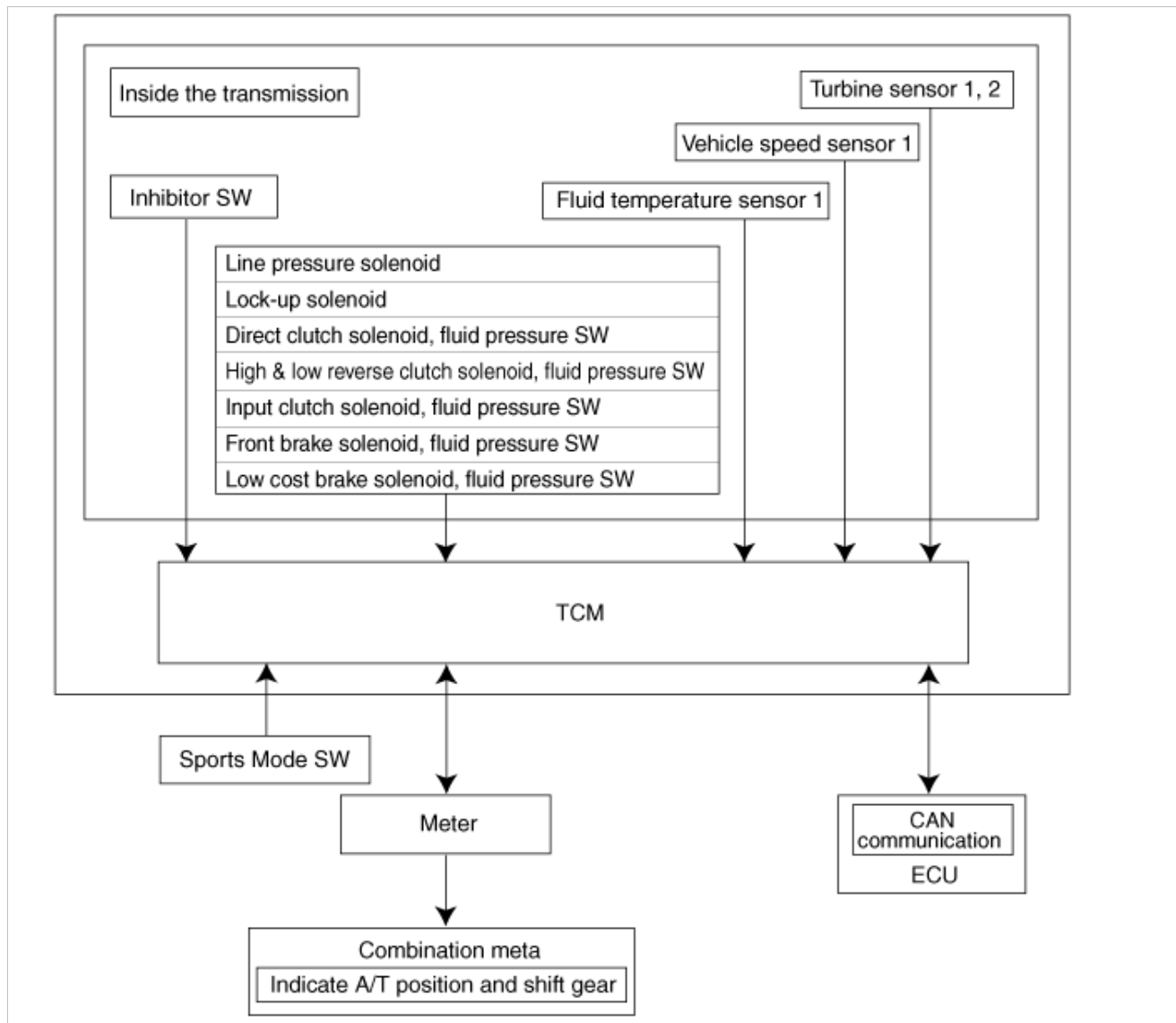


## Control System Diagram



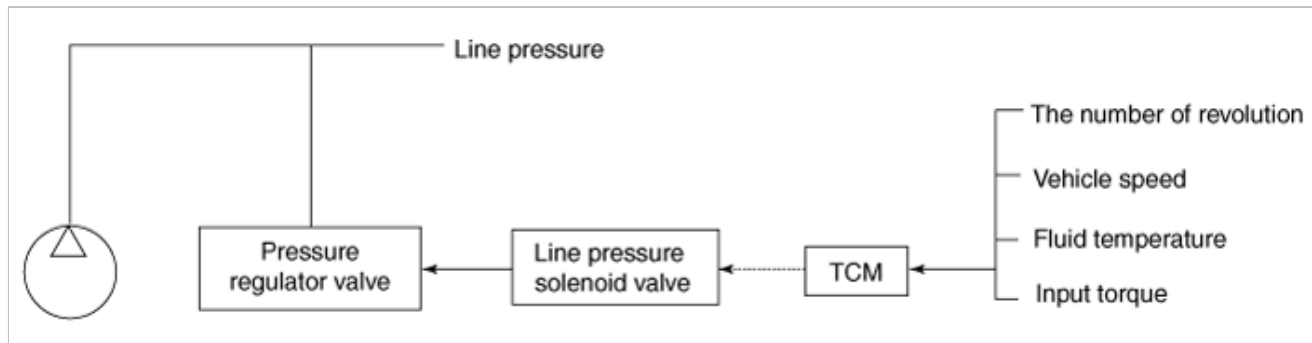
### Main Communication Signal

Input to ECM(CAN)	Output to ECM(CAN)	Input from external sys.	Output to external sys.
-	-	A/T driving mode SW	Self-diagnosis indicator
Engine torque signal	Output revolution signal	Sports mode SW	Range signal (P, R, N, D)
Engine revolution signal	Turbine sensor signal	Up SW	Range signal
-	Torque reduction request signal	Down SW	Reverse lamp signal
Accelerator opening signal		Stop lamp SW	N position signal
Power		4 x 4 Low signal	

### Line Pressure Control

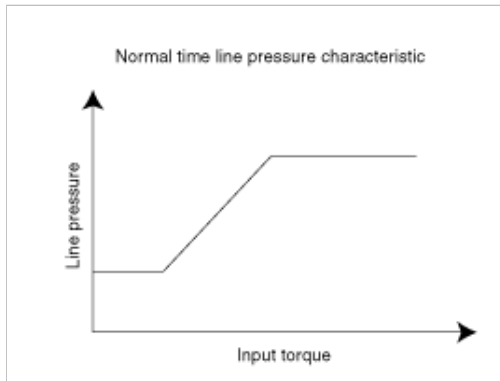
- If the engine control unit sends the input torque signal equivalent to the engine driving force to the A/T control unit (TCM), the A/T control unit (TCM) controls line pressure solenoid.
- This line pressure solenoid controls the pressure regulator valve as the signal pressure and adjusts the pressure of the operating oil discharged from the oil pump to the line pressure most appropriate to the driving plate.

## Line Pressure System Diagram

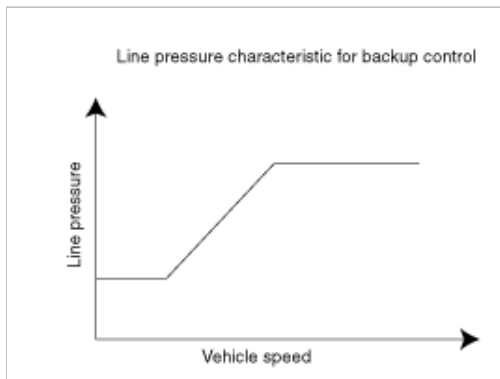


## Line Pressure Control Based On Line Pressure Characteristic Pattern Of A/T Control Unit (TCM)

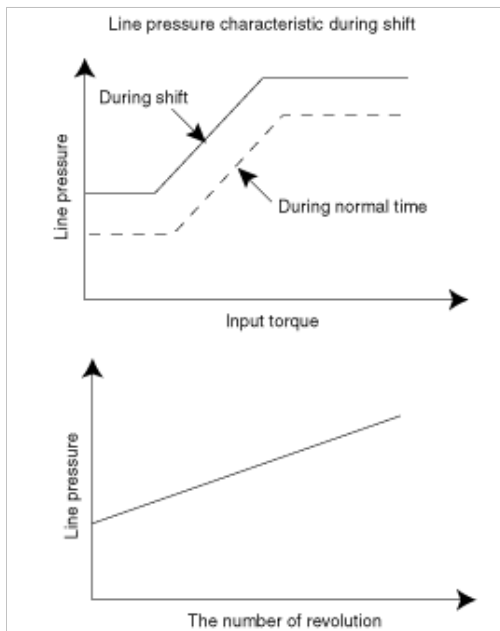
- A/T control unit (TCM) has stored in memory a number of patterns for the optimum line pressure characteristics according to driving conditions.
- In order to obtain the most appropriate line pressure characteristic to meet the current driving state, the TCM controls the line pressure solenoid current valve and thus controls the line pressure.
  - Normal line pressure control.  
Each clutch is adjusted to the necessary pressure to match the engine drive force.



- Back-up control (Engine brake)  
Line pressure according to speed is set during shift down by select operation while driving.

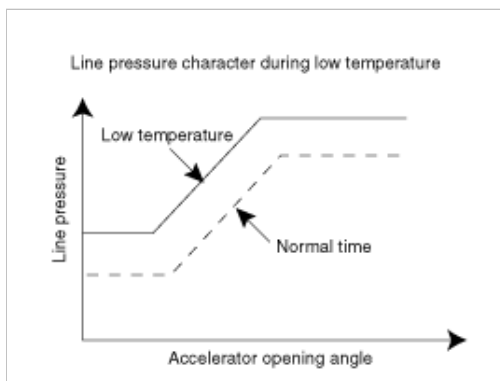


- During shift change  
Set to line pressure that is necessary for shift change. Therefore, line pressure characteristic is set according to input torque and shift types.



#### - At low fluid temperature

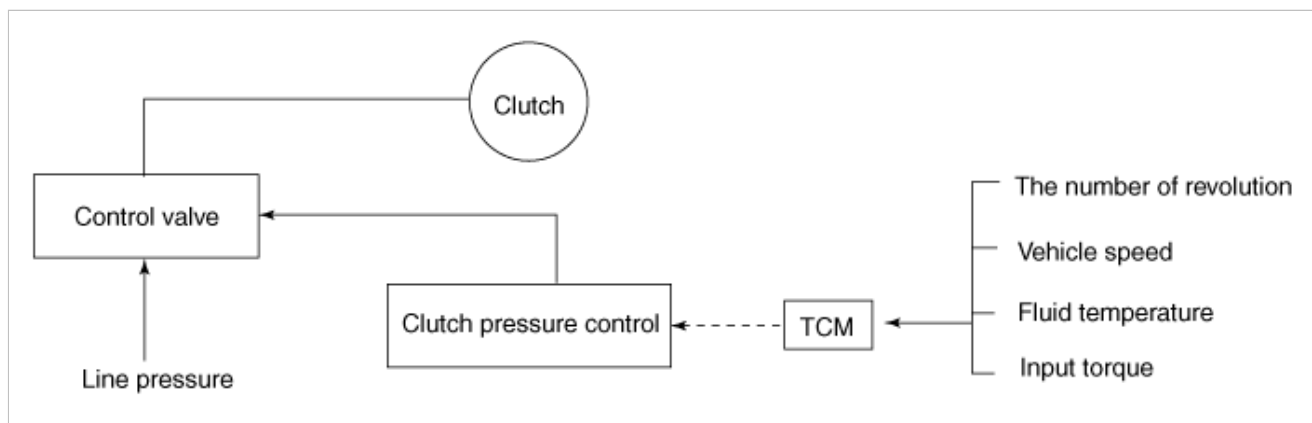
When the A/T fluid temperature drops below the prescribed temperature, in order to speed up the action of each friction element, the line pressure is set higher than the normal line pressure characteristic.



### Shift control

- The clutch pressure control solenoid is controlled by the signals from the switches and sensors. Thus the clutch pressure is adjusted to be appropriate to the engine load state and vehicle driving state. It becomes possible to finely control the clutch hydraulic pressure with high precision and a smoother shift change characteristic is attained.

### Shift Control System Diagram



#### Shift description

Controls clutches with optimum timing and fluid pressure in response to engine speed, engine torque information, and etc.

### Lock-up Control

Lock-up control is to enhance delivery efficiency by preventing the torque converter from slipping, engaging the lock-up piston

into the torque converter.

It operates lock-up solenoid control in response to a signal from A/T control unit (TCM) and lock-up control valve behavior control, engages or releases the lock up piston of the torque converter.

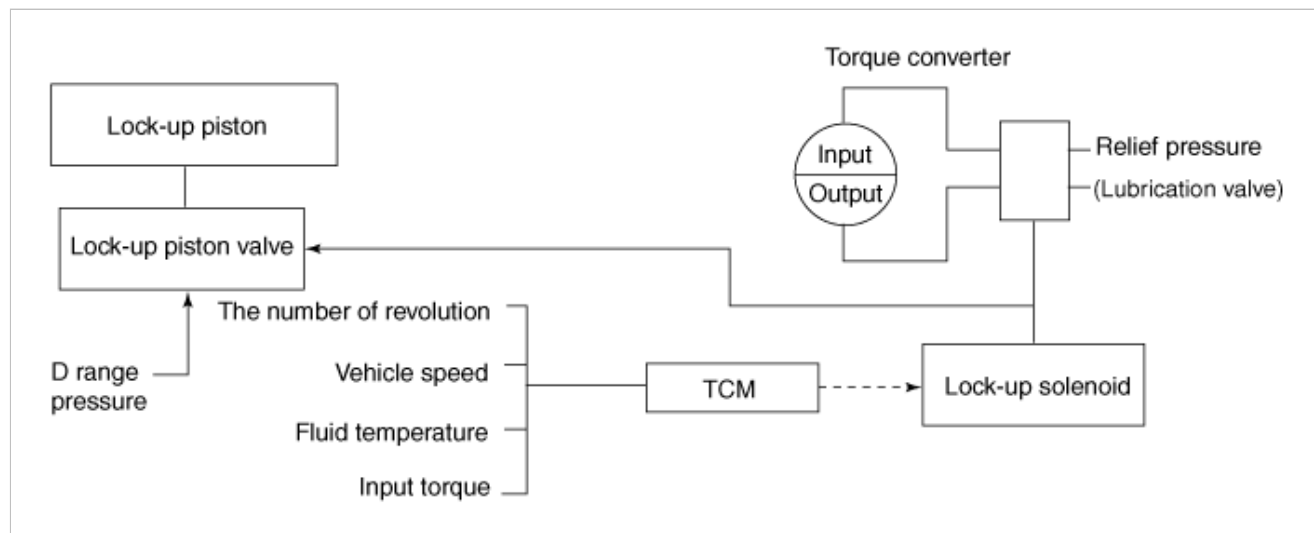
#### Lock-up Operating Condition Table

Select Lever	D range			Sports Mode	
Gear position	5	4	3	5	4
Lock-up	O	O	-	O	O

#### Lock-up control valve control

- In the lock-up control valve, there is operating fluid pressure circuit linked into the lock-up piston and lock-up solenoid operates valve shift in response to a signal from the A/T control unit.
- Operating fluid pressure circuit that is applied to the lock-up piston chamber is controlled with the release or apply sides.

#### Lock-up Control System Diagram



#### Lock-up released

- In the lock-up control valve, there is operating fluid pressure circuit connected into the lock-up piston and lock-up solenoid operates valve shift in response to a signal from the A/T control unit. Therefore, the lock-up piston is not coupled.

#### Lock-up applied

##### Smooth lock-up control

- A/T control unit (TCM) controls current value that is output to the lock-up solenoid when shifting lock-up applied state from lock-up released state. Therefore the lock-up clutch is temporarily set to half-clutched state when shifting the lock-up applied state to reduce the shock.
- During the lock-up applied status, lock-up apply pressure is generated having the lock-up control valve to L/U by the lock-up solenoid. Therefore, press the lock-up piston to be coupled.

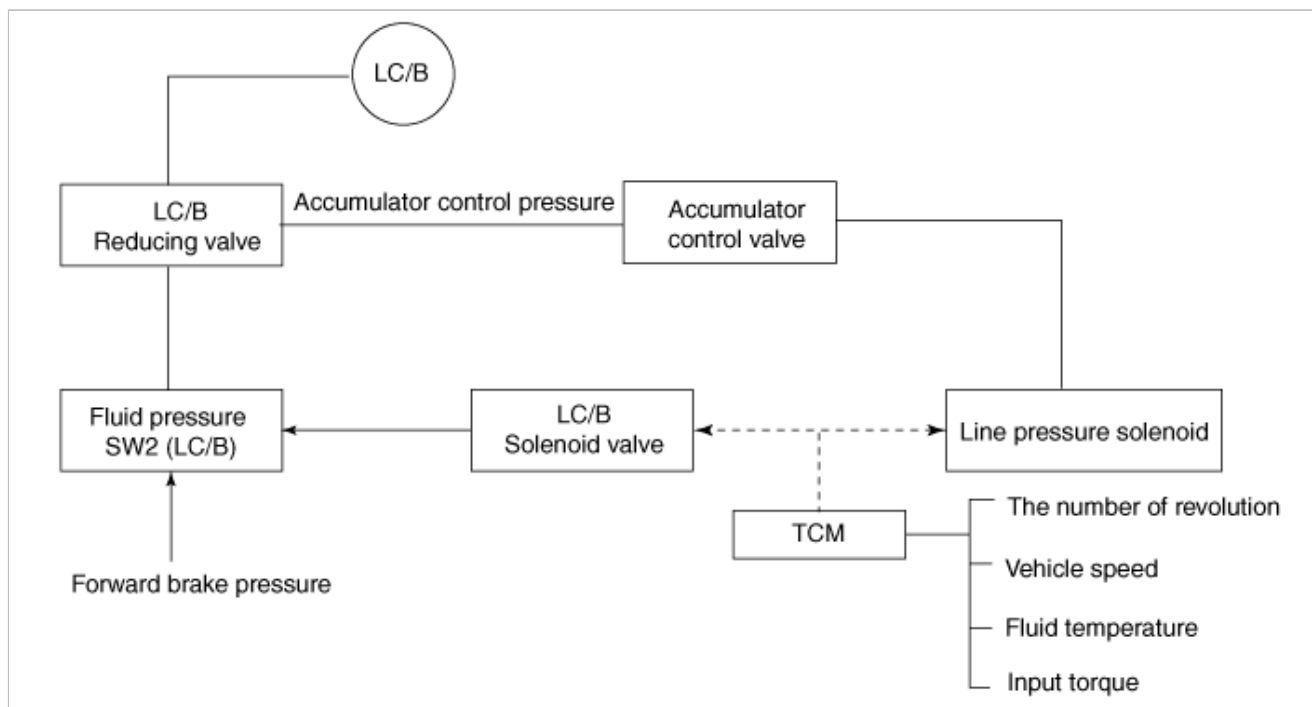
#### Half-clutched state

- Changes current value that is output to the lock-up solenoid from A/T control unit (TCM) to gradually increase lock-up solenoid pressure. In this way, the lock up apply pressure gradually rises and while the lock-up piston is put into half-clutched status, the lock-up piston operating pressure is increased and the coupling is completed smoothly.

#### Engine Brake Control

- The forward one-way clutch delivers driving force from the engine to the rear wheel but reverse driving from the wheel drive is not delivered since the one-way clutch is idling. Therefore low coast brake solenoid is operated to prevent the forward one-way clutch from idling so that the engine brake is operated in the same as before.

#### Engine Brake Control System Diagram



- The operation of the low coast brake solenoid switches the low coast brake switch valve and controls the coupling and releasing of the low coast brake.  
The low coast brake reducing valve controls the low coast brake coupling force.

## Control Valve

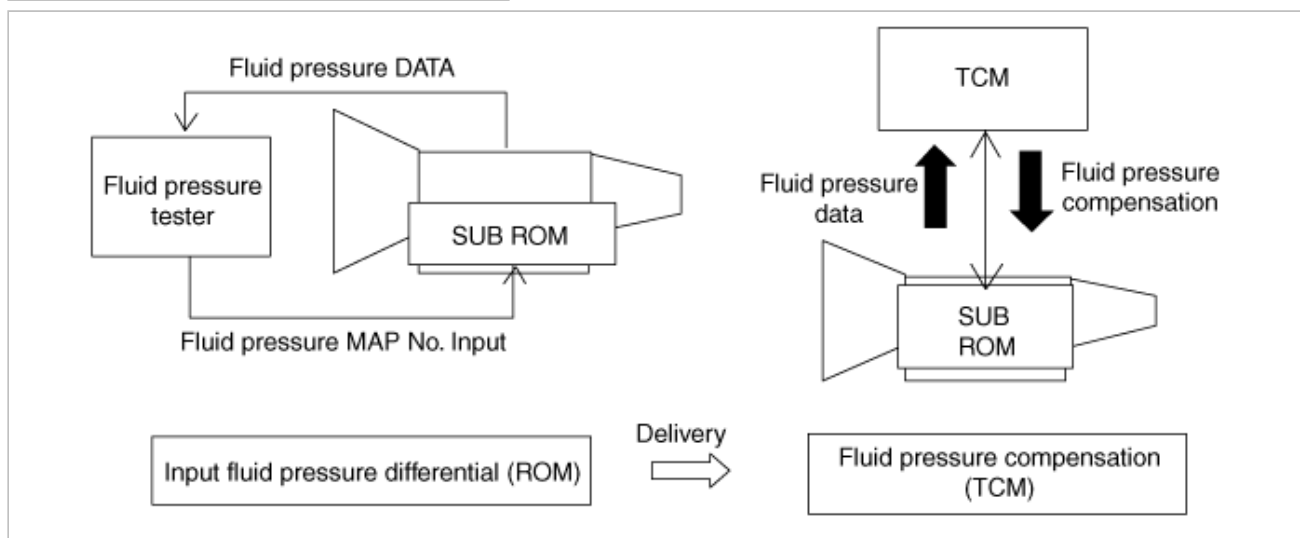
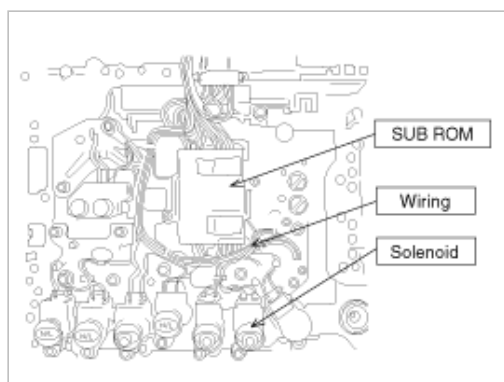
### Control Valve Functions

Valve name	Function
Torque converter regulator valve	Regulates line pressure to the optimum pressure (torque converter operating pressure) to prevent pressure applied to the torque converter from being excessive.
Pressure regulator valve Pressure regulator plug Pressure regulator sleeve	Regulates oil pump discharge pressure to the optimum pressure (line pressure) in response to the driving conditions.
Front brake control valve	Regulates line pressure to the optimum pressure (front brake pressure) to be applied to the front brake during the front brake apply.
Accumulator control valve	Regulates pressure applied to the accumulator piston, and the low coast reducing valve (accumulator control pressure) in response to the driving conditions (regulates clutch pressure at 1st, 2nd, 3rd, 5th gears).
Pilot valve A	Regulates line pressure to the regular pressure required by line pressure control, shift control, and lock-up control (pilot pressure).
Pilot valve B	Regulates line pressure to the regular pressure required by shift control (pilot pressure).
Low coast brake switching valve	Provides the low coast brake reducing valve with line pressure during engine brake operation.
Low coast brake reducing valve	Regulates line pressure to the optimum pressure to be applied to the low coast brake when the low coast brake is coupled.
N-R accumulator	Produces the stabilizing pressure for when N-R is selected.
Direct clutch piston switching valve	Operates in 4th gear and switches the direct clutch coupling capacity.
High&low reverse clutch control valve	Regulates line pressure to the optimum pressure (high&low reverse clutch pressure) to be applied to the high&low reverse clutch when the high&low reverse clutch is coupled (regulates clutch pressure in 1st, 3rd, 4th, 5th gears).
Input clutch control valve	Regulates line pressure to the optimum pressure (input clutch pressure) to be applied to the input clutch when the input clutch is coupled (regulates clutch pressure in 4th,

	5th gears).
Direct clutch control valve	Regulates line pressure to the optimum pressure (direct clutch pressure) to be applied to the direct clutch when the direct clutch is coupled (regulates clutch pressure in 2nd, 3rd, 4th gears).
Lock-up control valve Lock-up control plug Lock-up control sleeve	Switches lock-up to operating or released. Also, by performing the lock-up operation transiently, lock-up smoothly.
Torque converter lubrication valve	Operates to switch torque converter, cooling, and oil path of lubrication system during lock-up.
Cool bypass valve	Allows excess oil to by pass cooler circuit without being fed into it.
Line pressure relief valve	Discharges excess oil from line pressure circuit.
N-D accumulator	Produces the stabilizing pressure for when N-D is selected.
Manual valve	Delivers line pressure to each circuit in response to each select position. Circuit to which line pressure is not sent drain.

## SUB ROM unit

1. Installing location: The valve body upper part
2. Function: To obtain A/T fluid pressure stability by compensating for solenoid&valve body unit fluid pressure differential.
3. Principle: Install additional ROM onto valve body of automatic transmission and input fluid pressure differential of solenoid & valve body so that TCM reads the input data to perform fluid pressure compensation.



## 4. Maintenance

- (1) When replacing with a new TCM in the vehicle
  - A. TCM automatically reads SUB ROM DATA during I.G ON. At this time, shift range valve is off for about 2.5 second.
- (2) When replacing A/T (regardless of new or old ones) in the vehicle

A. Must erase SUB ROM DATA stored in TCM.

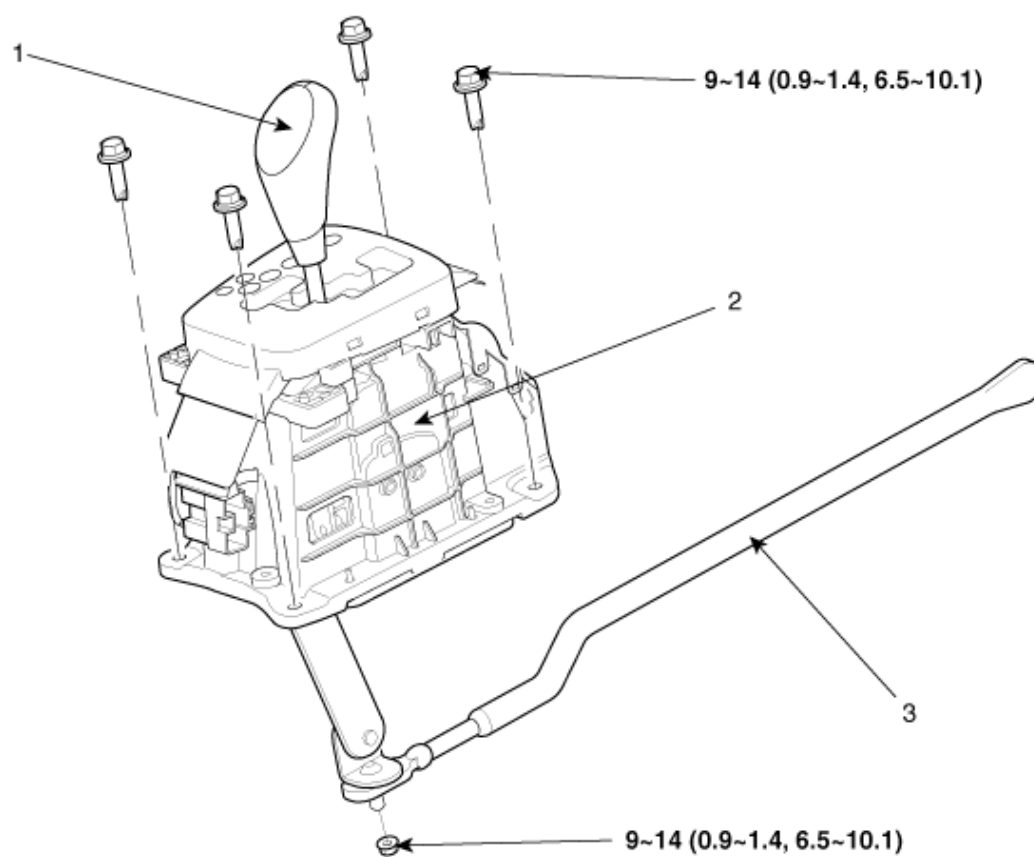
B. Erase SUB ROM DATA in SCAN TOOL delete mode during shift stage in R-range + accelerator opening angle maintains 50% + I.G ON.

C. TCM reads SUB ROM DATA from a new A/T upon I.G ON again after I.G OFF.

(3) Moving TCM from vehicle A to another vehicle B

A. Perform the same way as in 2) above.

## Components



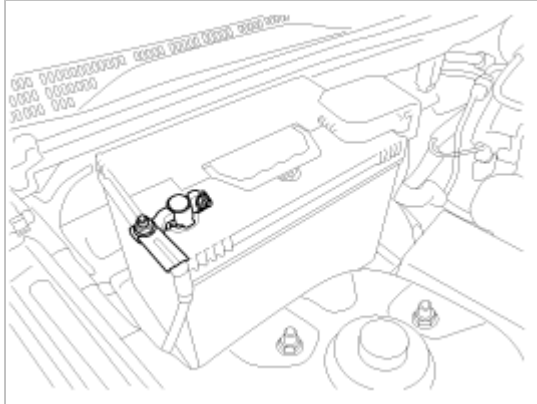
**Torque : Nm (kgf.m, lb-ft)**

1. Shift lever knob
2. Shift lever assembly
3. Shift link



## Removal

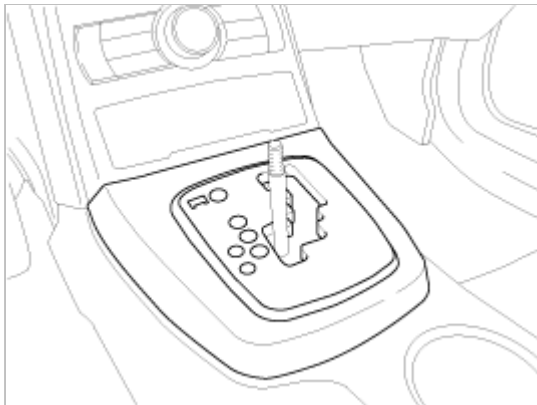
1. Disconnect (-) terminal from the battery in order to prevent current from flowing through wire.



2. Remove the shift lever knob by rotating counter clockwise.



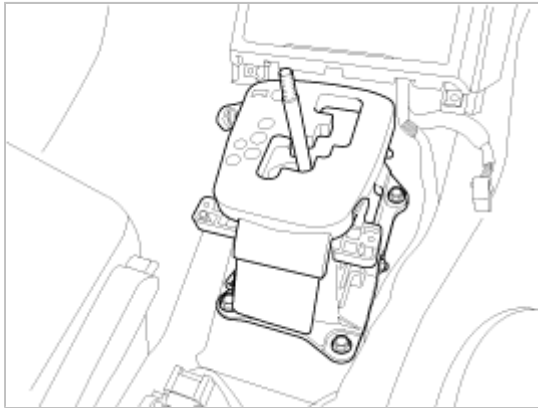
3. Remove the indicator assembly.



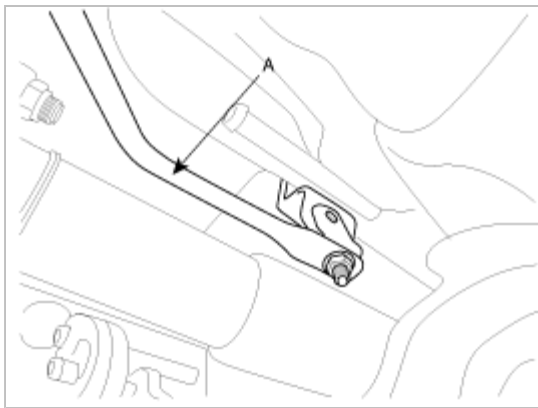
4. Disconnect the sports mode switch connector.



5. Remove the shift lever assembly by removing bolts(4ea).



6. Remove the shift link (A) by removing a nut.



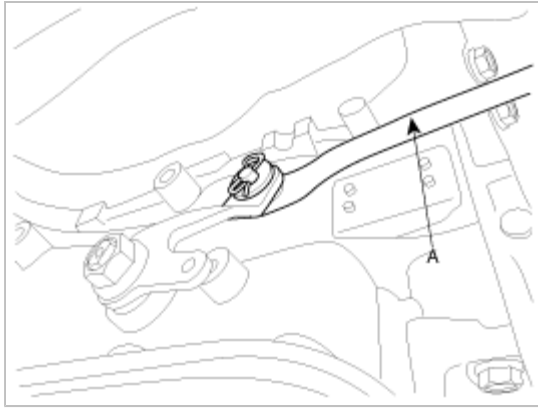
## Inspection

1. Check the shift lever assembly for proper operation and for damage.
2. Check the shift link for damage.
3. Check the boots for damage.

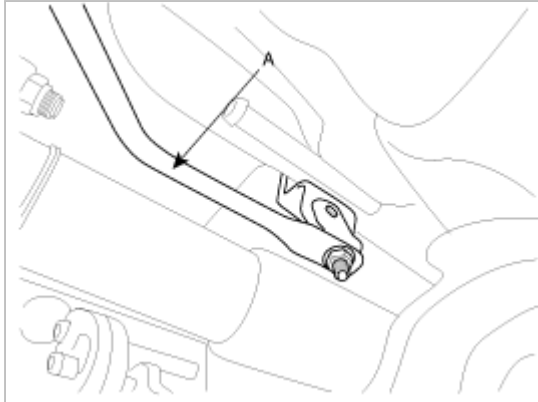
## Adjustment

### How To Adjust Shift Cable

1. Place the lever in 'N' position each of in-vehicle and of transmission.
2. Install the shift link (A) to the manual lever by inserting the snap pin.



3. Install the shift link (A) to the shift lever by installing a nut.



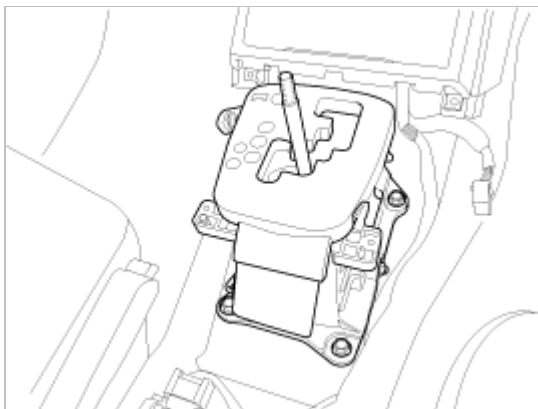
4. After adjusting according to procedure no. 3-4, check to be sure that this part operates surely at each range of T/M side corresponding to each position of room lever.

## Installation

1. Install the shift level assembly by installing bolts(4ea).

### Tightening torque:

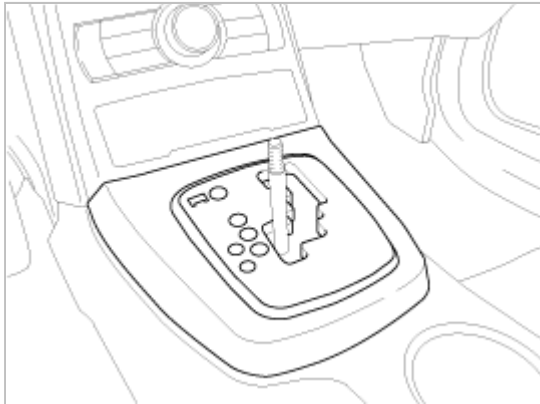
9~14 Nm (0.9~1.4 kgf.m, 6.5~10.1 lb-ft)



2. Connect the sports mode switch connector.



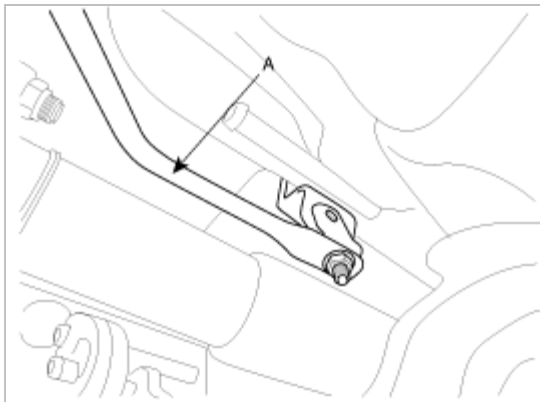
3. Install the indicator assembly.



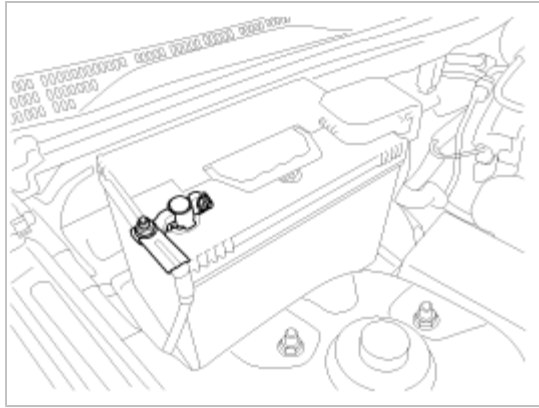
4. Install the shift lever knob by rotating clockwise.



5. Install the shift link (A) by installing a nut.

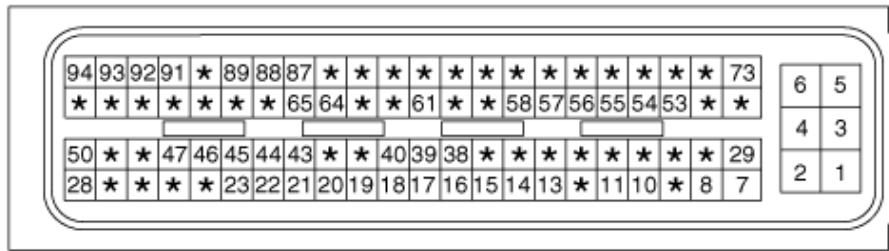


6. Connect (-) terminal to the battery.



## TCU Input/Output Signal

### TCU Connector



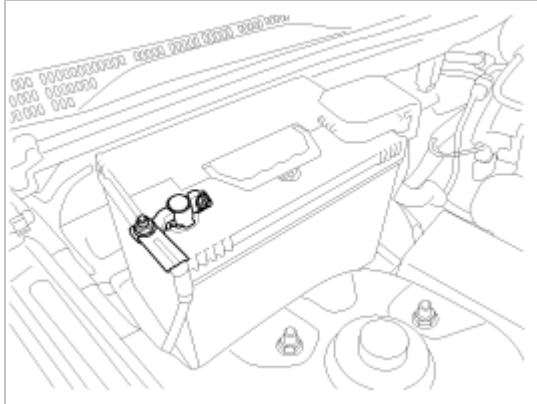
### Function of TCU terminals

Terminal No.	Terms	Descriptions
1	Battery	Main power supply
2	Battery	Main power supply
3	ON/START	ON/START
4	GND-P	Ground
5	GND-P	Ground
6	GND-C	Ground
7	STARTER RELEY	Starter relay control
8	B3-ON/OFF SOL	LC/B(Low Coast Brake) Solenoid actuation output signal
10	STOP LAMP SW	Stop lamp switch
11	INH SW3-MON	Inhibiter switch-3 break monitoring input signal
13	INH SW1	Inhibiter switch-1 input signal
14	ATF1	Oil temperature sensor-1 (Oil pan)
15	ATF2	Oil temperature sensor-2 (Torque converter outlet)
16	Manual-up shift SW	Sport mode up shift switch input signal
17	Manual-down shift SW	Sport mode down shift switch input signal
18	PSC2	H&LR/C(High&Low Reverse Clutch) Oil pressure switch input signal
19	PSB2	Fr/B(Front Brake) Oil pressure switch input signal
20	K-LINE	K-Line Communication
21	INH SW-2	Inhibiter switch-2 input signal
22	INH SW-4	Inhibiter switch-4 input signal
23	INH SW-3	Inhibiter switch-3 input signal
28	SELECTED GEAR DISPLAY	Selected gear output
29	SOLENOID SUPPLY	Solenoid power supply
38	GND-A	Ground
39	GND-A1	Ground
40	GND-C	Ground
43	C1-SOL	I/C(Input Clutch) Solenoid actuation output signal
44	L/U-SOL	L/U(Lock UP) Solenoid actuation output signal

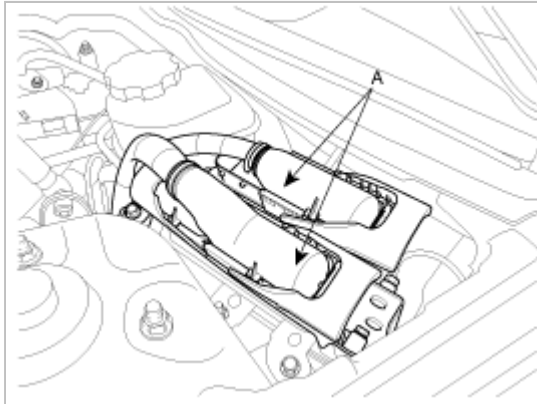
45	C2-SOL	H&LR/C(High&Low Reverse Clutch) Solenoid actuation output signal
46	B2-SOL	Fr/B(Front Brake) Solenoid actuation output signal
47	PL-SOL	PL(Line Pressure Control) Solenoid actuation output signal
50	C3-SOL	D/C(Direct Clutch) Solenoid actuation output signal
53	REV-LAMP RELAY	Back up lamp relay control
54	TURBIN 2	Turbine sensor-2 input signal (1,2,3,5th speed)
55	TURBIN1	Turbine sensor-1 input signal (4th speed)
56	VSP1	Vehicle speed sensor-1 (Output speed sensor) input signal
57	SEL2	D/C(Direct Clutch) Oil pressure switch signal and System clock signal in Sub-ROM communication
58	SEL3	I/C(Input Clutch) Oil pressure switch signal and System clock signal in Sub-ROM communication
61	Manual Mode select SW	Sport mode select switch input signal
64	SEL1	LC/B(Low Coast Brake) Oil pressure switch signal and System clock signal in Sub-ROM communication
65	CAN-L	CAN Low
73	SOLENOID SUPPLY	Solenoid power supply
87	CAN-H	CAN High
88	R range LAMP	R range lamp output signal
89	N range LAMP	N range lamp output signal
91	D range LAMP	D range lamp output signal
92	P range LAMP	P range lamp output signal
93	VIGN-OUT	Control valve power supply
94	DATABIT 1	Control valve communication line

## Repalcement

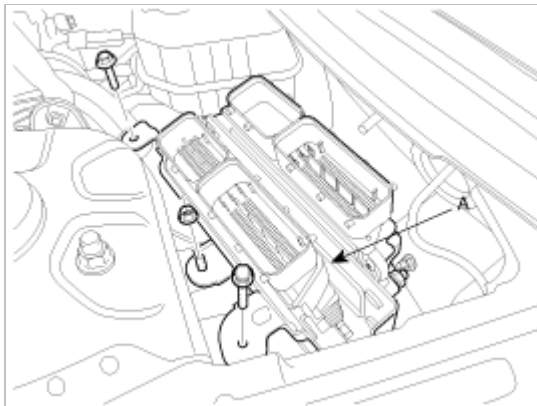
1. Disconnect (-) terminal from the battery.



2. Disconnect the ECU and TCU connectors (A).

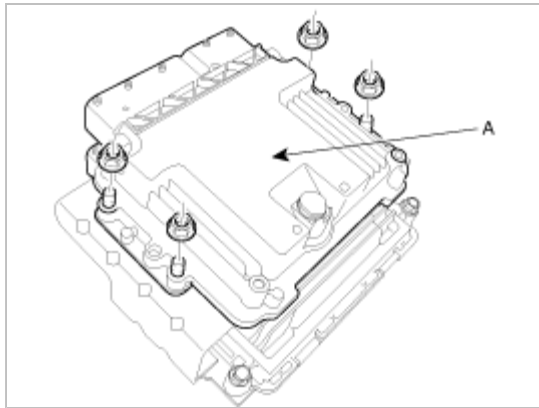


3. Remove the ECU and TCU with the bracket (C) by removing bolts (A-2ea) and a nut (B).



4. Remove the TCU (A) by removing bolts(4ea).





5. Replace the TCU with a new one.
6. Install the removed parts in reverse order of removal.