAND CHEROKEE

Figure 4.

TCU INPUTS

The **Throttle Position Sensor** has one three wire connector which sends throttle information to both the ECU (Engine Control Unit) and the TCU (Transmission Control Unit).

The first wire receives a reference voltage of about 5 volts from the ECU (violet / white wire).

The middle wire then sends a variable voltage back to both the ECU and to the TCU (red / dark blue or orange /dark blue wire). Unlike the earlier Jeeps however, the return voltage is **Low** (less than .5 volt) at **Idle**, and rises with throttle opening to about **5 volts** at **Wide Open Throttle**.

The third wire is the TPS signal ground (black/light blue wire). For the location of the throttle position sensor and connector identification. See Figure 5.

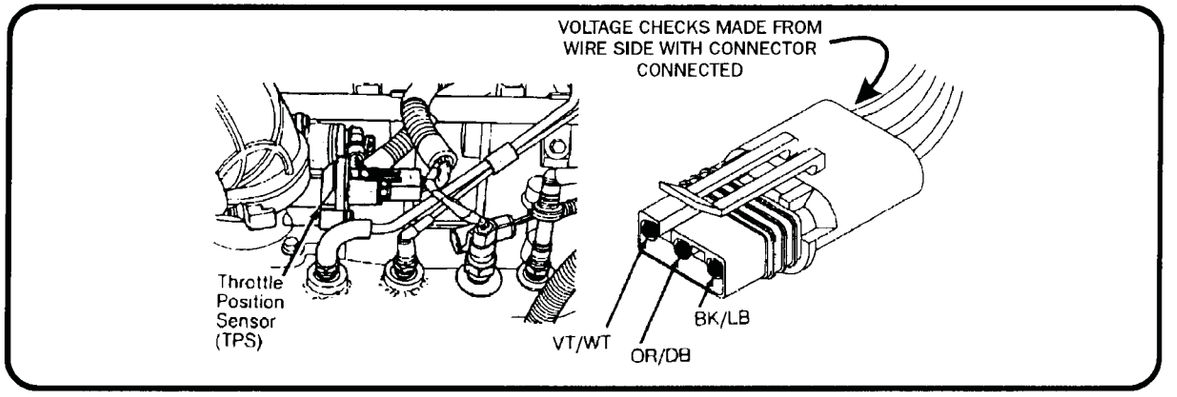


Figure 5.

The **Gear Select Switch** is mounted to the right side of the transmission. Besides allowing the engine to start only in parkor neutral and operating the back-up lights, it provides electrical inputs to the TCU. Electrical contacts are provided within the switch for each gear selector range except D which is not used. The shift positions that are used as input to the TCU are 1-2 ND 3. If the drivers selects either of these positions,the contacts inside the switch signal the TCU to prevent upshifts beyond these ranges or to allow the transmission to downshift into 1st,2nd or 3rd gear. For example if the driver selects 3, the transmission will upshift 1-2-3 and downshift 3-2-1. A safety system within the TCU will not allow the transmission to obtain 1st gear until the vehicle speed drops below approximately 30mph even though the driver has selected the 1-2 range. The gear select switch can be checked at the TCU or at the black 8-pin connector that connects the gear select switch to the body wiring harness. With the connector disconnected, check for continuity as shown in Figure 6.

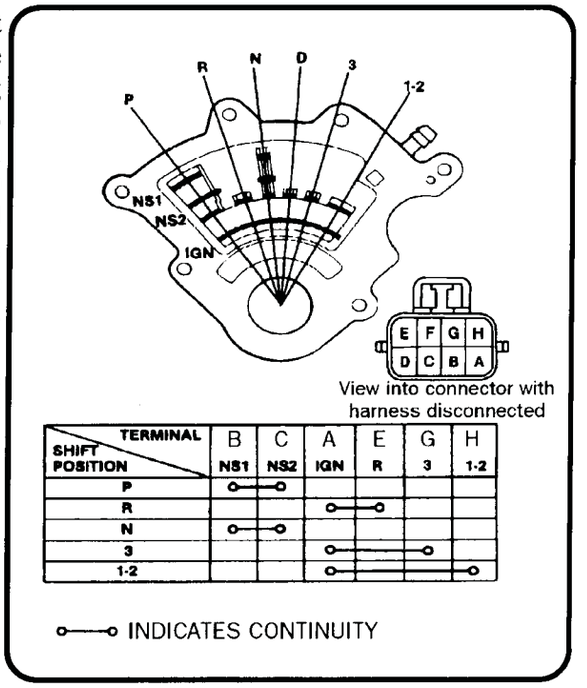


Figure 6.

TCU OUPUTS

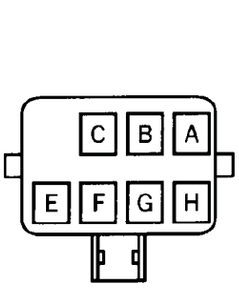
The **Shift Solenoids** and the **TCC Solenoid** operate the same as in the earlier Jeeps and can be checked or energized the same way to test transmission operation. The wire colors have changed at the 7-pin connector and can be identified as follows:

Shift Solenoid #1 wire is Dark Green on Cherokee and Brown/Yellow on Grand Cherokee.

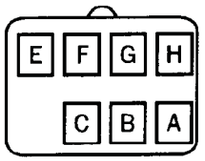
Shift Solenoid #2 wire is Violet on Cherokee and Pink on Grand Cherokee.

TCC Solenoid wire is White on Cherokee and Lt. Green/White on Grand Cherokee.

The 7-pin connector is the same for all models. Pin identification and solenoid operation chartcan be found in Figure 7. With the 7-pin connector disconnected, the solenoids can be checked with an ohmmeter to ground. The resistance for all of the solenoids is the same, and should be between 11 and 15 ohms.



TRANSMISSION 7-WAY CONNECTOR SIDE



TRANSMISSION 7-WAY CONNECTOR HARNESS SIDE

	G	F	E
USUAL COLOR	SEE ABOVE LIST		
GEAR	SOLENOID 1	SOLENOID 2	LOCKUP SOL
1st	ON	OFF	OFF
2nd	ON	ON	ON*
3rd	OFF	ON	ON*
4th	OFF	OFF	ON*
OHMS	11 - 15	11 - 15	11 - 15

* - AS DETERMINED BY COMPUTER

Figure 7.

On the valve body, the solenoids can be Identified in Figure 8. Solenoid # 1 and Solenoid #2 are normally closed solenoids, while Solenoid #3 is a normally open solenoid.

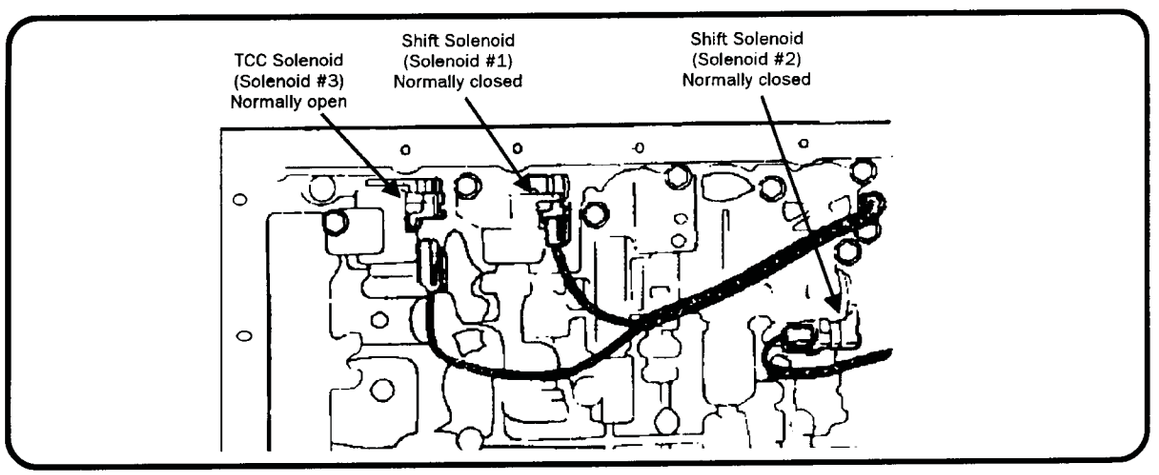


Figure 8.

N4AEL ELECTRICAL DIAGNOSIS

The Mazda 929 Series and the RX7 use an electronically controlled version of the Jatco rear drive 4 speed transmission. It uses 4 solenoids on the valve body to control shifting and 1 solenoid on the overdrive housing to control torque converter clutch. Pressure control is achieved with a conventional modulator, but all solenoids and shifts are controlled by the EC-AT Control Unit. Diagnosing electrical malfunctions can be tricky unless nornmal operation is understood. Computer shift strategy, or shift pattern determination, can be varied according to the Mode switch and the Hold Mode switch. These switches are explained further on in this chapter. This transmission will start in 4th gear if no electrical current is sent to the solenoids. A flashing "Hold" light on the dash is an indication that trouble codes are present. If an electrical malfunction occurs, trouble codes may be retrieved at the check connector located under the hood by using a hand held scanner or an EC-AT Tester.

Looking at a system overview for electrical component locations makes diagnosis faster and simpler. Figure 1 shows interior electrical component locations for the 929 models from 1988 - 1991. Note that the EC-AT Control Unit is smaller than the Engine control unit that is next to it. A small steel plate on the floor must be removed to access the control units. Figure 2 shows "under the hood" electrical component locations for all 929 models. The check connector, near the battery, has a blue 6 pin and a blue 1 pin connector. RX7 models are simliar.

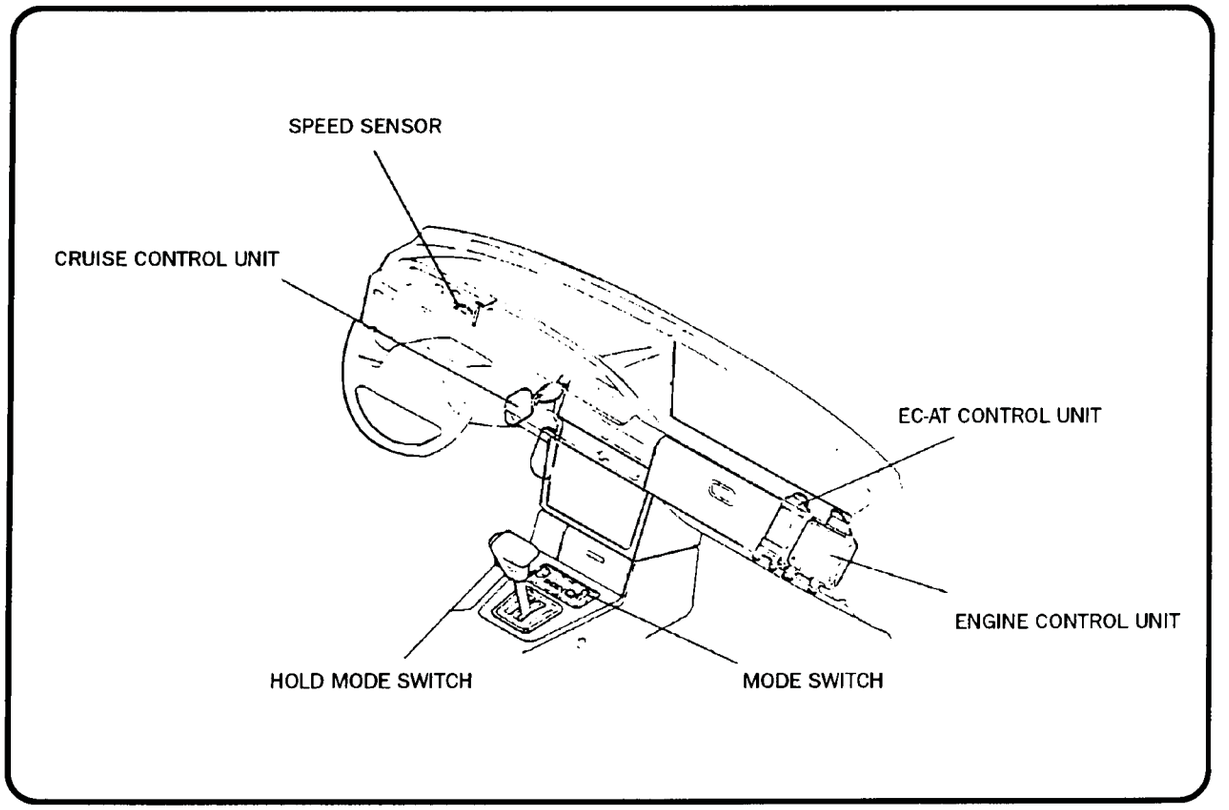


Figure 1.

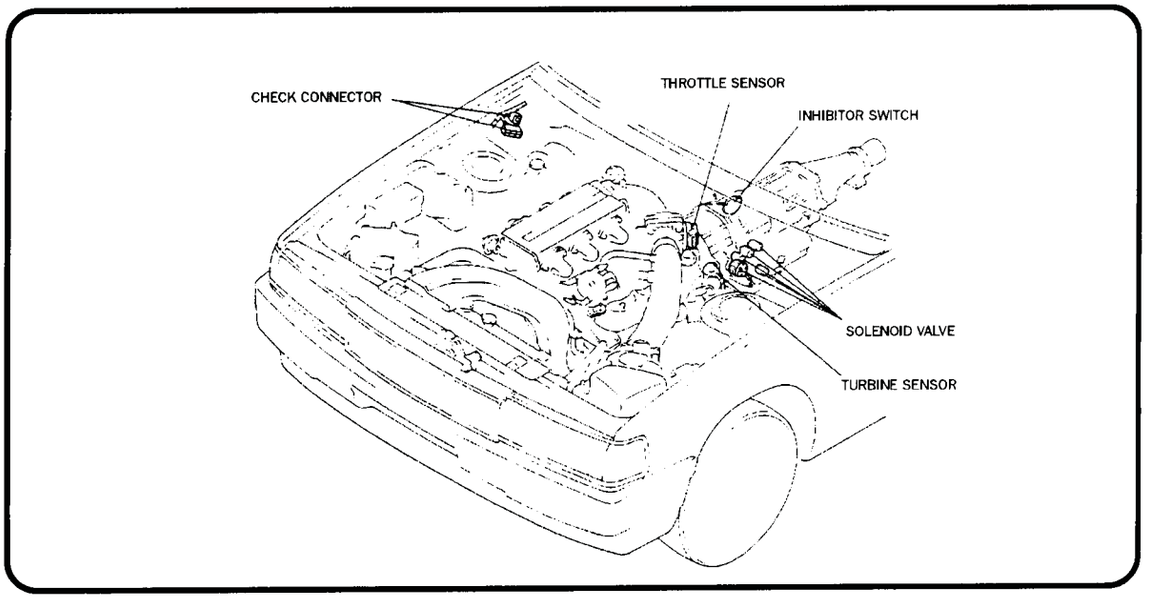


Figure 2.

The Electronic system is composed of three sensors (Speed Sensor, Turbine Sensor, and Throttle Sensor) and five Switches (Engine No-load Switch, Inhibitor Switch, Mode Switch, Hold Switch, and Cruise Control Switch) which provide input data. Also there are five solenoids (1-2 Shift Solenoid, 2-3 Shift Solenoid, 3-4 Shift Solenoid, Lockup Control Solenoid, and 3-2 Control Solenoid) and the Hold Indicator which are output components.

EC-AT CONTROL UNIT

The **EC-AT Control Unit** has a 20 pin connector and a 16 pin connector going to it. When checking solenoids, switches, sensors, and wiring, it is sometimes necessary to test the voltage readings at the Control Unit. Figures 4 and 5 identify the EC-AT connector pins, as viewed from the wire side, and show voltage checks that can be made. The conditions necessary for the voltage tests are shown on the right side of the charts. When making these voltage checks, the plastic wire plugs must be removed from the back of the connectors. To do this, first remove the connectors from the EC-AT Control Unit. Next squeeze the ends of the plastic plugs, (1) in Figure 3 and remove the plugs. Now the connectors can be re-installed into the EC-AT Control Unit so that the voltage checks can be performed.

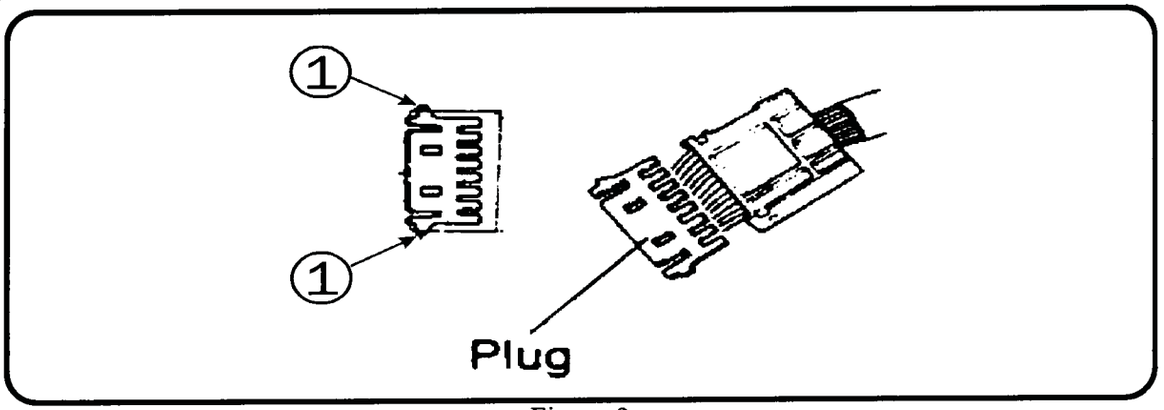


Figure 3.

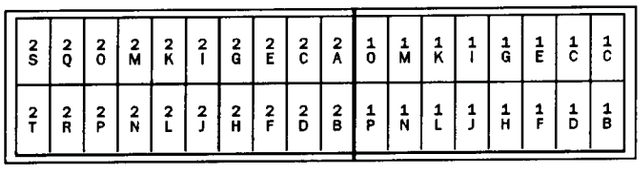
TRANSMISSION CONTROL UNIT (TCU)

TERMINAL	CONNECTED TO	VOLTAGE	CONDITION
1A (OUTPUT)	MODE INDICATOR	APPROX. 12V	HOLD MODE
		BELOW 1.5V	POWER OR ECONOMY MODE
1B (INPUT)	HOLD INDICATOR	BELOW 1.5V	HOLD MODE
		APPROX. 12V	OTHER MODES
1C (OUTPUT)	EC-AT TESTER (MALFUNCTION CODE)	APPROX. 12V	NORMAL
		BELOW 1.5V OR APPROX. 12V FLUCTUATING	IF MALFUNCTION PRESENT
		CODE SIGNAL	SELF-DIAGNOSIS CHECK CONNECTOR GROUNDED
1E (INPUT)	EC-AT CHECK CONNECTOR	APPROX. 12V	———
1H (INPUT)	HOLD SWITCH	APPROX. 12V	SWITCH DEPRESSED
		BELOW 1.5V	SWITCH RELEASED
1I (INPUT)	MODE SWITCH (ECONOMY SIDE)	BELOW 1.5V	ECONOMY SWITCH DEPRESSED (ECONOMY MODE)
		APPROX. 12V	POWER SWITCH DEPRESSED OR HOLD MODE
1J (GROUND)	ENGINE GROUND	BELOW 1.5V	———
1M (INPUT)	CRUISE CONTROL INPUT	BELOW 1.5V	SET OR RESUME SWITCH ON, OR VEHICLE SPEED 3km/h (2MPH) LOWER THAN PRESET SPEED (DRIVING VEHICLE; CRUISE CONTROL ON)
		APPROX. 12V	OTHER (NORMAL) CONDITIONS
1N (INPUT)	EGI CONTROL UNIT (1U TERMINAL)	BELOW 1.5V	COOLANT TEMP. BELOW 55°C (131°F)
		APPROX. 12V	COOLANT TEMP. ABOVE 55°C (131°F)
1O (INPUT)	IDLE SWITCH (IN THROTTLE SENSOR)	BELOW 1.5V	THROTTLE VALVE CLOSED FULLY
		APPROX. 12V	THROTTLE VALVE OPEN
1P (INPUT)	SPEED SENSOR	APPROX. 12V	WHILE DRIVING
		APPROX. 7-9V OR BELOW 1.5V	VEHICLE STOPPED
2A (INPUT)	THROTTLE SENSOR	BELOW 1.5V	IGNITION OFF
		4.5-5.5V	IGNITION SWITCH ON
2B (INPUT)	INHIBITOR SWITCH (N AND P RANGE)	BELOW 1.5V	N OR P RANGE
		APPROX. 12V	OTHER RANGES
2C	—	—	—
2D (INPUT)	INHIBITOR SWITCH (D RANGE)	BELOW 1.5V	OTHER RANGES
		APPROX. 12V	D RANGE
2E (OUTPUT)	1-2 SHIFT SOLENOID	APPROX. 12V	1ST GEAR POSITION
		BELOW 1.5V	OTHER RANGES
2F (INPUT)	INHIBITOR SWITCH (S RANGE)	BELOW 1.5V	S RANGE
		APPROX. 12V	OTHER RANGES
2G (OUTPUT)	2-3 SHIFT SOLENOID	APPROX. 12V	1ST OR 2ND GEAR POSITION
		BELOW 1.5V	OTHER RANGES

Figure 4.

TRANSMISSION CONTROL UNIT (TCU)

Wire Connectors 1 and 2 as seen from wire side



TERMINAL	CONNECTED TO	VOLTAGE	CONDITION
2H (INPUT)	INHIBITOR (L RANGE)	APPROX. 12V	L RANGE
		BELOW 1.5V	OTHER RANGES
2I (OUTPUT)	3-4 SHIFT SOLENOID	APPROX. 12V	1ST, 2ND, AND 3RD GEAR POSITION
		BELOW 1.5V	OD POSITION
2J (INPUT)	TURBINE SENSOR	APPROX. 0.05 - .1V	ENGINE RUNNING
		APPROX. 0.05V	ENGINE STOPPED
2N (OUTPUT)	LOCK-UP CONTROL SOL. VALVE	APPROX. 12V	LOCK-UP
		BELOW 1.5V	OTHER
2L (GROUND)	TURBINE SENSOR	BELOW 1.5V	———
2M (OUTPUT)	3-2 CONTROL SOLENOID	APPROX. 12V	3-2 OR 4-2 DOWNSHIFT
		BELOW 1.5V	OTHER CONDITIONS
2O (BATTERY)	BATTERY	APPROX. 12V	———
2P (GROUND)	ENGINE GROUND	BELOW 1.5V	———
2S (BATTERY POWER)	BATTERY	APPROX. 12V	IGNITION SWITCH ON
		BELOW 1.5V	IGNITION SWITCH OFF
2S (BATTERY POWER)	BATTERY	APPROX. 12V	IGNITION SWITCH ON
		BELOW 1.5V	IGNITION SWITCH OFF
2T (OUTPUT)	THROTTLE SENSOR TVO	0.4 - 4.5VOLTS	IGNITION SWITCH ON

Figure 5.

NOTE: Voltage values are basically the same for both the 929 models and the RX7 models. The EC-AT control unit location may vary from model to model.

TROUBLE CODE RETRIEVAL

A flashing hold light on the dash is an indication that trouble codes are present. Use an EC-AT Testor or other Hand-Held Scan tool to retreive codes. Follow Scan tool manufacturers instructions. An alternate method of obtaining trouble codes is to ground the 1 pin blue check connector under the hood and observe the hold light flashing pattern in relation to the EC-AT buzzer interpretation shown on the next pagein Figure 6. The Check Connector location under the hood is different for 929 and RX7. Both the 6-pin and the 1-pin connectors are blue for all models. The 929 check connector is on the passenger side. The RX7 check connector is on the drivers side.

TROUBLE CODE RETREIVAL CONTINUED

When the check connector pin is grounded and the hold light is flashing, the first digit of the code is the long flashes, and the second digit of the code is the short flashes. If there is more than one trouble code present, the lowest number trouble code will be flashed first. Trouble code interpretayion for the EC-AT tester is also shown below.

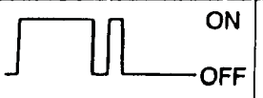
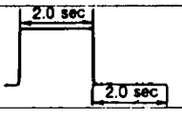
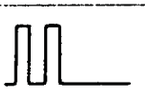
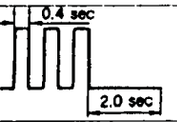
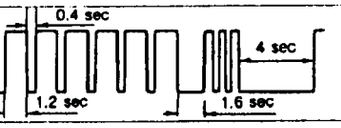
Code No.	Location of malfunction	Buzzer	
		'87 EC-AT Tester Body (49 G019 901)	'88 EC-AT Tester Body (49 G019 901A)
06	Speed sensor or circuit		
12	Throttle sensor or circuit		
55	Turbine sensor or circuit		
60	1-2 shift solenoid valve or circuit		
61	2-3 shift solenoid valve or circuit		
62	3-4 shift solenoid valve or circuit		
63	Lockup control solenoid valve or circuit		
64	3-2 control solenoid valve or circuit		

Figure 6.

EC-AT ELECTRICAL SCHEMATIC

The electrical wiring and the electrical schematic for the Mazda 929 is very complex. The easiest way to simplify the wiring is to isolate the schematic to deal only with those circuits that directly relate to the transmission. A simplified drawing of the wiring schematic for the 929 transmission is shown in Figure 7. The wire colors shown here are for 929 models only. The RX7 electrical schematic is similar to the 929 but there are some differences. The wire colors are different at the transmission for the RX7.

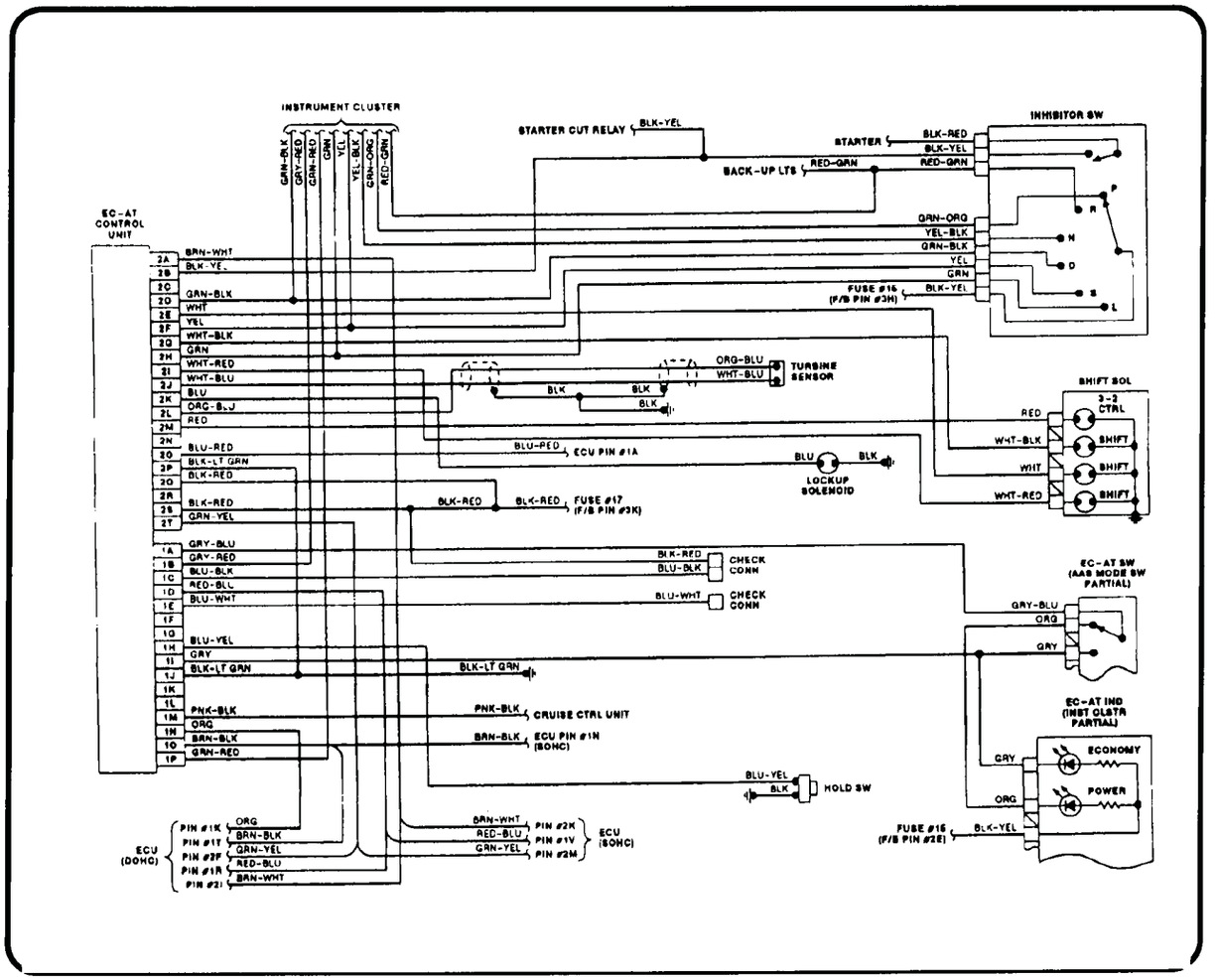


Figure 7.

TRANSMISSION SOLENOIDS, SENSORS, AND SWITCHES

The **Shift Solenoids** and the **3-2 Control Solenoid** are located on the valve body . See Figure 10. These solenoids are normally "closed" to hold pressure when they are off. They "open" and drain pressure when they are energized. These solenoids are grounded to the valve body and get a 12 volt signal to energize them. The order in which the Shift Solenoids are energized determines the transmission gear range. The 3-2 Solenoid is only turned on momentarily during a 3-2 downshift to control shift feel under various conditions. See Figure 8 for the solenoid shift schedule.

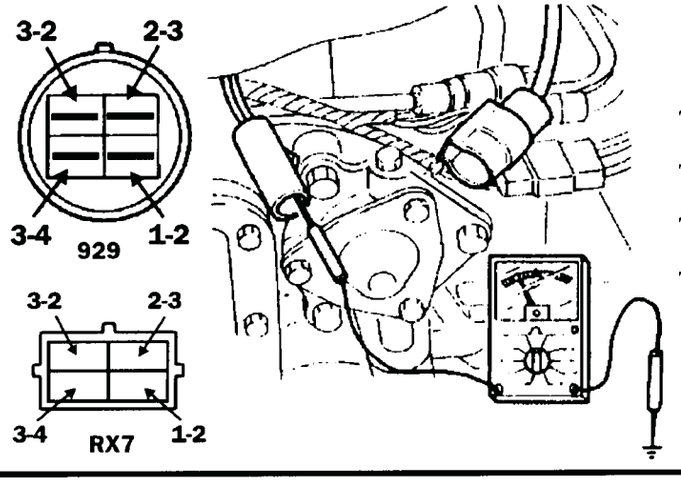
RANGE	GEAR	SOLENOID VALVES			
		1-2	2-3	3-4	LOCK-UP
R	REVERSE			ON	
D	1ST	ON	ON	ON	
	2ND		ON	ON	
	3RD			ON	ON*
	4TH				ON*

* - LOCK-UP CONTROL VALVE COMES ON IN 3RD AND O.D. RANGES WITH RESPECT TO THROTTLE POSITION, VEHICLE SPEED, AND TEMPERATURE.

NOTE: THE 3-2 CONTROL SOLENOID IS ENERGIZED MOMENTARILY ON A 3-2 DOWNSHIFT.

Figure 8.

To electrically check the solenoids on the valve body it is easiest to use an ohmmeter. With the round solenoid connector disconnected, the solenoids should have **13-27 ohms** of resistance. Check the resistance between each terminal and ground. See Figure 9. The wire colors for each solenoid are also shown below.



The 1-2 wire is GREEN

The 2-3 wire is WHITE

The 3-4 wire is BLACK

The 3-2 wire is BLUE

Figure 9.

TRANSMISSION INTERNAL SOLENOIDS

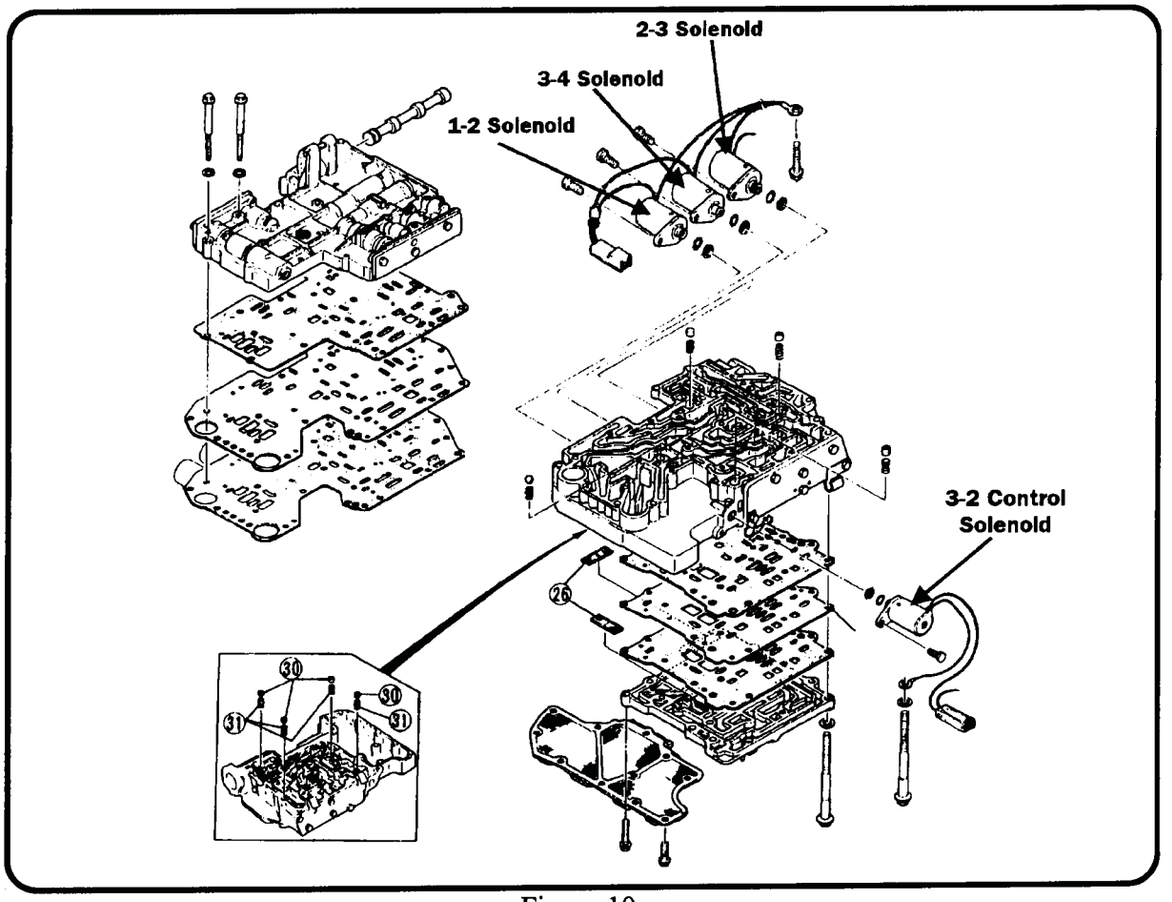


Figure 10.

The **Lock-Up Solenoid** is located on the overdrive section of the transmission. It is normally "open" when it is off. It has 2 wires at the connector. The black wire is a ground and the blue wire is the 12 volt signal sent by the TCU to command lock-up. It can be electrically checked with an ohmmeter. There should be 13-25 ohms of resistance across the connector. The connector must be disconnected to check the resistance. To identify the lock-up connector, see Figure 11.

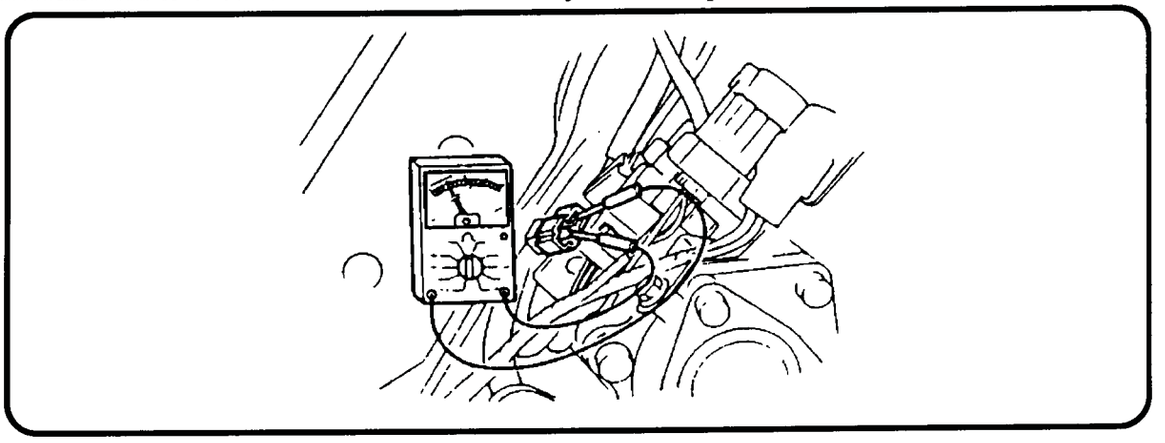


Figure 11.

TRANSMISSION SOLENOIDS, SENSORS, AND SWITCHES CONTINUED

The **Turbine Sensor** is located on the left side of the transmission near the front. It has a 2-wire round connector. It tells the EC-AT Unit how fast the input shaft is turning. It can be checked with an ohmmeter. Disconnect the round connector before checking the resistance. The turbine sensor should have approximately **245 ohms of resistance**. See Figure 12.

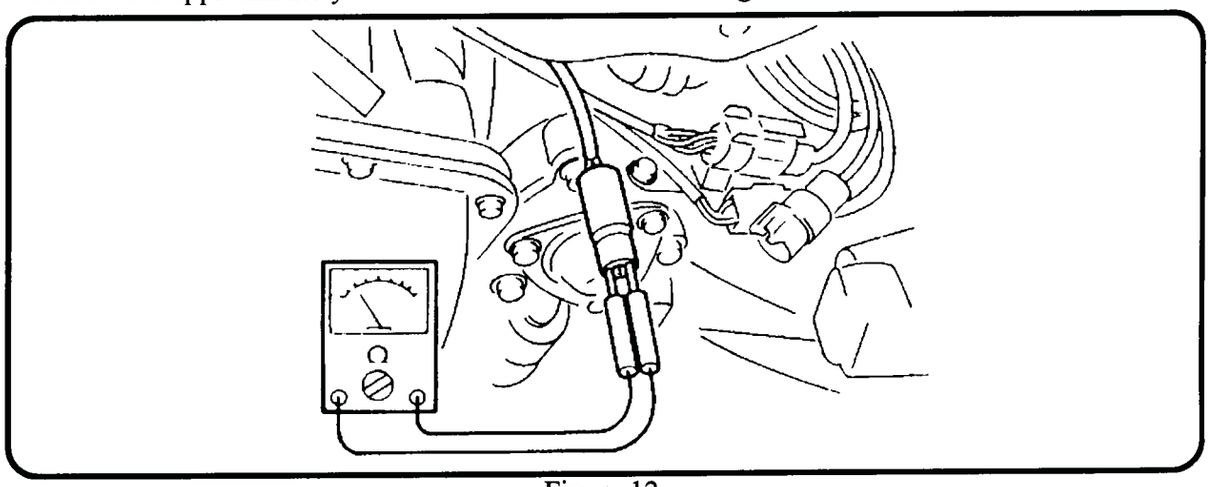
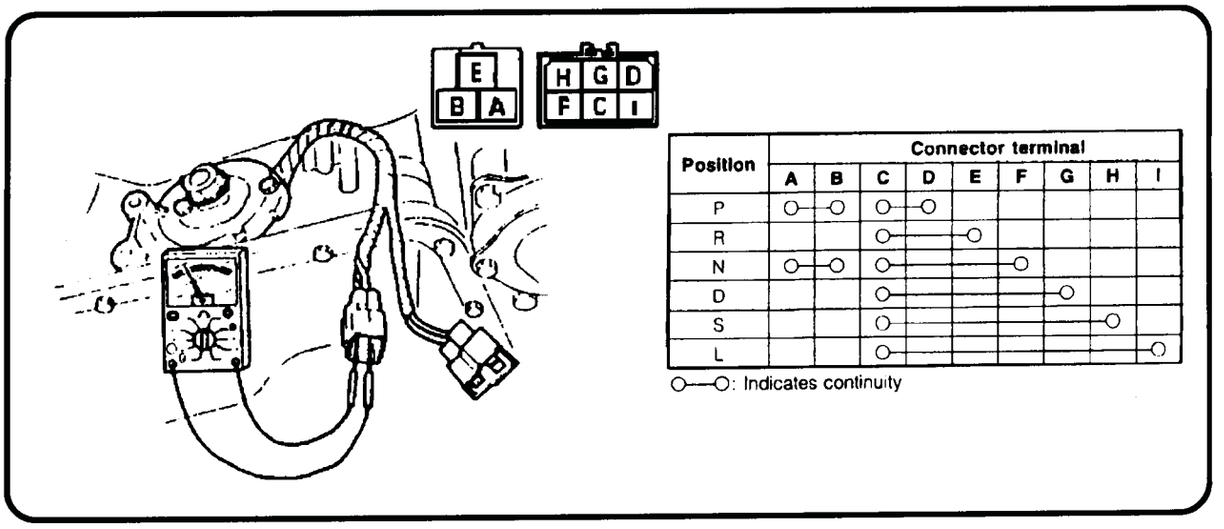


Figure 12.

The **Inhibitor Switch** is Mouted on the right side of the transmission. As the manual linkage is moved, so is the inhibitor switch. Besides acting as a neutral safety and back-up light switch, it tells the EC-AT Unit which range has been selected. Proper adjustment of this switch is important because if the EC-AT Unit does not know which range has been selected, then it will not properly energize the shift solenoids to change gears. The inhibitor switch can be checked and adjusted with an ohmmeter. Disconnect the electrical connectors and check for continuity as in each range as shown in Figure 13.



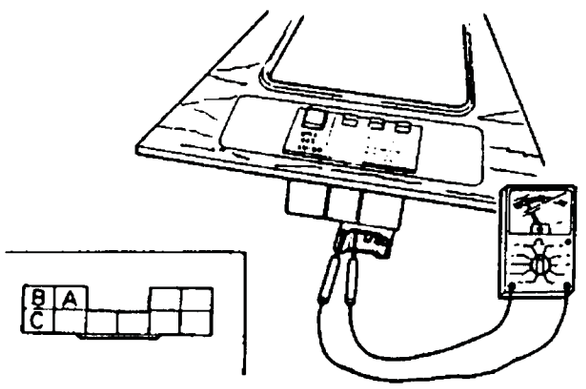
Position	Connector terminal								
	A	B	C	D	E	F	G	H	I
P	○	○	○	○					
R			○		○				
N	○	○	○			○			
D			○				○		
S			○					○	
L			○						○

○—○: Indicates continuity

Figure 13.

ELECTRICAL INPUTS

The **Mode Switch** is located on the counsol next to the gear shift lever. The purpose of the switch is to affect the shift strategy of the EC-AT control Unit. When the switch is in the economy position, the shifts will be very early in order to use less fuel. When the switch is in the power position the shifts will be somewhat later for a more positive "feel". This switch may be checked with an ohmmeter, and operation of the circuit can be checked with a volt meter. When checking with an ohmmeter, the switch connector must be **disconnected**. When checking the circuit with a volt meter, the switch connector must be **connected** and the ignition turned on. The cover plare must be removed to perform these checks. See Figure 14 for both checks.



Mode	Connector terminal		
	A	B	C
Power	O		O
Economy	O	O	

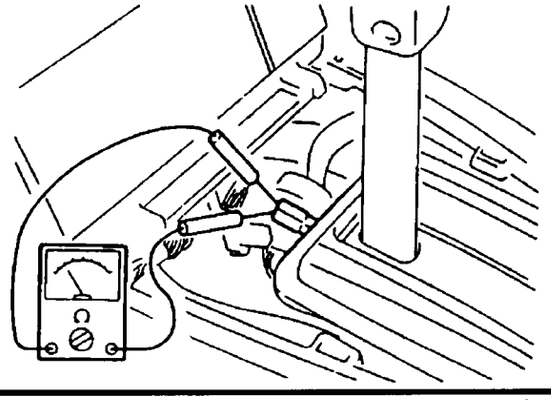
Continuity check

Terminal	Voltage		
	Power mode	Economy mode	Hold mode
A	Below 1.5V.	Below 1.5V.	Approx 12V.
B	Approx 12V.	Below 1.5V.	Approx 12V.
C	Below 1.5V.	Approx 12V.	Approx 12V.

Voltage check

Figure 14.

The **Hold Switch** is located on the gear shift handle. It allows the driver to "hold" certain gear ranges for driving in low traction or heavy pulling situations. When the transmission is in the hold mode, a light on the instrument cluster informs the driver. First gear only, second gear only, or second and third gear only can be selected in this mode. This switch can be checked with an ohmmeter. Disconnect the switch before checking for continuity. See Figure 15.



Continuity	Hold Switch
YES	Released
NO	Depressed

Figure 15

ELECTRICAL INPUTS CONTINUED

The **Speed Sensor** is located in the instrument cluster. It can be checked with an ohmmeter at the EC-AT Control Unit. Disconnect the speedometer cable. Remove the plug from the 16 pin connector of the control unit as shown in figure 3. Using a voltmeter, check the speed sensor at pin 1P. With the ignition on, slowly rotate the speedometer cable one turn. There should be approximately 7 volts at pin 1P four times while the cable is being turned. See Figure 16.

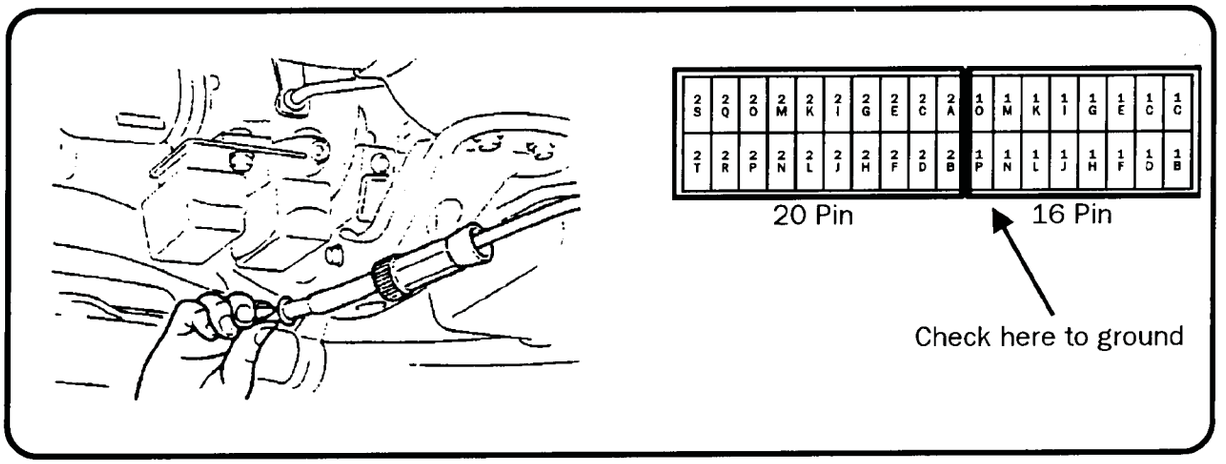


Figure 16.

The **Throttle Position Sensor** is mounted to the throttle body. A variable resistor detects the % of throttle opening. It also tells the EC-ATControl Unit when the engine is off of idle. The throttle position sensor can be checked with an ohmmeter while it is on the vehicle. See Figure 17 for terminal identification. When checking with an ohmmeter, disconnect the connector from the sensor. To check the idle circuit, connect an ohmmeter between terminals C and D. There should be continuity at closed throttle and no continuity when the throttle is opened .028 in. or more. To check the variable resistor in the throttle position sensor, connect an ohmmeter between terminals B and D. Gradually open the throttle valve and check the resistance. It should be below 1kΩ with the throttle closed and approximately 3.5k - 6.5k Ω with the throttle valve fully open.

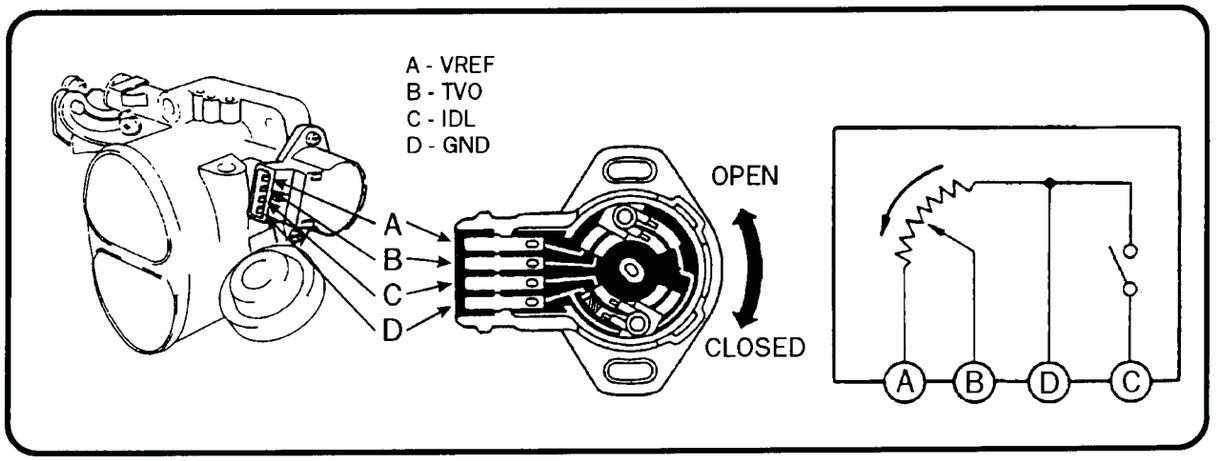


Figure 17.

INFINITI Q45 ELECTRICAL DIAGNOSIS

This four speed fully electronic automatic transmission has 5 solenoids and a temperature sensor on the valve body. There is also a turbine speed sensor on the top of the transmission case, a full throttle switch on the engine, and a separate 1 position switch at the gearshift control lever. See Figure 1 on the next page for an overview of the system layout. Q45 automatic transmission is similar to the Nissan RE4RO1A Transmissions, However the diagnostic routines have changed. This transmission uses 3rd gear as a "fail safe" that is if there is no power supplied to the valve body solenoids. In the event of a fail-safe condition, the diagnostic information display will say TRANSMISSION MALFUNCTION. The Infinity Q45 can be diagnosed using a Nissan "Consult" Scanner connected to the diagnostic link located in the fuse panel. The Self-Diagnostic procedure for use without a scanner is described below and illustrated in Figure 2.

DIAGNOSIS START

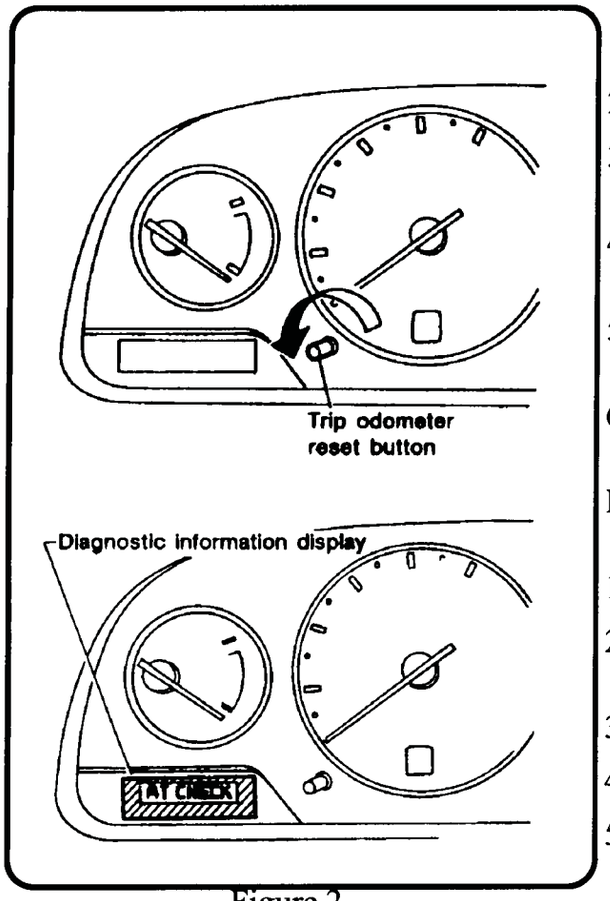


Figure 2.

1. Start engine and warm it up to normal engine operating temperature.
2. Turn ignition switch to "OFF" position.
3. Move the selector lever to "D" position. (Use shift lock release knob.)
4. Turn the trip odometer reset button counter-clockwise and hold it.
5. Turn ignition switch to "ON" position. (Do not start the engine.)
6. Does the diagnostic information display change to A/T diagnosis mode?

If **yes**, then continue. If **no,** see service manual.

1. Move selector lever to "3" position.
2. Depress the accelerator pedal fully and release it.
3. Move selector lever to "2" position.
4. Move selector lever to "1" position.
5. Depress the accelerator pedal fully and release it.
6. Check diagnostic information display. Refer to codes and their meanings shown on page 22.

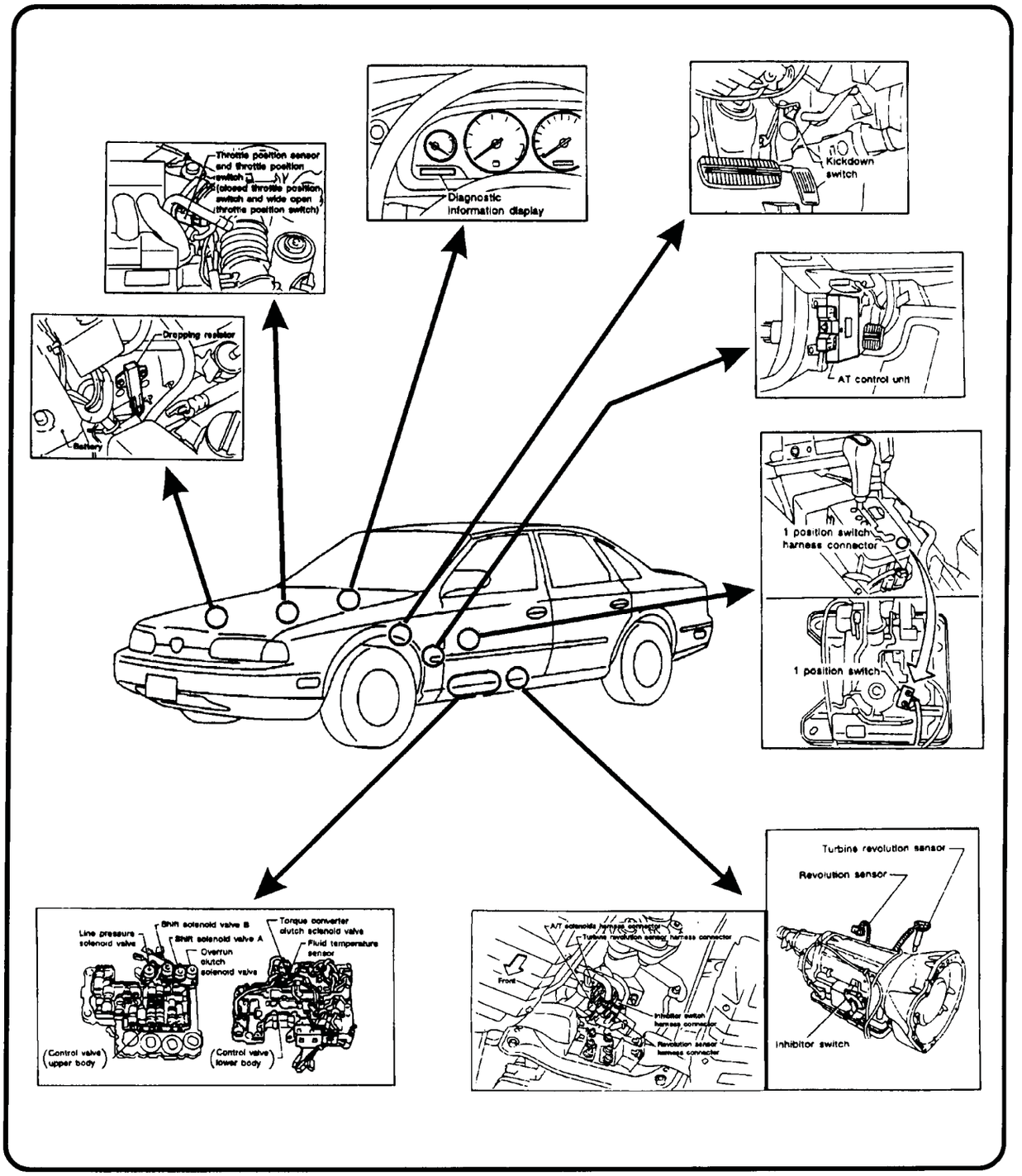
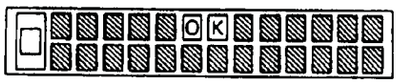
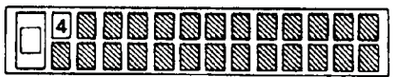
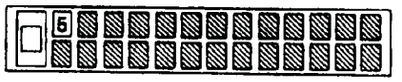
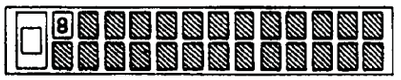
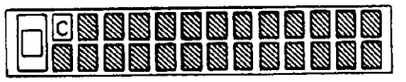
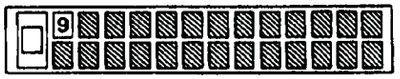
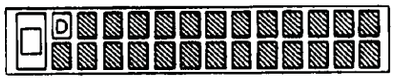
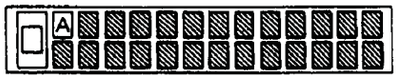

Throttle position sensor and throttle position switch (closed throttle position switch and wide open throttle position switch)
Diagnostic information display
Kickdown switch
Dropping resistor
Battery
AT control unit
1 position switch harness connector
1 position switch
Turbine revolution sensor
Revolution sensor
Inhibitor switch
Line pressure solenoid valve
Shift solenoid valve B
Shift solenoid valve A
Overrun clutch solenoid valve
Torque converter clutch solenoid valve
Fluid temperature sensor
Control valve upper body
Control valve lower body
Front

Figure 1.

SELF-DIAGNOSIS CODES

Diagnostic information display	Damaged circuit (Below)
The judgment is "OK".  All circuits that can be confirmed by self-diagnosis are O.K.	The judgment is "4".  Shift solenoid valve A circuit is short-circuited or disconnected. ➡ **Check Shift Solenoid "A" Circuit**
The judgment is "1".  Revolution sensor circuit is short-circuited or disconnected. ➡ **Check Revolution Sensor Circuit**	The judgment is "5".  Shift solenoid valve B circuit is short-circuited or disconnected. ➡ **Check Shift Solenoid "B" Circuit**
The judgment is "2".  Speed sensor circuit is short-circuited or disconnected. ➡ **Check Speed Sensor Circuit**	The judgment is "6".  Overrun clutch solenoid valve circuit is short-circuited or disconnected. ➡ **Check Overrun Solenoid Circuit**
The judgment is "3".  Throttle position sensor circuit is short-circuited or disconnected. ➡ **Check Throttle Position Sensor Circuit**	The judgment is "7".  Torque converter clutch solenoid valve circuit is short-circuited or disconnected. ➡ **Check Converter Clutch Solenoid Circuit**

SELF-DIAGNOSIS CODES

Diagnostic information display	Damaged circuit(below)
The judgment is "8".  Fluid temperature sensor is disconnected or A/T control unit power source circuit is damaged. ➡ **Check Fluid Temperature Sensor And A/T Control Unit Power Source**	The judgment is "C".  Engine control circuit between A/T control unit and ECM (ECCS control module) is short-circuited or disconnected. ➡ **Check Engine Control Circuit**
The judgment is "9".  Engine speed signal circuit is short-circuited or disconnected. ➡ **Check Engine Speed Signal Circuit**	The judgment is "D".  Battery power is low. Battery has been disconnected for a long time. Battery is connected conversely. (When reconnecting A/T control unit connectors, this is not a problem.)
The judgment is "A".  Turbine revolution sensor circuit is short-circuited or disconnected. ➡ **Check Turbine Revolution Sensor Circuit**	The judgment is "AT CHECK".  Inhibitor switch, 1 position switch, kickdown switch, closed throttle position switch or diagnostic information display system circuit is disconnected, or A/T control unit is damaged. ➡ **Check Inhibitor Switch, 1 Position Switch, Kickdown Switch, And Diagnostic System Circuit**
The judgment is "B".  Line pressure solenoid valve circuit is short-circuited or disconnected. ➡ **Check Line Pressure Circuit**	

INPUT SENSOR DESCRIPTION

The **Speed Sensor** is gear driven and it sends a signal to the speedometer and to the A/T control unit. It can be checked in two different ways.

When checking the speed sensor at the A/T control unit, use the **DC scale** on your voltmeter and check between pin 27 and ground. With the engine on and the wheels turning slowly(about 1-2 mph), voltage should alternate between **0 volts to 5 volts.**

When checking the speed sensor by itself, use the **AC scale** on your voltmeter. While quickly turning the drive gear, voltage should go to about **.5 volt.** See Figure 3.

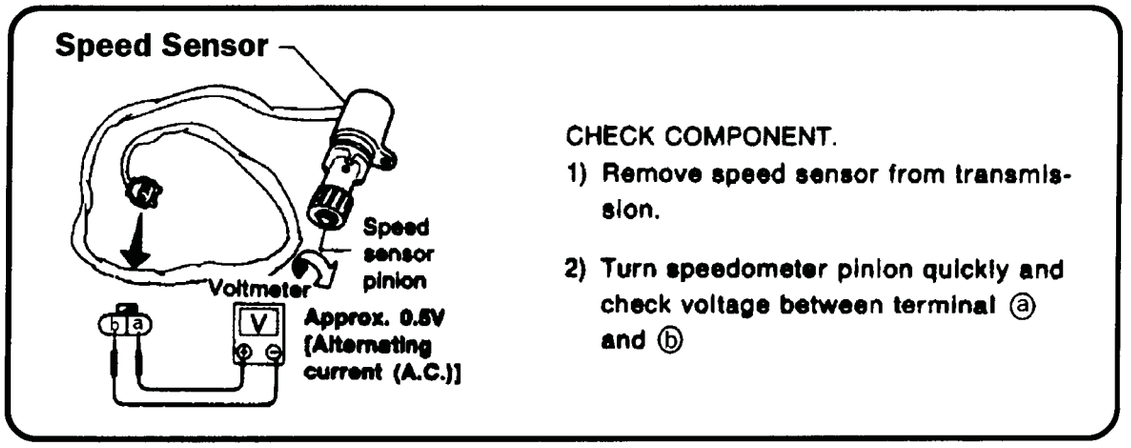
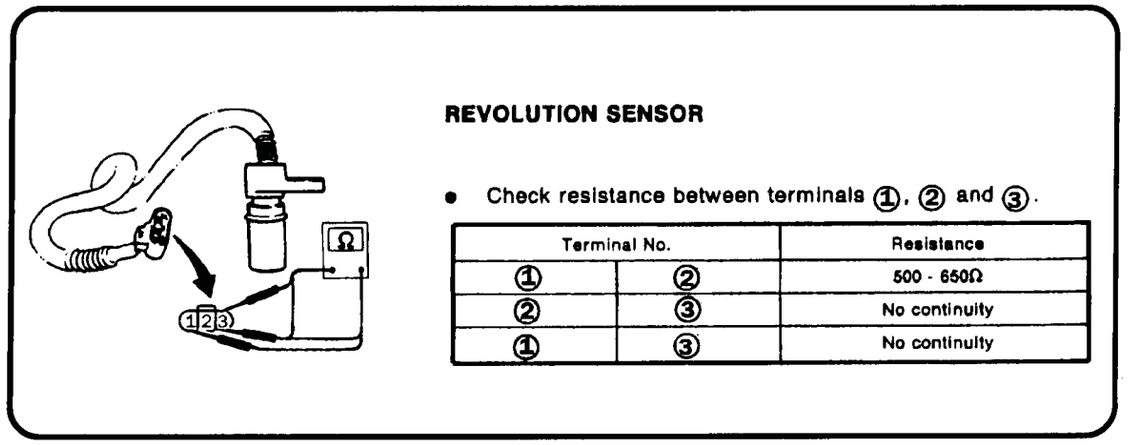


Figure 3.

The **Revolution Sensor** is mounted on the tail housing and it is most easily checked with an ohmmeter. When checking the revolution sensor, first disconnect it from the connector so that the ohms readings that you take are of the sensor only. See Figure 4.

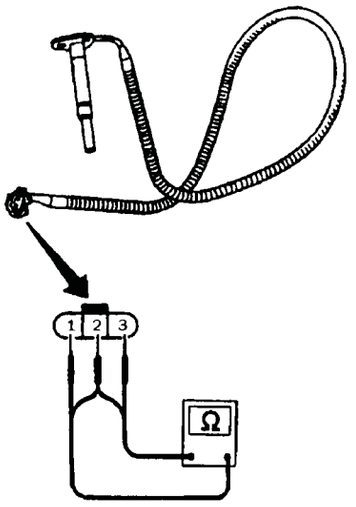


Terminal No.		Resistance
①	②	500 - 650Ω
②	③	No continuity
①	③	No continuity

Figure 4.

INPUT SENSORS CONTINUED

The **Turbine Revolution Sensor** is mounted on top of the transmission at the front of the case. It provedes additional information to the A/T Control Unit for shift timing and feel. This sensor is also checked with an ohmmeter. See Figure 5.



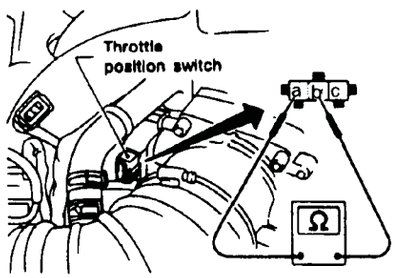
TURBINE REVOLUTION SENSOR

- Check resistance between terminals ①, ② and ③.

Terminal No.		Resistance
①	②	2,200 - 2,800Ω
②	③	No continuity
①	③	No continuity

Figure 5.

The **Throttle Position Sensor** and the **Throttle Position Switch** are located under the hood at the throttle body. They tell the A/T Control Unit anumber of things. First, the closed throttle position switch signals when the accelerator pedal is fully released. to check the closed throttle switch with an ohmmeter, see Figure 6. Next, the wide open throttle switch signals the A/T Control Unit when the accelerator is pushed over halfway down. To check the closed throttle switch, see Figure 7. The Throttle Position Sensor tell The A/T Control Unit the degree of throttle opening. It can be checked with either a volt meter or an ohmmeter. To check it with a volt meter, it must remain connected and probed at terminals 31 and 35. With the ignition on. voltge should vary between .5 volts at minimum throttle to about 4 volts at maximun throttle. To check the Throttle Position Sensor with an ohmmeter see Figure 8.



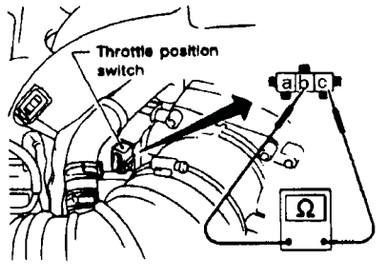
THROTTLE POSITION SWITCH (Closed throttle position switch)

1. Warm up engine sufficiently.
- Make sure fast idle cam holds cam follower lever released.
2. Disconnect throttle position switch harness connector.
3. Check continuity between terminals ⓐ and ⓑ

Accelerator pedal condition	Continuity
Released	Yes
Depressed	No

Figure 6.

INPUT SENSORS CONTINUED

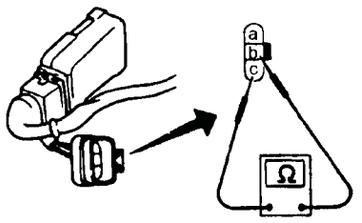


THROTTLE POSITION SWITCH (Wide open throttle position switch)

1. Warm up engine sufficiently.
   - Make sure fast idle cam holds cam follower lever released.
2. Disconnect throttle position switch harness connector.
3. Check continuity between terminals ⓑ and ⓒ.

Accelerator pedal condition	Continuity
Released	No
Depressed	Yes

Figure 7.



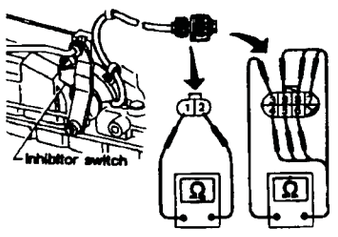
THROTTLE POSITION SENSOR

1. Disconnect throttle position sensor harness connector.
2. Make sure that resistance between terminals ⓑ and ⓒ changes when opening throttle valve manually.

Accelerator pedal condition	Resistance kΩ
Completely released	Approximately 0.7
Partially released	0.7 - 5
Completely depressed	Approximately 5

Figure 8.

The **Kickdown Switch** is mounted at the top of the accelerator pedal and it tells the A/T Control Unit when the Accelerator pedal is pushed all the way down. It is a normally open switch which closes when the accelerator pedal is fully depressed. To check this switch, place a voltmeter between pins 14. and ground with the ignition on. There should be between 3 and 8 volts present unless the throttle is fully depressed. At full throttle there should be 1 volt or less. Refer to the electrical circuit diagram for pin identification.



Check continuity between terminals ① and ② and between terminals ③ and ④, ⑤, ⑥, ⑦, ⑧, ⑨ while moving selector lever through each position.

Lever position	Terminal No.								
	①	②	③	④	⑤	⑥	⑦	⑧	⑨
P	○	○	○	○					
R			○		○				
N	○	○	○			○			
D			○				○		
3			○					○	
2, 1			○						○

INFINITY INHIBITOR SWITCH CONTINUITY CHART

Figure 9.

The **Inhibitor Switch** is located on the transmission manual lever shaft and it tells the A/T Controller which range is selected. See Figure 10 for the switch terminal identification and continuity testing.

A/T CONTROL UNIT

The **A/T Control Unit** is located under the dash on the drivers side by the kick panel. After recieving the input information described on the previous pages, it turns the transmission solenoids on and off to control shift timing and pressure. An overview of the wiring schematic with connector pin identification is provided in Figure 10.

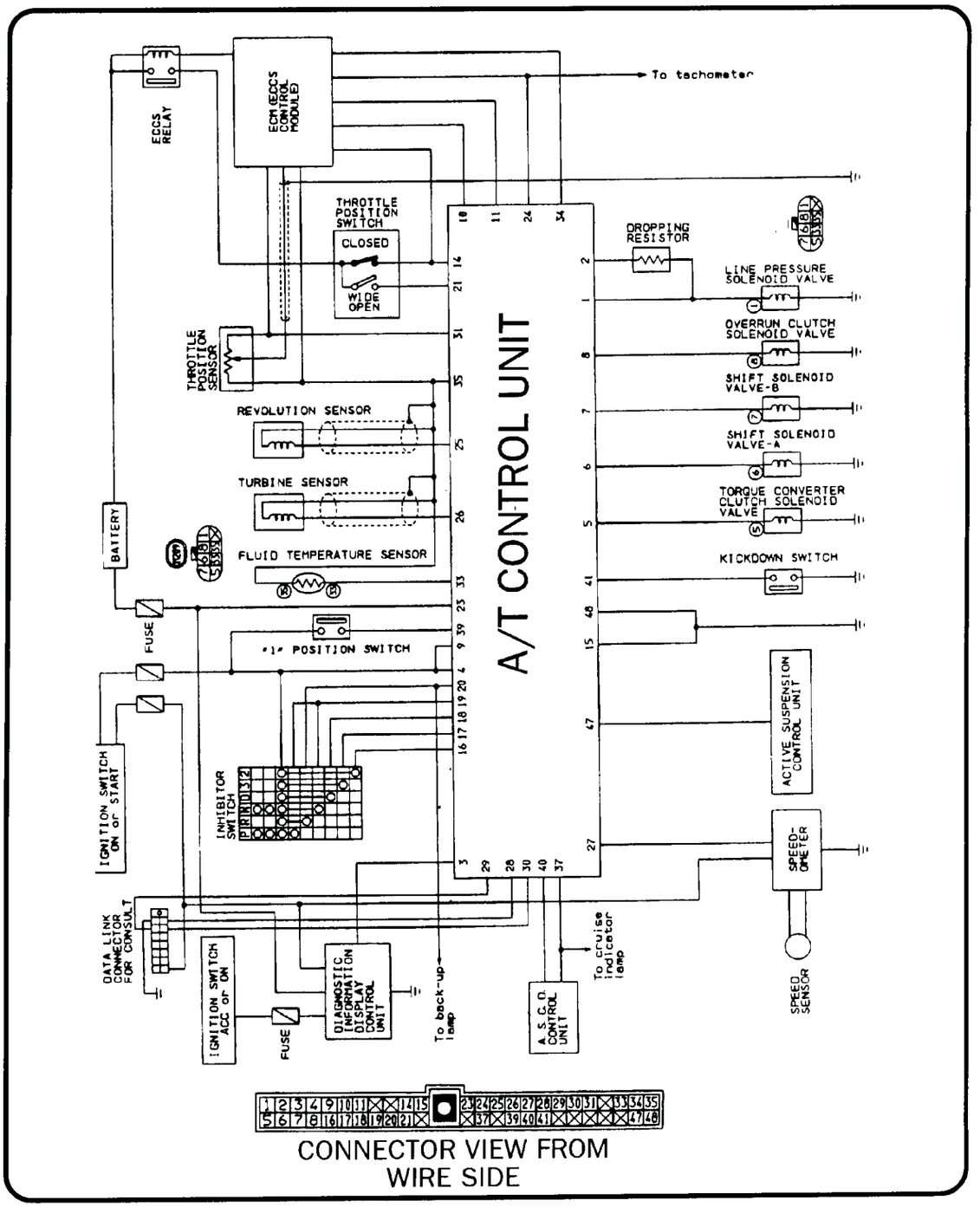


Figure 10.

INTERNAL SOLENOIDS AND SENSORS

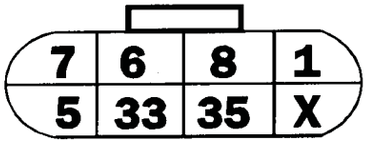
The **Shift Solenoids** and the **Overrun Solenoid** are mounted on the valve body. They are normally open when off and drain line pressure from the shift valves or control valve. When they are energized, they close and allow line pressure to stroke their respective valve. The sequence in which the solenoids are energized determines which gear is selected. Figure 11 describes the proper shift solenoid pattern and may be used as a guide for testing the transmission independently from the controller.

The **Line Pressure Solenoid** is mounted on the valve body. It is operated by a pulse signal from the controller and this varied pulse or duty cycle controls pressure. These timed pulses translates to from .5 to 5.5 volts after the signal goes through the dropping resistor. There should never be full battery voltage to the line pressure solenoid.

The **Lock-up Solenoid** is mounted on the valve body. It is normally closed when off and blocks the drain so that line pressure moves the lock-up control plug to the release position. When it is energized, it opens and drains pressure from the control plug.

The **TOT (Transmission Oil Temp.) Sensor** is located on the valve body all by itself but plugs into a common harness with the solenoids. The wires in the separate connector are black and white. At room temperature the resistance across the TOT Sensor wires should be about 2.5K ohms. The resistance will drop as the temperature increases. To ohms test the TOT Sensor, first make sure that it is disconnected from the harness connector.

GEAR	SOLENOID A	SOLENOID B	LOCK-UP SOLENOID	OVERRUN SOLENOID	PRESSURE SOLENOID
1st	ON	ON	OFF	ACTIVATES UPON VARIOUS THRROTTLE OPENONGS	PULSE MODULATION CONTROLLED BY COMPUTER
2nd	OFF	ON	OFF		
3rd	OFF	OFF	OFF		
4th	ON	OFF	ON	OFF	
OHMS	20 - 30	20 - 30	10 - 16	20 - 30	2.5 - 5



Pin	Description	Wire Color
7	Shift Solenoid B.	Yellow
6	Shift Solenoid A.	Green
8	Overrun Solenoid.	Gray
1	Line Pressure Solenoid.	Red
5	Lock-up Solenoid.	Blue
33	Fluid Temp. Sensor.	White
35	Fluid Temp. Sensor.	Black

PIN SIDE OF 8 TERMINAL CONNECTOR GOING TO THE TRANSMISSION.

Figure 11.

The **Dropping Resistor** is located under the hood near the air cleaner. Its function is to tailor the line pressure according to temperature. If it fails, to much voltage will get to the pressure control solenoid on the valve body, and the result will be insufficient pressure rise under various driving conditions. The Dropping resistor is easily checked with an ohmmeter. See Figure12.

INTERNAL SOLENOIDS AND SENSORS CONTINUED

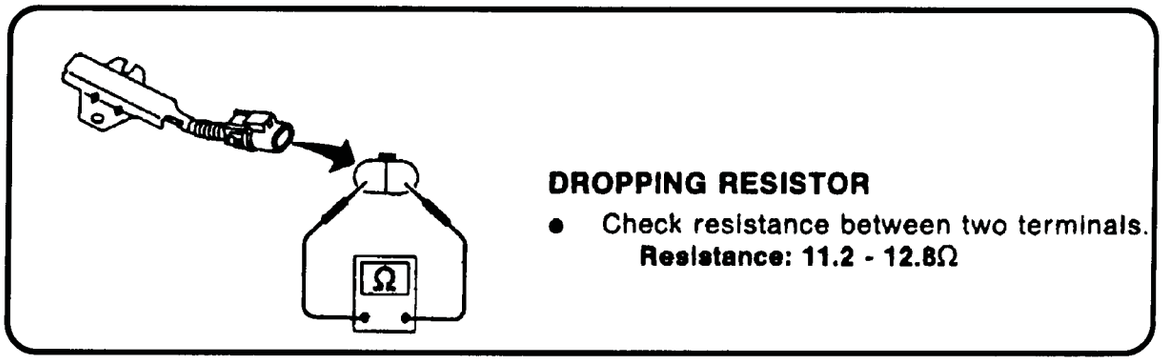
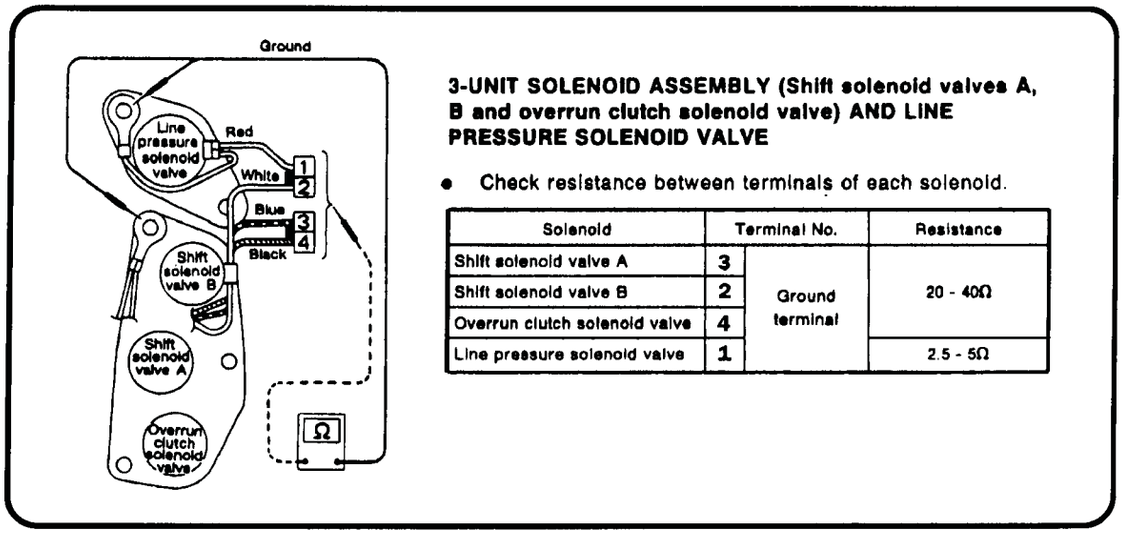


Figure 12.

The Three-Unit Solenoid Assembly and Pressure Control Solenoid are not serviced seperately. When the valve body is removed, each solenoid can be identified and checked. See Figure 13. The ground for each solenoid is connected to the solenoid assembly body. If necessary, the shift solenoids and overrun clutch solenoid operation can be tested by applying battery voltage. The Line Pressure Solenoid, however, should NOT be tested with battery voltage. Damage may result because its resistance is so low.



Solenoid	Terminal No.		Resistance
Shift solenoid valve A	3	Ground terminal	20 - 40Ω
Shift solenoid valve B	2		
Overrun clutch solenoid valve	4		
Line pressure solenoid valve	1		2.5 - 5Ω

Figure 13.

Each Solenoid, Sensor, and Switch described in this chapter can be checked at the A/T Control Unit or at the individual part. When checking these sensors, solenoids, and switches with an **ohmmeter**, remember that they must be **disconnected** first. When checking these sensors, solenoids, and switches with a **volt meter**, remember that they must be **connected** into their respective circuits under operating conditions.

SUBARU XT AND LEGACY 4 SPEED

The Subaru 4 speed automatic transmission is used in front drive and four wheel drive Subaru's beginning in 1987. The 4 wheel drive version has a separate set of clutches that are computer controlled to provide full time all wheel drive while allowing for cornering and handling. This transmission has five solenoids on the valve body to control shifting, converter clutch apply, and oil pressure. The all wheel drive version has a sixth solenoid to control the transfer clutches. Diagnostic procedures are basically the same for the FWD models and the AWD models. The first step is to determine exactly what the transmission is doing or not doing.

FAIL-SAFE FUNCTION

A fail-safe function is provided to maintain driveability even if trouble occurs in the speed sensor, throttle sensor, inhibitor switch,or any of the solenoids.

1. Vehicle Speed Sensor. A dual speed sensing system is used. The speed signal is taken from the transmission (output shaft revolution sensor) and also from a sensor built into the speedometer. Even if one sensor system fails, the vehicle can be controlled normally with the other sensor system.

2. Throttle Sensor. If the throttle sensor becomes faulty, the throttle will be set to a predetermined position.

3. Inhibitor Switch. If two signals are inputted due to inhibitor switch failure, the vehicle can be driven under the following priority. D } N (P) R 3 2 1.

4. Shift Solenoids 1 and 2. If trouble occurs in either of the solenoids 1 or 2, both solenoids are turned off and the vehicle is made driveable in the 3rd hold position. This means that the vehicle will start and stay in 3rd gear unless 1st gear is manually selected. 1st gear will only be available with the selector placed in first.

5. Shift Solenoid 3 (Overrunning Clutch) If the overrunning clutch solenoid fails, the solenoid is turned off. The overrunning clutch will then engage and engine braking will be applied when reducing vehicle speed.

6. Duty Solenoid A. (Line Pressure) If duty solenoid A fails, the solenoid is turned off and line pressure is raised to maximum to assure vehicle operation.

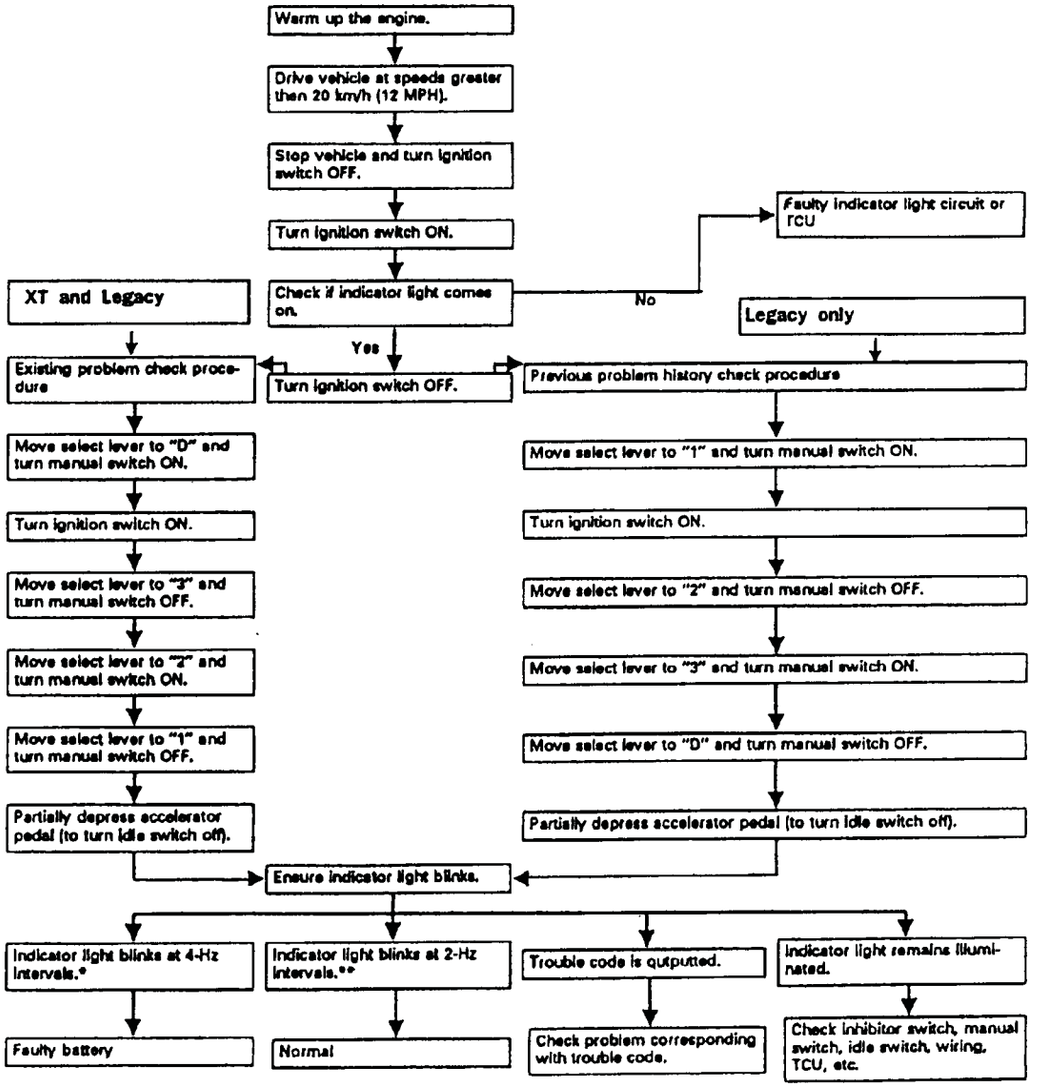
7. Duty Solenoid B (Lock-Up) If duty solenoid B fails, the solenoid is turned off and lock-up is released.

8. Duty Solenoid C (Transfer) When duty solenoid C becomes inoperative, it turns off. This causes maximum oil pressure to be sent to the transfer clutch so that power is always transmitted to the rear axle.

After we have determined exactly what the transmission is doing, we can begin electrical diagnosis. It is usually best to let the on-board diagnostic system look for any trouble before proceeding with individual sensor and solenoid checks.

SELF-DIAGNOSIS SYSTEM

The self diagnosis system is capable of sensing any trouble that has occurred in the major inputs to and outputs from the Transmission Control Unit (TCU). The results of the self-diagnosis are displayed as fault codes through a flashing power indicator light. Fault codes may be retrieved in two ways. On Legacy models, Select Monitor may be connected to a diagnostic connector located under the instrument panel on the drivers side. A self- diagnosis test may also be performed on all models. To perform the self-diagnosis test, refer to the chart below.



*: Blinks every 0.125 (1/8) seconds (with ignition switch OFF).
**: Blinks every 0.25 (1/4) seconds (until ignition switch is turned OFF).

Fault Codes are outputted in a series of blinks that contain long and short flashes. Interpretation of therse codes is described on the next page.

TROUBLE CODES

Follow the self- diagnosis as indicated in the chart on the previous page. This will cause the power light to flash the trouble code or codes corresponding to the faulty part. Long flashes (1.2 sec.) indicate a "ten" and short flashes (0.2 sec.) indicate a "one". See Figure 1. If there is more than one code, each complete code will flash once and then the next higher number code will follow. An example of a fault code is two long flashes (1.2sec. each) followed by three short flashes (0.2 each)with about 2 seconds delay after each code. This example is code 23. A list of trouble codes is found in Figure 2.

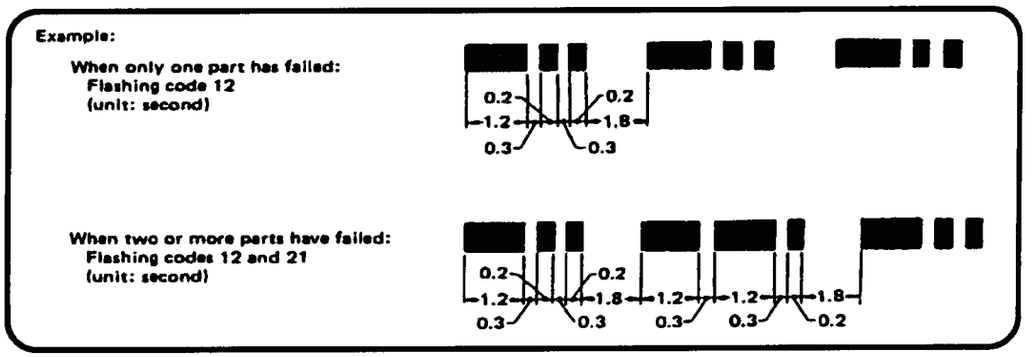


Figure 1.

Trouble code	Item	Content of diagnosis	Abbr. (Select monitor)
11	Duty solenoid A	Detects open or shorted drive circuit, as well as valve seizure.	PL
12	Duty solenoid B	Detects open or shorted drive circuit, as well as valve seizure.	L/U
13	Shift solenoid 3	Detects open or shorted drive circuit, as well as valve seizure.	OVR
14	Shift solenoid 2	Detects open or shorted drive circuit, as well as valve seizure.	SFT2
15	Shift solenoid 1	Detects open or shorted drive circuit, as well as valve seizure.	SFT1
21	ATF temperature sensor	Detects open or shorted input signal circuit.	ATFT
*22	Atmospheric sensor	Detects open or shorted input signal circuit.	BARO.P
23	Engine revolution signal	Detects open or shorted input signal circuit.	EREV
24	Duty solenoid C	Detects open or shorted drive circuit, as well as valve seizure.	4WD
31	Throttle sensor	Detects open or shorted input signal circuit.	THV
32	Vehicle speed sensor 1	Detects open or shorted input signal circuit.	VSP1
33	Vehicle speed sensor 2	Detects open or shorted input signal circuit.	VSP2

Figure 2.

CLEAR MEMORY

Current trouble codes displayed by the power light are cleared by turning the ignition switch OFF after conducting the self-diagnosis operation. Previous trouble codes, however, cannot be cleared since they are stored in the ECU memory which is operating on the back-up power supply. these codes can be cleared by removing the the #14 fuse located in the lower portion of the instrument panel. Be sure to keep the fuse out for at least one minute to insure that the codes have cleared.

TRANSMISSION CONTROL UNIT (TCU)

There are major differences in the Control Units and connectors between the XT version in 1987 and late model Legacy and SXV's. The XT has the TCU located inside of the left rear quarter panel. The Legacy TCU is located under the instrument panel, just to the left side of the steering column. A wiring schematic and connector information for the XT model is shown in Figure 3. The Legacy wiring schematic is shown in Figure 4. Connector information and votage checks for the Legacy are shown in Figure 5 and Figure 6.

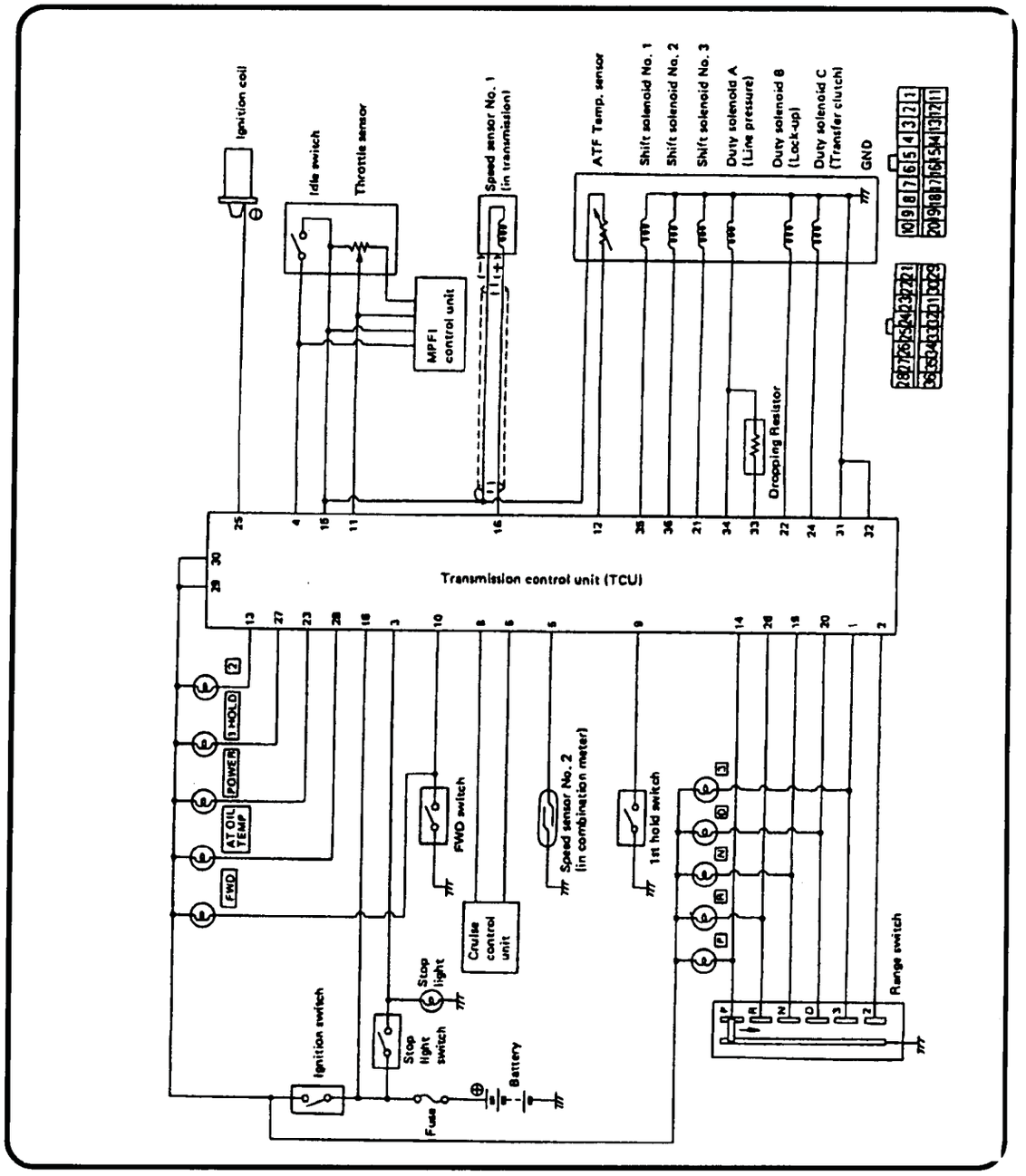


Figure 3.

TRANSMISSION CONTROL UNIT (TCU) CONTINUED

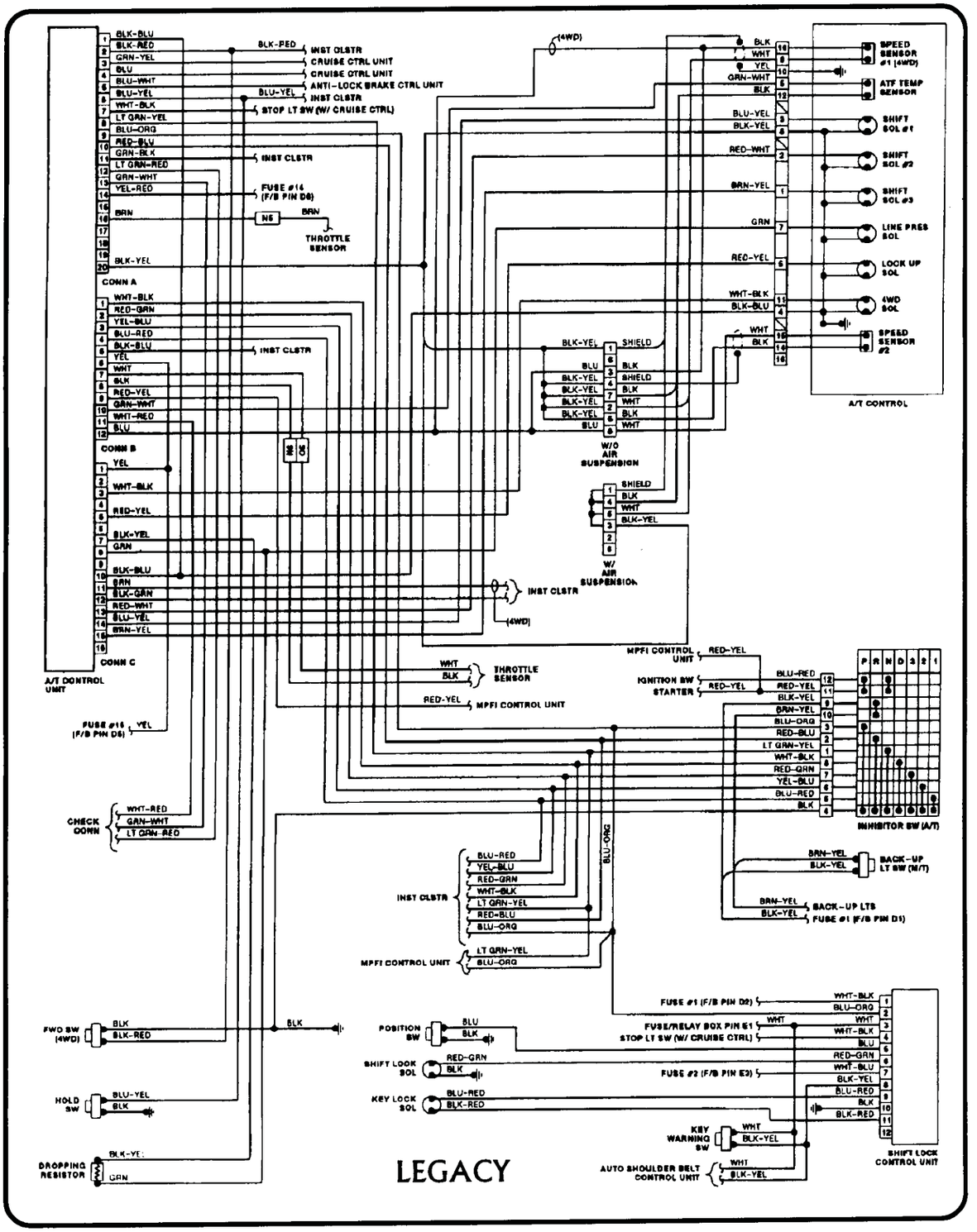
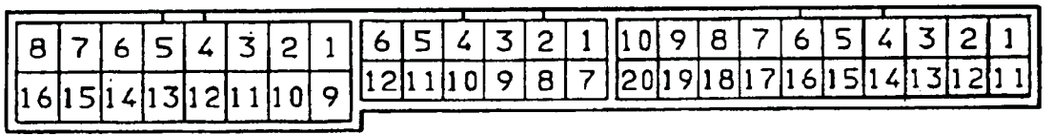


Figure 4.

TRANSMISSION CONTROL UNIT (TCU) CONTINUED

The Legacy models and the SXV models have three connectors that plug into the TCU. they are identified as connector B33, B44, and B46. When performing voltage checks or trying to identify individual circuits, be sure which connector contains the circuits to be checked.



LEGACY AT CONTROL UNIT CONNECTOR

VOLTAGE TESTS WITH IGNITION ON

Content			Connector No.	Terminal No.	Measuring conditions	Voltage (V)
Battery supply			B46	14	Ignition switch OFF	10 — 14
Ignition power supply			B33 B44	1 6	Ignition switch ON (with engine OFF)	10 — 14
Inhibitor switch	"P" range switch	Signal (—)	B46	9	Select lever in "P" range	Less than 1
					Select lever in any other than "P" range	9 — 13
	"R" range switch	Signal (—)	B46	10	Select lever in "R" range	Less than 1
					Select lever in any other than "R" range	8 — 10
	"N" range switch	Signal (—)	B46	8	Select lever in "N" range	Less than 1
					Select lever in any other than "N" range	9 — 13
	"D" range switch	Signal (—)	B44	1	Select lever in "D" range	Less than 1
					Select lever in any other than "D" range	4 — 7
	"3" range switch	Signal (—)	B44	2	Select lever in "3" range	Less than 1
					Select lever in any other than "3" range	6 — 10
	"2" range switch	Signal (—)	B44	3	Select lever in "2" range	Less than 1
					Select lever in any other than "2" range	8 — 10
	"1" range switch	Signal (—)	B44	4	Select lever in "1" range	Less than 1
					Select lever in any other than "1" range	8 — 10
Manual switch		Signal (—)	B46	6	Manual switch ON	Less than 1
					Manual switch OFF	8 — 10
Brake switch		Signal (+)	B46	7	Brake pedal depressed	10 — 14
					Brake pedal released	Less than 0.5
ABS signal		Signal (—)	B46	5	ABS switch ON	Less than 1
					ABS switch OFF	8 — 10

Figure 5.

TRANSMISSION CONTROL UNIT (TCU) CONTINUED

Content		Connector No.	Terminal No.	Measuring conditions	Voltage (V)	Resistance to body (ohms)
Throttle sensor	Signal	B44	8	Throttle fully closed	4.0 — 4.8	—
				Throttle fully open	0.7 — 1.7	
Idle switch	Signal	B46	18	Throttle fully closed	Less than 0.5	—
				Throttle open at least 2 degrees	3 — 6	
ATF temperature sensor	Signal (+)	B44	10	ATF temperature 20°C (68°F)	3.0 — 3.5	2.3 k — 2.7 k
				ATF temperature 80°C (176°F)	1.0 — 1.3	280 — 360
Vehicle speed sensor 1	Signal (+)	B44	12	Vehicle stopped	0	450 — 650
				Vehicle speed at least 20 km/h (12 MPH)	Greater than 1 (AC range)	
Vehicle speed sensor 2	Signal (+)	B46	11	When vehicle is slowly moved at least 2 meters (7ft)	Less than 1→↑greater than 4	—
*Atmospheric sensor	Signal (+)	B44	9	—	—	—
Cruise set signal	Signal (—)	B46	3	When cruise control is set (SET lamp ON)	Less than 1	—
				When cruise control is not set (SET lamp OFF)	8 — 10	
Shift solenoid 1		B33	14	Select lever in 1st or 4th gear	10 — 14	20 — 30
				Select lever in 2nd or 3rd gear	Less than 1	
Shift solenoid 2		B33	13	Select lever in 1st or 2nd gear	10 — 14	20 — 30
				Select lever in 3rd or 4th gear	Less than 1	
Shift solenoid 3		B33	15	Select lever in "N" range (with throttle fully closed)	Less than 1	20 — 30
				Select lever in "D" range (with throttle fully closed)	10 — 14	
Duty solenoid A		B33	8	Throttle fully closed (with engine OFF) after warm-up	1.5 — 3.0	1.5 — 4.5
				Throttle fully open (with engine OFF) after warm-up	Less than 0.5	
Dropping resistor		B33	7	Throttle fully closed (with engine OFF) after warm-up	5 — 14	9 — 15
				Throttle fully open (with engine OFF) after warm-up	Less than 0.5	
Duty solenoid B		B33	6	When lockup occurs	8 — 14	9 — 15
				When lockup is released	Less than 0.5	
Duty solenoid C		B33	3	Fuse on FWD switch	8 — 14	9 — 15
				Fuse removed from FWD switch (with throttle fully open and with select lever in 1st gear	Less than 0.5	
Sensor ground line 1		B44	7	—	0	Less than 1
Sensor ground line 2		B46	20	—	0	Less than 1
System ground line		B46	1	—	0	Less than 1
Power system ground line		B33	10	—	0	Less than 1
FWD switch		B46	2	Fuse removed	10 — 14	
				Fuse installed	Less than 1	

Figure 6.

FUNCTION OF MAJOR ELECTRICAL COMPONENTS

Figure 7 gives a breif description of each of the transmission and TCU input and output signals. The function of these signals is described in some detail. Further in this chapter, more specifics for each sensor and solenoid will be provided where possible.

INPUT SIGNAL

Signal name	Major function
Throttle sensor	Detects throttle opening and determines shift point, line pressure and lock-up vehicle speed according to engine load.
Vehicle speed sensor 1 (mounted to transmission)	Detects vehicle speed. This signal is used to control shifting, lock-up, line pressure, and transfer clutch.
Vehicle speed sensor 2 (build-in meter) (mounted to transmission)	Used to control transfer clutch and as backup in case of failure of vehicle speed sensor 1.
Engine revolution	Detects engine speed. This signal is used for lock-up clutch smooth, control at lock-up and to prevent engine overrunning at "2" and "1" range.
Inhibitor switch	Used to determine shifting and line pressure for respective ranges "P", "R", "N", "D", "3", "2" and "1".
Cruise switch (cruise control)	Detects operation of cruise control, and expands "4th" operating range.
ATF temperature sensor	Detects ATF temperature. This signal is used for inhibition of lock-up, release of OD and detection of ATF temperature.
Manual switch	Used to maintain the transmission in select range 2nd, 3rd when going up or down steep hills, running on sand, mud, or slippery surfaces.
FWD switch	Used to change the mode from AWD to FWD. Also used to adapt the vehicle to FWD tester roller. Changeover from AWD to FWD can be accomplished by inserting a fuse into the fuse holder.
ABS signal	When ABS is operating, to optimize ABS control, transfer clutch torque is controlled to eliminate the influence of engine braking and reduce the degree of coupling between front and rear wheels.
Atmospheric pressure sensor	Detects atmospheric pressure. This signal is used for decrease the shift shock at the high ground.

OUTPUT SIGNAL

Signal name	Function
Shift solenoids 1, 2	Controls shift stage by turning solenoid ON/OFF. Relationship between solenoid operation and shifting stage is shown in Table below. When shifting, timing is controlled for each solenoid to reduce shock.
Shift solenoid 3 (Overrunning clutch)	Controls 3-2 shift timing and overrunning clutch operation. Shift timing is controlled by controlling release speed of oil pressure to reduce shock while downshifting. The overrunning clutch is controlled so that it will operate during coasting to apply engine brake.
Duty solenoid A (line pressure)	Regulates the line pressure according to driving conditions.
Duty solenoid B (lock-up)	Regulates the hydraulic pressure of the lock-up clutch and operates in three modes (open, smooth and lock-up).
Duty solenoid C (transfer pressure)	Regulates the hydraulic pressure of the transfer clutch and controls the driving force to the rear drive shaft.
"Power" indicator light	Indicates whether the shift pattern is "Normal" or "Power". The indicator lights in power mode. This light is also used for "self-diagnosis".
FWD pilot light	Lights when the "FWD switch" turned ON.
ATF temperature warning light	Lights when ATF becomes hot (exceeds a set temperature level).

Figure 7.

INPUT COMPONENT DESCRIPTION

Vehicle Speed Sensor 1 (output shaft rotation sensor) is mounted on the top of the transmission on 2WD vehicles, and on the extention housing on AWD vehicles. See Figure 8. The speed sensor outputs a pulse signal which is transmitted to the TCU where it is converted to vehicle speed. It can be checked with an ohmmeter at the harness connector. First, disconnect the transaxle multiconnector harness. Models with the "round' connector are checked between pins 8 and 10. Models with the "square" connector are checked between pins 9 and 16. Pin identification is found in Figure 12.

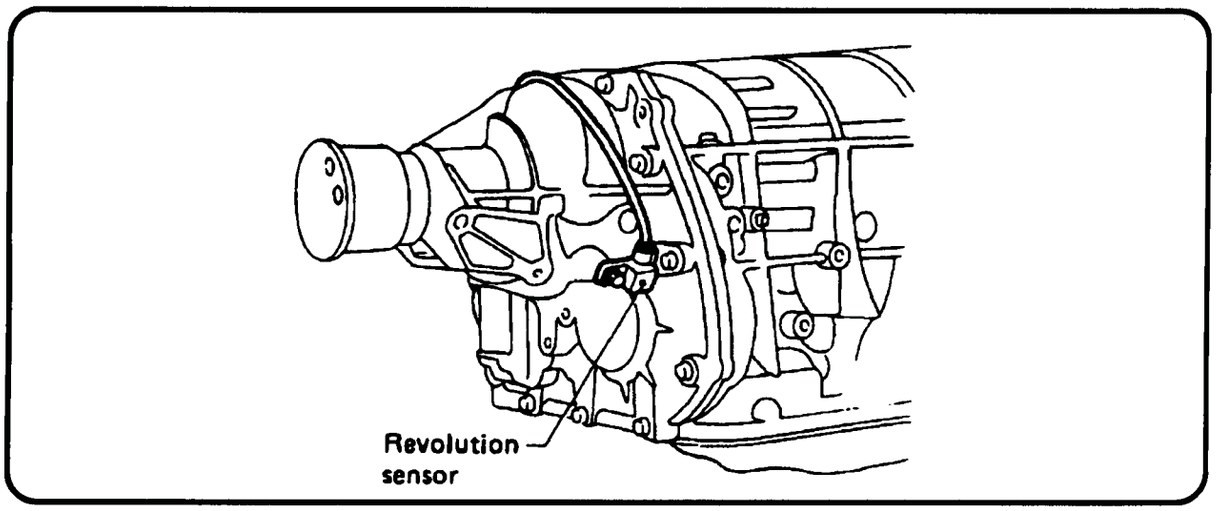


Figure 8.

Vehicle Speed Sensor 2 is in the combination meter (speedo head). The reed switch near the speedometer is turned on or off by the rotating of the speedometer cable and the pulse signal is converted to speed signal by the TCU. It can be checked at the TCU with a volt meter. With the wheels turning slowly, there should alternately be about 1 volt max. to 4 volts min. Check between ground and Connector B46, pin 11 on Legacy and between ground and pin 5 on XT models.

The **Throttle Sensor** provides electrical input to the TCU corresponding to throttle opening. The throttle opening and acceleator pedal depression speed are detected by this throttle sensor. it can be checked with an ohmmeter. First, disconnect the wire connector at the throttle sensor. Figure 9 shows typical throttle sensors and ohms test values.

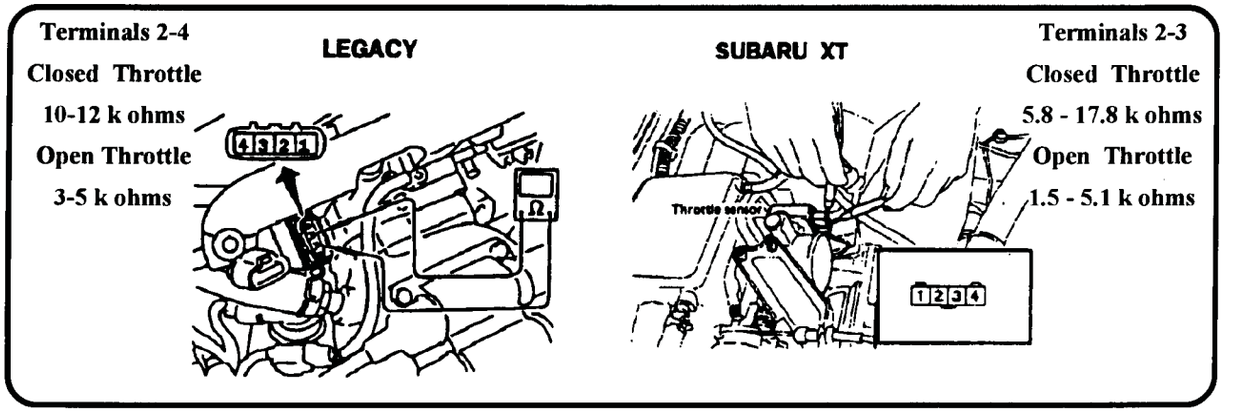


Figure 9.

INPUT COMPONENT DESCRIPTION CONTINUED

The **Inhibitor Switch** is mounted on the right side of the transmission case and it has two functions. First, it assures safety when starting the engine. When the selector is placed in "P" or "N", the electrical circuit in the inhibitor switch is completed so that the starter may be engaged. Second, the inhibitor switch incorporates circuits for detecting the selected range position and sending those range signals to the TCU. Figures 10 and 11 show wire color, connector identification, and continuity test charts for the XT and Legacy.

Lever Position \ Terminal #	1	2	3	4	5	6	7	8	9	10	11
Park	O	O						O	O		
Reverse	O		O							O	O
Neutral	O			O				O	O		
Drive	O				O						
3	O					O					
2	O						O				
Color	B	YL	BR	YG	YW	YB	R	BY	BW	BW	GB

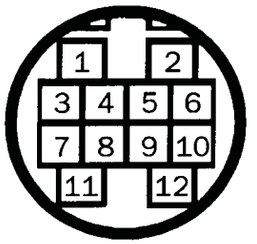


Figure 10.

PIN NO.	4	3	2	1	8	7	6	5	12	11	10	9
LEAD COLOR / POSITION	B	YL	BR	YG	YW	YB	R	GW	BY	BW	BW	GB
P	O	O							O	O		
R	O		O								O	O
N	O			O					O	O		
D	O				O							
3	O					O						
2	O						O					
1	O							O				
	SIGNAL SENT TO AT CONTROL UNIT								IGNITION CIRCUIT		BACK-UP LIGHT CIRCUIT	

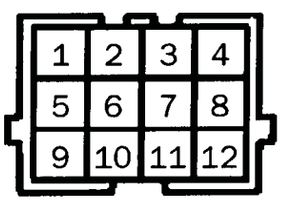


Figure 11.

The **"Hold" Switch"** and **"Power" Switch** are located on the gear shift lever and instrument cluster depending upon model. The "Hold' Switch signals the TCU to "hold" first or second gear as commanded by the driver. In drive range, it also prevents overdrive. The "Power" switch signals the TCU to change the shift strategy to proveide a sporty feel rather than conserve fuel.

The **FWD Switch** on all wheel drive vehicles only sends a ground signal to the TCU to energize the transfer solenoid which will cancel power to the rear wheels.

TRANSMISSION SOLENOID AND SENSOR DESCRIPTION

The **Transmission Temperature Sensor** is mounted on the valve body and signals the TCU a resistance value which affects shift strategy . Ohms resistance checks can be made at the TCU. For resistance values see Figure 6.

Shift Solenoids 1 and 2 are located on the valve body. See Figure 12. They are turne on and of according to the signal from the TCU. the pattern in which they are energized determines the gear range achieved. Figure 13 gives a solenoid operation chart and ohms test information.

Shift Solenoid 3 is also located on the valve body. See figure 12. The TCU turns this on or off to control engagement of the overrun clutch. This provides engine braking when needed.

Duty Solenoid A (Line Pressure Solenoid) uses a pulse signal sent by the TCU to control transmission oil pressure. This solenoid regulates the pressure modifier valve and the pressure regulator to adjust line pressure for best operating charactoristics at all throttle opening and load conditions. This solenoid is also on the valve body as shown in figure 12.

Duty Solenoid B (Lock-Up Solenoid) also uses a pulse signal sent by the TCU. This signal controls the lock-up control valve to provide smooth engagement and disengagement of the converter clutch.

Duty Solenoid C (Transfer Solenoid) used on 4WD and AWD models only, is mounted to the transfer control valve side of the extension case. It is duty ratio controlled by the TCU. It controls transfer control valve to make the rate of application of the transfer clutch correct for all traction conditions. it is identified in Figure 12.

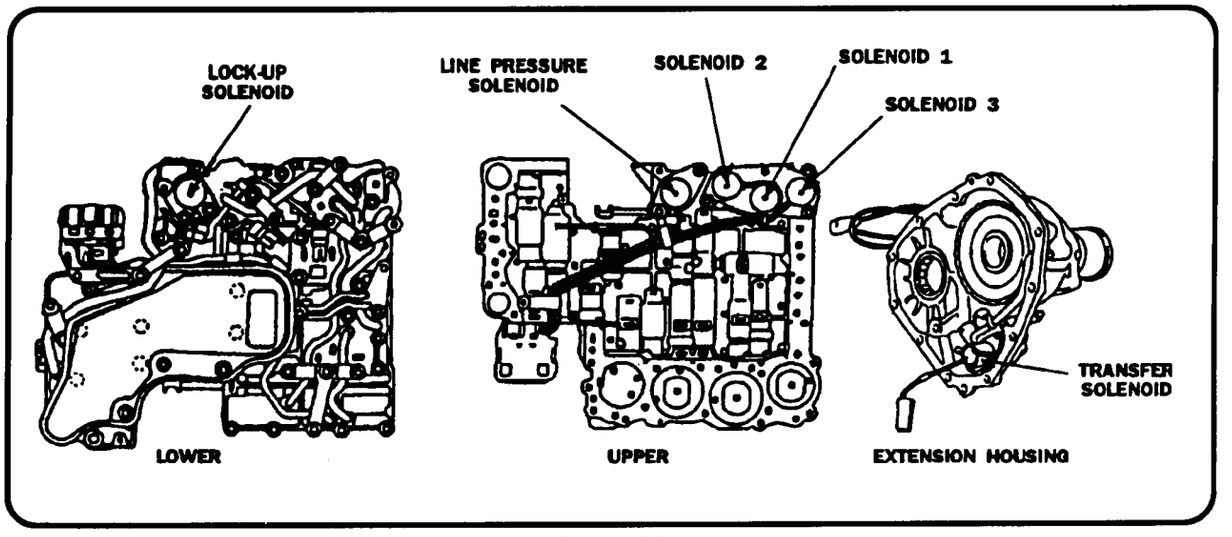
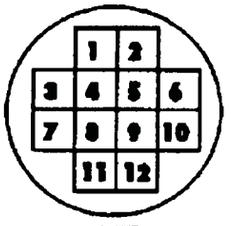


Figure 12.

TRANSMISSION SOLENOID AND SENSOR DESCRIPTION CONTINUED

The Solenoid application chart is shown in Figure 13. Pin identification is different between XT and Legacy, so be sure that you make checks and tests at the proper connector . The inhibitor connector is often mistaken for the solenoid connector.

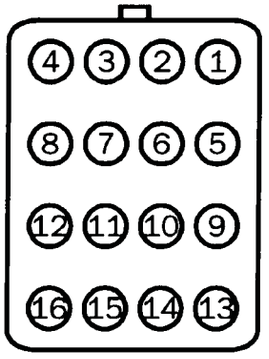
GEAR	SOLENOID A	SOLENOID B	LOCK-UP SOLENOID	OVERRUN SOLENOID	PRESSURE SOLENOID
1st	ON	ON	OFF	ACTIVATES FOR ENGINE BRAKING	PULSE MODULATION CONTROLLED BY COMPUTER
2nd	OFF	ON	OFF		
3rd	OFF	OFF	OFF		
4th	ON	OFF	ON	OFF	
OHMS	20 - 30	20 - 30	10 - 16	20 - 30	2.5 - 5



XT

Pin 7 is Shift Solenoid A. (Blue/Yellow)
Pin 1 is Shift Solenoid B. (Blue/Lt. Green)
Pin 4 is the Overrun Solenoid. (Blue/Black)
Pin 11 is the Pressure Solenoid.
Pin 2 is the Lock-up Solenoid.
Pins 5 and 9 are the TOT Sensor wires.
Pin 12 is the Transfer Clutch Solenoid.

WIRE SIDE OF 12 TERMINAL CONNECTOR GOING TO THE TRANSMISSION



LEGACY

PIN 1	SHIFT SOLENOID 1 (BLUE & YELLOW)
PIN 2	SHIFT SOLENOID 2 (RED & WHITE)
PIN 3	SHIFT SOLENOID 1 (BLUE & YELLOW)
PIN 4 & 8	GROUND
PIN 5 & 12	TEMPERATURE SENSOR
PIN 6	LOCK-UP SOLENOID
PIN 7	LINE PRESSURE SOLENOID
PIN 9 & 16	VEHICLE SPEED SENSOR (AWD)
PIN 10	SHEILD WIRE
PIN 11	TRANSFER CLUTCH (AWD)
PIN 13	NOT USED
PIN 14 & 15	VEHICLE SPEED SENSOR (FWD)

Figure 13.

TOYOTA COMPUTER CONTROLS

Toyota transmissions have had computer controls for almost a decade. Many updates and changes have occurred, but the basic design and test procedures have remained remarkably similar. Toyota front wheel drive models and rear wheel drive models use the same solenoid pattern, throttle signals, speed signals, and trouble codes. Therefore the test procedures and component descriptions described in this chapter will be generec except where specific differences need to be explained. The early model (1983-1984) computer controlled systems did not have built in diagnostics. These models required specific voltage tests to diagnose malfunctions. Procedures for testing the early models are also outlined in this chapter. Beginning in 1985, Toyota computers incorporated internal diagnostics with retrievable trouble codes. If a malfunction occurs in one of the speed sensors or solenoid valves, or in the circuitry of either,this fact will be communicated to the ECU and stored in its memory. These codes can be read using a scan tool or by jumping the diagnosic pin to trigger trouble codes to be displayed at the O D light.

SELF DIAGNOSTIC SYSTEM

When the ECU detects an open short circuit in the vehicle speed sensors or solenoid valves circuitry, it flashes the "O/D OFF" light to alert the driver.

(Note: When the O/D switch is OFF, the "O/D OFF" light merely lights; it does not blink.) At the same time, ECU stores the location of the fault in its memory. The memory contents remain intact even if the ignition switch is turned OFF because the memory stored is protected by a backup power supply.

Start the "O/D OFF" light by turning the ignition switch ON and short-circuiting the ECT and E1 terminals of the diagnostics connector for Supra and Camry, short- circuiting Tt ans E1 on 1990 and later Camrys, or grounding the DG terminal (Truck and Early Models). Six diagnostic codes, for A140E, A43DE, A340E or seven diagnostic codes for A340H, including Normal, are provided. They are displayed as flashing patterns on the "O/D OFF" light. See Figure 1 for diagnostic connector information and O/D light pattern interpretation.

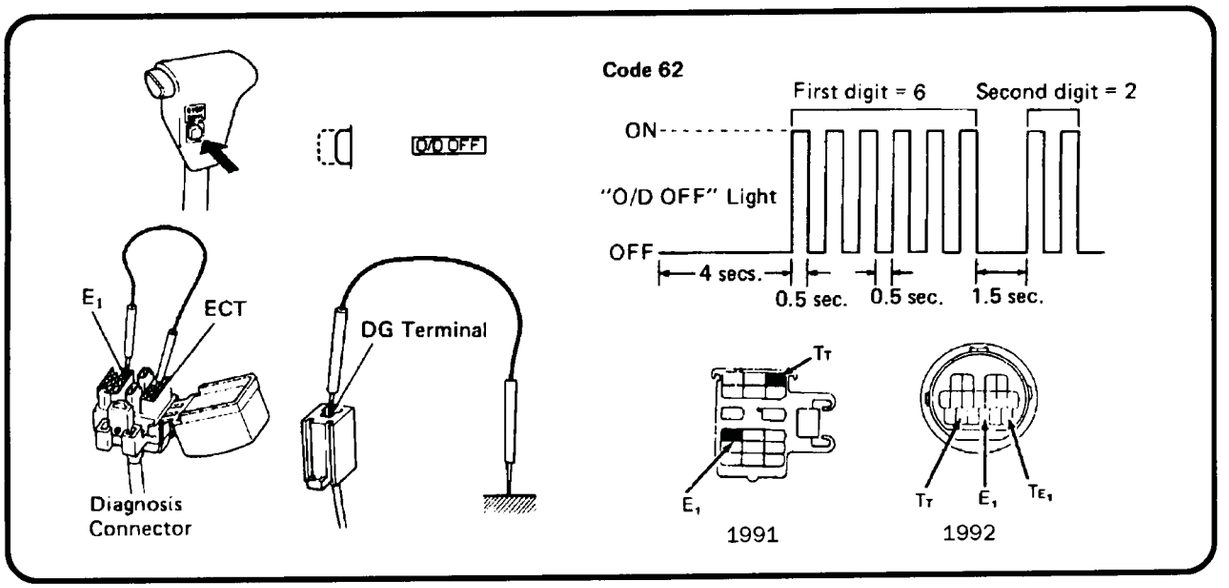


Figure 1

TROUBLE CODES

Normal code indication: The light will blink 2 times per second.

Malfunction code indication: First, the light will pause 4 seconds.

Thereafter, the number of times the light blinks once a second is the first figure of a code. Next, the number of times the light blinks once a second is the second figure of the code. See Figure 2 for a list of trouble codes and their meaning.

Code No.	Light Pattern	Diagnosis System
Normal		Normal: this appears when none of the other codes are indicated.
42		Defective No. 1 speed sensor (in combination meter) Severed wire harness or short circuit
61		Defective No. 2 speed sensor (in ATM) Severed wire harness or short circuit
62		Severed No. 1 solenoid or short circuit Severed wire harness or short circuit
63		Severed No. 2 solenoid or short circuit Severed wire harness or short circuit
64		Severed No. 3 solenoid or short circuit Severed wire harness or short circuit
65 (A340H)		Severed No. 4 solenoid or short circuit Severed wire harness or short circuit

Figure 2.

If there is more than one malfunction code, the code with the smallest number will appear first. Followed by a pause of 2.5 seconds, then the next code will appear in the same manner as described above. Finally, the entire procedure will be repeated.

-NOTES-

1. If the diagnosis system yields a code other than NORMAL even though the "O/D OFF" light was not blinking, there is intermittent trouble. Check all the connections in the circuits corresponding to that code.

2. Should the speed sensors No. 1 and No. 2 happen to fail simultaneously, the ECU will neither alert the driver by flashing the "O/D OFF" light nor record any diagnostic code except NORMAL. It will, however, decide that the driver allow to use only 1st and none of the other gears; shifting upward will then be disabled.

3. Codes 62, 63, 64 and 65 (A340H) are limited to short or open circuits in the electrical system comprised of the solenoids, wire harness, and connectors. The ECU is unable to detect mechanical trouble (sticking, for example) in the solenoid valves.

4. Should solenoid valve No. 3 (for lock-up clutch control) fail, the ECU will not flash the "O/D OFF" light to alert the driver. It will, however, record the failure in the form of code 64, which may be displayed during troubleshooting.

GENERAL OVERVIEW

The electronic control sytem for controlling the shift timings and the operation of the lock-up clutch is composed of the following three parts:

1. Sensors: These sense the vehicle speed and throttle position and send the data to the ECU in the form of electronic signals.

2. ECU: This determines the shift and lock-up timing based upon the signals from the sensors.

3. Actuators: Solenoid valves divert hydraulic control unit to another, thus controling shifting and lock-up timing.

SENSORS

The **Throttle Position Sensor** is located on the side of the throttle body, the throttle position sensor signals the throttle position to the ECU. This signal is crucial to the ECU determination of gear-shifting points. It corresponds to the throttle pressure in the hydraulically-controlled automatic transmission. Both the direct and indirect type throttle position sensors are shown in Figure 3.

INDIRECT TYPE : The indirect type throttle position sensor contains four terminnals: Vc, Vta, IDL, and E. The Vc terminal receives a constant voltage of 5 volts from the TCCS (Toyota computer-controlled system) ECU. The Vta terminal outputs a continuous voltage signal proportional to throttle position. The IDL terminal sends the "fully closed signal" to the ECU. The E terminal is used for grounding. The TCCS ECU converts the voltage signal from the VTA terminal into one of three signals - L-1, L-2, and L-3.

DIRECT TYPE: The direct type throttle position sensor contains the IDL contact which corresponds to fully closed throttle, and three other contacts, L1, L2, and L3 - which correspond to intermediate throttle positions. The electrical connections between the above mentioned four contacts and the grounding contact provide a range of nine throttle position signals to the ECU. This type of throttle sensor is more difficult to check independantly of the vehicle computer system and it is recommended that it be checked at the diagnostic connector with a volt meter.

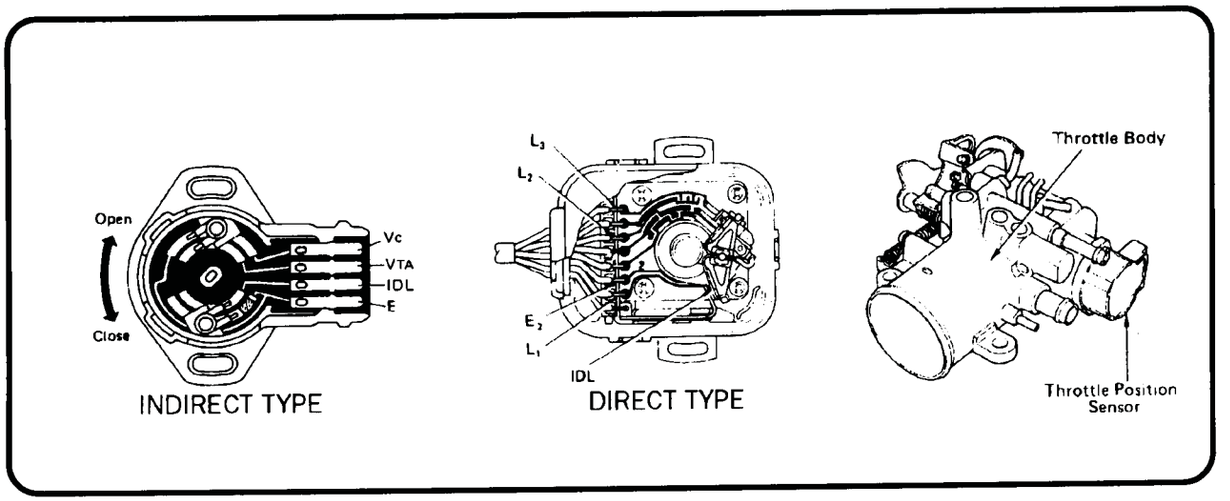


Figure 3.

SENSORS CONTINUED

Checking the throttle sensor is done with the ignition switch on and the engine off. Connect a volt meter as shown in Figure 4. Gradually depress the accelerator pedal from the fully closed position to the fully open position. If the voltage at the DG or ECT terminal rises in 1 volt increments from less than .5 volts, to approximately 8 volts, the throttle position sensor is working normally.

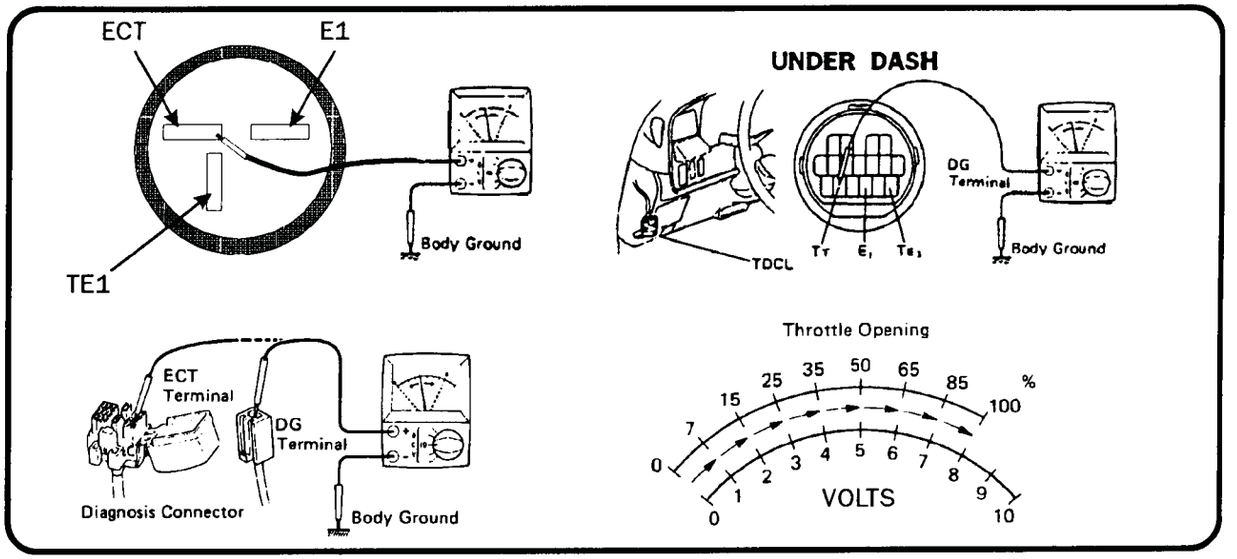


Figure 4.

SPEED SENSOR

The Speed sensors (No. 1 and No. 2) which replace the governor pressure of the hydraulically controlled automatic transmission tell the ECU the vehicle speed. They are critical as the ECU determines the gear shifting point from the throttle valve position and from vehicle speed.

NO. 1 SPEED SENSOR

This sensor is built into the the speedometer and operates in the place of the No. 2 Speed Sensor , if the No. 2 Speed Sensor should happen to malfunction. it outputs four pulses for every one revolution of the speedometer cable. This sensor can be checked at the ECU. See the appropriate wire schematic for pin identification.

NO. 2 SPEED SENSOR

A rotor with a built-in magnet is mounted to the transmission output shaft. Every time that the output shaft (and thus the rotor) makes one complete revolution, the magnet activates a reed switch in the No. 2 speed sensor, mounted to the extention housing or case.The reed switch activates over and over, causing a signal to be generated. This signal is sent to the ECU, which uses it in controlling the shift points and the operation of the lock-up clutch. It can be checked with an ohmmeter at the ECU or at the transmission . When checking it at the transmission, it must be disconnected from the wire connector. See Figure 5 for speed sensor identification and testinf information.

SENSORS CONTINUED

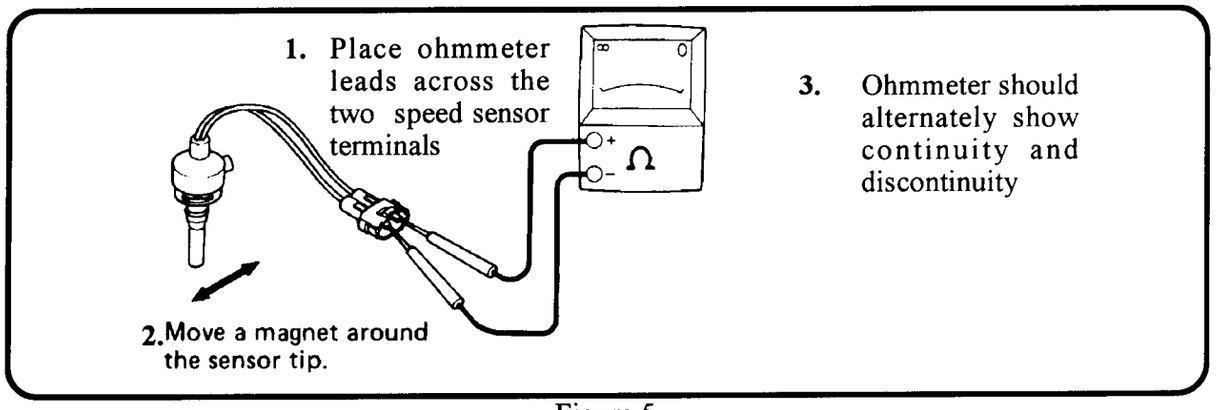
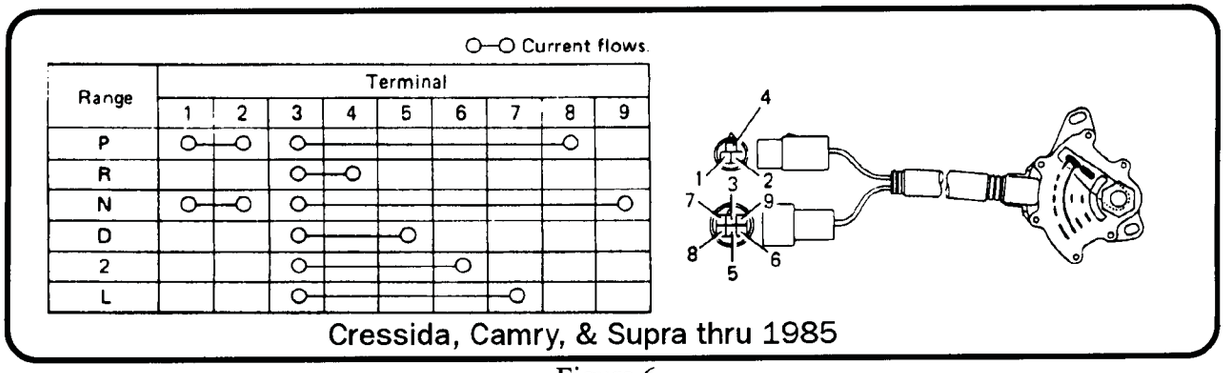


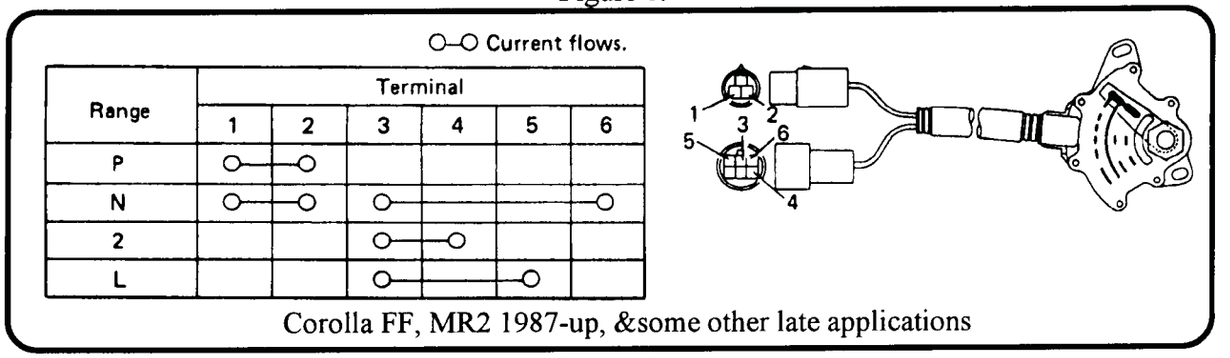
Figure 5.

The **Neutral Safety Switch** is mounted to the transmission and tells the ECU the selector lever position. This switch contains contacts for both starter circuit control and the shift position indicator, but the ECT uses signals from two of them on some models, three of them on others, and four of them on still others. The Supra, 340H, Cressida, and Camry and Celica thru 1985 use two signals from the neutral safety switch. The ECT interprets the grounding of contacts "2" and "L" for shift strategy and interprets all other positions as "D" range. The 340E and the Camry, Celica, Corolla, and MR2 from 1986-up use three signals from the neutral safety switch. In addition to the contacts described above, these models interpret the "N" position to reduce squat or jerk into gear. The "V6" Camry uses four signals from the neutral safety switch. The ECU interprets the "R" position as well as the other three positions described above. The neutral safety switch can be checked for continuity in the proper ranges according to Figure 6, Figure 7, and Figure 8.



Cressida, Camry, & Supra thru 1985

Figure 6.



Corolla FF, MR2 1987-up, &some other late applications

Figure 7.

SENSORS CONTINUED

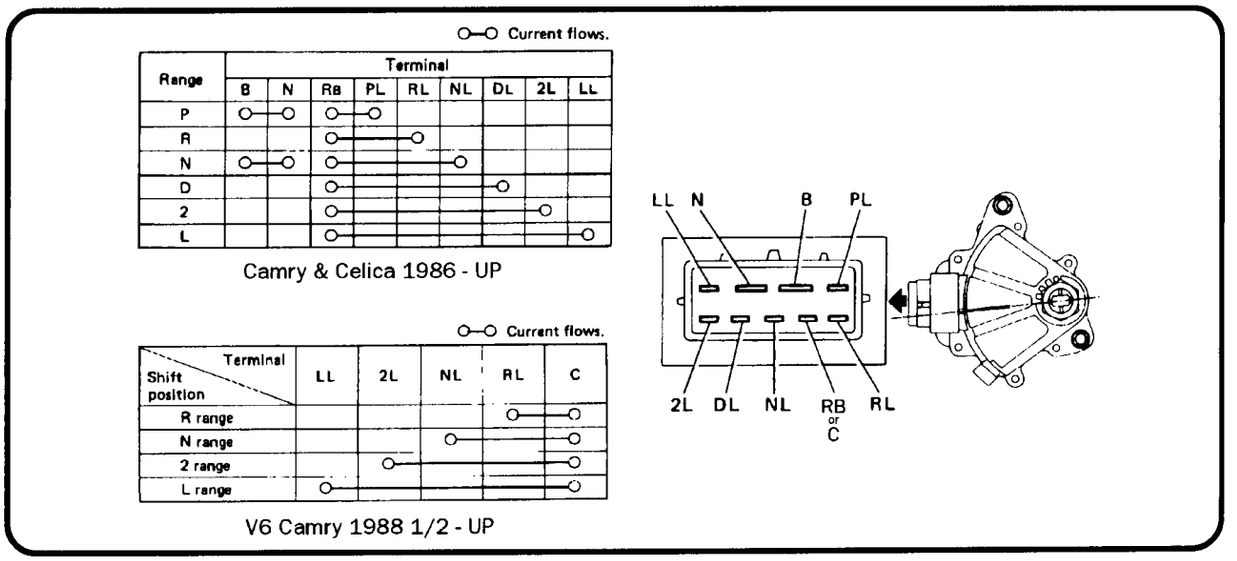


Figure 8.

Transfer Shift Position Switch (A340H only) he transfer shift position switch tells the ECU whether the transfer shift lever has been shifted into "L4" or not. When the switch contacts are closed, the ECU detects that the transfer shift lever is in the "L4" position. When the switch is open, the ECU detects that the lever is in "H2" or "H4". This switch can be checked for continuity according to Figure 9.

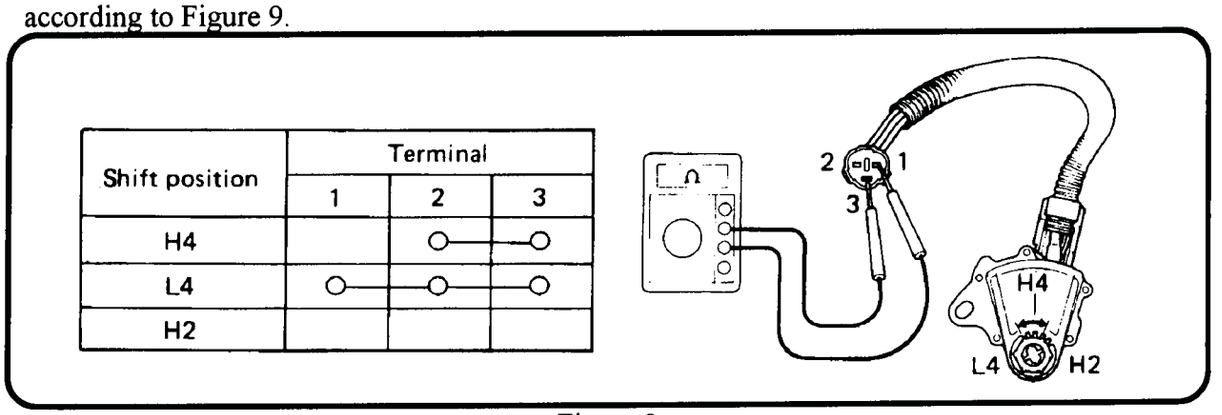


Figure 9.

BRAKE LIGHT SWITCH

This switch is mounted on the brake pedal bracket. It's purpose is to tell the ECU to turn off the lock-up clutch when braking occurs. It is a normally open switch that closes to ground. It can also be checked at the dignostic connector with a volt meter. With the ignition on and the engine off, the voltage at the ECT terminal should be about 8 volts with the gas pedal fully depressed (see throttle sensor checks). while observing the voltage reading for fully open throttle, depress the brake pedal. the voltage shoud drop to zero if the brake switch is working properly.

SENSORS CONTINUED

O/D SWITCH Some Toyotas use an overdrive switch that causes the transmission to shift into and out of overdrive. When the O/D switch is turned on, a signal is sent to the ECU to enable overdrive and turn off the O/D OFF light. A circuit diagram for the overdrive switch is shown in Figure 10.

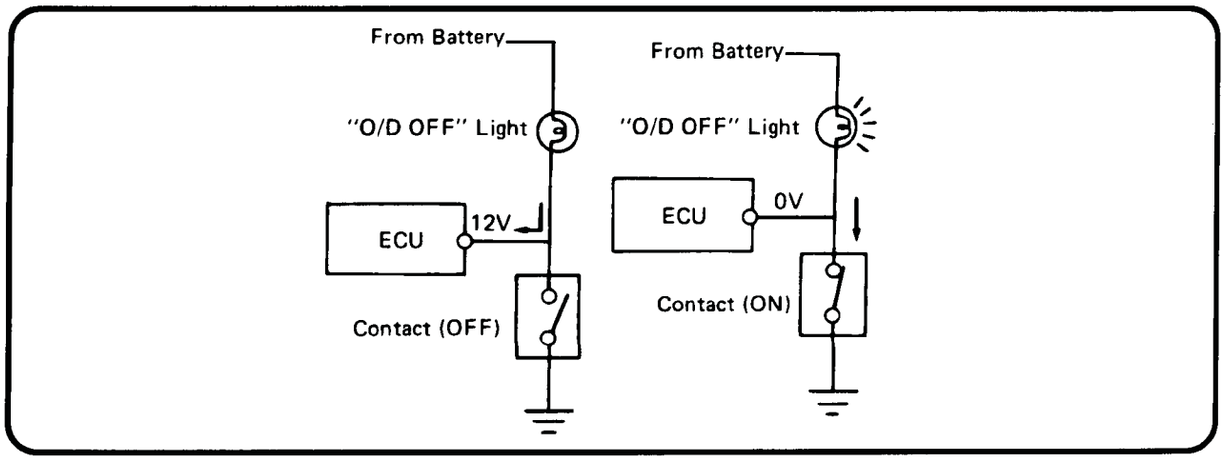


Figure 10.

O/D CANCEL SIGNAL The O/D cancel signal travels from the TCCS ECU and cruise control computer to the OD1 terminal of the ECU connector. Grounding the OD1 terminal prevents the ECU from shifting into overdrive gear. The TCCS ECU and the cruise control computer ground the OD1 terminal to inhibit shifting to O/D in the following situations:

TCCS ECU shows water temperature is 122° F. or less.

CRUISE CONTROL COMPUTER sees the the preset vehicle speed exceeds actual vehicle speed by more than 4 - 6 mph when the cruise control system is in operation.

Note: on late models vehicle that have one ECU that controls engine and transmission functions, the OD1 terminal is on the ECU so no seperate water temperature signal is necessary.

PATTERN SELECT SWITCH Two shift schedules are programmed into the ECU. They are the "Power" and "Normal" modes. The shift strategy provided by the ECU is determined bt the selection of this switch setting. It is usually found on the consol near the gear shift lever. It is easiest to check the pattern select switch at the ECT ECU with a volt meter. See the appropriate wire schematic on the following pages.

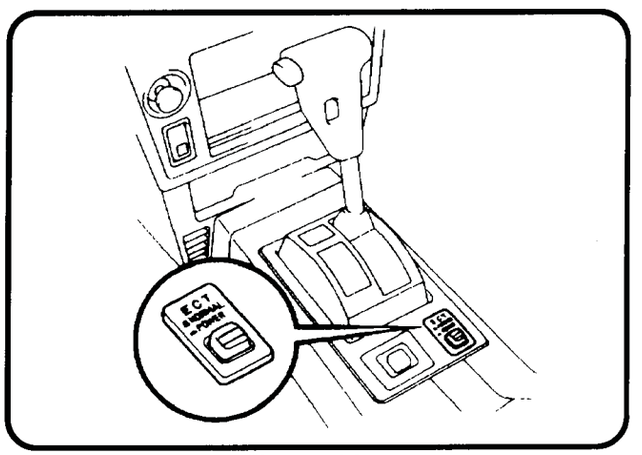


Figure 11.

SYSTEM LAYOUT

There are many location configurations possible for the solenoids, switchs, sensors, and the ECT (Electronically Controlled Transmission) computer. The most common system layouts are shown in the following Figures.

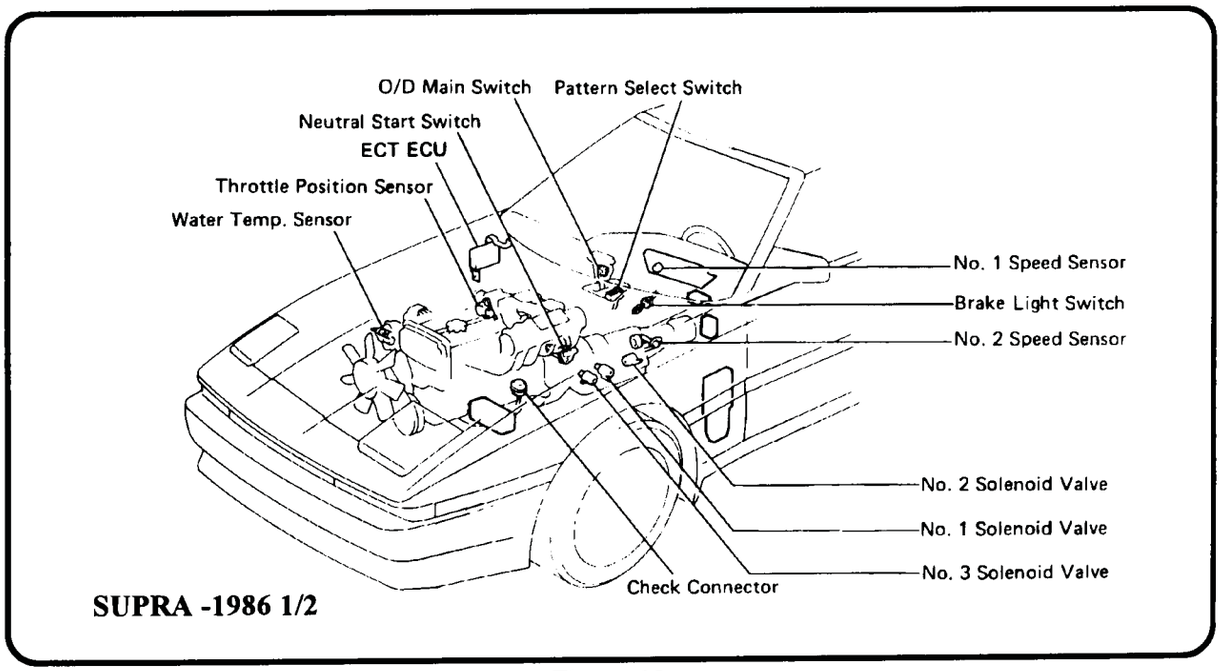


Figure 12.

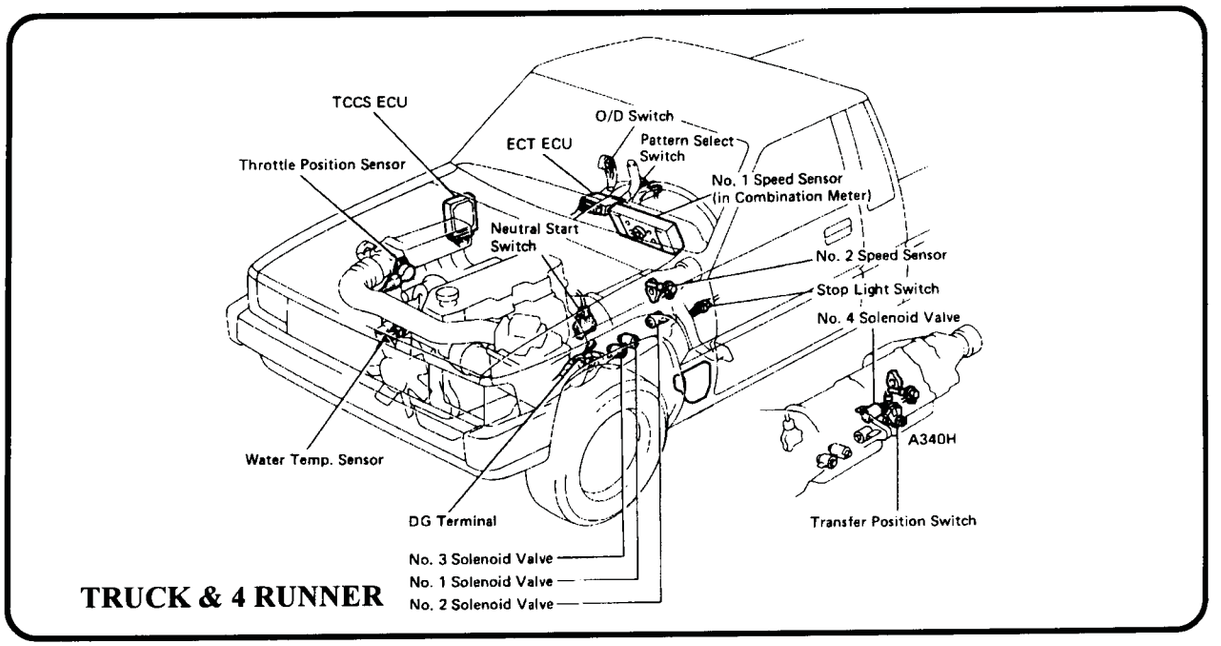


Figure 13.

SYSTEM LAYOUT CONTINUED

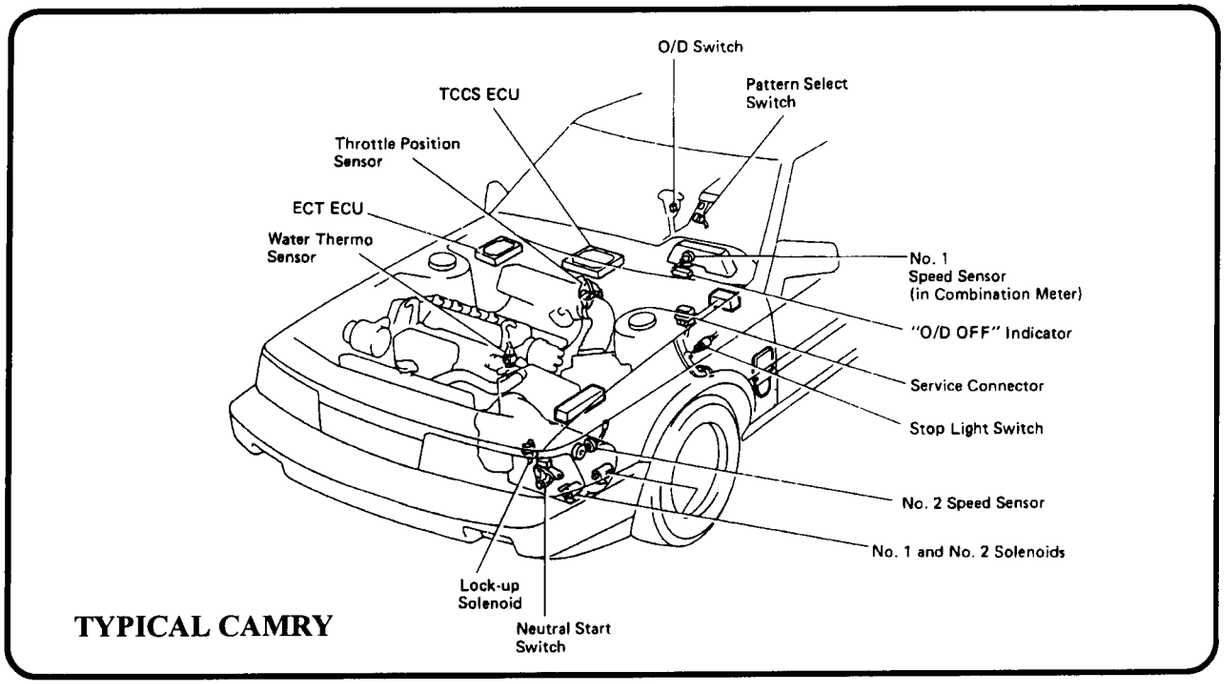


Figure 14.

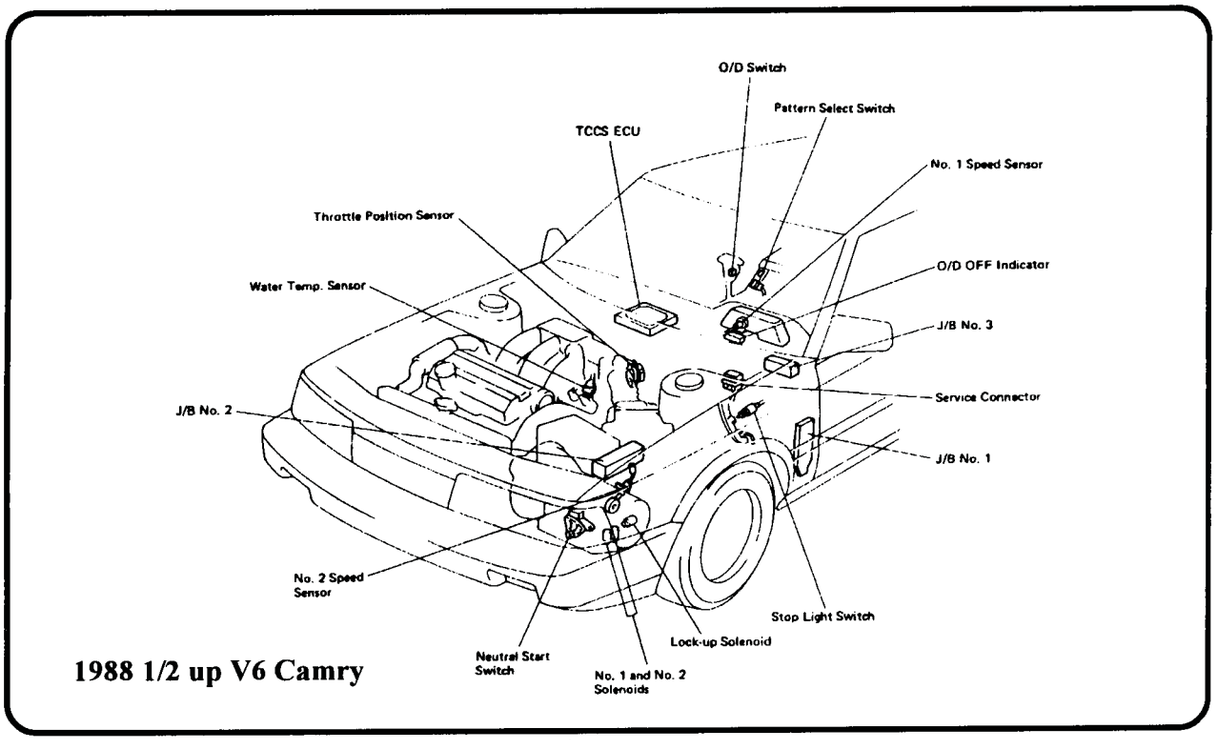


Figure 15.

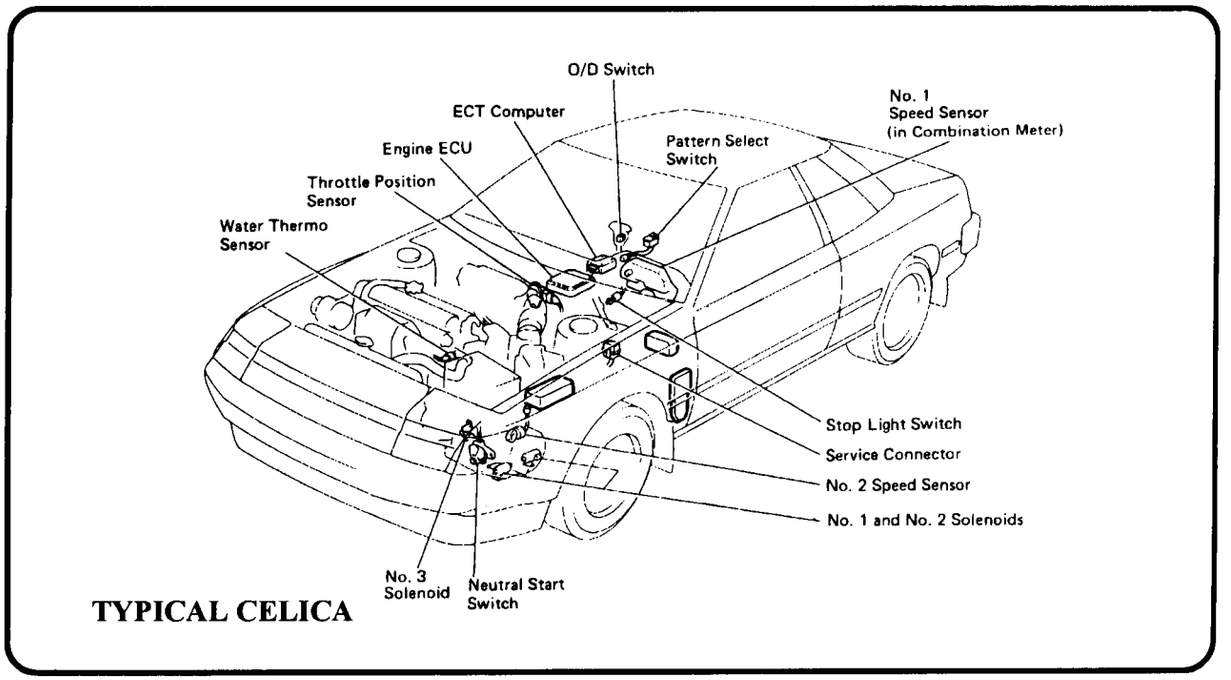


Figure 16.

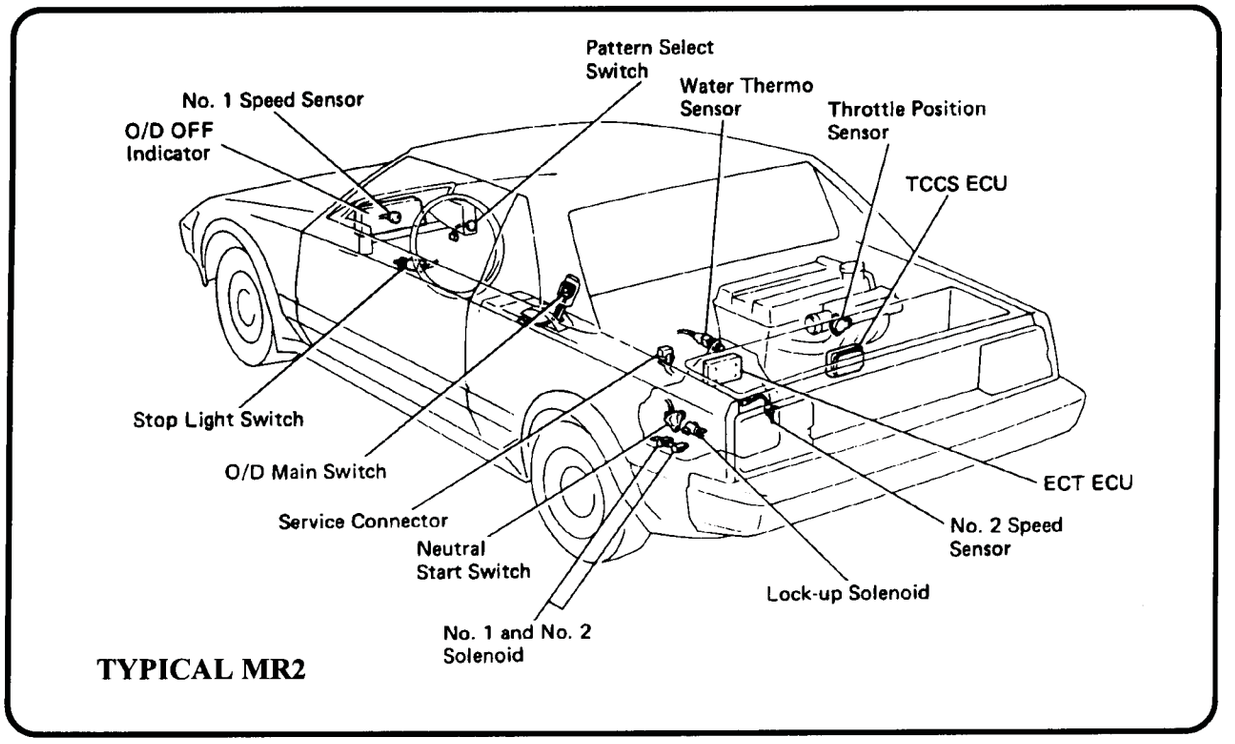


Figure 17.

SYSTEM LAYOUT CONTINUED

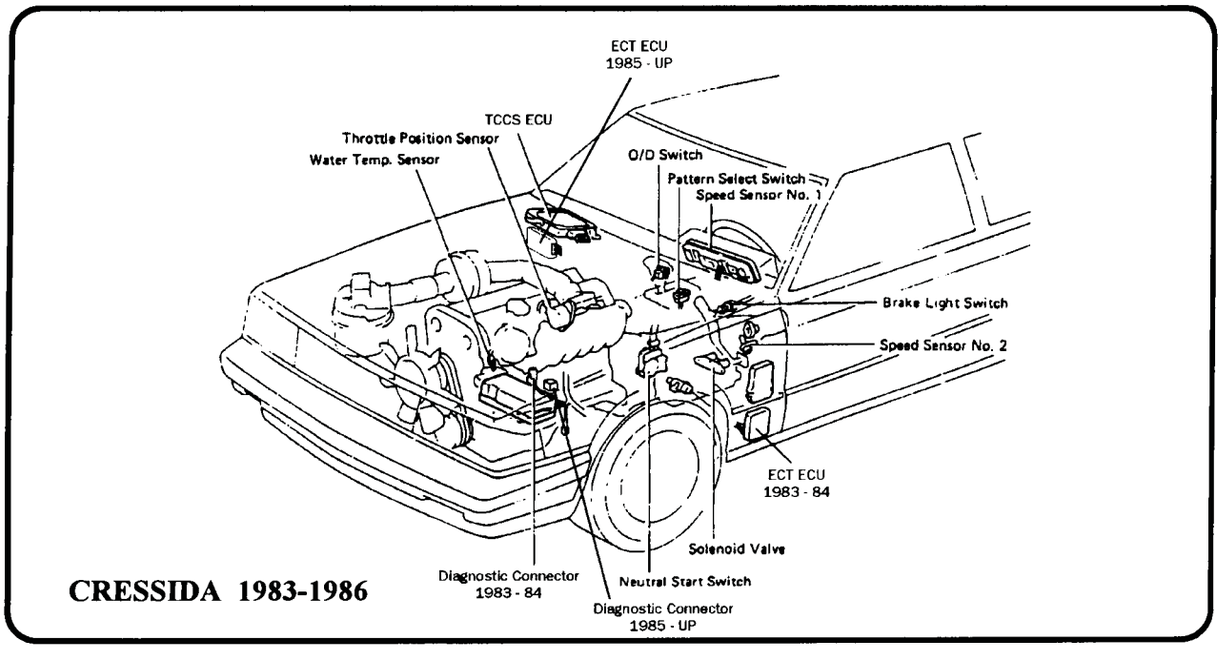


Figure 18.

ECT
(ELECTRONIC CONTROLLED TRANSMISSION)

Because of similarities in tems used in this chapter, it is necessary to define terms such as ECT, ECU, and TCCS.

ECT means Electronic Controlled Transmission,

ECU means Electronic Control Unit or computer. Therefore, the ECT ECU is the computer for the transmission.

TCCS means Toyota Computer Control System and usually refers to the engine computer. In late model Toyotas, the TCCS ECU and the ECT ECU are incorporated into one computer. The computer connections for the late models have three connectors which are similar but differerent for various models.

The wire connectors the for various Toyota ECT ECU's , as well as pin identifications is provided in a group form on the following pages. When making tests and wire continuity checks, be certain to find the correct system and connector drawing. All wire connectors are shown from the wire side unless specifically stated otherwise. The wiring schematics provided cover a wide range of Toyota models and each model is identified below the schematic.

WIRING SCHEMATICS

Toyota wiring schematics use abbreviations for wire and terminal identification . The most common abbreviations are described in the pin identification chart found in Figure 19. The connector for the truck, 4 runner, and Supra are the same.

SYMBOL	REMARKS
+B	Input power supply for ECU diagnosis memory
BR	Receives the brake light signal, which tells the ECU that the brake pedal is depressed.
DG	Outputs results of diagnosis system
E	ECU ground
IDL	Receives the "fully closed signal" from the throttle position sensor.
IG	Inputs ECU power
L_1	Receives the "opening angle signals" from the TCCS ECU.
L_2	
L_3	
L	Receives signals from the neutral start switch. The ECU interprets input from the L, 2, and N terminals as "L"-, "2"-, and "N"-range, respectively. In the absence of inputs, the ECU interprets the "D"-range.
2	
N*1	
L4*2	Receives the "L_4 position signal" from the transfer position switch.
OD1	Receives the "overdrive cancel" signal output from the TCCS ECU or cruise control computer.
OD2	Receives the overdrive ON/OFF signals from the O/D switch on the shift lever.
PWR	Inputs the "pattern select" switch status. The ECU uses the Power mode for PWR terminal input, and the Normal mode in the absence of PWR input.
S_1	Outputs the control signals for switching the three solenoid valves located on the transmission valve body and one solenoid valve on the transfer valve body ON and OFF. S_1 and S_2 control the transmission gearshift, S_3 the lock-up clutch, S_4 the transfer low-high gearshift.
S_2	
S_3	
S_4 *3	
SP1	Receives the vehicle speed signals. The ECU normally uses the signals output from the SP_2 terminal, but switches to SP_1 when the SP_2 signal is faulty.
SP2	

*1 340E (TOYOTA Supra and Truck 4x2) only *2 and *3 A340H (Truck 4x4 and 4 Runner) only

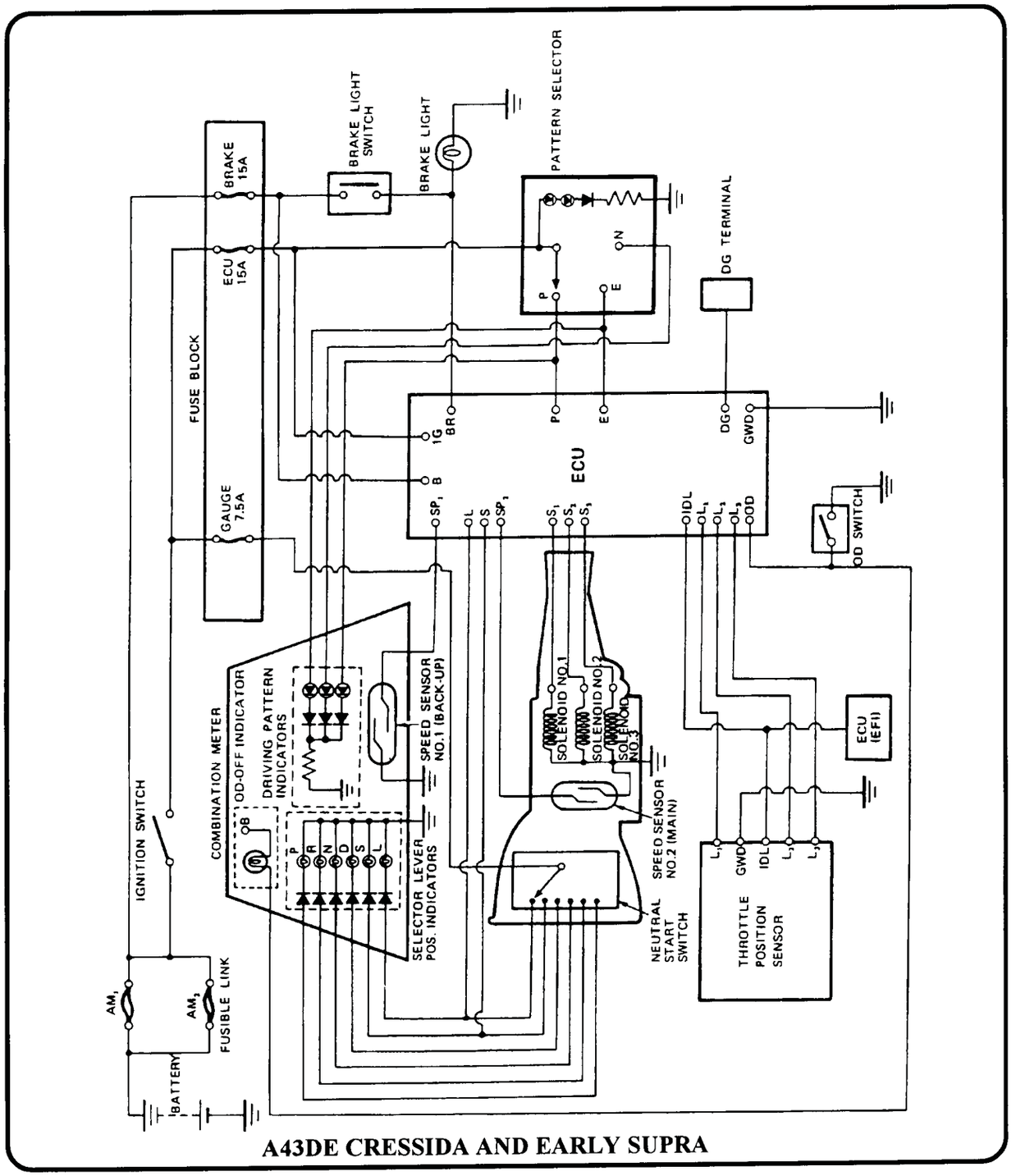
View from Wiring Side

S_1	S_2	S_3	PWR	TH +	S_4	L4	OD2	L_1	L_2	L_3	IDL
IG	+ B	BR	2	L	E	TH –	OD1	SP1	SP2	OIL	DG

SUPRA THRU 1987, TRUCK, and 4 RUNNER

Figure 19.

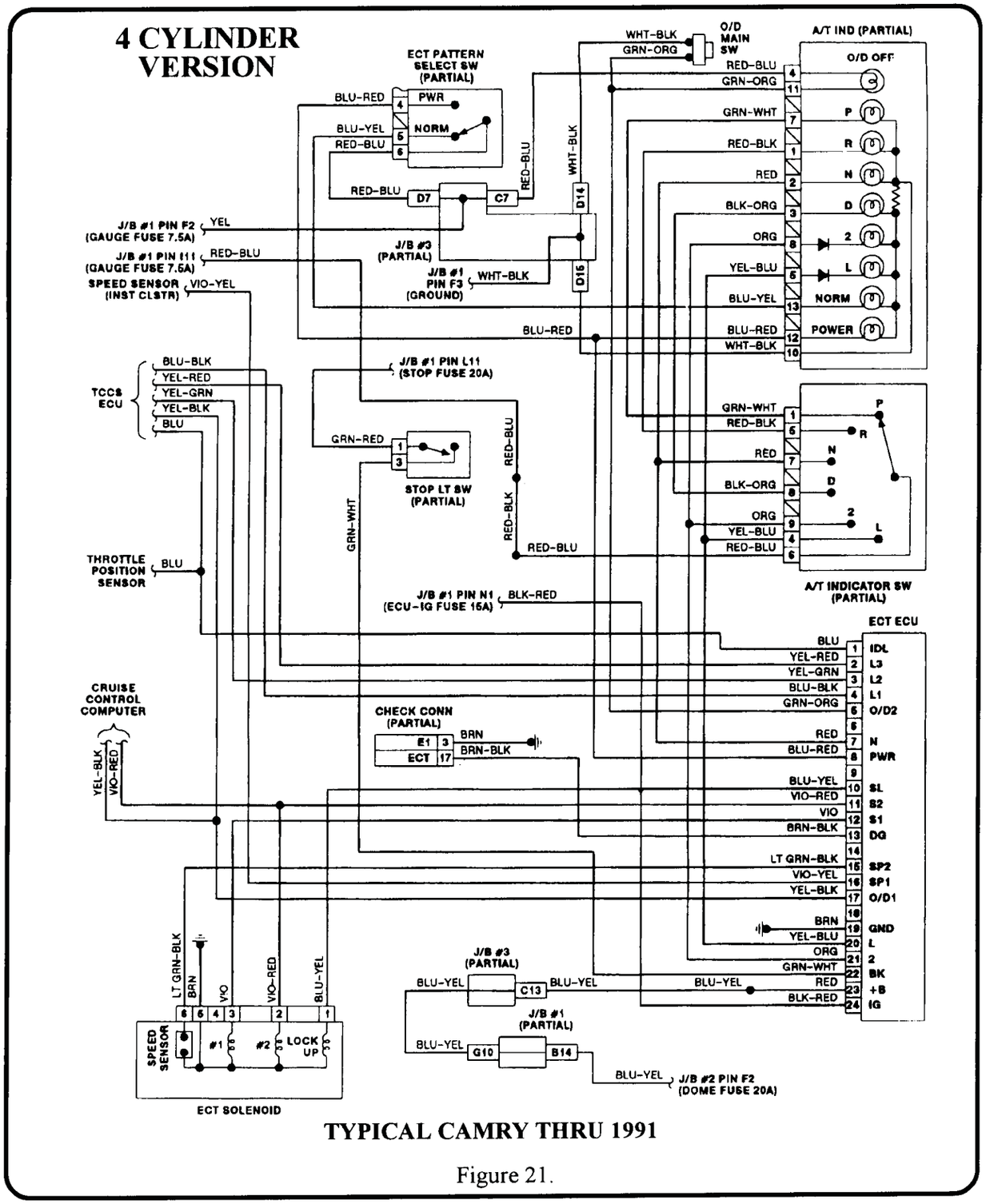
WIRING SCHEMATICS CONTINUED



A43DE CRESSIDA AND EARLY SUPRA

Figure 20..

WIRING SCHEMATICS CONTINUED



TYPICAL CAMRY THRU 1991

Figure 21.

WIRING SCHEMATICS CONTINUED

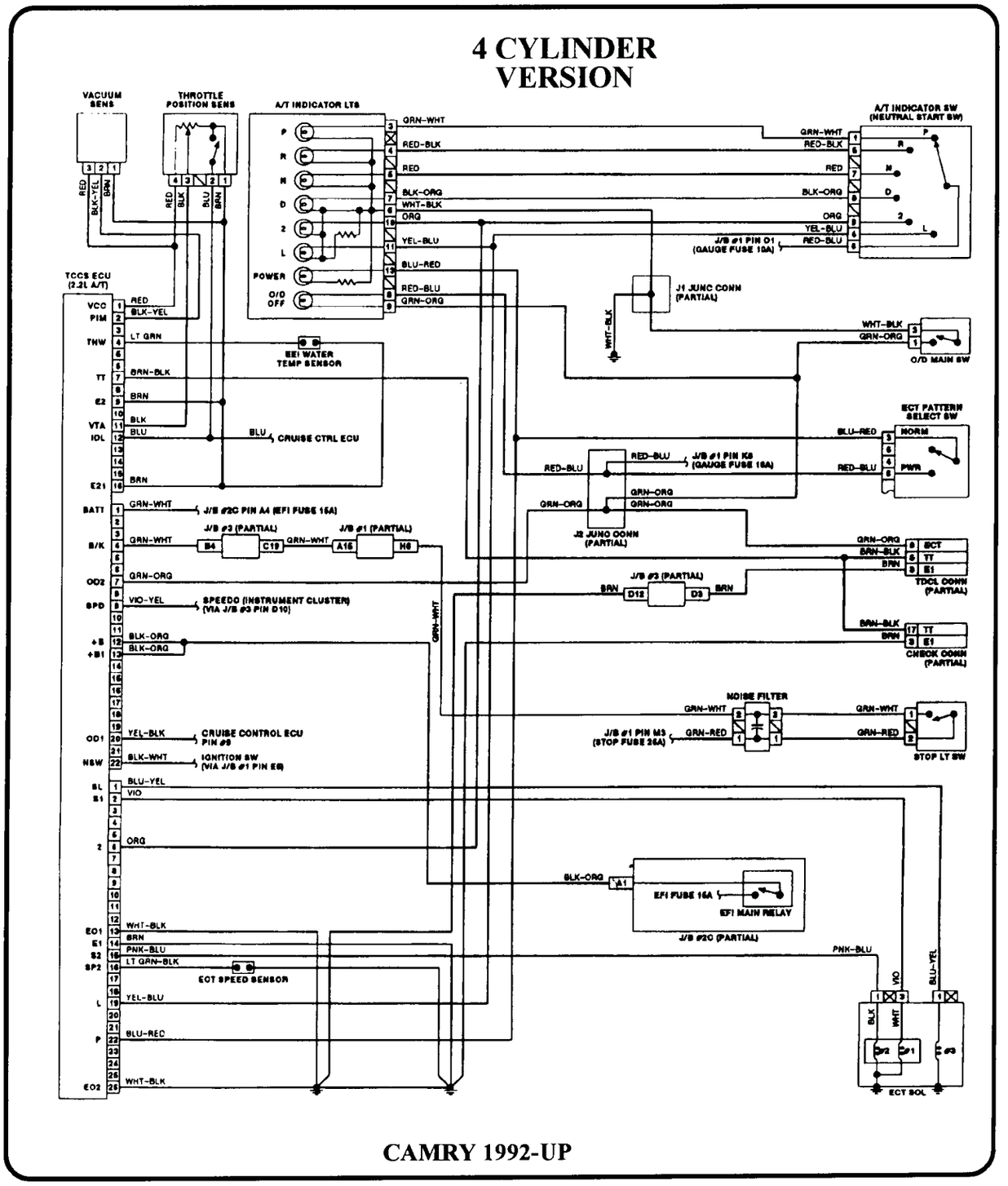
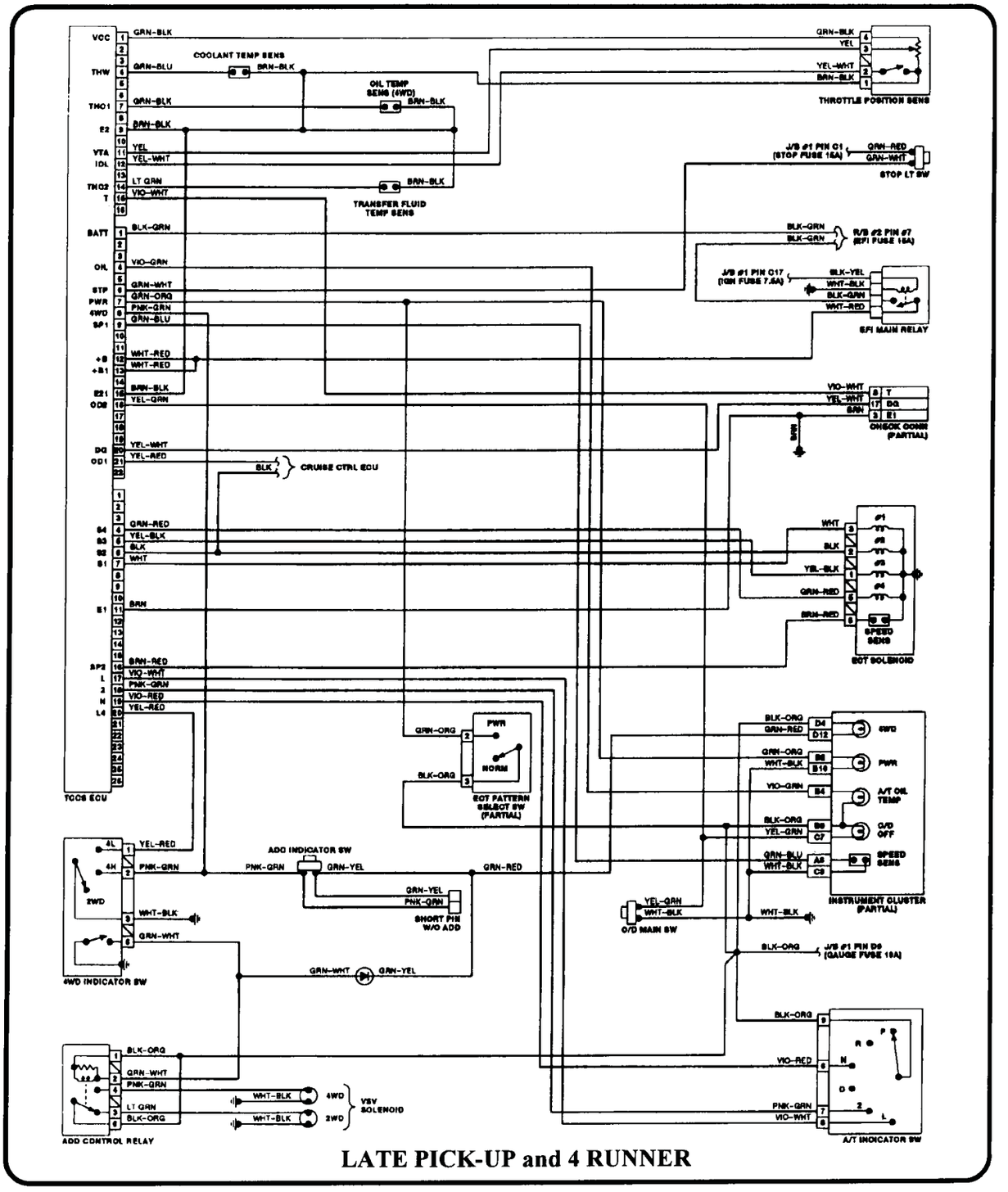


Figure 22.

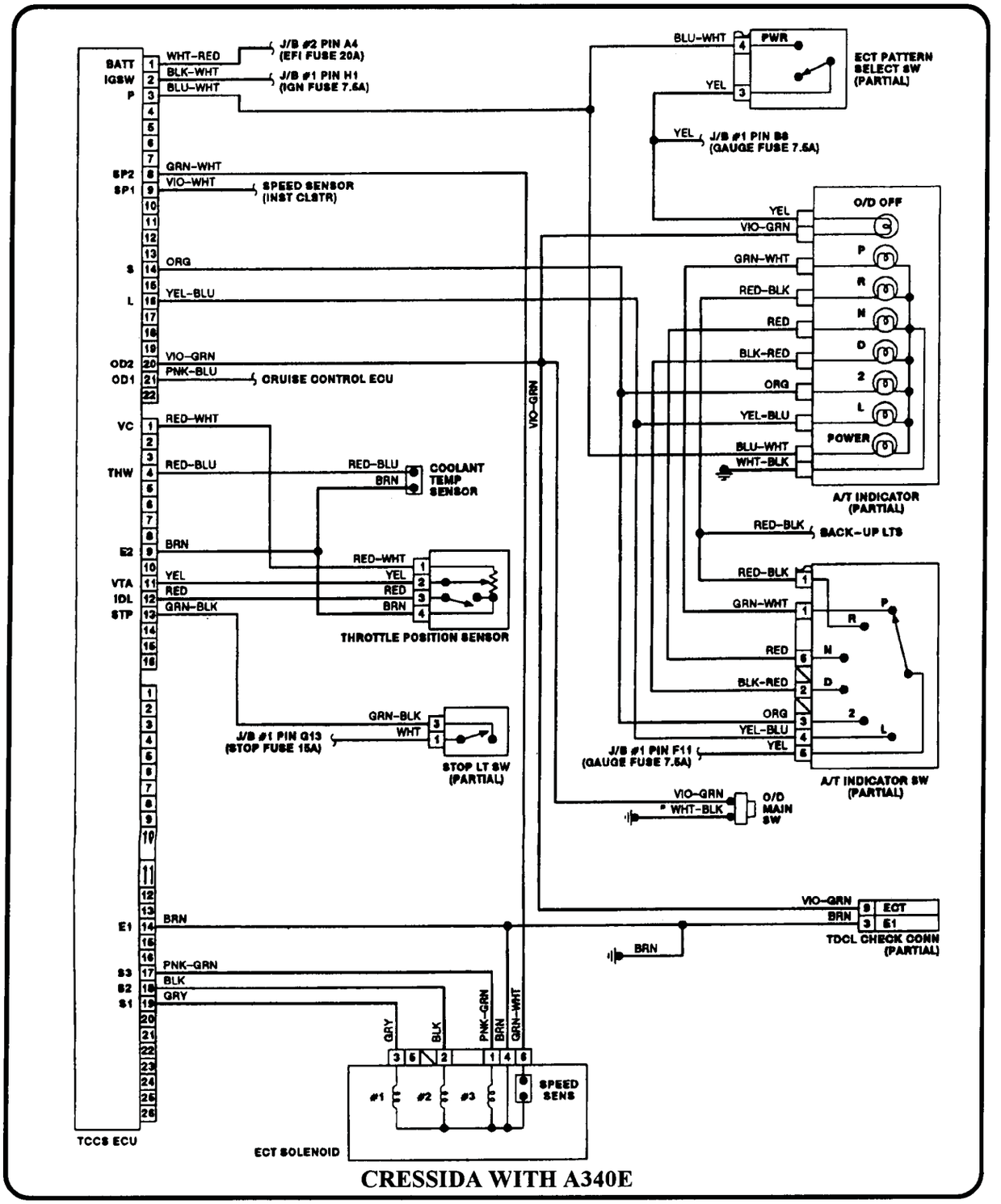
WIRING SCHEMATICS CONTINUED



LATE PICK-UP and 4 RUNNER

Figure 23.

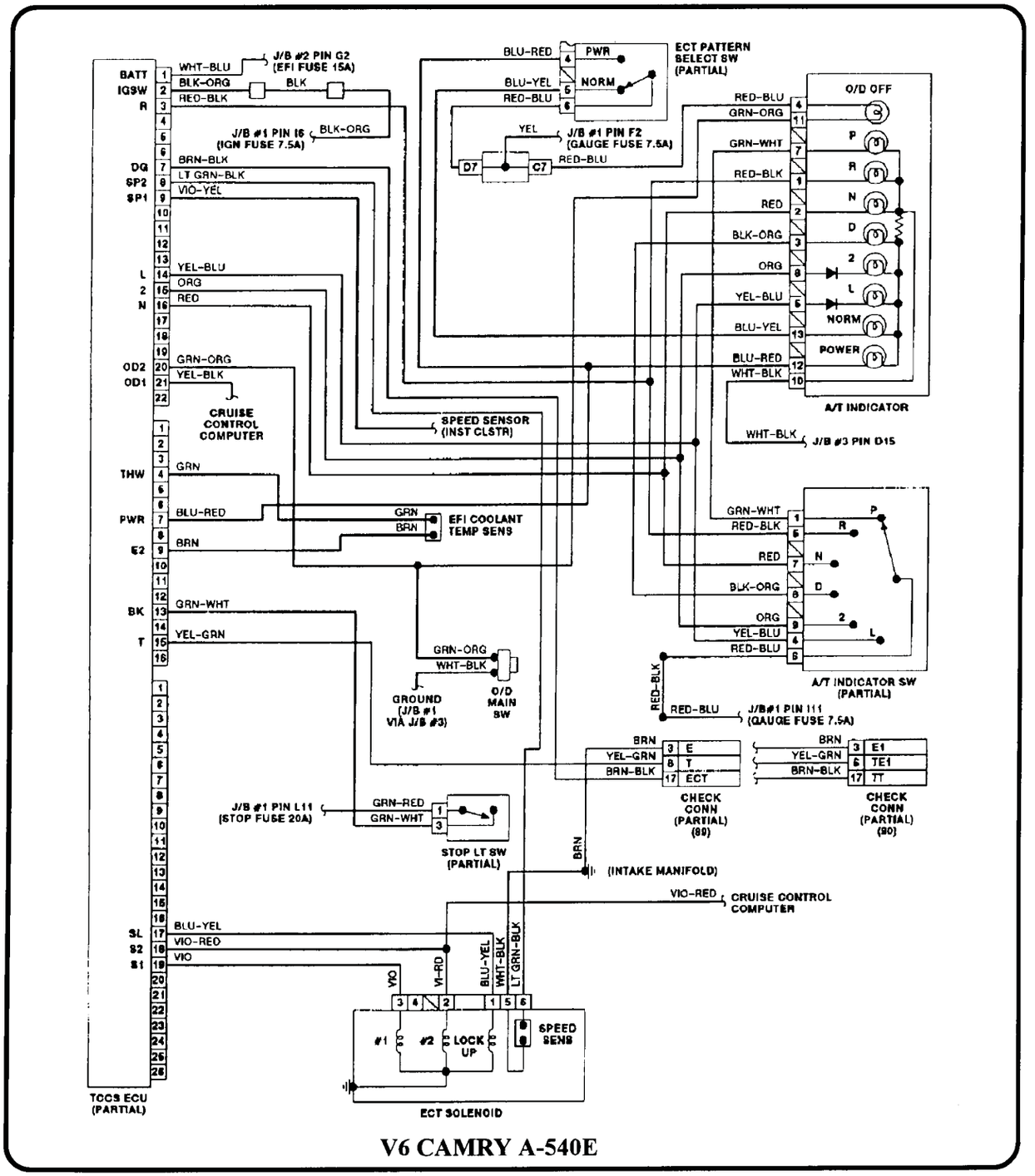
WIRING SCHEMATICS CONTINUED



CRESSIDA WITH A340E

Figure 24.

WIRING SCHEMATICS CONTINUED



V6 CAMRY A-540E

Figure 25.

WIRING SCHEMATICS CONTINUED

There are numerous **Wiring Schematics** and numerous **ECT ECU Connectors**. Many of these are very similar but there are differences. Yearly changes with added features and options cause pin locations to vary. Figure 26 gives a general overview of the most popular ECU ECT connectors, and combined TCCS and ECT ECU connectors. For checking solenoids and transmission related sensors the pins are all viewed from the wire side.

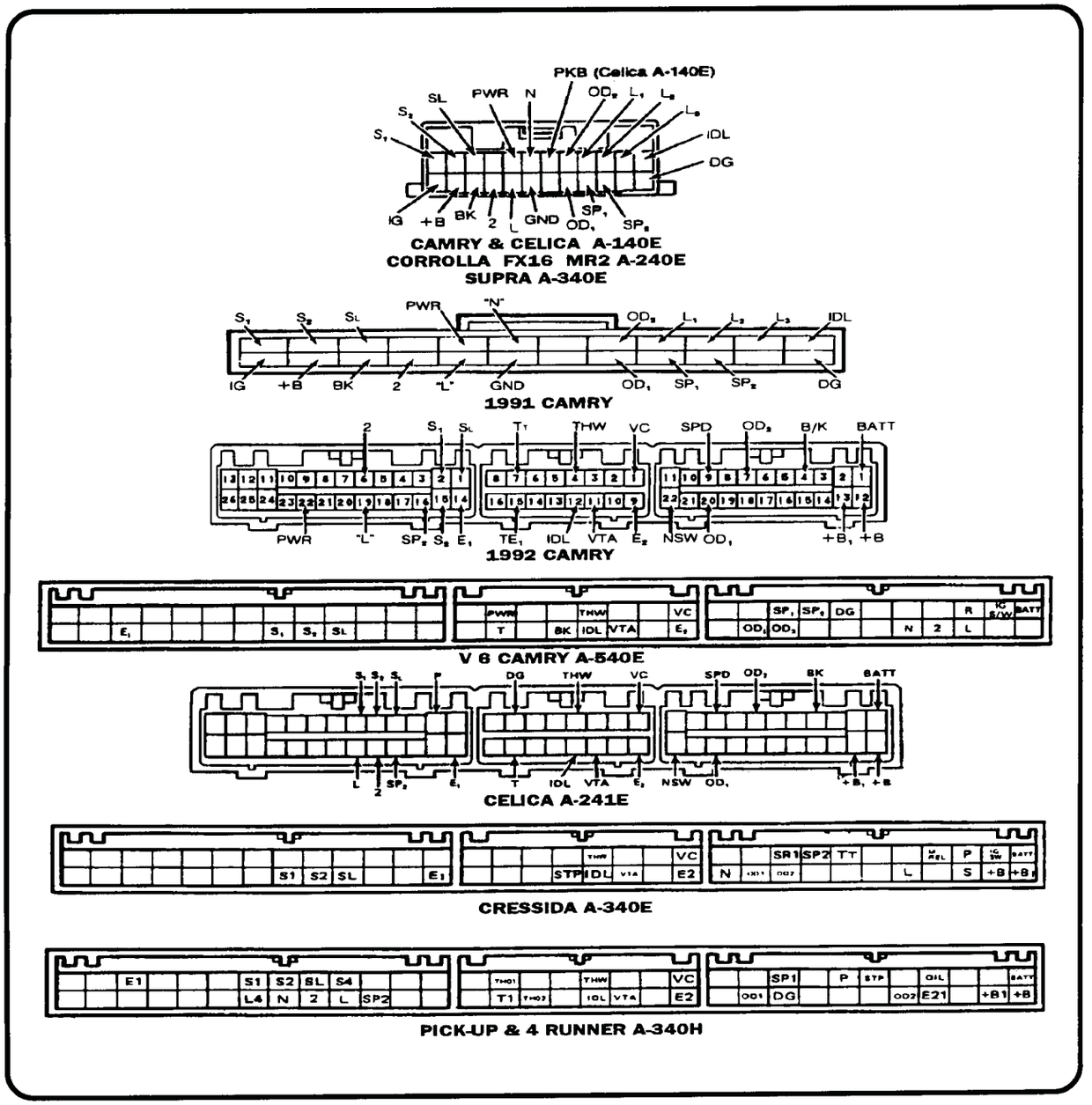


Figure 26.

TRANSMISSION SOLENOIDS

Shift Solenoids 1 and 2 are mounted on the valve body on all models.The ECU controls the transmission gear shifting by changing the ON-OFF combination of these solenoids. When not energized, the solenoid valve closes, allowing line pressure to flow to hydraulic circuits. When energized, the solenoid valve opens and drains pressure from the hydraulic circuit.The correct shift solenoid pattern for all models is shown in Figure . Ohms check information for all solenoids is also provided in Figure 27.

Solenoid No. 3 (TCC Solenoid) is located on the valve body on A43DE, A340E & H, and A540E models. Solenoid No. 3 is on the case behind the linkage on A140E models. Depending upon the model and year, this solenoid may be either normally open or closed. See the following figures for precise descriptions of solenoid location follows and Solenoid open or closed information for each model.is found in Figure 32.

GEAR	SOLENOID 1	SOLENOID 2	(LOCKUP SOL) SOLENOID 3
1st	ON	OFF	OFF
2nd	ON	ON	ON*
3rd	OFF	ON	ON*
4th	OFF	OFF	ON*
OHMS	11 - 15	11 - 15	11 - 15

* - AS DETERMINED BY ECU

Figure 27.

Solenoid No. 4 (A340H only) is mounted to the transfer valve body. The ECU controls transfer low and high gear shifting by switching the No. 4 Solenoid valve ON and OFF. Solenoid No. 4 operates the same as shift solenoids 1 and 2. When the No. 4 Solenoid valve is off, or closed, high range is achieved. With the No. 4 Solenoid valve on, or open, low range is applied in the transfer case.

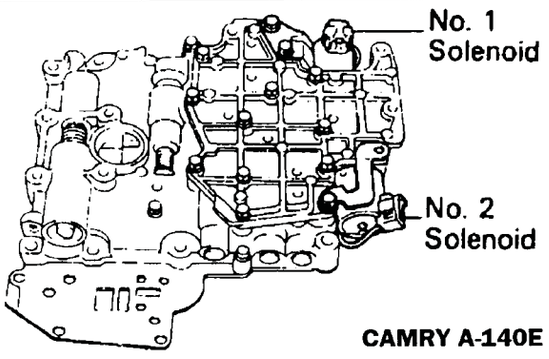
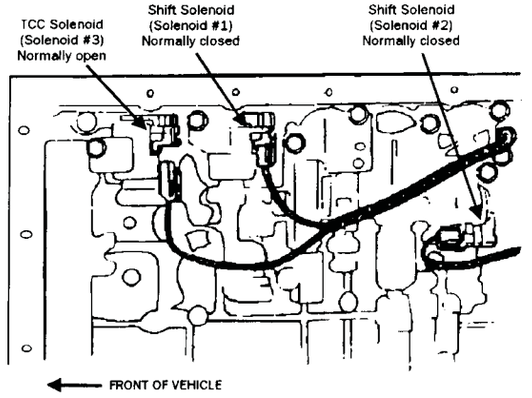


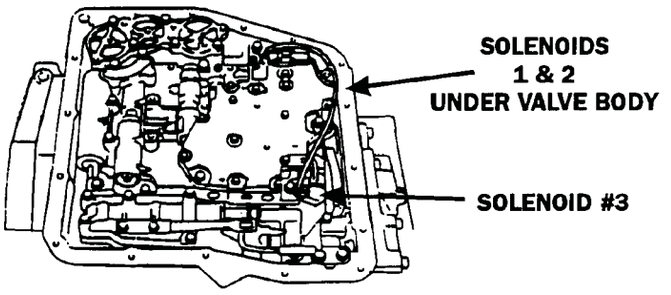
Figure 28.

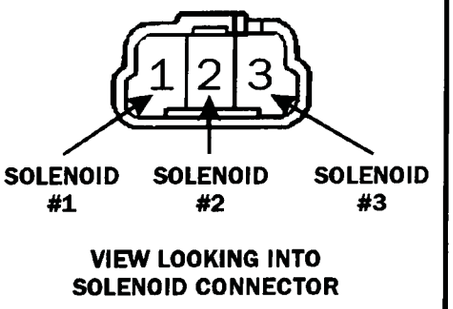
SOLENOIDS CONTINUED



TRUCK , 4 RUNNER, and CRESSIDA A-340E & H THRU 1991

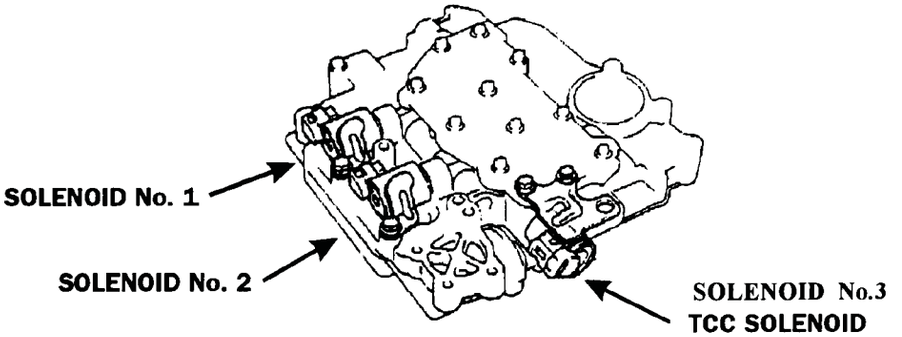
Figure 29.





V6 CAMRY A-540E

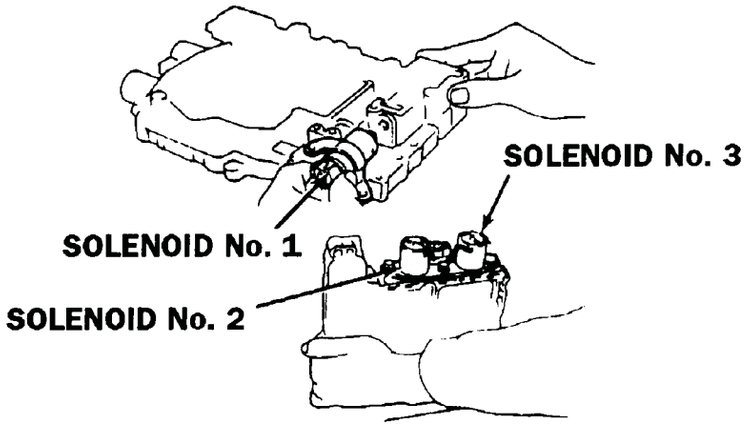
Figure 30.



A-240E

Figure 31.

SOLENOIDS CONTINUED



A-43DE

Figure 32.

Trans / Sol.	Solenoid #1	Solenoid #2	Solenoid #3
A-43DE	N/C	N/C	N/C
A-140E	N/C	N/C	N/O
A-240E	N/C	N/C	N/C
A-340E	N/C	N/C	N/O
A-540E	N/C	N/C	N/O

N/C = Normally Closed
N/O = Normally Open

Figure 33.